

CCAMP Working Group
Internet Draft
Intended status: Standards Track
Expires: November 27, 2018

J.E. Lopez de Vergara
Universidad Autonoma de Madrid
Daniel Perdices
Naudit HPCN
V. Lopez
O. Gonzalez de Dios
Telefonica I+D/GCTO
D. King
Lancaster University
Y. Lee
Huawei
G. Galimberti
Cisco Photonics Srl
May 24, 2018

**YANG data model for Flexi-Grid media-channels
draft-ietf-ccamp-flexigrid-media-channel-yang-00.txt**

Status of this Memo

This Internet-Draft is submitted in full conformance with the provisions of [BCP 78](#) and [BCP 79](#). This document may not be modified, and derivative works of it may not be created, except to publish it as an RFC and to translate it into languages other than English.

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/1id-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 November 27, 2018

Copyright Notice

Copyright (c) 2018 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

Lopez de Vergara, et al.

Expires November 27, 2018

[Page 1]

carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must 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.

Abstract

This document defines a YANG model for managing flexi-grid optical media channels, complementing the information provided by the flexi-grid TED model. It is also grounded on other defined YANG abstract models.

Table of Contents

- [1.](#) Introduction [2](#)
- [2.](#) Conventions used in this document [3](#)
- [3.](#) Flexi-grid media-channel overview [3](#)
- [4.](#) Example of use [4](#)
- [5.](#) Media Channel YANG Model [5](#)
 - [5.1.](#) YANG Model - Tree [5](#)
 - [5.2.](#) YANG Model - Code [6](#)
 - [5.3.](#) License [10](#)
- [6.](#) Security Considerations [10](#)
- [7.](#) IANA Considerations [10](#)
- [8.](#) References [11](#)
 - [8.1.](#) Normative References [11](#)
 - [8.2.](#) Informative References [11](#)
- [9.](#) Contributors [11](#)
- [10.](#) Acknowledgments [11](#)
- Authors' Addresses [12](#)

1. Introduction

Transport networks are evolving from current DWDM systems towards elastic optical networks, based on flexi-grid transmission and switching technologies [[RFC7698](#)]. Such technology aims at increasing both transport network scalability and flexibility, allowing the optimization of bandwidth usage.

While [I-D.[draft-ietf-ccamp-flexigrid-yang](#)] focuses on flexi-grid objects such as nodes, transponders and links, this document presents a YANG model for the flexi-grid media-channel. This YANG module defines the whole path from a source transponder or node to the destination through a number of intermediate nodes in the flexi-grid network.

This document identifies the flexi-grid media-channel components, parameters and their values, characterizes the features and the performances of the flexi-grid elements. An application example is provided towards the end of the document to better understand their utility.

2. Conventions used in this document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [[RFC2119](#)].

In this document, these words will appear with that interpretation only when in ALL CAPS. Lower case uses of these words are not to be interpreted as carrying [RFC-2119](#) significance.

In this document, the characters ">>" preceding an indented line(s) indicates a compliance requirement statement using the key words listed above. This convention aids reviewers in quickly identifying or finding the explicit compliance requirements of this RFC.

3. Flexi-grid media-channel overview

The present model defines a flexi-grid media-channel mainly composed of:

- source address
- source flexi-grid port
- source flexi-grid transponder
- destination address
- destination flexi-grid port
- destination flexi-grid transponder
- A list of links that defines the path
- Other optical attributes

Each path can be a media-channel (only defined by source and destination node) or a network media-channel (additionally needs source and destination transponders). Therefore, all the attributes are optional to support both situations.

This is achieved by a combination of the traffic engineering tunnel attributes explained in [I-D.draft-ietf-teas-yang-te] and augments when necessary. For instance, source address, source flexi-grid transponder, destination address and destination flexi-grid transponder attributes are directly taken from tunnel, whereas other attributes such as source flexi-grid port, destination flexi-grid port are defined, as they are specific for flexi-grid.

4. Example of use

In order to explain how this model is used, we provide the following example. An optical network usually has multiple transponders, switches (nodes) and links between them. Figure 1 shows a simple topology, where two physical paths interconnect two optical transponders.

