STIX™ Version 2.0. Part 3: Cyber Observable Core Concepts

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Additional artifacts:

This prose specification is one component of a Work Product that also includes:

- *STIX™ Version 2.0. Part 1: STIX Core Concepts.* http://docs.oasis-open.org/cti/stix/v2.0/csprd01/part1-stix-core/stix-v2.0-csprd01-part1-stix-core.html.
- *STIX™ Version 2.0. Part 2: STIX Objects.* http://docs.oasis-open.org/cti/stix/v2.0/csprd01/part2-stix-objects/stix-v2.0-csprd01-part2-stix-objects.html.
- (this document) *STIX™ Version 2.0. Part 3: Cyber Observable Core Concepts.* http://docs.oasis-open.org/cti/stix/v2.0/csprd01/part3-cyber-observable-core/stix-v2.0-csprd01-part3-cyber-observable-core.html.
- *STIX™ Version 2.0. Part 4: Cyber Observable Objects.* http://docs.oasis-open.org/cti/stix/v2.0/csprd01/part4-cyber-observable-objects/stix-v2.0-csprd01-part4-cyber-observable-objects.html.
- *STIX™ Version 2.0. Part 5: STIX Patterning.* http://docs.oasis-open.org/cti/stix/v2.0/csprd01/part5-stix-patterning/stix-v2.0-csprd01-part5-stix-patterning.html.

Related work:

This specification replaces or supersedes:

- *STIX™ Version 1.2.1. Part 1: Overview.* Edited by Sean Barnum, Desiree Beck, Aharon Chernin, and Rich Piazza. Latest version: http://docs.oasis-open.org/cti/stix/v1.2.1/stix-v1.2.1-part1-overview.html.
- *CybOX™ Version 2.1.1. Part 01: Overview.* Edited by Trey Darley, Ivan Kirillov, Rich Piazza, and Desiree Beck. Latest version: http://docs.oasis-open.org/cti/cybox/v2.1.1/cybox-v2.1.1-part01-overview.html.

This specification is related to:

- *TAXII™ Version 2.0.* Edited by Bret Jordan and Mark Davidson. Work in progress.

Abstract:

Structured Threat Information Expression (STIX™) is a language for expressing cyber threat and observable information. STIX Cyber Observables are defined in two documents. This document defines concepts that apply across all of STIX Cyber Observables.

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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Table of Contents

1 Introduction

The STIX 2.0 specification defines structured representations for observable objects and their properties in the cyber domain. These can be used to describe data in many different functional domains, including but not limited to:

- Malware characterization
- Intrusion detection
- Incident response & management
- Digital forensics

STIX Cyber Observables document the facts concerning **what** happened on a network or host, but not necessarily the who or when, and never the why. For example, information about a file that existed, a process that was observed running, or that network traffic occurred between two IPs can all be captured as Cyber Observable data.

STIX Cyber Observables are used by various STIX Domain Objects (SDOs) to provide additional context to the data that they characterize. The Observed Data SDO, for example, indicates that the raw data was observed at a particular time and by a particular party.

The Cyber Observable Objects chosen for inclusion in STIX 2.0 represent a minimally viable product (MVP) that fulfills basic consumer and producer requirements. Objects and properties not included in STIX 2.0, but deemed necessary by the community, will be included in future releases.

This document (*STIX™ Version 2.0. Part 3: Cyber Observable Core Concepts*) in the STIX specification describes Cyber Observable Core Concepts. *STIX™ Version 2.0. Part 4: Cyber Observable Objects* contains the definitions for the Cyber Observable Objects.

1.1 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].

CAPEC - Common Attack Pattern Enumeration and Classification

Consumer - Any entity that receives STIX content.

CTI - Cyber Threat Intelligence

Entity - Anything that has a separately identifiable existence (e.g., organization, person, group, etc.).

IEP - FIRST (Forum of Incident Response and Security Teams) Information Exchange Policy

Instance - A single occurrence of a STIX object version.

MTI - Mandatory To Implement

MVP - Minimally Viable Product

Object Creator - The entity that created or updated a STIX object (see section 3.3 of *STIX™ Version 2.0 Part 1: STIX Core Concepts*).

