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A YANG Data Model for Bandwidth Availability Topology

Abstract

This document defines a YANG data model to describe bandwidth availability for a link in a network topology.

Discussion Venues

This note is to be removed before publishing as an RFC.

Source for this draft and an issue tracker can be found at https://github.com/ietf-ccamp-wg/draft-ietf-ccamp-mw-topo-yang.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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1. Introduction

This document defines a YANG data model to describe bandwidth availability for a link. It is an important characteristic of links with variable bandwidth, where each level of bandwidth can be associated with a certain level of availability. An example of such a link is microwave radio link, where the bandwidth can be dynamically adapted to changing signal conditions, impacted by interference & fading, in order to guarantee the required quality of the link at every single moment. [RFC8330] defines a mechanism to report bandwidth-availability information through OSPF-TE, but it could also be useful for a controller to access such bandwidth-availability information as part of the topology model when performing a path/route computation. The model augments "YANG Data Model for Traffic Engineering (TE) Topologies" defined in [RFC8795], which is based on "A YANG Data Model for Network Topologies" defined in [RFC8345].

The bandwidth availability model is expected to be used between a Provisioning Network Controller (PNC) and a Multi Domain Service Coordinator(MDSC) [RFC8453]. Examples of use cases that can be supported are:

1. Propagation of relevant characteristics of a link, including bandwidth availability, to higher topology layers, where it e.g. could be used as a criterion when configuring and optimizing a path for a connection/service through the network end to end.

2. A link could dynamically adjust its bandwidth according to changes in the signal conditions. [RFC8330] defines a mechanism to report bandwidth-availability information through OSPF-TE, but it could also be useful for a controller to access such bandwidth-availability information as part of the topology model when performing a path/route computation.

1.1. Terminology and Definitions

The following acronyms are used in this document:

PNC Provisioning Network Controller

MDSC Multi Domain Service Coordinator

1.2. Tree Structure

A simplified graphical representation of the data model is used in chapter 3.1 of this document. The meaning of the symbols in these diagrams is defined in [RFC8340].

2. Requirements Language

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.

3. Bandwidth Availability Topology YANG Data Model

3.1. YANG Tree

```
module: ietf-bandwidth-availability-topology

  augment /nw:networks/nw:network/nt:link/tet:te
            /tet:te-link-attributes:
    +---u link-bw-availability-table
```

3.2. Bandwidth Availability Topology YANG Data Module

```
<CODE BEGINS> file "ietf-bandwidth-availability-topology.yang"

module ietf-bandwidth-availability-topology {
   yang-version "1.1";
   namespace
  "urn:ietf:params:xml:ns:yang:ietf-bandwidth-availability-topology";
   prefix "bwatopo";

   import ietf-yang-types {
     prefix yang;
     reference
       "RFC 6991";
   }

   import ietf-network {
     prefix "nw";
     reference "RFC 8345: A YANG Data Model for Network Topologies";
   }

   import ietf-network-topology {
     prefix "nt";
     reference "RFC 8345: A YANG Data Model for Network Topologies";
   }

   import ietf-te-topology {
     prefix "tet";
     reference "RFC 8795: YANG Data Model for Traffic Engineering
                (TE) Topologies";
   }

   organization
     "Internet Engineering Task Force (IETF) CCAMP WG";
   contact
     "WG List: <mailto:ccamp@ietf.org>

      Editor: Jonas Ahlberg
              <mailto:jonas.ahlberg@ericsson.com>
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              <mailto:scott.mansfield@ericsson.com>
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      Editor: Xi Li
              <mailto:Xi.Li@neclab.eu>
      Editor: Daniela Spreafico
              <mailto:daniela.spreafico@nokia.com>
     ";

   description
```

```
  "This is a module for defining bandwidth availability matrix,
   for links in a topology. It is intended to be used in
   conjunction with an instance of ietf-network-topology and its

   augmentations.
   Example use cases include:
   - Defining bandwidth availability matrix for a microwave link
   - Defining bandwidth availability matrix for a LAG link
     comprising of two or more member links

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  forth in Section 4.c of the IETF Trust's Legal Provisions
  Relating to IETF Documents
  (https://trustee.ietf.org/license-info).

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

revision 2023-02-15 {
  description
  "First rough draft.";
  reference "";
}

/*
 * Groupings
 */
grouping link-bw-availability-table {

  description "Grouping used for bandwidth availability.";

  list link-availability{
    key "availability";
    description
      "Table describing the bandwidths available at corresponding
       availability level for a link.";

    leaf availability {
      type decimal64 {
        fraction-digits 4;
        range "0..99.9999";
      }
      description "Availability level";
    }
```

```
      leaf link-bandwidth {
        type uint64;
        units "Kbps";

        description
          "The link bandwidth corresponding to the availability
           level";
      }
    }
    leaf actual-bandwidth{
      type yang:gauge64;
      units "bits/second";
      config false;
      description
        "An estimate of the link's current bandwidth in bits per
         second. Related to the data node speed in RFC 8343.";
      reference
        "RFC 8343: A YANG Data Model for Interface Management";
    }
  }

  /*
   * Data nodes
   */

  augment "/nw:networks/nw:network/nt:link/tet:te/"
          + "tet:te-link-attributes" {
    description
      "Augmenting link with link bandwidth availability matrix.";
    uses link-bw-availability-table;
  }
}

<CODE ENDS>
```

