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Validating State – A Customer Use Case

Automated State Validation for ACI Upgrades

Sebastian Jeuk, Test Architect, Solution Validation Services, Cisco CX
Michael Wielpuetz, Software Delivery Architect, Cisco CX
DEVNET – 2526

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Agenda

- Introduction
- The Customer Ask
- Validating State – Manually ...
- Validating State – Automatically ...
- Our State Validation Engine
- Walk Through
- Lessons Learned

The Customer Ask

The Customer Ask

- Handle upgrade of multiple large scale ACI Fabrics from Version 3.2 to 5.2
- Assure smooth Upgrade without business impacting interruptions
- Full Upgrade to be completed in a tight maintenance window
- Proof Pre- and Post-Upgrade State is the same

Challenge Accepted

- How can we proof ACI Fabric Upgrade is successful?
- How can we Validate Upgrade after each Maintenance Group?
- How can we make this repeatable for many ACI Fabric Upgrades?
- How to achieve the same results across a large Team?

Validating State – Manually

Complex
Error Prone
Time Consuming
Highly repetitive

Analysing State is key

- Find erroneous configurations
- Validate fabric state before and after changes/upgrades
- Share state with others
- Perform scheduled state validations
- Maintain a history of states
- Compare current state with any historical state
- Doing all this manually is not feasible!

Validating State means ...

- Running show commands and REST API calls
- Collecting health Information
- Checking for errors, faults or warnings
- Repeating the above on many devices
- Multiple times
- ... and finally comparing all collected information

	IP Route Table for VRF "default"	IP Route Table for VRF "default"	IP Route Table for VRF "default"
	denotes best ucast next-hop	denotes best ucast next-hop	denotes best ucast next-hop
BGP routing table entry for 1.1.1.1/32, version 2			BGP routing table entry for 1.1.1.1/32, version 2
Paths: (1 available, best #1, table default)			Paths: (1 available, best #1, table default)
Not advertised to any peer			Not advertised to any peer
Refresh Epoch 1			Refresh Epoch 1
Local			Local
114.114.114.1 from 114.114.114.1 (6.6.6.6)			114.114.114.1 from 114.114.114.1 (6.6.6.6)
Origin incomplete, metric 0, localpref 100, valid, internal, best			Origin incomplete, metric 0, localpref 100, valid, internal, best
rx pathid: 0, tx pathid: 0x0			rx pathid: 0, tx pathid: 0x0
Updated on Jun 12 2022 14:52:26 UTC			Updated on Jun 12 2022 14:52:26 UTC
BGP routing table entry for 2.2.2.2/32, version 3			BGP routing table entry for 2.2.2.2/32, version 3
Paths: (1 available, best #1, table default)			Paths: (1 available, best #1, table default)
Not advertised to any peer			Not advertised to any peer
Refresh Epoch 1			Refresh Epoch 1
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114.114.114.1 from 114.114.114.1 (6.6.6.6)			114.114.114.1 from 114.114.114.1 (6.6.6.6)
Origin incomplete, metric 0, localpref 100, valid, internal, best			Origin incomplete, metric 0, localpref 100, valid, internal, best
rx pathid: 0, tx pathid: 0x0			rx pathid: 0, tx pathid: 0x0
Updated on Jun 12 2022 14:52:26 UTC			Updated on Jun 12 2022 14:52:26 UTC
BGP routing table entry for 3.3.3.3/32, version 4			BGP routing table entry for 3.3.3.3/32, version 4
Paths: (1 available, best #1, table default)			Paths: (1 available, best #1, table default)
Not advertised to any peer			Not advertised to any peer
Refresh Epoch 1			Refresh Epoch 1
Local			Local
114.114.114.1 from 114.114.114.1 (6.6.6.6)			114.114.114.1 from 114.114.114.1 (6.6.6.6)
Origin incomplete, metric 0, localpref 100, valid, internal, best			Origin incomplete, metric 0, localpref 100, valid, internal, best
rx pathid: 0, tx pathid: 0x0			rx pathid: 0, tx pathid: 0x0
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Not advertised to any peer			Not advertised to any peer
Refresh Epoch 1			Refresh Epoch 1
Local			Local
114.114.114.1 from 114.114.114.1 (6.6.6.6)			114.114.114.1 from 114.114.114.1 (6.6.6.6)
Origin incomplete, metric 0, localpref 100, valid, internal, best			Origin incomplete, metric 0, localpref 100, valid, internal, best
rx pathid: 0, tx pathid: 0x0			rx pathid: 0, tx pathid: 0x0
Updated on Jun 12 2022 14:52:26 UTC			Updated on Jun 12 2022 14:52:26 UTC
BGP routing table entry for 5.5.5.5/32, version 6			BGP routing table entry for 5.5.5.5/32, version 6
Paths: (1 available, best #1, table default)			Paths: (1 available, best #1, table default)
Not advertised to any peer			Not advertised to any peer
Refresh Epoch 1			Refresh Epoch 1
Local			Local
114.114.114.1 from 114.114.114.1 (6.6.6.6)			114.114.114.1 from 114.114.114.1 (6.6.6.6)
Origin incomplete, metric 0, localpref 100, valid, internal, best			Origin incomplete, metric 0, localpref 100, valid, internal, best
rx pathid: 0, tx pathid: 0x0			rx pathid: 0, tx pathid: 0x0
Updated on Jun 12 2022 14:52:26 UTC			Updated on Jun 12 2022 14:52:26 UTC
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Not advertised to any peer			Not advertised to any peer
Refresh Epoch 1			Refresh Epoch 1
Local			Local
114.114.114.1 from 114.114.114.1 (6.6.6.6)			114.114.114.1 from 114.114.114.1 (6.6.6.6)

Comparing state before and after Fabric Upgrade manually...

