Getting Started with OpenConfig

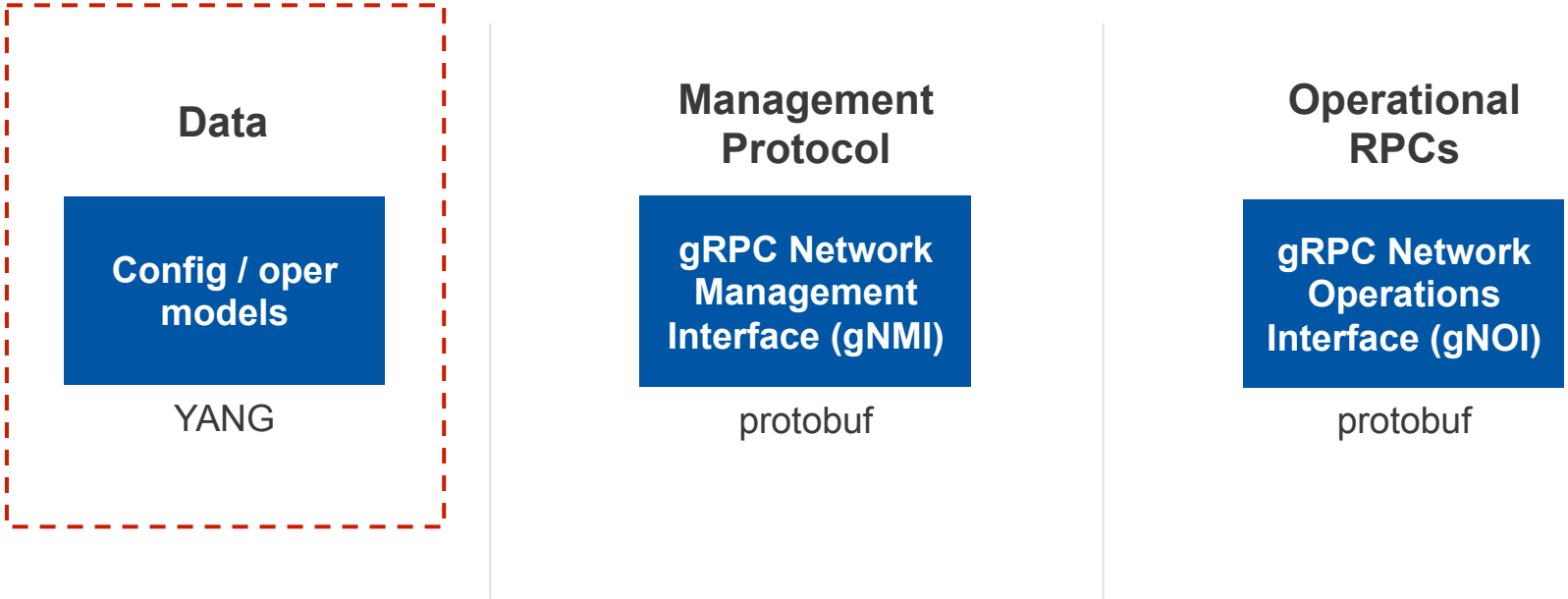
Santiago Alvarez

OpenConfig introduction

- Operator group pursuing more dynamic and programmable networks
- Specifications designed by operators for operators
- Initial specifications made public mid-2015
- Initial implementations available from several device vendors

Google	Yahoo!
at&t	Apple
Microsoft	Jive Communications
British Telecom	Deutsche Telekom
Facebook	Bell Canada
Comcast	SK Telecom
Verizon	Bloomberg
Level 3	Netflix
Cox Communications	Cloudflare

OpenConfig Major Components



OpenConfig Data Model Principles

- Modular model definition
- Model structure combines
  - Configuration (intended)
  - Operational data (applied config and derived state)
- Each module subtree declares config and state containers
- Model backward compatibility
  - Driven by use of semantic versioning (xx.yy.zz)
  - Diverges from IETF YANG guidelines (full compatibility)
- String patterns (regex) follow POSIX notation (instead of W3C as defined at IETF)

```
module: openconfig-bgp
tree-path /bgp/neighbors/neighbor/transport
    +--rw bgp!
       +--rw neighbors
          +--rw neighbor* [neighbor-address]
             +--rw transport
                +--rw config
                |  +--rw tcp-mss?
                |  +--rw mtu-discovery?
                |  +--rw passive-mode?
                |  +--rw local-address?
                +--ro state
                   +--ro tcp-mss?
                   +--ro mtu-discovery?
                   +--ro passive-mode?
                   +--ro local-address?
                   +--ro local-port?
                   +--ro remote-address?
                   +--ro remote-port?
```