Object Representation - An instance of an object version that is serialized as STIX.

Producer - Any entity that distributes STIX content, including object creators as well as those passing along existing content.

SDO - STIX Domain Object

SRO - STIX Relationship Object

STIX - Structured Threat Information Expression

STIX Content - STIX documents, including STIX Objects, STIX Objects grouped as bundles, etc.

STIX Object - A STIX Domain Object (SDO) or STIX Relationship Object (SRO)

TAXII - An application layer protocol for the communication of cyber threat information.

TLP - Traffic Light Protocol

TTP - Tactic, technique, or procedure; behaviors and resources that attackers use to carry out their attacks

1.2 Normative References

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1.4 Overview

1.4.1 Cyber Observable Objects

STIX 2.0 defines a set of Cyber Observable Objects for characterizing host-based, network, and related entities. Each of these objects correspond to a data point commonly represented in CTI and digital forensics. Using the building blocks of Cyber Observable Objects, in conjunction with relationships between these objects, individuals can create, document, and share comprehensive information about computer systems and their state.

Throughout this document, Cyber Observable Objects are referred to simply as "Observable Objects". These should not be confused with STIX Domain Objects (SDOs), as defined in *STIX™ Version 2.0. Part 1: STIX Core Concepts* and *STIX™ Version 2.0. Part 2: STIX Objects*.

1.4.2 Cyber Observable Relationships

A Cyber Observable Relationship is a reference linking two (or more) related Cyber Observable Objects. Cyber Observable Relationships are only resolvable within the same `observable-objects` container.

References are a property on Cyber Observable Objects that contain the ID of a different Cyber Observable Object.

Throughout this document, Cyber Observable Relationships are referred to simply as "Relationships". These should not be confused with STIX Relationship Objects (SROs), as defined in *STIX™ Version 2.0. Part 1: STIX Core Concepts* and *STIX™ Version 2.0. Part 2: STIX Objects*.

1.4.3 Cyber Observable Extensions

Each Observable Object defines a set of base properties that are generally applicable across any instance of the Object. However, there is also a need to encode additional data beyond the base definition of the Object data models. To enable this, STIX permits the specification of such additional properties through the set of Predefined Cyber Observable Object Extensions. Where applicable, Predefined Object Extensions are included in the definitions of Objects. For example, the File Object includes Predefined Object Extensions for characterizing PDF files, raster image files, archive files, NTFS files, and Windows PE binary files.

Producers may also define and include their own Custom Object Extensions. For further information, refer to section 5 (Customizing Cyber Observable Objects.)

1.4.4 Vocabularies & Enumerations

Many Cyber Observable Objects contain properties whose values are constrained by a predefined enumeration or open vocabulary. In the case of enumerations, this is a requirement that producers must use the values in the enumeration and cannot use any outside values. In the case of open vocabularies, this is a suggestion for producers that permits the use of values outside of the suggested vocabulary. If used consistently, vocabularies make it less likely that, for example, one entity refers to the md5 hashing algorithm as "MD5" and another as "md-5-hash", thereby making comparison and correlation easier.

1.5 Conventions

1.5.1 Naming Conventions

All type names, property names, and literals are in lowercase, except when referencing canonical names defined in another standard (e.g., literal values from an IANA registry). Words in property names are separated with an underscore(_), while words in type names and string enumerations are separated with a dash (-). All type names, property names, object names, and vocabulary terms are between three and 250 characters long.

In the JSON serialization all property names and string literals **MUST** be exactly the same, including case, as the names listed in the property tables in this specification. For example, the Cyber Observable Object property **`extensions`** must result in the JSON key name "extensions". Properties marked required in the property tables **MUST** be present in the JSON serialization.

1.5.2 Reserved Property Names

Reserved property names are marked with a type called `RESERVED` and a description text of “RESERVED FOR FUTURE USE”. Any property name that is marked as `RESERVED` **MUST NOT** be present in STIX content conforming to this version of the specification.

