CycloneDX
Bill of materials specification
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Introduction

CycloneDX is a modern standard designed to address the complexities of the software and system supply chain. Originating in 2017, CycloneDX has grown into a general-purpose Bill of Materials (BOM) standard capable of representing various types of inventories, including software, hardware, and services. CycloneDX continuously evolves to meet the changing needs of the industry, incorporating new features and improvements to stay ahead of emerging challenges.

The design philosophy of CycloneDX emphasizes simplicity and ease of use, making it accessible to both technical and non-technical stakeholders. Despite its straightforward design, CycloneDX is a full-stack BOM format with advanced capabilities. Its guiding principles include easy adoption, rapid risk identification, continuous improvement, and high degrees of automation and extensibility.

CycloneDX plays a crucial role in enhancing software and system transparency, providing detailed information about the components used in an application, including their versions, suppliers, and dependencies. This transparency is essential for identifying and managing risks, ensuring regulatory compliance, and building trust in both software and hardware systems. By offering a comprehensive and standardized way to document these components, CycloneDX enables organizations to achieve greater security and reliability in their supply chains, supporting a wide range of use cases from product security to vendor risk management.

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CycloneDX v1.6 Bill of materials specification

1 Scope
This standard defines the CycloneDX v1.6 Bill of materials specification.

2 Conformance

2.1 Requirements Terminology
In this standard, the words that are used to define the significance of each requirement are detailed below. These words are used in accordance with their definitions in RFC 2119, and their respective meanings are reproduced below:

- Must: This word, or the adjective “required” and the auxiliary verb "shall", means that the item is an absolute requirement of the standard.
- Should: This word, or the adjective “recommended”, means that there might exist valid reasons in particular circumstances to ignore this item, but the full implications should be understood and the case carefully weighed before making an implementation decision.
- May: This word, or the adjective "optional", means that this item is truly optional.

The words "must not", "shall not", "should not", and "not recommended", are the negative forms of "must", "shall", "should", and "recommended", respectively. There is no negative form of "may".

2.2 Implementation Conformance
This standard includes the implementation requirements that systems processing CycloneDX content must satisfy in order to achieve conforming interoperability. An implementation is a consumer, or a producer, or both a consumer and a producer.

In order for a consumer to be considered conformant, the following rules apply:

- It must interpret and process the contents of CycloneDX BOMs in a manner conforming to this standard. A consumer is not required to interpret or process all of the content in a CycloneDX BOM.
- It should instantiate a warning or error condition when a CycloneDX BOM is not conforming to this standard.
- It must not instantiate an error condition in response to a CycloneDX BOM conforming to this standard.
- When optional or recommended features contained within CycloneDX BOMs are accessed by a consumer, the consumer must interpret and process those features in a manner conforming to this standard.

In order for a producer to be considered conformant, the following rules apply:

- Any CycloneDX BOM it creates must conform to this standard.
- It must not introduce any non-conforming CycloneDX content when modifying or enriching a CycloneDX BOM.
- When a producer chooses to use an optional or recommended feature in an CycloneDX BOM, then the producer must create or modify that feature in a manner conforming to this standard.

3 Normative References
The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.
4 Terms and Definitions

For the purposes of this standard, the following definitions apply. Terms explicitly defined in this standard are not to be presumed to refer implicitly to similar terms defined elsewhere.

4.1 Attestation
A formal declaration that something is true or accurate, often backed by documentation or verification from an authoritative source. It serves as a confirmation or proof of a fact, condition, or compliance with specific standards or requirements.

4.2 Author
A person who creates written works, such as software or data.

4.3 Component function
The purpose for which a software component exists. Examples of component functions include parsers, database persistence, and authentication providers.

4.4 Component type
The general classification of a software components architecture. Examples of component types include libraries, frameworks, applications, containers, and operating systems.

4.5 Manufacturer
An entity that develops and produces products such as virtual or physical goods.

4.6 Direct dependency
A component that is referenced by a main (metadata) component itself.

4.7 Package URL (PURL)
An ecosystem-agnostic specification which standardizes the syntax and location information of software components.

4.8 Pedigree
Data which describes the lineage and/or process for which software has been created or altered.

4.9 Procurement
The process of agreeing to terms and acquiring software or services for later use.
4.10
**Provenance**
The chain of custody and origin of a software component. Provenance incorporates the point of origin through distribution as well as derivatives in the case of software that has been modified.

4.11
**Provider**
An entity that offers services, infrastructure, or platforms. These services can include computing resources, storage, software applications, and networking capabilities.

4.12
**Publisher**
An entity that produces and distributes content, such as software, to the public.

4.13
**Software Identification (SWID)**
An ISO standard that formalizes how software is tagged.

4.14
**Software Package Data Exchange (SPDX)**
A Linux Foundation project which produces a standardized list of open source licences and defines an expression language for those licences.

4.15
**Supplier**
An entity that provides products or services to another entity, typically within a supply chain.

4.16
**Third-party component**
Any software component not directly created including open source, "source available", and commercial or proprietary software.

4.17
**Transitive dependency**
A software component that is indirectly used by another component by means of being a dependency of a dependency.

5  Overview of CycloneDX

CycloneDX is a modern standard for the software supply chain. At its core, CycloneDX is a general-purpose Bill of Materials (BOM) standard capable of representing software, hardware, services, and other types of inventory. The CycloneDX standard began in 2017 in the Open Worldwide Application Security Project (OWASP) community. CycloneDX is an OWASP flagship project, has a formal standardization process and governance model, and is supported by the global information security community.

5.1.1  Design Philosophy and Guiding Principles

The simplicity of design is at the forefront of the CycloneDX philosophy. The format is easily understandable by a wide range of technical and non-technical roles. CycloneDX is a full-stack BOM format with many advanced capabilities that are achieved without sacrificing the design philosophy. Some guiding principles influencing its design include:

- Be easy to adopt and easy to contribute to
- Identify risk to as many adopters as possible, as quickly as possible
- Avoid blockers that prevent the identification of risk
- Continuous improvement - innovate quickly and improve over time
- Encourage innovation and competition through extensions
- Produce immutable and backward-compatible releases
• Focus on high degrees of automation
• Provide a smooth path to specification compliance through prescriptive design

5.1.2 Defining Software Bill of Materials

The U.S. National Telecommunications and Information Administration (NTIA) defines software bill as materials as "a formal, machine-readable inventory of software components and dependencies, information about those components, and their hierarchical relationships." OWASP CycloneDX implements this definition and extends it in many ways, including adding services as a foundational component in a Software Bill of Materials.

5.1.3 The Role of SBOM in Software Transparency

Software transparency involves providing clear and accurate information about the components used in an application, including their name, version, supplier, and any dependencies required by the component. This information helps identify and manage the risks associated with the software whilst also enabling compliance with relevant regulations and standards. With the growing importance of software in our daily lives, transparency is critical to building trust in software and ensuring that it is safe, secure, and reliable.

SBOMs are the vehicle through which software transparency can be achieved. With SBOMs, parties throughout the software supply chain can leverage the information within to enable various use cases that would not otherwise be easily achievable. SBOMs play a vital role in promoting software transparency, allowing users to make informed decisions about the software they use.

5.2 High-Level SBOM Use Cases

A complete and accurate inventory of all first-party and third-party components is essential for risk identification. SBOMs should ideally contain all direct and transitive components and the dependency relationships between them.

CycloneDX far exceeds the Minimum Elements for Software Bill of Materials as defined by the National Telecommunications and Information Administration (NTIA) in response to U.S. Executive Order 14028.

Adopting CycloneDX allows organizations to quickly meet these minimum requirements and mature into using more sophisticated use cases over time. CycloneDX is capable of achieving all SBOM requirements defined in the OWASP Software Component Verification Standard (SCVS).

A few high-level use cases for SBOM include:
• Product security, architectural, and licence risk
• Procurement and M&A
• Software component transparency
• Supply chain transparency
• Vendor risk management

5.3 xBOM Capabilities

CycloneDX provides advanced supply chain capabilities for cyber risk reduction. Among these capabilities are:
• Software Bill of Materials (SBOM)
• Software-as-a-Service Bill of Materials (SaaSBO)
• Hardware Bill of Materials (HBOM)
• Machine Learning Bill of Materials (ML-BOM)
• Cryptography Bill of Materials (CBOM)
• Operations Bill of Materials (OBOM)
• Manufacturing Bill of Materials (MBOM)
• Bill of Vulnerabilities (BOV)
• Vulnerability Disclosure Report (VDR)
• Vulnerability Exploitability eXchange (VEX)
• CycloneDX Attestations (CDXA)
• Common Release Notes Format

5.3.1 Software Bill of Materials (SBOM)

SBOMs describe the inventory of software components and services and the dependency relationships between them. A complete and accurate inventory of all first-party and third-party components is essential for risk identification. SBOMs should ideally contain all direct and transitive components and the dependency relationships between them.

5.3.2 Software-as-a-Service BOM (SaaSBOM)

SaaSBOMs provide an inventory of services, endpoints, and data flows and classifications that power cloud-native applications. CycloneDX is capable of describing any type of service, including microservices, Service Oriented Architecture (SOA), Function as a Service (FaaS), and System of Systems.

SaaSBOMs complement Infrastructure-as-Code (IaC) by providing a logical representation of a complex system, complete with an inventory of all services, their reliance on other services, endpoint URLs, data classifications, and the directional flow of data between services. Optionally, SaaSBOMs may also include the software components that make up each service.

5.3.3 Hardware Bill of Materials (HBOM)

CycloneDX supports many types of components, including hardware devices, making it ideal for use with consumer electronics, IoT, ICS, and other types of embedded devices. CycloneDX fills an important role in between traditional eBOM and mBOM use cases for hardware devices.

5.3.4 Machine Learning Bill of Materials (ML-BOM)

ML-BOMs provide transparency for machine learning models and datasets, which provide visibility into possible security, privacy, safety, and ethical considerations. CycloneDX standardizes model cards in a way where the inventory of models and datasets can be used independently or combined with the inventory of software and hardware components or services defined in HBOMs, SBOMs, and SaaSBOMs.

5.3.5 Cryptography Bill of Materials (CBOM)

A Cryptography Bill of Materials (CBOM) describes cryptographic assets and their dependencies. Discovering, managing, and reporting on cryptographic assets is necessary as the first step on the migration journey to quantum-safe systems and applications. Cryptography is typically buried deep within components used to compose and build systems and applications. As part of an agile cryptographic approach, organizations should seek to understand what cryptographic assets they are using and facilitate the assessment of the risk posture to provide a starting point for mitigation.

5.3.6 Operations Bill of Materials (OBOM)

OBOMs provide a full-stack inventory of runtime environments, configurations, and additional dependencies. CycloneDX is a full-stack bill of materials standard supporting entire runtime environments consisting of hardware, firmware, containers, operating systems, applications, and libraries. Coupled with the ability to specify configuration makes CycloneDX ideal for Operations Bill of Materials.

5.3.7 Manufacturing Bill of Materials (MBOM)

CycloneDX can describe declared and observed formulations for reproducibility throughout the product lifecycle of components and services. This advanced capability provides transparency into how components were made, how a model was trained, or how a service was created or deployed. In addition, every component and service in a CycloneDX BOM can optionally specify formulation and do so in existing BOMs or in dedicated MBOMs. By externalizing formulation into dedicated MBOMs, SBOMs can link to MBOMs for their components and services, and access control can be managed independently. This allows organizations to maintain tighter control over what parties gain access to inventory information in a BOM and what parties have access to MBOM information which may have higher sensitivity and data classification.
5.3.8 Bill of Vulnerabilities (BOV)

CycloneDX BOMs may consist solely of vulnerabilities and thus can be used to share vulnerability data between systems and sources of vulnerability intelligence. Complex vulnerability data can be represented, including the vulnerability source, references, multiple severities, risk ratings, details and recommendations, and the affected software and hardware, along with their versions.

5.3.9 Vulnerability Disclosure Report (VDR)

VDRs communicate known and unknown vulnerabilities affecting components and services. Known vulnerabilities inherited from the use of third-party and open-source software can be communicated with CycloneDX. Previously unknown vulnerabilities affecting both components and services may also be disclosed using CycloneDX, making it ideal for Vulnerability Disclosure Report (VDR) use cases. CycloneDX exceeds the data field requirements defined in ISO/IEC 29147:2018 for vulnerability disclosure information.

5.3.10 Vulnerability Exploitability eXchange (VEX)

VEX conveys the exploitability of vulnerable components in the context of the product in which they're used. VEX is a subset of VDR. Oftentimes, products are not affected by a vulnerability simply by including an otherwise vulnerable component. VEX allows software vendors and other parties to communicate the exploitability status of vulnerabilities, providing clarity on the vulnerabilities that pose a risk and the ones that do not.

5.3.11 CycloneDX Attestations (CDXA)

CycloneDX Attestations enable organizations to communicate security standards, claims, and evidence about security requirements, and attestations to the veracity and completeness of those claims. CycloneDX Attestations is a way to manage "compliance as code."

5.3.12 Common Release Notes Format

CycloneDX standardizes release notes into a common, machine-readable format. This capability unlocks new workflow potential for software publishers and consumers alike. This functionality works with or without the Bill of Materials capabilities of the specification.
5.4 CycloneDX Object Model

Within the root element, CycloneDX defines the following object types:

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<td></td>
<td>Observed</td>
<td>Workflows</td>
<td>Steps</td>
<td></td>
<td>Services</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annotations</td>
<td>Per Person</td>
<td>Per Organization</td>
<td>Per Tool</td>
<td>Per Tool</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Details</td>
<td>Timestamp</td>
<td>Signature</td>
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</tr>
<tr>
<td>Definitions</td>
<td>Standards</td>
<td>Requirements</td>
<td>Levels</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Declarations</td>
<td>Attestations</td>
<td>Evidence</td>
<td>Conformance</td>
<td>Mitigation Strategies</td>
<td>Assessors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Claims</td>
<td>Counter Evidence</td>
<td>Confidence</td>
<td></td>
<td></td>
<td>Signatories</td>
<td>Signature</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extensions</td>
<td>Properties</td>
<td>Per Organization</td>
<td>Per Team</td>
<td>Per Team</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formal Taxonomy</td>
<td>Per Industry</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5.4.1 BOM Identity

The bom element has properties for serialNumber and version. Together these two properties form the identity of a BOM. A BOM’s identity can be expressed using a BOM-Link, a formally registered URN capable of
referencing a BOM or any component, service, or vulnerability in a BOM. Refer to the chapter on Relationships for more information.

5.4.1.1 Serial Number
Every BOM generated should have a unique serial number, even if the contents of the BOM have not changed over time. If specified, the serial number must conform to RFC-4122. The use of serial numbers is recommended.

5.4.1.2 Version
Whenever an existing BOM is modified, either manually or through automated processes, the version of the BOM should be incremented by 1. When a system is presented with multiple BOMs with identical serial numbers, the system should use the most recent version of the BOM. The default version is ‘1’.

5.4.2 The Anatomy of a CycloneDX BOM
The following are descriptions of the root-level elements of a CycloneDX BOM.

5.4.2.1 Metadata
BOM metadata includes the supplier, manufacturer, and target component for which the BOM describes. It also includes the tools used to create the BOM, and licence information for the BOM document itself.

5.4.2.2 Components
Components describe the complete inventory of first-party and third-party components. The specification can represent software, hardware devices, machine learning models, source code, and configurations, along with the manufacturer information, licence and copyright details, and complete pedigree and provenance for every component.

5.4.2.3 Services
Services represent external APIs that the software may call. They describe endpoint URIs, authentication requirements, and trust boundary traversals. The data flow between software and services can also be described, including the data classifications and the flow direction of each type.

5.4.2.4 Dependencies
CycloneDX provides the ability to describe components and their dependency on other components. The dependency graph is capable of representing both direct and transitive relationships. Components that depend on services can be represented in the dependency graph, and services that depend on other services can be represented as well.

5.4.2.5 Compositions
Compositions describe constituent parts (including components, services, and dependency relationships) and their completeness. The aggregate of each composition can be described as complete, incomplete, incomplete first-party only, incomplete third-party only, or unknown.
5.4.2.6 Vulnerabilities

Known vulnerabilities inherited from the use of third-party and open-source software and the exploitability of the vulnerabilities can be communicated with CycloneDX. Previously unknown vulnerabilities affecting both components and services may also be disclosed using CycloneDX, making it ideal for both vulnerability disclosure and VEX use cases.

<table>
<thead>
<tr>
<th>Vulnerabilities</th>
<th>Details</th>
<th>Source</th>
<th>Exploitability (VEX)</th>
<th>Targets Affected</th>
<th>Proof of Concept</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advisories</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk Ratings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evidence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Version Ranges</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recommendations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5.4.2.7 Formulation

Formulation describes how something was manufactured or deployed. CycloneDX achieves this through the support of multiple formulas, workflows, tasks, and steps, which represent the declared formulation for reproduction along with the observed formula describing the actions which transpired in the manufacturing process.

<table>
<thead>
<tr>
<th>Formulation</th>
<th>Declared</th>
<th>Formulas</th>
<th>Tasks</th>
<th>Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observed</td>
<td></td>
<td>Workflows</td>
<td>Steps</td>
<td>Services</td>
</tr>
</tbody>
</table>

5.4.2.8 Annotations

Annotations contain comments, notes, explanations, or similar textual content which provide additional context to the object(s) being annotated. They are often automatically added to a BOM via a tool or as a result of manual review by individuals or organizations. Annotations can be independently signed and verified using digital signatures.

<table>
<thead>
<tr>
<th>Annotations</th>
<th>Per Person</th>
<th>Per Organization</th>
<th>Per Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Details</td>
<td></td>
<td>Timestamp</td>
<td>Signature</td>
</tr>
</tbody>
</table>

5.4.2.9 Definitions

Standards, requirements, levels, and all supporting documentation are defined here. CycloneDX provides a general-purpose, machine-readable way to define virtually any type of standard. Security standards such as OWASP ASVS, MASVS, SCVS, and SAMM are available in CycloneDX format. Standards from other bodies are available as well. Additionally, organizations can create internal standards and represent them in CycloneDX.

| Definitions | Standards | Requirements | Levels |

5.4.2.10 Declarations

Declarations describe the conformance to standards. Each declaration may include attestations, claims, counter-claims, evidence, counter-evidence, along with conformance and confidence. Signatories can also be declared and supports both digital and analogue signatures. Declarations provide the basis for "compliance-as-code".

<table>
<thead>
<tr>
<th>Declarations</th>
<th>Attestations</th>
<th>Evidence</th>
<th>Conformance</th>
<th>Mitigation Strategies</th>
<th>Assessors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Claims</td>
<td>Counter Evidence</td>
<td>Confidence</td>
<td>Signatories</td>
<td>Signatures</td>
</tr>
</tbody>
</table>
5.4.2.11 Extensions

Multiple extension points exist throughout the CycloneDX object model, allowing fast prototyping of new capabilities and support for specialized and future use cases. The CycloneDX project maintains extensions that are beneficial to the larger community. The project encourages community participation and the development of extensions that target specialized or industry-specific use cases.

5.5 Serialization Formats

CycloneDX can be represented in JSON, XML, and Protocol Buffers (protobuf) and has corresponding schemas for each.

<table>
<thead>
<tr>
<th>Format</th>
<th>Resource</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>JSON</td>
<td>Documentation</td>
<td><a href="https://cyclonedx.org/docs/latest/json/">https://cyclonedx.org/docs/latest/json/</a></td>
</tr>
<tr>
<td>JSON</td>
<td>Schema</td>
<td><a href="https://cyclonedx.org/schema/bom-1.6.schema.json">https://cyclonedx.org/schema/bom-1.6.schema.json</a></td>
</tr>
<tr>
<td>XML</td>
<td>Documentation</td>
<td><a href="https://cyclonedx.org/docs/latest/xml/">https://cyclonedx.org/docs/latest/xml/</a></td>
</tr>
<tr>
<td>XML</td>
<td>Schema</td>
<td><a href="https://cyclonedx.org/schema/bom-1.6.xsd">https://cyclonedx.org/schema/bom-1.6.xsd</a></td>
</tr>
<tr>
<td>Protobuf</td>
<td>Schema</td>
<td><a href="https://cyclonedx.org/schema/bom-1.6.proto">https://cyclonedx.org/schema/bom-1.6.proto</a></td>
</tr>
</tbody>
</table>

CycloneDX relies exclusively on JSON Schema, XML Schema, and protobuf for validation. The entirety of the specification can be validated using officially supported CycloneDX tools or via hundreds of available validators that support JSON Schema, XML Schema, or protobuf.

NOTE The CycloneDX JSON Schema is the reference implementation for the Ecma standard.

6 CycloneDX Bill of Materials Standard

Location: /

Type: Object

Table 1 – Properties for the root object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bomFormat</td>
<td>String</td>
<td>Required</td>
<td>Specifies the format of the BOM. This helps to identify the file as CycloneDX since BOMs do not have a filename convention, nor does JSON schema support namespaces. This value must be &quot;CycloneDX&quot;.</td>
</tr>
<tr>
<td>specVersion</td>
<td>String</td>
<td>Required</td>
<td>The version of the CycloneDX specification the BOM conforms to.</td>
</tr>
<tr>
<td>serialNumber</td>
<td>String</td>
<td>Optional</td>
<td>Every BOM generated SHOULD have a unique serial number, even if the contents of the BOM have not changed over time. If specified, the serial number must conform to RFC 4122. Use of serial numbers is recommended.</td>
</tr>
<tr>
<td>Property</td>
<td>Type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------</td>
<td>-------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>version</td>
<td>Integer</td>
<td>Optional</td>
<td>Whenever an existing BOM is modified, either manually or through automated processes, the version of the BOM SHOULD be incremented by 1. When a system is presented with multiple BOMs with identical serial numbers, the system SHOULD use the most recent version of the BOM. The default version is &quot;1&quot;.</td>
</tr>
<tr>
<td>metadata</td>
<td>Object</td>
<td>Optional</td>
<td>Provides additional information about a BOM.</td>
</tr>
<tr>
<td>components</td>
<td>Array</td>
<td>Optional</td>
<td>A list of software and hardware components.</td>
</tr>
<tr>
<td>services</td>
<td>Array</td>
<td>Optional</td>
<td>A list of services. This may include microservices, function-as-a-service, and other types of network or intra-process services.</td>
</tr>
<tr>
<td>externalReferences</td>
<td>Array</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
<tr>
<td>dependencies</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document dependency relationships including provided &amp; implemented components.</td>
</tr>
<tr>
<td>compositions</td>
<td>Array</td>
<td>Optional</td>
<td>Compositions describe constituent parts (including components, services, and dependency relationships) and their completeness. The completeness of vulnerabilities expressed in a BOM may also be described.</td>
</tr>
<tr>
<td>vulnerabilities</td>
<td>Array</td>
<td>Optional</td>
<td>Vulnerabilities identified in components or services.</td>
</tr>
<tr>
<td>annotations</td>
<td>Array</td>
<td>Optional</td>
<td>Comments made by people, organizations, or tools about any object with a bom-ref, such as components, services, vulnerabilities, or the BOM itself. Unlike inventory information, annotations may contain opinions or commentary from various stakeholders. Annotations may be inline (with inventory) or externalized via BOM-Link and may optionally be signed.</td>
</tr>
<tr>
<td>formulation</td>
<td>Array</td>
<td>Optional</td>
<td>Describes how a component or service was manufactured or deployed. This is achieved through the use of formulas, workflows, tasks, and steps, which declare the precise steps to reproduce along with the observed formulas describing the steps which transpired in the manufacturing process.</td>
</tr>
<tr>
<td>declarations</td>
<td>Object</td>
<td>Optional</td>
<td>The list of declarations which describe the conformance to standards. Each declaration may include attestations, claims, and evidence.</td>
</tr>
<tr>
<td>definitions</td>
<td>Object</td>
<td>Optional</td>
<td>A collection of reusable objects that are defined and may be used elsewhere in the BOM.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of</td>
</tr>
<tr>
<td>Property</td>
<td>Type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>---------------</td>
<td>------------</td>
<td>-------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>signature</td>
<td>Array</td>
<td>Optional</td>
<td>Enveloped signature in JSON Signature Format (JSF).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.</td>
</tr>
</tbody>
</table>

### 6.1 BOM Format

**Location:** /bomFormat  
**Property:** bomFormat (Required)  
**Type:** String  
**Description:** Specifies the format of the BOM. This helps to identify the file as CycloneDX since BOMs do not have a filename convention, nor does JSON schema support namespaces. This value must be "CycloneDX".

**Enumeration:** Must be one of:
- CycloneDX

### 6.2 CycloneDX Specification Version

**Location:** /specVersion  
**Property:** specVersion (Required)  
**Type:** String  
**Description:** The version of the CycloneDX specification the BOM conforms to.

**Examples:**
- 1.6

### 6.3 BOM Serial Number

**Location:** /serialNumber  
**Property:** serialNumber (Optional)  
**Type:** String  
**Pattern Constraint:** ^urn:uuid:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}$

**Description:** Every BOM generated SHOULD have a unique serial number, even if the contents of the BOM have not changed over time. If specified, the serial number must conform to RFC 4122. Use of serial numbers is recommended.

**Examples:**
- urn:uuid:3e671687-395b-41f5-a30f-a58921a69b79

### 6.4 BOM Version

**Location:** /version  
**Property:** version (Optional)  
**Type:** Integer  
**Minimum Value:** 1  
**Default Value:** 1  
**Description:** Whenever an existing BOM is modified, either manually or through automated processes, the version of the BOM SHOULD be incremented by 1. When a system is presented with multiple BOMs with
identical serial numbers, the system SHOULD use the most recent version of the BOM. The default version is ‘1’.

Examples:

- 1

7 BOM Metadata

Location: /metadata

Property: metadata (Optional)

Type: Object

Description: Provides additional information about a BOM.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>timestamp</td>
<td>String</td>
<td>Optional</td>
<td>The date and time (timestamp) when the BOM was created.</td>
</tr>
<tr>
<td>lifecycles</td>
<td>Array</td>
<td>Optional</td>
<td>Lifecycles communicate the stage(s) in which data in the BOM was captured. Different types of data may be available at various phases of a lifecycle, such as the Software Development Lifecycle (SDLC), IT Asset Management (ITAM), and Software Asset Management (SAM). Thus, a BOM may include data specific to or only obtainable in a given lifecycle.</td>
</tr>
<tr>
<td>tools</td>
<td>Array</td>
<td>Optional</td>
<td>The tool(s) used in the creation, enrichment, and validation of the BOM.</td>
</tr>
<tr>
<td>manufacturer</td>
<td>Object</td>
<td>Optional</td>
<td>The organization that created the BOM. Manufacturer is common in BOMs created through automated processes. BOMs created through manual means may have @.authors instead.</td>
</tr>
<tr>
<td>authors</td>
<td>Array</td>
<td>Optional</td>
<td>The person(s) who created the BOM. Authors are common in BOMs created through manual processes. BOMs created through automated means may have @.manufacturer instead.</td>
</tr>
<tr>
<td>component</td>
<td>Object</td>
<td>Optional</td>
<td>The component that the BOM describes.</td>
</tr>
<tr>
<td>manufacture</td>
<td>Object</td>
<td>Optional</td>
<td>[Deprecated] This will be removed in a future version. Use the @.component.manufacturer instead. The organization that manufactured the component that the BOM describes.</td>
</tr>
<tr>
<td>supplier</td>
<td>Object</td>
<td>Optional</td>
<td>The organization that supplied the component that the BOM describes. The supplier may often be the manufacturer, but may also be a distributor or repackager.</td>
</tr>
<tr>
<td>licenses</td>
<td>Array</td>
<td>Optional</td>
<td>The license information for the BOM document. This may be different from the license(s) of the component(s) that the BOM describes.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.</td>
</tr>
</tbody>
</table>
7.1 Timestamp

Location: /metadata/timestamp
Property: timestamp (Optional)
Type: String
Format: data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)
Description: The date and time (timestamp) when the BOM was created.

7.2 Lifecycles

Location: /metadata/lifecycles
Property: lifecycles (Optional)
Type: Array
Description: Lifecycles communicate the stage(s) in which data in the BOM was captured. Different types of data may be available at various phases of a lifecycle, such as the Software Development Lifecycle (SDLC), IT Asset Management (ITAM), and Software Asset Management (SAM). Thus, a BOM may include data specific to or only obtainable in a given lifecycle. Each item of this array must be a Lifecycle object.

7.2.1 Lifecycle

Location: /metadata/lifecycles/[]
Type: Object
Description: The product lifecycle(s) that this BOM represents.

Must be one of:
1. Pre-Defined Phase
2. Custom Phase

7.2.2 Pre-Defined Phase

Type: Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>phase</td>
<td>String</td>
<td>Required</td>
<td>A pre-defined phase in the product lifecycle.</td>
</tr>
</tbody>
</table>

7.2.3 Custom Phase

Type: Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the lifecycle phase</td>
</tr>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>The description of the lifecycle phase</td>
</tr>
</tbody>
</table>

7.2.4 Phase

Location: /metadata/lifecycles/[]/phase
Property: lifecycles (Required)

Type: String

Description: A pre-defined phase in the product lifecycle.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>design</td>
<td>BOM produced early in the development lifecycle containing an inventory of components and services that are proposed or planned to be used. The inventory may need to be procured, retrieved, or resourced prior to use.</td>
</tr>
<tr>
<td>pre-build</td>
<td>BOM consisting of information obtained prior to a build process and may contain source files and development artifacts and manifests. The inventory may need to be resolved and retrieved prior to use.</td>
</tr>
<tr>
<td>build</td>
<td>BOM consisting of information obtained during a build process where component inventory is available for use. The precise versions of resolved components are usually available at this time as well as the provenance of where the components were retrieved from.</td>
</tr>
<tr>
<td>post-build</td>
<td>BOM consisting of information obtained after a build process has completed and the resulting components(s) are available for further analysis. Built components may exist as the result of a CI/CD process, may have been installed or deployed to a system or device, and may need to be retrieved or extracted from the system or device.</td>
</tr>
<tr>
<td>operations</td>
<td>BOM produced that represents inventory that is running and operational. This may include staging or production environments and will generally encompass multiple SBOMs describing the applications and operating system, along with HBOMs describing the hardware that makes up the system. Operations Bill of Materials (OBOM) can provide full-stack inventory of runtime environments, configurations, and additional dependencies.</td>
</tr>
<tr>
<td>discovery</td>
<td>BOM consisting of information observed through network discovery providing point-in-time enumeration of embedded, on-premise, and cloud-native services such as server applications, connected devices, microservices, and serverless functions.</td>
</tr>
<tr>
<td>decommission</td>
<td>BOM containing inventory that will be, or has been retired from operations.</td>
</tr>
</tbody>
</table>

7.2.5 Name

Location: /metadata/lifecycles/[i]/name

Property: lifecycles (Required)

Type: String

Description: The name of the lifecycle phase

7.2.6 Description

Location: /metadata/lifecycles/[i]/description

Property: lifecycles (Optional)

Type: String

Description: The description of the lifecycle phase

7.3 Tools

Location: /metadata/tools
Property: tools (Optional)

Description: The tool(s) used in the creation, enrichment, and validation of the BOM.

Must be one of:
1. Tools
2. Tools (legacy)

7.3.1 Tools

Type: Object
Description: The tool(s) used in the creation, enrichment, and validation of the BOM.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>components</td>
<td>Array</td>
<td>Optional</td>
<td>A list of software and hardware components used as tools. Refer to the component definition at /components/[]</td>
</tr>
<tr>
<td>services</td>
<td>Array</td>
<td>Optional</td>
<td>A list of services used as tools. This may include microservices, function-as-a-service, and other types of network or intra-process services. Refer to the service definition at /services/[]</td>
</tr>
</tbody>
</table>

7.3.2 Tools (legacy)

Type: Array
Description: [Deprecated] The tool(s) used in the creation, enrichment, and validation of the BOM.

7.3.3 Components

Location: /metadata/tools/components
Property: tools (Optional)

Type: Array
Description: A list of software and hardware components used as tools. Each item of this array must be a Component object.

7.3.3.1 Component

Location: /metadata/tools/components/[]
Type: Object
Reference: Refer to the component definition at /components/[]

All items must be unique.

7.3.4 Services

Location: /metadata/tools/services
Property: tools (Optional)

Type: Array
Description: A list of services used as tools. This may include microservices, function-as-a-service, and other types of network or intra-process services. Each item of this array must be a Service object.

7.3.4.1 Service

Location: /metadata/tools/services/[]
Type: Object
Reference: Refer to the service definition at /services/[]

All items must be unique.

7.3.4.1.1 Tools (legacy)

Location: /metadata/tools

Property: tools

Type: Array

Description: [Deprecated] The tool(s) used in the creation, enrichment, and validation of the BOM. Each item of this array must be a Tool object.

7.3.5 Tool

Location: /metadata/tools/[]

Type: Object

Description: [Deprecated] This will be removed in a future version. Use component or service instead. Information about the automated or manual tool used

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>vendor</td>
<td>String</td>
<td>Optional</td>
<td>The name of the vendor who created the tool</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the tool</td>
</tr>
<tr>
<td>version</td>
<td>String</td>
<td>Optional</td>
<td>The version of the tool</td>
</tr>
<tr>
<td>hashes</td>
<td>Array</td>
<td>Optional</td>
<td>The hashes of the tool (if applicable).</td>
</tr>
<tr>
<td>externalReferences</td>
<td>Array</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant, but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

7.3.5.1 Tool Vendor

Location: /metadata/tools/[]/vendor

Property: vendor (Optional)

Type: String

Description: The name of the vendor who created the tool

7.3.5.2 Tool Name

Location: /metadata/tools/[]/name

Property: name (Optional)

Type: String

Description: The name of the tool

7.3.5.3 Tool Version

Location: /metadata/tools/[]/version

Property: version (Optional)
Type: String
Description: The version of the tool
Examples:
- 9.0.14
- v1.33.7
- 7.0.0-M1
- 2.0pre1
- 1.0.0-beta1
- 0.8.15

7.3.5.4 Hashes
Location: /metadata/tools/[]/hashes
Property: hashes (Optional)
Type: Array
Description: The hashes of the tool (if applicable). Each item of this array must be a Hash object.

7.3.5.4.1 Hash
Location: /metadata/tools/[]/hashes/[]
Type: Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>alg</td>
<td>String</td>
<td>Required</td>
<td>The algorithm that generated the hash value.</td>
</tr>
<tr>
<td>content</td>
<td>String</td>
<td>Required</td>
<td>The value of the hash.</td>
</tr>
</tbody>
</table>

7.3.5.4.2 Hash Algorithm
Location: /metadata/tools/[]/hashes/[]/alg
Property: alg (Required)
Type: String
Description: The algorithm that generated the hash value.
Enumeration: Must be one of:
- MD5
- SHA-1
- SHA-256
- SHA-384
- SHA-512
- SHA3-256
- SHA3-384
- SHA3-512
- BLAKE2b-256
• BLAKE2b-384
• BLAKE2b-512
• BLAKE3

7.3.5.4.3 Hash Value

**Location:** /metadata/tools/[]/hashes/[]/content

**Property:** content (Required)

**Type:** String

**Pattern Constraint:** ^([a-fA-F0-9]{32}|[a-fA-F0-9]{40}|[a-fA-F0-9]{64}|[a-fA-F0-9]{96}|[a-fA-F0-9]{128})$

**Description:** The value of the hash.

**Examples:**
• 3942447fac867ae5cdb3229b658f4d48

7.3.5.5 External References

**Location:** /metadata/tools/[]/externalReferences

**Property:** externalReferences (Optional)

**Type:** Array

**Description:** External references provide a way to document systems, sites, and information that may be relevant, but are not included with the BOM. They may also establish specific relationships within or external to the BOM. Each item of this array must be an External Reference object.

**Reference:** Refer to the external reference definition at /externalReferences/[]

7.3.5.5.1 External Reference

**Location:** /metadata/tools/[]/externalReferences/[]

**Type:** Object

**Description:** External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

7.4 BOM Manufacturer

**Location:** /metadata/manufacturer

**Property:** manufacturer (Optional)

**Type:** Object

**Description:** The organization that created the BOM. Manufacturer is common in BOMs created through automated processes. BOMs created through manual means may have @.authors instead.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the organization</td>
</tr>
<tr>
<td>address</td>
<td>Object</td>
<td>Optional</td>
<td>The physical address (location) of the organization</td>
</tr>
</tbody>
</table>
### 7.4.1 BOM Reference

**Location:** /metadata/manufacturer/bom-ref  
**Property:** bom-ref (Optional)  
**Type:** String  
**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

### 7.4.2 Organization Name

**Location:** /metadata/manufacturer/name  
**Property:** name (Optional)  
**Type:** String  
**Description:** The name of the organization

**Examples:**  
- Example Inc.

### 7.4.3 Organization Address

**Location:** /metadata/manufacturer/address  
**Property:** address (Optional)  
**Type:** Object  
**Description:** The physical address (location) of the organization

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>Optional</td>
<td>The country name or the two-letter ISO 3166-1 country code.</td>
</tr>
<tr>
<td>region</td>
<td>String</td>
<td>Optional</td>
<td>The region or state in the country.</td>
</tr>
<tr>
<td>locality</td>
<td>String</td>
<td>Optional</td>
<td>The locality or city within the country.</td>
</tr>
<tr>
<td>postOfficeBoxNumber</td>
<td>String</td>
<td>Optional</td>
<td>The post office box number.</td>
</tr>
<tr>
<td>postalCode</td>
<td>String</td>
<td>Optional</td>
<td>The postal code.</td>
</tr>
<tr>
<td>streetAddress</td>
<td>String</td>
<td>Optional</td>
<td>The street address.</td>
</tr>
</tbody>
</table>
7.4.3.1 BOM Reference
Location: /metadata/manufacturer/address/bom-ref
Property: bom-ref (Optional)
Type: String
Description: An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

7.4.3.2 Country
Location: /metadata/manufacturer/address/country
Property: country (Optional)
Type: String
Description: The country name or the two-letter ISO 3166-1 country code.

7.4.3.3 Region
Location: /metadata/manufacturer/address/region
Property: region (Optional)
Type: String
Description: The region or state in the country.
Examples:
- Texas

7.4.3.4 Locality
Location: /metadata/manufacturer/address/locality
Property: locality (Optional)
Type: String
Description: The locality or city within the country.
Examples:
- Austin

7.4.3.5 Post Office Box Number
Location: /metadata/manufacturer/address/postOfficeBoxNumber
Property: postOfficeBoxNumber (Optional)
Type: String
Description: The post office box number.
Examples:
- 901

7.4.3.6 Postal Code
Location: /metadata/manufacturer/address/postalCode
Property: postalCode (Optional)
Type: String
Description: The postal code.
Examples:
  • 78758

7.4.3.7 Street Address

Location: /metadata/manufacturer/address/streetAddress

Property: streetAddress (Optional)

Type: String

Description: The street address.

Examples:
  • 100 Main Street

7.4.4 Organization URL(s)

Location: /metadata/manufacturer/url

Property: url (Optional)

Type: array (of String)


Description: The URL of the organization. Multiple URLs are allowed. Each item of this array must be a string.

Examples:
  • https://example.com

7.4.5 Organizational Contact

Location: /metadata/manufacturer/contact

Property: contact (Optional)

Type: Array

Description: A contact at the organization. Multiple contacts are allowed. Each item of this array must be an Organizational Contact object.

7.4.5.1 Organizational Contact

Location: /metadata/manufacturer/contact/[]

Type: Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

7.4.5.1.1 BOM Reference

Location: /metadata/manufacturer/contact/[]/bom-ref
Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

7.4.5.1.2 Name

Location: /metadata/manufacturer/contact/[]/name

Property: name (Optional)

Type: String

Description: The name of a contact

Examples:
- Contact name

7.4.5.1.3 Email Address

Location: /metadata/manufacturer/contact/[]/email

Property: email (Optional)

Type: String

Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

Description: The email address of the contact.

Examples:
- firstname.lastname@example.com

7.4.5.1.4 Phone

Location: /metadata/manufacturer/contact/[]/phone

Property: phone (Optional)

Type: String

Description: The phone number of the contact.

Examples:
- 800-555-1212

7.5 BOM Authors

Location: /metadata/authors

Property: authors (Optional)

Type: Array

Description: The person(s) who created the BOM. Authors are common in BOMs created through manual processes. BOMs created through automated means may have @.manufacturer instead. Each item of this array must be an Organizational Contact object.

7.5.1 Organizational Contact

Location: /metadata/authors/[]

Type: Object
Table 12 – Properties for the authors object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

7.5.1.1 BOM Reference

**Location:** /metadata/authors[/]/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

7.5.1.2 Name

**Location:** /metadata/authors[/]/name

**Property:** name (Optional)

**Type:** String

**Description:** The name of a contact

**Examples:**
- Contact name

7.5.1.3 Email Address

**Location:** /metadata/authors[/]/email

**Property:** email (Optional)

**Type:** String

**Format:** idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

**Description:** The email address of the contact.

**Examples:**
- firstname.lastname@example.com

7.5.1.4 Phone

**Location:** /metadata/authors[/]/phone

**Property:** phone (Optional)

**Type:** String

**Description:** The phone number of the contact.

**Examples:**
- 800-555-1212
7.6 Component

Location: /metadata/component
Property: component (Optional)

Type: Object
Description: The component that the BOM describes.
Reference: Refer to the component definition at /components/[

7.7 Component Manufacture (legacy)

Location: /metadata/manufacture
Property: manufacture (Optional and Deprecated)

Type: Object
Description: [Deprecated] This will be removed in a future version. Use the @.component.manufacturer instead.
The organization that manufactured the component that the BOM describes.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the organization</td>
</tr>
<tr>
<td>address</td>
<td>Object</td>
<td>Optional</td>
<td>The physical address (location) of the organization</td>
</tr>
<tr>
<td>url</td>
<td>Array</td>
<td>Optional</td>
<td>The URL of the organization. Multiple URLs are allowed.</td>
</tr>
<tr>
<td>contact</td>
<td>Array</td>
<td>Optional</td>
<td>A contact at the organization. Multiple contacts are allowed.</td>
</tr>
</tbody>
</table>

7.7.1 BOM Reference

Location: /metadata/manufacture/bom-ref
Property: bom-ref (Optional)

Type: String
Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

7.7.2 Organization Name

Location: /metadata/manufacture/name
Property: name (Optional)

Type: String
Description: The name of the organization
Examples:
- Example Inc.
7.7.3 Organization Address

Location: /metadata/manufacture/address
Property: address (Optional)

Type: Object

Description: The physical address (location) of the organization

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>Optional</td>
<td>The country name or the two-letter ISO 3166-1 country code.</td>
</tr>
<tr>
<td>region</td>
<td>String</td>
<td>Optional</td>
<td>The region or state in the country.</td>
</tr>
<tr>
<td>locality</td>
<td>String</td>
<td>Optional</td>
<td>The locality or city within the country.</td>
</tr>
<tr>
<td>postOfficeBoxNumber</td>
<td>String</td>
<td>Optional</td>
<td>The post office box number.</td>
</tr>
<tr>
<td>postalCode</td>
<td>String</td>
<td>Optional</td>
<td>The postal code.</td>
</tr>
<tr>
<td>streetAddress</td>
<td>String</td>
<td>Optional</td>
<td>The street address.</td>
</tr>
</tbody>
</table>

7.7.3.1 BOM Reference

Location: /metadata/manufacture/address/bom-ref
Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

7.7.3.2 Country

Location: /metadata/manufacture/address/country
Property: country (Optional)

Type: String

Description: The country name or the two-letter ISO 3166-1 country code.

7.7.3.3 Region

Location: /metadata/manufacture/address/region
Property: region (Optional)

Type: String

Description: The region or state in the country.

Examples:
- Texas
7.7.3.4 Locality

Location: /metadata/manufacture/address/locality

Property: locality (Optional)

Type: String

Description: The locality or city within the country.

Examples:
  • Austin

7.7.3.5 Post Office Box Number

Location: /metadata/manufacture/address/postOfficeBoxNumber

Property: postOfficeBoxNumber (Optional)

Type: String

Description: The post office box number.

Examples:
  • 901

7.7.3.6 Postal Code

Location: /metadata/manufacture/address/postalCode

Property: postalCode (Optional)

Type: String

Description: The postal code.

Examples:
  • 78758

7.7.3.7 Street Address

Location: /metadata/manufacture/address/streetAddress

Property: streetAddress (Optional)

Type: String

Description: The street address.

Examples:
  • 100 Main Street

7.7.4 Organization URL(s)

Location: /metadata/manufacture/url

Property: url (Optional)

Type: array (of String)


Description: The URL of the organization. Multiple URLs are allowed. Each item of this array must be a string.

Examples:
  • https://example.com

7.7.5 Organizational Contact

Location: /metadata/manufacture/contact
Property: contact (Optional)

Type: Array

Description: A contact at the organization. Multiple contacts are allowed. Each item of this array must be an Organizational Contact object.

7.7.5.1 Organizational Contact

Location: /metadata/manufacture/contact/[

Type: Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

7.7.5.1.1 BOM Reference

Location: /metadata/manufacture/contact/[/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

7.7.5.1.2 Name

Location: /metadata/manufacture/contact/[/name

Property: name (Optional)

Type: String

Description: The name of a contact

Examples:
- Contact name

7.7.5.1.3 Email Address

Location: /metadata/manufacture/contact/[/email

Property: email (Optional)

Type: String

Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

Description: The email address of the contact.

Examples:
- firstname.lastname@example.com
7.7.5.1.4 Phone

Location: /metadata/manufacture/contact/[]/phone
Property: phone (Optional)

Type: String
Description: The phone number of the contact.
Examples:
  - 800-555-1212

7.8 Supplier

Location: /metadata/supplier
Property: supplier (Optional)

Type: Object
Description: The organization that supplied the component that the BOM describes. The supplier may often be the manufacturer, but may also be a distributor or repackager.

Table 16 – Properties for the supplier object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the organization</td>
</tr>
<tr>
<td>address</td>
<td>Object</td>
<td>Optional</td>
<td>The physical address (location) of the organization</td>
</tr>
<tr>
<td>url</td>
<td>Array</td>
<td>Optional</td>
<td>The URL of the organization. Multiple URLs are allowed.</td>
</tr>
<tr>
<td>contact</td>
<td>Array</td>
<td>Optional</td>
<td>A contact at the organization. Multiple contacts are allowed.</td>
</tr>
</tbody>
</table>

7.8.1 BOM Reference

Location: /metadata/supplier/bom-ref
Property: bom-ref (Optional)

Type: String
Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

7.8.2 Organization Name

Location: /metadata/supplier/name
Property: name (Optional)

Type: String
Description: The name of the organization
Examples: The name of the organization
  - Example Inc.
7.8.3 Organization Address

**Location:** /metadata/supplier/address

**Property:** address (Optional)

**Type:** Object

**Description:** The physical address (location) of the organization

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>Optional</td>
<td>The country name or the two-letter ISO 3166-1 country code.</td>
</tr>
<tr>
<td>region</td>
<td>String</td>
<td>Optional</td>
<td>The region or state in the country.</td>
</tr>
<tr>
<td>locality</td>
<td>String</td>
<td>Optional</td>
<td>The locality or city within the country.</td>
</tr>
<tr>
<td>postOfficeBoxNumber</td>
<td>String</td>
<td>Optional</td>
<td>The post office box number.</td>
</tr>
<tr>
<td>postalCode</td>
<td>String</td>
<td>Optional</td>
<td>The postal code.</td>
</tr>
<tr>
<td>streetAddress</td>
<td>String</td>
<td>Optional</td>
<td>The street address.</td>
</tr>
</tbody>
</table>

7.8.3.1 BOM Reference

**Location:** /metadata/supplier/address/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

7.8.3.2 Country

**Location:** /metadata/supplier/address/country

**Property:** country (Optional)

**Type:** String

**Description:** The country name or the two-letter ISO 3166-1 country code.

7.8.3.3 Region

**Location:** /metadata/supplier/address/region

**Property:** region (Optional)

**Type:** String

**Description:** The region or state in the country.

**Examples:**
- Texas
7.8.3.4 Locality
Location: /metadata/supplier/address/locality
Property: locality (Optional)
Type: String
Description: The locality or city within the country.
Examples:
  • Austin

7.8.3.5 Post Office Box Number
Location: /metadata/supplier/address/postOfficeBoxNumber
Property: postOfficeBoxNumber (Optional)
Type: String
Description: The post office box number.
Examples:
  • 901

7.8.3.6 Postal Code
Location: /metadata/supplier/address/postalCode
Property: postalCode (Optional)
Type: String
Description: The postal code.
Examples:
  • 78758

7.8.3.7 Street Address
Location: /metadata/supplier/address/streetAddress
Property: streetAddress (Optional)
Type: String
Description: The street address.
Examples:
  • 100 Main Street

7.8.4 Organization URL(s)
Location: /metadata/supplier/url
Property: url (Optional)
Type: array (of String)
Description: The URL of the organization. Multiple URLs are allowed. Each item of this array must be a string.
Examples:
  • https://example.com

7.8.5 Organizational Contact
Location: /metadata/supplier/contact
Property: contact (Optional)

Type: Array

Description: A contact at the organization. Multiple contacts are allowed. Each item of this array must be an Organizational Contact object.

7.8.5.1 Organizational Contact

Location: /metadata/supplier/contact/[]

Type: Object

Table 18 – Properties for the contact object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

7.8.5.1.1 BOM Reference

Location: /metadata/supplier/contact/[]/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

7.8.5.1.2 Name

Location: /metadata/supplier/contact/[]/name

Property: name (Optional)

Type: String

Description: The name of a contact

Examples:

- Contact name

7.8.5.1.3 Email Address

Location: /metadata/supplier/contact/[]/email

Property: email (Optional)

Type: String

Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

Description: The email address of the contact.

Examples:

- firstname.lastname@example.com
7.8.5.1.4 Phone

**Location:** /metadata/supplier/contact[/]/phone

**Property:** phone (Optional)

**Type:** String

**Description:** The phone number of the contact.

**Examples:**
- 800-555-1212

### 7.9 BOM Licence(s)

**Location:** /metadata/licenses

**Property:** licenses (Optional)

**Type:** Array

**Description:** The licence information for the BOM document. This may be different from the licence(s) of the component(s) that the BOM describes.

**Reference:** Refer to the license definition at /components[/]/licenses

### 7.10 Properties

**Location:** /metadata/properties

**Property:** properties (Optional)

**Type:** Array

**Description:** Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the [CycloneDX Property Taxonomy](https://cyclonedx.org/taxonomy). Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

#### 7.10.1 Lightweight name-value pair

**Location:** /metadata/properties[/]

**Type:** Object

**Description:** Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the [CycloneDX Property Taxonomy](https://cyclonedx.org/taxonomy). Formal registration is optional.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

#### 7.10.1.1 Name

**Location:** /metadata/properties[/]/name

**Property:** name (Required)
Type: String
Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

7.10.1.2 Value
Location: /metadata/properties/[]/value
Property: value (Optional)
Type: String
Description: The value of the property.

8 Components
Location: /components
Property: components (Optional)
Type: Array
Description: A list of software and hardware components. Each item of this array must be a Component object.

8.1 Component
Location: /components/[
Type: Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>type</td>
<td>String</td>
<td>Required</td>
<td>Specifies the type of component. For software components, classify as application if no more specific appropriate classification is available or cannot be determined for the component.</td>
</tr>
<tr>
<td>mime-type</td>
<td>String</td>
<td>Optional</td>
<td>The optional mime-type of the component. When used on file components, the mime-type can provide additional context about the kind of file being represented, such as an image, font, or executable. Some library or framework components may also have an associated mime-type.</td>
</tr>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the component elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>supplier</td>
<td>Object</td>
<td>Optional</td>
<td>The organization that supplied the component. The supplier may often be the manufacturer, but may also be a distributor or repackager.</td>
</tr>
<tr>
<td>manufacturer</td>
<td>Object</td>
<td>Optional</td>
<td>The organization that created the component. Manufacturer is common in components created through automated processes. Components created through manual means may have @.authors instead.</td>
</tr>
<tr>
<td>authors</td>
<td>Array</td>
<td>Optional</td>
<td>The person(s) who created the component. Authors are common in components created through manual processes. Components created through automated means may have @.manufacturer instead.</td>
</tr>
<tr>
<td>Property</td>
<td>Type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>-----------</td>
<td>---------</td>
<td>-------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>author</td>
<td>String</td>
<td>Optional</td>
<td>[Deprecated] This will be removed in a future version. Use @.authors or @.manufacturer instead. The person(s) or organization(s) that authored the component</td>
</tr>
<tr>
<td>publisher</td>
<td>String</td>
<td>Optional</td>
<td>The person(s) or organization(s) that published the component</td>
</tr>
<tr>
<td>group</td>
<td>String</td>
<td>Optional</td>
<td>The grouping name or identifier. This will often be a shortened, single name of the company or project that produced the component, or the source package or domain name. Whitespace and special characters should be avoided. Examples include: apache, org.apache.commons, and apache.org.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the component. This will often be a shortened, single name of the component. Examples: commons-lang3 and jquery</td>
</tr>
<tr>
<td>version</td>
<td>String</td>
<td>Optional</td>
<td>The component version. The version should ideally comply with semantic versioning but is not enforced.</td>
</tr>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>Specifies a description for the component</td>
</tr>
<tr>
<td>scope</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the scope of the component. If scope is not specified, 'required' scope SHOULD be assumed by the consumer of the BOM.</td>
</tr>
<tr>
<td>hashes</td>
<td>Array</td>
<td>Optional</td>
<td>The hashes of the component.</td>
</tr>
<tr>
<td>licenses</td>
<td>Array</td>
<td>Optional</td>
<td>EITHER (list of SPDX licenses and/or named licenses) OR (tuple of one SPDX License Expression)</td>
</tr>
<tr>
<td>copyright</td>
<td>String</td>
<td>Optional</td>
<td>A copyright notice informing users of the underlying claims to copyright ownership in a published work.</td>
</tr>
<tr>
<td>cpe</td>
<td>String</td>
<td>Optional</td>
<td>Asserts the identity of the component using CPE. The CPE must conform to the CPE 2.2 or 2.3 specification. See <a href="https://nvd.nist.gov/products/cpe">https://nvd.nist.gov/products/cpe</a>. Refer to @.evidence.identity to optionally provide evidence that substantiates the assertion of the component's identity.</td>
</tr>
<tr>
<td>purl</td>
<td>String</td>
<td>Optional</td>
<td>Asserts the identity of the component using package-url (purl). The purl, if specified, must be valid and conform to the specification defined at: <a href="https://github.com/package-url/purl-spec">https://github.com/package-url/purl-spec</a>. Refer to @.evidence.identity to optionally provide evidence that substantiates the assertion of the component's identity.</td>
</tr>
<tr>
<td>omniborId</td>
<td>Array</td>
<td>Optional</td>
<td>Asserts the identity of the component using the OmniBOR Artifact ID. The OmniBOR, if specified, must be valid and conform to the specification defined at: <a href="https://www.iana.org/assignments/uri-schemes/prov/gitoid">https://www.iana.org/assignments/uri-schemes/prov/gitoid</a>. Refer to @.evidence.identity to optionally provide evidence that substantiates the assertion of the component's identity.</td>
</tr>
<tr>
<td>Property</td>
<td>Type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>------------</td>
<td>---------</td>
<td>-------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>swhid</td>
<td>Array</td>
<td>Optional</td>
<td>Asserts the identity of the component using the Software Heritage persistent identifier (SWHID). The SWHID, if specified, must be valid and conform to the specification defined at: <a href="https://docs.softwareheritage.org/devel/swh-model/persistent-identifiers.html">https://docs.softwareheritage.org/devel/swh-model/persistent-identifiers.html</a>. Refer to @.evidence.identity to optionally provide evidence that substantiates the assertion of the component's identity.</td>
</tr>
<tr>
<td>swid</td>
<td>Object</td>
<td>Optional</td>
<td>Asserts the identity of the component using ISO-IEC 19770-2 Software Identification (SWID) Tags. Refer to @.evidence.identity to optionally provide evidence that substantiates the assertion of the component's identity.</td>
</tr>
<tr>
<td>modified</td>
<td>Boolean</td>
<td>Optional</td>
<td>[Deprecated] This will be removed in a future version. Use the pedigree element instead to supply information on exactly how the component was modified. A boolean value indicating if the component has been modified from the original. A value of true indicates the component is a derivative of the original. A value of false indicates the component has not been modified from the original.</td>
</tr>
<tr>
<td>pedigree</td>
<td>Object</td>
<td>Optional</td>
<td>Component pedigree is a way to document complex supply chain scenarios where components are created, distributed, modified, redistributed, combined with other components, etc. Pedigree supports viewing this complex chain from the beginning, the end, or anywhere in the middle. It also provides a way to document variants where the exact relation may not be known.</td>
</tr>
<tr>
<td>externalReferences</td>
<td>Array</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
<tr>
<td>components</td>
<td>Array</td>
<td>Optional</td>
<td>A list of software and hardware components included in the parent component. This is not a dependency tree. It provides a way to specify a hierarchical representation of component assemblies, similar to system → subsystem → parts assembly in physical supply chains.</td>
</tr>
<tr>
<td>evidence</td>
<td>Object</td>
<td>Optional</td>
<td>Provides the ability to document evidence collected through various forms of extraction or analysis.</td>
</tr>
<tr>
<td>releaseNotes</td>
<td>Object</td>
<td>Optional</td>
<td>Specifies optional release notes.</td>
</tr>
<tr>
<td>modelCard</td>
<td>Object</td>
<td>Optional</td>
<td>A model card describes the intended uses of a machine learning model and potential limitations, including biases and ethical considerations. Model cards typically contain the training parameters, which datasets were used to train the model, performance metrics, and other relevant data useful for ML transparency. This object SHOULD be specified for any component of type machine-learning-model and must not be specified for other component types.</td>
</tr>
<tr>
<td>Property</td>
<td>Type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>---------------</td>
<td>-----------</td>
<td>-------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>data</td>
<td>Array</td>
<td>Optional</td>
<td>This object SHOULD be specified for any component of type data and must not be specified for other component types.</td>
</tr>
<tr>
<td>cryptoProperties</td>
<td>Object</td>
<td>Optional</td>
<td>Cryptographic assets have properties that uniquely define them and that make them actionable for further reasoning. As an example, it makes a difference if one knows the algorithm family (e.g. AES) or the specific variant or instantiation (e.g. AES-128-GCM). This is because the security level and the algorithm primitive (authenticated encryption) are only defined by the definition of the algorithm variant. The presence of a weak cryptographic algorithm like SHA1 vs. HMAC-SHA1 also makes a difference.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.</td>
</tr>
<tr>
<td>tags</td>
<td>Array</td>
<td>Optional</td>
<td>Textual strings that aid in discovery, search, and retrieval of the associated object. Tags often serve as a way to group or categorize similar or related objects by various attributes.</td>
</tr>
<tr>
<td>signature</td>
<td>Array</td>
<td>Optional</td>
<td>Enveloped signature in JSON Signature Format (JSF).</td>
</tr>
</tbody>
</table>

### 8.1.1 Component Type

**Location:** /components/[]/type

**Property:** type (Required)

**Type:** String

**Description:** Specifies the type of component. For software components, classify as application if no more specific appropriate classification is available or cannot be determined for the component.

**Examples:**
- library

#### Table 21 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>application</td>
<td>A software application. Refer to <a href="https://en.wikipedia.org/wiki/Application_software">https://en.wikipedia.org/wiki/Application_software</a> for information about applications.</td>
</tr>
<tr>
<td><strong>Value</strong></td>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>container</td>
<td>A packaging and/or runtime format, not specific to any particular technology, which isolates software inside the container from software outside of a container through virtualization technology. Refer to <a href="https://en.wikipedia.org/wiki/OS-level_virtualization">https://en.wikipedia.org/wiki/OS-level_virtualization</a>.</td>
</tr>
<tr>
<td>platform</td>
<td>A runtime environment which interprets or executes software. This may include runtimes such as those that execute bytecode or low-code/no-code application platforms.</td>
</tr>
<tr>
<td>operating-system</td>
<td>A software operating system without regard to deployment model (i.e. installed on physical hardware, virtual machine, image, etc) Refer to <a href="https://en.wikipedia.org/wiki/Operating_system">https://en.wikipedia.org/wiki/Operating_system</a>.</td>
</tr>
<tr>
<td>device</td>
<td>A hardware device such as a processor or chip-set. A hardware device containing firmware SHOULD include a component for the physical hardware itself and another component of type 'firmware' or 'operating-system' (whichever is relevant), describing information about the software running on the device. See also the list of known device properties.</td>
</tr>
<tr>
<td>device-driver</td>
<td>A special type of software that operates or controls a particular type of device. Refer to <a href="https://en.wikipedia.org/wiki/Device_driver">https://en.wikipedia.org/wiki/Device_driver</a>.</td>
</tr>
<tr>
<td>firmware</td>
<td>A special type of software that provides low-level control over a device's hardware. Refer to <a href="https://en.wikipedia.org/wiki/Firmware">https://en.wikipedia.org/wiki/Firmware</a>.</td>
</tr>
<tr>
<td>machine-learning-model</td>
<td>A model based on training data that can make predictions or decisions without being explicitly programmed to do so.</td>
</tr>
<tr>
<td>data</td>
<td>A collection of discrete values that convey information.</td>
</tr>
<tr>
<td>cryptographic-asset</td>
<td>A cryptographic asset including algorithms, protocols, certificates, keys, tokens, and secrets.</td>
</tr>
</tbody>
</table>

**8.1.2 Mime-Type**

**Location:** /components/[/]mime-type

**Property:** mime-type (Optional)

**Type:** String

**Pattern Constraint:** ^[-+a-zA-Z0-9.]+/[-+a-zA-Z0-9.]+$

**Description:** The optional mime-type of the component. When used on file components, the mime-type can provide additional context about the kind of file being represented, such as an image, font, or executable. Some library or framework components may also have an associated mime-type.

**Examples:**
- image/jpeg
8.1.3 BOM Reference

Location: /components/[]/bom-ref
Property: bom-ref (Optional)

Type: String
Description: An optional identifier which can be used to reference the component elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

8.1.4 Component Supplier

Location: /components/[]/supplier
Property: supplier (Optional)

Type: Object
Description: The organization that supplied the component. The supplier may often be the manufacturer, but may also be a distributor or repackager.

Table 22 – Properties for the supplier object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the organization</td>
</tr>
<tr>
<td>address</td>
<td>Object</td>
<td>Optional</td>
<td>The physical address (location) of the organization</td>
</tr>
<tr>
<td>url</td>
<td>Array</td>
<td>Optional</td>
<td>The URL of the organization. Multiple URLs are allowed.</td>
</tr>
<tr>
<td>contact</td>
<td>Array</td>
<td>Optional</td>
<td>A contact at the organization. Multiple contacts are allowed.</td>
</tr>
</tbody>
</table>

8.1.4.1 BOM Reference

Location: /components/[]/supplier/bom-ref
Property: bom-ref (Optional)

Type: String
Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

8.1.4.2 Organization Name

Location: /components/[]/supplier/name
Property: name (Optional)

Type: String
Description: The name of the organization
Examples:
- Example Inc.
8.1.4.3 Organization Address

**Location:** /components/[/]/supplier/address

**Property:** address (Optional)

**Type:** Object

**Description:** The physical address (location) of the organization

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>Optional</td>
<td>The country name or the two-letter ISO 3166-1 country code.</td>
</tr>
<tr>
<td>region</td>
<td>String</td>
<td>Optional</td>
<td>The region or state in the country.</td>
</tr>
<tr>
<td>locality</td>
<td>String</td>
<td>Optional</td>
<td>The locality or city within the country.</td>
</tr>
<tr>
<td>postOfficeBoxNumber</td>
<td>String</td>
<td>Optional</td>
<td>The post office box number.</td>
</tr>
<tr>
<td>postalCode</td>
<td>String</td>
<td>Optional</td>
<td>The postal code.</td>
</tr>
<tr>
<td>streetAddress</td>
<td>String</td>
<td>Optional</td>
<td>The street address.</td>
</tr>
</tbody>
</table>

8.1.4.3.1 BOM Reference

**Location:** /components/[/]/supplier/address/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

8.1.4.3.2 Country

**Location:** /components/[/]/supplier/address/country

**Property:** country (Optional)

**Type:** String

**Description:** The country name or the two-letter ISO 3166-1 country code.

8.1.4.3.3 Region

**Location:** /components/[/]/supplier/address/region

**Property:** region (Optional)

**Type:** String

**Description:** The region or state in the country.

**Examples:**
- Texas
8.1.4.3.4 Locality
Location: /components/[]/supplier/address/locality
Property: locality (Optional)
Type: String
Description: The locality or city within the country.
Examples:
  • Austin

8.1.4.3.5 Post Office Box Number
Location: /components/[]/supplier/address/postOfficeBoxNumber
Property: postOfficeBoxNumber (Optional)
Type: String
Description: The post office box number.
Examples:
  • 901

8.1.4.3.6 Postal Code
Location: /components/[]/supplier/address/postalCode
Property: postalCode (Optional)
Type: String
Description: The postal code.
Examples:
  • 78758

8.1.4.3.7 Street Address
Location: /components/[]/supplier/address/streetAddress
Property: streetAddress (Optional)
Type: String
Description: The street address.
Examples:
  • 100 Main Street

8.1.4.4 Organization URL(s)
Location: /components/[]/supplier/url
Property: url (Optional)
Type: array (of String)
Description: The URL of the organization. Multiple URLs are allowed. Each item of this array must be a string.
Examples:
  • https://example.com

8.1.4.5 Organizational Contact
Location: /components/[]/supplier/contact
**Property:** contact (Optional)

**Type:** Array

**Description:** A contact at the organization. Multiple contacts are allowed. Each item of this array must be an Organizational Contact object.

### 8.1.4.5.1 Organizational Contact

**Location:** /components/[]/supplier/contact/[]

**Type:** Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

### 8.1.4.5.2 BOM Reference

**Location:** /components/[]/supplier/contact/[]/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

### 8.1.4.5.3 Name

**Location:** /components/[]/supplier/contact/[]/name

**Property:** name (Optional)

**Type:** String

**Description:** The name of a contact

**Examples:**
- Contact name

### 8.1.4.5.4 Email Address

**Location:** /components/[]/supplier/contact/[]/email

**Property:** email (Optional)

**Type:** String

**Format:** idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

**Description:** The email address of the contact

**Examples:**
- firstname.lastname@example.com
8.1.4.5.5 Phone

**Location:** /components/[]/supplier/contact/[]/phone
**Property:** phone (Optional)
**Type:** String
**Description:** The phone number of the contact.
**Examples:**
- 800-555-1212

8.1.5 Component Manufacturer

**Location:** /components/[]/manufacturer
**Property:** manufacturer (Optional)
**Type:** Object
**Description:** The organization that created the component. Manufacturer is common in components created through automated processes. Components created through manual means may have @.authors instead.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the organization</td>
</tr>
<tr>
<td>address</td>
<td>Object</td>
<td>Optional</td>
<td>The physical address (location) of the organization</td>
</tr>
<tr>
<td>url</td>
<td>Array</td>
<td>Optional</td>
<td>The URL of the organization. Multiple URLs are allowed.</td>
</tr>
<tr>
<td>contact</td>
<td>Array</td>
<td>Optional</td>
<td>A contact at the organization. Multiple contacts are allowed.</td>
</tr>
</tbody>
</table>

8.1.5.1 BOM Reference

**Location:** /components/[]/manufacturer/bom-ref
**Property:** bom-ref (Optional)
**Type:** String
**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

8.1.5.2 Organization Name

**Location:** /components/[]/manufacturer/name
**Property:** name (Optional)
**Type:** String
**Description:** The name of the organization
**Examples:**
- Example Inc.
8.1.5.3 Organization Address

Location: /components/*/manufacturer/address

Property: address (Optional)

Type: Object

Description: The physical address (location) of the organization

Table 26 – Properties for the address object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>Optional</td>
<td>The country name or the two-letter ISO 3166-1 country code.</td>
</tr>
<tr>
<td>region</td>
<td>String</td>
<td>Optional</td>
<td>The region or state in the country.</td>
</tr>
<tr>
<td>locality</td>
<td>String</td>
<td>Optional</td>
<td>The locality or city within the country.</td>
</tr>
<tr>
<td>postOfficeBoxNumber</td>
<td>String</td>
<td>Optional</td>
<td>The post office box number.</td>
</tr>
<tr>
<td>postalCode</td>
<td>String</td>
<td>Optional</td>
<td>The postal code.</td>
</tr>
<tr>
<td>streetAddress</td>
<td>String</td>
<td>Optional</td>
<td>The street address.</td>
</tr>
</tbody>
</table>

8.1.5.3.1 BOM Reference

Location: /components/*/manufacturer/address/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

8.1.5.3.2 Country

Location: /components/*/manufacturer/address/country

Property: country (Optional)

Type: String

Description: The country name or the two-letter ISO 3166-1 country code.

8.1.5.3.3 Region

Location: /components/*/manufacturer/address/region

Property: region (Optional)

Type: String

Description: The region or state in the country.

Examples:
- Texas
8.1.5.3.4  **Locality**

**Location:** /components/[]/manufacturer/address/locality
**Property:** locality (Optional)
**Type:** String
**Description:** The locality or city within the country.
**Examples:**
- Austin

8.1.5.3.5  **Post Office Box Number**

**Location:** /components/[]/manufacturer/address/postOfficeBoxNumber
**Property:** postOfficeBoxNumber (Optional)
**Type:** String
**Description:** The post office box number.
**Examples:**
- 901

8.1.5.3.6  **Postal Code**

**Location:** /components/[]/manufacturer/address/postalCode
**Property:** postalCode (Optional)
**Type:** String
**Description:** The postal code.
**Examples:**
- 78758

8.1.5.3.7  **Street Address**

**Location:** /components/[]/manufacturer/address/streetAddress
**Property:** streetAddress (Optional)
**Type:** String
**Description:** The street address.
**Examples:**
- 100 Main Street

8.1.5.4  **Organization URL(s)**

**Location:** /components/[]/manufacturer/url
**Property:** url (Optional)
**Type:** array (of String)
**Format:** iri-reference as specified in [RFC 3987](https://www.ietf.org/rfc/rfc3987.html)
**Description:** The URL of the organization. Multiple URLs are allowed. Each item of this array must be a string.
**Examples:**
- https://example.com

8.1.5.5  **Organizational Contact**

**Location:** /components/[]/manufacturer/contact
Property: contact (Optional)

Type: Array

Description: A contact at the organization. Multiple contacts are allowed. Each item of this array must be an Organizational Contact object.

8.1.5.5.1 Organizational Contact

Location: /components/manufacturer/contact/

Type: Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

8.1.5.5.2 BOM Reference

Location: /components/manufacturer/contact/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

8.1.5.5.3 Name

Location: /components/manufacturer/contact/name

Property: name (Optional)

Type: String

Description: The name of a contact

Examples:
- Contact name

8.1.5.5.4 Email Address

Location: /components/manufacturer/contact/email

Property: email (Optional)

Type: String

Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

Description: The email address of the contact.

Examples:
- firstname.lastname@example.com
8.1.5.5.5   Phone

Location: /components/[]/manufacturer/contact/[]/phone
Property: phone (Optional)

Type: String
Description: The phone number of the contact.
Examples:
  • 800-555-1212

8.1.6   Component Authors

Location: /components/[]/authors
Property: authors (Optional)

Type: Array
Description: The person(s) who created the component. Authors are common in components created through manual processes. Components created through automated means may have @.manufacturer instead. Each item of this array must be an Organizational Contact object.

8.1.6.1   Organizational Contact

Location: /components/[]/authors/[]
Type: Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

8.1.6.1.1   BOM Reference

Location: /components/[]/authors/[]/bom-ref
Property: bom-ref (Optional)

Type: String
Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

8.1.6.1.2   Name

Location: /components/[]/authors/[]/name
Property: name (Optional)

Type: String
Description: The name of a contact
Examples:
- Contact name

8.1.6.1.3 Email Address

Location: /components[]/authors[]/email
Property: email (Optional)
Type: String
Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)
Description: The email address of the contact.
Examples:
- firstname.lastname@example.com

8.1.6.1.4 Phone

Location: /components[]/authors[]/phone
Property: phone (Optional)
Type: String
Description: The phone number of the contact.
Examples:
- 800-555-1212

8.1.7 Component Author (legacy)

Location: /components[]/author
Property: author (Optional and Deprecated)
Type: String
Description: [Deprecated] This will be removed in a future version. Use @.authors or @.manufacturer instead. The person(s) or organization(s) that authored the component
Examples:
- Acme Inc

8.1.8 Component Publisher

Location: /components[]/publisher
Property: publisher (Optional)
Type: String
Description: The person(s) or organization(s) that published the component
Examples:
- Acme Inc

8.1.9 Component Group

Location: /components[]/group
Property: group (Optional)
Type: String
Description: The grouping name or identifier. This will often be a shortened, single name of the company or project that produced the component, or the source package or domain name. Whitespace and special characters should be avoided. Examples include: apache, org.apache.commons, and apache.org.
Examples:

- com.acme

8.1.10 Component Name

Location: /components/[i]/name
Property: name (Required)

Type: String

Description: The name of the component. This will often be a shortened, single name of the component. Examples: commons-lang3 and jquery

Examples:

- tomcat-catalina

8.1.11 Component Version

Location: /components/[i]/version
Property: version (Optional)

Type: String

Description: The component version. The version should ideally comply with semantic versioning but is not enforced.

Examples:

- 9.0.14
- v1.33.7
- 7.0.0-M1
- 2.0pre1
- 1.0.0-beta1
- 0.8.15

8.1.12 Component Description

Location: /components/[i]/description
Property: description (Optional)

Type: String

Description: Specifies a description for the component

8.1.13 Component Scope

Location: /components/[i]/scope
Property: scope (Optional)

Type: String

Default Value: required

Description: Specifies the scope of the component. If scope is not specified, 'required' scope SHOULD be assumed by the consumer of the BOM.
Table 29 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>required</td>
<td>The component is required for runtime</td>
</tr>
<tr>
<td>optional</td>
<td>The component is optional at runtime. Optional components are components that are not capable of being called due to them not being installed or otherwise accessible by any means. Components that are installed but due to configuration or other restrictions are prohibited from being called must be scoped as 'required'.</td>
</tr>
<tr>
<td>excluded</td>
<td>Components that are excluded provide the ability to document component usage for test and other non-runtime purposes. Excluded components are not reachable within a call graph at runtime.</td>
</tr>
</tbody>
</table>

8.1.14 Component Hashes

**Location:** `/components/[]/hashes`

**Property:** `hashes` (Optional)

**Type:** Array

**Description:** The hashes of the component. Each item of this array must be a Hash object.

8.1.14.1 Hash

**Location:** `/components/[]/hashes/[]`

**Type:** Object

Table 30 – Properties for the hashes object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>alg</td>
<td>String</td>
<td>Required</td>
<td>The algorithm that generated the hash value.</td>
</tr>
<tr>
<td>content</td>
<td>String</td>
<td>Required</td>
<td>The value of the hash.</td>
</tr>
</tbody>
</table>

8.1.14.1.1 Hash Algorithm

**Location:** `/components/[]/hashes/[]/alg`

**Property:** `alg` (Required)

**Type:** String

**Description:** The algorithm that generated the hash value.

**Enumeration:** Must be one of:

- MD5
- SHA-1
- SHA-256
- SHA-384
- SHA-512
- SHA3-256
- SHA3-384
- SHA3-512
• BLAKE2b-256
• BLAKE2b-384
• BLAKE2b-512
• BLAKE3

8.1.14.1.2 Hash Value

Location: /components/[]/hashes/[]/content

Property: content (Required)

Type: String

Pattern Constraint: ^([a-fA-F0-9]{32}|[a-fA-F0-9]{40}|[a-fA-F0-9]{64}|[a-fA-F0-9]{96}|[a-fA-F0-9]{128})$

Description: The value of the hash.

Examples:
• 3942447fac867ae5cdb3229b658f4d48

8.1.15 Component Licence(s)

Location: /components/[]/licenses

Property: licenses (Optional)

Type: Array

Description: EITHER (list of SPDX licences and/or named licences) OR (tuple of one SPDX Licence Expression)

Must be one of:
1. Multiple licenses
2. SPDX License Expression

8.1.16 Multiple licences

Type: Array

Description: A list of SPDX licences and/or named licences.

8.1.17 SPDX Licence Expression

Type: Array

Description: A tuple of exactly one SPDX Licence Expression.

8.1.18 Multiple licences

Location: /components/[]/licenses

Property: licenses

Type: Array

Description: A list of SPDX licences and/or named licences. Each item of this array must be a Licence object.

8.1.18.1 Licence

Location: /components/[]/licenses/[]

Type: Object
Table 31 – Properties for the licenses object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>license</td>
<td>Array</td>
<td>Required</td>
<td>Specifies the details and attributes related to a software license. It can either include a valid SPDX license identifier or a named license, along with additional properties such as license acknowledgment, comprehensive commercial licensing information, and the full text of the license.</td>
</tr>
</tbody>
</table>

8.1.18.1.1 Licence

**Location:** /components/[\]/licenses/[\]/license

**Property:** license (Required)

**Type:** Object

**Description:** Specifies the details and attributes related to a software license. It can either include a valid SPDX license identifier or a named license, along with additional properties such as license acknowledgment, comprehensive commercial licensing information, and the full text of the license.

