

CybOX™ Version 2.1.1. Part 63: Whois Object

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Additional artifacts:

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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 Whois Object data model, which is one of the Object data models for CybOX content.

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1 Introduction

[All text is normative unless otherwise labeled]

The Cyber Observable Expression (CybOX™) 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 Whois 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, 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 Whois Object data model. We present the Whois Object data model specification details in Section 3 and conformance information in Section 4.

1.1 CybOX™ 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 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](#) 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](#) also summarizes the relationship of CybOX to other languages, and outlines general CybOX data model conventions.

1.2 Document Conventions

The following conventions are used in this document.

1.2.1 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](#).

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 (with single 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*

1.2.2 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 `package_prefix` for the Whois data model is `WhoisObj`. Note that in this specification document, we do not explicitly specify the package prefix for any classes that originate from the Whois Object data model.

1.2.3 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.

1.2.3.1 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.

1.2.3.2 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 1-1. 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.

1.2.4 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 Whois 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.

1.2.5 Property and Class Descriptions

Each class and property defined in CybOX is described using the format, “The X property verb Y.” 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 preferred to use the three verbs, defined as follows, in class and property descriptions:

Verb	CybOX Definition
<u>captures</u>	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.
	<p><i>Examples:</i></p> <p>The <code>Observable_Source</code> property characterizes the source of the Observable information. Examples of details <u>captured</u> include identifying characteristics, time-related attributes, and a list of the tools used to collect the information.</p> <p>The <code>Description</code> property <u>captures</u> a textual description of the Action.</p>
<u>characterizes</u>	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.
	<p><i>Examples:</i></p> <p>The <code>Action</code> property <u>characterizes</u> a cyber observable Action.</p> <p>The <code>Obfuscation_Technique</code> property <u>characterizes</u> a technique an attacker could potentially leverage to obfuscate the Observable.</p>
<u>specifies</u>	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.
	<p><i>Example:</i></p> <p>The <code>cybox_major_version</code> property <u>specifies</u> the major version of the CybOX language used for the set of Observables.</p>

1.3 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].

1.4 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>.

2 Background Information

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

2.1 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.

2.2 Objects

Cyber observable objects (Files, IP Addresses, etc) in CybOX are characterized with a combination of two levels of data models.

The first level is the Object data model which specifies a base set of properties universal to all types of Objects and enables them to integrate with the overall cyber observable framework specified in the CybOX Core data model.

The second level are the object property models which specify the properties of a particular type of Object via individual data models each focused on 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.

Any specific instance of an Object is represented utilizing the particular object properties data model within the general Object data model.

3 Data Model

3.1 WhoisObjectType Class

The `WhoisObjectType` class is intended to characterize Whois information for a domain. The UML diagram corresponding to the `WhoisObjectType` class is shown in [Figure 3-1](#).

