Open. Together.

OCP SUMMIT
Open Networking (white box) in the Enterprise

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Why am I here?

To share Open Networking experiences from an enterprise perspective (non hyperscale)

Matt Turner Bio
- CCIE 16857 (Emeritus) Routing and Switching
- Data Center Network Manager at Qualcomm Inc.

Qualcomm Network Bio
- 30+ data centers (~850 switches, spine/leaf topologies)
- Many LAN & LAB switches (~2700)
- Dedicated “NetDevOps” team 😊
What is Open Networking?

- Disaggregation, White Box, VNF’s, controllers, ONF?
  - Depends who you’re talking to.
  - For Qualcomm, Open Networking is White/Brite Box+ONIE+Software

- ONIE = Open Network Install Environment (OCP open source initiative)
  - Cumulus
  - Big Switch Monitoring Fabric
  - OpenSwitch (OPX)
  - SONic
  - JunOS
Why Open Networking

• $uper exciting!
  • Roughly 33% the cost of traditional networking
    • (discounted rate)
• Disaggregation allows flexibility
  • Big Switch BMF and Cumulus today, tomorrow?
• Linux is easier to automate than Cisco/Arista/Junos/etc
  • Ansible/Chef/Puppet built for Linux, adapted for networking
• Great way to transition from **pets to cattle** approach for network switch provisioning and MGMT
• Open Linux platform (install collectd if you like...)
Lots of Lab Testing and Evaluation...

• Decided on Cumulus for networking, Big Switch Monitoring Fabric

• Cool network features
  • BGP/OSPF Unnumbered (IPv6 link local peering)
  • BGP Redistribute Neighbor (redistribute ARP table into BGP /32 routes)
  • Cumulus NCLU (meh... for some, CLI alternative for others)

• Cool monitoring fabric features
  • OpenFlow (behind the scenes) controller based
  • ZTP/DHCP capable
What About Hardware?

- Common hardware on vendor HCL’s
- Keep spares in stock vs purchasing hardware support
- Support for many brands of optics and cables
- Same chips, CPU as traditional vendors
  - Broadcom ASICs, Intel or AMD CPU, etc.
Building Blocks for Success

• ONIE, Zero Touch Provisioning (ZTP)
  • ONIE boot, ZTP using DHCP options and default URL (114)

• Git, GitHub
  • Version control for ZTP, operations playbooks, global switch configurations

• Jenkins
  • CI/CD platform for centralized Ansible controller
  • Splunk logging, RBAC, store credentials, cron, GUI!

• Ansible (or Chef, Puppet, Salt)
  • We prefer Ansible for use with legacy vendor hardware/OS (agentless)
Framework – GitHub/Jenkins/Ansible

- Initially deployed for Open Networking (Cumulus)
- Playbooks stored in GitHub for version control, change MGMT, and code/peer review
- Playbooks run from Jenkins for centralization, security, auditing, logs, etc. (logs all jobs and results to Splunk)
- Ansible and associated plugins/modules installed on Jenkins server
What We Automate

• Almost everything...
• ZTP for bring up
  • DHCP MAC reservation, DHCP default URL for image load
• Ansible for initial configuration
• API for user self service (rack and stack team, server/storage admins)
  • Add/change VLANs for access ports
  • Create MLAG
  • Add/change VLANs for existing MLAG ports
• Ansible for weekly global configuration compliance (declarative, no audit needed)
  • E.g. NTP servers shall be x, y, z

Do Automation Day One!
Zero Touch Provisioning

subnet 192.168.0.0 netmask 255.255.255.0 {
  range 192.168.0.20 192.168.0.200;
  option domain-name-servers 192.168.0.2;
  option routers 192.168.0.3;
  option default-url = "http://10.0.0.10/customer-abc-onie-installer";
ONIE Boot – ZTP

Info: Mounting ONIE-BOOT on /mnt/onie-boot ...
Info: Mounting EFI System on /boot/efi ...
Info: Using eth0 MAC address: 3c:2c:30:38:ed:00
Info: eth0: Checking link... up.
Info: Trying DHCPv4 on interface: eth0
ONIE: Using DHCPv4 addr: eth0: 10.1.19.221 / 255.255.255.224

