CSC

ICT Solutions for Brilliant Minds

Funet Kampus Configuration Automation

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Configuration and monitoring

- All router configuration is done using Ansible and Jinja2 templates
  - Based on tools developed for Funet 2020
  - Clean, standardized configuration
  - Routers can be pre-configured before sending them to customers
  - Configuration is stored in YAML files
- Routers and switches are added to monitoring using Ansible during the provisioning
  - Same alert and monitoring tools and processes are used as for the rest of the Funet network

Legacy configuration tools

- Task specific tools
  - Peering filters(as-path, prefix-lists) update and configuration
  - MPLS VPN service provisioning
  - Common configurationc
- Existing tools like scripts(Perl, Expect, Bash..) and Ansible-playbooks for specific purposes

Funet 2020 automation goals

- Simple provisioning of new routers
- Consistent configuration across the network
- Standardized services and easy provisioning of new customer connections and services

Partial vs. full automation

- Initial idea was to automate ”most” configuration and do the rest by hand
- However, having partially automated and partially manually maintained configuration is awkward
  - Possible conflicts between automatically and manually generated configs
  - How to remove elements from the configuration, if the whole configuration is not replaced ?
  - With manual configuration the configurations would deteriorate by time

Full automation

- Always re-generating the entire configuration and then overwrite the entire running config for each router
  - The configuration includes only the needed elements
  - No need for separate garbage collection
  - Manual hacks will simply get destroyed
- Possible because the new network is built from the scratch – no configuration copied from the old network

Tool: Ansible and Jinja2 templates

- Ansiblehas been used for server automation
- JunOS has a good Ansible support, e.g. existing modules
- Router configuration generatedfrom Jinja2 template
- Ansible is used for IP/MPLS network as a template engine
- The template-generated config could be loaded to routers with other tools if needed
  - For now the configs are also loaded to routers with Ansible, as it provides routines and error handling for that

Data model

- Owndata-model, formed by iteration
  - Most variables have default values in template and can be overridden in Ansiblevariables e.g. interface MTUs

```
interfaces:

 - name: xe-0/0/0:3
    description: funet2020_testlab-a
    units:
      - number: 1
        description: funet2020_testlab_internet-a
        ip_mtu: 9170
        ipv4_addresses:
          - address: 193.167.244.98/31
        ipv6_addresses:
          - address: 2001:708:0:f001:0:fe08::2/127
      - number: 100
        vrf: funet-mgmt
        description: funet2020_testlab_mgmt-a
        ipv4_addresses:
          - address: 192.168.255.0/31
```

```
routing_instances:
 - name: FUNET-MGMT
   import_communities:
      - name: MANAGEMENT
        accept_prefixes: [ FUNET-MANAGEMENT-NETWORKS ]
   bgp_groups_v4:
      - name: FUNET2020-TESTLAB
        peer_as: 65032
        role: primary
        accept_prefixes: [ TESTLAB1-SW1 ]
        export_prefixes: [ FUNET-MANAGEMENT-NETWORKS ]
        neighbors:
          - address: 192.168.255.1
            description: testlab1.ip.funet.fi
```

Initial Provisioning

- PoPs are equipped with a serial console server for OOB access, which are used for the initial commissioning
  - Only a few configuration commandsto make a new router reachable to Ansible, and then the playbook does the rest
  - During the initial commissioning Ansible playbook is run via "backdoor"
  - SSH is tunneled through serial console server to router mgmt interface
  - In Ansible inventory an alternative host is defined so it is used instead of in-band SSH

```
[funet2020-core-routers]
espoo1.ip.funet.fi ansible_host=espoo1_re0_fxp0
```

- Remote hands areonly needed for physical installation

Data

- The entire network configuration is in YAML files
  - Router specific configuration is defined in the router's host variables
  - Common elements defined in shared vars files (group_vars for Kampus)
    - Prefix-lists
    - Firewall filters and policers
    - BGP communities and route-targets
    - Customer AS numbers
- Possible to template another tools using the same meta-data, e.g. :
  - Nagios configuration generated when routers are configured
  - Interface statistics links to Grafana dashboards

Exceptions

- It is possible that a service needs to be deployed before it has been incorporated into the Ansible template
  - Custom configuration can be added as a normal JunOS configuration snippet tha twill be automatically read into the template
  - Still, we should find a generalized configuration and incorporate it into the automation template
  - Custom snippet is meant to be only a temporary solution

Considerations 1/2

- Initial learning curve
  - Using Ansible and running playbooks
  - Defining configurations in YAML data model
  - Fixing things in the playbook and/or Jinja2 template
- Ansible is only a tool, it is still needed to know what one is doing
  - Recommended to run in ”check mode” first and validate the diff
- Branching playbook to different networks
  - E.g. Funet core and Campus networks have different needs
  - Need of software developer skills

