CybOX™ Version 2.1.1. Part 84: Win Registry Key Object

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- *STIX™ Version 1.2.1*. Edited by Sean Barnum, Desiree Beck, Aharon Chernin, and Rich Piazza. 05 May 2016. OASIS Committee Specification 01. http://docs.oasis-open.org/cti/stix/v1.2.1/cs01/part1-overview/stix-v1.2.1-cs01-part1-overview.html.

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 Win Registry Key Object data model, which is one of the Object data models for CybOX content.

Status:

This document was last revised or approved by the OASIS Cyber Threat Intelligence (CTI) TC on the above date. The level of approval is also listed above. Check the “Latest version” location noted above for possible later revisions of this document. Any other numbered Versions and other technical work produced by the Technical Committee (TC) are listed at https://www.oasis-open.org/committees/tc_home.php?wg_abbrev=cti#technical.

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For information on whether any patents have been disclosed that may be essential to implementing this specification, and any offers of patent licensing terms, please refer to the Intellectual Property Rights section of the TC’s web page (https://www.oasis-open.org/committees/cti/ipr.php).

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Notices

Table of Contents

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 Win Registry Key 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 Win Registry Key Object data model. We present the Win Registry Key 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. In addition to the Core, Common, and numerous Object data models, the full set of CybOX 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 sections describe the conventions 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 Windows Registry Key data model is `WinRegistryKeyObj`. Note that in this specification document, we do not explicitly specify the package prefix for any classes that originate from the Win Registry Key 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.

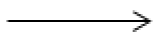
1.2.3.1 Class Properties

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. For example, properties of a class that are identifiers, titles, and timestamps will be represented 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 Win Registry Key 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
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.

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 Win Registry Key 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 WindowsRegistryKeyObjectType Class

The `WindowsRegistryKeyObjectType` class is intended to characterize Windows registry objects, including Keys and Key/Value pairs.

The UML diagram corresponding to the `WindowsRegistryKeyObjectType` class is shown in **Figure 3-1**.

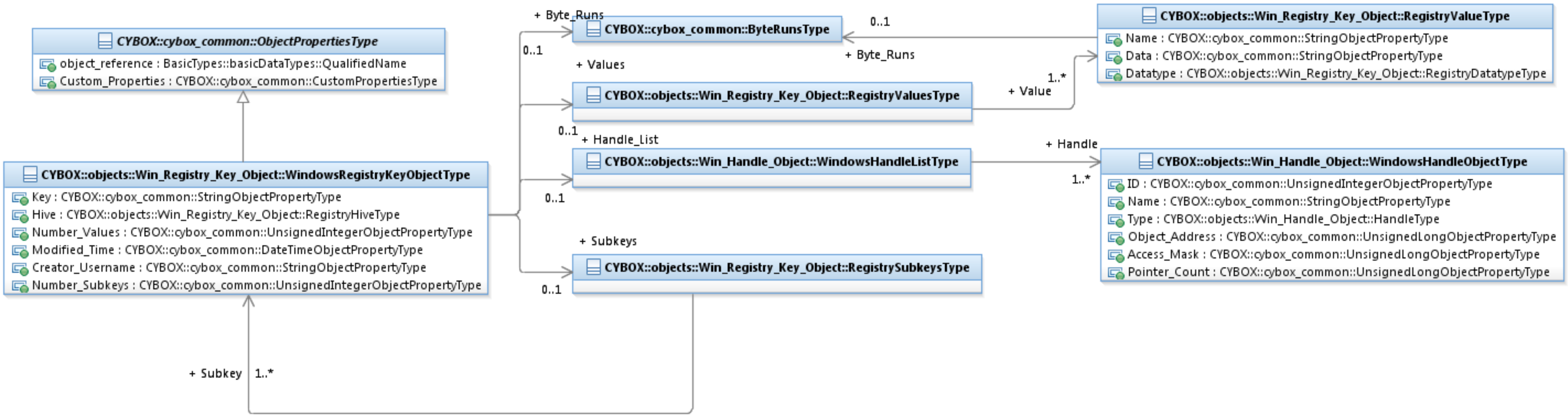


Figure 3-1. UML diagram of the `WindowsRegistryKeyObjectType` class

The property table of the `WindowsRegistryKeyObjectType` class is given in **Table 3-1**.

