Open Hardware and Open Networking Software

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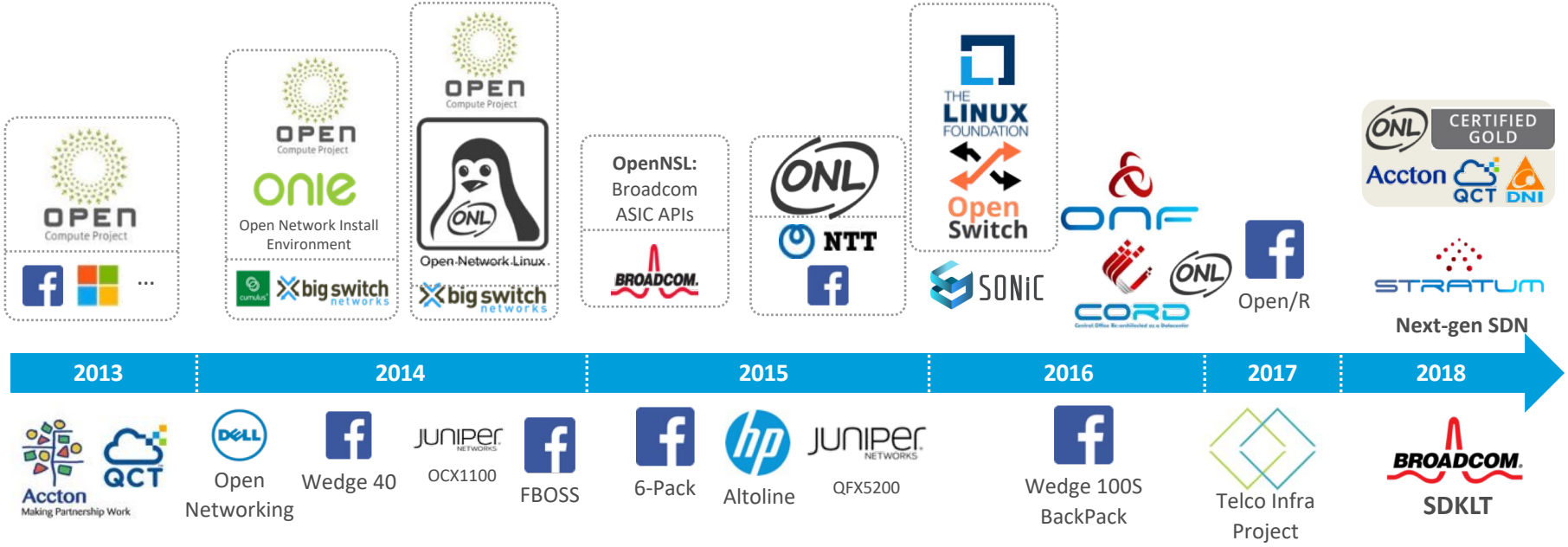
What is Open Networking?

- Open Networking includes:
  - Open Hardware (Switches)
    - Dell ON Series, HPE Altoline (Brite-Box)
    - Edge-Core, Quanta, Mellanox (White-Box)
  - Open Software (Network Operating System)
    - Microsoft Azure SONiC
    - Open Network Linux + Network API (SAI, OpenNSL)
    - 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

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

Open Networking Hardware

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Types of Open Networking Hardware