4. Security Considerations

The YANG module specified in this document defines schemas 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.

The YANG module specified in this document imports and augments the ietf-network and ietf-network-topology models defined in [RFC8345]. The security considerations from [RFC8345] are applicable to the module in this document.

There are a several data nodes defined in this YANG module that 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 data nodes and their sensitivity/vulnerability:

In the "ietf-bandwidth-availability-topology" module:

* availability: A malicious client could attempt to modify the availability level which could modify the intended behavior.

* link-bandwidth: A malicious client could attempt to modify the link bandwidth which could either provide more or less link bandwidth at the indicated availability level, changing the resource allocation in unintended ways.

5. IANA Considerations

IANA is asked to assign a new URI from the "IETF XML Registry" [RFC3688] as follows:

URI: urn:ietf:params:xml:ns:yang:ietf-bandwidth-availability-topology
Registrant Contact: The IESG
XML: N/A; the requested URI is an XML namespace.

It is proposed that IANA should record YANG module names in the "YANG Module Names" registry [RFC6020] as follows:

Name: ietf-bandwidth-availability-topology
Maintained by IANA?: N
Namespace:
urn:ietf:params:xml:ns:yang:ietf-bandwidth-availability-topology
Prefix: bwavtopo
Reference: RFC XXXX

6. References

6.1. Normative References

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6.2. Informative References

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Appendix A. Examples of the application of the Bandwidth Availability Topology Model

This appendix provides some examples and illustrations of how the Bandwidth Availability Topology Model can be used. There is one extended tree to illustrate the model and a JSON based instantiation for a small network example.

A.1. A tree for a the Bandwidth Availability Topology Model

The tree below shows the leafs for the Bandwidth Availability Model including the augmented Network Topology Model defined in [RFC8345] and Traffic Engineering (TE) Topologies model defined in [RFC8795].

```
module: ietf-network
  +--rw networks
     +--rw network* [network-id]
        +--rw network-id                network-id
        +--rw nt:link* [link-id]
           +--rw nt:link-id               link-id
           +--rw tet:te!
              +--rw tet:te-link-attributes
                 +--rw bwatopo:link-availability* [availability]
                 |  +--rw bwatopo:availability      decimal64
                 |  +--rw bwatopo:link-bandwidth?   uint64
                 +--ro bwatopo:actual-bandwidth?    yang:gauge64
```

A.2. A JSON example

```
{
  "ietf-network:networks": {
    "network": [
      {
        "network-id": "Generic-network",
        "network-types": {
          "ietf-te-topology:te-topology": {
            "ietf-eth-te-topology:eth-tran-topology": {}
          }
        },
        "node": [
          {
            "node-id": "Generic-N1",
            "ietf-network-topology:termination-point": [
              {
                "tp-id": "Generic-N1-TP1"
              }
            ]
          },
          {
            "node-id": "Generic-N2",
            "ietf-network-topology:termination-point": [
              {
                "tp-id": "Generic-N2-TP2"
              }
            ]
          }
        ],
        "ietf-network-topology:link": [
          {
            "link-id": "Generic-N1-N2",
            "source": {
              "source-node": "Generic-N1",
              "source-tp": "Generic-N1-TP1"
            },
            "destination": {
              "dest-node": "Generic-N2",
              "dest-tp": "Generic-N2-TP2"
            },
            "ietf-te-topology:te": {
              "te-link-attributes": {
      "ietf-bandwidth-availability-topology:link-availability": [
                {
                  "availability": "0.999",
                  "link-bandwidth": "20000000"
                }
              ]
            }
          }
```

```
            }
          ]
        }
      ]
    }
}
```

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