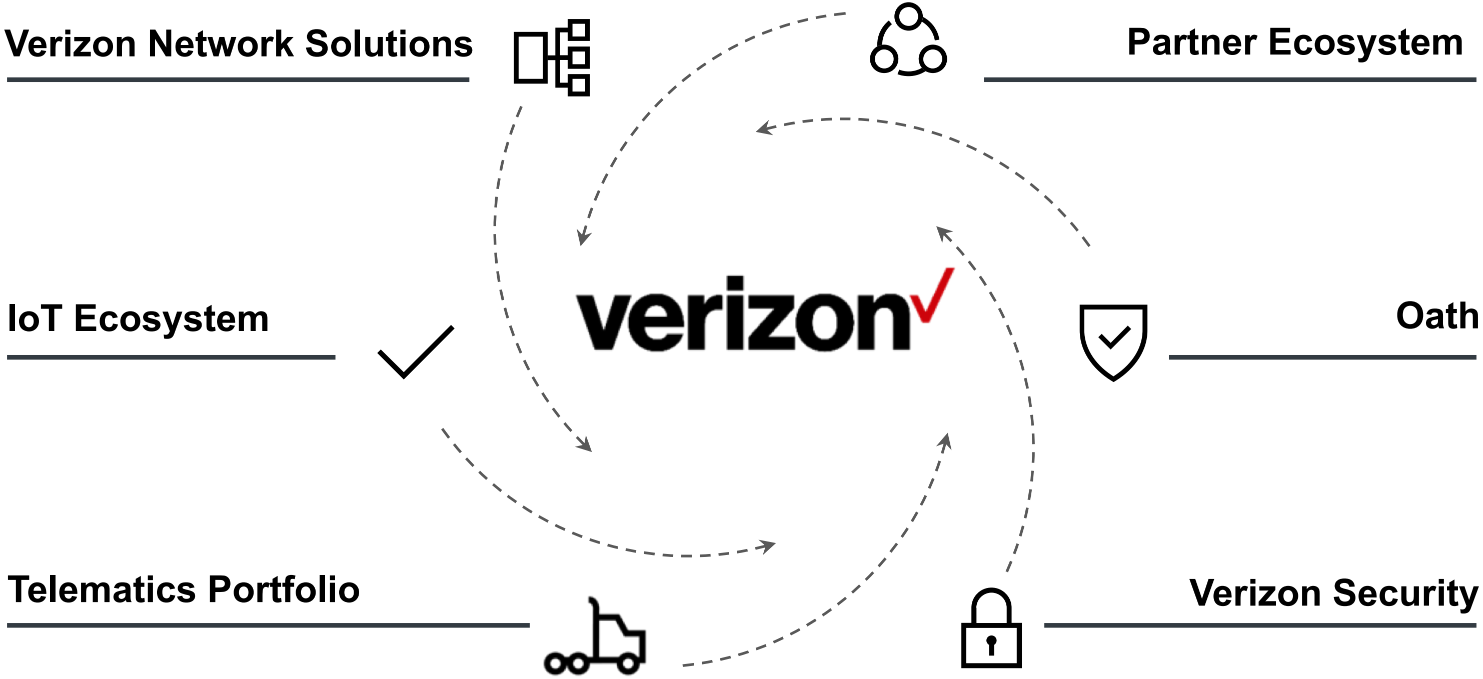
Telematics Container Cloud Platform

TCCP Architecture & Deployment

2018-03-05: Rick Davis

The power of Verizon



Verizon Network Solutions

Partner Ecosystem

IoT Ecosystem

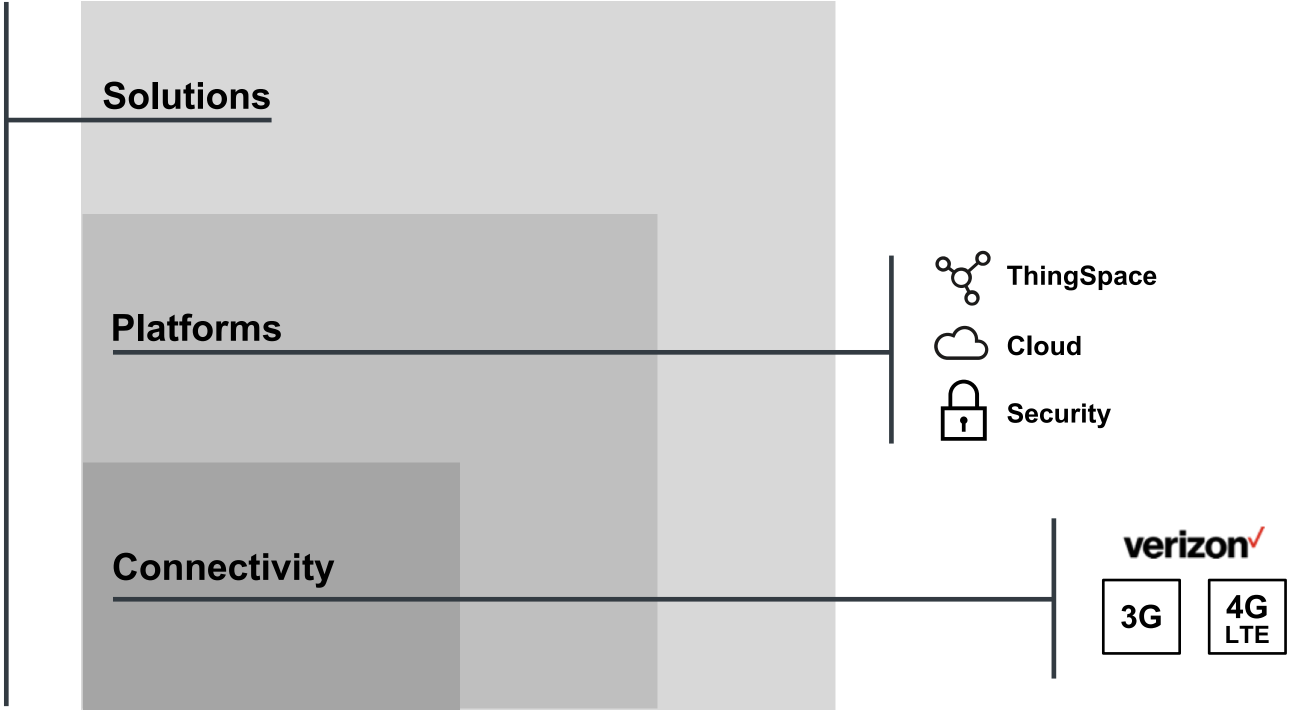
Oath

Telematics Portfolio

Verizon Security

Our technology portfolio is second to none

- IoT-enabled solutions
- Telematics solutions
- Advanced communications
- Managed mobility
- Secure networking



Solutions

Platforms

Connectivity

ThingSpace

Cloud

Security

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Agenda

1. Goals
2. Architecture
3. Automation
4. Collaboration & Lessons Learned
5. Q&A

Goals

What do we want to do?

