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# A YANG Data Model for Layer 1 Types
# draft-ietf-ccamp-layer1-types-01

## Abstract

This document defines a collection of common data types and groupings in YANG data modeling language for layer 1 networks. These derived common types and groupings are intended to be imported by modules that specifies the OTN networks, including the topology, tunnel, client signal adaptation and service.

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## 1. Introduction

This document introduces a collection of common data types which would be used in Layer 1 networks. The derived types and groupings are designed to be the common types applicable for modeling Traffic Engineering (TE) features for Layer 1 optical networks.

Typical L1 network, the Optical Transport Networking, was specified in [RFC7062]. Corresponding routing and signaling protocol have been specified in [RFC7138] and [RFC7139]. The types and groupings defined in this document is consistent to these document, and will be imported in other Layer 1 data models, including but not restrictive to, [I-D.ietf-ccamp-otn-topo-yang], [I-D.ietf-ccamp-otn-tunnel-model] and [I-D.ietf-ccamp-l1csm-yang].

The data model in this draft has only types defined including groupings, typedef and identities. There is no need to include configuration and state data according to the new Network Management Datastore Architecture [RFC8342]. The content in this draft is in consistent with [MEF63].

## 2. Terminology and Notations

Refer to [RFC7062] for the key terms used in this document, and the terminology for describing YANG data models can be found in [RFC7950].

## 3. Prefix in Data Node Names

In this document, names of data nodes and other data model objects are prefixed using the standard prefix associated with the corresponding YANG imported modules.

| Prefix | YANG module | Reference |
|---|---|---|
| layer1-types | ietf-layer1-types | This Document |

## 4. Layer 1 Types Overview

### 4.1. Relationship with other Modules

This document defines one YANG module for common Layer 1 types: ietf-layer1-types for OTN specific types. The objective is to specifies common Layer 1 TE types that can be imported by layer 1 specific technology, for example OTN, in its technology-specific modules such as topology and tunnels. It is worth noting that the generic traffic-engineering (TE) types module is specified in [I-D.ietf-teas-yang-te-types] as ietf-te-types, and both the module ietf-te-types and ietf-layer1-types are needed to be imported when the OTN is configured.

### 4.2. Content in Layer 1 Type Module

The module ietf-layer1-types contains the following YANG reusable types and groupings:

tributary-slot-granularity:

This is to define the granularity for ODUk or ODUCn. Three granularities, 1.25G/2.5G/5G, have been specified.

odu-type:

This is to specify the type of ODUk.

client-signal:

This is to specify the client signal types of OTN networks. The initial input was the G-PID specified in [RFC7139]. Identities about a few categories of client signal types, including ETH, STM-n, OC and Fiber Channel have been specified.

otn-label-range-type:

The label range type of OTN has two different representations, tributary slots (TS) and tributary port number (TPN), according to [RFC7139]. Respective representation is specified under this same base type.

otn-link-bandwidth:

This grouping defines the link bandwidth information and could be used in OTN topology model for bandwidth representation. All the bandwidth related sections in generic topology module, ietf-te-topology, need to be augmented with this grouping for the usage of Layer 1.

otn-path-bandwidth:

This grouping defines the path bandwidth information and could be used in OTN topology model for bandwidth representation. All the bandwidth related sections in generic topology module, ietf-te-topology, need to be augmented with this grouping for the usage of Layer 1. This grouping is also applicable to set up the OTN tunnel.

otn-label-restriction and otn-label-step:

These groupings are used for the augmentation of OTN label in a specific way.

otn-link-label and otn-path-label:

These groupings are used for the augmentation of label for OTN link and path respectively.

optical-interface-func:

The optical interface function is specified in [MEF63]. This grouping describes the functionality which encodes bits for transmission and the corresponding decode upon reception.

service-performance-metric:

The service performance metric is a quantitative characterization of Layer 1 characteristic information delivery quality experienced by the Layer 1 subscriber.

