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A YANG Data Model for Fabric Topology in Data Center Networks
draft-ietf-i2rs-yang-dc-fabric-network-topology-10

Abstract

This document defines a YANG data model for fabric topology in Data Center Networks and it represents only one possible view of the dc fabric.

Status of This Memo

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1. Introduction

Normally, a data center (DC) network is composed of single or multiple fabrics which are also known as PODs (Points Of Delivery). These fabrics may be heterogeneous due to implementation of different technologies when a DC network is upgraded or new techniques and features are rolled out. For example, Fabric A may use VXLAN while Fabric B may use VLAN within a DC network. Likewise, an existing fabric may use VXLAN while a new fabric, for example a fabric introduced for DC upgrade and expansion, may implement a technique discussed in NV03 WG, such as Geneve [I-D. [draft-ietf-nvo3-geneve](#)]. The configuration and management of such DC networks with heterogeneous fabrics will result in considerable complexity, requiring a fair amount of sophistication.

Luckily, for a DC network, a fabric can be considered as an atomic structure for management purposes. From this point of view, the management of the DC network can be decomposed into a set of tasks to manage each fabric separately, as well as the fabric interconnections. This way, the overall management task becomes very flexible and makes it easy to expand and adopt to DC networks that evolve over time.

As a basis for DC fabric management, this document defines a YANG data model [[RFC6020](#)][RFC7950] for a possible view of the fabric-based data center topology. To do so, it augments the generic network and network topology data models defined in [[RFC8345](#)] with information that is specific to Data Center fabric networks.

The model defines the generic configuration and operational state for a fabric-based network topology, which can subsequently be extended by vendors with vendor-specific information as needed. The model can be used by a network controller to represent its view of the fabric topology that it controls and expose this view to network administrators or applications for DC network management.

Within the context of topology architecture defined in [[RFC8345](#)], this model can also be treated as an application of the I2RS network topology model [[RFC8345](#)] in the scenario of Data center network management. It can also act as a service topology when mapping network elements at the fabric layer to elements of other topologies, such as L3 topologies as defined in [[RFC8346](#)].

By using the fabric topology model defined in this document, people can treat a fabric as a holistic entity and focus on characteristics of a fabric (such as encapsulation type, gateway type, etc.) as well as its connections to other fabrics while putting the underlay topology aside. As such, clients can consume the topology information at the fabric level with no need to be aware of the entire set of links and nodes in the corresponding underlay networks. A fabric topology can be configured by a network administrator using the controller by adding physical devices and links into a fabric. Alternatively, fabric topology can be learned from the underlay network infrastructure.

2. Definitions and Acronyms

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.

2.1. Terminology

POD: a module of network, compute, storage, and application components that work together to deliver networking services. It represents a repeatable design pattern. Its components maximize the modularity, scalability, and manageability of data centers.

Fabric: composed of several PODs to form a data center network.

3. Model Overview

This section provides an overview of the data center fabric topology model and its relationship with other topology models.

3.1. Topology Model structure

The relationship of the DC fabric topology model and other topology models is shown in the following figure.

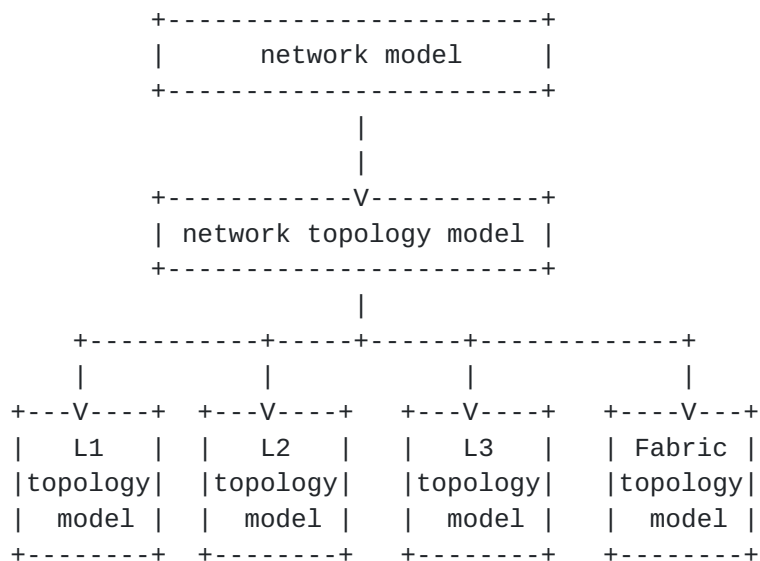


Figure 1: The network data model structure

From the perspective of resource management and service provisioning for a data center network, the fabric topology model augments the basic network topology model with definitions and features specific to a DC fabric, to provide common configuration and operations for heterogeneous fabrics.