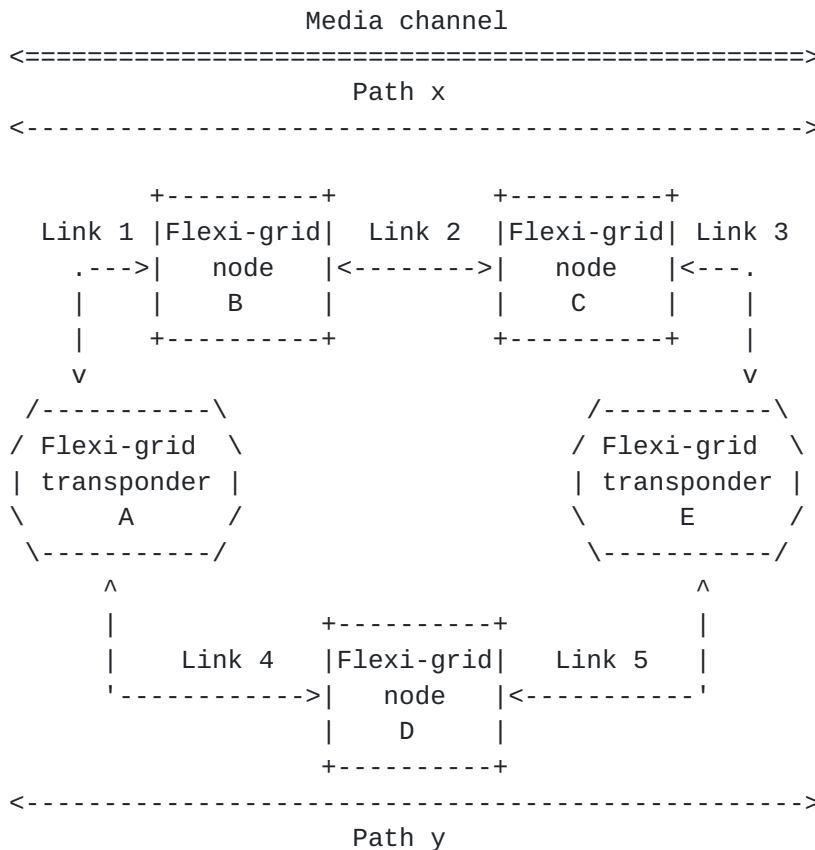


Figure 1. Topology example.

After the nodes, links and transponders have been defined using [I-D.draft-ietf-ccamp-flexigrid-yang], we can configure the media-channel from the information we have stored in the flexi-grid TED, by querying which elements are available, and

planning the resources that have to be provided on each situation.
Note that every element in the flexi-grid TED has a reference, and
this is the way in which they are called in the media-channel.

1. Depending on the case, it is possible to define either the source and destination node ports, or the source and destination node and transponder. In our case, we would define a network media channel, with source transponder A and source node B, and destination transponder E and destination node C. Thus, we are going to follow path x.
2. Then, for each link in the path x, we indicate which channel we are going to use, providing information about the slots, and what nodes are connected.
3. Finally, the flexi-grid TED has to be updated with each element usage status each time a media channel is created or torn down.

5. Media Channel YANG Model

5.1. YANG Model - Tree

```
module: ietf-flexi-grid-media-channel
  augment /te:te/te:tunnels/te:tunnel:
    +--rw source-port?          fg-ted:flexi-grid-node-port-ref
    +--rw destination-port?     fg-ted:flexi-grid-node-port-ref
    +--rw effective-freq-slot
      +--rw N?   int32
      +--rw M?   int32
  augment /te:te/te:tunnels/te:tunnel/te:state:
    +--ro source-port?          fg-ted:flexi-grid-node-port-ref
    +--ro destination-port?     fg-ted:flexi-grid-node-port-ref
    +--ro effective-freq-slot
      +--ro N?   int32
      +--ro M?   int32
  augment /te:te/te:lsp-state/te:lsp:
    +--ro N?          int32
    +--ro M?          int32
    +--ro source-port?  fg-ted:flexi-grid-node-port-ref
    +--ro destination-port? fg-ted:flexi-grid-node-port-ref
    +--ro link?        fg-ted:flexi-grid-link-ref
    +--ro bidirectional? boolean
```

