Campus Network as a Service

Initial production at SUNET

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CNaaS - Campus Network as a Service

By extending the NREN core network to the institutions on both equipment monitoring and change management

Our goal with CNaaS

“Share staff and expertise for campus network and security operations by standardizing network architecture, tools and processes.”

This means more automation with easier replacement of equipment without having to have senior network engineer always on-site.

Initial production at MDH.SE with new contracts signed with others.

Open transparent project on Github, please collaborate on thoughts to improve
General competency challenges

- Aging staff
- Retention
- Schooling
- Few with exposure to complex networking
- Not filling the ranks
No one gets fired!

This initiative is thought to help people grow!

Smaller colleges/unis have trouble retaining staff and giving them exposure to enterprise grade equipment.

Being alone puts stress on “planning” sickdays, vacation and conferences like this.
Technological shifts

Two major shifts are happening right now, in both past and present context that I acknowledge that it's not new but its gaining momentum for real.

1. Software defined %whatever% even reality nowadays… infrastructure routers, load balancers, firewalls, proxies, networks, interfaces

2. Less local compute, more cloud service and remote access
Reference Network Architecture SUNET CNaaS

Utilizing best practise leaf-spine architecture

Redundant except access ports
Partnership on this new service

Together we will share experiences, scripts, configurations and tools.

Active dialogue to improve the service to fit other NRENs needs. Collaborative development to share costs on wider deployment.

Making NAV, Argus and CNaaS NMS work for a NOC and local campuses it could be a reference and example for other European Universities and NRENs.
Business advantages for local Campuses

- Standardised processes tested and improved for multiple Campuses
- Higher security and repeatable quality
- Clear overview of cost and lowering TCO over time with shared procurement and support
- Does not lock local staff and resources, development and integrations is done in parallel
Technological advantages with CNaaS

- Existing NOC monitors and can create tickets 24/7. No need for local staff on call if case handled without hardware replacement
- Continuity of competence, long term commitment between organisations
- Spare depot without delays and troublesome change/support requests. Keeping track of warranty.
- Procurement done in bulk and supply chain centralised. Saves time/money
- Proactive maintenance and change of equipment even in smaller sites
- Independent of manufacturer and on the clients side, all resources and work are done for and together with participating Campuses. Every improvement is shared with all
CNaaS - 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
- 1st Line
  - End user support
  - Simple mgmt

NOC
- 2nd Line
  - Monitoring
  - Documentation
  - Incident/Problem Mgmt
  - Configuration Mgmt
  - Escalation/(Vendor mgt)

DEVOPS
- 3rd Line
  - Design
  - Development
  - Configuration Mgmt
  - Escalation/(Vendor mgt)

Engineering

Hands and Feet

Suppliers

University
Contracts
Sunet
Service delivery options and add-ons

1. Procurement and support
2. Wired & Wireless network configuration updates and management
3. Service extensions for infrastructure, NOC monitoring
4. Consulting and development

Local staff handles all physical and end user issues.
Local project together with MDH
Hardware design

4st Arista 7280
~60st Arista 720XP poe switchar
~140st Arista AP C130
100GE core
2 x 10GE to each Access switch.
Logging and management systems
Cnaas API calls via CLI

: 18:46 root@mdh-nms: ~ # ./cli.sh

CNaaS - Command Line Interface

(C) SUNET (http://www.sunet.se), 2020

'Type "help" for help.

CNaaS NMS (mdh-nms)#
Device diffs

Device(s): esk-d10918-d1
Failed: False
Diff:

    name cnaas3
    !
    vlan 101
    +!
+vlan 224
+    name uninett
+ vlan 1250
    name staff1
    interface Vlan101
       vrf MGMT
       ip address virtual 10.128.4.1/24
    +!
+interface Vlan224
+    description uninett
+    vrf STAFF
+    ip helper-address 130.243.76.79
+    ip helper-address 130.243.94.198
+    ip helper-address 130.243.94.199
+    ip address virtual 129.242.1.1/24
    +!

interface Vlan1250
    description staff1
    vxlan vlan 98 vni 10098
    vxlan vlan 99 vni 10099
    vxlan vlan 101 vni 2000101
    + vxlan vlan 224 vni 100224
    vxlan vlan 1250 vni 101250
    vxlan vlan 1251 vni 101251
    vxlan vlan 1252 vni 101252
       route-target both 1:1901
       redistribute learned
    +
+    vlan 224
+      rd 10.128.0.0:224
+      route-target both 1:224
+      redistribute learned
    +
+    vlan 3055
        rd 10.128.0.0:3055
        route-target both 1:3055
NI Network inventory

ODF D10918S2M04
Located in Esk D10918 D10918S2

Connections

<table>
<thead>
<tr>
<th>Port</th>
<th>Description</th>
<th>Cable</th>
<th>End site</th>
<th>End location</th>
<th>End equipment</th>
<th>End port</th>
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</table>

Connections:
- MDH-10010 (Patch)
  - D10918S2M04 1+2
  - B3W007_1 (Fixed)
  - D11038S2M04 1+2
  - MDH-10011 (Patch)
  - esk-d11038-a1 Et49
### Patch Panel D11204S1M40

**Located in:** Esk D11204 D11204S1

<table>
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<th>Name</th>
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<td>Operational State</td>
<td>In service</td>
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**Modified:** Jan. 23, 2020, 6:45 p.m. by Bergroth

**Created:** Jan. 23, 2020, 6:19 p.m. by Bergroth

### Description

skdf

### Connections

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<td>D11204S1M40:07</td>
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<td>I golvbrunn, A12.07</td>
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</table>
WiFi connections
Lab setup at Sunet office Stockholm

2x 7050 100GE CORE
2x 7050 25GE DIST
2x 7280 10GE DIST
2x 720XP poe 1GE
2x 720XP poe 2.5GE

4x C130 internal antennas AP
4x C130 external antennas AP
4x C250 AX AP (60W poe)
Hardware volumes, procurement and differences

Price and Discounted

Price  Volume discount  Integrator/Distributor
Adding customers will lower prices for CNaaS
Adding devices is assumed pretty linear, not exponential in complexity
Timeline

2019

- September - Finalise procurement
- Oct-Dec - Order and test equipment in lab together with local staff
- Nov - Test automated deployment at SUNET-office
- Dec-Jan - Initial deployment of new core infrastructure

2020

- Feb-Apr - Final testing and changes, monitoring
- Sep - Delivery report for actual service in production
- Oct-Dec NMS install project on new contracted campus
Important experiences to validate

Aggregated log and alert views

Inter-organisation escalation of support requests

Actual needed functionality; guesstimates from engineering meets the real world

Firmware upgrading over time

Local changes and central configuration
Components and ongoing development

- CNaaS NMS with ZTP
- CNaaS Monitoring NAV/NAGIOS integration
- CNaaS NAC API
- CNaaS Web interface
- CNaaS IPAM
- CNaaS Backup
- CNaaS Inventory
- CNaaS Security
- Change impact score
References and demos

- https://wiki.sunet.se/display/CNaaS
- https://cnaas-nms.readthedocs.io
- https://github.com/SUNET/cnaas-nms
- https://wiki.sunet.se/display/CNaaS/Modules
- https://github.com/sunet/cnaas-nac

NMS change demo:
https://play.sunet.se/media/CNaaS+NMS+change+workflow%2C+VSc ode+%2B+Web UI/0_4a34tciw

NMS ZTP demo:
https://play.sunet.se/media/CNaaS+NMS+WebUI+ZTP+demo/0_ff0l8enk
Questions