3.2. Fabric Topology Model

The fabric topology model module is designed to be generic and can be applied to data center fabrics built with different technologies, such as VLAN, VXLAN etc. The main purpose of this module is to configure and manage fabrics and their connections. It provides a fabric-based topology view for data center applications.

3.2.1. Fabric Topology

In the fabric topology module, a fabric is modeled as a node of a network, as such the fabric-based data center network consists of a set of fabric nodes and their connections. The following depicts a

snippet of the definitions to show the main structure of the model.
The notation syntax follows [[RFC8340](#)].

```
module: ietf-dc-fabric-topology
augment /nw:networks/nw:network/nw:network-types:
  +--rw fabric-network!
augment /nw:networks/nw:network/nw:node:
  +--rw fabric-attributes
    +--rw fabric-id?    fabric-id
    +--rw name?         string
    +--rw type?         fabrictype:underlay-network-type
    +--rw description?  string
    +--rw options
    +--...
augment /nw:networks/nw:network/nw:node/nt:termination-point:
  +--ro fport-attributes
    +--ro name?        string
    +--ro role?        fabric-port-role
    +--ro type?        fabric-port-type
```

The fabric topology module augments the generic ietf-network and ietf-network-topology modules as follows:

- o A new topology type "ietf-dc-fabric-topology" is introduced and added under the "network-types" container of the ietf-network module.
- o Fabric is defined as a node under the network/node container. A new container "fabric-attributes" is defined to carry attributes for a fabric such as gateway mode, fabric types, involved device nodes, and links.
- o Termination points (in network topology module) are augmented with fabric port attributes defined in a container. The "termination-point" here is used to represent a fabric "port" that provides connections to other nodes, such as an internal device, another fabric externally, or end hosts.

Details of the fabric node and the fabric termination point extension will be explained in the following sections.

3.2.2. Fabric node extension

As an atomic network, a fabric itself is composed of a set of network elements i.e. devices, and related links. The configuration of a fabric is contained under the "fabric-attributes" container depicted as follows. The notation syntax follows [[RFC8340](#)].


```

+--rw fabric-attributes
  +--rw fabric-id?      fabrictypes:fabric-id
  +--rw name?           string
  +--rw type?           fabrictype:underlay-network-type
  +--rw vni-capacity
    | +--rw min?        int32
    | +--rw max?        int32
  +--rw description?    string
  +--rw options
    | +--rw gateway-mode?      enumeration
    | +--rw traffic-behavior?  enumeration
    | +--rw capability-supported* fabrictype:service-capabilities
  +--rw device-nodes* [device-ref]
    | +--rw device-ref        fabrictype:node-ref
    | +--rw role*?            fabrictype:device-role
  +--rw device-links* [link-ref]
    | +--rw link-ref          fabrictype:link-ref
  +--rw device-ports* [port-ref]
    +--rw port-ref            fabrictype:tp-ref
    +--rw port-type?          fabrictypes:port-type
    +--rw bandwidth?          fabrictypes:bandwidth

```

In the module, additional data objects for fabric nodes are introduced by augmenting the "node" list of the network module. New objects include fabric name, type of the fabric, descriptions of the fabric as well as a set of options defined in an "options" container. The "options" container includes the gateway-mode type (centralized or distributed) and traffic-behavior (whether an Access Control Lists (ACLs) is needed for the traffic). Also, it includes a list of device-nodes and related links as supporting-nodes to form a fabric network. These device nodes and links are represented as leaf-refs of existing nodes and links in the underlay topology. For the device-node, the "role" object is defined to represent the role of a device within the fabric, such as "SPINE" or "LEAF", which should work together with the gateway-mode.

