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Software Inventory YANG module based on Software Identifiers
draft-birkholz-yang-swid-02

Abstract

This document provides a YANG module definition that enables a computing context to provide detailed information about installed software components. The structure of the module is based on the Concise Software Identifier draft and therefore also strongly related to the ISO 19770-2:2015 Software Identifiers standard. Both standards provide no interface to transport the SWID tag information between system entities and this document leverages the wide adoption of YANG based management interfaces.

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[1.](#) Introduction

Software Identification Tags (SWID tags [[SWID](#)]) or their binary equivalent - the CoSWID tags [[I-D.ietf-sacm-coswid](#)] - provide a versatile document standard that can be installed in conjunction with a software component on a system entity. There is no standard interface to access, export, or transfer these tag document between system entities. The following YANG module enables full, fine-grained access to every attribute and metadata defined in the SWID standards via a YANG-based management interface. In addition, access to all SWID documents - encoded in XML or CBOR - is enabled by corresponding SWID inventory statement. Changes to the SWID inventory can be emitted via SWID-Updates YANG notifications.

[2.](#) YANG SWID module

Every node defined is read-only, as there is no installation or deployment capability associated with tag information. The descriptions of each attribute are derived from the SWID XML schema definition provided by ISO:

<http://standards.iso.org/iso/19770/-2/2015-current/schema.xsd>

The definitions were adapted and modified if appropriate.

The following summary illustrates the module in tree format. The complete YANG module can be found in [Appendix A](#).

<CODE BEGINS>

```
module: yang-software-identity
  +--ro (swid-inventory-type)
    +--:(native)
```

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```
| +--ro (representation-type)?
|   +--:(isoswid)
|     | +--ro iso-software-identities*      anydata
|     +--:(coswid)
|       +--ro cbor-software-identities*    anydata
+--:(yang-modeled)
  +--ro concise-software-identities*
    +--ro concise-software-identity
      +--ro lang?                          string
      +--ro any-element*
        | +--ro any-attribute
        |   +--ro attribute-name?         string
        |   +--ro attribute-value?       string
      +--ro tag-id                          string
      +--ro swid-name                        string
      +--ro (major-ressource-collection)?
        | +--:(payload)
        | | +--ro payload
        | |   +--ro lang?                  string
        | |   +--ro any-element*
        | |     | +--ro any-attribute
        | |     |   +--ro attribute-name?  string
        | |     |   +--ro attribute-value? string
        | |     +--ro (item-type)?
        | |       +--:(directory)
        | |         | +--ro directory
        | |         |   +--ro directory-path?  string
        | |         +--:(file)
        | |           | +--ro file
        | |           |   +--ro directory-path?  string
        | |           |   +--ro size?            uint32
        | |           |   +--ro file-version?    string
        | |           |   +--ro file-hash
        | |           |     +--ro hash-algo?    int16
        | |           |     +--ro hash-value?   binary
        | |           +--:(key)
```

```

| | | +--ro key? boolean
| | | +--:(location)
| | | | +--ro location? string
| | | | +--:(fs-name)
| | | | +--ro fs-name string
| | | | +--:(root)
| | | | +--ro root? string
| | +--:(evidence)
| | | +--ro evidence
| | | | +--ro lang? string
| | | | +--ro any-element*
| | | | | +--ro any-attribute

```

```

| | | +--ro attribute-name? string
| | | +--ro attribute-value? string
| | +--ro (item-type)?
| | | +--:(directory)
| | | | +--ro directory
| | | | | +--ro directory-path? string
| | | | +--:(file)
| | | | | +--ro file
| | | | | | +--ro directory-path? string
| | | | | | +--ro size? uint32
| | | | | | +--ro file-version? string
| | | | | | +--ro file-hash
| | | | | | | +--ro hash-algo? int16
| | | | | | | +--ro hash-value? binary
| | | +--:(key)
| | | | +--ro key? boolean
| | | +--:(location)
| | | | +--ro location? string
| | | | +--:(fs-name)
| | | | | +--ro fs-name string
| | | | +--:(root)
| | | | | +--ro root? string
| | | +--ro date? string
| | | +--ro device-id? string
| | +--ro additional-resource-collection*
| | | +--ro process
| | | | +--ro lang? string
| | | | +--ro any-element*
| | | | | +--ro any-attribute

```

