Open Network Install Environment (ONIE)
Linux Plumbers 2015

Curt Brune, Member of Technical Staff

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Agenda

- What is It?

- ONIE Design Approach

- ONIE Technical Deep Dive

Modern, Efficient OS Installer

- Network OS Installer
- Improve Loading Dock to Rack Experience

Industry Support

- Sub-project with the Open Compute Project
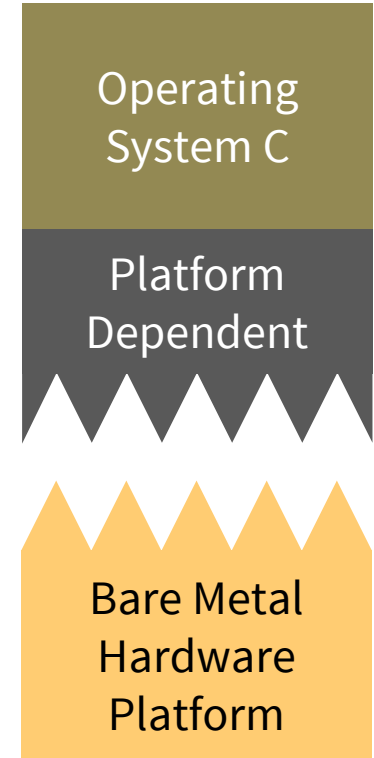- Enables open network hardware ecosystem
- Community Supported

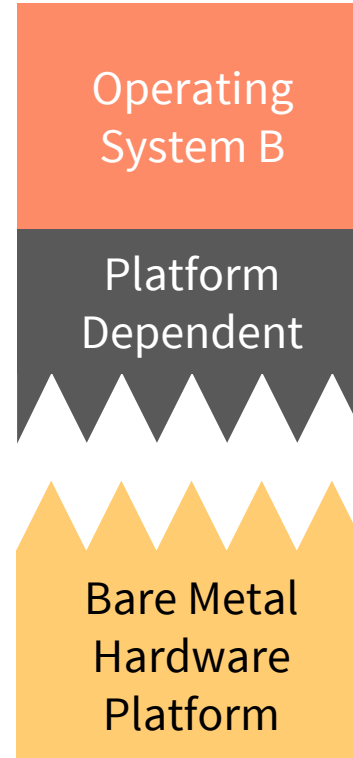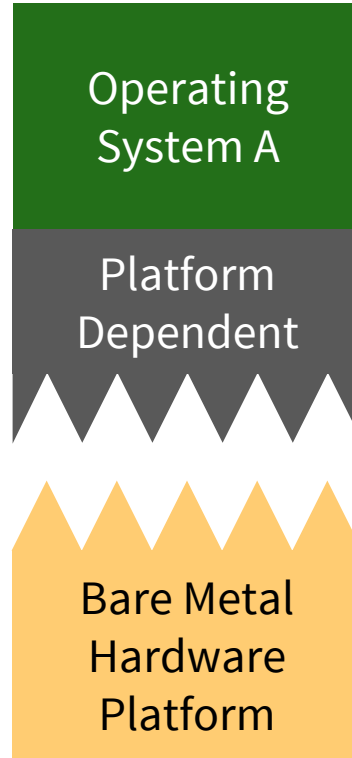# Create an Ecosystem for Bare Metal Switches

Before ONIE
The Appliance Model

- **OS Vendors** wrote their own platform dependent OS installer and integration layer
- **Hardware Vendors** maintained separate SKUs for each combination of OS and platform
- **End Users** could not change the OS, it was an appliance

Operating System A	Operating System B	Operating System C
Platform Dependent	Platform Dependent	Platform Dependent
Bare Metal Hardware Platform	Bare Metal Hardware Platform	Bare Metal Hardware Platform

Create an Ecosystem for Bare Metal Switches Cont.

