Open Networking (white box) in the Enterprise

One Year in. Lessons learned, and way ahead.
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
Which Hardware?

- Accton/Edgecore hardware initially, Dell hardware now
  - Snap in rack rails!
- 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)
• 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 ...

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

Branch: master
ansible-cumulus-switch-deploy / main.yml

mattt Update main.yml

2 contributors

203 lines (165 sloc) 5.1 KB

1 - hosts: cumulus
2  gather_facts: no
3  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
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
16:07:02 No emails were triggered.
16:07:02 Finished: SUCCESS
## Day Two Automation – Self Service Tools

### ITOS

#### Device Hostname:

- **san-if155-dcr-sw-03**

**Table:**

<table>
<thead>
<tr>
<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>
</tr>
</thead>
<tbody>
<tr>
<td>bridge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>eth0</td>
<td>OOB_MGMT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>swp1</td>
<td>BLCAF155-C9-1A</td>
<td>550</td>
<td></td>
<td></td>
<td>up</td>
<td>up</td>
</tr>
<tr>
<td>swp2</td>
<td>BLCAF155-C9-2A</td>
<td>550</td>
<td></td>
<td></td>
<td>up</td>
<td>up</td>
</tr>
<tr>
<td>swp3</td>
<td>BLCAF155-C10-2A</td>
<td>550</td>
<td></td>
<td></td>
<td>up</td>
<td>up</td>
</tr>
<tr>
<td>swp4</td>
<td>BLCAF155-C10-1A</td>
<td>550</td>
<td></td>
<td></td>
<td>up</td>
<td>up</td>
</tr>
<tr>
<td>swp5</td>
<td>oa-blca155-waves01a-new</td>
<td>550</td>
<td></td>
<td></td>
<td>up</td>
<td>up</td>
</tr>
<tr>
<td>swp6</td>
<td>daniel_testing_itos-2</td>
<td>116</td>
<td></td>
<td></td>
<td>down</td>
<td>down</td>
</tr>
<tr>
<td>swp7</td>
<td>daniel_testing_itos-2</td>
<td>130</td>
<td></td>
<td></td>
<td>down</td>
<td>down</td>
</tr>
</tbody>
</table>
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](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
Questions?

Pets vs Cattle...