```

| | |   +--ro attribute-name?   string
| | |   +--ro attribute-value?  string
| | |   +--ro process-name      string
| | |   +--ro pid?              uint16
+--ro resource
| | |   +--ro lang?              string
| | |   +--ro any-element*
| | |   |   +--ro any-attribute
| | |   |   |   +--ro attribute-name?   string
| | |   |   |   +--ro attribute-value?  string
| | |   |   +--ro type?          string
+--ro entity
| | |   +--ro lang?              string
| | |   +--ro any-element*
| | |   |   +--ro any-attribute
| | |   |   |   +--ro attribute-name?   string
| | |   |   |   +--ro attribute-value?  string
| | |   +--ro entity-name      string
| | |   +--ro reg-id?          string

```

```

| | |   +--ro role?              string
| | |   +--ro thumbprint
| | |   |   +--ro hash-algo?      int16
| | |   |   +--ro thumbprint-value?  binary
+--ro link
| | |   +--ro lang?              string
| | |   +--ro any-element*
| | |   |   +--ro any-attribute
| | |   |   |   +--ro attribute-name?   string
| | |   |   |   +--ro attribute-value?  string
| | |   +--ro artifact?         string
| | |   +--ro href               string
| | |   +--ro media?             string
| | |   +--ro ownership?         string
| | |   +--ro rel                 string
| | |   +--ro type?              string
| | |   +--ro use?               string
+--ro software-meta
| | |   +--ro lang?              string
| | |   +--ro any-element*
| | |   |   +--ro any-attribute
| | |   |   |   +--ro attribute-name?   string

```

```

|      |      +--ro attribute-value?  string
|      +--ro activation-status?      string
|      +--ro channel-type?           string
|      +--ro colloquial-version?    string
|      +--ro description?            string
|      +--ro edition?                string
|      +--ro entitlement-data-required? boolean
|      +--ro entitlement-key?        string
|      +--ro generator?              string
|      +--ro persistent-id?          string
|      +--ro product?                string
|      +--ro product-family?         string
|      +--ro revision?               string
|      +--ro summary?                string
|      +--ro unspsc-code?            string
|      +--ro unspsc-version?         string
+--ro corpus?                        boolean
+--ro patch?                          boolean
+--ro media?                          boolean
+--ro supplemental?                  boolean
+--ro tag-version?                   string
+--ro software-version?              string
+--ro version-scheme?                string

```

notifications:

```
+---n swid-inventory-update
```

```

+--ro swid-update-type                identityref
+--ro swid-relationships*
|  +--ro swid-relationship
|    +--ro relationship?              identityref
|    +--ro related-swids*             string
+--ro (representation-type)?
  +--:(isoswid)
  |  +--ro iso-software-identity?      anydata
  +--:(coswid)
  |  +--ro ietf-software-identity?     anydata

```

<CODE ENDS>

[3.](#) IANA considerations

This document includes no requests to IANA.

[4.](#) Security Considerations

This document includes no security considerations yet, but will act as an incubator to create them

[5.](#) Acknowledgements

Eric Voit

[6.](#) Change Log

First version -00

[7.](#) Normative References

[I-D.ietf-sacm-coswid]

Birkholz, H., Fitzgerald-McKay, J., Schmidt, C., and D. Waltermire, "Concise Software Identifiers", [draft-ietf-sacm-coswid-06](#) (work in progress), July 2018.

[SWID]

"Information technology - Software asset management - Part 2: Software identification tag", ISO/IEC 19770-2:2015, October 2015.

[Appendix A.](#) Detailed YANG SWID module

<CODE BEGINS>

```
module yang-software-identity {  
  
    namespace "urn:ietf:params:xml:ns:yang:swid";  
    prefix "yang-swid";  
    organization
```

```
"Fraunhofer SIT";  
contact  
  "Henk Birkholz  
  Fraunhofer Institute for Secure Information Technology  
  Email: henk.birkholz@sit.fraunhofer.de";  
description  
  "The YANG module to provide SWID tags via YANG modeled  
  management interfaces.
```

