How we deployed a datacenter in one click

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What's deployed?

- 2 Juniper QFX10002-72Q as edge routers,
- 32 Cisco Catalyst 2960S as OOB switches,
- 4 Facebook Wedge 100 as spine switches,
- 16 Facebook Wedge 100 as leaf switches,
- 4 Opengear CM71xx-2 as console servers,
- 2 Linux bastion/VPN/gateway servers,
- 1 Linux LibreNMS server.

What's configured?

- Edge routers:
  - BGP configuration + policies
  - Routing engine protection
- BGP-based fabric (Facebook Wedge)
- Out-of-band fabric (Cisco)
- Administrative gateway (Linux)
  - ZTP
  - Firewall and NAT
  - Access to console servers
  - VPN to other sites
- External stores: DNS, IRR, RPKI, NetBox

Steps

1. Get space, power, cooling, racks, equipments, cabling done.
2. Install Debian 10 on gateway servers.
3. `./run-ansible-gitlab playbooks/site.yaml --limit=adm-gateway:\&location-ussfo03,none`.
4. Wait for all devices to autoprovision.
5. `./run-ansible-gitlab playbooks/site.yaml --limit=location-ussfo03`.

Source of truth

- No **NetBox**.
- **YAML** files versioned with **Git**.
    1. List of **devices**
    2. **Classifier**: from device name, attach properties to build a scope
    3. **Hierarchy definition** for data: given a scope, where to lookup data for a device
    4. **Data files**: flat YAML files fitted inside a hierarchy of directories

List of devices

```
devices:
 # USSF003
 ## OOB
 - ob1-n1.ussfo03.blade-group.net
 - ob2-n1.ussfo03.blade-group.net
 - ob1-p1.ussfo03.blade-group.net
 - ob2-p1.ussfo03.blade-group.net
 - ob1-p2.ussfo03.blade-group.net
# [...]
```

Classifier

```
matchers:
  - '\.(ussfo03)\.':
      location: '\1'
      continent: us
  - '^to([12])-[as]?p(\d+)\.':
      member: '\1'
      pod: '\2'
  - '^to[12]-p\d+\.ussfo03\.':
      groups:
        - tor-bgp
        - tor-bgp-compute
  - '^to[12]-(p|ap|sp)\d+\.ussfo03\.':
      os: cumulus
      model: wedge100
```

