NANOG 75 Hackathon Final Presentation

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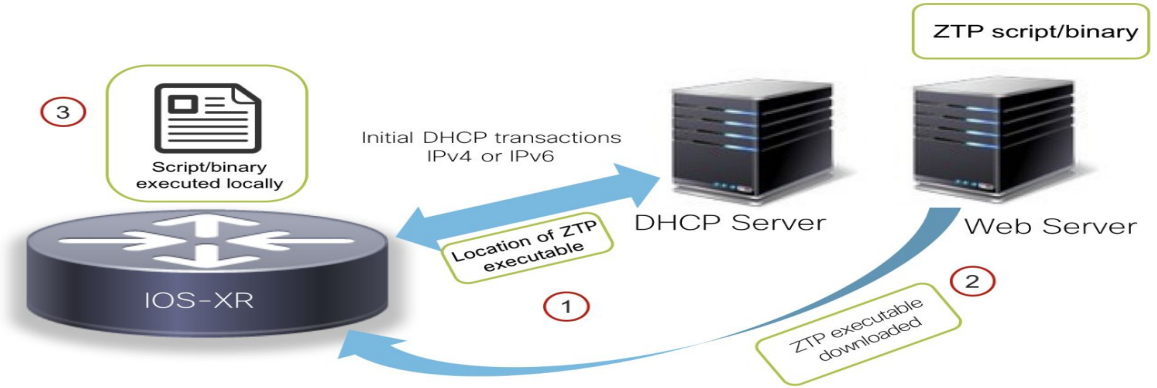
Agenda