- ... is time consuming
- ... not repeatable
- ... finding differences in large data sets nearly impossible
- ... error prone
- ... inconsistent

Validating State – Automatically

Easily Repeatable
Quick
Adaptable
Reusable
Consistent

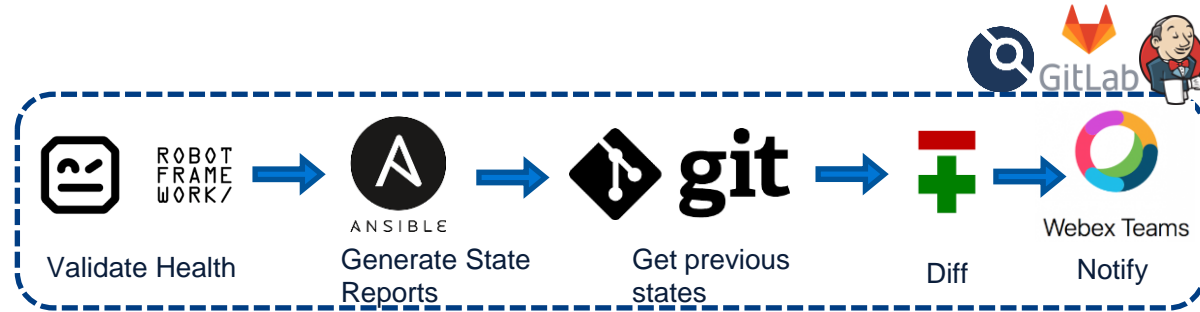


Automation

- How can you
 - extract the state of your fabric?
 - Make it comparable?
 - Share it with others?
 - Follow DevOps principles for state extraction?
- Historize the state of your Fabric?

CX ACI State Validation Engine

- Following NetDevOps principles it validates, generates and tests the state
- Fully based on open source
- Ready to be integrated into GitOps workflows (e.g. a IaC pipeline)
- Results can be versioned and historized
- Makes state comparable
- Flexible and extensible



CX ACI State Validation Engine

- Based on Ansible
- Easily extendable by simply adding roles
- Produces easy to consume CSV output (other formats in the works)
- Can be triggered individually for Upgrade Groups
- Can resume work

1101_bgp_table.csv	2138_bgp_table.csv	2185_lldp_table.csv	2240_lldp_table.csv	2289_pc_table.csv	2806_pc_table.csv
1101_lldp_table.csv	2138_lldp_table.csv	2185_pc_table.csv	2240_pc_table.csv	2289_phyIf_table.csv	2806_phyIf_table.csv
1101_pc_table.csv	2138_pc_table.csv	2185_phyIf_table.csv	2240_phyIf_table.csv	2289_vpc_table.csv	2806_vpc_table.csv
1101_phyIf_table.csv	2138_phyIf_table.csv	2185_vpc_table.csv	2240_vpc_table.csv	2290_bgp_table.csv	2807_bgp_table.csv
1101_vpc_table.csv	2138_vpc_table.csv	2186_bgp_table.csv	2241_bgp_table.csv	2290_lldp_table.csv	2807_lldp_table.csv
1102_bgp_table.csv	2139_bgp_table.csv	2186_lldp_table.csv	2241_lldp_table.csv	2290_pc_table.csv	2807_pc_table.csv
1102_lldp_table.csv	2139_lldp_table.csv	2186_pc_table.csv	2241_pc_table.csv	2290_phyIf_table.csv	2807_phyIf_table.csv
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1103_phyIf_table.csv	2140_phyIf_table.csv	2187_vpc_table.csv	2242_vpc_table.csv	2292_bgp_table.csv	2809_bgp_table.csv
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1201_bgp_table.csv	2141_bgp_table.csv	2188_lldp_table.csv	2243_lldp_table.csv	2292_pc_table.csv	2809_pc_table.csv
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CX ACI State Validation Engine

Currently Supporting ...

- Physical Interfaces
- Virtual Interfaces
- Port-Channels
- BGP
- LLDP
- Faults

Easily adaptable to validate state for your environment!

