Open Networking Hardware and Software

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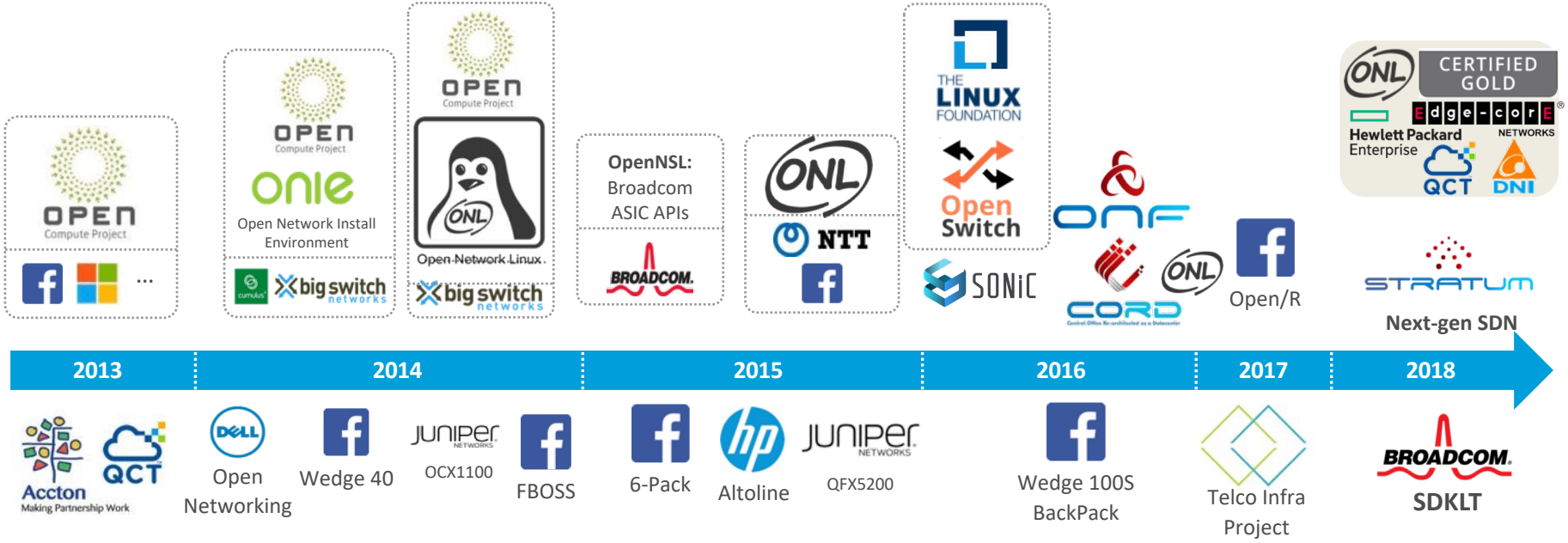
What is Open Networking?

- Open Networking includes:
  - Open Networking Hardware (Switches)
    - Dell ON Series, HPE Altoline (Brite-Box)
    - Edge-Core, Quanta, Mellanox (White-Box)
  - Open Networking Software (NOS)
    - Microsoft Azure SONiC
    - Open Network Linux + Network API (SAI, OpenNSL)
      - Supports FBOSS, Arrcus, Stratum, etc
    - OpenSwitch (OPX)

Brief History of Open Networking



"By 2020, we expect 22% of data center Ethernet switches to be either white-box or brite-box switches, with disaggregated hardware-software stack" -- Gartner Research (Jan 2017)

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Why Open Networking from 2013+?

- There has always been some level of open networking on the public Internet (e.g. Zebra)
- This talk focuses on when open networking hardware and software became mainstream and easy to use i.e. around the release of ONIE and ONL

The Importance of ONIE in Open Networking

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Before ONIE – A Few Hurdles

- Open switch and remove CF/SD Card
- Make image of CF/SD Card
- Put CF/SD Card back in switch
- Boot switch into diagnostic mode
- Mount CF/SD Card
- Copy/Uncompress image on to CF/SD Card
- Set bootloader arguments
  - set cfcard_bootcmd2 'setenv bootargs root=/dev/hda1 rw noinitrd console=ttyS0,$baudrate; ext2load ide 0:1 0x1000000 boot/uImage;ext2load ide 0:1 0x400000 boot/LB9A.dtb;bootm 1000000 – 400000'
  - set bootcmd 'run cfcard_bootcmd2'
- Save and reset to enjoy new image

