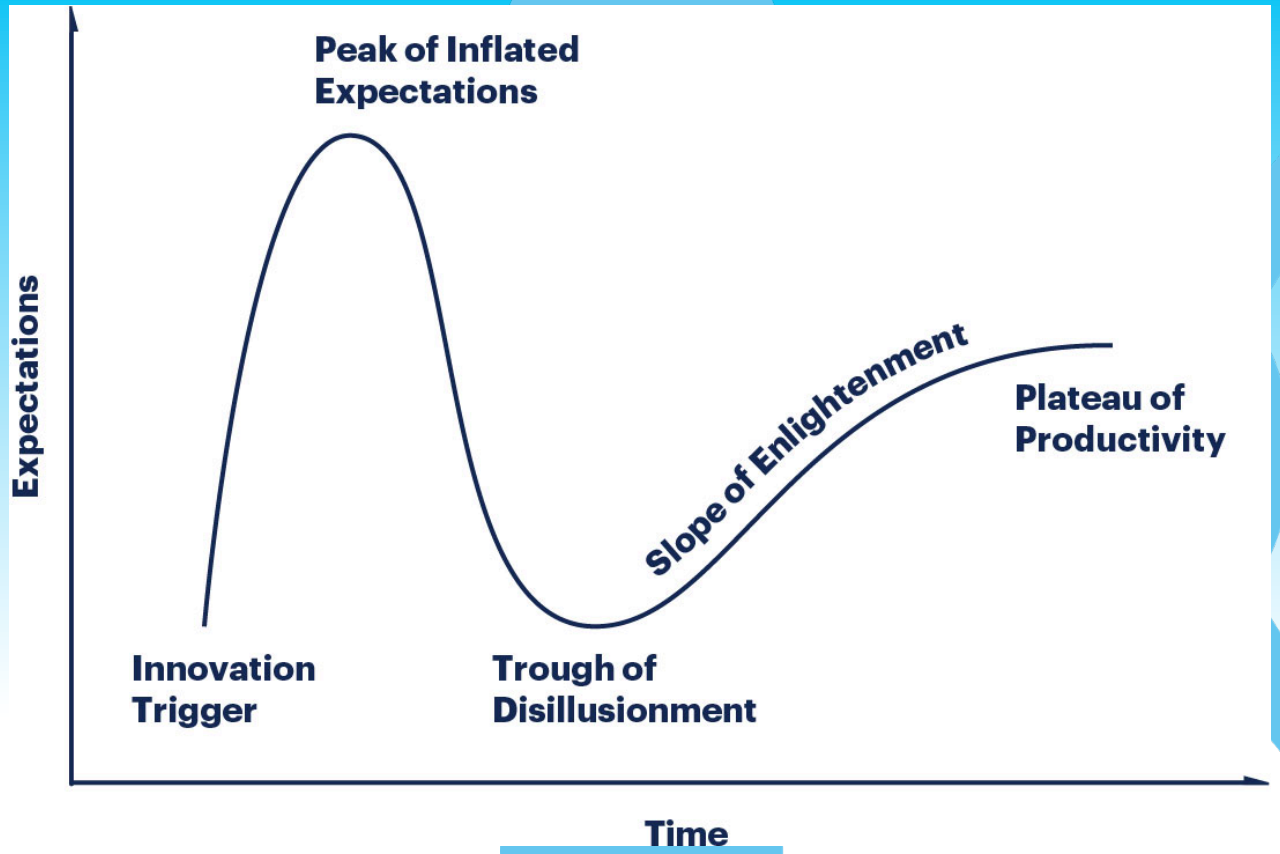
Faucet : Openflow SDN Made Easy

Richard Nelson
AusNOG 18, Sydney

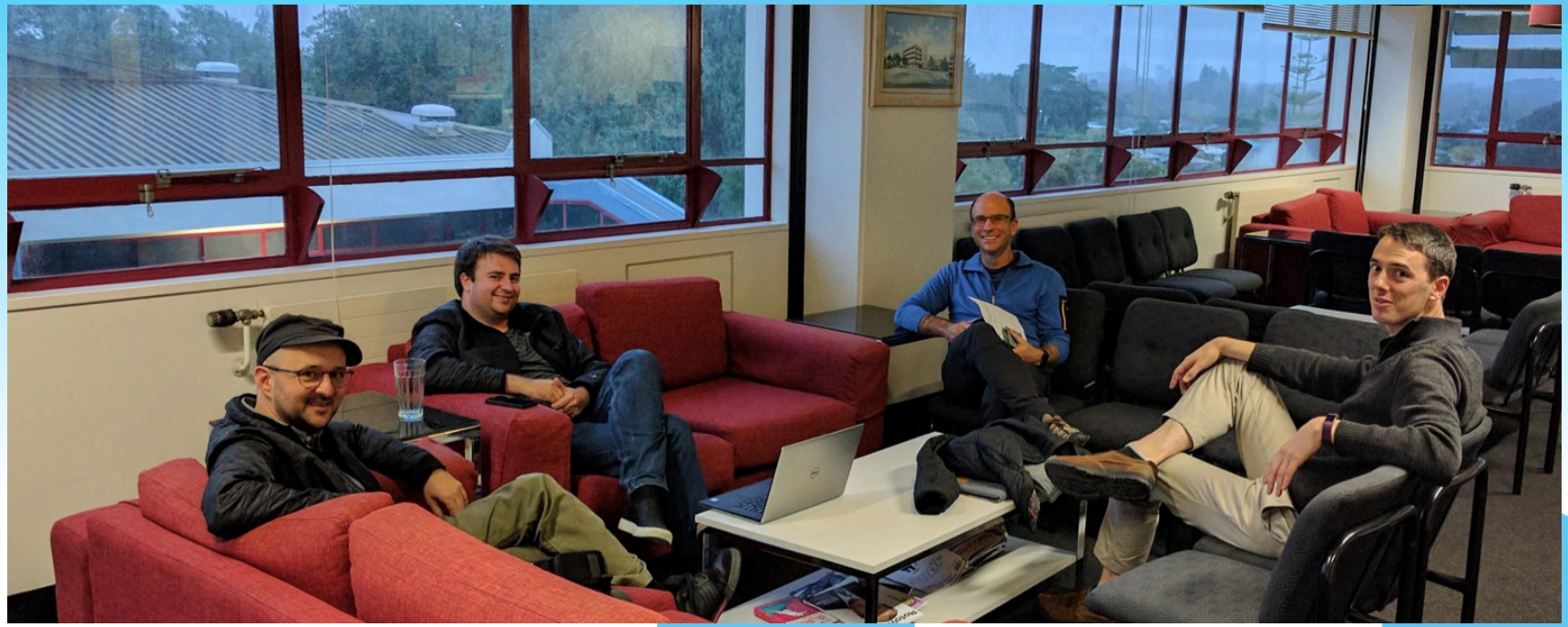
SDN



https://www.gartner.com/en/research/methodologies/gartner-hype-cycle

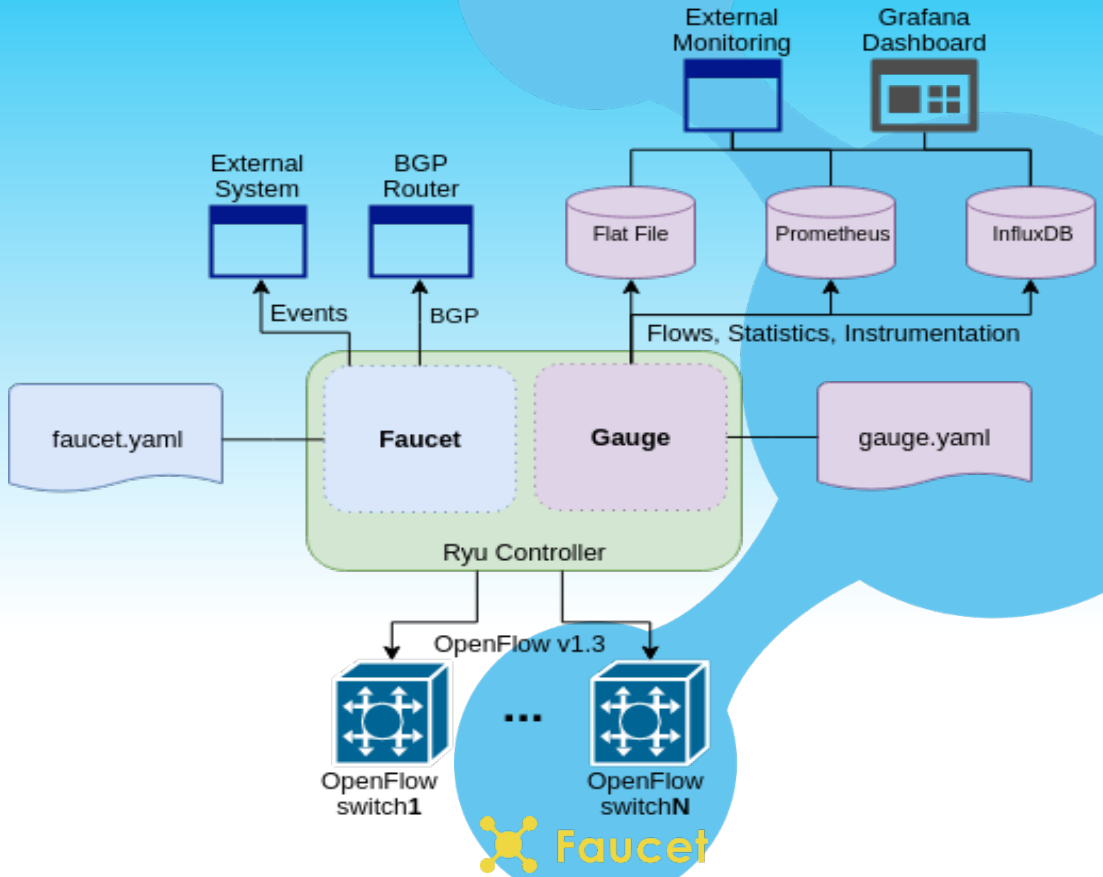
Faucet

In the beginning...



