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Guidelines for Authors and Reviewers of YANG Data Model Documents
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Abstract

This memo provides guidelines for authors and reviewers of standards track specifications containing YANG data model modules. Applicable portions may be used as a basis for reviews of other YANG data model documents. Recommendations and procedures are defined, which are intended to increase interoperability and usability of Network Configuration Protocol (NETCONF) implementations which utilize YANG data model modules.

Status of this Memo

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1. Introduction

The standardization of network configuration interfaces for use with the Network Configuration Protocol (NETCONF) [RFC4741] requires a modular set of data models, which can be reused and extended over time.

This document defines a set of usage guidelines for standards track documents containing YANG [I-D.ietf-netmod-yang] data models. YANG is used to define the data structures, protocol operations, and notification content used within a NETCONF server. A server which supports a particular YANG module will support client NETCONF operation requests, as indicated by the specific content defined in the YANG module.

This document is similar to the SMIV2 usage guidelines specification [RFC4181] in intent and structure. However, since that document was written a decade after SMIV2 modules had been in use, it was published as a 'best current practice' (BCP). This document is not a BCP, but rather an informational reference, intended to promote consistency in documents containing YANG modules.

Many YANG constructs are defined as optional to use, such as the description statement. However, in order to maximize interoperability of NETCONF implementations utilizing YANG data models, it is desirable to define a set of usage guidelines which may require a higher level of compliance than the minimum level defined in the YANG specification.

In addition, YANG allows constructs such as infinite length identifiers and string values, or top-level mandatory nodes, that a compliant server is not required to support. Only constructs which all servers are required to support can be used in IETF YANG modules.

This document defines usage guidelines related to the NETCONF operations layer, and NETCONF content layer, as defined in [RFC4741]. These guidelines are intended to be used by authors and reviewers to improve the readability and interoperability of published YANG data models.

2. Terminology

2.1. Requirements Notation

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].

RFC 2119 language is used here to express the views of the NETMOD working group regarding content for YANG modules. YANG modules complying with this document will treat the RFC 2119 terminology as if it were describing best current practices.

2.2. NETCONF Terms

The following terms are defined in [RFC4741] and are not redefined here:

- o capabilities
- o client
- o operation
- o server

2.3. YANG Terms

The following terms are defined in [I-D.ietf-netmod-yang] and are not redefined here:

- o data node
- o module
- o namespace
- o submodule
- o version
- o YANG
- o YIN

Note that the term 'module' may be used as a generic term for a YANG module or submodule. When describing properties which are specific to submodules, the term 'submodule' is used instead.

2.4. Terms

The following terms are used throughout this document:

published: A stable release of a module or submodule, usually contained in an RFC.

unpublished: An unstable release of a module or submodule, usually contained in an Internet-Draft.

3. General Documentation Guidelines

YANG data model modules under review are likely to be contained in Internet-Drafts. All guidelines for Internet-Draft authors MUST be followed. These guidelines are defined in [RFC2223] and updated in [RFC5741]. Additional information is also available online at:

<http://www.rfc-editor.org/rfc-editor/instructions2authors.txt>

The following sections MUST be present in an Internet-Draft containing a module:

- o Narrative sections
- o Definitions section
- o Security Considerations section
- o IANA Considerations section
- o References section

3.1. Module Copyright

The module description statement MUST contain a reference to the latest approved IETF Trust Copyright statement, which is available on-line at:

<http://trustee.ietf.org/license-info/>

Each YANG module or submodule contained within an Internet-Draft or RFC is considered to be a code component. The strings '<CODE BEGINS>' and '<CODE ENDS>' MUST be used to identify each code component.

The '<CODE BEGINS>' tag SHOULD be followed by a string identifying the file name specified in section 5.2 of [I-D.ietf-netmod-yang]. The following example is for the '2010-01-18' revision of the 'ietf-foo' module:

```
<CODE BEGINS> file "ietf-foo@2010-01-18.yang"
module ietf-foo {
    // ...
    revision 2010-01-18 {
        description "Latest revision";
        reference "RFC XXXXX";
    }
    // ...
}
<CODE ENDS>
```

Figure 1

3.2. Narrative Sections

The narrative part **MUST** include an overview section that describes the scope and field of application of the module(s) defined by the specification and that specifies the relationship (if any) of these modules to other standards, particularly to standards containing other YANG modules. The narrative part **SHOULD** include one or more sections to briefly describe the structure of the modules defined in the specification.