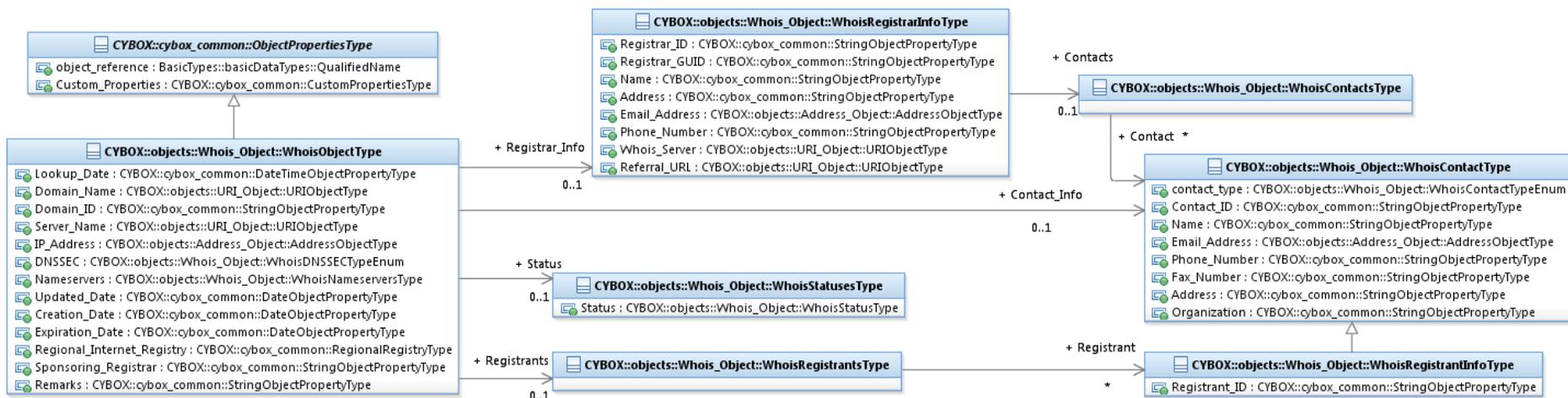


Figure 3-1. UML diagram of the `WhoisObjectType` class

The property table of the `WhoisObjectType` class is given in [Table 3-1](#).

Table 3-1. Properties of the `WhoisObjectType` class

Name	Type	Multiplicity	Description
Lookup_Date	cyboxCommon : DateTimeObjectPropertyType	0..1	The <code>Lookup_Date</code> property specifies the date and time that the Whois record was queried.

Domain_Name	URIObj:URIObjectType	0..1	The <code>Domain_Name</code> property specifies the corresponding domain name for this Whois entry.
Domain_ID	cyboxCommon: StringObjectPropertyType	0..1	The <code>Domain_ID</code> property specifies the domain id for the domain associated with this Whois entry.
Server_Name	URIObj:URIObjectType	0..1	The <code>Server_Name</code> property specifies the corresponding server name for this Whois entry. This usually corresponds to a nameserver lookup.
IP_Address	AddressObj: AddressObjectType	0..1	The <code>IP_Address</code> property specifies the corresponding ip address for this Whois entry. The usually corresponds to a nameserver lookup.
DNSSEC	WhoisDNSSECTypeEnum	0..1	The <code>DNSSEC</code> element corresponds to the DNSSEC property associated with a Whois entry. Acceptable values are: "Signed" or "Unsigned".
Nameservers	WhoisNameserversType	0..1	The <code>Nameservers</code> property represents a list of nameserver entries for a Whois entry.
Status	WhoisStatusesType	0..1	The <code>Status</code> property represents a list of statuses for a given Whois entry.
Updated_Date	cyboxCommon: DateObjectPropertyType	0..1	The <code>Updated_Date</code> property specifies the date in which the registered domain information was last updated.
Creation_Date	cyboxCommon: DateObjectPropertyType	0..1	The <code>Creation_Date</code> property specifies the date in which the registered domain was created.
Expiration_Date	cyboxCommon:	0..1	The <code>Expiration_Date</code> property specifies the date in which the registered domain will expire.

	DateObjectPropertyType		
Regional_Internet_Registry	cyboxCommon: RegionalRegistryType	0..1	The <code>Regional_Internet_Registry</code> property specifies the name of the Regional Internet Registry (RIR) which allocated the IP address contained in this Whois entry.
Sponsoring_Registrar	cyboxCommon: StringObjectPropertyType	0..1	The <code>Sponsoring_Registrar</code> property holds the name of the sponsoring registrar for the domain.
Registrar_Info	WhoisRegistrarInfoType	0..1	The <code>Registrar_Info</code> property represents registrar info that would be returned from a registrar lookup.
Registrants	WhoisRegistrantsType	0..1	The <code>Registrants</code> property represents the registrant information associated with a domain lookup.
Contact_Info	WhoisContactType	0..1	The <code>Contact_Info</code> property represents contact info that would be returned from a contact lookup.
Remarks	cyboxCommon: StringObjectPropertyType	0..1	The <code>Remarks</code> property specifies any remarks associated with this Whois entry.

3.2 WhoisRegistrarInfoType Class

The property table of the `WhoisRegistrarInfoType` class is given in [Table 3-2](#).

Table 3-2. Properties of the `WhoisRegistrarInfoType` class

Name	Type	Multiplicity	Description
Registrar_ID	cyboxCommon: StringObjectPropertyType	0..1	The <code>Registrar_ID</code> corresponds to the Registrar ID property of a Whois entry.