Faucet

Faucet is an Enterprise SDN Controller



As Simple as Possible but No Simpler

- Faucet is intentionally small
  - ~10,000 lines of code
  - ~5,000 lines of tests
- Production networking
  - Feature set
  - Testing
- Implements useful primitives that can be built on top of
  - Forwarding, VLANs, ACLs, L3 FIB
- Implement some additional protocols for interop
  - BGP, Stacking, LACP, ARP & IPv6 ND
  - Protocols modular so they are only turned on when configured

Faucet

State

Persistent state is stored in configuration

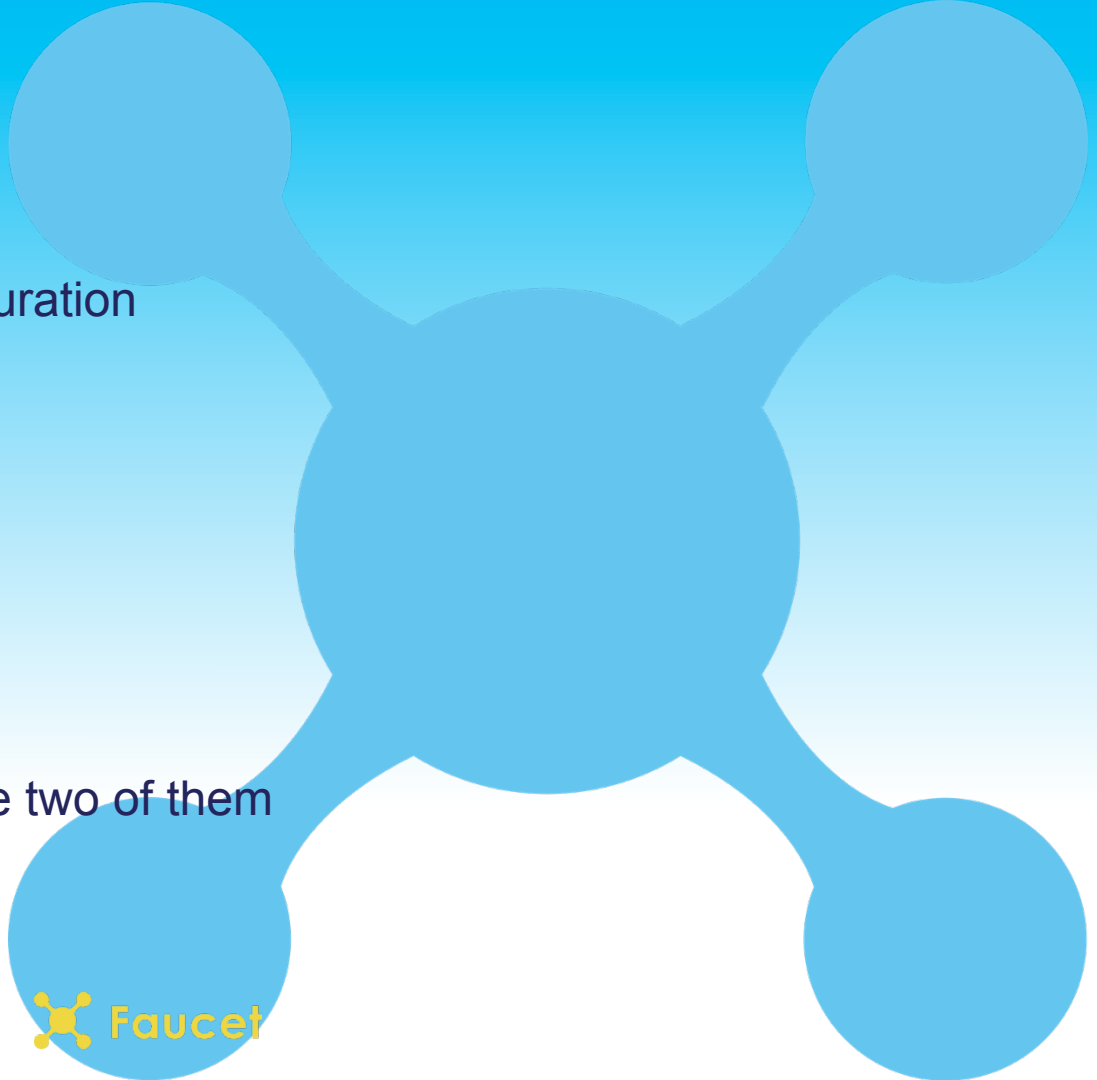
Everything else is ephemeral

- Next hop resolution
- L2 Learning

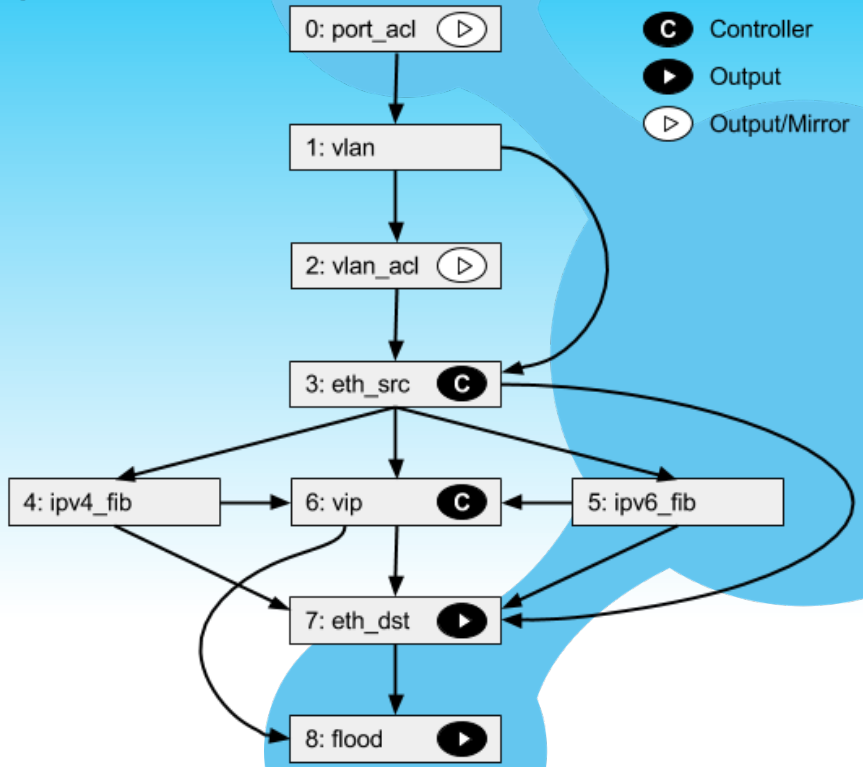
Fail-secure mode

Hitless restarts

If you need controller reliability use two of them



Faucet Pipeline



Faucet

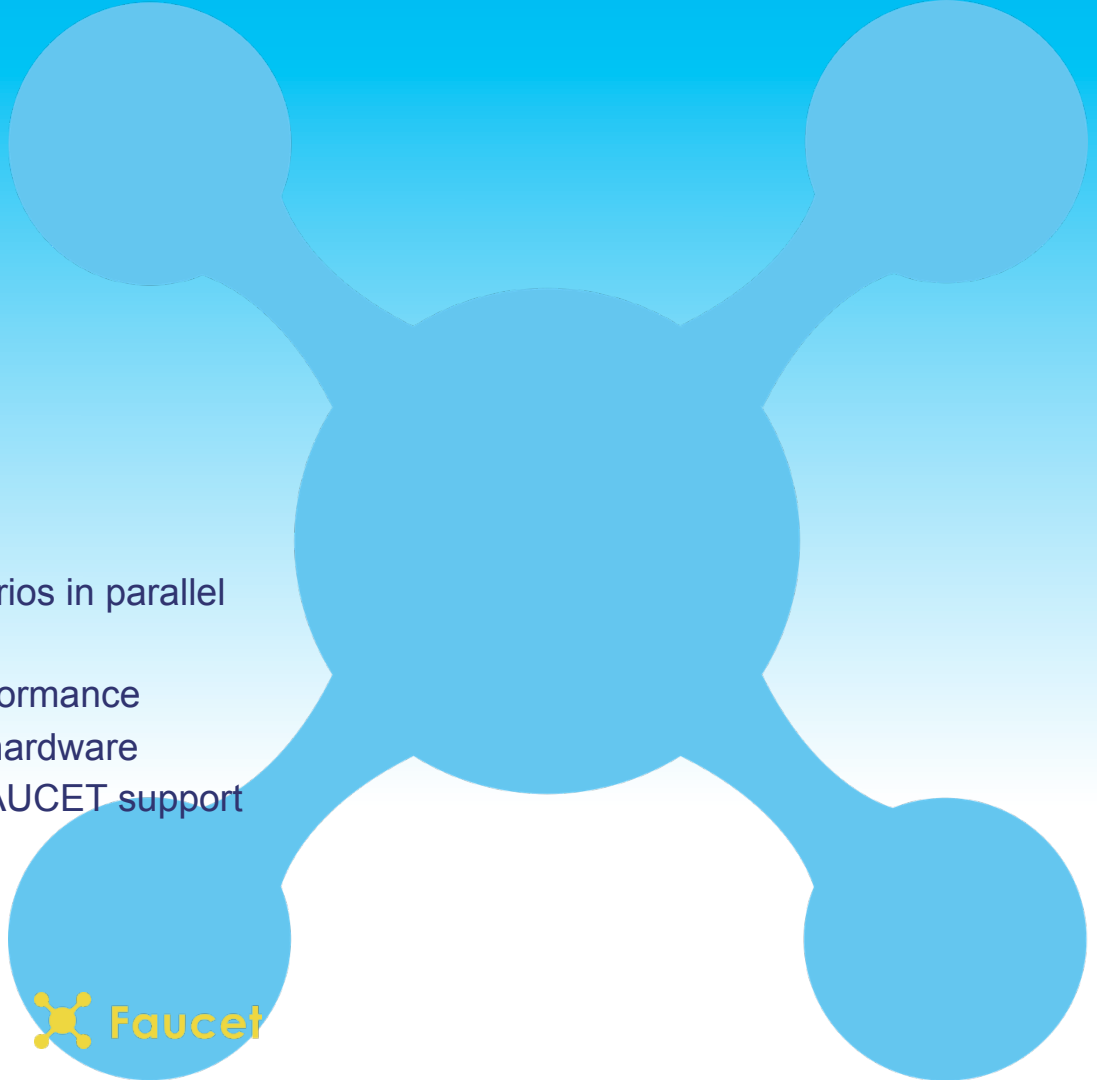
Testing

Unit Tests

- >90% code coverage
- Quick to write and to run

Integration Tests

- Boot up many different network scenarios in parallel
  - 30 - 60 minutes to complete
- Ensure features work and checks performance
- Runs against Open vSwitch and real hardware
  - Lets us prequalify devices for FAUCET support
  - Cyber RFP



FaucetCon Plugfest Oct‘17

Faucet

Easy to Install

```
$ echo "deb https://packagecloud.io/faucetsdn/faucet/ubuntu/bionic main" \
  | sudo tee /etc/apt/sources.list.d/faucet.list
$ curl -L https://packagecloud.io/faucetsdn/faucet/gpgkey \
  | sudo apt-key add -
$ sudo apt-get update
$ sudo apt-get install faucet gauge
```

or

```
$ docker run -d --name faucet \
         -v /etc/ryu/faucet/:/etc/ryu/faucet/ \
         -v /var/log/ryu/faucet/:/var/log/ryu/faucet/ \
         -p 6653:6653 -p 9244:9244 \
         faucet/faucet
```