If the module(s) defined by the specification import definitions from other modules (except for those defined in the YANG [I-D.ietf-netmod-yang] or YANG Types [I-D.ietf-netmod-yang-types] documents), or are always implemented in conjunction with other modules, then those facts **MUST** be noted in the overview section, as **MUST** be noted any special interpretations of definitions in other modules.

3.3. Definitions Section

This section contains the module(s) defined by the specification. These modules **MUST** be written using the YANG syntax defined in [I-D.ietf-netmod-yang]. A YIN syntax version of the module **MAY** also be present in the document. There **MAY** also be other types of modules present in the document, such as SMIV2, which are not affected by these guidelines.

See Section 4 for guidelines on YANG usage.

3.4. Security Considerations Section

Each specification that defines one or more modules **MUST** contain a section that discusses security considerations relevant to those

modules. This section **MUST** be patterned after the latest approved template (available at <http://www.ops.ietf.org/netconf/yang-security-considerations.txt>).

In particular:

- o Writable data nodes that could be especially disruptive if abused **MUST** be explicitly listed by name and the associated security risks **MUST** be explained.
- o Readable data nodes that contain especially sensitive information or that raise significant privacy concerns **MUST** be explicitly listed by name and the reasons for the sensitivity/privacy concerns **MUST** be explained.
- o Operations (i.e., YANG 'rpc' statements) which are potentially harmful to system behavior or that raise significant privacy concerns **MUST** be explicitly listed by name and the reasons for the sensitivity/privacy concerns **MUST** be explained.

3.5. IANA Considerations Section

In order to comply with IESG policy as set forth in <http://www.ietf.org/ID-Checklist.html>, every Internet-Draft that is submitted to the IESG for publication which has action items for IANA **MUST** contain an IANA Considerations section. The requirements for this section vary depending what actions are required of the IANA. If there are no IANA considerations applicable to the document, then the IANA Considerations section is not required. Refer to the guidelines in [RFC5226] for more details.

3.5.1. Documents that Create a New Name Space

If an Internet-Draft defines a new name space that is to be administered by the IANA, then the document **MUST** include an IANA Considerations section, that specifies how the name space is to be administered.

Specifically, if any YANG module namespace statement value contained in the document is not already registered with IANA, then a new YANG Namespace registry entry **MUST** be requested from the IANA. The YANG [I-D.ietf-netmod-yang] specification includes the procedure for this purpose in its IANA Considerations section.

3.5.2. Documents that Extend an Existing Name Space

It is possible to extend an existing namespace using a YANG submodule which belongs to an existing module already administered by IANA. In

this case, the document containing the main module MUST be updated to use the latest revision of the submodule.

3.6. Reference Sections

For every import or include statement which appears in a module contained in the specification, which identifies a module in a separate document, a corresponding normative reference to that document MUST appear in the Normative References section. The reference MUST correspond to the specific module version actually used within the specification.

For every normative reference statement which appears in a module contained in the specification, which identifies a separate document, a corresponding normative reference to that document SHOULD appear in the Normative References section. The reference SHOULD correspond to the specific document version actually used within the specification. If the reference statement identifies an informative reference, which identifies a separate document, a corresponding informative reference to that document MAY appear in the Informative References section.

4. YANG Usage Guidelines

In general, modules in IETF standards-track specifications MUST comply with all syntactic and semantic requirements of YANG. [I-D.ietf-netmod-yang]. The guidelines in this section are intended to supplement the YANG specification, which is intended to define a minimum set of conformance requirements.

In order to promote interoperability and establish a set of practices based on previous experience, the following sections establish usage guidelines for specific YANG constructs.

Only guidelines which clarify or restrict the minimum conformance requirements are included here.

4.1. Module Naming Conventions

Modules contained in standards track documents SHOULD be named according to the guidelines in the IANA considerations section of [I-D.ietf-netmod-yang].

