Abstract

This document uses the "information-type" extension point as defined in the Resource-Oriented Lightweight Information Exchange (ROLIE) [RFC8322] Section 7.1.2 to better support Software Record and Software Inventory use cases. This specification registers a new ROLIE information-type, "software-descriptor", that allows for the categorization of information relevant to software description activities and formats. In particular, the usage of the ISO 19770-2:2015 Software Identification Tag (SWID Tag) and the Concise SWID (COSWID) formats in ROLIE are standardized. Additionally, this document discusses requirements and usage of other ROLIE elements in order to best syndicate software description information.

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1. Introduction

This document defines an extension to the Resource-Oriented Lightweight Information Exchange (ROLIE) \[RFC8322\] to support the publication of software descriptor information. Software descriptor information is information that characterizes static software components, packages, and installers; including identification, version, software creation and publication, and file artifact information.

Software descriptor information provides data about what might be installed, but doesn’t describe a specific software installation’s
configuration or execution. This static approach to software
description is a tightly limited scope that still covers the majority
of current use cases for software inventory and record keeping.

Some possible use cases for software descriptor information ROLIE
Feeds (Section 6.1 of [RFC8322]) include:

- Software providers can publish software descriptor information so
  that software researchers, enterprises, and users of software can
  understand the collection of software produced by that software
  provider.

- Organizations can aggregate and syndicate collections of software
descriptor information provided by multiple software providers to
  support software-related analysis processes (e.g., vulnerability
  analysis) and to provide downstream services (e.g., software
  configuration checklist repositories).

- End user organizations can consume software descriptor information
  along with related software vulnerability and configuration
  information to provide the data needed to automate software asset,
  patch, and configuration management practices.

- Organizations can use software descriptors to support verification
  of other entities through integrity measurement mechanisms.

This document supports these use cases by describing the content
requirements for Feeds and Entries of software descriptor information
that are to be published to or retrieved from a ROLIE repository.

2. 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].

As an extension of [RFC8322], this document refers to many terms
defined in that document. In particular, the use of "Entry" and
"Feed" are aligned with the definitions presented in section TODO of
ROLIE.

Several places in this document refer to the "information-type" of a
Resource (Entry or Feed). This refers to the "term" attribute of an
"atom:category" element whose scheme is
"urn:ietf:params:rolie:category:information-type". For an Entry,
this value can be inherited from it’s containing Feed as per
[RFC8322].
3. Background

In order to effectively protect and secure an endpoint, it is vital to know what the software load of that endpoint is. Software load, the combination of software, patches and installers on a device, represents a significant portion of the endpoint’s attack surface. Unfortunately, without a reliable and secure package manager, or a secured and managed operating system with strict software whitelisting, tracking what software is installed on an endpoint is currently not feasible without undue effort. Even attempting to whitelist software is difficult without a way of identifying software and its editions, versions and hotfixes.

Software descriptor information, such as that standardized in the ISO 19770-2:2015 Software Identification Tag (SWID) format or expressed in proprietary enterprise databases, attempts to provide as much data about this software as possible.

Once this information is expressed, it needs to be stored and shared to internal and external parties. ROLIE provides a mechanism to handle this sharing in an automation-friendly way.

4. The "software-descriptor" information type

When an "atom:category" element has a "scheme" attribute equal to "urn:ietf:params:rolie:category:information-type", the "term" attribute defines the information type of the associated resource. A new valid value for this "term": "software-descriptor", is described in this section and registered in Section 8.1. When this value is used, the resource in question is considered to have an information-type of "software-descriptor" as per [RFC8322] Section 7.1.2.

The "software-descriptor" information type represents any static information that describes a piece of software. This document uses the definition of software provided by [RFC4949]. Note that as per this definition, this information type pertains to static software, that is, code on the disc. The "software-descriptor" information type is intended to provide a category for information that does one or more of the following:

- identifies and characterizes software: information that provides quantitative and qualitative data describing software. This information identifies and characterizes a given instance of software.

- provides software installer metadata: information about software used to install other software. This metadata identifies, and characterizes a software installation package or media.
describes stateless installation metadata: information that describes the software post-deployment, such as files that may be deployed during an installation. It is expected that this metadata is produced generally for a given installation, and may not exactly match the actual installed files on a given endpoint.

Provided below is a non-exhaustive list of information that may be considered to be of a software-descriptor information type.

- **Naming information**: IDs and names that aid in the identification of a piece of software.
- **Version and patching information**: Version numbers, patch identifiers, or other information that relates to software updates and patches.
- **Vendor and source information**: Includes where the software was developed or distributed, as well as where the software installation media may be located.
- **Payload and file information**: Information that describes or enumerates the files and folders that make up the piece of software, and information about those files.
- **Descriptive information and data**: Any information that otherwise characterizes a piece of software, such as libraries, runtime environments, target operating systems, intended purpose or audience, etc.

It is important to note that software descriptor information is static for a given piece of software. That is, the information expressed is the data that doesn’t change from the publication of the software to its final install. Information about the current status (e.g. install location, memory usage, CPU usage, launch parameters, job progress, etc.), is out of scope of this information type.