Please press Enter to activate this console. Info: eth0: Checking link... up.
Info: Trying DHCPv4 on interface: eth0
ONIE: Using DHCPv4 addr: eth0: 10.1.19.221 / 255.255.255.224
ONIE: Starting ONIE Service Discovery
Info: Fetching http://10.43.255.182/cumulus/cumulus-linux-3.7.0-bcm-amd64.bin ...
[ 21.497593] random: crng init done
ONIE: Executing installer: http://10.43.255.182/cumulus/cumulus-linux-3.7.0-bcm-amd64.bin
Verifying image checksum ...OK.
Preparing image archive ... OK.

Please reboot to start installing OS.
ONIE: NOS install successful: http://10.43.255.182/cumulus/cumulus-linux-3.7.0-bcm-amd64.bin
ONIE: Rebooting...
Framework

```
- hosts: cumulus
  gather_facts: no
tasks:
```

16:07:02 changed: [san-af145-sbx-sw-c501]
16:07:02 changed: [san-af145-sbx-sw-c502]
16:07:02 TASK [change_password_for_****_account] *****************************************
16:07:02 changed: [san-af145-sbx-sw-c501]
16:07:02 changed: [san-af145-sbx-sw-c502]
16:07:02 PLAY RECAP *****************************************
16:07:02 san-af145-sbx-sw-c501 : ok=24 changed=24 unreachable=0 failed=0
16:07:02 san-af145-sbx-sw-c502 : ok=24 changed=24 unreachable=0 failed=0
16:07:02 No emails were triggered.
16:07:02 Finished: SUCCESS
# Day Two Automation – Self Service Tools

## ITOS

**Device Hostname:**

- san-af155-dor-sw-03

---

## Table of Device Information

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<th>Name</th>
<th>Description</th>
<th>VLAN</th>
<th>Config Speed</th>
<th>Op Speed</th>
<th>Op Status</th>
<th>Admin Status</th>
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Obstacles to Overcome

• “Where’s my config-t?”
• Upper MGMT directors are/were CCIE’s, “Who do I call for support?”
• Legacy Network Management and Monitoring Tools
  • RSA/ACS – challenging to set up at first
  • SNMP – mostly works
  • Config Repo (HPNA Opsware for Cisco/Arista, GitHub/Jenkins for Cumulus)
• Change in mindset from a single config file, to Linux “net-sysadmin”
  • IMO this evolution needs to occur anyway for OpenStack, K8s, etc.. (Linux networking)
Non-Critical and Simple Deployments First

• OoB Data Center Network (switch mgmt.) - copper
• OoB Server Network (iLO/DRAC/MGMT) - copper
• Lab/Test/Dev Environments – fiber and copper
• LAN Access – copper PoE for fun and testing (works fine)
• Simple Critical Environments - HPC-LSF Top of Rack
  • Only requires BGP, LACP, MLAG
  • 80-96 servers per rack
  • QSFP Twinax cables to 4x25G SFP+
Test Network

• Have at least one...

• Vagrant/VirtualBox works well for us
  • Pre-canned topologies, stored in GitHub/GitLab
  • Great for learning, testing, planning for changes, developing automation

• Physical lab setup for optics, monitoring, etc. testing
Lessons Learned

• Adoption can be tough for seasoned network engineers
  • Need to learn Linux, Git/GitHub version control, CI/CD tools like Jenkins
  • Should learn Ansible/Puppet/Chef
  • Need to let go of the “config t”

• Linux experience very beneficial
• Automation required, day one
• Cattle instead of pets mindset
• Switch VM’s are great learning and testing tools
• https://github.com/mattincarlsbad
Conclusion

• Enterprises can:
  • Deploy and run white box switches
  • Save money by doing so
  • Usher in the new era of Linux networking

• As long as they...
  • Start in the lab
  • Start small
  • Don’t expect “config t”
  • Keep an open mind
Pets vs Cattle...
Open. Together.

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