Business Drivers

Increase Development Velocity

- Monolith to Microservice
- Latest Software Frameworks
- Containerized
- 100% CICD

Increase Infrastructure Velocity

- Site Rebuild & App Deploys < 12hr
- Repeatable/Predictable
- 100% CICD

Future Proofing

- Flexible & Extensible
- Easily Scalable
- Cloud Adaptable & Agnostic

Infrastructure Goals

Architecture

- Cost Conscious
  - Open Hardware
  - Open Source Software, Commercial Support Optional
- Global Deployment Capability w/Vendor Support
- Public & Private Cloud Adaptable

Automation

- Server & Network Provisioning
- Integrated Validations
- Infrastructure-as-Code

Extensibility

- Platform with Swappable Components
- Avoid Lock-in, Everywhere
  - Hardware, Software, and Cloud

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Architecture

How are we going to do it?

Architecture

eBGP Clos Fabric

- One Protocol/Simplified OPS
- Quagga with ECMP on Hosts
- Anycast Support

Open Source Routing Quagga

Spine/Leaf Topology

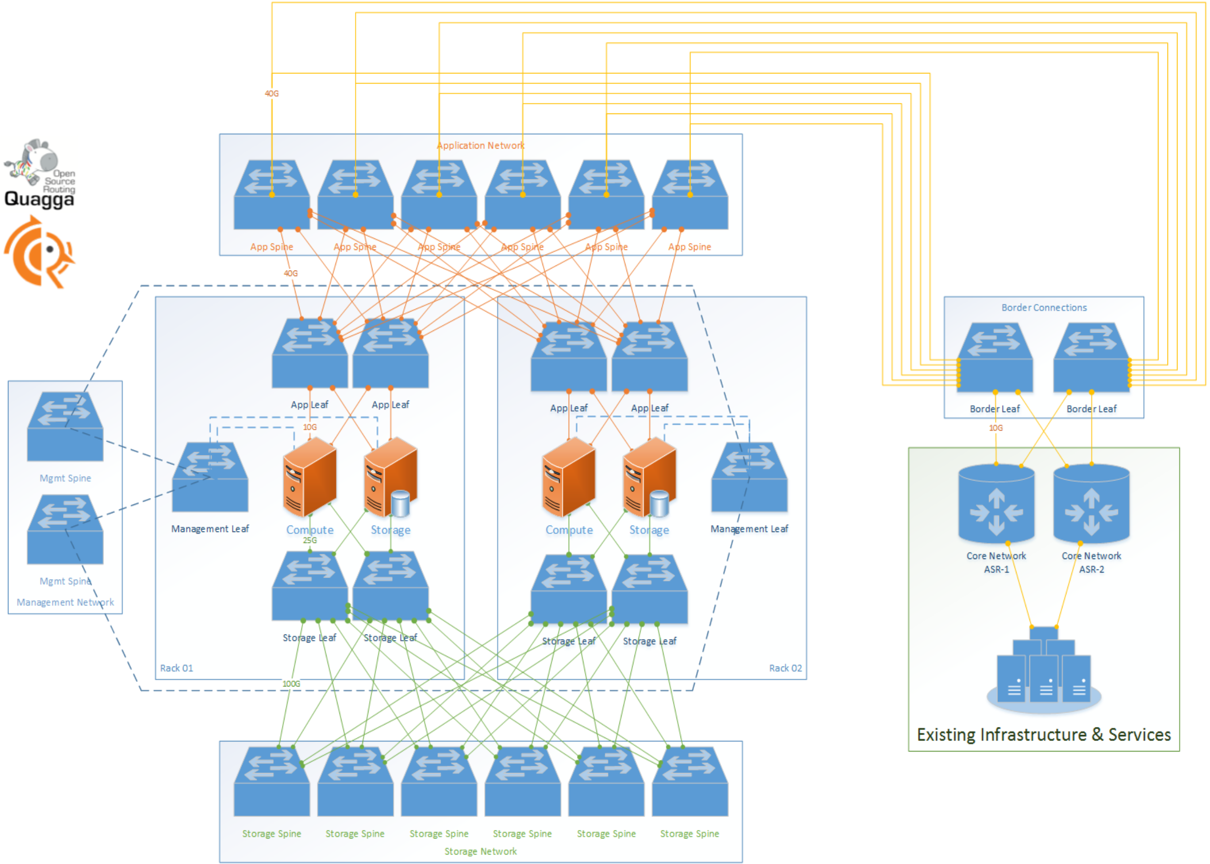
- Dedicated Storage Network
- Dedicated Border/Peering

Simple Scalability

- 100’s of Racks/Site

Open Hardware & Software, Commercial Support Optional

Open Switch



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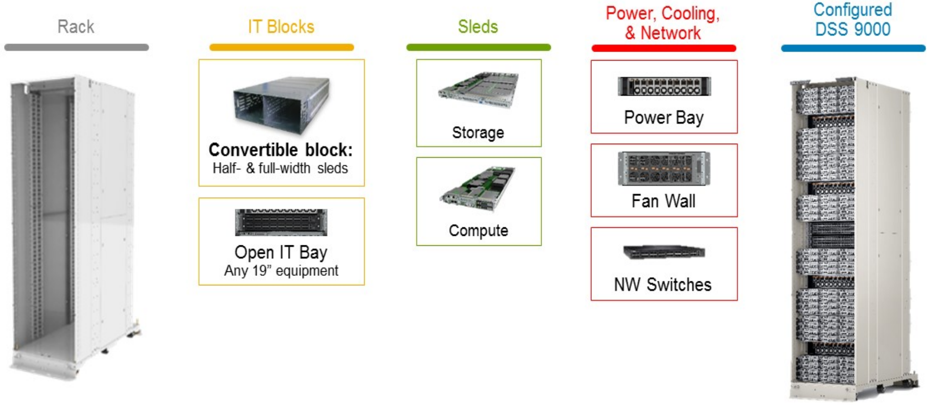
Hardware Platforms

