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YANG Semantic Versioning

Abstract

This document specifies a scheme and guidelines for applying an extended set of semantic versioning rules to revisions of YANG artifacts (e.g., modules and packages). Additionally, this document defines an RFCAAAA-compliant revision-label-scheme for this YANG semantic versioning scheme.

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1. Introduction

[[I-D.ietf-netmod-yang-module-versioning](#)] puts forth a number of concepts relating to modified rules for updating YANG modules and submodules, a means to signal when a new revision of a module or submodule has non-backwards-compatible (NBC) changes compared to its previous revision, and a scheme that uses the revision history as a lineage for determining from where a specific revision of a YANG module or submodule is derived. Additionally, section 3.4 of [[I-D.ietf-netmod-yang-module-versioning](#)] defines a revision-label

which can be used as an alias to provide additional context or as a meaningful label to refer to a specific revision.

This document defines a revision-label scheme that uses extended semantic versioning rules [[SemVer](#)] for YANG artifacts (i.e., YANG modules, YANG submodules, and YANG packages [[I-D.ietf-netmod-yang-packages](#)]) as well as the revision label definition for using this scheme. The goal being to add a human readable revision label that provides compatibility information for the YANG artifact without needing to compare or parse its body. The label and rules defined herein represent the RECOMMENDED revision label scheme for IETF YANG artifacts.

Note that a specific revision of the SemVer 2.0.0 specification is referenced here (from June 19, 2020) to provide an immutable version. This is because the 2.0.0 version of the specification has changed over time without any change to the semantic version itself. In some cases the text has changed in non-backwards-compatible ways.

2. Terminology and Conventions

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 BCP 14 [[RFC2119](#)] [[RFC8174](#)] when, and only when, they appear in all capitals, as shown here.

Additionally, this document uses the following terminology:

*YANG artifact: YANG modules, YANG submodules, and YANG packages [[I-D.ietf-netmod-yang-packages](#)] are examples of YANG artifacts for the purposes of this document.

*SemVer: A version string that corresponds to the rules defined in [[SemVer](#)] . This specific camel-case notation is the one used by the SemVer 2.0.0 website and used within this document to distinguish between YANG Semver.

*YANG Semver: A revision-label identifier that is consistent with the extended set of semantic versioning rules, based on [[SemVer](#)] , defined within this document.

3. YANG Semantic Versioning

This section defines YANG Semantic Versioning, explains how it is used with YANG artifacts, and describes the rules associated with changing an artifact's semantic version when its contents are updated.

3.1. Relationship Between SemVer and YANG Semver

[[SemVer](#)] is completely compatible with YANG Semver in that a SemVer semantic version number is legal according to the YANG Semver rules (though the inverse is not necessarily true). YANG Semver is a superset of the SemVer rules, and allow for limited branching within YANG artifacts. If no branching occurs within a YANG artifact (i.e., you do not use the compatibility modifiers described below), the YANG Semver version label will appear as a SemVer version number.

3.2. YANG Semver Pattern

YANG artifacts that employ semantic versioning as defined in this document MUST use a version string (e.g., in revision-label or as a package version) that corresponds to the following pattern:

'X.Y.Z_COMPAT'. Where:

- *X, Y and Z are mandatory non-negative integers that are each less than or equal to 2147483647 (i.e., the maximum signed 32-bit integer value) and MUST NOT contain leading zeroes,

- *The '.' is a literal period (ASCII character 0x2e),

- *The '_' is an optional single literal underscore (ASCII character 0x5f) and MUST only be present if the following COMPAT element is included,

- *COMPAT, if specified, MUST be either the literal string "compatible" or the literal string "non_compatible".

Additionally, [[SemVer](#)] defines two specific types of metadata that may be appended to a semantic version string. Pre-release metadata MAY be appended to a YANG Semver string after a trailing '-' character. Build metadata MAY be appended after a trailing '+' character. If both pre-release and build metadata are present, then build metadata MUST follow pre-release metadata. While build metadata MUST be ignored when comparing YANG semantic versions, pre-release metadata MUST be used during module and submodule development as specified in [Section 5](#) . Both pre-release and build metadata are allowed in order to support all the [[SemVer](#)] rules. Thus, a version lineage that follows strict [[SemVer](#)] rules is allowed for a YANG artifact.

To signal the use of this versioning scheme, modules and submodules MUST set the revision-label-scheme extension, as defined in [[I-D.ietf-netmod-yang-module-versioning](#)] , to the identity "yang-semver". That identity value is defined in the ietf-yang-semver module below.

Additionally, this `ietf-yang-semver` module defines a typedef that formally specifies the syntax of the YANG Semver.

3.3. Semantic Versioning Scheme for YANG Artifacts

This document defines the YANG semantic versioning scheme that is used for YANG artifacts that employ the YANG Semver label. The versioning scheme has the following properties:

*The YANG semantic versioning scheme is extended from version 2.0.0 of the semantic versioning scheme defined at semver.org [[SemVer](#)] to cover the additional requirements for the management of YANG artifact lifecycles that cannot be addressed using the `semver.org` 2.0.0 versioning scheme alone.