Hierarchy definition

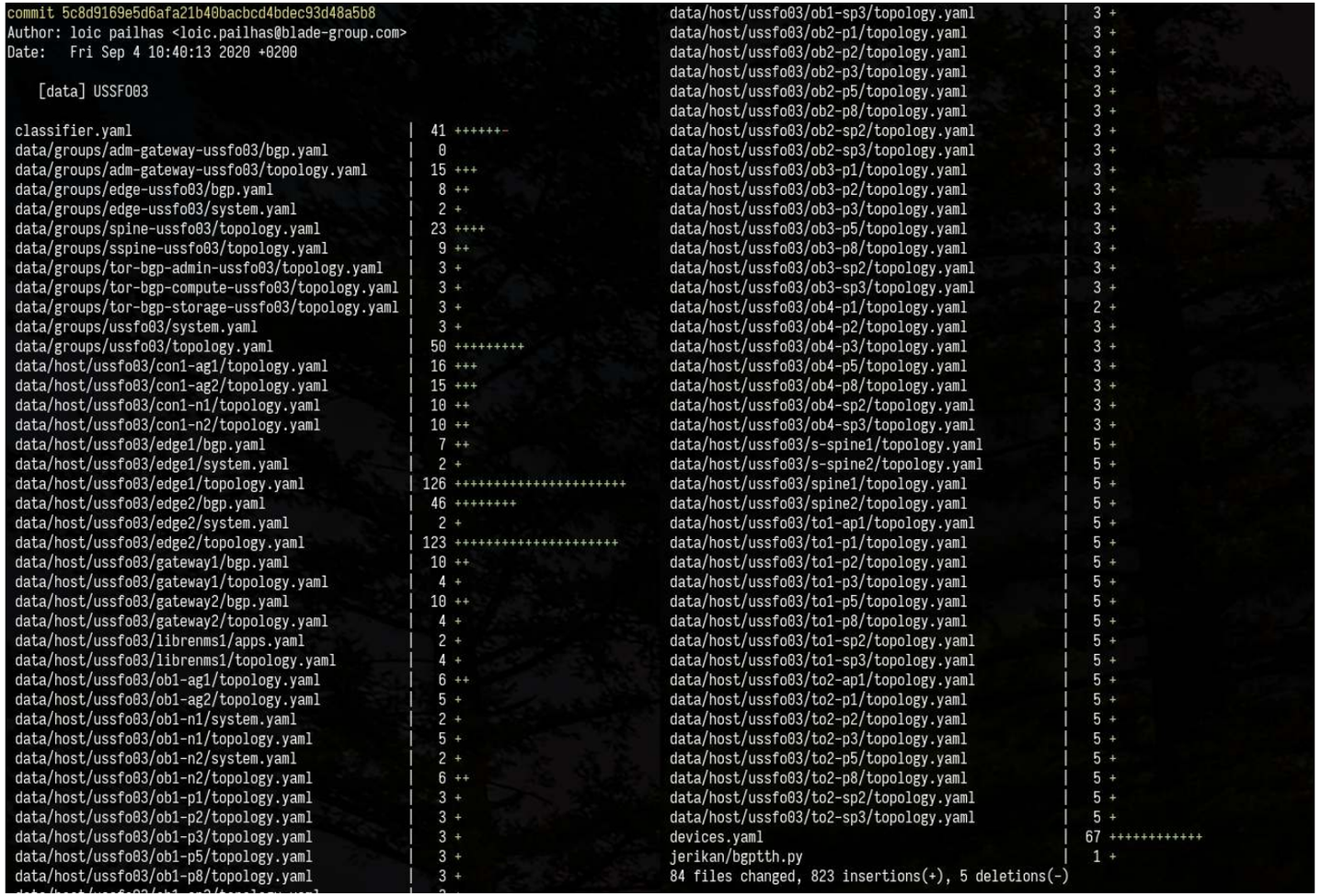
```
def searchpaths(scope):
  paths = [
    f"host/{scope[location]}/{scope[shorthost]}",
    f"location/{scope[location]}",
    f"os/{scope[os]}-{scope[model]}",
    f"os/{scope[os]}",
    'common'
  ]
  return paths
```

Data files

- Don't repeat yourself
- Data model should fit your needs

```
peer:
  ix-sfmix:
    rs-sfmix:
      monitored: true
      asn: 63055
      remote:
        - 206.197.187.253
        - 2001:504:30::ba06:3055:1
    blizzard:
      asn: 57976
      remote:
        - 206.197.187.42
        - 2001:504:30::ba05:7976:1
      irr: AS-BLIZZARD
```