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

Name	Type	Multiplicity	Description

Key	cyboxCommon: StringObjectPropertyType	0..1	The Key property specifies the full key to the Windows registry object, not including the hive.
Hive	RegistryHiveType	0..1	The Hive property specifies the Windows registry hive to which the registry object belongs to.
Number_Values	cyboxCommon: UnsignedIntegerObjectPropertyType	0..1	The Number_Values property specifies the number of values found in the registry key.
Values	RegistryValuesType	0..1	The Values property specifies the values (with their name/data pairs) held within the registry key.
Modified_Time	cyboxCommon: DateTimeObjectPropertyType	0..1	The Modified_Time property specifies the last date/time that the registry object was modified.
Creator_Username	cyboxCommon: StringObjectPropertyType	0..1	The Creator_Username property specifies the name of the user who created the registry object.
Handle_List	WinHandleObj: WindowsHandleListType	0..1	The Handle_List property specifies a list of open Handles for this registry object.
Number_Subkeys	cyboxCommon: UnsignedIntegerObjectPropertyType	0..1	The Number_Subkeys property specifies the number of subkeys contained under the registry key.
Subkeys	RegistrySubkeysType	0..1	The Subkeys property specifies the set of subkeys contained under the registry key.
Byte_Runs	cyboxCommon:ByteRunsType	0..1	The Byte_Runs property contains a list of byte runs from the raw registry.

3.2 RegistryValueType Class

The `RegistryValueType` class is intended to characterize Windows Registry Value name/data pairs.

The property table of the `RegistryValueType` class is given in **Table 3-2**.

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

Name	Type	Multiplicity	Description
Name	`cyboxCommon:StringObjectPropertyType`	0..1	The `Name` property specifies the name of the registry value. For specifying the default value in a registry key, an empty string should be used.
Data	`cyboxCommon:StringObjectPropertyType`	0..1	The `Data` property specifies the data contained in the registry value.
Datatype	`RegistryDatatypeType`	0..1	The `Datatype` property specifies the registry (REG_*) datatype used in the registry value.
Byte_Runs	`cyboxCommon:ByteRunsType`	0..1	The `Byte_Runs` property contains a list of byte runs from the raw registry key entry.

3.3 RegistryDatatypeType Data Type

The `RegistryDatatypeType` data type specifies the Windows registry datatype. Its core value SHOULD be a literal from the `RegistryDataTypesEnum` enumeration. It extends the `BaseObjectPropertyType` data type, in order to permit complex (i.e., regular-expression based) specifications.

3.4 RegistryHiveType Data Type

The `RegistryHiveType` data type specifies the Windows registry hive type. Its core value SHOULD be a literal from the `RegistryHiveEnum` enumeration. It extends the `BaseObjectPropertyType` data type, in order to permit complex (i.e., regular-expression based) specifications.

3.5 RegistryValuesType Class

The `RegistryValuesType` class specifies the values (with their name/data pairs) held within the registry key.

The property table of the `RegistryValuesType` class is given in **Table 3-3**.

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

Name	Type	Multiplicity	Description
Value	`RegistryValueType`	1..*	The `Value` property specifies the value (with name/data pair) held within the registry key.

3.6 RegistrySubkeysType Class

The `RegistrySubkeysType` class specifies the set of subkeys contained under the registry key.

The property table of the `RegistrySubkeysType` class is given in **Table 3-4**.

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

Name	Type	Multiplicity	Description
Subkey	`WindowsRegistryKeyObjectType`	1..*	The `Subkey` property specifies a single subkey contained under the registry key.

3.7 RegistryDataTypesEnum Enumeration

The literals of the `RegistryDataTypesEnum` enumeration are given in **Table 3-5**. For more information, see https://msdn.microsoft.com/en-us/library/windows/desktop/ms724884%28v=vs.85%29.aspx.