Learn more **https://docs.faucet.nz**

Simple to Configure

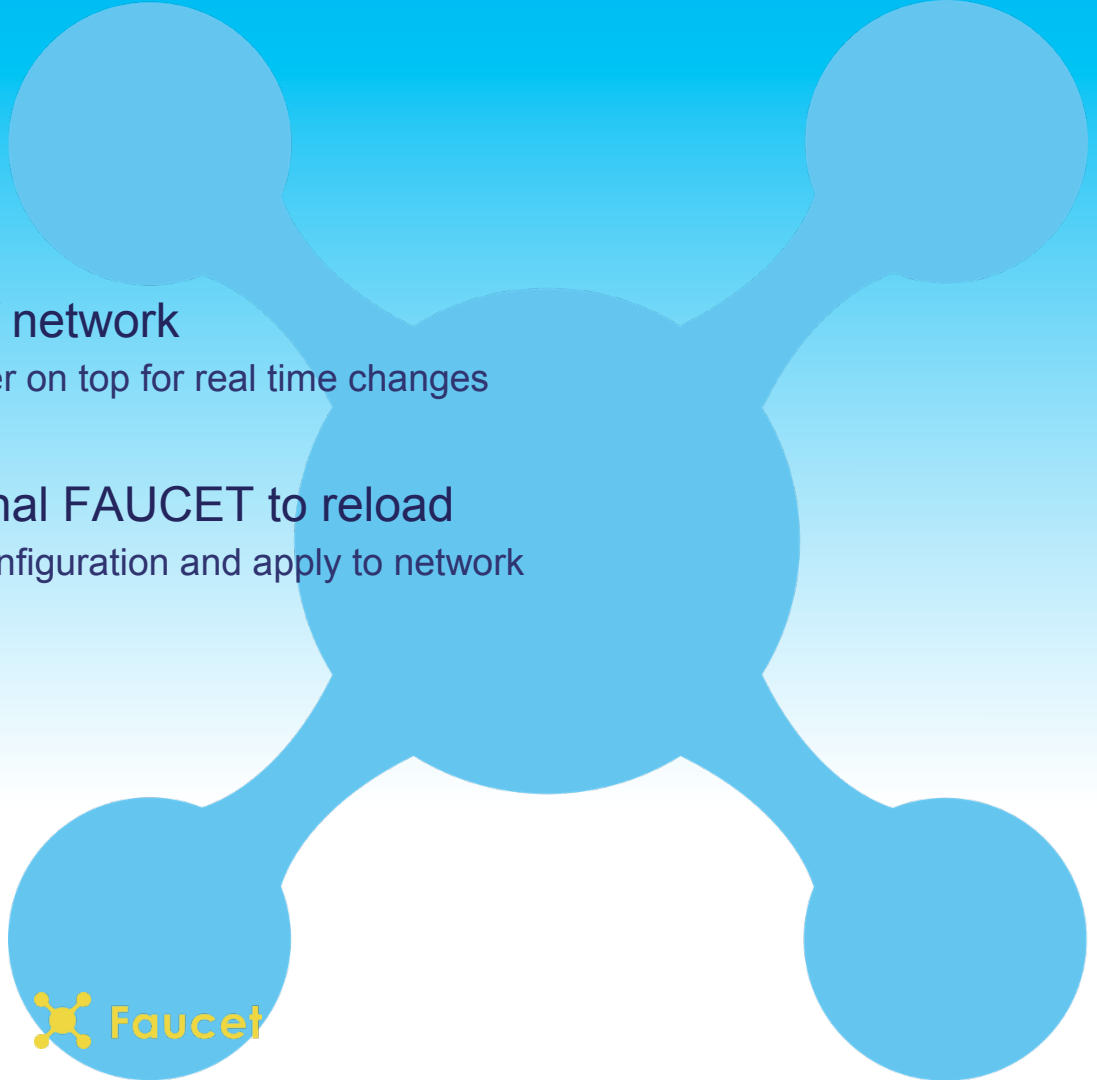
YAML-based configuration file

Represents topology & features of network

- Working on adding an abstraction layer on top for real time changes

Change configuration file then signal FAUCET to reload

- FAUCET will compute diff between configuration and apply to network

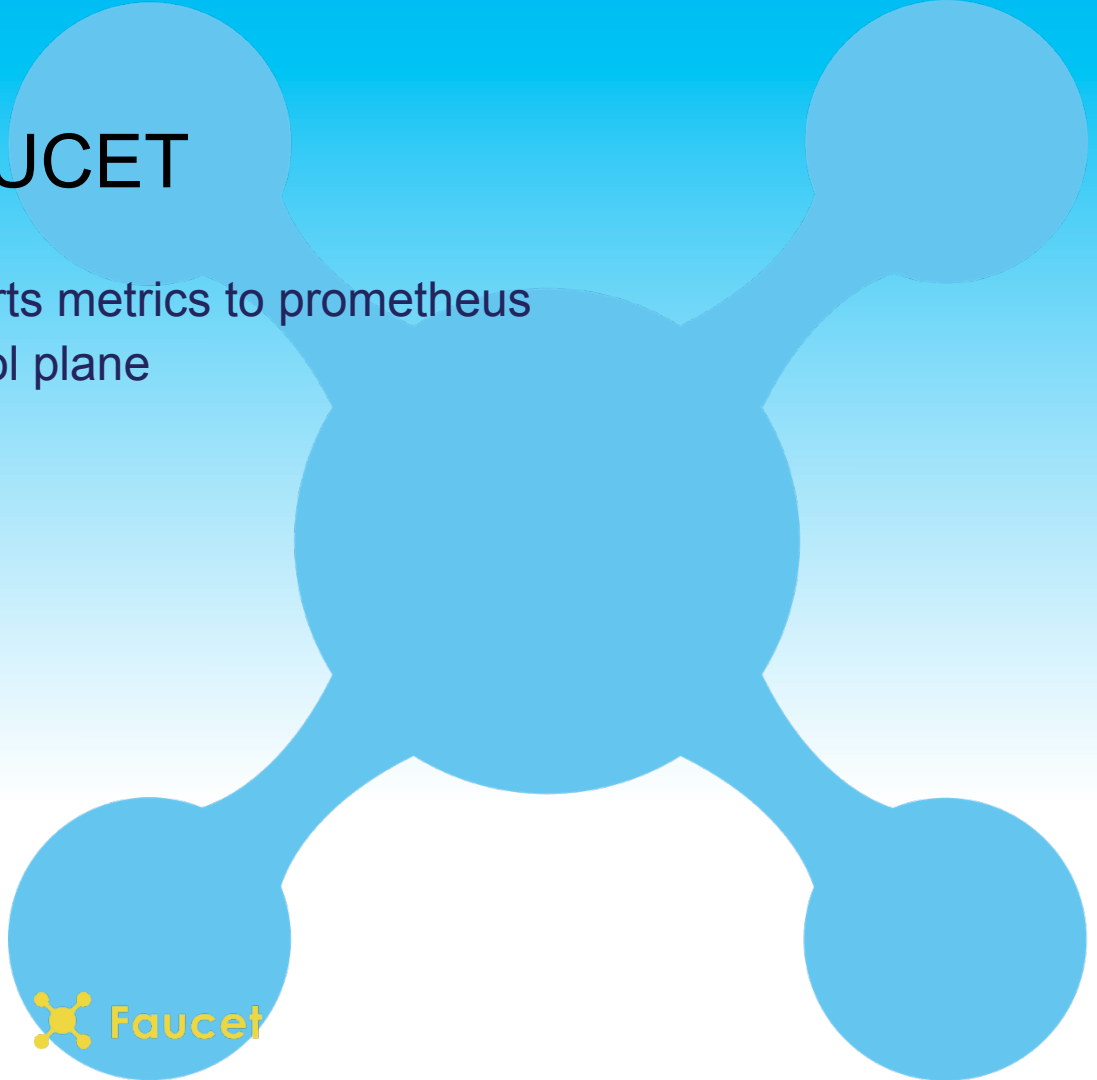


Network visibility - GAUGE

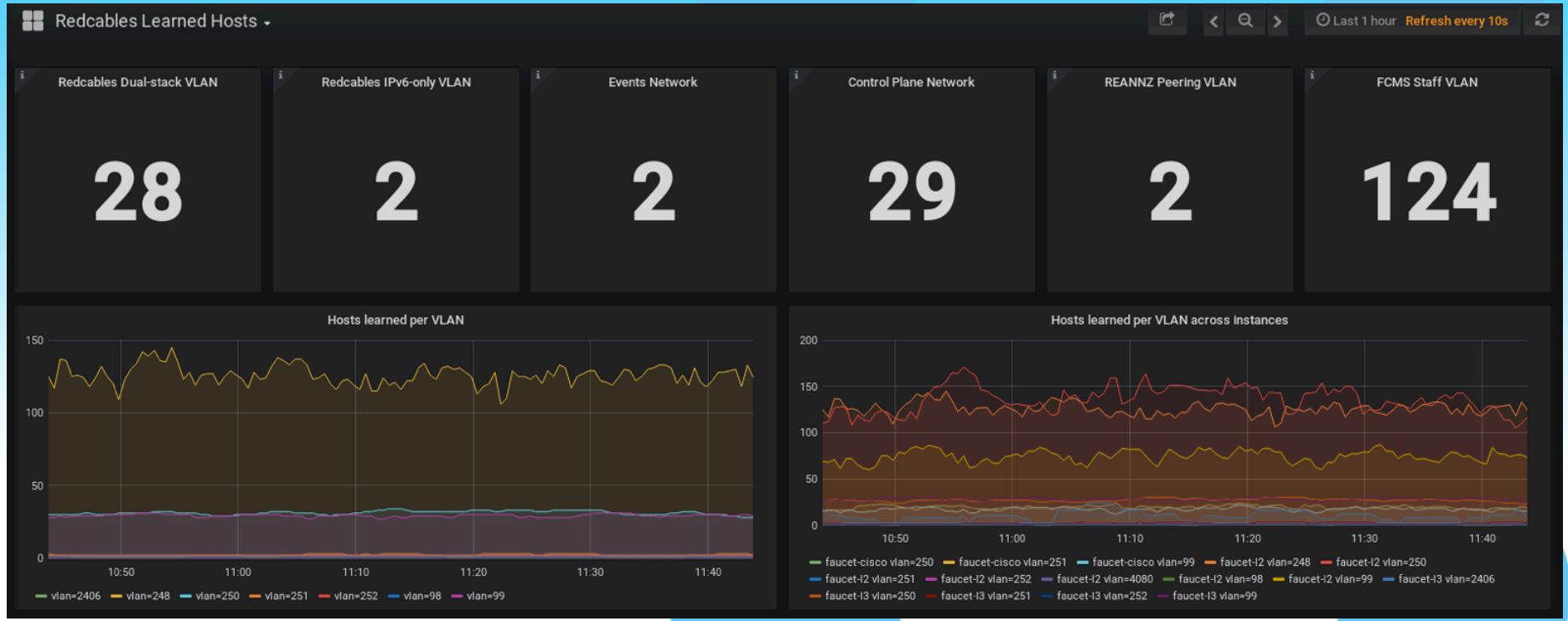
- Fetches metrics from OpenFlow v1.3 dataplanes
  - MAC learning information
  - Port state
  - Port counters (bytes in/out, packets in/out, errors)
- Pushes metrics to a database
  - InfluxDB
  - Prometheus
- Can use `fctl` tool to query database manually
- Can use grafana to make real-time dashboards

Network visibility - FAUCET

- FAUCET controller also exports metrics to prometheus
- Allows us to instrument control plane
  - Learning capacity
  - CPU/Memory usage
  - Inventory

