

Network Working Group
Internet-Draft
Intended status: Standards Track
Expires: October 16, 2010

J. Schoenwaelder, Ed.
Jacobs University
April 14, 2010

Common YANG Data Types
draft-ietf-netmod-yang-types-08

Abstract

This document introduces a collection of common data types to be used with the YANG data modeling language.

Status of this Memo

This Internet-Draft is submitted to IETF in full conformance with the provisions of [BCP 78](#) and [BCP 79](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF), its areas, and its working groups. Note that other groups may also distribute working documents as Internet-Drafts.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

The list of current Internet-Drafts can be accessed at <http://www.ietf.org/ietf/lid-abstracts.txt>.

The list of Internet-Draft Shadow Directories can be accessed at <http://www.ietf.org/shadow.html>.

This Internet-Draft will expire on October 16, 2010.

Copyright Notice

Copyright (c) 2010 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to [BCP 78](#) and the IETF Trust's Legal Provisions Relating to IETF Documents (<http://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must

Internet-Draft

YANG-TYPES

April 2010

include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

This document may contain material from IETF Documents or IETF Contributions published or made publicly available before November 10, 2008. The person(s) controlling the copyright in some of this material may not have granted the IETF Trust the right to allow modifications of such material outside the IETF Standards Process. Without obtaining an adequate license from the person(s) controlling the copyright in such materials, this document may not be modified outside the IETF Standards Process, and derivative works of it may not be created outside the IETF Standards Process, except to format it for publication as an RFC or to translate it into languages other than English.

Table of Contents

1.	Introduction	3
2.	Overview	4
3.	Core YANG Derived Types	6
4.	Internet Specific Derived Types	15
5.	IANA Considerations	24
6.	Security Considerations	25
7.	Contributors	26
8.	Acknowledgments	27
9.	References	28
9.1.	Normative References	28
9.2.	Informative References	28
	Author's Address	31

1. Introduction

YANG [[YANG](#)] is a data modeling language used to model configuration and state data manipulated by the NETCONF [[RFC4741](#)] protocol. The YANG language supports a small set of built-in data types and provides mechanisms to derive other types from the built-in types.

This document introduces a collection of common data types derived from the built-in YANG data types. The definitions are organized in several YANG modules. The "ietf-yang-types" module contains generally useful data types. The "ietf-inet-types" module contains definitions that are relevant for the Internet protocol suite.

The derived types are generally designed to be applicable for modeling all areas of management information.

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](#)].

2. Overview

This section provides a short overview over the types defined in subsequent sections and their equivalent Structure of Management Information Version 2 (SMIV2) [[RFC2578](#)][RFC2579] data types. A YANG data type is equivalent to an SMIV2 data type if the data types have the same set of values and the semantics of the values are equivalent.

Table 1 lists the types defined in the `ietf-yang-types` YANG module and the corresponding SMIV2 types (if any).

ietf-yang-types

YANG type	Equivalent SMIV2 type (module)
counter32	Counter32 (SNMPv2-SMI)
zero-based-counter32	ZeroBasedCounter32 (RMON2-MIB)
counter64	Counter64 (SNMPv2-SMI)
zero-based-counter64	ZeroBasedCounter64 (HCNUM-TC)
gauge32	Gauge32 (SNMPv2-SMI)
gauge64	CounterBasedGauge64 (HCNUM-TC)
object-identifier	-
object-identifier-128	OBJECT IDENTIFIER
date-and-time	-
timeticks	TimeTicks (SNMPv2-SMI)
timestamp	TimeStamp (SNMPv2-TC)
phys-address	PhysAddress (SNMPv2-TC)

mac-address	MacAddress (SNMPv2-TC)
xpath1.0	-

Table 1

Table 2 lists the types defined in the ietf-inet-types YANG module and the corresponding SMIV2 types (if any).

ietf-inet-types

YANG type	Equivalent SMIV2 type (module)
ip-version	InetVersion (INET-ADDRESS-MIB)
dscp	Dscp (DIFFSERV-DSCP-TC)
ipv6-flow-label	IPv6FlowLabel (IPV6-FLOW-LABEL-MIB)
port-number	InetPortNumber (INET-ADDRESS-MIB)
as-number	InetAutonomousSystemNumber (INET-ADDRESS-MIB)
ip-address	-
ipv4-address	-
ipv6-address	-
ip-prefix	-
ipv4-prefix	-
ipv6-prefix	-
domain-name	-
host	-
uri	Uri (URI-TC-MIB)

Table 2

[3.](#) Core YANG Derived Types

```
<CODE BEGINS> file "ietf-yang-types@2010-04-14.yang"
```

```
module ietf-yang-types {
```

```
  namespace "urn:ietf:params:xml:ns:yang:ietf-yang-types";  
  prefix "yang";
```

```
  organization
```

```
    "IETF NETMOD (NETCONF Data Modeling Language) Working Group";
```

```
  contact
```

```
    "WG Web: <http://tools.ietf.org/wg/netmod/>
```

```
    WG List: <mailto:netmod@ietf.org>
```

WG Chair: David Partain
<mailto:david.partain@ericsson.com>

WG Chair: David Kessens
<mailto:david.kessens@nsn.com>

Editor: Juergen Schoenwaelder
<mailto:j.schoenwaelder@jacobs-university.de>;

description

"This module contains a collection of generally useful derived YANG data types.