5. rolie:property Extensions

This document registers new valid rolie:property names as follows:

5.1. urn:ietf:params:rolie:property:swd:swname

This property provides an exposure point for the plain text name of the software being described. Naming of software is not a well standardized process, and software names can change between product versions or editions. As such, care should be taken that this value is set as consistently as possible by generating it directly from an attached software descriptor resource.
5.2. urn:ietf:params:rolie:property:swd:swversion

This property provides an exposure point for the version of the software being described. This value should be generated or taken from the software descriptor linked to by the entry. This helps avoid, but does not prevent, inconsistent versioning schemes being shared.

5.3. urn:ietf:params:rolie:property:swd:swcreator

This property provides an exposure point for a plain text name of the creator of the software being described. This is in many cases an organization or company, but certainly could be a single person. Most software descriptor formats include this information, and where possible, this property should be set equal to that value.

6. Data format requirements

This section defines usage guidance and additional requirements related to data formats above and beyond those specified in [RFC8322]. The following formats are expected to be commonly used to express software descriptor information. For this reason, this document specifies additional requirements to ensure interoperability.

6.1. The ISO SWID 2015 format

6.1.1. Description

ISO/IEC 19770-2:2015 defines a software record data format referred to as a "SWID Tag". It provides several tag types:

- primary: provides descriptive and naming information about software,
- patch: describes non-standalone software meant to patch existing software,
- corpus: describes the software installation media that installs a given piece of software,
- supplemental: provides additional metadata to be deployed alongside a tag.

For a more complete overview as well as normative requirements, refer to ISO/IEC 19770-2:2015 [SWID].
For additional requirements and guidance around creation of SWID Tags, consult NIST Internal Report 8060 [NISTIR8060].

6.1.2. Requirements

For an Entry to be considered as a "SWID Tag Entry", it MUST fulfill the following conditions:

- The information-type of the Entry is "software-descriptor". For a typical Entry, this is derived from the information type of the Feed it is contained in. For a standalone Entry, this is provided by an "atom:category" element.

- The document linked to by the "href" attribute of the "atom:content" element is a 2015 SWID Tag per ISO/IEC 19770-2:2015.

A "SWID Tag Entry" MUST conform to the following requirements:

- The value of the "type" attribute of the "atom:content" element MUST be "application/xml".

- There MUST be one "rolie:property" with the "name" attribute equal to "urn:ietf:params:rolie:property:content-id" and the "value" attribute exactly equal to the "<tagid>" element in the attached SWID Tag. This allows ROLIE consumers to more easily search for SWID tags without needing to download the tag itself.

- There MUST be one "rolie:property" with the "name" attribute equal to "urn:ietf:params:rolie:property:swd:swname", and the "value" attribute equal to the value of the "<name>" element in the attached SWID Tag. As above, this helps ROLIE consumers search and filter Entries.

- There MAY be a property element with the "name" attribute equal to "urn:ietf:params:rolie:property:swd:swversion". When this property appears, its value MUST be equal to the value of the "version" element in the attached SWID Tag.

6.2. The Concise SWID format

6.2.1. Description

The Concise SWID (COSWID) format is an alternative representation of the SWID Tag format using a Concise Binary Object Representation (CBOR) encoding. CBOR provides the format with a reduced size that is more suitable for constrained devices. COSWID provides the same features and attributes as are specified in ISO 19770-2:2015, plus:
a straightforward method to sign and encrypt using COSE, and

additional attributes that provide an improved structure to include file hashes intended to be used as Reference Integrity Measurements (RIM).

For more information and the complete specification, refer to the COSWID internet draft [I-D.ietf-sacm-coswid].

6.2.2. Requirements

For an Entry to be considered as a "COSWID Tag Entry", it MUST fulfill the following conditions:

- The information-type of the Entry is "software-descriptor". For a typical Entry, this is derived from the information-type of the Feed it is contained in. For a standalone Entry, this is provided by an "atom:category" element.

- The document linked to by the "href" attribute of the "atom:content" element is a COSWID Tag per [I-D.ietf-sacm-coswid]

A "COSWID Tag Entry" MUST conform to the following requirements:

- The value of the "type" attribute of the atom:content element MUST be "application/coswid+cbor".

- There MUST be one "rolie:property" with the "name" attribute equal to "urn:ietf:params:rolie:property:content-id" and the "value" attribute exactly equal to the "tag-id" element in the attached COSWID Tag (mapped to integer 0). This allows ROLIE consumers to more easily search for COSWID tags without needing to download the tag itself.

- There MUST be one "rolie:property" with the "name" attribute equal to "urn:ietf:params:rolie:property:swd:swname", and the "value" attribute equal to the value of the "swid-name" element in the attached COSWID Tag (mapped to the integer 1). As above, this helps ROLIE consumers search and filter Entries.