Table 32 – Properties for the license object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the license elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>id</td>
<td>String</td>
<td>Optional</td>
<td>A valid SPDX license identifier. If specified, this value must be one of the enumeration of valid SPDX license identifiers defined in the spdx.schema.json (or spdx.xml) subschema which is synchronized with the official SPDX license list.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the license. This may include the name of a commercial or proprietary license or an open source license that may not be defined by SPDX.</td>
</tr>
<tr>
<td>acknowledgement</td>
<td>String</td>
<td>Optional</td>
<td>Declared licenses and concluded licenses represent two different stages in the licensing process within software development. Declared licenses refer to the initial intention of the software authors regarding the licensing terms under which their code is released. On the other hand, concluded licenses are the result of a comprehensive analysis of the project's codebase to identify and confirm the actual licenses of the components used, which may differ from the initially declared licenses. While declared licenses provide an upfront indication of the licensing intentions, concluded licenses offer a more thorough understanding of the actual licensing within a project, facilitating proper compliance and risk management. Observed licenses are defined in @.evidence.licenses. Observed licenses form the evidence necessary to substantiate a concluded license.</td>
</tr>
<tr>
<td>text</td>
<td>Object</td>
<td>Optional</td>
<td>An optional way to include the textual content of a license.</td>
</tr>
<tr>
<td>url</td>
<td>String</td>
<td>Optional</td>
<td>The URL to the license file. If specified, a 'license' externalReference should also be specified for completeness</td>
</tr>
<tr>
<td>Property</td>
<td>Type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>---------------</td>
<td>---------</td>
<td>-------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>licensing</td>
<td>Object</td>
<td>Optional</td>
<td>Licensing details describing the licensor/licensee, license type, renewal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>and expiration dates, and other important metadata</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>provides flexibility to include data not officially supported in the standard</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>without having to use additional namespaces or create extensions.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Unlike key-value stores, properties support duplicate names, each</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>potentially having different values. Property names of interest to the</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>general public are encouraged to be registered in the CycloneDX</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Property Taxonomy. Formal registration is optional.</td>
</tr>
</tbody>
</table>

8.1.18.1.2 BOM Reference

Location: /components/[]/licenses/[]/license/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the licence elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

8.1.18.1.3 Licence ID (SPDX)

Location: /components/[]/licenses/[]/license/id

Property: id (Optional)

Type: String

Description: A valid SPDX licence identifier. If specified, this value must be one of the enumeration of valid SPDX licence identifiers defined in the spdx.schema.json (or spdx.xml) subschema which is synchronized with the official SPDX licence list.

Examples:
• Apache-2.0

8.1.18.1.4 Licence Name

Location: /components/[]/licenses/[]/license/name

Property: name (Optional)

Type: String

Description: The name of the licence. This may include the name of a commercial or proprietary licence or an open source licence that may not be defined by SPDX.

Examples:
• Acme Software License

8.1.18.1.5 Licence Acknowledgement

Location: /components/[]/licenses/[]/license/acknowledgement

Property: acknowledgement (Optional)

Type: String

Description: Declared licences and concluded licences represent two different stages in the licencing process within software development. Declared licences refer to the initial intention of the software authors regarding the licencing terms under which their code is released. On the other hand, concluded licences are the result of
a comprehensive analysis of the project's codebase to identify and confirm the actual licences of the components used, which may differ from the initially declared licences. While declared licences provide an upfront indication of the licencing intentions, concluded licences offer a more thorough understanding of the actual licencing within a project, facilitating proper compliance and risk management. Observed licences are defined in `@evidence.licenses`. Observed licences form the evidence necessary to substantiate a concluded licence.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>declared</td>
<td>Declared licences represent the initial intentions of authors regarding the licencing terms of their code.</td>
</tr>
<tr>
<td>concluded</td>
<td>Concluded licences are verified and confirmed.</td>
</tr>
</tbody>
</table>

### 8.1.18.1.6 Licence text

**Location:** /components/*/licenses/*/license/text

**Property:** text (Optional)

**Type:** Object

**Description:** An optional way to include the textual content of a licence.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>contentType</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plan text documents. <a href="https://tools.ietf.org/html/rfc2045">RFC 2045 section 5.1</a> outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the <a href="https">IANA media types registry</a>.</td>
</tr>
<tr>
<td>encoding</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the optional encoding the text is represented in.</td>
</tr>
<tr>
<td>content</td>
<td>String</td>
<td>Required</td>
<td>The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.</td>
</tr>
</tbody>
</table>

### 8.1.18.1.7 Content-Type

**Location:** /components/*/licenses/*/license/text/contentType

**Property:** contentType (Optional)

**Type:** String

**Default Value:** text/plain

**Description:** Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plan text documents. [RFC 2045 section 5.1](https://tools.ietf.org/html/rfc2045) outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the [IANA media types registry](https).

**Examples:**
- text/plain
- application/json
- image/png
8.1.18.1.8 Encoding

**Location:** /components/[]/licenses/[]/license/text/encoding

**Property:** encoding (Optional)

**Type:** String

**Description:** Specifies the optional encoding the text is represented in.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>base64</td>
<td>Base64 is a binary-to-text encoding scheme that represents binary data in an ASCII string.</td>
</tr>
</tbody>
</table>

8.1.18.1.9 Attachment Text

**Location:** /components/[]/licenses/[]/license/text/content

**Property:** content (Required)

**Type:** String

**Description:** The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.

8.1.18.1.10 Licence URL

**Location:** /components/[]/licenses/[]/license/url

**Property:** url (Optional)

**Type:** String

**Format:** iri-reference as specified in [RFC 3987](https://www.ietf.org/rfc/rfc3987.html)

**Description:** The URL to the licence file. If specified, a 'licence' externalReference should also be specified for completeness

**Examples:**
- https://www.apache.org/licenses/LICENSE-2.0.txt

8.1.18.1.11 Licencing information

**Location:** /components/[]/licenses/[]/license/licensing

**Property:** licensing (Optional)

**Type:** Object

**Description:** Licencing details describing the licensor/licensee, licence type, renewal and expiration dates, and other important metadata

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>altIds</td>
<td>Array</td>
<td>Optional</td>
<td>License identifiers that may be used to manage licenses and their lifecycle</td>
</tr>
<tr>
<td>licensor</td>
<td>Array</td>
<td>Optional</td>
<td>The individual or organization that grants a license to another individual or organization</td>
</tr>
<tr>
<td>licensee</td>
<td>Array</td>
<td>Optional</td>
<td>The individual or organization for which a license was granted to</td>
</tr>
<tr>
<td>purchaser</td>
<td>Array</td>
<td>Optional</td>
<td>The individual or organization that purchased the license</td>
</tr>
</tbody>
</table>
### Property Types

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>purchaseOrder</td>
<td>String</td>
<td>Optional</td>
<td>The purchase order identifier the purchaser sent to a supplier or vendor to authorize a purchase</td>
</tr>
<tr>
<td>licenseTypes</td>
<td>Array</td>
<td>Optional</td>
<td>The type of license(s) that was granted to the licensee.</td>
</tr>
<tr>
<td>lastRenewal</td>
<td>String</td>
<td>Optional</td>
<td>The timestamp indicating when the license was last renewed. For new purchases, this is often the purchase or acquisition date. For non-perpetual licenses or subscriptions, this is the timestamp of when the license was last renewed.</td>
</tr>
<tr>
<td>expiration</td>
<td>String</td>
<td>Optional</td>
<td>The timestamp indicating when the current license expires (if applicable).</td>
</tr>
</tbody>
</table>

### 8.1.18.1.12 Alternate Licence Identifiers

**Location:** /components/[]/licenses/[]/license/licensing/altIds  
**Property:** altIds (Optional)  
**Type:** array (of String)  
**Description:** Licence identifiers that may be used to manage licences and their lifecycle. Each item of this array must be a string.

### 8.1.18.1.13 Licensor

**Location:** /components/[]/licenses/[]/license/licensing/licensor  
**Property:** licensor (Optional)  
**Type:** Object  
**Description:** The individual or organization that grants a licence to another individual or organization

#### Table 37 – Properties for the licensor object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>organization</td>
<td>Object</td>
<td>Optional</td>
<td>The organization that granted the license</td>
</tr>
<tr>
<td>individual</td>
<td>Object</td>
<td>Optional</td>
<td>The individual, not associated with an organization, that granted the license</td>
</tr>
</tbody>
</table>

### 8.1.18.1.14 Licensor (Organization)

**Location:** /components/[]/licenses/[]/license/licensing/licensor/organization  
**Property:** organization (Optional)  
**Type:** Object  
**Description:** The organization that granted the licence
Table 38 – Properties for the organization object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the organization</td>
</tr>
<tr>
<td>address</td>
<td>Object</td>
<td>Optional</td>
<td>The physical address (location) of the organization</td>
</tr>
<tr>
<td>url</td>
<td>Array</td>
<td>Optional</td>
<td>The URL of the organization. Multiple URLs are allowed.</td>
</tr>
<tr>
<td>contact</td>
<td>Array</td>
<td>Optional</td>
<td>A contact at the organization. Multiple contacts are allowed.</td>
</tr>
</tbody>
</table>

8.1.18.1.15 BOM Reference

**Location:** /components/[]/licenses/[]/license/licensing/licensor/organization/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

8.1.18.1.16 Organization Name

**Location:** /components/[]/licenses/[]/license/licensing/licensor/organization/name

**Property:** name (Optional)

**Type:** String

**Description:** The name of the organization

**Examples:**
- Example Inc.

8.1.18.1.17 Organization Address

**Location:** /components/[]/licenses/[]/license/licensing/licensor/organization/address

**Property:** address (Optional)

**Type:** Object

**Description:** The physical address (location) of the organization

Table 39 – Properties for the address object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>Optional</td>
<td>The country name or the two-letter ISO 3166-1 country code.</td>
</tr>
<tr>
<td>Property</td>
<td>Type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------------</td>
<td>--------</td>
<td>-------------</td>
<td>---------------------------------------</td>
</tr>
<tr>
<td>region</td>
<td>String</td>
<td>Optional</td>
<td>The region or state in the country.</td>
</tr>
<tr>
<td>locality</td>
<td>String</td>
<td>Optional</td>
<td>The locality or city within the country.</td>
</tr>
<tr>
<td>postOfficeBoxNumber</td>
<td>String</td>
<td>Optional</td>
<td>The post office box number.</td>
</tr>
<tr>
<td>postalCode</td>
<td>String</td>
<td>Optional</td>
<td>The postal code.</td>
</tr>
<tr>
<td>streetAddress</td>
<td>String</td>
<td>Optional</td>
<td>The street address.</td>
</tr>
</tbody>
</table>

8.1.18.1.18  **BOM Reference**

**Location:** /components/[]/licenses/[]/license/licensing/licensor/organization/address/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

8.1.18.1.19  **Country**

**Location:** /components/[]/licenses/[]/license/licensing/licensor/organization/address/country

**Property:** country (Optional)

**Type:** String

**Description:** The country name or the two-letter ISO 3166-1 country code.

8.1.18.1.20  **Region**

**Location:** /components/[]/licenses/[]/license/licensing/licensor/organization/address/region

**Property:** region (Optional)

**Type:** String

**Description:** The region or state in the country.

**Examples:**
- Texas

8.1.18.1.21  **Locality**

**Location:** /components/[]/licenses/[]/license/licensing/licensor/organization/address/locality

**Property:** locality (Optional)

**Type:** String

**Description:** The locality or city within the country.

**Examples:**
- Austin

8.1.18.1.22  **Post Office Box Number**

**Location:** /components/[]/licenses/[]/license/licensing/licensor/organization/address/postOfficeBoxNumber

**Property:** postOfficeBoxNumber (Optional)
Type: String
Description: The post office box number.
Examples:
  • 901

8.1.18.1.23 Postal Code

Location: /components/[]/licenses/[]/license/licensing/licensor/organization/address/postalCode
Property: postalCode (Optional)

Type: String
Description: The postal code.
Examples:
  • 78758

8.1.18.1.24 Street Address

Location: /components/[]/licenses/[]/license/licensing/licensor/organization/address/streetAddress
Property: streetAddress (Optional)

Type: String
Description: The street address.
Examples:
  • 100 Main Street

8.1.18.1.25 Organization URL(s)

Location: /components/[]/licenses/[]/license/licensing/licensor/organization/address/url
Property: url (Optional)

Type: array (of String)
Description: The URL of the organization. Multiple URLs are allowed. Each item of this array must be a string.
Examples:
  • https://example.com

8.1.18.1.26 Organizational Contact

Location: /components/[]/licenses/[]/license/licensing/licensor/organization/contact
Property: contact (Optional)

Type: Array
Description: A contact at the organization. Multiple contacts are allowed. Each item of this array must be an Organizational Contact object.

8.1.18.1.27 Organizational Contact

Location: /components/[]/licenses/[]/license/licensing/licensor/organization/contact/[]
Type: Object
### Table 40 – Properties for the contact object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

#### 8.1.18.1.28 BOM Reference

**Location:** /components/[]/licenses/[]/license/licensing/licensor/organization/contact/[]/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

#### 8.1.18.1.29 Name

**Location:** /components/[]/licenses/[]/license/licensing/licensor/organization/contact/[]/name

**Property:** name (Optional)

**Type:** String

**Description:** The name of a contact

**Examples:**
- Contact name

#### 8.1.18.1.30 Email Address

**Location:** /components/[]/licenses/[]/license/licensing/licensor/organization/contact/[]/email

**Property:** email (Optional)

**Type:** String

**Format:** idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

**Description:** The email address of the contact.

**Examples:**
- firstname.lastname@example.com

#### 8.1.18.1.31 Phone

**Location:** /components/[]/licenses/[]/license/licensing/licensor/organization/contact/[]/phone

**Property:** phone (Optional)

**Type:** String

**Description:** The phone number of the contact.

**Examples:**
- 800-555-1212
8.1.18.1.32 Organizational Contact

Location: /components/[]/licenses/[]/license/licensing/licensor/individual

Property: individual (Optional)

Type: Object

Description: The individual, not associated with an organization, that granted the licence

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

8.1.18.1.33 BOM Reference

Location: /components/[]/licenses/[]/license/licensing/licensor/individual/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

8.1.18.1.34 Name

Location: /components/[]/licenses/[]/license/licensing/licensor/individual/name

Property: name (Optional)

Type: String

Description: The name of a contact

Examples:
- Contact name

8.1.18.1.35 Email Address

Location: /components/[]/licenses/[]/license/licensing/licensor/individual/email

Property: email (Optional)

Type: String

Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

Description: The email address of the contact.

Examples:
- firstname.lastname@example.com
8.1.18.1.36 Phone

**Location:** /components/[]/licenses/[]/license/licensing/licensor/individual/phone

**Property:** phone (Optional)

**Type:** String

**Description:** The phone number of the contact.

**Examples:**
- 800-555-1212

8.1.18.1.37 Licensee

**Location:** /components/[]/licenses/[]/license/licensing/licensee

**Property:** licensee (Optional)

**Type:** Object

**Description:** The individual or organization for which a licence was granted to

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>organization</td>
<td>Object</td>
<td>Optional</td>
<td>The organization that was granted the license</td>
</tr>
<tr>
<td>individual</td>
<td>Object</td>
<td>Optional</td>
<td>The individual, not associated with an organization, that was granted the</td>
</tr>
</tbody>
</table>

8.1.18.1.38 Licensee (Organization)

**Location:** /components/[]/licenses/[]/license/licensing/licensee/organization

**Property:** organization (Optional)

**Type:** Object

**Description:** The organization that was granted the licence

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the organization</td>
</tr>
<tr>
<td>address</td>
<td>Object</td>
<td>Optional</td>
<td>The physical address (location) of the organization</td>
</tr>
<tr>
<td>url</td>
<td>Array</td>
<td>Optional</td>
<td>The URL of the organization. Multiple URLs are allowed.</td>
</tr>
<tr>
<td>contact</td>
<td>Array</td>
<td>Optional</td>
<td>A contact at the organization. Multiple contacts are allowed.</td>
</tr>
</tbody>
</table>

8.1.18.1.39 BOM Reference

**Location:** /components/[]/licenses/[]/license/licensing/licensee/organization/bom-ref

**Property:** bom-ref (Optional)
Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

8.1.18.1.40 Organization Name

Location: /components/[]/licenses/[]/license/licensing/licensee/organization/name

Property: name (Optional)

Type: String

Description: The name of the organization

Examples:
- Example Inc.

8.1.18.1.41 Organization Address

Location: /components/[]/licenses/[]/license/licensing/licensee/organization/address

Property: address (Optional)

Type: Object

Description: The physical address (location) of the organization

Table 44 – Properties for the address object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>Optional</td>
<td>The country name or the two-letter ISO 3166-1 country code.</td>
</tr>
<tr>
<td>region</td>
<td>String</td>
<td>Optional</td>
<td>The region or state in the country.</td>
</tr>
<tr>
<td>locality</td>
<td>String</td>
<td>Optional</td>
<td>The locality or city within the country.</td>
</tr>
<tr>
<td>postOfficeBoxNumber</td>
<td>String</td>
<td>Optional</td>
<td>The post office box number.</td>
</tr>
<tr>
<td>postalCode</td>
<td>String</td>
<td>Optional</td>
<td>The postal code.</td>
</tr>
<tr>
<td>streetAddress</td>
<td>String</td>
<td>Optional</td>
<td>The street address.</td>
</tr>
</tbody>
</table>

8.1.18.1.42 BOM Reference

Location: /components/[]/licenses/[]/license/licensing/licensee/organization/address/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.
8.1.18.1.43  Country
Location: /components/[]/licenses/[]/license/licensing/licensee/organization/address/country
Property: country (Optional)
Type: String
Description: The country name or the two-letter ISO 3166-1 country code.

8.1.18.1.44  Region
Location: /components/[]/licenses/[]/license/licensing/licensee/organization/address/region
Property: region (Optional)
Type: String
Description: The region or state in the country.
Examples:
- Texas

8.1.18.1.45  Locality
Location: /components/[]/licenses/[]/license/licensing/licensee/organization/address/locality
Property: locality (Optional)
Type: String
Description: The locality or city within the country.
Examples:
- Austin

8.1.18.1.46  Post Office Box Number
Location: /components/[]/licenses/[]/license/licensing/licensee/organization/address/postOfficeBoxNumber
Property: postOfficeBoxNumber (Optional)
Type: String
Description: The post office box number.
Examples:
- 901

8.1.18.1.47  Postal Code
Location: /components/[]/licenses/[]/license/licensing/licensee/organization/address/postalCode
Property: postalCode (Optional)
Type: String
Description: The postal code.
Examples:
- 78758

8.1.18.1.48  Street Address
Location: /components/[]/licenses/[]/license/licensing/licensee/organization/address/streetAddress
Property: streetAddress (Optional)
Type: String
Description: The street address.
Examples:

- 100 Main Street

8.1.18.1.49 Organization URL(s)

**Location:** /components/[][]/licenses/[][]/license/licensing/licensee/organization/url

**Property:** url (Optional)

**Type:** array (of String)

**Format:** iri-reference as specified in [RFC 3987](https://www.ietf.org/rfc/rfc3987.html)

**Description:** The URL of the organization. Multiple URLs are allowed. Each item of this array must be a string.

Examples:

- https://example.com

8.1.18.1.50 Organizational Contact

**Location:** /components/[][]/licenses/[][]/license/licensing/licensee/organization/contact

**Property:** contact (Optional)

**Type:** Array

**Description:** A contact at the organization. Multiple contacts are allowed. Each item of this array must be an Organizational Contact object.

8.1.18.1.51 Organizational Contact

**Location:** /components/[][]/licenses/[][]/license/licensing/licensee/organization/contact/[]

**Type:** Object

**Table 45 – Properties for the contact object**

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

8.1.18.1.52 BOM Reference

**Location:** /components/[][]/licenses/[][]/license/licensing/licensee/organization/contact/[]/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

8.1.18.1.53 Name

**Location:** /components/[][]/licenses/[][]/license/licensing/licensee/organization/contact/[]/name

**Property:** name (Optional)
Type: String
Description: The name of a contact
Examples:
- Contact name

8.1.18.1.54 Email Address

Location: /components/[/]/licenses/[/]/license/licensing/licensee/organization/contact[/]/email
Property: email (Optional)
Type: String
Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)
Description: The email address of the contact.
Examples:
- firstname.lastname@example.com

8.1.18.1.55 Phone

Location: /components/[/]/licenses/[/]/license/licensing/licensee/organization/contact[/]/phone
Property: phone (Optional)
Type: String
Description: The phone number of the contact.
Examples:
- 800-555-1212

8.1.18.1.56 Organizational Contact

Location: /components/[/]/licenses/[/]/license/licensing/licensee/individual
Property: individual (Optional)
Type: Object
Description: The individual, not associated with an organization, that was granted the licence

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

8.1.18.1.57 BOM Reference

Location: /components/[/]/licenses/[/]/license/licensing/licensee/individual/bom-ref
Property: bom-ref (Optional)
Type: String
Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

8.1.18.1.58 Name

Location: /components/[]/licenses/[]/license/licensing/licensee/individual/name
Property: name (Optional)

Type: String
Description: The name of a contact
Examples:
  - Contact name

8.1.18.1.59 Email Address

Location: /components/[]/licenses/[]/license/licensing/licensee/individual/email
Property: email (Optional)

Type: String
Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)
Description: The email address of the contact.
Examples:
  - firstname.lastname@example.com

8.1.18.1.60 Phone

Location: /components/[]/licenses/[]/license/licensing/licensee/individual/phone
Property: phone (Optional)

Type: String
Description: The phone number of the contact.
Examples:
  - 800-555-1212

8.1.18.1.61 Purchaser

Location: /components/[]/licenses/[]/license/licensing/purchaser
Property: purchaser (Optional)

Type: Object
Description: The individual or organization that purchased the licence

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>organization</td>
<td>Object</td>
<td>Optional</td>
<td>The organization that purchased the license</td>
</tr>
<tr>
<td>individual</td>
<td>Object</td>
<td>Optional</td>
<td>The individual, not associated with an organization, that purchased the license</td>
</tr>
</tbody>
</table>

8.1.18.1.62 Purchaser (Organization)

Location: /components/[]/licenses/[]/license/licensing/purchaser/organization
Property: organization (Optional)
Type: Object

Description: The organization that purchased the licence

Table 48 – Properties for the organization object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the organization</td>
</tr>
<tr>
<td>address</td>
<td>Object</td>
<td>Optional</td>
<td>The physical address (location) of the organization</td>
</tr>
<tr>
<td>url</td>
<td>Array</td>
<td>Optional</td>
<td>The URL of the organization. Multiple URLs are allowed.</td>
</tr>
<tr>
<td>contact</td>
<td>Array</td>
<td>Optional</td>
<td>A contact at the organization. Multiple contacts are allowed.</td>
</tr>
</tbody>
</table>

8.1.18.1.63 BOM Reference

Location: /components/[]/licenses/[]/license/licensing/purchaser/organization/bom-ref

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

8.1.18.1.64 Organization Name

Location: /components/[]/licenses/[]/license/licensing/purchaser/organization/name

Type: String

Description: The name of the organization

Examples:
- Example Inc.

8.1.18.1.65 Organization Address

Location: /components/[]/licenses/[]/license/licensing/purchaser/organization/address

Type: Object

Description: The physical address (location) of the organization
### Table 49 – Properties for the address object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>Optional</td>
<td>The country name or the two-letter ISO 3166-1 country code.</td>
</tr>
<tr>
<td>region</td>
<td>String</td>
<td>Optional</td>
<td>The region or state in the country.</td>
</tr>
<tr>
<td>locality</td>
<td>String</td>
<td>Optional</td>
<td>The locality or city within the country.</td>
</tr>
<tr>
<td>postOfficeBoxNumber</td>
<td>String</td>
<td>Optional</td>
<td>The post office box number.</td>
</tr>
<tr>
<td>postalCode</td>
<td>String</td>
<td>Optional</td>
<td>The postal code.</td>
</tr>
<tr>
<td>streetAddress</td>
<td>String</td>
<td>Optional</td>
<td>The street address.</td>
</tr>
</tbody>
</table>

#### 8.1.18.1.66 BOM Reference

**Location:** /components/[]/licenses/[]/license/licensing/purchaser/organization/address/bom-ref  
**Property:** bom-ref (Optional)  
**Type:** String  
**Description:** An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

#### 8.1.18.1.67 Country

**Location:** /components/[]/licenses/[]/license/licensing/purchaser/organization/address/country  
**Property:** country (Optional)  
**Type:** String  
**Description:** The country name or the two-letter ISO 3166-1 country code.

#### 8.1.18.1.68 Region

**Location:** /components/[]/licenses/[]/license/licensing/purchaser/organization/address región  
**Property:** region (Optional)  
**Type:** String  
**Description:** The region or state in the country.

**Examples:**  
- Texas

#### 8.1.18.1.69 Locality

**Location:** /components/[]/licenses/[]/license/licensing/purchaser/organization/address/locality  
**Property:** locality (Optional)  
**Type:** String  
**Description:** The locality or city within the country.
Examples:

- Austin

8.1.18.1.70 Post Office Box Number

Location: /components/[]/license/licensing/purchaser/organization/address/postOfficeBoxNumber

Property: postOfficeBoxNumber (Optional)

Type: String

Description: The post office box number.

Examples:

- 901

8.1.18.1.71 Postal Code

Location: /components/[]/license/licensing/purchaser/organization/address/postalCode

Property: postalCode (Optional)

Type: String

Description: The postal code.

Examples:

- 78758

8.1.18.1.72 Street Address

Location: /components/[]/license/licensing/purchaser/organization/address/streetAddress

Property: streetAddress (Optional)

Type: String

Description: The street address.

Examples:

- 100 Main Street

8.1.18.1.73 Organization URL(s)

Location: /components/[]/license/licensing/purchaser/organization/url

Property: url (Optional)

Type: array (of String)


Description: The URL of the organization. Multiple URLs are allowed. Each item of this array must be a string.

Examples:

- https://example.com

8.1.18.1.74 Organizational Contact

Location: /components/[]/license/licensing/purchaser/organization/contact

Property: contact (Optional)

Type: Array

Description: A contact at the organization. Multiple contacts are allowed. Each item of this array must be an Organizational Contact object.

8.1.18.1.75 Organizational Contact

Location: /components/[]/license/licensing/purchaser/organization/contact/[]
Type: Object

### Table 50 – Properties for the contact object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

#### 8.1.18.1.76 BOM Reference

**Location:** /components/[]/licenses/[]/license/licensing/purchaser/organization/contact/[]/bom-ref  
**Property:** bom-ref (Optional)  
**Type:** String  
**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

#### 8.1.18.1.77 Name

**Location:** /components/[]/licenses/[]/license/licensing/purchaser/organization/contact/[]/name  
**Property:** name (Optional)  
**Type:** String  
**Description:** The name of a contact  
**Examples:**  
- Contact name

#### 8.1.18.1.78 Email Address

**Location:** /components/[]/licenses/[]/license/licensing/purchaser/organization/contact/[]/email  
**Property:** email (Optional)  
**Type:** String  
**Format:** idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)  
**Description:** The email address of the contact.  
**Examples:**  
- firstname.lastname@example.com

#### 8.1.18.1.79 Phone

**Location:** /components/[]/licenses/[]/license/licensing/purchaser/organization/contact/[]/phone  
**Property:** phone (Optional)  
**Type:** String  
**Description:** The phone number of the contact.
Examples:
- 800-555-1212

8.1.18.1.80 Organizational Contact

Location: /components/[]/licenses/[]/license/licensing/purchaser/individual
Property: individual (Optional)
Type: Object
Description: The individual, not associated with an organization, that purchased the licence

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

8.1.18.1.81 BOM Reference

Location: /components/[]/licenses/[]/license/licensing/purchaser/individual/bom-ref
Property: bom-ref (Optional)
Type: String
Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

8.1.18.1.82 Name

Location: /components/[]/licenses/[]/license/licensing/purchaser/individual/name
Property: name (Optional)
Type: String
Description: The name of a contact
Examples:
- Contact name

8.1.18.1.83 Email Address

Location: /components/[]/licenses/[]/license/licensing/purchaser/individual/email
Property: email (Optional)
Type: String
Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)
Description: The email address of the contact.
Examples:
- firstname.lastname@example.com
8.1.18.1.84 Phone

Location: /components/[]/licenses/[]/license/licensing/purchaser/individual/phone
Property: phone (Optional)
Type: String
Description: The phone number of the contact.
Examples:
  • 800-555-1212

8.1.18.1.85 Purchase Order

Location: /components/[]/licenses/[]/license/licensing/purchaseOrder
Property: purchaseOrder (Optional)
Type: String
Description: The purchase order identifier the purchaser sent to a supplier or vendor to authorize a purchase

8.1.18.1.86 Licence Type

Location: /components/[]/licenses/[]/license/licensing/licenseTypes
Property: licenseTypes (Optional)
Type: array (of String)
Description: The type of licence(s) that was granted to the licensee. Each item of this array must be a string.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>academic</td>
<td>A licence that grants use of software solely for the purpose of education or research.</td>
</tr>
<tr>
<td>appliance</td>
<td>A licence covering use of software embedded in a specific piece of hardware.</td>
</tr>
<tr>
<td>client-access</td>
<td>A Client Access Licence (CAL) allows client computers to access services provided by server software.</td>
</tr>
<tr>
<td>concurrent-user</td>
<td>A Concurrent User licence (aka floating licence) limits the number of licences for a software application and licences are shared among a larger number of users.</td>
</tr>
<tr>
<td>core-points</td>
<td>A licence where the core of a computer's processor is assigned a specific number of points.</td>
</tr>
<tr>
<td>custom-metric</td>
<td>A licence for which consumption is measured by non-standard metrics.</td>
</tr>
<tr>
<td>device</td>
<td>A licence that covers a defined number of installations on computers and other types of devices.</td>
</tr>
<tr>
<td>evaluation</td>
<td>A licence that grants permission to instal and use software for trial purposes.</td>
</tr>
<tr>
<td>named-user</td>
<td>A licence that grants access to the software to one or more pre-defined users.</td>
</tr>
<tr>
<td>node-locked</td>
<td>A licence that grants access to the software on one or more pre-defined computers or devices.</td>
</tr>
<tr>
<td>oem</td>
<td>An Original Equipment Manufacturer licence that is delivered with hardware, cannot be transferred to other hardware, and is valid for the life of the hardware.</td>
</tr>
<tr>
<td>Value</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>perpetual</td>
<td>A licence where the software is sold on a one-time basis and the licensee can use a copy of the software indefinitely.</td>
</tr>
<tr>
<td>processor-points</td>
<td>A licence where each installation consumes points per processor.</td>
</tr>
<tr>
<td>subscription</td>
<td>A licence where the licensee pays a fee to use the software or service.</td>
</tr>
<tr>
<td>user</td>
<td>A licence that grants access to the software or service by a specified number of users.</td>
</tr>
<tr>
<td>other</td>
<td>Another licence type.</td>
</tr>
</tbody>
</table>

8.1.18.1.87   Last Renewal

Location: /components/[]/licenses/[]/license/licensing/lastRenewal

Property: lastRenewal (Optional)

Type: String

Format: data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)

Description: The timestamp indicating when the licence was last renewed. For new purchases, this is often the purchase or acquisition date. For non-perpetual licences or subscriptions, this is the timestamp of when the licence was last renewed.

8.1.18.1.88   Expiration

Location: /components/[]/licenses/[]/license/licensing/expiration

Property: expiration (Optional)

Type: String

Format: data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)

Description: The timestamp indicating when the current licence expires (if applicable).

8.1.18.1.89   Properties

Location: /components/[]/licenses/[]/license/properties

Property: properties (Optional)

Type: Array

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

8.1.18.1.90   Lightweight name-value pair

Location: /components/[]/licenses/[]/license/properties/[]

Type: Object

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different
values. Property names of interest to the general public are encouraged to be registered in the [CycloneDX Property Taxonomy](https://www.cyclonedx.org/specifications/taxonomy). Formal registration is optional.

### Table 53 – Properties for the properties object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

8.1.18.1.91 **Name**

**Location:** /components/[object]/licenses/[object]/license/properties/[object]/name

**Property:** name (Required)

**Type:** String

**Description:** The name of the property. Duplicate names are allowed, each potentially having a different value.

8.1.18.1.92 **Value**

**Location:** /components/[object]/licenses/[object]/license/properties/[object]/value

**Property:** value (Optional)

**Type:** String

**Description:** The value of the property.

8.1.19 **SPDX Licence Expression**

**Location:** /components/[object]/licenses

**Property:** licenses

**Type:** Array

**Description:** A tuple of exactly one SPDX Licence Expression.

8.1.20 **Component Copyright**

**Location:** /components/[object]/copyright

**Property:** copyright (Optional)

**Type:** String

**Description:** A copyright notice informing users of the underlying claims to copyright ownership in a published work.

**Examples:**
- Acme Inc

8.1.21 **Common Platform Enumeration (CPE)**

**Location:** /components/[object]/cpe

**Property:** cpe (Optional)

**Type:** String

**Description:** Asserts the identity of the component using CPE. The CPE must conform to the CPE 2.2 or 2.3 specification. See [https://nvd.nist.gov/products/cpe](https://nvd.nist.gov/products/cpe). Refer to @ evidence.identity to optionally provide evidence that substantiates the assertion of the component’s identity.
### Examples

- `cpe:2.3:a:acme:component_framework:-:*:*:*:*:*:*:`

8.1.22 Package URL (purl)

**Location**: /components/[]/purl

**Property**: purl (Optional)

**Type**: String

**Description**: Asserts the identity of the component using package-url (purl). The purl, if specified, must be valid and conform to the specification defined at: [https://github.com/package-url/purl-spec](https://github.com/package-url/purl-spec). Refer to @.evidence.identity to optionally provide evidence that substantiates the assertion of the component's identity.

**Examples**:

- `pkg:maven/com.acme/tomcat-catalina@9.0.14?packaging=jar`

8.1.23 OmniBOR Artefact Identifier (gitoid)

**Location**: /components/[]/omniborId

**Property**: omniborId (Optional)

**Type**: array (of String)

**Description**: Asserts the identity of the component using the OmniBOR Artefact ID. The OmniBOR, if specified, must be valid and conform to the specification defined at: [https://www.iana.org/assignments/uri-schemes/prov/gitoid](https://www.iana.org/assignments/uri-schemes/prov/gitoid). Refer to @.evidence.identity to optionally provide evidence that substantiates the assertion of the component's identity. Each item of this array must be a string.

**Examples**:

- `gitoid:blob:sha1:a94a8fe5ccb19ba61c4c0873d391e987982fbbd3`
- `gitoid:blob:sha256:9f86d081884c7d659a2feaa0c55ad015a3bf4f1b2b0b822cd15d6c15b0f00a08`

8.1.24 Software Heritage Identifier

**Location**: /components/[]/swhid

**Property**: swhid (Optional)

**Type**: array (of String)

**Description**: Asserts the identity of the component using the Software Heritage persistent identifier (SWHID). The SWHID, if specified, must be valid and conform to the specification defined at: [https://docs.softwareheritage.org/devel/swh-model/persistent-identifiers.html](https://docs.softwareheritage.org/devel/swh-model/persistent-identifiers.html). Refer to @.evidence.identity to optionally provide evidence that substantiates the assertion of the component's identity. Each item of this array must be a string.

**Examples**:

- `swh:1:cnt:94a9ed024d3859793618152ea559a168bbcb5e2`

8.1.25 SWID Tag

**Location**: /components/[]/swid

**Property**: swid (Optional)

**Type**: Object

### Table 54 – Properties for the swid object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>tagId</td>
<td>String</td>
<td>Required</td>
<td>Maps to the tagId of a SoftwareIdentity.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>Maps to the name of a SoftwareIdentity.</td>
</tr>
<tr>
<td>version</td>
<td>String</td>
<td>Optional</td>
<td>Maps to the version of a SoftwareIdentity.</td>
</tr>
<tr>
<td>tagVersion</td>
<td>Integer</td>
<td>Optional</td>
<td>Maps to the tagVersion of a SoftwareIdentity.</td>
</tr>
<tr>
<td>patch</td>
<td>Boolean</td>
<td>Optional</td>
<td>Maps to the patch of a SoftwareIdentity.</td>
</tr>
<tr>
<td>text</td>
<td>Object</td>
<td>Optional</td>
<td>Specifies the metadata and content of the SWID tag.</td>
</tr>
<tr>
<td>url</td>
<td>String</td>
<td>Optional</td>
<td>The URL to the SWID file.</td>
</tr>
</tbody>
</table>

#### 8.1.25.1 Tag ID

**Location:** /components/[]/swid/tagId  
**Property:** tagId (Required)  
**Type:** String  
**Description:** Maps to the tagId of a SoftwareIdentity.

#### 8.1.25.2 Name

**Location:** /components/[]/swid/name  
**Property:** name (Required)  
**Type:** String  
**Description:** Maps to the name of a SoftwareIdentity.

#### 8.1.25.3 Version

**Location:** /components/[]/swid/version  
**Property:** version (Optional)  
**Type:** String  
**Default Value:** 0.0  
**Description:** Maps to the version of a SoftwareIdentity.

#### 8.1.25.4 Tag Version

**Location:** /components/[]/swid/tagVersion  
**Property:** tagVersion (Optional)  
**Type:** Integer  
**Description:** Maps to the tagVersion of a SoftwareIdentity.

#### 8.1.25.5 Patch

**Location:** /components/[]/swid/patch  
**Property:** patch (Optional)  
**Type:** Boolean
Description: Maps to the patch of a SoftwareIdentity.

8.1.25.6 Attachment text

Location: /components/[][]/swid/text

Property: text (Optional)

Type: Object

Description: Specifies the metadata and content of the SWID tag.

### Table 55 – Properties for the text object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>contentType</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. <a href="https://www.rfc-editor.org/rfc/rfc2045#section-5.1">RFC 2045 section 5.1</a> outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the <a href="https://www.iana.org/assignments/media-types">IANA media types registry</a>.</td>
</tr>
<tr>
<td>encoding</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the optional encoding the text is represented in.</td>
</tr>
<tr>
<td>content</td>
<td>String</td>
<td>Required</td>
<td>The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.</td>
</tr>
</tbody>
</table>

8.1.25.6.1 Content-Type

Location: /components/[][]/swid/text/contentType

Property: contentType (Optional)

Type: String

Default Value: text/plain

Description: Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. [RFC 2045 section 5.1](https://www.rfc-editor.org/rfc/rfc2045#section-5.1) outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the [IANA media types registry](https://www.iana.org/assignments/media-types).

Examples:
- text/plain
- application/json
- image/png

8.1.25.6.2 Encoding

Location: /components/[][]/swid/text/encoding

Property: encoding (Optional)

Type: String

Description: Specifies the optional encoding the text is represented in.
Table 56 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>base64</td>
<td>Base64 is a binary-to-text encoding scheme that represents binary data in an ASCII string.</td>
</tr>
</tbody>
</table>

8.1.25.6.3 Attachment Text

Location: /components/[]/swid/text/content

Property: content (Required)

Type: String

Description: The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.

8.1.25.7 URL

Location: /components/[]/swid/url

Property: url (Optional)

Type: String


Description: The URL to the SWID file.

8.1.26 Component Modified From Original

Location: /components/[]/modified

Property: modified (Optional and Deprecated)

Type: Boolean

Description: [Deprecated] This will be removed in a future version. Use the pedigree element instead to supply information on exactly how the component was modified. A boolean value indicating if the component has been modified from the original. A value of true indicates the component is a derivative of the original. A value of false indicates the component has not been modified from the original.

8.1.27 Component Pedigree

Location: /components/[]/pedigree

Property: pedigree (Optional)

Type: Object

Description: Component pedigree is a way to document complex supply chain scenarios where components are created, distributed, modified, redistributed, combined with other components, etc. Pedigree supports viewing this complex chain from the beginning, the end, or anywhere in the middle. It also provides a way to document variants where the exact relation may not be known.
<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ancestors</td>
<td>Array</td>
<td>Optional</td>
<td>Describes zero or more components in which a component is derived from. This is commonly used to describe forks from existing projects where the forked version contains a ancestor node containing the original component it was forked from. For example, Component A is the original component. Component B is the component being used and documented in the BOM. However, Component B contains a pedigree node with a single ancestor documenting Component A - the original component from which Component B is derived from.</td>
</tr>
<tr>
<td>descendants</td>
<td>Array</td>
<td>Optional</td>
<td>Descendants are the exact opposite of ancestors. This provides a way to document all forks (and their forks) of an original or root component.</td>
</tr>
<tr>
<td>variants</td>
<td>Array</td>
<td>Optional</td>
<td>Variants describe relations where the relationship between the components is not known. For example, if Component A contains nearly identical code to Component B. They are both related, but it is unclear if one is derived from the other, or if they share a common ancestor.</td>
</tr>
<tr>
<td>commits</td>
<td>Array</td>
<td>Optional</td>
<td>A list of zero or more commits which provide a trail describing how the component deviates from an ancestor, descendant, or variant.</td>
</tr>
<tr>
<td>patches</td>
<td>Array</td>
<td>Optional</td>
<td>A list of zero or more patches describing how the component deviates from an ancestor, descendant, or variant. Patches may be complementary to commits or may be used in place of commits.</td>
</tr>
<tr>
<td>notes</td>
<td>String</td>
<td>Optional</td>
<td>Notes, observations, and other non-structured commentary describing the components pedigree.</td>
</tr>
</tbody>
</table>

### 8.1.27.1 Ancestors

**Location:** /components[/]/pedigree/ancestors

**Property:** ancestors (Optional)

**Type:** Array

**Description:** Describes zero or more components in which a component is derived from. This is commonly used to describe forks from existing projects where the forked version contains a ancestor node containing the original component it was forked from. For example, Component A is the original component. Component B is the component being used and documented in the BOM. However, Component B contains a pedigree node with a single ancestor documenting Component A - the original component from which Component B is derived from. Each item of this array must be a Component object.

### 8.1.27.1.1 Component

**Location:** /components[/]/pedigree/ancestors[/]

**Type:** Object

**Reference:** Refer to the component definition at /components[/]

### 8.1.27.2 Descendants

**Location:** /components[/]/pedigree/descendants

**Property:** descendants (Optional)

**Type:** Array
**Description:** Descendants are the exact opposite of ancestors. This provides a way to document all forks (and their forks) of an original or root component. Each item of this array must be a Component object.

### 8.1.27.2.1 Component

**Location:** /components/[]/pedigree/descendants/[]

**Type:** Object

**Reference:** Refer to the component definition at /components/[]

### 8.1.27.3 Variants

**Location:** /components/[]/pedigree/variants

**Property:** variants (Optional)

**Type:** Array

**Description:** Variants describe relations where the relationship between the components is not known. For example, if Component A contains nearly identical code to Component B. They are both related, but it is unclear if one is derived from the other, or if they share a common ancestor. Each item of this array must be a Component object.

### 8.1.27.3.1 Component

**Location:** /components/[]/pedigree/variants/[]

**Type:** Object

**Reference:** Refer to the component definition at /components/[]

### 8.1.27.4 Commits

**Location:** /components/[]/pedigree/commits

**Property:** commits (Optional)

**Type:** Array

**Description:** A list of zero or more commits which provide a trail describing how the component deviates from an ancestor, descendant, or variant. Each item of this array must be a Commit object.

### 8.1.27.4.1 Commit

**Location:** /components/[]/pedigree/commits/[]

**Type:** Object

**Description:** Specifies an individual commit

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>uid</td>
<td>String</td>
<td>Optional</td>
<td>A unique identifier of the commit. This may be version control specific. For example, Subversion uses revision numbers whereas git uses commit hashes.</td>
</tr>
<tr>
<td>url</td>
<td>String</td>
<td>Optional</td>
<td>The URL to the commit. This URL will typically point to a commit in a version control system.</td>
</tr>
<tr>
<td>author</td>
<td>Object</td>
<td>Optional</td>
<td>The author who created the changes in the commit</td>
</tr>
<tr>
<td>committer</td>
<td>Object</td>
<td>Optional</td>
<td>The person who committed or pushed the commit</td>
</tr>
<tr>
<td>message</td>
<td>String</td>
<td>Optional</td>
<td>The text description of the contents of the commit</td>
</tr>
</tbody>
</table>
8.1.27.4.2  UID

Location: /components/[]/pedigree/commits/[]/uid
Property: uid (Optional)
Type: String
Description: A unique identifier of the commit. This may be version control specific. For example, Subversion uses revision numbers whereas git uses commit hashes.

8.1.27.4.3  URL

Location: /components/[]/pedigree/commits/[]/url
Property: url (Optional)
Type: String
Description: The URL to the commit. This URL will typically point to a commit in a version control system.

8.1.27.4.4  Author

Location: /components/[]/pedigree/commits/[]/author
Property: author (Optional)
Type: Object
Description: The author who created the changes in the commit

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>timestamp</td>
<td>String</td>
<td>Optional</td>
<td>The timestamp in which the action occurred</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the individual who performed the action</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the individual who performed the action</td>
</tr>
</tbody>
</table>

8.1.27.4.5  Timestamp

Location: /components/[]/pedigree/commits/[]/author/timestamp
Property: timestamp (Optional)
Type: String
Format: data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)
Description: The timestamp in which the action occurred

8.1.27.4.6  Name

Location: /components/[]/pedigree/commits/[]/author/name
Property: name (Optional)
Type: String
Description: The name of the individual who performed the action

8.1.27.4.7  E-mail

Location: /components/[]/pedigree/commits/[]/author/email
Property: email (Optional)
Type: String

Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

Description: The email address of the individual who performed the action

8.1.27.4.8 Committer

Location: /components/[]/pedigree/commits/[]/committer

Property: committer (Optional)

Type: Object

Description: The person who committed or pushed the commit

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>timestamp</td>
<td>String</td>
<td>Optional</td>
<td>The timestamp in which the action occurred</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the individual who performed the action</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the individual who performed the action</td>
</tr>
</tbody>
</table>

8.1.27.4.9 Timestamp

Location: /components/[]/pedigree/commits/[]/committer/timestamp

Property: timestamp (Optional)

Type: String

Format: data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)

Description: The timestamp in which the action occurred

8.1.27.4.10 Name

Location: /components/[]/pedigree/commits/[]/committer/name

Property: name (Optional)

Type: String

Description: The name of the individual who performed the action

8.1.27.4.11 E-mail

Location: /components/[]/pedigree/commits/[]/committer/email

Property: email (Optional)

Type: String

Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

Description: The email address of the individual who performed the action

8.1.27.4.12 Message

Location: /components/[]/pedigree/commits/[]/message

Property: message (Optional)

Type: String

Description: The text description of the contents of the commit
8.1.27.5  Patches

Location: /components/[]/pedigree/patches
Property: patches (Optional)
Type: Array
Description: A list of zero or more patches describing how the component deviates from an ancestor, descendant, or variant. Patches may be complementary to commits or may be used in place of commits. Each item of this array must be a Patch object.

8.1.27.5.1  Patch

Location: /components/[]/pedigree/patches/[]
Type: Object
Description: Specifies an individual patch

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>type</td>
<td>String</td>
<td>Required</td>
<td>Specifies the purpose for the patch including the resolution of defects, security issues, or new behavior or functionality.</td>
</tr>
<tr>
<td>diff</td>
<td>Object</td>
<td>Optional</td>
<td>The patch file (or diff) that shows changes. Refer to <a href="https://en.wikipedia.org/wiki/Diff">https://en.wikipedia.org/wiki/Diff</a></td>
</tr>
<tr>
<td>resolves</td>
<td>Array</td>
<td>Optional</td>
<td>A collection of issues the patch resolves</td>
</tr>
</tbody>
</table>

8.1.27.5.2  Patch Type

Location: /components/[]/pedigree/patches/[]/type
Property: type (Required)
Type: String
Description: Specifies the purpose for the patch including the resolution of defects, security issues, or new behaviour or functionality.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>unofficial</td>
<td>A patch which is not developed by the creators or maintainers of the software being patched. Refer to <a href="https://en.wikipedia.org/wiki/Unofficial_patch">https://en.wikipedia.org/wiki/Unofficial_patch</a>.</td>
</tr>
<tr>
<td>backport</td>
<td>A patch which takes code from a newer version of the software and applies it to older versions of the same software. Refer to <a href="https://en.wikipedia.org/wiki/Backporting">https://en.wikipedia.org/wiki/Backporting</a>.</td>
</tr>
<tr>
<td>cherry-pick</td>
<td>A patch created by selectively applying commits from other versions or branches of the same software.</td>
</tr>
</tbody>
</table>
8.1.27.5.3 Diff

Location: /components/[[]]pedigree/patches/[[]]/diff

Property: diff (Optional)

Type: Object

Description: The patch file (or diff) that shows changes. Refer to https://en.wikipedia.org/wiki/Diff

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>text</td>
<td>Object</td>
<td>Optional</td>
<td>Specifies the optional text of the diff</td>
</tr>
<tr>
<td>url</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the URL to the diff</td>
</tr>
</tbody>
</table>

8.1.27.5.4 Diff text

Location: /components/[[]]pedigree/patches/[[]]/diff/text

Property: text (Optional)

Type: Object

Description: Specifies the optional text of the diff

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>contentType</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plan text documents. RFC 2045 section 5.1 outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the IANA media types registry.</td>
</tr>
<tr>
<td>encoding</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the optional encoding the text is represented in.</td>
</tr>
<tr>
<td>content</td>
<td>String</td>
<td>Required</td>
<td>The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.</td>
</tr>
</tbody>
</table>

8.1.27.5.5 Content-Type

Location: /components/[[]]pedigree/patches/[[]]/diff/text/contentType

Property: contentType (Optional)

Type: String

Default Value: text/plain

Description: Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plan text documents. RFC 2045 section 5.1 outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the IANA media types registry.

Examples:
- text/plain
- application/json
8.1.27.5.6 Encoding

Location: /components/[]/pedigree/patches/[]/diff/text/encoding

Property: encoding (Optional)

Type: String

Description: Specifies the optional encoding the text is represented in.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>base64</td>
<td>Base64 is a binary-to-text encoding scheme that represents binary data in an ASCII string.</td>
</tr>
</tbody>
</table>

8.1.27.5.7 Attachment Text

Location: /components/[]/pedigree/patches/[]/diff/text/content

Property: content (Required)

Type: String

Description: The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.

8.1.27.5.8 URL

Location: /components/[]/pedigree/patches/[]/diff/url

Property: url (Optional)

Type: String


Description: Specifies the URL to the diff

8.1.27.5.9 Resolves

Location: /components/[]/pedigree/patches/[]/resolves

Property: resolves (Optional)

Type: Array

Description: A collection of issues the patch resolves Each item of this array must be an Issue object.

8.1.27.5.10 Issue

Location: /components/[]/pedigree/patches/[]/resolves/[]

Type: Object

Description: An individual issue that has been resolved.
Table 66 – Properties for the resolves object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>type</td>
<td>String</td>
<td>Required</td>
<td>Specifies the type of issue</td>
</tr>
<tr>
<td>id</td>
<td>String</td>
<td>Optional</td>
<td>The identifier of the issue assigned by the source of the issue</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the issue</td>
</tr>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>A description of the issue</td>
</tr>
<tr>
<td>source</td>
<td>Object</td>
<td>Optional</td>
<td>The source of the issue where it is documented</td>
</tr>
<tr>
<td>references</td>
<td>Array</td>
<td>Optional</td>
<td>A collection of URL’s for reference. Multiple URLs are allowed.</td>
</tr>
</tbody>
</table>

8.1.27.5.11 Issue Type

**Location:** /components/[]/pedigree/patches/[]/resolves/[]/type

**Property:** type (Required)

**Type:** String

**Description:** Specifies the type of issue

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>defect</td>
<td>A fault, flaw, or bug in software.</td>
</tr>
<tr>
<td>enhancement</td>
<td>A new feature or behaviour in software.</td>
</tr>
<tr>
<td>security</td>
<td>A special type of defect which impacts security.</td>
</tr>
</tbody>
</table>

8.1.27.5.12 Issue ID

**Location:** /components/[]/pedigree/patches/[]/resolves/[]/id

**Property:** id (Optional)

**Type:** String

**Description:** The identifier of the issue assigned by the source of the issue

8.1.27.5.13 Issue Name

**Location:** /components/[]/pedigree/patches/[]/resolves/[]/name

**Property:** name (Optional)

**Type:** String

**Description:** The name of the issue

8.1.27.5.14 Issue Description

**Location:** /components/[]/pedigree/patches/[]/resolves/[]/description

**Property:** description (Optional)
Type: String
Description: A description of the issue

8.1.27.5.15 Source

Location: /components/[]/pedigree/patches/[]/resolves/[]/source
Property: source (Optional)

Type: Object
Description: The source of the issue where it is documented

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the source.</td>
</tr>
<tr>
<td>url</td>
<td>String</td>
<td>Optional</td>
<td>The url of the issue documentation as provided by the source</td>
</tr>
</tbody>
</table>

8.1.27.5.16 Name

Location: /components/[]/pedigree/patches/[]/resolves/[]/source/name
Property: name (Optional)

Type: String
Description: The name of the source.

Examples:
- National Vulnerability Database
- NVD
- Apache

8.1.27.5.17 URL

Location: /components/[]/pedigree/patches/[]/resolves/[]/source/url
Property: url (Optional)

Type: String
Description: The url of the issue documentation as provided by the source

8.1.27.5.18 References

Location: /components/[]/pedigree/patches/[]/resolves/[]/references
Property: references (Optional)

Type: array (of String)
Description: A collection of URL’s for reference. Multiple URLs are allowed. Each item of this array must be a string.

Examples:
- https://example.com
8.1.27.6 Notes

Location: /components/[]/pedigree/notes
Property: notes (Optional)

Type: String
Description: Notes, observations, and other non-structured commentary describing the components pedigree.

8.1.28 External References

Location: /components/[]/externalReferences
Property: externalReferences (Optional)

Type: Array
Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM. Each item of this array must be an External Reference object.
Reference: Refer to the external reference definition at /externalReferences/[]

8.1.28.1 External Reference

Location: /components/[]/externalReferences/[]
Type: Object
Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

8.1.29 Components

Location: /components/[]/components
Property: components (Optional)

Type: Array
Description: A list of software and hardware components included in the parent component. This is not a dependency tree. It provides a way to specify a hierarchical representation of component assemblies, similar to system → subsystem → parts assembly in physical supply chains. Each item of this array must be a Component object.

8.1.29.1 Component

Location: /components/[]/components/[]
Type: Object
Reference: Refer to the component definition at /components/[]

All items must be unique.

8.1.30 Evidence

Location: /components/[]/evidence
Property: evidence (Optional)

Type: Object
Description: Provides the ability to document evidence collected through various forms of extraction or analysis.
Table 69 – Properties for the evidence object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>identity</td>
<td>Array</td>
<td>Optional</td>
<td>Evidence that substantiates the identity of a component. The identity may be an object or an array of identity objects. Support for specifying identity as a single object was introduced in CycloneDX v1.5. Arrays were introduced in v1.6. It is recommended that all implementations use arrays, even if only one identity object is specified.</td>
</tr>
<tr>
<td>occurrences</td>
<td>Array</td>
<td>Optional</td>
<td>Evidence of individual instances of a component spread across multiple locations.</td>
</tr>
<tr>
<td>callstack</td>
<td>Object</td>
<td>Optional</td>
<td>Evidence of the components use through the callstack.</td>
</tr>
<tr>
<td>licenses</td>
<td>Array</td>
<td>Optional</td>
<td>EITHER (list of SPDX licenses and/or named licenses) OR (tuple of one SPDX License Expression)</td>
</tr>
<tr>
<td>copyright</td>
<td>Array</td>
<td>Optional</td>
<td>Copyright evidence captures intellectual property assertions, providing evidence of possible ownership and legal protection.</td>
</tr>
</tbody>
</table>

8.1.30.1  Identity Evidence

**Location:** /components/[[evidence/identity

**Property:** identity (Optional)

**Description:** Evidence that substantiates the identity of a component. The identity may be an object or an array of identity objects. Support for specifying identity as a single object was introduced in CycloneDX v1.5. Arrays were introduced in v1.6. It is recommended that all implementations use arrays, even if only one identity object is specified.

**Must be one of:**
1. Array of Identity Objects
2. Identity Evidence

8.1.30.3  Identity Evidence

**Type:** Object

8.1.30.4  Array of Identity Objects

**Type:** Array

Table 70 – Properties for identity evidence

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>field</td>
<td>String</td>
<td>Required</td>
<td>The identity field of the component which the evidence describes.</td>
</tr>
<tr>
<td>confidence</td>
<td>Number</td>
<td>Optional</td>
<td>The overall confidence of the evidence from 0 - 1, where 1 is 100% confidence.</td>
</tr>
<tr>
<td>concludedValue</td>
<td>String</td>
<td>Optional</td>
<td>The value of the field (cpe, purl, etc) that has been concluded based on the aggregate of all methods (if available).</td>
</tr>
<tr>
<td>methods</td>
<td>Array</td>
<td>Optional</td>
<td>The methods used to extract and/or analyze the evidence.</td>
</tr>
<tr>
<td>Property</td>
<td>Type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>----------</td>
<td>--------</td>
<td>-------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>tools</td>
<td>Array</td>
<td>Optional</td>
<td>The object in the BOM identified by its bom-ref. This is often a component or service but may be any object type supporting bom-refs. Tools used for analysis should already be defined in the BOM, either in the metadata/tools, components, or formulation.</td>
</tr>
</tbody>
</table>

8.1.30.4 Array of Identity Objects

Location: /components/[]/evidence/identity

Property: identity

Type: Array

8.1.30.4.1 Identity Evidence

Location: /components/[]/evidence/identity/[]

Type: Object

Description: Evidence that substantiates the identity of a component.

Table 71 – Properties for the identity object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>field</td>
<td>String</td>
<td>Required</td>
<td>The identity field of the component which the evidence describes.</td>
</tr>
<tr>
<td>confidence</td>
<td>Number</td>
<td>Optional</td>
<td>The overall confidence of the evidence from 0 - 1, where 1 is 100% confidence.</td>
</tr>
<tr>
<td>concludedValue</td>
<td>String</td>
<td>Optional</td>
<td>The value of the field (cpe, purl, etc) that has been concluded based on the aggregate of all methods (if available).</td>
</tr>
<tr>
<td>methods</td>
<td>Array</td>
<td>Optional</td>
<td>The methods used to extract and/or analyze the evidence.</td>
</tr>
<tr>
<td>tools</td>
<td>Array</td>
<td>Optional</td>
<td>The object in the BOM identified by its bom-ref. This is often a component or service but may be any object type supporting bom-refs. Tools used for analysis should already be defined in the BOM, either in the metadata/tools, components, or formulation.</td>
</tr>
</tbody>
</table>

8.1.30.4.2 Field

Location: /components/[]/evidence/identity/[]/field

Property: field (Required)

Type: String

Description: The identity field of the component which the evidence describes.

Enumeration: Must be one of:

- group
- name
- version
- purl
- cpe
• omniborId
• swhid
• swid
• hash

8.1.30.4.3 Confidence

Location: /components/[]/evidence/identity/[]/confidence
Property: confidence (Optional)
Type: Number
Maximum Value: 1
Description: The overall confidence of the evidence from 0 - 1, where 1 is 100% confidence.

8.1.30.4.4 Concluded Value

Location: /components/[]/evidence/identity/[]/concludedValue
Property: concludedValue (Optional)
Type: String
Description: The value of the field (cpe, purl, etc) that has been concluded based on the aggregate of all methods (if available).

8.1.30.4.5 Methods

Location: /components/[]/evidence/identity/[]/methods
Property: methods (Optional)
Type: Array
Description: The methods used to extract and/or analyze the evidence.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>technique</td>
<td>String</td>
<td>Required</td>
<td>The technique used in this method of analysis.</td>
</tr>
<tr>
<td>confidence</td>
<td>Number</td>
<td>Required</td>
<td>The confidence of the evidence from 0 - 1, where 1 is 100% confidence. Confidence is specific to the technique used. Each technique of analysis can have independent confidence.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value or contents of the evidence.</td>
</tr>
</tbody>
</table>

8.1.30.4.6 Technique

Location: /components/[]/evidence/identity/[]/methods/[]/technique
Property: technique (Required)
Type: String
Description: The technique used in this method of analysis.
Enumeration: Must be one of:
• source-code-analysis
- binary-analysis
- manifest-analysis
- ast-fingerprint
- hash-comparison
- instrumentation
- dynamic-analysis
- filename
- attestation
- other

8.1.30.4.7  Confidence

**Location:** /components/[]/evidence/identity/[]/methods/[]/confidence

**Property:** confidence (Required)

**Type:** Number

**Maximum Value:** 1

**Description:** The confidence of the evidence from 0 - 1, where 1 is 100% confidence. Confidence is specific to the technique used. Each technique of analysis can have independent confidence.

8.1.30.4.8  Value

**Location:** /components/[]/evidence/identity/[]/methods/[]/value

**Property:** value (Optional)

**Type:** String

**Description:** The value or contents of the evidence.

8.1.30.4.9  BOM References

**Location:** /components/[]/evidence/identity/[]/tools

**Property:** tools (Optional)

**Type:** Array

**Description:** The object in the BOM identified by its bom-ref. This is often a component or service but may be any object type supporting bom-refs. Tools used for analysis should already be defined in the BOM, either in the metadata/tools, components, or formulation.

**Location:** /components/[]/evidence/identity/[]/tools/[]

**Must be any of:**

1. Ref
2. BOM-Link Element

8.1.30.4.10  Ref

**Type:** String

**Description:** Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

8.1.30.4.11  BOM-Link Element

**Type:** String

**Format:** iri-reference as specified in [RFC 3987](https://www.ietf.org/rfc/rfc3987.html)
Pattern Constraint: ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$

Description: Descriptor for an element in a BOM document. See https://cyclonedx.org/capabilities/bomlink/

All items must be unique.

8.1.30.4.12 Field

Location: /components/[]/evidence/identity/field

Property: identity (Required)

Type: String

Description: The identity field of the component which the evidence describes.

Enumeration: Must be one of:

- group
- name
- version
- purl
- cpe
- omniborId
- swid
- swid
- hash

8.1.30.4.13 Confidence

Location: /components/[]/evidence/identity/confidence

Property: identity (Optional)

Type: Number

Maximum Value: 1

Description: The overall confidence of the evidence from 0 - 1, where 1 is 100% confidence.

8.1.30.4.14 Concluded Value

Location: /components/[]/evidence/identity/concludedValue

Property: identity (Optional)

Type: String

Description: The value of the field (cpe, purl, etc) that has been concluded based on the aggregate of all methods (if available).

8.1.30.4.15 Methods

Location: /components/[]/evidence/identity/methods

Property: identity (Optional)

Type: Array

Description: The methods used to extract and/or analyze the evidence.

Location: /components/[]/evidence/identity/methods/[]

Type: Object
Table 73 – Properties for the identity object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>technique</td>
<td>String</td>
<td>Required</td>
<td>The technique used in this method of analysis.</td>
</tr>
<tr>
<td>confidence</td>
<td>Number</td>
<td>Required</td>
<td>The confidence of the evidence from 0 - 1, where 1 is 100% confidence. Confidence is specific to the technique used. Each technique of analysis can have independent confidence.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value or contents of the evidence.</td>
</tr>
</tbody>
</table>

8.1.30.4.16 Technique

**Location:** /components/[]/evidence/identity/methods/[]/technique

**Property:** technique (Required)

**Type:** String

**Description:** The technique used in this method of analysis.

**Enumeration:** Must be one of:

- source-code-analysis
- binary-analysis
- manifest-analysis
- ast-fingerprint
- hash-comparison
- instrumentation
- dynamic-analysis
- filename
- attestation
- other

8.1.30.4.17 Confidence

**Location:** /components/[]/evidence/identity/methods/[]/confidence

**Property:** confidence (Required)

**Type:** Number

**Maximum Value:** 1

**Description:** The confidence of the evidence from 0 - 1, where 1 is 100% confidence. Confidence is specific to the technique used. Each technique of analysis can have independent confidence.

8.1.30.4.18 Value

**Location:** /components/[]/evidence/identity/methods/[]/value

**Property:** value (Optional)

**Type:** String

**Description:** The value or contents of the evidence.
8.1.30.4.19 BOM References

**Location:** /components/[]/evidence/identity/tools

**Property:** identity (Optional)

**Type:** Array

**Description:** The object in the BOM identified by its bom-ref. This is often a component or service but may be any object type supporting bom-refs. Tools used for analysis should already be defined in the BOM, either in the metadata/tools, components, or formulation.

**Location:** /components/[]/evidence/identity/tools/[]

*Must be any of:*

1. Ref
2. BOM-Link Element

8.1.30.4.20 Ref

**Type:** String

**Description:** Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

8.1.30.4.21 BOM-Link Element

**Type:** String

**Format:** iri-reference as specified in [RFC 3987](https://www.ietf.org/rfc/rfc3987.html)

**Pattern Constraint:** ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$

**Description:** Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

*All items must be unique.*

8.1.30.5 Occurrences

**Location:** /components/[]/evidence/occurrences

**Property:** occurrences (Optional)

**Type:** Array

**Description:** Evidence of individual instances of a component spread across multiple locations.

**Location:** /components/[]/evidence/occurrences/[]

**Type:** Object

**Table 74 – Properties for the occurrences object**

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the occurrence elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>location</td>
<td>String</td>
<td>Required</td>
<td>The location or path to where the component was found.</td>
</tr>
<tr>
<td>line</td>
<td>Integer</td>
<td>Optional</td>
<td>The line number where the component was found.</td>
</tr>
<tr>
<td>offset</td>
<td>Integer</td>
<td>Optional</td>
<td>The offset where the component was found.</td>
</tr>
<tr>
<td>symbol</td>
<td>String</td>
<td>Optional</td>
<td>The symbol name that was found associated with the component.</td>
</tr>
<tr>
<td>Property</td>
<td>Type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------</td>
<td>---------</td>
<td>-------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>additionalContext</td>
<td>String</td>
<td>Optional</td>
<td>Any additional context of the detected component (e.g. a code snippet).</td>
</tr>
</tbody>
</table>

8.1.30.5.1  BOM Reference

**Location:** /components/[\]/evidence/occurrences/[\]/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the occurrence elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

8.1.30.5.2  Location

**Location:** /components/[\]/evidence/occurrences/[\]/location

**Property:** location (Required)

**Type:** String

**Description:** The location or path to where the component was found.

8.1.30.5.3  Line Number

**Location:** /components/[\]/evidence/occurrences/[\]/line

**Property:** line (Optional)

**Type:** Integer

**Description:** The line number where the component was found.

8.1.30.5.4  Offset

**Location:** /components/[\]/evidence/occurrences/[\]/offset

**Property:** offset (Optional)

**Type:** Integer

**Description:** The offset where the component was found.

8.1.30.5.5  Symbol

**Location:** /components/[\]/evidence/occurrences/[\]/symbol

**Property:** symbol (Optional)

**Type:** String

**Description:** The symbol name that was found associated with the component.

8.1.30.5.6  Additional Context

**Location:** /components/[\]/evidence/occurrences/[\]/additionalContext

**Property:** additionalContext (Optional)

**Type:** String

**Description:** Any additional context of the detected component (e.g. a code snippet).

8.1.30.6  Call Stack

**Location:** /components/[\]/evidence/callstack

**Property:** callstack (Optional)
Type: Object

Description: Evidence of the components use through the callstack.

Table 75 – Properties for the callstack object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>frames</td>
<td>Array</td>
<td>Optional</td>
<td>Within a call stack, a frame is a discrete unit that encapsulates an execution context, including local variables, parameters, and the return address. As function calls are made, frames are pushed onto the stack, forming an array-like structure that orchestrates the flow of program execution and manages the sequence of function invocations.</td>
</tr>
</tbody>
</table>

8.1.30.6.1 Frames

Location: /components/*/*/evidence/callstack/frames

Property: frames (Optional)

Type: Array

Description: Within a call stack, a frame is a discrete unit that encapsulates an execution context, including local variables, parameters, and the return address. As function calls are made, frames are pushed onto the stack, forming an array-like structure that orchestrates the flow of program execution and manages the sequence of function invocations.

Location: /components/*/*/evidence/callstack/frames/*

Type: Object

Table 76 – Properties for the frames object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>package</td>
<td>String</td>
<td>Optional</td>
<td>A package organizes modules into namespaces, providing a unique namespace for each type it contains.</td>
</tr>
<tr>
<td>module</td>
<td>String</td>
<td>Required</td>
<td>A module or class that encloses functions/methods and other code.</td>
</tr>
<tr>
<td>function</td>
<td>String</td>
<td>Optional</td>
<td>A block of code designed to perform a particular task.</td>
</tr>
<tr>
<td>parameters</td>
<td>Array</td>
<td>Optional</td>
<td>Optional arguments that are passed to the module or function.</td>
</tr>
<tr>
<td>line</td>
<td>Integer</td>
<td>Optional</td>
<td>The line number the code that is called resides on.</td>
</tr>
<tr>
<td>column</td>
<td>Integer</td>
<td>Optional</td>
<td>The column the code that is called resides.</td>
</tr>
<tr>
<td>fullFilename</td>
<td>String</td>
<td>Optional</td>
<td>The full path and filename of the module.</td>
</tr>
</tbody>
</table>

8.1.30.6.2 Package

Location: /components/*/evidence/callstack/frames/*/package

Property: package (Optional)

Type: String

Description: A package organizes modules into namespaces, providing a unique namespace for each type it contains.
8.1.30.6.3 Module
Location: /components/[]/evidence/callstack/frames/[]/module
Property: module (Required)
Type: String
Description: A module or class that encloses functions/methods and other code.

8.1.30.6.4 Function
Location: /components/[]/evidence/callstack/frames/[]/function
Property: function (Optional)
Type: String
Description: A block of code designed to perform a particular task.

8.1.30.6.5 Parameters
Location: /components/[]/evidence/callstack/frames/[]/parameters
Property: parameters (Optional)
Type: array (of String)
Description: Optional arguments that are passed to the module or function. Each item of this array must be a string.

8.1.30.6.6 Line
Location: /components/[]/evidence/callstack/frames/[]/line
Property: line (Optional)
Type: Integer
Description: The line number the code that is called resides on.

8.1.30.6.7 Column
Location: /components/[]/evidence/callstack/frames/[]/column
Property: column (Optional)
Type: Integer
Description: The column the code that is called resides.

8.1.30.6.8 Full Filename
Location: /components/[]/evidence/callstack/frames/[]/fullFilename
Property: fullFilename (Optional)
Type: String
Description: The full path and filename of the module.

8.1.30.7 Licence Evidence
Location: /components/[]/evidence/licenses
Property: licenses (Optional)
Type: Array
Description: EITHER (list of SPDX licences and/or named licences) OR (tuple of one SPDX Licence Expression)
Reference: Refer to the license definition at /components/[]/licenses
8.1.30.8 Copyright Evidence

Location: /components/[]/evidence/copyright
Property: copyright (Optional)

Type: Array

Description: Copyright evidence captures intellectual property assertions, providing evidence of possible ownership and legal protection. Each item of this array must be a Copyright object.

8.1.30.8.1 Copyright

Location: /components/[]/evidence/copyright/[

Type: Object

Description: A copyright notice informing users of the underlying claims to copyright ownership in a published work.

Table 77 – Properties for the copyright object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>text</td>
<td>String</td>
<td>Required</td>
<td>The textual content of the copyright.</td>
</tr>
</tbody>
</table>

8.1.30.8.2 Copyright Text

Location: /components/[]/evidence/copyright/[/text

Property: text (Required)

Type: String

Description: The textual content of the copyright.

8.1.31 Release notes

Location: /components/[]/releaseNotes

Property: releaseNotes (Optional)

Type: Object

Description: Specifies optional release notes.

Table 78 – Properties for the releaseNotes object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>type</td>
<td>String</td>
<td>Required</td>
<td>The software versioning type the release note describes.</td>
</tr>
<tr>
<td>title</td>
<td>String</td>
<td>Optional</td>
<td>The title of the release.</td>
</tr>
<tr>
<td>featuredImage</td>
<td>String</td>
<td>Optional</td>
<td>The URL to an image that may be prominently displayed with the release note.</td>
</tr>
<tr>
<td>socialImage</td>
<td>String</td>
<td>Optional</td>
<td>The URL to an image that may be used in messaging on social media platforms.</td>
</tr>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>A short description of the release.</td>
</tr>
<tr>
<td>timestamp</td>
<td>String</td>
<td>Optional</td>
<td>The date and time (timestamp) when the release note was created.</td>
</tr>
<tr>
<td>Property</td>
<td>Type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>------------</td>
<td>--------</td>
<td>-------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>aliases</td>
<td>Array</td>
<td>Optional</td>
<td>One or more alternate names the release may be referred to. This may include unofficial terms used by development and marketing teams (e.g. code names).</td>
</tr>
<tr>
<td>tags</td>
<td>Array</td>
<td>Optional</td>
<td>Textual strings that aid in discovery, search, and retrieval of the associated object. Tags often serve as a way to group or categorize similar or related objects by various attributes.</td>
</tr>
<tr>
<td>resolves</td>
<td>Array</td>
<td>Optional</td>
<td>A collection of issues that have been resolved.</td>
</tr>
<tr>
<td>notes</td>
<td>Array</td>
<td>Optional</td>
<td>Zero or more release notes containing the locale and content. Multiple note objects may be specified to support release notes in a wide variety of languages.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.</td>
</tr>
</tbody>
</table>

### 8.1.31.1 Type

**Location:** /components/[]/releaseNotes/type

**Property:** type (Required)

**Type:** String

**Description:** The software versioning type the release note describes.

**Examples:**
- major
- minor
- patch
- pre-release
- internal

### 8.1.31.2 Title

**Location:** /components/[]/releaseNotes/title

**Property:** title (Optional)

**Type:** String

**Description:** The title of the release.

### 8.1.31.3 Featured image

**Location:** /components/[]/releaseNotes/featuredImage

**Property:** featuredImage (Optional)

**Type:** String

**Format:** iri-reference as specified in [RFC 3987](https://www.ietf.org/rfc/rfc3987.html)
Description: The URL to an image that may be prominently displayed with the release note.

8.1.31.4 Social image

Location: /components/[]/releaseNotes/socialImage

Property: socialImage (Optional)

Type: String


Description: The URL to an image that may be used in messaging on social media platforms.

8.1.31.5 Description

Location: /components/[]/releaseNotes/description

Property: description (Optional)

Type: String

Description: A short description of the release.

8.1.31.6 Timestamp

Location: /components/[]/releaseNotes/timestamp

Property: timestamp (Optional)

Type: String

Format: data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)

Description: The date and time (timestamp) when the release note was created.

8.1.31.7 Aliases

Location: /components/[]/releaseNotes/aliases

Property: aliases (Optional)

Type: array (of String)

Description: One or more alternate names the release may be referred to. This may include unofficial terms used by development and marketing teams (e.g. code names). Each item of this array must be a string.

8.1.31.8 Tags

Location: /components/[]/releaseNotes/tags

Property: tags (Optional)

Type: array (of String)

Description: Textual strings that aid in discovery, search, and retrieval of the associated object. Tags often serve as a way to group or categorize similar or related objects by various attributes. Each item of this array must be a string.

Examples:
- json-parser
- object-persistence
- text-to-image
- translation
- object-detection

8.1.31.9 Resolves

Location: /components/[]/releaseNotes/resolves
Property: resolves (Optional)
Type: Array
Description: A collection of issues that have been resolved. Each item of this array must be an Issue object.

8.1.31.9.1 Issue
Location: /components/[]/releaseNotes/resolves/[]
Type: Object
Description: An individual issue that has been resolved.

Table 79 – Properties for the resolves object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>type</td>
<td>String</td>
<td>Required</td>
<td>Specifies the type of issue</td>
</tr>
<tr>
<td>id</td>
<td>String</td>
<td>Optional</td>
<td>The identifier of the issue assigned by the source of the issue</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the issue</td>
</tr>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>A description of the issue</td>
</tr>
<tr>
<td>source</td>
<td>Object</td>
<td>Optional</td>
<td>The source of the issue where it is documented</td>
</tr>
<tr>
<td>references</td>
<td>Array</td>
<td>Optional</td>
<td>A collection of URL's for reference. Multiple URLs are allowed.</td>
</tr>
</tbody>
</table>

8.1.31.9.2 Issue Type
Location: /components/[]/releaseNotes/resolves/[]/type
Property: type (Required)
Type: String
Description: Specifies the type of issue

Table 80 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>defect</td>
<td>A fault, flaw, or bug in software.</td>
</tr>
<tr>
<td>enhancement</td>
<td>A new feature or behaviour in software.</td>
</tr>
<tr>
<td>security</td>
<td>A special type of defect which impacts security.</td>
</tr>
</tbody>
</table>

8.1.31.9.3 Issue ID
Location: /components/[]/releaseNotes/resolves/[]/id
Property: id (Optional)
Type: String
Description: The identifier of the issue assigned by the source of the issue
8.1.31.9.4 Issue Name

Location: /components/[]/releaseNotes/resolves/[[]/name
Property: name (Optional)
Type: String
Description: The name of the issue

8.1.31.9.5 Issue Description

Location: /components/[[]/releaseNotes/resolves/[[]/description
Property: description (Optional)
Type: String
Description: A description of the issue

8.1.31.9.6 Source

Location: /components/[[]/releaseNotes/resolves/[[]/source
Property: source (Optional)
Type: Object
Description: The source of the issue where it is documented

Table 81 – Properties for the source object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the source.</td>
</tr>
<tr>
<td>url</td>
<td>String</td>
<td>Optional</td>
<td>The url of the issue documentation as provided by the source</td>
</tr>
</tbody>
</table>

8.1.31.9.7 Name

Location: /components/[[]/releaseNotes/resolves/[[]/source/name
Property: name (Optional)
Type: String
Description: The name of the source.

Examples:
- National Vulnerability Database
- NVD
- Apache

8.1.31.9.8 URL

Location: /components/[[]/releaseNotes/resolves/[[]/source/url
Property: url (Optional)
Type: String
Description: The url of the issue documentation as provided by the source

8.1.31.9.9 References

Location: /components/[[]/releaseNotes/resolves/[[]/references
Property: references (Optional)

Type: array (of String)


Description: A collection of URL's for reference. Multiple URLs are allowed. Each item of this array must be a string.

Examples:
- https://example.com

8.1.31.10 Notes

Location: /components/[]/releaseNotes/notes

Property: notes (Optional)

Type: Array

Description: Zero or more release notes containing the locale and content. Multiple note objects may be specified to support release notes in a wide variety of languages. Each item of this array must be a Note object.

8.1.31.10.1 Note

Location: /components/[]/releaseNotes/notes/[

Property: locale (Optional)

Type: String

Pattern Constraint: ^([a-z]{2})([-A-Z]{2})?$

Description: The ISO-639 (or higher) language code and optional ISO-3166 (or higher) country code. Examples include: "en", "en-US", "fr" and "fr-CA"

8.1.31.10.2 Locale

Location: /components/[]/releaseNotes/notes/[]/locale

Property: locale (Optional)

Type: String

Pattern Constraint: ^([a-z]{2})([-A-Z]{2})?$

Description: The ISO-639 (or higher) language code and optional ISO-3166 (or higher) country code. Examples include: "en", "en-US", "fr" and "fr-CA"

8.1.31.10.3 Release note content

Location: /components/[]/releaseNotes/notes/[]/text

Property: text (Required)

Type: Object

Description: Specifies the full content of the release note.