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

```
revision 2010-04-14 {  
  description  
    "Initial revision.";  
  reference  
    "RFC XXXX: Common YANG Data Types";
```

```
}  
// RFC Ed.: replace XXXX with actual RFC number and remove this note  
  
/*** collection of counter and gauge types ***/  
  
typedef counter32 {  
  type uint32;  
  description
```

"The counter32 type represents a non-negative integer which monotonically increases until it reaches a maximum value of $2^{32}-1$ (4294967295 decimal), when it wraps around and starts increasing again from zero.

Counters have no defined 'initial' value, and thus, a single value of a counter has (in general) no information content. Discontinuities in the monotonically increasing value normally occur at re-initialization of the management system, and at other times as specified in the description of a schema node using this type. If such other times can occur, for example, the creation of an a schema node of type counter32 at times other than re-initialization, then a corresponding schema node should be defined, with an appropriate type, to indicate the last discontinuity.

The counter32 type should not be used for configuration schema nodes. A default statement SHOULD NOT be used in combination with the type counter32.

This type is in the value set and its semantics equivalent to the Counter32 type of the SMIV2.";

reference

[RFC 2578](#): Structure of Management Information Version 2 (SMIV2)";

}

```
typedef zero-based-counter32 {
```

```
  type yang:counter32;
```

```
  default "0";
```

```
  description
```

```
    "The zero-based-counter32 type represents a counter32 which has the defined 'initial' value zero.
```

```
    A schema node of this type will be set to zero(0) on creation and will thereafter increase monotonically until it reaches a maximum value of  $2^{32}-1$  (4294967295 decimal), when it wraps around and starts increasing again from zero.
```

```
    Provided that an application discovers a new schema node
```

of this type within the minimum time to wrap, it can use the

initial value as a delta. It is important for a management station to be aware of this minimum time and the actual time between polls, and to discard data if the actual time is too long or there is no defined minimum time.

This type is in the value set and its semantics equivalent to the ZeroBasedCounter32 textual convention of the SMIV2.";
reference

"[RFC 4502](#): Remote Network Monitoring Management Information Base Version 2 using SMIV2";

}

typedef counter64 {

type uint64;

description

"The counter64 type represents a non-negative integer which monotonically increases until it reaches a maximum value of $2^{64}-1$ (18446744073709551615 decimal), when it wraps around and starts increasing again from zero.

Counters have no defined 'initial' value, and thus, a single value of a counter has (in general) no information content. Discontinuities in the monotonically increasing value normally occur at re-initialization of the management system, and at other times as specified in the description of a schema node using this type. If such other times can occur, for example, the creation of a schema node of type counter64 at times other than re-initialization, then a corresponding schema node should be defined, with an appropriate type, to indicate the last discontinuity.

The counter64 type should not be used for configuration schema nodes. A default statement SHOULD NOT be used in combination with the type counter64.

This type is in the value set and its semantics equivalent to the Counter64 type of the SMIV2.";

reference

"[RFC 2578](#): Structure of Management Information Version 2 (SMIV2)";

}

typedef zero-based-counter64 {

type yang:counter64;

default "0";

description

"The zero-based-counter64 type represents a counter64 which

has the defined `initial' value zero.

A schema node of this type will be set to zero(0) on creation and will thereafter increase monotonically until it reaches a maximum value of $2^{64}-1$ (18446744073709551615 decimal), when it wraps around and starts increasing again from zero.

Provided that an application discovers a new schema node of this type within the minimum time to wrap, it can use the initial value as a delta. It is important for a management station to be aware of this minimum time and the actual time between polls, and to discard data if the actual time is too long or there is no defined minimum time.

This type is in the value set and its semantics equivalent to the ZeroBasedCounter64 textual convention of the SMIV2.;"
reference

```
"RFC 2856: Textual Conventions for Additional High Capacity  
Data Types";  
}
```

```
typedef gauge32 {  
    type uint32;  
    description  
        "The gauge32 type represents a non-negative integer, which  
        may increase or decrease, but shall never exceed a maximum  
        value, nor fall below a minimum value. The maximum value  
        cannot be greater than  $2^{32}-1$  (4294967295 decimal), and  
        the minimum value cannot be smaller than 0. The value of  
        a gauge32 has its maximum value whenever the information  
        being modeled is greater than or equal to its maximum  
        value, and has its minimum value whenever the information  
        being modeled is smaller than or equal to its minimum value.  
        If the information being modeled subsequently decreases  
        below (increases above) the maximum (minimum) value, the  
        gauge32 also decreases (increases)."
```