Registrar_GUID	cyboxCommon: StringObjectPropertyType	0..1	The <code>Registrar_GUID</code> corresponds to the Registrar GUID property of a Whois entry.
Name	cyboxCommon: StringObjectPropertyType	0..1	The <code>Name</code> property holds the name of the registrar organization.
Address	cyboxCommon: StringObjectPropertyType	0..1	The <code>Address</code> property holds the address (location) of the registrar organization.
Email_Address	AddressObj: AddressObjectType	0..1	The <code>Email_Address</code> property holds the main email address for the registrar.
Phone_Number	cyboxCommon: StringObjectPropertyType	0..1	The <code>Phone_Number</code> property holds the phone number of the registrar organization.
Whois_Server	URIObj:URIObjectType	0..1	The <code>Whois_Server</code> property specifies the corresponding whois server for this registrar.
Referral_URL	URIObj:URIObjectType	0..1	The <code>Referral_URL</code> property specifies the corresponding referral URL for registrar.
Contacts	WhoisContactsType	0..1	The <code>Contacts</code> property specifies a list of registrar contacts.

3.3 WhoisContactsType Class

The `WhoisContactsType` class represents a list of contacts (usually registrar or registrant) found in a Whois entry.

The property table of the `WhoisContactsType` class is given in [Table 3-3](#).

Table 3-3. Properties of the `WhoisContactsType` class

Name	Type	Multiplicity	Description
Contact	WhoisContactType	0..*	The <code>Contact</code> property specifies a contact found in a Whois entry.

3.4 WhoisContactType Data Type

The property table of the `WhoisContactType` class is given in [Table 3-4](#).

Table 3-4. Properties of the `WhoisContactType` class

Name	Type	Multiplicity	Description
contact_type	WhoisContactTypeEnum	0..1	The <code>contact_type</code> property specifies what type of contact this is.
Contact_ID	cyboxCommon: StringObjectPropertyType	0..1	The <code>Contact_ID</code> property corresponds to an ID for the contact. This can be presented as Contact ID, Billing ID, Admin ID, Tech ID, etc.
Name	cyboxCommon: StringObjectPropertyType	0..1	The <code>Name</code> property specifies the name of the contact.
Email_Address	AddressObj: AddressObjectType	0..1	The <code>Email_Address</code> property specifies the email address of the contact.
Phone_Number	cyboxCommon: StringObjectPropertyType	0..1	The <code>Phone_Number</code> property specifies the phone number of the contact.
Fax_Number	cyboxCommon: StringObjectPropertyType	0..1	The <code>Fax_Number</code> property specifies the fax number of the contact.

Address	cyboxCommon: StringObjectPropertyType	0..1	The <code>Address</code> property specifies the address of the contact.
Organization	cyboxCommon: StringObjectPropertyType	0..1	The <code>Organization</code> property specifies the name of the organization this contact works for or is associated with.

3.5 WhoisStatusesType Class

The `WhoisStatusesType` class defines a list of `WhoisStatusType` objects.

The property table of the `WhoisStatusesType` class is given in [Table 3-5](#).

Table 3-5. Properties of the `WhoisStatusesType` class

Name	Type	Multiplicity	Description
Status	WhoisObj:WhoisStatusType	0..*	The <code>Status</code> property

3.6 WhoisStatusType Data Type

The `WhoisStatusType` data type specifies a status for a domain as listed in its Whois entry. Its core value SHOULD be a literal found in the `WhoisStatusTypeEnum` enumeration. Its base type is the `BaseObjectPropertyType` data type, in order to permit complex (i.e. regular-expression based) specifications.

3.7 WhoisNameserversType Class

The `WhoisNameserversType` class defines a list of nameservers associated with a Whois entry.

The property table of the `WhoisNameserversType` class is given in [Table 3-6](#).

Table 3-6. Properties of the `WhoisNameserversType` class

Name	Type	Multiplicity	Description
Nameserver	URIObj:URIObjectType	0..*	The <code>Nameserver</code> property specifies a nameserver of the domain for this whois entry.

3.8 WhoisRegistrantInfoType Class

The property table of the `WhoisRegistrantInfoType` class is given in [Table 3-7](#).