## 5. OTN Tunnel YANG Code

```
<CODE BEGINS>file "ietf-layer1-types@2019-07-08.yang"
module ietf-layer1-types {
  namespace "urn:ietf:params:xml:ns:yang:ietf-layer1-types";
  prefix "layer1-types";

  organization
    "IETF CCAMP Working Group";
  contact
    "WG Web: <http://tools.ietf.org/wg/ccamp/>
     WG List: <mailto:ccamp@ietf.org>

     Editor: Haomian Zheng
             <mailto:zhenghaomian@huawei.com>

    Editor: Italo Busi
       <mailto:Italo.Busi@huawei.com>";

  description
    "This module defines Layer 1 types.";

  revision "2019-07-07" {
    description
      "Initial Version";
    reference
      "RFC XXXX: A YANG Data Model for Layer 1 Types";
    // RFC Ed.: replace XXXX with actual RFC number, update date
    // information and remove this note
  }

  identity tributary-slot-granularity {
    description
      "Tributary slot granularity";
    reference
      "G.709/Y.1331, February 2016: Interfaces for the Optical
       Transport Network (OTN)";
  }

  identity tsg-1.25G {
    base tributary-slot-granularity;
    description
      "1.25G tributary slot granularity";
  }

  identity tsg-2.5G {
    base tributary-slot-granularity;
```

```
    description
      "2.5G tributary slot granularity";
  }

  identity tsg-5G {
    base tributary-slot-granularity;
    description
      "5G tributary slot granularity";
  }

  identity odu-type {
    description
      "Base identity for protocol framing used by tributary signals.";
  }

  identity ODU0 {
    base odu-type;
    description
      "ODU0 protocol (1.24G), RFC7139/ITU-T G.709, standard track.";
  }

  identity ODU1 {
    base odu-type;
    description
      "ODU1 protocol (2.49G), RFC7139/ITU-T G.709, standard track.";
  }

  identity ODU1e {
    base odu-type;
    description
      "ODU1e protocol (10.35G), RFC7963/ITU-T G.sup43, informational.";
  }

  identity ODU2 {
    base odu-type;
    description
      "ODU2 protocol (10.03G), RFC7139/ITU-T G.709, standard track.";
  }

  identity ODU2e {
    base odu-type;
    description
      "ODU2e protocol (10.39G), RFC7139/ITU-T G.709, standard track.";
  }

  identity ODU3 {
    base odu-type;
    description
```

```
      "ODU3 protocol (40.31G), RFC7139/ITU-T G.709, standard track.";
  }

  identity ODU3e1 {
    base odu-type;
    description
      "ODU3e1 protocol (41.77G), RFC7963/ITU-T G.sup43, informational.";
  }

  identity ODU3e2 {
    base odu-type;
    description
      "ODU3e2 protocol (41.78G), RFC7963/ITU-T G.sup43, informational.";
  }

  identity ODU4 {
    base odu-type;
    description
      "ODU4 protocol (104.79G), RFC7139/ITU-T G.709, standard track.";
  }

  identity ODUFlex-cbr {
    base odu-type;
    description
      "ODU Flex CBR protocol for transporting constant bit rate
       signal";
  }

  identity ODUFlex-gfp {
    base odu-type;
    description
      "ODU Flex GFP protocol for transporting stream of packets
       using Generic Framing Procedure";
  }

  identity ODUCn {
    base odu-type;
    description
      "ODUCn protocol (beyond 100G)";
  }

  identity client-signal {
    description
      "Base identity from which specific client signals for the
       tunnel are derived";
  }

// Editor Notes: may consider add the OTUk as client signal;
```

```
  identity ETH-1Gb {
    base client-signal;
    description
      "Client signal type of 1GbE";
  }

  identity ETH-10Gb-LAN {
    base client-signal;
    description
      "Client signal type of 10GbE LAN";
  }

  identity ETH-10Gb-WAN {
    base client-signal;
    description
      "Client signal type of 10GbE WAN";
  }

  identity ETH-40Gb {
    base client-signal;
    description
      "Client signal type of 40GbE";
  }

  identity ETH-100Gb {
    base client-signal;
    description
      "Client signal type of 100GbE";
  }

  identity STM-1 {
    base client-signal;
    description
      "Client signal type of STM-1";
  }

  identity STM-4 {
    base client-signal;
    description
      "Client signal type of STM-4";
  }

  identity STM-16 {
    base client-signal;
    description
      "Client signal type of STM-16";
  }
```

```
  identity STM-64 {
    base client-signal;
    description
      "Client signal type of STM-64";
  }

  identity STM-256 {
    base client-signal;
    description
      "Client signal type of STM-256";