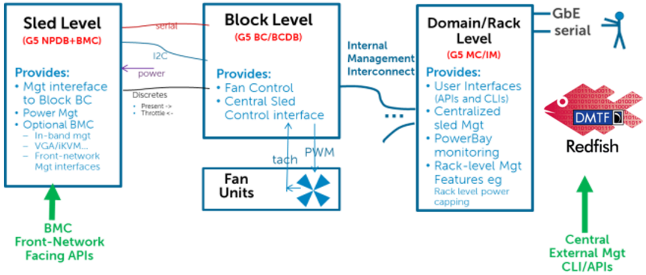
Dell EMC DSS 9000 Servers & Storage

- Open Compute based infrastructure avoids lock-in
- Rack-Level Hyperscale Infrastructure
- Rack-Level Management – IPMI/Redfish
- Flexible Compute & Storage Configurations
- OEM support & reliability, ODM pricing



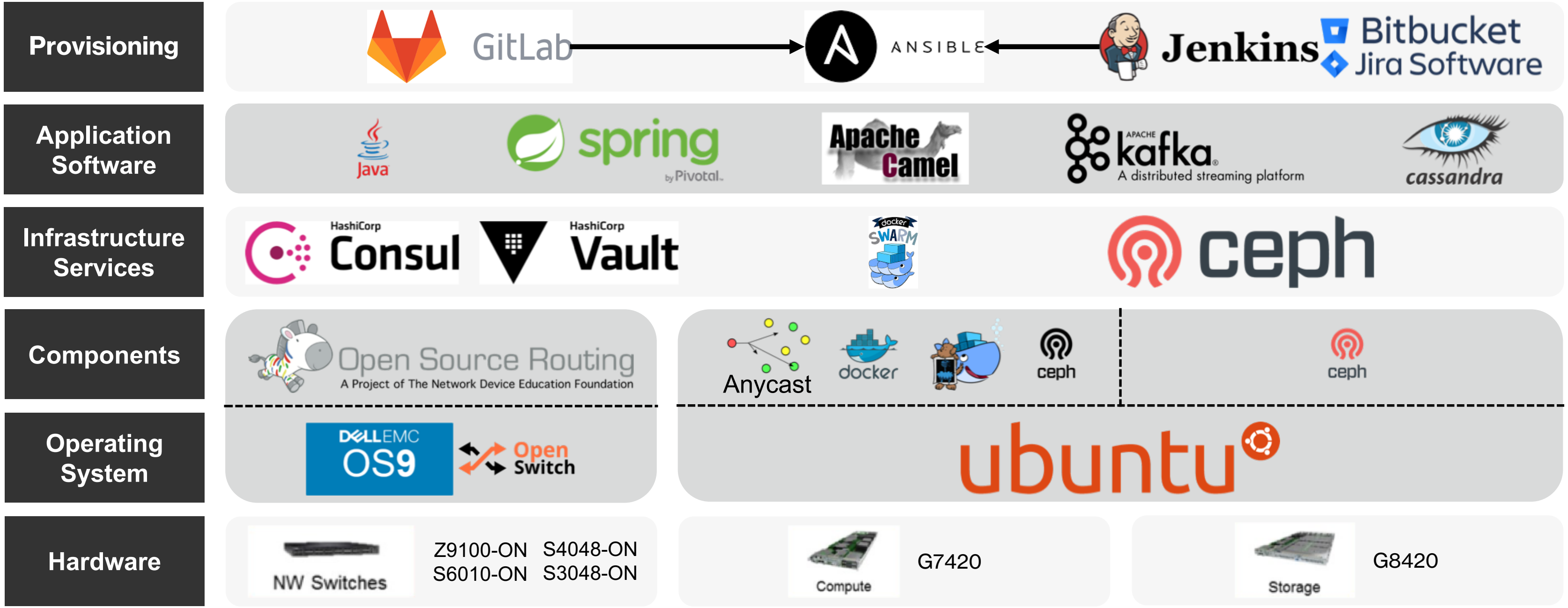
Dell EMC Open Networking Switches

- Swappable Network OS via ONIE
- Latest high performance platform (e.g. Tomahawk 4x25G/100G)
- Commodity silicon avoids vendor lock-in (Z9100 ~= FB Wedge100)
- OEM support & reliability, ODM pricing



Source: Dell EMC ESI

Infrastructure Stack



Provisioning
GitLab → ANSIBLE ← Jenkins
Bitbucket
Jira Software

Application Software
Java
spring by Pivotal
Apache Camel
Apache kafka A distributed streaming platform
cassandra

Infrastructure Services
HashiCorp Consul
HashiCorp Vault
docker SWARM
ceph

Components
Open Source Routing A Project of The Network Device Education Foundation
Anycast
docker
ceph
ceph

Operating System
DELL EMC OS9
Open Switch
ubuntu

Hardware
NW Switches
Z9100-ON S4048-ON
S6010-ON S3048-ON
Compute
G7420
Storage
G8420