[3.2.3.](#) Fabric termination-point extension

Since a fabric can be considered as a node, "termination-points" can represent fabric "ports" that connect to other fabrics, end hosts, as well as devices inside the fabric.

As such, the set of "termination-points" of a fabric indicate all connections of the fabric, including its internal connections, interconnections with other fabrics, and connections to end hosts.

The structure of fabric ports is as follows. The notation syntax follows [\[RFC8340\]](#).

The structure of fabric ports is as follows:

```
augment /nw:networks/nw:network/nw:node/nt:termination-point:
  +--ro fport-attributes
    +--ro name?          string
    +--ro role?          fabric-port-role
    +--ro type?          fabric-port-type
    +--ro device-port?   tp-ref
    +--ro (tunnel-option)?
```

It augments the termination points (in network topology module) with fabric port attributes defined in a container.

New nodes are defined for fabric ports including fabric name, role of the port within the fabric (internal port, external port to outside network, access port to end hosts), port type (l2 interface, l3 interface, etc). By defining the device-port as a tp-ref, a fabric port can be mapped to a device node in the underlay network.

Also, a new container for tunnel-options is introduced to present the tunnel configuration on a port.

The termination point information is learned from the underlay networks, not configured by the fabric topology layer.

4. Fabric YANG Module

This module imports typedefs from [\[RFC8345\]](#), and it references [\[RFC7348\]](#) and [\[RFC8344\]](#).

```
<CODE BEGINS> file "ietf-dc-fabric-types@2018-04-16.yang"
  module ietf-dc-fabric-types {

    yang-version 1.1;
    namespace "urn:ietf:params:xml:ns:yang:ietf-dc-fabric-types";
    prefix fabriotypes;

    import ietf-network {
      prefix nw;

      reference
        "RFC 8345: A Data Model for Network Topologies";
    }
  }
```


organization

"IETF I2RS (Interface to the Routing System) Working Group";

contact

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<<mailto:shidanian@huawei.com>>;

description

"This module contains a collection of YANG definitions for Fabric.

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This version of this YANG module is part of [draft-ietf-i2rs-yang-dc-fabric-network-topology](#); see the RFC itself for full legal notices.

NOTE TO RFC EDITOR: Please replace above reference to [draft-ietf-i2rs-yang-dc-fabric-network-topology-09](#) with RFC number when published (i.e. RFC xxxx).";

revision "2018-04-16"{

description

"Initial revision.

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with RFC number when published (i.e. RFC xxxx).";

reference

"[draft-ietf-i2rs-yang-dc-fabric-network-topology-09](#)";