  }
  identity OC-3 {
    base client-signal;
    description
      "Client signal type of OC3";
  }

  identity OC-12 {
    base client-signal;
    description
      "Client signal type of OC12";
  }

  identity OC-48 {
    base client-signal;
    description
      "Client signal type of OC48";
  }

  identity OC-192 {
    base client-signal;
    description
      "Client signal type of OC192";
  }

  identity OC-768 {
    base client-signal;
    description
      "Client signal type of OC768";
  }

  identity FC-100 {
    base client-signal;
    description
      "Client signal type of Fibre Channel FC-100";
  }

  identity FC-200 {
```

```
    base client-signal;
    description
      "Client signal type of Fibre Channel FC-200";
  }

  identity FC-400 {
    base client-signal;
    description
      "Client signal type of Fibre Channel FC-400";
  }

  identity FC-800 {
    base client-signal;
    description
      "Client signal type of Fibre Channel FC-800";
  }

  identity FC-1200 {
    base client-signal;
    description
      "Client signal type of Fibre Channel FC-1200";
  }

  identity FC-1600 {
    base client-signal;
    description
      "Client signal type of Fibre Channel FC-1600";
  }

  identity FC-3200 {
    base client-signal;
    description
      "Client signal type of Fibre Channel FC-3200";
  }

  identity FICON-4G {
    base client-signal;
    description
      "Client signal type of Fibre Connection 4G";
  }

  identity FICON-8G {
    base client-signal;
    description
      "Client signal type of Fibre Connection 8G";
  }

  identity otn-label-range-type {
```

```
    description
      "Base identity from which specific OTN label
           range types derived";
  }

  identity label-range-trib-slot {
    base otn-label-range-type;
    description
      "Defines a range of OTN tributary slots";
  }

  identity label-range-trib-port {
    base otn-label-range-type;
    description
      "Defines a range of OTN tributary ports";
  }

  // Editor Notes: following grouping only used in otn topology model,
  // so suggest to move to ietf-otn-topology and remove from types.
  grouping otn-link-bandwidth {
    description "link bandwidth attributes for OTN";
    list odulist {
      key "odu-type";
      description
        "OTN bandwidth definition";
      leaf odu-type {
        type identityref {
          base layer1-types:odu-type;
        }
        description "ODU type";
      }
      leaf number {
        type uint16;
        description "Number of ODUs";
      }
    }
  }

  // Editor Notes: following groupings are used in both otn topology
  // and tunnel model, so suggest to be kept in the types.
  grouping otn-path-bandwidth {
        description "path bandwidth attributes for OTN";
    leaf odu-type {
      type identityref {
        base layer1-types:odu-type;
      }
      description "ODU type";
    }
```

```
  }
  // Editor Notes: following groupings are used in both otn topology
  // and tunnel model, so suggest to be kept in the types.
  grouping otn-label-restriction {
        description "label restriction information for OTN";
    leaf range-type {
      type identityref {
        base layer1-types:otn-label-range-type;
      }
      description "type for range";
    }
    leaf tsg {
      type identityref {
        base layer1-types:tributary-slot-granularity;
      }
      description "Tributary slot granularity.";
      reference
        "G.709/Y.1331, February 2016: Interfaces for the
         Optical Transport Network (OTN)";
    }
    leaf priority {
      type uint8;
      description "priority.";
    }
  }

  // Editor Notes: following groupings are used in both otn topology
  // and tunnel model, so suggest to be kept in the types.
  grouping otn-link-label {
    description "link label information for OTN, for label-start/end";
    choice otn-label-type {
      description
        "OTN label range type, either TPN range or TS range";
      case tributary-port {
        leaf tpn {
          type uint16 {
            range "1..4095";
          }
          description
            "Tributary Port Number. Applicable for mux services.";
          reference
            "RFC7139: GMPLS Signaling Extensions for Control of Evolving
             G.709 Optical Transport Networks.";
        }
      }