OpenConfig Style Conventions

	Naming	Example
Module (File) Name	openconfig-<function>(.yang) openconfig-<function>-<subfunction>(.yang)	openconfig-bgp(.yang) openconfig-bgp-policy(.yang)
Module Prefix Name	oc-<abbreviation> oc-<abbreviation>-<abbreviation>	oc-bgp oc-bgp-pol
Module Namespace	http://openconfig.net/yang/<function> http://openconfig.net/yang/<function>-<subfunction>	http://openconfig.net/yang/bgp http://openconfig.net/yang/bgp-policy
Enumeration and Identity Identifiers	UPPERCASE_WITH_UNDERSCORES	NOT_PRESENT
Other Node Identifiers	lowercase-with-dashes	oper-status

OpenConfig Models

Post version 1.0.0	Pre version 1.0.0	
openconfig-interfaces	openconfig-system	
openconfig-vlan	openconfig-ospfv2	openconfig-aft
openconfig-acl	openconfig-network-instance	openconfig-isis
openconfig-routing-policy	openconfig-rib-bgp	openconfig-telemetry
openconfig-bgp	openconfig-segment-routing	openconfig-lldp
openconfig-local-routing	openconfig-openflow	openconfig-policy-forwarding
openconfig-mpls	openconfig-channel-monitor	openconfig-spanning-tree
openconfig-terminal-device	openconfig-optical-amplifier	openconfig-platform
	openconfig-transport-line-protection	openconfig-module-catalog
	openconfig-wavelength-router	

OpenConfig BGP: Overview (openconfig-bgp)

- Model for BGP configuration and operational data
- Three top-level containers:
  - Global
  - Neighbors
  - Peer groups
- Multi-protocol support

```
module: openconfig-bgp
    +--rw bgp!
       +--rw global
       |     ...
       +--rw neighbors
       |     ...
       +--rw peer-groups
             ...
```

OpenConfig BGP: Neighbors and Peer Groups

```
module: openconfig-bgp
tree-path /bgp/neighbors
    +--rw bgp!
       +--rw neighbors
          +--rw neighbor* [neighbor-address]
             +--rw neighbor-address
             +--rw config
             |     ...
             +--ro state
             |     ...
             +--rw timers
             |     ...
             +--rw transport
             |     ...
             +--rw error-handling
             |     ...
             +--rw logging-options
             |     ...
             :
```

```
module: openconfig-bgp
tree-path /bgp/peer-groups
    +--rw bgp!
       +--rw peer-groups
          +--rw peer-group* [peer-group-name]
             +--rw peer-group-name
             +--rw config
             |     ...
             +--ro state
             |     ...
             +--rw timers
             |     ...
             +--rw transport
             |     ...
             +--rw error-handling
             |     ...
             +--rw logging-options
             |     ...
             :
```

OpenConfig Routing Policy: Overview (openconfig-routing-policy)

- Model for routing policy configuration (no oper data)
- Two top-level containers:
  - Defined sets
  - Policy definitions
- Supports policy chains and nested policies
- Each policy has one or more statements with condition-action tuples
- BGP policy augmentations defined in openconfig-bgp-policy

```
module: openconfig-routing-policy
   +--rw routing-policy
      +--rw defined-sets
      |     ...
      +--rw policy-definitions
            ...
```

OpenConfig Routing Policy: Evaluation Rules

- Policies in a chain are evaluated in order
- Policy statements are evaluated in order
- Actions are executed when conditions are satisfied. Otherwise, next statement is evaluated.
- Policy chain evaluation stops if accept-route or reject-route action is executed
- If no policy statement conditions are satisfied, the next policy definition in the chain is evaluated
- Default route disposition action is performed when the end of the policy chain is reached

OpenConfig Routing Policy: Defined Sets and Policy Definitions

```
module: openconfig-routing-policy
tree-path /routing-policy/defined-sets
   +--rw routing-policy
      +--rw defined-sets
         +--rw prefix-sets
         |     ...
         +--rw neighbor-sets
         |     ...
         +--rw tag-sets
               ...
```

```
module: openconfig-routing-policy
tree-path /routing-policy/policy-definitions
   +--rw routing-policy
      +--rw policy-definitions
         +--rw policy-definition* [name]
            +--rw name
            +--rw statements
               +--rw statement* [name]
                  +--rw name
                  +--rw conditions
                  |     ...
                  +--rw actions
                        ...
```

OpenConfig Routing Policy: BGP Augmentations for Defined Sets

```
module: openconfig-bgp-policy
augment /rpol:routing-policy/rpol:defined-sets:
   +--rw bgp-defined-sets
      +--rw community-sets
      |  +--rw community-set* [community-set-name]
      |     +--rw community-set-name
      |     +--rw community-member*
      +--rw ext-community-sets
      |  +--rw ext-community-set* [ext-community-set-name]
      |     +--rw ext-community-set-name
      |     +--rw ext-community-member*
      +--rw as-path-sets
         +--rw as-path-set* [as-path-set-name]
            +--rw as-path-set-name
            +--rw as-path-set-member*
```

