Bare-metal provisioning in data center, including network switches

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Also at: OCP Global Summit 2019, March 14, San Jose
Clonezilla for Open Network Install Environment (ONIE): A Network Switch Storage Operations Enabler
Presenter: Jim Chen
System Deployment/Provisioning

image source: maggiesfarm.anotherdotcom.com
www.compsults.com, and jervisdabreo.com
What is Clonezilla?

- A partition and disk imaging/cloning utility similar to True image® or Ghost®
- GPL license
- A system provisioning, bare metal recovery tool for

*Logo source: (1) Larry Ewing, Simon Budig and Anja Gerwinski, (2) Apple, (3) Microsoft, (4) Marshall Kirk McKusick, (5) VMWare (6) Distrowatch.com
Clonezilla

19 million downloads (2004-2018)

Source: sourceforge.net; osdn.net; www.clustrmaps.com
Machine Room Deployment & Provisioning

- Server nodes
- Compute nodes
- Storage nodes

- Network switches

until...

Source: www.nchc.org.tw; www.dell.com
Open Network Install Environment (ONIE)

Created by Cumulus Networks in 2012

Adopted by Open Compute project in 2013

bare metal, white box

open source, open networking hardware

## ONIE compatible NOS

<table>
<thead>
<tr>
<th>Vendor</th>
<th>OS</th>
<th>Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>Big Switch Networks</td>
<td>Switch Light</td>
<td>Debian</td>
</tr>
<tr>
<td>Cumulus Networks</td>
<td>Cumulus Linux</td>
<td>Debian</td>
</tr>
<tr>
<td>Dell</td>
<td>Force 10 Operating System (FTOS)</td>
<td>NetBSD</td>
</tr>
<tr>
<td>HPE</td>
<td>OpenSwitch</td>
<td>Yocto</td>
</tr>
<tr>
<td>Mellanox</td>
<td>MLNX_OS</td>
<td>Debian</td>
</tr>
<tr>
<td>Lenovo</td>
<td>cNOS</td>
<td>Yocto</td>
</tr>
<tr>
<td>Lenovo</td>
<td>eNOS</td>
<td>Yocto</td>
</tr>
<tr>
<td>OCP</td>
<td>ONL</td>
<td>Debian</td>
</tr>
<tr>
<td>Pica8</td>
<td>PicOS</td>
<td>Debian</td>
</tr>
<tr>
<td>Pluribus Networks</td>
<td>Netvisor OS</td>
<td>Illumos/CentOS</td>
</tr>
</tbody>
</table>

- **CPU (32/64-bit)**
  - X86
  - PowerPC
  - ARM

Source: https://www.opencompute.org/wiki/Networking/ONIE/NOS_Status
Inside ONIE: initial system boot

First Time Boot Up

- Boot Loader (HW Vendor Supplied)
  - Low Level boot loader, configures CPU complex
  - Loads and boots ONIE from flash

- ONIE (HW Vendor Supplied)
  - Linux OS with Busybox
  - Configures management Ethernet interface
  - Locates and executes installer from network
  - Provides tools and environment for installer

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

- Network OS (OS Vendor Supplied)

Source: https://opencomputeproject.github.io/onie/
## NOS Interface

<table>
<thead>
<tr>
<th>Reinstalling</th>
<th>Reinstalling a different NOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uninstalling</td>
<td>Uninstalling/wiping the system clean</td>
</tr>
<tr>
<td>Rescue</td>
<td>Rescue and recovery</td>
</tr>
<tr>
<td>Updating</td>
<td>Updating ONIE</td>
</tr>
<tr>
<td></td>
<td>Updating the machine CPLD/FPGAs and BIOS firmware</td>
</tr>
</tbody>
</table>

where Clonezilla live starts...

Source: https://opencomputeproject.github.io/onie/
Inside ONIE: subsequent system boots

Vendor’s OS is Already Installed. ONIE is not used.

Boot Loader
(HW Vendor Supplied)

ONIE
(HW Vendor Supplied)

Network OS
(OS Vendor Supplied)

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

ONIE
- Still exists in the flash, but is not used
- Available for uninstall / re-install operations

Network OS
- Configures Switching ASIC
- Runs Network Protocols
- Provides CLI

Source: https://opencomputeproject.github.io/onie/
Prepare Clonezilla live for ONIE
Once per software version

- Download Clonezilla live ISO
- Convert to ONIE self-extracting boot file
- Clonezilla live image

ONIE network switch

- Boot loader
  - ONIE
  - Clonezilla live
  - Target NOS

NOS Image store
(Networked or locally attached)

Fetch (http, ftp, USB...)
Copy to Memory
Store, Recover, Provision req.
Screenshots from Dell S4048-ON ONIE switch

Images source: virtualbox.org; onie.org
Demo

- ONIE network switch backup or restore
  - Prepare Clonezilla live ONIE self-extracting boot file
    • `sudo ocs-is0-2-onie clonezilla-live-2.6.0-37-amd64.iso`
  - ONIE network switch
    • Simulate: Boot VM in Virtualbox with ONIE iso
    • Use serial console
  - Enter rescue mode
  - Switch to Clonezilla live
  - Backup, restore...

Images source: virtualbox.org; onie.org

- `git clone https://github.com/opencomputeproject/onie.git`
- `cd onie/build-config`
- `sudo apt-get update`
- `sudo apt-get install build-essential`
- `makedebian-prepare-build-host`
- `make -j4 MACHINE=kvm_x86_64 allrecovery-iso`
- `../build/images/onie-recovery-x86_64-kvm_x86_64-r0.iso`
Reference

- https://clonezilla.org
- http://onie.org
- https://github.com/opencomputeproject/onie
- https://www.opencompute.org
- https://www.icair.org
- https://www.nchc.org.tw
Questions?