5.2. YANG Model - Code

```
<CODE BEGINS> file "ietf-flexi-grid-media-channel@2018-05-24.yang"

module ietf-flexi-grid-media-channel {
  yang-version 1.1;

  namespace
    "urn:ietf:params:xml:ns:yang:ietf-flexi-grid-media-channel";
  prefix "fg-mc";

  import ietf-flexi-grid-ted {
    prefix "fg-ted";
  }

  import ietf-te {
    prefix "te";
  }

  import ietf-network {
    prefix "nd";
  }
  organization
    "IETF CCAMP Working Group";
  contact
    "Editor: Jorge Lopez de Vergara
      <jorge.lopez_vergara@uam.es>";

  description
    "This module contains a collection of YANG definitions for
    a Flexi-Grid media channel.

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

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

  revision 2018-05-24 {
    description
      "version 0.1";

    reference
      "RFC XXX: A Yang Data Model for Flexi-Grid media-channels";
  }
}
```



```

grouping flexi-grid-media-channel {
  description
    "Media association that represents both the topology
    (i.e., path through the media) and the resource
    (frequency slot) that it occupies. As a topological
    construct, it represents a (effective) frequency slot
    supported by a concatenation of media elements (fibers,
    amplifiers, filters, switching matrices...). This term
    is used to identify the end-to-end physical layer entity
    with its corresponding (one or more) frequency slots
    local at each link filters.";
  reference "rfc7698";
  leaf source-port {
    type fg-ted:flexi-grid-node-port-ref;
    description "Source port";
  }
  leaf destination-port {
    type fg-ted:flexi-grid-node-port-ref;
    description "Destination port";
  }
  container effective-freq-slot {
    description "The effective frequency slot is an attribute
    of a media channel and, being a frequency slot, it is
    described by its nominal central frequency and slot
    width";
    reference "rfc7698";
    leaf N {
      type int32;
      description
        "Is used to determine the Nominal Central
        Frequency. The set of nominal central frequencies
        can be built using the following expression:
           $f = 193.1 \text{ THz} + n \times 0.00625 \text{ THz}$ ,
        where 193.1 THz is ITU-T 'anchor frequency' for
        transmission over the C band, n is a positive or
        negative integer including 0.";
      reference "rfc7698";
    }
    leaf M {
      type int32;
      description
        "Is used to determine the slot width. A slot width
        is constrained to be M x SWG (that is, M x 12.5 GHz),
        where M is an integer greater than or equal to 1.";
      reference "rfc7698";
    }
  }
}
}

```



```

grouping link-channel-attributes {
  description
    "A link channel is one of the concatenated elements of
    the media channel.";
  leaf N {
    type int32;
    description
      "Is used to determine the Nominal Central Frequency.
      The set of nominal central frequencies can be built
      using the following expression:
       $f = 193.1 \text{ THz} + n \times 0.00625 \text{ THz}$ ,
      where 193.1 THz is ITU-T 'anchor frequency' for
      transmission over the C band, n is a positive or
      negative integer including 0.";
    reference "rfc7698";
  }
  leaf M {
    type int32;
    description
      "Is used to determine the slot width. A slot
      width is constrained to be  $M \times \text{SWG}$  (that is,
       $M \times 12.5 \text{ GHz}$ ), where M is an integer greater than
      or equal to 1.";
    reference "rfc7698";
  }
  leaf source-port {
    type fg-ted:flexi-grid-node-port-ref;
    description "Source port of the link channel";
  }
  leaf destination-port {
    type fg-ted:flexi-grid-node-port-ref;
    description "Destination port of the link channel";
  }
  leaf link {
    type fg-ted:flexi-grid-link-ref;
    description "Link of the link channel";
  }
  leaf bidirectional {
    type boolean;
    description
      "Determines whether the link is bidirectional or
      not";
  }
}