      case tributary-slot {
        leaf ts {
          type uint16 {
```

```
            range "1..4095";
          }
          description
            "Tributary Slot Number. Applicable for mux services.";
          reference
            "RFC7139: GMPLS Signaling Extensions for Control of Evolving
             G.709 Optical Transport Networks.";
        }
      }
    }
  }

  // Editor Notes: following groupings are used in both otn topology
  // and tunnel model, so suggest to be kept in the types.
  grouping otn-path-label {
    description "label information for OTN, for label-hop";
    leaf tpn {
      type uint16 {
        range "1..4095";
      }
      description
        "Tributary Port Number. Applicable in case of mux services.";
      reference
        "RFC7139: GMPLS Signaling Extensions for Control of Evolving
         G.709 Optical Transport Networks.";
    }
    leaf tsg {
      type identityref {
        base layer1-types:tributary-slot-granularity;
      }
      description "Tributary slot granularity.";
      reference
        "G.709/Y.1331, February 2016: Interfaces for the
         Optical Transport Network (OTN)";
    }
    leaf ts-list {
      type string {
          pattern "([1-9][0-9]{0,3}(-[1-9][0-9]{0,3})?"
                + "(,[1-9][0-9]{0,3}(-[1-9][0-9]{0,3})?)*)";
        }
        description
          "A list of available tributary slots ranging
           between 1 and 9999.
           For example 1-20,25,50-1000";
        reference "RFC 7139: GMPLS Signaling Extensions for Control
                   of Evolving G.709 Optical Transport Networks";
    }
  }
```

```
  // Editor Notes: following grouping only used in otn topology model,
  // so suggest to move to ietf-otn-topology and remove from types.
  grouping otn-label-step {
    description "Label step for OTN";
    choice otn-label-type {
      description
        "OTN label range type, either TPN range or TS range";
      case tributary-port {
        leaf tpn-step {
          type uint16 {
            range "1..80";
          }
          default 1;
          description
            "Label step which represents possible increments for
             Tributary Port Number.";
          reference
            "RFC7139: GMPLS Signaling Extensions for Control of Evolving
             G.709 Optical Transport Networks.";
        }
      }
      case tributary-slot {
        leaf ts {
          type uint16 {
            range "1..80";
          }
          default 1;
          description
            "Label step which represents possible increments for
             Tributary Slot Number.";
          reference
            "RFC7139: GMPLS Signaling Extensions for Control of Evolving
             G.709 Optical Transport Networks.";
        }
      }
    }
  }

  // Editor Notes: to be reviewed for the following coding functions.
  identity optical-interface-func {
      description
        "base identity from which optical-interface-function is
         derived.";
     }

      identity SX-PMD-clause-38 {
         base "optical-interface-func";
         description
```

```
            "SX-PMD-clause-38 Optical Interface function for
            1000BASE-X PCS-36";
         reference "MEF63 & IEEE802.3";
      }

      identity LX-PMD-clause-38 {
         base "optical-interface-func";
         description
            "LX-PMD-clause-38 Optical Interface function for
            1000BASE-X PCS-36";
         reference "MEF63 & IEEE802.3";
      }

      identity LX10-PMD-clause-59 {
         base "optical-interface-func";
         description
            "LX10-PMD-clause-59 Optical Interface function for
            1000BASE-X PCS-36";
         reference "MEF63 & IEEE802.3";
      }

      identity BX10-PMD-clause-59 {
         base "optical-interface-func";
         description
            "BX10-PMD-clause-59 Optical Interface function for
            1000BASE-X PCS-36";
         reference "MEF63 & IEEE802.3";
      }

      identity LW-PMD-clause-52 {
         base "optical-interface-func";
         description
            "LW-PMD-clause-52 Optical Interface function for
            10GBASE-W PCS-49-WIS-50";
         reference "MEF63 & IEEE802.3";
      }

      identity EW-PMD-clause-52 {
         base "optical-interface-func";
         description