OpenConfig Routing Policy: BGP Augmentations for Conditions and Actions

```
module: openconfig-routing-policy
augment /routing-policy/policy-definitions/policy-
definition/statements/statement/conditions:
   +--rw bgp-conditions
      +--rw match-community-set!
      |     ...
      +--rw match-ext-community-set!
      |     ...
      +--rw match-as-path-set!
      |     ...
      +--rw med-eq?
      +--rw origin-eq?
      +--rw next-hop-in*
      +--rw afi-safi-in*
      +--rw local-pref-eq?
      +--rw community-count!
      |     ...
      +--rw as-path-length!
      |     ...
      +--rw route-type?
```

```
module: openconfig-routing-policy
augment /routing-policy/policy-definitions/policy-
definition/statements/statement/actions:
   +--rw bgp-actions
      +--rw set-as-path-prepend!
      |     ...
      +--rw set-community!
      |     ...
      +--rw set-ext-community!
      |     ...
      +--rw set-route-origin?
      +--rw set-local-pref?
      +--rw set-next-hop?
      +--rw set-med?
```

OpenConfig Interfaces (openconfig-interfaces)

- Model for interface configuration and operational data
- Four top-level containers under each interface:
  - Config
  - State
  - Hold time
  - subinterfaces
- Four main augmentations:
  - Bundles – openconfig-if-aggregate
  - Ethernet – openconfig-if-Ethernet
  - IP – openconfig-if-ip
  - VLAN – openconfig-vlan
- All protocol configuration resides on subinterfaces
- IP augmentations include static ARP and VRRP

```
module: openconfig-interfaces
    +--rw interfaces
       +--rw interface* [name]
          +--rw name
          +--rw config
          |     ...
          +--ro state
          |     ...
          +--rw hold-time
          |     ...
          +--rw subinterfaces
                ...
```

OpenConfig Interfaces: Bundle and Ethernet Augmentations

```
module: openconfig-if-aggregate
augment /ocif:interfaces/ocif:interface:
   +--rw aggregation!
      +--rw config
      |  +--rw lag-type?
      |  +--rw min-links?
      +--ro state
      |  +--ro lag-type?
      |  +--ro min-links?
      |  +--ro members*
      +--rw lacp!
         +--rw config
         |     ...
         +--ro state
         |     ...
         +--ro members
```

```
module: openconfig-if-ethernet
augment /ocif:interfaces/ocif:interface:
   +--rw ethernet
      +--rw config
      |  +--rw mac-address?
      |  +--rw auto-negotiate?
      |  +--rw duplex-mode?
      |  +--rw port-speed?
      |  +--rw enable-flow-control?
      +--ro state
         +--ro mac-address?
         +--ro auto-negotiate?
         +--ro duplex-mode?
         +--ro port-speed?
         +--ro enable-flow-control?
         +--ro hw-mac-address?
         +--ro counters
                ...
```

OpenConfig Interfaces: IP Augmentations

```
module: openconfig-if-ip
augment /ocif:interfaces/
ocif:interface/ocif:subinterfaces/
ocif:subinterface:
   +--rw ipv4!
      +--rw address* [ip]
      |     ...
      +--rw neighbor* [ip]
      |     ...
      +--rw config
      |     ...
      +--ro state
            ...
```

```
module: openconfig-if-ip
augment /ocif:interfaces/ocif:interface/
ocif:subinterfaces/ocif:subinterface:
   +--rw ipv6!
      +--rw address* [ip]
      |     ...
      +--rw neighbor* [ip]
      |     ...
      +--rw config
      |     ...
      +--ro state
      |     ...
      +--rw autoconf
            ...
```

OpenConfig Interfaces: VLAN Augmentations

```
module: openconfig-vlan
augment /ocif:interfaces/ocif:interface/
eth:ethernet:
   +--rw vlan
      +--rw config
      |  +--rw interface-mode?
      |  +--rw native-vlan?
      |  +--rw access-vlan?
      |  +--rw trunk-vlans*
      +--ro state
         +--ro interface-mode?
         +--ro native-vlan?
         +--ro access-vlan?
         +--ro trunk-vlans*
```

```
module: openconfig-vlan
augment /ocif:interfaces/ocif:interface/
lag:aggregation:
   +--rw vlan
      +--rw config
      |  +--rw interface-mode?
      |  +--rw native-vlan?
      |  +--rw access-vlan?
      |  +--rw trunk-vlans*
      +--ro state
         +--ro interface-mode?
         +--ro native-vlan?
         +--ro access-vlan?
         +--ro trunk-vlans*
```