ONIE Smooths out the Rough Edges

- Hardware Vendors maintain a single ONIE SKU for each hardware platform. Opens up the distribution channels
- OS Vendors target a common installer format. Speeds time to market
- End Users can pick and choose among a variety of Operating Systems. Automated mega-scale OS and hardware provisioning is now possible

Operating System A	Operating System B	Operating System C
ONIE	ONIE	ONIE
Bare Metal Hardware Platform	Bare Metal Hardware Platform	Bare Metal Hardware Platform
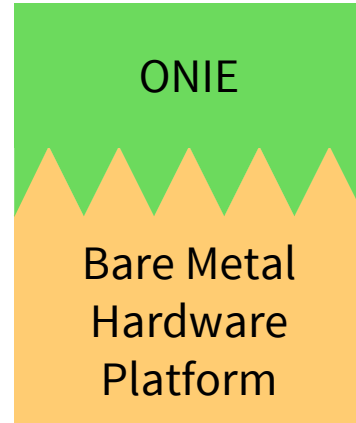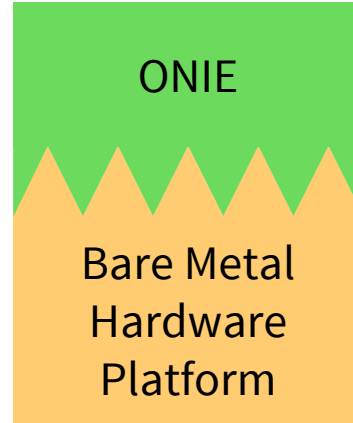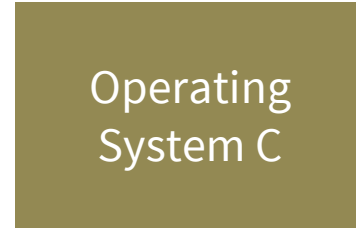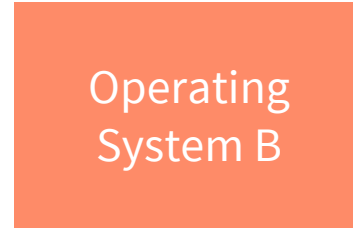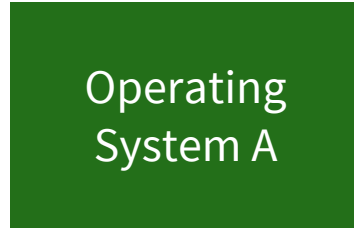
How Does ONIE Work?