This type is in the value set and its semantics equivalent to the Gauge32 type of the SMIV2.;"
reference

```
"RFC 2578: Structure of Management Information Version 2 (SMIV2)";  
}
```

```
typedef gauge64 {  
    type uint64;  
    description
```

"The gauge64 type represents a non-negative integer, which may increase or decrease, but shall never exceed a maximum

value, nor fall below a minimum value. The maximum value cannot be greater than $2^{64}-1$ (18446744073709551615), and the minimum value cannot be smaller than 0. The value of a gauge64 has its maximum value whenever the information being modeled is greater than or equal to its maximum value, and has its minimum value whenever the information being modeled is smaller than or equal to its minimum value. If the information being modeled subsequently decreases below (increases above) the maximum (minimum) value, the gauge64 also decreases (increases).

This type is in the value set and its semantics equivalent to the CounterBasedGauge64 SMIV2 textual convention defined in [RFC 2856](#)";

reference

"[RFC 2856](#): Textual Conventions for Additional High Capacity Data Types";

}

/** collection of identifier related types */

typedef object-identifier {

type string {

pattern '((([0-1](\.[1-3]?[0-9]))|(2\.(0|([1-9]\d*))))'+
+ '(\.(0|([1-9]\d*)))*';

}

description

"The object-identifier type represents administratively assigned names in a registration-hierarchical-name tree.

Values of this type are denoted as a sequence of numerical non-negative sub-identifier values. Each sub-identifier value MUST NOT exceed $2^{32}-1$ (4294967295). Sub-identifiers are separated by single dots and without any intermediate white space.

Although the number of sub-identifiers is not limited, module designers should realize that there may be implementations that stick with the SMIV2 limit of 128

sub-identifiers.

This type is a superset of the SMIV2 OBJECT IDENTIFIER type since it is not restricted to 128 sub-identifiers. Hence, this type SHOULD NOT be used to represent the SMIV2 OBJECT IDENTIFIER type, the object-identifier-128 type SHOULD be used instead.";

reference

"ISO/IEC 9834-1: Information technology -- Open Systems

Schoenwaelder

Expires October 16, 2010

[Page 10]

Internet-Draft

YANG-TYPES

April 2010

Interconnection -- Procedures for the operation of OSI
Registration Authorities: General procedures and top
arcs of the ASN.1 Object Identifier tree";

}

```
typedef object-identifier-128 {  
  type object-identifier {  
    pattern '\d*(\.\d*){1,127}';  
  }  
}
```

description

"This type represents object-identifiers restricted to 128
sub-identifiers.

This type is in the value set and its semantics equivalent
to the OBJECT IDENTIFIER type of the SMIV2.";

reference

"[RFC 2578](#): Structure of Management Information Version 2 (SMIV2)";

}

/** collection of date and time related types */

```
typedef date-and-time {  
  type string {  
    pattern '\d{4}-\d{2}-\d{2}T\d{2}:\d{2}:\d{2}(\.\d+)?'  
    + '(Z|[\+|-]\d{2}:\d{2})';  
  }  
}
```

description

"The date-and-time type is a profile of the ISO 8601
standard for representation of dates and times using the
Gregorian calendar. The format is most easily described
using the following ABFN (replacing double quotes with
single quotes):

```

date-fullyear    = 4DIGIT
date-month       = 2DIGIT  ; 01-12
date-mday        = 2DIGIT  ; 01-28, 01-29, 01-30, 01-31
time-hour        = 2DIGIT  ; 00-23
time-minute      = 2DIGIT  ; 00-59
time-second      = 2DIGIT  ; 00-58, 00-59, 00-60
time-secfrac     = '.' 1*DIGIT
time-numoffset   = ('+' / '-') time-hour ':' time-minute
time-offset      = 'Z' / time-numoffset

partial-time     = time-hour ':' time-minute ':' time-second
                  [time-secfrac]
full-date        = date-fullyear '-' date-month '-' date-mday
full-time        = partial-time time-offset

```

```

date-time        = full-date 'T' full-time

```

The date-and-time type is consistent with the semantics defined in [RFC 3339](#). The date-and-time type is compatible with the dateTime XML schema type with the following two notable exceptions:

- (a) The date-and-time type does not allow negative years.
- (b) The date-and-time time-offset -00:00 indicates an unknown time zone (see [RFC 3339](#)) while -00:00 and +00:00 and Z all represent the same time zone in dateTime.
- (c) The canonical format (see below) of data-and-time values differs from the canonical format used by the dateTime XML schema type, which requires all times to be in UTC using the time-offset 'Z'.

This type is not equivalent to the DateAndTime textual convention of the SMIV2 since [RFC 3339](#) uses a different separator between full-date and full-time and provides higher resolution of time-secfrac.