```

    Copyright (C) Fraunhofer SIT (2017).";
revision "2017-10-30" {
description
    "Initial version";
reference
    "draft-birkholz-yang-swid-00";
}

grouping global-attributes {
    leaf lang {
        type string;
        description
            "An RFC5646 conferment language tag";
    }
    list any-element {
        container any-attribute {
            leaf attribute-name {
                type string;
                description
                    "The name of the custom attribute.";
            }
            leaf attribute-value {
                type string;
                description
                    "The value of the custom attribute.";
            }
        }
    }
}

grouping relative-path {
    leaf directory-path {
        type string;
        description
            "A file-system path expression relative to the SWID tag document,";
    }
}

grouping filesystem-item {
    uses global-attributes;
}

```

```

choice item-type {

```



```

container directory {
    uses relative-path;
}
container file {
    uses relative-path;
    leaf size {
        type uint32;
        description
            "The file size in bytes of the file.";
    }
    leaf file-version {
        type string;
        description
            "The file version.";
    }
    container file-hash {
        leaf hash-algo {
            type int16;
            description
                "The integer index of the IANA Named Information Hash Algorithm
                Registry table";
        }
        leaf hash-value {
            type binary;
            description
                "The binary hash value of the file";
        }
    }
}
leaf key {
    type boolean;
    description
        "Files that are considered important or required
        for the use of a software component. Typical key files
        would be those which, if not available on a system entity,
        would cause the software component not to execute or
        function properly.
        Key files will typically be used to validate that
        a software component referenced by the CoSWID tag document
        is actually installed on a specific system
        entity.";
}
leaf location {
    type string;
    description
        "The directory or location where a file was found
        or can expected to be located. This text-string is intended

```

```
        to include the filename itself. This SHOULD be the relative
        path represented by the root item.";
    }
    leaf fs-name {
        type string;
        mandatory true;
        description
            "The file name or directory name without any path characters.";
    }
    leaf root {
        type string;
        description
            "A system-specific root folder that the location
            item is an offset from. If this is not specified the
            assumption is the root is the same folder as the location of
            the CoSWID tag. The text-string value represents a path
            expression relative to the CoSWID tag document location in
            the (composite) file-system hierarchy.";
    }
}
}
}

identity update-type {
    description
        "The type of update with respect to a change in the SWID inventory.";
}

identity added {
    base update-type;
    description
        "A SIWD was added to the inventory.";
}

identity removed {
    base update-type;
    description
        "A SWID was removed from the inventory.";
}

identity relationship-type {
    description
        "The type of relationship the SWID tag in the inventory update
        notification has to other SWID tags currently in the inventory.";
}

identity patches {
```

```
base relationship-type;
description
```

```
    "This SWID tag represents a software component that patches
      different software components (to be identified via tag-id).";
}

identity supersedes {
  base relationship-type;
  description
    "This SWID tag represents a software component that supersedes
      different software components (to be identified via tag-id).";
}

identity requires {
  base relationship-type;
  description
    "This SWID tag represents a software component that requires
      different software component (to be identified via tag-id).";
}

identity required-by {
  base relationship-type;
  description
    "This SWID tag represents a software component that is required by
      different software components (to be identified via tag-ids).";
}

grouping representation {
  description
    "Identifies the type of the native representation of individual
      SWID documents. On this level, the choice is between
      ISO 19770-2:2015 and I-D.ietf-sacm-coswid Software
      Identifiers: isoswid or coswid. In case of CoMI, the choice
      is between 0 and 1, respectively.";
  choice representation-type {
    case isoswid {
      description
        "Native representation of ISO 19770-2:2015 Software Identifiers";
      leaf-list iso-software-identities {
        type anydata;
        description
```

```

        "A list of XML encoded SWID documents.";
    }
}
case coswid {
    description
        "Native representation of Concise Software Identifiers";
    leaf-list ietf-software-identities {
        type anydata;
        description

```

```

        "A list of CNOR encoded SWID documents.";
    }
}
}
}

notification swid-inventory-update {
    description
        "This notification is emitted, if the composition of software components
        in a computing context changes.";
    leaf swid-update-type {
        type identityref {
            base update-type;
        }
        mandatory true;
        description
            "Indicates if a SWID tag was added or removed.";
    }
    list swid-relationships {
        description
            "A list of relationships to other SWID documents.";
        container swid-relationship {
            description
                "An individual SWID relationship.";
            leaf relationship {
                type identityref {
                    base relationship-type;
                }
                description
                    "The type of relationship, e.g. supersedes or patches.";
            }
            leaf-list related-swids {

```