Table 3-5. Literals of the `RegistryDataTypesEnum` enumeration

Enumeration Literal	Description
REG_NONE	No defined value type.
REG_SZ	A null-terminated string. This will be either a Unicode or an ANSI string, depending on whether you use the Unicode or ANSI functions.
REG_EXPAND_SZ	A null-terminated string that contains unexpanded references to environment variables (for example, "%PATH%"). It will be a Unicode or ANSI string depending on whether you use the Unicode or ANSI functions.
REG_BINARY	Binary data in any form.
REG_DWORD	A 32-bit number.
REG_DWORD_BIG_ENDIAN	A 32-bit number in big-endian format. Some UNIX systems support big-endian architectures.
REG_LINK	A null-terminated Unicode string that contains the target path of a symbolic link.
REG_MULTI_SZ	A sequence of null-terminated strings, terminated by an empty string (\0).
REG_RESOURCE_LIST	A series of nested arrays designed to store a resource list used by a hardware device driver or one of the physical devices it controls. This data is detected and written into the ResourceMap tree by the system and is displayed in Registry Editor in hexadecimal format as a Binary Value.

REG_FULL_RESOURCE_DESCRIPTOR	A series of nested arrays designed to store a resource list used by a physical hardware device. This data is detected and written into the HardwareDescription tree by the system and is displayed in Registry Editor in hexadecimal format as a Binary Value.
REG_RESOURCE_REQUIREMENTS_LIST	Device driver list of hardware resource requirements in Resource Map tree. See http://www.mdgx.com/reg.htm.
REG_QWORD	A 64-bit number.
REG_INVALID_TYPE	Specifies an invalid key.

3.8 RegistryHiveEnum Enumeration

The literals of the `RegistryHiveEnum` enumeration are given in **Table 3-6**.

Also, see https://msdn.microsoft.com/en-us/library/windows/desktop/ms724836%28v=vs.85%29.aspx.

Table 3-6. Literals of the `RegistryHiveEnum` enumeration

Enumeration Literal	Description
HKEY_CLASSES_ROOT	Registry entries subordinate to this key define types (or classes) of documents and the properties associated with those types. Shell and COM applications use the information stored under this key.
HKEY_CURRENT_CONFIG	Contains information about the current hardware profile of the local computer system. The information under HKEY_CURRENT_CONFIG describes only the differences between the current hardware configuration and the standard

	configuration.
HKEY_CURRENT_USER	Registry entries subordinate to this key define the preferences of the current user. These preferences include the settings of environment variables, data about program groups, colors, printers, network connections, and application preferences. This key makes it easier to establish the current user's settings; the key maps to the current user's branch in HKEY_USERS.
HKEY_LOCAL_MACHINE	Registry entries subordinate to this key define the physical state of the computer, including data about the bus type, system memory, and installed hardware and software.
HKEY_USERS	Registry entries subordinate to this key define the default user configuration for new users on the local computer and the user configuration for the current user.
HKEY_CURRENT_USER_ LOCAL_SETTINGS	Registry entries subordinate to this key define preferences of the current user that are local to the machine. These entries are not included in the per-user registry portion of a roaming user profile.
HKEY_PERFORMANCE_DATA	Registry entries subordinate to this key allow you to access performance data. The data is not actually stored in the registry; the registry functions cause the system to collect the data from its source.
HKEY_PERFORMANCE_NLSTEXT	Registry entries subordinate to this key reference the text strings that describe counters in the local language of the area in which the computer system is running. These entries are not available to Regedit.exe and Regedt32.exe.
HKEY_PERFORMANCE_TEXT	Registry entries subordinate to this key reference the text strings that describe counters in US English. These entries are not available to Regedit.exe and Regedt32.exe.

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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Appendix B. Revision History

Revision	Date	Editor	Changes Made
wd01	15 December 2015	Desiree Beck Trey Darley Ivan Kirillov Rich Piazza	Initial transfer to OASIS template