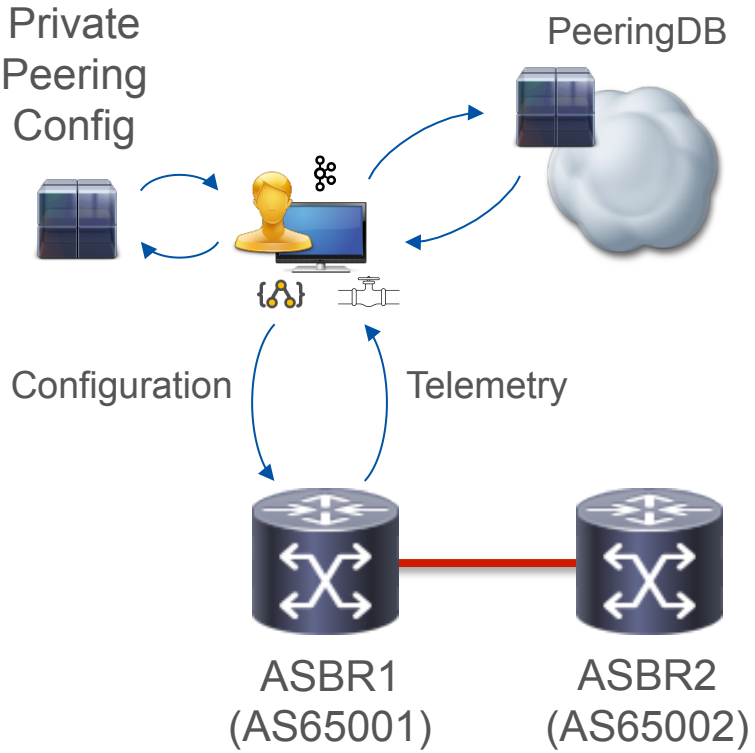
OpenConfig Telemetry (openconfig-telemetry)

- Model for telemetry configuration and operational data
- Three top-level containers:
  - Sensor groups
  - Destination groups
  - subscriptions

```
module: openconfig-telemetry
   +--rw telemetry-system
      +--rw sensor-groups
      |  +--rw sensor-group* [sensor-group-id]
      |        ...
      +--rw destination-groups
      |  +--rw destination-group* [group-id]
      |        ...
      +--rw subscriptions
         +--rw persistent
         |     ...
         +--rw dynamic
               ...
```

Peering Use Case
Configure and Validate Peering on ASBR1

1. Configure routing policy on ASBR1
2. Configure telemetry (interface and BGP subscriptions) on ASBR1
3. Load peer configuration
4. Configure interface and validate operation
5. Configure BGP neighbor and validate operation



Open Source Tool Chain

YDK
(ydk.io)

- Python/C++ bindings for OpenConfig models
- Detailed client-side data validation
- Protocol / transport / encoding abstraction

Pipeline
(git.io/vdnnT)

- Collector for router streaming telemetry
- Performs basic encoding transformation
- Data producer for Kafka, InfluxDB, Prometheus, etc.

Kafka
(kafka.apache.org)

- Distributed streaming platform (message bus)
- Producer, consumer, stream and connector APIs
- Rich client support (Python, Java, etc)

Configure Routing Policy (Prefix Set)

```
# configure prefix set
prefix_set = routing_policy.defined_sets.prefix_sets.PrefixSet()
prefix_set.prefix_set_name = "PREFIX-SET"
prefix = prefix_set.Prefix()
prefix.ip_prefix = "10.0.0.0/8"
prefix.masklength_range = "8..32"
prefix_set.prefix.append(prefix)
prefix = prefix_set.Prefix()
prefix.ip_prefix = "172.16.0.0/12"
prefix.masklength_range = "12..32"
prefix_set.prefix.append(prefix)
routing_policy.defined_sets.prefix_sets.prefix_set.append(prefix_set)
```

Match prefixes for 10/8

Match prefixes for 172.16/12

Configure Routing Policy (Statements)

```
# configure policy definition
policy_definition = routing_policy.policy_definitions.PolicyDefinition()
policy_definition.name = "ROUTE-POLICY"
# configure drop-prefix statement
statement = policy_definition.statements.Statement()
statement.name = "DROP-PREFIXES"
match_prefix_set = statement.conditions.MatchPrefixSet()
match_prefix_set.prefix_set = "PREFIX-SET"
match_set_options = oc_policy_types.MatchSetOptionsRestrictedTypeEnum.ANY
match_prefix_set.match_set_options = match_set_options
statement.conditions.match_prefix_set = match_prefix_set
statement.actions.reject_route = Empty()
policy_definition.statements.statement.append(statement)
# configure accept statement
statement = policy_definition.statements.Statement()
statement.name = "ACCEPT-ROUTE"
statement.actions.accept_route = Empty()
policy_definition.statements.statement.append(statement)
routing_policy.policy_definitions.policy_definition.append(policy_definition)
```