*Unlike the [[SemVer](#)] versioning scheme, the YANG semantic versioning scheme supports updates to older versions of YANG artifacts, to allow for bug fixes and enhancements to artifact versions that are not the latest. However, it does not provide for the unlimited branching and updating of older revisions which are documented by the general rules in [[I-D.ietf-netmod-yang-module-versioning](#)].

*YANG artifacts that follow the [[SemVer](#)] versioning scheme are fully compatible with implementations that understand the YANG semantic versioning scheme defined in this document.

*If updates are always restricted to the latest revision of the artifact only, then the version numbers used by the YANG semantic versioning scheme are exactly the same as those defined by the [[SemVer](#)] versioning scheme.

Every YANG module and submodule versioned using the YANG semantic versioning scheme specifies the module's or submodule's semantic version as the argument to the `'rev:revision-label'` statement.

Because the rules put forth in [[I-D.ietf-netmod-yang-module-versioning](#)] are designed to work well with existing versions of YANG and allow for artifact authors to migrate to this scheme, it is not expected that all revisions of a given YANG artifact will have a semantic version label. For example, the first revision of a module or submodule may have been produced before this scheme was available.

YANG packages that make use of this YANG Semver will reflect that in the package metadata.

As stated above, the YANG semantic version is expressed as a string of the form: 'X.Y.Z_COMPAT'.

*'X' is the MAJOR version. Changes in the MAJOR version number indicate changes that are non-backwards-compatible to versions with a lower MAJOR version number.

*'Y' is the MINOR version. Changes in the MINOR version number indicate changes that are backwards-compatible to versions with the same MAJOR version number, but a lower MINOR version number and no "_compatible" or "_non_compatible" modifier.

*'Z' is the PATCH version. Changes in the PATCH version number can indicate an editorial change to the YANG artifact. In conjunction with the '_COMPAT' modifier (see below) changes to 'Z' may indicate a more substantive module change. An editorial change is defined to be a change in the YANG artifact's content that does not affect the semantic meaning or functionality provided by the artifact in any way. Some examples include correcting a spelling mistake in the description of a leaf within a YANG module or submodule, non-significant whitespace changes (e.g., realigning description statements or changing indentation), or changes to YANG comments. Note: restructuring how a module uses, or does not use, submodules is treated as an editorial level change on the condition that there is no change in the module's semantic behavior due to the restructuring.

*'_COMPAT' is an additional modifier, unique to YANG Semver (i.e., not valid in [\[SemVer\]](#)), that indicates backwards-compatible, or non-backwards-compatible changes relative to versions with the same MAJOR and MINOR version numbers, but lower PATCH version number, depending on what form modifier '_COMPAT' takes:

- If the modifier string is absent, the change represents an editorial change.

- If, however, the modifier string is present, the meaning is described below:

- "_compatible" - the change represents a backwards-compatible change

- "_non_compatible" - the change represents a non-backwards-compatible change

The '_COMPAT' modifier string is "sticky". Once a revision of a module has a modifier in the revision label, then all descendants of that revision with the same X.Y version digits will also have a modifier. The modifier can change from "_compatible" to "_non_compatible" in a descendant revision, but the modifier MUST

NOT change from "_non_compatible" to "_compatible" and MUST NOT be removed. The persistence of the "_non_compatible" modifier ensures that comparisons of revision labels do not give the false impression of compatibility between two potentially non-compatible revisions. If "_non_compatible" was removed, for example between revisions "3.3.2_non_compatible" and "3.3.3" (where "3.3.3" was simply an editorial change), then comparing revision labels of "3.3.3" back to an ancestor "3.0.0" would look like they are backwards compatible when they are not (since "3.3.2_non_compatible" was in the chain of ancestors and introduced a non-backwards-compatible change).

The YANG artifact name and YANG semantic version uniquely identify a revision of said artifact. There MUST NOT be multiple instances of a YANG artifact definition with the same name and YANG semantic version but different content (and in the case of modules and submodules, different revision dates).

There MUST NOT be multiple versions of a YANG artifact that have the same MAJOR, MINOR and PATCH version numbers, but different patch modifier strings. E.g., artifact version "1.2.3_non_compatible" MUST NOT be defined if artifact version "1.2.3" has already been defined.

3.3.1. Branching Limitations with YANG Semver

YANG artifacts that use the YANG Semver revision-label scheme MUST ensure that two artifacts with the same MAJOR version number and no _compatible or _non_compatible modifiers are backwards compatible. Therefore, certain branching schemes cannot be used with YANG Semver. For example, the following branched parent-child module relationship using the following YANG Semver revision labels is not supported:

```
3.5.0 -- 3.6.0 (add leaf foo)
  |
  |
3.20.0 (added leaf bar)
```

In this case, given only the revision labels 3.6.0 and 3.20.0 without any parent-child relationship information, one would assume that 3.20.0 is backwards compatible with 3.6.0. But in the illegal example above, 3.20.0 is not backwards compatible with 3.6.0 since 3.20.0 does not contain the leaf foo.