A distinctive word or acronym (e.g., protocol name or working group acronym) SHOULD be used in the module name. If new definitions are being defined to extend one or more existing modules, then the same word or acronym should be reused, instead of creating a new one.

All published module names MUST be unique. For a YANG module published in an RFC, this uniqueness is guaranteed by IANA. For unpublished modules, the authors need to check that no other work in progress is using the same module name.

Once a module name is published, it MUST NOT be reused, even if the RFC containing the module is reclassified to 'Historic' status.

4.2. Identifiers

Identifiers for all YANG identifiers in published modules MUST be between 1 and 64 characters in length. These include any construct specified as an 'identifier-arg-str' token in the ABNF in section 12 of [I-D.ietf-netmod-yang].

4.3. Defaults

In general, it is suggested that sub-statements containing very common default values SHOULD NOT be present. The following sub-statements are commonly used with the default value, which would make the module difficult to read if used everywhere they are allowed.

Statement	Default Value
config	true
mandatory	false
max-elements	unbounded
min-elements	0
ordered-by	system
status	current
yin-element	false

4.4. Conditional Statements

A module may be conceptually partitioned in several ways, using the 'if-feature' and/or 'when' statements.

Data model designers need to carefully consider all modularity aspects, including the use of YANG conditional statements.

If a data definition is optional, depending on server support for a NETCONF protocol capability, then a YANG 'feature' statement SHOULD be defined to indicate that the NETCONF capability is supported within the data model.

If any notification data, or any data definition, for a non-configuration data node is not mandatory, then the server may or may not be required to return an instance of this data node. If any conditional requirements exist for returning the data node in a notification payload or retrieval request, they MUST be documented somewhere. For example, a 'when' or 'if-feature' statement could apply to the data node, or the conditional requirements could be explained in a 'description' statement within the data node or one of its ancestors (if any).

4.5. XPath Usage

This section describes guidelines for using the XML Path Language [W3C.REC-xpath-19991116] (XPath) within YANG modules.

The 'attribute' and 'namespace' axes are not supported in YANG, and MAY be empty in a NETCONF server implementation.

The 'position' and 'last' functions SHOULD NOT be used. This applies to implicit use of the 'position' function as well (e.g., '//chapter[42]'). A server is only required to maintain the relative XML document order of all instances of a particular user-ordered list or leaf-list. The 'position' and 'last' functions MAY be used if they are evaluated in a context where the context node is a user-ordered 'list' or 'leaf-list'.

The 'preceding', and 'following' axes SHOULD NOT be used. These constructs rely on XML document order within a NETCONF server configuration database, which may not be supported consistently or produce reliable results across implementations. Predicate expressions based on static node properties (e.g., element name or value, 'ancestor' or 'descendant' axes) SHOULD be used instead. The 'preceding' and 'following' axes MAY be used if document order is not relevant to the outcome of the expression (e.g., check for global uniqueness of a parameter value.)

The 'preceding-sibling' and 'following-sibling' axes SHOULD NOT be used. A server is only required to maintain the relative XML document order of all instances of a particular user-ordered list or leaf-list. The 'preceding-sibling' and 'following-sibling' axes MAY be used if they are evaluated in a context where the context node is a user-ordered 'list' or 'leaf-list'.

Data nodes which use the 'int64' and 'uint64' built-in type SHOULD NOT be used within numeric expressions. There are boundary conditions in which the translation from the YANG 64-bit type to an XPath number can cause incorrect results. Specifically, an XPath 'double' precision floating point number cannot represent very large positive or negative 64-bit numbers because it only provides a total precision of 53 bits. The 'int64' and 'uint64' data types MAY be used in numeric expressions if the value can be represented with no more than 53 bits of precision.

Data modelers need to be careful not to confuse the YANG value space and the XPath value space. The data types are not the same in both, and conversion between YANG and XPath data types SHOULD be considered carefully.

Explicit XPath data type conversions MAY be used (e.g., 'string', 'boolean', or 'number' functions), instead of implicit XPath data type conversions.

4.6. Lifecycle Management

The status statement MUST be present if its value is 'deprecated' or 'obsolete'.

