CNaaS deployment and pScheduler DotX plugin development

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Campus Network As A Service

Request from university
• Secure network knowledge
• Generation shift in equipment and personal
• Joint procurement

Current users
• Mälardalens University, in production 2020-02
• Stockholm University, in production 2021-04

More in the pipeline
work simplification

- Build on today's network best practice, Data Center Leaf Spine
- Use only industry standards, no vendor lock in
- Automation in network deployment
- Automation in network operation
- Automation in network documentation
- Automation in network monitoring
Key drivers

- Open standards
- All links active
- Well proven technology
- No brand lock in
- No rush to fix broken hardware

Resulted in
- VXLAN
- BGP
- EVPN
- EVPN/ESI multi-homeing

Excludes
Multichassi lag
Spanningtree
Virtual-chassis
Utilizing best practice DC leaf-spine architecture

Redundant except access ports

IP only core
CNaaS-NMS Overview

CNaaS-NMS is open source and everything including source code, documentation etc is available to the public on Github.

CNaaS-NMS is a hybrid infrastructure-as-code (IaC) and API driven automation system.

The components of CNaaS-NMS are executed in separate Docker containers.
Service delivery - collaborative service

HELPDESK

NOC

DEVOPS Engineering

1\textsuperscript{st} Line
End user support
Simple mgmt

Hands and Feet

Suppliers

2\textsuperscript{nd} Line
Monitoring
Documentation
Incident/Problem Mgmt
Configuration Mgmt
Escalation/(Vendor mgt)

University
Contracts
Sunet
Some problems: during deployment at first Campus

- Switch came up with no access to Radius server. Put ports into fail-vlan. Stuck ip-address.
- Radius Server ran out of disk space.
- eduroam on fixed network ports. Radius chain broken.
- Large radius certificates, jumbo frames
- Firewall filters deny and allow
- DHCP server running out of scope
Monitoring: verify that the network is performing

- Verifying access to the network
  - Dot1x, user + password, local account and from eduroam other provider
  - Dot1x, certificates
  - MAB, login with mac-address
  - Fail vlan
- Vlan assignment
  - User gets to correct VLAN
    - Gets IP-address from correct vlan pool.
Monitoring: verify that the network is performing

- Network access
  - Verify DNS
  - Verify access to public services
    - When connected to “Passage system” VLAN, public services should not be allowed
  - Verify access to local services
    - When connected to Student network access to economy servers should be restricted
  - Dot1x, user + password, local account and from eduroam other provider
PF tests

- Request node to authenticate to VLAN (test in it self)
- Run test, twamp, traceroute, ping
- Test Multicast 😊

Ip-address changes depending on VLAN.
Requires Mgmt port with fixed address
probe – probe req synchronization
Use fixed probe as reference point
Probe hardware requirements

- No power adapter,
- Remote power cycle
- Power via POE
- Dual NICs
- Rack mountable
- No Fans
- Run Perfsonar
- Cheap, many probes
Raspberry Pi

Does the job, sort of
- one NIC
- no PoE

POE Hat has a fan

NanoPi R2S
no Poe
not that available
Parts Cnaas Probe

- Linksys USB3 Gigabit Ethernet Adaptor (11€)
- PoE to micro USB Splitter (20€)
- Raspberry 4 Model B 4GB (60€)
- SD-card (8€)

Total cost of 99€
PCB

USB NIC

POE Splitter
Complete probe

Solder the POE splitter cables to the raspberry +5V and GND
Case 3D printed
Installed in rack

Rack mounted
Dual Ethernet
POE on MGMT port
reset disable POE
Monitor port build in port.
Iperf3 between two Raspberry

pi@raspberrypi:~ $ iperf3 -c 192.168.100.10
Connecting to host 192.168.100.10, port 5201
[ 5] local 192.168.100.11 port 56628 connected to 192.168.100.10 port 5201
[ ID] Interval Transfer Bitrate Retr  Cwnd
[ 5] 0.00-1.00 sec  110 MBytes  919 Mbits/sec  0   368 KBytes
[ 5] 1.00-2.0 sec  112 MBytes  937 Mbits/sec  0   368 KBytes
[ 5] 2.00-3.00 sec  112 MBytes  941 Mbits/sec  0   368 KBytes
[ 5] 3.00-4.00 sec  112 MBytes  937 Mbits/sec  0   368 KBytes
[ 5] 4.00-5.00 sec  112 MBytes  937 Mbits/sec  0   368 KBytes
[ 5] 5.00-6.00 sec  112 MBytes  937 Mbits/sec  0   368 KBytes
[ 5] 6.00-7.00 sec  112 MBytes  941 Mbits/sec  0   513 KBytes
[ 5] 7.00-8.00 sec  111 MBytes  935 Mbits/sec  0   513 KBytes
[ 5] 8.00-9.00 sec  112 MBytes  938 Mbits/sec  0   513 KBytes
[ 5] 9.00-10.00 sec  112 MBytes  939 Mbits/sec  0   513 KBytes

-------------------------------------------------------------------------------------
[ ID] Interval Transfer Bitrate Retr
[ 5] 0.00-10.00 sec  1.09 GBytes  936 Mbits/sec  0 sender
[ 5] 0.00-10.00 sec  1.09 GBytes  935 Mbits/sec  0 receiver

Accepted connection from 192.168.100.11, port 56626
[ 8] local 192.168.100.10 port 5201 connected to 192.168.100.11 port 56628
[ ID] Interval Transfer Bitrate
[ 8] 0.00-1.00 sec  109 MBytes  911 Mbits/sec
[ 8] 1.00-2.00 sec  112 MBytes  938 Mbits/sec
[ 8] 2.00-3.00 sec  112 MBytes  938 Mbits/sec
[ 8] 3.00-4.00 sec  112 MBytes  938 Mbits/sec
[ 8] 4.00-5.00 sec  112 MBytes  938 Mbits/sec
[ 8] 5.00-6.00 sec  112 MBytes  936 Mbits/sec
[ 8] 6.00-7.00 sec  112 MBytes  937 Mbits/sec
[ 8] 7.00-8.00 sec  112 MBytes  938 Mbits/sec
[ 8] 8.00-9.00 sec  112 MBytes  938 Mbits/sec
[ 8] 9.00-10.00 sec  112 MBytes  938 Mbits/sec
[ 8] 10.00-10.00 sec  160 KBytes  917 Mbits/sec

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[ ID] Interval Transfer Bitrate
[ 8] 0.00-10.00 sec  1.09 GBytes  935 Mbits/sec receiver

Server listening on 5201

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