The canonical format for date-and-time values with a known time zone uses a numeric time zone offset that is calculated using

the device's configured known offset to UTC time. A change of the device's offset to UTC time will cause date-and-time values to change accordingly. Such changes might happen periodically in case a server follows automatically daylight saving time (DST) time zone offset changes. The canonical format for date-and-time values with an unknown time zone (usually referring to the notion of local time) uses the time-offset -00:00.";

reference

[RFC 3339](#): Date and Time on the Internet: Timestamps

[RFC 2579](#): Textual Conventions for SMIV2

W3C REC-xmlschema-2-20041028: XML Schema Part 2: Datatypes
Second Edition";

}

typedef timeticks {

type uint32;

description

"The timeticks type represents a non-negative integer which represents the time, modulo 2^{32} (4294967296 decimal), in hundredths of a second between two epochs. When a schema node is defined which uses this type, the description of the schema node identifies both of the reference epochs.

This type is in the value set and its semantics equivalent to the TimeTicks type of the SMIV2.";

reference

[RFC 2578](#): Structure of Management Information Version 2 (SMIV2)";

}

typedef timestamp {

type yang:timeticks;

description

"The timestamp type represents the value of an associated timeticks schema node at which a specific occurrence happened. The specific occurrence must be defined in the description of any schema node defined using this type. When the specific occurrence occurred prior to the last time the associated timeticks attribute was zero, then the timestamp value is zero. Note that this requires all timestamp values to be reset to zero when the value of the associated timeticks attribute reaches 497+ days and wraps around to zero.

The associated timeticks schema node must be specified in the description of any schema node using this type.

This type is in the value set and its semantics equivalent to the TimeStamp textual convention of the SMIV2.";

reference

"[RFC 2579](#): Textual Conventions for SMIV2";

}

/** collection of generic address types */

typedef phys-address {

type string {

pattern '([0-9a-fA-F]{2}(:[0-9a-fA-F]{2})*)?';

}

description

"Represents media- or physical-level addresses represented as a sequence octets, each octet represented by two hexadecimal numbers. Octets are separated by colons. The canonical representation uses lower-case characters.

This type is in the value set and its semantics equivalent to the PhysAddress textual convention of the SMIV2.";

reference

"[RFC 2579](#): Textual Conventions for SMIV2";

}

typedef mac-address {

type string {

pattern '[0-9a-fA-F]{2}(:[0-9a-fA-F]{2}){5}';

}

description

"The mac-address type represents an IEEE 802 MAC address. The canonical representation uses lower-case characters.

This type is in the value set and its semantics equivalent to the MacAddress textual convention of the SMIV2.";

reference

"IEEE 802: IEEE Standard for Local and Metropolitan Area Networks: Overview and Architecture

```
    RFC 2579: Textual Conventions for SMIV2";
}

/** collection of XML specific types */

typedef xpath1.0 {
    type string;
    description
        "This type represents an XPATH 1.0 expression.

        When a schema node is defined which uses this type, the
        description of the schema node MUST specify the XPath
        context in which the XPath expression is evaluated.";
    reference
        "W3C REC-xpath-19991116: XML Path Language (XPath) Version 1.0";
}
}

<CODE ENDS>
```

[4.](#) Internet Specific Derived Types

```
<CODE BEGINS> file "ietf-inet-types@2010-04-14.yang"
```



```

module ietf-inet-types {

    namespace "urn:ietf:params:xml:ns:yang:ietf-inet-types";
    prefix "inet";

    organization
        "IETF NETMOD (NETCONF Data Modeling Language) Working Group";

    contact
        "WG Web:  <http://tools.ietf.org/wg/netmod/>
        WG List:  <mailto:netmod@ietf.org>

        WG Chair: David Partain
                  <mailto:david.partain@ericsson.com>

        WG Chair: David Kessens
                  <mailto:david.kessens@nsn.com>

        Editor:   Juergen Schoenwaelder
                  <mailto:j.schoenwaelder@jacobs-university.de>";

    description
        "This module contains a collection of generally useful derived
        YANG data types for Internet addresses and related things.

        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

    revision 2010-04-14 {
        description
            "Initial revision.";
        reference
            "RFC XXXX: Common YANG Data Types";
    }
}

```

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

/** collection of protocol field related types */

typedef ip-version {
  type enumeration {
    enum unknown {
      value "0";
      description
        "An unknown or unspecified version of the Internet protocol.";
    }
    enum ipv4 {
      value "1";
      description
        "The IPv4 protocol as defined in RFC 791.";
    }
    enum ipv6 {
      value "2";
      description
        "The IPv6 protocol as defined in RFC 2460.";
    }
  }
  description
    "This value represents the version of the IP protocol.

    This type is in the value set and its semantics equivalent
    to the InetVersion textual convention of the SMIV2.";
  reference
    "RFC 791: Internet Protocol
    RFC 2460: Internet Protocol, Version 6 (IPv6) Specification
    RFC 4001: Textual Conventions for Internet Network Addresses";
}

typedef dscp {
  type uint8 {
    range "0..63";
  }
  description
    "The dscp type represents a Differentiated Services Code-Point
    that may be used for marking packets in a traffic stream.

