

YANG Introduction

Introduction to NETCONF, RESTCONF, CORECONF, and YANG
basics

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IEEE 802 YANGsters Vice-Chair*



YANG

- Defined by the IETF
 - YANG 1.0: defined in RFC 6020 (2010)
 - YANG 1.1 (current): defined in RFC 7950 (2016)
- Data modeling language for network management protocols
- Initially designed for use with NETCONF
 - Now also used for other protocols, such as RESTCONF, or CORECONF

```
module ieee802-dot1q-bridge {
  yang-version "1.1";
  namespace urn:ieee:std:802.1Q:yang:ieee802-dot1q-bridge;
  prefix dot1q;
  import ieee802-types {
    prefix ieee;
  }
  import ietf-yang-types {
    prefix yang;
  }
  import ietf-interfaces {
    prefix if;
  }
  import iana-if-type {
    prefix ianaif;
  }
  import ieee802-dot1q-types {
    prefix dot1qtypes;
  }
  organization
    "IEEE 802.1 Working Group";
  contact
    "WG-URL: http://ieee802.org/1/
    WG-EMail: stds-802-1-1@ieee.org

    Contact: IEEE 802.1 Working Group Chair
    Postal: C/O IEEE 802.1 Working Group
           IEEE Standards Association
           445 Hoes Lane
           Piscataway, NJ 08854
           USA

    E-mail: stds-802-1-chairs@ieee.org";
  description
    "This YANG module describes the Bridge configuration model for the
    following IEEE 802.1Q Bridges:
    1) Two Port MAC Relays
    2) Customer VLAN Bridges
    3) Provider Bridges.

    Copyright (C) IEEE (2023).

    This version of this YANG module is part of IEEE Std 802.1Q; see the
    standard itself for full legal notices.";
```

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YANG

- RFC 7950 describes and defines how data is
 - modeled
 - represented in XML
- YANG models data as hierarchical tree
 - Each node has
 - a name and either
 - a value, or
 - a set of child nodes
- Data models are defined in YANG modules

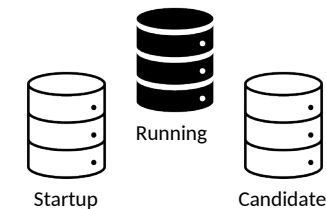
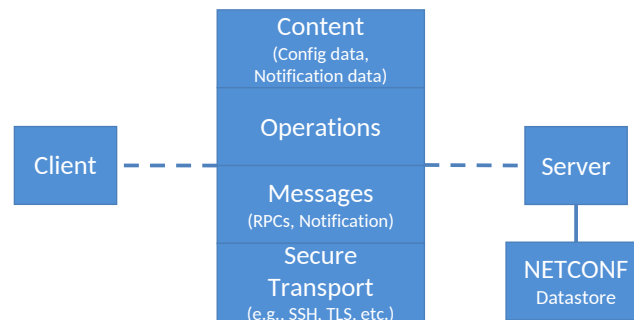
```
module: ieee802-dot1q-bridge
+--rw bridges
  +--rw bridge* [name]
    +--rw name                dot1qtypes:name-type
    +--rw address              ieee:mac-address
    +--rw bridge-type          identityref
    +--ro ports?                uint16
    +--ro up-time?              yang:zero-based-counter32
    +--ro components?           uint32
    +--rw component* [name]
      +--rw name                string
      +--rw id?                  uint32
      +--rw type                  identityref
      +--rw address?              ieee:mac-address
      +--rw traffic-class-enabled? boolean
      +--ro ports?                uint16
      +--ro bridge-port*          if:interface-ref
      +--ro capabilities
        | +--ro extended-filtering?    boolean
        | +--ro traffic-classes?        boolean
        | +--ro static-entry-individual-port? boolean
        | +--ro ivl-capable?            boolean
        | +--ro svl-capable?            boolean
        | +--ro hybrid-capable?         boolean
        | +--ro configurable-pvid-tagging? boolean
        | +--ro local-vlan-capable?     boolean
```