Table 82 – Properties for the notes object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>locale</td>
<td>String</td>
<td>Optional</td>
<td>The ISO-639 (or higher) language code and optional ISO-3166 (or higher) country code. Examples include: &quot;en&quot;, &quot;en-US&quot;, &quot;fr&quot; and &quot;fr-CA&quot;</td>
</tr>
<tr>
<td>text</td>
<td>Object</td>
<td>Required</td>
<td>Specifies the full content of the release note.</td>
</tr>
</tbody>
</table>

8.1.31.10.4 Additional notes
Table 83 – Properties for the text object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>contentType</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. <a href="https://tools.ietf.org/html/rfc2045">RFC 2045 section 5.1</a> outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the <a href="https">IANA media types registry</a>.</td>
</tr>
<tr>
<td>encoding</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the optional encoding the text is represented in.</td>
</tr>
<tr>
<td>content</td>
<td>String</td>
<td>Required</td>
<td>The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.</td>
</tr>
</tbody>
</table>

8.1.31.10.4  Content-Type

**Location:** /components/[]/releaseNotes/notes/[]/text/contentType

**Property:** contentType (Optional)

**Type:** String

**Default Value:** text/plain

**Description:** Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. [RFC 2045 section 5.1](https://tools.ietf.org/html/rfc2045) outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the [IANA media types registry](https).

**Examples:**
- text/plain
- application/json
- image/png

8.1.31.10.5  Encoding

**Location:** /components/[]/releaseNotes/notes/[]/text/encoding

**Property:** encoding (Optional)

**Type:** String

**Description:** Specifies the optional encoding the text is represented in.

Table 84 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>base64</td>
<td>Base64 is a binary-to-text encoding scheme that represents binary data in an ASCII string.</td>
</tr>
</tbody>
</table>

8.1.31.10.6  Attachment Text

**Location:** /components/[]/releaseNotes/notes/[]/text/content

**Property:** content (Required)

**Type:** String
Description: The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.

8.1.31.11 Properties

Location: /components/[]/releaseNotes/properties

Property: properties (Optional)

Type: Array

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

8.1.31.11.1 Lightweight name-value pair

Location: /components/[]/releaseNotes/properties/[]

Type: Object

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

Table 85 – Properties for the properties object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

8.1.31.11.2 Name

Location: /components/[]/releaseNotes/properties/[]/name

Property: name (Required)

Type: String

Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

8.1.31.11.3 Value

Location: /components/[]/releaseNotes/properties/[]/value

Property: value (Optional)

Type: String

Description: The value of the property.

8.1.32 AI/ML Model Card

Location: /components/[]/modelCard

Property: modelCard (Optional)

Type: Object
Description: A model card describes the intended uses of a machine learning model and potential limitations, including biases and ethical considerations. Model cards typically contain the training parameters, which datasets were used to train the model, performance metrics, and other relevant data useful for ML transparency. This object SHOULD be specified for any component of type machine-learning-model and must not be specified for other component types.

Table 86 – Properties for the modelCard object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the model card elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>modelParameters</td>
<td>Object</td>
<td>Optional</td>
<td>Hyper-parameters for construction of the model.</td>
</tr>
<tr>
<td>quantitativeAnalysis</td>
<td>Object</td>
<td>Optional</td>
<td>A quantitative analysis of the model</td>
</tr>
<tr>
<td>considerations</td>
<td>Object</td>
<td>Optional</td>
<td>What considerations should be taken into account regarding the model's construction, training, and application?</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.</td>
</tr>
</tbody>
</table>

8.1.32.1 BOM Reference

Location: /components/[]/modelCard/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the model card elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

8.1.32.2 Model Parameters

Location: /components/[]/modelCard/modelParameters

Property: modelParameters (Optional)

Type: Object

Description: Hyper-parameters for construction of the model.
Table 87 – Properties for the modelParameters object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>approach</td>
<td>Object</td>
<td>Optional</td>
<td>The overall approach to learning used by the model for problem solving.</td>
</tr>
<tr>
<td>task</td>
<td>String</td>
<td>Optional</td>
<td>Directly influences the input and/or output. Examples include classification, regression, clustering, etc.</td>
</tr>
<tr>
<td>architectureFamily</td>
<td>String</td>
<td>Optional</td>
<td>The model architecture family such as transformer network, convolutional neural network, residual neural network, LSTM neural network, etc.</td>
</tr>
<tr>
<td>modelArchitecture</td>
<td>String</td>
<td>Optional</td>
<td>The specific architecture of the model such as GPT-1, ResNet-50, YOLOv3, etc.</td>
</tr>
<tr>
<td>datasets</td>
<td>Array</td>
<td>Optional</td>
<td>The datasets used to train and evaluate the model.</td>
</tr>
<tr>
<td>inputs</td>
<td>Array</td>
<td>Optional</td>
<td>The input format(s) of the model</td>
</tr>
<tr>
<td>outputs</td>
<td>Array</td>
<td>Optional</td>
<td>The output format(s) from the model</td>
</tr>
</tbody>
</table>

8.1.32.2.1 Approach

**Location:** /components/[]/modelCard/modelParameters/approach

**Property:** approach (Optional)

**Type:** Object

**Description:** The overall approach to learning used by the model for problem solving.

Table 88 – Properties for the approach object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>type</td>
<td>String</td>
<td>Optional</td>
<td>Learning types describing the learning problem or hybrid learning problem.</td>
</tr>
</tbody>
</table>

8.1.32.2.2 Learning Type

**Location:** /components/[]/modelCard/modelParameters/approach/type

**Property:** type (Optional)

**Type:** String

**Description:** Learning types describing the learning problem or hybrid learning problem.
Table 89 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>supervised</td>
<td>Supervised machine learning involves training an algorithm on labelled data to predict or classify new data based on the patterns learned from the labelled examples.</td>
</tr>
<tr>
<td>unsupervised</td>
<td>Unsupervised machine learning involves training algorithms on unlabeled data to discover patterns, structures, or relationships without explicit guidance, allowing the model to identify inherent structures or clusters within the data.</td>
</tr>
<tr>
<td>reinforcement-</td>
<td>Reinforcement learning is a type of machine learning where an agent learns to make decisions by interacting with an environment to maximize cumulative rewards, through trial and error.</td>
</tr>
<tr>
<td>learning</td>
<td></td>
</tr>
<tr>
<td>semi-supervised</td>
<td>Semi-supervised machine learning utilizes a combination of labelled and unlabeled data during training to improve model performance, leveraging the benefits of both supervised and unsupervised learning techniques.</td>
</tr>
<tr>
<td>self-supervised</td>
<td>Self-supervised machine learning involves training models to predict parts of the input data from other parts of the same data, without requiring external labels, enabling learning from large amounts of unlabeled data.</td>
</tr>
</tbody>
</table>

8.1.32.2.3 Task

Location: /components/[]/modelCard/modelParameters/task

Property: task (Optional)

Type: String

Description: Directly influences the input and/or output. Examples include classification, regression, clustering, etc.

8.1.32.2.4 Architecture Family

Location: /components/[]/modelCard/modelParameters/architectureFamily

Property: architectureFamily (Optional)

Type: String

Description: The model architecture family such as transformer network, convolutional neural network, residual neural network, LSTM neural network, etc.

8.1.32.2.5 Model Architecture

Location: /components/[]/modelCard/modelParameters/modelArchitecture

Property: modelArchitecture (Optional)

Type: String

Description: The specific architecture of the model such as GPT-1, ResNet-50, YOLOv3, etc.

8.1.32.2.6 Datasets

Location: /components/[]/modelCard/modelParameters/datasets

Property: datasets (Optional)

Type: Array

Description: The datasets used to train and evaluate the model.

Location: /components/[]/modelCard/modelParameters/datasets/[]
Must be one of:
1. Inline Data Information
2. Data Reference

8.1.32.2.7 Inline Data Information

Type: Object

Table 90 – Properties for inline data information

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the dataset elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>type</td>
<td>String</td>
<td>Required</td>
<td>The general theme or subject matter of the data being specified.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the dataset.</td>
</tr>
<tr>
<td>contents</td>
<td>Object</td>
<td>Optional</td>
<td>The contents or references to the contents of the data being described.</td>
</tr>
<tr>
<td>classification</td>
<td>String</td>
<td>Optional</td>
<td>Data classification tags data according to its type, sensitivity, and value if altered, stolen, or destroyed.</td>
</tr>
<tr>
<td>sensitiveData</td>
<td>Array</td>
<td>Optional</td>
<td>A description of any sensitive data in a dataset.</td>
</tr>
<tr>
<td>graphics</td>
<td>Object</td>
<td>Optional</td>
<td>A collection of graphics that represent various measurements.</td>
</tr>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>A description of the dataset. Can describe size of dataset, whether it's used for source code, training, testing, or validation, etc.</td>
</tr>
<tr>
<td>governance</td>
<td>Object</td>
<td>Optional</td>
<td>Data governance captures information regarding data ownership, stewardship, and custodianship, providing insights into the individuals or entities responsible for managing, overseeing, and safeguarding the data throughout its lifecycle.</td>
</tr>
</tbody>
</table>

8.1.32.2.8 Data Reference

Type: Object

Table 91 – Properties for data reference

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>String</td>
<td>Optional</td>
<td>References a data component by the components bom-ref attribute</td>
</tr>
</tbody>
</table>

8.1.32.2.9 BOM Reference

Location: /components/[/modelCard/modelParameters/datasets/[]/bom-ref

Property: datasets (Optional)

Type: String
Description: An optional identifier which can be used to reference the dataset elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

8.1.32.2.10 Type of Data

Location: /components/[]/modelCard/modelParameters/datasets/[]/type

Property: datasets (Required)

Type: String

Description: The general theme or subject matter of the data being specified.

Table 92 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>source-code</td>
<td>Any type of code, code snippet, or data-as-code.</td>
</tr>
<tr>
<td>configuration</td>
<td>Parameters or settings that may be used by other components.</td>
</tr>
<tr>
<td>dataset</td>
<td>A collection of data.</td>
</tr>
<tr>
<td>definition</td>
<td>Data that can be used to create new instances of what the definition defines.</td>
</tr>
<tr>
<td>other</td>
<td>Any other type of data that does not fit into existing definitions.</td>
</tr>
</tbody>
</table>

8.1.32.2.11 Dataset Name

Location: /components/[]/modelCard/modelParameters/datasets/[]/name

Property: datasets (Optional)

Type: String

Description: The name of the dataset.

8.1.32.2.12 Data Contents

Location: /components/[]/modelCard/modelParameters/datasets/[]/contents

Property: datasets (Optional)

Type: Object

Description: The contents or references to the contents of the data being described.

Table 93 – Properties for the datasets object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>attachment</td>
<td>Object</td>
<td>Optional</td>
<td>An optional way to include textual or encoded data.</td>
</tr>
<tr>
<td>url</td>
<td>String</td>
<td>Optional</td>
<td>The URL to where the data can be retrieved.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document name-value parameters used for configuration.</td>
</tr>
</tbody>
</table>

8.1.32.2.13 Data Attachment

Location: /components/[]/modelCard/modelParameters/datasets/[]/contents/attachment

Property: attachment (Optional)
Type: Object

Description: An optional way to include textual or encoded data.

Table 94 – Properties for the attachment object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>contentType</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. RFC 2045 section 5.1 outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the IANA media types registry.</td>
</tr>
<tr>
<td>encoding</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the optional encoding the text is represented in.</td>
</tr>
<tr>
<td>content</td>
<td>String</td>
<td>Required</td>
<td>The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.</td>
</tr>
</tbody>
</table>

8.1.32.2.14 Content-Type

Location: /components/[]/modelCard/modelParameters/datasets/[]/contents/attachment/contentType

Property: contentType (Optional)

Type: String

Default Value: text/plain

Description: Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. RFC 2045 section 5.1 outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the IANA media types registry.

Examples:
- text/plain
- application/json
- image/png

8.1.32.2.15 Encoding

Location: /components/[]/modelCard/modelParameters/datasets/[]/contents/attachment/encoding

Property: encoding (Optional)

Type: String

Description: Specifies the optional encoding the text is represented in.

Table 95 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>base64</td>
<td>Base64 is a binary-to-text encoding scheme that represents binary data in an ASCII string.</td>
</tr>
</tbody>
</table>

8.1.32.2.16 Attachment Text

Location: /components/[]/modelCard/modelParameters/datasets/[]/contents/attachment/content

Property: content (Required)
Type: String
Description: The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.

8.1.32.2.17 Data URL

Location: /components/[]/modelCard/modelParameters/datasets/[]/contents/url
Property: url (Optional)

Type: String
Description: The URL to where the data can be retrieved.

8.1.32.2.18 Configuration Properties

Location: /components/[]/modelCard/modelParameters/datasets/[]/contents/properties
Property: properties (Optional)

Type: Array
Description: Provides the ability to document name-value parameters used for configuration. Each item of this array must be a Lightweight name-value pair object.

8.1.32.2.19 Lightweight name-value pair

Location: /components/[]/modelCard/modelParameters/datasets/[]/contents/properties/[]

Type: Object
Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

Table 96 – Properties for the properties object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

8.1.32.2.20 Name

Location: /components/[]/modelCard/modelParameters/datasets/[]/contents/properties/[]/name
Property: name (Required)

Type: String
Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

8.1.32.2.21 Value

Location: /components/[]/modelCard/modelParameters/datasets/[]/contents/properties/[]/value
Property: value (Optional)

Type: String
Description: The value of the property.
8.1.32.22 Data Classification

Location: /components/[]/modelCard/modelParameters/datasets/[]/classification

Property: datasets (Optional)

Type: String

Description: Data classification tags data according to its type, sensitivity, and value if altered, stolen, or destroyed.

8.1.32.23 Sensitive Data

Location: /components/[]/modelCard/modelParameters/datasets/[]/sensitiveData

Property: datasets (Optional)

Type: array (of String)

Description: A description of any sensitive data in a dataset. Each item of this array must be a string.

8.1.32.24 Graphics Collection

Location: /components/[]/modelCard/modelParameters/datasets/[]/graphics

Property: datasets (Optional)

Type: Object

Description: A collection of graphics that represent various measurements.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>A description of this collection of graphics.</td>
</tr>
<tr>
<td>collection</td>
<td>Array</td>
<td>Optional</td>
<td>A collection of graphics.</td>
</tr>
</tbody>
</table>

8.1.32.25 Description

Location: /components/[]/modelCard/modelParameters/datasets/[]/graphics/description

Property: description (Optional)

Type: String

Description: A description of this collection of graphics.

8.1.32.26 Collection

Location: /components/[]/modelCard/modelParameters/datasets/[]/graphics/collection

Property: collection (Optional)

Type: Array

Description: A collection of graphics. Each item of this array must be a Graphic object.

8.1.32.27 Graphic

Location: /components/[]/modelCard/modelParameters/datasets/[]/graphics/collection/[]

Type: Object
Table 98 – Properties for the collection object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the graphic.</td>
</tr>
<tr>
<td>image</td>
<td>Object</td>
<td>Optional</td>
<td>The graphic (vector or raster). Base64 encoding must be specified for binary images.</td>
</tr>
</tbody>
</table>

8.1.32.28 Name

**Location:** /components/[][]/modelCard/modelParameters/datasets/[][]/graphics/collection/[][]/name

**Property:** name (Optional)

**Type:** String

**Description:** The name of the graphic.

8.1.32.29 Graphic Image

**Location:** /components/[][]/modelCard/modelParameters/datasets/[][]/graphics/collection/[][]/image

**Property:** image (Optional)

**Type:** Object

**Description:** The graphic (vector or raster). Base64 encoding must be specified for binary images.

Table 99 – Properties for the image object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>contentType</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. <a href="https://tools.ietf.org/html/rfc2045">RFC 2045 section 5.1</a> outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the <a href="https">IANA media types registry</a>.</td>
</tr>
<tr>
<td>encoding</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the optional encoding the text is represented in.</td>
</tr>
<tr>
<td>content</td>
<td>String</td>
<td>Required</td>
<td>The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.</td>
</tr>
</tbody>
</table>

8.1.32.30 Content-Type

**Location:** /components/[][]/modelCard/modelParameters/datasets/[][]/graphics/collection/[][]/image/contentType

**Property:** contentType (Optional)

**Type:** String

**Default Value:** text/plain

**Description:** Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. [RFC 2045 section 5.1](https://tools.ietf.org/html/rfc2045) outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the [IANA media types registry](https).
Examples:
- text/plain
- application/json
- image/png

8.1.32.2.31 Encoding

Location: /components/[]/modelCard/modelParameters/datasets/[]/graphics/collection/[]/image/encoding
Property: encoding (Optional)
Type: String
Description: Specifies the optional encoding the text is represented in.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>base64</td>
<td>Base64 is a binary-to-text encoding scheme that represents binary data in an ASCII string.</td>
</tr>
</tbody>
</table>

8.1.32.2.32 Attachment Text

Location: /components/[]/modelCard/modelParameters/datasets/[]/graphics/collection/[]/image/content
Property: content (Required)
Type: String
Description: The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.

8.1.32.2.33 Dataset Description

Location: /components/[]/modelCard/modelParameters/datasets/[]/description
Property: datasets (Optional)
Type: String
Description: A description of the dataset. Can describe size of dataset, whether it's used for source code, training, testing, or validation, etc.

8.1.32.2.34 Data Governance

Location: /components/[]/modelCard/modelParameters/datasets/[]/governance
Property: datasets (Optional)
Type: Object
Description: Data governance captures information regarding data ownership, stewardship, and custodianship, providing insights into the individuals or entities responsible for managing, overseeing, and safeguarding the data throughout its lifecycle.
### Table 101 – Properties for the datasets object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>custodians</td>
<td>Array</td>
<td>Optional</td>
<td>Data custodians are responsible for the safe custody, transport, and storage of data.</td>
</tr>
<tr>
<td>stewards</td>
<td>Array</td>
<td>Optional</td>
<td>Data stewards are responsible for data content, context, and associated business rules.</td>
</tr>
<tr>
<td>owners</td>
<td>Array</td>
<td>Optional</td>
<td>Data owners are concerned with risk and appropriate access to data.</td>
</tr>
</tbody>
</table>

#### 8.1.32.2.35 Data Custodians

**Location:** /components/[x]/modelCard/modelParameters/datasets/[y]/governance/custodians  
**Property:** custodians (Optional)  
**Type:** Array  
**Description:** Data custodians are responsible for the safe custody, transport, and storage of data.  
**Location:** /components/[x]/modelCard/modelParameters/datasets/[y]/governance/custodians/[z]  
**Type:** Object

### Table 102 – Properties for the custodians object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>organization</td>
<td>Object</td>
<td>Optional</td>
<td>The organization that is responsible for specific data governance role(s).</td>
</tr>
<tr>
<td>contact</td>
<td>Object</td>
<td>Optional</td>
<td>The individual that is responsible for specific data governance role(s).</td>
</tr>
</tbody>
</table>

#### 8.1.32.2.36 Organization

**Location:** /components/[x]/modelCard/modelParameters/datasets/[y]/governance/custodians/[z]/organization  
**Property:** organization (Optional)  
**Type:** Object  
**Description:** The organization that is responsible for specific data governance role(s).

### Table 103 – Properties for the organization object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the organization</td>
</tr>
<tr>
<td>address</td>
<td>Object</td>
<td>Optional</td>
<td>The physical address (location) of the organization</td>
</tr>
<tr>
<td>url</td>
<td>Array</td>
<td>Optional</td>
<td>The URL of the organization. Multiple URLs are allowed.</td>
</tr>
<tr>
<td>contact</td>
<td>Array</td>
<td>Optional</td>
<td>A contact at the organization. Multiple contacts are allowed.</td>
</tr>
</tbody>
</table>
8.1.32.2.37  BOM Reference

Location: /components[/modelCard/modelParameters/datasets[/governance/custodians/]organization/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

8.1.32.2.38  Organization Name

Location: /components[/modelCard/modelParameters/datasets[/governance/custodians/]organization/name

Property: name (Optional)

Type: String

Description: The name of the organization

Examples:
- Example Inc.

8.1.32.2.39  Organization Address

Location: /components[/modelCard/modelParameters/datasets[/governance/custodians/]organization/address

Property: address (Optional)

Type: Object

Description: The physical address (location) of the organization

Table 104 – Properties for the address object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>Optional</td>
<td>The country name or the two-letter ISO 3166-1 country code.</td>
</tr>
<tr>
<td>region</td>
<td>String</td>
<td>Optional</td>
<td>The region or state in the country.</td>
</tr>
<tr>
<td>locality</td>
<td>String</td>
<td>Optional</td>
<td>The locality or city within the country.</td>
</tr>
<tr>
<td>postOfficeBoxNumber</td>
<td>String</td>
<td>Optional</td>
<td>The post office box number.</td>
</tr>
<tr>
<td>postalCode</td>
<td>String</td>
<td>Optional</td>
<td>The postal code.</td>
</tr>
<tr>
<td>streetAddress</td>
<td>String</td>
<td>Optional</td>
<td>The street address.</td>
</tr>
</tbody>
</table>
8.1.32.2.40  BOM Reference

Location: /components/[/modelCard/modelParameters/datasets/[/governance/custodians/[/organization/address/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

8.1.32.2.41  Country

Location: /components/[/modelCard/modelParameters/datasets/[/governance/custodians/[/organization/address/country

Property: country (Optional)

Type: String

Description: The country name or the two-letter ISO 3166-1 country code.

8.1.32.2.42  Region

Location: /components/[/modelCard/modelParameters/datasets/[/governance/custodians/[/organization/address/region

Property: region (Optional)

Type: String

Description: The region or state in the country.

Examples:

- Texas

8.1.32.2.43  Locality

Location: /components/[/modelCard/modelParameters/datasets/[/governance/custodians/[/organization/address/locality

Property: locality (Optional)

Type: String

Description: The locality or city within the country.

Examples:

- Austin

8.1.32.2.44  Post Office Box Number

Location: /components/[/modelCard/modelParameters/datasets/[/governance/custodians/[/organization/address/postOfficeBoxNumber

Property: postOfficeBoxNumber (Optional)

Type: String

Description: The post office box number.

Examples:

- 901
8.1.32.2.45 Postal Code

Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/custodians/[]/organization/address/postal

Property: postalCode (Optional)

Type: String

Description: The postal code.

Examples:
- 78758

8.1.32.2.46 Street Address

Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/custodians/[]/organization/address/street

Property: streetAddress (Optional)

Type: String

Description: The street address.

Examples:
- 100 Main Street

8.1.32.2.47 Organization URL(s)

Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/custodians/[]/organization/url

Property: url (Optional)

Type: array (of String)


Description: The URL of the organization. Multiple URLs are allowed. Each item of this array must be a string.

Examples:
- https://example.com

8.1.32.2.48 Organizational Contact

Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/custodians/[]/organization/contact

Property: contact (Optional)

Type: Array

Description: A contact at the organization. Multiple contacts are allowed. Each item of this array must be an Organizational Contact object.

8.1.32.2.49 Organizational Contact

Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/custodians/[]/organization/contact/[]

Type: Object
Table 105 – Properties for the contact object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

8.1.32.2.50 BOM Reference

Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/custodians/[]/organization/contact/[]/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

8.1.32.2.51 Name

Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/custodians/[]/organization/contact/[]/name

Property: name (Optional)

Type: String

Description: The name of a contact

Examples:
- Contact name

8.1.32.2.52 Email Address

Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/custodians/[]/organization/contact/[]/email

Property: email (Optional)

Type: String

Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

Description: The email address of the contact.

Examples:
- firstname.lastname@example.com
8.1.32.2.53 Phone

Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/custodians/[]/organization/contact/[]/phone

Property: phone (Optional)

Type: String

Description: The phone number of the contact.

Examples:
- 800-555-1212

8.1.32.2.54 Organizational Contact

Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/custodians/[]/contact

Property: contact (Optional)

Type: Object

Description: The individual that is responsible for specific data governance role(s).

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

8.1.32.2.55 BOM Reference

Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/custodians/[]/contact/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

8.1.32.2.56 Name

Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/custodians/[]/contact/name

Property: name (Optional)

Type: String

Description: The name of a contact

Examples:
- Contact name
8.1.32.2.57  Email Address

Location: /components/[][]/modelCard/modelParameters/datasets/[][]/governance/custodians/[][]/contact/email
Property: email (Optional)

Type: String
Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)
Description: The email address of the contact.
Examples:
  - firstname.lastname@example.com

8.1.32.2.58  Phone

Location: /components/[][]/modelCard/modelParameters/datasets/[][]/governance/custodians/[][]/contact/phone
Property: phone (Optional)

Type: String
Description: The phone number of the contact.
Examples:
  - 800-555-1212

8.1.32.2.59  Data Stewards

Location: /components/[][]/modelCard/modelParameters/datasets/[][]/governance/stewards
Property: stewards (Optional)

Type: Array
Description: Data stewards are responsible for data content, context, and associated business rules.

Table 107 – Properties for the stewards object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>organization</td>
<td>Object</td>
<td>Optional</td>
<td>The organization that is responsible for specific data governance role(s).</td>
</tr>
<tr>
<td>contact</td>
<td>Object</td>
<td>Optional</td>
<td>The individual that is responsible for specific data governance role(s).</td>
</tr>
</tbody>
</table>

8.1.32.2.60  Organization

Location: /components/[][]/modelCard/modelParameters/datasets/[][]/governance/stewards/[][]/organization
Property: organization (Optional)

Type: Object
Description: The organization that is responsible for specific data governance role(s).
Table 108 – Properties for the organization object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the organization</td>
</tr>
<tr>
<td>address</td>
<td>Object</td>
<td>Optional</td>
<td>The physical address (location) of the organization</td>
</tr>
<tr>
<td>url</td>
<td>Array</td>
<td>Optional</td>
<td>The URL of the organization. Multiple URLs are allowed.</td>
</tr>
<tr>
<td>contact</td>
<td>Array</td>
<td>Optional</td>
<td>A contact at the organization. Multiple contacts are allowed.</td>
</tr>
</tbody>
</table>

8.1.32.2.61 BOM Reference

**Location:** /components/[]/modelCard/modelParameters/datasets/[]/governance/stewards/[]/organization/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

8.1.32.2.62 Organization Name

**Location:** /components/[]/modelCard/modelParameters/datasets/[]/governance/stewards/[]/organization/name

**Property:** name (Optional)

**Type:** String

**Description:** The name of the organization

**Examples:**
- Example Inc.

8.1.32.2.63 Organization Address

**Location:** /components/[]/modelCard/modelParameters/datasets/[]/governance/stewards/[]/organization/address

**Property:** address (Optional)

**Type:** Object

**Description:** The physical address (location) of the organization
### Table 109 – Properties for the address object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>Optional</td>
<td>The country name or the two-letter ISO 3166-1 country code.</td>
</tr>
<tr>
<td>region</td>
<td>String</td>
<td>Optional</td>
<td>The region or state in the country.</td>
</tr>
<tr>
<td>locality</td>
<td>String</td>
<td>Optional</td>
<td>The locality or city within the country.</td>
</tr>
<tr>
<td>postOfficeBoxNumber</td>
<td>String</td>
<td>Optional</td>
<td>The post office box number.</td>
</tr>
<tr>
<td>postalCode</td>
<td>String</td>
<td>Optional</td>
<td>The postal code.</td>
</tr>
<tr>
<td>streetAddress</td>
<td>String</td>
<td>Optional</td>
<td>The street address.</td>
</tr>
</tbody>
</table>

### 8.1.32.2.64 BOM Reference

**Location:** `/components/[]/modelCard/modelParameters/datasets/[]/governance/stewards/[]/organization/address/bom-ref`

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

### 8.1.32.2.65 Country

**Location:** `/components/[]/modelCard/modelParameters/datasets/[]/governance/stewards/[]/organization/address/country`

**Property:** country (Optional)

**Type:** String

**Description:** The country name or the two-letter ISO 3166-1 country code.

### 8.1.32.2.66 Region

**Location:** `/components/[]/modelCard/modelParameters/datasets/[]/governance/stewards/[]/organization/address/region`

**Property:** region (Optional)

**Type:** String

**Description:** The region or state in the country.

**Examples:**
- Texas

### 8.1.32.2.67 Locality

**Location:** `/components/[]/modelCard/modelParameters/datasets/[]/governance/stewards/[]/organization/address/locality`
**Property:** locality (Optional)

**Type:** String

**Description:** The locality or city within the country.

**Examples:**
- Austin

---

### 8.1.32.2.68 Post Office Box Number

**Location:**
/components/[/modelCard/modelParameters/datasets/[/governance/stewards/[/organization/address/postOfficeBoxNumber

**Property:** postOfficeBoxNumber (Optional)

**Type:** String

**Description:** The post office box number.

**Examples:**
- 901

---

### 8.1.32.2.69 Postal Code

**Location:**
/components/[/modelCard/modelParameters/datasets/[/governance/stewards/[/organization/address/postalCode

**Property:** postalCode (Optional)

**Type:** String

**Description:** The postal code.

**Examples:**
- 78758

---

### 8.1.32.2.70 Street Address

**Location:**
/components/[/modelCard/modelParameters/datasets/[/governance/stewards/[/organization/address/streetAddress

**Property:** streetAddress (Optional)

**Type:** String

**Description:** The street address.

**Examples:**
- 100 Main Street

---

### 8.1.32.2.71 Organization URL(s)

**Location:** /components/[/modelCard/modelParameters/datasets/[/governance/stewards/[/organization/url

**Property:** url (Optional)

**Type:** array (of String)

**Format:** iri-reference as specified in [RFC 3987](https://www.ietf.org/rfc/rfc3987.html)

**Description:** The URL of the organization. Multiple URLs are allowed. Each item of this array must be a string.

**Examples:**
- https://example.com
8.1.32.2.72 Organizational Contact

Location:
/components/[]/modelCard/modelParameters/datasets/[]/governance/stewards/[]/organization/contact

Property: contact (Optional)

Type: Array

Description: A contact at the organization. Multiple contacts are allowed. Each item of this array must be an Organizational Contact object.

8.1.32.2.73 Organizational Contact

Location:
/components/[]/modelCard/modelParameters/datasets/[]/governance/stewards/[]/organization/contact/[]

Type: Object

### Table 110 – Properties for the contact object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

8.1.32.2.74 BOM Reference

Location:
/components/[]/modelCard/modelParameters/datasets/[]/governance/stewards/[]/organization/contact/[]/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

8.1.32.2.75 Name

Location:
/components/[]/modelCard/modelParameters/datasets/[]/governance/stewards/[]/organization/contact/[]/name

Property: name (Optional)

Type: String

Description: The name of a contact

Examples:
- Contact name

8.1.32.2.76 Email Address

Location:
/components/[]/modelCard/modelParameters/datasets/[]/governance/stewards/[]/organization/contact/[]/email
Property: email (Optional)
Type: String
Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)
Description: The email address of the contact.
Examples:
  - firstname.lastname@example.com

8.1.32.2.77 Phone
Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/stewards/[]/organization/contact/[]/phone
Property: phone (Optional)
Type: String
Description: The phone number of the contact.
Examples:
  - 800-555-1212

8.1.32.2.78 Organizational Contact
Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/stewards/[]/contact
Property: contact (Optional)
Type: Object
Description: The individual that is responsible for specific data governance role(s).

Table 111 – Properties for the contact object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

8.1.32.2.79 BOM Reference
Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/stewards/[]/contact/bom-ref
Property: bom-ref (Optional)
Type: String
Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

8.1.32.2.80 Name
Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/stewards/[]/contact/name
Property: name (Optional)
Type: String
Description: The name of a contact
Examples:
  • Contact name

8.1.32.2.81   Email Address

Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/stewards/[]/contact/email
Property: email (Optional)
Type: String
Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)
Description: The email address of the contact.
Examples:
  • firstname.lastname@example.com

8.1.32.2.82   Phone

Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/stewards/[]/contact/phone
Property: phone (Optional)
Type: String
Description: The phone number of the contact.
Examples:
  • 800-555-1212

8.1.32.2.83   Data Owners

Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/owners
Property: owners (Optional)
Type: Array
Description: Data owners are concerned with risk and appropriate access to data.
Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/owners/[]

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>organization</td>
<td>Object</td>
<td>Optional</td>
<td>The organization that is responsible for specific data governance role(s).</td>
</tr>
<tr>
<td>contact</td>
<td>Object</td>
<td>Optional</td>
<td>The individual that is responsible for specific data governance role(s).</td>
</tr>
</tbody>
</table>

8.1.32.2.84   Organization

Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/owners/[]/organization
Property: organization (Optional)
Type: Object
Description: The organization that is responsible for specific data governance role(s).
<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the organization</td>
</tr>
<tr>
<td>address</td>
<td>Object</td>
<td>Optional</td>
<td>The physical address (location) of the organization</td>
</tr>
<tr>
<td>url</td>
<td>Array</td>
<td>Optional</td>
<td>The URL of the organization. Multiple URLs are allowed.</td>
</tr>
<tr>
<td>contact</td>
<td>Array</td>
<td>Optional</td>
<td>A contact at the organization. Multiple contacts are allowed.</td>
</tr>
</tbody>
</table>

**8.1.32.2.85 ** **BOM Reference**

**Location:** /components/[]/modelCard/modelParameters/datasets/[]/governance/owners/[]/organization/bom-ref  
**Property:** bom-ref (Optional)  
**Type:** String  
**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

**8.1.32.2.86 ** **Organization Name**

**Location:** /components/[]/modelCard/modelParameters/datasets/[]/governance/owners/[]/organization/name  
**Property:** name (Optional)  
**Type:** String  
**Description:** The name of the organization  
**Examples:**  
- Example Inc.

**8.1.32.2.87 ** **Organization Address**

**Location:** /components/[]/modelCard/modelParameters/datasets/[]/governance/owners/[]/organization/address  
**Property:** address (Optional)  
**Type:** Object  
**Description:** The physical address (location) of the organization
### Table 114 – Properties for the address object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>Optional</td>
<td>The country name or the two-letter ISO 3166-1 country code.</td>
</tr>
<tr>
<td>region</td>
<td>String</td>
<td>Optional</td>
<td>The region or state in the country.</td>
</tr>
<tr>
<td>locality</td>
<td>String</td>
<td>Optional</td>
<td>The locality or city within the country.</td>
</tr>
<tr>
<td>postOfficeBoxNumber</td>
<td>String</td>
<td>Optional</td>
<td>The post office box number.</td>
</tr>
<tr>
<td>postalCode</td>
<td>String</td>
<td>Optional</td>
<td>The postal code.</td>
</tr>
<tr>
<td>streetAddress</td>
<td>String</td>
<td>Optional</td>
<td>The street address.</td>
</tr>
</tbody>
</table>

#### 8.1.32.2.88 BOM Reference

**Location:**
/components/[]/modelCard/modelParameters/datasets/[]/governance/owners/[]/organization/address/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

#### 8.1.32.2.89 Country

**Location:**
/components/[]/modelCard/modelParameters/datasets/[]/governance/owners/[]/organization/address/country

**Property:** country (Optional)

**Type:** String

**Description:** The country name or the two-letter ISO 3166-1 country code.

#### 8.1.32.2.90 Region

**Location:**
/components/[]/modelCard/modelParameters/datasets/[]/governance/owners/[]/organization/address/region

**Property:** region (Optional)

**Type:** String

**Description:** The region or state in the country.

**Examples:**
- Texas

#### 8.1.32.2.91 Locality

**Location:**
/components/[]/modelCard/modelParameters/datasets/[]/governance/owners/[]/organization/address/locality
Property: locality (Optional)
Type: String
Description: The locality or city within the country.
Examples:
- Austin

8.1.32.2.92 Post Office Box Number
Location:
/components/[]/modelCard/modelParameters/datasets/[]/governance/owners/[]/organization/address/postOfficeBoxNumber
Property: postOfficeBoxNumber (Optional)
Type: String
Description: The post office box number.
Examples:
- 901

8.1.32.2.93 Postal Code
Location:
/components/[]/modelCard/modelParameters/datasets/[]/governance/owners/[]/organization/address/postalCode
Property: postalCode (Optional)
Type: String
Description: The postal code.
Examples:
- 78758

8.1.32.2.94 Street Address
Location:
/components/[]/modelCard/modelParameters/datasets/[]/governance/owners/[]/organization/address/streetAddress
Property: streetAddress (Optional)
Type: String
Description: The street address.
Examples:
- 100 Main Street

8.1.32.2.95 Organization URL(s)
Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/owners/[]/organization/url
Property: url (Optional)
Type: array (of String)
Description: The URL of the organization. Multiple URLs are allowed. Each item of this array must be a string.
Examples:
- https://example.com
8.1.32.2.96 Organizational Contact

Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/owners/[]/organization/contact

Property: contact (Optional)

Type: Array

Description: A contact at the organization. Multiple contacts are allowed. Each item of this array must be an Organizational Contact object.

8.1.32.2.97 Organizational Contact

Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/owners/[]/organization/contact/[]

Type: Object

Table 115 – Properties for the contact object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

8.1.32.2.98 BOM Reference

Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/owners/[]/organization/contact/[]/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

8.1.32.2.99 Name

Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/owners/[]/organization/contact/[]/name

Property: name (Optional)

Type: String

Description: The name of a contact

Examples:

- Contact name

8.1.32.2.100 Email Address

Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/owners/[]/organization/contact/[]/email

Property: email (Optional)
Type: String
Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)
Description: The email address of the contact.
Examples:
- firstname.lastname@example.com

8.1.32.2.101 Phone
Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/owners/[]/organization/contact/[]/phone
Property: phone (Optional)
Type: String
Description: The phone number of the contact.
Examples:
- 800-555-1212

8.1.32.2.102 Organizational Contact
Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/owners/[]/contact
Property: contact (Optional)
Type: Object
Description: The individual that is responsible for specific data governance role(s).

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

8.1.32.2.103 BOM Reference
Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/owners/[]/contact/bom-ref
Property: bom-ref (Optional)
Type: String
Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

8.1.32.2.104 Name
Location: /components/[]/modelCard/modelParameters/datasets/[]/governance/owners/[]/contact/name
Property: name (Optional)
Type: String
Description: The name of a contact
Examples:
  •  Contact name

8.1.32.2.105  Email Address

Location: /components/[][]/modelCard/modelParameters/datasets/[][]/governance/owners/[][]/contact/email
Property: email (Optional)
Type: String
Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)
Description: The email address of the contact.
Examples:
  •  firstname.lastname@example.com

8.1.32.2.106  Phone

Location: /components/[][]/modelCard/modelParameters/datasets/[][]/governance/owners/[][]/contact/phone
Property: phone (Optional)
Type: String
Description: The phone number of the contact.
Examples:
  •  800-555-1212

8.1.32.2.107  Reference

Location: /components/[][]/modelCard/modelParameters/datasets/[][]/ref
Property: datasets (Optional)
Type: String
Description: References a data component by the components bom-ref attribute
Must be any of:
  1.  Ref
  2.  BOM-Link Element

8.1.32.2.108  Ref

Type: String
Description: Descriptor for an element identified by the attribute "bom-ref" in the same BOM document. In contrast to bomLinkElementType.

8.1.32.2.109  BOM-Link Element

Type: String
Pattern Constraint: ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$
Description: Descriptor for an element in a BOM document. See https://cyclonedx.org/capabilities/bomlink/

8.1.32.2.110  Inputs

Location: /components/[][]/modelCard/modelParameters/inputs
Property: inputs (Optional)
Type: Array
Description: The input format(s) of the model. Each item of this array must be an Input and Output Parameters object.

8.1.32.2.111 Input and Output Parameters

Location: /components/[]/modelCard/modelParameters/inputs/[]

Type: Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>format</td>
<td>String</td>
<td>Optional</td>
<td>The data format for input/output to the model.</td>
</tr>
</tbody>
</table>

8.1.32.2.112 Input/Output Format

Location: /components/[]/modelCard/modelParameters/inputs/[]/format

Property: format (Optional)

Type: String

Description: The data format for input/output to the model.

Examples:
- string
- image
- time-series

8.1.32.2.113 Outputs

Location: /components/[]/modelCard/modelParameters/outputs

Property: outputs (Optional)

Type: Array

Description: The output format(s) from the model. Each item of this array must be an Input and Output Parameters object.

8.1.32.2.114 Input and Output Parameters

Location: /components/[]/modelCard/modelParameters/outputs/[]

Type: Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>format</td>
<td>String</td>
<td>Optional</td>
<td>The data format for input/output to the model.</td>
</tr>
</tbody>
</table>

8.1.32.2.115 Input/Output Format

Location: /components/[]/modelCard/modelParameters/outputs/[]/format

Property: format (Optional)

Type: String

Description: The data format for input/output to the model.
Examples:
- string
- image
- time-series

8.1.32.3 Quantitative Analysis

Location: /components/[/modelCard/quantitativeAnalysis

Property: quantitativeAnalysis (Optional)

Type: Object

Description: A quantitative analysis of the model

Table 119 – Properties for the quantitativeAnalysis object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>performanceMetrics</td>
<td>Array</td>
<td>Optional</td>
<td>The model performance metrics being reported. Examples may include accuracy, F1 score, precision, top-3 error rates, MSC, etc.</td>
</tr>
<tr>
<td>graphics</td>
<td>Object</td>
<td>Optional</td>
<td>A collection of graphics that represent various measurements.</td>
</tr>
</tbody>
</table>

8.1.32.3.1 Performance Metrics

Location: /components/[/modelCard/quantitativeAnalysis/performanceMetrics

Property: performanceMetrics (Optional)

Type: Array

Description: The model performance metrics being reported. Examples may include accuracy, F1 score, precision, top-3 error rates, MSC, etc. Each item of this array must be a Performance Metric object.

8.1.32.3.2 Performance Metric

Location: /components/[/modelCard/quantitativeAnalysis/performanceMetrics[/]

Type: Object

Table 120 – Properties for the performanceMetrics object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>type</td>
<td>String</td>
<td>Optional</td>
<td>The type of performance metric.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the performance metric.</td>
</tr>
<tr>
<td>slice</td>
<td>String</td>
<td>Optional</td>
<td>The name of the slice this metric was computed on. By default, assume this metric is not sliced.</td>
</tr>
<tr>
<td>confidenceInterval</td>
<td>Object</td>
<td>Optional</td>
<td>The confidence interval of the metric.</td>
</tr>
</tbody>
</table>

8.1.32.3.3 Type

Location: /components/[/modelCard/quantitativeAnalysis/performanceMetrics[/]/type

Property: type (Optional)

Type: String
Description: The type of performance metric.

8.1.32.3.4 Value

Location: /components[/]/modelCard/quantitativeAnalysis/performanceMetrics[/]/value

Property: value (Optional)

Type: String

Description: The value of the performance metric.

8.1.32.3.5 Slice

Location: /components[/]/modelCard/quantitativeAnalysis/performanceMetrics[/]/slice

Property: slice (Optional)

Type: String

Description: The name of the slice this metric was computed on. By default, assume this metric is not sliced.

8.1.32.3.6 Confidence Interval

Location: /components[/]/modelCard/quantitativeAnalysis/performanceMetrics[/]/confidenceInterval

Property: confidenceInterval (Optional)

Type: Object

Description: The confidence interval of the metric.

Table 121 – Properties for the confidenceInterval object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>lowerBound</td>
<td>String</td>
<td>Optional</td>
<td>The lower bound of the confidence interval.</td>
</tr>
<tr>
<td>upperBound</td>
<td>String</td>
<td>Optional</td>
<td>The upper bound of the confidence interval.</td>
</tr>
</tbody>
</table>

8.1.32.3.7 Lower Bound

Location: /components[/]/modelCard/quantitativeAnalysis/performanceMetrics[/]/confidenceInterval/lowerBound

Property: lowerBound (Optional)

Type: String

Description: The lower bound of the confidence interval.

8.1.32.3.8 Upper Bound

Location: /components[/]/modelCard/quantitativeAnalysis/performanceMetrics[/]/confidenceInterval/upperBound

Property: upperBound (Optional)

Type: String

Description: The upper bound of the confidence interval.

8.1.32.3.9 Graphics Collection

Location: /components[/]/modelCard/quantitativeAnalysis/graphics

Property: graphics (Optional)

Type: Object

Description: A collection of graphics that represent various measurements.
<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>A description of this collection of graphics.</td>
</tr>
<tr>
<td>collection</td>
<td>Array</td>
<td>Optional</td>
<td>A collection of graphics.</td>
</tr>
</tbody>
</table>

8.1.32.3.10 Description

**Location:** /components/[]/modelCard/quantitativeAnalysis/graphics/description

**Property:** description (Optional)

**Type:** String

**Description:** A description of this collection of graphics.

8.1.32.3.11 Collection

**Location:** /components/[]/modelCard/quantitativeAnalysis/graphics/collection

**Property:** collection (Optional)

**Type:** Array

**Description:** A collection of graphics. Each item of this array must be a Graphic object.

8.1.32.3.12 Graphic

**Location:** /components/[]/modelCard/quantitativeAnalysis/graphics/collection/[]

**Type:** Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the graphic.</td>
</tr>
<tr>
<td>image</td>
<td>Object</td>
<td>Optional</td>
<td>The graphic (vector or raster). Base64 encoding must be specified for binary images.</td>
</tr>
</tbody>
</table>

8.1.32.3.13 Name

**Location:** /components/[]/modelCard/quantitativeAnalysis/graphics/collection/[]/name

**Property:** name (Optional)

**Type:** String

**Description:** The name of the graphic.

8.1.32.3.14 Graphic Image

**Location:** /components/[]/modelCard/quantitativeAnalysis/graphics/collection/[]/image

**Property:** image (Optional)

**Type:** Object

**Description:** The graphic (vector or raster). Base64 encoding must be specified for binary images.
Table 124 – Properties for the image object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>contentType</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. <a href="https://tools.ietf.org/html/rfc2045#section-5.1">RFC 2045 section 5.1</a> outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the <a href="https">IANA media types registry</a>.</td>
</tr>
<tr>
<td>encoding</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the optional encoding the text is represented in.</td>
</tr>
<tr>
<td>content</td>
<td>String</td>
<td>Required</td>
<td>The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.</td>
</tr>
</tbody>
</table>

8.1.32.3.15 Content-Type

**Location:** /components/[]/modelCard/quantitativeAnalysis/graphics/collection/[]/image/contentType

**Property:** contentType (Optional)

**Type:** String

**Default Value:** text/plain

**Description:** Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. [RFC 2045 section 5.1](https://tools.ietf.org/html/rfc2045#section-5.1) outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the [IANA media types registry](https).

**Examples:**
- text/plain
- application/json
- image/png

8.1.32.3.16 Encoding

**Location:** /components/[]/modelCard/quantitativeAnalysis/graphics/collection/[]/image/encoding

**Property:** encoding (Optional)

**Type:** String

**Description:** Specifies the optional encoding the text is represented in.

**Table 125 – Enumeration of possible values**

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>base64</td>
<td>Base64 is a binary-to-text encoding scheme that represents binary data in an ASCII string.</td>
</tr>
</tbody>
</table>

8.1.32.3.17 Attachment Text

**Location:** /components/[]/modelCard/quantitativeAnalysis/graphics/collection/[]/image/content

**Property:** content (Required)

**Type:** String
**Description:** The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.

### 8.1.32.4 Considerations

**Location:** /components/[]/modelCard/considerations  
**Property:** considerations (Optional)

**Type:** Object  
**Description:** What considerations should be taken into account regarding the model's construction, training, and application?

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>users</td>
<td>Array</td>
<td>Optional</td>
<td>Who are the intended users of the model?</td>
</tr>
<tr>
<td>useCases</td>
<td>Array</td>
<td>Optional</td>
<td>What are the intended use cases of the model?</td>
</tr>
<tr>
<td>technicalLimitations</td>
<td>Array</td>
<td>Optional</td>
<td>What are the known technical limitations of the model? E.g. What kind(s) of data should the model be expected not to perform well on? What are the factors that might degrade model performance?</td>
</tr>
<tr>
<td>performanceTradeoffs</td>
<td>Array</td>
<td>Optional</td>
<td>What are the known tradeoffs in accuracy/performance of the model?</td>
</tr>
<tr>
<td>ethicalConsiderations</td>
<td>Array</td>
<td>Optional</td>
<td>What are the ethical risks involved in the application of this model?</td>
</tr>
<tr>
<td>environmentalConsiderations</td>
<td>Object</td>
<td>Optional</td>
<td>What are the various environmental impacts the corresponding machine learning model has exhibited across its lifecycle?</td>
</tr>
<tr>
<td>fairnessAssessments</td>
<td>Array</td>
<td>Optional</td>
<td>How does the model affect groups at risk of being systematically disadvantaged? What are the harms and benefits to the various affected groups?</td>
</tr>
</tbody>
</table>

#### 8.1.32.4.1 Users

**Location:** /components/[]/modelCard/considerations/users  
**Property:** users (Optional)

**Type:** array (of String)  
**Description:** Who are the intended users of the model? Each item of this array must be a string.

#### 8.1.32.4.2 Use Cases

**Location:** /components/[]/modelCard/considerations/useCases  
**Property:** useCases (Optional)

**Type:** array (of String)  
**Description:** What are the intended use cases of the model? Each item of this array must be a string.

#### 8.1.32.4.3 Technical Limitations

**Location:** /components/[]/modelCard/considerations/technicalLimitations
**Property:** technicalLimitations (Optional)

**Type:** array (of String)

**Description:** What are the known technical limitations of the model? E.g. What kind(s) of data should the model be expected not to perform well on? What are the factors that might degrade model performance? Each item of this array must be a string.

8.1.32.4.4 Performance Tradeoffs

**Location:** /components/[]/modelCard/considerations/performanceTradeoffs

**Property:** performanceTradeoffs (Optional)

**Type:** array (of String)

**Description:** What are the known tradeoffs in accuracy/performance of the model? Each item of this array must be a string.

8.1.32.4.5 Ethical Considerations

**Location:** /components/[]/modelCard/considerations/ethicalConsiderations

**Property:** ethicalConsiderations (Optional)

**Type:** Array

**Description:** What are the ethical risks involved in the application of this model? Each item of this array must be a Risk object.

8.1.32.4.6 Risk

**Location:** /components/[]/modelCard/considerations/ethicalConsiderations/[]

**Type:** Object

Table 127 – Properties for the ethicalConsiderations object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the risk.</td>
</tr>
<tr>
<td>mitigationStrategy</td>
<td>String</td>
<td>Optional</td>
<td>Strategy used to address this risk.</td>
</tr>
</tbody>
</table>

8.1.32.4.7 Name

**Location:** /components/[]/modelCard/considerations/ethicalConsiderations/[]/name

**Property:** name (Optional)

**Type:** String

**Description:** The name of the risk.

8.1.32.4.8 Mitigation Strategy

**Location:** /components/[]/modelCard/considerations/ethicalConsiderations/[]/mitigationStrategy

**Property:** mitigationStrategy (Optional)

**Type:** String

**Description:** Strategy used to address this risk.

8.1.32.4.9 Environmental Considerations

**Location:** /components/[]/modelCard/considerations/environmentalConsiderations

**Property:** environmentalConsiderations (Optional)
Type: Object

Description: What are the various environmental impacts the corresponding machine learning model has exhibited across its lifecycle?

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>energyConsumptions</td>
<td>Array</td>
<td>Optional</td>
<td>Describes energy consumption information incurred for one or more component lifecycle activities.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.</td>
</tr>
</tbody>
</table>

8.1.32.4.10 Energy Consumption

Location: /components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions

Property: energyConsumptions (Optional)

Type: Array

Description: Describes energy consumption information incurred for one or more component lifecycle activities. Each item of this array must be an Energy consumption object.

8.1.32.4.11 Energy consumption

Location: /components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]

Type: Object

Description: Describes energy consumption information incurred for the specified lifecycle activity.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>activity</td>
<td>String</td>
<td>Required</td>
<td>The type of activity that is part of a machine learning model development or operational lifecycle.</td>
</tr>
<tr>
<td>energyProviders</td>
<td>Array</td>
<td>Required</td>
<td>The provider(s) of the energy consumed by the associated model development lifecycle activity.</td>
</tr>
<tr>
<td>activityEnergyCost</td>
<td>Object</td>
<td>Required</td>
<td>The total energy cost associated with the model lifecycle activity.</td>
</tr>
<tr>
<td>co2CostEquivalent</td>
<td>Object</td>
<td>Optional</td>
<td>The CO2 cost (debit) equivalent to the total energy cost.</td>
</tr>
<tr>
<td>co2CostOffset</td>
<td>Object</td>
<td>Optional</td>
<td>The CO2 offset (credit) for the CO2 equivalent cost.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the...</td>
</tr>
</tbody>
</table>
general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

8.1.32.4.12 Activity

Location: /components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/activity
Property: activity (Required)
Type: String
Description: The type of activity that is part of a machine learning model development or operational lifecycle.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>design</td>
<td>A model design including problem framing, goal definition and algorithm selection.</td>
</tr>
<tr>
<td>data-collection</td>
<td>Model data acquisition including search, selection and transfer.</td>
</tr>
<tr>
<td>data-preparation</td>
<td>Model data preparation including data cleaning, labelling and conversion.</td>
</tr>
<tr>
<td>training</td>
<td>Model building, training and generalized tuning.</td>
</tr>
<tr>
<td>fine-tuning</td>
<td>Refining a trained model to produce desired outputs for a given problem space.</td>
</tr>
<tr>
<td>validation</td>
<td>Model validation including model output evaluation and testing.</td>
</tr>
<tr>
<td>deployment</td>
<td>Explicit model deployment to a target hosting infrastructure.</td>
</tr>
<tr>
<td>inference</td>
<td>Generating an output response from a hosted model from a set of inputs.</td>
</tr>
<tr>
<td>other</td>
<td>A lifecycle activity type whose description does not match currently defined values.</td>
</tr>
</tbody>
</table>

8.1.32.4.13 Energy Providers

Location: /components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/energyProviders
Property: energyProviders (Required)
Type: Array
Description: The provider(s) of the energy consumed by the associated model development lifecycle activity. Each item of this array must be an Energy Provider object.

8.1.32.4.14 Energy Provider

Location: /components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/energyProviders/
Type: Object
Description: Describes the physical provider of energy used for model development or operations.

Table 131 – Properties for the energyProviders object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the energy provider elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>A description of the energy provider.</td>
</tr>
<tr>
<td>organization</td>
<td>Object</td>
<td>Required</td>
<td>The organization that provides energy.</td>
</tr>
<tr>
<td>energySource</td>
<td>String</td>
<td>Required</td>
<td>The energy source for the energy provider.</td>
</tr>
<tr>
<td>energyProvided</td>
<td>Object</td>
<td>Required</td>
<td>The energy provided by the energy source for an associated activity.</td>
</tr>
<tr>
<td>externalReferences</td>
<td>Array</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

8.1.32.4.15 BOM Reference

Location: /components[/]/modelCard/considerations/environmentalConsiderations/energyConsumptions[/]/energyProviders[/]/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the energy provider elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

8.1.32.4.16 Description

Location: /components[/]/modelCard/considerations/environmentalConsiderations/energyConsumptions[/]/energyProviders[/]/description

Property: description (Optional)

Type: String

Description: A description of the energy provider.

8.1.32.4.17 Organization

Location: /components[/]/modelCard/considerations/environmentalConsiderations/energyConsumptions[/]/energyProviders[/]/organization

Property: organization (Required)

Type: Object

Description: The organization that provides energy.
**Table 132 – Properties for the organization object**

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the organization</td>
</tr>
<tr>
<td>address</td>
<td>Object</td>
<td>Optional</td>
<td>The physical address (location) of the organization</td>
</tr>
<tr>
<td>url</td>
<td>Array</td>
<td>Optional</td>
<td>The URL of the organization. Multiple URLs are allowed.</td>
</tr>
<tr>
<td>contact</td>
<td>Array</td>
<td>Optional</td>
<td>A contact at the organization. Multiple contacts are allowed.</td>
</tr>
</tbody>
</table>

**8.1.32.4.18 BOM Reference**

**Location:**
/components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/energyProviders/[]/organization/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

**8.1.32.4.19 Organization Name**

**Location:**
/components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/energyProviders/[]/organization/name

**Property:** name (Optional)

**Type:** String

**Description:** The name of the organization

**Examples:**
- Example Inc.

**8.1.32.4.20 Organization Address**

**Location:**
/components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/energyProviders/[]/organization/address

**Property:** address (Optional)

**Type:** Object

**Description:** The physical address (location) of the organization
## Table 133 – Properties for the address object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>Optional</td>
<td>The country name or the two-letter ISO 3166-1 country code.</td>
</tr>
<tr>
<td>region</td>
<td>String</td>
<td>Optional</td>
<td>The region or state in the country.</td>
</tr>
<tr>
<td>locality</td>
<td>String</td>
<td>Optional</td>
<td>The locality or city within the country.</td>
</tr>
<tr>
<td>postOfficeBoxNumber</td>
<td>String</td>
<td>Optional</td>
<td>The post office box number.</td>
</tr>
<tr>
<td>postalCode</td>
<td>String</td>
<td>Optional</td>
<td>The postal code.</td>
</tr>
<tr>
<td>streetAddress</td>
<td>String</td>
<td>Optional</td>
<td>The street address.</td>
</tr>
</tbody>
</table>

### 8.1.32.4.21 BOM Reference

**Location:**
```
/components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/energyProviders/[]/organization/address/bom-ref
```

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

### 8.1.32.4.22 Country

**Location:**
```
/components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/energyProviders/[]/organization/address/country
```

**Property:** country (Optional)

**Type:** String

**Description:** The country name or the two-letter ISO 3166-1 country code.

### 8.1.32.4.23 Region

**Location:**
```
/components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/energyProviders/[]/organization/address/region
```

**Property:** region (Optional)

**Type:** String

**Description:** The region or state in the country.

**Examples:**
- Texas
8.1.32.4.24 Locality

**Location:**
/components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/energyProviders/[]/organization/address/locality

**Property:** locality (Optional)

**Type:** String

**Description:** The locality or city within the country.

**Examples:**
- Austin

8.1.32.4.25 Post Office Box Number

**Location:**
/components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/energyProviders/[]/organization/address/postOfficeBoxNumber

**Property:** postOfficeBoxNumber (Optional)

**Type:** String

**Description:** The post office box number.

**Examples:**
- 901

8.1.32.4.26 Postal Code

**Location:**
/components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/energyProviders/[]/organization/address/postalCode

**Property:** postalCode (Optional)

**Type:** String

**Description:** The postal code.

**Examples:**
- 78758

8.1.32.4.27 Street Address

**Location:**
/components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/energyProviders/[]/organization/address/streetAddress

**Property:** streetAddress (Optional)

**Type:** String

**Description:** The street address.

**Examples:**
- 100 Main Street

8.1.32.4.28 Organization URL(s)

**Location:**
/components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/energyProviders/[]/organization/url

**Property:** url (Optional)

**Type:** array (of String)

Description: The URL of the organization. Multiple URLs are allowed. Each item of this array must be a string.

Examples:
- https://example.com

8.1.32.4.29 Organizational Contact

Location: /components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/energyProviders/[]/organization/contact

Property: contact (Optional)

Type: Array

Description: A contact at the organization. Multiple contacts are allowed. Each item of this array must be an Organizational Contact object.

8.1.32.4.30 Organizational Contact

Location: /components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/energyProviders/[]/organization/contact/[]

Type: Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

8.1.32.4.31 BOM Reference

Location: /components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/energyProviders/[]/organization/contact/[]/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

8.1.32.4.32 Name

Location: /components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/energyProviders/[]/organization/contact/[]/name

Property: name (Optional)

Type: String
**Description:** The name of a contact

**Examples:**
- Contact name

### 8.1.32.4.33 Email Address

**Location:**
/components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/energyProviders/[]/organization/contact/[]/email

**Property:** email (Optional)

**Type:** String

**Format:** idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

**Description:** The email address of the contact.

**Examples:**
- firstname.lastname@example.com

### 8.1.32.4.34 Phone

**Location:**
/components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/energyProviders/[]/organization/contact/[]/phone

**Property:** phone (Optional)

**Type:** String

**Description:** The phone number of the contact.

**Examples:**
- 800-555-1212

### 8.1.32.4.35 Energy Source

**Location:**
/components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/energyProviders/[]/energySource

**Property:** energySource (Required)

**Type:** String

**Description:** The energy source for the energy provider.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>coal</td>
<td>Energy produced by types of coal.</td>
</tr>
<tr>
<td>oil</td>
<td>Petroleum products (primarily crude oil and its derivative fuel oils).</td>
</tr>
<tr>
<td>natural-gas</td>
<td>Hydrocarbon gas liquids (HGL) that occur as gasses at atmospheric pressure and as liquids under higher pressures including Natural gas (CH4 and heavier), Ethane (C2H6), Propane (C3H8), etc.</td>
</tr>
<tr>
<td>nuclear</td>
<td>Energy produced from the cores of atoms (i.e., through nuclear fission or fusion).</td>
</tr>
<tr>
<td>wind</td>
<td>Energy produced from moving air.</td>
</tr>
<tr>
<td>solar</td>
<td>Energy produced from the sun (i.e., solar radiation).</td>
</tr>
</tbody>
</table>
### Value | Description
---|---
geothermal | Energy produced from heat within the earth.
hydropower | Energy produced from flowing water.
biomass | Liquid fuels produced from biomass feedstocks (i.e., organic materials such as plants or animals).
unknown | The energy source is unknown.
other | An energy source that is not listed.

#### 8.1.32.4.36 Energy Provided

**Location:**
/components[/modelCard/considerations/environmentalConsiderations/energyConsumptions[/energyProvided

**Property:** energyProvided (Required)

**Type:** Object

**Description:** The energy provided by the energy source for an associated activity.

#### Table 136 – Properties for the energyProvided object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>Number</td>
<td>Required</td>
<td>Quantity of energy</td>
</tr>
<tr>
<td>unit</td>
<td>String</td>
<td>Required</td>
<td>Unit of energy</td>
</tr>
</tbody>
</table>

#### 8.1.32.4.37 Value

**Location:**
/components[/modelCard/considerations/environmentalConsiderations/energyConsumptions[/energyProvided/value

**Property:** value (Required)

**Type:** Number

**Description:** Quantity of energy.

#### 8.1.32.4.38 Unit

**Location:**
/components[/modelCard/considerations/environmentalConsiderations/energyConsumptions[/energyProvided/unit

**Property:** unit (Required)

**Type:** String

**Description:** Unit of energy.
Table 137 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>kWh</td>
<td>Kilowatt-hour (kWh) is the energy delivered by one kilowatt (kW) of power for one hour (h).</td>
</tr>
</tbody>
</table>

8.1.32.4.39  **External References**

**Location:**
/\components/[/modelCard/considerations/environmentalConsiderations/energyConsumptions[/energyProvid\ers[/externalReferences

**Property:** externalReferences (Optional)

**Type:** Array

**Description:** External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM. Each item of this array must be an External Reference object.

**Reference:** Refer to the external reference definition at /externalReferences[/]

8.1.32.4.40  **External Reference**

**Location:**
/\components/[/modelCard/considerations/environmentalConsiderations/energyConsumptions[/energyProvid\ers[/externalReferences[/

**Type:** Object

**Description:** External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

8.1.32.4.41  **Activity Energy Cost**

**Location:**
/\components/[/modelCard/considerations/environmentalConsiderations/energyConsumptions[/activityEnergy\Cost

**Property:** activityEnergyCost (Required)

**Type:** Object

**Description:** The total energy cost associated with the model lifecycle activity.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>Number</td>
<td>Required</td>
<td>Quantity of energy.</td>
</tr>
<tr>
<td>unit</td>
<td>String</td>
<td>Required</td>
<td>Unit of energy.</td>
</tr>
</tbody>
</table>

8.1.32.4.42  **Value**

**Location:**
/\components/[/modelCard/considerations/environmentalConsiderations/energyConsumptions[/activityEnergy\Cost/value

**Property:** value (Required)

**Type:** Number
Description: Quantity of energy.

8.1.32.4.43 Unit

Location: /components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/activityEnergy Cost/unit

Property: unit (Required)

Type: String

Description: Unit of energy.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>kWh</td>
<td>Kilowatt-hour (kWh) is the energy delivered by one kilowatt (kW) of power for one hour (h).</td>
</tr>
</tbody>
</table>

8.1.32.4.44 CO2 Equivalent Cost

Location: /components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/co2CostEquivalent

Property: co2CostEquivalent (Optional)

Type: Object

Description: The CO2 cost (debit) equivalent to the total energy cost.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>Number</td>
<td>Required</td>
<td>Quantity of carbon dioxide (CO2).</td>
</tr>
<tr>
<td>unit</td>
<td>String</td>
<td>Required</td>
<td>Unit of carbon dioxide (CO2).</td>
</tr>
</tbody>
</table>

8.1.32.4.45 Value

Location: /components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/co2CostEquivalent/value

Property: value (Required)

Type: Number

Description: Quantity of carbon dioxide (CO2).

8.1.32.4.46 Unit

Location: /components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/co2CostEquivalent/unit

Property: unit (Required)

Type: String

Description: Unit of carbon dioxide (CO2).
Table 141 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>tCO2eq</td>
<td>Tons (t) of carbon dioxide (CO2) equivalent (eq).</td>
</tr>
</tbody>
</table>

8.1.32.4.47 CO2 Cost Offset

Location:
/components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[{}]/co2CostOffset

Property: co2CostOffset (Optional)

Type: Object

Description: The CO2 offset (credit) for the CO2 equivalent cost.

Table 142 – Properties for the co2CostOffset object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>value</td>
<td>Number</td>
<td>Required</td>
<td>Quantity of carbon dioxide (CO2).</td>
</tr>
<tr>
<td>unit</td>
<td>String</td>
<td>Required</td>
<td>Unit of carbon dioxide (CO2).</td>
</tr>
</tbody>
</table>

8.1.32.4.48 Value

Location:
/components/[{}]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[{}]/co2CostOffset/value

Property: value (Required)

Type: Number

Description: Quantity of carbon dioxide (CO2).

8.1.32.4.49 Unit

Location:
/components/[{}]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[{}]/co2CostOffset/unit

Property: unit (Required)

Type: String

Description: Unit of carbon dioxide (CO2).

Table 143 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>tCO2eq</td>
<td>Tons (t) of carbon dioxide (CO2) equivalent (eq).</td>
</tr>
</tbody>
</table>

8.1.32.4.50 Properties

Location:
/components/[{}]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[{}]/properties

Property: properties (Optional)
Type: Array

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

8.1.32.4.51 Lightweight name-value pair

Location: /components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/properties/[]

Type: Object

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

Table 144 – Properties for the properties object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

8.1.32.4.52 Name

Location: /components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/properties/[]/name

Property: name (Required)

Type: String

Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

8.1.32.4.53 Value

Location: /components/[]/modelCard/considerations/environmentalConsiderations/energyConsumptions/[]/properties/[]/value

Property: value (Optional)

Type: String

Description: The value of the property.

8.1.32.4.54 Properties

Location: /components/[]/modelCard/considerations/environmentalConsiderations/properties

Property: properties (Optional)

Type: Array

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different
values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

8.1.32.4.55 Lightweight name-value pair

Location: /components/[]}modelCard/considerations/environmentalConsiderations/properties/[]

Type: Object

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

Table 145 – Properties for the properties object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

8.1.32.4.56 Name

Location: /components/[]}modelCard/considerations/environmentalConsiderations/properties/[]/name

Property: name (Required)

Type: String

Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

8.1.32.4.57 Value

Location: /components/[]}modelCard/considerations/environmentalConsiderations/properties/[]/value

Property: value (Optional)

Type: String

Description: The value of the property.

8.1.32.4.58 Fairness Assessments

Location: /components/[]}modelCard/considerations/fairnessAssessments

Property: fairnessAssessments (Optional)

Type: Array

Description: How does the model affect groups at risk of being systematically disadvantaged? What are the harms and benefits to the various affected groups? Each item of this array must be a Fairness Assessment object.

8.1.32.4.59 Fairness Assessment

Location: /components/[]}modelCard/considerations/fairnessAssessments/[]

Type: Object

Description: Information about the benefits and harms of the model to an identified at risk group.
Table 146 – Properties for the fairnessAssessments object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>groupAtRisk</td>
<td>String</td>
<td>Optional</td>
<td>The groups or individuals at risk of being systematically disadvantaged by the model.</td>
</tr>
<tr>
<td>benefits</td>
<td>String</td>
<td>Optional</td>
<td>Expected benefits to the identified groups.</td>
</tr>
<tr>
<td>harms</td>
<td>String</td>
<td>Optional</td>
<td>Expected harms to the identified groups.</td>
</tr>
<tr>
<td>mitigationStrategy</td>
<td>String</td>
<td>Optional</td>
<td>With respect to the benefits and harms outlined, please describe any mitigation strategy implemented.</td>
</tr>
</tbody>
</table>

8.1.32.4.60 Group at Risk

**Location:** /components[/]modelCard/considerations/fairnessAssessments[/]groupAtRisk

**Property:** groupAtRisk (Optional)

**Type:** String

**Description:** The groups or individuals at risk of being systematically disadvantaged by the model.

8.1.32.4.61 Benefits

**Location:** /components[/]modelCard/considerations/fairnessAssessments[/]benefits

**Property:** benefits (Optional)

**Type:** String

**Description:** Expected benefits to the identified groups.

8.1.32.4.62 Harms

**Location:** /components[/]modelCard/considerations/fairnessAssessments[/]harms

**Property:** harms (Optional)

**Type:** String

**Description:** Expected harms to the identified groups.

8.1.32.4.63 Mitigation Strategy

**Location:** /components[/]modelCard/considerations/fairnessAssessments[/]mitigationStrategy

**Property:** mitigationStrategy (Optional)

**Type:** String

**Description:** With respect to the benefits and harms outlined, please describe any mitigation strategy implemented.

8.1.32.5 Properties

**Location:** /components[/]modelCard/properties

**Property:** properties (Optional)

**Type:** Array

**Description:** Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX.
**Property Taxonomy.** Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

### 8.1.32.5.1 Lightweight name-value pair

**Location:** /components/[]/modelCard/properties/[]

**Type:** Object

**Description:** Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

**Table 147 – Properties for the properties object**

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

### 8.1.32.5.2 Name

**Location:** /components/[]/modelCard/properties/[]/name

**Property:** name (Required)

**Type:** String

**Description:** The name of the property. Duplicate names are allowed, each potentially having a different value.

### 8.1.32.5.3 Value

**Location:** /components/[]/modelCard/properties/[]/value

**Property:** value (Optional)

**Type:** String

**Description:** The value of the property.

### 8.1.33 Data

**Location:** /components/[]/data

**Property:** data (Optional)

**Type:** Array

**Description:** This object SHOULD be specified for any component of type data and must not be specified for other component types.

**Location:** /components/[]/data/[]

**Type:** Object
Table 148 – Properties for the data object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the dataset elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>type</td>
<td>String</td>
<td>Required</td>
<td>The general theme or subject matter of the data being specified.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the dataset.</td>
</tr>
<tr>
<td>contents</td>
<td>Object</td>
<td>Optional</td>
<td>The contents or references to the contents of the data being described.</td>
</tr>
<tr>
<td>classification</td>
<td>String</td>
<td>Optional</td>
<td>Data classification tags data according to its type, sensitivity, and value if altered, stolen, or destroyed.</td>
</tr>
<tr>
<td>sensitiveData</td>
<td>Array</td>
<td>Optional</td>
<td>A description of any sensitive data in a dataset.</td>
</tr>
<tr>
<td>graphics</td>
<td>Object</td>
<td>Optional</td>
<td>A collection of graphics that represent various measurements.</td>
</tr>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>A description of the dataset. Can describe size of dataset, whether it's used for source code, training, testing, or validation, etc.</td>
</tr>
<tr>
<td>governance</td>
<td>Object</td>
<td>Optional</td>
<td>Data governance captures information regarding data ownership, stewardship, and custodianship, providing insights into the individuals or entities responsible for managing, overseeing, and safeguarding the data throughout its lifecycle.</td>
</tr>
</tbody>
</table>

8.1.33.1.1 BOM Reference

Location: /components/[]/data/[]/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the dataset elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

8.1.33.1.2 Type of Data

Location: /components/[]/data/[]/type

Property: type (Required)

Type: String

Description: The general theme or subject matter of the data being specified.
Table 149 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>source-code</td>
<td>Any type of code, code snippet, or data-as-code.</td>
</tr>
<tr>
<td>configuration</td>
<td>Parameters or settings that may be used by other components.</td>
</tr>
<tr>
<td>dataset</td>
<td>A collection of data.</td>
</tr>
<tr>
<td>definition</td>
<td>Data that can be used to create new instances of what the definition defines.</td>
</tr>
<tr>
<td>other</td>
<td>Any other type of data that does not fit into existing definitions.</td>
</tr>
</tbody>
</table>

8.1.33.1.3 Dataset Name

Location: /components/[]/data/[]/name

Property: name (Optional)

Type: String

Description: The name of the dataset.

8.1.33.1.4 Data Contents

Location: /components/[]/data/[]/contents

Property: contents (Optional)

Type: Object

Description: The contents or references to the contents of the data being described.

Table 150 – Properties for the contents object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>attachment</td>
<td>Object</td>
<td>Optional</td>
<td>An optional way to include textual or encoded data.</td>
</tr>
<tr>
<td>url</td>
<td>String</td>
<td>Optional</td>
<td>The URL to where the data can be retrieved.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document name-value parameters used for configuration.</td>
</tr>
</tbody>
</table>

8.1.33.1.5 Data Attachment

Location: /components/[]/data/[]/contents/attachment

Property: attachment (Optional)

Type: Object

Description: An optional way to include textual or encoded data.
Table 151 – Properties for the attachment object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>contentType</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. RFC 2045 section 5.1 outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the IANA media types registry.</td>
</tr>
<tr>
<td>encoding</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the optional encoding the text is represented in.</td>
</tr>
<tr>
<td>content</td>
<td>String</td>
<td>Required</td>
<td>The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.</td>
</tr>
</tbody>
</table>

8.1.33.1.6 Content-Type

**Location:** /components/[]/data/[]/contents/attachment/contentType

**Property:** contentType (Optional)

**Type:** String

**Default Value:** text/plain

**Description:** Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. RFC 2045 section 5.1 outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the IANA media types registry.

**Examples:**
- text/plain
- application/json
- image/png

8.1.33.1.7 Encoding

**Location:** /components/[]/data/[]/contents/attachment/encoding

**Property:** encoding (Optional)

**Type:** String

**Description:** Specifies the optional encoding the text is represented in.

**Table 152 – Enumeration of possible values**

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>base64</td>
<td>Base64 is a binary-to-text encoding scheme that represents binary data in an ASCII string.</td>
</tr>
</tbody>
</table>

8.1.33.1.8 Attachment Text

**Location:** /components/[]/data/[]/contents/attachment/content

**Property:** content (Required)

**Type:** String
Description: The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.

8.1.33.1.9 Data URL

Location: /components/[]/data/[]/contents/url

Property: url (Optional)

Type: String


Description: The URL to where the data can be retrieved.

8.1.33.1.10 Configuration Properties

Location: /components/[]/data/[]/contents/properties

Property: properties (Optional)

Type: Array

Description: Provides the ability to document name-value parameters used for configuration. Each item of this array must be a Lightweight name-value pair object.

8.1.33.1.11 Lightweight name-value pair

Location: /components/[]/data/[]/contents/properties/[]

Type: Object

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

Table 153 – Properties for the properties object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

8.1.33.1.12 Name

Location: /components/[]/data/[]/contents/properties/[]/name

Property: name (Required)

Type: String

Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

8.1.33.1.13 Value

Location: /components/[]/data/[]/contents/properties/[]/value

Property: value (Optional)

Type: String

Description: The value of the property.
8.1.33.1.14 Data Classification

Location: /components/[]/data/[]/classification

Property: classification (Optional)

Type: String

Description: Data classification tags data according to its type, sensitivity, and value if altered, stolen, or destroyed.

8.1.33.1.15 Sensitive Data

Location: /components/[]/data/[]/sensitiveData

Property: sensitiveData (Optional)

Type: array (of String)

Description: A description of any sensitive data in a dataset. Each item of this array must be a string.

8.1.33.1.16 Graphics Collection

Location: /components/[]/data/[]/graphics

Property: graphics (Optional)

Type: Object

Description: A collection of graphics that represent various measurements.

Table 154 – Properties for the graphics object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>A description of this collection of graphics.</td>
</tr>
<tr>
<td>collection</td>
<td>Array</td>
<td>Optional</td>
<td>A collection of graphics.</td>
</tr>
</tbody>
</table>

8.1.33.1.17 Description

Location: /components/[]/data/[]/graphics/description

Property: description (Optional)

Type: String

Description: A description of this collection of graphics.

8.1.33.1.18 Collection

Location: /components/[]/data/[]/graphics/collection

Property: collection (Optional)

Type: Array

Description: A collection of graphics. Each item of this array must be a Graphic object.

8.1.33.1.19 Graphic

Location: /components/[]/data/[]/graphics/collection/[]

Type: Object
Table 155 – Properties for the collection object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the graphic.</td>
</tr>
<tr>
<td>image</td>
<td>Object</td>
<td>Optional</td>
<td>The graphic (vector or raster). Base64 encoding must be specified for binary images.</td>
</tr>
</tbody>
</table>

8.1.33.1.20 Name

Location: /components/[]/data/[]/graphics/collection/[]/name

Property: name (Optional)

Type: String

Description: The name of the graphic.

8.1.33.1.21 Graphic Image

Location: /components/[]/data/[]/graphics/collection/[]/image

Property: image (Optional)

Type: Object

Description: The graphic (vector or raster). Base64 encoding must be specified for binary images.

Table 156 – Properties for the image object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>contentType</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. RFC 2045 section 5.1 outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the IANA media types registry.</td>
</tr>
<tr>
<td>encoding</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the optional encoding the text is represented in.</td>
</tr>
<tr>
<td>content</td>
<td>String</td>
<td>Required</td>
<td>The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.</td>
</tr>
</tbody>
</table>

8.1.33.1.22 Content-Type

Location: /components/[]/data/[]/graphics/collection/[]/image/contentType

Property: contentType (Optional)

Type: String

Default Value: text/plain

Description: Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. RFC 2045 section 5.1 outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the IANA media types registry.

Examples:
- text/plain
8.1.33.1.23 Encoding
Location: /components/[]/data/[]/graphics/collection/[]/image/encoding
Property: encoding (Optional)
Type: String
Description: Specifies the optional encoding the text is represented in.

Table 157 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>base64</td>
<td>Base64 is a binary-to-text encoding scheme that represents binary data in an ASCII string.</td>
</tr>
</tbody>
</table>

8.1.33.1.24 Attachment Text
Location: /components/[]/data/[]/graphics/collection/[]/image/content
Property: content (Required)
Type: String
Description: The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.