}

identity fabric-type {

description


```
        "Base type for fabric networks";
    }

    identity vxlan-fabric {
        base fabric-type;
        description
            "Vxlan fabric";
    }

    identity vlan-fabric {
        base fabric-type;
        description
            "Vlan fabric";
    }

    identity trill-fabric {
        base fabric-type;
        description "Trill fabric";
    }

    identity port-type {
        description
            "Base type for fabric port";
    }

    identity eth {
        base port-type;
        description "ETH";
    }

    identity serial {
        base port-type;
        description "Serial";
    }

    identity bandwidth {
        description "Base for bandwidth";
    }

    identity bw-1M {
        base bandwidth;
        description "1M";
    }

    identity bw-10M {
        base bandwidth;
        description "10M";
    }

    identity bw-100M {
        base bandwidth;
        description "100M";
    }

    identity bw-1G {
```



```
        base bandwidth;
        description "1G";
    }
    identity bw-10G {
        base bandwidth;
        description "10G";
    }
    identity bw-40G {
        base bandwidth;
        description "40G";
    }
    identity bw-100G{
        base bandwidth;
        description "100G";
    }

    identity device-role {
        description "Base for the device role in a fabric.";
    }
    identity spine {
        base device-role;
        description "This is a spine node in a fabric.";
    }
    identity leaf {
        base device-role;
        description "This is a leaf node in a fabric. ";
    }
    identity border {
        base device-role;
        description "This is a border node to connect to other
        fabric/network.";
    }
    identity fabric-port-role {
        description "Base for the port's role in a fabric.";
    }
    identity internal {
        base fabric-port-role;
        description "The port is used for devices to access each
        other within a fabric.";
    }
    identity external {
        base fabric-port-role;
        description "The port is used for a fabric to connect to
        outside network.";
    }
    identity access {
        base fabric-port-role;
        description "The port is used for an endpoint to connect
```



```
        to a fabric.";
    }

    identity service-capability {
        description "Base for the service of the fabric ";
    }
    identity ip-mapping {
        base service-capability;
        description "NAT.";
    }
    identity acl-redirect {
        base service-capability;
        description "Acl redirect, which can provide SFC function.";
    }
    identity dynamic-route-exchange {
        base service-capability;
        description "Dynamic route exchange.";
    }
}

/*
 * Typedefs
 */
typedef fabric-id {
    type nw:node-id;
    description
        "An identifier for a fabric in a topology.
        This identifier can be generated when composing a fabric.
        The composition of a fabric can be achieved by defining a
        RPC, which is left for vendor specific implementation
        and not provided in this model.";
}

typedef service-capabilities {
    type identityref {
        base service-capability;
    }
    description
        "Service capability of the fabric";
}

typedef port-type {
    type identityref {
        base port-type;
    }
    description "Port type: ethernet or serial or others.";
}
typedef bandwidth {
```



```
    type identityref {
        base bandwidth;
    }
    description "Bandwidth of the port.";
}
typedef node-ref {
    type instance-identifier;
    description "A reference to a node in topology";
}

typedef tp-ref {
    type instance-identifier;
    description "A reference to a termination point in topology";
}

typedef link-ref {
    type instance-identifier;
    description "A reference to a link in topology";
}

typedef underlay-network-type {
    type identityref {
        base fabric-type;
    }
    description "The type of physical network that implements
    this fabric.Examples are vlan, and trill.";
}
typedef device-role {
    type identityref {
        base device-role;
    }
    description "Role of the device node.";
}
typedef fabric-port-role {
    type identityref {
        base fabric-port-role;
    }
    description "Role of the port in a fabric.";
}

typedef fabric-port-type {
    type enumeration {
        enum layer2interface {
            description "L2 interface";
        }
        enum layer3interface {
            description "L3 interface";
        }
    }
}
```



```
        enum layer2Tunnel {
            description "L2 tunnel";
        }
        enum layer3Tunnel {
            description "L3 tunnel";
        }
    }
    description
        "Fabric port type";
}

grouping fabric-port {
    description
        "Attributes of a fabric port.";
    leaf name {
        type string;
        description "Name of the port.";
    }
    leaf role {
        type fabric-port-role;
        description "Role of the port in a fabric.";
    }
    leaf type {
        type fabric-port-type;
        description "Type of the port";
    }
    leaf device-port {
        type tp-ref;
        description "The device port it mapped to.";
    }
    choice tunnel-option {
        description "Tunnel options to connect two fabrics.
            It could be L2 Tunnel or L3 Tunnel.";
    }
}
}

<CODE ENDS>

<CODE BEGINS> file "ietf-dc-fabric-topology@2018-04-16.yang"
module ietf-dc-fabric-topology {

    yang-version 1.1;
    namespace "urn:ietf:params:xml:ns:yang:ietf-dc-fabric-topology";
    prefix fabric;

    import ietf-network {
        prefix nw;
```



```
reference
  "RFC 8345:A Data Model for Network Topologies";
}

import ietf-network-topology {
  prefix nt;

  reference
    "RFC 8345:A Data Model for Network Topologies";
}

import ietf-dc-fabric-types {
  prefix fabrictypes;

  reference
    "draft-ietf-i2rs-yang-dc-fabric-network-topology-09
    NOTE TO RFC EDITOR:
    (1) Please replace above reference to
    draft-ietf-i2rs-yang-dc-fabric-network-topology-09
    with RFC number when publised (i.e. RFC xxxx).
    (2) Please replace the data in the revision statement
    with the data of publication when published.";
}

organization
  "IETF I2RS (Interface to the Routing System) Working Group";

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  "WG Web:    <http://tools.ietf.org/wg/i2rs/>
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  Editor:     Danian Shi
              <mailto:shidanian@huawei.com>";

description
  "This module contains a collection of YANG definitions for
  Fabric.
```

