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YANG Module Tags
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Abstract

This document provides for the association of tags with YANG modules. The expectation is for such tags to be used to help classify and organize modules. A method for defining, reading and writing a modules tags is provided. Tags may be standardized and assigned during module definition; assigned by implementations; or dynamically defined and set by users. This document provides guidance to future model writers and, as such, this document updates [RFC8407].

Status of This Memo

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1. Introduction

The use of tags for classification and organization is fairly ubiquitous not only within IETF protocols, but in the internet itself (e.g., #hashtags). One benefit of using tags for organization over a rigid structure is that it is more flexible and can more easily adapt over time as technologies evolve. Tags can be usefully standardized, but they can also serve as a non-standardized mechanism available for users to define themselves. This document provides a mechanism to define tags and associate them with YANG modules in a flexible manner. In particular, tags may be standardized as well as assigned during module definition; assigned by implementations; or dynamically defined and set by users.

This document defines a YANG module [RFC6020] which provides a list of module entries to allow for adding or removing of tags as well as viewing the set of tags associated with a module.

This document defines an extension statement to be used to indicate tags that SHOULD be added by the module implementation automatically (i.e., outside of configuration).

This document also defines an IANA registry for tag prefixes as well as a set of globally assigned tags.

Section 7 provides guidelines for authors of YANG data models. This section updates [RFC8407].

1.1. Some possible use cases of YANG module tags

During this documents progression there were requests for example uses of module tags. The following are a few example use cases for tags. This list is certainly not exhaustive.

One example use of tags would be to help filter different discrete categories of YANG modules supported by a device. E.g., if modules are suitably tagged, then an XPath query can be used to list all of the vendor modules supported by a device.

Tags can also be used to help coordination when multiple semi-independent clients are interacting with the same devices. E.g., one management client could mark that some modules should not be used because they have not been verified to behave correctly, so that other management clients avoid querying the data associated with those modules.

Tag classification is useful for users searching module repositories (e.g. YANG catalog). A query restricted to the 'ietf:routing' module tag could be used to return only the IETF YANG modules associated with routing. Without tags, a user would need to know the name of all the IETF routing protocol YANG modules.

Future management protocol extensions could allow for filtering queries of configuration or operational state on a server based on tags. E.g., return all operational state related to system-management.

2. Conventions Used in This Document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in

[RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

3. Tag Values

All tags begin with a prefix indicating who owns their definition. An IANA registry is used to support standardizing tag prefixes. Currently 3 prefixes are defined with all others reserved. No further structure is imposed by this document on the value following the standard prefix, and the value can contain any yang type 'string' characters except carriage-returns, newlines and tabs.

3.1. IETF Standard Tags

An IETF standard tag is a tag that has the prefix "ietf:". All IETF standard tags are registered with IANA in a registry defined later in this document.

3.2. Vendor Tags

A vendor tag is a tag that has the prefix "vendor:". These tags are defined by the vendor that implements the module, and are not standardized; however, it is RECOMMENDED that the vendor include extra identification in the tag to avoid collisions such as using the enterpise or organization name follwing the "vendor:" prefix (e.g., vendor:example.com:vendor-defined-classifier).

3.3. User Tags

A user tag is any tag that has the prefix "user:". These tags are defined by the user/administrator and will never be standardized.

3.4. Reserved Tags

Any tag not starting with the prefix "ietf:", "vendor:" or "user:" is reserved for future standardization.

4. Tag Management

Tags can become associated with a module in a number of ways. Tags may be defined and associated at module design time, at implementation time, or via user administrative control. As the main consumer of tags are users, users may also remove any tag, no matter how the tag became associated with a module.

4.1. Module Definition Association

A module definition can indicate a set of tags to be added by the module implementer. These design time tags are indicated using the module-tag extension statement. If the module definition will be IETF standards track, the tags MUST also be IETF standard tags (Section 3.1). Thus, new modules can drive the addition of new standard tags to the IANA registry, and the IANA registry can serve as a check against duplication.

4.2. Implementation Association

An implementation MAY include additional tags associated with a module. These tags may be standard or vendor specific tags.

4.3. Administrative Tagging

Tags of any kind can be assigned and removed with using normal configuration mechanisms.