1.5.3 Font Colors and Style

The following color, font and font style conventions are used in this document:

- The `Consolas` font is used for all type names, property names and literals.
  - type names are in red with a light red background - `hashes-type`
  - property names are in bold style - **`protocols`**
  - literals (values) are in green with a green background - `SHA-256`
- In an object's property table, if a common property is being redefined in some way, then the background is dark gray.

- All examples in this document are expressed in JSON. They are in `Consolas` 9-point font, with straight quotes, black text and a `light blue background`, and 2-space indentation.
- Parts of the example may be omitted for conciseness and clarity. These omitted parts are denoted with the ellipses (...).

2 Cyber Observable Specific Data Types

The Cyber Observable specification within STIX makes use of many common types that are defined in section 2 of *STIX™ Version 2.0. Part 1: STIX Core Concepts*. In addition, data types specific to the representation of Cyber Observables are defined in this section. The table below lists common data types from STIX Core with a gray background and the Cyber Observable specific types with a white background.

Type	Description
`boolean`	A value of `true` or `false`.
`float`	An IEEE 754 [IEEE 754-2008] double-precision number.
`integer`	A whole number.
`list`	An ordered sequence of values. The phrasing "`list` of type `<type>`" is used to indicate that all values within the list **MUST** conform to the specified type.
`open-vocab`	A value from a STIX open (`open-vocab`) or suggested vocabulary.
`string`	A series of Unicode characters.
`timestamp`	A time value (date and time).
`binary`	A sequence of bytes.
`hex`	An array of octets as hexadecimal.
`dictionary`	A set of key/value pairs.
`object-ref`	A local reference to a Cyber Observable Object.
`hashes-type`	One or more cryptographic hashes.
`observable-objects`	One or more Cyber Observable Objects.

2.1 Binary

Type Name: `binary`

The `binary` data type represents a sequence of bytes. In order to allow pattern matching on custom objects, for all properties that use the binary type, the property name **MUST** end with '_bin'.

The JSON MTI serialization represents this as a base64-encoded string as specified in [RFC4648]. Other serializations **SHOULD** use a native binary type, if available.

2.2 Hexadecimal

Type Name: `hex`

The `hex` data type encodes an array of octets (8-bit bytes) as hexadecimal. The string **MUST** consist of an even number of hexadecimal characters, which are the digits '0' through '9' and the letters 'a' through

'f'. In order to allow pattern matching on custom objects, for all properties that use the `hex` type, the property name **MUST** end with '_hex'.

Examples

```
...
  "src_flags_hex": "00000002"
...
```

2.3 Dictionary

Type Name: `dictionary`

A `dictionary` captures an arbitrary set of key/value pairs. `dictionary` keys **MUST** be unique in each dictionary, **MUST** be in ASCII, and are limited to the characters a-z (lowercase ASCII), A-Z (uppercase ASCII), numerals 0-9, hyphen (-), and underscore (_). `dictionary` keys **SHOULD** be no longer than 30 ASCII characters in length, **MUST** have a minimum length of 3 ASCII characters, **MUST** be no longer than 256 ASCII characters in length, and **SHOULD** be lowercase.

`dictionary` values **MUST** be valid property base types.

2.4 Object Reference

Type Name: `object-ref`

The Object Reference data type specifies a local reference to an Observable Object, that is, one which **MUST** be valid within the local scope of the Observable Objects (`observable-objects`) container that holds both the source Observable Object and the Observable Object that it references.

Examples
The following example demonstrates how a Network Traffic Object specifies its destination via a reference to an IPv4 Address Object.

```
{
  "0": {
    "type": "ipv4-addr",
    "value": "198.51.100.2"
  },
  "1": {
    "type": "network-traffic",
    "dst_ref": "0"
  }
}
```

2.5 Hashes Type

Type Name: `hashes-type`

The Hashes type represents 1 or more cryptographic hashes, as a special set of key/value pairs. Accordingly, the name of each hashing algorithm **MUST** be specified as a key in the dictionary and **MUST** identify the name of the hashing algorithm used to generate the corresponding value. This name **SHOULD** either be one of the values defined in the `hash-algo-ov` OR a custom value prepended with “x_” (e.g., “x_custom_hash”).