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```
revision "2018-04-16"{
  description
    "Initial revision.
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    reference to draft-ietf-i2rs-yang-dc-fabric-network-topology-09 with RFC number when published
    (i.e. RFC xxxx).";
  reference
    "draft-ietf-i2rs-yang-dc-fabric-network-topology-09";
}

/*identity fabric-context {
  description
    "Identity of fabric context";
}*/

//grouping statements
grouping fabric-network-type {
  description "Identify the topology type to be fabric.";
  container fabric-network {
    presence "indicates fabric Network";
    description
      "The presence of the container node indicates
      fabric Topology";
  }
}

grouping fabric-options {
  description "Options for a fabric";

  leaf gateway-mode {
    type enumeration {
      enum centralized {
        description "The Fabric uses centerilized
        gateway,in which gateway is deployed on SPINE
        node.";
```



```
    }
    enum distributed {
        description "The Fabric uses distributed
        gateway, in which gateway is deployed on LEAF
        node.";
    }
}
default "distributed";
description "Gateway mode of the fabric";
}

leaf traffic-behavior {
    type enumeration {
        enum normal {
            description "Normal means no policy is needed
            for all traffic";
        }
        enum policy-driven {
            description "Policy driven means policy is
            needed for the traffic otherwise the traffic
            will be discard.";
        }
    }
    default "normal";
    description "Traffic behavior of the fabric";
}

leaf-list capability-supported {
    type fabrictypes:service-capabilities;
    description
        "It provides a list of supported services of the
        fabric. The service-capabilities is defined as
        identity-ref. Developers can define more services
        by defining new identities.";
}

}

grouping device-attributes {
    description "device attributes";
    leaf device-ref {
        type fabrictypes:node-ref;
        description
            "The device that the fabric includes which refers
            to a node in another topolopogy.";
    }
    leaf-list role {
        type fabrictypes:device-role;
        default fabrictypes:leaf;
    }
}
```



```
        description
            "It is a list of device-role to represent the roles
            that a device plays within a PoD, such as SPINE,
            LEAF, Border, or Border-Leaf.
            The device-role is defined as identity-ref. If more
            than 2 stage is used for a PoD, developers can
            define new identities for the device-role.";
    }
}

grouping link-attributes {
    description "Link attributes";
    leaf link-ref {
        type fabrictypes:link-ref;
        description
            "The link that the fabric includes which refers to
            a link in another topology.";
    }
}

grouping port-attributes {
    description "Port attributes";
    leaf port-ref {
        type fabrictypes:tp-ref;
        description
            "The port that the fabric includes which refers to
            a termination-point in another topology.";
    }
    leaf port-type {
        type fabrictypes:port-type;
        description
            "Port type is defined as identity-ref. If current
            types includes ethernet or serial. If more types
            are needed, developers can define new identities.";
    }
    leaf bandwidth {
        type fabrictypes:bandwidth;
        description
            "Bandwidth of the port. It is defined as identity-ref.
            If more speeds are introduced, developers can define
            new identities for them. Current speeds include 1M, 10M,
            100M, 1G, 10G, 40G and 100G.";
    }
}

grouping fabric-attributes {
    description "Attributes of a fabric";
```



```
leaf fabric-id {
  type fabrictypes:fabric-id;
  description
    "An identifier for a fabric in a topology.
    This identifier can be generated when composing a fabric.
    The composition of a fabric can be achieved by defining a
    RPC, which is left for vendor specific implementation and
    not provided in this model.";
}

leaf name {
  type string;
  description
    "Name of the fabric";
}

leaf type {
  type fabrictypes:underlay-network-type;
  description
    "The type of physical network that implements this
    fabric.Examples are vlan, and trill.";
}

container vni-capacity {
  description "The range of the VNI(VXLAN Network Identifier
    defined in RFC 7348)s that the PoD uses.";

  leaf min {
    type int32;
    description
      "The lower limit Vni.";
  }

  leaf max {
    type int32;
    description
      "The upper limite Vni.";
  }
}

leaf description {
  type string;
  description
    "Description of the fabric";
}

container options {
  description "Options of the fabric";
```



```
        uses fabric-options;
    }

    list device-nodes {
        key device-ref;
        description "Device nodes that include in a fabric.";
        uses device-attributes;
    }

    list device-links {
        key link-ref;
        description "Links that include within a fabric.";
        uses link-attributes;
    }

    list device-ports {
        key port-ref;
        description "Ports that include in the fabric.";
        uses port-attributes;
    }
}

