CybOXTM Version 2.1.1 Part 13: Artifact Object

Working Draft 01

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Additional artifacts:

This prose specification is one component of a Work Product which consists of:

* *CybOXTM Version 2.1.1 Part 1: Overview*. [URI]
* *CybOXTM Version 2.1.1 Part 2: Common*. [URI]
* *CybOXTM Version 2.1.1 Part 3: Core*. [URI]
* *CybOXTM Version 2.1.1 Part 4: Default Extensions*. [URI]
* *CybOXTM Version 2.1.1 Part 5: Vocabularies*. [URI]
* *CybOXTM Version 2.1.1 Part 6: UML Model*. [URI]
* *CybOXTM Version 2.1.1 Part 7: API Object*. [URI]
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* *CybOXTM Version 2.1.1 Part 9: AS Object*. [URI]
* *CybOXTM Version 2.1.1 Part 10: Account Object*. [URI]
* *CybOXTM Version 2.1.1 Part 11: Address Object*. [URI]
* *CybOXTM Version 2.1.1 Part 12: Archive File Object*. [URI]
* *CybOXTM Version 2.1.1 Part 13: Artifact Object*. (this document)
* *CybOXTM Version 2.1.1 Part 14: Code Object*. [URI]
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* *CybOXTM Version 2.1.1 Part 27: GUI Window Object*. [URI]
* *CybOXTM Version 2.1.1 Part 28: HTTP Session Object*. [URI]
* *CybOXTM Version 2.1.1 Part 29: Hostname Session Object*. [URI]
* *CybOXTM Version 2.1.1 Part 30: Image File Object*. [URI]
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* *CybOXTM Version 2.1.1 Part 34: Memory Object*. [URI]
* *CybOXTM Version 2.1.1 Part 35: Mutex Object*. [URI]
* *CybOXTM Version 2.1.1 Part 36: Network Connection Object*. [URI]
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* *CybOXTM Version 2.1.1 Part 39: Network Route Entry Object*. [URI]
* *CybOXTM Version 2.1.1 Part 40: Network Route Object*. [URI]
* *CybOXTM Version 2.1.1 Part 41: Network Socket Object*. [URI]
* *CybOXTM Version 2.1.1 Part 42: Network Subnet Object*. [URI]
* *CybOXTM Version 2.1.1 Part 43: PDF File Object*. [URI]
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* *CybOXTM Version 2.1.1 Part 46: Process Object*. [URI]
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* *CybOXTM Version 2.1.1 Part 49: Semaphore Object*. [URI]
* *CybOXTM Version 2.1.1 Part 50: Socket Address Object*. [URI]
* *CybOXTM Version 2.1.1 Part 51: System Object*. [URI]
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* *CybOXTM Version 2.1.1 Part 65: Win Critical Section Object*. [URI]
* *CybOXTM Version 2.1.1 Part 66: Win Driver Object*. [URI]
* *CybOXTM Version 2.1.1 Part 67: Win Event Log Object*. [URI]
* *CybOXTM Version 2.1.1 Part 68: Win Event Object*. [URI]
* *CybOXTM Version 2.1.1 Part 69: Win Executable File Object*. [URI]
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* *CybOXTM Version 2.1.1 Part 78: Win Mutex Object*. [URI]
* *CybOXTM Version 2.1.1 Part 79: Win Network Route Entry Object*. [URI]
* *CybOXTM Version 2.1.1 Part 80: Win Network Share Object*. [URI]
* *CybOXTM Version 2.1.1 Part 81: Win Pipe Object*. [URI]
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* *CybOXTM Version 2.1.1 Part 91: Win User Account Object*. [URI]
* *CybOXTM Version 2.1.1 Part 92: Win Volume Object*. [URI]
* *CybOXTM Version 2.1.1 Part 93: Win Waitable Timer Object*. [URI]
* *CybOXTM Version 2.1.1 Part 94: X509 Certificate Object*. [URI]

Related work:

This specification is related to:

* *STIXTM Version 1.2.1 (placeholder)*

Abstract:

The Cyber Observable Expression (CybOX) is a standardized language for encoding and communicating high-fidelity information about cyber observables, whether dynamic events or stateful measures that are observable in the operational cyber domain. By specifying a common structured schematic mechanism for these cyber observables, the intent is to enable the potential for detailed automatable sharing, mapping, detection and analysis heuristics. This specification document defines the Artifact Object data model, which is one of the Object data models for CybOX content.