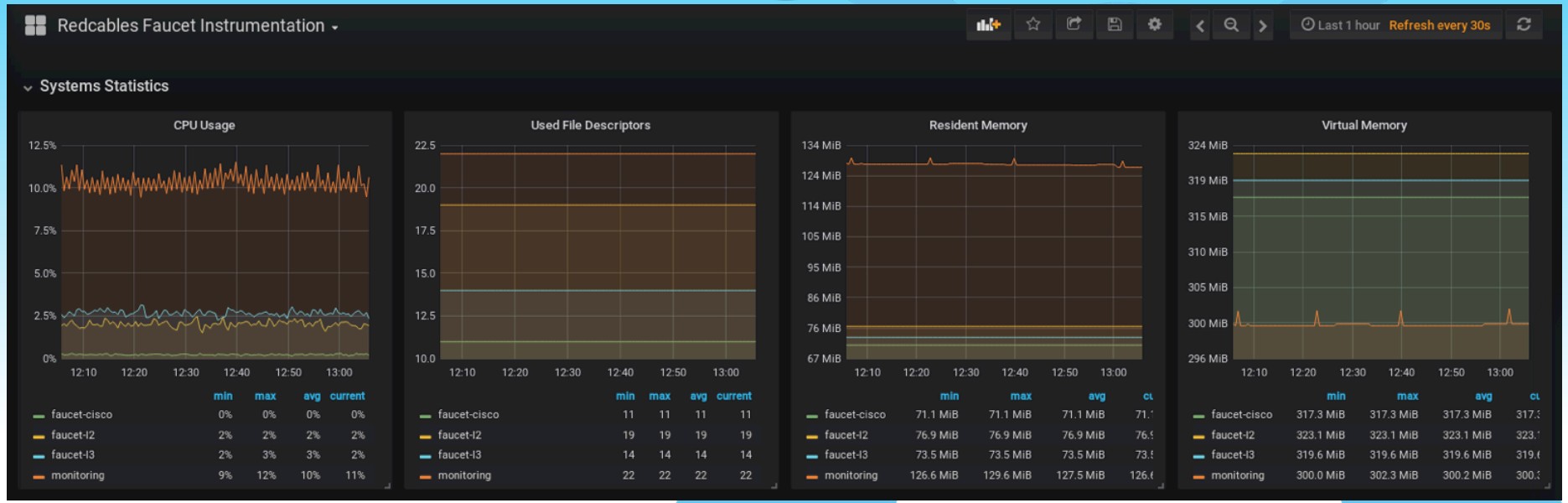


Network visibility



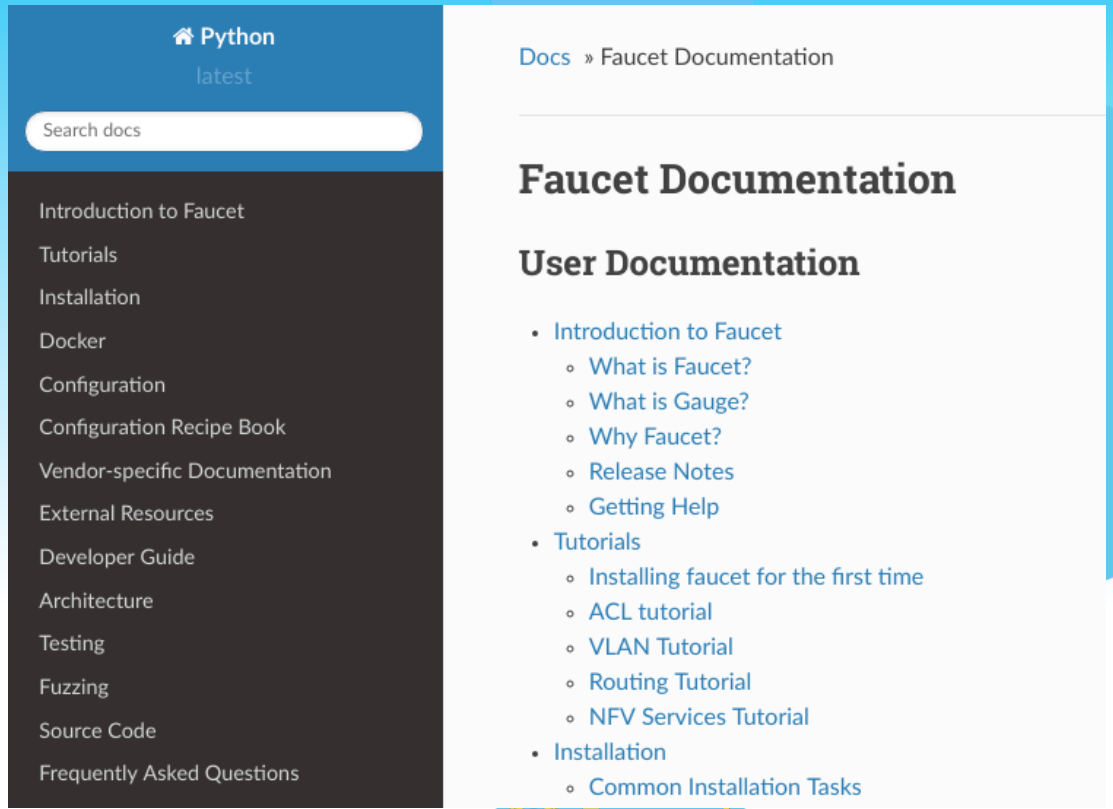
Faucet

Controller visibility



Faucet

Well Documented



Faucet

Simple to Automate

YAML is easy to machine generate

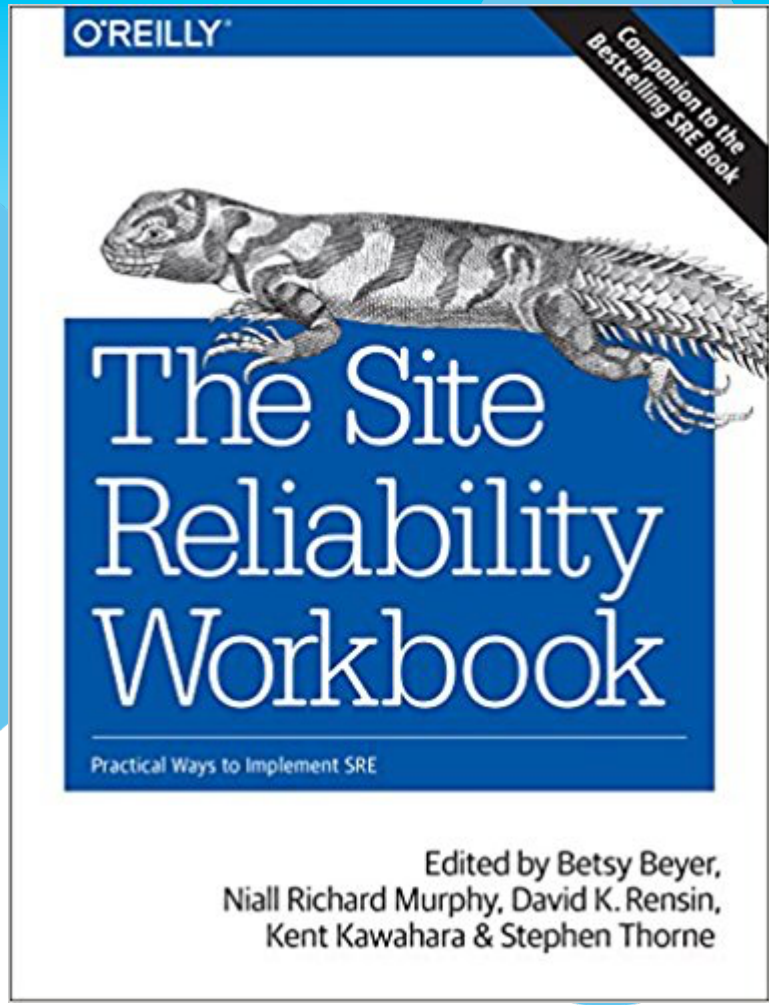
Integration tests can be customised to specific architectures

- Test that everything is working

Automation with Ansible, Docker and Github

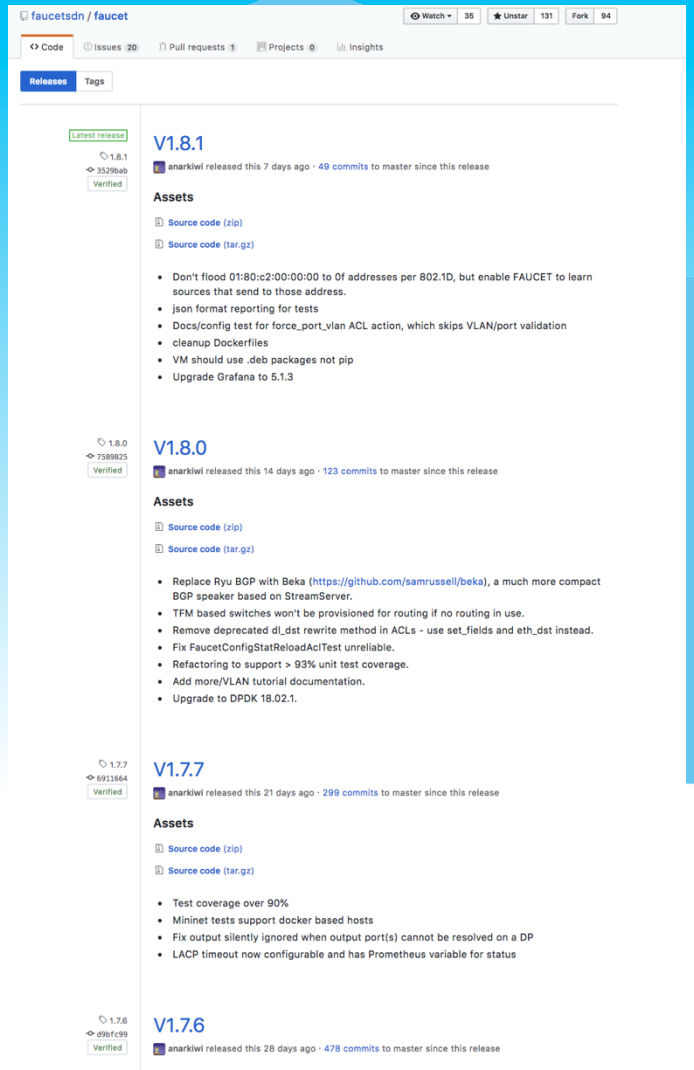
Continuous integration

- Deploy on green



Faucet

Release often



faucetsdn / faucet

Watch 35 · Unstar 131 · Fork 94

Code · Issues 20 · Pull requests 1 · Projects 0 · Insights

Releases · Tags

Latest release
1.8.1
3529bab
Verified

V1.8.1

anarkiwi released this 7 days ago · 49 commits to master since this release

Assets

Source code (zip)

Source code (tar.gz)

- Don't flood 01:80:c2:00:00:00 to 0f addresses per 802.1D, but enable FAUCET to learn sources that send to those address.
- json format reporting for tests
- Docs/config test for force_port_vlan ACL action, which skips VLAN/port validation
- cleanup Dockerfiles
- VM should use .deb packages not pip
- Upgrade Grafana to 5.1.3