Examples
MD5 and Custom Hash

```
{
```



```
  "MD5": "3773a88f65a5e780c8dff9cdc3a056f3",
  "x_foo_hash": "aaaabbbbccccddddeeeeffff0123457890"
}
```

2.6 Observable Objects

Type Name: `observable-objects`

The Observable Objects type represents 1 or more Observable Objects as a special set of key/value pairs. The keys in the dictionary are references used to refer to the values, which are objects. Each key in the dictionary **SHOULD** be a non-negative monotonically increasing integer, incrementing by 1 from a starting value of 0, and represented as a string within the JSON MTI serialization. However, implementers **MAY** elect to use an alternate key format if necessary.

Examples

```
{
  "0": {
    "type": "email-addr",
    "value": "jdoe@example.com",
    "display_name": "John Doe"
  },
  "1": {
    "type": "email-addr",
    "value": "mary@example.com",
    "display_name": "Mary Smith"
  },
  "2": {
    "type": "email-message",
    "from_ref": "0",
    "to_refs": ["1"],
    "date": "1997-11-21T15:55:06Z",
    "subject": "Saying Hello"
  }
}
```


3 Cyber Observable Objects

This section outlines the common properties and behavior across all Cyber Observable Objects.

The JSON MTI serialization uses the JSON object type [RFC7159] when representing Objects.

3.1 Common Properties

Property Name	Type	Description
type (required)	`string`	Indicates that this object is an Observable Object. The value of this property **MUST** be a valid Observable Object type name.
description (optional)	`string`	Specifies a textual description of the Object.
extensions (optional)	`dictionary`	Specifies any extensions of the object, as a dictionary. Dictionary keys **MUST** identify the extension type by name. The corresponding dictionary values **MUST** contain the contents of the extension instance.

3.2 Object References

Identifiers on Observable Objects are specified as keys in the `observable-objects` type. For more information on how such keys may be defined, see section 2.6.

The `object-ref` type is used to define Observable Object properties that are *references* to other Observable Objects (such as the **src_ref** property on the Network Traffic Object). *Resolving* a reference is the process of identifying and obtaining the actual Observable Object referred to by the reference property. References resolve to an object when the value of the property (e.g., **src_ref**) is an exact match with the key of another Observable Object that resides in the same parent container as the Observable Object that specifies the reference. This specification does not address the implementation of reference resolution.

3.3 Object Property Metadata

3.3.1 String Encoding

Capturing the observed encoding of a particular Observable Object string is useful for attribution, the creation of indicators, and related use cases.

Certain string properties in Observable Objects may contain an additional sibling property with the same base name and a suffix of **_enc** that captures the name of the original observed encoding of the property value. All **_enc** properties **MUST** specify their encoding using the corresponding name from the IANA character set registry [Character Sets]. If the preferred MIME name for a character set is defined, this value **MUST** be used; if it is not defined, then the Name value from the registry **MUST** be used instead.

As an example of how this capability may be used in an Object, the **name** property in the File Object has the sibling property **name_enc**, for capturing the observed encoding of the file name string.

Examples

File with Unicode representation of the filename and a corresponding encoding specification

```
{
  "0": {
    "type": "file",
    "hashes": {
      "MD5": "66e2ea40dc71d5ba701574ea215a81f1"
    },
    "name": "quêry.dll",
    "name_enc": "windows-1252"
  }
}
```

3.4 Object Relationships

A Cyber Observable Relationship is a connection between two or more Cyber Observable Objects within the scope of a given Observable Objects dictionary. Cyber Observable relationships are references that are represented as properties of a Cyber Observable Object, containing the keys of the target Cyber Observable Object(s).

Cyber Observable Object relationships are implemented in Object properties as either singletons or lists. In the case of singleton relationships, the name of their Object property **MUST** end in **`_ref`**, whereas for lists of relationships the name of their Object property **MUST** end in **`_refs`**.