```

        type string;
        description
            "A list of tag-ids that reference corresponding SWID tags.";
    }
}
}
choice representation-type {
    description
        "Identifies the type of the native representation of individual
        SWID documents. On this level, the choice is between
        ISO 19770-2:2015 and I-D.ietf-sacm-coswid Software
        Identifiers: isoswid or coswid. In case of CoMI, the choice
        is between 0 and 1, respectively.";
    case isoswid {
        description
            "Native representation of ISO 19770-2:2015 Software Identifiers";
    }
}

```

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```

        leaf iso-software-identity {
            type anydata;
            description
                "An XML encoded SWID document.";
        }
    }
    case coswid {
        description
            "Native representation of Concise Software Identifiers";
        leaf ietf-software-identity {
            type anydata;
            description
                "A CNOR encoded SWID document.";
        }
    }
}
}

choice swid-inventory-type {
    config false;
    mandatory true;
    description
        "Identifies the representation of the SWID inventory.
        On this level, the choice is between native representation and
        YANG representation: native or yang-modeled. In case of CoMI,

```

```

    the choice is between 0 and 1, respectively.";
case native {
  choice representation-type {
    description
      "Identifies the type of the native representation of individual
      SWID documents. On this level, the choice is between
      ISO 19770-2:2015 and I-D.ietf-sacm-coswid Software
      Identifiers: isoswid or coswid. In case of CoMI, the choice
      is between 0 and 1, respectively.";
    case isoswid {
      description
        "Native representation of ISO 19770-2:2015 Software Identifiers";
      leaf-list iso-software-identities {
        type anydata;
        description
          "A list of XML encoded SWID documents.";
      }
    }
    case coswid {
      description
        "Native representation of Concise Software Identifiers";
      leaf-list cbor-software-identities {
        type anydata;

```

```

      description
        "A list of CNOR encoded SWID documents.";
    }
  }
}
}
case yang-modeled {
  description
    "A list of YANG-modeled SWID document containers.";
  list concise-software-identities {
    container concise-software-identity {
      uses global-attributes;
      leaf tag-id {
        type string;
        mandatory true;
        description
          "An identifier uniquely referencing a (composite)
          software component. The tag identifier is intended to be

```

```

        globally unique. There are no strict guidelines on how this
        identifier is structured, but examples include a 16 byte
        GUID (e.g. class 4 UUID).";
    }
    leaf swid-name {
        type string;
        mandatory true;
        description
            "This item provides the software component name as
            it would typically be referenced. For example, what would
            be seen in the add/remove dialog on a Windows device, or
            what is specified as the name of a packaged software product
            or a patch identifier name on a Linux device.";
    }
    choice major-ressource-collection {
        container payload {
            uses filesystem-item;
        }
        container evidence {
            uses filesystem-item;
            leaf date {
                type string;
                description
                    "The sate and time evidence represented by an
                    evidence item was gathered.";
            }
            leaf device-id {
                type string;
                description
                    "A text-string identifier for a device

```

```

        evidence was gathered from.";
    }
}
}
list additional-resource-collection {
    container process {
        uses global-attributes;
        leaf process-name {
            type string;
            mandatory true;
            description

```

```

        "The process name as it will be found in the
        system entity's process table.";
    }
    leaf pid {
        type uint16;
        description
            "The process ID for the process in execution
            that can be included in the process item as part of an
            evidence tag.";
    }
}
container resource {
    uses global-attributes;
    leaf type {
        type string;
        description
            "The type of resource represented via a
            text-string (typically, registry-key, port
            or root-uri).";
    }
}
container entity {
    uses global-attributes;
    leaf entity-name {
        type string;
        mandatory true;
        description
            "The text-string name of the organization
            claiming a particular role in the SWID tag";
    }
    leaf reg-id {
        type string;
        description
            "The registration id is intended to uniquely
            identify a naming authority in a given scope (e.g. global,
            organization, vendor, customer, administrative domain, etc.)
            that is implied by the referenced naming authority. The

```

```

value of an registration ID MUST be a RFC 3986 URI. The
scope SHOULD be the scope of an organization. In a given
scope, the registration id MUST be used consistently.";
}