Commit by Loïc



```
commit 5c8d9169e5d6afa21b40bacbcd4bdec93d48a5b8
Author: loic pailhas <loic.pailhas@blade-group.com>
Date:   Fri Sep 4 10:40:13 2020 +0200

    [data] USSFO03

 classifier.yaml                                 |  41 ++++++-
 data/groups/adm-gateway-ussfo03/bgp.yaml        |   0
 data/groups/adm-gateway-ussfo03/topology.yaml   |  15 +++
 data/groups/edge-ussfo03/bgp.yaml               |   8 ++
 data/groups/edge-ussfo03/system.yaml            |   2 +
 data/groups/spine-ussfo03/topology.yaml         |  23 ++++
 data/groups/sspine-ussfo03/topology.yaml        |   9 ++
 data/groups/tor-bgp-admin-ussfo03/topology.yaml |   3 +
 data/groups/tor-bgp-compute-ussfo03/topology.yaml |   3 +
 data/groups/tor-bgp-storage-ussfo03/topology.yaml |   3 +
 data/groups/ussfo03/system.yaml                 |   3 +
 data/groups/ussfo03/topology.yaml               |  50 +++++++++
 data/host/ussfo03/con1-ag1/topology.yaml        |  16 +++
 data/host/ussfo03/con1-ag2/topology.yaml        |  15 +++
 data/host/ussfo03/con1-n1/topology.yaml         |  10 ++
 data/host/ussfo03/con1-n2/topology.yaml         |  10 ++
 data/host/ussfo03/edge1/bgp.yaml                |   7 ++
 data/host/ussfo03/edge1/system.yaml             |   2 +
 data/host/ussfo03/edge1/topology.yaml           | 126 ++++++++++++++++++++++
 data/host/ussfo03/edge2/bgp.yaml                |  46 +++++++++
 data/host/ussfo03/edge2/system.yaml             |   2 +
 data/host/ussfo03/edge2/topology.yaml           | 123 ++++++++++++++++++++++
 data/host/ussfo03/gateway1/bgp.yaml             |  10 ++
 data/host/ussfo03/gateway1/topology.yaml        |   4 +
 data/host/ussfo03/gateway2/bgp.yaml             |  10 ++
 data/host/ussfo03/gateway2/topology.yaml        |   4 +
 data/host/ussfo03/librenms1/apps.yaml           |   2 +
 data/host/ussfo03/librenms1/topology.yaml       |   4 +
 data/host/ussfo03/ob1-ag1/topology.yaml         |   6 ++
 data/host/ussfo03/ob1-ag2/topology.yaml         |   5 +
 data/host/ussfo03/ob1-n1/system.yaml            |   2 +
 data/host/ussfo03/ob1-n1/topology.yaml          |   5 +
 data/host/ussfo03/ob1-n2/system.yaml            |   2 +
 data/host/ussfo03/ob1-n2/topology.yaml          |   6 ++
 data/host/ussfo03/ob1-p1/topology.yaml          |   3 +
 data/host/ussfo03/ob1-p2/topology.yaml          |   3 +
 data/host/ussfo03/ob1-p3/topology.yaml          |   3 +
 data/host/ussfo03/ob1-p5/topology.yaml          |   3 +
 data/host/ussfo03/ob1-p8/topology.yaml          |   3 +
 data/host/ussfo03/ob1-sp3/topology.yaml         |   3 +
 data/host/ussfo03/ob2-p1/topology.yaml          |   3 +
 data/host/ussfo03/ob2-p2/topology.yaml          |   3 +
 data/host/ussfo03/ob2-p3/topology.yaml          |   3 +
 data/host/ussfo03/ob2-p5/topology.yaml          |   3 +
 data/host/ussfo03/ob2-p8/topology.yaml          |   3 +
 data/host/ussfo03/ob2-sp2/topology.yaml         |   3 +
 data/host/ussfo03/ob2-sp3/topology.yaml         |   3 +
 data/host/ussfo03/ob3-p1/topology.yaml          |   3 +
 data/host/ussfo03/ob3-p2/topology.yaml          |   3 +
 data/host/ussfo03/ob3-p3/topology.yaml          |   3 +
 data/host/ussfo03/ob3-p5/topology.yaml          |   3 +
 data/host/ussfo03/ob3-p8/topology.yaml          |   3 +
 data/host/ussfo03/ob3-sp2/topology.yaml         |   3 +
 data/host/ussfo03/ob3-sp3/topology.yaml         |   3 +
 data/host/ussfo03/ob4-p1/topology.yaml          |   2 +
 data/host/ussfo03/ob4-p2/topology.yaml          |   3 +
 data/host/ussfo03/ob4-p3/topology.yaml          |   3 +
 data/host/ussfo03/ob4-p5/topology.yaml          |   3 +
 data/host/ussfo03/ob4-p8/topology.yaml          |   3 +
 data/host/ussfo03/ob4-sp2/topology.yaml         |   3 +
 data/host/ussfo03/ob4-sp3/topology.yaml         |   3 +
 data/host/ussfo03/s-spine1/topology.yaml        |   5 +
 data/host/ussfo03/s-spine2/topology.yaml        |   5 +
 data/host/ussfo03/spine1/topology.yaml          |   5 +
 data/host/ussfo03/spine2/topology.yaml          |   5 +
 data/host/ussfo03/to1-ap1/topology.yaml         |   5 +
 data/host/ussfo03/to1-p1/topology.yaml          |   5 +
 data/host/ussfo03/to1-p2/topology.yaml          |   5 +
 data/host/ussfo03/to1-p3/topology.yaml          |   5 +
 data/host/ussfo03/to1-p5/topology.yaml          |   5 +
 data/host/ussfo03/to1-p8/topology.yaml          |   5 +
 data/host/ussfo03/to1-sp2/topology.yaml         |   5 +
 data/host/ussfo03/to1-sp3/topology.yaml         |   5 +
 data/host/ussfo03/to2-ap1/topology.yaml         |   5 +
 data/host/ussfo03/to2-p1/topology.yaml          |   5 +
 data/host/ussfo03/to2-p2/topology.yaml          |   5 +
 data/host/ussfo03/to2-p3/topology.yaml          |   5 +
 data/host/ussfo03/to2-p5/topology.yaml          |   5 +
 data/host/ussfo03/to2-p8/topology.yaml          |   5 +
 data/host/ussfo03/to2-sp2/topology.yaml         |   5 +
 data/host/ussfo03/to2-sp3/topology.yaml         |   5 +
 devices.yaml                                    |  67 ++++++++++++
 jerikan/bgptth.py                               |   1 +
 84 files changed, 823 insertions(+), 5 deletions(-)
```