Note that this type of branched parent-child relationship, where two revisions have different backwards compatible changes based on the same parent, is allowed in [\[I-D.ietf-netmod-yang-module-versioning\]](#) .

3.3.2. YANG Semver with submodules

YANG Semver MAY be used to version submodules. Submodule version are separate of any version on the including module, but if a submodule has changed, then the version of the including module MUST also be updated.

The rules for determining the version change of a submodule are the same as those defined in [Section 3.2](#) and [Section 3.3](#) as applied to YANG modules, except they only apply to the part of the module schema defined within the submodule's file.

One interesting case is moving definitions from one submodule to another in a way that does not change the resultant schema of the including module. In this case:

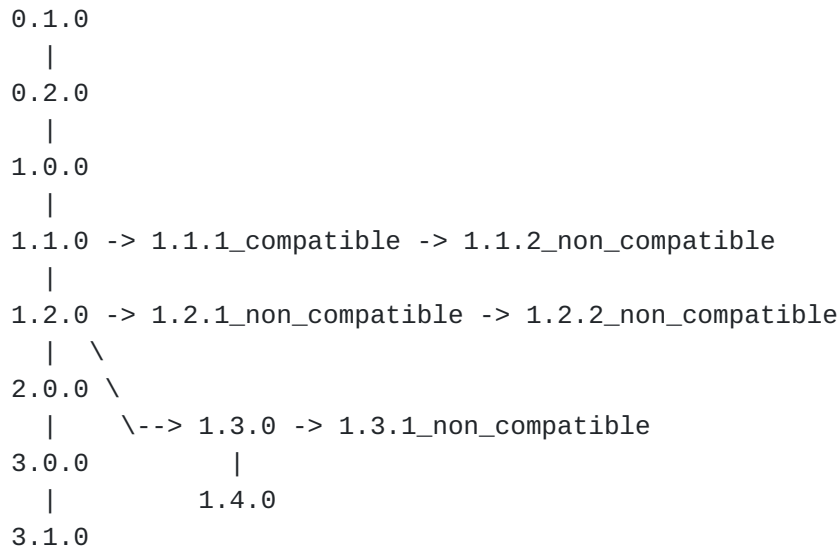
1. The including module has editorial changes
2. The submodule with the schema definition removed has non-backwards-compatible changes
3. The submodule with the schema definitions added has backwards-compatible changes

Note that the meaning of a submodule may change drastically despite having no changes in content or revision due to changes in other submodules belonging to the same module (e.g. groupings and typedefs declared in one submodule and used in another).

3.3.3. Examples for YANG semantic versions

The following diagram and explanation illustrate how YANG semantic versions work.

YANG Semantic versions for an example module:



The tree diagram above illustrates how the version history might evolve for an example module. The tree diagram only shows the parent/child ancestry relationships between the revisions. It does not describe the chronology of the revisions (i.e. when in time each revision was published relative to the other revisions).

The following description lists an example of what the chronological order of the revisions could look like, from oldest revision to newest:

- 0.1.0 - first pre-release module version
- 0.2.0 - second pre-release module version (with NBC changes)
- 1.0.0 - first release (may have NBC changes from 0.2.0)
- 1.1.0 - added new functionality, leaf "foo" (BC)
- 1.2.0 - added new functionality, leaf "baz" (BC)
- 2.0.0 - change existing model for performance reasons, e.g. re-key list (NBC)
- 1.3.0 - improve existing functionality, added leaf "foo-64" (BC)
- 1.1.1_compatible - backport "foo-64" leaf to 1.1.x to avoid implementing "baz" from 1.2.0. This revision was created after 1.2.0 otherwise it may have been released as 1.2.0. (BC)
- 3.0.0 - NBC bugfix, rename "baz" to "bar"; also add new BC leaf "wibble"; (NBC)
- 1.3.1_non_compatible - backport NBC fix, rename "baz" to "bar" (NBC)

1.2.1_non_compatible - backport NBC fix, rename "baz" to "bar"
(NBC)

1.1.2_non_compatible - NBC point bug fix, not required in 2.0.0
due to model changes (NBC)

1.4.0 - introduce new leaf "ghoti" (BC)

3.1.0 - introduce new leaf "wobble" (BC)

1.2.2_non_compatible - backport "wibble". This is a BC change but
"non_compatible" modifier is sticky. (BC)

The partial ancestry relationships based on the semantic versioning
numbers are as follows:

1.0.0 < 1.1.0 < 1.2.0 < 2.0.0 < 3.0.0 < 3.1.0

1.0.0 < 1.1.0 < 1.1.1_compatible < 1.1.2_non_compatible

1.0.0 < 1.1.0 < 1.2.0 < 1.2.1_non_compatible <
1.2.2_non_compatible

1.0.0 < 1.1.0 < 1.2.0 < 1.3.0 < 1.3.1_non_compatible

1.0.0 < 1.1.0 < 1.2.0 < 1.3.0 < 1.4.0

There is no ordering relationship between "1.1.1_non_compatible" and
either "1.2.0" or "1.2.1_non_compatible", except that they share the
common ancestor of "1.1.0".