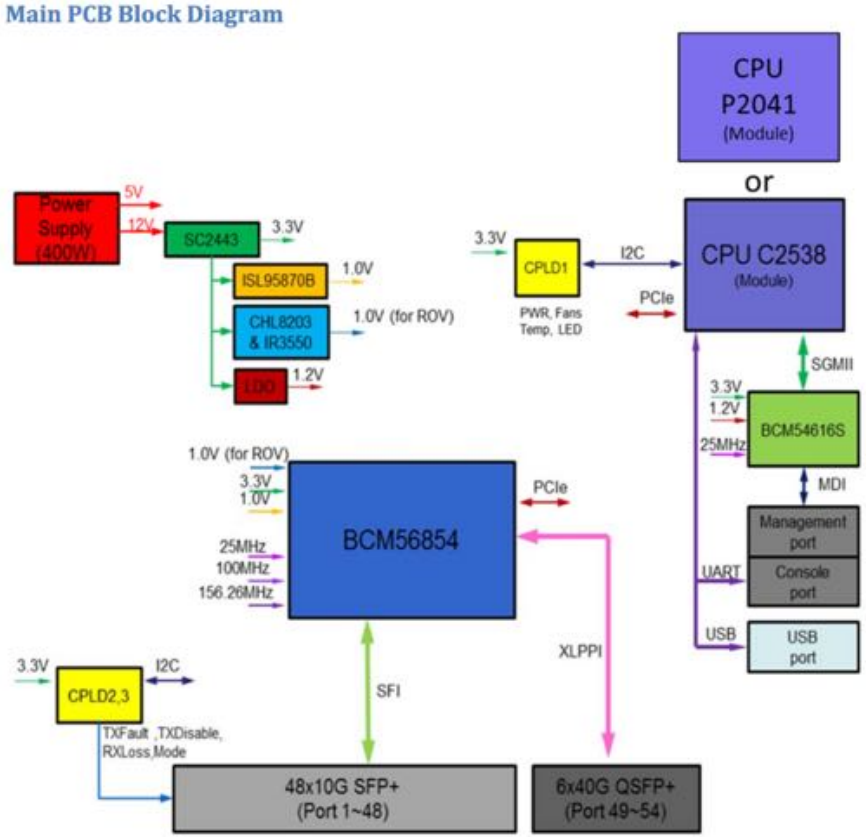
- White-Box
  - Generic switches with hardware support
  - Generally come with ONIE and no NOS
- Brite-Box
  - Branded, supported switches sold by big name vendors such as Dell and HPE
  - Generally come with vendors NOS but can run other networking operating systems
  - Note: Many Brite-Box switches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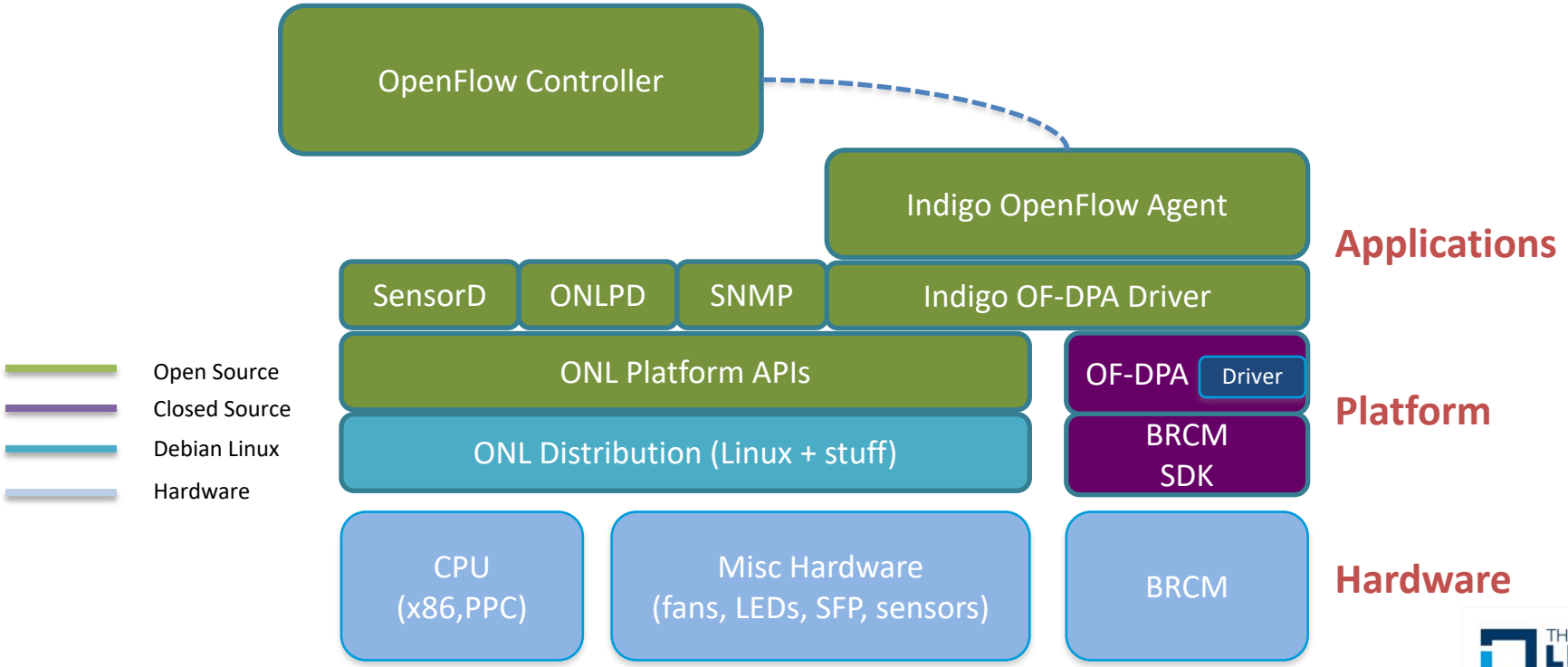
What Makes Networking Software Open?

