

Clonezilla for Open Network Install Environment (ONIE)

A Network Switch Storage Operations Enabler

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Abstract—Clonezilla for ONIE (CzfO) enables network switch storage operations that previously did not exist in the open source network community. CzfO supports switch storage operations at the partition or disk/sector level, which enables rapid iteration for Software Defined Networking (SDN) and other programmable networks. CzfO supports switch storage operations on the switch, in the rack, and over the network to support different development and production requirements. CzfO enables low level switch storage backup, recovery, snapshot, and many other switch storage operations, which can also avoid the limitation of a target switch OS.

I. INTRODUCTION

Neilsen's Law of Internet Bandwidth states: A high-end user's connection speed grows by 50% per year [1]. This constant growth in demand for Internet network bandwidth has led to the industry wide adoption of SDN and the adoption of bare metal network switches. The Open Network Install Environment (ONIE) enables bare metal network switches to install any switch OS and software innovation. The extension of ONIE: Clonezilla for ONIE enables network switch storage operations for rapid software iteration. The switch storage operations will not be limited by the target switch OSs.

II. NEW CHALLENGES WITH NETWORK SWITCH INNOVATIONS

In the last few years, the success of SDN led the trend to opening up network switch software architecture for innovation. For example: this trend led to Open Network Linux (ONL), OpenSwitch (OPX), Open Networking in the Cloud (SONiC), Stratum, etc. This open network switch software architecture also provides a platform for rapid network switch software iteration. To support this open network switch software architecture in development and production environment, we need to address the challenges of enabling bare metal switches to easily select different boot images and the challenges of enabling network switches to support low level storage operations for rapid software iteration.

One approach to enable this open network switch software architecture on bare metal switches is the Open Network Install Environment (ONIE), which we describe in Section III. The other open source solution to enabling switch storage operations is described in section IV.

III. ONIE: OPEN NETWORK INSTALL ENVIRONMENT

ONIE is an open source initiative that defines an open "install environment" for bare metal network switches [2,3]. ONIE allows users to use different network operating systems (NOS) and applications on different network switches. Using ONIE enabled bare metal switches, the switch can load different switch OS, application software, controllers and data.

Other important building blocks to enable rapid software iteration for the open network switch software architecture are Clonezilla and Clonezilla for ONIE (CzfO), which we describe in Section IV.

IV. SYSTEM PROVISIONING BY CLONEZILLA

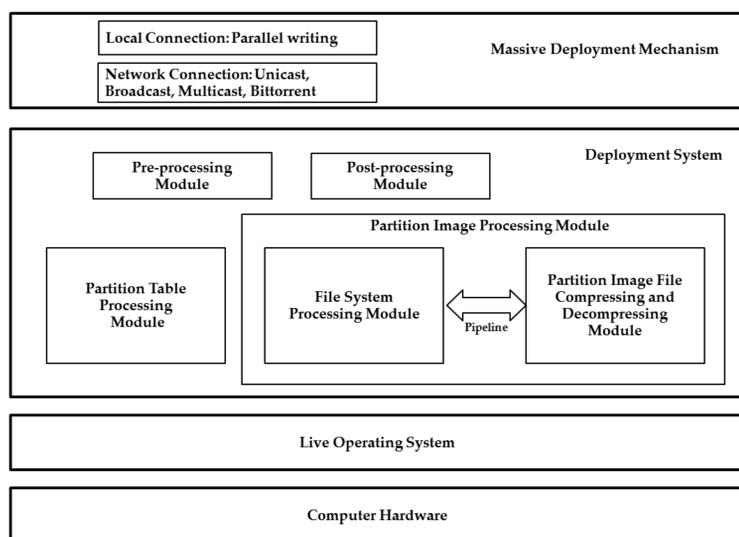


Figure 1. The system architecture of Clonezilla. [4]

4.1. Clonezilla

Clonezilla is an open source project with roughly 2 million downloads per year worldwide. The system architecture of Clonezilla consists of computer hardware, live OS, deployment system, and massive deployment mechanism (refer to Figure 1) [4]. Clonezilla supports single machine backup and recovery, as well as the massive deployment mechanism, which can be used either in local or network connections. Massive deployment for local connection is based on the connections of massive disks to the system buses, such as the USB or the external Serial Advanced Technology Attachment (eSATA) bus. In addition, a network connection mechanism exists for massive machines connected to network switches.