Looking at the version number alone does not indicate ancestry. The
module definition in "2.0.0", for example, does not contain all the
contents of "1.3.0". Version "2.0.0" is not derived from "1.3.0".

3.4. YANG Semantic Version Update Rules

When a new revision of an artifact is produced, then the following
rules define how the YANG semantic version for the new artifact
revision is calculated, based on the changes between the two
artifact revisions, and the YANG semantic version of the base
artifact revision from which the changes are derived.

The following four rules specify the RECOMMENDED, and REQUIRED
minimum, update to a YANG semantic version:

1. If an artifact is being updated in a non-backwards-compatible
way, then the artifact version "X.Y.Z[_compatible|
_non_compatible]" SHOULD be updated to "X+1.0.0" unless that
version has already been used for this artifact but with

different content, in which case the artifact version "X.Y.Z+1_non_compatible" SHOULD be used instead.

2. If an artifact is being updated in a backwards-compatible way, then the next version number depends on the format of the current version number:

- i** "X.Y.Z" - the artifact version SHOULD be updated to "X.Y+1.0", unless that version has already been used for this artifact but with different content, when the artifact version SHOULD be updated to "X.Y.Z+1_compatible" instead.

- ii** "X.Y.Z_compatible" - the artifact version SHOULD be updated to "X.Y.Z+1_compatible".

- iii** "X.Y.Z_non_compatible" - the artifact version SHOULD be updated to "X.Y.Z+1_non_compatible".

3. If an artifact is being updated in an editorial way, then the next version number depends on the format of the current version number:

- i** "X.Y.Z" - the artifact version SHOULD be updated to "X.Y.Z+1"

- ii** "X.Y.Z_compatible" - the artifact version SHOULD be updated to "X.Y.Z+1_compatible".

- iii** "X.Y.Z_non_compatible" - the artifact version SHOULD be updated to "X.Y.Z+1_non_compatible".

4. YANG artifact semantic version numbers beginning with 0, i.e., "0.X.Y", are regarded as pre-release definitions and need not follow the rules above. Either the MINOR or PATCH version numbers may be updated, regardless of whether the changes are non-backwards-compatible, backwards-compatible, or editorial. See [Section 5](#) for more details on using this notation during module and submodule development.

5. Additional pre-release rules for modules that have had at least one release are specified in [Section 5](#) .

Although artifacts SHOULD be updated according to the rules above, which specify the recommended (and minimum required) update to the version number, the following rules MAY be applied when choosing a new version number:

1. An artifact author MAY update the version number with a more significant update than described by the rules above. For

example, an artifact could be given a new MAJOR version number (i.e., X+1.0.0), even though no non-backwards-compatible changes have occurred, or an artifact could be given a new MINOR version number (i.e., X.Y+1.0) even if the changes were only editorial.

2. An artifact author MAY skip version numbers. That is, an artifact's revision history could be 1.0.0, 1.1.0, and 1.3.0 where 1.2.0 is skipped. Note that skipping versions has an impact when importing modules by revision-or-derived. See [Section 4](#) for more details on importing modules with revision-label version gaps.

Although YANG Semver always indicates when a non-backwards-compatible, or backwards-compatible change may have occurred to a YANG artifact, it does not guarantee that such a change has occurred, or that consumers of that YANG artifact will be impacted by the change. Hence, tooling, e.g., [\[I-D.ietf-netmod-yang-schema-comparison\]](#) , also plays an important role for comparing YANG artifacts and calculating the likely impact from changes.

[\[I-D.ietf-netmod-yang-module-versioning\]](#) defines the "rev:non-backwards-compatible" extension statement to indicate where non-backwards-compatible changes have occurred in the module revision history. If a revision entry in a module's revision history includes the "rev:non-backwards-compatible" statement then that MUST be reflected in any YANG semantic version associated with that revision. However, the reverse does not necessarily hold, i.e., if the MAJOR version has been incremented it does not necessarily mean that a "rev:non-backwards-compatible" statement would be present.