- ▪ Leverages the Linux kernel and BusyBox
- ▪ A few state machines to manage network interfaces and image discovery methods
- ▪ Shell scripting is the programming language
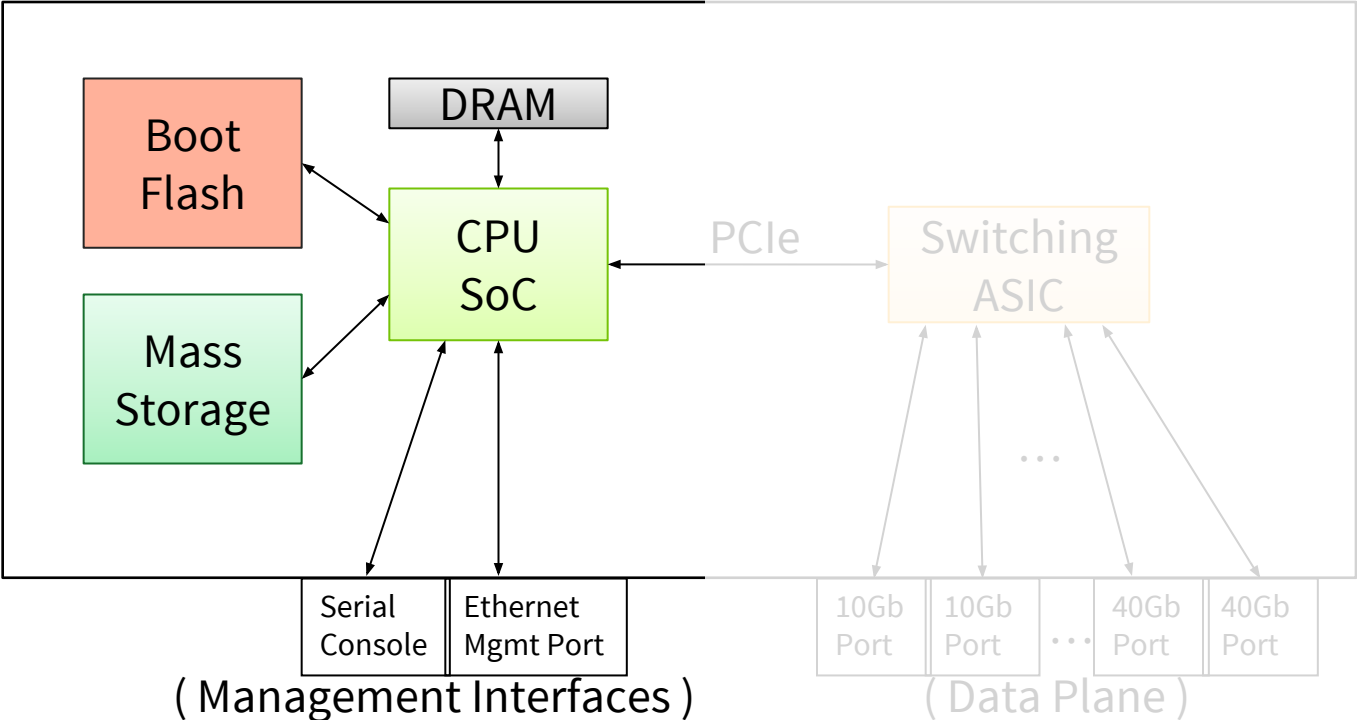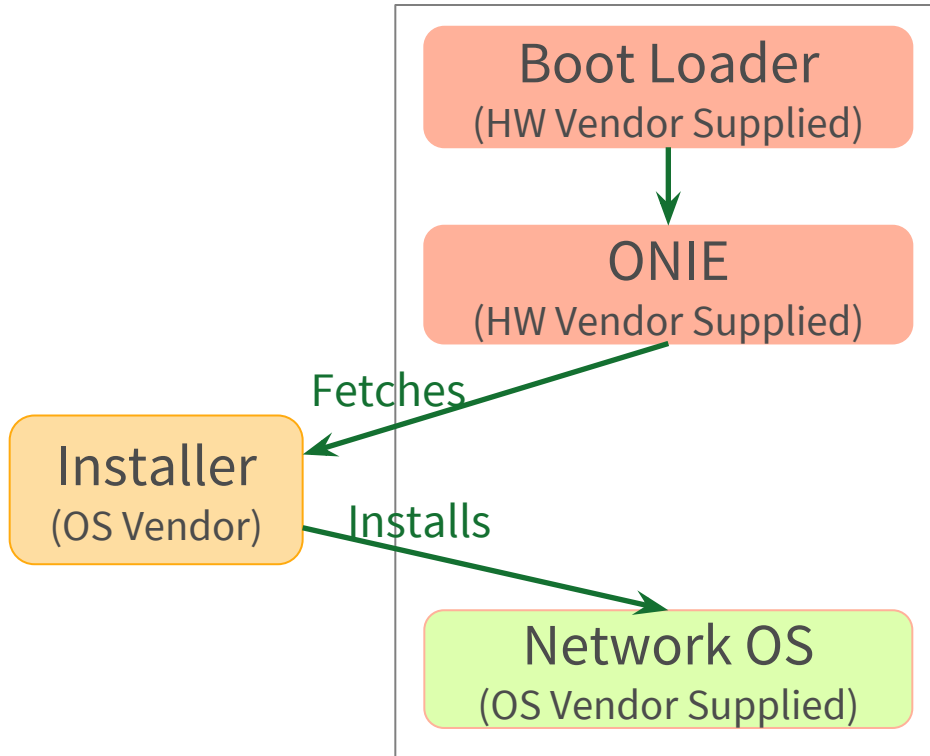
Anatomy of a Network Switch

