NANOG 80 HACKATHON

- Aakash Rawal
- Hast Patel
- Mukesh Jaiswal
- Nikhil Gadre
- Swati Niture

PROPOSAL

Proof of Concept for a fully automated Tier 2 ISP Data Center – Deployment and Monitoring

What did we achieve ?

- Centralized control and monitoring of the network
- Cost-effectiveness (reduces OpEx)
- One-click configuration and deployment (saves time)
- Reduction in human errors

HIGH-LEVEL DIAGRAM

University of Colorado Boulder

CU Boulder
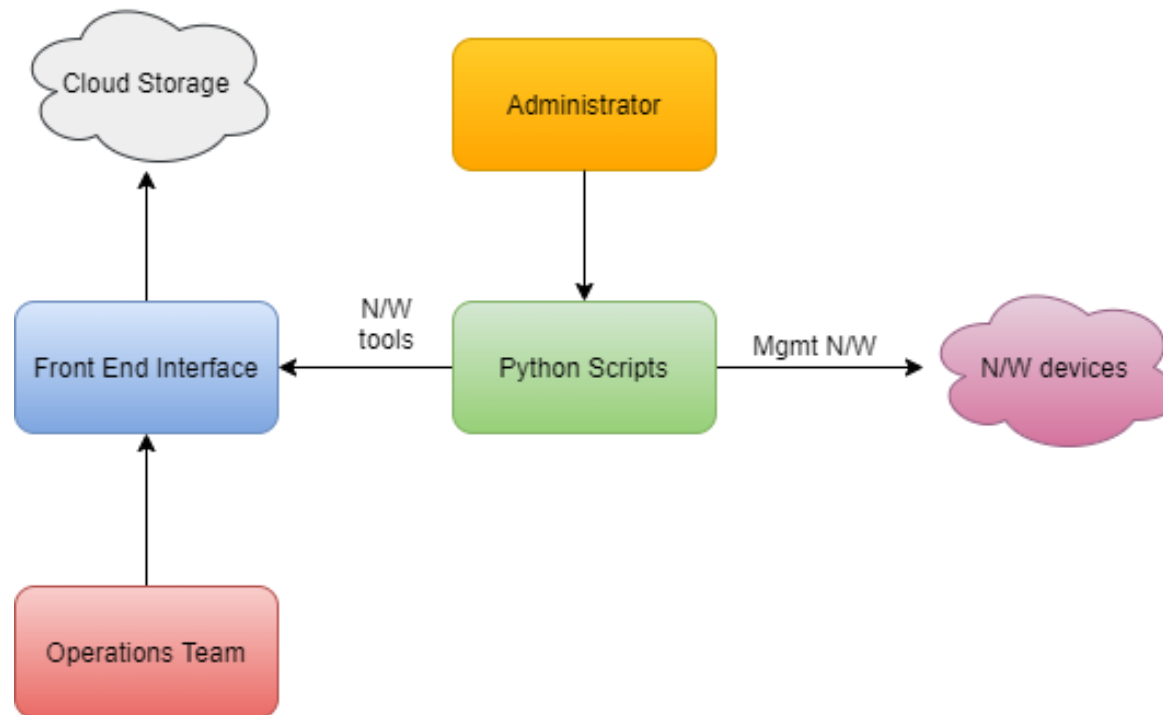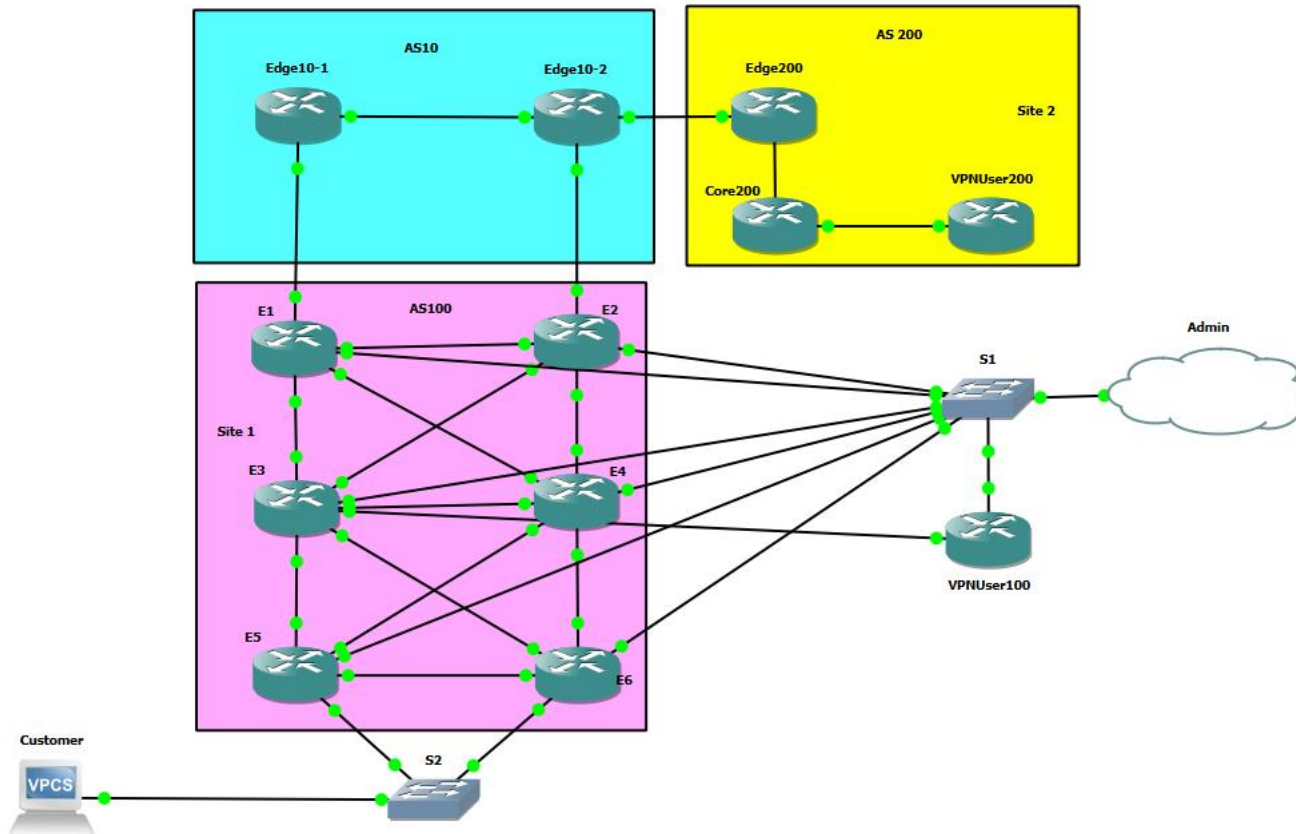
Welcome to the Network Management and Automation Station