3.5. Examples of the YANG Semver Label

3.5.1. Example Module Using YANG Semver

Below is a sample YANG module that uses the YANG Semver revision-label based on the rules defined in this document.

```

module example-versioned-module {
  yang-version 1.1;
  namespace "urn:example:versioned:module";
  prefix "exvermod";
  rev:revision-label-scheme "ysver:yang-semver";

  import ietf-yang-revisions { prefix "rev"; }
  import ietf-yang-semver { prefix "ysver"; }

  description
    "to be completed";

  revision 2017-08-30 {
    description "Backport 'wibble' leaf";
    rev:revision-label 1.2.2_non_compatible;
  }

  revision 2017-07-30 {
    description "Rename 'baz' to 'bar'";
    rev:revision-label 1.2.1_non_compatible;
    rev:non-backwards-compatible;
  }

  revision 2017-04-20 {
    description "Add new functionality, leaf 'baz'";
    rev:revision-label 1.2.0;
  }

  revision 2017-04-03 {
    description "Add new functionality, leaf 'foo'";
    rev:revision-label 1.1.0;
  }

  revision 2017-02-07 {
    description "First release version.";
    rev:revision-label 1.0.0;
  }

  // Note: YANG Semver rules do not apply to 0.X.Y labels.
  // The following pre-release revision statements would not
  // appear in any final published version of a module. They
  // are removed when the final version is published.
  // During the pre-release phase of development, only a
  // single one of these revision statements would appear

  // revision 2017-01-30 {
  //   description "NBC changes to initial revision";
  //   rev:revision-label 0.2.0;
  //   rev:non-backwards-compatible; // optional
  //                               // (theoretically no

```

```
//                                     // 'previous released version')
// }

// revision 2017-01-26 {
//   description "Initial module version";
//   rev:revision-label 0.1.0;
// }

//YANG module definition starts here
}
```

3.5.2. Example of Package Using YANG Semver

Below is an example YANG package that uses the YANG Semver revision label based on the rules defined in this document. Note: '\' line wrapping per [\[RFC8792\]](#) .

```
{
  "ietf-yang-instance-data:instance-data-set": {
    "name": "example-yang-pkg",
    "content-schema": {
      "module": "ietf-yang-packages@2022-03-04"
    },
    "timestamp": "2022-12-06T17:00:38Z",
    "description": ["Example of a Package \
      using YANG Semver"],
    "content-data": {
      "ietf-yang-packages:packages": {
        "package": [
          {
            "name": "example-yang-pkg",
            "version": "1.3.1",
            ...
          }
        ]
      }
    }
  }
}
```

Figure 1

4. Import Module by Semantic Version

[\[I-D.ietf-netmod-yang-module-versioning\]](#) allows for imports to be done based on a module or a derived revision of a module. The `rev:revision-or-derived` statement can specify either a revision date or a revision label. The YANG Semver revision-label value can be used as the argument to `rev:revision-or-derived` . When used as such, any module that contains exactly the same YANG semantic version in its revision history may be used to satisfy the import requirement. For example:

```
import example-module {
  rev:revision-or-derived 3.0.0;
}
```

Note: the import lookup does not stop when a non-backward-compatible change is encountered. That is, if module B imports a module A at or derived from version 2.0.0, resolving that import will pass through

a revision of module A with version "2.1.0_non_compatible" in order to determine if the present instance of module A derives from "2.0.0".

If an import by revision-or-derived cannot locate the specified revision-label in a given module's revision history, that import will fail. This is noted in the case of version gaps. That is, if a module's history includes "1.0.0", "1.1.0", and "1.3.0", an import from revision-or-derived at "1.2.0" will be unable to locate the specified revision entry and thus the import cannot be satisfied.

5. Guidelines for Using Semver During Module Development

This section and the IETF-specific sub-section below provides YANG Semver-specific guidelines to consider when developing new YANG modules. As such this section updates [\[RFC8407\]](#) .

Development of a brand new YANG module or submodule outside of the IETF that uses YANG Semver as its revision-label scheme SHOULD begin with a 0 for the MAJOR version component. This allows the module or submodule to disregard strict SemVer rules with respect to non-backwards-compatible changes during its initial development. However, module or submodule developers MAY choose to use the SemVer pre-release syntax instead with a 1 for the MAJOR version component. For example, an initial module or submodule revision-label might be either 0.0.1 or 1.0.0-alpha.1. If the authors choose to use the 0 MAJOR version component scheme, they MAY switch to the pre-release scheme with a MAJOR version component of 1 when the module or submodule is nearing initial release (e.g., a module's or submodule's revision label may transition from 0.3.0 to 1.0.0-beta.1 to indicate it is more mature and ready for testing).

When using pre-release notation, the format MUST include at least one alphabetic component and MUST end with a '.' or '-' and then one or more digits. These alphanumeric components will be used when deciding pre-release precedence. The following are examples of valid pre-release versions:

1.0.0-alpha.1

1.0.0-alpha.3

2.1.0-beta.42

3.0.0-202007.rc.1

When developing a new revision of an existing module or submodule using the YANG Semver revision-label scheme, the intended target semantic version MUST be used along with pre-release notation. For example, if a released module or submodule which has a current

revision-label of 1.0.0 is being modified with the intent to make non-backwards-compatible changes, the first development MAJOR version component must be 2 with some pre-release notation such as -alpha.1, making the version 2.0.0-alpha.1. That said, every publicly available release of a module or submodule MUST have a unique YANG Semver revision-label (where a publicly available release is one that could be implemented by a vendor or consumed by an end user). Therefore, it may be prudent to include the year or year and month development began (e.g., 2.0.0-201907-alpha.1). As a module or submodule undergoes development, it is possible that the original intent changes. For example, a 1.0.0 version of a module or submodule that was destined to become 2.0.0 after a development cycle may have had a scope change such that the final version has no non-backwards-compatible changes and becomes 1.1.0 instead. This change is acceptable to make during the development phase so long as pre-release notation is present in both versions (e.g., 2.0.0-alpha.3 becomes 1.1.0-alpha.4). However, on the next development cycle (after 1.1.0 is released), if again the new target release is 2.0.0, new pre-release components must be used such that every revision-label for a given module or submodule MUST be unique throughout its entire lifecycle (e.g., the first pre-release version might be 2.0.0-202005-alpha.1 if keeping the same year and month notation mentioned above).