Drop prefixes matching ANY prefix in PREFIX-SET

Accept all other prefixes

Configure Interface and BGP Telemetry (Sensors)

```
# configure sensor group
sensor_group = telemetry_system.sensor_groups.SensorGroup()
sensor_group.sensor_group_id = "PEERING-SENSORS"
sensor_group.config.sensor_group_id = "PEERING-SENSORS"
# configure interface sensor path
sensor_path = sensor_group.sensor_paths.SensorPath()
sensor_path.path = "openconfig-interfaces:interfaces/interface"
sensor_path.config.path = "openconfig-interfaces:interfaces/interface"
sensor_group.sensor_paths.sensor_path.append(sensor_path)
# configure bgp-neighbor sensor path
sensor_path = sensor_group.sensor_paths.SensorPath()
sensor_path.path = "openconfig-bgp:bgp/neighbors"
sensor_path.config.path = "openconfig-bgp:bgp/neighbors"
sensor_group.sensor_paths.sensor_path.append(sensor_path)
telemetry_system.sensor_groups.sensor_group.append(sensor_group)
```

Stream interface data

Stream BGP data

Configure Interface and BGP Telemetry (Destination)

```
# configure destination group
destination_group = telemetry_system.destination_groups.DestinationGroup()
destination_group.group_id = "PIPELINE"
destination_group.config.group_id = "PIPELINE"
# configure destination
destination = destination_group.destinations.Destination()
destination.destination_address = "10.16.10.129"
destination.destination_port = 5432
destination.config.destination_address = "10.16.10.129"
destination.config.destination_port = 5432
destination.config.destination_protocol = oc_telemetry.TelemetryStreamProtocolEnum.TCP
destination_group.destinations.destination.append(destination)
telemetry_system.destination_groups.destination_group.append(destination_group)
```

Add Pipeline host to destination group

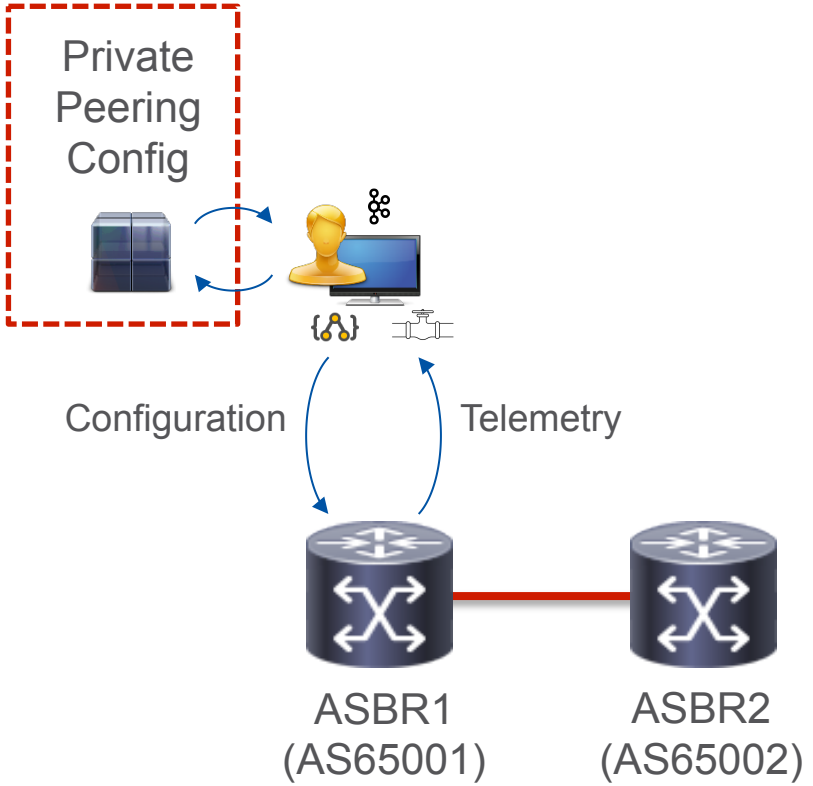
Configure Interface and BGP Telemetry (Subscription)

```
# configure subscription
subscription = telemetry_system.subscriptions.persistent.Subscription()
subscription.subscription_id = 10
subscription.config.subscription_id = 10
sensor_profile = subscription.sensor_profiles.SensorProfile()
sensor_profile.sensor_group = "PEERING-SENSORS"
sensor_profile.config.sensor_group = "PEERING-SENSORS"
sensor_profile.config.sample_interval = 10000
subscription.sensor_profiles.sensor_profile.append(sensor_profile)
destination_group = subscription.destination_groups.DestinationGroup()
destination_group.group_id = "PIPELINE"
destination_group.config.group_id = "PIPELINE“
subscription.destination_groups.destination_group.append(destination_group)
telemetry_system.subscriptions.persistent.subscription.append(subscription)
```

Specify a subscription (sensor + destination groups)