// augment statements

augment "/nw:networks/nw:network/nw:network-types" {
    description
        "Introduce new network type for Fabric-based topology";

    uses fabric-network-type;
}

augment "/nw:networks/nw:network/nw:node" {
    when "/nw:networks/nw:network/nw:network-types/"
    +"fabric:fabric-network"{
        description
            "Augmentation parameters apply only for networks
            with fabric topology";
    }
    description "Augmentation for fabric nodes created by
    fabric topology.";

    container fabric-attributes {
        description
            "Attributes for a fabric network";

        uses fabric-attributes;
    }
}
```



```
    }

    augment "/nw:networks/nw:network/nw:node/nt:termination-point" {
      when "/nw:networks/nw:network/nw:network-types/"
        +"fabric:fabric-network" {
        description
          "Augmentation parameters apply only for networks
           with fabric topology";
      }
      description "Augmentation for port on fabric.";

      container fport-attributes {
        config false;
        description
          "Attributes for fabric ports";
        uses fabrictypes:fabric-port;
      }
    }
  }
}
<CODE ENDS>
```

5. IANA Considerations

This document registers the following namespace URIs in the "IETF XML Registry" [[RFC3688](#)]:

URI:urn:ietf:params:xml:ns:yang:ietf-dc-fabric-types

Registrant Contact: The IESG.

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

URI:urn:ietf:params:xml:ns:yang:ietf-dc-fabric-topology

Registrant Contact: The IESG.

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

URI:urn:ietf:params:xml:ns:yang:ietf-dc-fabric-topology-state

Registrant Contact: The IESG.

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

This document registers the following YANG modules in the "YANG Module Names" registry [[RFC6020](#)]:

NOTE TO THE RFC EDITOR: In the list below, please replace references to "[draft-ietf-i2rs-yang-dc-fabric-network-topology-09](#) (RFC form)" with RFC number when published (i.e. RFC xxxx).

Name: ietf-dc-fabric-types

Namespace: urn:ietf:params:xml:ns:yang:ietf-dc-fabric-types

Prefix: fabrictypes

Reference: [draft-ietf-i2rs-yang-dc-fabric-network-topology-09.txt](#)
(RFC form)

Name: ietf-dc-fabric-topology

Namespace: urn:ietf:params:xml:ns:yang:ietf-dc-fabric-topology

Prefix: fabric

Reference: [draft-ietf-i2rs-yang-dc-fabric-network-topology-09.txt](#)
(RFC form)

Name: ietf-dc-fabric-topology-state

Namespace: urn:ietf:params:xml:ns:yang:ietf-dc-fabric-topology-state

Prefix: sfabric

Reference: [draft-ietf-i2rs-yang-dc-fabric-network-topology-09.txt](#)
(RFC form)

6. Security Considerations

The YANG module defined in this document 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 [[RFC5246](#)].

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 subtrees and data nodes and their sensitivity/vulnerability in the ietf-dc-fabric-topology module are as follows:

fabric-attributes: A malicious client could attempt to sabotage the configuration of important fabric attributes, such as device-nodes or type.

Some of the readable data nodes in this YANG module may be considered sensitive or vulnerable in some network environments. It is thus important to control read access (e.g., via get, get-config, or notification) to these data nodes. The subtrees and data nodes and their sensitivity/vulnerability in the ietf-dc-fabric-topology module are as follows:

fport-attributes: A malicious client could attempt to read the connections of fabrics without permission, such as device-port, name.

7. Acknowledgements

We wish to acknowledge the helpful contributions, comments, and suggestions that were received from Alexander Clemm, Donald E. Eastlake, Xufeng Liu, Susan Hares, Wei Song, Luis M. Contreras and Benoit Claise.

8. References

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[Appendix A.](#) Non NMDA -state modules

The YANG module `ietf-dc-fabric-topology` defined in this document augments two modules, `ietf-network` and `ietf-network-topology`, that are designed to be used in conjunction with implementations that support the Network Management Datastore Architecture (NMDA) defined in [\[RFC8342\]](#). In order to allow implementations to use the model even in case when NMDA is not supported, a set of companion modules have been defined that represent a state model of networks and network topologies, `ietf-network-state` and `ietf-network-topology-state`, respectively.

In order to be able to use the model for fabric topologies defined in this in this document in conjunction with non-NMDA compliant implementations, a corresponding companion module needs to be introduced as well. This companion module, `ietf-dc-fabric-topology-state`, mirrors `ietf-dc-fabric-topology`. However, the module augments `ietf-network-state` (instead of `ietf-network` and `ietf-network-topology`) and all of its data nodes are non-configurable.

Like `ietf-network-state` and `ietf-network-topology-state`, `ietf-dc-fabric-topology-state` SHOULD NOT be supported by implementations that support NMDA. It is for this reason that the module is defined in the Appendix.

The definition of the module follows below. As the structure of the module mirrors that of its underlying module, the YANG tree is not depicted separately.

<CODE BEGINS>