5.1. Pre-release Version Precedence

As a module or submodule is developed, the scope of the work may change. That is, while a ratified module or submodule with revision-label 1.0.0 is initially intended to become 2.0.0 in its next ratified version, the scope of work may change such that the final version is 1.1.0. During the development cycle, the pre-release versions could move from 2.0.0-some-pre-release-tag to 1.1.0-some-pre-release-tag. This downwards changing of version numbers makes it difficult to evaluate semantic version rules between pre-release versions. However, taken independently, each pre-release version can be compared to the previously ratified version (e.g., 1.1.0-some-pre-release-tag and 2.0.0-some-pre-release-tag can each be compared to 1.0.0). Module and submodule developers SHOULD maintain only one revision statement in a pre-released module or submodule that reflects the latest revision. IETF authors MAY choose to include an appendix in the associated draft to track overall changes to the module or submodule.

5.2. YANG Semver in IETF Modules

All published IETF modules and submodules MUST use YANG semantic versions for their revision-labels.

Development of a new module or submodule within the IETF SHOULD begin with the 0 MAJOR number scheme as described above. When revising an existing IETF module or submodule, the revision-label MUST use the target (i.e., intended) MAJOR and MINOR version components with a 0 PATCH version component. If the intended ratified release will be non-backward-compatible with the current ratified release, the MINOR version component MUST be 0.

5.2.1. Guidelines for IETF Module Development

All IETF modules and submodules in development MUST use the whole document name as a pre-release version string, including the current document revision. For example, if a module or submodule which is currently released at version 1.0.0 is being revised to include non-backwards-compatible changes in draft-user-netmod-foo, its development revision-labels MUST include 2.0.0-draft-user-netmod-foo followed by the document's revision (e.g., 2.0.0-draft-user-netmod-foo-02). This will ensure each pre-release version is unique across the lifecycle of the module or submodule. Even when using the 0 MAJOR version for initial module or submodule development (where MINOR and PATCH can change), appending the draft name as a pre-release component helps to ensure uniqueness when there are perhaps multiple, parallel efforts creating the same module or submodule.

Some draft revisions may not include an update to the YANG modules or submodules contained in the draft. In that case, those modules or submodules that are not updated do not not require a change to their versions. Updates to the YANG Semver version MUST only be done when the revision of the module changes.

See [Appendix A](#) for a detailed example of IETF pre-release versions.

5.2.2. Guidelines for Published IETF Modules

For IETF YANG modules and submodules that have already been published, revision-labels MUST be retroactively applied to all existing revisions when the next new revision is created, starting at version "1.0.0" for the initial published revision, and then incrementing according to the YANG Semver version rules specified in [Section 3.4](#) . For example, if a module or submodule started out in the pre-NMDA ([RFC8342](#)) world, and then had NMDA support added without removing any legacy "state" branches -- and you are looking to add additional new features -- a sensible choice for the target YANG Semver would be 1.2.0 (since 1.0.0 would have been the initial, pre-NMDA release, and 1.1.0 would have been the NMDA revision).

6. YANG Module

This YANG module contains the typedef for the YANG semantic version and the identity to signal its use.

```
<CODE BEGINS> file "ietf-yang-semver@2023-01-17.yang"

module ietf-yang-semver {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-yang-semver";
  prefix ysver;
  rev:revision-label-scheme "yang-semver";

  import ietf-yang-revisions {
    prefix rev;
  }

  organization
    "IETF NETMOD (Network Modeling) Working Group";
  contact
    "WG Web: <http://tools.ietf.org/wg/netmod/>
    WG List: <mailto:netmod@ietf.org>

    Author: Joe Clarke
            <mailto:jclarke@cisco.com>
    Author: Robert Wilton
            <mailto:rwilton@cisco.com>
    Author: Reshad Rahman
            <mailto:reshad@yahoo.com>
    Author: Balazs Lengyel
            <mailto:balazs.lengyel@ericsson.com>
    Author: Jason Sterne
            <mailto:jason.sterne@nokia.com>
    Author: Benoit Claise
            <mailto:benoit.claise@huawei.com>";

  description
    "This module provides type and grouping definitions for YANG
    packages.

    Copyright (c) 2022 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 Revised 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.: update the date below with the date of RFC publication
  // and remove this note.
  // RFC Ed.: replace XXXX with actual RFC number and remove this
```

```

// note.
// RFC Ed. update the rev:revision-label to "1.0.0".

revision 2023-01-17 {
  rev:label "1.0.0-draft-ietf-netmod-yang-semver-10";
  description
    "Initial revision";
  reference
    "RFC XXXX: YANG Semantic Versioning.";
}

/*
 * Identities
 */

identity yang-semver {
  base rev:revision-label-scheme-base;
  description
    "The revision-label scheme corresponds to the YANG Semver
    scheme which is defined by the pattern in the 'version'
    typedef below. The rules governing this revision-label
    scheme are defined in the reference for this identity.";
  reference
    "RFC XXXX: YANG Semantic Versioning.";
}

/*
 * Typedefs
 */

typedef version {
  type rev:revision-label {
    pattern '[0-9]+[.][0-9]+[.][0-9]+(_(non_)?compatible)?'
      + '(-[A-Za-z0-9.-]+[.-][0-9]+)?(#[A-Za-z0-9.-]+)?';
  }
  description
    "Represents a YANG semantic version. The rules governing the
    use of this revision label scheme are defined in the
    reference for this typedef.";
  reference
    "RFC XXXX: YANG Semantic Versioning.";
}
}

<CODE ENDS>