Day 0, Day 1, Day 2

- Overview
- Implementation
- Demo

Day0: ZTP Overview



- Openconfig requests to configure Interfaces (ipv4, ipv6), Loopback, lldp.
- Modification of ztp_ncclient.py to configure lldp, interfaces, mpls, hostname and grpc.

```
RP/0/RP0/CPU0:ios#
RP/0/RP0/CPU0:ios#bash
Mon Feb 18 00:27:44.349 UTC
[host:~]$ wget http://100.96.0.20/scripts/retry_manual_ztp.sh
--2019-02-18 00:28:00--  http://100.96.0.20/scripts/retry_manual_ztp.sh
Connecting to 100.96.0.20:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: 881 [text/x-sh]
Saving to: 'retry_manual_ztp.sh.1'

100%[======================================>] 881         --.-K/s   in 0s

2019-02-18 00:28:00 (106 MB/s) - 'retry_manual_ztp.sh.1' saved [881/881]

[host:~]$ chmod +x retry_manual_ztp.sh
[host:~]$ chmod +x retry_manual_ztp.sh.1
[host:~]$ ./retry_manual_ztp.sh.1
+ read -r -d '' mgmt_clean_config
+ xrapply_string '!
interface MgmtEth0/RP0/CPU0/0
 no ipv4 address
 shutdown
!
!
end'
+ xrnns_apply_string '!
interface MgmtEth0/RP0/CPU0/0
 no ipv4 address
 shutdown
!
!
end'
++ mktemp
+ local filename=/tmp/tmp.boBWVOXEko
+ printf '!
interface MgmtEth0/RP0/CPU0/0
 no ipv4 address
 shutdown
!
!
end\n'
+ xrnns_apply /tmp/tmp.boBWVOXEko
+ local filename=/tmp/tmp.boBWVOXEko
+ ip netns exec xrnns /pkg/bin/ztp_exec.sh xrnns_apply_ noisy ZTP /tmp/tmp.boBWVOXEko
RP/0/RP0/CPU0:Feb 18 00:28:23.512 UTC: config[68293]: %MGBL-CONFIG_HIST_UPDATE-3-SYSDB_GET :
ing host address from  sysdb
+ local ret=0
+ safe_rm_file /tmp/tmp.boBWVOXEko
+ [[ /tmp/tmp.boBWVOXEko = '' ]]
+ /bin/rm -f /tmp/tmp.boBWVOXEko
+ return 0
+ xrcmd 'ztp initiate noprompt'
+ xrnns_cmd 'ztp initiate noprompt'
+ ip netns exec xrnns /pkg/bin/ztp_exec.sh xrnns_cmd_ 'ztp initiate noprompt'
ZTP will now run in the background.
Please use "show logging" or look at /disk0:/ztp/ztp.log to check progress.
Killed
[host:~]$ exit
logout

RP/0/RP0/CPU0:ios#
RP/0/RP0/CPU0:ios#
```

```
RP/0/RP0/CPU0:rtr2#show logging 10
                                  ^
% Invalid input detected at '^' marker.
RP/0/RP0/CPU0:rtr2#show logging last 10
Mon Feb 18 00:31:03.411 UTC
Syslog logging: enabled (0 messages dropped, 0 flushes, 0 overruns)
    Console logging: level warnings, 208 messages logged
    Monitor logging: level debugging, 0 messages logged
    Trap logging: level informational, 0 messages logged
    Buffer logging: level debugging, 868 messages logged

Log Buffer (2097152 bytes):

RP/0/RP0/CPU0:Feb 18 00:30:28.229 UTC: netconf[1116]: %MGBL-CONFIG-6-DB_COMMIT : Configuration committed by user 'ztp-user'. Use 'show configuration comm
RP/0/RP0/CPU0:Feb 18 00:30:29.637 UTC: SSHD_[65907]: %SECURITY-SSHD-6-INFO_REKEY : Server initiated time rekey for session 107 , session_rekey_count = 1
RP/0/RP0/CPU0:Feb 18 00:30:29.762 UTC: netconf[1116]: %MGBL-CONFIG-6-DB_COMMIT : Configuration committed by user 'ztp-user'. Use 'show configuration comm
RP/0/RP0/CPU0:Feb 18 00:30:33.225 UTC: fib_mgr[299]: %OS-MMAP_PEER-7-CONNECT : Connect from process 4168 to 29419 skipped: Connection refused
RP/0/RP0/CPU0:Feb 18 00:30:36.159 UTC: config[67722]: %MGBL-CONFIG-6-DB_COMMIT : Configuration committed by user 'ZTP'. Use 'show configuration commit ch
RP/0/RP0/CPU0:Feb 18 00:30:43.140 UTC: syslog_dev[118]: locald_DLRSC[367] PID-23009: passwd: password expiry information changed.
RP/0/RP0/CPU0:Feb 18 00:30:43.275 UTC: syslog_dev[118]: locald_DLRSC[367] PID-23033: Removing user ztp-user from group root-lr
RP/0/RP0/CPU0:Feb 18 00:30:47.065 UTC: config[68017]: %MGBL-CONFIG-6-DB_COMMIT : Configuration committed by user 'ZTP'. Use 'show configuration commit ch
RP/0/RP0/CPU0:Feb 18 00:30:48.943 UTC: ztp.sh[68181]: %OS-SYSLOG-6-LOG_INFO : ZTP dhclient is complete
RP/0/RP0/CPU0:Feb 18 00:30:50.442 UTC: ztp.sh[68265]: %OS-SYSLOG-6-LOG_INFO : ZTP has completed
```

```
RP/0/RP0/CPU0:rtr2#show running-config
Mon Feb 18 00:31:17.983 UTC
Building configuration...
!! IOS XR Configuration version = 6.5.2.28I
!! Last configuration change at Mon Feb 18 00:30:42 2019 by ZTP
!
hostname rtr2
domain name cisco.local
domain name-server 8.8.8.8
username rtrdev
 group root-lr
 group cisco-support
 secret 5 $1$mtK/$tVi/gbwfgZu6imOoriwxV.
!
tpa
 vrf default
  address-family ipv4
   default-route mgmt
   update-source dataports MgmtEth0/RP0/CPU0/0
  !
  address-family ipv6
   default-route mgmt
   update-source dataports MgmtEth0/RP0/CPU0/0
  !
 !
!
call-home
 service active
 contact smart-licensing
 profile CiscoTAC-1
  active
  destination transport-method http
 !
!
interface Loopback0
 ipv4 address 172.16.2.1 255.255.255.255
!
interface MgmtEth0/RP0/CPU0/0
 ipv4 address 100.96.0.16 255.240.0.0
!
interface GigabitEthernet0/0/0/0
 ipv4 address 10.2.1.20 255.255.255.0
 ipv6 enable
!
interface GigabitEthernet0/0/0/1
 ipv4 address 10.4.1.10 255.255.255.0
 ipv6 enable
!
interface GigabitEthernet0/0/0/2
 ipv4 address 10.5.1.10 255.255.255.0
 ipv6 enable
!
interface GigabitEthernet0/0/0/3
 shutdown
!
interface GigabitEthernet0/0/0/4
 shutdown
!
interface GigabitEthernet0/0/0/5
 shutdown
!
interface GigabitEthernet0/0/0/6
 shutdown
!
interface GigabitEthernet0/0/0/7
 shutdown
!
interface GigabitEthernet0/0/0/8
 shutdown
!
interface GigabitEthernet0/0/0/9
 shutdown
!
router static
 address-family ipv4 unicast
  0.0.0.0/0 100.96.0.1
 !
!
mpls static
 interface GigabitEthernet0/0/0/0
 interface GigabitEthernet0/0/0/1
 interface GigabitEthernet0/0/0/2
!
grpc
 port 57777
 no-tls
 service-layer
 !
!
xml agent tty
!
netconf-yang agent
 ssh
!
lldp
!
ssh server v2
ssh server vrf default
ssh server netconf vrf default
end

RP/0/RP0/CPU0:rtr2#
RP/0/RP0/CPU0:rtr2#
RP/0/RP0/CPU0:rtr2#
RP/0/RP0/CPU0:rtr2#
```