The target(s) of Cyber Observable relationships may be restricted to a subset of Cyber Observable Object types, as specified in the description of the Observable Object property that defines the relationship. For example, the **`belongs_to_refs`** property on the IPv4 Address Object specifies that the *only* valid target of the relationship is one or more AS Objects.

Examples

Network Traffic with Source/Destination IPv4 Addresses and AS

```
{
  "0": {
    "type": "ipv4-addr",
    "value": "1.2.3.4",
    "belongs_to_refs": ["3"]
  },
  "1": {
    "type": "ipv4-addr",
    "value": "2.3.4.5"
  },
  "2": {
    "type": "network-traffic",
    "src_ref": "0",
    "dst_ref": "1",
  }
  "3": {
    "type": "as"
    "number": 42
  }
}
```

3.5 Predefined Object Extensions

Predefined Object Extensions have a specific purpose in Cyber Observable Objects: defining coherent sets of properties beyond the base, e.g., HTTP request information for a Network Traffic object. Accordingly, each Cyber Observable Object may include one or more Predefined Object Extensions.

Each Predefined Object Extension can be defined at most once on a given Observable Object. In an Observable Object instance, each extension is specified under the **`extensions`** property, which is of type `dictionary`. Note that this means that each extension is specified through a corresponding key in the

`extensions` property. For example, when specified in a File Object instance, the NTFS extension would be specified using the key value of `ntfs-ext`.

Examples

Basic File with NTFS Extension

```
{
  "0": {
    "type": "file",
    "hashes": {
      "MD5": "3773a88f65a5e780c8dff9cdc3a056f3"
    },
    "size": 25537,
    "extensions": {
      "ntfs-ext": {
        "sid": "1234567"
      }
    }
  }
}
```


4 Common Vocabularies

4.1 Hashing Algorithm Vocabulary

Type Name: `hash-algo-ov`

An open vocabulary of hashing algorithms.

When specifying a hashing algorithm not already defined within the `hash-algo-ov`, wherever an authoritative name for a hashing algorithm name is defined, it should be used as the value. In cases where no authoritative name exists and/or where there is variance in the naming of a particular hashing algorithm, producers should exercise their best judgement.

Vocabulary Value	Description
`MD5`	Specifies the MD5 message digest algorithm. The corresponding hash string for this value **MUST** be a valid MD5 message digest as defined in [RFC1321].
`MD6`	Specifies the MD6 message digest algorithm. The corresponding hash string for this value **MUST** be a valid MD6 message digest as defined in the [MD6] proposal.
`RIPEMD-160`	Specifies the RIPEMD-160 (RACE Integrity Primitives Evaluation Message Digest) cryptographic hash function. The corresponding hash string for this value **MUST** be a valid RIPEMD-160 message digest as defined in the [RIPEMD-160] specification.
`SHA-1`	Specifies the SHA-1 (secure-hash algorithm 1) cryptographic hash function. The corresponding hash string for this value **MUST** be a valid SHA-1 message digest as defined in [RFC3174].
`SHA-224`	Specifies the SHA-224 cryptographic hash function (part of the SHA2 family). The corresponding hash string for this value **MUST** be a valid SHA-224 message digest as defined in [RFC6234].
`SHA-256`	Specifies the SHA-256 cryptographic hash function (part of the SHA2 family). The corresponding hash string for this value **MUST** be a valid SHA-256 message digest as defined in [RFC6234].
`SHA-384`	Specifies the SHA-384 cryptographic hash function (part of the SHA2 family). The corresponding hash string for this value **MUST** be a valid SHA-384 message digest as defined in [RFC6234].
`SHA-512`	Specifies the SHA-512 cryptographic hash function (part of the SHA2 family). The corresponding hash string for this value **MUST** be a valid SHA-512 message digest as defined in [RFC3174].
`SHA3-224`	Specifies the SHA3-224 cryptographic hash function. The corresponding hash string for this value **MUST** be a valid SHA3-224 message digest as defined in [FIPS202].
`SHA3-256`	Specifies the SHA3-256 cryptographic hash function. The corresponding hash string for this value **MUST** be a valid SHA3-256 message digest as defined in [FIPS202].