```

7. Contributors

This document grew out of the YANG module versioning design team that started after IETF 101. The design team consists of the following members whom have worked on the YANG versioning project: Balazs Lengyel, Benoit Claise, Bo Wu, Ebben Aries, Jan Lindblad, Jason Sterne, Joe Clarke, Juergen Schoenwaelder, Mahesh Jethanandani, Michael (Wangzitao), Qin Wu, Reshad Rahman, and Rob Wilton.

The initial revision of this document was refactored and built upon [\[I-D.clacla-netmod-yang-model-update\]](#) . We would like to thank Kevin D'Souza for his initial work in this problem space.

Discussions on the use of SemVer for YANG versioning has been held with authors of the OpenConfig YANG models based on their own [\[openconfigsemver\]](#) . We would like to thank both Anees Shaikh and Rob Shakir for their input into this problem space.

8. Security Considerations

The YANG module specified in this document defines a schema for data that is designed to be accessed via network management protocols such as NETCONF [\[RFC6241\]](#) or RESTCONF [\[RFC8040\]](#) . The lowest NETCONF layer is the secure transport layer, and the mandatory-to-implement secure transport is Secure Shell (SSH) [\[RFC6242\]](#) . The lowest RESTCONF layer is HTTPS, and the mandatory-to-implement secure transport is TLS [\[RFC8446\]](#) .

The NETCONF access control model [\[RFC8341\]](#) provides the means to restrict access for particular NETCONF or RESTCONF users to a preconfigured subset of all available NETCONF or RESTCONF protocol operations and content.

That said, the YANG module in this document does not define any schema nodes (i.e., nothing that can be read or written). It only defines a typedef and an identity. Therefore, there is no need to further protect any nodes with access control.

9. IANA Considerations

9.1. YANG Module Registrations

This document requests IANA to register a URI in the "IETF XML Registry" [\[RFC3688\]](#) . Following the format in RFC 3688, the following registration is requested.

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

Registrant Contact: The IESG.

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

The following YANG module is requested to be registered in the "IANA Module Names" [[RFC6020](#)]. Following the format in RFC 6020, the following registrations are requested:

The ietf-yang-semver module:

Name: ietf-yang-semver

XML Namespace: urn:ietf:params:xml:ns:yang:ietf-yang-semver

Prefix: ysver

Reference: [RFCXXXX]

9.2. Guidance for YANG Semver in IANA maintained YANG modules and submodules

Note for IANA (to be removed by the RFC editor): Please check that the registries and IANA YANG modules and submodules are referenced in the appropriate way.

IANA is responsible for maintaining and versioning some YANG modules and submodules, e.g., iana-if-types.yang [[IfTypeYang](#)] and iana-routing-types.yang [[RoutingTypesYang](#)].

In addition to following the rules specified in the IANA Considerations section of [[I-D.ietf-netmod-yang-module-versioning](#)], IANA maintained YANG modules and submodules MUST also include a YANG Semver revision label for all new revisions, as defined in [Section 3](#).

The YANG Semver version associated with the new revision MUST follow the rules defined in [Section 3.4](#).

Note: For IANA maintained YANG modules and submodules that have already been published, revision labels MUST be retroactively applied to all existing revisions when the next new revision is created, starting at version "1.0.0" for the initial published revision, and then incrementing according to the YANG Semver rules specified in [Section 3.4](#).

Most changes to IANA maintained YANG modules and submodules are expected to be backwards-compatible changes and classified as MINOR version changes. The PATCH version may be incremented instead when only editorial changes are made, and the MAJOR version would be incremented if non-backwards-compatible changes are made.

Given that IANA maintained YANG modules are versioned with a linear history, it is anticipated that it should not be necessary to use the "_compatible" or "_non_compatible" modifiers to the "Z_COMPAT" version element.