Make OSPF configuration

Push OSPF configuration

Make BGP configuration

Make NAT configuration

Push NAT configuration

Push BGP Configuration

Network Monitoring

Global_Router_Troubleshoot

Individual_Router_Troubleshoot

Upload to S3 Bucket

Check golden config

IPsecconfig

NETWORK MANAGEMENT AND AUTOMATION SYSTEM (NMAS)

Web App
- Generate Configuration Files
- Push Configuration to Devices
- Monitor Individual Devices and Network
- Compare Running Config to Golden Config
- Backup Configuration to Cloud

GENERATING CONFIG FILES

- Python
- Jinja2 Templates
- Modules
    - Netmiko
    - NAPALM
    - Flask
- Multi-threading

```
1   {% for k in natinfo["Interfaceout"] %}
2   interface {{ k }}
3   ip nat outside
4   {% endfor %}
5
6   {% for k in natinfo["Interfacein"] %}
7   int {{ k }}
8   ip nat inside
9   {% endfor %}
10
11  {% for k in natinfo["accesslist1"] %}
12  access-list {{ k }}
13  {% endfor %}
14
15  {% set count=namespace(value=1) %}
16  {% if natinfo["accesslist1"] | length == 1 %}
17  ip nat inside source list 1 interface {{natinfo["Interfaceout"]
18  {% else %}
19      {% for k in natinfo["Interfaceout"] %}
20  ip nat inside source list {{count.value}} interface {{k}} overl
21      {% set count.value=count.value +1 %}
22      {% endfor %}
23  {% endif %}
```

```
1   {% for k in ospfinfo["int"] %}
2   int {{ k }}
3   ip address {{ ospfinfo["int"][k] }}
4   no shut
5   exit
6   {% endfor %}
7   {% for j in range((ospfinfo["network"])|length) %}
8   router ospf {{ ospfinfo["pid"] }}
9   network {{ ospfinfo["network"][j] }} area {{ ospfinfo["area"] }
10  exit
11  {% endfor %}
12
13
```

nat_info.txt - Notepad

File Edit Format View Help

{

"R1":
{"Interfaceout":["fa4/1"], "accesslist1": ["1 permit 198.51.0.0
0.0.255.255"], "Interfacein":["fa0/1","fa1/0","f0/0"]},