After ONIE

- Install ONIE via USB (if not already installed)
- Boot switch and choose from
  - ONIE: Install OS
  - ONIE: Rescue (drop to shell)
  - ONIE: Uninstall OS
  - ONIE: Update ONIE
- Done

The Importance of ONL in Open Networking

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ONL

- The first fully open source network operating system with support for hardware switches
- Supports a diverse set of platforms (e.g. Edge-Core, Dell, HPE) and chip vendors (e.g Broadcom, Barefoot, Mellanox)
- Used in many projects such as Stratum and CoRD
- Accelerates commercial NOS development: Big Switch, SnapRoute, Arrcus

ONL Certified Program

- A no cost certification program for switch vendors who have ported their devices to ONL
- Provides multiple options including a Gold level where the switches are tested on a routine basis
- All testing is automatic and uses real hardware
- Current Gold members: DNI, Edge-Core, HPE and Quanta

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Open Networking Hardware

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Types of Open Networking Hardware

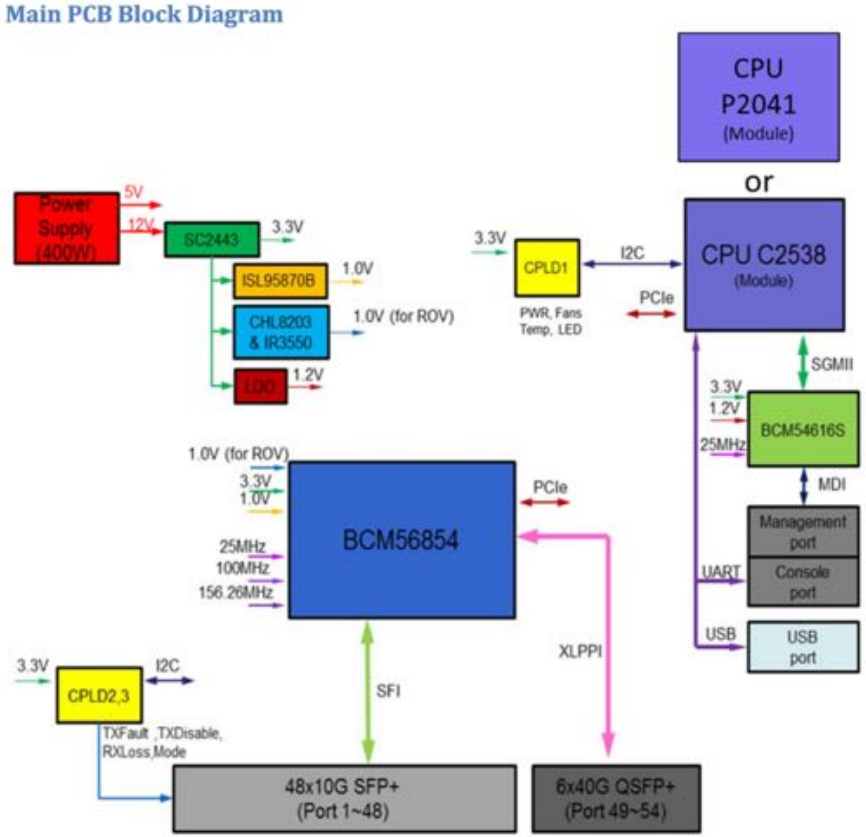
- White-Box
  - Generic switches with hardware support
  - Generally come with ONIE and no NOS
- Brite-Box
  - Branded, supported switches sold by big name vendors such as Dell and HPE
  - Generally come with vendors NOS but can run other networking operating systems
  - Note: Many Brite-Box switches are re-branded White-Box switches

What Makes Hardware Open?