Peering Use Case
Peer Configuration

```
{
    "asbr": {
        "name": "asbr1",
        "address": "198.18.1.11"
    },
    "as": 65001,
    "interface": {
        "name": "GigabitEthernet0/0/0/0",
        "description": "Peering with AS65002",
        "address": "192.168.0.1",
        "netmask": 24
    },
    "neighbor": {
        "address": "192.168.0.2",
        "as": 65002
    }
}
```



Configure Interface (Including IP Subinterface)

```
# configure interface
interface = interfaces.Interface()
interface.name = "GigabitEthernet0/0/0/0 "
interface.config.name = "GigabitEthernet0/0/0/0 "
interface.config.description = "Peering with AS65002"
interface.config.enabled = True
# configure ip subinterface
subinterface = interface.subinterfaces.Subinterface()
subinterface.index = 0
subinterface.config.index = 0
subinterface.ipv4 = subinterface.Ipv4()
address = subinterface.ipv4.Address()
address.ip = "192.168.0.1"
address.config.ip = "192.168.0.1"
address.config.prefix_length = 24
subinterface.ipv4.address.append(address)
interface.subinterfaces.subinterface.append(subinterface)
interfaces.interface.append(interface)
```

Configure interface

Configure IP sub-interface

Interface State Validation

Model: openconfig-interfaces

Path: interfaces/interface/subinterfaces/subinterface/state/oper-status

- UP - Ready to pass packets.
- DOWN - The interface does not pass any packets.
- TESTING - In some test mode. No operational packets can be passed.
- UNKNOWN - Status cannot be determined for some reason.
- DORMANT - Waiting for some external event.
- NOT_PRESENT - Some component (typically hardware) is missing.
- LOWER_LAYER_DOWN - Down due to state of lower-layer interface(s).

Configure Global BGP and Peer Group

```
# configure global bgp
bgp.global_.config.as_ = 65001
afi_safi = bgp.global_.afi_safis.AfiSafi()
afi_safi.afi_safi_name = oc_bgp_types.Ipv4UnicastIdentity()
afi_safi.config.afi_safi_name = oc_bgp_types.Ipv4UnicastIdentity()
afi_safi.config.enabled = True
bgp.global_.afi_safis.afi_safi.append(afi_safi)
```

Global BGP configuration

```
# configure EBGP peer group
peer_group = bgp.peer_groups.PeerGroup()
peer_group.peer_group_name = "EBGP"
peer_group.config.peer_group_name = "EBGP"
afi_safi = peer_group.afi_safis.AfiSafi()
afi_safi.afi_safi_name = oc_bgp_types.Ipv4UnicastIdentity()
afi_safi.config.afi_safi_name = oc_bgp_types.Ipv4UnicastIdentity()
afi_safi.config.enabled = True
afi_safi.apply_policy.config.import_policy.append("ROUTE-POLICY")
afi_safi.apply_policy.config.export_policy.append("ROUTE-POLICY")
peer_group.afi_safis.afi_safi.append(afi_safi)
bgp.peer_groups.peer_group.append(peer_group)
```

EBGP peer-group definition

Configure BGP Neighbor

```
# configure EBGP neighbor
neighbor = bgp.neighbors.Neighbor()
neighbor.neighbor_address = "192.168.0.2"
neighbor.config.neighbor_address = "192.168.0.2"
neighbor.config.peer_as = 65001
neighbor.config.peer_group = "EBGP"
bgp.neighbors.neighbor.append(neighbor)
```