Logical Architecture

Service-by-Service Failover

Service-by-Service Isolation

- VXLAN/MACVLAN Isolation
- Line Rate ACL's in Silicon

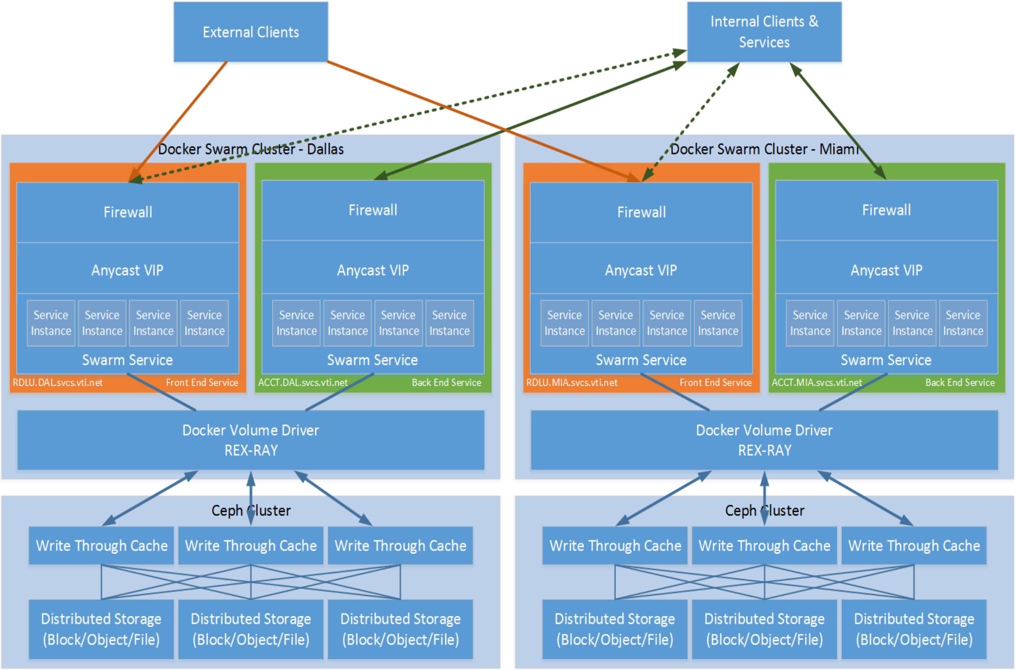
Anycast Load Balancing

Ceph Block/Object/File Store

- Persistent Container Storage via REX-Ray

Independent Clusters

- Failure Domain Isolation
- Site-to-Site Replication in App/DB Control



External Clients

Internal Clients & Services

Docker Swarm Cluster - Dallas

Firewall

Anycast VIP

Service Instance | Service Instance | Service Instance | Service Instance

Swarm Service

RDLU.DAL.svcs.vti.net — Front End Service

Firewall

Anycast VIP

Service Instance | Service Instance | Service Instance | Service Instance

Swarm Service

ACCT.DAL.svcs.vti.net — Back End Service

Docker Volume Driver
REX-RAY

Ceph Cluster

Write Through Cache | Write Through Cache | Write Through Cache

Distributed Storage (Block/Object/File) | Distributed Storage (Block/Object/File) | Distributed Storage (Block/Object/File)

Docker Swarm Cluster - Miami

Firewall

Anycast VIP

Service Instance | Service Instance | Service Instance | Service Instance

Swarm Service

RDLU.MIA.svcs.vti.net — Front End Service

Firewall

Anycast VIP

Service Instance | Service Instance | Service Instance | Service Instance

Swarm Service

ACCT.MIA.svcs.vti.net — Back End Service

Docker Volume Driver
REX-RAY

Ceph Cluster

Write Through Cache | Write Through Cache | Write Through Cache

Distributed Storage (Block/Object/File) | Distributed Storage (Block/Object/File) | Distributed Storage (Block/Object/File)

Docker Swarm – Our Perspective (Early 2016)

Decision Factors

- Developer Simplicity & Talent Pool
- Blue/Green Deployment & Rolling Upgrades
- Network, Volume, Logging Drivers
- API Compatibility & Ecosystem Tools
- Windows/Mac/Linux Hosts
- Windows & Linux Containers

Reduced Complexity

Swappable Components

Large Ecosystem

Sounds good…what if it doesn't work?

Swap Components

- **Need cloud?**
  - Swap provisioning to cloud
- **Need Kubernetes?**
  - Enable in Docker or swap it
- **Need etcd?**
  - Add it or swap it

Handover

- **Certify hardware with other VZ platforms**
- **Handover few racks for platform deployment**
- **Convert apps**
- **Validate, update CICD**
- **Deploy in PROD**
- **Convert remaining racks**

Migrate & Repurpose

- **Validate/convert apps and infrastructure services**
  - Service Discovery, Logging, Monitoring, etc, etc
- **Validate, update CICD**
- **Deploy in PROD**
- **Repurpose existing racks**

Automation

How do we keep doing it?

Automation Goals

Simplified

Fully Automated

Easily Repeatable & Predictable

Zero Touch & Zero Downtime

Standardized

Ansible First

Bash/Python Second

Same CI Pipeline, Every Site

End-to-End

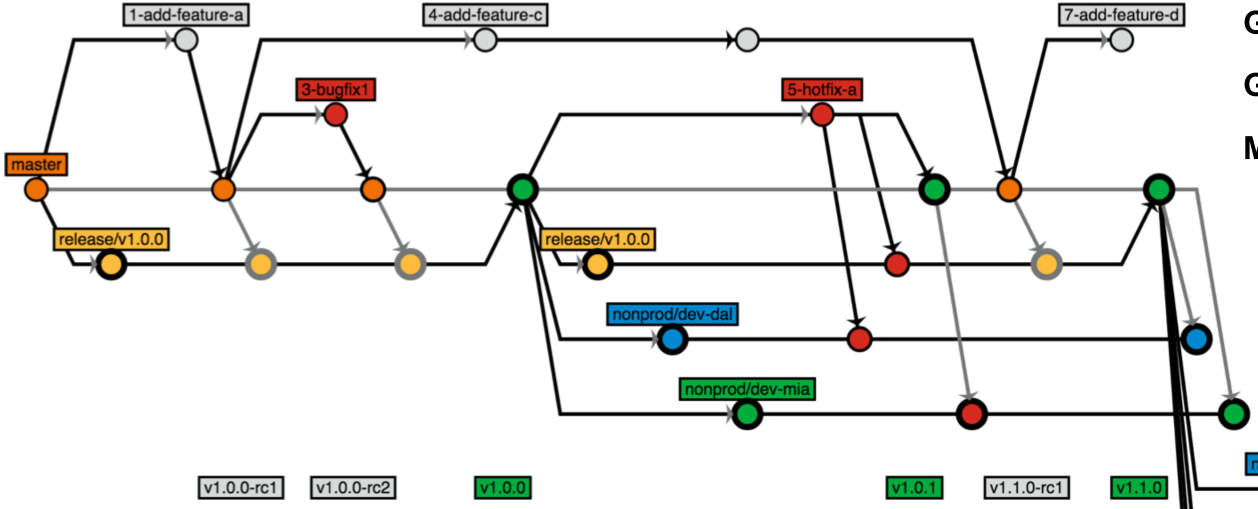
Server AND Network

- Configuration AND Provisioning

Public & Private Cloud Adaptable

Automated Maintenance & Healing

CI Pipeline & Deployment Management



GitLab Flow based model

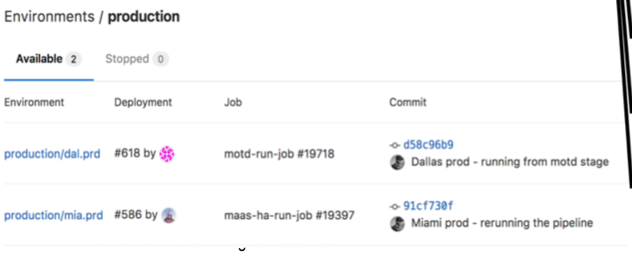
Git Tags = Immutable

Maintenance Automation

Fully Automated: Eliminate human error

Code/OPS/Change Review: Merge Request

Branch Protections: RBAC


Environments / **production**

Environment	Deployment	Job	Commit
production/dal.prd	#618 by	motd-run-job #19718	d58c96b9 Dallas prod - running from motd stage
production/mia.prd	#586 by	maas-ha-run-job #19397	91cf730f Miami prod - rerunning the pipeline