Walk Through

Automated State Validation During Fabric Upgrade

ACI Fabric Upgrade 3.2 to 5.2

Pre-Check Steps

- Step 1: Generate Pre-State CSV Files
- Step 2: Validate Pre-Check State using Robot
- Step 3: Run Pre-Checks on non-ACI Devices (optional)

Upgrade

- Step 3: Delete Existing Maintenance Groups
- Trigger Upgrade for APIC Cluster (per Customer request manually)
- Step 4: Create Upgrade Groups
- Trigger Upgrade per Upgrade Group (per Customer request manually)

Post-Check Steps

- Step 5: Generate and Validate State per Upgrade Group (ACI and non-ACI)

1. Step: Generate Pre-State CSV Files

ansible-playbook

--ask-vault-pass -i inventories/aci-apic/fabric_1.yaml

--extra-vars "type=precheck"

--extra-vars "aci_upgrade_root_folder=/home/test"

playbooks/aci/aci_firmware_upgrade/generate_report.yaml

- Generates CSV Reports

2. Step: Run Robot Test Pre-Checks

ansible-playbook

--ask-vault-pass -e "target_controller_version=5.2.5"

--extra-vars "aci_upgrade_root_folder=/home/test"

--extra-vars "aci_upgrade_folder=precheck_aci_upgrade" -i inventories/aci-apic/fabric_1.yaml

[playbooks/aci/aci_firmware_upgrade/pre_checks.yaml](#)

- Validates Pre-State of Faults, Physical/vPC/PC Interfaces and multiple health checks

3. Step: Run Pre-Checks on non-ACI Devices (optional)

```
ansible-playbook -vv -e "@vars/secret.yaml"  
  --vault-id ./vars/secret.yaml@prompt  
  -i inventories/core-router/core_router_1.yaml  
  playbooks/aci/aci_firmware_upgrade/upgrade_pre_check_ios_router.yaml
```

- Captures relevant state for connected devices (here IOS based)

4. Step: Delete Maintenance Groups

ansible-playbook

--vault-id ./vars/secret.yaml@prompt

-i inventories/aci-apic/fabric_1.yaml

playbooks/aci/delete_maintenance_groups.yaml

- Deletes Maintenance Groups as part of Upgrade preparation

--> Upgrade APIC Cluster

5. Step: Create Upgrade Groups

ansible-playbook

-vvvvv

--vault-id ./vars/secret.yaml@prompt

-i inventories/aci-apic/fabric_1.yaml

-e "@/path/to/upgrade/group/definition.yaml"

playbooks/aci/aci_firmware_upgrade/create_upgrade_groups.yaml

- Automatically defines Upgrade Groups and assigns relevant switches

--> Upgrade specific Upgrade Group

6. Step: Validate After Individual Upgrade Group Upgrade

ansible-playbook -v

--ask-vault-pass -i inventories/aci-apic/fabric_1.yaml

--extra-vars "aci_upgrade_root_folder=/home/test"

--extra-vars="upgrade_group_name=even"

--extra-vars "type=postcheck" playbooks/aci/aci_firmware_upgrade/
generate_and_validate_reports_for_ug.yaml

- Validates Post-State of Faults, Physical Interfaces and VPC Interfaces and compares it to Pre-State

Conclusion

Lessons Learned

- Release Management to assure show commands / API calls haven't changed
- Report engine must be able to resume work
- Being able to share state with different stakeholders is super important
- Good Understanding of Production Environment is Key
- Being able to change output format is important
- Do all necessary pre-checks before the Maintenance Window starts
- Validate state after each upgrade of an Upgrade Group
- Do another state validation of the complete fabric, once the upgrade is completed

Automation helped us to ...

... execute numerous ACI Fabric Upgrades in short amount of time

... validate state quickly and repeatedly during a single maintenance window

... provide precise details to aid troubleshooting

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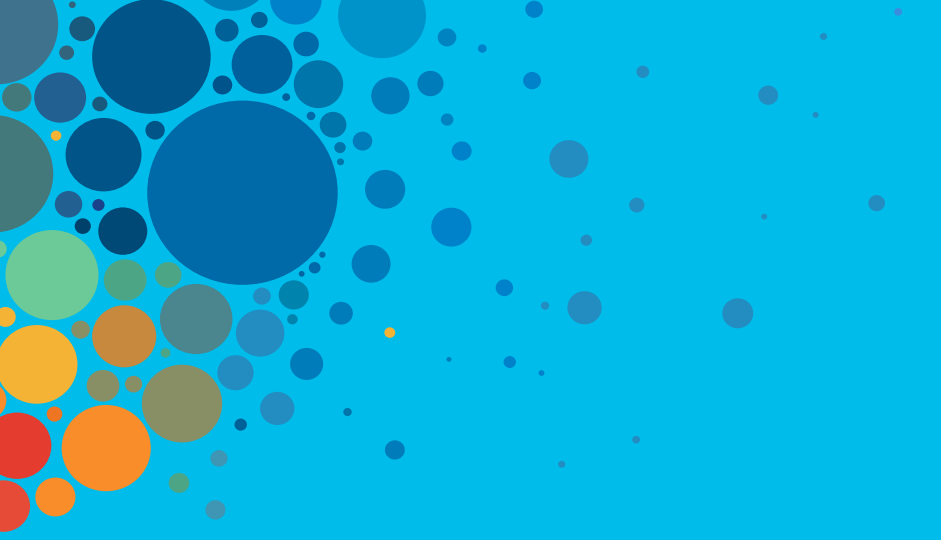
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