Management Interfaces
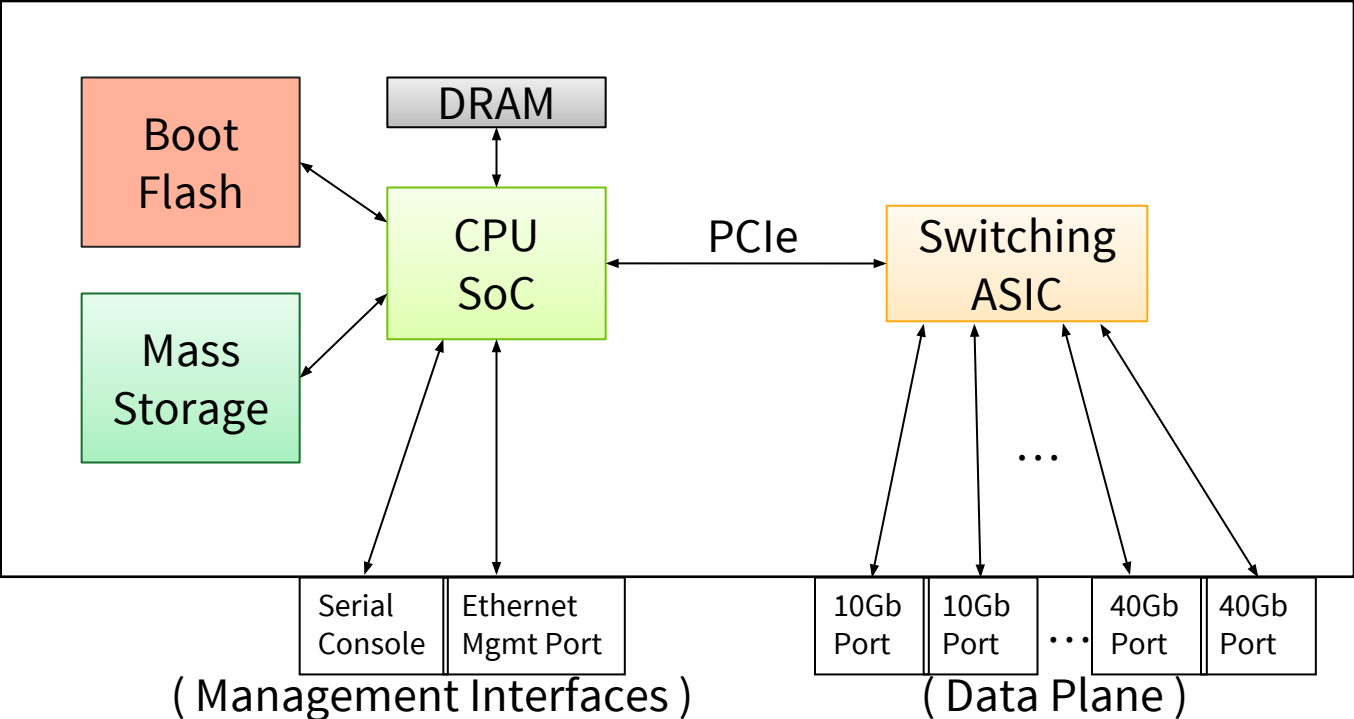
(Management Interfaces)
(Data Plane)

Bare Metal Install - First Time Boot Up

Boot Loader
- Low Level boot loader, configures CPU complex
- Loads and boots ONIE

ONIE
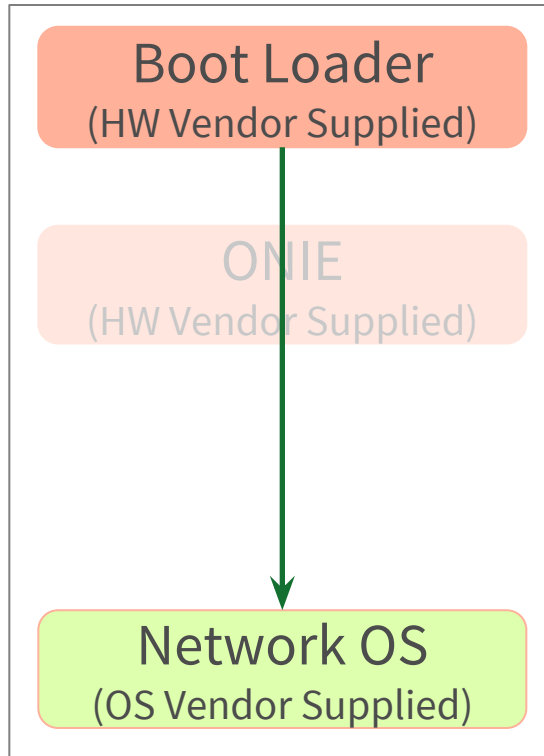- Linux Kernel with Busybox
- Configures management Ethernet interface
- Locates and executes an OS installer
- Provides tools and environment for installer

OS Installer
- Available from network or USB
- Linux executable
- Installs vendor OS into mass storage

Boot Loader
(HW Vendor Supplied)

ONIE
(HW Vendor Supplied)

Installer
(OS Vendor)

Network OS
(OS Vendor Supplied)