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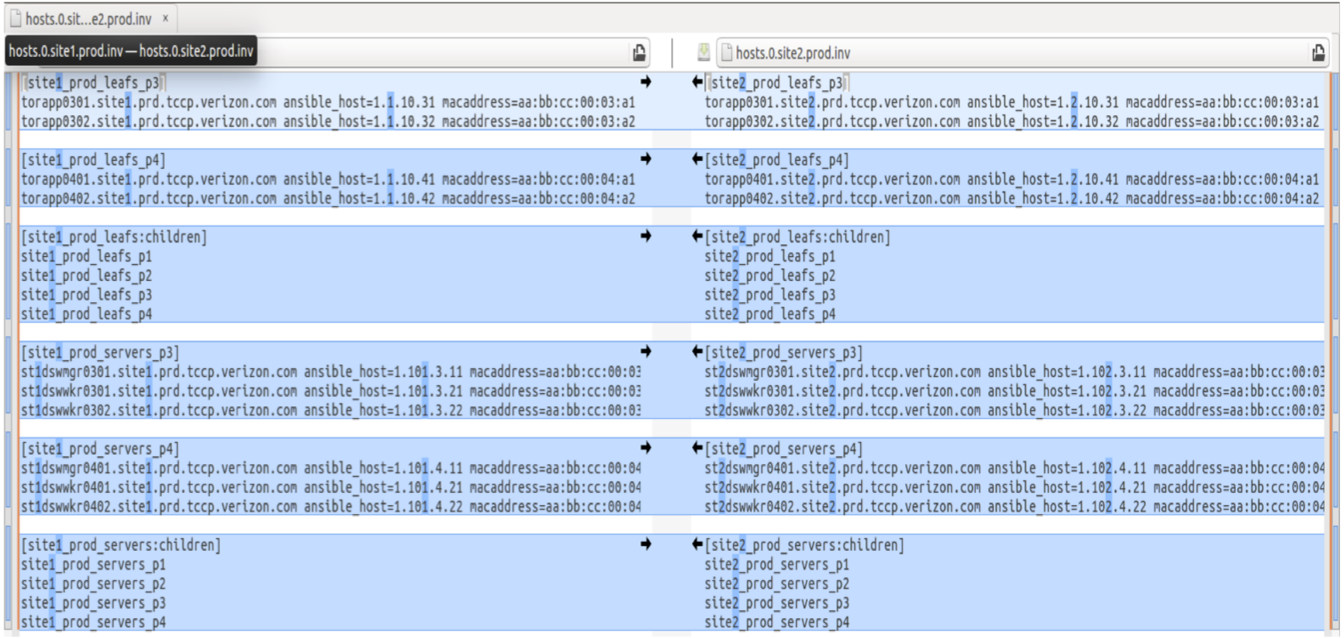
Simple Scalability – Adding Racks

Add rack group (P4)

Update device details

Execute CI Pipeline


hosts.0.sit...e2.prod.inv ×
hosts.0.site1.prod.inv — hosts.0.site2.prod.inv
hosts.0.site2.prod.inv

```
[site1_prod_leafs_p3]
torapp0301.site1.prd.tccp.verizon.com ansible_host=1.1.10.31 macaddress=aa:bb:cc:00:03:a1
torapp0302.site1.prd.tccp.verizon.com ansible_host=1.1.10.32 macaddress=aa:bb:cc:00:03:a2

[site1_prod_leafs_p4]
torapp0401.site1.prd.tccp.verizon.com ansible_host=1.1.10.41 macaddress=aa:bb:cc:00:04:a1
torapp0402.site1.prd.tccp.verizon.com ansible_host=1.1.10.42 macaddress=aa:bb:cc:00:04:a2

[site1_prod_leafs:children]
site1_prod_leafs_p1
site1_prod_leafs_p2
site1_prod_leafs_p3
site1_prod_leafs_p4

[site1_prod_servers_p3]
st1dswmgr0301.site1.prd.tccp.verizon.com ansible_host=1.101.3.11 macaddress=aa:bb:cc:00:03
st1dswwkr0301.site1.prd.tccp.verizon.com ansible_host=1.101.3.21 macaddress=aa:bb:cc:00:03
st1dswwkr0302.site1.prd.tccp.verizon.com ansible_host=1.101.3.22 macaddress=aa:bb:cc:00:03

[site1_prod_servers_p4]
st1dswmgr0401.site1.prd.tccp.verizon.com ansible_host=1.101.4.11 macaddress=aa:bb:cc:00:04
st1dswwkr0401.site1.prd.tccp.verizon.com ansible_host=1.101.4.21 macaddress=aa:bb:cc:00:04
st1dswwkr0402.site1.prd.tccp.verizon.com ansible_host=1.101.4.22 macaddress=aa:bb:cc:00:04

[site1_prod_servers:children]
site1_prod_servers_p1
site1_prod_servers_p2
site1_prod_servers_p3
site1_prod_servers_p4
```