            "EW-PMD-clause-52 Optical Interface function for
            10GBASE-W PCS-49-WIS-50";
         reference "MEF63 & IEEE802.3";
      }

      identity LR-PMD-clause-52 {
         base "optical-interface-func";
         description
```

```
            "LR-PMD-clause-52 Optical Interface function for
            10GBASE-R PCS-49";
         reference "MEF63 & IEEE802.3";
      }

      identity ER-PMD-clause-52 {
         base "optical-interface-func";
         description
            "ER-PMD-clause-52 Optical Interface function for
            10GBASE-R PCS-49";
         reference "MEF63 & IEEE802.3";
      }

      identity LR4-PMD-clause-87 {
         base "optical-interface-func";
         description
            "LR4-PMD-clause-87 Optical Interface function for
            40GBASE-R PCS-82";
         reference "MEF63 & IEEE802.3";
      }

      identity ER4-PMD-clause-87 {
         base "optical-interface-func";
         description
            "ER4-PMD-clause-87 Optical Interface function for
            40GBASE-R PCS-82";
         reference "MEF63 & IEEE802.3";
      }

      identity FR-PMD-clause-89 {
         base "optical-interface-func";
         description
            "FR-PMD-clause-89 Optical Interface function for
            40GBASE-R PCS-82";
         reference "MEF63 & IEEE802.3";
      }

      identity LR4-PMD-clause-88 {
         base "optical-interface-func";
         description
            "LR4-PMD-clause-88 Optical Interface function for
            100GBASE-R PCS-82";
         reference "MEF63 & IEEE802.3";
      }

      identity ER4-PMD-clause-88 {
         base "optical-interface-func";
         description
```

```
            "ER4-PMD-clause-88 Optical Interface function for
            100GBASE-R PCS-82";
         reference "MEF63 & IEEE802.3";
      }

  // Editor Notes: To add the performance monitor parameters per L1CSM;
   identity service-performance-metric {
      description "list of service-specific performance metric";
     }

      identity One-way-Delay {
         base "service-performance-metric";
         description "one-way-delay";
      }

      identity One-way-Errored-Second {
         base "service-performance-metric";
         description "one-way-errored-second";
      }

      identity One-way-Severely-Errored-Second {
         base "service-performance-metric";
         description "one-way-severely-errored-second";
      }

      identity One-way-Unavailable-Second {
         base "service-performance-metric";
         description "one-way-unavailable-second";
      }

      identity One-way-Availability {
         base "service-performance-metric";
         description "one-way-availability";
      }

   //Editor Notes: it's useful to separate network specific performance
   //monitoring with service-specific
   identity network-performance-metric {
      description "list of network-specific performance metric";
     }

   identity pm-placeholder {
         base "network-performance-metric";
         description "A placeholder for potential performance monitoring
                 on L1 networks";
      }
}
<CODE ENDS>
```

## 6. 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.

The YANG module in this document defines layer 1 type definitions (i.e., typedef, identity and grouping statements) in YANG data modeling language to be imported and used by other layer 1 technology-specific modules. When imported and used, the resultant schema will have data nodes that can be writable, or readable. The access to such data nodes may be onsidered 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.

The security considerations spelled out in the YANG 1.1 specification [RFC7950] apply for this document as well.

## 7. IANA Considerations

It is proposed that IANA should assign new URIs from the "IETF XML Registry" [RFC3688] as follows:

```
URI: urn:ietf:params:xml:ns:yang:ietf-layer1-types
Registrant Contact: The IESG
XML: N/A; the requested URI is an XML namespace.
```

This document registers following YANG modules in the YANG Module Names registry [RFC7950].

```
name:         ietf-layer1-types
namespace:    urn:ietf:params:xml:ns:yang:ietf-otn-types
prefix:       layer1-types
reference:    RFC XXXX
```

## 8. Acknowledgements

TBD.

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