Day 1 - Overview

- Configure iBGP sessions between R1 and R4 using Ansible
- Use of netconf and SSH for ansible to “speak” to the routers
- Spin up docker images to run Open/R for IGP
- Verify loopback reachability (via ansible!)
- Setup docker image for collecting the telemetry data
- Combine all playbooks to single playbook

Day 1 - The single playbook...

```
---

  - import_playbook:
/home/tesuto/code-samples/ansible/playbooks/config_bgp/config_xr_bgp_netconf.yml

  - import_playbook:
/home/tesuto/code-samples/ansible/playbooks/openr_bringup/docker_bringup.yml

  - import_playbook: /home/tesuto/code-samples/ansible/telemetry.yml

  - import_playbook:
/home/tesuto/code-samples/ansible/playbooks/reachability_check/ip_dest_reachable_y
dk.yml
```

Day 1 - telemetry.yml

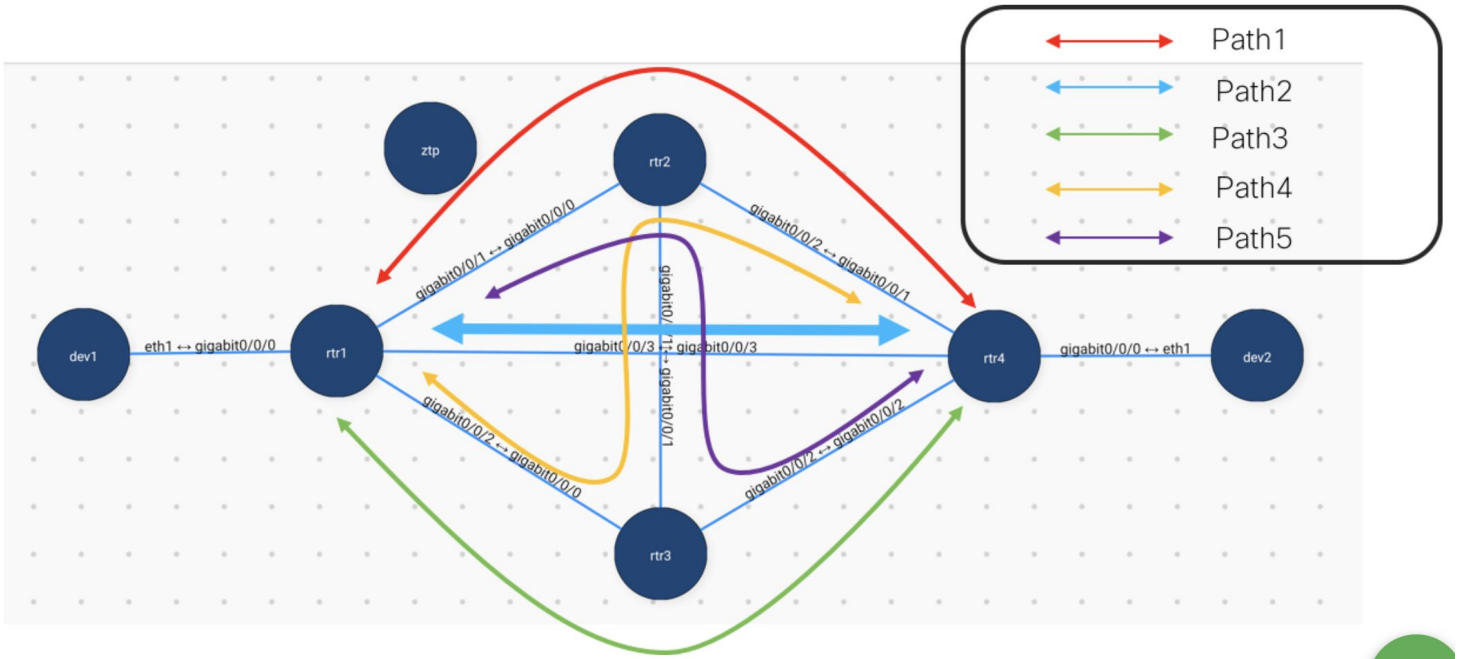
```yaml
---
- hosts: dev1
  become: yes

  tasks:
    - name: Ensure kafka-python is present
      pip:
        name: kafka-python
        state: present

    - name: Ensure docker is present
      pip:
         name: docker
         state: present

    - name: Ensure container is present
      docker_container:
        name: telemetry
        # detached: yes
        # interactive: yes
        #tty: yes
        image: akshshar/nanog75-telemetry
        #state: present
        volumes:
          - /home/tesuto/code-samples/telemetry/telemetry.py:/root/telemetry.py
        command: /bin/bash -c "python3 /root/telemetry.py"
```