5. Tags Module Structure

5.1. Tags Module Tree

The tree associated with the "ietf-module-tags" module follows. The meaning of the symbols can be found in [RFC8340].

```
module: ietf-module-tags
  +--rw module-tags
     +--rw module* [name]
        +--rw name          yang:yang-identifier
        +--rw tag*          tag
        +--rw masked-tag*   tag
```

5.2. Tags Module

```
<CODE BEGINS> file "ietf-module-tags@2018-10-17.yang"
module ietf-module-tags {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-module-tags";
  prefix tags;

  import ietf-yang-types {
    prefix yang;
  }

  organization
    "IETF NetMod Working Group (NetMod)";
```

```
  contact
    "NetMod Working Group - <netmod@ietf.org>";

  // RFC Ed.: replace XXXX with actual RFC number and
  // remove this note.

  description
    "This module describes a mechanism associating tags with YANG
     modules. Tags may be IANA assigned or privately defined.

     Copyright (c) 2018 IETF Trust and the persons identified as
     authors of the code. All rights reserved.

     Redistribution and use in source and binary forms, with or
     without modification, is permitted pursuant to, and subject to
     the license terms contained in, the Simplified BSD License set
     forth in Section 4.c of the IETF Trust's Legal Provisions
     Relating to IETF Documents
     (https://trustee.ietf.org/license-info).

     The key words 'MUST', 'MUST NOT', 'REQUIRED', 'SHALL', 'SHALL
     NOT', 'SHOULD', 'SHOULD NOT', 'RECOMMENDED', 'MAY', and
     'OPTIONAL' in the module text are to be interpreted as described
     in RFC 2119 (https://tools.ietf.org/html/rfc2119).

     This version of this YANG module is part of RFC XXXX
     (https://tools.ietf.org/html/rfcXXXX); see the RFC itself for
     full legal notices.";

  // RFC Ed.: update the date below with the date of RFC publication
  // and RFC number and remove this note.

  revision 2018-10-17 {
    description
      "Initial revision.";
    reference "RFC XXXX: YANG Module Tags";
  }

  typedef tag {
    type string {
      length "1..max";
      pattern '[a-zA-Z_][a-zA-Z0-9\-_]*:[\S ]+';
    }
    description
      "A tag value is composed of a standard prefix followed by any type
       'string' value that does not include carriage return, newline or
       tab characters.";
  }
```

```
  extension module-tag {
    argument tag;
    description
      "The argument 'tag' is of type 'tag'. This extension statement is
       used by module authors to indicate the tags that SHOULD be added
       automatically by the system. As such the origin of the value
       for the pre-defined tags should be set to 'system'.";
  }

  container module-tags {
    description
      "Contains the list of modules and their associated tags";
    list module {
      key "name";
      description
        "A list of modules and their associated tags";
      leaf name {
        type yang:yang-identifier;
        mandatory true;
        description
          "The YANG module name.";
      }
      leaf-list tag {
        type tag;
        description
          "Tags associated with the module. See the IANA 'YANG Module
           Tag Prefix' registry for reserved prefixes and the IANA 'YANG
           Module IETF Tag' registry for IETF standard tags.

           The operational view of this list is constructed using the following
steps:

           1) System added tags are added.
           2) User configured tags are added.
           3) Any tag that is equal to a masked-tag is removed.";
      }
      leaf-list masked-tag {
        type tag;
        description
          "The list of tags that should not be associated with this
           module. This user can remove (mask) tags by adding
           them to this list. It is not an error to add tags to this
           list that are not associated with the module.";
      }
    }
  }
}
<CODE ENDS>
```

6. Other Classifications

It's worth noting that a different YANG module classification document exists [RFC8199]. That document is classifying modules in only a logical manner and does not define tagging or any other mechanisms. It divides YANG modules into 2 categories (service or element) and then into one of 3 origins: standard, vendor or user. It does provide a good way to discuss and identify modules in general. This document defines standard tags to support [RFC8199] style classification.

7. Guidelines to Model Writers

This section updates [RFC8407].

7.1. Define Standard Tags

A module can indicate using module-tag extension statements a set of tags that are to be automatically associated with it (i.e., not added through configuration).

```
module example-module {
  ...
  import module-tags { prefix tags; }

  tags:module-tag "ietf:some-new-tag";
  tags:module-tag "ietf:some-other-tag";
  ...
}
```

The module writer can use existing standard tags, or use new tags defined in the model definition, as appropriate. For standardized modules new tags MUST be assigned in the IANA registry defined below, see Section 8.2 below.