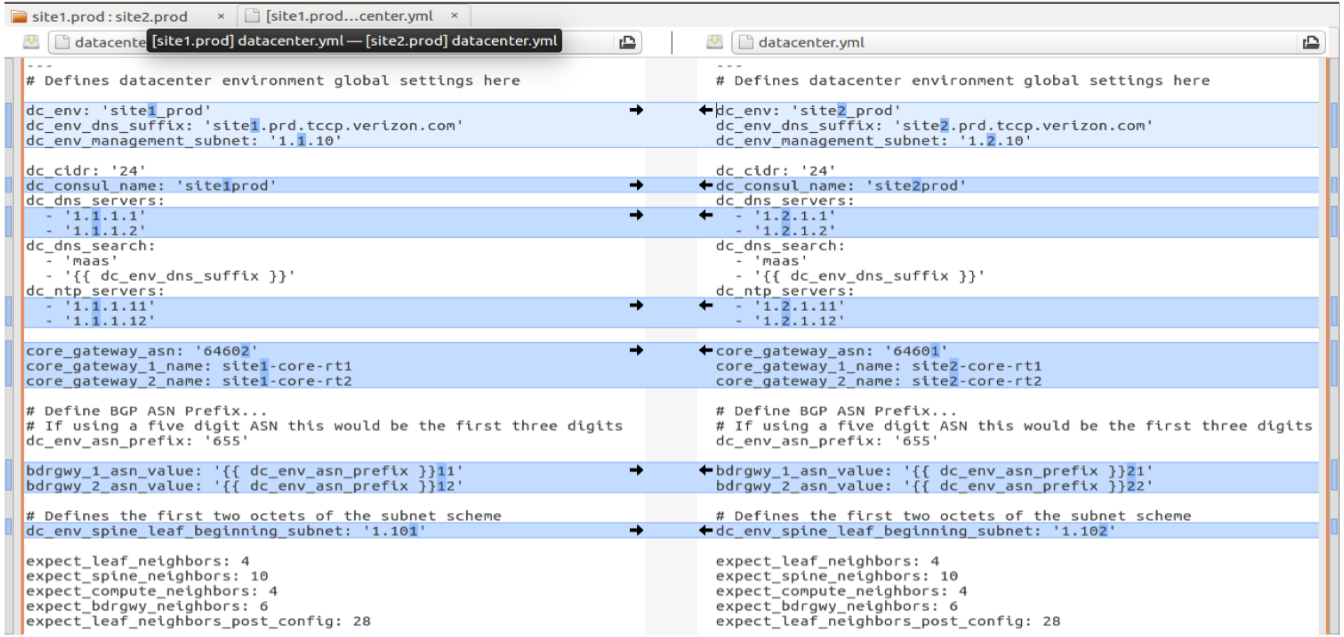
```
[site2_prod_leafs_p3]
torapp0301.site2.prd.tccp.verizon.com ansible_host=1.2.10.31 macaddress=aa:bb:cc:00:03:a1
torapp0302.site2.prd.tccp.verizon.com ansible_host=1.2.10.32 macaddress=aa:bb:cc:00:03:a2

[site2_prod_leafs_p4]
torapp0401.site2.prd.tccp.verizon.com ansible_host=1.2.10.41 macaddress=aa:bb:cc:00:04:a1
torapp0402.site2.prd.tccp.verizon.com ansible_host=1.2.10.42 macaddress=aa:bb:cc:00:04:a2

[site2_prod_leafs:children]
site2_prod_leafs_p1
site2_prod_leafs_p2
site2_prod_leafs_p3
site2_prod_leafs_p4

[site2_prod_servers_p3]
st2dswmgr0301.site2.prd.tccp.verizon.com ansible_host=1.102.3.11 macaddress=aa:bb:cc:00:03
st2dswwkr0301.site2.prd.tccp.verizon.com ansible_host=1.102.3.21 macaddress=aa:bb:cc:00:03
st2dswwkr0302.site2.prd.tccp.verizon.com ansible_host=1.102.3.22 macaddress=aa:bb:cc:00:03

[site2_prod_servers_p4]
st2dswmgr0401.site2.prd.tccp.verizon.com ansible_host=1.102.4.11 macaddress=aa:bb:cc:00:04
st2dswwkr0401.site2.prd.tccp.verizon.com ansible_host=1.102.4.21 macaddress=aa:bb:cc:00:04
st2dswwkr0402.site2.prd.tccp.verizon.com ansible_host=1.102.4.22 macaddress=aa:bb:cc:00:04

[site2_prod_servers:children]
site2_prod_servers_p1
site2_prod_servers_p2
site2_prod_servers_p3
site2_prod_servers_p4
```

Simple Scalability – Adding Sites

Add datacenter config

Add racks

Execute CI Pipeline



```
---
# Defines datacenter environment global settings here

dc_env: 'site1_prod'
dc_env_dns_suffix: 'site1.prd.tccp.verizon.com'
dc_env_management_subnet: '1.1.10'

dc_cidr: '24'
dc_consul_name: 'site1prod'
dc_dns_servers:
  - '1.1.1.1'
  - '1.1.1.2'
dc_dns_search:
  - 'maas'
  - '{{ dc_env_dns_suffix }}'
dc_ntp_servers:
  - '1.1.1.11'
  - '1.1.1.12'

core_gateway_asn: '64602'
core_gateway_1_name: site1-core-rt1
core_gateway_2_name: site1-core-rt2

# Define BGP ASN Prefix...
# If using a five digit ASN this would be the first three digits
dc_env_asn_prefix: '655'

bdrgwy_1_asn_value: '{{ dc_env_asn_prefix }}11'
bdrgwy_2_asn_value: '{{ dc_env_asn_prefix }}12'

# Defines the first two octets of the subnet scheme
dc_env_spine_leaf_beginning_subnet: '1.101'

expect_leaf_neighbors: 4
expect_spine_neighbors: 10
expect_compute_neighbors: 4
expect_bdrgwy_neighbors: 6
expect_leaf_neighbors_post_config: 28
```

```
---
# Defines datacenter environment global settings here

dc_env: 'site2_prod'
dc_env_dns_suffix: 'site2.prd.tccp.verizon.com'
dc_env_management_subnet: '1.2.10'

dc_cidr: '24'
dc_consul_name: 'site2prod'
dc_dns_servers:
  - '1.2.1.1'
  - '1.2.1.2'
dc_dns_search:
  - 'maas'
  - '{{ dc_env_dns_suffix }}'
dc_ntp_servers:
  - '1.2.1.11'
  - '1.2.1.12'

core_gateway_asn: '64601'
core_gateway_1_name: site2-core-rt1
core_gateway_2_name: site2-core-rt2

# Define BGP ASN Prefix...
# If using a five digit ASN this would be the first three digits
dc_env_asn_prefix: '655'

bdrgwy_1_asn_value: '{{ dc_env_asn_prefix }}21'
bdrgwy_2_asn_value: '{{ dc_env_asn_prefix }}22'

# Defines the first two octets of the subnet scheme
dc_env_spine_leaf_beginning_subnet: '1.102'

expect_leaf_neighbors: 4
expect_spine_neighbors: 10
expect_compute_neighbors: 4
expect_bdrgwy_neighbors: 6
expect_leaf_neighbors_post_config: 28
```

verizon connect

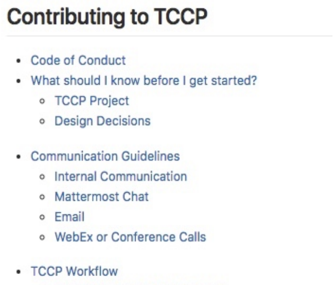
Collaboration & Lessons Learned

What should we have done?