SHA3-384	Specifies the SHA3-384 cryptographic hash function. The corresponding hash string for this value **MUST** be a valid SHA3-384 message digest as defined in [FIPS202].
SHA3-512	Specifies the SHA3-512 cryptographic hash function. The corresponding hash string for this value **MUST** be a valid SHA3-512 message digest as defined in [FIPS202].
ssdeep	Specifies the ssdeep fuzzy hashing algorithm. The corresponding hash string for this value **MUST** be a valid piecewise hash as defined in the [SSDEEP] specification.
WHIRLPOOL	Specifies the whirlpool cryptographic hash function. The corresponding hash string for this value **MUST** be a valid WHIRLPOOL message digest as defined in [ISO10118].

4.2 Encryption Algorithm Vocabulary

Type Name: `encryption-algo-ov`

An open vocabulary of encryption algorithms.

When specifying an encryption algorithm not already defined within the `encryption-algo-ov`, wherever an authoritative name for an encryption algorithm name is defined, it should be used as the value. In cases where no authoritative name exists and/or where there is variance in the naming of a particular encryption algorithm, producers should exercise their best judgement.

Vocabulary Value	Description
AES128-ECB	Specifies the Advanced Encryption Standard (AES) with Electronic Codebook (ECB) mode, as a defined in [NIST SP 800-38A].
AES128-CBC	Specifies the Advanced Encryption Standard (AES) with Cipher Block Chaining (CBC) mode, as a defined in [NIST SP 800-38A].
AES128-CFB	Specifies the Advanced Encryption Standard (AES) with Cipher Feedback (CFB) mode, as a defined in [NIST SP 800-38A].
AES128-OFB	Specifies the Advanced Encryption Standard (AES) with Output Feedback (OFB) mode, as a defined in [NIST SP 800-38A].
AES128-CTR	Specifies the Advanced Encryption Standard (AES) with counter (CTR) mode, as a defined in [NIST SP 800-38A].
AES128-XTS	Specifies the Advanced Encryption Standard (AES) with XEX Tweakable Block Cipher with Ciphertext Stealing (XTS) mode, as a defined in [NIST SP 800-38E].
AES128-GCM	Specifies the Advanced Encryption Standard (AES) with Galois/Counter (GCM) mode, as a defined in [NIST SP 800-38D].
Salsa20	Specifies the Salsa20 stream cipher, as defined in the [Salsa20] specification.

`Salsa12`	Specifies the Salsa20/12 stream cipher as defined in the [Salsa20/8 20/12] specification.
`Salsa8`	Specifies the Salsa20/8 stream cipher as defined in the [Salsa20/8 20/12] specification.
`ChaCha20-Poly1305`	Specifies the ChaCha20-Poly1305 stream cipher, as defined in [RFC7539].
`ChaCha20`	Specifies the ChaCha20 stream cipher (without poly1305 authentication), as defined in [RFC7539].
`DES-CBC`	Specifies the Data Encryption Standard algorithm with Cipher Block Chaining (CBC) mode, as defined in [FIPS81].
`3DES-CBC`	Specifies the Triple Data Encryption Standard algorithm with Cipher Block Chaining (CBC) mode, as defined in [NIST 800-67] and [NIST 800-38A].
`DES-ECB`	Specifies the Data Encryption Standard algorithm with Electronic Codebook (ECB) mode, as defined in [FIPS81].
`3DES-ECB`	Specifies the Triple Data Encryption Standard algorithm with Electronic Codebook (ECB) mode, as defined in [NIST 800-67].
`CAST128-CBC`	Specifies the CAST-128 algorithm with Cipher Block Chaining (CBC) mode, as defined in [RFC2144].
`CAST256-CBC`	Specifies the CAST-256 algorithm with Cipher Block Chaining (CBC) mode, as defined in [RFC2612].
`RSA`	Specifies the RSA symmetric encryption algorithm, as defined by [RFC8017].
`DSA`	Specifies the Digital Signature Algorithm, as defined by [FIPS186-4].