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NETCONF

- Defined in RFC 6241
- Protocol to
 - install,
 - manipulate,
 - and delete configuration of network devices
- Client-server model
- Connection-oriented

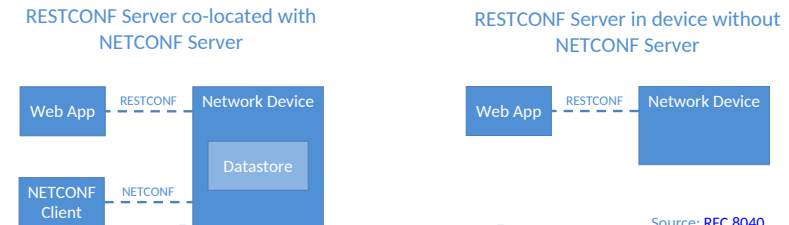
- XML-based data encoding
 - for configuration
 - for protocol messages
- Protocol operations: RPCs
- Defines three configuration datastores



RESTCONF

- Defined in RFC 8040
- RESTful protocol for accessing data modeled in YANG
 - running over HTTP(S),
 - using datastore concepts defined in NETCONF
- Client-server model
- Stateless

- Not intended to replace NETCONF
- RESTCONF and NETCONF can run co-located on a device

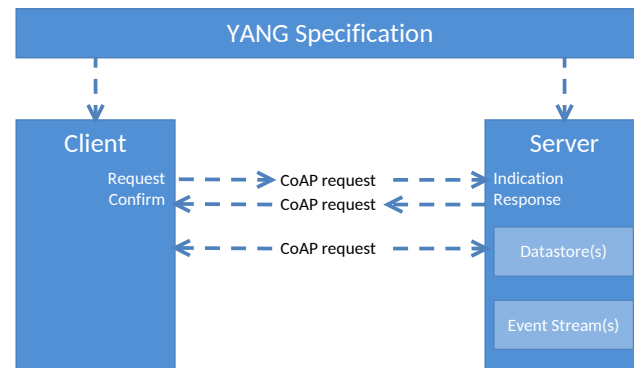


- Designed to be modular and extensible

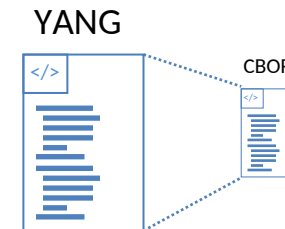
CORECONF

- Defined by the IETF
 - Currently in draft state
- RESTful protocol for constrained devices and networks
- Client-server model
- Stateless

- CoAP used to access datastore and data node resources
 - resources specified in YANG
- Uses YANG to CBOR mapping
 - Reduces payload size by converting YANG identifier strings to numeric identifiers



Source: [draft-ietf-core-comi-17](#)



NETCONF, RESTCONF, and CORECONF – a comparison

	NETCONF	RESTCONF	CORECONF
Communication Paradigm	Client-server based model, connection-oriented	Client-server based model, stateless, RESTful principles	Client-server based model, stateless, RESTful principles
Data Modeling	YANG	YANG	YANG (or SMIv2 converted to YANG)
Transport Protocols	Secure transport protocols, such as SSH or TLS	HTTP or HTTPS	CoAP/UDP
Security Features	Security provided by underlying secure transport protocol	Security provided by HTTPS	Security provided by CoAP

Use of YANG in IEEE 802

- Used to model configuration of IEEE 802 features in several IEEE 802 WG
 - IEEE 802.1: YANG used to provide configuration modules for all current projects since ~2018
 - IEEE 802.3: Ongoing project to revise the YANG module in IEEE 802.3.2-2019
- Replaced MIBs as standard way to provide management modules in IEEE 802.1
- YANGsters: group in IEEE 802 that
 - discusses common practice for YANG models supporting IEEE 802 protocols
 - provides guidelines on modelling and tooling
 - <https://1.ieee802.org/yangsters/>

IEEE
802