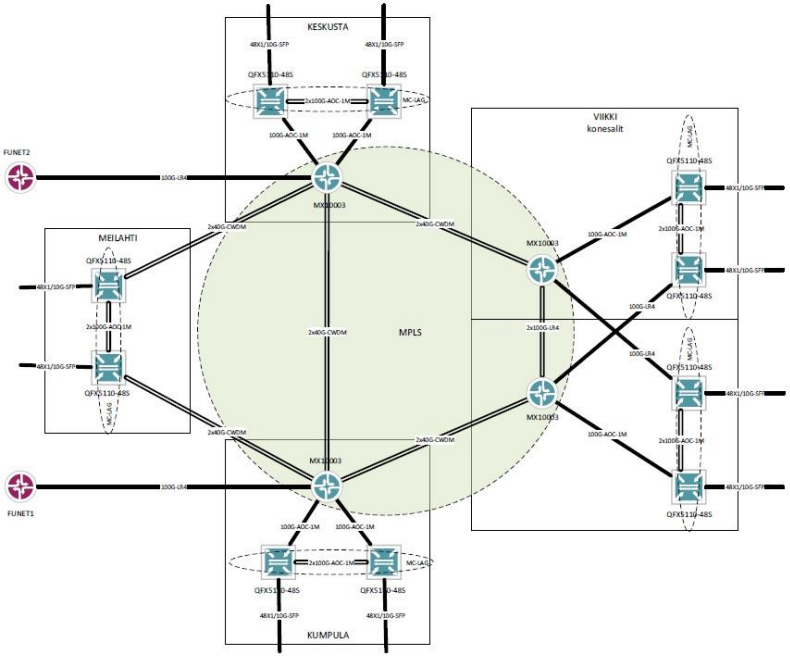
Considerations 2/2

- YAML data model documentation
  - Current work-around by an example file – needs updating
- Workflow
  - Version control conflicts – e.g. change committed to routers not committed in Git repository

Shared configuration pilot

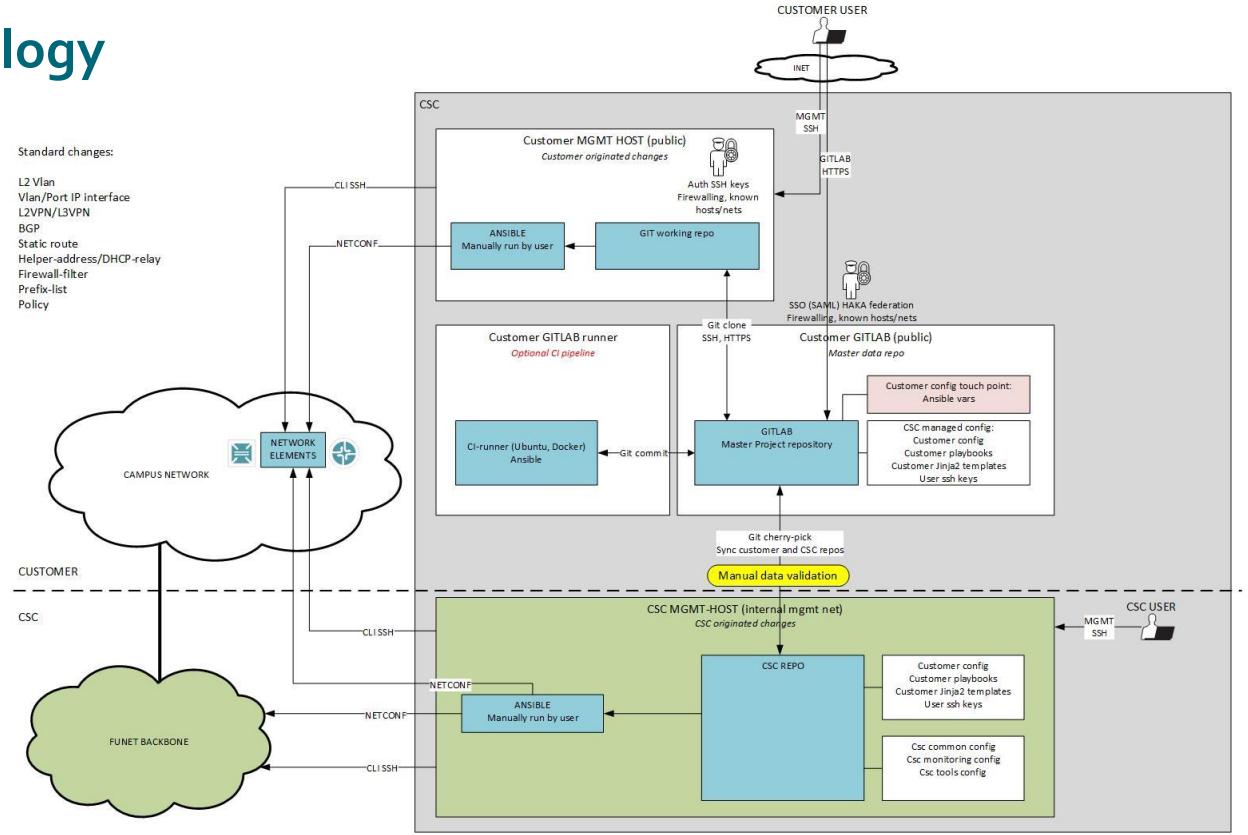
- Managing large customer networks
  - Lot of changes -> workload
- Configuration changes by customer
  - All configuration is managed by Ansible – no manual changes are possible
  - No customer access or customer generated YAML files allowed to our management network
  - Customer specific Gitlab and Management server
    - Customer is allowed to edit host_vars and group_vars files
    - Changes merged manually by Funet

Case: Helsinki University



- MPLS core for 5 campuses
- 4 routers and 10 switches
- New Ansible features
  - MX 10003 support in Kampus
  - QFX 5110 support in Kampus
  - MC-LAG support etc.

Pilot topology



Initial Provisioning at customer premises

- All equipment delivered directly to customers' central data center
- OOB console server from Funet for initial provisioning
- Configuration and transceiver tests before moving the devices to their final location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