8. IANA Considerations

8.1. YANG Module Tag Prefix Registry

This registry allocates tag prefixes. All YANG module tags SHOULD begin with one of the prefixes in this registry.

The allocation policy for this registry is Specification Required [RFC5226].

The initial values for this registry are as follows.

```
 prefix    description
 --------  ------------------------------------------------
 ietf:     IETF Standard Tag allocated in the IANA YANG Module
           IETF Tag Registry.
 vendor:   Non-standardized tags allocated by the module implementer.
 user:    Non-standardized tags allocated by and for the user.
```

Other SDOs (standard organizations) wishing to standardize their own set of tags could allocate a top level prefix from this registry.

8.2. YANG Module IETF Tag Registry

This registry allocates prefixes that have the standard prefix "ietf:". New values should be well considered and not achievable through a combination of already existing standard tags.

The allocation policy for this registry is IETF Review [RFC5226].

The initial values for this registry are as follows.

Tag	Description	Reference
ietf:rfc8199-element	A module for a network element.	[RFC8199]
ietf:rfc8199-service	A module for a network service.	[RFC8199]
ietf:rfc8199-standard	A module defined by a standards organization.	[RFC8199]
ietf:rfc8199-vendor	A module defined by a vendor.	[RFC8199]
ietf:rfc8199-user	A module defined by the user.	[RFC8199]
ietf:hardware	A module relating to hardware (e.g., inventory).	[This document]
ietf:software	A module relating to software (e.g., installed OS).	[This document]
ietf:qos	A module for managing quality of service.	[This document]

ietf:protocol	A module representing a protocol.	[This document]
ietf:system-management	A module relating to system management (e.g., a system management protocol such as syslog, TACAC+, SNMP, netconf, ...).	[This document]
ietf:network-service	A module relating to network service (e.g., a network service protocol such as an NTP server, DNS server, DHCP server, etc).	[This document]
ietf:oam	A module representing Operations, Administration, and Maintenance (e.g., BFD).	[This document]
ietf:routing	A module related to routing.	[This document]
ietf:signaling	A module representing control plane signaling.	[This document]
ietf:lmp	A module representing a link management protocol.	[This document]

Table 1: IETF Module Tag Registry

9. Acknowledgements

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10. References

10.1. Normative References

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[RFC5226] Narten, T. and H. Alvestrand, "Guidelines for Writing an IANA Considerations Section in RFCs", RFC 5226, DOI 10.17487/RFC5226, May 2008, <https://www.rfc-editor.org/info/rfc5226>.

[RFC6020] Bjorklund, M., Ed., "YANG - A Data Modeling Language for the Network Configuration Protocol (NETCONF)", RFC 6020, DOI 10.17487/RFC6020, October 2010, <https://www.rfc-editor.org/info/rfc6020>.

[RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174, May 2017, <https://www.rfc-editor.org/info/rfc8174>.

[RFC8199] Bogdanovic, D., Claise, B., and C. Moberg, "YANG Module Classification", RFC 8199, DOI 10.17487/RFC8199, July 2017, <https://www.rfc-editor.org/info/rfc8199>.

[RFC8407] Bierman, A., "Guidelines for Authors and Reviewers of Documents Containing YANG Data Models", BCP 216, RFC 8407, DOI 10.17487/RFC8407, October 2018, <https://www.rfc-editor.org/info/rfc8407>.

10.2. Informative References

[RFC8340] Bjorklund, M. and L. Berger, Ed., "YANG Tree Diagrams", BCP 215, RFC 8340, DOI 10.17487/RFC8340, March 2018, <https://www.rfc-editor.org/info/rfc8340>.

Appendix A. Example

The following is a fictional example result from a query of the module tags list. For the sake of brevity only a few module results are imagined.

```
{
  "ietf-module-tags:module-tags": {
    "module": [
      {
        "name": "ietf-bfd",
        "tag": [
          "ietf:protocol",
          "ietf:oam",
          "ietf:rfc8199-element",
          "ietf:rfc8199-standard"
        ]
      },
      {
        "name": "ietf-isis",
        "tag": [
          "ietf:protocol",
          "ietf:rfc8199-element",
          "ietf:rfc8199-standard",
          "ietf:routing"
        ]
      },
      {
        "name": "ietf-ssh-server",
        "tag": [
          "ietf:protocol",
          "ietf:rfc8199-element",
          "ietf:rfc8199-standard",
          "ietf:system-management"
        ]
      }
    ]
  }
}
```

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