8.1.33.1.25 Dataset Description
Location: /components/[]/data/[]/description
Property: description (Optional)
Type: String
Description: A description of the dataset. Can describe size of dataset, whether it's used for source code, training, testing, or validation, etc.

8.1.33.1.26 Data Governance
Location: /components/[]/data/[]/governance
Property: governance (Optional)
Type: Object
Description: Data governance captures information regarding data ownership, stewardship, and custodianship, providing insights into the individuals or entities responsible for managing, overseeing, and safeguarding the data throughout its lifecycle.

Table 158 – Properties for the governance object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>custodians</td>
<td>Array</td>
<td>Optional</td>
<td>Data custodians are responsible for the safe custody, transport, and storage of data.</td>
</tr>
<tr>
<td>stewards</td>
<td>Array</td>
<td>Optional</td>
<td>Data stewards are responsible for data content, context, and associated business rules.</td>
</tr>
<tr>
<td>owners</td>
<td>Array</td>
<td>Optional</td>
<td>Data owners are concerned with risk and appropriate access to data.</td>
</tr>
</tbody>
</table>
8.1.33.1.27  Data Custodians

**Location:** /components/*/data/*/governance/custodians

**Property:** custodians (Optional)

**Type:** Array

**Description:** Data custodians are responsible for the safe custody, transport, and storage of data.

**Location:** /components/*/data/*/governance/custodians/*/ 

**Type:** Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>organization</td>
<td>Object</td>
<td>Optional</td>
<td>The organization that is responsible for specific data governance role(s).</td>
</tr>
<tr>
<td>contact</td>
<td>Object</td>
<td>Optional</td>
<td>The individual that is responsible for specific data governance role(s).</td>
</tr>
</tbody>
</table>

8.1.33.1.28  Organization

**Location:** /components/*/data/*/governance/custodians/*/organization

**Property:** organization (Optional)

**Type:** Object

**Description:** The organization that is responsible for specific data governance role(s).

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:;' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the organization</td>
</tr>
<tr>
<td>address</td>
<td>Object</td>
<td>Optional</td>
<td>The physical address (location) of the organization</td>
</tr>
<tr>
<td>url</td>
<td>Array</td>
<td>Optional</td>
<td>The URL of the organization. Multiple URLs are allowed.</td>
</tr>
<tr>
<td>contact</td>
<td>Array</td>
<td>Optional</td>
<td>A contact at the organization. Multiple contacts are allowed.</td>
</tr>
</tbody>
</table>

8.1.33.1.29  BOM Reference

**Location:** /components/*/data/*/governance/custodians/*/organization/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

8.1.33.1.30  Organization Name

**Location:** /components/*/data/*/governance/custodians/*/organization/name
Property: name (Optional)

Type: String

Description: The name of the organization

Examples:
- Example Inc.

8.1.33.1.31 Organization Address

Location: /components/[]/data/[]/governance/custodians/[]/organization/address

Property: address (Optional)

Type: Object

Description: The physical address (location) of the organization

Table 161 – Properties for the address object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>Optional</td>
<td>The country name or the two-letter ISO 3166-1 country code.</td>
</tr>
<tr>
<td>region</td>
<td>String</td>
<td>Optional</td>
<td>The region or state in the country.</td>
</tr>
<tr>
<td>locality</td>
<td>String</td>
<td>Optional</td>
<td>The locality or city within the country.</td>
</tr>
<tr>
<td>postOfficeBoxNumber</td>
<td>String</td>
<td>Optional</td>
<td>The post office box number.</td>
</tr>
<tr>
<td>postalCode</td>
<td>String</td>
<td>Optional</td>
<td>The postal code.</td>
</tr>
<tr>
<td>streetAddress</td>
<td>String</td>
<td>Optional</td>
<td>The street address.</td>
</tr>
</tbody>
</table>

8.1.33.1.32 BOM Reference

Location: /components/[]/data/[]/governance/custodians/[]/organization/address/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

8.1.33.1.33 Country

Location: /components/[]/data/[]/governance/custodians/[]/organization/address/country

Property: country (Optional)

Type: String

Description: The country name or the two-letter ISO 3166-1 country code.
8.1.33.1.34 Region
Location: /components/[[data]/[governance/custodians/][organization/address/region
Property: region (Optional)
Type: String
Description: The region or state in the country.
Examples:
• Texas

8.1.33.1.35 Locality
Location: /components/[[data]/[governance/custodians/][organization/address/locality
Property: locality (Optional)
Type: String
Description: The locality or city within the country.
Examples:
• Austin

8.1.33.1.36 Post Office Box Number
Location: /components/[[data]/[governance/custodians/][organization/address/postOfficeBoxNumber
Property: postOfficeBoxNumber (Optional)
Type: String
Description: The post office box number.
Examples:
• 901

8.1.33.1.37 Postal Code
Location: /components/[[data]/[governance/custodians/][organization/address/postalCode
Property: postalCode (Optional)
Type: String
Description: The postal code.
Examples:
• 78758

8.1.33.1.38 Street Address
Location: /components/[[data]/[governance/custodians/][organization/address/streetAddress
Property: streetAddress (Optional)
Type: String
Description: The street address.
Examples:
• 100 Main Street

8.1.33.1.39 Organization URL(s)
Location: /components/[[data]/[governance/custodians/][organization/url
Property: url (Optional)
Type: array (of String)


Description: The URL of the organization. Multiple URLs are allowed. Each item of this array must be a string.

Examples:
- https://example.com

8.1.33.1.40 Organizational Contact

Location: /components/[]/data/[]/governance/custodians/[]/organization/contact

Property: contact (Optional)

Type: Array

Description: A contact at the organization. Multiple contacts are allowed. Each item of this array must be an Organizational Contact object.

8.1.33.1.41 Organizational Contact

Location: /components/[]/data/[]/governance/custodians/[]/organization/contact/[]

Type: Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

8.1.33.1.42 BOM Reference

Location: /components/[]/data/[]/governance/custodians/[]/organization/contact/[]/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

8.1.33.1.43 Name

Location: /components/[]/data/[]/governance/custodians/[]/organization/contact/[]/name

Property: name (Optional)

Type: String

Description: The name of a contact

Examples:
- Contact name
8.1.33.1.44 Email Address

Location: /components/[]/data/[]/governance/custodians/[]/organization/contact/[]/email

Property: email (Optional)

Type: String

Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

Description: The email address of the contact.

Examples:
- firstname.lastname@example.com

8.1.33.1.45 Phone

Location: /components/[]/data/[]/governance/custodians/[]/organization/contact/[]/phone

Property: phone (Optional)

Type: String

Description: The phone number of the contact.

Examples:
- 800-555-1212

8.1.33.1.46 Organizational Contact

Location: /components/[]/data/[]/governance/custodians/[]/contact

Property: contact (Optional)

Type: Object

Description: The individual that is responsible for specific data governance role(s).

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

8.1.33.1.47 BOM Reference

Location: /components/[]/data/[]/governance/custodians/[]/contact/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.
8.1.33.1.48 Name
Location: /components/[]/data/[]/governance/custodians/[]/contact/name
Property: name (Optional)
Type: String
Description: The name of a contact
Examples:
• Contact name

8.1.33.1.49 Email Address
Location: /components/[]/data/[]/governance/custodians/[]/contact/email
Property: email (Optional)
Type: String
Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)
Description: The email address of the contact.
Examples:
• firstname.lastname@example.com

8.1.33.1.50 Phone
Location: /components/[]/data/[]/governance/custodians/[]/contact/phone
Property: phone (Optional)
Type: String
Description: The phone number of the contact.
Examples:
• 800-555-1212

8.1.33.1.51 Data Stewards
Location: /components/[]/data/[]/governance/stewards
Property: stewards (Optional)
Type: Array
Description: Data stewards are responsible for data content, context, and associated business rules.
Location: /components/[]/data/[]/governance/stewards/
Type: Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>organization</td>
<td>Object</td>
<td>Optional</td>
<td>The organization that is responsible for specific data governance role(s).</td>
</tr>
<tr>
<td>contact</td>
<td>Object</td>
<td>Optional</td>
<td>The individual that is responsible for specific data governance role(s).</td>
</tr>
</tbody>
</table>

8.1.33.1.52 Organization
Location: /components/[]/data/[]/governance/stewards/[]/organization
Property: organization (Optional)
**Type:** Object

**Description:** The organization that is responsible for specific data governance role(s).

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the organization</td>
</tr>
<tr>
<td>address</td>
<td>Object</td>
<td>Optional</td>
<td>The physical address (location) of the organization</td>
</tr>
<tr>
<td>url</td>
<td>Array</td>
<td>Optional</td>
<td>The URL of the organization. Multiple URLs are allowed.</td>
</tr>
<tr>
<td>contact</td>
<td>Array</td>
<td>Optional</td>
<td>A contact at the organization. Multiple contacts are allowed.</td>
</tr>
</tbody>
</table>

**8.1.33.1.53 BOM Reference**

**Location:** /components/[]/data/[]/governance/stewards/[]/organization/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

**8.1.33.1.54 Organization Name**

**Location:** /components/[]/data/[]/governance/stewards/[]/organization/name

**Property:** name (Optional)

**Type:** String

**Description:** The name of the organization

**Examples:**
- Example Inc.

**8.1.33.1.55 Organization Address**

**Location:** /components/[]/data/[]/governance/stewards/[]/organization/address

**Property:** address (Optional)

**Type:** Object

**Description:** The physical address (location) of the organization
<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>Optional</td>
<td>The country name or the two-letter ISO 3166-1 country code.</td>
</tr>
<tr>
<td>region</td>
<td>String</td>
<td>Optional</td>
<td>The region or state in the country.</td>
</tr>
<tr>
<td>locality</td>
<td>String</td>
<td>Optional</td>
<td>The locality or city within the country.</td>
</tr>
<tr>
<td>postOfficeBoxNumber</td>
<td>String</td>
<td>Optional</td>
<td>The post office box number.</td>
</tr>
<tr>
<td>postalCode</td>
<td>String</td>
<td>Optional</td>
<td>The postal code.</td>
</tr>
<tr>
<td>streetAddress</td>
<td>String</td>
<td>Optional</td>
<td>The street address.</td>
</tr>
</tbody>
</table>

8.1.33.1.56       BOM Reference
Location: /components/[]/data/[]/governance/stewards/[]/organization/address/bom-ref
Property: bom-ref (Optional)
Type: String
Description: An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

8.1.33.1.57       Country
Location: /components/[]/data/[]/governance/stewards/[]/organization/address/country
Property: country (Optional)
Type: String
Description: The country name or the two-letter ISO 3166-1 country code.

8.1.33.1.58       Region
Location: /components/[]/data/[]/governance/stewards/[]/organization/address/region
Property: region (Optional)
Type: String
Description: The region or state in the country.
Examples:
- Texas

8.1.33.1.59       Locality
Location: /components/[]/data/[]/governance/stewards/[]/organization/address/locality
Property: locality (Optional)
Type: String
Description: The locality or city within the country.
Examples:
  - Austin

8.1.33.1.60 Post Office Box Number

Location: /components/[]/data/[]/governance/stewards/[]/organization/address/postOfficeBoxNumber
Property: postOfficeBoxNumber (Optional)
Type: String
Description: The post office box number.
Examples:
  - 901

8.1.33.1.61 Postal Code

Location: /components/[]/data/[]/governance/stewards/[]/organization/address/postalCode
Property: postalCode (Optional)
Type: String
Description: The postal code.
Examples:
  - 78758

8.1.33.1.62 Street Address

Location: /components/[]/data/[]/governance/stewards/[]/organization/address/streetAddress
Property: streetAddress (Optional)
Type: String
Description: The street address.
Examples:
  - 100 Main Street

8.1.33.1.63 Organization URL(s)

Location: /components/[]/data/[]/governance/stewards/[]/organization/url
Property: url (Optional)
Type: array (of String)
Description: The URL of the organization. Multiple URLs are allowed. Each item of this array must be a string.
Examples:
  - https://example.com

8.1.33.1.64 Organizational Contact

Location: /components/[]/data/[]/governance/stewards/[]/organization/contact
Property: contact (Optional)
Type: Array
Description: A contact at the organization. Multiple contacts are allowed. Each item of this array must be an Organizational Contact object.
Type: Object

Table 167 – Properties for the contact object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

8.1.33.1.66  BOM Reference

Location: /components/*/data/*/governance/stewards/*/organization/contact/*/bom-ref
Property: bom-ref (Optional)

Type: String
Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

8.1.33.1.67  Name

Location: /components/*/data/*/governance/stewards/*/organization/contact/*/name
Property: name (Optional)

Type: String
Description: The name of a contact
Examples:
  - Contact name

8.1.33.1.68  Email Address

Location: /components/*/data/*/governance/stewards/*/organization/contact/*/email
Property: email (Optional)

Type: String
Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)
Description: The email address of the contact.
Examples:
  - firstname.lastname@example.com

8.1.33.1.69  Phone

Location: /components/*/data/*/governance/stewards/*/organization/contact/*/phone
Property: phone (Optional)

Type: String
Description: The phone number of the contact.
Examples:
- 800-555-1212

8.1.33.1.70 Organizational Contact

Location: /components/[]/data/[]/governance/stewards/[]/contact
Property: contact (Optional)

Type: Object

Description: The individual that is responsible for specific data governance role(s).

Table 168 – Properties for the contact object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

8.1.33.1.71 BOM Reference

Location: /components/[]/data/[]/governance/stewards/[]/contact/bom-ref
Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

8.1.33.1.72 Name

Location: /components/[]/data/[]/governance/stewards/[]/contact/name
Property: name (Optional)

Type: String

Description: The name of a contact

Examples:
- Contact name

8.1.33.1.73 Email Address

Location: /components/[]/data/[]/governance/stewards/[]/contact/email
Property: email (Optional)

Type: String

Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

Description: The email address of the contact.

Examples:
- firstname.lastname@example.com
### 8.1.33.1.74 Phone

**Location:** /components/[]/data/[]/governance/stewards/[]/contact/phone  
**Property:** phone (Optional)  
**Type:** String  
**Description:** The phone number of the contact.  
**Examples:**  
- 800-555-1212

### 8.1.33.1.75 Data Owners

**Location:** /components/[]/data/[]/governance/owners  
**Property:** owners (Optional)  
**Type:** Array  
**Description:** Data owners are concerned with risk and appropriate access to data.  
**Location:** /components/[]/data/[]/governance/owners/[]

**Type:** Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>organization</td>
<td>Object</td>
<td>Optional</td>
<td>The organization that is responsible for specific data governance role(s).</td>
</tr>
<tr>
<td>contact</td>
<td>Object</td>
<td>Optional</td>
<td>The individual that is responsible for specific data governance role(s).</td>
</tr>
</tbody>
</table>

### 8.1.33.1.76 Organization

**Location:** /components/[]/data/[]/governance/owners/[]/organization  
**Property:** organization (Optional)  
**Type:** Object  
**Description:** The organization that is responsible for specific data governance role(s).

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the organization</td>
</tr>
<tr>
<td>address</td>
<td>Object</td>
<td>Optional</td>
<td>The physical address (location) of the organization</td>
</tr>
<tr>
<td>url</td>
<td>Array</td>
<td>Optional</td>
<td>The URL of the organization. Multiple URLs are allowed.</td>
</tr>
<tr>
<td>contact</td>
<td>Array</td>
<td>Optional</td>
<td>A contact at the organization. Multiple contacts are allowed.</td>
</tr>
</tbody>
</table>
8.1.33.1.77  BOM Reference

Location: /components/[/data/[/governance/owners/[/]organization/bom-ref
Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

8.1.33.1.78  Organization Name

Location: /components/[/data/[/governance/owners/[/]organization/name
Property: name (Optional)

Type: String

Description: The name of the organization

Examples:
   • Example Inc.

8.1.33.1.79  Organization Address

Location: /components/[/data/[/governance/owners/[/]organization/address
Property: address (Optional)

Type: Object

Description: The physical address (location) of the organization

Table 171 – Properties for the address object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>Optional</td>
<td>The country name or the two-letter ISO 3166-1 country code.</td>
</tr>
<tr>
<td>region</td>
<td>String</td>
<td>Optional</td>
<td>The region or state in the country.</td>
</tr>
<tr>
<td>locality</td>
<td>String</td>
<td>Optional</td>
<td>The locality or city within the country.</td>
</tr>
<tr>
<td>postOfficeBoxNumber</td>
<td>String</td>
<td>Optional</td>
<td>The post office box number.</td>
</tr>
<tr>
<td>postalCode</td>
<td>String</td>
<td>Optional</td>
<td>The postal code.</td>
</tr>
<tr>
<td>streetAddress</td>
<td>String</td>
<td>Optional</td>
<td>The street address.</td>
</tr>
</tbody>
</table>

8.1.33.1.80  BOM Reference

Location: /components/[/data/[/governance/owners/[/]organization/address/bom-ref
Property: bom-ref (Optional)

Type: String
**Description**: An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

8.1.33.1.81 Country

**Location**: /components[/]data[/]governance/owners[/]organization/address/country

**Property**: country (Optional)

**Type**: String

**Description**: The country name or the two-letter ISO 3166-1 country code.

8.1.33.1.82 Region

**Location**: /components[/]data[/]governance/owners[/]organization/address/region

**Property**: region (Optional)

**Type**: String

**Description**: The region or state in the country.

**Examples**:
- Texas

8.1.33.1.83 Locality

**Location**: /components[/]data[/]governance/owners[/]organization/address/locality

**Property**: locality (Optional)

**Type**: String

**Description**: The locality or city within the country.

**Examples**:
- Austin

8.1.33.1.84 Post Office Box Number

**Location**: /components[/]data[/]governance/owners[/]organization/address/postOfficeBoxNumber

**Property**: postOfficeBoxNumber (Optional)

**Type**: String

**Description**: The post office box number.

**Examples**:
- 901

8.1.33.1.85 Postal Code

**Location**: /components[/]data[/]governance/owners[/]organization/address/postalCode

**Property**: postalCode (Optional)

**Type**: String

**Description**: The postal code.

**Examples**:
- 78758

8.1.33.1.86 Street Address

**Location**: /components[/]data[/]governance/owners[/]organization/address/streetAddress

**Property**: streetAddress (Optional)
Type: String
Description: The street address.
Examples:
  - 100 Main Street

8.1.33.1.87 Organization URL(s)

Location: /components/[]/data/[]/governance/owners/[]/organization/url
Property: url (Optional)
Type: array (of String)
Description: The URL of the organization. Multiple URLs are allowed. Each item of this array must be a string.
Examples:
  - https://example.com

8.1.33.1.88 Organizational Contact

Location: /components/[]/data/[]/governance/owners/[]/organization/contact
Property: contact (Optional)
Type: Array
Description: A contact at the organization. Multiple contacts are allowed. Each item of this array must be an Organizational Contact object.

8.1.33.1.89 Organizational Contact

Location: /components/[]/data/[]/governance/owners/[]/organization/contact/[]
Type: Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

8.1.33.1.90 BOM Reference

Location: /components/[]/data/[]/governance/owners/[]/organization/contact/[]/bom-ref
Property: bom-ref (Optional)
Type: String
Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.
### 8.1.33.1.91 Name

**Location:** /components/[]/data/[]/governance/owners/[]/organization/contact/[]/name  
**Property:** name (Optional)  
**Type:** String  
**Description:** The name of a contact  
**Examples:**  
- Contact name

### 8.1.33.1.92 Email Address

**Location:** /components/[]/data/[]/governance/owners/[]/organization/contact/[]/email  
**Property:** email (Optional)  
**Type:** String  
**Format:** idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)  
**Description:** The email address of the contact.  
**Examples:**  
- firstname.lastname@example.com

### 8.1.33.1.93 Phone

**Location:** /components/[]/data/[]/governance/owners/[]/organization/contact/[]/phone  
**Property:** phone (Optional)  
**Type:** String  
**Description:** The phone number of the contact.  
**Examples:**  
- 800-555-1212

### 8.1.33.1.94 Organizational Contact

**Location:** /components/[]/data/[]/governance/owners/[]/contact  
**Property:** contact (Optional)  
**Type:** Object  
**Description:** The individual that is responsible for specific data governance role(s).

#### Table 173 – Properties for the contact object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>
8.1.33.1.95 BOM Reference

Location: /components/[]/data/[]/governance/owners/[]/contact/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

8.1.33.1.96 Name

Location: /components/[]/data/[]/governance/owners/[]/contact/name

Property: name (Optional)

Type: String

Description: The name of a contact

Examples:
  • Contact name

8.1.33.1.97 Email Address

Location: /components/[]/data/[]/governance/owners/[]/contact/email

Property: email (Optional)

Type: String

Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

Description: The email address of the contact.

Examples:
  • firstname.lastname@example.com

8.1.33.1.98 Phone

Location: /components/[]/data/[]/governance/owners/[]/contact/phone

Property: phone (Optional)

Type: String

Description: The phone number of the contact.

Examples:
  • 800-555-1212

8.1.34 Cryptographic Properties

Location: /components/[]/cryptoProperties

Property: cryptoProperties (Optional)

Type: Object

Description: Cryptographic assets have properties that uniquely define them and that make them actionable for further reasoning. As an example, it makes a difference if one knows the algorithm family (e.g. AES) or the specific variant or instantiation (e.g. AES-128-GCM). This is because the security level and the algorithm primitive (authenticated encryption) are only defined by the definition of the algorithm variant. The presence of a weak cryptographic algorithm like SHA1 vs. HMAC-SHA1 also makes a difference.
Table 174 – Properties for the cryptoProperties object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>assetType</td>
<td>String</td>
<td>Required</td>
<td>Cryptographic assets occur in several forms. Algorithms and protocols are most commonly implemented in specialized cryptographic libraries. They may, however, also be 'hardcoded' in software components. Certificates and related cryptographic material like keys, tokens, secrets or passwords are other cryptographic assets to be modelled.</td>
</tr>
<tr>
<td>algorithmProperties</td>
<td>Object</td>
<td>Optional</td>
<td>Additional properties specific to a cryptographic algorithm.</td>
</tr>
<tr>
<td>certificateProperties</td>
<td>Object</td>
<td>Optional</td>
<td>Properties for cryptographic assets of asset type 'certificate'</td>
</tr>
<tr>
<td>relatedCryptoMaterialProperties</td>
<td>Object</td>
<td>Optional</td>
<td>Properties for cryptographic assets of asset type: related-crypto-material</td>
</tr>
<tr>
<td>protocolProperties</td>
<td>Object</td>
<td>Optional</td>
<td>Properties specific to cryptographic assets of type: protocol.</td>
</tr>
<tr>
<td>oid</td>
<td>String</td>
<td>Optional</td>
<td>The object identifier (OID) of the cryptographic asset.</td>
</tr>
</tbody>
</table>

8.1.34.1 Asset Type

Location: /components[]/cryptoProperties/assetType

Property: assetType (Required)

Type: String

Description: Cryptographic assets occur in several forms. Algorithms and protocols are most commonly implemented in specialized cryptographic libraries. They may, however, also be 'hardcoded' in software components. Certificates and related cryptographic material like keys, tokens, secrets or passwords are other cryptographic assets to be modeled.

Table 175 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>algorithm</td>
<td>Mathematical function commonly used for data encryption, authentication, and digital signatures.</td>
</tr>
<tr>
<td>certificate</td>
<td>An electronic document that is used to provide the identity or validate a public key.</td>
</tr>
<tr>
<td>protocol</td>
<td>A set of rules and guidelines that govern the behaviour and communication with each other.</td>
</tr>
<tr>
<td>related-crypto-material</td>
<td>Other cryptographic assets related to algorithms, certificates, and protocols such as keys and tokens.</td>
</tr>
</tbody>
</table>

8.1.34.2 Algorithm Properties

Location: /components[]/cryptoProperties/algorithmProperties

Property: algorithmProperties (Optional)
**Type:** Object  
**Description:** Additional properties specific to a cryptographic algorithm.

### Table 176 – Properties for the algorithmProperties object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>primitive</td>
<td>String</td>
<td>Optional</td>
<td>Cryptographic building blocks used in higher-level cryptographic systems and protocols. Primitives represent different cryptographic routines: deterministic random bit generators (drbg, e.g. CTR_DRBG from NIST SP800-90A-r1), message authentication codes (mac, e.g. HMAC-SHA-256), blockciphers (e.g. AES), streamciphers (e.g. Salsa20), signatures (e.g. ECDSA), hash functions (e.g. SHA-256), public-key encryption schemes (pke, e.g. RSA), extended output functions (xof, e.g. SHAKE256), key derivation functions (e.g. pbkdf2), key agreement algorithms (e.g. ECDH), key encapsulation mechanisms (e.g. ML-KEM), authenticated encryption (ae, e.g. AES-GCM) and the combination of multiple algorithms (combiner, e.g. SP800-56Cr2).</td>
</tr>
<tr>
<td>parameterSetIdentifier</td>
<td>String</td>
<td>Optional</td>
<td>An identifier for the parameter set of the cryptographic algorithm. Examples: in AES128, ‘128’ identifies the key length in bits, in SHA256, ‘256’ identifies the digest length, ‘128’ in SHAKE128 identifies its maximum security level in bits, and ‘SHA2-128s’ identifies a parameter set used in SLH-DSA (FIPS205).</td>
</tr>
<tr>
<td>curve</td>
<td>String</td>
<td>Optional</td>
<td>The specific underlying Elliptic Curve (EC) definition employed which is an indicator of the level of security strength, performance and complexity. Absent an authoritative source of curve names, CycloneDX recommends using curve names as defined at <a href="https://neuromancer.sk/std/">https://neuromancer.sk/std/</a>, the source of which can be found at <a href="https://github.com/J08nY/std-curves">https://github.com/J08nY/std-curves</a>.</td>
</tr>
<tr>
<td>executionEnvironment</td>
<td>String</td>
<td>Optional</td>
<td>The target and execution environment in which the algorithm is implemented in.</td>
</tr>
<tr>
<td>implementationPlatform</td>
<td>String</td>
<td>Optional</td>
<td>The target platform for which the algorithm is implemented. The implementation can be ‘generic’, running on any platform or for a specific platform.</td>
</tr>
<tr>
<td>certificationLevel</td>
<td>Array</td>
<td>Optional</td>
<td>The certification that the implementation of the cryptographic algorithm has received, if any. Certifications include revisions and levels of FIPS 140 or Common Criteria of different Extended Assurance Levels (CC-EAL).</td>
</tr>
<tr>
<td>mode</td>
<td>String</td>
<td>Optional</td>
<td>The mode of operation in which the cryptographic algorithm (block cipher) is used.</td>
</tr>
<tr>
<td>padding</td>
<td>String</td>
<td>Optional</td>
<td>The padding scheme that is used for the cryptographic algorithm.</td>
</tr>
<tr>
<td>cryptoFunctions</td>
<td>Array</td>
<td>Optional</td>
<td>The cryptographic functions implemented by the cryptographic algorithm.</td>
</tr>
</tbody>
</table>
### classicalSecurityLevel

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>classicalSecurityLevel</td>
<td>Integer</td>
<td>Optional</td>
<td>The classical security level that a cryptographic algorithm provides (in bits).</td>
</tr>
</tbody>
</table>

### nistQuantumSecurityLevel

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
</table>

### 8.1.34.2.1 primitive

**Location:** /components/[[]/cryptoProperties/algorithmProperties/primitive

**Property:** primitive (Optional)

**Type:** String

**Description:** Cryptographic building blocks used in higher-level cryptographic systems and protocols. Primitives represent different cryptographic routines: deterministic random bit generators (drbg, e.g. CTR_DRBG from NIST SP800-90A-r1), message authentication codes (mac, e.g. HMAC-SHA-256), blockciphers (e.g. AES), streamciphers (e.g. Salsa20), signatures (e.g. ECDSA), hash functions (e.g. SHA-256), public-key encryption schemes (pke, e.g. RSA), extended output functions (xof, e.g. SHAKE256), key derivation functions (e.g. pbkdf2), key agreement algorithms (e.g. ECDH), key encapsulation mechanisms (e.g. ML-KEM), authenticated encryption (ae, e.g. AES-GCM) and the combination of multiple algorithms (combiner, e.g. SP800-56Cr2).

#### Table 177 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>drbg</td>
<td>Deterministic Random Bit Generator (DRBG) is a type of pseudorandom number generator designed to produce a sequence of bits from an initial seed value. DRBGs are commonly used in cryptographic applications where reproducibility of random values is important.</td>
</tr>
<tr>
<td>mac</td>
<td>In cryptography, a Message Authentication Code (MAC) is information used for authenticating and integrity-checking a message.</td>
</tr>
<tr>
<td>block-cipher</td>
<td>A block cipher is a symmetric key algorithm that operates on fixed-size blocks of data. It encrypts or decrypts the data in block units, providing confidentiality. Block ciphers are widely used in various cryptographic modes and protocols for secure data transmission.</td>
</tr>
<tr>
<td>stream-cipher</td>
<td>A stream cipher is a symmetric key cipher where plaintext digits are combined with a pseudorandom cipher digit stream (keystream).</td>
</tr>
<tr>
<td>signature</td>
<td>In cryptography, a signature is a digital representation of a message or data that proves its origin, identity, and integrity. Digital signatures are generated using cryptographic algorithms and are widely used for authentication and verification in secure communication.</td>
</tr>
<tr>
<td>hash</td>
<td>A hash function is a mathematical algorithm that takes an input (or 'message') and produces a fixed-size string of characters, which is typically a hash value. Hash functions are commonly used in various cryptographic applications, including data integrity verification and password hashing.</td>
</tr>
<tr>
<td>pke</td>
<td>Public Key Encryption (PKE) is a type of encryption that uses a pair of public and private keys for secure communication. The public key is used for encryption, while the private key is used for decryption. PKE is a fundamental component of public-key cryptography.</td>
</tr>
<tr>
<td>Value</td>
<td>Description</td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
</tr>
<tr>
<td>xof</td>
<td>An XOF is an extendable output function that can take arbitrary input and creates a stream of output, up to a limit determined by the size of the internal state of the hash function that underlies the XOF.</td>
</tr>
<tr>
<td>kdf</td>
<td>A Key Derivation Function (KDF) derives key material from another source of entropy while preserving the entropy of the input.</td>
</tr>
<tr>
<td>key-agree</td>
<td>In cryptography, a key-agreement is a protocol whereby two or more parties agree on a cryptographic key in such a way that both influence the outcome.</td>
</tr>
<tr>
<td>kem</td>
<td>A Key Encapsulation Mechanism (KEM) algorithm is a mechanism for transporting random keying material to a recipient using the recipient's public key.</td>
</tr>
<tr>
<td>ae</td>
<td>Authenticated Encryption (AE) is a cryptographic process that provides both confidentiality and data integrity. It ensures that the encrypted data has not been tampered with and comes from a legitimate source. AE is commonly used in secure communication protocols.</td>
</tr>
<tr>
<td>combiner</td>
<td>A combiner aggregates many candidates for a cryptographic primitive and generates a new candidate for the same primitive.</td>
</tr>
<tr>
<td>other</td>
<td>Another primitive type.</td>
</tr>
<tr>
<td>unknown</td>
<td>The primitive is not known.</td>
</tr>
</tbody>
</table>

### 8.1.34.2.2 Parameter Set Identifier

**Location:** /components/[]/cryptoProperties/algorithmProperties/parameterSetIdentifier  
**Property:** parameterSetIdentifier (Optional)  
**Type:** String  
**Description:** An identifier for the parameter set of the cryptographic algorithm. Examples: in AES128, ‘128’ identifies the key length in bits, in SHA256, ‘256’ identifies the digest length, ‘128’ in SHAKE128 identifies its maximum security level in bits, and ‘SHA2-128s’ identifies a parameter set used in SLH-DSA (FIPS205).

### 8.1.34.2.3 Elliptic Curve

**Location:** /components/[]/cryptoProperties/algorithmProperties/curve  
**Property:** curve (Optional)  
**Type:** String  
**Description:** The specific underlying Elliptic Curve (EC) definition employed which is an indicator of the level of security strength, performance and complexity. Absent an authoritative source of curve names, CycloneDX recommends using curve names as defined at [https://neuromancer.sk/std/](https://neuromancer.sk/std/), the source of which can be found at [https://github.com/J08nY/std-curves](https://github.com/J08nY/std-curves).

### 8.1.34.2.4 Execution Environment

**Location:** /components/[]/cryptoProperties/algorithmProperties/executionEnvironment  
**Property:** executionEnvironment (Optional)  
**Type:** String  
**Description:** The target and execution environment in which the algorithm is implemented in.
### 8.1.34.2.5 Implementation platform

**Location:** /components/[]/cryptoProperties/algorithmProperties/implementationPlatform  
**Property:** implementationPlatform (Optional)  
**Type:** String  
**Description:** The target platform for which the algorithm is implemented. The implementation can be 'generic', running on any platform or for a specific platform.  
**Enumeration:** Must be one of:
- generic  
- x86_32  
- x86_64  
- armv7-a  
- armv7-m  
- armv8-a  
- armv8-m  
- armv9-a  
- armv9-m  
- s390x  
- ppc64  
- ppc64le  
- other  
- unknown

### 8.1.34.2.6 Certification Level

**Location:** /components/[]/cryptoProperties/algorithmProperties/certificationLevel  
**Property:** certificationLevel (Optional)  
**Type:** array (of String)

---

#### Table 178 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>software-plain-ram</td>
<td>A software implementation running in plain unencrypted RAM.</td>
</tr>
<tr>
<td>software-encrypted-ram</td>
<td>A software implementation running in encrypted RAM.</td>
</tr>
<tr>
<td>software-tee</td>
<td>A software implementation running in a trusted execution environment.</td>
</tr>
<tr>
<td>hardware</td>
<td>A hardware implementation.</td>
</tr>
<tr>
<td>other</td>
<td>Another implementation environment.</td>
</tr>
<tr>
<td>unknown</td>
<td>The execution environment is not known.</td>
</tr>
</tbody>
</table>
Description: The certification that the implementation of the cryptographic algorithm has received, if any. Certifications include revisions and levels of FIPS 140 or Common Criteria of different Extended Assurance Levels (CC-EAL). Each item of this array must be a string.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td>No certification obtained</td>
</tr>
<tr>
<td>fips140-1-l1</td>
<td>FIPS 140-1 Level 1</td>
</tr>
<tr>
<td>fips140-1-l2</td>
<td>FIPS 140-1 Level 2</td>
</tr>
<tr>
<td>fips140-1-l3</td>
<td>FIPS 140-1 Level 3</td>
</tr>
<tr>
<td>fips140-1-l4</td>
<td>FIPS 140-1 Level 4</td>
</tr>
<tr>
<td>fips140-2-l1</td>
<td>FIPS 140-2 Level 1</td>
</tr>
<tr>
<td>fips140-2-l2</td>
<td>FIPS 140-2 Level 2</td>
</tr>
<tr>
<td>fips140-2-l3</td>
<td>FIPS 140-2 Level 3</td>
</tr>
<tr>
<td>fips140-2-l4</td>
<td>FIPS 140-2 Level 4</td>
</tr>
<tr>
<td>fips140-3-l1</td>
<td>FIPS 140-3 Level 1</td>
</tr>
<tr>
<td>fips140-3-l2</td>
<td>FIPS 140-3 Level 2</td>
</tr>
<tr>
<td>fips140-3-l3</td>
<td>FIPS 140-3 Level 3</td>
</tr>
<tr>
<td>fips140-3-l4</td>
<td>FIPS 140-3 Level 4</td>
</tr>
<tr>
<td>cc-eal1</td>
<td>Common Criteria - Evaluation Assurance Level 1</td>
</tr>
<tr>
<td>cc-eal1+</td>
<td>Common Criteria - Evaluation Assurance Level 1 (Augmented)</td>
</tr>
<tr>
<td>cc-eal2</td>
<td>Common Criteria - Evaluation Assurance Level 2</td>
</tr>
<tr>
<td>cc-eal2+</td>
<td>Common Criteria - Evaluation Assurance Level 2 (Augmented)</td>
</tr>
<tr>
<td>cc-eal3</td>
<td>Common Criteria - Evaluation Assurance Level 3</td>
</tr>
<tr>
<td>cc-eal3+</td>
<td>Common Criteria - Evaluation Assurance Level 3 (Augmented)</td>
</tr>
<tr>
<td>cc-eal4</td>
<td>Common Criteria - Evaluation Assurance Level 4</td>
</tr>
<tr>
<td>cc-eal4+</td>
<td>Common Criteria - Evaluation Assurance Level 4 (Augmented)</td>
</tr>
<tr>
<td>cc-eal5</td>
<td>Common Criteria - Evaluation Assurance Level 5</td>
</tr>
<tr>
<td>cc-eal5+</td>
<td>Common Criteria - Evaluation Assurance Level 5 (Augmented)</td>
</tr>
<tr>
<td>Value</td>
<td>Description</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------------------------------------------------</td>
</tr>
<tr>
<td>cc-eal6</td>
<td>Common Criteria - Evaluation Assurance Level 6</td>
</tr>
<tr>
<td>cc-eal6+</td>
<td>Common Criteria - Evaluation Assurance Level 6 (Augmented)</td>
</tr>
<tr>
<td>cc-eal7</td>
<td>Common Criteria - Evaluation Assurance Level 7</td>
</tr>
<tr>
<td>cc-eal7+</td>
<td>Common Criteria - Evaluation Assurance Level 7 (Augmented)</td>
</tr>
<tr>
<td>other</td>
<td>Another certification</td>
</tr>
<tr>
<td>unknown</td>
<td>The certification level is not known</td>
</tr>
</tbody>
</table>

8.1.34.2.7 Mode

**Location:** /components[/]cryptoProperties/algorithmProperties/mode

**Property:** mode (Optional)

**Type:** String

**Description:** The mode of operation in which the cryptographic algorithm (block cipher) is used.

Table 180 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>cbc</td>
<td>Cipher block chaining</td>
</tr>
<tr>
<td>ecb</td>
<td>Electronic codebook</td>
</tr>
<tr>
<td>ccm</td>
<td>Counter with cipher block chaining message authentication code</td>
</tr>
<tr>
<td>gcm</td>
<td>Galois/counter</td>
</tr>
<tr>
<td>cfb</td>
<td>Cipher feedback</td>
</tr>
<tr>
<td>ofb</td>
<td>Output feedback</td>
</tr>
<tr>
<td>ctr</td>
<td>Counter</td>
</tr>
<tr>
<td>other</td>
<td>Another mode of operation</td>
</tr>
<tr>
<td>unknown</td>
<td>The mode of operation is not known</td>
</tr>
</tbody>
</table>

8.1.34.2.8 Padding

**Location:** /components[/]cryptoProperties/algorithmProperties/padding

**Property:** padding (Optional)

**Type:** String

**Description:** The padding scheme that is used for the cryptographic algorithm.
### Table 181 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>pkcs5</td>
<td>Public Key Cryptography Standard: Password-Based Cryptography</td>
</tr>
<tr>
<td>pkcs7</td>
<td>Public Key Cryptography Standard: Cryptographic Message Syntax</td>
</tr>
<tr>
<td>pkcs1v15</td>
<td>Public Key Cryptography Standard: RSA Cryptography v1.5</td>
</tr>
<tr>
<td>oaep</td>
<td>Optimal asymmetric encryption padding</td>
</tr>
<tr>
<td>raw</td>
<td>Raw</td>
</tr>
<tr>
<td>other</td>
<td>Another padding scheme</td>
</tr>
<tr>
<td>unknown</td>
<td>The padding scheme is not known</td>
</tr>
</tbody>
</table>

### 8.1.34.2.9 Cryptographic functions

**Location:** /components/[]/cryptoProperties/algorithmProperties/cryptoFunctions

**Property:** cryptoFunctions (Optional)

**Type:** array (of String)

**Description:** The cryptographic functions implemented by the cryptographic algorithm. Each item of this array must be a string.

**Enumeration:** Must be one of:
- generate
- keygen
- encrypt
- decrypt
- digest
- tag
- keyderive
- sign
- verify
- encapsulate
- decapsulate
- other
- unknown

### 8.1.34.2.10 classical security level

**Location:** /components/[]/cryptoProperties/algorithmProperties/classicalSecurityLevel

**Property:** classicalSecurityLevel (Optional)

**Type:** Integer

**Description:** The classical security level that a cryptographic algorithm provides (in bits).
8.1.34.2.11  NIST security strength category

**Location:** /components[[]]/cryptoProperties/algorithmProperties/nistQuantumSecurityLevel

**Property:** nistQuantumSecurityLevel (Optional)

**Type:** Integer

**Maximum Value:** 6


8.1.34.3  Certificate Properties

**Location:** /components[[]]/cryptoProperties/certificateProperties

**Property:** certificateProperties (Optional)

**Type:** Object

**Description:** Properties for cryptographic assets of asset type 'certificate'

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>subjectName</td>
<td>String</td>
<td>Optional</td>
<td>The subject name for the certificate</td>
</tr>
<tr>
<td>issuerName</td>
<td>String</td>
<td>Optional</td>
<td>The issuer name for the certificate</td>
</tr>
<tr>
<td>notValidBefore</td>
<td>String</td>
<td>Optional</td>
<td>The date and time according to ISO-8601 standard from which the certificate is valid</td>
</tr>
<tr>
<td>notValidAfter</td>
<td>String</td>
<td>Optional</td>
<td>The date and time according to ISO-8601 standard from which the certificate is not valid anymore</td>
</tr>
<tr>
<td>signatureAlgorithmRef</td>
<td>String</td>
<td>Optional</td>
<td>The bom-ref to signature algorithm used by the certificate</td>
</tr>
<tr>
<td>subjectPublicKeyRef</td>
<td>String</td>
<td>Optional</td>
<td>The bom-ref to the public key of the subject</td>
</tr>
<tr>
<td>certificateFormat</td>
<td>String</td>
<td>Optional</td>
<td>The format of the certificate</td>
</tr>
<tr>
<td>certificateExtension</td>
<td>String</td>
<td>Optional</td>
<td>The file extension of the certificate</td>
</tr>
</tbody>
</table>

8.1.34.3.1  Subject Name

**Location:** /components[[]]/cryptoProperties/certificateProperties/subjectName

**Property:** subjectName (Optional)

**Type:** String

**Description:** The subject name for the certificate

8.1.34.3.2  Issuer Name

**Location:** /components[[]]/cryptoProperties/certificateProperties/issuerName

**Property:** issuerName (Optional)

**Type:** String

**Description:** The issuer name for the certificate
8.1.34.3.3 Not Valid Before

**Location:** /components/[]/cryptoProperties/certificateProperties/notValidBefore

**Property:** notValidBefore (Optional)

**Type:** String

**Format:** data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)

**Description:** The date and time according to ISO-8601 standard from which the certificate is valid

8.1.34.3.4 Not Valid After

**Location:** /components/[]/cryptoProperties/certificateProperties/notValidAfter

**Property:** notValidAfter (Optional)

**Type:** String

**Format:** data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)

**Description:** The date and time according to ISO-8601 standard from which the certificate is not valid anymore

8.1.34.3.5 Algorithm Reference

**Location:** /components/[]/cryptoProperties/certificateProperties/signatureAlgorithmRef

**Property:** signatureAlgorithmRef (Optional)

**Type:** String

**Description:** The bom-ref to signature algorithm used by the certificate

8.1.34.3.6 Key Reference

**Location:** /components/[]/cryptoProperties/certificateProperties/subjectPublicKeyRef

**Property:** subjectPublicKeyRef (Optional)

**Type:** String

**Description:** The bom-ref to the public key of the subject

8.1.34.3.7 Certificate Format

**Location:** /components/[]/cryptoProperties/certificateProperties/certificateFormat

**Property:** certificateFormat (Optional)

**Type:** String

**Description:** The format of the certificate

**Examples:**
- X.509
- PEM
- DER
- CVC

8.1.34.3.8 Certificate File Extension

**Location:** /components/[]/cryptoProperties/certificateProperties/certificateExtension

**Property:** certificateExtension (Optional)

**Type:** String

**Description:** The file extension of the certificate
Examples:
- crt
- pem
- cer
- der
- p12

8.1.34.4 Related Cryptographic Material Properties

Location: /components/[]/cryptoProperties/relatedCryptoMaterialProperties
Property: relatedCryptoMaterialProperties (Optional)

Type: Object

Description: Properties for cryptographic assets of asset type: related-crypto-material

Table 183 – Properties for the relatedCryptoMaterialProperties object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>type</td>
<td>String</td>
<td>Optional</td>
<td>The type for the related cryptographic material</td>
</tr>
<tr>
<td>id</td>
<td>String</td>
<td>Optional</td>
<td>The optional unique identifier for the related cryptographic material.</td>
</tr>
<tr>
<td>state</td>
<td>String</td>
<td>Optional</td>
<td>The key state as defined by NIST SP 800-57.</td>
</tr>
<tr>
<td>algorithmRef</td>
<td>String</td>
<td>Optional</td>
<td>The bom-ref to the algorithm used to generate the related cryptographic material.</td>
</tr>
<tr>
<td>creationDate</td>
<td>String</td>
<td>Optional</td>
<td>The date and time (timestamp) when the related cryptographic material was created.</td>
</tr>
<tr>
<td>activationDate</td>
<td>String</td>
<td>Optional</td>
<td>The date and time (timestamp) when the related cryptographic material was activated.</td>
</tr>
<tr>
<td>updateDate</td>
<td>String</td>
<td>Optional</td>
<td>The date and time (timestamp) when the related cryptographic material was updated.</td>
</tr>
<tr>
<td>expirationDate</td>
<td>String</td>
<td>Optional</td>
<td>The date and time (timestamp) when the related cryptographic material expires.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The associated value of the cryptographic material.</td>
</tr>
<tr>
<td>size</td>
<td>Integer</td>
<td>Optional</td>
<td>The size of the cryptographic asset (in bits).</td>
</tr>
<tr>
<td>format</td>
<td>String</td>
<td>Optional</td>
<td>The format of the related cryptographic material (e.g. P8, PEM, DER).</td>
</tr>
<tr>
<td>securedBy</td>
<td>Object</td>
<td>Optional</td>
<td>The mechanism by which the cryptographic asset is secured by.</td>
</tr>
</tbody>
</table>

8.1.34.4.1 relatedCryptoMaterialType

Location: /components/[]/cryptoProperties/relatedCryptoMaterialProperties/type
Property: type (Optional)
**Type:** String

**Description:** The type for the related cryptographic material

### Table 184 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>private-key</td>
<td>The confidential key of a key pair used in asymmetric cryptography.</td>
</tr>
<tr>
<td>public-key</td>
<td>The non-confidential key of a key pair used in asymmetric cryptography.</td>
</tr>
<tr>
<td>secret-key</td>
<td>A key used to encrypt and decrypt messages in symmetric cryptography.</td>
</tr>
<tr>
<td>key</td>
<td>A piece of information, usually an octet string, which, when processed through a cryptographic algorithm, processes cryptographic data.</td>
</tr>
<tr>
<td>ciphertext</td>
<td>The result of encryption performed on plaintext using an algorithm (or cipher).</td>
</tr>
<tr>
<td>signature</td>
<td>A cryptographic value that is calculated from the data and a key known only by the signer.</td>
</tr>
<tr>
<td>digest</td>
<td>The output of the hash function.</td>
</tr>
<tr>
<td>initialization-vector</td>
<td>A fixed-size random or pseudo-random value used as an input parameter for cryptographic algorithms.</td>
</tr>
<tr>
<td>nonce</td>
<td>A random or pseudo-random number that can only be used once in a cryptographic communication.</td>
</tr>
<tr>
<td>seed</td>
<td>The input to a pseudo-random number generator. Different seeds generate different pseudo-random sequences.</td>
</tr>
<tr>
<td>salt</td>
<td>A value used in a cryptographic process, usually to ensure that the results of computations for one instance cannot be reused by an attacker.</td>
</tr>
<tr>
<td>shared-secret-tag</td>
<td>A piece of data known only to the parties involved, in a secure communication.</td>
</tr>
<tr>
<td>tag</td>
<td>A message authentication code (MAC), sometimes known as an authentication tag, is a short piece of information used for authenticating and integrity-checking a message.</td>
</tr>
<tr>
<td>additional-data</td>
<td>An unspecified collection of data with relevance to cryptographic activity.</td>
</tr>
<tr>
<td>password</td>
<td>A secret word, phrase, or sequence of characters used during authentication or authorization.</td>
</tr>
<tr>
<td>credential</td>
<td>Establishes the identity of a party to communication, usually in the form of cryptographic keys or passwords.</td>
</tr>
<tr>
<td>token</td>
<td>An object encapsulating a security identity.</td>
</tr>
<tr>
<td>other</td>
<td>Another type of cryptographic asset.</td>
</tr>
<tr>
<td>unknown</td>
<td>The type of cryptographic asset is not known.</td>
</tr>
</tbody>
</table>

### 8.1.34.4.2 ID

**Location:** /components/[]/cryptoProperties/relatedCryptoMaterialProperties/id
Property: id (Optional)

Type: String

Description: The optional unique identifier for the related cryptographic material.

8.1.34.4.3 State

Location: /components/[]/cryptoProperties/relatedCryptoMaterialProperties/state

Property: state (Optional)

Type: String

Description: The key state as defined by NIST SP 800-57.

Enumeration: Must be one of:
- pre-activation
- active
- suspended
- deactivated
- compromised
- destroyed

8.1.34.4.4 Algorithm Reference

Location: /components/[]/cryptoProperties/relatedCryptoMaterialProperties/algorithmRef

Property: algorithmRef (Optional)

Type: String

Description: The bom-ref to the algorithm used to generate the related cryptographic material.

8.1.34.4.5 Creation Date

Location: /components/[]/cryptoProperties/relatedCryptoMaterialProperties/creationDate

Property: creationDate (Optional)

Type: String

Format: data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)

Description: The date and time (timestamp) when the related cryptographic material was created.

8.1.34.4.6 Activation Date

Location: /components/[]/cryptoProperties/relatedCryptoMaterialProperties/activationDate

Property: activationDate (Optional)

Type: String

Format: data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)

Description: The date and time (timestamp) when the related cryptographic material was activated.

8.1.34.4.7 Update Date

Location: /components/[]/cryptoProperties/relatedCryptoMaterialProperties/updateDate

Property: updateDate (Optional)

Type: String

Format: data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)

Description: The date and time (timestamp) when the related cryptographic material was updated.
8.1.34.4.8 Expiration Date

**Location:** /components/[]/cryptoProperties/relatedCryptoMaterialProperties/expirationDate

**Property:** expirationDate (Optional)

**Type:** String

**Format:** data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)

**Description:** The date and time (timestamp) when the related cryptographic material expires.

8.1.34.4.9 Value

**Location:** /components/[]/cryptoProperties/relatedCryptoMaterialProperties/value

**Property:** value (Optional)

**Type:** String

**Description:** The associated value of the cryptographic material.

8.1.34.4.10 Size

**Location:** /components/[]/cryptoProperties/relatedCryptoMaterialProperties/size

**Property:** size (Optional)

**Type:** Integer

**Description:** The size of the cryptographic asset (in bits).

8.1.34.4.11 Format

**Location:** /components/[]/cryptoProperties/relatedCryptoMaterialProperties/format

**Property:** format (Optional)

**Type:** String

**Description:** The format of the related cryptographic material (e.g. P8, PEM, DER).

8.1.34.4.12 Secured By

**Location:** /components/[]/cryptoProperties/relatedCryptoMaterialProperties/securedBy

**Property:** securedBy (Optional)

**Type:** Object

**Description:** The mechanism by which the cryptographic asset is secured by.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>mechanism</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the mechanism by which the cryptographic asset is secured by.</td>
</tr>
<tr>
<td>algorithmRef</td>
<td>String</td>
<td>Optional</td>
<td>The bom-ref to the algorithm.</td>
</tr>
</tbody>
</table>

8.1.34.4.13 Mechanism

**Location:** /components/[]/cryptoProperties/relatedCryptoMaterialProperties/securedBy/mechanism

**Property:** mechanism (Optional)

**Type:** String

**Description:** Specifies the mechanism by which the cryptographic asset is secured by.
Examples:
- HSM
- TPM
- SGX
- Software
- None

8.1.34.4.14 Algorithm Reference

Location: /components/[]/cryptoProperties/relatedCryptoMaterialProperties/securedBy/algorithnRef

Property: algorithmRef (Optional)

Type: String

Description: The bom-ref to the algorithm.

8.1.34.5 Protocol Properties

Location: /components/[]/cryptoProperties/protocolProperties

Property: protocolProperties (Optional)

Type: Object

Description: Properties specific to cryptographic assets of type: protocol.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>type</td>
<td>String</td>
<td>Optional</td>
<td>The concrete protocol type.</td>
</tr>
<tr>
<td>version</td>
<td>String</td>
<td>Optional</td>
<td>The version of the protocol.</td>
</tr>
<tr>
<td>cipherSuites</td>
<td>Array</td>
<td>Optional</td>
<td>A list of cipher suites related to the protocol.</td>
</tr>
<tr>
<td>ikev2TransformTypes</td>
<td>Object</td>
<td>Optional</td>
<td>The IKEv2 transform types supported (types 1-4), defined in RFC 7296 section 3.3.2, and additional properties.</td>
</tr>
<tr>
<td>cryptoRefArray</td>
<td>Array</td>
<td>Optional</td>
<td>A list of protocol-related cryptographic assets</td>
</tr>
</tbody>
</table>

8.1.34.5.1 Type

Location: /components/[]/cryptoProperties/protocolProperties/type

Property: type (Optional)

Type: String

Description: The concrete protocol type.
Table 187 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>tls</td>
<td>Transport Layer Security</td>
</tr>
<tr>
<td>ssh</td>
<td>Secure Shell</td>
</tr>
<tr>
<td>ipsec</td>
<td>Internet Protocol Security</td>
</tr>
<tr>
<td>ike</td>
<td>Internet Key Exchange</td>
</tr>
<tr>
<td>sstp</td>
<td>Secure Socket Tunnelling Protocol</td>
</tr>
<tr>
<td>wpa</td>
<td>Wi-Fi Protected Access</td>
</tr>
<tr>
<td>other</td>
<td>Another protocol type</td>
</tr>
<tr>
<td>unknown</td>
<td>The protocol type is not known</td>
</tr>
</tbody>
</table>

8.1.34.5.2 Protocol Version

Location: /components/[]/cryptoProperties/protocolProperties/version

Property: version (Optional)

Type: String

Description: The version of the protocol.

Examples:
- 1.0
- 1.2
- 1.99

8.1.34.5.3 Cipher Suites

Location: /components/[]/cryptoProperties/protocolProperties/cipherSuites

Property: cipherSuites (Optional)

Type: Array

Description: A list of cipher suites related to the protocol. Each item of this array must be a Cipher Suite object.

8.1.34.5.4 Cipher Suite

Location: /components/[]/cryptoProperties/protocolProperties/cipherSuites/[]

Type: Object

Description: Object representing a cipher suite
Table 188 – Properties for the cipherSuites object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>A common name for the cipher suite.</td>
</tr>
<tr>
<td>algorithms</td>
<td>Array</td>
<td>Optional</td>
<td>A list of algorithms related to the cipher suite.</td>
</tr>
<tr>
<td>identifiers</td>
<td>Array</td>
<td>Optional</td>
<td>A list of common identifiers for the cipher suite.</td>
</tr>
</tbody>
</table>

8.1.34.5.5 Common Name

**Location:** /components/[]/cryptoProperties/protocolProperties/cipherSuites/[]/name

**Property:** name (Optional)

**Type:** String

**Description:** A common name for the cipher suite.

**Examples:**
- TLS_DHE_RSA_WITH_AES_128_CCM

8.1.34.5.6 Related Algorithms

**Location:** /components/[]/cryptoProperties/protocolProperties/cipherSuites/[]/algorithms

**Property:** algorithms (Optional)

**Type:** array (of String)

**Description:** A list of algorithms related to the cipher suite. The bom-ref to algorithm cryptographic asset. Each item of this array must be a string.

8.1.34.5.7 Cipher Suite Identifiers

**Location:** /components/[]/cryptoProperties/protocolProperties/cipherSuites/[]/identifiers

**Property:** identifiers (Optional)

**Type:** array (of String)

**Description:** A list of common identifiers for the cipher suite. Cipher suite identifier Each item of this array must be a string.

**Examples:**
- 0xC0
- 0x9E

8.1.34.5.8 IKEv2 Transform Types

**Location:** /components/[]/cryptoProperties/protocolProperties/ikev2TransformTypes

**Property:** ikev2TransformTypes (Optional)

**Type:** Object

**Description:** The IKEv2 transform types supported (types 1-4), defined in [RFC 7296 section 3.3.2](https://tools.ietf.org/html/rfc7296#section-3.3.2), and additional properties.
Table 189 – Properties for the ikev2TransformTypes object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>encr</td>
<td>Array</td>
<td>Optional</td>
<td>Transform Type 1: encryption algorithms</td>
</tr>
<tr>
<td>prf</td>
<td>Array</td>
<td>Optional</td>
<td>Transform Type 2: pseudorandom functions</td>
</tr>
<tr>
<td>integ</td>
<td>Array</td>
<td>Optional</td>
<td>Transform Type 3: integrity algorithms</td>
</tr>
<tr>
<td>ke</td>
<td>Array</td>
<td>Optional</td>
<td>Transform Type 4: Key Exchange Method (KE) per RFC 9370, formerly called Diffie-Hellman Group (D-H).</td>
</tr>
<tr>
<td>esn</td>
<td>Boolean</td>
<td>Optional</td>
<td>Specifies if an Extended Sequence Number (ESN) is used.</td>
</tr>
<tr>
<td>auth</td>
<td>Array</td>
<td>Optional</td>
<td>IKEv2 Authentication method</td>
</tr>
</tbody>
</table>

8.1.34.5.9   Encryption Algorithm (ENCR)

**Location:** /components [[]/cryptoProperties/protocolProperties/ikev2TransformTypes/encr
**Property:** encr (Optional)

**Type:** array (of String)

**Description:** Transform Type 1: encryption algorithms Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links. Each item of this array must be a string.

8.1.34.5.10   Pseudorandom Function (PRF)

**Location:** /components [[]/cryptoProperties/protocolProperties/ikev2TransformTypes/prf
**Property:** prf (Optional)

**Type:** array (of String)

**Description:** Transform Type 2: pseudorandom functions Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links. Each item of this array must be a string.

8.1.34.5.11   Integrity Algorithm (INTEG)

**Location:** /components [[]/cryptoProperties/protocolProperties/ikev2TransformTypes/integ
**Property:** integ (Optional)

**Type:** array (of String)

**Description:** Transform Type 3: integrity algorithms Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links. Each item of this array must be a string.

8.1.34.5.12   Key Exchange Method (KE)

**Location:** /components [[]/cryptoProperties/protocolProperties/ikev2TransformTypes/ke
**Property:** ke (Optional)

**Type:** array (of String)

**Description:** Transform Type 4: Key Exchange Method (KE) per RFC 9370, formerly called Diffie-Hellman Group (D-H). Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links. Each item of this array must be a string.
8.1.34.5.13 Extended Sequence Numbers (ESN)
Location: /components/[]/cryptoProperties/protocolProperties/ikev2TransformTypes/esn
Property: esn (Optional)
Type: Boolean
Description: Specifies if an Extended Sequence Number (ESN) is used.

8.1.34.5.14 IKEv2 Authentication method
Location: /components/[]/cryptoProperties/protocolProperties/ikev2TransformTypes/auth
Property: auth (Optional)
Type: array (of String)
Description: IKEv2 Authentication method Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links. Each item of this array must be a string.

8.1.34.5.15 Cryptographic References
Location: /components/[]/cryptoProperties/protocolProperties/cryptoRefArray
Property: cryptoRefArray (Optional)
Type: array (of String)
Description: A list of protocol-related cryptographic assets Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links. Each item of this array must be a string.

8.1.34.6 OID
Location: /components/[]/cryptoProperties/oid
Property: oid (Optional)
Type: String
Description: The object identifier (OID) of the cryptographic asset.

8.1.35 Properties
Location: /components/[]/properties
Property: properties (Optional)
Type: Array
Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

8.1.35.1 Lightweight name-value pair
Location: /components/[]/properties/[]
Type: Object
Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.
Table 190 – Properties for the properties object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

8.1.35.1.1 Name

Location: /components/[]/properties/[]/name
Property: name (Required)

Type: String
Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

8.1.35.1.2 Value

Location: /components/[]/properties/[]/value
Property: value (Optional)

Type: String
Description: The value of the property.

8.1.36 Tags

Location: /components/[]/tags
Property: tags (Optional)

Type: array (of String)
Description: Textual strings that aid in discovery, search, and retrieval of the associated object. Tags often serve as a way to group or categorize similar or related objects by various attributes. Each item of this array must be a string.

Examples:
- json-parser
- object-persistence
- text-to-image
- translation
- object-detection

8.1.37 Signature

Location: /components/[]/signature
Property: signature (Optional)

Type: Object
Description: An enveloped digital signature embedded within and specific to this object within the BOM. CycloneDX signatures enable integrity and authenticity verification without separating the signature from the BOM. Enveloped signatures enable each party in the supply chain to take responsibility for and sign their specific data, ensuring its integrity and authenticity. By aggregating all signatures, stakeholders can independently verify discrete pieces of information from each provider, enhancing overall transparency and trust in the supply chain.

Reference: Refer to the JSON Signature Format specification or to the XML Signature specification for implementation details.
9 Services

Location: /services
Property: services (Optional)

Type: Array

Description: A list of services. This may include microservices, function-as-a-service, and other types of network or intra-process services. Each item of this array must be a Service object.

9.1 Service

Location: /services/[

Type: Object

Table 191 – Properties for the services object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>provider</td>
<td>Object</td>
<td>Optional</td>
<td>The organization that provides the service.</td>
</tr>
<tr>
<td>group</td>
<td>String</td>
<td>Optional</td>
<td>The grouping name, namespace, or identifier. This will often be a shortened, single name of the company or project that produced the service or domain name. Whitespace and special characters should be avoided.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the service. This will often be a shortened, single name of the service.</td>
</tr>
<tr>
<td>version</td>
<td>String</td>
<td>Optional</td>
<td>The service version.</td>
</tr>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>Specifies a description for the service</td>
</tr>
<tr>
<td>endpoints</td>
<td>Array</td>
<td>Optional</td>
<td>The endpoint URIs of the service. Multiple endpoints are allowed.</td>
</tr>
<tr>
<td>authenticated</td>
<td>Boolean</td>
<td>Optional</td>
<td>A boolean value indicating if the service requires authentication. A value of true indicates the service requires authentication prior to use. A value of false indicates the service does not require authentication.</td>
</tr>
<tr>
<td>x-trust-boundary</td>
<td>Boolean</td>
<td>Optional</td>
<td>A boolean value indicating if use of the service crosses a trust zone or boundary. A value of true indicates that by using the service, a trust boundary is crossed. A value of false indicates that by using the service, a trust boundary is not crossed.</td>
</tr>
<tr>
<td>trustZone</td>
<td>String</td>
<td>Optional</td>
<td>The name of the trust zone the service resides in.</td>
</tr>
<tr>
<td>data</td>
<td>Array</td>
<td>Optional</td>
<td>Specifies information about the data including the directional flow of data and the data classification.</td>
</tr>
<tr>
<td>Property</td>
<td>Type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>---------------</td>
<td>-----------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td>licenses</td>
<td>Array</td>
<td>Optional</td>
<td>EITHER (list of SPDX licenses and/or named licenses) OR (tuple of one SPDX License Expression)</td>
</tr>
<tr>
<td>externalReferences</td>
<td>Array</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
<tr>
<td>services</td>
<td>Array</td>
<td>Optional</td>
<td>A list of services included or deployed behind the parent service. This is not a dependency tree. It provides a way to specify a hierarchical representation of service assemblies.</td>
</tr>
<tr>
<td>releaseNotes</td>
<td>Object</td>
<td>Optional</td>
<td>Specifies optional release notes.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the <a href="https://www.cyclonedx.org/taxonomy">CycloneDX Property Taxonomy</a>. Formal registration is optional.</td>
</tr>
<tr>
<td>tags</td>
<td>Array</td>
<td>Optional</td>
<td>Textual strings that aid in discovery, search, and retrieval of the associated object. Tags often serve as a way to group or categorize similar or related objects by various attributes.</td>
</tr>
<tr>
<td>signature</td>
<td>Array</td>
<td>Optional</td>
<td>Enveloped signature in <a href="https://www.jsonwebtoken.io/">JSON Signature Format (JSF)</a>.</td>
</tr>
</tbody>
</table>

### 9.1.1 BOM Reference

**Location:** /services[/]/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

### 9.1.2 Provider

**Location:** /services[/]/provider

**Property:** provider (Optional)

**Type:** Object

**Description:** The organization that provides the service.
### Table 192 – Properties for the provider object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the organization</td>
</tr>
<tr>
<td>address</td>
<td>Object</td>
<td>Optional</td>
<td>The physical address (location) of the organization</td>
</tr>
<tr>
<td>url</td>
<td>Array</td>
<td>Optional</td>
<td>The URL of the organization. Multiple URLs are allowed.</td>
</tr>
<tr>
<td>contact</td>
<td>Array</td>
<td>Optional</td>
<td>A contact at the organization. Multiple contacts are allowed.</td>
</tr>
</tbody>
</table>

#### 9.1.2.1 BOM Reference

**Location:** /services/ provider/bom-ref  
**Property:** bom-ref (Optional)  
**Type:** String  
**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

#### 9.1.2.2 Organization Name

**Location:** /services/ provider/name  
**Property:** name (Optional)  
**Type:** String  
**Description:** The name of the organization  
**Examples:**  
- Example Inc.

#### 9.1.2.3 Organization Address

**Location:** /services/ provider/address  
**Property:** address (Optional)  
**Type:** Object  
**Description:** The physical address (location) of the organization

### Table 193 – Properties for the address object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>Optional</td>
<td>The country name or the two-letter ISO 3166-1 country code.</td>
</tr>
<tr>
<td>Property</td>
<td>Type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>----------------</td>
<td>---------</td>
<td>-------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>region</td>
<td>String</td>
<td>Optional</td>
<td>The region or state in the country.</td>
</tr>
<tr>
<td>locality</td>
<td>String</td>
<td>Optional</td>
<td>The locality or city within the country.</td>
</tr>
<tr>
<td>postOfficeBoxNumber</td>
<td>String</td>
<td>Optional</td>
<td>The post office box number.</td>
</tr>
<tr>
<td>postalCode</td>
<td>String</td>
<td>Optional</td>
<td>The postal code.</td>
</tr>
<tr>
<td>streetAddress</td>
<td>String</td>
<td>Optional</td>
<td>The street address.</td>
</tr>
</tbody>
</table>

9.1.2.3.1 BOM Reference

Location: /services/\[\]/provider/address/bom-ref
Property: bom-ref (Optional)

Type: String
Description: An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

9.1.2.3.2 Country

Location: /services/\[\]/provider/address/country
Property: country (Optional)

Type: String
Description: The country name or the two-letter ISO 3166-1 country code.

9.1.2.3.3 Region

Location: /services/\[\]/provider/address/region
Property: region (Optional)

Type: String
Description: The region or state in the country.
Examples:
- Texas

9.1.2.3.4 Locality

Location: /services/\[\]/provider/address/locality
Property: locality (Optional)

Type: String
Description: The locality or city within the country.
Examples:
- Austin

9.1.2.3.5 Post Office Box Number

Location: /services/\[\]/provider/address/postOfficeBoxNumber
Property: postOfficeBoxNumber (Optional)
Type: String
Description: The post office box number.
Examples:
  • 901

9.1.2.3.6 Postal Code
Location: /services/[]/provider/address/postalCode
Property: postalCode (Optional)
Type: String
Description: The postal code.
Examples:
  • 78758

9.1.2.3.7 Street Address
Location: /services/[]/provider/address/streetAddress
Property: streetAddress (Optional)
Type: String
Description: The street address.
Examples:
  • 100 Main Street

9.1.2.4 Organization URL(s)
Location: /services/[]/provider/url
Property: url (Optional)
Type: array (of String)
Description: The URL of the organization. Multiple URLs are allowed. Each item of this array must be a string.
Examples:
  • https://example.com

9.1.2.5 Organizational Contact
Location: /services/[]/provider/contact
Property: contact (Optional)
Type: Array
Description: A contact at the organization. Multiple contacts are allowed. Each item of this array must be an Organizational Contact object.

9.1.2.5.1 Organizational Contact
Location: /services/[]/provider/contact/[]
Type: Object
Table 194 – Properties for the contact object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:;' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

9.1.2.5.2 BOM Reference

**Location:** /services/[]/provider/contact/[]/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:;' to avoid conflicts with BOM-Links.

9.1.2.5.3 Name

**Location:** /services/[]/provider/contact/[]/name

**Property:** name (Optional)

**Type:** String

**Description:** The name of a contact

**Examples:**
- Contact name

9.1.2.5.4 Email Address

**Location:** /services/[]/provider/contact/[]/email

**Property:** email (Optional)

**Type:** String

**Format:** idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

**Description:** The email address of the contact.

**Examples:**
- firstname.lastname@example.com

9.1.2.5.5 Phone

**Location:** /services/[]/provider/contact/[]/phone

**Property:** phone (Optional)

**Type:** String

**Description:** The phone number of the contact.

**Examples:**
- 800-555-1212
9.1.3 Service Group

Location: /services/[i]/group
Property: group (Optional)

Type: String

Description: The grouping name, namespace, or identifier. This will often be a shortened, single name of the company or project that produced the service or domain name. Whitespace and special characters should be avoided.

Examples:
- com.acme

9.1.4 Service Name

Location: /services/[i]/name
Property: name (Required)

Type: String

Description: The name of the service. This will often be a shortened, single name of the service.

Examples:
- ticker-service

9.1.5 Service Version

Location: /services/[i]/version
Property: version (Optional)

Type: String

Description: The service version.

Examples:
- 9.0.14
- v1.33.7
- 7.0.0-M1
- 2.0pre1
- 1.0.0-beta1
- 0.8.15

9.1.6 Service Description

Location: /services/[i]/description
Property: description (Optional)

Type: String

Description: Specifies a description for the service

9.1.7 Endpoints

Location: /services/[i]/endpoints
Property: endpoints (Optional)

Type: array (of String)

Description: The endpoint URIs of the service. Multiple endpoints are allowed. Each item of this array must be a string.

Examples:
- https://example.com/api/v1/ticker

9.1.8 Authentication Required

Location: /services/[]/authenticated

Property: authenticated (Optional)

Type: Boolean

Description: A boolean value indicating if the service requires authentication. A value of true indicates the service requires authentication prior to use. A value of false indicates the service does not require authentication.

9.1.9 Crosses Trust Boundary

Location: /services/[]/x-trust-boundary

Property: x-trust-boundary (Optional)

Type: Boolean

Description: A boolean value indicating if use of the service crosses a trust zone or boundary. A value of true indicates that by using the service, a trust boundary is crossed. A value of false indicates that by using the service, a trust boundary is not crossed.

9.1.10 Trust Zone

Location: /services/[]/trustZone

Property: trustZone (Optional)

Type: String

Description: The name of the trust zone the service resides in.

9.1.11 Data

Location: /services/[]/data

Property: data (Optional)

Type: Array

Description: Specifies information about the data including the directional flow of data and the data classification. Each item of this array must be a Hash Objects object.

9.1.11.1 Hash Objects

Location: /services/[]/data/[]

Type: Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>flow</td>
<td>String</td>
<td>Required</td>
<td>Specifies the flow direction of the data. Direction is relative to the service. Inbound flow states that data enters the service. Outbound flow states that data leaves the service. Bi-directional states that data flows both ways and unknown states that the direction is not known.</td>
</tr>
<tr>
<td>classification</td>
<td>String</td>
<td>Required</td>
<td>Data classification tags data according to its type, sensitivity, and value if altered, stolen, or destroyed.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>Name for the defined data</td>
</tr>
<tr>
<td>Property</td>
<td>Type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>----------</td>
<td>----------------</td>
<td>--------------------------------------------------------------</td>
</tr>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>Short description of the data content and usage</td>
</tr>
<tr>
<td>governance</td>
<td>Object</td>
<td>Optional</td>
<td>Data governance captures information regarding data ownership,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>stewardship, and custodianship, providing insights into the</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>individuals or entities responsible for managing, overseeing,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>and safeguarding the data throughout its lifecycle.</td>
</tr>
<tr>
<td>source</td>
<td>Array</td>
<td>Optional</td>
<td>The URI, URL, or BOM-Link of the components or services the</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>data came in from</td>
</tr>
<tr>
<td>destination</td>
<td>Array</td>
<td>Optional</td>
<td>The URI, URL, or BOM-Link of the components or services the</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>data is sent to</td>
</tr>
</tbody>
</table>

### 9.1.11.1 Directional Flow

**Location:** /services/[]/data/[]/flow  
**Property:** flow (Required)

**Type:** String  
**Description:** Specifies the flow direction of the data. Direction is relative to the service. Inbound flow states that data enters the service. Outbound flow states that data leaves the service. Bi-directional states that data flows both ways and unknown states that the direction is not known.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>inbound</td>
<td>Data that enters a service.</td>
</tr>
<tr>
<td>outbound</td>
<td>Data that exits a service.</td>
</tr>
<tr>
<td>bi-directional</td>
<td>Data flows in and out of the</td>
</tr>
<tr>
<td>unknown</td>
<td>The directional flow of data is</td>
</tr>
<tr>
<td></td>
<td>not known.</td>
</tr>
</tbody>
</table>

### 9.1.11.2 Data Classification

**Location:** /services/[]/data/[]/classification  
**Property:** classification (Required)

**Type:** String  
**Description:** Data classification tags data according to its type, sensitivity, and value if altered, stolen, or destroyed.

### 9.1.11.3 Name

**Location:** /services/[]/data/[]/name  
**Property:** name (Optional)

**Type:** String  
**Description:** Name for the defined data
Examples:
  • Credit card reporting

9.1.11.1.4 Description

Location: /services/[]/data/[]/description
Property: description (Optional)

Type: String
Description: Short description of the data content and usage
Examples:
  • Credit card information being exchanged in between the web app and the database

9.1.11.1.5 Data Governance

Location: /services/[]/data/[]/governance
Property: governance (Optional)

Type: Object
Description: Data governance captures information regarding data ownership, stewardship, and custodianship, providing insights into the individuals or entities responsible for managing, overseeing, and safeguarding the data throughout its lifecycle.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>custodians</td>
<td>Array</td>
<td>Optional</td>
<td>Data custodians are responsible for the safe custody, transport, and storage of data.</td>
</tr>
<tr>
<td>stewards</td>
<td>Array</td>
<td>Optional</td>
<td>Data stewards are responsible for data content, context, and associated business rules.</td>
</tr>
<tr>
<td>owners</td>
<td>Array</td>
<td>Optional</td>
<td>Data owners are concerned with risk and appropriate access to data.</td>
</tr>
</tbody>
</table>

9.1.11.1.6 Data Custodians

Location: /services/[]/data/[]/governance/custodians
Property: custodians (Optional)

Type: Array
Description: Data custodians are responsible for the safe custody, transport, and storage of data.

Location: /services/[]/data/[]/governance/custodians/[]

Type: Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>organization</td>
<td>Object</td>
<td>Optional</td>
<td>The organization that is responsible for specific data governance role(s).</td>
</tr>
<tr>
<td>contact</td>
<td>Object</td>
<td>Optional</td>
<td>The individual that is responsible for specific data governance role(s).</td>
</tr>
</tbody>
</table>
9.1.11.1.7 Organization

Location: /services[/]/data[/]/governance/custodians[/]/organization

Property: organization (Optional)

Type: Object

Description: The organization that is responsible for specific data governance role(s).

Table 199 – Properties for the organization object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the organization</td>
</tr>
<tr>
<td>address</td>
<td>Object</td>
<td>Optional</td>
<td>The physical address (location) of the organization</td>
</tr>
<tr>
<td>url</td>
<td>Array</td>
<td>Optional</td>
<td>The URL of the organization. Multiple URLs are allowed.</td>
</tr>
<tr>
<td>contact</td>
<td>Array</td>
<td>Optional</td>
<td>A contact at the organization. Multiple contacts are allowed.</td>
</tr>
</tbody>
</table>

9.1.11.1.8 BOM Reference

Location: /services[/]/data[/]/governance/custodians[/]/organization/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

9.1.11.1.9 Organization Name

Location: /services[/]/data[/]/governance/custodians[/]/organization/name

Property: name (Optional)

Type: String

Description: The name of the organization

Examples:

- Example Inc.

9.1.11.1.10 Organization Address

Location: /services[/]/data[/]/governance/custodians[/]/organization/address

Property: address (Optional)

Type: Object

Description: The physical address (location) of the organization
Table 200 – Properties for the address object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>Optional</td>
<td>The country name or the two-letter ISO 3166-1 country code.</td>
</tr>
<tr>
<td>region</td>
<td>String</td>
<td>Optional</td>
<td>The region or state in the country.</td>
</tr>
<tr>
<td>locality</td>
<td>String</td>
<td>Optional</td>
<td>The locality or city within the country.</td>
</tr>
<tr>
<td>postOfficeBoxNumber</td>
<td>String</td>
<td>Optional</td>
<td>The post office box number.</td>
</tr>
<tr>
<td>postalCode</td>
<td>String</td>
<td>Optional</td>
<td>The postal code.</td>
</tr>
<tr>
<td>streetAddress</td>
<td>String</td>
<td>Optional</td>
<td>The street address.</td>
</tr>
</tbody>
</table>

9.1.11.1.11 BOM Reference

Location: /services[/data[/governance/custodians[/organization/address/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

9.1.11.1.12 Country

Location: /services[/data[/governance/custodians[/organization/address/country

Property: country (Optional)

Type: String

Description: The country name or the two-letter ISO 3166-1 country code.

9.1.11.1.13 Region

Location: /services[/data[/governance/custodians[/organization/address/region

Property: region (Optional)

Type: String

Description: The region or state in the country.