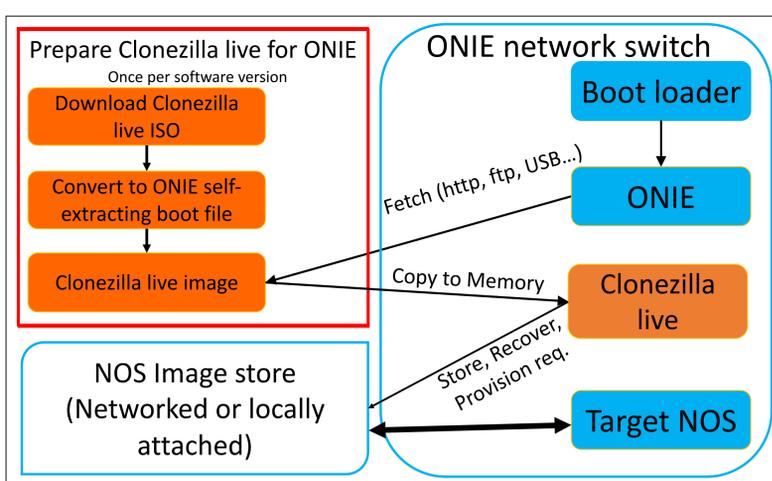
The Clonezilla project provides Clonezilla Live, a live system based on Debian or Ubuntu Linux with special purpose capabilities for system backup and provisioning. By booting Clonezilla Live on the machine intended to be backed up, one can save the operating system (OS), applications and configurations as an image. Once system crashes or it is required to be reverted to the state at some time point, the image can be restored on the machine. This enables the system administrator or programmer to test and develop the program and environment easily because the OS and/or application environment can be switched quickly.

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Bare-metal provisioning in data center, including network switches

Presenter: Steven Shiau

Abstract -- Bare-metal provisioning in data center normally covers the server, computing, and storage nodes. Open Network Install Environment (ONIE) is an open source initiative that defines an open "install environment" for bare metal network switches. ONIE allows users to have a choice among different network operating systems, and also to keep the network configurations. In this talk we introduce the way to use Clonezilla to deploy the systems for the whole cabinet, including the ONIE network switches. This presentation will give you a picture about how to fast deploy the system environment you need.



Clonezilla for ONIE workflow

4.2. Clonezilla for ONIE

ONIE network switches come with a (NOS) [2], which is basically a GNU/Linux system nowadays. In addition, ONIE provides a mechanism called "onie-nos-install" [2] that enables the NOS bundled with the network switch to be downloaded and switched to another ONIE compatible network OS installer. Therefore, we have developed a mechanism in Clonezilla called "ocs-iso-2-onie" to convert Clonezilla live ISO file to the ONIE compatible image so that "onie-nos-install" can download the image and then run Clonezilla live. The program adopted what Luca Boccassi [5] has contributed to Debian live [6]. To convert the Clonezilla live iso file to an ONIE image, a user first downloads Clonezilla live ISO file from the Clonezilla website [7], then issues the following command to convert the image:

```
ocs-iso-2-onie clonezilla-live-2.6.1-2-amd64.iso
```

A file called "clonezilla-live-2.6.1-2-amd64.iso-onie.bin" will be generated. It can be put on a http server, ftp server, or even the USB flash drive so that after booting into the NOS environment on ONIE switch, one can run:

```
onie-nos-install clonezilla-live-2.6.1-2-amd64.iso-onie.bin
```

Once the command is finished, the ONIE network switch will be converted to the Clonezilla live environment so one can start backing up or restoring the NOS, including OS, applications and the configurations.

V. RESULT

We have used CzfO on multiple switches from Inventec. This included Tofino P4 switches, Broadcom chip based switches to support rapid software iteration. The current version of CzfO supports network switches with Intel CPU and 64-bit ARM CPU. CzfO initiated a new path for computer based storage operation tool to bare-metal switches.

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REFERENCES

- [1] <https://www.nngroup.com/articles/law-of-bandwidth/> (24 January 2019)
- [2] Open network install environment. <http://onie.org/> (accessed on 24 January 2019),
- [3] Open network install environment document and software. <https://opencomputeproject.github.io/onie/index.html> (accessed on 24 January 2019)
- [4] Shiau, S.J.; Sun, C.-K.; Tsai, Y.-C.; Juang, J.-N.; Huang, C.-Y. The design and implementation of a novel open source massive deployment system. *Applied Sciences* (2076-3417) 2018, 8.
- [5] Patch file for debian live: Add options to build onie images. https://salsa.debian.org/live-team/live-build/merge_requests/4 (accessed on 24 January 2019),
- [6] Debian live image. <https://www.debian.org/blends/hamradio/get/live> (22 October 2018),
- [7] Clonezilla project. <https://clonezilla.org> (accessed on 24 January 2019)