Fetches

Installs

Subsequent Reboots - OS is Already Installed

Boot Loader

- Low Level boot loader, configures CPU complex
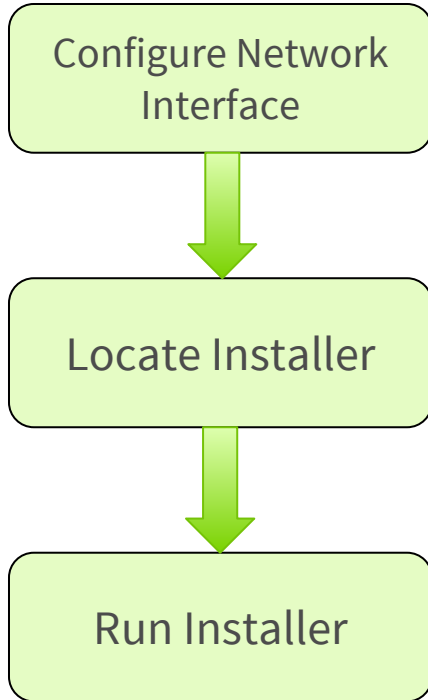- Loads and boots OS vendor's installed OS

ONIE

- Still exists, but is not used
- Available for uninstall / re-install operations

Network OS

- Configures Switching ASIC
- Runs Network Protocols
- Provides CLI

Network OS Installer Discovery and Install Behavior

Configure Network Interface

- Uses DHCPv4, DHCPv6
- Configures Ethernet interface for IPv4 / IPv6
- Configures DNS and hostname

Locate Installer

- Determines the location of an installer executable
- Examines local file systems, e.g. USB flash drives
- Uses DHCP options and IPv6 Neighbors

Run Installer

- Downloads installer via URL
- Launches installer

IPv4 / IPv6 HTTP and TFTP Waterfall

```
Info: Fetching http://10.0.1.251/onie-installer-x86_64-dell_s6000_s1220-r0 ...
Info: Fetching http://10.0.1.251/onie-installer-x86_64-dell_s6000_s1220 ...
Info: Fetching http://10.0.1.251/onie-installer-dell_s6000_s1220 ...
Info: Fetching http://10.0.1.251/onie-installer-x86_64 ...
Info: Fetching http://10.0.1.251/onie-installer ...
Info: Fetching http://fe80::206:67ff:fe24:679b0.000000e+00th0/onie-installer-x86_64-dell_s6000_s1220-r0 ...
Info: Fetching http://fe80::206:67ff:fe24:679b0.000000e+00th0/onie-installer-x86_64-dell_s6000_s1220 ...
Info: Fetching http://fe80::206:67ff:fe24:679b0.000000e+00th0/onie-installer-dell_s6000_s1220 ...
Info: Fetching http://fe80::206:67ff:fe24:679b0.000000e+00th0/onie-installer-x86_64 ...
Info: Fetching http://fe80::206:67ff:fe24:679b0.000000e+00th0/onie-installer ...
Info: Fetching tftp://10.0.1.251/44-38-39-00-68-00/onie-installer-x86_64-dell_s6000_s1220-r0 ...
Info: Fetching tftp://10.0.1.251/0A2A0020/onie-installer-x86_64-dell_s6000_s1220-r0 ...
Info: Fetching tftp://10.0.1.251/0A2A002/onie-installer-x86_64-dell_s6000_s1220-r0 ...
Info: Fetching tftp://10.0.1.251/0A2A00/onie-installer-x86_64-dell_s6000_s1220-r0 ...
Info: Fetching tftp://10.0.1.251/0A2A0/onie-installer-x86_64-dell_s6000_s1220-r0 ...
Info: Fetching tftp://10.0.1.251/0A2A/onie-installer-x86_64-dell_s6000_s1220-r0 ...
Info: Fetching tftp://10.0.1.251/0A2/onie-installer-x86_64-dell_s6000_s1220-r0 ...
```

Image Request HTTP Headers

```
GET /onie-installer HTTP/1.1
Host: 192.168.1.240
User-Agent: onie/1.0 (Linux-4.1.3-onie+2015.08; BusyBox-v1.20.0)
Connection: close
ONIE-SERIAL-NUMBER:
ONIE-ETH-ADDR: 44:38:39:00:68:00
ONIE-VENDOR-ID: 674
ONIE-MACHINE: dell_s6000_s1220
ONIE-MACHINE-REV: 0
ONIE-ARCH: x86_64
ONIE-SECURITY-KEY:
ONIE-OPERATION: os-install
ONIE-VERSION: 2015.08
```

Resources

ONIE Websites

- Home Page: www.onie.org
- Source Code: github.com/opencomputeproject/onie
- Documentation: github.com/opencomputeproject/onie/wiki
- Mailing List: lists.opencompute.org/mailman/listinfo/opencompute-onie
- OCP Wiki: www.opencompute.org/wiki/Networking/ONIE
- Blogs: cumulusnetworks.com/blog
- Twitter: @ProjectONIE @curtbrune

Thank You!