Jerikan

- Compile **configuration files** from **source of truth** and **templates**
- Faster than Ansible
- Easier to debug than Ansible
- Optionally checks generated configuration

Templates

- Using Jinja2
- Same as Ansible

```
system {
  ntp {
{% for ntp in lookup("system", "ntp") %}
    server {{ ntp }};
{% endfor %}
  }
  name-server {
{% for dns in lookup("system", "dns") %}
    {{ dns }};
{% endfor %}
  }
}
```

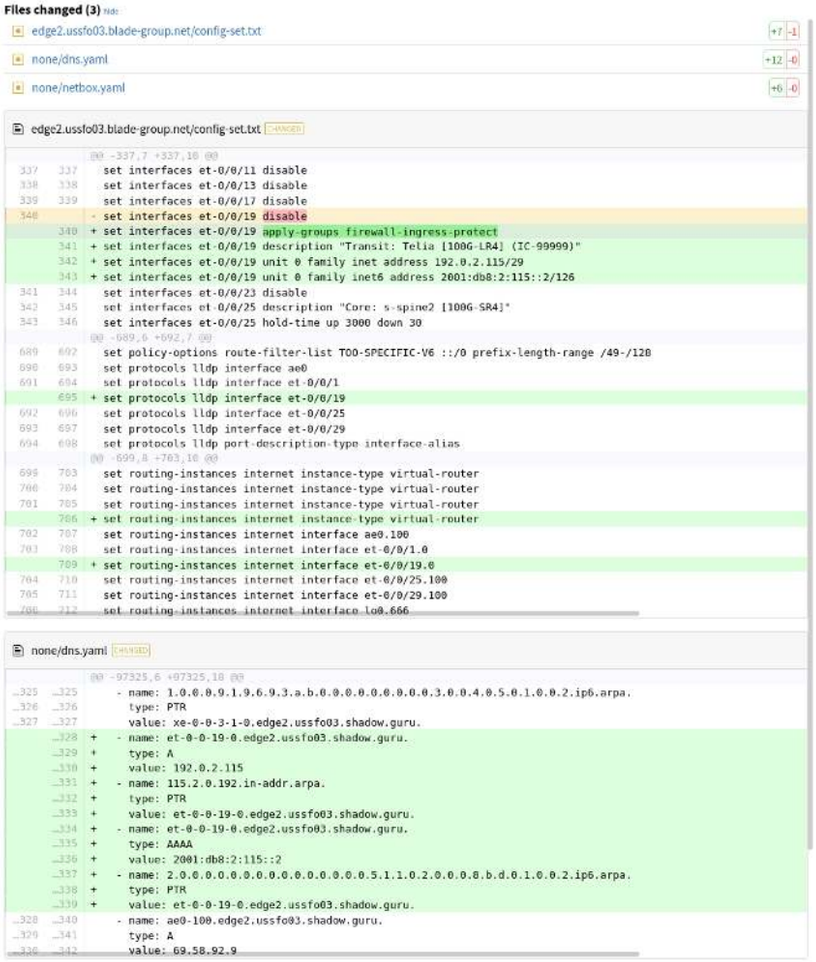
Error handling

```
templates/opengear/config.j2:15: in top-level template code
    config.interfaces.{{ interface }}.netmask {{ infos.adddress | ipaddr("netmask") }}
        continent  = 'us'
        device     = 'con1-ag2.ussfo03.blade-group.net'
        environment = 'prod'
        host       = 'con1-ag2.ussfo03'
        infos      = {'address': '172.30.24.19/21'}
        interface  = 'wan'
        location   = 'ussfo03'
        loop       = <LoopContext 1/2>
        member     = '2'
        model      = 'cm7132-2-dac'
        os         = 'opengear'
        shorthost  = 'con1-ag2'
_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

value = JerkianUndefined, query = 'netmask', version = False, alias = 'ipaddr'

[…]
        # Check if value is a list and parse each element
        if isinstance(value, (list, tuple, types.GeneratorType)):
            _ret = [ipaddr(element, str(query), version) for element in value]
            return [item for item in _ret if item]

>       elif not value or value is True:
E       jinja2.exceptions.UndefinedError: 'dict object' has no attribute 'adddress'
```