Status:

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# Introduction

[All text is normative unless otherwise labeled]

The Cyber Observable Expression (CybOXTM) provides a common structure for representing cyber observables across and among the operational areas of enterprise cyber security. CybOX improves the consistency, efficiency, and interoperability of deployed tools and processes, and it increases overall situational awareness by enabling the potential for detailed automatable sharing, mapping, detection, and analysis heuristics.

This document serves as the specification for the CybOX Artifact Object Version 2.1.1 data model, which is one of eighty-eight CybOX Object data models.

In Section **1.1** we discuss additional specification documents, in Section **1.2** we provide document conventions in, and in Section **1.3** we provide terminology. References are given in Section **1.4**. In Section **2**, we give background information necessary to fully understand the Artifact Object data model. We present the Artifact Object data model specification details in Section **3**, and conformance information in Section **4**.

## CybOXTM Specification Documents

The CybOX specification consists of a formal UML model and a set of textual specification documents that explain the UML model. Specification documents have been written for each of the key individual data models that compose the full CybOX UML model.

CybOX has a modular design comprising two fundamental data models and a collection of Object data models. The fundamental data models – CybOX Core and CybOX Common – provide essential CybOX structure and functionality. The CybOX Objects, defined in individual data models, are precise characterizations of particular types of observable cyber entities (e.g., HTTP session, Windows registry key, DNS query).

Use of the CybOX Core and Common data models is required; however, use of the CybOX Object data models is purely optional: users select and use only those Objects and corresponding data models that are needed. Importing the entire CybOX suite of data models is not necessary.

The [*CybOX Version 2.1.1 Part 1: Overview*](#AdditionalArtifacts) document provides a comprehensive overview of the full set of CybOX data models, which in addition to the Core, Common, and numerous Object data models, includes various extension data models and a vocabularies data model, which contains a set of default controlled vocabularies. [*CybOX Version 2.1.1 Part 1: Overview*](#AdditionalArtifacts) also summarizes the relationship of CybOX to other languages, and outlines general CybOX data model conventions.

## Document Conventions

The following conventions are used in this document.

### Fonts

The following font and font style conventions are used in the document:

* Capitalization is used for CybOX high level concepts, which are defined in [*CybOX Version 2.1.1 Part 1: Overview*](#AdditionalArtifacts).

Examples: Action, Object, Event, Property

* The Courier New font is used for writing UML objects.

Examples: ActionType, cyboxCommon:BaseObjectPropertyType

Note that all high level concepts have a corresponding UML object. For example, the Action high level concept is associated with a UML class named, ActionType.

* The ‘*italic’* font (withsingle quotes) is used for noting actual, explicit values for CybOX Language properties. The *italic* font (without quotes) is used for noting example values.

Example:  *‘HashNameVocab-1.0,’ high, medium, low*

### UML Package References

Each CybOX data model is captured in a different UML package (e.g., Core package) where the packages together compose the full CybOX UML model. To refer to a particular class of a specific package, we use the format package\_prefix:class, where package\_prefix corresponds to the appropriate UML package. The [*CybOX Version 2.1.1 Part 1: Overview*](#AdditionalArtifacts) document contains the full list of CybOX packages, along with the associated prefix notations, descriptions, and examples.

Note that in this specification document, we do not explicitly specify the package prefix for any classes that originate from the Artifact Object data model.

### UML Diagrams

This specification makes use of UML diagrams to visually depict relationships between CybOX Language constructs. Note that the diagrams have been extracted directly from the full UML model for CybOX; they have not been constructed purely for inclusion in the specification documents.  Typically, diagrams are included for the primary class of a data model, and for any other class where the visualization of its relationships between other classes would be useful.  This implies that there will be very few diagrams for classes whose only properties are either a data type or a class from the CybOX Common data model.  Other diagrams that are included correspond to classes that specialize a superclass and abstract or generalized classes that are extended by one or more subclasses.

In UML diagrams, classes are often presented with their attributes elided, to avoid clutter. The fully described class can usually be found in a related diagram. A class presented with an empty section at the bottom of the icon indicates that there are no attributes other than those that are visualized using associations.

#### Class Properties

Generally, a class property can be shown in a UML diagram as either an attribute or an association (i.e., the distinction between attributes and associations is somewhat subjective). In order to make the size of UML diagrams in the specifications manageable, we have chosen to capture most properties as attributes and to capture only higher level properties as associations, especially in the main top-level component diagrams. In particular, we will always capture properties of UML data types as attributes. For example, properties of a class that are identifiers, titles, and timestamps will be represented as attributes.