    This type is in the value set and its semantics equivalent
    to the Dscp textual convention of the SMIV2.";
  reference
    "RFC 3289: Management Information Base for the Differentiated
    Services Architecture
```

```
        (DS Field) in the IPv4 and IPv6 Headers
RFC 2780: IANA Allocation Guidelines For Values In
        the Internet Protocol and Related Headers";
    }

typedef ipv6-flow-label {
    type uint32 {
        range "0..1048575";
    }
    description
        "The flow-label type represents flow identifier or Flow Label
        in an IPv6 packet header that may be used to discriminate
        traffic flows.

        This type is in the value set and its semantics equivalent
        to the IPv6FlowLabel textual convention of the SMIV2.";
    reference
        "RFC 3595: Textual Conventions for IPv6 Flow Label
        RFC 2460: Internet Protocol, Version 6 (IPv6) Specification";
    }

typedef port-number {
    type uint16 {
        range "1..65535";
    }
    description
        "The port-number type represents a 16-bit port number of an
        Internet transport layer protocol such as UDP, TCP, DCCP or
        SCTP. Port numbers are assigned by IANA. A current list of
        all assignments is available from <http://www.iana.org/>.

        Note that the value zero is not a valid port number. A union
        type might be used in situations where the value zero is
        meaningful.

        This type is in the value set and its semantics equivalent
        to the InetPortNumber textual convention of the SMIV2.";
    reference
        "RFC 768: User Datagram Protocol
        RFC 793: Transmission Control Protocol
```

```
    RFC 4960: Stream Control Transmission Protocol
    RFC 4340: Datagram Congestion Control Protocol (DCCP)
    RFC 4001: Textual Conventions for Internet Network Addresses";
}
```

```
/** collection of autonomous system related types */
```

```
typedef as-number {
```

Schoenwaelder

Expires October 16, 2010

[Page 17]

Internet-Draft

YANG-TYPES

April 2010

```
type uint32;
```

```
description
```

```
"The as-number type represents autonomous system numbers which identify an Autonomous System (AS). An AS is a set of routers under a single technical administration, using an interior gateway protocol and common metrics to route packets within the AS, and using an exterior gateway protocol to route packets to other ASs'. IANA maintains the AS number space and has delegated large parts to the regional registries.
```

```
Autonomous system numbers were originally limited to 16 bits. BGP extensions have enlarged the autonomous system number space to 32 bits. This type therefore uses an uint32 base type without a range restriction in order to support a larger autonomous system number space.
```

```
This type is in the value set and its semantics equivalent to the InetAutonomousSystemNumber textual convention of the SMIV2.";
```

```
reference
```

```
"RFC 1930: Guidelines for creation, selection, and registration of an Autonomous System (AS)
```

```
RFC 4271: A Border Gateway Protocol 4 (BGP-4)
```

```
RFC 4893: BGP Support for Four-octet AS Number Space
```

```
RFC 4001: Textual Conventions for Internet Network Addresses";
```

```
}
```

```
/** collection of IP address and hostname related types */
```

```
typedef ip-address {
```

```
type union {
```

```
type inet:ipv4-address;
```

```

    type inet:ipv6-address;
  }
  description
    "The ip-address type represents an IP address and is IP
    version neutral. The format of the textual representations
    implies the IP version.";
}

```

```

typedef ipv4-address {
  type string {
    pattern '((([0-1]?[0-9]?[0-9]|2[0-4][0-9]|25[0-5])\.){3}'
      + '([0-1]?[0-9]?[0-9]|2[0-4][0-9]|25[0-5])'
      + '(%[\p{N}\p{L}]+)?';
  }
  description

```

"The ipv4-address type represents an IPv4 address in dotted-quad notation. The IPv4 address may include a zone index, separated by a % sign.

The zone index is used to disambiguate identical address values. For link-local addresses, the zone index will typically be the interface index number or the name of an interface. If the zone index is not present, the default zone of the device will be used.

The canonical format for the zone index is the numerical format";