Integration into GitLab

- Use merge request workflow
- Review changes to data files and templates
- Build generated configuration files
- Produce a diff

Integration into GitLab



Files changed (3)

edge2.ussfo03.blade-group.net/config-set.txt +7 -1

none/dns.yaml +12 -0

none/netbox.yaml +6 -0

edge2.ussfo03.blade-group.net/config-set.txt CHANGED

```
@@ -337,7 +337,16 @@
 337  337   set interfaces et-0/0/11 disable
 338  338   set interfaces et-0/0/13 disable
 339  339   set interfaces et-0/0/17 disable
 340      - set interfaces et-0/0/19 disable
      340 + set interfaces et-0/0/19 apply-groups firewall-ingress-protect
      341 + set interfaces et-0/0/19 description "Transit: Telia [100G-LR4] (IC-99999)"
      342 + set interfaces et-0/0/19 unit 0 family inet address 192.0.2.115/29
      343 + set interfaces et-0/0/19 unit 0 family inet6 address 2001:db8:2:115::2/126
 341  344   set interfaces et-0/0/23 disable
 342  345   set interfaces et-0/0/25 description "Core: s-spine2 [100G-SR4]"
 343  346   set interfaces et-0/0/25 hold-time up 3000 down 30
@@ -689,6 +692,7 @@
 689  692   set policy-options route-filter-list TOO-SPECIFIC-V6 ::/0 prefix-length-range /49-/128
 690  693   set protocols lldp interface ae0
 691  694   set protocols lldp interface et-0/0/1
      695 + set protocols lldp interface et-0/0/19
 692  696   set protocols lldp interface et-0/0/25
 693  697   set protocols lldp interface et-0/0/29
 694  698   set protocols lldp port-description-type interface-alias
@@ -699,8 +703,10 @@
 698  703   set routing-instances internet instance-type virtual-router
 700  704   set routing-instances internet instance-type virtual-router
 701  705   set routing-instances internet instance-type virtual-router
      706 + set routing-instances internet instance-type virtual-router
 702  707   set routing-instances internet interface ae0.100
 703  708   set routing-instances internet interface et-0/0/1.0
      709 + set routing-instances internet interface et-0/0/19.0
 704  710   set routing-instances internet interface et-0/0/25.100
 705  711   set routing-instances internet interface et-0/0/29.100
 706  712   set routing-instances internet interface lo0.666
```

none/dns.yaml CHANGED

```
@@ -97325,6 +97325,18 @@
...325 ...325     - name: 1.0.0.0.9.1.9.6.9.3.a.b.0.0.0.0.0.0.0.0.3.0.0.4.0.5.0.1.0.0.2.ip6.arpa.
...326 ...326       type: PTR
...327 ...327       value: xe-0-0-3-1-0.edge2.ussfo03.shadow.guru.
       ...328 +   - name: et-0-0-19-0.edge2.ussfo03.shadow.guru.
       ...329 +     type: A
       ...330 +     value: 192.0.2.115
       ...331 +   - name: 115.2.0.192.in-addr.arpa.
       ...332 +     type: PTR
       ...333 +     value: et-0-0-19-0.edge2.ussfo03.shadow.guru.
       ...334 +   - name: et-0-0-19-0.edge2.ussfo03.shadow.guru.
       ...335 +     type: AAAA
       ...336 +     value: 2001:db8:2:115::2
       ...337 +   - name: 2.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.5.1.1.0.2.0.0.0.8.b.d.0.1.0.0.2.ip6.arpa.
       ...338 +     type: PTR
       ...339 +     value: et-0-0-19-0.edge2.ussfo03.shadow.guru.
...328 ...340     - name: ae0-100.edge2.ussfo03.shadow.guru.
...329 ...341       type: A
...330 ...342       value: 69.58.92.9
```

Ansible

- Inventory generated by **Jerikan**
- Single playbook
- Idempotency is important
- `--diff --check` should work as expected
- deploy complete configuration

Further reading

- Blog post about Jerikan+Ansible (w/ demo)
- GitHub repository (free bundle: Jerikan, Ansible playbooks, data, templates and generated configuration for two datacenters)