Examples:
- Texas

9.1.11.1.14 Locality

Location: /services[/data[/governance/custodians[/organization/address/locality

Property: locality (Optional)

Type: String

Description: The locality or city within the country.
Examples:
- Austin

9.1.11.1.15 Post Office Box Number
Location: /services/[]/data/[]/governance/custodians/[]/organization/address/postOfficeBoxNumber
Property: postOfficeBoxNumber (Optional)
Type: String
Description: The post office box number.
Examples:
- 901

9.1.11.1.16 Postal Code
Location: /services/[]/data/[]/governance/custodians/[]/organization/address/postalCode
Property: postalCode (Optional)
Type: String
Description: The postal code.
Examples:
- 78758

9.1.11.1.17 Street Address
Location: /services/[]/data/[]/governance/custodians/[]/organization/address/streetAddress
Property: streetAddress (Optional)
Type: String
Description: The street address.
Examples:
- 100 Main Street

9.1.11.1.18 Organization URL(s)
Location: /services/[]/data/[]/governance/custodians/[]/organization/url
Property: url (Optional)
Type: array (of String)
Description: The URL of the organization. Multiple URLs are allowed. Each item of this array must be a string.
Examples:
- https://example.com

9.1.11.1.19 Organizational Contact
Location: /services/[]/data/[]/governance/custodians/[]/organization/contact
Property: contact (Optional)
Type: Array
Description: A contact at the organization. Multiple contacts are allowed. Each item of this array must be an Organizational Contact object.

9.1.11.1.20 Organizational Contact
Location: /services/[]/data/[]/governance/custodians/[]/organization/contact/[]
Type: Object

Table 201 – Properties for the contact object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

9.1.11.1.21 BOM Reference

Location: /services/[]/data/[]/governance/custodians/[]/organization/contact/[]/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

9.1.11.1.22 Name

Location: /services/[]/data/[]/governance/custodians/[]/organization/contact/[]/name

Property: name (Optional)

Type: String

Description: The name of a contact

Examples:
- Contact name

9.1.11.1.23 Email Address

Location: /services/[]/data/[]/governance/custodians/[]/organization/contact/[]/email

Property: email (Optional)

Type: String

Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

Description: The email address of the contact.

Examples:
- firstname.lastname@example.com

9.1.11.1.24 Phone

Location: /services/[]/data/[]/governance/custodians/[]/organization/contact/[]/phone

Property: phone (Optional)

Type: String

Description: The phone number of the contact.
Examples:
- 800-555-1212

9.1.11.1.25 Organizational Contact

Location: /services/[]/data/[]/governance/custodians/[]/contact

Property: contact (Optional)

Type: Object

Description: The individual that is responsible for specific data governance role(s).

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

9.1.11.1.26 BOM Reference

Location: /services/[]/data/[]/governance/custodians/[]/contact/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

9.1.11.1.27 Name

Location: /services/[]/data/[]/governance/custodians/[]/contact/name

Property: name (Optional)

Type: String

Description: The name of a contact

Examples:
- Contact name

9.1.11.1.28 Email Address

Location: /services/[]/data/[]/governance/custodians/[]/contact/email

Property: email (Optional)

Type: String

Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

Description: The email address of the contact.

Examples:
- firstname.lastname@example.com
9.1.11.1.29 Phone

**Location:** /services/[]/data/[]/governance/custodians/[]/contact/phone

**Property:** phone (Optional)

**Type:** String

**Description:** The phone number of the contact.

**Examples:**
- 800-555-1212

9.1.11.1.30 Data Stewards

**Location:** /services/[]/data/[]/governance/stewards

**Property:** stewards (Optional)

**Type:** Array

**Description:** Data stewards are responsible for data content, context, and associated business rules.

**Location:** /services/[]/data/[]/governance/stewards/[]

**Type:** Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>organization</td>
<td>Object</td>
<td>Optional</td>
<td>The organization that is responsible for specific data governance role(s).</td>
</tr>
<tr>
<td>contact</td>
<td>Object</td>
<td>Optional</td>
<td>The individual that is responsible for specific data governance role(s).</td>
</tr>
</tbody>
</table>

9.1.11.1.31 Organization

**Location:** /services/[]/data/[]/governance/stewards/[]/organization

**Property:** organization (Optional)

**Type:** Object

**Description:** The organization that is responsible for specific data governance role(s).

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the organization</td>
</tr>
<tr>
<td>address</td>
<td>Object</td>
<td>Optional</td>
<td>The physical address (location) of the organization</td>
</tr>
<tr>
<td>url</td>
<td>Array</td>
<td>Optional</td>
<td>The URL of the organization. Multiple URLs are allowed.</td>
</tr>
<tr>
<td>contact</td>
<td>Array</td>
<td>Optional</td>
<td>A contact at the organization. Multiple contacts are allowed.</td>
</tr>
</tbody>
</table>
9.1.11.1.32 BOM Reference

Location: /services/[]/data/[]/governance/stewards/[]/organization/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

9.1.11.1.33 Organization Name

Location: /services/[]/data/[]/governance/stewards/[]/organization/name

Property: name (Optional)

Type: String

Description: The name of the organization

Examples:
- Example Inc.

9.1.11.1.34 Organization Address

Location: /services/[]/data/[]/governance/stewards/[]/organization/address

Property: address (Optional)

Type: Object

Description: The physical address (location) of the organization

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>Optional</td>
<td>The country name or the two-letter ISO 3166-1 country code.</td>
</tr>
<tr>
<td>region</td>
<td>String</td>
<td>Optional</td>
<td>The region or state in the country.</td>
</tr>
<tr>
<td>locality</td>
<td>String</td>
<td>Optional</td>
<td>The locality or city within the country.</td>
</tr>
<tr>
<td>postOfficeBoxNumber</td>
<td>String</td>
<td>Optional</td>
<td>The post office box number.</td>
</tr>
<tr>
<td>postalCode</td>
<td>String</td>
<td>Optional</td>
<td>The postal code.</td>
</tr>
<tr>
<td>streetAddress</td>
<td>String</td>
<td>Optional</td>
<td>The street address.</td>
</tr>
</tbody>
</table>

9.1.11.1.35 BOM Reference

Location: /services/[]/data/[]/governance/stewards/[]/organization/address/bom-ref

Property: bom-ref (Optional)

Type: String
**Description:** An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

9.1.11.1.36 Country

**Location:** /services/[]/data/[]/governance/stewards/[]/organization/address/country

**Property:** country (Optional)

**Type:** String

**Description:** The country name or the two-letter ISO 3166-1 country code.

9.1.11.1.37 Region

**Location:** /services/[]/data/[]/governance/stewards/[]/organization/address/region

**Property:** region (Optional)

**Type:** String

**Description:** The region or state in the country.

**Examples:**
- Texas

9.1.11.1.38 Locality

**Location:** /services/[]/data/[]/governance/stewards/[]/organization/address/locality

**Property:** locality (Optional)

**Type:** String

**Description:** The locality or city within the country.

**Examples:**
- Austin

9.1.11.1.39 Post Office Box Number

**Location:** /services/[]/data/[]/governance/stewards/[]/organization/address/postOfficeBoxNumber

**Property:** postOfficeBoxNumber (Optional)

**Type:** String

**Description:** The post office box number.

**Examples:**
- 901

9.1.11.1.40 Postal Code

**Location:** /services/[]/data/[]/governance/stewards/[]/organization/address/postalCode

**Property:** postalCode (Optional)

**Type:** String

**Description:** The postal code.

**Examples:**
- 78758

9.1.11.1.41 Street Address

**Location:** /services/[]/data/[]/governance/stewards/[]/organization/address/streetAddress

**Property:** streetAddress (Optional)
Type: String
Description: The street address.
Examples:
  - 100 Main Street

9.1.11.1.42 Organization URL(s)
Location: /services[/data[/governance/stewards/]organization/url
Property: url (Optional)
Type: array (of String)
Description: The URL of the organization. Multiple URLs are allowed. Each item of this array must be a string.
Examples:
  - https://example.com

9.1.11.1.43 Organizational Contact
Location: /services[/data[/governance/stewards/]organization/contact
Property: contact (Optional)
Type: Array
Description: A contact at the organization. Multiple contacts are allowed. Each item of this array must be an Organizational Contact object.

9.1.11.1.44 Organizational Contact
Location: /services[/data[/governance/stewards/]organization/contact/]

Table 206 – Properties for the contact object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

9.1.11.1.45 BOM Reference
Location: /services[/data[/governance/stewards/]organization/contact/]/bom-ref
Property: bom-ref (Optional)
Type: String
Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.
9.1.11.1.46 Name

Location: /services/[][]/data/[][]/governance/stewards/[][]/organization/contact/[][]/name

Property: name (Optional)

Type: String

Description: The name of a contact

Examples:
- Contact name

9.1.11.1.47 Email Address

Location: /services/[][]/data/[][]/governance/stewards/[][]/organization/contact/[][]/email

Property: email (Optional)

Type: String

Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

Description: The email address of the contact.

Examples:
- firstname.lastname@example.com

9.1.11.1.48 Phone

Location: /services/[][]/data/[][]/governance/stewards/[][]/organization/contact/[][]/phone

Property: phone (Optional)

Type: String

Description: The phone number of the contact.

Examples:
- 800-555-1212

9.1.11.1.49 Organizational Contact

Location: /services/[][]/data/[][]/governance/stewards/[][]/contact

Property: contact (Optional)

Type: Object

Description: The individual that is responsible for specific data governance role(s).

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro &quot;urn:cdx:&quot; to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>
9.1.11.1.50 BOM Reference

Location: /services/]/data/]/governance/stewards/]/contact/bom-ref
Property: bom-ref (Optional)

Type: String
Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

9.1.11.1.51 Name

Location: /services/]/data/]/governance/stewards/]/contact/name
Property: name (Optional)

Type: String
Description: The name of a contact
Examples:
- Contact name

9.1.11.1.52 Email Address

Location: /services/]/data/]/governance/stewards/]/contact/email
Property: email (Optional)

Type: String
Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)
Description: The email address of the contact.
Examples:
- firstname.lastname@example.com

9.1.11.1.53 Phone

Location: /services/]/data/]/governance/stewards/]/contact/phone
Property: phone (Optional)

Type: String
Description: The phone number of the contact.
Examples:
- 800-555-1212

9.1.11.1.54 Data Owners

Location: /services/]/data/]/governance/owners
Property: owners (Optional)

Type: Array
Description: Data owners are concerned with risk and appropriate access to data.
Location: /services/]/data/]/governance/owners/]
Type: Object
Table 208 – Properties for the owners object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>organization</td>
<td>Object</td>
<td>Optional</td>
<td>The organization that is responsible for specific data governance role(s).</td>
</tr>
<tr>
<td>contact</td>
<td>Object</td>
<td>Optional</td>
<td>The individual that is responsible for specific data governance role(s).</td>
</tr>
</tbody>
</table>

9.1.11.1.55 Organization

Location: /services/[]/data/[]/governance/owners/[]/organization

Property: organization (Optional)

Type: Object

Description: The organization that is responsible for specific data governance role(s).

Table 209 – Properties for the organization object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the organization</td>
</tr>
<tr>
<td>address</td>
<td>Object</td>
<td>Optional</td>
<td>The physical address (location) of the organization</td>
</tr>
<tr>
<td>url</td>
<td>Array</td>
<td>Optional</td>
<td>The URL of the organization. Multiple URLs are allowed.</td>
</tr>
<tr>
<td>contact</td>
<td>Array</td>
<td>Optional</td>
<td>A contact at the organization. Multiple contacts are allowed.</td>
</tr>
</tbody>
</table>

9.1.11.1.56 BOM Reference

Location: /services/[]/data/[]/governance/owners/[]/organization/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

9.1.11.1.57 Organization Name

Location: /services/[]/data/[]/governance/owners/[]/organization/name

Property: name (Optional)

Type: String

Description: The name of the organization

Examples:
- Example Inc.

9.1.11.1.58 Organization Address

Location: /services/[]/data/[]/governance/owners/[]/organization/address
**Property:** address (Optional)

**Type:** Object

**Description:** The physical address (location) of the organization

### Table 210 – Properties for the address object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>Optional</td>
<td>The country name or the two-letter ISO 3166-1 country code.</td>
</tr>
<tr>
<td>region</td>
<td>String</td>
<td>Optional</td>
<td>The region or state in the country.</td>
</tr>
<tr>
<td>locality</td>
<td>String</td>
<td>Optional</td>
<td>The locality or city within the country.</td>
</tr>
<tr>
<td>postOfficeBoxNumber</td>
<td>String</td>
<td>Optional</td>
<td>The post office box number.</td>
</tr>
<tr>
<td>postalCode</td>
<td>String</td>
<td>Optional</td>
<td>The postal code.</td>
</tr>
<tr>
<td>streetAddress</td>
<td>String</td>
<td>Optional</td>
<td>The street address.</td>
</tr>
</tbody>
</table>

**9.1.11.1.59 BOM Reference**

**Location:** /services[/]/data[/]/governance/owners[/]/organization/address/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

**9.1.11.1.60 Country**

**Location:** /services[/]/data[/]/governance/owners[/]/organization/address/country

**Property:** country (Optional)

**Type:** String

**Description:** The country name or the two-letter ISO 3166-1 country code.

**9.1.11.1.61 Region**

**Location:** /services[/]/data[/]/governance/owners[/]/organization/address/region

**Property:** region (Optional)

**Type:** String

**Description:** The region or state in the country.

**Examples:**
- Texas
9.1.11.1.62 Locality

Location: /services/[]/data/[]/governance/owners/[]/organization/address/locality

Property: locality (Optional)

Type: String

Description: The locality or city within the country.

Examples:
- Austin

9.1.11.1.63 Post Office Box Number

Location: /services/[]/data/[]/governance/owners/[]/organization/address/postOfficeBoxNumber

Property: postOfficeBoxNumber (Optional)

Type: String

Description: The post office box number.

Examples:
- 901

9.1.11.1.64 Postal Code

Location: /services/[]/data/[]/governance/owners/[]/organization/address/postalCode

Property: postalCode (Optional)

Type: String

Description: The postal code.

Examples:
- 78758

9.1.11.1.65 Street Address

Location: /services/[]/data/[]/governance/owners/[]/organization/address/streetAddress

Property: streetAddress (Optional)

Type: String

Description: The street address.

Examples:
- 100 Main Street

9.1.11.1.66 Organization URL(s)

Location: /services/[]/data/[]/governance/owners/[]/organization/url

Property: url (Optional)

Type: array (of String)


Description: The URL of the organization. Multiple URLs are allowed. Each item of this array must be a string.

Examples:
- https://example.com

9.1.11.1.67 Organizational Contact

Location: /services/[]/data/[]/governance/owners/[]/organization/contact
Property: contact (Optional)

Type: Array

Description: A contact at the organization. Multiple contacts are allowed. Each item of this array must be an Organizational Contact object.

9.1.11.1.68 Organizational Contact

Location: /services/[/data/[/governance/owners/[/organization/contact/[/

Type: Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

9.1.11.1.69 BOM Reference

Location: /services/[/data/[/governance/owners/[/organization/contact/[/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

9.1.11.1.70 Name

Location: /services/[/data/[/governance/owners/[/organization/contact/[/name

Property: name (Optional)

Type: String

Description: The name of a contact

Examples:

- Contact name

9.1.11.1.71 Email Address

Location: /services/[/data/[/governance/owners/[/organization/contact/[/email

Property: email (Optional)

Type: String

Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

Description: The email address of the contact.

Examples:

- firstname.lastname@example.com
9.1.11.1.72  Phone

Location: /services/|/data/|/governance/owners/|/organization/contact/|/phone
Property: phone (Optional)

Type: String
Description: The phone number of the contact.
Examples:
  • 800-555-1212

9.1.11.1.73  Organizational Contact

Location: /services/|/data/|/governance/owners/|/contact
Property: contact (Optional)

Type: Object
Description: The individual that is responsible for specific data governance role(s).

Table 212 – Properties for the contact object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

9.1.11.1.74  BOM Reference

Location: /services/|/data/|/governance/owners/|/contact/bom-ref
Property: bom-ref (Optional)

Type: String
Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

9.1.11.1.75  Name

Location: /services/|/data/|/governance/owners/|/contact/name
Property: name (Optional)

Type: String
Description: The name of a contact
Examples:
  • Contact name

9.1.11.1.76  Email Address

Location: /services/|/data/|/governance/owners/|/contact/email
Property: email (Optional)
Type: String
Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)
Description: The email address of the contact.
Examples:
- firstname.lastname@example.com

9.1.11.1.77 Phone
Location: /services/[path]/data/[path]/governance/owners/[path]/contact/phone
Property: phone (Optional)
Type: String
Description: The phone number of the contact.
Examples:
- 800-555-1212

9.1.11.1.78 Source
Location: /services/[path]/data/[path]/source
Property: source (Optional)
Type: Array
Description: The URI, URL, or BOM-Link of the components or services the data came in from
Location: /services/[path]/data/[path]/source/
Must be any of:
1. URL
2. BOM-Link Element

9.1.11.1.79 URL
Type: String

9.1.11.1.80 BOM-Link Element
Type: String
Pattern Constraint: ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$
Description: Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

9.1.11.1.81 Destination
Location: /services/[path]/data/[path]/destination
Property: destination (Optional)
Type: Array
Description: The URI, URL, or BOM-Link of the components or services the data is sent to
Location: /services/[path]/data/[path]/destination/
Must be any of:
1. URL
2. BOM-Link Element
9.1.11.1.82 URL

Type: String

9.1.11.1.83 BOM-Link Element

Type: String
Pattern Constraint: ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$
Description: Descriptor for an element in a BOM document. See https://cyclonedx.org/capabilities/bomlink/

9.1.12 Service Licence(s)

Location: /services/[]/licenses
Property: licenses (Optional)
Type: Array
Description: EITHER (list of SPDX licences and/or named licences) OR (tuple of one SPDX Licence Expression)
Reference: Refer to the license definition at /components/[]/licenses

9.1.13 External References

Location: /services/[]/externalReferences
Property: externalReferences (Optional)
Type: Array
Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM. Each item of this array must be an External Reference object.
Reference: Refer to the external reference definition at /externalReferences/[]

9.1.13.1 External Reference

Location: /services/[]/externalReferences/[]
Type: Object
Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

9.1.14 Services

Location: /services/[]/services
Property: services (Optional)
Type: Array
Description: A list of services included or deployed behind the parent service. This is not a dependency tree. It provides a way to specify a hierarchical representation of service assemblies. Each item of this array must be a Service object.

9.1.14.1 Service

Location: /services/[]/services/[]
Type: Object
Reference: Refer to the service definition at /services/[]

All items must be unique.
9.1.15  Release notes

Location: /services/[]/releaseNotes
Property: releaseNotes (Optional)

Type: Object
Description: Specifies optional release notes.

Table 213 – Properties for the releaseNotes object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>type</td>
<td>String</td>
<td>Required</td>
<td>The software versioning type the release note describes.</td>
</tr>
<tr>
<td>title</td>
<td>String</td>
<td>Optional</td>
<td>The title of the release.</td>
</tr>
<tr>
<td>featuredImage</td>
<td>String</td>
<td>Optional</td>
<td>The URL to an image that may be prominently displayed with the release note.</td>
</tr>
<tr>
<td>socialImage</td>
<td>String</td>
<td>Optional</td>
<td>The URL to an image that may be used in messaging on social media platforms.</td>
</tr>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>A short description of the release.</td>
</tr>
<tr>
<td>timestamp</td>
<td>String</td>
<td>Optional</td>
<td>The date and time (timestamp) when the release note was created.</td>
</tr>
<tr>
<td>aliases</td>
<td>Array</td>
<td>Optional</td>
<td>One or more alternate names the release may be referred to. This may include unofficial terms used by development and marketing teams (e.g. code names).</td>
</tr>
<tr>
<td>tags</td>
<td>Array</td>
<td>Optional</td>
<td>Textual strings that aid in discovery, search, and retrieval of the associated object. Tags often serve as a way to group or categorize similar or related objects by various attributes.</td>
</tr>
<tr>
<td>resolves</td>
<td>Array</td>
<td>Optional</td>
<td>A collection of issues that have been resolved.</td>
</tr>
<tr>
<td>notes</td>
<td>Array</td>
<td>Optional</td>
<td>Zero or more release notes containing the locale and content. Multiple note objects may be specified to support release notes in a wide variety of languages.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.</td>
</tr>
</tbody>
</table>

9.1.15.1  Type

Location: /services/[]/releaseNotes/type
Property: type (Required)

Type: String
Description: The software versioning type the release note describes.
Examples:
- major
- minor
- patch
- pre-release
- internal

9.1.15.2 Title

Location: /services/[/]/releaseNotes/title
Property: title (Optional)
Type: String
Description: The title of the release.

9.1.15.3 Featured image

Location: /services/[/]/releaseNotes/featuredImage
Property: featuredImage (Optional)
Type: String
Description: The URL to an image that may be prominently displayed with the release note.

9.1.15.4 Social image

Location: /services/[/]/releaseNotes/socialImage
Property: socialImage (Optional)
Type: String
Description: The URL to an image that may be used in messaging on social media platforms.

9.1.15.5 Description

Location: /services/[/]/releaseNotes/description
Property: description (Optional)
Type: String
Description: A short description of the release.

9.1.15.6 Timestamp

Location: /services/[/]/releaseNotes/timestamp
Property: timestamp (Optional)
Type: String
Format: data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)
Description: The date and time (timestamp) when the release note was created.

9.1.15.7 Aliases

Location: /services/[/]/releaseNotes/aliases
Property: aliases (Optional)
Type: array (of String)
**Description:** One or more alternate names the release may be referred to. This may include unofficial terms used by development and marketing teams (e.g. code names). Each item of this array must be a string.

### 9.1.15.8 Tags

**Location:** /services[/]/releaseNotes/tags

**Property:** tags (Optional)

**Type:** array (of String)

**Description:** Textual strings that aid in discovery, search, and retrieval of the associated object. Tags often serve as a way to group or categorize similar or related objects by various attributes. Each item of this array must be a string.

**Examples:**
- json-parser
- object-persistence
- text-to-image
- translation
- object-detection

### 9.1.15.9 Resolves

**Location:** /services[/]/releaseNotes/resolves

**Property:** resolves (Optional)

**Type:** Array

**Description:** A collection of issues that have been resolved. Each item of this array must be an Issue object.

#### 9.1.15.9.1 Issue

**Location:** /services[/]/releaseNotes/resolves[/]

**Type:** Object

**Description:** An individual issue that has been resolved.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>type</td>
<td>String</td>
<td>Required</td>
<td>Specifies the type of issue</td>
</tr>
<tr>
<td>id</td>
<td>String</td>
<td>Optional</td>
<td>The identifier of the issue assigned by the source of the issue</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the issue</td>
</tr>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>A description of the issue</td>
</tr>
<tr>
<td>source</td>
<td>Object</td>
<td>Optional</td>
<td>The source of the issue where it is documented</td>
</tr>
<tr>
<td>references</td>
<td>Array</td>
<td>Optional</td>
<td>A collection of URL's for reference. Multiple URLs are allowed.</td>
</tr>
</tbody>
</table>

#### 9.1.15.9.2 Issue Type

**Location:** /services[/]/releaseNotes/resolves[/]/type

**Property:** type (Required)
Type: String
Description: Specifies the type of issue

Table 215 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>defect</td>
<td>A fault, flaw, or bug in software.</td>
</tr>
<tr>
<td>enhancement</td>
<td>A new feature or behaviour in software.</td>
</tr>
<tr>
<td>security</td>
<td>A special type of defect which impacts security.</td>
</tr>
</tbody>
</table>

9.1.15.9.3 Issue ID
Location: /services/[1]/releaseNotes/resolves/[1]/id
Property: id (Optional)
Type: String
Description: The identifier of the issue assigned by the source of the issue

9.1.15.9.4 Issue Name
Location: /services/[1]/releaseNotes/resolves/[1]/name
Property: name (Optional)
Type: String
Description: The name of the issue

9.1.15.9.5 Issue Description
Location: /services/[1]/releaseNotes/resolves/[1]/description
Property: description (Optional)
Type: String
Description: A description of the issue

9.1.15.9.6 Source
Location: /services/[1]/releaseNotes/resolves/[1]/source
Property: source (Optional)
Type: Object
Description: The source of the issue where it is documented

Table 216 – Properties for the source object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the source.</td>
</tr>
<tr>
<td>url</td>
<td>String</td>
<td>Optional</td>
<td>The url of the issue documentation as provided by the source</td>
</tr>
</tbody>
</table>

9.1.15.9.7 Name
Location: /services/[1]/releaseNotes/resolves/[1]/source/name


**Property:** name (Optional)

**Type:** String

**Description:** The name of the source.

**Examples:**
- National Vulnerability Database
- NVD
- Apache

9.1.15.9.8 **URL**

**Location:** /services/[]/releaseNotes/resolves/[]/source/url

**Property:** url (Optional)

**Type:** String

**Format:** iri-reference as specified in [RFC 3987](https://www.ietf.org/rfc/rfc3987.html)

**Description:** The url of the issue documentation as provided by the source

9.1.15.9.9 **References**

**Location:** /services/[]/releaseNotes/resolves/[]/references

**Property:** references (Optional)

**Type:** array (of String)

**Format:** iri-reference as specified in [RFC 3987](https://www.ietf.org/rfc/rfc3987.html)

**Description:** A collection of URL's for reference. Multiple URLs are allowed. Each item of this array must be a string.

**Examples:**
- https://example.com

9.1.15.10 **Notes**

**Location:** /services/[]/releaseNotes/notes

**Property:** notes (Optional)

**Type:** Array

**Description:** Zero or more release notes containing the locale and content. Multiple note objects may be specified to support release notes in a wide variety of languages. Each item of this array must be a Note object.

9.1.15.10.1 **Note**

**Location:** /services/[]/releaseNotes/notes/[]

**Type:** Object

**Description:** A note containing the locale and content.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>locale</td>
<td>String</td>
<td>Optional</td>
<td>The ISO-639 (or higher) language code and optional ISO-3166 (or higher) country code. Examples include: &quot;en&quot;, &quot;en-US&quot;, &quot;fr&quot; and &quot;fr-CA&quot;</td>
</tr>
<tr>
<td>text</td>
<td>Object</td>
<td>Required</td>
<td>Specifies the full content of the release note.</td>
</tr>
</tbody>
</table>
9.1.15.10.2 Locale

Location: /services/[/]/releaseNotes/notes[/]/locale
Property: locale (Optional)
Type: String
Pattern Constraint: ^([a-z]{2})(-[A-Z]{2})?$
Description: The ISO-639 (or higher) language code and optional ISO-3166 (or higher) country code. Examples include: "en", "en-US", "fr" and "fr-CA"

9.1.15.10.3 Release note content

Location: /services/[/]/releaseNotes/notes[/]/text
Property: text (Required)
Type: Object
Description: Specifies the full content of the release note.

Table 218 – Properties for the text object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>contentType</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. <a href="https://tools.ietf.org/html/rfc2045">RFC 2045 section 5.1</a> outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the <a href="https">IANA media types registry</a>.</td>
</tr>
<tr>
<td>encoding</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the optional encoding the text is represented in.</td>
</tr>
<tr>
<td>content</td>
<td>String</td>
<td>Required</td>
<td>The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.</td>
</tr>
</tbody>
</table>

9.1.15.10.4 Content-Type

Location: /services/[/]/releaseNotes/notes[/]/text/contentType
Property: contentType (Optional)
Type: String
Default Value: text/plain
Description: Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. [RFC 2045 section 5.1](https://tools.ietf.org/html/rfc2045) outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the [IANA media types registry](https).
Examples:
- text/plain
- application/json
- image/png

9.1.15.10.5 Encoding

Location: /services/[/]/releaseNotes/notes[/]/text/encoding
Property: encoding (Optional)
Type: String
Description: Specifies the optional encoding the text is represented in.

Table 219 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>base64</td>
<td>Base64 is a binary-to-text encoding scheme that represents binary data in an ASCII string.</td>
</tr>
</tbody>
</table>

9.1.15.10.6 Attachment Text

Location: /services/[]/releaseNotes/notes/[]/text/content

Property: content (Required)

Type: String
Description: The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.

9.1.15.11 Properties

Location: /services/[]/releaseNotes/properties

Property: properties (Optional)

Type: Array
Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

9.1.15.11.1 Lightweight name-value pair

Location: /services/[]/releaseNotes/properties/[]

Type: Object
Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

Table 220 – Properties for the properties object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

9.1.15.11.2 Name

Location: /services/[]/releaseNotes/properties/[]/name

Property: name (Required)

Type: String
Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

9.1.15.11.3 Value

Location: /services/[]/releaseNotes/properties/[]/value

Property: value (Optional)

Type: String

Description: The value of the property.

9.1.16 Properties

Location: /services/[]/properties

Property: properties (Optional)

Type: Array

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

9.1.16.1 Lightweight name-value pair

Location: /services/[]/properties/[]

Type: Object

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

9.1.16.1.1 Name

Location: /services/[]/properties/[]/name

Property: name (Required)

Type: String

Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

9.1.16.1.2 Value

Location: /services/[]/properties/[]/value

Property: value (Optional)

Type: String

Description: The value of the property.
9.1.17 Tags

Location: /services[/]/tags
Property: tags (Optional)
Type: array (of String)
Description: Textual strings that aid in discovery, search, and retrieval of the associated object. Tags often serve as a way to group or categorize similar or related objects by various attributes. Each item of this array must be a string.
Examples:
- json-parser
- object-persistence
- text-to-image
- translation
- object-detection

9.1.18 Signature

Location: /services[/]/signature
Property: signature (Optional)
Type: Object
Description: An enveloped digital signature embedded within and specific to this object within the BOM. CycloneDX signatures enable integrity and authenticity verification without separating the signature from the BOM. Enveloped signatures enable each party in the supply chain to take responsibility for and sign their specific data, ensuring its integrity and authenticity. By aggregating all signatures, stakeholders can independently verify discrete pieces of information from each provider, enhancing overall transparency and trust in the supply chain.
Reference: Refer to the JSON Signature Format specification or to the XML Signature specification for implementation details.
- https://www.w3.org/TR/xmlsig-core/

All items must be unique.

10 External References

Location: /externalReferences
Property: externalReferences (Optional)
Type: Array
Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM. Each item of this array must be an External Reference object.

10.1 External Reference

Location: /externalReferences[/]
Type: Object
Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.
Table 222 – Properties for the externalReferences object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>url</td>
<td>Array</td>
<td>Required</td>
<td>The URI (URL or URN) to the external reference. External references are URIs and therefore can accept any URL scheme including https (<a href="https://www.ietf.org/rfc/rfc7230.html">RFC-7230</a>), mailto (<a href="https://www.ietf.org/rfc/rfc2368.html">RFC-2368</a>), tel (<a href="https://www.ietf.org/rfc/rfc3966.html">RFC-3966</a>), and dns (<a href="https://www.ietf.org/rfc/rfc4501.html">RFC-4501</a>). External references may also include formally registered URNs such as <a href="https://www.cyclonedx.org">CycloneDX BOM-Link</a> to reference CycloneDX BOMs or any object within a BOM. BOM-Link transforms applicable external references into relationships that can be expressed in a BOM or across BOMs.</td>
</tr>
<tr>
<td>comment</td>
<td>String</td>
<td>Optional</td>
<td>An optional comment describing the external reference</td>
</tr>
<tr>
<td>type</td>
<td>String</td>
<td>Required</td>
<td>Specifies the type of external reference</td>
</tr>
<tr>
<td>hashes</td>
<td>Array</td>
<td>Optional</td>
<td>The hashes of the external reference (if applicable).</td>
</tr>
</tbody>
</table>

10.1.1 URL

**Location:** /externalReferences/[/url

**Property:** url (Required)

**Description:** The URI (URL or URN) to the external reference. External references are URIs and therefore can accept any URL scheme including https ([RFC-7230](https://www.ietf.org/rfc/rfc7230.html)), mailto ([RFC-2368](https://www.ietf.org/rfc/rfc2368.html)), tel ([RFC-3966](https://www.ietf.org/rfc/rfc3966.html)), and dns ([RFC-4501](https://www.ietf.org/rfc/rfc4501.html)). External references may also include formally registered URNs such as [CycloneDX BOM-Link](https://www.cyclonedx.org) to reference CycloneDX BOMs or any object within a BOM. BOM-Link transforms applicable external references into relationships that can be expressed in a BOM or across BOMs.

Must be any of:

1. URL

10.1.2 URL

**Type:** String

**Format:** iri-reference as specified in [RFC 3987](https://www.ietf.org/rfc/rfc3987.html)

10.1.3 BOM-Link

10.1.4 Comment

**Location:** /externalReferences/[/comment

**Property:** comment (Optional)

**Type:** String

**Description:** An optional comment describing the external reference

10.1.5 Type

**Location:** /externalReferences/[/type

**Property:** type (Required)

**Type:** String

**Description:** Specifies the type of external reference.
<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>vcs</td>
<td>Version Control System</td>
</tr>
<tr>
<td>issue-tracker</td>
<td>Issue or defect tracking system, or an Application Lifecycle Management (ALM) system</td>
</tr>
<tr>
<td>website</td>
<td>Website</td>
</tr>
<tr>
<td>advisories</td>
<td>Security advisories</td>
</tr>
<tr>
<td>bom</td>
<td>Bill of Materials (SBOM, OBOM, HBOM, SaaSBOM, etc)</td>
</tr>
<tr>
<td>mailing-list</td>
<td>Mailing list or discussion group</td>
</tr>
<tr>
<td>social</td>
<td>Social media account</td>
</tr>
<tr>
<td>chat</td>
<td>Real-time chat platform</td>
</tr>
<tr>
<td>documentation</td>
<td>Documentation, guides, or how-to instructions</td>
</tr>
<tr>
<td>support</td>
<td>Community or commercial support</td>
</tr>
<tr>
<td>source-distribution</td>
<td>The location where the source code distributable can be obtained. This is often an archive format such as zip or tgz. The source-distribution type complements use of the version control (vcs) type.</td>
</tr>
<tr>
<td>distribution</td>
<td>Direct or repository download location</td>
</tr>
<tr>
<td>distribution-intake</td>
<td>The location where a component was published to. This is often the same as &quot;distribution&quot; but may also include specialized publishing processes that act as an intermediary.</td>
</tr>
<tr>
<td>license</td>
<td>The reference to the licence file. If a licence URL has been defined in the licence node, it should also be defined as an external reference for completeness.</td>
</tr>
<tr>
<td>build-meta</td>
<td>Build-system specific meta file (i.e. pom.xml, package.json, .nuspec, etc)</td>
</tr>
<tr>
<td>build-system</td>
<td>Reference to an automated build system</td>
</tr>
<tr>
<td>release-notes</td>
<td>Reference to release notes</td>
</tr>
<tr>
<td>security-contact</td>
<td>Specifies a way to contact the maintainer, supplier, or provider in the event of a security incident. Common URIs include links to a disclosure procedure, a mailto (RFC-2368) that specifies an email address, a tel (RFC-3966) that specifies a phone number, or dns (RFC-4501) that specifies the records containing DNS Security TXT.</td>
</tr>
<tr>
<td>model-card</td>
<td>A model card describes the intended uses of a machine learning model, potential limitations, biases, ethical considerations, training parameters, datasets used to train the model, performance metrics, and other relevant data useful for ML transparency.</td>
</tr>
<tr>
<td>log</td>
<td>A record of events that occurred in a computer system or application, such as problems, errors, or information on current operations.</td>
</tr>
<tr>
<td>configuration</td>
<td>Parameters or settings that may be used by other components or services.</td>
</tr>
<tr>
<td>Value</td>
<td>Description</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>evidence</td>
<td>Information used to substantiate a claim.</td>
</tr>
<tr>
<td>formulation</td>
<td>Describes how a component or service was manufactured or deployed.</td>
</tr>
<tr>
<td>attestation</td>
<td>Human or machine-readable statements containing facts, evidence, or testimony.</td>
</tr>
<tr>
<td>threat-model</td>
<td>An enumeration of identified weaknesses, threats, and countermeasures, dataflow diagram (DFD), attack tree, and other supporting documentation in human-readable or machine-readable format.</td>
</tr>
<tr>
<td>adversary-model</td>
<td>The defined assumptions, goals, and capabilities of an adversary.</td>
</tr>
<tr>
<td>risk-assessment</td>
<td>Identifies and analyses the potential of future events that may negatively impact individuals, assets, and/or the environment. Risk assessments may also include judgments on the tolerability of each risk.</td>
</tr>
<tr>
<td>vulnerability-assertion</td>
<td>A Vulnerability Disclosure Report (VDR) which asserts the known and previously unknown vulnerabilities that affect a component, service, or product including the analysis and findings describing the impact (or lack of impact) that the reported vulnerability has on a component, service, or product.</td>
</tr>
<tr>
<td>exploitability-statement</td>
<td>A Vulnerability Exploitability eXchange (VEX) which asserts the known vulnerabilities that do not affect a product, product family, or organization, and optionally the ones that do. The VEX should include the analysis and findings describing the impact (or lack of impact) that the reported vulnerability has on the product, product family, or organization.</td>
</tr>
<tr>
<td>pentest-report</td>
<td>Results from an authorized simulated cyberattack on a component or service, otherwise known as a penetration test.</td>
</tr>
<tr>
<td>static-analysis-report</td>
<td>SARIF or proprietary machine or human-readable report for which static analysis has identified code quality, security, and other potential issues with the source code.</td>
</tr>
<tr>
<td>dynamic-analysis-report</td>
<td>Dynamic analysis report that has identified issues such as vulnerabilities and misconfigurations.</td>
</tr>
<tr>
<td>runtime-analysis-report</td>
<td>Report generated by analyzing the call stack of a running application.</td>
</tr>
<tr>
<td>component-analysis-report</td>
<td>Report generated by Software Composition Analysis (SCA), container analysis, or other forms of component analysis.</td>
</tr>
<tr>
<td>maturity-report</td>
<td>Report containing a formal assessment of an organization, business unit, or team against a maturity model.</td>
</tr>
<tr>
<td>certification-report</td>
<td>Industry, regulatory, or other certification from an accredited (if applicable) certification body.</td>
</tr>
<tr>
<td>codified-infrastructure</td>
<td>Code or configuration that defines and provisions virtualized infrastructure, commonly referred to as Infrastructure as Code (IaC).</td>
</tr>
<tr>
<td>quality-metrics</td>
<td>Report or system in which quality metrics can be obtained.</td>
</tr>
</tbody>
</table>
Poam

Plans of Action and Milestones (POA&M) complement an "attestation" external reference. POA&M is defined by NIST as a "document that identifies tasks needing to be accomplished. It details resources required to accomplish the elements of the plan, any milestones in meeting the tasks and scheduled completion dates for the milestones".

electronic-signature

An e-signature is commonly a scanned representation of a written signature or a stylized script of the person's name.

digital-signature

A signature that leverages cryptography, typically public/private key pairs, which provides strong authenticity verification.

rfc-9116

Document that complies with RFC 9116 (A File Format to Aid in Security Vulnerability Disclosure)

other

Use this if no other types accurately describe the purpose of the external reference.

### 10.1.6 Hashes

**Location:** /externalReferences/[]/hashes

**Property:** hashes (Optional)

**Type:** Array

**Description:** The hashes of the external reference (if applicable). Each item of this array must be a Hash object.

#### 10.1.6.1 Hash

**Location:** /externalReferences/[]/hashes/[]

**Type:** Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>alg</td>
<td>String</td>
<td>Required</td>
<td>The algorithm that generated the hash value.</td>
</tr>
<tr>
<td>content</td>
<td>String</td>
<td>Required</td>
<td>The value of the hash.</td>
</tr>
</tbody>
</table>

#### 10.1.6.1.1 Hash Algorithm

**Location:** /externalReferences/[]/hashes/[]/alg

**Property:** alg (Required)

**Type:** String

**Description:** The algorithm that generated the hash value.

**Enumeration:** Must be one of:

- MD5
- SHA-1
- SHA-256
- SHA-384
- SHA-512
• SHA3-256
• SHA3-384
• SHA3-512
• BLAKE2b-256
• BLAKE2b-384
• BLAKE2b-512
• BLAKE3

10.1.6.1.2 Hash Value

Location: /externalReferences/[]/hashes/[]/content

Property: content (Required)

Type: String

Pattern Constraint: ^([a-fA-F0-9]{32}|[a-fA-F0-9]{40}|[a-fA-F0-9]{64}|[a-fA-F0-9]{96}|[a-fA-F0-9]{128})$

Description: The value of the hash.

Examples:
• 3942447fac867ae5cdb3229b658f4d48

11 Dependencies

Location: /dependencies

Property: dependencies (Optional)

Type: Array

Description: Provides the ability to document dependency relationships including provided & implemented components. Each item of this array must be a Dependency object.

11.1 Dependency

Location: /dependencies/[]

Type: Object

Description: Defines the direct dependencies of a component, service, or the components provided/implemented by a given component. Components or services that do not have their own dependencies must be declared as empty elements within the graph. Components or services that are not represented in the dependency graph may have unknown dependencies. It is recommended that implementations assume this to be opaque and not an indicator of an object being dependency-free. It is recommended to leverage compositions to indicate unknown dependency graphs.

Table 225 – Properties for the dependencies object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>String</td>
<td>Required</td>
<td>References a component or service by its bom-ref attribute</td>
</tr>
<tr>
<td>dependsOn</td>
<td>Array</td>
<td>Optional</td>
<td>The bom-ref identifiers of the components or services that are dependencies of this dependency object.</td>
</tr>
<tr>
<td>provides</td>
<td>Array</td>
<td>Optional</td>
<td>The bom-ref identifiers of the components or services that define a given specification or standard, which are provided or implemented by this dependency object. For example, a cryptographic library which implements a</td>
</tr>
</tbody>
</table>
cryptographic algorithm. A component which implements another component does not imply that the implementation is in use.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
</table>

11.1.1 Reference

**Location:** /dependencies/[]/ref

**Property:** ref (Required)

**Type:** String

**Description:** References a component or service by its bom-ref attribute

11.1.2 Depends On

**Location:** /dependencies/[]/dependsOn

**Property:** dependsOn (Optional)

**Type:** array (of String)

**Description:** The bom-ref identifiers of the components or services that are dependencies of this dependency object. Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType. Each item of this array must be a string. *All items must be unique.*

11.1.3 Provides

**Location:** /dependencies/[]/provides

**Property:** provides (Optional)

**Type:** array (of String)

**Description:** The bom-ref identifiers of the components or services that define a given specification or standard, which are provided or implemented by this dependency object. For example, a cryptographic library which implements a cryptographic algorithm. A component which implements another component does not imply that the implementation is in use. Descriptor for an element identified by the attribute "bom-ref" in the same BOM document. In contrast to bomLinkElementType. Each item of this array must be a string. *All items must be unique.*

12 Compositions

**Location:** /compositions

**Property:** compositions (Optional)

**Type:** Array

**Description:** Compositions describe constituent parts (including components, services, and dependency relationships) and their completeness. The completeness of vulnerabilities expressed in a BOM may also be described. Each item of this array must be a Compositions object.

12.1 Compositions

**Location:** /compositions/[]

**Type:** Object
### Table 226 – Properties for the compositions object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>aggregate</td>
<td>String</td>
<td>Required</td>
<td>Specifies an aggregate type that describe how complete a relationship is.</td>
</tr>
<tr>
<td>assemblies</td>
<td>Array</td>
<td>Optional</td>
<td>The bom-ref identifiers of the components or services being described. Assemblies refer to nested relationships whereby a constituent part may include other constituent parts. References do not cascade to child parts. References are explicit for the specified constituent part only.</td>
</tr>
<tr>
<td>vulnerabilities</td>
<td>Array</td>
<td>Optional</td>
<td>The bom-ref identifiers of the vulnerabilities being described.</td>
</tr>
<tr>
<td>signature</td>
<td>Array</td>
<td>Optional</td>
<td>Enveloped signature in [JSON Signature Format (JSF)]</td>
</tr>
</tbody>
</table>

### 12.1.1 BOM Reference

**Location:** /compositions/[]/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

### 12.1.2 Aggregate

**Location:** /compositions/[]/aggregate

**Property:** aggregate (Required)

**Type:** String

**Default Value:** not_specified

**Description:** Specifies an aggregate type that describe how complete a relationship is.

**Table 227 – Enumeration of possible values**

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>complete</td>
<td>The relationship is complete. No further relationships including constituent components, services, or dependencies are known to exist.</td>
</tr>
<tr>
<td>incomplete</td>
<td>The relationship is incomplete. Additional relationships exist and may include constituent components, services, or dependencies.</td>
</tr>
<tr>
<td>incomplete_first_party_only</td>
<td>The relationship is incomplete. Only relationships for first-party components, services, or their dependencies are represented.</td>
</tr>
<tr>
<td>Value</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>incomplete_first_party_proprietary_only</td>
<td>The relationship is incomplete. Only relationships for first-party components, services, or their dependencies are represented, limited specifically to those that are proprietary.</td>
</tr>
<tr>
<td>incomplete_first_party_opensource_only</td>
<td>The relationship is incomplete. Only relationships for first-party components, services, or their dependencies are represented, limited specifically to those that are opensource.</td>
</tr>
<tr>
<td>incomplete_third_party_only</td>
<td>The relationship is incomplete. Only relationships for third-party components, services, or their dependencies are represented.</td>
</tr>
<tr>
<td>incomplete_third_party_proprietary_only</td>
<td>The relationship is incomplete. Only relationships for third-party components, services, or their dependencies are represented, limited specifically to those that are proprietary.</td>
</tr>
<tr>
<td>incomplete_third_party_opensource_only</td>
<td>The relationship is incomplete. Only relationships for third-party components, services, or their dependencies are represented, limited specifically to those that are opensource.</td>
</tr>
<tr>
<td>unknown</td>
<td>The relationship may be complete or incomplete. This usually signifies a 'best-effort' to obtain constituent components, services, or dependencies but the completeness is inconclusive.</td>
</tr>
<tr>
<td>not_specified</td>
<td>The relationship completeness is not specified.</td>
</tr>
</tbody>
</table>

### 12.1.3 BOM references

**Location:** /compositions/[]/assemblies

**Property:** assemblies (Optional)

**Type:** Array

**Description:** The bom-ref identifiers of the components or services being described. Assemblies refer to nested relationships whereby a constituent part may include other constituent parts. References do not cascade to child parts. References are explicit for the specified constituent part only.

**Location:** /compositions/[]/assemblies/[]

**Must be any of:**

1. Ref
2. BOM-Link Element

#### 12.1.3.1 Ref

**Type:** String

**Description:** Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

#### 12.1.3.2 BOM-Link Element

**Type:** String

**Format:** iri-reference as specified in [RFC 3987](https://www.ietf.org/rfc/rfc3987.html)

**Pattern Constraint:** ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$

**Description:** Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)
All items must be unique.

12.1.4 BOM references

Location: /compositions/[]/dependencies
Property: dependencies (Optional)
Type: array (of String)
Description: The bom-ref identifiers of the components or services being described. Dependencies refer to a relationship whereby an independent constituent part requires another independent constituent part. References do not cascade to transitive dependencies. References are explicit for the specified dependency only. Each item of this array must be a string.

All items must be unique.

12.1.5 BOM references

Location: /compositions/[]/vulnerabilities
Property: vulnerabilities (Optional)
Type: array (of String)
Description: The bom-ref identifiers of the vulnerabilities being described. Each item of this array must be a string.

All items must be unique.

12.1.6 Signature

Location: /compositions/[]/signature
Property: signature (Optional)
Type: Object
Description: An enveloped digital signature embedded within and specific to this object within the BOM. CycloneDX signatures enable integrity and authenticity verification without separating the signature from the BOM. Enveloped signatures enable each party in the supply chain to take responsibility for and sign their specific data, ensuring its integrity and authenticity. By aggregating all signatures, stakeholders can independently verify discrete pieces of information from each provider, enhancing overall transparency and trust in the supply chain.
Reference: Refer to the JSON Signature Format specification or to the XML Signature specification for implementation details.
  - https://www.w3.org/TR/xmldsig-core/

All items must be unique.

13 Vulnerabilities

Location: /vulnerabilities
Property: vulnerabilities (Optional)
Type: Array
Description: Vulnerabilities identified in components or services. Each item of this array must be a Vulnerability object.

13.1 Vulnerability

Location: /vulnerabilities[]
Type: Object
Description: Defines a weakness in a component or service that could be exploited or triggered by a threat source.
## Table 228 – Properties for the vulnerabilities object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>id</td>
<td>String</td>
<td>Optional</td>
<td>The identifier that uniquely identifies the vulnerability.</td>
</tr>
<tr>
<td>source</td>
<td>Object</td>
<td>Optional</td>
<td>The source that published the vulnerability.</td>
</tr>
<tr>
<td>references</td>
<td>Array</td>
<td>Optional</td>
<td>Zero or more pointers to vulnerabilities that are the equivalent of the vulnerability specified. Often times, the same vulnerability may exist in multiple sources of vulnerability intelligence, but have different identifiers. References provide a way to correlate vulnerabilities across multiple sources of vulnerability intelligence.</td>
</tr>
<tr>
<td>ratings</td>
<td>Array</td>
<td>Optional</td>
<td>List of vulnerability ratings</td>
</tr>
<tr>
<td>cwe</td>
<td>Array</td>
<td>Optional</td>
<td>List of Common Weaknesses Enumerations (CWEs) codes that describes this vulnerability.</td>
</tr>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>A description of the vulnerability as provided by the source.</td>
</tr>
<tr>
<td>detail</td>
<td>String</td>
<td>Optional</td>
<td>If available, an in-depth description of the vulnerability as provided by the source organization. Details often include information useful in understanding root cause.</td>
</tr>
<tr>
<td>recommendation</td>
<td>String</td>
<td>Optional</td>
<td>Recommendations of how the vulnerability can be remediated or mitigated.</td>
</tr>
<tr>
<td>workaround</td>
<td>String</td>
<td>Optional</td>
<td>A bypass, usually temporary, of the vulnerability that reduces its likelihood and/or impact. Workarounds often involve changes to configuration or deployments.</td>
</tr>
<tr>
<td>proofOfConcept</td>
<td>Object</td>
<td>Optional</td>
<td>Evidence used to reproduce the vulnerability.</td>
</tr>
<tr>
<td>advisories</td>
<td>Array</td>
<td>Optional</td>
<td>Published advisories of the vulnerability if provided.</td>
</tr>
<tr>
<td>created</td>
<td>String</td>
<td>Optional</td>
<td>The date and time (timestamp) when the vulnerability record was created in the vulnerability database.</td>
</tr>
<tr>
<td>published</td>
<td>String</td>
<td>Optional</td>
<td>The date and time (timestamp) when the vulnerability record was first published.</td>
</tr>
<tr>
<td>updated</td>
<td>String</td>
<td>Optional</td>
<td>The date and time (timestamp) when the vulnerability record was last updated.</td>
</tr>
<tr>
<td>rejected</td>
<td>String</td>
<td>Optional</td>
<td>The date and time (timestamp) when the vulnerability record was rejected (if applicable).</td>
</tr>
<tr>
<td>credits</td>
<td>Object</td>
<td>Optional</td>
<td>Individuals or organizations credited with the discovery of the vulnerability.</td>
</tr>
<tr>
<td>tools</td>
<td>Array</td>
<td>Optional</td>
<td>The tool(s) used to identify, confirm, or score the vulnerability.</td>
</tr>
<tr>
<td>Property</td>
<td>Type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>------------</td>
<td>---------</td>
<td>-------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>analysis</td>
<td>Object</td>
<td>Optional</td>
<td>An assessment of the impact and exploitability of the vulnerability.</td>
</tr>
<tr>
<td>affects</td>
<td>Array</td>
<td>Optional</td>
<td>The components or services that are affected by the vulnerability.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>provides flexibility to include data not officially supported in the standard</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>without having to use additional namespaces or create extensions. Unlike</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>key-value stores, properties support duplicate names, each potentially</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>having different values. Property names of interest to the general public</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>are encouraged to be registered in the <a href="#">CycloneDX Property Taxonomy</a>.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Formal registration is optional.</td>
</tr>
</tbody>
</table>

13.1.1 BOM Reference

**Location:** `/vulnerabilities/[/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

13.1.2 ID

**Location:** `/vulnerabilities/[/id

**Property:** id (Optional)

**Type:** String

**Description:** The identifier that uniquely identifies the vulnerability.

**Examples:**
- CVE-2021-39182
- GHSA-35m5-8cvj-8783
- SNYK-PYTHON-ENROCRYPT-1912876

13.1.3 Source

**Location:** `/vulnerabilities/[/source

**Property:** source (Optional)

**Type:** Object

**Description:** The source that published the vulnerability.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>url</td>
<td>String</td>
<td>Optional</td>
<td>The url of the vulnerability documentation as provided by the source.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the source.</td>
</tr>
</tbody>
</table>
13.1.3.1 URL

Location: /vulnerabilities/\[\]/source/url
Property: url (Optional)

Type: String
Description: The url of the vulnerability documentation as provided by the source.
Examples:
  • https://nvd.nist.gov/vuln/detail/CVE-2021-39182

13.1.3.2 Name

Location: /vulnerabilities/\[\]/source/name
Property: name (Optional)

Type: String
Description: The name of the source.
Examples:
  • NVD
  • National Vulnerability Database
  • OSS Index
  • VulnDB
  • GitHub Advisories

13.1.4 References

Location: /vulnerabilities/\[\]/references
Property: references (Optional)

Type: Array
Description: Zero or more pointers to vulnerabilities that are the equivalent of the vulnerability specified. Often times, the same vulnerability may exist in multiple sources of vulnerability intelligence, but have different identifiers. References provide a way to correlate vulnerabilities across multiple sources of vulnerability intelligence.

Location: /vulnerabilities/\[\]/references/\[

Type: Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>id</td>
<td>String</td>
<td>Required</td>
<td>An identifier that uniquely identifies the vulnerability.</td>
</tr>
<tr>
<td>source</td>
<td>Object</td>
<td>Required</td>
<td>The source that published the vulnerability.</td>
</tr>
</tbody>
</table>

13.1.4.1.1 ID

Location: /vulnerabilities/\[\]/references/\[\]/id
Property: id (Required)

Type: String
Description: An identifier that uniquely identifies the vulnerability.
Examples:
- CVE-2021-39182
- GHSA-35m5-8cvj-8783
- SNYK-PYTHON-ENROCRYPT-1912876

13.1.4.1.2 Source
Location: /vulnerabilities[/j]/references[/j]/source
Property: source (Required)
Type: Object
Description: The source that published the vulnerability.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>url</td>
<td>String</td>
<td>Optional</td>
<td>The url of the vulnerability documentation as provided by the source.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the source.</td>
</tr>
</tbody>
</table>

13.1.4.1.3 URL
Location: /vulnerabilities[/j]/references[/j]/source/url
Property: url (Optional)
Type: String
Description: The url of the vulnerability documentation as provided by the source.
Examples:
- https://nvd.nist.gov/vuln/detail/CVE-2021-39182

13.1.4.1.4 Name
Location: /vulnerabilities[/j]/references[/j]/source/name
Property: name (Optional)
Type: String
Description: The name of the source.
Examples:
- NVD
- National Vulnerability Database
- OSS Index
- VulnDB
- GitHub Advisories

13.1.5 Ratings
Location: /vulnerabilities[/j]/ratings
Property: ratings (Optional)
Type: Array
Description: List of vulnerability ratings Each item of this array must be a Rating object.
13.1.5.1 Rating

**Location:** /vulnerabilities/[/ratings/[/

**Type:** Object

**Description:** Defines the severity or risk ratings of a vulnerability.

**Table 232 – Properties for the ratings object**

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>source</td>
<td>Object</td>
<td>Optional</td>
<td>The source that calculated the severity or risk rating of the vulnerability.</td>
</tr>
<tr>
<td>score</td>
<td>Number</td>
<td>Optional</td>
<td>The numerical score of the rating.</td>
</tr>
<tr>
<td>severity</td>
<td>String</td>
<td>Optional</td>
<td>Textual representation of the severity that corresponds to the numerical score of the rating.</td>
</tr>
<tr>
<td>method</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the severity or risk scoring methodology or standard used.</td>
</tr>
<tr>
<td>vector</td>
<td>String</td>
<td>Optional</td>
<td>Textual representation of the metric values used to score the vulnerability</td>
</tr>
<tr>
<td>justification</td>
<td>String</td>
<td>Optional</td>
<td>An optional reason for rating the vulnerability as it was</td>
</tr>
</tbody>
</table>

13.1.5.1.1 Source

**Location:** /vulnerabilities/[/ratings/[/source

**Property:** source (Optional)

**Type:** Object

**Description:** The source that calculated the severity or risk rating of the vulnerability.

**Table 233 – Properties for the source object**

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>url</td>
<td>String</td>
<td>Optional</td>
<td>The url of the vulnerability documentation as provided by the source.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the source.</td>
</tr>
</tbody>
</table>

13.1.5.1.2 URL

**Location:** /vulnerabilities/[/ratings/[/source/url

**Property:** url (Optional)

**Type:** String

**Description:** The url of the vulnerability documentation as provided by the source.

**Examples:**
- https://nvd.nist.gov/vuln/detail/CVE-2021-39182

13.1.5.1.3 Name

**Location:** /vulnerabilities/[/ratings/[/source/name

**Property:** name (Optional)
Type: String

Description: The name of the source.

Examples:
- NVD
- National Vulnerability Database
- OSS Index
- VulnDB
- GitHub Advisories

13.1.5.1.4 Score

Location: /vulnerabilities[/]/ratings[/]/score

Property: score (Optional)

Type: Number

Description: The numerical score of the rating.

13.1.5.1.5 Severity

Location: /vulnerabilities[/]/ratings[/]/severity

Property: severity (Optional)

Type: String

Description: Textual representation of the severity that corresponds to the numerical score of the rating.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>critical</td>
<td>Critical severity</td>
</tr>
<tr>
<td>high</td>
<td>High severity</td>
</tr>
<tr>
<td>medium</td>
<td>Medium severity</td>
</tr>
<tr>
<td>low</td>
<td>Low severity</td>
</tr>
<tr>
<td>info</td>
<td>Informational warning.</td>
</tr>
<tr>
<td>none</td>
<td>None</td>
</tr>
<tr>
<td>unknown</td>
<td>The severity is not known</td>
</tr>
</tbody>
</table>

13.1.5.1.6 Method

Location: /vulnerabilities[/]/ratings[/]/method

Property: method (Optional)

Type: String

Description: Specifies the severity or risk scoring methodology or standard used.
Table 235 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVSSv2</td>
<td>Common Vulnerability Scoring System v2.0</td>
</tr>
<tr>
<td>CVSSv3</td>
<td>Common Vulnerability Scoring System v3.0</td>
</tr>
<tr>
<td>CVSSv31</td>
<td>Common Vulnerability Scoring System v3.1</td>
</tr>
<tr>
<td>CVSSv4</td>
<td>Common Vulnerability Scoring System v4.0</td>
</tr>
<tr>
<td>OWASP</td>
<td>OWASP Risk Rating Methodology</td>
</tr>
<tr>
<td>SSVC</td>
<td>Stakeholder Specific Vulnerability Categorization</td>
</tr>
<tr>
<td>other</td>
<td>Another severity or risk scoring methodology</td>
</tr>
</tbody>
</table>

13.1.5.1.7 Vector

**Location:** /vulnerabilities/[]/ratings/[]/vector

**Property:** vector (Optional)

**Type:** String

**Description:** Textual representation of the metric values used to score the vulnerability

13.1.5.1.8 Justification

**Location:** /vulnerabilities/[]/ratings/[]/justification

**Property:** justification (Optional)

**Type:** String

**Description:** An optional reason for rating the vulnerability as it was

13.1.6 CWEs

**Location:** /vulnerabilities/[]/cwes

**Property:** cwes (Optional)

**Type:** array (of Integer)

**Minimum Value:** 1

**Description:** List of Common Weaknesses Enumerations (CWEs) codes that describes this vulnerability. Integer representation of a Common Weaknesses Enumerations (CWE). For example 399 (of [https://cwe.mitre.org/data/definitions/399.html](https://cwe.mitre.org/data/definitions/399.html)) Each item of this array must be an integer.

**Examples:**
- 399

13.1.7 Description

**Location:** /vulnerabilities/[]/description

**Property:** description (Optional)

**Type:** String

**Description:** A description of the vulnerability as provided by the source.
13.1.8 Details

Location: /vulnerabilities/[/detail
Property: detail (Optional)

Type: String
Description: If available, an in-depth description of the vulnerability as provided by the source organization. Details often include information useful in understanding root cause.

13.1.9 Recommendation

Location: /vulnerabilities/[/recommendation
Property: recommendation (Optional)

Type: String
Description: Recommendations of how the vulnerability can be remediated or mitigated.

13.1.10 Workarounds

Location: /vulnerabilities/[/workaround
Property: workaround (Optional)

Type: String
Description: A bypass, usually temporary, of the vulnerability that reduces its likelihood and/or impact. Workarounds often involve changes to configuration or deployments.

13.1.11 Proof of Concept

Location: /vulnerabilities/[/proofOfConcept
Property: proofOfConcept (Optional)

Type: Object
Description: Evidence used to reproduce the vulnerability.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>reproductionSteps</td>
<td>String</td>
<td>Optional</td>
<td>Precise steps to reproduce the vulnerability.</td>
</tr>
<tr>
<td>environment</td>
<td>String</td>
<td>Optional</td>
<td>A description of the environment in which reproduction was possible.</td>
</tr>
<tr>
<td>supportingMaterial</td>
<td>Array</td>
<td>Optional</td>
<td>Supporting material that helps in reproducing or understanding how reproduction is possible. This may include screenshots, payloads, and PoC exploit code.</td>
</tr>
</tbody>
</table>

13.1.11.1 Steps to Reproduce

Location: /vulnerabilities/[/proofOfConcept/reproductionSteps
Property: reproductionSteps (Optional)

Type: String
Description: Precise steps to reproduce the vulnerability.

13.1.11.2 Environment

Location: /vulnerabilities/[/proofOfConcept/environment
Property: environment (Optional)
Type: String

Description: A description of the environment in which reproduction was possible.

13.1.11.3 Supporting Material

Location: /vulnerabilities/[/proofOfConcept/supportingMaterial

Property: supportingMaterial (Optional)

Type: Array

Description: Supporting material that helps in reproducing or understanding how reproduction is possible. This may include screenshots, payloads, and PoC exploit code. Each item of this array must be an Attachment object.

13.1.11.3.1 Attachment

Location: /vulnerabilities/[/proofOfConcept/supportingMaterial[/]

Type: Object

Description: Specifies the metadata and content for an attachment.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>contentType</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plan text documents. <a href="https://tools.ietf.org/html/rfc2045">RFC 2045 section 5.1</a> outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the <a href="https">IANA media types registry</a>.</td>
</tr>
<tr>
<td>encoding</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the optional encoding the text is represented in.</td>
</tr>
<tr>
<td>content</td>
<td>String</td>
<td>Required</td>
<td>The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.</td>
</tr>
</tbody>
</table>

13.1.11.3.2 Content-Type

Location: /vulnerabilities/[/proofOfConcept/supportingMaterial[/]/contentType

Property: contentType (Optional)

Type: String

Default Value: text/plain

Description: Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plan text documents. RFC 2045 section 5.1 outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the [IANA media types registry](https).

Examples:

- text/plain
- application/json
- image/png

13.1.11.3.3 Encoding

Location: /vulnerabilities/[/proofOfConcept/supportingMaterial[/]/encoding

Property: encoding (Optional)
Type: String
Description: Specifies the optional encoding the text is represented in.

Table 238 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>base64</td>
<td>Base64 is a binary-to-text encoding scheme that represents binary data in an ASCII string.</td>
</tr>
</tbody>
</table>

13.1.11.3.4 Attachment Text

Location: /vulnerabilities/[]/proofOfConcept/supportingMaterial/[]/content
Property: content (Required)

Type: String
Description: The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.

13.1.12 Advisories

Location: /vulnerabilities/[]/advisories
Property: advisories (Optional)

Type: Array
Description: Published advisories of the vulnerability if provided. Each item of this array must be an Advisory object.

13.1.12.1 Advisory

Location: /vulnerabilities/[]/advisories/[]

Type: Object
Description: Title and location where advisory information can be obtained. An advisory is a notification of a threat to a component, service, or system.

Table 239 – Properties for the advisories object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>title</td>
<td>String</td>
<td>Optional</td>
<td>An optional name of the advisory.</td>
</tr>
<tr>
<td>url</td>
<td>String</td>
<td>Required</td>
<td>Location where the advisory can be obtained.</td>
</tr>
</tbody>
</table>

13.1.12.1.1 Title

Location: /vulnerabilities/[]/advisories/[]/title
Property: title (Optional)

Type: String
Description: An optional name of the advisory.

13.1.12.1.2 URL

Location: /vulnerabilities/[]/advisories/[]/url
Property: url (Required)

Type: String

Description: Location where the advisory can be obtained.

13.1.13 Created

Location: /vulnerabilities/[i]/created

Property: created (Optional)

Type: String

Format: data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)

Description: The date and time (timestamp) when the vulnerability record was created in the vulnerability database.

13.1.14 Published

Location: /vulnerabilities/[i]/published

Property: published (Optional)

Type: String

Format: data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)

Description: The date and time (timestamp) when the vulnerability record was first published.

13.1.15 Updated

Location: /vulnerabilities/[i]/updated

Property: updated (Optional)

Type: String

Format: data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)

Description: The date and time (timestamp) when the vulnerability record was last updated.

13.1.16 Rejected

Location: /vulnerabilities/[i]/rejected

Property: rejected (Optional)

Type: String

Format: data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)

Description: The date and time (timestamp) when the vulnerability record was rejected (if applicable).

13.1.17 Credits

Location: /vulnerabilities/[i]/credits

Property: credits (Optional)

Type: Object

Description: Individuals or organizations credited with the discovery of the vulnerability.

Table 240 – Properties for the credits object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>organizations</td>
<td>Array</td>
<td>Optional</td>
<td>The organizations credited with vulnerability discovery.</td>
</tr>
<tr>
<td>individuals</td>
<td>Array</td>
<td>Optional</td>
<td>The individuals, not associated with organizations, that are credited with vulnerability discovery.</td>
</tr>
</tbody>
</table>
13.1.17.1 Organizations

**Location:** /vulnerabilities/[/]credits/organizations

**Property:** organizations (Optional)

**Type:** Array

**Description:** The organizations credited with vulnerability discovery. Each item of this array must be an Organizational Entity object.

13.1.17.1.1 Organizational Entity

**Location:** /vulnerabilities/[/]credits/organizations/[/]

**Type:** Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the organization</td>
</tr>
<tr>
<td>address</td>
<td>Object</td>
<td>Optional</td>
<td>The physical address (location) of the organization</td>
</tr>
<tr>
<td>url</td>
<td>Array</td>
<td>Optional</td>
<td>The URL of the organization. Multiple URLs are allowed.</td>
</tr>
<tr>
<td>contact</td>
<td>Array</td>
<td>Optional</td>
<td>A contact at the organization. Multiple contacts are allowed.</td>
</tr>
</tbody>
</table>

13.1.17.1.2 BOM Reference

**Location:** /vulnerabilities/[/]credits/organizations/[/]bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

13.1.17.1.3 Organization Name

**Location:** /vulnerabilities/[/]credits/organizations/[/]name

**Property:** name (Optional)

**Type:** String

**Description:** The name of the organization

**Examples:**
- Example Inc.

13.1.17.1.4 Organization Address

**Location:** /vulnerabilities/[/]credits/organizations/[/]address

**Property:** address (Optional)

**Type:** Object
Description: The physical address (location) of the organization

Table 242 – Properties for the address object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>Optional</td>
<td>The country name or the two-letter ISO 3166-1 country code.</td>
</tr>
<tr>
<td>region</td>
<td>String</td>
<td>Optional</td>
<td>The region or state in the country.</td>
</tr>
<tr>
<td>locality</td>
<td>String</td>
<td>Optional</td>
<td>The locality or city within the country.</td>
</tr>
<tr>
<td>postOfficeBoxNumber</td>
<td>String</td>
<td>Optional</td>
<td>The post office box number.</td>
</tr>
<tr>
<td>postalCode</td>
<td>String</td>
<td>Optional</td>
<td>The postal code.</td>
</tr>
<tr>
<td>streetAddress</td>
<td>String</td>
<td>Optional</td>
<td>The street address.</td>
</tr>
</tbody>
</table>

13.1.17.1.5 BOM Reference

Location: /vulnerabilities/[]/credits/organizations/[]/address/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:' to avoid conflicts with BOM-Links.

13.1.17.1.6 Country

Location: /vulnerabilities/[]/credits/organizations/[]/address/country

Property: country (Optional)

Type: String

Description: The country name or the two-letter ISO 3166-1 country code.

13.1.17.1.7 Region

Location: /vulnerabilities/[]/credits/organizations/[]/address/region

Property: region (Optional)

Type: String

Description: The region or state in the country.

Examples:
- Texas

13.1.17.1.8 Locality

Location: /vulnerabilities/[]/credits/organizations/[]/address/locality

Property: locality (Optional)

Type: String
Description: The locality or city within the country.

Examples:
- Austin

13.1.17.1.9 Post Office Box Number

Location: /vulnerabilities/[1]/credits/organizations/[1]/address/postOfficeBoxNumber

Property: postOfficeBoxNumber (Optional)

Type: String

Description: The post office box number.

Examples:
- 901

13.1.17.1.10 Postal Code

Location: /vulnerabilities/[1]/credits/organizations/[1]/address/postalCode

Property: postalCode (Optional)

Type: String

Description: The postal code.

Examples:
- 78758

13.1.17.1.11 Street Address

Location: /vulnerabilities/[1]/credits/organizations/[1]/address/streetAddress

Property: streetAddress (Optional)

Type: String

Description: The street address.

Examples:
- 100 Main Street

13.1.17.1.12 Organization URL(s)

Location: /vulnerabilities/[1]/credits/organizations/[1]/url

Property: url (Optional)

Type: array (of String)


Description: The URL of the organization. Multiple URLs are allowed. Each item of this array must be a string.

Examples:
- https://example.com

13.1.17.1.13 Organizational Contact

Location: /vulnerabilities/[1]/credits/organizations/[1]/contact

Property: contact (Optional)

Type: Array

Description: A contact at the organization. Multiple contacts are allowed. Each item of this array must be an Organizational Contact object.
### Organizational Contact

**Location:** /vulnerabilities/[]/credits/organizations/[]/contact/[]

**Type:** Object

#### Table 243 – Properties for the contact object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

#### BOM Reference

**Location:** /vulnerabilities/[]/credits/organizations/[]/contact/[]/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

#### Name

**Location:** /vulnerabilities/[]/credits/organizations/[]/contact/[]/name

**Property:** name (Optional)

**Type:** String

**Description:** The name of a contact

#### Email Address

**Location:** /vulnerabilities/[]/credits/organizations/[]/contact/[]/email

**Property:** email (Optional)

**Type:** String

**Format:** idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

**Description:** The email address of the contact.

#### Phone

**Location:** /vulnerabilities/[]/credits/organizations/[]/contact/[]/phone

**Property:** phone (Optional)
**Type:** String

**Description:** The phone number of the contact.

**Examples:**
- 800-555-1212

### 13.1.17.2 Individuals

**Location:** /vulnerabilities/[i]/credits/individuals

**Property:** individuals (Optional)

**Type:** Array

**Description:** The individuals, not associated with organizations, that are credited with vulnerability discovery. Each item of this array must be an Organizational Contact object.

### 13.1.17.2.1 Organizational Contact

**Location:** /vulnerabilities/[i]/credits/individuals/[i]

**Type:** Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

### 13.1.17.2.2 BOM Reference

**Location:** /vulnerabilities/[i]/credits/individuals/[i]/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

### 13.1.17.2.3 Name

**Location:** /vulnerabilities/[i]/credits/individuals/[i]/name

**Property:** name (Optional)

**Type:** String

**Description:** The name of a contact

**Examples:**
- Contact name

### 13.1.17.2.4 Email Address

**Location:** /vulnerabilities/[i]/credits/individuals/[i]/email
Property: email (Optional)
Type: String
Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)
Description: The email address of the contact.
Examples:
- firstname.lastname@example.com

13.1.17.2.5 Phone
Location: /vulnerabilities/[\]/credits/individuals/[\]/phone
Property: phone (Optional)
Type: String
Description: The phone number of the contact.
Examples:
- 800-555-1212

13.1.18 Tools
Location: /vulnerabilities/[\]/tools
Property: tools (Optional)
Description: The tool(s) used to identify, confirm, or score the vulnerability.
Must be one of:
1. Tools
2. Tools (legacy)

13.1.19 Tools
Type: Object
Description: The tool(s) used to identify, confirm, or score the vulnerability.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>components</td>
<td>Array</td>
<td>Optional</td>
<td>A list of software and hardware components used as tools. Refer to the</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>component definition at /components/[]</td>
</tr>
<tr>
<td>services</td>
<td>Array</td>
<td>Optional</td>
<td>A list of services used as tools. This may include microservices, function-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>as-a-service, and other types of network or intra-process services. Refer to</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>the service definition at /services/[]</td>
</tr>
</tbody>
</table>

13.1.20 Tools (legacy)
Type: Array
Description: [Deprecated] The tool(s) used to identify, confirm, or score the vulnerability.

13.1.20.1 Components
Location: /vulnerabilities/[\]/tools/components
Property: tools (Optional)
Type: Array
Description: A list of software and hardware components used as tools. Each item of this array must be a Component object.

13.1.20.1.1 Component

Location: /vulnerabilities[/][tools/components[/]]

Type: Object

Reference: Refer to the component definition at /components[/]

All items must be unique.

13.1.20.2 Services

Location: /vulnerabilities[/][tools/services]

Property: tools (Optional)

Type: Array

Description: A list of services used as tools. This may include microservices, function-as-a-service, and other types of network or intra-process services. Each item of this array must be a Service object.

13.1.20.2.1 Service

Location: /vulnerabilities[/][tools/services[/]]

Type: Object

Reference: Refer to the service definition at /services[/]

All items must be unique.

13.1.21 Tools (legacy)

Location: /vulnerabilities[/][tools]

Property: tools

Type: Array

Description: [Deprecated] The tool(s) used to identify, confirm, or score the vulnerability. Each item of this array must be a Tool object.

13.1.21.1 Tool

Location: /vulnerabilities[/][tools[/]]

Type: Object

Description: [Deprecated] This will be removed in a future version. Use component or service instead. Information about the automated or manual tool used

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>vendor</td>
<td>String</td>
<td>Optional</td>
<td>The name of the vendor who created the tool</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the tool</td>
</tr>
<tr>
<td>version</td>
<td>String</td>
<td>Optional</td>
<td>The version of the tool</td>
</tr>
<tr>
<td>hashes</td>
<td>Array</td>
<td>Optional</td>
<td>The hashes of the tool (if applicable).</td>
</tr>
<tr>
<td>externalReferences</td>
<td>Array</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant, but are not included with the BOM.</td>
</tr>
<tr>
<td>Property</td>
<td>Type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>--------</td>
<td>-------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

13.1.21.1.1 Tool Vendor

**Location:** /vulnerabilities/*/*/tools/*/*/vendor

**Property:** vendor (Optional)

**Type:** String

**Description:** The name of the vendor who created the tool

13.1.21.1.2 Tool Name

**Location:** /vulnerabilities/*/*/tools/*/*/name

**Property:** name (Optional)

**Type:** String

**Description:** The name of the tool

13.1.21.1.3 Tool Version

**Location:** /vulnerabilities/*/*/tools/*/*/version

**Property:** version (Optional)

**Type:** String

**Description:** The version of the tool

**Examples:**
- 9.0.14
- v1.33.7
- 7.0.0-M1
- 2.0pre1
- 1.0.0-beta1
- 0.8.15

13.1.21.1.4 Hashes

**Location:** /vulnerabilities/*/*/tools/*/*/hashes

**Property:** hashes (Optional)

**Type:** Array

**Description:** The hashes of the tool (if applicable). Each item of this array must be a Hash object.

13.1.21.1.5 Hash

**Location:** /vulnerabilities/*/*/tools/*/*/hashes/*

**Type:** Object
### 13.1.21.1.6 Hash Algorithm

**Location:** /vulnerabilities[/]/tools[/]/hashes[/]/alg

**Property:** alg (Required)

**Type:** String

**Description:** The algorithm that generated the hash value.

**Enumeration:** Must be one of:
- MD5
- SHA-1
- SHA-256
- SHA-384
- SHA-512
- SHA3-256
- SHA3-384
- SHA3-512
- BLAKE2b-256
- BLAKE2b-384
- BLAKE2b-512
- BLAKE3

### 13.1.21.1.7 Hash Value

**Location:** /vulnerabilities[/]/tools[/]/hashes[/]/content

**Property:** content (Required)

**Type:** String

**Pattern Constraint:** ^([a-fA-F0-9]{32}|[a-fA-F0-9]{40}|[a-fA-F0-9]{64}|[a-fA-F0-9]{96}|[a-fA-F0-9]{128})$

**Description:** The value of the hash.

**Examples:**
- 3942447fac867ae5cddb3229b658f4d48

### 13.1.21.1.8 External References

**Location:** /vulnerabilities[/]/tools[/]/externalReferences

**Property:** externalReferences (Optional)

**Type:** Array

**Description:** External references provide a way to document systems, sites, and information that may be relevant, but are not included with the BOM. They may also establish specific relationships within or external to the BOM. Each item of this array must be an External Reference object.
13.1.21.9 External Reference

Location: /vulnerabilities/[/tools/[/externalReferences[/]

Type: Object

Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

13.1.22 Impact Analysis

Location: /vulnerabilities/[/analysis

Property: analysis (Optional)

Type: Object

Description: An assessment of the impact and exploitability of the vulnerability.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>state</td>
<td>String</td>
<td>Optional</td>
<td>Declares the current state of an occurrence of a vulnerability, after automated or manual analysis.</td>
</tr>
<tr>
<td>justification</td>
<td>String</td>
<td>Optional</td>
<td>The rationale of why the impact analysis state was asserted.</td>
</tr>
<tr>
<td>response</td>
<td>Array</td>
<td>Optional</td>
<td>A response to the vulnerability by the manufacturer, supplier, or project responsible for the affected component or service. More than one response is allowed. Responses are strongly encouraged for vulnerabilities where the analysis state is exploitable.</td>
</tr>
<tr>
<td>detail</td>
<td>String</td>
<td>Optional</td>
<td>Detailed description of the impact including methods used during assessment. If a vulnerability is not exploitable, this field should include specific details on why the component or service is not impacted by this vulnerability.</td>
</tr>
<tr>
<td>firstIssued</td>
<td>String</td>
<td>Optional</td>
<td>The date and time (timestamp) when the analysis was first issued.</td>
</tr>
<tr>
<td>lastUpdated</td>
<td>String</td>
<td>Optional</td>
<td>The date and time (timestamp) when the analysis was last updated.</td>
</tr>
</tbody>
</table>

13.1.22.1 Impact Analysis State

Location: /vulnerabilities/[/analysis/state

Property: state (Optional)

Type: String

Description: Declares the current state of an occurrence of a vulnerability, after automated or manual analysis.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>resolved</td>
<td>The vulnerability has been remediated.</td>
</tr>
<tr>
<td>resolved_with_pedigree</td>
<td>The vulnerability has been remediated and evidence of the changes are provided in the affected components pedigree containing verifiable commit history and/or diff(s).</td>
</tr>
<tr>
<td>Value</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>exploitable</td>
<td>The vulnerability may be directly or indirectly exploitable.</td>
</tr>
<tr>
<td>in_triage</td>
<td>The vulnerability is being investigated.</td>
</tr>
<tr>
<td>false_positive</td>
<td>The vulnerability is not specific to the component or service and was falsely identified or associated.</td>
</tr>
<tr>
<td>not_affected</td>
<td>The component or service is not affected by the vulnerability. Justification should be specified for all not_affected cases.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>code_not_present</td>
<td>The code has been removed or tree-shaked.</td>
</tr>
<tr>
<td>code_not_reachable</td>
<td>The vulnerable code is not invoked at runtime.</td>
</tr>
<tr>
<td>requires_configuration</td>
<td>Exploitability requires a configurable option to be set/unset.</td>
</tr>
<tr>
<td>requires_dependency</td>
<td>Exploitability requires a dependency that is not present.</td>
</tr>
<tr>
<td>requires_environment</td>
<td>Exploitability requires a certain environment which is not present.</td>
</tr>
<tr>
<td>protected_by_compiler</td>
<td>Exploitability requires a compiler flag to be set/unset.</td>
</tr>
<tr>
<td>protected_at_runtime</td>
<td>Exploits are prevented at runtime.</td>
</tr>
<tr>
<td>protected_at_perimeter</td>
<td>Attacks are blocked at physical, logical, or network perimeter.</td>
</tr>
<tr>
<td>protected_by_mitigating_control</td>
<td>Preventative measures have been implemented that reduce the likelihood and/or impact of the vulnerability.</td>
</tr>
</tbody>
</table>

### 13.1.22.2 Impact Analysis Justification

**Location:** /vulnerabilities[/]analysis/justification  
**Property:** justification (Optional)  
**Type:** String  
**Description:** The rationale of why the impact analysis state was asserted.