1.8.0
7589825
Verified

V1.8.0

anarkiwi released this 14 days ago · 123 commits to master since this release

Assets

Source code (zip)

Source code (tar.gz)

- Replace Ryu BGP with Beka (https://github.com/samrussell/beka), a much more compact BGP speaker based on StreamServer.
- TFM based switches won't be provisioned for routing if no routing in use.
- Remove deprecated dl_dst rewrite method in ACLs - use set_fields and eth_dst instead.
- Fix FaucetConfigStatReloadAclTest unreliable.
- Refactoring to support > 93% unit test coverage.
- Add more/VLAN tutorial documentation.
- Upgrade to DPDK 18.02.1.

1.7.7
6911664
Verified

V1.7.7

anarkiwi released this 21 days ago · 299 commits to master since this release

Assets

Source code (zip)

Source code (tar.gz)

- Test coverage over 90%
- Mininet tests support docker based hosts
- Fix output silently ignored when output port(s) cannot be resolved on a DP
- LACP timeout now configurable and has Prometheus variable for status

1.7.6
d9bfc99
Verified

V1.7.6

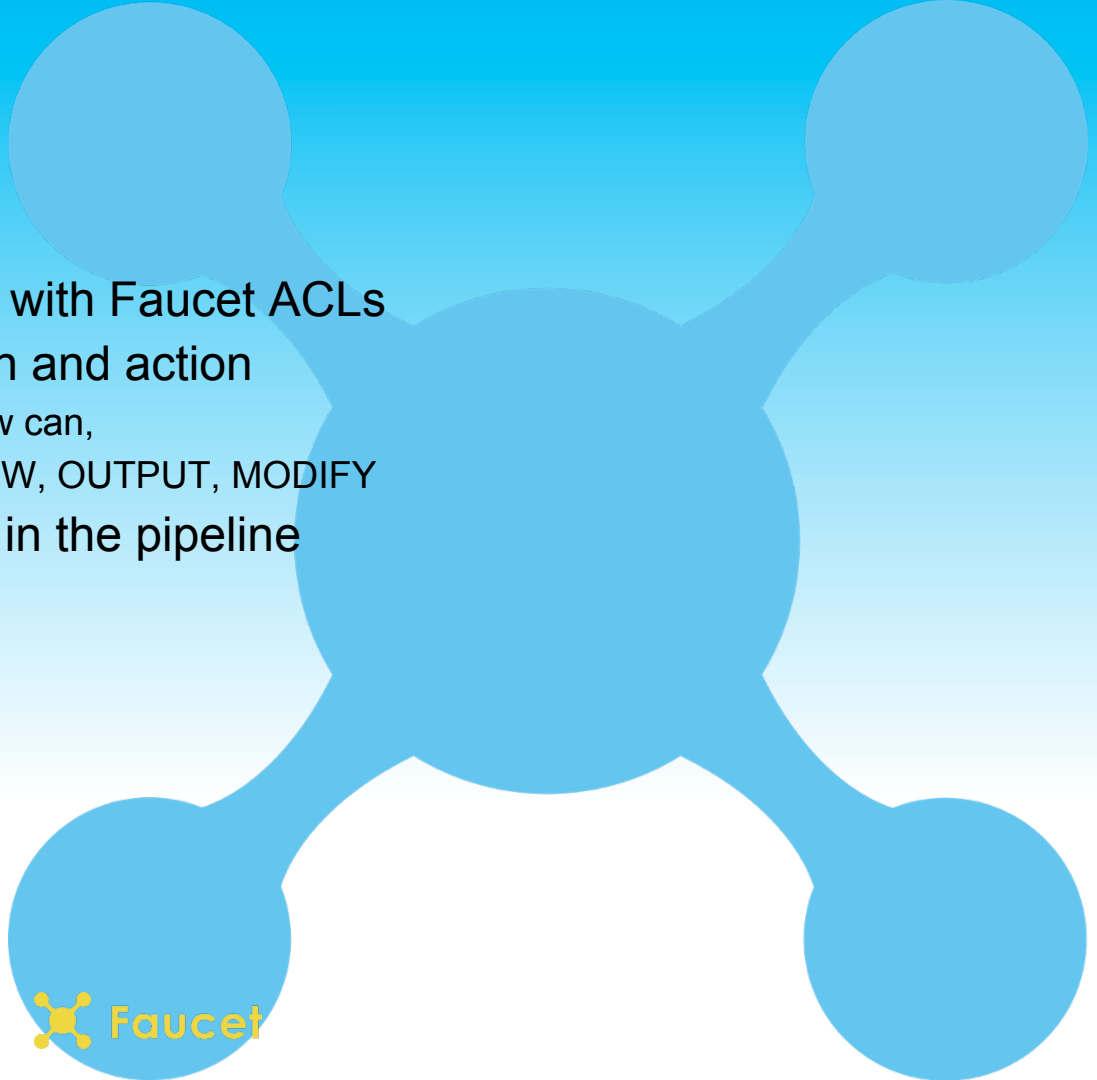
anarkiwi released this 28 days ago · 478 commits to master since this release