Collaboration

Collaboration

- Issues/Merge Requests, Milestones, and Boards
- GitLab Flow Based Model
- Source Controlled CI
- Reusable repositories

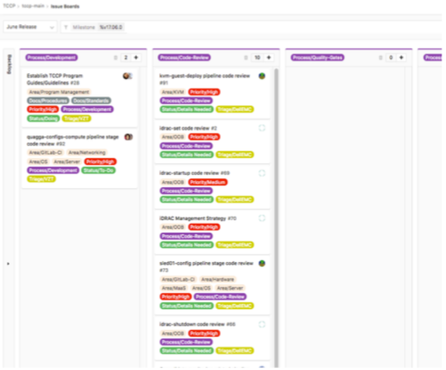


Contributing to TCCP

- Code of Conduct
- What should I know before I get started?
  - TCCP Project
  - Design Decisions
- Communication Guidelines
  - Internal Communication
  - Mattermost Chat
  - Email
  - WebEx or Conference Calls
- TCCP Workflow

Communication

- Wiki & GitLab Pages
- ChatOps
- CI Analytics



TCCP › tccp-main › Issue Boards

June Release | Milestone %v17.06.0

Process/Development 2

Establish TCCP Program Guides/Guidelines #28

quagga-configs-compute pipeline stage code review #92

Process/Code-Review 10

kvm-guest-deploy pipeline code review #91

idrac-set code review #2

idrac-startup code review #69

iDRAC Management Strategy #70

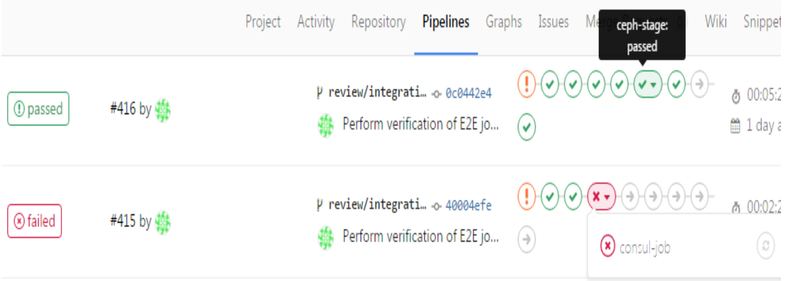
sled01-config pipeline stage code review #73

idrac-shutdown code review #66

Process/Quality-Gates 0

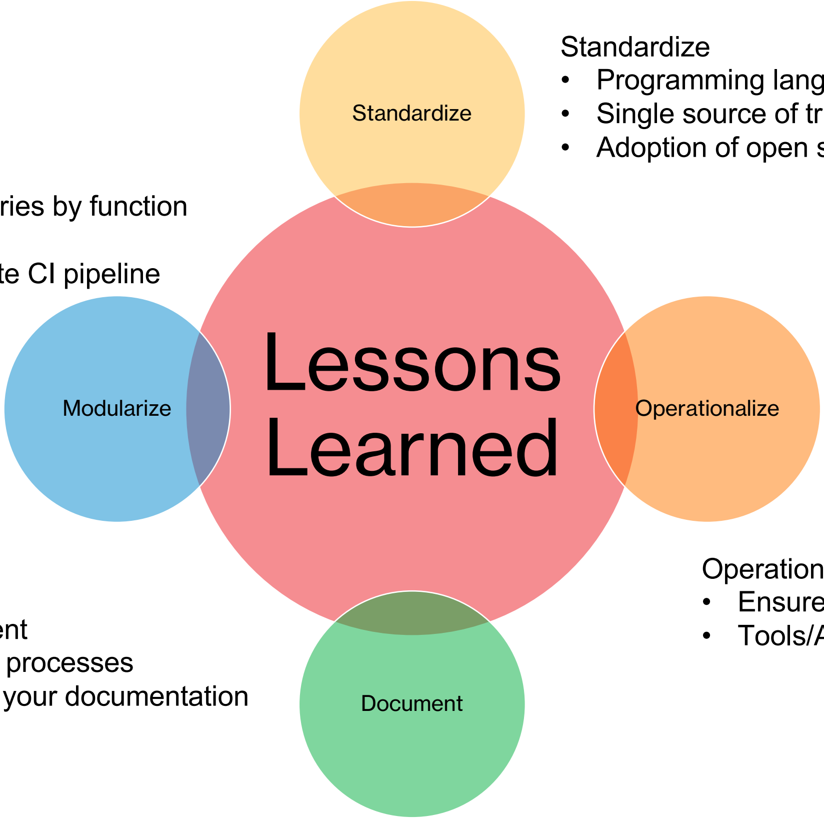
Flexibility

- Single Solution, Multiple Integrations
- Push & Pull Git Mirroring
- Granular Permissions by Team/Group/Project
- Multi-project CI pipelines



passed #416 by review/integrati… 0c0442e4 Perform verification of E2E jo… 00:05:2 1 day a

failed #415 by review/integrati… 40004efe Perform verification of E2E jo… 00:02:2 consul-job



Standardize

- Programming language
- Single source of truth – Ansible inventory
- Adoption of open source roles

Modularize

- Separate repositories by function
- Consolidate roles
- Logically segregate CI pipeline