### 13.1.22.3 Response

**Location:** /vulnerabilities[/]analysis/response  
**Property:** response (Optional)  
**Type:** array (of String)  
**Description:** A response to the vulnerability by the manufacturer, supplier, or project responsible for the affected component or service. More than one response is allowed. Responses are strongly encouraged for vulnerabilities where the analysis state is exploitable. Each item of this array must be a string.
Table 251 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>can_not_fix</td>
<td>Can not fix</td>
</tr>
<tr>
<td>will_not_fix</td>
<td>Will not fix</td>
</tr>
<tr>
<td>update</td>
<td>Update to a different revision or release</td>
</tr>
<tr>
<td>rollback</td>
<td>Revert to a previous revision or release</td>
</tr>
<tr>
<td>workaround_available</td>
<td>There is a workaround available</td>
</tr>
</tbody>
</table>

13.1.22.4  **Detail**

*Location:* /vulnerabilities[/]analysis/detail

*Property:* detail (Optional)

*Type:* String

*Description:* Detailed description of the impact including methods used during assessment. If a vulnerability is not exploitable, this field should include specific details on why the component or service is not impacted by this vulnerability.

13.1.22.5  **First Issued**

*Location:* /vulnerabilities[/]analysis/firstIssued

*Property:* firstIssued (Optional)

*Type:* String

*Format:* data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)

*Description:* The date and time (timestamp) when the analysis was first issued.

13.1.22.6  **Last Updated**

*Location:* /vulnerabilities[/]analysis/lastUpdated

*Property:* lastUpdated (Optional)

*Type:* String

*Format:* data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)

*Description:* The date and time (timestamp) when the analysis was last updated.

13.1.23  **Affects**

*Location:* /vulnerabilities[/]affects

*Property:* affects (Optional)

*Type:* Array

*Description:* The components or services that are affected by the vulnerability.

*Location:* /vulnerabilities[/]affects[/]

*Type:* Object
Table 252 – Properties for the affects object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Required</td>
<td>References a component or service by the objects bom-ref</td>
</tr>
<tr>
<td>versions</td>
<td>Array</td>
<td>Optional</td>
<td>Zero or more individual versions or range of versions.</td>
</tr>
</tbody>
</table>

13.1.23.1.1 Reference

**Location:** /vulnerabilities[/]/affects[/]/ref

**Property:** ref (Required)

**Description:** References a component or service by the objects bom-ref

*Must be any of:*

1. Ref
2. BOM-Link Element

13.1.23.1.2 Ref

**Type:** String

**Description:** Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

13.1.23.1.3 BOM-Link Element

**Type:** String

**Format:** iri-reference as specified in [RFC 3987](https://www.ietf.org/rfc/rfc3987.html)

**Pattern Constraint:** ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*/^+$

**Description:** Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

13.1.23.1.4 Versions

**Location:** /vulnerabilities[/]/affects[/]/versions

**Property:** versions (Optional)

**Type:** Array

**Description:** Zero or more individual versions or range of versions.

**Location:** /vulnerabilities[/]/affects[/]/versions[/]

**Type:** Object

Table 253 – Properties for the versions object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>version</td>
<td>String</td>
<td>Optional</td>
<td>A single version of a component or service.</td>
</tr>
<tr>
<td>range</td>
<td>String</td>
<td>Optional</td>
<td>A version range specified in Package URL Version Range syntax (vers) which is defined at <a href="https://github.com/package-url/purl-spec/VERSION-RANGE-SPEC.rst">https://github.com/package-url/purl-spec/VERSION-RANGE-SPEC.rst</a></td>
</tr>
<tr>
<td>status</td>
<td>String</td>
<td>Optional</td>
<td>The vulnerability status for the version or range of versions.</td>
</tr>
</tbody>
</table>
13.1.23.1.5 Version

Location: /vulnerabilities/[]/affects/[]/versions/[]/version

Property: version (Optional)

Type: String

Description: A single version of a component or service.

Examples:
- 9.0.14
- v1.33.7
- 7.0.0-M1
- 2.0pre1
- 1.0.0-beta1
- 0.8.15

13.1.23.1.6 Version Range

Location: /vulnerabilities/[]/affects/[]/versions/[]/range

Property: range (Optional)

Type: String

Description: A version range specified in Package URL Version Range syntax (vers) which is defined at https://github.com/package-url/purl-spec/VERSION-RANGE-SPEC.rst

Examples:
- vers:cargo/9.0.14
- vers:npm/1.2.3|>=2.0.0|<5.0.0
- vers:pypi/0.0.0|0.0.1|0.0.2|0.0.3|1.0|2.0pre1
- vers:tomee/>=1.0.0-beta1|<=1.7.5|>=7.0.0-M1|<=7.0.7|>=7.1.0|<=7.1.2|>=8.0.0-M1|<=8.0.1
- vers:gem/|>=2.2.0|!= 2.2.1|<2.3.0

13.1.23.1.7 Status

Location: /vulnerabilities/[]/affects/[]/versions/[]/status

Property: status (Optional)

Type: String

Default Value: affected

Description: The vulnerability status for the version or range of versions.

Table 254 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>affected</td>
<td>The version is affected by the vulnerability.</td>
</tr>
<tr>
<td>unaffected</td>
<td>The version is not affected by the vulnerability.</td>
</tr>
<tr>
<td>unknown</td>
<td>It is unknown (or unspecified) whether the given version is affected.</td>
</tr>
</tbody>
</table>

All items must be unique.
13.1.24 Properties

Location: /vulnerabilities/[]/properties

Property: properties (Optional)

Type: Array

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

13.1.24.1 Lightweight name-value pair

Location: /vulnerabilities/[]/properties/[]

Type: Object

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

Table 255 – Properties for the properties object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

13.1.24.1.1 Name

Location: /vulnerabilities/[]/properties/[]/name

Property: name (Required)

Type: String

Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

13.1.24.1.2 Value

Location: /vulnerabilities/[]/properties/[]/value

Property: value (Optional)

Type: String

Description: The value of the property.

All items must be unique.

14 Annotations

Location: /annotations

Property: annotations (Optional)

Type: Array
Description: Comments made by people, organizations, or tools about any object with a bom-ref, such as components, services, vulnerabilities, or the BOM itself. Unlike inventory information, annotations may contain opinions or commentary from various stakeholders. Annotations may be inline (with inventory) or externalized via BOM-Link and may optionally be signed. Each item of this array must be an Annotations object.

14.1 Annotations

Location: /annotations/[]

Type: Object

Description: A comment, note, explanation, or similar textual content which provides additional context to the object(s) being annotated.

Table 256 – Properties for the annotations object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>subjects</td>
<td>Array</td>
<td>Required</td>
<td>The object in the BOM identified by its bom-ref. This is often a component or service, but may be any object type supporting bom-refs.</td>
</tr>
<tr>
<td>annotator</td>
<td>Array</td>
<td>Required</td>
<td>The organization, person, component, or service which created the textual content of the annotation.</td>
</tr>
<tr>
<td>timestamp</td>
<td>String</td>
<td>Required</td>
<td>The date and time (timestamp) when the annotation was created.</td>
</tr>
<tr>
<td>text</td>
<td>String</td>
<td>Required</td>
<td>The textual content of the annotation.</td>
</tr>
<tr>
<td>signature</td>
<td>Array</td>
<td>Optional</td>
<td>Enveloped signature in JSON Signature Format (JSF).</td>
</tr>
</tbody>
</table>

14.1.1 BOM Reference

Location: /annotations/[]/bom-ref

Property: bom-ref (Optional)

Type: String

Description: Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

14.1.2 Subjects

Location: /annotations/[]/subjects

Property: subjects (Required)

Type: Array

Description: The object in the BOM identified by its bom-ref. This is often a component or service, but may be any object type supporting bom-refs.

Location: /annotations/[]/subjects/[]

Must be any of:
1. Ref
2. BOM-Link Element
14.1.2.1 Ref

**Type:** String

**Description:** Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

14.1.2.2 BOM-Link Element

**Type:** String

**Format:** iri-reference as specified in [RFC 3987](https://www.ietf.org/rfc/rfc3987.html)

**Pattern Constraint:** `^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$`

**Description:** Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

*All items must be unique.*

14.1.3 Annotator

**Location:** /annotations/[]/annotator

**Property:** annotator (Required)

**Type:** Object

**Description:** The organization, person, component, or service which created the textual content of the annotation.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>organization</td>
<td>Object</td>
<td>Optional</td>
<td>The organization that created the annotation</td>
</tr>
<tr>
<td>individual</td>
<td>Object</td>
<td>Optional</td>
<td>The person that created the annotation</td>
</tr>
<tr>
<td>component</td>
<td>Object</td>
<td>Optional</td>
<td>The tool or component that created the annotation</td>
</tr>
<tr>
<td>service</td>
<td>Object</td>
<td>Optional</td>
<td>The service that created the annotation</td>
</tr>
</tbody>
</table>

14.1.3.1 Organizational Entity

**Location:** /annotations/[]/annotator/organization

**Property:** organization (Optional)

**Type:** Object

**Description:** The organization that created the annotation

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the organization</td>
</tr>
<tr>
<td>address</td>
<td>Object</td>
<td>Optional</td>
<td>The physical address (location) of the organization</td>
</tr>
</tbody>
</table>
### 14.1.3.1.1 BOM Reference

**Location:** /annotations/[/]annotator/organization/bom-ref  
**Property:** bom-ref (Optional)  
**Type:** String  
**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

### 14.1.3.1.2 Organization Name

**Location:** /annotations/[/]annotator/organization/name  
**Property:** name (Optional)  
**Type:** String  
**Description:** The name of the organization  
**Examples:**  
- Example Inc.

### 14.1.3.1.3 Organization Address

**Location:** /annotations/[/]annotator/organization/address  
**Property:** address (Optional)  
**Type:** Object  
**Description:** The physical address (location) of the organization

#### Table 259 – Properties for the address object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>Optional</td>
<td>The country name or the two-letter ISO 3166-1 country code.</td>
</tr>
<tr>
<td>region</td>
<td>String</td>
<td>Optional</td>
<td>The region or state in the country.</td>
</tr>
<tr>
<td>locality</td>
<td>String</td>
<td>Optional</td>
<td>The locality or city within the country.</td>
</tr>
<tr>
<td>postOfficeBoxNumber</td>
<td>String</td>
<td>Optional</td>
<td>The post office box number.</td>
</tr>
<tr>
<td>postalCode</td>
<td>String</td>
<td>Optional</td>
<td>The postal code.</td>
</tr>
<tr>
<td>streetAddress</td>
<td>String</td>
<td>Optional</td>
<td>The street address.</td>
</tr>
</tbody>
</table>
14.1.3.1.4  BOM Reference

Location: /annotations/[]/annotator/organization/address/bom-ref
Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

14.1.3.1.5  Country

Location: /annotations/[]/annotator/organization/address/country
Property: country (Optional)

Type: String

Description: The country name or the two-letter ISO 3166-1 country code.

14.1.3.1.6  Region

Location: /annotations/[]/annotator/organization/address/region
Property: region (Optional)

Type: String

Description: The region or state in the country.

Examples:
  • Texas

14.1.3.1.7  Locality

Location: /annotations/[]/annotator/organization/address/locality
Property: locality (Optional)

Type: String

Description: The locality or city within the country.

Examples:
  • Austin

14.1.3.1.8  Post Office Box Number

Location: /annotations/[]/annotator/organization/address/postOfficeBoxNumber
Property: postOfficeBoxNumber (Optional)

Type: String

Description: The post office box number.

Examples:
  • 901

14.1.3.1.9  Postal Code

Location: /annotations/[]/annotator/organization/address/postalCode
Property: postalCode (Optional)

Type: String

Description: The postal code.
Examples:
- 78758

14.1.3.1.10 Street Address

Location: /annotations/[]/annotator/organization/address/streetAddress
Property: streetAddress (Optional)
Type: String
Description: The street address.
Examples:
- 100 Main Street

14.1.3.1.11 Organization URL(s)

Location: /annotations/[]/annotator/organization/url
Property: url (Optional)
Type: array (of String)
Description: The URL of the organization. Multiple URLs are allowed. Each item of this array must be a string.
Examples:
- https://example.com

14.1.3.1.12 Organizational Contact

Location: /annotations/[]/annotator/organization/contact
Property: contact (Optional)
Type: Array
Description: A contact at the organization. Multiple contacts are allowed. Each item of this array must be an Organizational Contact object.

14.1.3.1.13 Organizational Contact

Location: /annotations/[]/annotator/organization/contact/[]
Type: Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

14.1.3.1.14 BOM Reference

Location: /annotations/[]/annotator/organization/contact/[]/bom-ref
Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

14.1.3.1.15 Name

Location: /annotations/[]/annotator/organization/contact/[]/name

Property: name (Optional)

Type: String

Description: The name of a contact

Examples:
- Contact name

14.1.3.1.16 Email Address

Location: /annotations/[]/annotator/organization/contact/[]/email

Property: email (Optional)

Type: String

Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

Description: The email address of the contact.

Examples:
- firstname.lastname@example.com

14.1.3.1.17 Phone

Location: /annotations/[]/annotator/organization/contact/[]/phone

Property: phone (Optional)

Type: String

Description: The phone number of the contact.

Examples:
- 800-555-1212

14.1.3.2 Organizational Contact

Location: /annotations/[]/annotator/individual

Property: individual (Optional)

Type: Object

Description: The person that created the annotation
Table 261 – Properties for the individual object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

14.1.3.2.1 BOM Reference

**Location:** /annotations/[]/annotator/individual/bom-ref  
**Property:** bom-ref (Optional)

**Type:** String  
**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

14.1.3.2.2 Name

**Location:** /annotations/[]/annotator/individual/name  
**Property:** name (Optional)

**Type:** String  
**Description:** The name of a contact

**Examples:**  
- Contact name

14.1.3.2.3 Email Address

**Location:** /annotations/[]/annotator/individual/email  
**Property:** email (Optional)

**Type:** String  
**Format:** idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)  
**Description:** The email address of the contact.

**Examples:**  
- firstname.lastname@example.com

14.1.3.2.4 Phone

**Location:** /annotations/[]/annotator/individual/phone  
**Property:** phone (Optional)

**Type:** String  
**Description:** The phone number of the contact.

**Examples:**  
- 800-555-1212
14.1.3.3 Component

Location: /annotations/[]/annotator/component
Property: component (Optional)
Type: Object
Description: The tool or component that created the annotation
Reference: Refer to the component definition at /components/[]

14.1.3.4 Service

Location: /annotations/[]/annotator/service
Property: service (Optional)
Type: Object
Description: The service that created the annotation
Reference: Refer to the service definition at /services/[]

14.1.4 Timestamp

Location: /annotations/[]/timestamp
Property: timestamp (Required)
Type: String
Format: data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)
Description: The date and time (timestamp) when the annotation was created.

14.1.5 Text

Location: /annotations/[]/text
Property: text (Required)
Type: String
Description: The textual content of the annotation.

14.1.6 Signature

Location: /annotations/[]/signature
Property: signature (Optional)
Type: Object
Description: An enveloped digital signature embedded within and specific to this object within the BOM. CycloneDX signatures enable integrity and authenticity verification without separating the signature from the BOM. Enveloped signatures enable each party in the supply chain to take responsibility for and sign their specific data, ensuring its integrity and authenticity. By aggregating all signatures, stakeholders can independently verify discrete pieces of information from each provider, enhancing overall transparency and trust in the supply chain.
Reference: Refer to the JSON Signature Format specification or to the XML Signature specification for implementation details.
  - [https://www.w3.org/TR/xmldsig-core/](https://www.w3.org/TR/xmldsig-core/)

All items must be unique.

15 Formulation

Location: /formulation
Property: formulation (Optional)
Type: Array
Description: Describes how a component or service was manufactured or deployed. This is achieved through the use of formulas, workflows, tasks, and steps, which declare the precise steps to reproduce along with the observed formulas describing the steps which transpired in the manufacturing process. Each item of this array must be a Formula object.

15.1 Formula

Location: /formulation/
Type: Object
Description: Describes workflows and resources that captures rules and other aspects of how the associated BOM component or service was formed.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>components</td>
<td>Array</td>
<td>Optional</td>
<td>Transient components that are used in tasks that constitute one or more of this formula's workflows</td>
</tr>
<tr>
<td>services</td>
<td>Array</td>
<td>Optional</td>
<td>Transient services that are used in tasks that constitute one or more of this formula's workflows</td>
</tr>
<tr>
<td>workflows</td>
<td>Array</td>
<td>Optional</td>
<td>List of workflows that can be declared to accomplish specific orchestrated goals and independently triggered.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.</td>
</tr>
</tbody>
</table>

15.1.1 BOM Reference

Location: /formulation/[]/bom-ref
Property: bom-ref (Optional)
Type: String
Description: Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

15.1.2 Components

Location: /formulation/[]/components
Property: components (Optional)
Type: Array
Description: Transient components that are used in tasks that constitute one or more of this formula's workflows. Each item of this array must be a Component object.
15.1.2.1 Component

**Location:** /formulation/[]/components/[]

**Type:** Object

**Reference:** Refer to the component definition at /components/[]

*All items must be unique.*

15.1.3 Services

**Location:** /formulation/[]/services

**Property:** services (Optional)

**Type:** Array

**Description:** Transient services that are used in tasks that constitute one or more of this formula's workflows. Each item of this array must be a Service object.

15.1.3.1 Service

**Location:** /formulation/[]/services/[]

**Type:** Object

**Reference:** Refer to the service definition at /services/[]

*All items must be unique.*

15.1.4 Workflows

**Location:** /formulation/[]/workflows

**Property:** workflows (Optional)

**Type:** Array

**Description:** List of workflows that can be declared to accomplish specific orchestrated goals and independently triggered. Each item of this array must be a Workflow object.

15.1.4.1 Workflow

**Location:** /formulation/[]/workflows/[]

**Type:** Object

**Description:** A specialized orchestration task.

**Table 263 – Properties for the workflows object**

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Required</td>
<td>Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>uid</td>
<td>String</td>
<td>Required</td>
<td>The unique identifier for the resource instance within its deployment context.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the resource instance.</td>
</tr>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>A description of the resource instance.</td>
</tr>
<tr>
<td>resourceReferences</td>
<td>Array</td>
<td>Optional</td>
<td>References to component or service resources that are used to realize the resource instance.</td>
</tr>
<tr>
<td>Property</td>
<td>Type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>------------------</td>
<td>--------</td>
<td>-------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>tasks</td>
<td>Array</td>
<td>Optional</td>
<td>The tasks that comprise the workflow.</td>
</tr>
<tr>
<td>taskDependencies</td>
<td>Array</td>
<td>Optional</td>
<td>The graph of dependencies between tasks within the workflow.</td>
</tr>
<tr>
<td>taskTypes</td>
<td>Array</td>
<td>Required</td>
<td>Indicates the types of activities performed by the set of workflow tasks.</td>
</tr>
<tr>
<td>trigger</td>
<td>Object</td>
<td>Optional</td>
<td>The trigger that initiated the task.</td>
</tr>
<tr>
<td>steps</td>
<td>Array</td>
<td>Optional</td>
<td>The sequence of steps for the task.</td>
</tr>
<tr>
<td>inputs</td>
<td>Array</td>
<td>Optional</td>
<td>Represents resources and data brought into a task at runtime by executor or task commands</td>
</tr>
<tr>
<td>outputs</td>
<td>Array</td>
<td>Optional</td>
<td>Represents resources and data output from a task at runtime by executor or task commands</td>
</tr>
<tr>
<td>timeStart</td>
<td>String</td>
<td>Optional</td>
<td>The date and time (timestamp) when the task started.</td>
</tr>
<tr>
<td>timeEnd</td>
<td>String</td>
<td>Optional</td>
<td>The date and time (timestamp) when the task ended.</td>
</tr>
<tr>
<td>workspaces</td>
<td>Array</td>
<td>Optional</td>
<td>A set of named filesystem or data resource shareable by workflow tasks.</td>
</tr>
<tr>
<td>runtimeTopology</td>
<td>Array</td>
<td>Optional</td>
<td>A graph of the component runtime topology for workflow's instance.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.</td>
</tr>
</tbody>
</table>

### 15.1.4.1.1 BOM Reference

**Location:** /formulation/[/]workflows[/]bom-ref  
**Property:** bom-ref (Required)  
**Type:** String  
**Description:** Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

### 15.1.4.1.2 Unique Identifier (UID)

**Location:** /formulation/[/]workflows[/]uid  
**Property:** uid (Required)  
**Type:** String  
**Description:** The unique identifier for the resource instance within its deployment context.

### 15.1.4.1.3 Name

**Location:** /formulation/[/]workflows[/]name
**Property:** name (Optional)

**Type:** String

**Description:** The name of the resource instance.

15.1.4.1.4 **Description**

**Location:** /formulation/[]/workflows/[]/description

**Property:** description (Optional)

**Type:** String

**Description:** A description of the resource instance.

15.1.4.1.5 **Resource references**

**Location:** /formulation/[]/workflows/[]/resourceReferences

**Property:** resourceReferences (Optional)

**Type:** Array

**Description:** References to component or service resources that are used to realize the resource instance. Each item of this array must be a Resource reference choice object.

15.1.4.1.6 **Resource reference choice**

**Location:** /formulation/[]/workflows/[]/resourceReferences/[]

**Type:** Object

**Description:** A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

### Table 264 – Properties for the resourceReferences object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

15.1.4.1.7 **BOM Reference**

**Location:** /formulation/[]/workflows/[]/resourceReferences/[]/ref

**Property:** ref (Optional)

**Description:** References an object by its bom-ref attribute

*Must be any of:*

1. Ref
2. BOM-Link Element

15.1.4.1.8 **Ref**

**Type:** String

**Description:** Descriptor for an element identified by the attribute ‘bom-ref’ in the same BOM document. In contrast to bomLinkElementType.

15.1.4.1.9 **BOM-Link Element**

**Type:** String

Pattern Constraint: ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$

Description: Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

15.1.4.1.10 External Reference

Location: /formulation/[]/workflows/[]/resourceReferences/[]/externalReference

Property: externalReference (Optional)

Type: Object

Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

Reference: Refer to the external reference definition at /externalReferences/[]

All items must be unique.

15.1.4.1.11 Tasks

Location: /formulation/[]/workflows/[]/tasks

Property: tasks (Optional)

Type: Array

Description: The tasks that comprise the workflow. Each item of this array must be a Task object.

15.1.4.1.12 Task

Type: Object

Description: Describes the inputs, sequence of steps and resources used to accomplish a task and its output.

### Table 265 – Properties for the tasks object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Required</td>
<td>Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>uid</td>
<td>String</td>
<td>Required</td>
<td>The unique identifier for the resource instance within its deployment context.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the resource instance.</td>
</tr>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>A description of the resource instance.</td>
</tr>
<tr>
<td>resourceReferences</td>
<td>Array</td>
<td>Optional</td>
<td>References to component or service resources that are used to realize the resource instance.</td>
</tr>
<tr>
<td>taskTypes</td>
<td>Array</td>
<td>Required</td>
<td>Indicates the types of activities performed by the set of workflow tasks.</td>
</tr>
<tr>
<td>trigger</td>
<td>Object</td>
<td>Optional</td>
<td>The trigger that initiated the task.</td>
</tr>
<tr>
<td>steps</td>
<td>Array</td>
<td>Optional</td>
<td>The sequence of steps for the task.</td>
</tr>
<tr>
<td>Property</td>
<td>Type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>---------</td>
<td>-------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>inputs</td>
<td>Array</td>
<td>Optional</td>
<td>Represents resources and data brought into a task at runtime by executor or task commands</td>
</tr>
<tr>
<td>outputs</td>
<td>Array</td>
<td>Optional</td>
<td>Represents resources and data output from a task at runtime by executor or task commands</td>
</tr>
<tr>
<td>timeStart</td>
<td>String</td>
<td>Optional</td>
<td>The date and time (timestamp) when the task started.</td>
</tr>
<tr>
<td>timeEnd</td>
<td>String</td>
<td>Optional</td>
<td>The date and time (timestamp) when the task ended.</td>
</tr>
<tr>
<td>workspaces</td>
<td>Array</td>
<td>Optional</td>
<td>A set of named filesystem or data resource shareable by workflow tasks.</td>
</tr>
<tr>
<td>runtimeTopology</td>
<td>Array</td>
<td>Optional</td>
<td>A graph of the component runtime topology for task's instance.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.</td>
</tr>
</tbody>
</table>

15.1.4.1.13  BOM Reference

**Location:** /formulation/[]/workflows/[]/tasks/[]/bom-ref

**Property:** bom-ref (Required)

**Type:** String

**Description:** Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

15.1.4.1.14  Unique Identifier (UID)

**Location:** /formulation/[]/workflows/[]/tasks/[]/uid

**Property:** uid (Required)

**Type:** String

**Description:** The unique identifier for the resource instance within its deployment context.

15.1.4.1.15  Name

**Location:** /formulation/[]/workflows/[]/tasks/[]/name

**Property:** name (Optional)

**Type:** String

**Description:** The name of the resource instance.

15.1.4.1.16  Description

**Location:** /formulation/[]/workflows/[]/tasks/[]/description

**Property:** description (Optional)

**Type:** String
Description: A description of the resource instance.

15.1.4.1.17 Resource references

Location: /formulation/[[/workflows/[[/tasks/[[resourceReferences

Property: resourceReferences (Optional)

Type: Array

Description: References to component or service resources that are used to realize the resource instance. Each item of this array must be a Resource reference choice object.

15.1.4.1.18 Resource reference choice

Location: /formulation/[[/workflows/[[/tasks/[[resourceReferences/[]

Type: Object

Description: A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

Table 266 – Properties for the resourceReferences object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

15.1.4.1.19 BOM Reference

Location: /formulation/[[/workflows/[[/tasks/[[resourceReferences/[[/ref

Property: ref (Optional)

Description: References an object by its bom-ref attribute

Must be any of:
1. Ref
2. BOM-Link Element

15.1.4.1.20 Ref

Type: String

Description: Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

15.1.4.1.21 BOM-Link Element

Type: String


Pattern Constraint: ^urn:cdx:([0-9a-f][8]-[0-9a-f][4]-[0-9a-f][4]-[0-9a-f][4]-[0-9a-f][12][1-9][0-9])#$

Description: Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

15.1.4.1.22 External Reference

Location: /formulation/[[/workflows/[[/tasks/[[resourceReferences/[[/externalReference

Property: externalReference (Optional)

Type: Object
Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

Reference: Refer to the external reference definition at /externalReferences/[]

All items must be unique.

15.1.4.1.23 Task types

Location: /formulation/[]/workflows/[]/tasks/[]/taskTypes

Property: taskTypes (Required)

Type: array (of String)

Description: Indicates the types of activities performed by the set of workflow tasks. Each item of this array must be a string.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>copy</td>
<td>A task that copies software or data used to accomplish other tasks in the workflow.</td>
</tr>
<tr>
<td>clone</td>
<td>A task that clones a software repository into the workflow in order to retrieve its source code or data for use in a build step.</td>
</tr>
<tr>
<td>lint</td>
<td>A task that checks source code for programmatic and stylistic errors.</td>
</tr>
<tr>
<td>scan</td>
<td>A task that performs a scan against source code, or built or deployed components and services. Scans are typically run to gather or test for security vulnerabilities or policy compliance.</td>
</tr>
<tr>
<td>merge</td>
<td>A task that merges changes or fixes into source code prior to a build step in the workflow.</td>
</tr>
<tr>
<td>build</td>
<td>A task that builds the source code, dependencies and/or data into an artefact that can be deployed to and executed on target systems.</td>
</tr>
<tr>
<td>test</td>
<td>A task that verifies the functionality of a component or service.</td>
</tr>
<tr>
<td>deliver</td>
<td>A task that delivers a built artefact to one or more target repositories or storage systems.</td>
</tr>
<tr>
<td>deploy</td>
<td>A task that deploys a built artefact for execution on one or more target systems.</td>
</tr>
<tr>
<td>release</td>
<td>A task that releases a built, versioned artefact to a target repository or distribution system.</td>
</tr>
<tr>
<td>clean</td>
<td>A task that cleans unnecessary tools, build artifacts and/or data from workflow storage.</td>
</tr>
<tr>
<td>other</td>
<td>A workflow task that does not match current task type definitions.</td>
</tr>
</tbody>
</table>

15.1.4.1.24 Trigger

Location: /formulation/[]/workflows/[]/tasks/[]/trigger

Property: trigger (Optional)

Type: Object

Description: The trigger that initiated the task.
### Table 268 – Properties for the trigger object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Required</td>
<td>Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>uid</td>
<td>String</td>
<td>Required</td>
<td>The unique identifier for the resource instance within its deployment context.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the resource instance.</td>
</tr>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>A description of the resource instance.</td>
</tr>
<tr>
<td>resourceReferences</td>
<td>Array</td>
<td>Optional</td>
<td>References to component or service resources that are used to realize the resource instance.</td>
</tr>
<tr>
<td>type</td>
<td>String</td>
<td>Required</td>
<td>The source type of event which caused the trigger to fire.</td>
</tr>
<tr>
<td>event</td>
<td>Object</td>
<td>Optional</td>
<td>The event data that caused the associated trigger to activate.</td>
</tr>
<tr>
<td>conditions</td>
<td>Array</td>
<td>Optional</td>
<td>A list of conditions used to determine if a trigger should be activated.</td>
</tr>
<tr>
<td>timeActivated</td>
<td>String</td>
<td>Optional</td>
<td>The date and time (timestamp) when the trigger was activated.</td>
</tr>
<tr>
<td>inputs</td>
<td>Array</td>
<td>Optional</td>
<td>Represents resources and data brought into a task at runtime by executor or task commands.</td>
</tr>
<tr>
<td>outputs</td>
<td>Array</td>
<td>Optional</td>
<td>Represents resources and data output from a task at runtime by executor or task commands.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the <a href="https://cyclonedx.org/Taxonomy/">CycloneDX Property Taxonomy</a>. Formal registration is optional.</td>
</tr>
</tbody>
</table>

#### 15.1.4.1.25 BOM Reference

**Location:** /formulation[/*]/workflows[/*]/tasks[/*]/trigger/bom-ref  
**Property:** bom-ref (Required)  
**Type:** String  
**Description:** Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

#### 15.1.4.1.26 Unique Identifier (UID)

**Location:** /formulation[/*]/workflows[/*]/tasks[/*]/trigger/uid  
**Property:** uid (Required)  
**Type:** String
Description: The unique identifier for the resource instance within its deployment context.

15.1.4.1.27 Name

Location: /formulation[/]workflows[/]tasks[/]trigger/name
Property: name (Optional)
Type: String
Description: The name of the resource instance.

15.1.4.1.28 Description

Location: /formulation[/]workflows[/]tasks[/]trigger/description
Property: description (Optional)
Type: String
Description: A description of the resource instance.

15.1.4.1.29 Resource references

Location: /formulation[/]workflows[/]tasks[/]trigger/resourceReferences
Property: resourceReferences (Optional)
Type: Array
Description: References to component or service resources that are used to realize the resource instance. Each item of this array must be a Resource reference choice object.

15.1.4.1.30 Resource reference choice

Location: /formulation[/]workflows[/]tasks[/]trigger/resourceReferences[/]
Type: Object
Description: A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

15.1.4.1.31 BOM Reference

Location: /formulation[/]workflows[/]tasks[/]trigger/resourceReferences[/]/ref
Property: ref (Optional)
Description: References an object by its bom-ref attribute
Must be any of:
   1. Ref
   2. BOM-Link Element

15.1.4.1.32 Ref
Type: String
Description: Descriptor for an element identified by the attribute ‘bom-ref’ in the same BOM document. In contrast to bomLinkElementType.

15.1.4.1.33 BOM-Link Element

Type: String


Pattern Constraint: ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$

Description: Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

15.1.4.1.34 External Reference

Location: /formulation/]/workflows/]/tasks/]/trigger/resourceReferences/]/externalReference

Property: externalReference (Optional)

Type: Object

Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

Reference: Refer to the external reference definition at /externalReferences/]

All items must be unique.

15.1.4.1.35 Type

Location: /formulation/]/workflows/]/tasks/]/trigger/type

Property: type (Required)

Type: String

Description: The source type of event which caused the trigger to fire.

Enumeration: Must be one of:

- manual
- api
- webhook
- scheduled

15.1.4.1.36 Event

Location: /formulation/]/workflows/]/tasks/]/trigger/event

Property: event (Optional)

Type: Object

Description: The event data that caused the associated trigger to activate.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>uid</td>
<td>String</td>
<td>Optional</td>
<td>The unique identifier of the event.</td>
</tr>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>A description of the event.</td>
</tr>
<tr>
<td>timeReceived</td>
<td>String</td>
<td>Optional</td>
<td>The date and time (timestamp) when the event was received.</td>
</tr>
<tr>
<td>data</td>
<td>Object</td>
<td>Optional</td>
<td>Specifies the metadata and content for an attachment.</td>
</tr>
<tr>
<td>Property</td>
<td>Type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>----------</td>
<td>--------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td>source</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
<tr>
<td>target</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the <a href="https://cylone-dx.org/taxonomy">CycloneDX Property Taxonomy</a>. Formal registration is optional.</td>
</tr>
</tbody>
</table>

### 15.1.4.1.37 Unique Identifier (UID)

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/event/uid  
**Property:** uid (Optional)  
**Type:** String  
**Description:** The unique identifier of the event.

### 15.1.4.1.38 Description

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/event/description  
**Property:** description (Optional)  
**Type:** String  
**Description:** A description of the event.

### 15.1.4.1.39 Time Received

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/event/timeReceived  
**Property:** timeReceived (Optional)  
**Type:** String  
**Format:** data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)  
**Description:** The date and time (timestamp) when the event was received.

### 15.1.4.1.40 Attachment

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/event/data  
**Property:** data (Optional)  
**Type:** Object  
**Description:** Specifies the metadata and content for an attachment.
Table 271 – Properties for the data object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>contentType</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plan text documents. RFC 2045 section 5.1 outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the IANA media types registry.</td>
</tr>
<tr>
<td>encoding</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the optional encoding the text is represented in.</td>
</tr>
<tr>
<td>content</td>
<td>String</td>
<td>Required</td>
<td>The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.</td>
</tr>
</tbody>
</table>

15.1.4.1.41 Content-Type

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/event/data/contentType

**Property:** contentType (Optional)

**Type:** String

**Default Value:** text/plain

**Description:** Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plan text documents. RFC 2045 section 5.1 outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the IANA media types registry.

**Examples:**
- text/plain
- application/json
- image/png

15.1.4.1.42 Encoding

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/event/data/encoding

**Property:** encoding (Optional)

**Type:** String

**Description:** Specifies the optional encoding the text is represented in.

Table 272 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>base64</td>
<td>Base64 is a binary-to-text encoding scheme that represents binary data in an ASCII string.</td>
</tr>
</tbody>
</table>

15.1.4.1.43 Attachment Text

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/event/data/content

**Property:** content (Required)

**Type:** String
**Description:** The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.

**15.1.4.1.44 Resource reference choice**

**Location:** /formulation/[/workflows/[/tasks/[/trigger/event/source

**Property:** source (Optional)

**Type:** Object

**Description:** A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

**15.1.4.1.45 BOM Reference**

**Location:** /formulation/[/workflows/[/tasks/[/trigger/event/source/ref

**Property:** ref (Optional)

**Description:** References an object by its bom-ref attribute

*Must be any of:*

1. Ref
2. BOM-Link Element

**15.1.4.1.46 Ref**

**Type:** String

**Description:** Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

**15.1.4.1.47 BOM-Link Element**

**Type:** String

**Format:** iri-reference as specified in [RFC 3987](https://www.ietf.org/rfc/rfc3987.html)

**Pattern Constraint:** ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$

**Description:** Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

**15.1.4.1.48 External Reference**

**Location:** /formulation/[/workflows/[/tasks/[/trigger/event/source/externalReference

**Property:** externalReference (Optional)

**Type:** Object

**Description:** External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

**Reference:** Refer to the external reference definition at /externalReferences/[]
15.1.4.1.49 Resource reference choice

Location: /formulation/[]/workflows/[]/tasks/[]/trigger/event/target

Property: target (Optional)

Type: Object

Description: A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

15.1.4.1.50 BOM Reference

Location: /formulation/[]/workflows/[]/tasks/[]/trigger/event/target/ref

Property: ref (Optional)

Description: References an object by its bom-ref attribute

Must be any of:

1. Ref
2. BOM-Link Element

15.1.4.1.51 Ref

Type: String

Description: Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

15.1.4.1.52 BOM-Link Element

Type: String


Pattern Constraint: ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$

Description: Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

15.1.4.1.53 External Reference

Location: /formulation/[]/workflows/[]/tasks/[]/trigger/event/target/externalReference

Property: externalReference (Optional)

Type: Object

Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

Reference: Refer to the external reference definition at /externalReferences/[]

15.1.4.1.54 Properties

Location: /formulation/[]/workflows/[]/tasks/[]/trigger/event/properties
**Property**: properties (Optional)

**Type**: Array

**Description**: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

**15.1.4.1.55 Lightweight name-value pair**

**Location**: /formulation/*/workflows/*/tasks/*/trigger/event/properties/*

**Type**: Object

**Description**: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

**15.1.4.1.56 Name**

**Location**: /formulation/*/workflows/*/tasks/*/trigger/event/properties/*/name

**Property**: name (Required)

**Type**: String

**Description**: The name of the property. Duplicate names are allowed, each potentially having a different value.

**15.1.4.1.57 Value**

**Location**: /formulation/*/workflows/*/tasks/*/trigger/event/properties/*/value

**Property**: value (Optional)

**Type**: String

**Description**: The value of the property.

**15.1.4.1.58 Conditions**

**Location**: /formulation/*/workflows/*/tasks/*/trigger/conditions

**Property**: conditions (Optional)

**Type**: Array

**Description**: A list of conditions used to determine if a trigger should be activated. Each item of this array must be a Condition object.

**15.1.4.1.59 Condition**

**Location**: /formulation/*/workflows/*/tasks/*/trigger/conditions/*

**Type**: Object
Description: A condition that was used to determine a trigger should be activated.

Table 276 – Properties for the conditions object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>Describes the set of conditions which cause the trigger to activate.</td>
</tr>
<tr>
<td>expression</td>
<td>String</td>
<td>Optional</td>
<td>The logical expression that was evaluated that determined the trigger should be fired.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.</td>
</tr>
</tbody>
</table>

15.1.4.1.60 Description

Location: /formulation/[]/workflows/[]/tasks/[]/trigger/conditions/[]/description

Property: description (Optional)

Type: String

Description: Describes the set of conditions which cause the trigger to activate.

15.1.4.1.61 Expression

Location: /formulation/[]/workflows/[]/tasks/[]/trigger/conditions/[]/expression

Property: expression (Optional)

Type: String

Description: The logical expression that was evaluated that determined the trigger should be fired.

15.1.4.1.62 Properties

Location: /formulation/[]/workflows/[]/tasks/[]/trigger/conditions/[]/properties

Property: properties (Optional)

Type: Array

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

15.1.4.1.63 Lightweight name-value pair

Location: /formulation/[]/workflows/[]/tasks/[]/trigger/conditions/[]/properties/[]

Type: Object

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.
Table 277 – Properties for the properties object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

15.1.4.1.64 Name

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/conditions/[]/properties/[]/name

**Property:** name (Required)

**Type:** String

**Description:** The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.4.1.65 Value

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/conditions/[]/properties/[]/value

**Property:** value (Optional)

**Type:** String

**Description:** The value of the property.

*All items must be unique.*

15.1.4.1.66 Time activated

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/timeActivated

**Property:** timeActivated (Optional)

**Type:** String

**Format:** data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)

**Description:** The date and time (timestamp) when the trigger was activated.

15.1.4.1.67 Inputs

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/inputs

**Property:** inputs (Optional)

**Type:** Array

**Description:** Represents resources and data brought into a task at runtime by executor or task commands
Each item of this array must be an Input type object.

**Examples:**

- a configurationfile which was declared as a localcomponentorexternalReference``

15.1.4.1.68 Input type

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/inputs/[]

**Type:** Object

**Description:** Type that represents various input data types and formats.
Table 278 – Properties for the inputs object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>source</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
<tr>
<td>target</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
<tr>
<td>resource</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
<tr>
<td>parameters</td>
<td>Array</td>
<td>Optional</td>
<td>Inputs that have the form of parameters with names and values.</td>
</tr>
<tr>
<td>environmentVars</td>
<td>Array</td>
<td>Optional</td>
<td>Inputs that have the form of parameters with names and values.</td>
</tr>
<tr>
<td>data</td>
<td>Object</td>
<td>Optional</td>
<td>Specifies the metadata and content for an attachment.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the <a href="https://cyclone-dx.org">CycloneDX Property Taxonomy</a>. Formal registration is optional.</td>
</tr>
</tbody>
</table>

15.1.4.1.69 Resource reference choice

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/inputs/[]/source

**Property:** source (Optional)

**Type:** Object

**Description:** A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

**Examples:**
- source code repository
- database

Table 279 – Properties for the source object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

15.1.4.1.70 BOM Reference

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/inputs/[]/source/ref

**Property:** ref (Optional)
Description: References an object by its bom-ref attribute

Must be any of:
1. Ref
2. BOM-Link Element

15.1.4.1.71 Ref

Type: String

Description: Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

15.1.4.1.72 BOM-Link Element

Type: String


Pattern Constraint: `^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$`

Description: Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

15.1.4.1.73 External Reference

Location: /formulation/[]/workflows/[]/tasks/[]/trigger/inputs/[]/source/externalReference

Property: externalReference (Optional)

Type: Object

Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

Reference: Refer to the external reference definition at /externalReferences/[]

15.1.4.1.74 Resource reference choice

Location: /formulation/[]/workflows/[]/tasks/[]/trigger/inputs/[]/target

Property: target (Optional)

Type: Object

Description: A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

Examples:
- workspace
- directory

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

15.1.4.1.75 BOM Reference

Location: /formulation/[]/workflows/[]/tasks/[]/trigger/inputs/[]/target/ref
Property: ref (Optional)

Description: References an object by its bom-ref attribute

Must be any of:
   1. Ref
   2. BOM-Link Element

15.1.4.1.76 Ref

Type: String

Description: Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

15.1.4.1.77 BOM-Link Element

Type: String


Pattern Constraint: `^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$`

Description: Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

15.1.4.1.78 External Reference

Location: /formulation/[/workflows/[/tasks/[/trigger/inputs/[/target/externalReference

Property: externalReference (Optional)

Type: Object

Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

Reference: Refer to the external reference definition at /externalReferences/[]

15.1.4.1.79 Resource reference choice

Location: /formulation/[/workflows/[/tasks/[/trigger/inputs/[/resource

Property: resource (Optional)

Type: Object

Description: A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

Examples:
   - a reference to a configuration file in a repository (i.e., a bom-ref)
   - a reference to a scanning service used in a task (i.e., a bom-ref)

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>and information that may be relevant but are not included</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>with the BOM. They may also establish specific</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

Table 281 – Properties for the resource object
15.1.4.1.80  BOM Reference

Location: /formulation/[]/workflows/[]/tasks/[]/trigger/inputs/[]/resource/ref

Property: ref (Optional)

Description: References an object by its bom-ref attribute

Must be any of:
1. Ref
2. BOM-Link Element

15.1.4.1.81  Ref

Type: String

Description: Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

15.1.4.1.82  BOM-Link Element

Type: String


Pattern Constraint: ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$

Description: Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

15.1.4.1.83  External Reference

Location: /formulation/[]/workflows/[]/tasks/[]/trigger/inputs/[]/resource/externalReference

Property: externalReference (Optional)

Type: Object

Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

Reference: Refer to the external reference definition at /externalReferences/[]

15.1.4.1.84  Parameters

Location: /formulation/[]/workflows/[]/tasks/[]/trigger/inputs/[]/parameters

Property: parameters (Optional)

Type: Array

Description: Inputs that have the form of parameters with names and values. Each item of this array must be a Parameter object.

15.1.4.1.85  Parameter

Location: /formulation/[]/workflows/[]/tasks/[]/trigger/inputs/[]/parameters/[]

Type: Object

Description: A representation of a functional parameter.
### Table 282 – Properties for the parameters object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the parameter.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the parameter.</td>
</tr>
<tr>
<td>dataType</td>
<td>String</td>
<td>Optional</td>
<td>The data type of the parameter.</td>
</tr>
</tbody>
</table>

#### 15.1.4.1.86 Name

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/inputs/[]/parameters/[]/name  
**Property:** name (Optional)

**Type:** String  
**Description:** The name of the parameter.

#### 15.1.4.1.87 Value

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/inputs/[]/parameters/[]/value  
**Property:** value (Optional)

**Type:** String  
**Description:** The value of the parameter.

#### 15.1.4.1.88 Data type

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/inputs/[]/parameters/[]/dataType  
**Property:** dataType (Optional)

**Type:** String  
**Description:** The data type of the parameter.  

*All items must be unique.*

#### 15.1.4.1.89 Environment variables

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/inputs/[]/environmentVars  
**Property:** environmentVars (Optional)

**Type:** Array  
**Description:** Inputs that have the form of parameters with names and values.

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/inputs/[]/environmentVars/[

*Must be one of:*  
1. Lightweight name-value pair

#### 15.1.4.1.90 Lightweight name-value pair

**Type:** Object  
**Description:** Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the [CycloneDX Property Taxonomy](https://cyloneDX.org). Formal registration is optional.
Table 283 – Properties for lightweight name-value pair

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

**Type:** String

**15.1.4.1.91 Name**

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/inputs/[]/environmentVars/[]/name

**Property:** environmentVars (Required)

**Type:** String

**Description:** The name of the property. Duplicate names are allowed, each potentially having a different value.

**15.1.4.1.92 Value**

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/inputs/[]/environmentVars/[]/value

**Property:** environmentVars (Optional)

**Type:** String

**Description:** The value of the property.

_All items must be unique._

**15.1.4.1.93 Attachment**

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/inputs/[]/data

**Property:** data (Optional)

**Type:** Object

**Description:** Specifies the metadata and content for an attachment.

Table 284 – Properties for the data object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>contentType</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. <em>RFC 2045 section 5.1</em> outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the <em>IANA media types registry</em>.</td>
</tr>
<tr>
<td>encoding</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the optional encoding the text is represented in.</td>
</tr>
<tr>
<td>content</td>
<td>String</td>
<td>Required</td>
<td>The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.</td>
</tr>
</tbody>
</table>

**15.1.4.1.94 Content-Type**

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/inputs/[]/data/contentType

**Property:** contentType (Optional)
Type: String

Default Value: text/plain

Description: Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. RFC 2045 section 5.1 outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the IANA media types registry.

Examples:
- text/plain
- application/json
- image/png

15.1.4.1.95 Encoding

Location: /formulation/[]/workflows/[]/tasks/[]/trigger/inputs/[]/data/encoding

Property: encoding (Optional)

Type: String

Description: Specifies the optional encoding the text is represented in.

Table 285 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>base64</td>
<td>Base64 is a binary-to-text encoding scheme that represents binary data in an ASCII string.</td>
</tr>
</tbody>
</table>

15.1.4.1.96 Attachment Text

Location: /formulation/[]/workflows/[]/tasks/[]/trigger/inputs/[]/data/content

Property: content (Required)

Type: String

Description: The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.

15.1.4.1.97 Properties

Location: /formulation/[]/workflows/[]/tasks/[]/trigger/inputs/[]/properties

Property: properties (Optional)

Type: Array

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

15.1.4.1.98 Lightweight name-value pair

Location: /formulation/[]/workflows/[]/tasks/[]/trigger/inputs/[]/properties/[]

Type: Object

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different
values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

Table 286 – Properties for the properties object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

15.1.4.1.99 Name

Location: /formulation/[]/workflows/[]/tasks/[]/trigger/inputs/[]/properties/[]/name

Property: name (Required)

Type: String

Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.4.1.100 Value

Location: /formulation/[]/workflows/[]/tasks/[]/trigger/inputs/[]/properties/[]/value

Property: value (Optional)

Type: String

Description: The value of the property.

All items must be unique.

15.1.4.1.101 Outputs

Location: /formulation/[]/workflows/[]/tasks/[]/trigger/outputs

Property: outputs (Optional)

Type: Array

Description: Represents resources and data output from a task at runtime by executor or task commands

Examples:
- a log file or metrics data produced by the task

Location: /formulation/[]/workflows/[]/tasks/[]/trigger/outputs/[]

Type: Object

Table 287 – Properties for the outputs object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>type</td>
<td>String</td>
<td>Optional</td>
<td>Describes the type of data output.</td>
</tr>
<tr>
<td>source</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
<tr>
<td>target</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
<tr>
<td>Property</td>
<td>Type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>---------------</td>
<td>----------</td>
<td>-------------</td>
<td>------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>resource</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
<tr>
<td>data</td>
<td>Object</td>
<td>Optional</td>
<td>Specifies the metadata and content for an attachment.</td>
</tr>
<tr>
<td>environmentVars</td>
<td>Array</td>
<td>Optional</td>
<td>Outputs that have the form of environment variables.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.</td>
</tr>
</tbody>
</table>

**15.1.4.1.102 Type**

**Location:** /formulation[/]/workflows[/]/tasks[/]/trigger/outputs[/]/type

**Property:** type (Optional)

**Type:** String

**Description:** Describes the type of data output.

**Enumeration:** Must be one of:
- artifact
- attestation
- log
- evidence
- metrics
- other

**15.1.4.1.103 Resource reference choice**

**Location:** /formulation[/]/workflows[/]/tasks[/]/trigger/outputs[/]/source

**Property:** source (Optional)

**Type:** Object

**Description:** A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

**Table 288 – Properties for the source object**

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>
15.1.4.1.104  BOM Reference

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/outputs/[]/source/ref

**Property:** ref (Optional)

**Description:** References an object by its bom-ref attribute

*Must be any of:*
1. Ref
2. BOM-Link Element

15.1.4.1.105  Ref

**Type:** String

**Description:** Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

15.1.4.1.106  BOM-Link Element

**Type:** String

**Format:** iri-reference as specified in [RFC 3987](https://www.ietf.org/rfc/rfc3987.html)

**Pattern Constraint:** ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$

**Description:** Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

15.1.4.1.107  External Reference

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/outputs/[]/source/externalReference

**Property:** externalReference (Optional)

**Type:** Object

**Description:** External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

**Reference:** Refer to the external reference definition at /externalReferences/[]

15.1.4.1.108  Resource reference choice

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/outputs/[]/target

**Property:** target (Optional)

**Type:** Object

**Description:** A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

**Examples:**
- a log file described as an externalReference within its target domain.

**Table 289 – Properties for the target object**

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>
15.1.4.1.109  BOM Reference

Location: /formulation/[/workflows/[/tasks/[/trigger/outputs/[/target/ref

Property: ref (Optional)

Description: References an object by its bom-ref attribute

Must be any of:
1. Ref
2. BOM-Link Element

15.1.4.1.110  Ref

Type: String

Description: Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

15.1.4.1.111  BOM-Link Element

Type: String


Pattern Constraint: `^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$`

Description: Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

15.1.4.1.112  External Reference

Location: /formulation/[/workflows/[/tasks/[/trigger/outputs/[/target/externalReference

Property: externalReference (Optional)

Type: Object

Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

Reference: Refer to the external reference definition at /externalReferences/[/

15.1.4.1.113  Resource reference choice

Location: /formulation/[/workflows/[/tasks/[/trigger/outputs/[/resource

Property: resource (Optional)

Type: Object

Description: A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

Examples:
- configuration file
- source code
- scanning service
### Table 290 – Properties for the resource object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

15.1.4.1.114   **BOM Reference**

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/outputs/[]/resource/ref

**Property:** ref (Optional)

**Description:** References an object by its bom-ref attribute

*Must be any of:*

1. Ref
2. BOM-Link Element

15.1.4.1.115   **Ref**

**Type:** String

**Description:** Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

15.1.4.1.116   **BOM-Link Element**

**Type:** String

**Format:** iri-reference as specified in [RFC 3987](https://www.ietf.org/rfc/rfc3987.html)

**Pattern Constraint:** ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$

**Description:** Descriptor for an element in a BOM document. See https://cyclonedx.org/capabilities/bomlink/

15.1.4.1.117   **External Reference**

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/outputs/[]/resource/externalReference

**Property:** externalReference (Optional)

**Type:** Object

**Description:** External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

**Reference:** Refer to the external reference definition at /externalReferences/[]

15.1.4.1.118   **Attachment**

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/outputs/[]/data

**Property:** data (Optional)

**Type:** Object

**Description:** Specifies the metadata and content for an attachment.
Table 291 – Properties for the data object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>contentType</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. RFC 2045 section 5.1 outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the IANA media types registry.</td>
</tr>
<tr>
<td>encoding</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the optional encoding the text is represented in.</td>
</tr>
<tr>
<td>content</td>
<td>String</td>
<td>Required</td>
<td>The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.</td>
</tr>
</tbody>
</table>

15.1.4.1.119    Content-Type

**Location:** /formulation[/]workflows[/]tasks[/]trigger/outputs[/]data/contentType

**Property:** contentType (Optional)

**Type:** String

**Default Value:** text/plain

**Description:** Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. RFC 2045 section 5.1 outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the IANA media types registry.

**Examples:**
- text/plain
- application/json
- image/png

15.1.4.1.120    Encoding

**Location:** /formulation[/]workflows[/]tasks[/]trigger/outputs[/]data/encoding

**Property:** encoding (Optional)

**Type:** String

**Description:** Specifies the optional encoding the text is represented in.

Table 292 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>base64</td>
<td>Base64 is a binary-to-text encoding scheme that represents binary data in an ASCII string.</td>
</tr>
</tbody>
</table>

15.1.4.1.121    Attachment Text

**Location:** /formulation[/]workflows[/]tasks[/]trigger/outputs[/]data/content

**Property:** content (Required)

**Type:** String
Description: The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.

15.1.4.1.122 Environment variables

Location: /formulation/\tasks/\trigger/outputs/\environmentVars
Property: environmentVars (Optional)

Type: Array
Description: Outputs that have the form of environment variables.
Location: /formulation/\tasks/\trigger/outputs/\environmentVars

Must be one of:
1. Lightweight name-value pair

15.1.4.1.123 Lightweight name-value pair

Type: Object
Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

Table 293 – Properties for lightweight name-value pair

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

Type: String

15.1.4.1.124 Name

Location: /formulation/\tasks/\trigger/outputs/\name
Property: environmentVars (Required)

Type: String
Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.4.1.125 Value

Location: /formulation/\tasks/\trigger/outputs/\value
Property: environmentVars (Optional)

Type: String
Description: The value of the property. All items must be unique.

15.1.4.1.126 Properties

Location: /formulation/\tasks/\trigger/outputs/\properties
Property: properties (Optional)

Type: Array
Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

15.1.4.1.127 Lightweight name-value pair

Location: /formulation/[]/workflows/[]/tasks/[]/trigger/outputs/[]/properties/[]

Type: Object

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

Table 294 – Properties for the properties object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

15.1.4.1.128 Name

Location: /formulation/[]/workflows/[]/tasks/[]/trigger/outputs/[]/properties/[]/name

Property: name (Required)

Type: String

Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.4.1.129 Value

Location: /formulation/[]/workflows/[]/tasks/[]/trigger/outputs/[]/properties/[]/value

Property: value (Optional)

Type: String

Description: The value of the property. All items must be unique.

15.1.4.1.130 Properties

Location: /formulation/[]/workflows/[]/tasks/[]/trigger/properties

Property: properties (Optional)

Type: Array

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.
15.1.4.1.131 Lightweight name-value pair

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/properties/[]

**Type:** Object

**Description:** Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the [CycloneDX Property Taxonomy](https://dx.cyclone.org/property-taxonomy). Formal registration is optional.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

15.1.4.1.132 Name

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/properties/[]/name

**Property:** name (Required)

**Type:** String

**Description:** The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.4.1.133 Value

**Location:** /formulation/[]/workflows/[]/tasks/[]/trigger/properties/[]/value

**Property:** value (Optional)

**Type:** String

**Description:** The value of the property.

15.1.4.1.134 Steps

**Location:** /formulation/[]/workflows/[]/tasks/[]/steps

**Property:** steps (Optional)

**Type:** Array

**Description:** The sequence of steps for the task.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>A name for the step.</td>
</tr>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>A description of the step.</td>
</tr>
<tr>
<td>commands</td>
<td>Array</td>
<td>Optional</td>
<td>Ordered list of commands or directives for the step</td>
</tr>
</tbody>
</table>
**properties**

<table>
<thead>
<tr>
<th></th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the <strong>CycloneDX Property Taxonomy</strong>. Formal registration is optional.</td>
</tr>
</tbody>
</table>

15.1.4.1.135 **Name**

**Location:** /formulation/[]/workflows/[]/tasks/[]/steps/[]/name

**Property:** name (Optional)

**Type:** String

**Description:** A name for the step.

15.1.4.1.136 **Description**

**Location:** /formulation/[]/workflows/[]/tasks/[]/steps/[]/description

**Property:** description (Optional)

**Type:** String

**Description:** A description of the step.

15.1.4.1.137 **Commands**

**Location:** /formulation/[]/workflows/[]/tasks/[]/steps/[]/commands

**Property:** commands (Optional)

**Type:** Array

**Description:** Ordered list of commands or directives for the step

**Location:** /formulation/[]/workflows/[]/tasks/[]/steps/[]/commands/[]

**Type:** Object

**Table 297 – Properties for the commands object**

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>executed</td>
<td>String</td>
<td>Optional</td>
<td>A text representation of the executed command.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the <strong>CycloneDX Property Taxonomy</strong>. Formal registration is optional.</td>
</tr>
</tbody>
</table>

15.1.4.1.138 **Executed**

**Location:** /formulation/[]/workflows/[]/tasks/[]/steps/[]/commands/[]/executed

**Property:** executed (Optional)

**Type:** String

**Description:** A text representation of the executed command.
15.1.4.1.139  Properties

Location: /formulation/*/workflows/*/tasks/*/steps/*/commands/*/properties

Property: properties (Optional)

Type: Array

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

15.1.4.1.140  Lightweight name-value pair

Location: /formulation/*/workflows/*/tasks/*/steps/*/commands/*/properties/*

Type: Object

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

15.1.4.1.141  Name

Location: /formulation/*/workflows/*/tasks/*/steps/*/commands/*/properties/*/name

Property: name (Required)

Type: String

Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.4.1.142  Value

Location: /formulation/*/workflows/*/tasks/*/steps/*/commands/*/properties/*/value

Property: value (Optional)

Type: String

Description: The value of the property.

15.1.4.1.143  Properties

Location: /formulation/*/workflows/*/tasks/*/steps/*/properties

Property: properties (Optional)

Type: Array

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.
Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

15.1.4.1.144 Lightweight name-value pair

Location: /formulation/[]/workflows/[]/tasks/[]/steps/[]/properties/[]

Type: Object

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

Table 299 – Properties for the properties object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

15.1.4.1.145 Name

Location: /formulation/[]/workflows/[]/tasks/[]/steps/[]/properties/[]/name

Property: name (Required)

Type: String

Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.4.1.146 Value

Location: /formulation/[]/workflows/[]/tasks/[]/steps/[]/properties/[]/value

Property: value (Optional)

Type: String

Description: The value of the property.

All items must be unique.

15.1.4.1.147 Inputs

Location: /formulation/[]/workflows/[]/tasks/[]/inputs

Property: inputs (Optional)

Type: Array

Description: Represents resources and data brought into a task at runtime by executor or task commands. Each item of this array must be an Input type object.

Examples:
- a configuration file which was declared as a local component or external reference``

15.1.4.1.148 Input type

Location: /formulation/[]/workflows/[]/tasks/[]/inputs/[]

Type: Object

Description: Type that represents various input data types and formats.
Table 300 – Properties for the inputs object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>source</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
<tr>
<td>target</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
<tr>
<td>resource</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
<tr>
<td>parameters</td>
<td>Array</td>
<td>Optional</td>
<td>Inputs that have the form of parameters with names and values.</td>
</tr>
<tr>
<td>environmentVars</td>
<td>Array</td>
<td>Optional</td>
<td>Inputs that have the form of parameters with names and values.</td>
</tr>
<tr>
<td>data</td>
<td>Object</td>
<td>Optional</td>
<td>Specifies the metadata and content for an attachment.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.</td>
</tr>
</tbody>
</table>

15.1.4.1.149 Resource reference choice

**Location:** /formulation/[/workflows/] [/tasks/] [/inputs/] [/source]

**Property:** source (Optional)

**Type:** Object

**Description:** A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

**Examples:**
- source code repository
- database

Table 301 – Properties for the source object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

15.1.4.1.150 BOM Reference

**Location:** /formulation/[/workflows/] [/tasks/] [/inputs/] [/source]/ref

**Property:** ref (Optional)
Description: References an object by its bom-ref attribute

Must be any of:
1. Ref
2. BOM-Link Element

15.1.4.1.151 Ref
Type: String
Description: Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

15.1.4.1.152 BOM-Link Element
Type: String
Pattern Constraint: ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$
Description: Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

15.1.4.1.153 External Reference
Location: /formulation/[]/workflows/[]/tasks/[]/inputs/[]/source/externalReference
Property: externalReference (Optional)
Type: Object
Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.
Reference: Refer to the external reference definition at /externalReferences/[]

15.1.4.1.154 Resource reference choice
Location: /formulation/[]/workflows/[]/tasks/[]/inputs/[]/target
Property: target (Optional)
Type: Object
Description: A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.
Examples:
- workspace
- directory

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

15.1.4.1.155 BOM Reference
Location: /formulation/[]/workflows/[]/tasks/[]/inputs/[]/target/ref
Property: ref (Optional)

description: References an object by its bom-ref attribute

must be any of:
1. Ref
2. BOM-Link Element

15.1.4.1.156 Ref

Type: String

description: Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

15.1.4.1.157 BOM-Link Element

Type: String


Pattern Constraint: ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$

Description: Descriptor for an element in a BOM document. See https://cyclonedx.org/capabilities/bomlink/

15.1.4.1.158 External Reference

Location: /formulation/[/workflows/[/tasks/[/inputs/[/target/externalReference

Property: externalReference (Optional)

Type: Object

description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

Reference: Refer to the external reference definition at /externalReferences/[

15.1.4.1.159 Resource reference choice

Location: /formulation/[/workflows/[/tasks/[/inputs/[/resource

Property: resource (Optional)

Type: Object

description: A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

Examples:
- a reference to a configuration file in a repository (i.e., a bom-ref)
- a reference to a scanning service used in a task (i.e., a bom-ref)

Table 303 – Properties for the resource object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>
15.1.4.1.160   **BOM Reference**

*Location:* /formulation/[/]/workflows/[/]/tasks/[/]/inputs/[/]/resource/ref

*Property:* ref (Optional)

*Description:* References an object by its bom-ref attribute

*Must be any of:*

1. Ref
2. BOM-Link Element

15.1.4.1.161   **Ref**

*Type:* String

*Description:* Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

15.1.4.1.162   **BOM-Link Element**

*Type:* String

*Format:* iri-reference as specified in [RFC 3987](https://www.ietf.org/rfc/rfc3987.html)

*Pattern Constraint:* ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#$+.+$

*Description:* Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

15.1.4.1.163   **External Reference**

*Location:* /formulation/[/]/workflows/[/]/tasks/[/]/inputs/[/]/resource/externalReference

*Property:* externalReference (Optional)

*Type:* Object

*Description:* External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

*Reference:* Refer to the external reference definition at /externalReferences/[/]

15.1.4.1.164   **Parameters**

*Location:* /formulation/[/]/workflows/[/]/tasks/[/]/inputs/[/]/parameters

*Property:* parameters (Optional)

*Type:* Array

*Description:* Inputs that have the form of parameters with names and values. Each item of this array must be a Parameter object.

15.1.4.1.165   **Parameter**

*Location:* /formulation/[/]/workflows/[/]/tasks/[/]/inputs/[/]/parameters/[/]

*Type:* Object

*Description:* A representation of a functional parameter.
Table 304 – Properties for the parameters object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the parameter.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the parameter.</td>
</tr>
<tr>
<td>dataType</td>
<td>String</td>
<td>Optional</td>
<td>The data type of the parameter.</td>
</tr>
</tbody>
</table>

15.1.4.1.166    Name

**Location:** /formulation[/]workflows[/]tasks[/]inputs[/]parameters[/]name

**Property:** name (Optional)

**Type:** String

**Description:** The name of the parameter.

15.1.4.1.167    Value

**Location:** /formulation[/]workflows[/]tasks[/]inputs[/]parameters[/]value

**Property:** value (Optional)

**Type:** String

**Description:** The value of the parameter.

15.1.4.1.168    Data type

**Location:** /formulation[/]workflows[/]tasks[/]inputs[/]parameters[/]dataType

**Property:** dataType (Optional)

**Type:** String

**Description:** The data type of the parameter.

*All items must be unique.*

15.1.4.1.169    Environment variables

**Location:** /formulation[/]workflows[/]tasks[/]inputs[/]environmentVars

**Property:** environmentVars (Optional)

**Type:** Array

**Description:** Inputs that have the form of parameters with names and values.

**Location:** /formulation[/]workflows[/]tasks[/]inputs[/]environmentVars[/]

*Must be one of:*

1. Lightweight name-value pair

15.1.4.1.170    Lightweight name-value pair

**Type:** Object

**Description:** Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the [CycloneDX Property Taxonomy](https://cyclonedx.com/property-taxonomy). Formal registration is optional.
<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

**Type:** String

15.1.4.1.171 Name

**Location:** /formulation/[]/workflows/[]/tasks/[]/inputs/[]/environmentVars/[]/name

**Property:** environmentVars (Required)

**Type:** String

**Description:** The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.4.1.172 Value

**Location:** /formulation/[]/workflows/[]/tasks/[]/inputs/[]/environmentVars/[]/value

**Property:** environmentVars (Optional)

**Type:** String

**Description:** The value of the property.

*All items must be unique.*

15.1.4.1.173 Attachment

**Location:** /formulation/[]/workflows/[]/tasks/[]/inputs/[]/data

**Property:** data (Optional)

**Type:** Object

**Description:** Specifies the metadata and content for an attachment.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>contentType</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. RFC 2045 section 5.1 outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the IANA media types registry.</td>
</tr>
<tr>
<td>encoding</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the optional encoding the text is represented in.</td>
</tr>
<tr>
<td>content</td>
<td>String</td>
<td>Required</td>
<td>The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.</td>
</tr>
</tbody>
</table>

15.1.4.1.174 Content-Type

**Location:** /formulation/[]/workflows/[]/tasks/[]/inputs/[]/data/contentType

**Property:** contentType (Optional)
**Type:** String

**Default Value:** text/plain

**Description:** Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. [RFC 2045 section 5.1](https://tools.ietf.org/html/rfc2045) outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the [IANA media types registry](https://www.iana.org/assignments/media-types).

**Examples:**
- text/plain
- application/json
- image/png

### 15.1.4.1.175 Encoding

**Location:** /formulation[/]/workflows[/]/tasks[/]/inputs[/]/data/encoding

**Property:** encoding (Optional)

**Type:** String

**Description:** Specifies the optional encoding the text is represented in.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>base64</td>
<td>Base64 is a binary-to-text encoding scheme that represents binary data in an ASCII string.</td>
</tr>
</tbody>
</table>

### 15.1.4.1.176 Attachment Text

**Location:** /formulation[/]/workflows[/]/tasks[/]/inputs[/]/data/content

**Property:** content (Required)

**Type:** String

**Description:** The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.

### 15.1.4.1.177 Properties

**Location:** /formulation[/]/workflows[/]/tasks[/]/inputs[/]/properties

**Property:** properties (Optional)

**Type:** Array

**Description:** Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the [CycloneDX Property Taxonomy](https://www.cyclonedx.org/property-taxonomy). Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

### 15.1.4.1.178 Lightweight name-value pair

**Location:** /formulation[/]/workflows[/]/tasks[/]/inputs[/]/properties[/]

**Type:** Object

**Description:** Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different
values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

Table 308 – Properties for the properties object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

15.1.4.1.179 Name

Location: /formulation/[]/workflows/[]/tasks/[]/inputs/[]/properties/[]/name

Property: name (Required)

Type: String

Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.4.1.180 Value

Location: /formulation/[]/workflows/[]/tasks/[]/inputs/[]/properties/[]/value

Property: value (Optional)

Type: String

Description: The value of the property.

All items must be unique.

15.1.4.1.181 Outputs

Location: /formulation/[]/workflows/[]/tasks/[]/outputs

Property: outputs (Optional)

Type: Array

Description: Represents resources and data output from a task at runtime by executor or task commands

Examples:

- a log file or metrics data produced by the task

Location: /formulation/[]/workflows/[]/tasks/[]/outputs/

Type: Object

Table 309 – Properties for the outputs object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>type</td>
<td>String</td>
<td>Optional</td>
<td>Describes the type of data output.</td>
</tr>
<tr>
<td>source</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
<tr>
<td>target</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
</tbody>
</table>
### Property Types and Requirements

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>resource</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
<tr>
<td>data</td>
<td>Object</td>
<td>Optional</td>
<td>Specifies the metadata and content for an attachment.</td>
</tr>
<tr>
<td>environmentVars</td>
<td>Array</td>
<td>Optional</td>
<td>Outputs that have the form of environment variables.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the <a href="https://www.cyclonedx.org">CycloneDX Property Taxonomy</a>. Formal registration is optional.</td>
</tr>
</tbody>
</table>

### 15.1.4.1.182 Type

**Location:** /formulation/[/]workflows/[/]tasks/[/]outputs/[/]type

**Property:** type (Optional)

**Type:** String

**Description:** Describes the type of data output.

**Enumeration:** Must be one of:
- artifact
- attestation
- log
- evidence
- metrics
- other

### 15.1.4.1.183 Resource reference choice

**Location:** /formulation/[/]workflows/[/]tasks/[/]outputs/[/]source

**Property:** source (Optional)

**Type:** Object

**Description:** A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

### Table 310 – Properties for the source object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>
15.1.4.1.184  BOM Reference

Location: /formulation/[]/workflows/[]/tasks/[]/outputs/[]/source/ref

Property: ref (Optional)

Description: References an object by its bom-ref attribute

Must be any of:
1. Ref
2. BOM-Link Element

15.1.4.1.185  Ref

Type: String

Description: Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

15.1.4.1.186  BOM-Link Element

Type: String


Pattern Constraint: ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$

Description: Descriptor for an element in a BOM document. See https://cyclonedx.org/capabilities/bomlink/

15.1.4.1.187  External Reference

Location: /formulation/[]/workflows/[]/tasks/[]/outputs/[]/source/externalReference

Property: externalReference (Optional)

Type: Object

Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

Reference: Refer to the external reference definition at /externalReferences/[]

15.1.4.1.188  Resource reference choice

Location: /formulation/[]/workflows/[]/tasks/[]/outputs/[]/target

Property: target (Optional)

Type: Object

Description: A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

Examples:
- a log file described as an externalReference within its target domain.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>
15.1.4.1.189  BOM Reference

**Location:** /formulation/[/]workflows[/]tasks[/]outputs[/]target/ref

**Property:** ref (Optional)

**Description:** References an object by its bom-ref attribute

*Must be any of:*

1. Ref
2. BOM-Link Element

15.1.4.1.190  Ref

**Type:** String

**Description:** Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

15.1.4.1.191  BOM-Link Element

**Type:** String

**Format:** iri-reference as specified in [RFC 3987](https://www.ietf.org/rfc/rfc3987.html)

**Pattern Constraint:** ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$

**Description:** Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

15.1.4.1.192  External Reference

**Location:** /formulation/[/]workflows[/]tasks[/]outputs[/]target/externalReference

**Property:** externalReference (Optional)

**Type:** Object

**Description:** External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

**Reference:** Refer to the external reference definition at /externalReferences[/]

15.1.4.1.193  Resource reference choice

**Location:** /formulation/[/]workflows[/]tasks[/]outputs[/]resource

**Property:** resource (Optional)

**Type:** Object

**Description:** A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

**Examples:**

- configuration file
- source code
- scanning service

**Table 312 – Properties for the resource object**

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM.</td>
</tr>
</tbody>
</table>
Table 313 – Properties for the data object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>contentType</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. RFC 2045 section 5.1 outlines the structure and use of content types. For a</td>
</tr>
<tr>
<td>Property</td>
<td>Type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>----------</td>
<td>---------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td>encoding</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the optional encoding the text is represented in.</td>
</tr>
<tr>
<td>content</td>
<td>String</td>
<td>Required</td>
<td>The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.</td>
</tr>
</tbody>
</table>

### 15.1.4.1.199 Content-Type

**Location:** /formulation/[]/workflows/[]/tasks/[]/outputs/[]/data/contentType  
**Property:** contentType (Optional)  
**Type:** String  
**Default Value:** text/plain  
**Description:** Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. RFC 2045 section 5.1 outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the IANA media types registry.

**Examples:**  
- text/plain  
- application/json  
- image/png

### 15.1.4.1.200 Encoding

**Location:** /formulation/[]/workflows/[]/tasks/[]/outputs/[]/data/encoding  
**Property:** encoding (Optional)  
**Type:** String  
**Description:** Specifies the optional encoding the text is represented in.

#### Table 314 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>base64</td>
<td>Base64 is a binary-to-text encoding scheme that represents binary data in an ASCII string.</td>
</tr>
</tbody>
</table>

### 15.1.4.1.201 Attachment Text

**Location:** /formulation/[]/workflows/[]/tasks/[]/outputs/[]/data/content  
**Property:** content (Required)  
**Type:** String  
**Description:** The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.

### 15.1.4.1.202 Environment variables

**Location:** /formulation/[]/workflows/[]/tasks/[]/outputs/[]/environmentVars  
**Property:** environmentVars (Optional)
Type: Array

Description: Outputs that have the form of environment variables.

Location: /formulation/[/workflows/[/tasks/[/outputs/[/environmentVars[/]]

Must be one of:

1. Lightweight name-value pair

15.1.4.1.203 Lightweight name-value pair

Type: Object

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

Table 315 – Properties for lightweight name-value pair

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

Type: String

15.1.4.1.204 Name

Location: /formulation/[/workflows/[/tasks/[/outputs/[/environmentVars[/]/name

Property: environmentVars (Required)

Type: String

Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.4.1.205 Value

Location: /formulation/[/workflows/[/tasks/[/outputs/[/environmentVars[/]/value

Property: environmentVars (Optional)

Type: String

Description: The value of the property.

All items must be unique.

15.1.4.1.206 Properties

Location: /formulation/[/workflows/[/tasks/[/outputs/[/properties

Property: properties (Optional)

Type: Array

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.
15.1.4.1.207 Lightweight name-value pair

**Location:** /formulation/[]/workflows/[]/tasks/[]/outputs/[]/properties/[]

**Type:** Object

**Description:** Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the [CycloneDX Property Taxonomy](https://www.cyclonedx.org). Formal registration is optional.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

15.1.4.1.208 Name

**Location:** /formulation/[]/workflows/[]/tasks/[]/outputs/[]/properties/[]/name

**Property:** name (Required)

**Type:** String

**Description:** The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.4.1.209 Value

**Location:** /formulation/[]/workflows/[]/tasks/[]/outputs/[]/properties/[]/value

**Property:** value (Optional)

**Type:** String

**Description:** The value of the property.

*All items must be unique.*

15.1.4.1.210 Time start

**Location:** /formulation/[]/workflows/[]/tasks/[]/timeStart

**Property:** timeStart (Optional)

**Type:** String

**Format:** data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)

**Description:** The date and time (timestamp) when the task started.

15.1.4.1.211 Time end

**Location:** /formulation/[]/workflows/[]/tasks/[]/timeEnd

**Property:** timeEnd (Optional)

**Type:** String

**Format:** data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)

**Description:** The date and time (timestamp) when the task ended.

15.1.4.1.212 Workspaces

**Location:** /formulation/[]/workflows/[]/tasks/[]/workspaces
Property: workspaces (Optional)

Type: Array

Description: A set of named filesystem or data resource shareable by workflow tasks. Each item of this array must be a Workspace object.