Table 3-7. Properties of the `WhoisRegistrantInfoType` class

Name	Type	Multiplicity	Description
Registrant_ID	cyboxCommon:StringObjectType	0..1	The <code>Registrant_ID</code> property specifies the registrant id for a given registrant.

3.9 WhoisRegistrantsType Class

The `WhoisRegistrantsType` class represents a list of registrant information for a given Whois entry.

The property table of the `WhoisRegistrantsType` class is given in [Table 3-8](#).

Table 3-8. Properties of the `WhoisRegistrantsType` class

Name	Type	Multiplicity	Description
Registrant	<code>WhoisRegistrantInfoType</code>	0..*	The <code>Registrant</code> property

3.10 WhoisStatusTypeEnum Enumeration

The literals of the WhoisStatusTypeEnum enumeration are given in [Table 3-9](#).

Table 3-9. Literals of the WhoisStatusTypeEnum enumeration

Enumeration Literal	Description
ADD_PERIOD	The 5-day Add Grace Period after the initial registration of a domain. If the domain is deleted by the registrar during this period, the registry provides a credit to the registrar for the cost of the registration.
RENEW_PERIOD	The 5-day period after a domain registration period is explicitly extended (renewed) by the registrar. If the domain is deleted by the registrar during this period, the registry provides a credit to the registrar for the cost of the renewal.
AUTO_RENEW_PERIOD	The 45-day period after a domain registration period expires and is extended (renewed) automatically by the registry. If the domain is deleted by the registrar during this period, the registry provides a credit to the registrar for the cost of the renewal.
TRANSFER_PERIOD	The 5-day period after the successful transfer of domain name registration sponsorship from one registrar to another registrar. If the domain is deleted by the new sponsoring registrar during this period, the registry provides a credit to the registrar for the cost of the transfer.
PENDING_DELETE_RESTORABLE	The 30-day period after a registrar has submitted a delete command to delete a domain from the registry. All Internet services associated with the domain are disabled. During this period, a registrar can submit a request to Restore the domain.
PENDING_DELETE_	The 5-day period following the PENDING DELETE RESTORABLE period. During this period, all Internet services

SCHEDULED_FOR_RELEASE	associated with the domain will remain disabled and domain cannot be Restored.
PENDING_RESTORE	The registrar has submitted a Restore request for a domain that was previously in the status of PENDING DELETE RESTORABLE and the registry is awaiting a Restore Report from the registrar.
OK	This is the normal status for a domain that has no pending operations or prohibitions.
INACTIVE	The domain has no associated nameservers. A minimum of 2 nameservers must be associated with the domain before it can be published to the zone.
CLIENT_TRANSFER_PROHIBITED	Registrar does not allow the transfer of a domain.
CLIENT_RENEW_PROHIBITED	Registrar does not allow the renewal of a domain.
CLIENT_DELETE_PROHIBITED	Registrar does not allow the deletion of a domain.
CLIENT_UPDATE_PROHIBITED	Registrar does not allow the update or modification of a domain.
CLIENT_HOLD	Registrar will not allow the domain to be published to the zone.
TRANSFER_PROHIBITED	Registry does not allow the transfer of a domain.
RENEW_PROHIBITED	Registry does not allow the renewal of a domain.
DELETE_PROHIBITED	Registry does not allow the deletion of a domain.

UPDATE_PROHIBITED	Registry does not allow all the update or modification of a domain.
HOLD	Registry will not allow the domain to be published to the zone.

3.11 WhoisDNSSECTypeEnum Enumeration

The literals of the `WhoisDNSSECTypeEnum` enumeration are given in [Table 3-10](#).

Table 3-10. Literals of the `WhoisDNSSECTypeEnum` enumeration

Enumeration Literal	Description
Signed	The Signed value signifies that the domain name associated with the Whois entry is digitally signed.
Unsigned	The Unsigned value signifies that the domain name associated with the Whois entry is not digitally signed.

3.12 WhoisContactTypeEnum Enumeration

The literals of the `WhoisContactTypeEnum` enumeration are given in [Table 3-11](#).

Table 3-11. Literals of the `WhoisContactTypeEnum` enumeration

Enumeration Literal	Description
ADMIN	The contact is an administrator.
BILLING	The contact is for billing.

TECHNICAL	The contact is for technical assistance.
------------------	--

4 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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