The module or submodule name MUST NOT be changed, once the document containing the module or submodule is published.

The module namespace URI value MUST NOT be changed, once the document containing the module is published.

The revision-date sub-statement within the imports statement SHOULD be present if any groupings are used from the external module.

The revision-date sub-statement within the include statement SHOULD be present if any groupings are used from the external sub-module.

If submodules are used, then the document containing the main module MUST be updated so that the main module revision date is equal or more recent than the revision date of any submodule which is (directly or indirectly) included by the main module.

4.7. Module Header, Meta, and Revision Statements

For published modules, the namespace MUST be a globally unique URI, as defined in [RFC3986]. This value is usually assigned by the IANA.

The organization statement MUST be present. If the module is contained in a document intended for standards-track status, then the organization SHOULD be the IETF working group chartered to write the document.

The contact statement MUST be present. If the module is contained in a document intended for standards-track status, then the working group WEB and mailing information MUST be present, and the main document author or editor contact information SHOULD be present. If additional authors or editors exist, their contact information MAY be present. In addition, the Area Director and other contact information MAY be present.

The description statement MUST be present. The appropriate IETF Trust Copyright text MUST be present, as described in Section 3.1.

If the module relies on information contained in other documents, which are not the same documents implied by the import statements present in the module, then these documents MUST be identified in the reference statement.

A revision statement MUST be present for each published version of the module. The revision statement MUST have a reference substatement. It MUST identify the published document which contains the module. Modules are often extracted from their original documents and it is useful for developers and operators to know how

to find the original source document in a consistent manner. The revision statement MAY have a description substatement.

Each new revision MUST include a revision date which is higher than any other revision date in the module. The revision date does not need to be updated if the module contents do not change in the new document revision.

It is acceptable to reuse the same revision statement within unpublished versions (i.e., Internet-Drafts), but the revision date MUST be updated to a higher value each time the Internet-Draft is re-published.

4.8. Namespace Assignments

It is RECOMMENDED that only valid YANG modules are included in documents, whether they are published yet or not. This allows:

- o the module to compile correctly instead of generating disruptive fatal errors.
- o early implementors to use the modules without picking a random value for the XML namespace.
- o early interoperability testing since independent implementations will use the same XML namespace value.

Until a URI is assigned by the IANA, a proposed namespace URI MUST be provided for the namespace statement in a YANG module. A value SHOULD be selected which is not likely to collide with other YANG namespaces. Standard module names, prefixes, and URI strings already listed in the YANG Module Registry MUST NOT be used.

A standard namespace statement value SHOULD have the following form:

```
<URN prefix string>:<module-name>
```

The following URN prefix string SHOULD be used for published and unpublished YANG modules:

```
urn:ietf:params:xml:ns:yang:
```

The following example URNs would be valid temporary namespace statement values for standards-track modules:

```
urn:ietf:params:xml:ns:yang:ietf-netconf-partial-lock
```

```
urn:ietf:params:xml:ns:yang:ietf-netconf-state
```

```
urn:ietf:params:xml:ns:yang:ietf-netconf
```

Note that a different URN prefix string SHOULD be used for non-standards track modules. The string SHOULD be selected according to the guidelines in [I-D.ietf-netmod-yang].

The following examples of non-standards track modules are only suggestions. There are no guidelines for this type of URN in this document:

```
http://example.com/ns/example-interfaces
```

```
http://example.com/ns/example-system
```

4.9. Top Level Data Definitions

There SHOULD only be one top-level data node defined in each YANG module, if any data nodes are defined at all.

The top-level data organization SHOULD be considered carefully, in advance. Data model designers need to consider how the functionality for a given protocol or protocol family will grow over time.

The names and data organization SHOULD reflect persistent information, such as the name of a protocol. The name of the working group SHOULD NOT be used because this may change over time.

A mandatory database data definition is defined as a node that a client must provide for the database to be valid. The server is not required to provide a value.

Top-level database data definitions MUST NOT be mandatory. If a mandatory node appears at the top-level, it will immediately cause the database to be invalid. This can occur when the server boots or when a module is loaded dynamically at runtime.