Day 1 - Checking reachability

```
tesuto@dev1:~/code-samples/ansible/playbooks/reachability_check$ ansible-playbook -i ~/code-samples/ansible/ansible_hosts ip_dest_reachable_ydk.yml

PLAY [Verify IPv4 connectivity to routes learnt via Open/R] ********************************************************************************

TASK [Reachability of loopbacks learnt via Open/R] *****************************************************************************************
ok: [rtr3] => (item=172.16.1.1)
ok: [rtr4] => (item=172.16.1.1)
ok: [rtr1] => (item=172.16.1.1)
ok: [rtr2] => (item=172.16.1.1)
ok: [rtr3] => (item=172.16.3.1)
ok: [rtr1] => (item=172.16.3.1)
ok: [rtr4] => (item=172.16.3.1)
ok: [rtr2] => (item=172.16.3.1)
ok: [rtr3] => (item=172.16.4.1)
ok: [rtr4] => (item=172.16.4.1)
ok: [rtr1] => (item=172.16.4.1)
ok: [rtr2] => (item=172.16.4.1)

PLAY RECAP *********************************************************************************************************************************
rtr1                       : ok=1    changed=0    unreachable=0    failed=0
rtr2                       : ok=1    changed=0    unreachable=0    failed=0
rtr3                       : ok=1    changed=0    unreachable=0    failed=0
rtr4                       : ok=1    changed=0    unreachable=0    failed=0
```

Overview: Day2 gRIBI

The figure below shows the possible LSP paths in the current topology:



Overview: Day2 gRIBI

A gRPC Interface to a Network Element RIB.

Supports pushing routes to network device RIBs, support for Pv4, IPv6, MPLS.

Supports push and pop operations. Basically adding and removing labels and setting next-hop IP address, interface and weight.

Configured RPC calls on port 57777 which was pre-configured on each router.

```
grpc
 port 57777
 no-tls
 service-layer
 !
!
```

Overview: Day2 gRIBI

In example ping from dev2 (10.to dev 1 (10.1.1.10) or vice/versa

Output below you can see the difference between the direct route from rtr1 to rtr3 and then rtr4 and the shorter more direct path from rtr1 to rtr4

```
tesuto@dev2:~$ traceroute 10.1.1.10
traceroute to 10.1.1.10 (10.1.1.10), 30 hops max, 60 byte packets
 1  10.8.1.10 (10.8.1.10)  3.696 ms  3.652 ms  3.628 ms
 2  * * *
 3  * * *
 4  10.1.1.10 (10.1.1.10)  5.978 ms  5.970 ms  5.944 ms
tesuto@dev2:~$ traceroute 10.1.1.10
traceroute to 10.1.1.10 (10.1.1.10), 30 hops max, 60 byte packets
 1  10.8.1.10 (10.8.1.10)  2.803 ms  2.719 ms  2.630 ms
 2  * * *
 3  10.1.1.10 (10.1.1.10)  3.549 ms  3.526 ms  3.479 ms
tesuto@dev2:~$ traceroute 10.1.1.10
```

Overview: Day2 gRIBI

In example ping from dev2 to dev 1 (10.1.1.10) or vice/versa

Output below displays the MPLS forwarding paths for the direct path between dev1 and dev2 via rtr1 and rtr4

```
RP/0/RP0/CPU0:rtr1#show mpls forwarding
Mon Feb 18 01:31:39.430 UTC
Local  Outgoing    Prefix            Outgoing     Next Hop        Bytes
Label  Label       or ID             Interface                    Switched
------ ----------- ----------------- ------------ --------------- ------------
2436   17010       No ID             Gi0/0/0/3    10.7.1.20       1236
17010  Aggregate   SR Pfx (idx 0)    default                      1392
```

```
RP/0/RP0/CPU0:rtr4#show mpls forwarding
Mon Feb 18 01:32:04.811 UTC
Local  Outgoing    Prefix            Outgoing     Next Hop        Bytes
Label  Label       or ID             Interface                    Switched
------ ----------- ----------------- ------------ --------------- ------------
2436   17010       No ID             Gi0/0/0/3    10.7.1.10       1560
17010  Aggregate   SR Pfx (idx 0)    default                      1236
```