```

}

```

```

typedef ipv6-address {
  type string {
    pattern '(((:|[0-9a-fA-F]{0,4}):)([0-9a-fA-F]{0,4}:){0,5}'
      + '(((|[0-9a-fA-F]{0,4}:)?(:|[0-9a-fA-F]{0,4}))|'
      + '(((25[0-5]|2[0-4][0-9]|[01]?[0-9]?[0-9])\.){3}'
      + '(25[0-5]|2[0-4][0-9]|[01]?[0-9]?[0-9])))'
      + '(%[\p{N}\p{L}]+)?';
    pattern '((([^\:]+\:){6}([^\:]+\:|(\.\*\.\*\.\*)))|'
      + '(((([^\:]+\:)*[^\:]+\:)?::((([^\:]+\:)*[^\:]+\:)?)'
      + '(%.\+)?';
  }
  description

```

"The ipv6-address type represents an IPv6 address in full, mixed, shortened and shortened mixed notation. The IPv6 address may include a zone index, separated by a % sign.

The zone index is used to disambiguate identical address values. For link-local addresses, the zone index will typically be the interface index number or the name of an interface. If the zone index is not present, the default zone of the device will be used.

The canonical format of IPv6 addresses uses the compressed format described in [RFC 4291 section 2.2](#) item 2 with the following additional rules: The :: substitution must be applied to the longest sequence of all-zero 16-bit chunks in an IPv6 address. If there is a tie, the first sequence of all-zero 16-bit chunks is replaced by ::. Single all-zero 16-bit chunks are not compressed. The canonical format uses lower-case characters and leading zeros are not allowed. The canonical format for the zone index is the numerical format as described in [RFC 4007 section 11.2](#).";
reference

```
"RFC 4291: IP Version 6 Addressing Architecture
RFC 4007: IPv6 Scoped Address Architecture
IDv6TREP: A Recommendation for IPv6 Address Text Representation";
}

typedef ip-prefix {
  type union {
    type inet:ipv4-prefix;
    type inet:ipv6-prefix;
  }
  description
  "The ip-prefix type represents an IP prefix and is IP
  version neutral. The format of the textual representations
  implies the IP version.";
}

typedef ipv4-prefix {
  type string {
    pattern '((([0-1]?[0-9]?[0-9])|2[0-4][0-9]|25[0-5])\.){3}'
```

```

    + '([0-1]?[0-9]?[0-9]|2[0-4][0-9]|25[0-5])'
    + '/(((0-9)|([1-2][0-9])|(3[0-2])))';
}
description
"The ipv4-prefix type represents an IPv4 address prefix.
The prefix length is given by the number following the
slash character and must be less than or equal to 32.

A prefix length value of n corresponds to an IP address
mask which has n contiguous 1-bits from the most
significant bit (MSB) and all other bits set to 0.

The canonical format of an IPv4 prefix has all bits of
the IPv4 address set to zero that are not part of the
IPv4 prefix.";
}

typedef ipv6-prefix {
  type string {
    pattern '((:|[0-9a-fA-F]{0,4}):)([0-9a-fA-F]{0,4}:){0,5}'
      + '(((0-9a-fA-F){0,4}:)?(:|[0-9a-fA-F]{0,4}))|'
      + '(((25[0-5]|2[0-4][0-9]|[01]?[0-9]?[0-9])\.){3}'
      + '(25[0-5]|2[0-4][0-9]|[01]?[0-9]?[0-9])))'
      + '(/(((0-9)|([0-9]{2})|(1[0-1][0-9])|(12[0-8]))))';
    pattern '([[:^:]]+){6}([[:^:]]+:[[:^:]]+)|(.*\.\.*)"|'
      + '((([:^:]]+)*[[:^:]]+)?::((([:^:]]+)*[[:^:]]+)?)'
      + '(/.+)';
  }
  description

```

"The ipv6-prefix type represents an IPv6 address prefix. The prefix length is given by the number following the slash character and must be less than or equal 128.

A prefix length value of n corresponds to an IP address mask which has n contiguous 1-bits from the most significant bit (MSB) and all other bits set to 0.

The IPv6 address should have all bits that do not belong to the prefix set to zero.

The canonical format of an IPv6 prefix has all bits of

the IPv6 address set to zero that are not part of the IPv6 prefix. Furthermore, IPv6 address is represented in the compressed format described in [RFC 4291 section 2.2](#) item 2 with the following additional rules: The :: substitution must be applied to the longest sequence of all-zero 16-bit chunks in an IPv6 address. If there is a tie, the first sequence of all-zero 16-bit chunks is replaced by ::. Single all-zero 16-bit chunks are not compressed. The canonical format uses lower-case characters and leading zeros are not allowed.";

reference
["RFC 4291: IP Version 6 Addressing Architecture"](#);
}

/** collection of domain name and URI types */

```
typedef domain-name {
  type string {
    pattern '((([a-zA-Z0-9_]([a-zA-Z0-9\_-]){0,61})?[a-zA-Z0-9]\.)*'
      + '([a-zA-Z0-9_]([a-zA-Z0-9\_-]){0,61})?[a-zA-Z0-9]\.?)'
      + '|\.';
    length "1..253";
  }
  description
    "The domain-name type represents a DNS domain name. The name SHOULD be fully qualified whenever possible.