"R2":
{"Interfaceout":["fa4/1"], "accesslist1": ["1 permit 198.51.0.0
0.0.255.255"], "Interfacein":["fa0/1","fa1/0","f0/0"]},

"R5":
{"Interfaceout":["fa1/1","fa2/0","fa0/0"], "accesslist1": ["1 permit
205.0.0.0 0.0.255.255","2 permit 205.0.0.0 0.0.255.255","3 permit
205.0.0.0 0.0.255.255"], "Interfacein":["fa4/1"]},

"R6":
{"Interfaceout":["fa1/1","fa2/0","fa0/0"], "accesslist1": ["1 permit
205.0.0.0 0.0.255.255","2 permit 205.0.0.0 0.0.255.255","3 permit
205.0.0.0 0.0.255.255"], "Interfacein":["fa4/1"]}

}

R6_natconf.txt - Notepad

File Edit Format View Help

```
interface fa1/1
ip nat outside
interface fa2/0
ip nat outside
interface fa0/0
ip nat outside

int fa4/1
ip nat inside

access-list 1 permit 205.0.0.0 0.0.255.255
access-list 2 permit 205.0.0.0 0.0.255.255
access-list 3 permit 205.0.0.0 0.0.255.255

ip nat inside source list 1 interface fa1/1 overload
ip nat inside source list 2 interface fa2/0 overload
ip nat inside source list 3 interface fa0/0 overload
```

University of Colorado Boulder

Network Management and Automation Station (NMAS)

Version 1.0

OSPF config files are successfully created, the files are:

R1_ospfconf.txt

R2_ospfconf.txt

R3_ospfconf.txt

R4_ospfconf.txt

R5_ospfconf.txt

R6_ospfconf.txt

press here to return to home page.

PUSH CONFIGS TO DEVICES

Netmiko, Napalm

- Interface Configs
- OSPF
- NAT
- BGP
- IPSec
- 6to4 Tunneling

Network Management and Automation Station (NMAS)

Version 1.0

OSPF files are successfully loaded into routers, press here to return to home page.

Local tunnel ep	Remote tunnel ep	No. of encrypted pkts	No. of decrypted pkts	Tunnel status
70.70.70.1	60.0.0.2	8	8	ACTIVE

Type escape sequence to abort. Sending 5, 100-byte ICMP Echos to 2001::3, timeout is 2 seconds: Packet sent with a source address of 2001::1 !!!!! Success rate is 100 percent (5/5), round-trip min/avg/max = 200/300/504 ms

MONITOR INDIVIDUAL DEVICES

- Device Interfaces
  - IP / Status
- OSPF Neighborship
- BGP Neighborship
- View Running Config
- Show Commands

Network Management and Automation Station (NMAS)

Version 1.0

Interfaces IPs

BGP data

OSPF data

Running configs

press [here](#) to return to home page.

Network Management and Automation Station (NMAS)

Version 1.0

```
+--------+------------------+----------------+
| Router | Interface | IP |
+--------+------------------+----------------+
| R1 | FastEthernet0/0 | 198.51.101.1 |
| R1 | FastEthernet0/1 | 198.51.103.1 |
| R1 | FastEthernet1/0 | 198.51.102.1 |
| R1 | FastEthernet1/1 | unassigned |
| R1 | FastEthernet4/0 | 192.168.100.1 |
| R1 | FastEthernet4/1 | 200.0.0.1 |
| R2 | FastEthernet0/0 | 198.51.101.2 |
| R2 | FastEthernet0/1 | 198.51.105.2 |
| R2 | FastEthernet1/0 | 198.51.104.2 |
```

University of Colorado Boulder

Network Management and Automation Station (NMAS)