Operationalize

- Ensure idempotency
- Tools/Alerts/Dashboards in roles

- Document
- Change processes
- Code is your documentation

Q&A

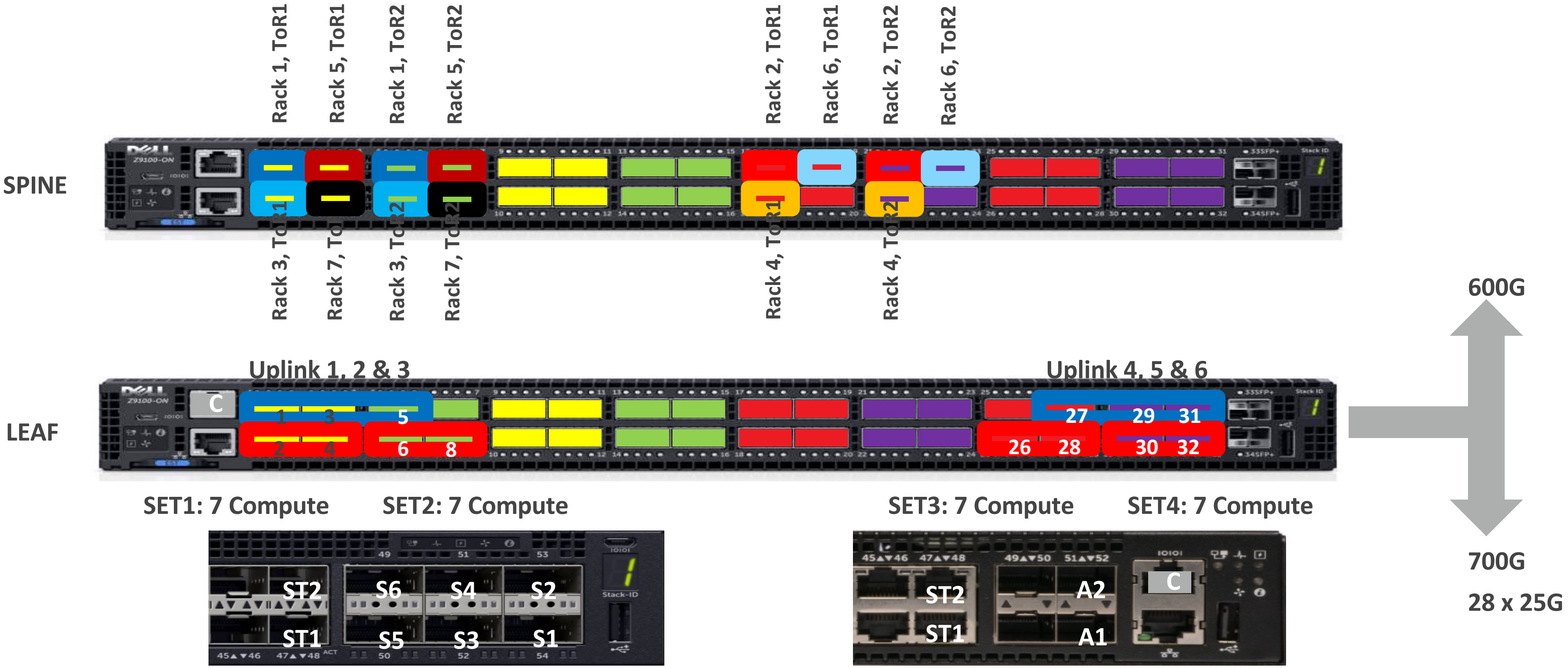
verizon✓
connect

Thank you.

verizon✓
connect

BACKUP

Z9100 Port Mapping & Buffer Zone Utilization



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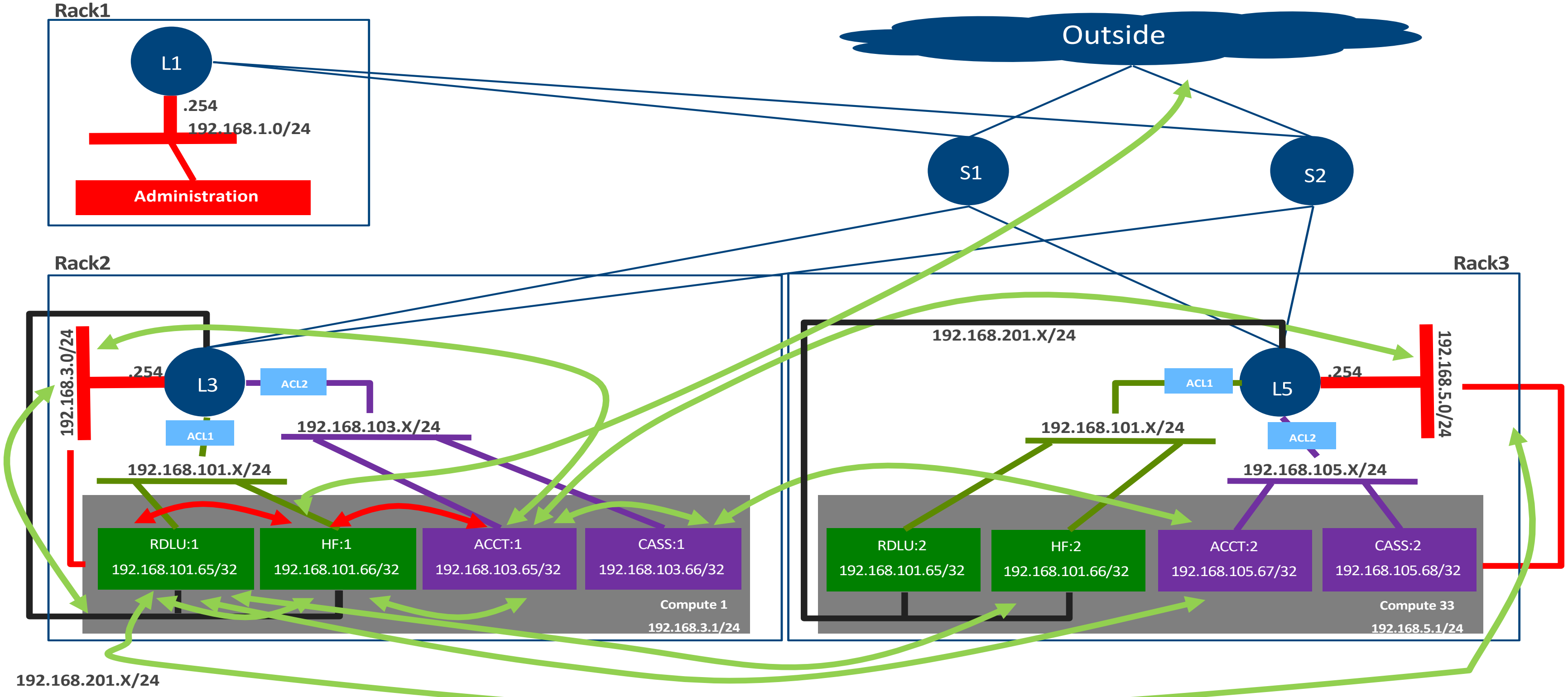
MACVLAN & Anycast is Easy :)


Rack1
L1
.254
192.168.1.0/24
Administration
Outside
S1
S2
Rack2
Rack3
192.168.3.0/24
.254
L3
ACL2
ACL1
192.168.103.X/24
192.168.101.X/24
192.168.201.X/24
ACL1
L5
.254
192.168.5.0/24
192.168.101.X/24
ACL2
192.168.105.X/24
RDLU:1
192.168.101.65/32
HF:1
192.168.101.66/32
ACCT:1
192.168.103.65/32
CASS:1
192.168.103.66/32
Compute 1
192.168.3.1/24
RDLU:2
192.168.101.65/32
HF:2
192.168.101.66/32
ACCT:2
192.168.105.67/32
CASS:2
192.168.105.68/32
Compute 33
192.168.5.1/24
192.168.201.X/24