    Internet domain names are only loosely specified. Section 3.5 of RFC 1034 recommends a syntax (modified in section 2.1 of RFC 1123). The pattern above is intended to allow for current practise in domain name use, and some possible future expansion. It is designed to hold various types of domain names, including names used for A or AAAA records (host names) and other records, such as SRV records. Note that Internet host names have a stricter syntax (described in RFC 952) than the DNS recommendations in RFCs 1034 and
```

1123, and that systems that want to store host names in schema nodes using the domain-name type are recommended to adhere to this stricter standard to ensure interoperability.

The encoding of DNS names in the DNS protocol is limited

to 255 characters. Since the encoding consists of labels prefixed by a length bytes and there is a trailing NULL byte, only 253 characters can appear in the textual dotted notation.

The description clause of schema nodes using the domain-name type MUST describe when and how these names are resolved to IP addresses. Note that the resolution of a domain-name value may require to query multiple DNS records (e.g., A for IPv4 and AAAA for IPv6). The order of the resolution process and which DNS record takes precedence can either be defined explicitly or it may depend on the configuration of the resolver.

The canonical format for domain-name values uses the US-ASCII encoding and case-insensitive characters are set to lowercase.";

reference

```
"RFC 952: DoD Internet Host Table Specification
RFC 1034: Domain Names - Concepts and Facilities
RFC 1123: Requirements for Internet Hosts -- Application
and Support
RFC 3490: Internationalizing Domain Names in Applications
(IDNA)";
```

```
}
```

```
typedef host {
  type union {
    type inet:ip-address;
    type inet:domain-name;
  }
  description
  "The host type represents either an IP address or a DNS
  domain name.";
}
```

```
typedef uri {
  type string;
  description
  "The uri type represents a Uniform Resource Identifier
  (URI) as defined by STD 66.
```

Objects using the uri type MUST be in US-ASCII encoding,

and MUST be normalized as described by [RFC 3986](#) Sections 6.2.1, 6.2.2.1, and 6.2.2.2. All unnecessary percent-encoding is removed, and all case-insensitive characters are set to lowercase except for hexadecimal digits, which are normalized to uppercase as described in [Section 6.2.2.1](#).

The purpose of this normalization is to help provide unique URIs. Note that this normalization is not sufficient to provide uniqueness. Two URIs that are textually distinct after this normalization may still be equivalent.

Objects using the uri type may restrict the schemes that they permit. For example, 'data:' and 'urn:' schemes might not be appropriate.

A zero-length URI is not a valid URI. This can be used to express 'URI absent' where required.

This type is in the value set and its semantics equivalent to the Uri SMIV2 textual convention defined in [RFC 5017](#)."; reference

```
"RFC 3986: Uniform Resource Identifier (URI): Generic Syntax  
RFC 3305: Report from the Joint W3C/IETF URI Planning Interest  
Group: Uniform Resource Identifiers (URIs), URLs,  
and Uniform Resource Names (URNs): Clarifications  
and Recommendations  
RFC 5017: MIB Textual Conventions for Uniform Resource  
Identifiers (URIs)";
```