5 Customizing Cyber Observables

There are three means to customize Cyber Observable Objects: custom object extensions, custom observable objects, and custom properties. Custom object extensions provide a mechanism and requirements for the specification of extensions not defined by this specification (including relationships) on Observable Objects. Custom Observable Objects provide a mechanism and requirements to create Observable Objects not defined by this specification. Custom properties, as in the rest of STIX, provide a mechanism to add individual properties anywhere in the data model.

Custom Observable Object properties **SHOULD** be used for cases where it is necessary to add one or more simple additional properties (i.e. key/value pairs) on an Observable Object. On the other hand, Custom Observable Object extensions **SHOULD** be used for cases where it is necessary to describe more complex additional properties (i.e., those with potentially multiple levels of hierarchy). As an example, a vendor-specific property that expresses some custom threat score for a File Object should be added directly to the Observable Object as a custom property, whereas a set of properties that represent metadata around a new file system to the File Object should be done as a custom extension.

A consumer that receives a STIX document containing Custom Cyber Observable Properties, Extensions, or Objects it does not understand **MAY** refuse to process the document or **MAY** ignore those properties or objects and continue processing the document.

5.1 Custom Observable Objects

There will be cases where certain information exchanges can be improved by adding objects that are not specified nor reserved in this document; these objects are called Custom Observable Objects. This section provides guidance and requirements for how producers can use Custom Observable Objects and how consumers should interpret them in order to extend STIX in an interoperable manner.

5.1.1 Requirements

- Producers **MAY** include any number of Custom Observable Objects in an Observable Objects entity.
- The type property in a Custom Observable Object **MUST** be in ASCII and **MUST** only contain the characters a-z (lowercase ASCII), 0-9, and hyphen (-).
- The type property **MUST NOT** contain a hyphen (-) character immediately following another hyphen (-) character.
- Custom Observable Object names **MUST** have a minimum length of 3 ASCII characters.
- Custom Observable Object names **MUST** be no longer than 250 ASCII characters in length.
- The value of the **`type`** property in a Custom Observable Object **SHOULD** start with “x-” followed by a source unique identifier (like a domain name with dots replaced by dashes), a dash and then the name. For example: `x-example-com-customobject`.
- A Custom Observable Object whose name is not prefixed with “x-” **MAY** be used in a future version of the specification with a different meaning. Therefore, if compatibility with future versions of this specification is required, the “x-” prefix **MUST** be used.
- A Custom Observable Object **MUST** have one or more Custom Properties:
  - Custom Property names **MUST** be in ASCII and **MUST** only contain the characters a–z (lowercase ASCII), 0–9, and underscore (_).
  - Custom Property names **MUST** have a minimum length of 3 ASCII characters.
  - Custom Property names **MUST** be no longer than 250 ASCII characters in length.
- Custom Observable Objects **SHOULD** only be used when there is no existing Observable Object defined by the STIX specification that fulfills that need.
- Custom Observable Object property values **MUST** be a valid primitive, type, or a homogenous list of types.

Examples

Simple Custom Observable Object

```
{
```



```
  "0": {
    "type": "x-example",
    "foo": "bar",
    "vals": [
      "this",
      "is",
      "an",
      "example"
    ]
  }
}
```

5.2 Custom Object Extensions

In addition to the Predefined Cyber Observable Object extensions specified in *STIX™ Version 2.0. Part 4: Cyber Observable Objects*, STIX supports user-defined custom extensions for Cyber Observable Objects. As with Predefined Object Extensions, custom extension data **MUST** be conveyed under the **`extensions`** property.