EBGP neighbor configuration

BGP Neighbor State Validation

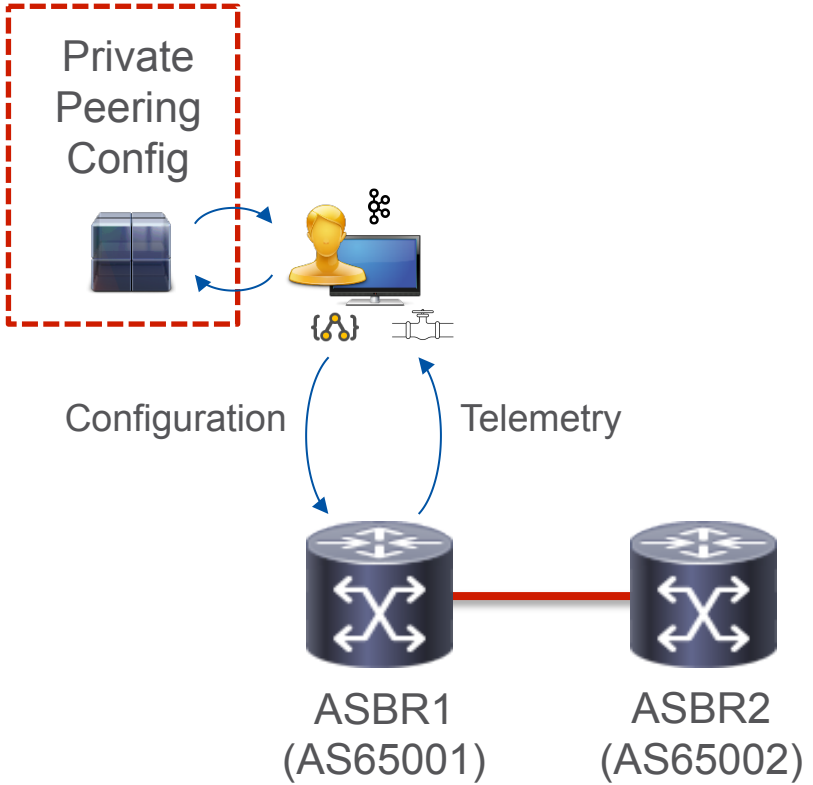
Model: openconfig-bgp

Path: openconfig-bgp:bgp/neighbors/neighbor/state/session-state

- IDLE - neighbor is down, and in the Idle state of the FSM
- CONNECT - neighbor is down, and the session is waiting for the underlying transport session to be established
- ACTIVE - neighbor is down, and the local system is awaiting a connection from the remote peer
- OPENSENT - neighbor is in the process of being established. The local system has sent an OPEN message.
- OPENCONFIRM - neighbor is in the process of being established. The local system is awaiting a NOTIFICATION or KEEPALIVE message.
- ESTABLISHED - neighbor is up - the BGP session with the peer is established.

Peering Use Case Execution

```
Loading peer configuration .... [ OK ]
Configure interface ........... [ OK ]
Configure BGP ................. [ OK ]
```



Demo Components

Vagrant Box at https://github.com/CiscoDevNet/ydk-py-samples

Component	Version
openconfig-routing-policy	1.1.0
openconfig-telemetry	0.2.0
openconfig-interfaces	0.2.0
openconfig-bgp	1.1.0
YDK	0.5.5
Pipeline	1.0.0
Kafka	0.10.0.0
zookeeper	3.4.6

Summary

- OpenConfig provides a growing number of vendor-neutral data models
- Available implementations support real use cases
- Data models and streaming telemetry simplify automation of operational workflows

Resources

- OpenConfig Site

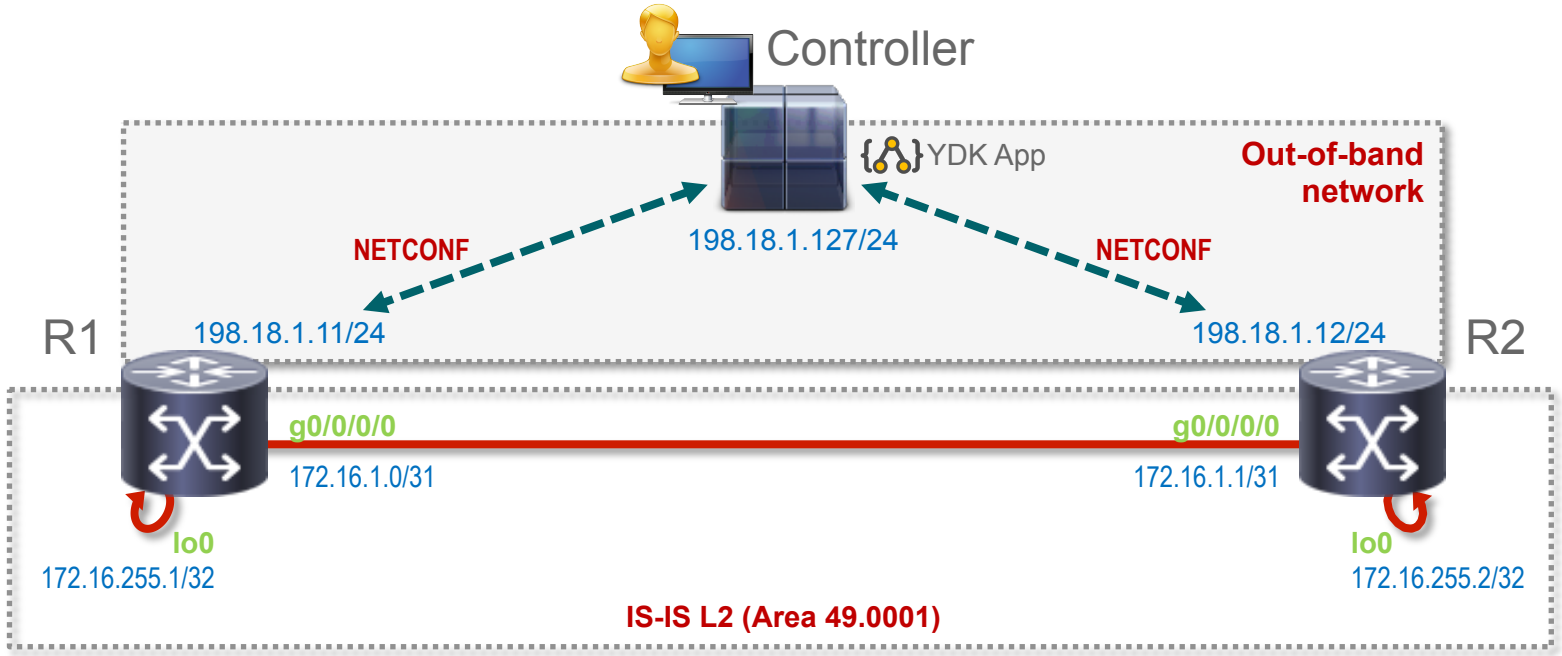
  http://www.openconfig.net/
- Vagrant box with clients and telemetry collector