```
}
```

```
}
```

```
<CODE ENDS>
```

Internet-Draft

YANG-TYPES

April 2010

5. IANA Considerations

This document registers two URIs 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-types
URI: urn:ietf:params:xml:ns:yang:ietf-inet-types

Registrant Contact: The NETMOD WG of the IETF.

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

This document registers two YANG modules in the YANG Module Names registry [[YANG](#)].

name: ietf-yang-types
namespace: urn:ietf:params:xml:ns:yang:ietf-yang-types
prefix: yang
reference: RFCXXXX

name: ietf-inet-types
namespace: urn:ietf:params:xml:ns:yang:ietf-inet-types
prefix: inet
reference: RFCXXXX

[6.](#) Security Considerations

This document defines common data types using the YANG data modeling language. The definitions themselves have no security impact on the Internet but the usage of these definitions in concrete YANG modules might have. The security considerations spelled out in the YANG specification [[YANG](#)] apply for this document as well.

[7.](#) Contributors

The following people contributed significantly to the initial version of this draft:

- Andy Bierman (Netconf Central)
- Martin Bjorklund (Tail-f Systems)
- Balazs Lengyel (Ericsson)
- David Partain (Ericsson)
- Phil Shafer (Juniper Networks)

[8.](#) Acknowledgments

The editor wishes to thank the following individuals for providing helpful comments on various versions of this document: Ladislav Lhotka, Lars-Johan Liman, Dan Romascanu.

[9.](#) References

[9.1.](#) Normative References

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.
- [RFC3688] Mealling, M., "The IETF XML Registry", [BCP 81](#), [RFC 3688](#), January 2004.
- [YANG] Bjorklund, M., Ed., "YANG - A data modeling language for NETCONF", [draft-ietf-netmod-yang-12](#) (work in progress).

[9.2.](#) Informative References

[IDv6TREP]

Kawamura, S. and M. Kawashima, "A Recommendation for IPv6 Address Text Representation", [draft-ietf-6man-text-addr-representation-06](#) (work in progress).

[IEEE802] IEEE, "IEEE Standard for Local and Metropolitan Area Networks: Overview and Architecture", IEEE Std. 802-2001.

[RFC0768] Postel, J., "User Datagram Protocol", STD 6, [RFC 768](#), August 1980.

[RFC0791] Postel, J., "Internet Protocol", STD 5, [RFC 791](#), September 1981.

[RFC0793] Postel, J., "Transmission Control Protocol", STD 7, [RFC 793](#), September 1981.

[RFC0952] Harrenstien, K., Stahl, M., and E. Feinler, "DoD Internet host table specification", [RFC 952](#), October 1985.

[RFC1034] Mockapetris, P., "Domain names - concepts and facilities", STD 13, [RFC 1034](#), November 1987.

[RFC1123] Braden, R., "Requirements for Internet Hosts - Application and Support", STD 3, [RFC 1123](#), October 1989.

[RFC1930] Hawkinson, J. and T. Bates, "Guidelines for creation, selection, and registration of an Autonomous System (AS)", [BCP 6](#), [RFC 1930](#), March 1996.

[RFC2460] Deering, S. and R. Hinden, "Internet Protocol, Version 6 (IPv6) Specification", [RFC 2460](#), December 1998.

Schoenwaelder

Expires October 16, 2010

[Page 28]

Internet-Draft

YANG-TYPES

April 2010

[RFC2474] Nichols, K., Blake, S., Baker, F., and D. Black, "Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers", [RFC 2474](#), December 1998.

[RFC2578] McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., "Structure of Management Information

Version 2 (SMIv2)", STD 58, [RFC 2578](#), April 1999.

- [RFC2579] McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., "Textual Conventions for SMIv2", STD 58, [RFC 2579](#), April 1999.
- [RFC2780] Bradner, S. and V. Paxson, "IANA Allocation Guidelines For Values In the Internet Protocol and Related Headers", [BCP 37](#), [RFC 2780](#), March 2000.
- [RFC2856] Bierman, A., McCloghrie, K., and R. Presuhn, "Textual Conventions for Additional High Capacity Data Types", [RFC 2856](#), June 2000.
- [RFC3289] Baker, F., Chan, K., and A. Smith, "Management Information Base for the Differentiated Services Architecture", [RFC 3289](#), May 2002.
- [RFC3305] Mealling, M. and R. Denenberg, "Report from the Joint W3C/IETF URI Planning Interest Group: Uniform Resource Identifiers (URIs), URLs, and Uniform Resource Names (URNs): Clarifications and Recommendations", [RFC 3305](#), August 2002.
- [RFC3339] Klyne, G., Ed. and C. Newman, "Date and Time on the Internet: Timestamps", [RFC 3339](#), July 2002.
- [RFC3490] Faltstrom, P., Hoffman, P., and A. Costello, "Internationalizing Domain Names in Applications (IDNA)", [RFC 3490](#), March 2003.
- [RFC3595] Wijnen, B., "Textual Conventions for IPv6 Flow Label", [RFC 3595](#), September 2003.
- [RFC3986] Berners-Lee, T., Fielding, R., and L. Masinter, "Uniform Resource Identifier (URI): Generic Syntax", STD 66, [RFC 3986](#), January 2005.
- [RFC4001] Daniele, M., Haberman, B., Routhier, S., and J. Schoenwaelder, "Textual Conventions for Internet Network Addresses", [RFC 4001](#), February 2005.

- [RFC4007] Deering, S., Haberman, B., Jinmei, T., Nordmark, E., and B. Zill, "IPv6 Scoped Address Architecture", [RFC 4007](#), March 2005.
- [RFC4271] Rekhter, Y., Li, T., and S. Hares, "A Border Gateway Protocol 4 (BGP-4)", [RFC 4271](#), January 2006.
- [RFC4291] Hinden, R. and S. Deering, "IP Version 6 Addressing Architecture", [RFC 4291](#), February 2006.
- [RFC4340] Kohler, E., Handley, M., and S. Floyd, "Datagram Congestion Control Protocol (DCCP)", [RFC 4340](#), March 2006.
- [RFC4502] Waldbusser, S., "Remote Network Monitoring Management Information Base Version 2", [RFC 4502](#), May 2006.
- [RFC4741] Enns, R., "NETCONF Configuration Protocol", [RFC 4741](#), December 2006.
- [RFC4893] Vohra, Q. and E. Chen, "BGP Support for Four-octet AS Number Space", [RFC 4893](#), May 2007.
- [RFC4960] Stewart, R., "Stream Control Transmission Protocol", [RFC 4960](#), September 2007.
- [RFC5017] McWalter, D., "MIB Textual Conventions for Uniform Resource Identifiers (URIs)", [RFC 5017](#), September 2007.
- [RFC5226] Narten, T. and H. Alvestrand, "Guidelines for Writing an IANA Considerations Section in RFCs", [BCP 26](#), [RFC 5226](#), May 2008.

Internet-Draft

YANG-TYPES

April 2010

Author's Address

Juergen Schoenwaelder (editor)
Jacobs University

Email: j.schoenwaelder@jacobs-university.de

Schoenwaelder

Expires October 16, 2010

[Page 31]