- 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



NOS Components Are Not All OSS But Getting Better

Most chip vendors only allow binary versions of their switch abstraction interfaces. But with SAI and P4 we are seeing changes:

Broadcom

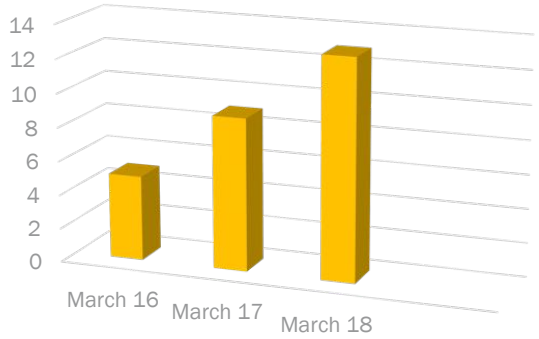
- OpenNSL (Closed Source, Open API)
- OF-DPA (Closed Source, OpenFlow vX compatible)
- SAI (Closed Source, SAI vX compatible)
- P4 Runtime (Closed Source, P4 vX compatible)
- SDKLT (Announced Open Source SDK) <- Yay!

Others:

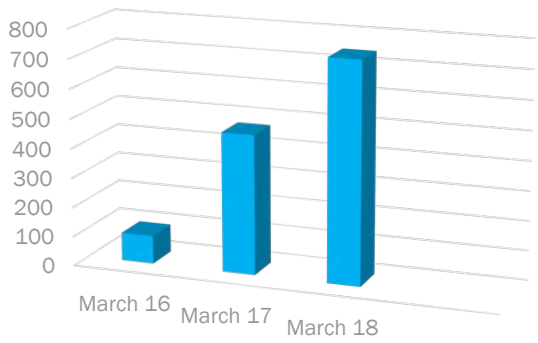
- Cavium OpenXPS (Open Source, SAI compatible)

SAI – Building an Open ASIC Abstraction

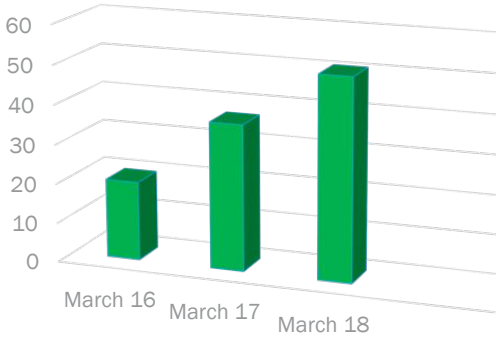
Organizations

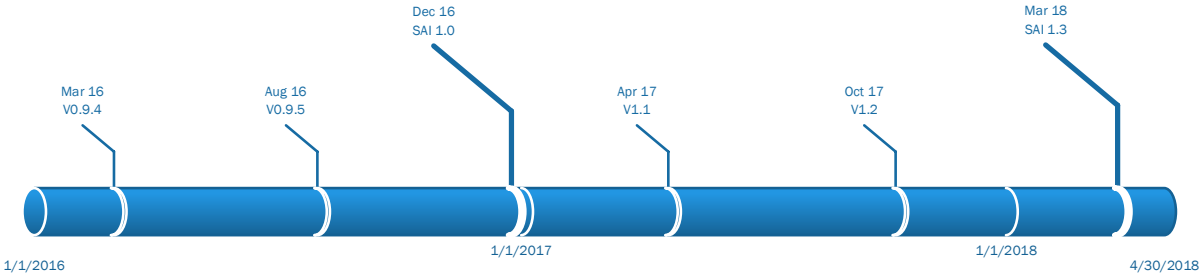


Commits



Proposals





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Linux Foundation Networking

Linux Foundation Networking Subprojects

- OpenSwitch (OPX)
  - Dell OS10 Open Edition (Debian + CPS) + Quagga/FRR focused on Dell Open Networking switches
- CoRD
  - ONOS Controller with Indigo agent on switches
- FRR
  - Routing suite used by most open networking software

Open Compute Networking

Open Compute Networking 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)
- SAI - Switch Abstraction Interface
  - Cross Platform Switch API
- SONiC
  - Microsoft / Azure NOS used by Alibaba, Tencent and many others

OPX and SONiC

- Platform Support
  - SONiC Supports more vendors
    - Edge-Core, Dell, Mellanox, etc
    - 33 devices currently
  - OPX Supports most Dell ON platforms
    - 13 Dell ON devices, 1 Edge-Core device
- L3
  - Using Quagga moving to FRR
- L2
  - Both support VLANS, LLDP. OPX supports STP, RSTP, PVST, MSTP
- OPX has significant documentation due to using OS10 Open Edition.

ONL Spreading Across Many Platforms

NOS Project

Specialized Routing Agent

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

Hyper-scaler NOS stack

Rapidly leverage open hardware ecosystem with modular NOS approach

Telco Central Office Stack

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

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 Currently Supports 71 Different Network Devices

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 (e.g. SONiC)
- SAI included as default in most Open Source NOS
- Expansion of ONL platform ecosystem (currently 71 systems)
- P4 gains more traction

Questions?

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