4.10. Data Types

Selection of an appropriate data type (i.e., built-in type, existing derived type, or new derived type) is very subjective and therefore few requirements can be specified on that subject.

Data model designers SHOULD use the most appropriate built-in data type for the particular application.

If extensibility of enumerated values is required, then the

'identityref' data type SHOULD be used instead of an enumeration or other built-in type.

For string data types, if a machine-readable pattern can be defined for the desired semantics, then one or more pattern statements SHOULD be present.

For string data types, if the length of the string is required to be bounded in all implementations, then a length statement MUST be present.

For numeric data types, if the values allowed by the intended semantics are different than those allowed by the unbounded intrinsic data type (e.g., 'int32'), then a range statement SHOULD be present.

The signed numeric data types (i.e., 'int8', 'int16', 'int32', and 'int64') SHOULD NOT be used unless negative values are allowed for the desired semantics.

For 'enumeration' or 'bits' data types, the semantics for each 'enum' or 'bit' SHOULD be documented. A separate description statement (within each 'enum' or 'bit' statement) SHOULD be present.

4.11. Reusable Type Definitions

If an appropriate derived type exists in any standard module, such as [I-D.ietf-netmod-yang-types], then it SHOULD be used instead of defining a new derived type.

If an appropriate units identifier can be associated with the desired semantics, then a units statement SHOULD be present.

If an appropriate default value can be associated with the desired semantics, then a default statement SHOULD be present.

If a significant number of derived types are defined, and it is anticipated that these data types will be reused by multiple modules, then these derived types SHOULD be contained in a separate module or submodule, to allow easier reuse without unnecessary coupling.

The description statement MUST be present.

If the type definition semantics are defined in an external document (other than another YANG module indicated by an import statement), then the reference statement MUST be present.

4.12. Data Definitions

The description statement **MUST** be present in the following YANG statements:

- o anyxml
- o augment
- o choice
- o container
- o extension
- o feature
- o grouping
- o identity
- o leaf
- o leaf-list
- o list
- o notification
- o rpc
- o typedef

If the data definition semantics are defined in an external document, (other than another YANG module indicated by an import statement), then a reference statement **MUST** be present.

The 'anyxml' construct may be useful to represent an HTML banner containing markup elements, such as '' and '', and **MAY** be used in such cases . However, this construct **SHOULD NOT** be used if other YANG data node types can be used instead to represent the desired syntax and semantics.

If there are referential integrity constraints associated with the desired semantics that can be represented with XPath, then one or more must statements **SHOULD** be present.

For list and leaf-list data definitions, if the number of possible

instances is required to be bounded for all implementations, then the max-elements statements SHOULD be present.

If any must or when statements are used within the data definition, then the data definition description statement SHOULD describe the purpose of each one.

4.13. Operation Definitions

If the operation semantics are defined in an external document (other than another YANG module indicated by an import statement), then a reference statement MUST be present.

If the operation impacts system behavior in some way, it SHOULD be mentioned in the description statement.

If the operation is potentially harmful to system behavior in some way, it MUST be mentioned in the Security Considerations section of the document.

4.14. Notification Definitions

The description statement MUST be present.

If the notification semantics are defined in an external document (other than another YANG module indicated by an import statement), then a reference statement MUST be present.

5. IANA Considerations

This document registers one URI in the IETF XML registry [RFC3688]. The following registration is requested:

URI: urn:ietf:params:xml:ns:yang:ietf-template

Registrant Contact: The NETMOD WG of the IETF.

XML: N/A, the requested URI is an XML namespace.

This document requests the following assignment in the YANG Module Names Registry for the YANG module template in Appendix B.

Field	Value
name	ietf-template
namespace	urn:ietf:params:xml:ns:yang:ietf-template
prefix	temp
reference	RFCXXXX

6. Security Considerations

This document defines documentation guidelines for NETCONF content defined with the YANG data modeling language. The guidelines for how to write a Security Considerations section for a YANG module are defined in the online document

<http://www.ops.ietf.org/netconf/yang-security-considerations.txt>

This document does not introduce any new or increased security risks into the management system.

The following section contains the security considerations template dated 2010-06-16. Be sure to check the WEB page at the URL listed above in case there is a more recent version available.