```



```

leaf role {
  type string;
  description
    "The relationship between this organization
    and this tag. The role of tag creator is required for every
    SWID tag. The role of an entity may include any role value,
    but the per-defined roles include: "aggregator",
    "distributor", "licensor", "software-creator",
    "tag-creator". The enumerations of this will include a
    request to IANA in order to be reference-able via an integer
    index.";
}
container thumbprint {
  leaf hash-algo {
    type int16;
    description
      "The integer index of the IANA Named Information Hash Algorithm
      Registry table that is used to create the
      thumbprint.";
  }
  leaf thumbprint-value {
    type binary;
    description
      "This value provides a hexadecimal string
      that contains a hash (i.e. the thumbprint) of the signing
      entities certificate.";
  }
}
container link {
  uses global-attributes;
  leaf artifact {
    type string;
    description
      "For installation media
      (rel=installation-media); dictates the canonical name for
      the file.
      Items with the same artifact name should be considered
      mirrors of each other (so download from
      wherever works).";
  }
  leaf href {
    type string;
    mandatory true;
  }
}

```

```
    description
      "An URI pointing to the resource referenced
       using a system-acceptable URI scheme (e.g., file:// http://
       https:// ftp://), including yang+swid://";
  }
  leaf media {
    type string;
    description
      "This text value is a hint to the tag consumer
       to understand what this SWID tag applies to. This item can
       also be included in the link item to represent a attributes
       defined by the W3C Media Queries Recommendation (see
       http://www.w3.org/TR/css3-mediaqueries/). A hint to the
       consumer of the link to what the target item is applicable
       for.";
  }
  leaf ownership {
    type string;
    description
      "Determines the relative strength of ownership
       of the software components. Valid enumerations are: abandon,
       private, shared.";
  }
  leaf rel {
    type string;
    mandatory true;
    description
      "The relationship between this SWID and the
       target file. Relationships can be identified by referencing
       the IANA registration library:
       https://www.iana.org/assignments/link-relations/link-relatio
";
  }
  leaf type {
    type string;
    description
      "A longer, detailed description of the
       software. This description can be multiple sentences
       (differentiated from summary, which is a very short,
       one-sentence description).";
  }
  leaf use {
    type string;
    description
      "Determines if the target software is a hard
       requirement or not. Valid enumerations are: required,
       recommended, optional.";
  }
}
```

}

```
container software-meta {
  uses global-attributes;
  leaf activation-status {
    type string;
    description
      "Identification of the activation status of
      this software title (e.g. Trial, Serialized, Licensed,
      Unlicensed, etc). Typically, this is used in supplemental
      tags.";
  }
  leaf channel-type {
    type string;
    description
      "Provides information on which channel this
      particular software was targeted for (e.g. Volume, Retail,
      OEM, Academic, etc). Typically used in supplemental tags.";
  }
  leaf colloquial-version {
    type string;
    description
      "The informal or colloquial version of the
      product (i.e. 2013). Note that this version may be the same
      through multiple releases of a software product where the
      version specified in entity is much more specific and will
      change for each software release.
      Note that this representation of version is typically used
      to identify a group of specific software releases that are
      part of the same release/support infrastructure (i.e.
      Fabrikam Office 2013). This version is used for string
      comparisons only and is not compared to be an earlier or
      later release (that is done via the entity
      version).";
  }
  leaf description {
    type string;
    description
      "A longer, detailed description of the
      software. This description can be multiple sentences
      (differentiated from summary, which is a very short,
      one-sentence description).";
  }
}
```

```

}
leaf edition {
    type string;
    description
        "The variation of the product (Extended,
        Enterprise, Professional, Standard etc).";
}
leaf entitlement-data-required {

```

```

    type boolean;
    description
        "An indicator to determine if there should be
        accompanying proof of entitlement when a software license
        reconciliation is completed.";
}
leaf entitlement-key {
    type string;
    description
        "A vendor-specific textual key that can be
        used to reconcile the validity of an entitlement. (e.g.
        serial number, product or license key).";
}
leaf generator {
    type string;
    description
        "The name of the software tool that created a
        SWID tag. This item is typically used if tags are created
        on the fly or via a catalog-based analysis for data found on
        a computing device.";
}
leaf persistent-id {
    type string;
    description
        "A GUID used to represent products installed
        where the product are related, but may be different
        versions. For example, an "upgradeCode" (see
        http://msdn.microsoft.com/en-us/library/aa372375\(v=vs.85\).as
        as an reference for this example).";
}
leaf product {
    type string;
    description

