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YANG Data Model for FlexE Management
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Abstract

This document defines a service provider targeted YANG data model for the configuration and management of a Flex Ethernet (FlexE) network, including FlexE groups. It also supports the configuration of each FlexE client as an interface. The YANG module in this document conforms to the Network Management Datastore Architecture (NMDA).

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[1.](#) Introduction

From a service provider's point of view, a transport network with FlexE support are usually deployed with all FlexE Groups configured at first, and then FlexE clients are added one by one at a later stage.

Furthermore, when a FlexE transport network is used to backhaul 5G mobile services, synchronization channel can also be imbed in a FlexE PHY. The specific PHY used for synchronization channel can be retrieved for management.

Thus, this document defines a service provider targeted YANG data model for the configuration and management of a Flex Ethernet (FlexE) network, including FlexE groups. It also supports the configuration of each FlexE client as an interface. The data model of the FlexE client is augmented based on the generic interfaces data model as defined in [\[RFC8343\]](#), the FlexE attributes are based on the FlexE 2.1 Implementation Agreement as specified in [\[FLEXE\]](#).

The YANG modules in this document conforms to the Network Management Datastore Architecture (NMDA) [\[RFC8342\]](#).

[1.1.](#) Conventions used in this document

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.

[1.2.](#) Terminology

Most terminologies used in this document are extracted from [[FLEXE](#)].

FlexE: Flex Ethernet.

FlexE Client: An Ethernet flow based on a MAC data rate that may or may not correspond to any Ethernet PHY rate.

FlexE Group: A FlexE Group is composed of from 1 to n Ethernet PHYs.

Ethernet PHY: an entity representing Ethernet Physical Coding Sublayer (PCS), Physical Media Attachment (PMA), and Physical Media Dependent (PMD) layers. Each PHY is consisted of one or more FlexE Instance (e.g., a 400GBASE-R PHY has four FlexE Instances).

Calendar: The total capacity of a FlexE Group is represented as a collection of slots. The calendar for a FlexE Group composed of n PHYs is represented in each PHY as an array of slots (e.g., each representing 5Gbps of bandwidth), i.e., timeslot-list string.

[2.](#) YANG model hierarchy for FlexE

This section describes the hierarchy of the YANG modules for the FlexE management.

Configuration management of FlexE groups include:

- flexe-groups specifies management configuration of all FlexE groups, and flexe-phys further specifies management configuration of a list of PHYs in a specific Flex Group.

Configuration management of a FlexE client include:

- flexe-client specifies the FlexE slots used for the FlexE Client in the FlexE group.

A simplified YANG tree diagram [[RFC8340](#)] representing the data model is typically used by YANG modules. This document uses the same tree diagram syntax as described in [[RFC8340](#)].

A tree diagram of the module is depicted as the following:


```

module: ietf-flexe-cm
  +--rw flexe
    +--rw flexe-groups
      +--rw flexe-group* [group-index]
        +--rw index                uint32
        +--rw group-num?           uint32
        +--rw negotiation-mode?    negotiation-mode-type
        +--ro total-bandwidth?     string
        +--ro free-bandwidth?      string
        +--ro sync-phy-number      uint32
        +--rw flexe-phys
          +--rw flexe-phy-list* [port-name]
            +--rw port-name        if:interface-ref
            +--rw phy-number?      uint32
            +--ro free-timeslot-list? string
            +--ro used-timeslot-list? string

  augment /if:interfaces/if:interface:
    +--rw flexe-client
      +--rw client-index?          uint32
      +--rw group-index?           leafref
      +--rw client-num?            uint32
      +--rw timeslot-lists
        +--rw timeslot-list*       [port-name]
          +--rw port-name?         if:interface-ref
          +--rw time-slot?         string

```

3. YANG Module for FlexE group interface

The following YANG data module augments the interface container defined in [\[RFC8343\]](#) for a FlexE group interface. It imports iana-if-type [\[RFC7224\]](#) and ietf-interfaces [\[RFC8343\]](#).

```

<CODE BEGINS> file "ietf-flexe-cm@2021-06-18.yang"
module ietf-flexe-cm {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-flexe-cm";
  prefix "flexe-cm";

  import iana-if-type {
    prefix ianaift;
  }
  import ietf-interfaces {
    prefix if;
    reference
      "RFC8343: A YANG Data Model for Interface Management";
  }