Simple to Upgrade

Policy and Security

Network policy is implemented with Faucet ACLs

- A Faucet ACL has a match and action
  - Matches anything OpenFlow can,
  - Action can be DROP, ALLOW, OUTPUT, MODIFY
- Can install at most places in the pipeline
  - Port-based
  - VLAN-based
  - Inter-VLAN / Routing
  - Policy-based Routing



3rd Party Security Integration

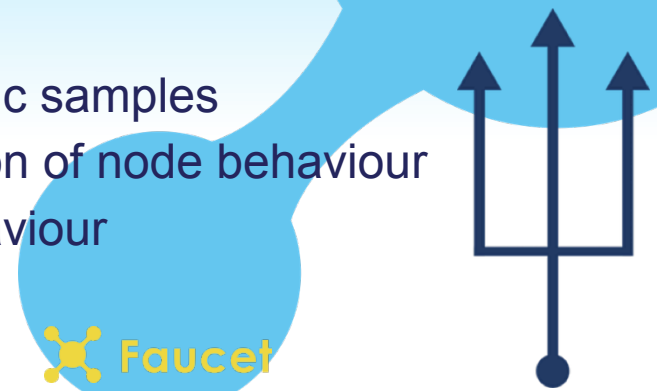
Nozzle - UNSW

DAQ - Google

- Flexible IoT Device Automated Qualification (DAQ) framework
- Extends Faucet test framework to test IoT device behaviour

Poseidon - Cyber Reboot

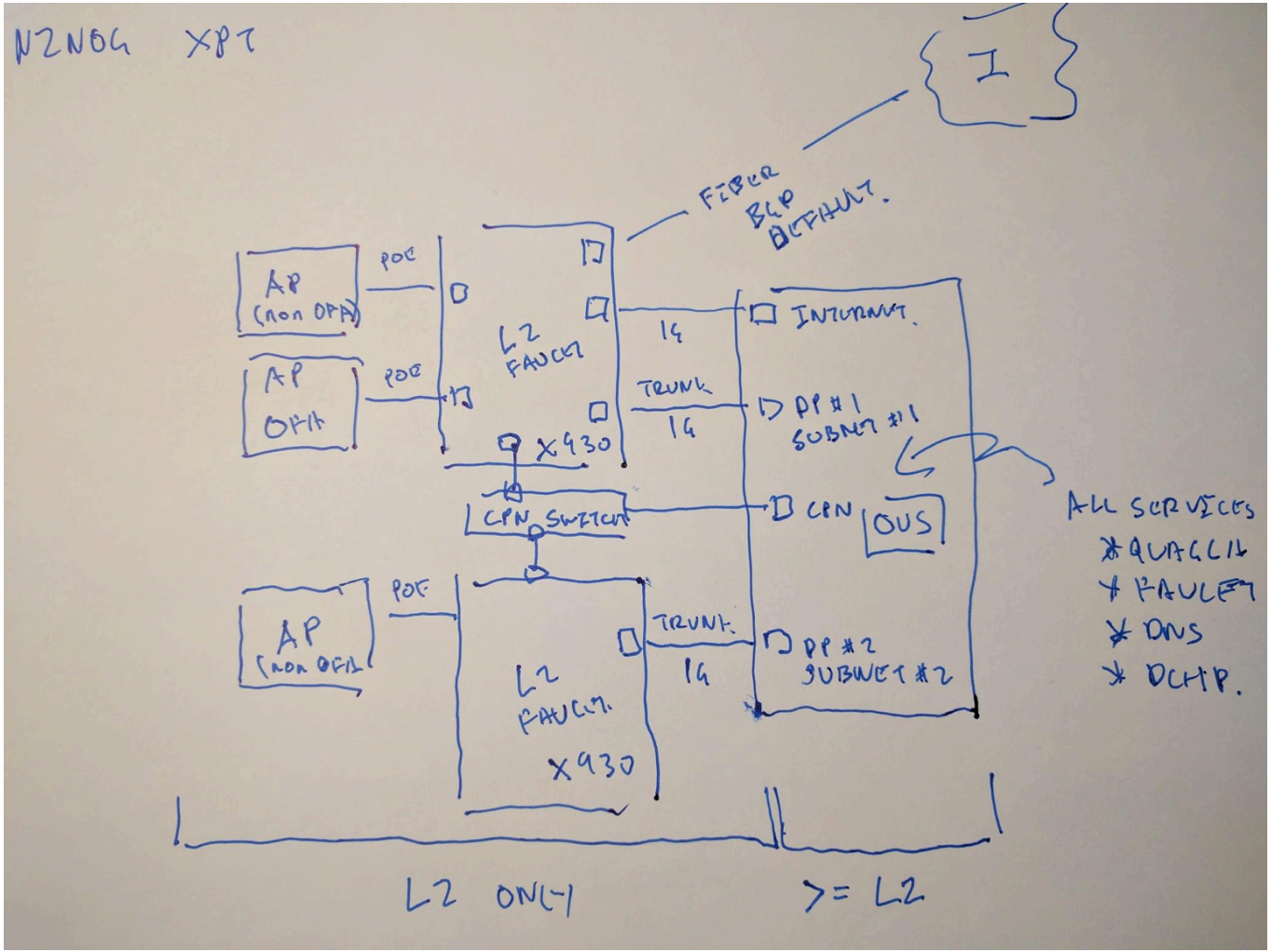
- Uses Faucet events and traffic samples
- Machine learning classification of node behaviour
- Detect changes in node behaviour