#### Diagram Icons and Arrow Types

Diagram icons are used in a UML diagram to indicate whether a shape is a class, enumeration, or a data type, and decorative icons are used to indicate whether an element is an attribute of a class or an enumeration literal. In addition, two different arrow styles indicate either a directed association relationship (regular arrowhead) or a generalization relationship (triangle-shaped arrowhead). The icons and arrow styles we use are shown and described in **Table 1‑1**.

Table ‑. UML diagram icons

|  |  |
| --- | --- |
| **Icon** | **Description** |
|  | This diagram icon indicates a class. If the name is in italics, it is an abstract class. |
|  | This diagram icon indicates an enumeration. |
|  | This diagram icon indicates a data type. |
|  | This decorator icon indicates an attribute of a class. The green circle means its visibility is public. If the circle is red or yellow, it means its visibility is private or protected. |
|  | This decorator icon indicates an enumeration literal. |
|  | This arrow type indicates a directed association relationship. |
|  | This arrow type indicates a generalization relationship. |

### Property Table Notation

Throughout Section **3**, tables are used to describe the properties of each data model class. Each property table consists of a column of names to identify the property, a type column to reflect the datatype of the property, a multiplicity column to reflect the allowed number of occurrences of the property, and a description column that describes the property. Package prefixes are provided for classes outside of the Artifact Object data model (see Section **1.2.2**).

Note that if a class is a specialization of a superclass, only the properties that constitute the specialization are shown in the property table (i.e., properties of the superclass will not be shown). However, details of the superclass may be shown in the UML diagram.

### Property and Class Descriptions

Each class and property defined in CybOX is described using the format, “The X property verbY.” For example, in the specification for the CybOX Core data model, we write, “The id property specifies a globally unique identifier for the Action.” In fact, the verb “specifies” could have been replaced by any number of alternatives: “defines,” “describes,” “contains,” “references,” etc.

However, we thought that using a wide variety of verb phrases might confuse a reader of a specification document because the meaning of each verb could be interpreted slightly differently. On the other hand, we didn’t want to use a single, generic verb, such as “describes,” because although the different verb choices may or may not be meaningful from an implementation standpoint, a distinction could be useful to those interested in the modeling aspect of CybOX.

Consequently, we have chosen to use the three verbs, defined as follows, in class and property descriptions:

|  |  |
| --- | --- |
| **Verb** | **CybOX Definition** |
| captures | Used to record and preserve information without implying anything about the structure of a class or property. Often used for properties that encompass general content. This is the least precise of the three verbs. |
|  | *Examples*:  The Observable\_Source property characterizes the source of the Observable information. Examples of details captured include identifying characteristics, time-related attributes, and a list of the tools used to collect the information.  The Description property captures a textual description of the Action. |
| characterizes | Describes the distinctive nature or features of a class or property. Often used to describe classes and properties that themselves comprise one or more other properties. |
|  | *Examples*:  The Action property characterizes a cyber observable Action.  The Obfuscation\_Technique property characterizes a technique an attacker could potentially leverage to obfuscate the Observable. |
| specifies | Used to clearly and precisely identify particular instances or values associated with a property. Often used for properties that are defined by a controlled vocabulary or enumeration; typically used for properties that take on only a single value. |
|  | *Example*:  The cybox\_major\_version property specifies the major version of the CybOX language used for the set of Observables. |

## Terminology

The key words “MUST”, “MUST NOT”, “REQUIRED”, “SHALL”, “SHALL NOT”, “SHOULD”, “SHOULD NOT”, “RECOMMENDED”, “MAY”, and “OPTIONAL” in this document are to be interpreted as described in [**[RFC2119]**](#rfc2119).

## Normative References

[RFC2119] Bradner, S., “Key words for use in RFCs to Indicate Requirement Levels”, BCP 14, RFC 2119, March 1997. <http://www.ietf.org/rfc/rfc2119.txt>.

# Background Information

In this section, we provide high level information about the Artifact Object data model that is necessary to fully understand the specification details given in Section **3**.

## Cyber Observables

A cyber observable is a dynamic event or a stateful property that occurs, or may occur, in the operational cyber domain. Examples of stateful properties include the value of a registry key, the MD5 hash of a file, and an IP address. Examples of events include the deletion of a file, the receipt of an HTTP GET request, and the creation of a remote thread.