```

```
/* Augment for media-channel */
augment "/te:te/te:tunnels/te:tunnel" {
  when "/nd:networks/nd:network/nd:network-types/
fg-ted:flexi-grid-network"{
    description "Augment only for Flexigrid network.";
  }
  description "Augment tunnel with media-channel config";
  uses flexi-grid-media-channel;
}

  augment "/te:te/te:tunnels/te:tunnel/te:state" {
    when "/nd:networks/nd:network/nd:network-types/
fg-ted:flexi-grid-network"{
      description "Augment only for Flexigrid network.";
    }
    uses flexi-grid-media-channel;
    description "Augment tunnel with media-channel state";
  }

/* Augment for LSP */
augment "/te:te/te:lsp-state/te:lsp" {
  when "/nd:networks/nd:network/nd:network-types/
fg-ted:flexi-grid-network"{
    description "Augment only for Flexigrid network.";
  }
  uses link-channel-attributes;
  description "Augment LSP for paths";
}
}

<CODE ENDS>
```

5.3. License

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

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- o Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- o Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- o Neither the name of Internet Society, IETF or IETF Trust, nor the names of specific contributors, may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT OWNER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

6. Security Considerations

The transport protocol used for sending the managed information MUST support authentication and SHOULD support encryption.

The defined data-model by itself does not create any security implications.

7. IANA Considerations

The namespace used in the defined models is currently based on the METRO-HAUL project URI. Future versions of this document could register a URI in the IETF XML registry [[RFC3688](#)], as well as in the YANG Module Names registry [[RFC6020](#)].

8. References

8.1. Normative References

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.
- [RFC6020] Bjorklund, M., Ed., "YANG - A Data Modeling Language for the Network Configuration Protocol (NETCONF)", [RFC 6020](#), October 2010.
- [RFC3688] Mealling, M., "The IETF XML Registry", [BCP 81](#), [RFC 3688](#), January 2004.

8.2. Informative References

- [RFC7698] Gonzalez de Dios, O., Casellas, R., Eds. "Framework and Requirements for GMPLS-Based Control of Flexi-Grid Dense Wavelength Division Multiplexing (DWDM) Networks", [RFC7698](#), November 2015.
- [I-D.[draft-ietf-ccamp-flexigrid-yang](#)] Lopez de Vergara, J., Perdices, D., Lopez, V., Gonzalez de Dios, O., King, D., Lee, Y., Galimberti, G., "YANG data model for Flexi-Grid Optical Networks", Internet Draft, [draft-ietf-ccamp-flexigrid-yang-00](#), 2018.
- [I-D.[draft-ietf-teas-yang-te](#)] Saad, T., Gandhi, R., Liu, X., Beeram, V., Shah, H., Bryskin, I., Chen, X., Jones, R., and B. Wen, "A YANG Data Model for Traffic Engineering Tunnels and Interfaces", [draft-ietf-teas-yang-te-14](#), 2018.

9. Contributors

The model presented in this paper was contributed to by more people than can be listed on the author list. Additional contributors include:

- o Zafar Ali, Cisco Systems
- o Daniel Michaud Vallinoto, Universidad Autonoma de Madrid

10. Acknowledgments

The work presented in this Internet-Draft has been partially funded by the European Commission under the project H2020 METRO-HAUL (Metro High bandwidth, 5G Application-aware optical network, with edge storage, compUte and low Latency), Grant Agreement number:

761727, and by the Spanish Ministry of Economy and Competitiveness under the project TRAFICA, MINECO/FEDER TEC2015-69417-C2-1-R.

Lopez de Vergara, et al.

Expires November 27, 2018

[Page 11]

Authors' Addresses

Jorge E. Lopez de Vergara
Universidad Autonoma de Madrid
Escuela Politecnica Superior
C/Francisco Tomas y Valiente, 11
E-28049 Madrid, Spain

Email: jorge.lopez_vergara@uam.es

Daniel Perdices Burrero
Naudit High Performance Computing and Networking, S.L.
C/Faraday, 7
E-28049 Madrid, Spain

Email: daniel.perdices@naudit.es

Victor Lopez
Telefonica I+D/GCTO
Distrito Telefonica
E-28050 Madrid, Spain

Email: victor.lopezalvarez@telefonica.com

Oscar Gonzalez de Dios
Telefonica I+D/GCTO
Distrito Telefonica
E-28050 Madrid, Spain

Email: oscar.gonzalezdedios@telefonica.com

Daniel King
Lancaster University

Email: d.king@lancaster.ac.uk

Young Lee
Huawei Technologies

Email: leeyoung@huawei.com

Gabriele Galimberti
Cisco Photonics Srl

Email: ggalimbe@cisco.com

