Creating Additional Scripts to Configure BGP With The Cisco NXOS YANG Model

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the AIS Hackathon Kampala Uganda,
Network Programmability

- **BGP** is a standardized exterior gateway protocol designed to exchange routing and reachability information among autonomous systems on the Internet.
- **Cisco NXOS YANG model** provides a clear and concise description of the BGP elements.
- For more details about Yang Models:
    1. https://github.com/YangModels/yang/tree/master/vendor/cisco/nx
    2. https://www.cisco.com/c/en/us/td/docs/switches/datacenter/nexus9000/sw/7-x/programmability/guide/b_Cisco_Nexus_9000_Series_NX-OS_Programmability_Guide_7x/b_Cisco_Nexus_9000_Series_NX-OS_Programmability_Guide_7x_chapter_010011.html

Environment Set Up

- We created a directory and cloned the CiscoDevnet repo for NXOS code
    1. git clone https://github.com/CiscoDevNet/nxos-code
- We then created a virtual environment, activated it and then installed the python packages listed in the requirements text file in addition with the ncclient package.
    1. python3 -m venv nxos
    2. source nxos/bin/activate
    3. pip install -r requirements.txt
    4. pip install ncclient

Network Device Preparation

- We executed the config_bgp_baseline.py script to ensure that the default BGP configuration in the Always On Sandbox device matches our needs. This file is located in the nxos-code/yang/02-yang directory.

NB: The Sandbox device is simplify a virtual machine that runs a router image.

1. python config_bgp_baseline.py

Output:

Now sending baseline bgp configuration to device sbx-nxos-mgmt.cisco.com...

<?xml version="1.0" encoding="UTF-8"?>

<rpc-reply message-id="urn:uuid:a223475d-9f8d-4e0a-a76e-7cc45ddf9e5a" xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">

<ok/>

</rpc-reply>

Mapping BGP configuration to the Cisco NXOS YANG model

- We used pyang to visualize the BGP elements within the NXOS YANG mode. Then ran the Cisco-NX-OS-device.yang file in this directory nxos-code/yang/02-yang.
    1. pyang -f tree Cisco-NX-OS-device.yang -o nxos_bgp.txt
- This created a nxos_bgp.txt file which contained the mapped bgp configs to the cisco nxos yang model.

Review of the existing scripts for collecting (ASN, BGP ROUTER ID) and advertising (subnets over BGP)

- Reviewing the generated nxos_bgp.txt file which describes the NXOS Yang Model for BGP, we found out that: -
  1. ASN is obtained via this path /System/bgp-items/inst-items/asn
  2. the router ID is obtained via /System/bgp-items/inst-items/dom-items/Dom-list/rtrId
  3. The BGP prefixes are obtained via /System/bgp-items/inst-items/dom-items/Dom-list/af-items/DomAf-list/prefix-items. To get more details on the prefixes, you continue with the same path to pick more information

- **Each of the existing scripts contains an XML string** that acts as a **NETCONF filter** to query the **device** for the requested information following the defined path in yang models.

Review of the existing scripts for collecting (ASN, BGP ROUTER ID) and advertising (subnets over BGP) - 2

We executed some of the scripts under the nxos-code/yang/02-yang directory and got output from the router

Command: python get_bgp_asn.py

Output:

The ASN number **for** sbx-nxos-mgmt.cisco.com is 65535

Command: Python get_bgp_rtrid.py

Output:

The BGP router-id **for** sbx-nxos-mgmt.cisco.com is 172.16.0.1

Creating a Script to Query the mode of the router.

- According to our nxos_bgp.txt file that contains the yang model description of the bgp elements, the path of the mode is: /System/bgp-items/inst-items/dom-items/Dom-list/mode.
- We created a get_bgn_mode.py script with an **XML string that** acted as a **NETCONF filter** to query the **device** for the **mode in BGP. On** executing the created script, we manged to get the mode of the router as "**fabric**"

  Command: python get_bgp_mode.py

  Output:

  The BGP router mode **for** sbx-nxos-mgmt.cisco.com is fabric

- **With this knowledge, we realized that we could make more other scripts with various NETCONF filters to configure BGP on the router and query the router for BGP information.**
- **Link to Our work: https://github.com/JanetJanx/nxos-code-samples**

Thank You