```

```
        "The base name of the product (e.g. Office,
          Creative Suites, Websphere, etc).";
    }
leaf product-family {
    type string;
    description
        "The overall product family this software
        belongs to. Product family is not used to identify that a
        product is part of a suite, but is instead used when a set
        of products that are all related may be installed on
        multiple different devices.
        For example, an enterprise backup system may consist of a
        backup services, multiple different backup services that
        support mail services, databases and ERP systems, as well as
        individual software components that backup client system
```

```
        entities. In such an usage scenario, all software components
        that are part of the backup system would have the same
        product-family name so they can be grouped together in
        respect to reporting systems.";
    }
leaf revision {
    type string;
    description
        "The informal or colloquial representation of
        the sub-version of the given product (ie, SP1, R2, RC1, Beta
        2, etc). Note that the SoftwareIdentity.version will
        provide very exact version details,
        the revision is intended for use in environments where
        reporting on the informal or colloquial representation of
        the software is important (for example, if for a certain
        business process, an organization recognizes that it must
        have, for example "ServicePack 1" or later of a specific
        product installed on all devices, they can use the revision
        data value to quickly identify any devices that do not meet
        this requirement).
        Depending on how a software organizations distributes
        revisions, this value could be specified in a primary (if
        distributed as an upgrade) or supplemental (if distributed
        as a patch) SWID tag.";
    }
leaf summary {
```

```

    type string;
    description
        "A short (one-sentence) description of the
        software.";
}
leaf unspsc-code {
    type string;
    description
        "An 8 digit code that provides UNSPSC
        classification of the software product this SWID tag
        identifies. For more information see,
        http://www.unspsc.org/.";
}
leaf unspsc-version {
    type string;
    description
        "An 8 digit code that provides UNSPSC
        classification of the software product this SWID tag
        identifies. For more information see,
        http://www.unspsc.org/.";
}
}

```

```

}
leaf corpus {
    type boolean;
    description
        "Set to true, if this attribute specifies that this SWID tag is a
        collection of information that describes the pre-installation
        data of software component.";
}
leaf patch {
    type boolean;
    description
        "A set of files that is intended to modify an
        existing set of files (including configuration files,
        scripts and corresponding environment variables that are
        create by the OS for the runtime environment) that composes
        a software component. A software component patch does
        neither alter the version number (see 13) nor the release
        details (descriptive english text, see 44) of a software
        components.

```

If a SWID tag is a patch, it MUST contain the patch item and its value MUST be set to true.

It is recommended but not required to include a rel(ation) item in a patch CoSWID. If a CoSWID includes a patch member, but not a rel member, it is implied that it SHOULD be installed independently of any other CoSWID tag document -- even if an effective but not explicit relationship exists.";

```
}
leaf media {
  type boolean;
  description
    "This text value is a hint to the tag consumer to
    understand what this SWID tag applies to. This item can also
    be included in the link item to represent a attributes
    defined by the W3C Media Queries Recommendation (see
    http://www.w3.org/TR/css3-mediaqueries/). A hint to the
    consumer of the link to what the target item is applicable
    for.";
}
leaf supplemental {
  type boolean;
  description
    "Specifies that this tag provides supplemental tag
    data that can be merged with primary tag data to create a
    complete record of the software information. Supplemental
    tags will often be provided at install time and may be
```

```
provided by different entities (such as the tag consumer, or
a Value Added Reseller).";
```

```
}
leaf tag-version {
  type string;
  description
    "This item indicates if a specific release of a
    software component has more than one tag that can represent
    that specific release. This may be the case if a CoSWID tag
    producer creates and releases an incorrect tag that they
    subsequently want to fix, but with no underlying changes to
    the product the CoSWID tag represents. This could happen if,
```

for example, a patch is distributed that has a link reference that does not cover all the various software releases it can patch. A newer CoSWID tag for that patch can be generated and the tag-version value incremented to indicate that the data is updated.";

```
}
leaf software-version {
  type string;
  description
    "Underlying development version for the software
    component.";
}
leaf version-scheme {
  type string;
  description
    "Scheme used for the version number. Valid
    enumerations are :
    * alphanumeric: strictly a string, sorting alphanumerically
    * decimal: a floating point number (i.e., 1.25 is less than
      1.3 )
    * multipartnumeric: numbers separated via dots, where the
      numbers are interpreted as integers (ie, 1.2.3 , 1.4.5.6
      , 1.2.3.4.5.6.7). This string convention is similar to
      OIDs.
    * multipartnumeric+suffix: numbers separated via dots, where
      the numbers are interpreted as integers with an additional
      string suffix (e.g., 1.2.3a).
    * semver: a string as defined by the semver.org spec [FixME:
      reference]
    * unknown: the last resort choice, no attempt should be made
      to order these";
}
}
}
}
```


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