Each specification that defines one or more YANG modules MUST contain a section that discusses security considerations relevant to those modules. This section MUST be patterned after the latest approved template (available at [ed: URL TBD]).

In particular, writable data nodes that could be especially disruptive if abused MUST be explicitly listed by name and the associated security risks MUST be spelled out.

Similarly, readable data nodes that contain especially sensitive information or that raise significant privacy concerns MUST be explicitly listed by name and the reasons for the sensitivity/privacy concerns MUST be explained.

Further, if new RPC operations have been defined, then the security considerations of each new RPC operation MUST be explained.

6.1. Security Considerations Section Template

X. Security Considerations

The YANG module defined in this memo is designed to be accessed via the NETCONF protocol [RFC4741]. The lowest NETCONF layer is the secure transport layer and the mandatory to implement secure transport is SSH [RFC4742].

```
-- if you have any writeable data nodes (those are all the
-- "config true" nodes, and remember, that is the default)
-- describe their specific sensitivity or vulnerability.
```

There are a number of data nodes defined in this YANG module which are writable/creatable/deletable (i.e. config true, which is the default). These data nodes may be considered sensitive or vulnerable in some network environments. Write operations (e.g. edit-config) to these data nodes without proper protection can have a negative effect on network operations. These are the subtrees and data nodes and their sensitivity/vulnerability:

<list subtrees and data nodes and state why they are sensitive>

```
-- for all YANG modules you must evaluate whether any readable data
-- nodes (those are all the "config false" nodes, but also all other
-- nodes, because they can also be read via operations like get or
-- get-config) are sensitive or vulnerable (for instance, if they
-- might reveal customer information or violate personal privacy
-- laws such as those of the European Union if exposed to
-- unauthorized parties)
```

Some of the readable data nodes in this YANG module may be considered sensitive or vulnerable in some network environments. It is thus important to control read access (e.g. via get, get-config or notification) to these data nodes. These are the subtrees and data nodes and their sensitivity/vulnerability:

<list subtrees and data nodes and state why they are sensitive>

```
-- if your YANG module has defined any rpc operations
-- describe their specific sensitivity or vulnerability.
```

Some of the RPC operations in this YANG module may be considered sensitive or vulnerable in some network environments. It is thus important to control access to these operations. These are the operations and their sensitivity/vulnerability:

<list RPC operations and state why they are sensitive>

Figure 2

7. Acknowledgments

The structure and contents of this document are adapted from Guidelines for MIB Documents [RFC4181], by C. M. Heard.

The working group thanks Martin Bjorklund and Juergen Schoenwaelder for their extensive reviews and contributions to this document.

8. References

8.1. Normative References

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DeRose, S. and J. Clark, "XML Path Language (XPath) Version 1.0", World Wide Web Consortium Recommendation REC-xpath-19991116, November 1999, <<http://www.w3.org/TR/1999/REC-xpath-19991116>>.
- [I-D.ietf-netmod-yang]
Bjorklund, M., "YANG - A data modeling language for the Network Configuration Protocol (NETCONF)", draft-ietf-netmod-yang-13 (work in progress), June 2010.
- [I-D.ietf-netmod-yang-types]
Schoenwaelder, J., "Common YANG Data Types", draft-ietf-netmod-yang-types-09 (work in progress), April 2010.

8.2. Informative References

- [RFC4181] Heard, C., "Guidelines for Authors and Reviewers of MIB Documents", BCP 111, RFC 4181, September 2005.
- [RFC5226] Narten, T. and H. Alvestrand, "Guidelines for Writing an

IANA Considerations Section in RFCs", BCP 26, RFC 5226,
May 2008.

Appendix A. Module Review Checklist

This section is adapted from RFC 4181.