Version 1.0

Enter show command

| show ip bgp | Submit |

show running-config

debug ip bgp

show ip interface brief

show ip bgp

show ip route

show running-config

Network Management and Automation Station (NMAS)

Version 1.0

Enter show command

show ip route

Enter host

192.168.100.1

Enter username

test

Enter password

test

Enter device-type i.e cisco_ios

cisco_ios   Submit

COMPARE RUNNING CONFIG TO GOLDEN CONFIG
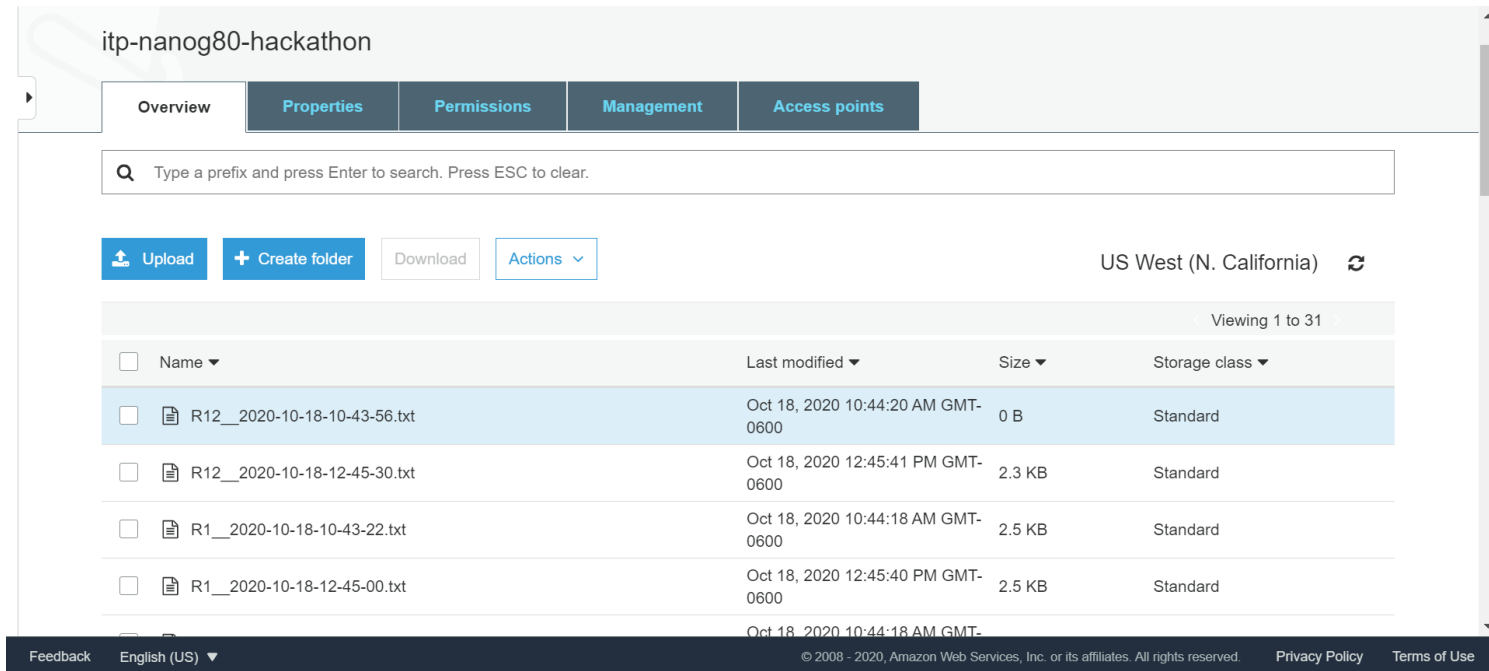
- Backup Running Config
- Compare
  - Latest Backed Up Running Config
  - Golden Config
- Show Difference

['Difference found for R1', 'Difference found for R2', 'Difference found for R3', 'Difference not found for R4', 'Difference found for R5', 'Difference found for R6', 'Difference not found for R12']

BACKUP CONFIG FILES TO CLOUD

FUTURE ENHANCEMENTS

- Zero Touch Provisioning (ZTP) – Management Network

- Automated Device Backups – Cron Job

- Security
    - Firewall
    - Access-lists

- Redundancy
    - For Default Gateway

THANK YOU