15.1.4.1.213  Workspace

Location: /formulation/[]/workflows/[]/tasks/[]/workspaces/[]

Type: Object

Description: A named filesystem or data resource shareable by workflow tasks.

Table 317 – Properties for the workspaces object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Required</td>
<td>Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>uid</td>
<td>String</td>
<td>Required</td>
<td>The unique identifier for the resource instance within its deployment context.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the resource instance.</td>
</tr>
<tr>
<td>aliases</td>
<td>Array</td>
<td>Optional</td>
<td>The names for the workspace as referenced by other workflow tasks. Effectively, a name mapping so other tasks can use their own local name in their steps.</td>
</tr>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>A description of the resource instance.</td>
</tr>
<tr>
<td>resourceReferences</td>
<td>Array</td>
<td>Optional</td>
<td>References to component or service resources that are used to realize the resource instance.</td>
</tr>
<tr>
<td>accessMode</td>
<td>String</td>
<td>Optional</td>
<td>Describes the read-write access control for the workspace relative to the owning resource instance.</td>
</tr>
<tr>
<td>mountPath</td>
<td>String</td>
<td>Optional</td>
<td>A path to a location on disk where the workspace will be available to the associated task's steps.</td>
</tr>
<tr>
<td>managedDataType</td>
<td>String</td>
<td>Optional</td>
<td>The name of a domain-specific data type the workspace represents.</td>
</tr>
<tr>
<td>volumeRequest</td>
<td>String</td>
<td>Optional</td>
<td>Identifies the reference to the request for a specific volume type and parameters.</td>
</tr>
<tr>
<td>volume</td>
<td>Object</td>
<td>Optional</td>
<td>Information about the actual volume instance allocated to the workspace.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.</td>
</tr>
</tbody>
</table>
15.1.4.1.214  BOM Reference  

**Location:** /formulation/[]/workflows/[]/tasks/[]/workspaces/[]/bom-ref  
*Property:* bom-ref (Required)  
**Type:** String  
**Description:** Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

15.1.4.1.215  Unique Identifier (UID)  

**Location:** /formulation/[]/workflows/[]/tasks/[]/workspaces/[]/uid  
*Property:* uid (Required)  
**Type:** String  
**Description:** The unique identifier for the resource instance within its deployment context.

15.1.4.1.216  Name  

**Location:** /formulation/[]/workflows/[]/tasks/[]/workspaces/[]/name  
*Property:* name (Optional)  
**Type:** String  
**Description:** The name of the resource instance.

15.1.4.1.217  Aliases  

**Location:** /formulation/[]/workflows/[]/tasks/[]/workspaces/[]/aliases  
*Property:* aliases (Optional)  
**Type:** array (of String)  
**Description:** The names for the workspace as referenced by other workflow tasks. Effectively, a name mapping so other tasks can use their own local name in their steps. Each item of this array must be a string.

15.1.4.1.218  Description  

**Location:** /formulation/[]/workflows/[]/tasks/[]/workspaces/[]/description  
*Property:* description (Optional)  
**Type:** String  
**Description:** A description of the resource instance.

15.1.4.1.219  Resource references  

**Location:** /formulation/[]/workflows/[]/tasks/[]/workspaces/[]/resourceReferences  
*Property:* resourceReferences (Optional)  
**Type:** Array  
**Description:** References to component or service resources that are used to realize the resource instance. Each item of this array must be a Resource reference choice object.

15.1.4.1.220  Resource reference choice  

**Location:** /formulation/[]/workflows/[]/tasks/[]/workspaces/[]/resourceReferences/[]  
**Type:** Object  
**Description:** A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

Table 318 – Properties for the resourceReferences object
<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

### 15.1.4.1.221 BOM Reference

**Location:** /formulation/[:]/workflows/[:]/tasks/[:]/workspaces/[:]/resourceReferences/[:]/ref

**Property:** ref (Optional)

**Description:** References an object by its bom-ref attribute

*Must be any of:*

1. Ref
2. BOM-Link Element

### 15.1.4.1.222 Ref

**Type:** String

**Description:** Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

### 15.1.4.1.223 BOM-Link Element

**Type:** String

**Format:** iri-reference as specified in [RFC 3987](https://www.ietf.org/rfc/rfc3987.html)

**Pattern Constraint:** ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$

**Description:** Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

### 15.1.4.1.224 External Reference

**Location:** /formulation/[:]/workflows/[:]/tasks/[:]/workspaces/[:]/resourceReferences/[:]/externalReference

**Property:** externalReference (Optional)

**Type:** Object

**Description:** External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

**Reference:** Refer to the external reference definition at /externalReferences/[:]

*All items must be unique.*

### 15.1.4.1.225 Access mode

**Location:** /formulation/[:]/workflows/[:]/tasks/[:]/workspaces/[:]/accessMode

**Property:** accessMode (Optional)

**Type:** String

**Description:** Describes the read-write access control for the workspace relative to the owning resource instance.

**Enumeration:** Must be one of:

- read-only
• read-write
• read-write-once
• write-once
• write-only

15.1.4.1.226 Mount path
Location: /formulation/[/]workflows/[/]tasks/[/]workspaces/[/]mountPath
Property: mountPath (Optional)
Type: String
Description: A path to a location on disc where the workspace will be available to the associated task's steps.

15.1.4.1.227 Managed data type
Location: /formulation/[/]workflows/[/]tasks/[/]workspaces/[/]managedDataType
Property: managedDataType (Optional)
Type: String
Description: The name of a domain-specific data type the workspace represents.
Examples:
• ConfigMap
• Secret

15.1.4.1.228 Volume request
Location: /formulation/[/]workflows/[/]tasks/[/]workspaces/[/]volumeRequest
Property: volumeRequest (Optional)
Type: String
Description: Identifies the reference to the request for a specific volume type and parameters.
Examples:
• a kubernetes Persistent Volume Claim (PVC) name

15.1.4.1.229 Volume
Location: /formulation/[/]workflows/[/]tasks/[/]workspaces/[/]volume
Property: volume (Optional)
Type: Object
Description: Information about the actual volume instance allocated to the workspace.
Examples:
• see https://kubernetes.io/docs/concepts/storage/persistent-volumes/

**Table 319 – Properties for the volume object**

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>uid</td>
<td>String</td>
<td>Optional</td>
<td>The unique identifier for the volume instance within its deployment context.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the volume instance</td>
</tr>
<tr>
<td>mode</td>
<td>String</td>
<td>Optional</td>
<td>The mode for the volume instance.</td>
</tr>
<tr>
<td>Property</td>
<td>Type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>---------------</td>
<td>------------</td>
<td>-------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>path</td>
<td>String</td>
<td>Optional</td>
<td>The underlying path created from the actual volume.</td>
</tr>
<tr>
<td>sizeAllocated</td>
<td>String</td>
<td>Optional</td>
<td>The allocated size of the volume accessible to the associated workspace.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>This should include the scalar size as well as IEC standard unit in either</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>decimal or binary form.</td>
</tr>
<tr>
<td>persistent</td>
<td>Boolean</td>
<td>Optional</td>
<td>Indicates if the volume persists beyond the life of the resource it is</td>
</tr>
<tr>
<td>remote</td>
<td>Boolean</td>
<td>Optional</td>
<td>Indicates if the volume is remotely (i.e., network) attached.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>provides flexibility to include data not officially supported in the standard</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>without having to use additional namespaces or create extensions. Unlike</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>key-value stores, properties support duplicate names, each potentially</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>having different values. Property names of interest to the general public</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>are encouraged to be registered in the CycloneDX Property Taxonomy. Formal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>registration is optional.</td>
</tr>
</tbody>
</table>

15.1.4.1.230   Unique Identifier (UID)

Location: /formulation/[]/workflows/[]/tasks/[]/workspaces/[]/volume/uid
Property: uid (Optional)
Type: String
Description: The unique identifier for the volume instance within its deployment context.

15.1.4.1.231   Name

Location: /formulation/[]/workflows/[]/tasks/[]/workspaces/[]/volume/name
Property: name (Optional)
Type: String
Description: The name of the volume instance

15.1.4.1.232   Mode

Location: /formulation/[]/workflows/[]/tasks/[]/workspaces/[]/volume/mode
Property: mode (Optional)
Type: String
Default Value: filesystem
Description: The mode for the volume instance.
Enumeration: Must be one of:
- filesystem
- block

15.1.4.1.233   Path

Location: /formulation/[]/workflows/[]/tasks/[]/workspaces/[]/volume/path
Property: path (Optional)
Type: String
Description: The underlying path created from the actual volume.

15.1.4.1.234  Size allocated

Location: /formulation/[]/workflows/[]/tasks/[]/workspaces/[]/volume/sizeAllocated

Property: sizeAllocated (Optional)

Type: String

Description: The allocated size of the volume accessible to the associated workspace. This should include the scalar size as well as IEC standard unit in either decimal or binary form.

Examples:
- 10GB
- 2Ti
- 1Pi

15.1.4.1.235  Persistent

Location: /formulation/[]/workflows/[]/tasks/[]/workspaces/[]/volume/persistent

Property: persistent (Optional)

Type: Boolean

Description: Indicates if the volume persists beyond the life of the resource it is associated with.

15.1.4.1.236  Remote

Location: /formulation/[]/workflows/[]/tasks/[]/workspaces/[]/volume/remote

Property: remote (Optional)

Type: Boolean

Description: Indicates if the volume is remotely (i.e., network) attached.

15.1.4.1.237  Properties

Location: /formulation/[]/workflows/[]/tasks/[]/workspaces/[]/volume/properties

Property: properties (Optional)

Type: Array

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

15.1.4.1.238  Lightweight name-value pair

Location: /formulation/[]/workflows/[]/tasks/[]/workspaces/[]/volume/properties/[]

Type: Object

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

Table 320 – Properties for the properties object
## Table 321 – Properties for the properties object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>
15.1.4.1.243 Name

**Location:** /formulation/[]/workflows/[]/tasks/[]/workspaces/[]/properties/[]/name

**Property:** name (Required)

**Type:** String

**Description:** The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.4.1.244 Value

**Location:** /formulation/[]/workflows/[]/tasks/[]/workspaces/[]/properties/[]/value

**Property:** value (Optional)

**Type:** String

**Description:** The value of the property. All items must be unique.

15.1.4.1.245 Runtime topology

**Location:** /formulation/[]/workflows/[]/tasks/[]/runtimeTopology

**Property:** runtimeTopology (Optional)

**Type:** Array

**Description:** A graph of the component runtime topology for task's instance. Each item of this array must be a Dependency object.

15.1.4.1.246 Dependency

**Location:** /formulation/[]/workflows/[]/tasks/[]/runtimeTopology/[]

**Type:** Object

**Description:** Defines the direct dependencies of a component, service, or the components provided/implemented by a given component. Components or services that do not have their own dependencies must be declared as empty elements within the graph. Components or services that are not represented in the dependency graph may have unknown dependencies. It is recommended that implementations assume this to be opaque and not an indicator of an object being dependency-free. It is recommended to leverage compositions to indicate unknown dependency graphs.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>String</td>
<td>Required</td>
<td>References a component or service by its bom-ref attribute</td>
</tr>
<tr>
<td>dependsOn</td>
<td>Array</td>
<td>Optional</td>
<td>The bom-ref identifiers of the components or services that are dependencies of this dependency object.</td>
</tr>
<tr>
<td>provides</td>
<td>Array</td>
<td>Optional</td>
<td>The bom-ref identifiers of the components or services that define a given specification or standard, which are provided or implemented by this dependency object. For example, a cryptographic library which implements a cryptographic algorithm. A component which implements another component does not imply that the implementation is in use.</td>
</tr>
</tbody>
</table>

15.1.4.1.247 Reference

**Location:** /formulation/[]/workflows/[]/tasks/[]/runtimeTopology/[]/ref

**Property:** ref (Required)
Type: String
Description: References a component or service by its bom-ref attribute

15.1.4.1.248 Depends On
Location: /formulation/[]/workflows/[]/tasks/[]/runtimeTopology/[]/dependsOn
Property: dependsOn (Optional)
Type: array (of String)
Description: The bom-ref identifiers of the components or services that are dependencies of this dependency object. Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType. Each item of this array must be a string.
All items must be unique.

15.1.4.1.249 Provides
Location: /formulation/[]/workflows/[]/tasks/[]/runtimeTopology/[]/provides
Property: provides (Optional)
Type: array (of String)
Description: The bom-ref identifiers of the components or services that define a given specification or standard, which are provided or implemented by this dependency object. For example, a cryptographic library which implements a cryptographic algorithm. A component which implements another component does not imply that the implementation is in use. Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType. Each item of this array must be a string.
All items must be unique.

15.1.4.1.250 Properties
Location: /formulation/[]/workflows/[]/tasks/[]/properties
Property: properties (Optional)
Type: Array
Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

15.1.4.1.251 Lightweight name-value pair
Location: /formulation/[]/workflows/[]/tasks/[]/properties/[]
Type: Object
Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

**Table 323 – Properties for the properties object**

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>
15.1.4.1.252 Name
Location: /formulation/[/workflows/[/tasks/[/properties/[/name
Property: name (Required)
Type: String
Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.4.1.253 Value
Location: /formulation/[/workflows/[/tasks/[/properties/[/value
Property: value (Optional)
Type: String
Description: The value of the property. 
All items must be unique.

15.1.4.1.254 Task dependency graph
Location: /formulation/[/workflows/[/taskDependencies
Property: taskDependencies (Optional)
Type: Array
Description: The graph of dependencies between tasks within the workflow. Each item of this array must be a Dependency object.

15.1.4.1.255 Dependency
Location: /formulation/[/workflows/[/taskDependencies/[/
Type: Object
Description: Defines the direct dependencies of a component, service, or the components provided/implemented by a given component. Components or services that do not have their own dependencies must be declared as empty elements within the graph. Components or services that are not represented in the dependency graph may have unknown dependencies. It is recommended that implementations assume this to be opaque and not an indicator of an object being dependency-free. It is recommended to leverage compositions to indicate unknown dependency graphs.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>String</td>
<td>Required</td>
<td>References a component or service by its bom-ref attribute</td>
</tr>
<tr>
<td>dependsOn</td>
<td>Array</td>
<td>Optional</td>
<td>The bom-ref identifiers of the components or services that are dependencies of this dependency object.</td>
</tr>
<tr>
<td>provides</td>
<td>Array</td>
<td>Optional</td>
<td>The bom-ref identifiers of the components or services that define a given specification or standard, which are provided or implemented by this dependency object. For example, a cryptographic library which implements a cryptographic algorithm. A component which implements another component does not imply that the implementation is in use.</td>
</tr>
</tbody>
</table>

15.1.4.1.256 Reference
Location: /formulation/[/workflows/[/taskDependencies/[/ref
Property: ref (Required)

Type: String

Description: References a component or service by its bom-ref attribute

15.1.4.1.257 Depends On

Location: /formulation/[array]/workflows/[array]/taskDependencies/[array]/dependsOn

Property: dependsOn (Optional)

Type: array (of String)

Description: The bom-ref identifiers of the components or services that are dependencies of this dependency object. Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType. Each item of this array must be a string.

All items must be unique.

15.1.4.1.258 Provides

Location: /formulation/[array]/workflows/[array]/taskDependencies/[array]/provides

Property: provides (Optional)

Type: array (of String)

Description: The bom-ref identifiers of the components or services that define a given specification or standard, which are provided or implemented by this dependency object. For example, a cryptographic library which implements a cryptographic algorithm. A component which implements another component does not imply that the implementation is in use. Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType. Each item of this array must be a string.

All items must be unique.

15.1.4.1.259 Task types

Location: /formulation/[array]/workflows/[array]/taskTypes

Property: taskTypes (Required)

Type: array (of String)

Description: Indicates the types of activities performed by the set of workflow tasks. Each item of this array must be a string.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>copy</td>
<td>A task that copies software or data used to accomplish other tasks in the workflow.</td>
</tr>
<tr>
<td>clone</td>
<td>A task that clones a software repository into the workflow in order to retrieve its source code or data for use in a build step.</td>
</tr>
<tr>
<td>lint</td>
<td>A task that checks source code for programmatic and stylistic errors.</td>
</tr>
<tr>
<td>scan</td>
<td>A task that performs a scan against source code, or built or deployed components and services. Scans are typically run to gather or test for security vulnerabilities or policy compliance.</td>
</tr>
<tr>
<td>merge</td>
<td>A task that merges changes or fixes into source code prior to a build step in the workflow.</td>
</tr>
<tr>
<td>build</td>
<td>A task that builds the source code, dependencies and/or data into an artefact that can be deployed to and executed on target systems.</td>
</tr>
<tr>
<td>Value</td>
<td>Description</td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
</tr>
<tr>
<td>test</td>
<td>A task that verifies the functionality of a component or service.</td>
</tr>
<tr>
<td>deliver</td>
<td>A task that delivers a built artefact to one or more target repositories or storage systems.</td>
</tr>
<tr>
<td>deploy</td>
<td>A task that deploys a built artefact for execution on one or more target systems.</td>
</tr>
<tr>
<td>release</td>
<td>A task that releases a built, versioned artefact to a target repository or distribution system.</td>
</tr>
<tr>
<td>clean</td>
<td>A task that cleans unnecessary tools, build artifacts and/or data from workflow storage.</td>
</tr>
<tr>
<td>other</td>
<td>A workflow task that does not match current task type definitions.</td>
</tr>
</tbody>
</table>

15.1.4.1.260 Trigger

**Location:** /formulation[/]/workflows[/]/trigger

**Property:** trigger (Optional)

**Type:** Object

**Description:** The trigger that initiated the task.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Required</td>
<td>Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>uid</td>
<td>String</td>
<td>Required</td>
<td>The unique identifier for the resource instance within its deployment context.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the resource instance.</td>
</tr>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>A description of the resource instance.</td>
</tr>
<tr>
<td>resourceReferences</td>
<td>Array</td>
<td>Optional</td>
<td>References to component or service resources that are used to realize the resource instance.</td>
</tr>
<tr>
<td>type</td>
<td>String</td>
<td>Required</td>
<td>The source type of event which caused the trigger to fire.</td>
</tr>
<tr>
<td>event</td>
<td>Object</td>
<td>Optional</td>
<td>The event data that caused the associated trigger to activate.</td>
</tr>
<tr>
<td>conditions</td>
<td>Array</td>
<td>Optional</td>
<td>A list of conditions used to determine if a trigger should be activated.</td>
</tr>
<tr>
<td>timeActivated</td>
<td>String</td>
<td>Optional</td>
<td>The date and time (timestamp) when the trigger was activated.</td>
</tr>
<tr>
<td>inputs</td>
<td>Array</td>
<td>Optional</td>
<td>Represents resources and data brought into a task at runtime by executor or task commands</td>
</tr>
<tr>
<td>outputs</td>
<td>Array</td>
<td>Optional</td>
<td>Represents resources and data output from a task at runtime by executor or task commands</td>
</tr>
<tr>
<td>Property</td>
<td>Type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>----------</td>
<td>----------</td>
<td>-------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the <a href="https://cyclonedx.org/taxonomy">CycloneDX Property Taxonomy</a>. Formal registration is optional.</td>
</tr>
</tbody>
</table>

### 15.1.4.1.261 BOM Reference

**Location:** /formulation/[]/workflows/[]/trigger/bom-ref  
**Property:** bom-ref (Required)

**Type:** String  
**Description:** Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

### 15.1.4.1.262 Unique Identifier (UID)

**Location:** /formulation/[]/workflows/[]/trigger/uid  
**Property:** uid (Required)

**Type:** String  
**Description:** The unique identifier for the resource instance within its deployment context.

### 15.1.4.1.263 Name

**Location:** /formulation/[]/workflows/[]/trigger/name  
**Property:** name (Optional)

**Type:** String  
**Description:** The name of the resource instance.

### 15.1.4.1.264 Description

**Location:** /formulation/[]/workflows/[]/trigger/description  
**Property:** description (Optional)

**Type:** String  
**Description:** A description of the resource instance.

### 15.1.4.1.265 Resource references

**Location:** /formulation/[]/workflows/[]/trigger/resourceReferences  
**Property:** resourceReferences (Optional)

**Type:** Array  
**Description:** References to component or service resources that are used to realize the resource instance. Each item of this array must be a Resource reference choice object.

### 15.1.4.1.266 Resource reference choice

**Location:** /formulation/[]/workflows/[]/trigger/resourceReferences/[]  
**Type:** Object  
**Description:** A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.
Table 327 – Properties for the resourceReferences object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

15.1.4.1.267    BOM Reference

**Location:** /formulation/[[]/workflows/[[]/trigger/resourceReferences/[[]/ref

**Property:** ref (Optional)

**Description:** References an object by its bom-ref attribute

*Must be any of:*
1. Ref
2. BOM-Link Element

15.1.4.1.268    Ref

**Type:** String

**Description:** Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

15.1.4.1.269    BOM-Link Element

**Type:** String

**Format:** iri-reference as specified in [RFC 3987](https://www.ietf.org/rfc/rfc3987.html)

**Pattern Constraint:** ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$

**Description:** Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

15.1.4.1.270    External Reference

**Location:** /formulation/[[]/workflows/[[]/trigger/resourceReferences/[[]/externalReference

**Property:** externalReference (Optional)

**Type:** Object

**Description:** External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

**Reference:** Refer to the external reference definition at /externalReferences/[[]

*All items must be unique.*

15.1.4.1.271    Type

**Location:** /formulation/[[]/workflows/[[]/trigger/type

**Property:** type (Required)

**Type:** String

**Description:** The source type of event which caused the trigger to fire.

**Enumeration:** Must be one of:
15.1.4.1.272  Event

Location: /formulation[/]/workflows[/]/trigger/event

Property: event (Optional)

Type: Object

Description: The event data that caused the associated trigger to activate.

Table 328 – Properties for the event object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>uid</td>
<td>String</td>
<td>Optional</td>
<td>The unique identifier of the event.</td>
</tr>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>A description of the event.</td>
</tr>
<tr>
<td>timeReceived</td>
<td>String</td>
<td>Optional</td>
<td>The date and time (timestamp) when the event was received.</td>
</tr>
<tr>
<td>data</td>
<td>Object</td>
<td>Optional</td>
<td>Specifies the metadata and content for an attachment.</td>
</tr>
<tr>
<td>source</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
<tr>
<td>target</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.</td>
</tr>
</tbody>
</table>

15.1.4.1.273  Unique Identifier (UID)

Location: /formulation[/]/workflows[/]/trigger/event/uid

Property: uid (Optional)

Type: String

Description: The unique identifier of the event.

15.1.4.1.274  Description

Location: /formulation[/]/workflows[/]/trigger/event/description

Property: description (Optional)

Type: String

Description: A description of the event.
15.1.4.1.275 Time Received

**Location:** /formulation/[]/workflows/[]/trigger/event/timeReceived  
**Property:** timeReceived (Optional)  
**Type:** String  
**Format:** data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)  
**Description:** The date and time (timestamp) when the event was received.

15.1.4.1.276 Attachment

**Location:** /formulation/[]/workflows/[]/trigger/event/data  
**Property:** data (Optional)  
**Type:** Object  
**Description:** Specifies the metadata and content for an attachment.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>contentType</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. RFC 2045 section 5.1 outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the IANA media types registry.</td>
</tr>
<tr>
<td>encoding</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the optional encoding the text is represented in.</td>
</tr>
<tr>
<td>content</td>
<td>String</td>
<td>Required</td>
<td>The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.</td>
</tr>
</tbody>
</table>

15.1.4.1.277 Content-Type

**Location:** /formulation/[]/workflows/[]/trigger/event/data/contentType  
**Property:** contentType (Optional)  
**Type:** String  
**Default Value:** text/plain  
**Description:** Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. RFC 2045 section 5.1 outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the IANA media types registry.  
**Examples:**  
- text/plain  
- application/json  
- image/png

15.1.4.1.278 Encoding

**Location:** /formulation/[]/workflows/[]/trigger/event/data/encoding  
**Property:** encoding (Optional)  
**Type:** String
Description: Specifies the optional encoding the text is represented in.

Table 330 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>base64</td>
<td>Base64 is a binary-to-text encoding scheme that represents binary data in an ASCII string.</td>
</tr>
</tbody>
</table>

15.1.4.1.279 Attachment Text

Location: /formulation[/]/workflows[/]/trigger/event/data/content

Property: content (Required)

Type: String

Description: The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.

15.1.4.1.280 Resource reference choice

Location: /formulation[/]/workflows[/]/trigger/event/source

Property: source (Optional)

Type: Object

Description: A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

Table 331 – Properties for the source object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

15.1.4.1.281 BOM Reference

Location: /formulation[/]/workflows[/]/trigger/event/source/ref

Property: ref (Optional)

Description: References an object by its bom-ref attribute

Must be any of:

1. Ref
2. BOM-Link Element

15.1.4.1.282 Ref

Type: String

Description: Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

15.1.4.1.283 BOM-Link Element

Type: String

Pattern Constraint: ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$  
Description: Descriptor for an element in a BOM document. See https://cyclonedx.org/capabilities/bomlink/

15.1.4.1.284 External Reference

Location: /formulation/[]/workflows/[]/trigger/event/source/externalReference

Property: externalReference (Optional)

Type: Object

Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

Reference: Refer to the external reference definition at /externalReferences/[]

15.1.4.1.285 Resource reference choice

Location: /formulation/[]/workflows/[]/trigger/event/target

Property: target (Optional)

Type: Object

Description: A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

Table 332 – Properties for the target object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

15.1.4.1.286 BOM Reference

Location: /formulation/[]/workflows/[]/trigger/event/target/ref

Property: ref (Optional)

Description: References an object by its bom-ref attribute

Must be any of:

1. Ref
2. BOM-Link Element

15.1.4.1.287 Ref

Type: String

Description: Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

15.1.4.1.288 BOM-Link Element

Type: String


Pattern Constraint: ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$

Description: Descriptor for an element in a BOM document. See https://cyclonedx.org/capabilities/bomlink/
15.1.4.1.289  **External Reference**

**Location:** /formulation/[]/workflows/[]/trigger/event/target/externalReference  
**Property:** externalReference (Optional)

**Type:** Object

**Description:** External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

**Reference:** Refer to the external reference definition at /externalReferences/[]

15.1.4.1.290  **Properties**

**Location:** /formulation/[]/workflows/[]/trigger/event/properties  
**Property:** properties (Optional)

**Type:** Array

**Description:** Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

15.1.4.1.291  **Lightweight name-value pair**

**Location:** /formulation/[]/workflows/[]/trigger/event/properties/[]

**Type:** Object

**Description:** Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

**Table 333 – Properties for the properties object**

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

15.1.4.1.292  **Name**

**Location:** /formulation/[]/workflows/[]/trigger/event/properties/[]/name  
**Property:** name (Required)

**Type:** String

**Description:** The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.4.1.293  **Value**

**Location:** /formulation/[]/workflows/[]/trigger/event/properties/[]/value  
**Property:** value (Optional)

**Type:** String
**Description**: The value of the property.

**15.1.4.1.294 Conditions**

**Location**: /formulation/[ ]/workflows/[ ]/trigger/conditions

**Property**: conditions (Optional)

**Type**: Array

**Description**: A list of conditions used to determine if a trigger should be activated. Each item of this array must be a Condition object.

**15.1.4.1.295 Condition**

**Location**: /formulation/[ ]/workflows/[ ]/trigger/conditions/[ ]

**Type**: Object

**Description**: A condition that was used to determine a trigger should be activated.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>Describes the set of conditions which cause the trigger to activate.</td>
</tr>
<tr>
<td>expression</td>
<td>String</td>
<td>Optional</td>
<td>The logical expression that was evaluated that determined the trigger should be fired.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the <a href="https://cyclonedx.org/taxonomy">CycloneDX Property Taxonomy</a>. Formal registration is optional.</td>
</tr>
</tbody>
</table>

**15.1.4.1.296 Description**

**Location**: /formulation/[ ]/workflows/[ ]/trigger/conditions/[ ]/description

**Property**: description (Optional)

**Type**: String

**Description**: Describes the set of conditions which cause the trigger to activate.

**15.1.4.1.297 Expression**

**Location**: /formulation/[ ]/workflows/[ ]/trigger/conditions/[ ]/expression

**Property**: expression (Optional)

**Type**: String

**Description**: The logical expression that was evaluated that determined the trigger should be fired.

**15.1.4.1.298 Properties**

**Location**: /formulation/[ ]/workflows/[ ]/trigger/conditions/[ ]/properties

**Property**: properties (Optional)

**Type**: Array

**Description**: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values.
values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

15.1.4.1.299 Lightweight name-value pair

**Location:** /formulation/[/]workflows/[/]trigger/conditions/[/]properties[/]

**Type:** Object

**Description:** Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

15.1.4.1.300 Name

**Location:** /formulation/[/]workflows/[/]trigger/conditions/[/]properties[/]name

**Property:** name (Required)

**Type:** String

**Description:** The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.4.1.301 Value

**Location:** /formulation/[/]workflows/[/]trigger/conditions/[/]properties[/]value

**Property:** value (Optional)

**Type:** String

**Description:** The value of the property.

*All items must be unique.*

15.1.4.1.302 Time activated

**Location:** /formulation/[/]workflows/[/]trigger/timeActivated

**Property:** timeActivated (Optional)

**Type:** String

**Format:** data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)

**Description:** The date and time (timestamp) when the trigger was activated.

15.1.4.1.303 Inputs

**Location:** /formulation/[/]workflows/[/]trigger/inputs

**Property:** inputs (Optional)

**Type:** Array

**Description:** Represents resources and data brought into a task at runtime by executor or task commands. Each item of this array must be an Input type object.
Examples:

- a configuration file which was declared as a localcomponentexternalReference``

15.1.4.1.304 Input type

Location: /formulation[/]/workflows[/]/trigger/inputs[/]

Type: Object

Description: Type that represents various input data types and formats.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>source</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
<tr>
<td>target</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
<tr>
<td>resource</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
<tr>
<td>parameters</td>
<td>Array</td>
<td>Optional</td>
<td>Inputs that have the form of parameters with names and values.</td>
</tr>
<tr>
<td>environmentVars</td>
<td>Array</td>
<td>Optional</td>
<td>Inputs that have the form of parameters with names and values.</td>
</tr>
<tr>
<td>data</td>
<td>Object</td>
<td>Optional</td>
<td>Specifies the metadata and content for an attachment.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the <a href="https://cyclonedx.org">CycloneDX Property Taxonomy</a>. Formal registration is optional.</td>
</tr>
</tbody>
</table>

15.1.4.1.305 Resource reference choice

Location: /formulation[/]/workflows[/]/trigger/inputs[/]/source

Property: source (Optional)

Type: Object

Description: A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

Examples:

- source code repository
- database

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
</tbody>
</table>
## External Reference

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

### 15.1.4.1.306  BOM Reference

**Location:** /formulation/[/]workflows/[/]trigger/inputs/[/]source/ref  
**Property:** ref (Optional)

**Description:** References an object by its bom-ref attribute

*Must be any of:*
1. Ref
2. BOM-Link Element

### 15.1.4.1.307 Ref

**Type:** String

**Description:** Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

### 15.1.4.1.308 BOM-Link Element

**Type:** String

**Format:** iri-reference as specified in [RFC 3987](https://www.ietf.org/rfc/rfc3987.html)

**Pattern Constraint:** ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$

**Description:** Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

### 15.1.4.1.309 External Reference

**Location:** /formulation/[/]workflows/[/]trigger/inputs/[/]source/externalReference

**Property:** externalReference (Optional)

**Type:** Object

**Description:** External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

**Reference:** Refer to the external reference definition at /externalReferences[/]

### 15.1.4.1.310 Resource reference choice

**Location:** /formulation/[/]workflows/[/]trigger/inputs/[/]target

**Property:** target (Optional)

**Type:** Object

**Description:** A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

**Examples:**
- workspace
- directory

#### Table 338 – Properties for the target object
<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

15.1.4.1.311  BOM Reference

Location: /formulation/[/workflows/[/trigger/inputs/[/target/ref

Property: ref (Optional)

Description: References an object by its bom-ref attribute

Must be any of:
1. Ref
2. BOM-Link Element

15.1.4.1.312  Ref

Type: String

Description: Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

15.1.4.1.313  BOM-Link Element

Type: String


Pattern Constraint: ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$

Description: Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

15.1.4.1.314  External Reference

Location: /formulation/[/workflows/[/trigger/inputs/[/target/externalReference

Property: externalReference (Optional)

Type: Object

Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

Reference: Refer to the external reference definition at /externalReferences/[/

15.1.4.1.315  Resource reference choice

Location: /formulation/[/workflows/[/trigger/inputs/[/resource

Property: resource (Optional)

Type: Object

Description: A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

Examples:
- a reference to a configuration file in a repository (i.e., a bom-ref)
- a reference to a scanning service used in a task (i.e., a bom-ref)
### Table 339 – Properties for the resource object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

#### 15.1.4.1.316 BOM Reference

**Location:** /formulation/[]/workflows/[]/trigger/inputs/[]/resource/ref

**Property:** ref (Optional)

**Description:** References an object by its bom-ref attribute

*Must be any of:*
1. Ref
2. BOM-Link Element

#### 15.1.4.1.317 Ref

**Type:** String

**Description:** Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

#### 15.1.4.1.318 BOM-Link Element

**Type:** String

**Format:** iri-reference as specified in [RFC 3987](https://www.ietf.org/rfc/rfc3987.html)

**Pattern Constraint:** ^urn:cdx:[0-9a-f][8]-[0-9a-f][4]-[0-9a-f][4]-[0-9a-f][4]-[0-9a-f][4]-[0-9a-f][12](1-9)[0-9]*#.+$

**Description:** Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

#### 15.1.4.1.319 External Reference

**Location:** /formulation/[]/workflows/[]/trigger/inputs/[]/resource/externalReference

**Property:** externalReference (Optional)

**Type:** Object

**Description:** External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

**Reference:** Refer to the external reference definition at /externalReferences/[]

#### 15.1.4.1.320 Parameters

**Location:** /formulation/[]/workflows/[]/trigger/inputs/[]/parameters

**Property:** parameters (Optional)

**Type:** Array

**Description:** Inputs that have the form of parameters with names and values. Each item of this array must be a Parameter object.
15.1.4.1.321 Parameter

Location: /formulation/[]/workflows/[]/trigger/inputs/[]/parameters/[]
Type: Object
Description: A representation of a functional parameter.

### Table 340 – Properties for the parameters object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the parameter.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the parameter.</td>
</tr>
<tr>
<td>dataType</td>
<td>String</td>
<td>Optional</td>
<td>The data type of the parameter.</td>
</tr>
</tbody>
</table>

15.1.4.1.322 Name

Location: /formulation/[]/workflows/[]/trigger/inputs/[]/parameters/[]/name
Property: name (Optional)
Type: String
Description: The name of the parameter.

15.1.4.1.323 Value

Location: /formulation/[]/workflows/[]/trigger/inputs/[]/parameters/[]/value
Property: value (Optional)
Type: String
Description: The value of the parameter.

15.1.4.1.324 Data type

Location: /formulation/[]/workflows/[]/trigger/inputs/[]/parameters/[]/dataType
Property: dataType (Optional)
Type: String
Description: The data type of the parameter.

*All items must be unique.*

15.1.4.1.325 Environment variables

Location: /formulation/[]/workflows/[]/trigger/inputs/[]/environmentVars
Property: environmentVars (Optional)
Type: Array
Description: Inputs that have the form of parameters with names and values.

*Must be one of:*
1. Lightweight name-value pair

15.1.4.1.326 Lightweight name-value pair

Type: Object
Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

### Table 341 – Properties for lightweight name-value pair

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

Type: String

15.1.4.1.327 Name

Location: /formulation/[]/workflows/[]/trigger/inputs/[]/environmentVars/[]/name

Property: environmentVars (Required)

Type: String

Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.4.1.328 Value

Location: /formulation/[]/workflows/[]/trigger/inputs/[]/environmentVars/[]/value

Property: environmentVars (Optional)

Type: String

Description: The value of the property.

*All items must be unique.*

15.1.4.1.329 Attachment

Location: /formulation/[]/workflows/[]/trigger/inputs/[]/data

Property: data (Optional)

Type: Object

Description: Specifies the metadata and content for an attachment.

### Table 342 – Properties for the data object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>contentType</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. <a href="https://tools.ietf.org/html/rfc2045">RFC 2045 section 5.1</a> outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the <a href="https://www.iana.org/assignments/media-types">IANA media types registry</a>.</td>
</tr>
<tr>
<td>encoding</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the optional encoding the text is represented in.</td>
</tr>
<tr>
<td>content</td>
<td>String</td>
<td>Required</td>
<td>The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.</td>
</tr>
</tbody>
</table>
15.1.4.1.330   Content-Type

Location: /formulation/[]/workflows/[]/trigger/inputs/[]/data/contentType
Property: contentType (Optional)
Type: String
Default Value: text/plain
Description: Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. RFC 2045 section 5.1 outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the IANA media types registry.
Examples:
- text/plain
- application/json
- image/png

15.1.4.1.331   Encoding

Location: /formulation/[]/workflows/[]/trigger/inputs/[]/data/encoding
Property: encoding (Optional)
Type: String
Description: Specifies the optional encoding the text is represented in.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>base64</td>
<td>Base64 is a binary-to-text encoding scheme that represents binary data in an ASCII string.</td>
</tr>
</tbody>
</table>

15.1.4.1.332   Attachment Text

Location: /formulation/[]/workflows/[]/trigger/inputs/[]/data/content
Property: content (Required)
Type: String
Description: The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.

15.1.4.1.333   Properties

Location: /formulation/[]/workflows/[]/trigger/inputs/[]/properties
Property: properties (Optional)
Type: Array
Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.
15.1.4.1.334 Lightweight name-value pair

Location: /formulation/[/]workflows/[/]trigger/inputs/[/]properties[/]

Type: Object

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

15.1.4.1.335 Name

Location: /formulation/[/]workflows/[/]trigger/inputs/[/]properties/[/]/name

Property: name (Required)

Type: String

Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.4.1.336 Value

Location: /formulation/[/]workflows/[/]trigger/inputs/[/]properties/[/]/value

Property: value (Optional)

Type: String

Description: The value of the property.

*All items must be unique.*

15.1.4.1.337 Outputs

Location: /formulation/[/]workflows/[/]trigger/outputs

Property: outputs (Optional)

Type: Array

Description: Represents resources and data output from a task at runtime by executor or task commands

Examples:

- a log file or metrics data produced by the task

Location: /formulation/[/]workflows/[/]trigger/outputs[/]

Type: Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>type</td>
<td>String</td>
<td>Optional</td>
<td>Describes the type of data output.</td>
</tr>
<tr>
<td>Property</td>
<td>Type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>----------</td>
<td>-------------</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>source</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
<tr>
<td>target</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
<tr>
<td>resource</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
<tr>
<td>data</td>
<td>Object</td>
<td>Optional</td>
<td>Specifies the metadata and content for an attachment.</td>
</tr>
<tr>
<td>environmentVars</td>
<td>Array</td>
<td>Optional</td>
<td>Outputs that have the form of environment variables.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.</td>
</tr>
</tbody>
</table>

### 15.1.4.1.338 Type
**Location:** /formulation/[]/workflows/[]/trigger/outputs/[]/type
**Property:** type (Optional)

**Type:** String

**Description:** Describes the type of data output.

**Enumeration:** Must be one of:
- artifact
- attestation
- log
- evidence
- metrics
- other

### 15.1.4.1.339 Resource reference choice
**Location:** /formulation/[]/workflows/[]/trigger/outputs/[]/source
**Property:** source (Optional)

**Type:** Object

**Description:** A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>Property</td>
<td>Type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------</td>
<td>-------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

### 15.1.4.1.340 BOM Reference

**Location:** /formulation/[]/workflows/[]/trigger/outputs/[]/source/ref  
**Property:** ref (Optional)  
**Description:** References an object by its bom-ref attribute  
*Must be any of:*  
1. Ref  
2. BOM-Link Element

### 15.1.4.1.341 Ref

**Type:** String  
**Description:** Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

### 15.1.4.1.342 BOM-Link Element

**Type:** String  
**Format:** iri-reference as specified in [RFC 3987](https://www.ietf.org/rfc/rfc3987.html)  
**Pattern Constraint:** ^urn:cdx:[0-9a-f]{8}[-][0-9a-f]{4}[-][0-9a-f]{4}[-][0-9a-f]{4}[-][0-9a-f]{12}/[1-9][0-9]*#.+$  
**Description:** Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

### 15.1.4.1.343 External Reference

**Location:** /formulation/[]/workflows/[]/trigger/outputs/[]/source/externalReference  
**Property:** externalReference (Optional)  
**Type:** Object  
**Description:** External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.  
**Reference:** Refer to the external reference definition at /externalReferences/[]

### 15.1.4.1.344 Resource reference choice

**Location:** /formulation/[]/workflows/[]/trigger/outputs/[]/target  
**Property:** target (Optional)  
**Type:** Object  
**Description:** A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.  
**Examples:**  
- a log file described as an externalReference within its target domain.

Table 347 – Properties for the target object
<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

15.1.4.1.345 **BOM Reference**

**Location:** /formulation/[/]workflows[/]trigger/outputs[/]target/ref

**Property:** ref (Optional)

**Description:** References an object by its bom-ref attribute

*Must be any of:*

1. Ref
2. BOM-Link Element

15.1.4.1.346 **Ref**

**Type:** String

**Description:** Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

15.1.4.1.347 **BOM-Link Element**

**Type:** String

**Format:** iri-reference as specified in [RFC 3987](https://www.ietf.org/rfc/rfc3987.html)

**Pattern Constraint:** ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$

**Description:** Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

15.1.4.1.348 **External Reference**

**Location:** /formulation/[/]workflows[/]trigger/outputs[/]target/externalReference

**Property:** externalReference (Optional)

**Type:** Object

**Description:** External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

**Reference:** Refer to the external reference definition at /externalReferences[/]

15.1.4.1.349 **Resource reference choice**

**Location:** /formulation/[/]workflows[/]trigger/outputs[/]resource

**Property:** resource (Optional)

**Type:** Object

**Description:** A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

**Examples:**

- configuration file
- source code
Table 348 – Properties for the resource object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

15.1.4.1.350 BOM Reference

Location: /formulation/[]/workflows/[]/trigger/outputs/[]/resource/ref

Property: ref (Optional)

Description: References an object by its bom-ref attribute

Must be any of:
1. Ref
2. BOM-Link Element

15.1.4.1.351 Ref

Type: String

Description: Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

15.1.4.1.352 BOM-Link Element

Type: String


Pattern Constraint: ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$

Description: Descriptor for an element in a BOM document. See https://cyclonedx.org/capabilities/bomlink/

15.1.4.1.353 External Reference

Location: /formulation/[]/workflows/[]/trigger/outputs/[]/resource/externalReference

Property: externalReference (Optional)

Type: Object

Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

Reference: Refer to the external reference definition at /externalReferences/[]

15.1.4.1.354 Attachment

Location: /formulation/[]/workflows/[]/trigger/outputs/[]/data

Property: data (Optional)

Type: Object

Description: Specifies the metadata and content for an attachment.
Table 349 – Properties for the data object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>contentType</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. RFC 2045 section 5.1 outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the IANA media types registry.</td>
</tr>
<tr>
<td>encoding</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the optional encoding the text is represented in.</td>
</tr>
<tr>
<td>content</td>
<td>String</td>
<td>Required</td>
<td>The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.</td>
</tr>
</tbody>
</table>

15.1.4.1.355  Content-Type

**Location:** /formulation/[/]/workflows/[/]/trigger/outputs[/]/data/contentType

**Property:** contentType (Optional)

**Type:** String

**Default Value:** text/plain

**Description:** Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. RFC 2045 section 5.1 outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the IANA media types registry.

**Examples:**
- text/plain
- application/json
- image/png

15.1.4.1.356  Encoding

**Location:** /formulation/[/]/workflows/[/]/trigger/outputs[/]/data/encoding

**Property:** encoding (Optional)

**Type:** String

**Description:** Specifies the optional encoding the text is represented in.

### Table 350 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>base64</td>
<td>Base64 is a binary-to-text encoding scheme that represents binary data in an ASCII string.</td>
</tr>
</tbody>
</table>

15.1.4.1.357  Attachment Text

**Location:** /formulation/[/]/workflows/[/]/trigger/outputs[/]/data/content

**Property:** content (Required)

**Type:** String
Description: The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.

15.1.4.1.358 Environment variables

Location: /formulation/[/workflows/[/trigger/outputs/[/environmentVars

Property: environmentVars (Optional)

Type: Array

Description: Outputs that have the form of environment variables.

Location: /formulation/[/workflows/[/trigger/outputs/[/environmentVars[]

Must be one of:

1. Lightweight name-value pair

15.1.4.1.359 Lightweight name-value pair

Type: Object

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

Table 351 – Properties for lightweight name-value pair

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

Type: String

15.1.4.1.360 Name

Location: /formulation/[/workflows/[/trigger/outputs/[/environmentVars/[/name

Property: environmentVars (Required)

Type: String

Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.4.1.361 Value

Location: /formulation/[/workflows/[/trigger/outputs/[/environmentVars/[/value

Property: environmentVars (Optional)

Type: String

Description: The value of the property.

All items must be unique.

15.1.4.1.362 Properties

Location: /formulation/[/workflows/[/trigger/outputs/[/properties

Property: properties (Optional)

Type: Array
**Description:** Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

### 15.1.4.1.363 Lightweight name-value pair

**Location:** /formulation/[]/workflows/[]/trigger/outputs/[]/properties/[]

**Type:** Object

**Description:** Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

#### Table 352 – Properties for the properties object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

### 15.1.4.1.364 Name

**Location:** /formulation/[]/workflows/[]/trigger/outputs/[]/properties/[]/name

**Property:** name (Required)

**Type:** String

**Description:** The name of the property. Duplicate names are allowed, each potentially having a different value.

### 15.1.4.1.365 Value

**Location:** /formulation/[]/workflows/[]/trigger/outputs/[]/properties/[]/value

**Property:** value (Optional)

**Type:** String

**Description:** The value of the property.

*All items must be unique.*

### 15.1.4.1.366 Properties

**Location:** /formulation/[]/workflows/[]/trigger/properties

**Property:** properties (Optional)

**Type:** Array

**Description:** Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.
15.1.4.1.367 Lightweight name-value pair

**Location:** /formulation/[]/workflows/[]/trigger/properties/[]

**Type:** Object

**Description:** Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the [CycloneDX Property Taxonomy](https://cyclone-dx.org). Formal registration is optional.

**Table 353 – Properties for the properties object**

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

15.1.4.1.368 Name

**Location:** /formulation/[]/workflows/[]/trigger/properties/[]/name

**Property:** name (Required)

**Type:** String

**Description:** The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.4.1.369 Value

**Location:** /formulation/[]/workflows/[]/trigger/properties/[]/value

**Property:** value (Optional)

**Type:** String

**Description:** The value of the property.

15.1.4.1.370 Steps

**Location:** /formulation/[]/workflows/[]/steps

**Property:** steps (Optional)

**Type:** Array

**Description:** The sequence of steps for the task.

**Location:** /formulation/[]/workflows/[]/steps/[]

**Type:** Object

**Description:** Executes specific commands or tools in order to accomplish its owning task as part of a sequence.

**Table 354 – Properties for the steps object**

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>A name for the step.</td>
</tr>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>A description of the step.</td>
</tr>
<tr>
<td>commands</td>
<td>Array</td>
<td>Optional</td>
<td>Ordered list of commands or directives for the step.</td>
</tr>
<tr>
<td>Property</td>
<td>Type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>----------</td>
<td>--------</td>
<td>-------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.</td>
</tr>
</tbody>
</table>

15.1.4.1.371 Name
Location: /formulation/[]/workflows/[]/steps/[]/name
Property: name (Optional)
Type: String
Description: A name for the step.

15.1.4.1.372 Description
Location: /formulation/[]/workflows/[]/steps/[]/description
Property: description (Optional)
Type: String
Description: A description of the step.

15.1.4.1.373 Commands
Location: /formulation/[]/workflows/[]/steps/[]/commands
Property: commands (Optional)
Type: Array
Description: Ordered list of commands or directives for the step
Location: /formulation/[]/workflows/[]/steps/[]/commands/[]
Type: Object

Table 355 – Properties for the commands object
<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>executed</td>
<td>String</td>
<td>Optional</td>
<td>A text representation of the executed command.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.</td>
</tr>
</tbody>
</table>

15.1.4.1.374 Executed
Location: /formulation/[]/workflows/[]/steps/[]/commands/[]/executed
Property: executed (Optional)
Type: String
Description: A text representation of the executed command.
15.1.4.1.375 Properties

Location: /formulation[/]workflows[/]steps[/]commands[/]properties

Property: properties (Optional)

Type: Array

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

15.1.4.1.376 Lightweight name-value pair

Location: /formulation[/]workflows[/]steps[/]commands[/]properties[/]

Type: Object

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

Table 356 – Properties for the properties object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

15.1.4.1.377 Name

Location: /formulation[/]workflows[/]steps[/]commands[/]properties[/]name

Property: name (Required)

Type: String

Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.4.1.378 Value

Location: /formulation[/]workflows[/]steps[/]commands[/]properties[/]value

Property: value (Optional)

Type: String

Description: The value of the property.

15.1.4.1.379 Properties

Location: /formulation[/]workflows[/]steps[/]properties

Property: properties (Optional)

Type: Array

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.
Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

15.1.4.1.380 Lightweight name-value pair

**Location:** /formulation/[]/workflows/[]/steps/[]/properties/[]

**Type:** Object

**Description:** Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

15.1.4.1.381 Name

**Location:** /formulation/[]/workflows/[]/steps/[]/properties/[]/name

**Property:** name (Required)

**Type:** String

**Description:** The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.4.1.382 Value

**Location:** /formulation/[]/workflows/[]/steps/[]/properties/[]/value

**Property:** value (Optional)

**Type:** String

**Description:** The value of the property.

*All items must be unique.*

15.1.4.1.383 Inputs

**Location:** /formulation/[]/workflows/[]/inputs

**Property:** inputs (Optional)

**Type:** Array

**Description:** Represents resources and data brought into a task at runtime by executor or task commands. Each item of this array must be an Input type object.

**Examples:**
- a configuration file which was declared as a localcomponentorexternalReference``

15.1.4.1.384 Input type

**Location:** /formulation/[]/workflows/[]/inputs/[]

**Type:** Object

**Description:** Type that represents various input data types and formats.
Table 358 – Properties for the inputs object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>source</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
<tr>
<td>target</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
<tr>
<td>resource</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
<tr>
<td>parameters</td>
<td>Array</td>
<td>Optional</td>
<td>Inputs that have the form of parameters with names and values.</td>
</tr>
<tr>
<td>environmentVars</td>
<td>Array</td>
<td>Optional</td>
<td>Inputs that have the form of parameters with names and values.</td>
</tr>
<tr>
<td>data</td>
<td>Object</td>
<td>Optional</td>
<td>Specifies the metadata and content for an attachment.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.</td>
</tr>
</tbody>
</table>

15.1.4.1.385   Resource reference choice

Location: /formulation/[]/workflows/[]/inputs/[]/source

Property: source (Optional)

Type: Object

Description: A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

Examples:
- source code repository
- database

Table 359 – Properties for the source object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

15.1.4.1.386   BOM Reference

Location: /formulation/[]/workflows/[]/inputs/[]/source/ref

Property: ref (Optional)
Description: References an object by its bom-ref attribute

Must be any of:
1. Ref
2. BOM-Link Element

15.1.4.1.387  Ref

Type: String
Description: Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

15.1.4.1.388  BOM-Link Element

Type: String
Pattern Constraint: ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$
Description: Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

15.1.4.1.389  External Reference

Location: /formulation/[]/workflows/[]/inputs/[]/source/externalReference
Property: externalReference (Optional)

Type: Object
Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.
Reference: Refer to the external reference definition at /externalReferences/[]

15.1.4.1.390  Resource reference choice

Location: /formulation/[]/workflows/[]/inputs/[]/target
Property: target (Optional)

Type: Object
Description: A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.
Examples:
- workspace
- directory

Table 360 – Properties for the target object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

15.1.4.1.391  BOM Reference

Location: /formulation/[]/workflows/[]/inputs/[]/target/ref
**Property:** ref (Optional)

**Description:** References an object by its bom-ref attribute

*Must be any of:*

1. Ref
2. BOM-Link Element

**15.1.4.1.392 Ref**

**Type:** String

**Description:** Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

**15.1.4.1.393 BOM-Link Element**

**Type:** String

**Format:** iri-reference as specified in [RFC 3987](https://www.ietf.org/rfc/rfc3987.html)

**Pattern Constraint:** ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$

**Description:** Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

**15.1.4.1.394 External Reference**

**Location:** /formulation/*/*/workflows/*/*/inputs/*/*/target/externalReference

**Property:** externalReference (Optional)

**Type:** Object

**Description:** External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

**Reference:** Refer to the external reference definition at /externalReferences/*/

**15.1.4.1.395 Resource reference choice**

**Location:** /formulation/*/*/workflows/*/*/inputs/*/*/resource

**Property:** resource (Optional)

**Type:** Object

**Description:** A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

**Examples:**

- a reference to a configuration file in a repository (i.e., a bom-ref)
- a reference to a scanning service used in a task (i.e., a bom-ref)

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>
15.1.4.1.396  BOM Reference

Location: /formulation/[]/workflows/[]/inputs/[]/resource/ref
Property: ref (Optional)
Description: References an object by its bom-ref attribute
Must be any of:
1. Ref
2. BOM-Link Element

15.1.4.1.397  Ref
Type: String
Description: Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

15.1.4.1.398  BOM-Link Element
Type: String
Pattern Constraint: ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$
Description: Descriptor for an element in a BOM document. See https://cyclonedx.org/capabilities/bomlink/

15.1.4.1.399  External Reference
Location: /formulation/[]/workflows/[]/inputs/[]/resource/externalReference
Property: externalReference (Optional)
Type: Object
Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.
Reference: Refer to the external reference definition at /externalReferences/[]

15.1.4.1.400  Parameters
Location: /formulation/[]/workflows/[]/inputs/[]/parameters
Property: parameters (Optional)
Type: Array
Description: Inputs that have the form of parameters with names and values. Each item of this array must be a Parameter object.

15.1.4.1.401  Parameter
Location: /formulation/[]/workflows/[]/inputs/[]/parameters/[]
Type: Object
Description: A representation of a functional parameter.
Table 362 – Properties for the parameters object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the parameter.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the parameter.</td>
</tr>
<tr>
<td>dataType</td>
<td>String</td>
<td>Optional</td>
<td>The data type of the parameter.</td>
</tr>
</tbody>
</table>

15.1.4.1.402 Name

**Location:** /formulation/*[/workflows/*[/inputs/*[/parameters/*[/name

**Property:** name (Optional)

**Type:** String

**Description:** The name of the parameter.

15.1.4.1.403 Value

**Location:** /formulation/*[/workflows/*[/inputs/*[/parameters/*[/value

**Property:** value (Optional)

**Type:** String

**Description:** The value of the parameter.

15.1.4.1.404 Data type

**Location:** /formulation/*[/workflows/*[/inputs/*[/parameters/*[/dataType

**Property:** dataType (Optional)

**Type:** String

**Description:** The data type of the parameter. 

*All items must be unique.*

15.1.4.1.405 Environment variables

**Location:** /formulation/*[/workflows/*[/inputs/*[/environmentVars

**Property:** environmentVars (Optional)

**Type:** Array

**Description:** Inputs that have the form of parameters with names and values.

**Location:** /formulation/*[/workflows/*[/inputs/*[/environmentVars/*

*Must be one of:

1. Lightweight name-value pair

15.1.4.1.406 Lightweight name-value pair

**Type:** Object

**Description:** Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.
### Table 363 – Properties for lightweight name-value pair

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

**Type:** String  

**15.1.4.1.407 Name**  

**Location:** /formulation/[]/workflows/[]/inputs/[]/environmentVars/[]/name  

**Property:** environmentVars (Required)  

**Type:** String  

**Description:** The name of the property. Duplicate names are allowed, each potentially having a different value.  

**15.1.4.1.408 Value**  

**Location:** /formulation/[]/workflows/[]/inputs/[]/environmentVars/[]/value  

**Property:** environmentVars (Optional)  

**Type:** String  

**Description:** The value of the property.  

*All items must be unique.*  

**15.1.4.1.409 Attachment**  

**Location:** /formulation/[]/workflows/[]/inputs/[]/data  

**Property:** data (Optional)  

**Type:** Object  

**Description:** Specifies the metadata and content for an attachment.  

### Table 364 – Properties for the data object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>contentType</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plan text documents. RFC 2045 section 5.1 outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the IANA media types registry.</td>
</tr>
<tr>
<td>encoding</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the optional encoding the text is represented in.</td>
</tr>
<tr>
<td>content</td>
<td>String</td>
<td>Required</td>
<td>The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.</td>
</tr>
</tbody>
</table>

**15.1.4.1.410 Content-Type**  

**Location:** /formulation/[]/workflows/[]/inputs/[]/data/contentType  

**Property:** contentType (Optional)
Type: String

Default Value: text/plain

Description: Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plain text documents. RFC 2045 section 5.1 outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the IANA media types registry.

Examples:
- text/plain
- application/json
- image/png

15.1.4.1.411 Encoding

Location: /formulation/[]/workflows/[]/inputs/[]/data/encoding

Property: encoding (Optional)

Type: String

Description: Specifies the optional encoding the text is represented in.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>base64</td>
<td>Base64 is a binary-to-text encoding scheme that represents binary data in an ASCII string.</td>
</tr>
</tbody>
</table>

15.1.4.1.412 Attachment Text

Location: /formulation/[]/workflows/[]/inputs/[]/data/content

Property: content (Required)

Type: String

Description: The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.

15.1.4.1.413 Properties

Location: /formulation/[]/workflows/[]/inputs/[]/properties

Property: properties (Optional)

Type: Array

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

15.1.4.1.414 Lightweight name-value pair

Location: /formulation/[]/workflows/[]/inputs/[]/properties/[]

Type: Object

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different
values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

15.1.4.1.415 Name

**Location:** /formulation/[]/workflows/[]/inputs/[]/properties/[]/name

**Property:** name (Required)

**Type:** String

**Description:** The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.4.1.416 Value

**Location:** /formulation/[]/workflows/[]/inputs/[]/properties/[]/value

**Property:** value (Optional)

**Type:** String

**Description:** The value of the property.

*All items must be unique.*

15.1.4.1.417 Outputs

**Location:** /formulation/[]/workflows/[]/outputs

**Property:** outputs (Optional)

**Type:** Array

**Description:** Represents resources and data output from a task at runtime by executor or task commands

**Examples:**
- a log file or metrics data produced by the task

**Location:** /formulation/[]/workflows/[]/outputs/[]

**Type:** Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>type</td>
<td>String</td>
<td>Optional</td>
<td>Describes the type of data output.</td>
</tr>
<tr>
<td>source</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
<tr>
<td>target</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
</tbody>
</table>
### Property Type Requirement Description

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>resource</td>
<td>Array</td>
<td>Optional</td>
<td>A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.</td>
</tr>
<tr>
<td>data</td>
<td>Object</td>
<td>Optional</td>
<td>Specifies the metadata and content for an attachment.</td>
</tr>
<tr>
<td>environmentVars</td>
<td>Array</td>
<td>Optional</td>
<td>Outputs that have the form of environment variables.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.</td>
</tr>
</tbody>
</table>

#### 15.1.4.1.418 Type

**Location:** /formulation/**\[\]/workflows/**\[\]/outputs/**\[\]/type

**Property:** type (Optional)

**Type:** String

**Description:** Describes the type of data output.

**Enumeration:** Must be one of:
- artifact
- attestation
- log
- evidence
- metrics
- other

#### 15.1.4.1.419 Resource reference choice

**Location:** /formulation/**\[\]/workflows/**\[\]/outputs/**\[\]/source

**Property:** source (Optional)

**Type:** Object

**Description:** A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

---

### Table 368 – Properties for the source object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>
15.1.4.1.420  BOM Reference

Location: /formulation/[/]workflows/[/]outputs/[/]source/ref
Property: ref (Optional)
Description: References an object by its bom-ref attribute
Must be any of:
1. Ref
2. BOM-Link Element

15.1.4.1.421  Ref

Type: String
Description: Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

15.1.4.1.422  BOM-Link Element

Type: String
Pattern Constraint: ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$
Description: Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

15.1.4.1.423  External Reference

Location: /formulation/[/]workflows/[/]outputs/[/]source/externalReference
Property: externalReference (Optional)
Type: Object
Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.
Reference: Refer to the external reference definition at /externalReferences/[/]

15.1.4.1.424  Resource reference choice

Location: /formulation/[/]workflows/[/]outputs/[/]target
Property: target (Optional)
Type: Object
Description: A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.
Examples:
- a log file described as an externalReference within its target domain.

Table 369 – Properties for the target object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>
15.1.4.1.425  BOM Reference

**Location:** /formulation/[]/workflows/[]/outputs/[]/target/ref

**Property:** ref (Optional)

**Description:** References an object by its bom-ref attribute

*Must be any of:*

1. Ref
2. BOM-Link Element

15.1.4.1.426  Ref

**Type:** String

**Description:** Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

15.1.4.1.427  BOM-Link Element

**Type:** String

**Format:** iri-reference as specified in [RFC 3987](https://www.ietf.org/rfc/rfc3987.html)

**Pattern Constraint:** ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$

**Description:** Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

15.1.4.1.428  External Reference

**Location:** /formulation/[]/workflows/[]/outputs/[]/target/externalReference

**Property:** externalReference (Optional)

**Type:** Object

**Description:** External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

**Reference:** Refer to the external reference definition at /externalReferences/[]

15.1.4.1.429  Resource reference choice

**Location:** /formulation/[]/workflows/[]/outputs/[]/resource

**Property:** resource (Optional)

**Type:** Object

**Description:** A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

**Examples:**

- configuration file
- source code
- scanning service
Table 370 – Properties for the resource object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

15.1.4.1.430 BOM Reference

Location: /formulation/[/]/workflows/[/]/outputs/[/]/resource/ref

Property: ref (Optional)

Description: References an object by its bom-ref attribute

Must be any of:
1. Ref
2. BOM-Link Element

15.1.4.1.431 Ref

Type: String

Description: Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

15.1.4.1.432 BOM-Link Element

Type: String


Pattern Constraint: ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$

Description: Descriptor for an element in a BOM document. See https://cyclonedx.org/capabilities/bomlink/

15.1.4.1.433 External Reference

Location: /formulation/[/]/workflows/[/]/outputs/[/]/resource/externalReference

Property: externalReference (Optional)

Type: Object

Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

Reference: Refer to the external reference definition at /externalReferences/[/]

15.1.4.1.434 Attachment

Location: /formulation/[/]/workflows/[/]/outputs/[/]/data

Property: data (Optional)

Type: Object

Description: Specifies the metadata and content for an attachment.
Table 371 – Properties for the data object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>contentType</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plan text documents. RFC 2045 section 5.1 outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the IANA media types registry.</td>
</tr>
<tr>
<td>encoding</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the optional encoding the text is represented in.</td>
</tr>
<tr>
<td>content</td>
<td>String</td>
<td>Required</td>
<td>The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.</td>
</tr>
</tbody>
</table>

15.1.4.1.435    Content-Type

**Location:** /formulation[/]/workflows[/]/outputs[/]/data/contentType
**Property:** contentType (Optional)
**Type:** String
**Default Value:** text/plain
**Description:** Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include application/json for JSON data and text/plain for plan text documents. RFC 2045 section 5.1 outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the IANA media types registry.

**Examples:**
- text/plain
- application/json
- image/png

15.1.4.1.436    Encoding

**Location:** /formulation[/]/workflows[/]/outputs[/]/data/encoding
**Property:** encoding (Optional)
**Type:** String
**Description:** Specifies the optional encoding the text is represented in.

Table 372 – Enumeration of possible values

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>base64</td>
<td>Base64 is a binary-to-text encoding scheme that represents binary data in an ASCII string.</td>
</tr>
</tbody>
</table>

15.1.4.1.437    Attachment Text

**Location:** /formulation[/]/workflows[/]/outputs[/]/data/content
**Property:** content (Required)
**Type:** String
Description: The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.

15.1.4.1.438 Environment variables

Location: /formulation\\[/\\]/workflows\\[/\\]/outputs\\[/\\]/environmentVars

Property: environmentVars (Optional)

Type: Array

Description: Outputs that have the form of environment variables.

Location: /formulation\\[/\\]/workflows\\[/\\]/outputs\\[/\\]/environmentVars\\[/\\]

Must be one of:

1. Lightweight name-value pair

15.1.4.1.439 Lightweight name-value pair

Type: Object

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

Table 373 – Properties for lightweight name-value pair

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

Type: String

15.1.4.1.440 Name

Location: /formulation\\[/\\]/workflows\\[/\\]/outputs\\[/\\]/environmentVars\\[/\\]/name

Property: environmentVars (Required)

Type: String

Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.4.1.441 Value

Location: /formulation\\[/\\]/workflows\\[/\\]/outputs\\[/\\]/environmentVars\\[/\\]/value

Property: environmentVars (Optional)

Type: String

Description: The value of the property.

All items must be unique.

15.1.4.1.442 Properties

Location: /formulation\\[/\\]/workflows\\[/\\]/outputs\\[/\\]/properties

Property: properties (Optional)

Type: Array
Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

15.1.4.1.443 Lightweight name-value pair

Location: /formulation/[]/workflows/[]/outputs/[]/properties/[]

Type: Object

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

Table 374 – Properties for the properties object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

15.1.4.1.444 Name

Location: /formulation/[]/workflows/[]/outputs/[]/properties/[]/name

Property: name (Required)

Type: String

Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.4.1.445 Value

Location: /formulation/[]/workflows/[]/outputs/[]/properties/[]/value

Property: value (Optional)

Type: String

Description: The value of the property.

*All items must be unique.*

15.1.4.1.446 Time start

Location: /formulation/[]/workflows/[]/timeStart

Property: timeStart (Optional)

Type: String

Format: data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)

Description: The date and time (timestamp) when the task started.

15.1.4.1.447 Time end

Location: /formulation/[]/workflows/[]/timeEnd

Property: timeEnd (Optional)

Type: String
Format: data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)

Description: The date and time (timestamp) when the task ended.

### 15.1.4.1.448 Workspaces

**Location:** /formulation/[]/workflows/[]/workspaces

**Property:** workspaces (Optional)

**Type:** Array

**Description:** A set of named filesystem or data resource shareable by workflow tasks. Each item of this array must be a Workspace object.

### 15.1.4.1.449 Workspace

**Location:** /formulation/[]/workflows/[]/workspaces/[]

**Type:** Object

**Description:** A named filesystem or data resource shareable by workflow tasks.

#### Table 375 – Properties for the workspaces object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Required</td>
<td>Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>uid</td>
<td>String</td>
<td>Required</td>
<td>The unique identifier for the resource instance within its deployment context.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the resource instance.</td>
</tr>
<tr>
<td>aliases</td>
<td>Array</td>
<td>Optional</td>
<td>The names for the workspace as referenced by other workflow tasks. Effectively, a name mapping so other tasks can use their own local name in their steps.</td>
</tr>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>A description of the resource instance.</td>
</tr>
<tr>
<td>resourceReferences</td>
<td>Array</td>
<td>Optional</td>
<td>References to component or service resources that are used to realize the resource instance.</td>
</tr>
<tr>
<td>accessMode</td>
<td>String</td>
<td>Optional</td>
<td>Describes the read-write access control for the workspace relative to the owning resource instance.</td>
</tr>
<tr>
<td>mountPath</td>
<td>String</td>
<td>Optional</td>
<td>A path to a location on disk where the workspace will be available to the associated task's steps.</td>
</tr>
<tr>
<td>managedDataType</td>
<td>String</td>
<td>Optional</td>
<td>The name of a domain-specific data type the workspace represents.</td>
</tr>
<tr>
<td>volumeRequest</td>
<td>String</td>
<td>Optional</td>
<td>Identifies the reference to the request for a specific volume type and parameters.</td>
</tr>
<tr>
<td>volume</td>
<td>Object</td>
<td>Optional</td>
<td>Information about the actual volume instance allocated to the workspace.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the</td>
</tr>
</tbody>
</table>
Property | Type | Requirement | Description
--- | --- | --- | ---
 | | |standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the [CycloneDX Property Taxonomy](https://www.cyclonedx.org/project/property-taxonomy). Formal registration is optional.

15.1.4.1.450 **BOM Reference**

**Location:** /formulation/

**Property:** bom-ref (Required)

**Type:** String

**Description:** Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

15.1.4.1.451 **Unique Identifier (UID)**

**Location:** /formulation/

**Property:** uid (Required)

**Type:** String

**Description:** The unique identifier for the resource instance within its deployment context.

15.1.4.1.452 **Name**

**Location:** /formulation/

**Property:** name (Optional)

**Type:** String

**Description:** The name of the resource instance.

15.1.4.1.453 **Aliases**

**Location:** /formulation/

**Property:** aliases (Optional)

**Type:** array (of String)

**Description:** The names for the workspace as referenced by other workflow tasks. Effectively, a name mapping so other tasks can use their own local name in their steps. Each item of this array must be a string.

15.1.4.1.454 **Description**

**Location:** /formulation/

**Property:** description (Optional)

**Type:** String

**Description:** A description of the resource instance.

15.1.4.1.455 **Resource references**

**Location:** /formulation/

**Property:** resourceReferences (Optional)

**Type:** Array

**Description:** References to component or service resources that are used to realize the resource instance. Each item of this array must be a Resource reference choice object.
15.1.4.1.456 Resource reference choice

Location: /formulation/[/workflows/[/workspaces/[/resourceReferences/[]

Type: Object

Description: A reference to a locally defined resource (e.g., a bom-ref) or an externally accessible resource.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>Array</td>
<td>Optional</td>
<td>References an object by its bom-ref attribute</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

15.1.4.1.457 BOM Reference

Location: /formulation/[/workflows/[/workspaces/[/resourceReferences/[/ref

Property: ref (Optional)

Description: References an object by its bom-ref attribute

Must be any of:

1. Ref
2. BOM-Link Element

15.1.4.1.458 Ref

Type: String

Description: Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

15.1.4.1.459 BOM-Link Element

Type: String


Pattern Constraint: ^urn:cdx:[0-9a-f]{8}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{4}-[0-9a-f]{12}/[1-9][0-9]*#.+$

Description: Descriptor for an element in a BOM document. See [https://cyclonedx.org/capabilities/bomlink/](https://cyclonedx.org/capabilities/bomlink/)

15.1.4.1.460 External Reference

Location: /formulation/[/workflows/[/workspaces/[/resourceReferences/[/externalReference

Property: externalReference (Optional)

Type: Object

Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

Reference: Refer to the external reference definition at /externalReferences/[]

All items must be unique.

15.1.4.1.461 Access mode

Location: /formulation/[/workflows/[/workspaces/[/accessMode
Property: accessMode (Optional)

Type: String

Description: Describes the read-write access control for the workspace relative to the owning resource instance.

Enumeration: Must be one of:
• read-only
• read-write
• read-write-once
• write-once
• write-only

15.1.4.1.462 Mount path

Location: /formulation/[]/workflows/[]/workspaces/[]/mountPath

Property: mountPath (Optional)

Type: String

Description: A path to a location on disc where the workspace will be available to the associated task's steps.

15.1.4.1.463 Managed data type

Location: /formulation/[]/workflows/[]/workspaces/[]/managedDataType

Property: managedDataType (Optional)

Type: String

Description: The name of a domain-specific data type the workspace represents.

Examples:
• ConfigMap
• Secret

15.1.4.1.464 Volume request

Location: /formulation/[]/workflows/[]/workspaces/[]/volumeRequest

Property: volumeRequest (Optional)

Type: String

Description: Identifies the reference to the request for a specific volume type and parameters.

Examples:
• a kubernetes Persistent Volume Claim (PVC) name

15.1.4.1.465 Volume

Location: /formulation/[]/workflows/[]/workspaces/[]/volume

Property: volume (Optional)

Type: Object

Description: Information about the actual volume instance allocated to the workspace.

Examples:
• see https://kubernetes.io/docs/concepts/storage/persistent-volumes/
### Table 377 – Properties for the volume object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>uid</td>
<td>String</td>
<td>Optional</td>
<td>The unique identifier for the volume instance within its deployment context.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the volume instance</td>
</tr>
<tr>
<td>mode</td>
<td>String</td>
<td>Optional</td>
<td>The mode for the volume instance.</td>
</tr>
<tr>
<td>path</td>
<td>String</td>
<td>Optional</td>
<td>The underlying path created from the actual volume.</td>
</tr>
<tr>
<td>sizeAllocated</td>
<td>String</td>
<td>Optional</td>
<td>The allocated size of the volume accessible to the associated workspace.</td>
</tr>
<tr>
<td>persistent</td>
<td>Boolean</td>
<td>Optional</td>
<td>Indicates if the volume persists beyond the life of the resource it is</td>
</tr>
<tr>
<td>remote</td>
<td>Boolean</td>
<td>Optional</td>
<td>Indicates if the volume is remotely (i.e., network) attached.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>provides flexibility to include data not officially supported in the standard</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>without having to use additional namespaces or create extensions. Unlike</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>key-value stores, properties support duplicate names, each potentially</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>having different values. Property names of interest to the general public</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>are encouraged to be registered in the CycloneDX Property Taxonomy. Formal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>registration is optional.</td>
</tr>
</tbody>
</table>

#### 15.1.4.1.466 Unique Identifier (UID)

**Location:** /formulation/[]/workflows/[]/workspaces/[]/volume/uid

**Property:** uid (Optional)

**Type:** String

**Description:** The unique identifier for the volume instance within its deployment context.

#### 15.1.4.1.467 Name

**Location:** /formulation/[]/workflows/[]/workspaces/[]/volume/name

**Property:** name (Optional)

**Type:** String

**Description:** The name of the volume instance

#### 15.1.4.1.468 Mode

**Location:** /formulation/[]/workflows/[]/workspaces/[]/volume(mode)

**Property:** mode (Optional)

**Type:** String

**Default Value:** filesystem

**Description:** The mode for the volume instance.

**Enumeration:** Must be one of:
- filesystem
15.1.4.1.469 Path
Location: /formulation/[]/workflows/[]/workspaces/[]/volume/path
Property: path (Optional)
Type: String
Description: The underlying path created from the actual volume.

15.1.4.1.470 Size allocated
Location: /formulation/[]/workflows/[]/workspaces/[]/volume/sizeAllocated
Property: sizeAllocated (Optional)
Type: String
Description: The allocated size of the volume accessible to the associated workspace. This should include the scalar size as well as IEC standard unit in either decimal or binary form.
Examples:
- 10GB
- 2Ti
- 1Pi

15.1.4.1.471 Persistent
Location: /formulation/[]/workflows/[]/workspaces/[]/volume/persistent
Property: persistent (Optional)
Type: Boolean
Description: Indicates if the volume persists beyond the life of the resource it is associated with.

15.1.4.1.472 Remote
Location: /formulation/[]/workflows/[]/workspaces/[]/volume/remote
Property: remote (Optional)
Type: Boolean
Description: Indicates if the volume is remotely (i.e., network) attached.

15.1.4.1.473 Properties
Location: /formulation/[]/workflows/[]/workspaces/[]/volume/properties
Property: properties (Optional)
Type: Array
Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

15.1.4.1.474 Lightweight name-value pair
Location: /formulation/[]/workflows/[]/workspaces/[]/volume/properties/[]
Type: Object
Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create
extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

Table 378 – Properties for the properties object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

15.1.4.1.475 Name

Location: /formulation/[/workflows/[/workspaces/[/volume/properties[/name

Property: name (Required)

Type: String

Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.4.1.476 Value

Location: /formulation/[/workflows/[/workspaces/[/volume/properties[/value

Property: value (Optional)

Type: String

Description: The value of the property.

15.1.4.1.477 Properties

Location: /formulation/[/workflows/[/workspaces/[/properties

Property: properties (Optional)

Type: Array

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

15.1.4.1.478 Lightweight name-value pair

Location: /formulation/[/workflows/[/workspaces/[/properties/

Type: Object

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.
Table 379 – Properties for the properties object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

15.1.4.1.479 Name

**Location:** /formulation/[][]/workflows/[][]/workspaces/[][]/properties/[][]/name

**Property:** name (Required)

**Type:** String

**Description:** The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.4.1.480 Value

**Location:** /formulation/[][]/workflows/[][]/workspaces/[][]/properties/[][]/value

**Property:** value (Optional)

**Type:** String

**Description:** The value of the property.

*All items must be unique.*

15.1.4.1.481 Runtime topology

**Location:** /formulation/[][]/workflows/[][]/runtimeTopology

**Property:** runtimeTopology (Optional)

**Type:** Array

**Description:** A graph of the component runtime topology for workflow's instance. Each item of this array must be a Dependency object.

15.1.4.1.482 Dependency

**Location:** /formulation/[][]/workflows/[][]/runtimeTopology/[]

**Type:** Object

**Description:** Defines the direct dependencies of a component, service, or the components provided/implemented by a given component. Components or services that do not have their own dependencies must be declared as empty elements within the graph. Components or services that are not represented in the dependency graph may have unknown dependencies. It is recommended that implementations assume this to be opaque and not an indicator of an object being dependency-free. It is recommended to leverage compositions to indicate unknown dependency graphs.

Table 380 – Properties for the runtimeTopology object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ref</td>
<td>String</td>
<td>Required</td>
<td>References a component or service by its bom-ref attribute</td>
</tr>
<tr>
<td>dependsOn</td>
<td>Array</td>
<td>Optional</td>
<td>The bom-ref identifiers of the components or services that are dependencies of this dependency object.</td>
</tr>
<tr>
<td>provides</td>
<td>Array</td>
<td>Optional</td>
<td>The bom-ref identifiers of the components or services that define a given specification or standard, which are provided or implemented by this</td>
</tr>
</tbody>
</table>
dependency object. For example, a cryptographic library which implements a cryptographic algorithm. A component which implements another component does not imply that the implementation is in use.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

15.1.4.1.483 **Reference**

**Location:** /formulation/[ ]/workflows/[ ]/runtimeTopology/[ ]/ref

**Property:** ref (Required)

**Type:** String

**Description:** References a component or service by its bom-ref attribute

15.1.4.1.484 **Depends On**

**Location:** /formulation/[ ]/workflows/[ ]/runtimeTopology/[ ]/dependsOn

**Property:** dependsOn (Optional)

**Type:** array (of String)

**Description:** The bom-ref identifiers of the components or services that are dependencies of this dependency object. Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType. Each item of this array must be a string.