The purpose of a YANG module review is to review the YANG module both for technical correctness and for adherence to IETF documentation requirements. The following checklist may be helpful when reviewing a draft document:

1. I-D Boilerplate -- verify that the draft contains the required Internet-Draft boilerplate (see <http://www.ietf.org/ietf/lid-guidelines.txt>), including the appropriate statement to permit publication as an RFC, and that I-D boilerplate does not contain references or section numbers.
2. Abstract -- verify that the abstract does not contain references, that it does not have a section number, and that its content follows the guidelines in <http://www.ietf.org/ietf/lid-guidelines.txt>.
3. IETF Trust Copyright -- verify that the draft has the appropriate text regarding the rights that document contributors provide to the IETF Trust [RFC5378]. Some guidelines related to this requirement are described in Section 3.1. The IETF Trust license policy (TLP) can be found at:

<http://trustee.ietf.org/docs/IETF-Trust-License-Policy.pdf>
4. Security Considerations Section -- verify that the draft uses the latest approved template from the OPS area web site (<http://www.ops.ietf.org/netconf/yang-security-considerations.txt>) and that the guidelines therein have been followed.
5. IANA Considerations Section -- this section must always be present. For each module within the document, ensure that the IANA Considerations section contains entries for the following IANA registries:

XML Namespace Registry: Register the YANG module namespace.

YANG Module Registry: Register the YANG module name, prefix, namespace, and RFC number, according to the rules specified in [I-D.ietf-netmod-yang].
6. References -- verify that the references are properly divided between normative and informative references, that RFC 2119 is included as a normative reference if the terminology defined therein is used in the document, that all references required by

the boilerplate are present, that all YANG modules containing imported items are cited as normative references, and that all citations point to the most current RFCs unless there is a valid reason to do otherwise (for example, it is OK to include an informative reference to a previous version of a specification to help explain a feature included for backward compatibility). Be sure citations for all imported modules are present somewhere in the document text (outside the YANG module).

7. Copyright Notices -- verify that the draft contains an abbreviated IETF Trust copyright notice in the description statement of each YANG module or sub-module, and that it contains the full IETF Trust copyright notice at the end of the document. Make sure that the correct year is used in all copyright dates. Use the approved text from the latest Trust Legal Provisions (TLP) document, which can be found at:

<http://trustee.ietf.org/license-info/>

8. Other Issues -- check for any issues mentioned in <http://www.ietf.org/ID-Checklist.html> that are not covered elsewhere.

9. Technical Content -- review the actual technical content for compliance with the guidelines in this document. The use of a YANG module compiler is recommended when checking for syntax errors. A list of freely available tools and other information can be found at:

<http://trac.tools.ietf.org/wg/netconf/trac/wiki>

Checking for correct syntax, however, is only part of the job. It is just as important to actually read the YANG module document from the point of view of a potential implementor. It is particularly important to check that description statements are sufficiently clear and unambiguous to allow interoperable implementations to be created.

Appendix B. YANG Module Template

```
<CODE BEGINS> file "ietf-template@2010-05-18.yang"

module iETF-template {

    // replace this string with a unique namespace URN value
    namespace
        "urn:ietf:params:xml:ns:yang:ietf-template";

    // replace this string, and try to pick a unique prefix
    prefix "temp";

    // import statements here: e.g.,
    // import iETF-yang-types { prefix yang; }
    // import iETF-inet-types { prefix inet; }

    // identify the IETF working group if applicable
    organization
        "IETF NETMOD (NETCONF Data Modeling Language) Working Group";

    // update this contact statement with your info
    contact
        "WG Web:    <http://tools.ietf.org/wg/your-wg-name/>
        WG List:    <mailto:your-wg-name@ietf.org>

        WG Chair:  your-WG-chair
                   <mailto:your-WG-chair@example.com>

        Editor:    your-name
                   <mailto:your-email@example.com>";

    // replace the first sentence in this description statement.
    // replace the copyright notice with the most recent
    // version, if it has been updated since the publication
    // of this document
    description
        "This module defines a template for other YANG modules.

        Copyright (c) 2010 IETF Trust and the persons identified as
        the document authors.  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 (<http://trustee.ietf.org/license-info>).

This version of this YANG module is part of RFC XXXX; see the RFC itself for full legal notices."

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

reference "RFC XXXX";

// RFC Ed.: remove this note

// Note: extracted from draft-ietf-netmod-yang-usage-04.txt

// replace '2010-05-18' with the module publication date

// The format is (year-month-day)