```
file "ietf-dc-fabric-topology-state@2018-04-16.yang"
  module ietf-dc-fabric-topology-state {

    yang-version 1.1;
    namespace
      "urn:ietf:params:xml:ns:yang:ietf-dc-fabric-topology-state";
    prefix sfabric;

    import ietf-network-state {
```



```
    prefix nws;
    reference
    "RFC 8345:A Data Model for Network Topologies";
}
import ietf-dc-fabric-types {
    prefix fabrictypes;

    reference
    "draft-ietf-i2rs-yang-dc-fabric-network-topology-09
    NOTE TO RFC EDITOR:
    (1) Please replace above reference to draft-ietf-i2rs-yang
    -dc-fabric-network-topology-09 with RFC number when
    published (i.e. RFC xxxx).
    (2) Please replace the data in the revision statement
    with the data of publication when published.";
}

organization
"IETF I2RS (Interface to the Routing System) Working Group";

contact
"WG Web:    <http://tools.ietf.org/wg/i2rs/>
WG List:    <mailto:i2rs@ietf.org>

Editor:     Yan Zhuang
            <mailto:zhuangyan.zhuang@huawei.com>

Editor:     Danian Shi
            <mailto:shidanian@huawei.com>";

description
    "This module contains a collection of YANG definitions for
    Fabric state, representing topology that is either learned,
    or topology that results from applying topology that has been
    configured per the ietf-dc-fabric-topology model, mirroring
    the corresponding data nodes in this model.

    This model mirrors the configuration tree of ietf-dc-fabric-
    -topology, but contains only read-only state data. The model
    is not needed when the implementation infrastructure supports
    the Network Management Datastore Architecture(NMDA).

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    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
```


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This version of this YANG module is part of [draft-ietf-i2rs-yang-dc-fabric-network-topology](#); see the RFC itself for full legal notices.

NOTE TO RFC EDITOR: Please replace above reference to [draft-ietf-i2rs-yang-dc-fabric-network-topology-09](#) with RFC number when published (i.e. RFC xxxx).";

```
revision "2018-04-16"{
  description
    "Initial revision.
    NOTE TO RFC EDITOR:
    Please replace the following reference to
    draft-ietf-i2rs-yang-dc-fabric-network-topology-09
    with RFC number when published (i.e. RFC xxxx).";
  reference
    "draft-ietf-i2rs-yang-dc-fabric-network-topology-09";
}
```

//grouping statements

```
grouping fabric-network-type {
  description "Identify the topology type to be fabric.";
  container fabric-network {
    presence "indicates fabric Network";
    description
      "The presence of the container node indicates
      fabric Topology";
  }
}

grouping fabric-options {
  description "Options for a fabric";

  leaf gateway-mode {
    type enumeration {
      enum centralized {
        description "The Fabric uses centerilized
        gateway, in which gateway is deployed on SPINE
        node.";
      }
      enum distributed {
        description "The Fabric uses distributed
```