A cyber observable is different than a cyber indicator. A cyber observable is a statement of fact, capturing what was observed or could be observed in the cyber operational domain. Cyber indicators are cyber observable patterns, such as a registry key value associated with a known bad actor or a spoofed email address used on a particular date.

## Objects

Objects in CybOX are individual data models for characterizing a particular cyber entity, such as a Windows registry key, or an Email Message. Accordingly, each release of the CybOX language includes a particular set of Objects that are part of the release. The data model for each of these Objects is defined by its own specification that describes the context-specific classes and properties that compose the Object.

# Data Model

## ArtifactObjectType Class

The ArtifactObjectType class is intended to encapsulate and convey the content of a Raw Artifact. The UML diagram corresponding to the ArtifactObjectType class is shown in **Figure 3‑1**.

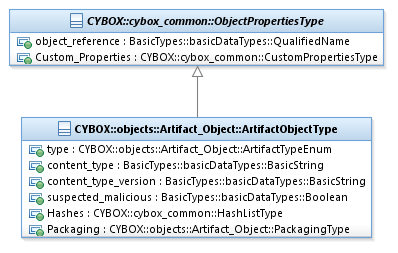


Figure ‑. UML diagram of the ArtifactObjectType class

The property table of the ArtifactObjectType class is given in **Table 3‑1**.

Table ‑. Properties of the ArtifactObjectType class

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Multiplicity** | **Description** |
| **type** | ArtifactObj:ArtifactTypeEnum | 0..1 | The type property specifies the general type of the artifact contained in this Defined Object. |
| **content\_type** | basicDataTypes:BasicString | 0..1 | The content\_type property specifies the Internet Media Type of the artifact contained in this Defined Object. |
| **content\_type\_version** | basicDataTypes:BasicString | 0..1 | The content\_type\_version property specifies the content type version of the artifact contained in this Defined Object. |
| **suspected\_malicious** | basicDataTypes:Boolean | 0..1 | The suspected\_malicious property conveys whether the content of the Raw\_Artifact is believed to be malicious. |
| **Hashes** | cyboxCommon:HashListType | 0..1 | The Hashes property specifies hashes for the Raw\_Artifact content. |
| **Packaging** | ArtifactObj:PackagingType | 0..1 | The Packaging property characterizes packaging layers (e.g. compression, encryption, encoding) applied to the original content to generate the content of the Raw\_Artifact field of this Object. The ordering of entries in this sequence implicitly denotes the ordering of packaging layer operations applied. |
| **Raw\_Artifact** | ArtifactObj:RawArtifactType | 0..1 | The Raw\_Artifact property contains the raw content of a cyber artifact (rather than simply analysis of that artifact). It is conveyed within a string-based field and should be further enclosed in a CDATA section within the string-based field. |
| **Raw\_Artifact\_Reference** | xs:anyURI | 0..1 | The Raw\_Artifact\_Reference property contains a reference to an external instance of the raw content of a cyber artifact (rather than simply analysis of that artifact). |

## RawArtifactType Class

The RawArtifactType class is intended to convey, with minimal characterization, the content of the Raw Artifact itself.

The property table of the RawArtifactType class is given in **Table 3‑2**.

Table ‑. Properties of the RawArtifactType class

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Multiplicity** | **Description** |
| **byte\_order** | cyboxCommon:EndiannessTypeEnum | 0..1 | The byte\_order property specifies the endianness of the unpacked (e.g., unencrypted, base64-decoded, decompressed, etc.) Raw Artifact data. |

## PackagingType Class

The PackagingType class captures any packaging layers applied to an artifact.

The property table of the PackagingType class is given in **Table 3‑3**.

Table ‑. Properties of the PackagingType class

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Multiplicity** | **Description** |
| **is\_encrypted** | basicDataTypes:Boolean | 0..1 | The is\_encrypted property specifies whether the Raw\_Artifact content is protected/encrypted. |
| **is\_compressed** | basicDataTypes:Boolean | 0..1 | The is\_compressed property specifies whether the Raw\_Artifact content is compressed. |
| **Compression** | ArtifactObj:CompressionType | 0..1 | The Compression property specifies details for a compression layer applied to the content of the Raw\_Artifact. |
| **Encryption** | ArtifactObj:EncryptionType | 0..1 | The Encryption property specifies details for an encryption layer applied to the content of the Raw\_Artifact. |
| **Encoding** | ArtifactObj:EncodingType | 0..1 | The Encoding property specifies details for an encoding layer applied to the content of the Raw\_Artifact. |

## CompressionType Class

The CompressionType class captures any compression packaging details for an artifact.