Overview: Day2 gRIBI

Output below displays the MPLS forwarding path from dev1 to dev2 via less direct path from rtr1 to rtr3 to rtr4

RTR1

```
RP/0/RP0/CPU0:rtr1#show mpls forwarding
Sun Feb 17 23:14:34.533 UTC
Local  Outgoing    Prefix            Outgoing     Next Hop        Bytes
Label  Label       or ID             Interface                    Switched
------ ----------- ----------------- ------------ --------------- ------------
2417   17010       No ID             Gi0/0/0/1    10.2.1.20       0
17010  Aggregate   SR Pfx (idx 0)    default                      0
```

RTR2

```
RP/0/RP0/CPU0:rtr2#show mpls forwarding
Mon Feb 18 00:13:19.621 UTC
Local  Outgoing    Prefix            Outgoing     Next Hop        Bytes
Label  Label       or ID             Interface                    Switched
------ ----------- ----------------- ------------ --------------- ------------
16030  17010       SR Pfx (idx 0)    Gi0/0/0/0    10.2.1.10       1260
17010  16030       SR Pfx (idx 0)    Gi0/0/0/2    10.5.1.20       1260
```

RTR4

```
RP/0/RP0/CPU0:rtr4#show mpls forwarding
Mon Feb 18 00:19:55.979 UTC
Local  Outgoing    Prefix            Outgoing     Next Hop        Bytes
Label  Label       or ID             Interface                    Switched
------ ----------- ----------------- ------------ --------------- ------------
2428   16030       No ID             Gi0/0/0/1    10.5.2.20       10848
16030  Aggregate   SR Pfx (idx 0)    default                      0
```

Overview: Day2 gRIBI Controller

Last step would be to create a controller to parse the streaming telemetry data from kafka and then push paths based on network topology changes.

```
tesuto@dev2:~/code-samples/gribi/src/gribi_client$ ls -la
total 84
drwxrwxr-x 7 tesuto tesuto 4096 Feb 18 01:49 .
drwxrwxr-x 6 tesuto tesuto 4096 Feb 17 18:53 ..
-rw-rw-r-- 1 tesuto tesuto   72 Feb 17 18:49 __init__.py
-rw-rw-r-- 1 tesuto tesuto 4218 Feb 17 18:49 gribi_client.py
-rw-rw-r-- 1 tesuto tesuto 2825 Feb 17 18:49 gribi_template.json
drwxrwxr-x 2 tesuto tesuto 4096 Feb 18 00:12 path1
-rwxrwxr-x 1 tesuto tesuto  248 Feb 17 22:34 path1_add_lsp.sh
-rwxrwxr-x 1 tesuto tesuto  257 Feb 17 22:34 path1_delete_lsp.sh
drwxrwxr-x 2 tesuto tesuto 4096 Feb 17 21:55 path2
-rwxrwxr-x 1 tesuto tesuto  170 Feb 17 21:20 path2_add_lsp.sh
-rwxrwxr-x 1 tesuto tesuto  176 Feb 17 21:19 path2_delete_lsp.sh
drwxrwxr-x 2 tesuto tesuto 4096 Feb 17 21:58 path3
-rwxrwxr-x 1 tesuto tesuto  248 Feb 17 18:49 path3_add_lsp.sh
-rwxrwxr-x 1 tesuto tesuto  257 Feb 17 21:19 path3_delete_lsp.sh
drwxrwxr-x 2 tesuto tesuto 4096 Feb 18 00:27 path4
-rwxrwxr-x 1 tesuto tesuto  326 Feb 17 22:13 path4_add_lsp.sh
-rwxrwxr-x 1 tesuto tesuto  338 Feb 17 22:20 path4_delete_lsp.sh
drwxrwxr-x 2 tesuto tesuto 4096 Feb 18 01:48 path5
-rwxrwxr-x 1 tesuto tesuto  326 Feb 18 01:48 path5_add_lsp.sh
-rwxrwxr-x 1 tesuto tesuto  338 Feb 18 01:49 path5_delete_lsp.sh
tesuto@dev2:~/code-samples/gribi/src/gribi_client$
```