```
revision "2010-05-18" {  
  description  
    "Initial version";  
}
```

// extension statements

// feature statements

// identity statements

// typedef statements

// grouping statements

// data definition statements

// augment statements

// rpc statements

// notification statements

// DO NOT put deviation statements in a published module

}

<CODE ENDS>

Figure 3

Appendix C. Change Log

C.1. Changes from 10 to 11

- o Removed Intellectual Property section, since no longer required.
- o Reworded XPath guidelines related to XML document order, 'int64' and 'uint64' data types, and 'anyxml' data nodes.

C.2. Changes from 09 to 10

- o Added security considerations section template.
- o Added guideline for documenting conditional requirements for non-mandatory non-configuration data nodes.
- o Clarified that revision date update applies to the module contents.

C.3. Changes from 08 to 09

- o Clarifications and corrections to address Gen-ART review comments.

C.4. Changes from 07 to 08

- o Corrected YANG security considerations URL.
- o Expanded 'CODE BEGINS' example.
- o Added RPC operations to the security considerations guidelines section.
- o Removed guideline about leading and trailing whitespace.

C.5. Changes from 06 to 07

- o Corrected title change bug; supposed to be page header instead.
- o Fixed typos added to last revision.
- o Added sentence to checklist to make sure text outside module contains citations for imports.

C.6. Changes from 05 to 06

- o Several clarifications and corrections, based on the AD review by Dan Romascanu.

C.7. Changes from 04 to 05

- o Changed 'object' terminology to 'data definition'.
- o Put XPath guidelines in separate section.
- o Clarified XPath usage for XML document order dependencies.
- o Updated <CODE BEGINS> guidelines to current conventions.
- o Added informative reference for IANA considerations guidelines and XML registry.
- o Updated IANA Considerations section to reserve the ietf-template module in the YANG Module Name Registry so it cannot be reused accidentally.
- o Many other clarifications and fixed typos found in WGLC reviews.

C.8. Changes from 03 to 04

- o Removed figure 1 to reduce duplication, just refer to 4741bis draft.
- o Fixed bugs and typos found in WGLC reviews.
- o Removed some guidelines and referring to YANG draft instead of duplicating YANG rules here.
- o Changed security guidelines so they refer to the IETF Trust TLP instead of MIB-specific references.
- o Change temporary namespace guidelines so the DRAFT-XX and RFC-nnnn suffix strings are not used.
- o Changed some MIB boilerplate so it refers to YANG boilerplate instead.
- o Introduced dangling URL reference to online YANG security guidelines

<http://www.ops.ietf.org/yang-security.html>

[ed.: Text from Bert Wijnen will be completed soon and posted online, and then this URL will be finalized.]
- o Moved reference for identifying the source document inside the each revision statement.

- o Removed guideline about valid XPath since YANG already requires valid XPath.
- o Added guideline that strings should not rely on preservation of leading and trailing whitespace characters.
- o Relaxed some XPath and anyxml guidelines from SHOULD NOT or MUST NOT to MAY use with caution.
- o Updated the TLP text within the example module again.
- o Reversed order of change log so most recent entries are first.

C.9. Changes from 02 to 03

- o Updated figure 1 to align with 4741bis draft.
- o Updated guidelines for import-by-revision and include-by-revision.
- o Added file name to code begins convention in ietf-template module.

C.10. Changes from 01 to 02

- o Updated figure 1 per mailing list comments.
- o Updated suggested organization to include the working group name.
- o Updated ietf-template.yang to use new organization statement value.
- o Updated Code Component requirements as per new TLP.
- o Updated ietf-template.yang to use new Code Component begin and end markers.
- o Updated references to the TLP in a couple sections.
- o Change manager/agent terminology to client/server.

C.11. Changes from 00 to 01

- o Added transport 'TLS' to figure 1.
- o Added note about RFC 2119 terminology.
- o Corrected URL for instructions to authors.

- o Updated namespace procedures section.
- o Updated guidelines on module contact, reference, and organization statements.
- o Added note on use of preceding-sibling and following-sibling axes in XPath expressions.
- o Added section on temporary namespace statement values.
- o Added section on top level database objects.
- o Added ietf-template.yang appendix.

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