5.2.1 Requirements

- An Observable Object **MAY** have any number of Custom Extensions.
- Custom Extension names **MUST** be in ASCII and are limited to characters a-z (lowercase ASCII), 0-9, and dash (-).
- Custom Extension names **SHOULD** start with "x-" followed by a source unique identifier (like a domain name), a dash and then the name. For example: `x-example-com-customextension`.
- Custom Extension names **MUST** have a minimum length of 3 ASCII characters.
- Custom Extension names **MUST** be no longer than 250 ASCII characters in length.
- Custom Extension names that are not prefixed with "x-" may be used in a future version of the specification for a different meaning. If compatibility with future versions of this specification is required, the "x-" prefix **MUST** be used.
- Custom Extensions **SHOULD** only be used when there is no existing extension defined by the STIX 2.0 specification that fulfills that need.
- A Custom Extension **MUST** have one or more Custom Properties:
  - Custom Property names **MUST** be in ASCII and **MUST** only contain the characters a–z (lowercase ASCII), 0–9, and underscore (_).
  - Custom Property names **MUST** have a minimum length of 3 ASCII characters.
  - Custom Property names **MUST** be no longer than 250 ASCII characters in length.

Examples

Custom File Object Extension

```
{
  "0": {
    "type": "file",
    "hashes": {
      "MD5": "9B996B8785BFC7C857FF346931FC4B51"
    },
    "extensions": {
      "x-example-com-foo": {
        "foo_val": "foo",
        "bar_val": "bar"
      }
    }
  }
}
```


5.3 Custom Object Properties

There will be cases where certain information exchanges can be improved by adding properties to Observable Objects that are neither specified nor reserved in this document; these properties are called Custom Object Properties. This section provides guidance and requirements for how producers can use Custom Object Properties and how consumers should interpret them in order to extend Cyber Observable Objects in an interoperable manner.

5.3.1 Requirements

- A Cyber Observable Object **MAY** have any number of Custom Properties.
- Custom Property names **MUST** be in ASCII and MUST only contain the characters a–z (lowercase ASCII), 0–9, and underscore (_).
- Custom Property names **SHOULD** start with “x_” followed by a source unique identifier (such as a domain name with dots replaced by underscores), an underscore and then the name. For example, **`x_example_com_customfield`**.
- Custom Property names **MUST** have a minimum length of 3 ASCII characters.
- Custom Property names **MUST** be no longer than 250 ASCII characters in length.
- Custom Property names that do not start with “x_” may be used in a future version of the specification for a different meaning. If compatibility with future versions of this specification is required, the “x_” prefix **MUST** be used.
- Custom Properties **SHOULD** only be used when there are no existing properties defined by the STIX 2.0 specification that fulfils that need.
- Custom Properties **SHOULD** only be used to define simple properties (e.g., those of string or integer type)
- For Custom Properties that use the `hex` type, the property name **MUST** end with '_hex'.
- For Custom Properties that use the `binary` type, the property name **MUST** end with '_bin'.

Examples

File Object with Custom Properties

```
{
  "0": {
    "type": "file",
    "hashes": {
      "MD5": "9B996B8785BFC7C857FF346931FC4B51"
    },
    "x_example_com_foo": "bar",
    "x_example_com_bar": 27
  }
}
```


6 Reserved Names

This section defines names that are reserved for future use in revisions of this document. The names defined in this section **MUST NOT** be used for the name of any Custom Cyber Observable Object or Property.

The following object names are reserved:

- `action`

7 Conformance

7.1 Producers and Consumers

A "Cyber Observable Producer" is any software that creates Cyber Observable content and conforms to the following normative requirements:

1. It **MUST** be able to create content encoded as JSON.
2. All required properties **MUST** be present in the created content.
3. All properties **MUST** conform to the specified data type and normative requirements.
4. It **MUST** support at least one defined Cyber Observable Object per the Conformance section in *STIX™ Version 2.0. Part 4: Cyber Observable Objects*.

A "Cyber Observable Consumer" is any software that consumes Cyber Observable content and conforms to the following normative requirements:

1. It **MUST** support parsing all required properties for the content that it consumes.

Appendix A. Acknowledgments

The contributions of the OASIS Cyber Threat Intelligence (CTI) Technical Committee members, enumerated in STIX™ Version 2.0. Part 1: STIX Core Concepts, are gratefully acknowledged.

Appendix B. Revision History

Revision	Date	Editor	Changes Made
01	2017-01-20	Bret Jordan, John Wunder, Rich Piazza, Ivan Kirillov, Trey Darley	Initial Version