- Open can stand for several things from the ability to install a different NOS to making full design packages available to the public

- The best representation comes from the Open Compute Project Networking Group
  - Founded in 2013
  - Hardware Design contributors include: Edge-Core, Quanta, Facebook, Mellanox and others.
  - All submitted designs are open and include the necessary data to construct the network device

Edge-Core AS5712-54X Specs



Open Networking Software

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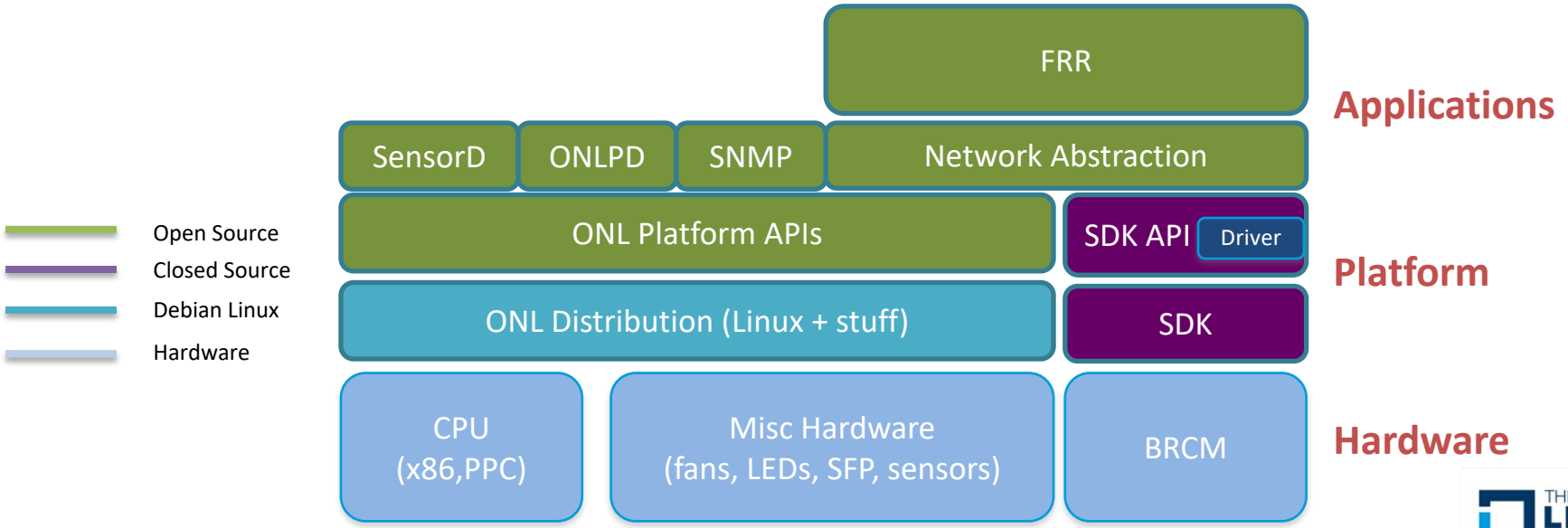
What Makes Networking Software Open?

- Open Source Network Operating Systems
  - Generally based on Debian Linux (OPX, SONiC, ONL, etc.)
  - Provide hardware and network abstraction
  - Use Open Source networking stacks such as FRR or BIRD
  - Most all have some non-open dependencies such as forwarding ASIC API/SDK for network abstraction
    - Note: SAI is the first cross platform open source switch abstraction

Anatomy of an Open Source NOS



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NOS Components Are Not All OSS But Getting Better

Most chip vendors only allow binary versions of their switch abstraction interfaces with a documented open API. But with SAI we are seeing changes:

Broadcom

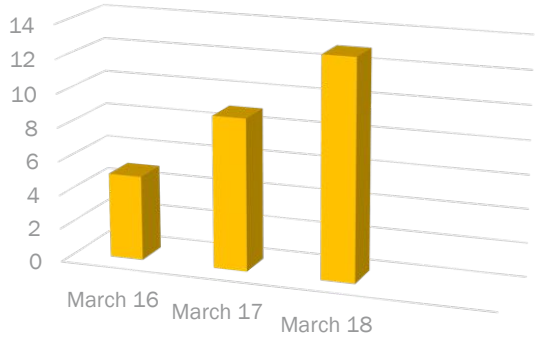
- OpenNSL (Open API)
- OF-DPA (Open API)
- SAI (Open API)
- SDKLT (Open Source)

Others:

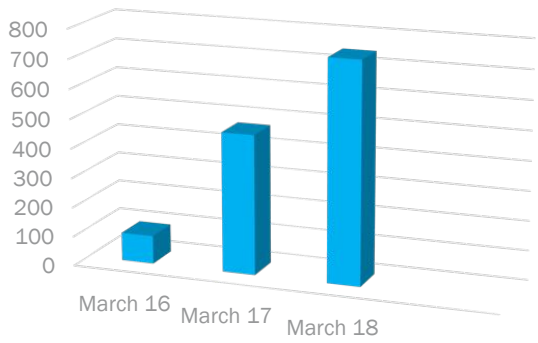
- Cavium OpenXPS (Open Source, SAI compatible)
- Mellanox SAI