```
        gateway, in which gateway is deployed on LEAF
        node.";
    }
}
default "distributed";
description "Gateway mode of the fabric";
}

leaf traffic-behavior {
    type enumeration {
        enum normal {
            description "Normal means no policy is needed
            for all traffic";
        }
        enum policy-driven {
            description "Policy driven means policy is
            needed for the traffic otherwise the traffic
            will be discard.";
        }
    }
    default "normal";
    description "Traffic behavior of the fabric";
}

leaf-list capability-supported {
    type fabricktypes:service-capabilities;
    description
        "It provides a list of supported services of the
        fabric. The service-capabilities is defined as
        identity-ref. Developers can define more services
        by defining new identities.";
}

}

grouping device-attributes {
    description "device attributes";
    leaf device-ref {
        type fabricktypes:node-ref;
        description
            "The device that the fabric includes which refers
            to a node in another topolopogy.";
    }
    leaf-list role {
        type fabricktypes:device-role;
        default fabricktypes:leaf;
        description
            "It is a list of devce-role to represent the roles
            that a device plays within a PoD, such as SPINE,
```



```
        LEAF, Border, or Border-Leaf.
        The device-role is defined as identity-ref. If more
        than 2 stage is used for a PoD, developers can
        define new identities for the device-role.";
    }
}

grouping link-attributes {
    description "Link attributes";
    leaf link-ref {
        type fabrictypes:link-ref;
        description
            "The link that the fabric includes which refers to
            a link in another topology.";
    }
}

grouping port-attributes {
    description "Port attributes";
    leaf port-ref {
        type fabrictypes:tp-ref;
        description
            "The port that the fabric includes which refers to
            a termination-point in another topology.";
    }
    leaf port-type {
        type fabrictypes:port-type;
        description
            "Port type is defined as identiy-ref. If current
            types includes ethernet or serial. If more types
            are needed, developers can define new identities.";
    }
    leaf bandwidth {
        type fabrictypes:bandwidth;
        description
            "Bandwidth of the port. It is defined as
            identity-ref. If more speeds are introduced,
            developers can define new identities for them.
            Current speeds include 1M, 10M, 100M, 1G, 10G,
            40G and 100G.";
    }
}

grouping fabric-attributes {
    description "Attributes of a fabric";

    leaf fabric-id {
        type fabrictypes:fabric-id;
```



```
        description
            "Fabric id";
    }

    leaf name {
        type string;
        description
            "Name of the fabric";
    }

    leaf type {
        type fabrictypes:underlay-network-type;
        description
            "The type of physical network that implements this
            fabric.Examples are vlan, and trill.";
    }

    container vni-capacity {
        description "The range of the VNI(VXLAN Network
        Identifier defined in RFC 7348)s that the PoD uses.";

        leaf min {
            type int32;
            description
                "The lower limit Vni.";
        }

        leaf max {
            type int32;
            description
                "The upper limite Vni.";
        }
    }

    leaf description {
        type string;
        description
            "Description of the fabric";
    }

    container options {
        description "Options of the fabric";
        uses fabric-options;
    }

    list device-nodes {
        key device-ref;
        description "Device nodes that include in a fabric.";
```



```
        uses device-attributes;
    }

    list device-links {
        key link-ref;
        description "Links that include within a fabric.";
        uses link-attributes;
    }

    list device-ports {
        key port-ref;
        description "Ports that include in the fabric.";
        uses port-attributes;
    }
}

// augment statements

augment "/nws:networks/nws:network/nws:network-types" {
    description
        "Introduce new network type for Fabric-based logical
        topology";
    uses fabric-network-type;
}

augment "/nws:networks/nws:network/nws:node" {
    when "/nws:networks/nws:network/nws:network-types"
    +"/sfabric:fabric-network"{
        description "Augmentation parameters apply only for
        networks with fabric topology.";
    }
    description "Augmentation for fabric nodes.";
    container fabric-attributes-state {
        description
            "Attributes for a fabric network";
        uses fabric-attributes;
    }
}
}
<CODE ENDS>
```

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