- There MAY be a property element with the "name" attribute equal to "urn:ietf:params:rolie:property:swd:swversion". When this property appears, it’s value MUST be equal to the value of the tag-version element in the attached COSWID Tag (mapped to the integer 12).
7. atom:link Extensions

This section defines additional link relationships that implementations MUST support. These relationships are not registered in the Link Relation IANA table as their use case is too narrow. Each relationship is named and described.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ancestor</td>
<td>Links to a software descriptor resource that defines an ancestor of the software being described by this Entry. This is usually a previous version of the software.</td>
</tr>
<tr>
<td>descendent</td>
<td>Links to a software descriptor resource that defines a descendent of the software being described by this Entry. This is usually a more recent version or edition of the software.</td>
</tr>
<tr>
<td>patches</td>
<td>Links to a software descriptor resource that defines the software being patched by this software</td>
</tr>
<tr>
<td>patchedby</td>
<td>Links to a software descriptor resource that defines the patch or update itself that can be or has been applied to this software.</td>
</tr>
<tr>
<td>requires</td>
<td>Links to a software descriptor resource that defines a piece of software required for this software to function properly, i.e., a dependency.</td>
</tr>
<tr>
<td>requiredBy</td>
<td>Links to a software descriptor resource that defines a piece of software that requires this software to function properly.</td>
</tr>
<tr>
<td>installs</td>
<td>Links to a software descriptor resource that defines the software that is installed by this software.</td>
</tr>
<tr>
<td>installedBy</td>
<td>Links to a software descriptor resource that defines the software package that installs this software.</td>
</tr>
<tr>
<td>patchesVulnerability</td>
<td>Links to a vulnerability that this software update fixes. Used for software descriptors that describe software patches or updates.</td>
</tr>
<tr>
<td>----------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>hasVulnerability</td>
<td>Links to a vulnerability description object that details a vulnerability that this software has.</td>
</tr>
</tbody>
</table>

Table 1: Link Relations for Resource-Oriented Lightweight Indicator Exchange

8. IANA Considerations

8.1. software-descriptor information-type

IANA has added an entry to the "ROLIE Security Resource Information Type Sub-Registry" registry located at <https://www.iana.org/assignments/rolie/category/information-type>.

The entry is as follows:

name: software-descriptor

index: TBD

reference: This document, Section 4

8.2. swd:swname property

IANA has added an entry to the "ROLIE URN Parameters" registry located in <https://www.iana.org/assignments/rolie/>.

The entry is as follows:

name: property:swd:swname


Reference: This document, Section 5.1

Subregistry: None
8.3. swd:swversion property

IANA has added an entry to the "ROLIE URN Parameters" registry located in <https://www.iana.org/assignments/rolie/>.

The entry is as follows:

name: property:swd:swversion


Reference: This document, Section 5.1

Subregistry: None

8.4. swd:swcreator property

IANA has added an entry to the "ROLIE URN Parameters" registry located in <https://www.iana.org/assignments/rolie/>.

The entry is as follows:

name: property:swd:swcreator


Reference: This document, Section 5.1

Subregistry: None

9. Security Considerations

Use of this extension implies dealing with the security implications of both ROLIE and of software descriptors in general. As with any data, care should be taken to verify the trustworthiness and veracity of the descriptor information to the fullest extent possible.

Ideally, software descriptors should be signed by the software manufacturer, or signed by whichever agent processed the source code. Software descriptor documents from these sources are more likely to be accurate than those generated by scraping installed software.

These "authoritative" sources of software descriptor content should consider additional security for their ROLIE repository beyond the typical recommendations, as the central importance of the repository is likely to make it a target.
Version information is often represented differently across manufacturers and even across product releases. If using software version information for low fault tolerance comparisons and searches, care should be taken that the correct version scheme is being used.

10. Normative References

[I-D.ietf-sacm-coswid]

[NISTIR8060]


Appendix A. Schema

This document does not require any schema extensions.
Appendix B. Examples of Use

Use of this extension in a ROLIE repository will not typically change that repository’s operation. As such, the general examples provided by the ROLIE core document would serve as examples. Provided below is a sample software descriptor ROLIE entry:

```xml
<?xml version="1.0" encoding="UTF-8"?>
<entry xmlns="http://www.w3.org/2005/Atom"
   xmlns:rolie="urn:ietf:params:xml:ns:rolie-1.0">
   <id>dd786dba-88e6-440b-9158-b8fae67ef67c</id>
   <title>Sample Software Descriptor</title>
   <published>2015-08-04T18:13:51.0Z</published>
   <updated>2015-08-05T18:13:51.0Z</updated>
   <summary>A descriptor for a piece of software published by this organization.</summary>
   <link rel="self" href="http://www.example.org/rolie/SWD/123456"/>
   <link rel="feed" href="http://www.example.org/rolie/SWD/"/>
   <link rel="requires" href="http://www.example.org/rolie/SWD/78430"/>
   <rolie:property name="urn:ietf:params:rolie:property:swd:swname" value="Example Software Name"/>
   <category
      scheme="urn:ietf:params:rolie:category:information-type"
      term="software-descriptor"/>
   <rolie:format
      ns="http://standards.iso.org/iso/19770/-2/2015/schema.xsd"/>
   <content type="application/xml"
      src="http://www.example.org/rolie/SWD/123456/data"/>
</entry>
```

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