  https://github.com/CiscoDevNet/ydk-py-samples
- Getting Started With OpenConfig

  https://github.com/CiscoDevNet/openconfig-getting-started

Backup

Testbed Topology



OpenConfig VLAN (openconfig-vlan)

- Model for VLAN configuration and operational data
- Two top-level containers under each VLAN:
  - Config
  - State
- Augments openconfig-interfaces

```
module: openconfig-vlan
    +--rw vlans
       +--rw vlan* [vlan-id]
          +--rw vlan-id
          +--rw config
          |  +--rw vlan-id?
          |  +--rw name?
          |  +--rw status?
          +--ro state
             +--ro vlan-id?
             +--ro name?
             +--ro status?
             +--ro member-ports*
```

OpenConfig MPLS (openconfig-mpls)

- Model for MPLS related configuration and operational data
- Includes data for:
  - Static MPLS
  - LDP
  - Traffic Engineering
  - RSVP
  - Segment Routing
- Five top-level containers under each interface:
  - global
  - TE global attributes
  - TE interface attributes
  - Signaling protocols
  - LSPs
- Only supports named LSP and named explicit paths

```
module: openconfig-mpls
   +--rw mpls!
      +--rw global
      |     ...
      +--rw te-global-attributes
      |     ...
      +--rw te-interface-attributes
      |     ...
      +--rw signaling-protocols
      |     ...
      +--rw lsps
            ...
```

OpenConfig MPLS: Global and TE Global Attributes

```
module: openconfig-mpls
tree-path /mpls/global
   +--rw mpls!
      +--rw global
         +--rw config
         |  +--rw null-label?
         +--ro state
         |  +--ro null-label?
         +--rw mpls-interface-attributes
            +--rw interface* [name]
               +--rw name
               +--rw config
               |  +--rw name?
               |  +--rw mpls-enabled?
               +--ro state
                  +--ro name?
                  +--ro mpls-enabled?
```

```
module: openconfig-mpls
tree-path /mpls/te-global-attributes
   +--rw mpls!
      +--rw te-global-attributes
         +--rw srlgs
         |  +--rw srlg* [name]
         |        ...
         +--rw igp-flooding-bandwidth
         |  +--rw config
         |  |     ...
         |  +--ro state
         |        ...
         +--rw mpls-admin-groups
         |  +--rw admin-group* [admin-group-name]
         |        ...
         +--rw te-lsp-timers
            +--rw config
            |     ...
            +--ro state
                  ...
```

OpenConfig MPLS: TE Interface Attributes and Signaling Protocols

```
module: openconfig-mpls
tree-path /mpls/te-interface-attributes
   +--rw mpls!
      +--rw te-interface-attributes
         +--rw interface* [name]
            +--rw name
            +--rw config
            |     ...
            +--ro state
            |     ...
            +--rw igp-flooding-bandwidth
                  ...
```

```
module: openconfig-mpls
tree-path /mpls/signaling-protocols
   +--rw mpls!
      +--rw signaling-protocols
         +--rw rsvp-te
         |  +--rw sessions
         |  |     ...
         |  +--rw neighbors
         |  |     ...
         |  +--rw global
         |  |     ...
         |  +--rw interface-attributes
         |        ...
         +--rw segment-routing
         |  +--rw srgbs
         |  |     ...
         |  +--rw interfaces
         |        ...
         +--rw ldp
            +--rw timers
```

OpenConfig MPLS: LSPs

```
module: openconfig-mpls
tree-path /mpls/lsps
   +--rw mpls!
      +--rw lsps
         +--rw constrained-path
         |  +--rw named-explicit-paths
         |  |  +--rw named-explicit-path* [name]
         |  |        ...
         |  +--rw tunnels
         |     +--rw tunnel* [name source]
         |           ...
         +--rw unconstrained-path
         |  +--rw path-setup-protocol
         |     +--rw ldp!
         |     |     ...
         |     +--rw segment-routing
         |           ...
         +--rw static-lsps
```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