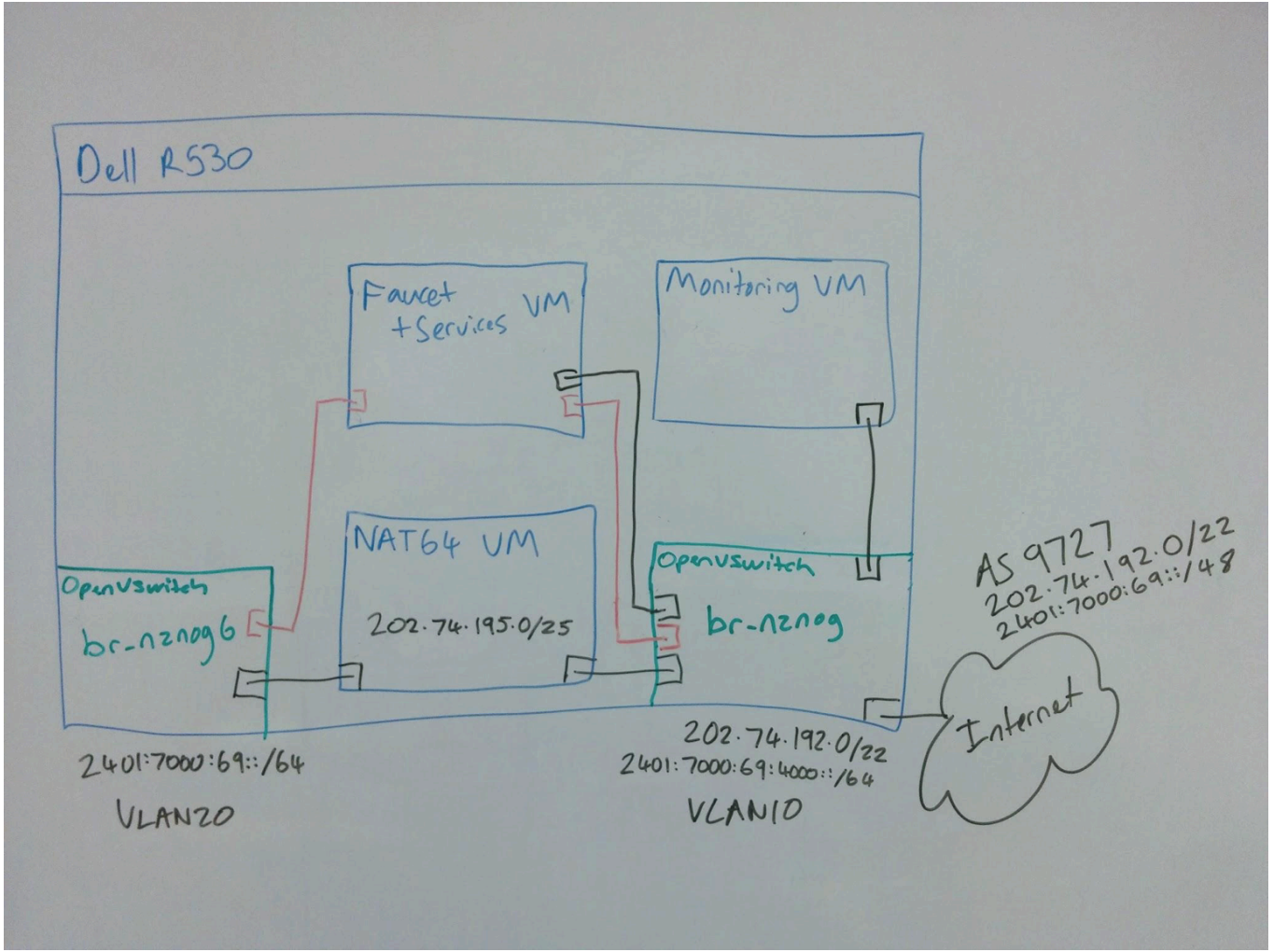


NZNOG 2017

New Zealand Network Operators Group

Faucet


N2NOC XPT
I
FIBER
BGP DEFAULT.
AP (non OPX)
AP OPX
POE
POE
L2 FAUCET
X930
INTERNET.
1G
TRUNK
1G
PP #1 SUBNET #1
CPN SWITCH
CPN
OUS
ALL SERVICES
* QUAGGLE
* FAUCET
* DNS
* DCHP.
AP (non OPX)
POE
TRUNK
1G
PP #2 SUBNET #2
L2 FAUCET
X930
L2 ONLY
>= L2

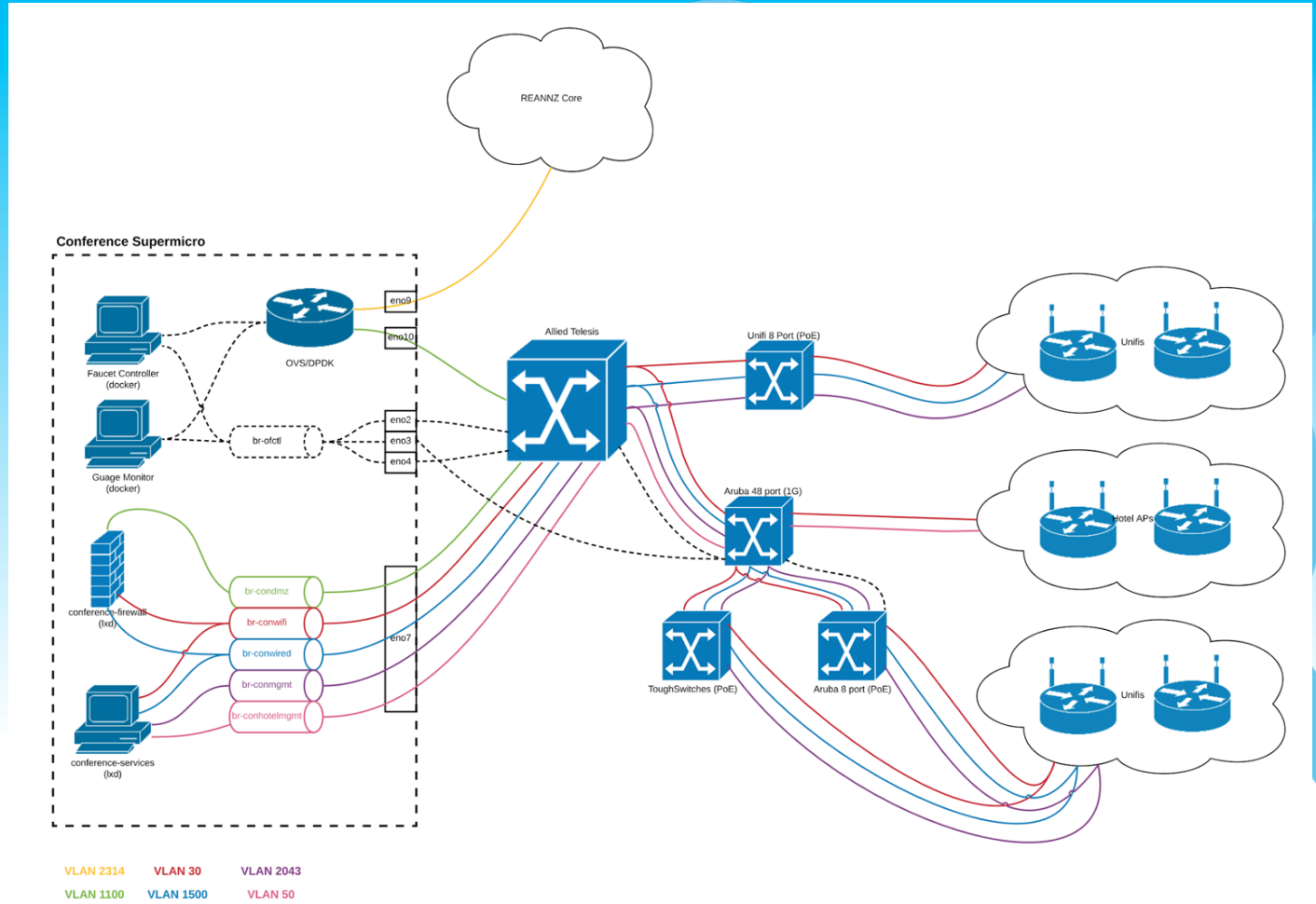

Dell R530
Faucet +Services VM
Monitoring VM
NAT64 VM
202.74.195.0/25
OpenVSwitch
br-nznog6
OpenVSwitch
br-nznog
AS 9727
202.74.192.0/22
2401:7000:69::/48
Internet
202.74.192.0/22
2401:7000:69:4000::/64
VLAN10
2401:7000:69::/64
VLAN20

https://github.com/wandsdn/conference-sdn-nfv-network

3518 commits
+67045 lines
-53666 lines
35 released versions
22 contributors

NZNOG
New Zealand Network Operators Group

2018


REANNZ Core
Conference Supermicro
Faucet Controller (docker)
OVS/DPDK
Guage Monitor (docker)
br-ofctl
conference-firewall (lxd)
conference-services (lxd)
br-condmz
br-conwifi
br-conwired
br-conmgmt
br-conhotelmgmt
eno9
eno10
eno2
eno3
eno4
eno7
Allied Telesis
Unifi 8 Port (PoE)
Aruba 48 port (1G)
ToughSwitches (PoE)
Aruba 8 port (PoE)
Unifis
Hotel APs
Unifis
VLAN 2314
VLAN 30
VLAN 2043
VLAN 1100
VLAN 1500
VLAN 50

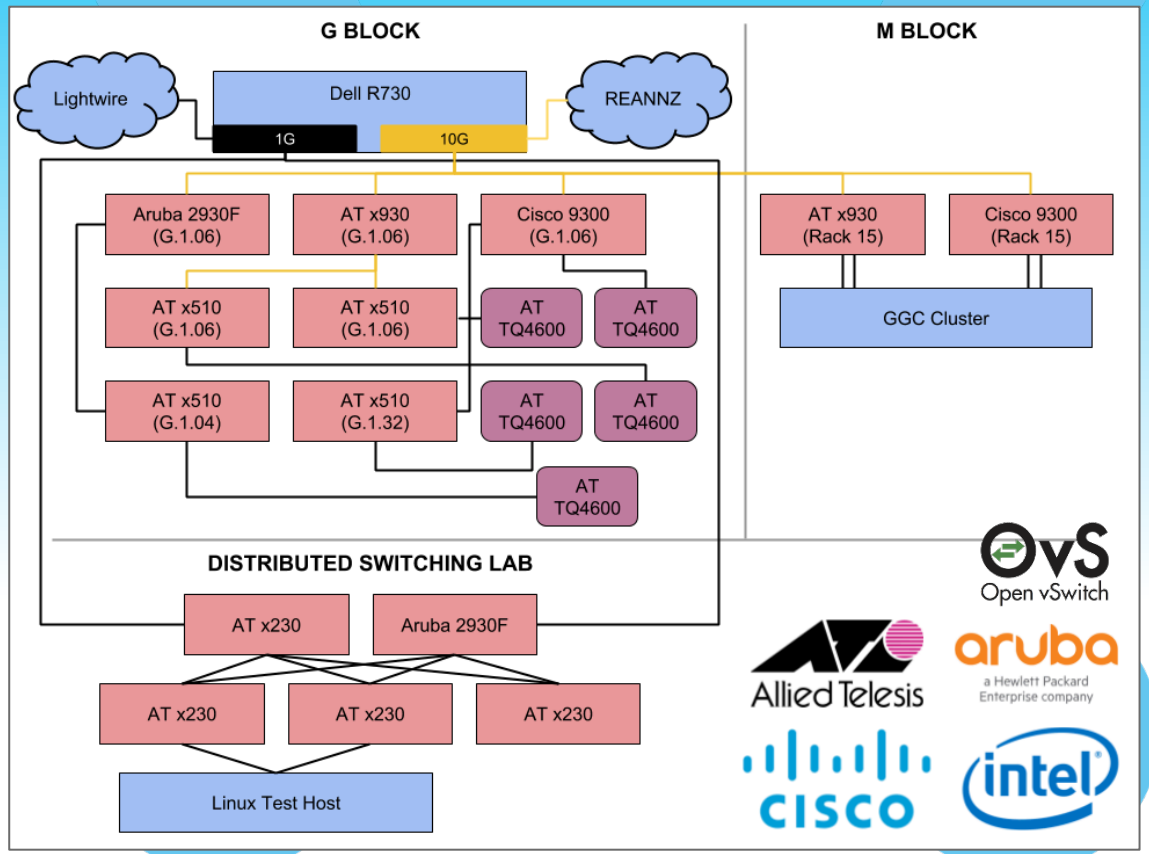
WAND Network

AS 134227
192.107.171.0/24
192.107.172.0/24
2001:df2:9d00::/45
248 OpenFlow ports