SAI – Building an Open ASIC Abstraction

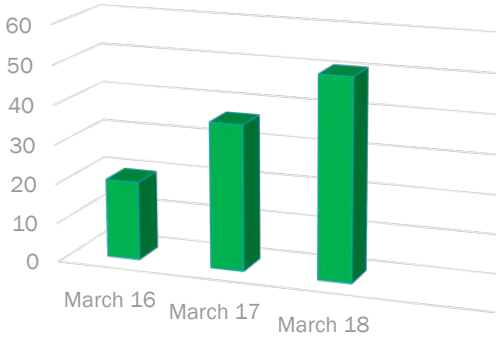
Organizations

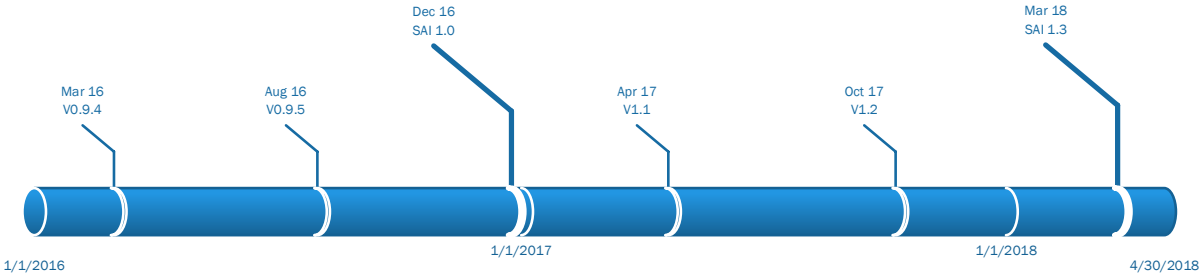


Commits



Proposals





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Linux Foundation Networking

Linux Foundation Networking Subprojects

- OpenSwitch (OPX)
  - Debian + Dell Control Plane Services (CPS) + Quagga/FRR
- CoRD
  - ONOS Controller with Indigo agent on switches
- FRR
  - Routing suite used by most open networking software
- Stratum
  - P4 based NOS contributed by Google to the ONF

Open Compute Project Networking

Open Compute Networking (OCP) Subprojects

- ONIE – Open Network Install Environment
  - Tiny Linux environment that allows for installation/removal/debugging of NOS
- Open Networking Linux (ONL)
  - Switch OS with platform support (ONLP)
  - Used by Arrcus, Snaproute, IOS-XR
- SAI - Switch Abstraction Interface
  - Cross Platform Switch API
- SONiC
  - Microsoft / Azure NOS used by Alibaba, Tencent and many others

OPX, ONL and SONiC

- Platform Support
  - SONiC Supports 33 devices
  - OPX Supports 14 devices
  - ONL Supports 71 devices
- L3
  - Using Quagga moving to FRR
- L2
  - Basic L2 Support: VLANS, LLDP

ONL Spreading Across Many Platforms

NTT NOS Project

Specialized Routing Agent

Leverage ONL + SONiC on Edge-Core Cassini with NTT Electronics DSPs.

Google

Hyperscaler NOS Stack

Rapidly leverage open hardware ecosystem with modular NOS approach

CORD

Telco Central Office Stack

Leverage white-box ecosystem with ONL platform software for open leaf-spine fabric for central offices

STRATUM

Open-source NG-SDN switching platform

Leveraging ONL as as part of open reference platform for “software-defined” data plane

Big Monitoring Fabric

Big Cloud Fabric

BSN’s Commercial SDN Fabric Solutions

Hardened ONL versions for supported open networking hardware

ONL

Leveraged By: Arrcus, Snaproute and IOS-XR

ONL Currently Supports 71 Different Network Devices

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Future of Open Networking?

- Large vendors recognize importance of OS NOS (e.g. Cisco IOS-XR w/ ONLP)
- Increased customer requirement for Open Source NOS driving adoption (ONL, FRR, SONiC, etc)
- SAI included as default in most Open Source NOS
- Expansion of ONL platform ecosystem (currently 71 systems)
- Emergence of P4, NPL and other network programming languages.

Questions?

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