The property table of the CompressionType class is given in **Table 3‑4**.

Table ‑. Properties of the CompressionType class

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Multiplicity** | **Description** |
| **compression\_mechanism** | basicDataTypes:BasicString | 0..1 | The compression\_mechanism property specifies the compression algorithm utilized to protect the Raw\_Artifact content. |
| **compression\_mechanism\_ref** | basicDataTypes:URI | 0..1 | The compression\_mechanism\_ref property conveys a reference to a description of the compression algorithm utilized to protect the Raw\_Artifact content. |

## EncryptionType Class

The EncryptionType class captures any encryption packaging details for an artifact.

The property table of the EncryptionType class is given in **Table 3‑5**.

Table ‑. Properties of the EncryptionType class

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Multiplicity** | **Description** |
| **encryption\_mechanism** | basicDataTypes:BasicString | 0..1 | The encryption\_mechanism property specifies the protection/encryption algorithm utilized to protect the Raw\_Artifact content. |
| **encryption\_mechanism\_ref** | basicDataTypes:URI | 0..1 | The encryption\_mechanism\_ref property conveys a reference to a description of the protection/encryption algorithm utilized to protect the Raw\_Artifact content. |
| **encryption\_key** | basicDataTypes:BasicString | 0..1 | The encryption\_key property locally specifies the password for unprotecting/decrypting the Raw\_Artifact content. |
| **encryption\_key\_ref** | xs:anyURI | 0..1 | The encryption\_key\_ref property specifies a reference to a remote specification of the password for unlocking/decrypting the Raw\_Artifact content. |

## EncodingType Class

The EncodingType class captures any encoding packaging details for an artifact.

The property table of the EncodingType class is given in **Table 3‑6**.

Table ‑. Properties of the EncodingType class

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Type** | **Multiplicity** | **Description** |
| **algorithm** | basicDataTypes:BasicString | 0..1 | The algorithm property specifies the encoding algorithm utilized to encode the Raw\_Artifact. |
| **character\_set** | basicDataTypes:BasicString | 0..1 | The character\_set property specifies the character set utilized in the Raw\_Artifact content encoding. |
| **custom\_character\_set\_ref** | xs:anyURI | 0..1 | The custom\_character\_set\_ref property conveys a reference to a specification of the custom character set used to encode the Raw\_Artifact. |

## ArtifactTypeEnum Enumeration

The literals of the ArtifactTypeEnum enumeration are given in **Table 3‑7**.

Table ‑. Literals of the ArtifactTypeEnum enumeration

|  |  |
| --- | --- |
| **Enumeration Literal** | **Description** |
| **File** | The File value specifies that the artifact is a file. |
| **Memory Region** | The Memory Region value specifies that the artifact is a block of data from a region of memory. |
| **File System Fragment** | The File System Fragment value specifies that the artifact is a block of data from a file system. |
| **Network Traffic** | The Network Traffic value specifies that the artifact is a block of network traffic data such as PCAP. |
| **Generic Data Region** | The Generic Data Region value specifies that the artifact is a block of data from an unknown source. |

# Conformance

Implementations have discretion over which parts (components, properties, extensions, controlled vocabularies, etc.) of CybOX they implement (e.g., Observable/Object).

[1] Conformant implementations must conform to all normative structural specifications of the UML model or additional normative statements within this document that apply to the portions of CybOX they implement (e.g., implementers of the entire Observable class must conform to all normative structural specifications of the UML model regarding the Observable class or additional normative statements contained in the document that describes the Observable class).

[2] Conformant implementations are free to ignore normative structural specifications of the UML model or additional normative statements within this document that do not apply to the portions of CybOX they implement (e.g., non-implementers of any particular properties of the Observable class are free to ignore all normative structural specifications of the UML model regarding those properties of the Observable class or additional normative statements contained in the document that describes the Observable class).

The conformance section of this document is intentionally broad and attempts to reiterate what already exists in this document.

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|  |  |  |  |
| --- | --- | --- | --- |
| **Revision** | **Date** | **Editor** | **Changes Made** |
| wd01 | 16 November 2015 | Desiree Beck Trey Darley Ivan Kirillov Rich Piazza | Initial transfer to OASIS template |