*All items must be unique.*

15.1.4.1.485 **Provides**

**Location:** /formulation/[ ]/workflows/[ ]/runtimeTopology/[ ]/provides

**Property:** provides (Optional)

**Type:** array (of String)

**Description:** The bom-ref identifiers of the components or services that define a given specification or standard, which are provided or implemented by this dependency object. For example, a cryptographic library which implements a cryptographic algorithm. A component which implements another component does not imply that the implementation is in use. Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType. Each item of this array must be a string.

*All items must be unique.*

15.1.4.1.486 **Properties**

**Location:** /formulation/[ ]/workflows/[ ]/properties

**Property:** properties (Optional)

**Type:** Array

**Description:** Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

15.1.4.1.487 **Lightweight name-value pair**

**Location:** /formulation/[ ]/workflows/[ ]/properties/[ ]

**Type:** Object
Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

Table 381 – Properties for the properties object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

15.1.4.1.488 Name

Location: /formulation/[/]workflows/[]/properties/[]/name

Property: name (Required)

Type: String

Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.4.1.489 Value

Location: /formulation/[/]workflows/[]/properties/[]/value

Property: value (Optional)

Type: String

Description: The value of the property. All items must be unique.

15.1.5 Properties

Location: /formulation/[]/properties

Property: properties (Optional)

Type: Array

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

15.1.5.1 Lightweight name-value pair

Location: /formulation/[]/properties/[]

Type: Object

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.
Table 382 – Properties for the properties object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

15.1.5.1.1 Name

Location: /formulation[/]/properties[/]/name

Property: name (Required)

Type: String

Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

15.1.5.1.2 Value

Location: /formulation[/]/properties[/]/value

Property: value (Optional)

Type: String

Description: The value of the property.

All items must be unique.

16 Declarations

Location: /declarations

Property: declarations (Optional)

Type: Object

Description: The list of declarations which describe the conformance to standards. Each declaration may include attestations, claims, and evidence.

Table 383 – Properties for the declarations object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>assessors</td>
<td>Array</td>
<td>Optional</td>
<td>The list of assessors evaluating claims and determining conformance to requirements and confidence in that assessment.</td>
</tr>
<tr>
<td>attestations</td>
<td>Array</td>
<td>Optional</td>
<td>The list of attestations asserted by an assessor that maps requirements to claims.</td>
</tr>
<tr>
<td>claims</td>
<td>Array</td>
<td>Optional</td>
<td>The list of claims.</td>
</tr>
<tr>
<td>evidence</td>
<td>Array</td>
<td>Optional</td>
<td>The list of evidence</td>
</tr>
<tr>
<td>targets</td>
<td>Object</td>
<td>Optional</td>
<td>The list of targets which claims are made against.</td>
</tr>
<tr>
<td>affirmation</td>
<td>Object</td>
<td>Optional</td>
<td>A concise statement affirmed by an individual regarding all declarations, often used for third-party auditor acceptance or recipient acknowledgment. It includes a list of authorized signatories who assert the validity of the document on behalf of the organization.</td>
</tr>
</tbody>
</table>
**Property** | **Type** | **Requirement** | **Description**
---|---|---|---
signature | Array | Optional | Enveloped signature in [JSON Signature Format (JSF)](https://www.w3.org/2000/09/xmldsig-core#RSA-SHA1).

### 16.1 Assessors

**Location:** /declarations/assessors

**Property:** assessors (Optional)

**Type:** Array

**Description:** The list of assessors evaluating claims and determining conformance to requirements and confidence in that assessment. Each item of this array must be an Assessor object.

#### 16.1.1 Assessor

**Location:** /declarations/assessors/[]

**Type:** Object

**Description:** The assessor who evaluates claims and determines conformance to requirements and confidence in that assessment.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>thirdParty</td>
<td>Boolean</td>
<td>Optional</td>
<td>The boolean indicating if the assessor is outside the organization generating claims. A value of false indicates a self assessor.</td>
</tr>
<tr>
<td>organization</td>
<td>Object</td>
<td>Optional</td>
<td>The entity issuing the assessment.</td>
</tr>
</tbody>
</table>

#### 16.1.1.1 BOM Reference

**Location:** /declarations/assessors/[]/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

#### 16.1.1.2 Third Party

**Location:** /declarations/assessors/[]/thirdParty

**Property:** thirdParty (Optional)

**Type:** Boolean

**Description:** The boolean indicating if the assessor is outside the organization generating claims. A value of false indicates a self assessor.

#### 16.1.1.3 Organizational Entity

**Location:** /declarations/assessors/[]/organization

**Property:** organization (Optional)
**Type:** Object

**Description:** The entity issuing the assessment.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the organization</td>
</tr>
<tr>
<td>address</td>
<td>Object</td>
<td>Optional</td>
<td>The physical address (location) of the organization</td>
</tr>
<tr>
<td>url</td>
<td>Array</td>
<td>Optional</td>
<td>The URL of the organization. Multiple URLs are allowed.</td>
</tr>
<tr>
<td>contact</td>
<td>Array</td>
<td>Optional</td>
<td>A contact at the organization. Multiple contacts are allowed.</td>
</tr>
</tbody>
</table>

16.1.1.3.1 **BOM Reference**

**Location:** /declarations/assessors/[]/organization/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

16.1.1.3.2 **Organization Name**

**Location:** /declarations/assessors/[]/organization/name

**Property:** name (Optional)

**Type:** String

**Description:** The name of the organization

**Examples:**
- Example Inc.

16.1.1.3.3 **Organization Address**

**Location:** /declarations/assessors/[]/organization/address

**Property:** address (Optional)

**Type:** Object

**Description:** The physical address (location) of the organization
### Table 386 – Properties for the address object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>Optional</td>
<td>The country name or the two-letter ISO 3166-1 country code.</td>
</tr>
<tr>
<td>region</td>
<td>String</td>
<td>Optional</td>
<td>The region or state in the country.</td>
</tr>
<tr>
<td>locality</td>
<td>String</td>
<td>Optional</td>
<td>The locality or city within the country.</td>
</tr>
<tr>
<td>postOfficeBoxNumber</td>
<td>String</td>
<td>Optional</td>
<td>The post office box number.</td>
</tr>
<tr>
<td>postalCode</td>
<td>String</td>
<td>Optional</td>
<td>The postal code.</td>
</tr>
<tr>
<td>streetAddress</td>
<td>String</td>
<td>Optional</td>
<td>The street address.</td>
</tr>
</tbody>
</table>

16.1.1.3.4 BOM Reference

**Location:** /declarations/assessors/[]/organization/address/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

16.1.1.3.5 Country

**Location:** /declarations/assessors/[]/organization/address/country

**Property:** country (Optional)

**Type:** String

**Description:** The country name or the two-letter ISO 3166-1 country code.

16.1.1.3.6 Region

**Location:** /declarations/assessors/[]/organization/address/region

**Property:** region (Optional)

**Type:** String

**Description:** The region or state in the country.

**Examples:**
- Texas

16.1.1.3.7 Locality

**Location:** /declarations/assessors/[]/organization/address/locality

**Property:** locality (Optional)

**Type:** String

**Description:** The locality or city within the country.
Examples:

- Austin

16.1.1.3.8 Post Office Box Number

Location: /declarations/assessors/organization/address/postOfficeBoxNumber
Property: postOfficeBoxNumber (Optional)
Type: String
Description: The post office box number.
Examples:

- 901

16.1.1.3.9 Postal Code

Location: /declarations/assessors/organization/address/postalCode
Property: postalCode (Optional)
Type: String
Description: The postal code.
Examples:

- 78758

16.1.1.3.10 Street Address

Location: /declarations/assessors/organization/address/streetAddress
Property: streetAddress (Optional)
Type: String
Description: The street address.
Examples:

- 100 Main Street

16.1.1.3.11 Organization URL(s)

Location: /declarations/assessors/organization/url
Property: url (Optional)
Type: array (of String)
Description: The URL of the organization. Multiple URLs are allowed. Each item of this array must be a string.
Examples:

- https://example.com

16.1.1.3.12 Organizational Contact

Location: /declarations/assessors/organization/contact
Property: contact (Optional)
Type: Array
Description: A contact at the organization. Multiple contacts are allowed. Each item of this array must be an Organizational Contact object.

16.1.1.3.13 Organizational Contact

Location: /declarations/assessors/organization/contact/
### Table 387 – Properties for the contact object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

#### 16.1.1.3.14 BOM Reference

**Location:** /declarations/assessors/[]/organization/contact/[]/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

#### 16.1.1.3.15 Name

**Location:** /declarations/assessors/[]/organization/contact/[]/name

**Property:** name (Optional)

**Type:** String

**Description:** The name of a contact

**Examples:**
- Contact name

#### 16.1.1.3.16 Email Address

**Location:** /declarations/assessors/[]/organization/contact/[]/email

**Property:** email (Optional)

**Type:** String

**Format:** idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

**Description:** The email address of the contact.

**Examples:**
- firstname.lastname@example.com

#### 16.1.1.3.17 Phone

**Location:** /declarations/assessors/[]/organization/contact/[]/phone

**Property:** phone (Optional)

**Type:** String

**Description:** The phone number of the contact.
Examples:
- 800-555-1212

16.2 Attestations

**Location:** /declarations/attestations

**Property:** attestations (Optional)

**Type:** Array

**Description:** The list of attestations asserted by an assessor that maps requirements to claims. Each item of this array must be an Attestation object.

16.2.1 Attestation

**Location:** /declarations/attestations/

**Type:** Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>summary</td>
<td>String</td>
<td>Optional</td>
<td>The short description explaining the main points of the attestation.</td>
</tr>
<tr>
<td>assessor</td>
<td>String</td>
<td>Optional</td>
<td>Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.</td>
</tr>
<tr>
<td>map</td>
<td>Array</td>
<td>Optional</td>
<td>The grouping of requirements to claims and the attestors declared conformance and confidence thereof.</td>
</tr>
<tr>
<td>signature</td>
<td>Array</td>
<td>Optional</td>
<td>Enveloped signature in JSON Signature Format (JSF).</td>
</tr>
</tbody>
</table>

16.2.1.1 Summary

**Location:** /declarations/attestations/[]/summary

**Property:** summary (Optional)

**Type:** String

**Description:** The short description explaining the main points of the attestation.

16.2.1.2 Assessor

**Location:** /declarations/attestations/[]/assessor

**Property:** assessor (Optional)

**Type:** String

**Description:** Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

16.2.1.3 Map

**Location:** /declarations/attestations/[]/map

**Property:** map (Optional)

**Type:** Array

**Description:** The grouping of requirements to claims and the attestors declared conformance and confidence thereof. Each item of this array must be a Map object.
16.2.1.3.1 Map

**Location:** /declarations/attestations/[i]/map/[i]

**Type:** Object

### Table 389 – Properties for the map object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>requirement</td>
<td>String</td>
<td>Optional</td>
<td>Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.</td>
</tr>
<tr>
<td>claims</td>
<td>Array</td>
<td>Optional</td>
<td>The list of bom-ref to the claims being attested to.</td>
</tr>
<tr>
<td>counterClaims</td>
<td>Array</td>
<td>Optional</td>
<td>The list of bom-ref to the counter claims being attested to.</td>
</tr>
<tr>
<td>conformance</td>
<td>Object</td>
<td>Optional</td>
<td>The conformance of the claim meeting a requirement.</td>
</tr>
<tr>
<td>confidence</td>
<td>Object</td>
<td>Optional</td>
<td>The confidence of the claim meeting the requirement.</td>
</tr>
</tbody>
</table>

16.2.1.3.2 Requirement

**Location:** /declarations/attestations/[i]/map/[i]/requirement

**Property:** requirement (Optional)

**Type:** String

**Description:** Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

16.2.1.3.3 Claims

**Location:** /declarations/attestations/[i]/map/[i]/claims

**Property:** claims (Optional)

**Type:** array (of String)

**Description:** The list of bom-ref to the claims being attested to. Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType. Each item of this array must be a string.

16.2.1.3.4 Counter Claims

**Location:** /declarations/attestations/[i]/map/[i]/counterClaims

**Property:** counterClaims (Optional)

**Type:** array (of String)

**Description:** The list of bom-ref to the counter claims being attested to. Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType. Each item of this array must be a string.

16.2.1.3.5 Conformance

**Location:** /declarations/attestations/[i]/map/[i]/conformance

**Property:** conformance (Optional)

**Type:** Object

**Description:** The conformance of the claim meeting a requirement.
Table 390 – Properties for the conformance object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>score</td>
<td>Number</td>
<td>Optional</td>
<td>The conformance of the claim between and inclusive of 0 and 1, where 1 is 100% conformance.</td>
</tr>
<tr>
<td>rationale</td>
<td>String</td>
<td>Optional</td>
<td>The rationale for the conformance score.</td>
</tr>
<tr>
<td>mitigationStrategies</td>
<td>Array</td>
<td>Optional</td>
<td>The list of bom-ref to the evidence provided describing the mitigation strategies.</td>
</tr>
</tbody>
</table>

16.2.1.3.6 Score

**Location:** /declarations/attestations[/]/map[/]/conformance/score

**Property:** score (Optional)

**Type:** Number

**Maximum Value:** 1

**Description:** The conformance of the claim between and inclusive of 0 and 1, where 1 is 100% conformance.

16.2.1.3.7 Rationale

**Location:** /declarations/attestations[/]/map[/]/conformance/rationale

**Property:** rationale (Optional)

**Type:** String

**Description:** The rationale for the conformance score.

16.2.1.3.8 Mitigation Strategies

**Location:** /declarations/attestations[/]/map[/]/conformance/mitigationStrategies

**Property:** mitigationStrategies (Optional)

**Type:** array (of String)

**Description:** The list of bom-ref to the evidence provided describing the mitigation strategies. Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType. Each item of this array must be a string.

16.2.1.3.9 Confidence

**Location:** /declarations/attestations[/]/map[/]/confidence

**Property:** confidence (Optional)

**Type:** Object

**Description:** The confidence of the claim meeting the requirement.

Table 391 – Properties for the confidence object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>score</td>
<td>Number</td>
<td>Optional</td>
<td>The confidence of the claim between and inclusive of 0 and 1, where 1 is 100% confidence.</td>
</tr>
<tr>
<td>rationale</td>
<td>String</td>
<td>Optional</td>
<td>The rationale for the confidence score.</td>
</tr>
</tbody>
</table>
16.2.1.3.10 Score

Location: /declarations/attestations/[/map/[/]confidence/score
Property: score (Optional)
Type: Number
Maximum Value: 1
Description: The confidence of the claim between and inclusive of 0 and 1, where 1 is 100% confidence.

16.2.1.3.11 Rationale

Location: /declarations/attestations/[/map/[/]confidence/rationale
Property: rationale (Optional)
Type: String
Description: The rationale for the confidence score.

16.2.1.4 Signature

Location: /declarations/attestations/[/signature
Property: signature (Optional)
Type: Object
Description: An enveloped digital signature embedded within and specific to this object within the BOM. CycloneDX signatures enable integrity and authenticity verification without separating the signature from the BOM. Enveloped signatures enable each party in the supply chain to take responsibility for and sign their specific data, ensuring its integrity and authenticity. By aggregating all signatures, stakeholders can independently verify discrete pieces of information from each provider, enhancing overall transparency and trust in the supply chain.

Reference: Refer to the JSON Signature Format specification or to the XML Signature specification for implementation details.
- [https://www.w3.org/TR/xmldsig-core/](https://www.w3.org/TR/xmldsig-core/)

16.3 Claims

Location: /declarations/claims
Property: claims (Optional)
Type: Array
Description: The list of claims. Each item of this array must be a Claim object.

16.3.1 Claim

Location: /declarations/claims/[/
Type: Object
Table 392 – Properties for the claims object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>target</td>
<td>String</td>
<td>Optional</td>
<td>Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.</td>
</tr>
<tr>
<td>predicate</td>
<td>String</td>
<td>Optional</td>
<td>The specific statement or assertion about the target.</td>
</tr>
<tr>
<td>mitigationStrategies</td>
<td>Array</td>
<td>Optional</td>
<td>The list of bom-ref to the evidence provided describing the mitigation strategies. Each mitigation strategy should include an explanation of how any weaknesses in the evidence will be mitigated.</td>
</tr>
<tr>
<td>reasoning</td>
<td>String</td>
<td>Optional</td>
<td>The written explanation of why the evidence provided substantiates the claim.</td>
</tr>
<tr>
<td>evidence</td>
<td>Array</td>
<td>Optional</td>
<td>The list of bom-ref to evidence that supports this claim.</td>
</tr>
<tr>
<td>counterEvidence</td>
<td>Array</td>
<td>Optional</td>
<td>The list of bom-ref to counterEvidence that supports this claim.</td>
</tr>
<tr>
<td>externalReferences</td>
<td>Array</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
<tr>
<td>signature</td>
<td>Array</td>
<td>Optional</td>
<td>Enveloped signature in JSON Signature Format (JSF).</td>
</tr>
</tbody>
</table>

16.3.1.1 BOM Reference

**Location:** /declarations/claims/[CLAIM]/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

16.3.1.2 Target

**Location:** /declarations/claims/[CLAIM]/target

**Property:** target (Optional)

**Type:** String

**Description:** Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

16.3.1.3 Predicate

**Location:** /declarations/claims/[CLAIM]/predicate

**Property:** predicate (Optional)

**Type:** String

**Description:** The specific statement or assertion about the target.
16.3.1.4 Mitigation Strategies

Location: /declarations/claims/[]/mitigationStrategies
Property: mitigationStrategies (Optional)
Type: array (of String)
Description: The list of bom-ref to the evidence provided describing the mitigation strategies. Each mitigation strategy should include an explanation of how any weaknesses in the evidence will be mitigated. Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType. Each item of this array must be a string.

16.3.1.5 Reasoning

Location: /declarations/claims/[]/reasoning
Property: reasoning (Optional)
Type: String
Description: The written explanation of why the evidence provided substantiates the claim.

16.3.1.6 Evidence

Location: /declarations/claims/[]/evidence
Property: evidence (Optional)
Type: array (of String)
Description: The list of bom-ref to evidence that supports this claim. Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType. Each item of this array must be a string.

16.3.1.7 Counter Evidence

Location: /declarations/claims/[]/counterEvidence
Property: counterEvidence (Optional)
Type: array (of String)
Description: The list of bom-ref to counterEvidence that supports this claim. Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType. Each item of this array must be a string.

16.3.1.8 External References

Location: /declarations/claims/[]/externalReferences
Property: externalReferences (Optional)
Type: Array
Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM. Each item of this array must be an External Reference object.

Reference: Refer to the external reference definition at /externalReferences/[]

16.3.1.8.1 External Reference

Location: /declarations/claims/[]/externalReferences/[]
Type: Object
Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.
16.3.1.9 Signature

**Location:** /declarations/claims/[]/signature

**Property:** signature (Optional)

**Type:** Object

**Description:** An enveloped digital signature embedded within and specific to this object within the BOM. CycloneDX signatures enable integrity and authenticity verification without separating the signature from the BOM. Enveloped signatures enable each party in the supply chain to take responsibility for and sign their specific data, ensuring its integrity and authenticity. By aggregating all signatures, stakeholders can independently verify discrete pieces of information from each provider, enhancing overall transparency and trust in the supply chain.

**Reference:** Refer to the JSON Signature Format specification or to the XML Signature specification for implementation details.
- [https://www.w3.org/TR/xmldsig-core/](https://www.w3.org/TR/xmldsig-core/)

16.4 Evidence

**Location:** /declarations/evidence

**Property:** evidence (Optional)

**Type:** Array

**Description:** The list of evidence. Each item of this array must be an Evidence object.

16.4.1 Evidence

**Location:** /declarations/evidence/[]

**Type:** Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>propertyName</td>
<td>String</td>
<td>Optional</td>
<td>The reference to the property name as defined in the CycloneDX Property Taxonomy.</td>
</tr>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>The written description of what this evidence is and how it was created.</td>
</tr>
<tr>
<td>data</td>
<td>Array</td>
<td>Optional</td>
<td>The output or analysis that supports claims.</td>
</tr>
<tr>
<td>created</td>
<td>String</td>
<td>Optional</td>
<td>The date and time (timestamp) when the evidence was created.</td>
</tr>
<tr>
<td>expires</td>
<td>String</td>
<td>Optional</td>
<td>The optional date and time (timestamp) when the evidence is no longer valid.</td>
</tr>
<tr>
<td>author</td>
<td>Object</td>
<td>Optional</td>
<td>The author of the evidence.</td>
</tr>
<tr>
<td>reviewer</td>
<td>Object</td>
<td>Optional</td>
<td>The reviewer of the evidence.</td>
</tr>
<tr>
<td>signature</td>
<td>Array</td>
<td>Optional</td>
<td>Enveloped signature in JSON Signature Format (JSF).</td>
</tr>
</tbody>
</table>
16.4.1.1 BOM Reference

Location: /declarations/evidence/[/bom-ref
Property: bom-ref (Optional)

Type: String

Description: Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

16.4.1.2 Property Name

Location: /declarations/evidence/[/propertyName
Property: propertyName (Optional)

Type: String

Description: The reference to the property name as defined in the CycloneDX Property Taxonomy.

16.4.1.3 Description

Location: /declarations/evidence/[/description
Property: description (Optional)

Type: String

Description: The written description of what this evidence is and how it was created.

16.4.1.4 Data

Location: /declarations/evidence/[/data
Property: data (Optional)

Type: Array

Description: The output or analysis that supports claims. Each item of this array must be a Data object.

16.4.1.4.1 Data

Location: /declarations/evidence/[/data[/

Type: Object

**Table 394 – Properties for the data object**

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the data.</td>
</tr>
<tr>
<td>contents</td>
<td>Object</td>
<td>Optional</td>
<td>The contents or references to the contents of the data being described.</td>
</tr>
<tr>
<td>classification</td>
<td>String</td>
<td>Optional</td>
<td>Data classification tags data according to its type, sensitivity, and value if altered, stolen, or destroyed.</td>
</tr>
<tr>
<td>sensitiveData</td>
<td>Array</td>
<td>Optional</td>
<td>A description of any sensitive data included.</td>
</tr>
<tr>
<td>governance</td>
<td>Object</td>
<td>Optional</td>
<td>Data governance captures information regarding data ownership, stewardship, and custodianship, providing insights into the individuals or entities responsible for managing, overseeing, and safeguarding the data throughout its lifecycle.</td>
</tr>
</tbody>
</table>
16.4.1.4.2  Data Name

**Location:** /declarations/evidence/[i]/data/[i]/name

**Property:** name (Optional)

**Type:** String

**Description:** The name of the data.

16.4.1.4.3  Data Contents

**Location:** /declarations/evidence/[i]/data/[i]/contents

**Property:** contents (Optional)

**Type:** Object

**Description:** The contents or references to the contents of the data being described.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>attachment</td>
<td>Object</td>
<td>Optional</td>
<td>Specifies the metadata and content for an attachment.</td>
</tr>
<tr>
<td>url</td>
<td>String</td>
<td>Optional</td>
<td>The URL to where the data can be retrieved.</td>
</tr>
</tbody>
</table>

16.4.1.4.4  Attachment

**Location:** /declarations/evidence/[i]/data/[i]/contents/attachment

**Property:** attachment (Optional)

**Type:** Object

**Description:** Specifies the metadata and content for an attachment.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>contentType</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. For a comprehensive list of registered content types, refer to the IANA media types registry.</td>
</tr>
<tr>
<td>encoding</td>
<td>String</td>
<td>Optional</td>
<td>Specifies the optional encoding the text is represented in.</td>
</tr>
<tr>
<td>content</td>
<td>String</td>
<td>Required</td>
<td>The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.</td>
</tr>
</tbody>
</table>

16.4.1.4.5  Content-Type

**Location:** /declarations/evidence/[i]/data/[i]/contents/attachment/contentType

**Property:** contentType (Optional)

**Type:** String

**Default Value:** text/plain
**Description**: Specifies the format and nature of the data being attached, helping systems correctly interpret and process the content. Common content type examples include `application/json` for JSON data and `text/plain` for plain text documents. RFC 2045 section 5.1 outlines the structure and use of content types. For a comprehensive list of registered content types, refer to the IANA media types registry.

**Examples**:
- `text/plain`
- `application/json`
- `image/png`

16.4.1.4.6 Encoding

**Location**: /declarations/evidence/[]/data/[]/contents/attachment/encoding

**Property**: encoding (Optional)

**Type**: String

**Description**: Specifies the optional encoding the text is represented in.

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>base64</td>
<td>Base64 is a binary-to-text encoding scheme that represents binary data in an ASCII string.</td>
</tr>
</tbody>
</table>

16.4.1.4.7 Attachment Text

**Location**: /declarations/evidence/[]/data/[]/contents/attachment/content

**Property**: content (Required)

**Type**: String

**Description**: The attachment data. Proactive controls such as input validation and sanitization should be employed to prevent misuse of attachment text.

16.4.1.4.8 Data URL

**Location**: /declarations/evidence/[]/data/[]/contents/url

**Property**: url (Optional)

**Type**: String

**Format**: iri-reference as specified in [RFC 3987](https://www.ietf.org/rfc/rfc3987.html)

**Description**: The URL to where the data can be retrieved.

16.4.1.4.9 Data Classification

**Location**: /declarations/evidence/[]/data/[]/classification

**Property**: classification (Optional)

**Type**: String

**Description**: Data classification tags data according to its type, sensitivity, and value if altered, stolen, or destroyed.

16.4.1.4.10 Sensitive Data

**Location**: /declarations/evidence/[]/data/[]/sensitiveData

**Property**: sensitiveData (Optional)

**Type**: array (of String)
Description: A description of any sensitive data included. Each item of this array must be a string.

### 16.4.1.4.11 Data Governance

**Location:** /declarations/evidence/[][]/data/[][]/governance

**Property:** governance (Optional)

**Type:** Object

**Description:** Data governance captures information regarding data ownership, stewardship, and custodianship, providing insights into the individuals or entities responsible for managing, overseeing, and safeguarding the data throughout its lifecycle.

#### Table 398 – Properties for the governance object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>custodians</td>
<td>Array</td>
<td>Optional</td>
<td>Data custodians are responsible for the safe custody, transport, and storage of data.</td>
</tr>
<tr>
<td>stewards</td>
<td>Array</td>
<td>Optional</td>
<td>Data stewards are responsible for data content, context, and associated business rules.</td>
</tr>
<tr>
<td>owners</td>
<td>Array</td>
<td>Optional</td>
<td>Data owners are concerned with risk and appropriate access to data.</td>
</tr>
</tbody>
</table>

### 16.4.1.4.12 Data Custodians

**Location:** /declarations/evidence/[][]/data/[][]/governance/custodians

**Property:** custodians (Optional)

**Type:** Array

**Description:** Data custodians are responsible for the safe custody, transport, and storage of data.

**Location:** /declarations/evidence/[][]/data/[][]/governance/custodians/[]

**Type:** Object

#### Table 399 – Properties for the custodians object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>organization</td>
<td>Object</td>
<td>Optional</td>
<td>The organization that is responsible for specific data governance role(s).</td>
</tr>
<tr>
<td>contact</td>
<td>Object</td>
<td>Optional</td>
<td>The individual that is responsible for specific data governance role(s).</td>
</tr>
</tbody>
</table>

### 16.4.1.4.13 Organization

**Location:** /declarations/evidence/[][]/data/[][]/governance/custodians/[]/organization

**Property:** organization (Optional)

**Type:** Object

**Description:** The organization that is responsible for specific data governance role(s).
Table 400 – Properties for the organization object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the organization</td>
</tr>
<tr>
<td>address</td>
<td>Object</td>
<td>Optional</td>
<td>The physical address (location) of the organization</td>
</tr>
<tr>
<td>url</td>
<td>Array</td>
<td>Optional</td>
<td>The URL of the organization. Multiple URLs are allowed.</td>
</tr>
<tr>
<td>contact</td>
<td>Array</td>
<td>Optional</td>
<td>A contact at the organization. Multiple contacts are allowed.</td>
</tr>
</tbody>
</table>

16.4.1.4.14 BOM Reference

**Location:** /declarations/evidence/[]/data/[]/governance/custodians/[]/organization/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

16.4.1.4.15 Organization Name

**Location:** /declarations/evidence/[]/data/[]/governance/custodians/[]/organization/name

**Property:** name (Optional)

**Type:** String

**Description:** The name of the organization

**Examples:**
- Example Inc.

16.4.1.4.16 Organization Address

**Location:** /declarations/evidence/[]/data/[]/governance/custodians/[]/organization/address

**Property:** address (Optional)

**Type:** Object

**Description:** The physical address (location) of the organization
Table 401 – Properties for the address object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>Optional</td>
<td>The country name or the two-letter ISO 3166-1 country code.</td>
</tr>
<tr>
<td>region</td>
<td>String</td>
<td>Optional</td>
<td>The region or state in the country.</td>
</tr>
<tr>
<td>locality</td>
<td>String</td>
<td>Optional</td>
<td>The locality or city within the country.</td>
</tr>
<tr>
<td>postOfficeBoxNumber</td>
<td>String</td>
<td>Optional</td>
<td>The post office box number.</td>
</tr>
<tr>
<td>postalCode</td>
<td>String</td>
<td>Optional</td>
<td>The postal code.</td>
</tr>
<tr>
<td>streetAddress</td>
<td>String</td>
<td>Optional</td>
<td>The street address.</td>
</tr>
</tbody>
</table>

16.4.1.4.17 BOM Reference

**Location:** /declarations/evidence/[identity]/data/[identity]/governance/custodians/[identity]/organization/address/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

16.4.1.4.18 Country

**Location:** /declarations/evidence/[identity]/data/[identity]/governance/custodians/[identity]/organization/address/country

**Property:** country (Optional)

**Type:** String

**Description:** The country name or the two-letter ISO 3166-1 country code.

16.4.1.4.19 Region

**Location:** /declarations/evidence/[identity]/data/[identity]/governance/custodians/[identity]/organization/address/region

**Property:** region (Optional)

**Type:** String

**Description:** The region or state in the country.

**Examples:**
- Texas

16.4.1.4.20 Locality

**Location:** /declarations/evidence/[identity]/data/[identity]/governance/custodians/[identity]/organization/address/locality

**Property:** locality (Optional)

**Type:** String

**Description:** The locality or city within the country.
Examples:
- Austin

16.4.1.4.21 Post Office Box Number

Location: /declarations/evidence/[]/data/[]/governance/custodians/[]/organization/address/postOfficeBoxNumber
Property: postOfficeBoxNumber (Optional)

Type: String
Description: The post office box number.
Examples:
- 901

16.4.1.4.22 Postal Code

Location: /declarations/evidence/[]/data/[]/governance/custodians/[]/organization/address/postalCode
Property: postalCode (Optional)

Type: String
Description: The postal code.
Examples:
- 78758

16.4.1.4.23 Street Address

Location: /declarations/evidence/[]/data/[]/governance/custodians/[]/organization/address/streetAddress
Property: streetAddress (Optional)

Type: String
Description: The street address.
Examples:
- 100 Main Street

16.4.1.4.24 Organization URL(s)

Location: /declarations/evidence/[]/data/[]/governance/custodians/[]/organization/url
Property: url (Optional)

Type: array (of String)
Description: The URL of the organization. Multiple URLs are allowed. Each item of this array must be a string.
Examples:
- https://example.com

16.4.1.4.25 Organizational Contact

Location: /declarations/evidence/[]/data/[]/governance/custodians/[]/organization/contact
Property: contact (Optional)

Type: Array
Description: A contact at the organization. Multiple contacts are allowed. Each item of this array must be an Organizational Contact object.
16.4.1.4.26 Organizational Contact

**Location:** /declarations/evidence/[/data/][/governance/custodians/][/organization/contact/]

**Type:** Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

16.4.1.4.27 BOM Reference

**Location:** /declarations/evidence/[/data/][/governance/custodians/][/organization/contact/][/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

16.4.1.4.28 Name

**Location:** /declarations/evidence/[/data/][/governance/custodians/][/organization/contact/][/name

**Property:** name (Optional)

**Type:** String

**Description:** The name of a contact

**Examples:**
- Contact name

16.4.1.4.29 Email Address

**Location:** /declarations/evidence/[/data/][/governance/custodians/][/organization/contact/][/email

**Property:** email (Optional)

**Type:** String

**Format:** idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

**Description:** The email address of the contact.

**Examples:**
- firstname.lastname@example.com

16.4.1.4.30 Phone

**Location:** /declarations/evidence/[/data/][/governance/custodians/][/organization/contact/][/phone

**Property:** phone (Optional)
Type: String
Description: The phone number of the contact.
Examples:
- 800-555-1212

16.4.1.4.31 Organizational Contact
Location: /declarations/evidence/[/data/[/governance/custodians/]//contact
Property: contact (Optional)
Type: Object
Description: The individual that is responsible for specific data governance role(s).

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

16.4.1.4.32 BOM Reference
Location: /declarations/evidence/[/data/[/governance/custodians/]//contact/bom-ref
Property: bom-ref (Optional)
Type: String
Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

16.4.1.4.33 Name
Location: /declarations/evidence/[/data/[/governance/custodians/]//contact/name
Property: name (Optional)
Type: String
Description: The name of a contact
Examples:
- Contact name

16.4.1.4.34 Email Address
Location: /declarations/evidence/[/data/[/governance/custodians/]//contact/email
Property: email (Optional)
Type: String
Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)
Description: The email address of the contact.
Examples:
- firstname.lastname@example.com

16.4.1.4.35 Phone

Location: /declarations/evidence/[data]/governance/custodians/[contact]/phone

Property: phone (Optional)

Type: String

Description: The phone number of the contact.

Examples:
- 800-555-1212

16.4.1.4.36 Data Stewards

Location: /declarations/evidence/[data]/governance/stewards

Property: stewards (Optional)

Type: Array

Description: Data stewards are responsible for data content, context, and associated business rules.

Location: /declarations/evidence/[data]/governance/stewards/

Table 404 – Properties for the stewards object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>organization</td>
<td>Object</td>
<td>Optional</td>
<td>The organization that is responsible for specific data governance role(s).</td>
</tr>
<tr>
<td>contact</td>
<td>Object</td>
<td>Optional</td>
<td>The individual that is responsible for specific data governance role(s).</td>
</tr>
</tbody>
</table>

16.4.1.4.37 Organization

Location: /declarations/evidence/[data]/governance/stewards/[organization]

Property: organization (Optional)

Type: Object

Description: The organization that is responsible for specific data governance role(s).

Table 405 – Properties for the organization object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the organization</td>
</tr>
<tr>
<td>address</td>
<td>Object</td>
<td>Optional</td>
<td>The physical address (location) of the organization</td>
</tr>
<tr>
<td>url</td>
<td>Array</td>
<td>Optional</td>
<td>The URL of the organization. Multiple URLs are allowed.</td>
</tr>
<tr>
<td>contact</td>
<td>Array</td>
<td>Optional</td>
<td>A contact at the organization. Multiple contacts are allowed.</td>
</tr>
</tbody>
</table>
16.4.1.4.38  BOM Reference

**Location:** /declarations/evidence/[l]/data/[l]/governance/stewards/[l]/organization/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

16.4.1.4.39  Organization Name

**Location:** /declarations/evidence/[l]/data/[l]/governance/stewards/[l]/organization/name

**Property:** name (Optional)

**Type:** String

**Description:** The name of the organization

**Examples:**
- Example Inc.

16.4.1.4.40  Organization Address

**Location:** /declarations/evidence/[l]/data/[l]/governance/stewards/[l]/organization/address

**Property:** address (Optional)

**Type:** Object

**Description:** The physical address (location) of the organization

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>Optional</td>
<td>The country name or the two-letter ISO 3166-1 country code.</td>
</tr>
<tr>
<td>region</td>
<td>String</td>
<td>Optional</td>
<td>The region or state in the country.</td>
</tr>
<tr>
<td>locality</td>
<td>String</td>
<td>Optional</td>
<td>The locality or city within the country.</td>
</tr>
<tr>
<td>postOfficeBoxNumber</td>
<td>String</td>
<td>Optional</td>
<td>The post office box number.</td>
</tr>
<tr>
<td>postalCode</td>
<td>String</td>
<td>Optional</td>
<td>The postal code.</td>
</tr>
<tr>
<td>streetAddress</td>
<td>String</td>
<td>Optional</td>
<td>The street address.</td>
</tr>
</tbody>
</table>

16.4.1.4.41  BOM Reference

**Location:** /declarations/evidence/[l]/data/[l]/governance/stewards/[l]/organization/address/bom-ref

**Property:** bom-ref (Optional)
Type: String

Description: An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

16.4.1.4.42 Country

Location: /declarations/evidence/[/data[/]/governance/stewards[/]/organization/address/country
Property: country (Optional)

Type: String

Description: The country name or the two-letter ISO 3166-1 country code.

16.4.1.4.43 Region

Location: /declarations/evidence/[/data[/]/governance/stewards[/]/organization/address/region
Property: region (Optional)

Type: String

Description: The region or state in the country.

Examples:
- Texas

16.4.1.4.44 Locality

Location: /declarations/evidence/[/data[/]/governance/stewards[/]/organization/address/locality
Property: locality (Optional)

Type: String

Description: The locality or city within the country.

Examples:
- Austin

16.4.1.4.45 Post Office Box Number

Location: /declarations/evidence/[/data[/]/governance/stewards[/]/organization/address/postOfficeBoxNumber
Property: postOfficeBoxNumber (Optional)

Type: String

Description: The post office box number.

Examples:
- 901

16.4.1.4.46 Postal Code

Location: /declarations/evidence/[/data[/]/governance/stewards[/]/organization/address/postalCode
Property: postalCode (Optional)

Type: String

Description: The postal code.

Examples:
- 78758
16.4.1.4.47 Street Address

Location: /declarations/evidence[/]/data[/]/governance/stewards[/]/organization/address/streetAddress
Property: streetAddress (Optional)
Type: String
Description: The street address.
Examples:
• 100 Main Street

16.4.1.4.48 Organization URL(s)

Location: /declarations/evidence[/]/data[/]/governance/stewards[/]/organization/url
Property: url (Optional)
Type: array (of String)
Description: The URL of the organization. Multiple URLs are allowed. Each item of this array must be a string.
Examples:
• https://example.com

16.4.1.4.49 Organizational Contact

Location: /declarations/evidence[/]/data[/]/governance/stewards[/]/organization/contact
Property: contact (Optional)
Type: Array
Description: A contact at the organization. Multiple contacts are allowed. Each item of this array must be an Organizational Contact object.

16.4.1.4.50 Organizational Contact

Location: /declarations/evidence[/]/data[/]/governance/stewards[/]/organization/contact[/]

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro &quot;urn:cdx: &quot; to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

16.4.1.4.51 BOM Reference

Location: /declarations/evidence[/]/data[/]/governance/stewards[/]/organization/contact[/]/bom-ref
Property: bom-ref (Optional)
Type: String
Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

16.4.1.4.52 Name

Location: /declarations/evidence/[[]]/data/[[]]/governance/stewards/[[]]/organization/contact/[[]]/name

Property: name (Optional)

Type: String

Description: The name of a contact

Examples:
- Contact name

16.4.1.4.53 Email Address

Location: /declarations/evidence/[[]]/data/[[]]/governance/stewards/[[]]/organization/contact/[[]]/email

Property: email (Optional)

Type: String

Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

Description: The email address of the contact.

Examples:
- firstname.lastname@example.com

16.4.1.4.54 Phone

Location: /declarations/evidence/[[]]/data/[[]]/governance/stewards/[[]]/organization/contact/[[]]/phone

Property: phone (Optional)

Type: String

Description: The phone number of the contact.

Examples:
- 800-555-1212

16.4.1.4.55 Organizational Contact

Location: /declarations/evidence/[[]]/data/[[]]/governance/stewards/[[]]/contact

Property: contact (Optional)

Type: Object

Description: The individual that is responsible for specific data governance role(s).
Table 408 – Properties for the contact object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

16.4.1.4.56 BOM Reference

**Location:** /declarations/evidence[/]/data[/]/governance/stewards[/]/contact/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

16.4.1.4.57 Name

**Location:** /declarations/evidence[/]/data[/]/governance/stewards[/]/contact/name

**Property:** name (Optional)

**Type:** String

**Description:** The name of a contact

**Examples:**
- Contact name

16.4.1.4.58 Email Address

**Location:** /declarations/evidence[/]/data[/]/governance/stewards[/]/contact/email

**Property:** email (Optional)

**Type:** String

**Format:** idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

**Description:** The email address of the contact.

**Examples:**
- firstname.lastname@example.com

16.4.1.4.59 Phone

**Location:** /declarations/evidence[/]/data[/]/governance/stewards[/]/contact/phone

**Property:** phone (Optional)

**Type:** String

**Description:** The phone number of the contact.

**Examples:**
- 800-555-1212
### 16.4.1.4.60 Data Owners

**Location:** /declarations/evidence/[/]/data/[/]/governance/owners

**Property:** owners (Optional)

**Type:** Array

**Description:** Data owners are concerned with risk and appropriate access to data.

**Location:** /declarations/evidence/[/]/data/[/]/governance/owners[/]

**Type:** Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>organization</td>
<td>Object</td>
<td>Optional</td>
<td>The organization that is responsible for specific data governance role(s).</td>
</tr>
<tr>
<td>contact</td>
<td>Object</td>
<td>Optional</td>
<td>The individual that is responsible for specific data governance role(s).</td>
</tr>
</tbody>
</table>

### 16.4.1.4.61 Organization

**Location:** /declarations/evidence/[/]/data/[/]/governance/owners[/]/organization

**Property:** organization (Optional)

**Type:** Object

**Description:** The organization that is responsible for specific data governance role(s).

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the organization</td>
</tr>
<tr>
<td>address</td>
<td>Object</td>
<td>Optional</td>
<td>The physical address (location) of the organization</td>
</tr>
<tr>
<td>url</td>
<td>Array</td>
<td>Optional</td>
<td>The URL of the organization. Multiple URLs are allowed.</td>
</tr>
<tr>
<td>contact</td>
<td>Array</td>
<td>Optional</td>
<td>A contact at the organization. Multiple contacts are allowed.</td>
</tr>
</tbody>
</table>

### 16.4.1.4.62 BOM Reference

**Location:** /declarations/evidence/[/]/data/[/]/governance/owners[/]/organization/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

### 16.4.1.4.63 Organization Name

**Location:** /declarations/evidence/[/]/data/[/]/governance/owners[/]/organization/name
Property: name (Optional)

Type: String

Description: The name of the organization

Examples:
- Example Inc.

16.4.1.4.64 Organization Address

Location: /declarations/evidence/[]/data/[]/governance/owners/[]/organization/address

Property: address (Optional)

Type: Object

Description: The physical address (location) of the organization

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>Optional</td>
<td>The country name or the two-letter ISO 3166-1 country code.</td>
</tr>
<tr>
<td>region</td>
<td>String</td>
<td>Optional</td>
<td>The region or state in the country.</td>
</tr>
<tr>
<td>locality</td>
<td>String</td>
<td>Optional</td>
<td>The locality or city within the country.</td>
</tr>
<tr>
<td>postOfficeBoxNumber</td>
<td>String</td>
<td>Optional</td>
<td>The post office box number.</td>
</tr>
<tr>
<td>postalCode</td>
<td>String</td>
<td>Optional</td>
<td>The postal code.</td>
</tr>
<tr>
<td>streetAddress</td>
<td>String</td>
<td>Optional</td>
<td>The street address.</td>
</tr>
</tbody>
</table>

16.4.1.4.65 BOM Reference

Location: /declarations/evidence/[]/data/[]/governance/owners/[]/organization/address/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

16.4.1.4.66 Country

Location: /declarations/evidence/[]/data/[]/governance/owners/[]/organization/address/country

Property: country (Optional)

Type: String

Description: The country name or the two-letter ISO 3166-1 country code.
16.4.1.4.67 Region

**Location:** /declarations/evidence/[]/data/[]/governance/owners/[]/organization/address/region

**Property:** region (Optional)

**Type:** String

**Description:** The region or state in the country.

**Examples:**
- Texas

16.4.1.4.68 Locality

**Location:** /declarations/evidence/[]/data/[]/governance/owners/[]/organization/address/locality

**Property:** locality (Optional)

**Type:** String

**Description:** The locality or city within the country.

**Examples:**
- Austin

16.4.1.4.69 Post Office Box Number

**Location:** /declarations/evidence/[]/data/[]/governance/owners/[]/organization/address/postOfficeBoxNumber

**Property:** postOfficeBoxNumber (Optional)

**Type:** String

**Description:** The post office box number.

**Examples:**
- 901

16.4.1.4.70 Postal Code

**Location:** /declarations/evidence/[]/data/[]/governance/owners/[]/organization/address/postalCode

**Property:** postalCode (Optional)

**Type:** String

**Description:** The postal code.

**Examples:**
- 78758

16.4.1.4.71 Street Address

**Location:** /declarations/evidence/[]/data/[]/governance/owners/[]/organization/address/streetAddress

**Property:** streetAddress (Optional)

**Type:** String

**Description:** The street address.

**Examples:**
- 100 Main Street

16.4.1.4.72 Organization URL(s)

**Location:** /declarations/evidence/[]/data/[]/governance/owners/[]/organization/url

**Property:** url (Optional)
Type: array (of String)


Description: The URL of the organization. Multiple URLs are allowed. Each item of this array must be a string.

Examples:
- https://example.com

16.4.1.4.73 Organizational Contact

Location: /declarations/evidence/[]/data/[]/governance/owners/[]/organization/contact

Property: contact (Optional)

Type: Array

Description: A contact at the organization. Multiple contacts are allowed. Each item of this array must be an Organizational Contact object.

16.4.1.4.74 Organizational Contact

Location: /declarations/evidence/[]/data/[]/governance/owners/[]/organization/contact/[]

Type: Object

Table 412 – Properties for the contact object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

16.4.1.4.75 BOM Reference

Location: /declarations/evidence/[]/data/[]/governance/owners/[]/organization/contact/[]/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

16.4.1.4.76 Name

Location: /declarations/evidence/[]/data/[]/governance/owners/[]/organization/contact/[]/name

Property: name (Optional)

Type: String

Description: The name of a contact

Examples:
- Contact name
16.4.1.4.77 Email Address

Location: /declarations/evidence/[/data/[/governance/owners/[/organization/contact/[/email

Property: email (Optional)

Type: String

Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

Description: The email address of the contact.

Examples:
- firstname.lastname@example.com

16.4.1.4.78 Phone

Location: /declarations/evidence/[/data/[/governance/owners/[/organization/contact/[/phone

Property: phone (Optional)

Type: String

Description: The phone number of the contact.

Examples:
- 800-555-1212

16.4.1.4.79 Organizational Contact

Location: /declarations/evidence/[/data/[/governance/owners/[/contact

Property: contact (Optional)

Type: Object

Description: The individual that is responsible for specific data governance role(s).

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

16.4.1.4.80 BOM Reference

Location: /declarations/evidence/[/data/[/governance/owners/[/contact/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.
16.4.1.4.81 Name
Location: /declarations/evidence/[/data/[/governance/owners/[/[/contact/name
Property: name (Optional)
Type: String
Description: The name of a contact
Examples:
• Contact name

16.4.1.4.82 Email Address
Location: /declarations/evidence/[/data/[/governance/owners/[/[/contact/email
Property: email (Optional)
Type: String
Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)
Description: The email address of the contact.
Examples:
• firstname.lastname@example.com

16.4.1.4.83 Phone
Location: /declarations/evidence/[/data/[/governance/owners/[/[/contact/phone
Property: phone (Optional)
Type: String
Description: The phone number of the contact.
Examples:
• 800-555-1212

16.4.1.5 Created
Location: /declarations/evidence/[/created
Property: created (Optional)
Type: String
Format: data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)
Description: The date and time (timestamp) when the evidence was created.

16.4.1.6 Expires
Location: /declarations/evidence/[/expires
Property: expires (Optional)
Type: String
Format: data-time as specified in [RFC 3339 section 5.6](https://www.ietf.org/rfc/rfc3339.html#section-5.6)
Description: The optional date and time (timestamp) when the evidence is no longer valid.

16.4.1.7 Organizational Contact
Location: /declarations/evidence/[/author
Property: author (Optional)
Type: Object
**Description:** The author of the evidence.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

### 16.4.1.7.1 BOM Reference

**Location:** /declarations/evidence/[}/author/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

### 16.4.1.7.2 Name

**Location:** /declarations/evidence/[}/author/name

**Property:** name (Optional)

**Type:** String

**Description:** The name of a contact

**Examples:**
- Contact name

### 16.4.1.7.3 Email Address

**Location:** /declarations/evidence/[}/author/email

**Property:** email (Optional)

**Type:** String

**Format:** idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

**Description:** The email address of the contact.

**Examples:**
- firstname.lastname@example.com

### 16.4.1.7.4 Phone

**Location:** /declarations/evidence/[}/author/phone

**Property:** phone (Optional)

**Type:** String

**Description:** The phone number of the contact.
Examples:
  • 800-555-1212

16.4.1.8 Organizational Contact

Location: /declarations/evidence/[]/reviewer

Property: reviewer (Optional)

Type: Object

Description: The reviewer of the evidence.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

16.4.1.8.1 BOM Reference

Location: /declarations/evidence/[]/reviewer/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

16.4.1.8.2 Name

Location: /declarations/evidence/[]/reviewer/name

Property: name (Optional)

Type: String

Description: The name of a contact

Examples:
  • Contact name

16.4.1.8.3 Email Address

Location: /declarations/evidence/[]/reviewer/email

Property: email (Optional)

Type: String

Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

Description: The email address of the contact.

Examples:
  • firstname.lastname@example.com
16.4.1.8.4  Phone
Location: /declarations/evidence/[]/reviewer/phone
Property: phone (Optional)
Type: String
Description: The phone number of the contact.
Examples:
- 800-555-1212

16.4.1.9  Signature
Location: /declarations/evidence/[]/signature
Property: signature (Optional)
Type: Object
Description: An enveloped digital signature embedded within and specific to this object within the BOM. CycloneDX signatures enable integrity and authenticity verification without separating the signature from the BOM. Enveloped signatures enable each party in the supply chain to take responsibility for and sign their specific data, ensuring its integrity and authenticity. By aggregating all signatures, stakeholders can independently verify discrete pieces of information from each provider, enhancing overall transparency and trust in the supply chain.
Reference: Refer to the JSON Signature Format specification or to the XML Signature specification for implementation details.
- https://www.w3.org/TR/xmldsig-core/

16.5  Targets
Location: /declarations/targets
Property: targets (Optional)
Type: Object
Description: The list of targets which claims are made against.

Table 416 – Properties for the targets object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>organizations</td>
<td>Array</td>
<td>Optional</td>
<td>The list of organizations which claims are made against.</td>
</tr>
<tr>
<td>components</td>
<td>Array</td>
<td>Optional</td>
<td>The list of components which claims are made against.</td>
</tr>
<tr>
<td>services</td>
<td>Array</td>
<td>Optional</td>
<td>The list of services which claims are made against.</td>
</tr>
</tbody>
</table>

16.5.1  Organizations
Location: /declarations/targets/organizations
Property: organizations (Optional)
Type: Array
Description: The list of organizations which claims are made against. Each item of this array must be an Organizational Entity object.

16.5.1.1  Organizational Entity
Location: /declarations/targets/organizations/[]
16.5.1.1 BOM Reference

Location: /declarations/targets/organizations/[]/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

16.5.1.2 Organization Name

Location: /declarations/targets/organizations/[]/name

Property: name (Optional)

Type: String

Description: The name of the organization

Examples:
  - Example Inc.

16.5.1.3 Organization Address

Location: /declarations/targets/organizations/[]/address

Property: address (Optional)

Type: Object

Description: The physical address (location) of the organization
Table 418 – Properties for the address object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>Optional</td>
<td>The country name or the two-letter ISO 3166-1 country code.</td>
</tr>
<tr>
<td>region</td>
<td>String</td>
<td>Optional</td>
<td>The region or state in the country.</td>
</tr>
<tr>
<td>locality</td>
<td>String</td>
<td>Optional</td>
<td>The locality or city within the country.</td>
</tr>
<tr>
<td>postOfficeBoxNumber</td>
<td>String</td>
<td>Optional</td>
<td>The post office box number.</td>
</tr>
<tr>
<td>postalCode</td>
<td>String</td>
<td>Optional</td>
<td>The postal code.</td>
</tr>
<tr>
<td>streetAddress</td>
<td>String</td>
<td>Optional</td>
<td>The street address.</td>
</tr>
</tbody>
</table>

16.5.1.1.4 BOM Reference

**Location:** /declarations/targets/organizations/*[/]*/address/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

16.5.1.1.5 Country

**Location:** /declarations/targets/organizations/*[/]*/address/country

**Property:** country (Optional)

**Type:** String

**Description:** The country name or the two-letter ISO 3166-1 country code.

16.5.1.1.6 Region

**Location:** /declarations/targets/organizations/*[/]*/address/region

**Property:** region (Optional)

**Type:** String

**Description:** The region or state in the country.

**Examples:**
- Texas

16.5.1.1.7 Locality

**Location:** /declarations/targets/organizations/*[/]*/address/locality

**Property:** locality (Optional)

**Type:** String

**Description:** The locality or city within the country.
Examples:
  • Austin

16.5.1.1.8 Post Office Box Number

Location: /declarations/targets/organizations/*/address/postOfficeBoxNumber

Property: postOfficeBoxNumber (Optional)

Type: String

Description: The post office box number.

Examples:
  • 901

16.5.1.1.9 Postal Code

Location: /declarations/targets/organizations/*/address/postalCode

Property: postalCode (Optional)

Type: String

Description: The postal code.

Examples:
  • 78758

16.5.1.1.10 Street Address

Location: /declarations/targets/organizations/*/address/streetAddress

Property: streetAddress (Optional)

Type: String

Description: The street address.

Examples:
  • 100 Main Street

16.5.1.1.11 Organization URL(s)

Location: /declarations/targets/organizations/*/url

Property: url (Optional)

Type: array (of String)


Description: The URL of the organization. Multiple URLs are allowed. Each item of this array must be a string.

Examples:
  • https://example.com

16.5.1.1.12 Organizational Contact

Location: /declarations/targets/organizations/*/contact

Property: contact (Optional)

Type: Array

Description: A contact at the organization. Multiple contacts are allowed. Each item of this array must be an Organizational Contact object.

16.5.1.1.13 Organizational Contact

Location: /declarations/targets/organizations/*/contact/*
Type: Object

Table 419 – Properties for the contact object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

16.5.1.1.14 BOM Reference

Location: /declarations/targets/organizations/[]/contact/[]/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

16.5.1.1.15 Name

Location: /declarations/targets/organizations/[]/contact/[]/name

Property: name (Optional)

Type: String

Description: The name of a contact

Examples:
  - Contact name

16.5.1.1.16 Email Address

Location: /declarations/targets/organizations/[]/contact/[]/email

Property: email (Optional)

Type: String

Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

Description: The email address of the contact.

Examples:
  - firstname.lastname@example.com

16.5.1.1.17 Phone

Location: /declarations/targets/organizations/[]/contact/[]/phone

Property: phone (Optional)

Type: String

Description: The phone number of the contact.
16.5.2 Components

**Location:** /declarations/targets/components

**Property:** components (Optional)

**Type:** Array

**Description:** The list of components which claims are made against. Each item of this array must be a Component object.

16.5.2.1 Component

**Location:** /declarations/targets/components/[]

**Type:** Object

**Reference:** Refer to the component definition at /components/[]

16.5.3 Services

**Location:** /declarations/targets/services

**Property:** services (Optional)

**Type:** Array

**Description:** The list of services which claims are made against. Each item of this array must be a Service object.

16.5.3.1 Service

**Location:** /declarations/targets/services/[]

**Type:** Object

**Reference:** Refer to the service definition at /services/[]

16.6 Affirmation

**Location:** /declarations/affirmation

**Property:** affirmation (Optional)

**Type:** Object

**Description:** A concise statement affirmed by an individual regarding all declarations, often used for third-party auditor acceptance or recipient acknowledgment. It includes a list of authorized signatories who assert the validity of the document on behalf of the organization.

### Table 420 – Properties for the affirmation object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>statement</td>
<td>String</td>
<td>Optional</td>
<td>The brief statement affirmed by an individual regarding all declarations. *- Notes: This could be an affirmation of acceptance by a third-party auditor or receiving individual of a file.</td>
</tr>
<tr>
<td>signatories</td>
<td>Array</td>
<td>Optional</td>
<td>The list of signatories authorized on behalf of an organization to assert validity of this document.</td>
</tr>
<tr>
<td>signature</td>
<td>Array</td>
<td>Optional</td>
<td>Enveloped signature in [JSON Signature Format (JSF)].</td>
</tr>
</tbody>
</table>

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16.6.1 Statement

**Location:** /declarations/affirmation/statement  
**Property:** statement (Optional)

**Type:** String  
**Description:** The brief statement affirmed by an individual regarding all declarations. *- Notes This could be an affirmation of acceptance by a third-party auditor or receiving individual of a file.

**Examples:**
- I certify, to the best of my knowledge, that all information is correct.

16.6.2 Signatories

**Location:** /declarations/affirmation/signatories  
**Property:** signatories (Optional)

**Type:** Array  
**Description:** The list of signatories authorized on behalf of an organization to assert validity of this document. Each item of this array must be a Signatory object.

16.6.2.1 Signatory

**Location:** /declarations/affirmation/signatories[/]

**Type:** Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The signatory's name.</td>
</tr>
<tr>
<td>role</td>
<td>String</td>
<td>Optional</td>
<td>The signatory's role within an organization.</td>
</tr>
<tr>
<td>signature</td>
<td>Array</td>
<td>Optional</td>
<td>Enveloped signature in [JSON Signature Format (JSF)]</td>
</tr>
<tr>
<td>organization</td>
<td>Object</td>
<td>Optional</td>
<td>The signatory's organization.</td>
</tr>
<tr>
<td>externalReference</td>
<td>Object</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

16.6.2.1.1 Name

**Location:** /declarations/affirmation/signatories[/]/name  
**Property:** name (Optional)

**Type:** String  
**Description:** The signatory's name.

16.6.2.1.2 Role

**Location:** /declarations/affirmation/signatories[/]/role  
**Property:** role (Optional)

**Type:** String
Description: The signatory's role within an organization.

16.6.2.1.3 Signature

Location: /declarations/affirmation/signatories/[]/signature

Property: signature (Optional)

Type: Object

Description: An enveloped digital signature embedded within and specific to this object within the BOM. CycloneDX signatures enable integrity and authenticity verification without separating the signature from the BOM. Enveloped signatures enable each party in the supply chain to take responsibility for and sign their specific data, ensuring its integrity and authenticity. By aggregating all signatures, stakeholders can independently verify discrete pieces of information from each provider, enhancing overall transparency and trust in the supply chain.

Reference: Refer to the JSON Signature Format specification or to the XML Signature specification for implementation details.

- https://www.w3.org/TR/xmldsig-core/

16.6.2.1.4 Organizational Entity

Location: /declarations/affirmation/signatories/[]/organization

Property: organization (Optional)

Type: Object

Description: The signatory's organization.

Table 422 – Properties for the organization object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the organization</td>
</tr>
<tr>
<td>address</td>
<td>Object</td>
<td>Optional</td>
<td>The physical address (location) of the organization</td>
</tr>
<tr>
<td>url</td>
<td>Array</td>
<td>Optional</td>
<td>The URL of the organization. Multiple URLs are allowed.</td>
</tr>
<tr>
<td>contact</td>
<td>Array</td>
<td>Optional</td>
<td>A contact at the organization. Multiple contacts are allowed.</td>
</tr>
</tbody>
</table>

16.6.2.1.5 BOM Reference

Location: /declarations/affirmation/signatories/[]/organization/bom-ref

Property: bom-ref (Optional)

Type: String

Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro ‘urn:cdx:’ to avoid conflicts with BOM-Links.

16.6.2.1.6 Organization Name

Location: /declarations/affirmation/signatories/[]/organization/name

Property: name (Optional)
**Type:** String

**Description:** The name of the organization

**Examples:**
- Example Inc.

16.6.2.1.7 **Organization Address**

**Location:** /declarations/affirmation/signatories/[]/organization/address

**Property:** address (Optional)

**Type:** Object

**Description:** The physical address (location) of the organization

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>country</td>
<td>String</td>
<td>Optional</td>
<td>The country name or the two-letter ISO 3166-1 country code.</td>
</tr>
<tr>
<td>region</td>
<td>String</td>
<td>Optional</td>
<td>The region or state in the country.</td>
</tr>
<tr>
<td>locality</td>
<td>String</td>
<td>Optional</td>
<td>The locality or city within the country.</td>
</tr>
<tr>
<td>postOfficeBoxNumber</td>
<td>String</td>
<td>Optional</td>
<td>The post office box number.</td>
</tr>
<tr>
<td>postalCode</td>
<td>String</td>
<td>Optional</td>
<td>The postal code.</td>
</tr>
<tr>
<td>streetAddress</td>
<td>String</td>
<td>Optional</td>
<td>The street address.</td>
</tr>
</tbody>
</table>

16.6.2.1.8 **BOM Reference**

**Location:** /declarations/affirmation/signatories/[]/organization/address/bom-ref

**Property:** bom-ref (Optional)

**Type:** String

**Description:** An optional identifier which can be used to reference the address elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

16.6.2.1.9 **Country**

**Location:** /declarations/affirmation/signatories/[]/organization/address/country

**Property:** country (Optional)

**Type:** String

**Description:** The country name or the two-letter ISO 3166-1 country code.

16.6.2.1.10 **Region**

**Location:** /declarations/affirmation/signatories/[]/organization/address/region

**Property:** region (Optional)
Type: String
Description: The region or state in the country.
Examples:
- Texas

16.6.2.1.11 Locality
Location: /declarations/affirmation/signatories/[]/organization/address/locality
Property: locality (Optional)
Type: String
Description: The locality or city within the country.
Examples:
- Austin

16.6.2.1.12 Post Office Box Number
Location: /declarations/affirmation/signatories/[]/organization/address/postOfficeBoxNumber
Property: postOfficeBoxNumber (Optional)
Type: String
Description: The post office box number.
Examples:
- 901

16.6.2.1.13 Postal Code
Location: /declarations/affirmation/signatories/[]/organization/address/postalCode
Property: postalCode (Optional)
Type: String
Description: The postal code.
Examples:
- 78758

16.6.2.1.14 Street Address
Location: /declarations/affirmation/signatories/[]/organization/address/streetAddress
Property: streetAddress (Optional)
Type: String
Description: The street address.
Examples:
- 100 Main Street

16.6.2.1.15 Organization URL(s)
Location: /declarations/affirmation/signatories/[]/organization/url
Property: url (Optional)
Type: array (of String)
Description: The URL of the organization. Multiple URLs are allowed. Each item of this array must be a string.
Examples:
- https://example.com

16.6.2.1.16 Organizational Contact

Location: /declarations/affirmation/signatories/[]/organization/contact
Property: contact (Optional)

Type: Array
Description: A contact at the organization. Multiple contacts are allowed. Each item of this array must be an Organizational Contact object.

16.6.2.1.17 Organizational Contact

Location: /declarations/affirmation/signatories/[]/organization/contact/[]
Type: Object

Table 424 – Properties for the contact object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of a contact</td>
</tr>
<tr>
<td>email</td>
<td>String</td>
<td>Optional</td>
<td>The email address of the contact.</td>
</tr>
<tr>
<td>phone</td>
<td>String</td>
<td>Optional</td>
<td>The phone number of the contact.</td>
</tr>
</tbody>
</table>

16.6.2.1.18 BOM Reference

Location: /declarations/affirmation/signatories/[]/organization/contact/[]/bom-ref
Property: bom-ref (Optional)

Type: String
Description: An optional identifier which can be used to reference the object elsewhere in the BOM. Every bom-ref must be unique within the BOM. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

16.6.2.1.19 Name

Location: /declarations/affirmation/signatories/[]/organization/contact/[]/name
Property: name (Optional)

Type: String
Description: The name of a contact

Examples:
- Contact name

16.6.2.1.20 Email Address

Location: /declarations/affirmation/signatories/[]/organization/contact/[]/email
Property: email (Optional)

Type: String
Format: idn-email address as specified in [RFC 6531](https://www.ietf.org/rfc/rfc6531.html)

Description: The email address of the contact.

Examples:
- firstname.lastname@example.com

16.6.2.1.21 Phone

Location: /declarations/affirmation/signatories/[]/organization/contact/[]/phone

Property: phone (Optional)

Type: String

Description: The phone number of the contact.

Examples:
- 800-555-1212

16.6.2.1.22 External Reference

Location: /declarations/affirmation/signatories/[]/externalReference

Property: externalReference (Optional)

Type: Object

Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

Reference: Refer to the external reference definition at /externalReferences/[]

16.6.3 Signature

Location: /declarations/affirmation/signature

Property: signature (Optional)

Type: Object

Description: An enveloped digital signature embedded within and specific to this object within the BOM. CycloneDX signatures enable integrity and authenticity verification without separating the signature from the BOM. Enveloped signatures enable each party in the supply chain to take responsibility for and sign their specific data, ensuring its integrity and authenticity. By aggregating all signatures, stakeholders can independently verify discrete pieces of information from each provider, enhancing overall transparency and trust in the supply chain.

Reference: Refer to the JSON Signature Format specification or to the XML Signature specification for implementation details.
- [https://www.w3.org/TR/xmldsig-core/](https://www.w3.org/TR/xmldsig-core/)

16.7 Signature

Location: /declarations/signature

Property: signature (Optional)

Type: Object

Description: An enveloped digital signature embedded within and specific to this object within the BOM. CycloneDX signatures enable integrity and authenticity verification without separating the signature from the BOM. Enveloped signatures enable each party in the supply chain to take responsibility for and sign their specific data, ensuring its integrity and authenticity. By aggregating all signatures, stakeholders can independently verify discrete pieces of information from each provider, enhancing overall transparency and trust in the supply chain.

Reference: Refer to the JSON Signature Format specification or to the XML Signature specification for implementation details.
17 Definitions

Location: /definitions

Property: definitions (Optional)

Type: Object

Description: A collection of reusable objects that are defined and may be used elsewhere in the BOM.

Table 425 – Properties for the definitions object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>standards</td>
<td>Array</td>
<td>Optional</td>
<td>The list of standards which may consist of regulations, industry or organizational-specific standards, maturity models, best practices, or any other requirements which can be evaluated against or attested to.</td>
</tr>
</tbody>
</table>

17.1 Standards

Location: /definitions/standards

Property: standards (Optional)

Type: Array

Description: The list of standards which may consist of regulations, industry or organizational-specific standards, maturity models, best practices, or any other requirements which can be evaluated against or attested to. Each item of this array must be a Standard object.

17.1.1 Standard

Location: /definitions/standards/[]

Type: Object

Description: A standard may consist of regulations, industry or organizational-specific standards, maturity models, best practices, or any other requirements which can be evaluated against or attested to.

Table 426 – Properties for the standards object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>name</td>
<td>String</td>
<td>Optional</td>
<td>The name of the standard. This will often be a shortened, single name of the standard.</td>
</tr>
<tr>
<td>version</td>
<td>String</td>
<td>Optional</td>
<td>The version of the standard.</td>
</tr>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>The description of the standard.</td>
</tr>
<tr>
<td>owner</td>
<td>String</td>
<td>Optional</td>
<td>The owner of the standard, often the entity responsible for its release.</td>
</tr>
<tr>
<td>requirements</td>
<td>Array</td>
<td>Optional</td>
<td>The list of requirements comprising the standard.</td>
</tr>
<tr>
<td>Property</td>
<td>Type</td>
<td>Requirement</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------</td>
<td>-------</td>
<td>-------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>levels</td>
<td>Array</td>
<td>Optional</td>
<td>The list of levels associated with the standard. Some standards have different levels of compliance.</td>
</tr>
<tr>
<td>externalReferences</td>
<td>Array</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
<tr>
<td>signature</td>
<td>Array</td>
<td>Optional</td>
<td>Enveloped signature in JSON Signature Format (JSF).</td>
</tr>
</tbody>
</table>

17.1.1.1  BOM Reference

Location: /definitions/standards/[]/bom-ref
Property: bom-ref (Optional)

Type: String
Description: Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

17.1.1.2  Name

Location: /definitions/standards/[]/name
Property: name (Optional)

Type: String
Description: The name of the standard. This will often be a shortened, single name of the standard.

17.1.1.3  Version

Location: /definitions/standards/[]/version
Property: version (Optional)

Type: String
Description: The version of the standard.

17.1.1.4  Description

Location: /definitions/standards/[]/description
Property: description (Optional)

Type: String
Description: The description of the standard.

17.1.1.5  Owner

Location: /definitions/standards/[]/owner
Property: owner (Optional)

Type: String
Description: The owner of the standard, often the entity responsible for its release.

17.1.1.6  Requirements

Location: /definitions/standards/[]/requirements
Property: requirements (Optional)
**Type:** Array

**Description:** The list of requirements comprising the standard. Each item of this array must be a Requirement object.

**17.1.1.6.1 Requirement**

**Location:** /definitions/standards/[]/requirements/[]

**Type:** Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>identifier</td>
<td>String</td>
<td>Optional</td>
<td>The unique identifier used in the standard to identify a specific requirement. This should match what is in the standard and should not be the requirements bom-ref.</td>
</tr>
<tr>
<td>title</td>
<td>String</td>
<td>Optional</td>
<td>The title of the requirement.</td>
</tr>
<tr>
<td>text</td>
<td>String</td>
<td>Optional</td>
<td>The textual content of the requirement.</td>
</tr>
<tr>
<td>descriptions</td>
<td>Array</td>
<td>Optional</td>
<td>The supplemental text that provides additional guidance or context to the requirement, but is not directly part of the requirement.</td>
</tr>
<tr>
<td>openCre</td>
<td>Array</td>
<td>Optional</td>
<td>The Common Requirements Enumeration (CRE) identifier(s). CRE is a structured and standardized framework for uniting security standards and guidelines. CRE links each section of a resource to a shared topic identifier (a Common Requirement). Through this shared topic link, all resources map to each other. Use of CRE promotes clear and unambiguous communication among stakeholders.</td>
</tr>
<tr>
<td>parent</td>
<td>String</td>
<td>Optional</td>
<td>Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.</td>
</tr>
<tr>
<td>properties</td>
<td>Array</td>
<td>Optional</td>
<td>Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.</td>
</tr>
<tr>
<td>externalReferences</td>
<td>Array</td>
<td>Optional</td>
<td>External references provide a way to document systems, sites, and information that may be relevant, but are not included with the BOM. They may also establish specific relationships within or external to the BOM.</td>
</tr>
</tbody>
</table>

**17.1.1.6.2 BOM Reference**

**Location:** /definitions/standards/[]/requirements/[]/bom-ref

**Property:** bom-ref (Optional)
Type: String
Description: Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

17.1.1.6.3 Identifier

Location: /definitions/standards/[]/requirements/[]/identifier
Property: identifier (Optional)

Type: String
Description: The unique identifier used in the standard to identify a specific requirement. This should match what is in the standard and should not be the requirements bom-ref.

17.1.1.6.4 Title

Location: /definitions/standards/[]/requirements/[]/title
Property: title (Optional)

Type: String
Description: The title of the requirement.

17.1.1.6.5 Text

Location: /definitions/standards/[]/requirements/[]/text
Property: text (Optional)

Type: String
Description: The textual content of the requirement.

17.1.1.6.6 Descriptions

Location: /definitions/standards/[]/requirements/[]/descriptions
Property: descriptions (Optional)

Type: array (of String)
Description: The supplemental text that provides additional guidance or context to the requirement, but is not directly part of the requirement. Each item of this array must be a string.

17.1.1.6.7 OWASP OpenCRE Identifier(s)

Location: /definitions/standards/[]/requirements/[]/openCre
Property: openCre (Optional)

Type: array (of String)
Pattern Constraint: ^CRE:[0-9]+-[0-9]+$
Description: The Common Requirements Enumeration (CRE) identifier(s). CRE is a structured and standardized framework for uniting security standards and guidelines. CRE links each section of a resource to a shared topic identifier (a Common Requirement). Through this shared topic link, all resources map to each other. Use of CRE promotes clear and unambiguous communication among stakeholders. Each item of this array must be a string.

Examples:
- CRE:764-507

17.1.1.6.8 Parent BOM Reference

Location: /definitions/standards/[]/requirements/[]/parent
Property: parent (Optional)

Type: String
Description: Descriptor for an element identified by the attribute 'bom-ref' in the same BOM document. In contrast to bomLinkElementType.

17.1.1.6.9 Properties

Location: /definitions/standards/[]/requirements/[]/properties

Property: properties (Optional)

Type: Array

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

17.1.1.6.10 Lightweight name-value pair

Location: /definitions/standards/[]/requirements/[]/properties/[]

Type: Object

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

17.1.1.6.11 Name

Location: /definitions/standards/[]/requirements/[]/properties/[]/name

Property: name (Required)

Type: String

Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

17.1.1.6.12 Value

Location: /definitions/standards/[]/requirements/[]/properties/[]/value

Property: value (Optional)

Type: String

Description: The value of the property.

17.1.1.6.13 External References

Location: /definitions/standards/[]/requirements/[]/externalReferences

Property: externalReferences (Optional)

Type: Array
Description: External references provide a way to document systems, sites, and information that may be relevant, but are not included with the BOM. They may also establish specific relationships within or external to the BOM. Each item of this array must be an External Reference object.

Reference: Refer to the external reference definition at /externalReferences/[]

17.1.1.6.14 External Reference

Location: /definitions/standards/[]/requirements/[]/externalReferences/[]

Type: Object

Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

17.1.1.7 Levels

Location: /definitions/standards/[]/levels

Property: levels (Optional)

Type: Array

Description: The list of levels associated with the standard. Some standards have different levels of compliance. Each item of this array must be a Level object.

17.1.1.7.1 Level

Location: /definitions/standards/[]/levels/[]

Type: Object

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bom-ref</td>
<td>String</td>
<td>Optional</td>
<td>Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.</td>
</tr>
<tr>
<td>identifier</td>
<td>String</td>
<td>Optional</td>
<td>The identifier used in the standard to identify a specific level.</td>
</tr>
<tr>
<td>title</td>
<td>String</td>
<td>Optional</td>
<td>The title of the level.</td>
</tr>
<tr>
<td>description</td>
<td>String</td>
<td>Optional</td>
<td>The description of the level.</td>
</tr>
<tr>
<td>requirements</td>
<td>Array</td>
<td>Optional</td>
<td>The list of requirement bom-refs that comprise the level.</td>
</tr>
</tbody>
</table>

17.1.1.7.2 BOM Reference

Location: /definitions/standards/[]/levels/[]/bom-ref

Property: bom-ref (Optional)

Type: String

Description: Identifier for referable and therefore interlinkable elements. Value SHOULD not start with the BOM-Link intro 'urn:cdx:' to avoid conflicts with BOM-Links.

17.1.1.7.3 Identifier

Location: /definitions/standards/[]/levels/[]/identifier

Property: identifier (Optional)

Type: String
Description: The identifier used in the standard to identify a specific level.

17.1.1.7.4 Title
Location: /definitions/standards/[]/levels/[]/title
Property: title (Optional)
Type: String
Description: The title of the level.

17.1.1.7.5 Description
Location: /definitions/standards/[]/levels/[]/description
Property: description (Optional)
Type: String
Description: The description of the level.

17.1.1.7.6 Requirements
Location: /definitions/standards/[]/levels/[]/requirements
Property: requirements (Optional)
Type: array (of String)
Description: The list of requirement bom-refs that comprise the level. Descriptor for an element identified by the attribute ‘bom-ref’ in the same BOM document. In contrast to bomLinkElementType. Each item of this array must be a string.

17.1.1.8 External References
Location: /definitions/standards/[]/externalReferences
Property: externalReferences (Optional)
Type: Array
Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM. Each item of this array must be an External Reference object.
Reference: Refer to the external reference definition at /externalReferences/[]

17.1.1.8.1 External Reference
Location: /definitions/standards/[]/externalReferences/[]
Type: Object
Description: External references provide a way to document systems, sites, and information that may be relevant but are not included with the BOM. They may also establish specific relationships within or external to the BOM.

17.1.1.9 Signature
Location: /definitions/standards/[]/signature
Property: signature (Optional)
Type: Object
Description: An enveloped digital signature embedded within and specific to this object within the BOM. CycloneDX signatures enable integrity and authenticity verification without separating the signature from the BOM. Enveloped signatures enable each party in the supply chain to take responsibility for and sign their specific data, ensuring its integrity and authenticity. By aggregating all signatures, stakeholders can independently verify discrete pieces of information from each provider, enhancing overall transparency and trust in the supply chain.
18 Properties

Location: /properties

Property: properties (Optional)

Type: Array

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional. Each item of this array must be a Lightweight name-value pair object.

18.1 Lightweight name-value pair

Location: /properties/[]

Type: Object

Description: Provides the ability to document properties in a name-value store. This provides flexibility to include data not officially supported in the standard without having to use additional namespaces or create extensions. Unlike key-value stores, properties support duplicate names, each potentially having different values. Property names of interest to the general public are encouraged to be registered in the CycloneDX Property Taxonomy. Formal registration is optional.

<table>
<thead>
<tr>
<th>Property</th>
<th>Type</th>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>name</td>
<td>String</td>
<td>Required</td>
<td>The name of the property. Duplicate names are allowed, each potentially having a different value.</td>
</tr>
<tr>
<td>value</td>
<td>String</td>
<td>Optional</td>
<td>The value of the property.</td>
</tr>
</tbody>
</table>

18.1.1 Name

Location: /properties/[]/name

Property: name (Required)

Type: String

Description: The name of the property. Duplicate names are allowed, each potentially having a different value.

18.1.2 Value

Location: /properties/[]/value

Property: value (Optional)

Type: String

Description: The value of the property.
19 Signature

Location: /signature
Property: signature (Optional)

Type: Object

Description: An enveloped digital signature embedded within and specific to this object within the BOM. CycloneDX signatures enable integrity and authenticity verification without separating the signature from the BOM. Enveloped signatures enable each party in the supply chain to take responsibility for and sign their specific data, ensuring its integrity and authenticity. By aggregating all signatures, stakeholders can independently verify discrete pieces of information from each provider, enhancing overall transparency and trust in the supply chain.

Reference: Refer to the JSON Signature Format specification or to the XML Signature specification for implementation details.

- https://www.w3.org/TR/xmldsig-core/