https://redcables.wand.nz/

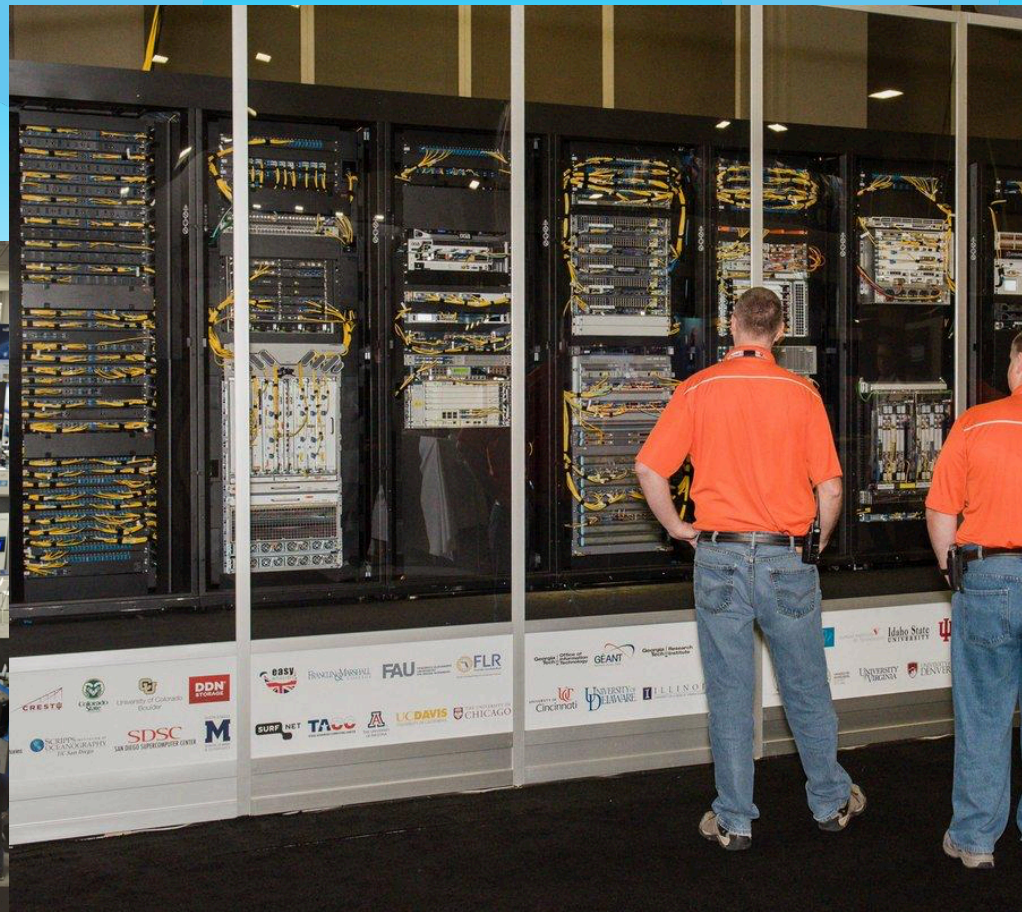
https://grafana.redcables.wand.nz/

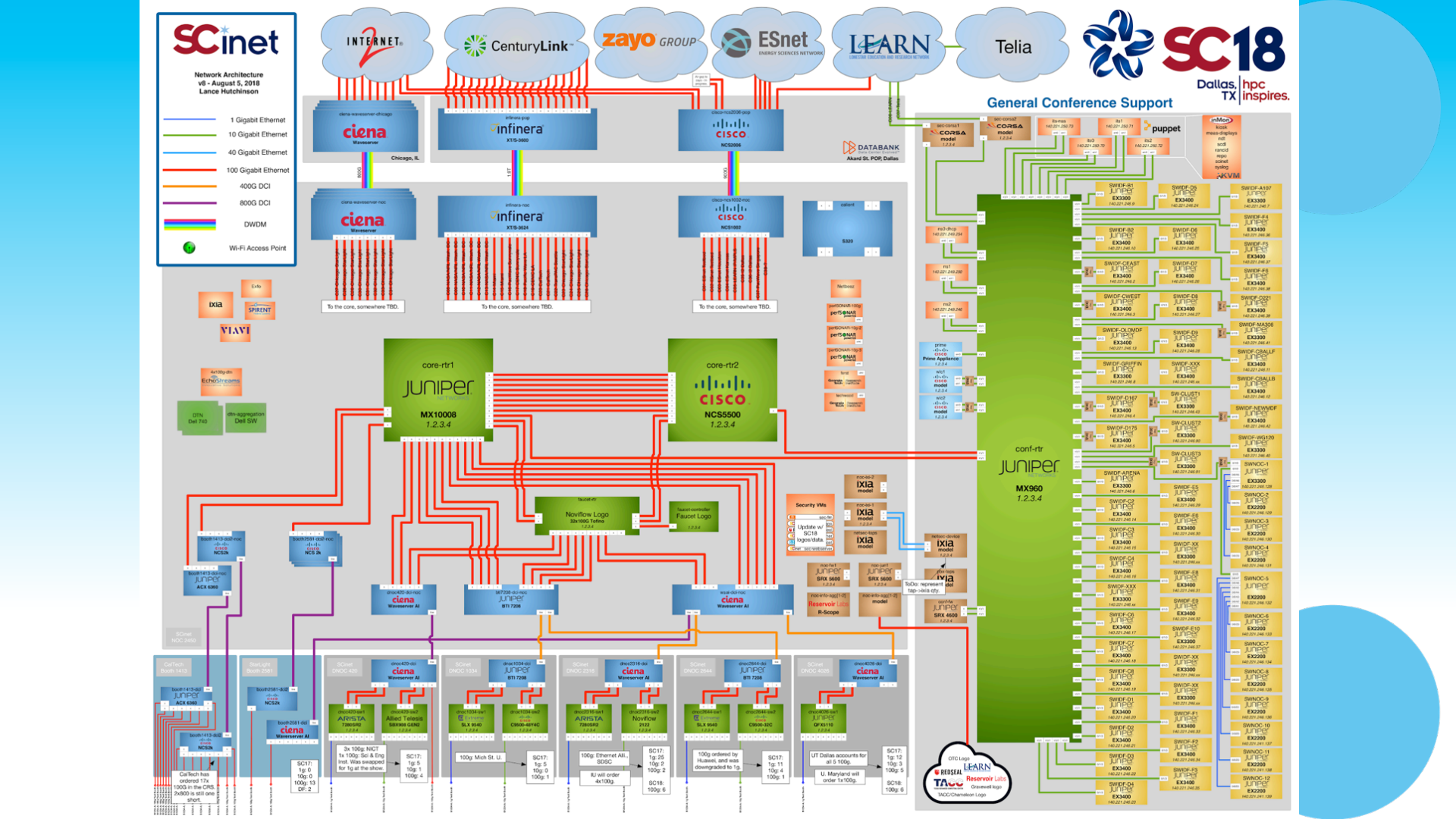
https://github.com/wandsdn/redcables-ansible



SC18

Dallas, TX | hpc inspires.




SCinet
Network Architecture
v8 - August 5, 2018
Lance Hutchinson
1 Gigabit Ethernet
10 Gigabit Ethernet
40 Gigabit Ethernet
100 Gigabit Ethernet
400G DCI
800G DCI
DWDM
Wi-Fi Access Point
INTERNET2
CenturyLink
zayo GROUP
ESnet
ENERGY SCIENCES NETWORK
LEARN
Telia
SC18
Dallas, TX
hpc inspires.
General Conference Support
DATABANK
Akard St. POP, Dallas
Chicago, IL
core-rtr1
JUNIPER
MX10008
1.2.3.4
core-rtr2
CISCO
NCS5500
1.2.3.4
conf-rtr
JUNIPER
MX960
1.2.3.4
Noviflow Logo
32x100G Tofino
Faucet Logo
Security VMs
Update w/ SC18 logos/data
To the core, somewhere TBD.
To the core, somewhere TBD.
To the core, somewhere TBD.
CalTech has ordered 17x 100G in the CRS 2x800 is still one short.
3x 100g: NICT
1x 100g: Sci & Eng Inst. Was swapped for 1g at the show.
100g: Mich St. U.
100g: Ethernet Alli., SDSC
IU will order 4x100g
100g ordered by Huawei, and was downgraded to 1g.
UT Dallas accounts for all 5 100g.
U. Maryland will order 1x100g.
OTC Logo
REDSEAL
LEARN
TACC
Reservoir Labs
TACC/Chameleon Logo

Learn more **http://faucet.nz**

Follow us on Twitter **@faucetsdn**