10. References

10.1. Normative References

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- [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>>.
- [I-D.ietf-netmod-yang-module-versioning] Wilton, R., Rahman, R., Lengyel, B., Clarke, J., and J. Sterne, "Updated YANG Module Revision Handling", Work in Progress, Internet-Draft, draft-ietf-netmod-yang-module-versioning-08, 12 January 2023, <<https://www.ietf.org/archive/id/draft-ietf-netmod-yang-module-versioning-08.txt>>.

10.2. Informative References

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[I-D.ietf-netmod-yang-packages] Wilton, R., Rahman, R., Clarke, J., Sterne, J., and B. Wu, "YANG Packages", Work in Progress, Internet-Draft, draft-ietf-netmod-yang-packages-03, 4 March 2022, <<https://www.ietf.org/archive/id/draft-ietf-netmod-yang-packages-03.txt>>.

[I-D.ietf-netmod-yang-schema-comparison]

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[RFC8342] Bjorklund, M., Schoenwaelder, J., Shafer, P., Watsen, K., and R. Wilton, "Network Management Datastore Architecture (NMDA)", RFC 8342, DOI 10.17487/RFC8342, March 2018, <<https://www.rfc-editor.org/info/rfc8342>>.

[RFC6241] Enns, R., Ed., Bjorklund, M., Ed., Schoenwaelder, J., Ed., and A. Bierman, Ed., "Network Configuration Protocol (NETCONF)", RFC 6241, DOI 10.17487/RFC6241, June 2011, <<https://www.rfc-editor.org/info/rfc6241>>.

[RFC6242] Wasserman, M., "Using the NETCONF Protocol over Secure Shell (SSH)", RFC 6242, DOI 10.17487/RFC6242, June 2011, <<https://www.rfc-editor.org/info/rfc6242>>.

[RFC8040] Bierman, A., Bjorklund, M., and K. Watsen, "RESTCONF Protocol", RFC 8040, DOI 10.17487/RFC8040, January 2017, <<https://www.rfc-editor.org/info/rfc8040>>.

[RFC8341] Bierman, A. and M. Bjorklund, "Network Configuration Access Control Model", STD 91, RFC 8341, DOI 10.17487/RFC8341, March 2018, <<https://www.rfc-editor.org/info/rfc8341>>.

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[SemVer]

"Semantic Versioning 2.0.0 (text from June 19, 2020)",
<<https://github.com/semver/semver/blob/8b2e8eec394948632957639dfa99fc7ec6286911/semver.md>>.

[IfTypeYang] "iana-if-type YANG Module", <<https://www.iana.org/assignments/iana-if-type/iana-if-type.xhtml>>.

[RoutingTypesYang] "iana-routing-types YANG Module", <<https://www.iana.org/assignments/iana-routing-types/iana-routing-types.xhtml>>.

Appendix A. Example IETF Module Development

Assume a new YANG module is being developed in the netmod working group in the IETF. Initially, this module is being developed in an individual internet draft, draft-jdoe-netmod-example-module. The following represents the initial version tree (i.e., value of revision-label) of the module as it's being initially developed.

Version lineage for initial module development:

```
0.0.1-draft-jdoe-netmod-example-module-00
|
0.1.0-draft-jdoe-netmod-example-module-01
|
0.2.0-draft-jdoe-netmod-example-module-02
|
0.2.1-draft-jdoe-netmod-example-module-03
```

At this point, development stabilizes, and the workgroup adopts the draft. Thus now the draft becomes draft-ietf-netmod-example-module. The initial pre-release lineage continues as follows.

Continued version lineage after adoption:

```
1.0.0-draft-ietf-netmod-example-module-00
|
1.0.0-draft-ietf-netmod-example-module-01
|
1.0.0-draft-ietf-netmod-example-module-02
```

At this point, the draft is ratified and becomes RFC12345 and the YANG module version becomes 1.0.0.

A time later, the module needs to be revised to add additional capabilities. Development will be done in a backwards-compatible way. Two new individual drafts are proposed to go about adding the capabilities in different ways: draft-jdoe-netmod-exmod-enhancements

and draft-asmith-netmod-exmod-changes. These are initially developed in parallel with the following versions.

Parallel development for next module revision (track 1):

```
1.1.0-draft-jdoe-netmod-exmod-enhancements-00
|
1.1.0-draft-jdoe-netmod-exmod-enhancements-01
```

In parallel with (track 2):

```
1.1.0-draft-asmith-netmod-exmod-changes-00
|
1.1.0-draft-asmith-netmod-exmod-changes-01
```

At this point, the WG decides to merge some aspects of both and adopt the work in asmith's draft as draft-ietf-netmod-exmod-changes. A single version lineage continues.

```
1.1.0-draft-ietf-netmod-exmod-changes-00
|
1.1.0-draft-ietf-netmod-exmod-changes-01
|
1.1.0-draft-ietf-netmod-exmod-changes-02
|
1.1.0-draft-ietf-netmod-exmod-changes-03
```

The draft is ratified, and the new module version becomes 1.1.0.

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