```



```
organization "IETF CCAMP Working Group";
contact
  "WG Web: http://tools.ietf.org/wg/ccamp/
  WG List: <mailto:ccamp@ietf.org>
  Author: Minxue Wang
           <mailto:wangminxue@chinamobile.com>
  Author: Liuyan Han
           <mailto:hanliuyan@chinamobile.com>
  Author: Fan Yang
           <mailto:shirley.yangfan@huawei.com>
  Author: Yuanlong Jiang
           <mailto:jiangyuanlong21@yeah.net>";
description
  "This YANG module defines a data model for the configuration
  of a FlexE network and its clients.";

revision "2021-06-18" {
  description "Initial version";
  reference
    "draft-wang-ccamp-flexex-yang-cm-00: YANG Data Model for FlexE
    Management";
}

typedef negotiation-mode-type {
  type enumeration {
    enum "dynamic" {
      value 1;
      description
        "Dynamic mode.";
    }
    enum "static" {
      value 2;
      description
        "Static mode.";
    }
  }
  description
    "Negotiation mode of a FlexE group.";
}

container flexe {
  description
    "Specify FlexE configuration information.";
  container flexe-groups {
    description
      "List of FlexE groups.";
    list flexe-group {
      key "index";
```



```
description
  "Configure FlexE group.";
leaf index {
  type uint32 {
    range "1..65535";
  }
  description
    "FlexE group index.";
}
leaf group-num {
  type uint32 {
    range "1..1048574";
  }
  description
    "FlexE group number, as specified in OIF FlexE 2.1.";
}
leaf negotiation-mode {
  type negotiation-mode-type;
  default "dynamic";
  description
    "FlexE group calendar negotiation mode.";
}
leaf total-bandwidth {
  type string {
    length "1..9";
  }
  config false;
  description
    "FlexE group total bandwidth in Gbit/s, such as 10.";
}
leaf free-bandwidth {
  type string {
    length "1..9";
  }
  config false;
  description
    "FlexE group free bandwidth in Gbit/s, such as 100.";
}
leaf sync-phy-number {
  type uint32 {
    range "1..254";
  }
  config false;
  description
    "The FlexE PHY number used for synchronization management
    channel in a FlexE group, which is one of the PHY number
    value in a FlexE group.";
}
```



```

    container flexe-phys {
      description
        "List of physical port information in a FlexE Group.";
      list flexe-phy {
        key "port-name";
        description
          "FlexE PHY port name.";
        leaf port-name {
          type if:interface-ref;
          description
            "Physical port name. ";
        }
        leaf flexe-phy-number {
          type uint32 {
            range "1..254";
          }
          description
            "Number of a FlexE physical port. The PHY number of
            a 100G port is an integer ranging from 1 to 254.
            The PHY number of a 50G port is an integer ranging
            from 1 to 126.";
        }
        leaf free-timeslot-list {
          type string {
            length "1..199";
          }
          config false;
          description
            "Free timeslots.";
        }
        leaf used-timeslot-list {
          type string {
            length "1..199";
          }
          config false;
          description
            "Timeslots that have been used.";
        }
      }
    }
  }
}

augment "/if:interfaces/if:interface" {
  when "if:type = 'ianaift:flexEclient'" {
    description "Applies to FlexE client interfaces";
  }
}

```



```
description
  "Augment interface model with FlexE client interface specific
  configuration nodes. Each flexEclient interface represents a
  FlexE Client configured in a device.";

container flexex-client {
  description
    "FlexE client.";
  leaf client-index {
    type uint32 {
      range "1..65535";
    }
    description
      "FlexE client index.";
  }
  leaf group-index {
    type leafref {
      path "/flexex-cm:flexex/flexex-cm:flexex-groups/flexex-cm:flexex-group"
        + "/flexex-cm:index";
    }
    description
      "A local FlexE group index configured for a client on one
      equipment for the sake of simplicity on configuration and
      management.";
  }
  leaf client-num {
    type uint32 {
      range "1..65534";
    }
    description
      "FlexE Client number.";
  }
}

container timeslot-lists {
  description
    "List of binding timeslots.";
  list timeslot-list {
    key "port-name";
    description
      "Configure binding timeslots.";
    leaf port-name {
      type if:interface-ref;
      description
        "FlexE physical port name.";
    }
    leaf time-slot {
      type string {
        length "1..199";
      }
    }
  }
}
```



```
        description
          "Set timeslot. The string consists of one or more
           numbers separated by commas (,) or hyphens (-).";
      }
    }
  }
}
<CODE ENDS>
```

4. Security Considerations

TBD

5. References

5.1. Normative References

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