Clonezilla: 
A Next Generation Clone Solution for Cloud

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Jazz Wang, Thomas Tsai

National Center for High-Performance Computing
Taiwan
Q3, 2012
Outline

- Introduction to Clonezilla
  - A Quick Demo as a Beginning
  - Feature/How/Limitation/Image Architecture
  - Comparison with Live and Sever Edition (SE)
  - A Toolkit for Windows Mass Deployment: DRBL-Winroll
  - A Possible Solution in Cloud: Cloudboot

- Cases of Usages
  - Unattended Recovery CD or USB
  - Mass Deployment with Multicast by SE
  - One Image to Multi Devices Deployment

- Q&A
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- Q&A
About us

• From Taiwan, working for the NPO NCHC (National Center for High-Performance Computing)

• Developers of free/open-source software:
  - DRBL, Clonezilla
  - DRBL-Winroll, Tux2live
    - Partclone, Tuxboot, Cloudboot
  - ... more
What is Clonezilla?

• A partition and disk imaging/cloning utility similar to Ghost® and True image®
• A 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
A Quick Demo as a Beginning

- Restore a bare hard disk by Clonezilla Live
- A pre-saving image Ubuntu 12.04 system
  - Text mode only. The whole system uses about 1.0 GB space. Using grub2 as **boot loader**.
    - /dev/sda1 is used as swap partition
    - /dev/sda2 on / and /dev/sda3 on /home with **ext4 and reiserfs**
- Use sshfs as repository
Clonezilla (再生龍)

- **Clonezilla [OCS (Opensource Clone System)]**

- **What does it handle?**
  - **Physical data**: basic unit is partition, then LVM, and part of hardware RAID
  - **Partition table / Boot sector**: (MBR:446+64+2, GPT, EFI)
  - **Hidden data**: data between boot sector and 1ˢᵗ partition

- **Block-based recovery**, is different from
  - File base recovery: **Differential / Incremental** backup
  - Hardware recovery (recovery card): **Instant** recovery

- **Two kind of release**
  - **Live** edition
  - **Server** edition (SE)
Clonezilla Feature

- **Free (GPL) Software**
- **File systems supported:**
  - Ext2/3/4, ReiserFS, Reiser4, XFS, JFS, BrtFS, HFS+, UFS, VMFS, FAT and NTFS
  - Supports LVM2
  - Support some hardware RAID chips (by kernel)
- **Smart copying** for supported filesystem. For unsupported file systems sector-to-sector copying is done via `dd`.
- **Boot loader** : syslinux, grub 1/2; MBR and hidden data (if exist)
- **Serial console**
- **Unattended mode**
- **One image restoring to multiple local devices**
- **Multicast** supported in Clonezilla Server Edition (SE)
- The image format is transparent, open and flexible
- **Use Clonezilla-live** as client OS on server edition
Save and Restore procedure of Clonezilla

**Flow chart about saving disk image**

- **Start**
- Parse partition table
- Find the Device (partition/LV)
  - YES
    - Find the file system of device
    - Smart copying?
      - YES
        - Use dd to save image to stdout
      - NO
        - Decide device imaging engine
          - partclone
          - partimage
          - ntfsclone
        - Save device image to stdout
        - Save stdin as file in the image dir
  - NO
    - Save MBR/GPT data
    - Save partition table
    - Save hardware info
- **End**

**Flow chart about restoring disk image**

- **Start**
- Read image
- Create partition table
- Create LV if LV image found in image dir
- Find the image of device
  - YES
    - Tune the file system size to fit partition size
    - Reinstall grub if assigned
    - Restore the image of device to device
    - **End**
  - NO
    - Decide device imaging engine
      - partclone
      - partimage
      - ntfsclone
    - Save device image
- **End**

Imaging and compressing engines can be easily added.
Open and Flexible Format of Clonezilla Image

root@debian:~# ls -alFh /home/partimag/lucid-img/
total 220M
drwxr-xr-x 2 root root 512 07:12 ./
image name

-rw-r--r-- 1 root root 420 07:12 disk

-rw-r--r-- 1 root root 18K 07:12 Info-lshw.txt
-rw-r--r-- 1 root root 34K 07:12 Info-dmi.txt
-rw-r--r-- 1 root root 1.4K 07:12 Info-lspci.txt
-rw-r--r-- 1 root root 260 07:12 Info-packages.txt
-rw-r--r-- 1 root root 10 07:12 parts
-rw-r--r-- 1 root root 216M 07:12 sda1.ext4-ptcl-img.gz.aa
-rw-r--r-- 1 root root 2.3M 07:12 sda5.ext4-ptcl-img.gz.aa
-rw-r--r-- 1 root root 36 07:11 sda-chs.sf
-rw-r--r-- 1 root root 1.0M 07:11 sda-hidden-data-after-mbr
-rw-r--r-- 1 root root 512 07:11 sda-mbr
-rw-r--r-- 1 root root 434 07:11 sda-pt.parted
-rw-r--r-- 1 root root 310 07:11 sda-pt.sf
-rw-r--r-- 1 root root 53 07:12 swappt-sda2.info

Use dd to save MBR and other hidden data

UUID and label info of sda2 (swap partition)

partition info from parted and sfdisk

disk C.H.S. value via sfdisk

real data of partition

hardware information
## Comparison: Live vs SE (Server Edition)

<table>
<thead>
<tr>
<th>Support</th>
<th>Live</th>
<th>SE (Server Edition)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The same for: File system, LVM/Boot loader/Hidden data</td>
<td>Need to install DRBL package (or use DRBL Live, but still need to configure)</td>
</tr>
<tr>
<td>Installation</td>
<td>None, just boot and go</td>
<td>Need to install DRBL package (or use DRBL Live, but still need to configure)</td>
</tr>
<tr>
<td>Basic OS</td>
<td>Debian/Ubuntu</td>
<td>Depends on OS installed</td>
</tr>
<tr>
<td>Multicast/Broadcast</td>
<td>None (still “udpcast” package included, only be used on SE*)</td>
<td>Yes (only unicast can be used when image save)</td>
</tr>
<tr>
<td>Portable</td>
<td>Easy</td>
<td>Hard</td>
</tr>
</tbody>
</table>
| Extra effort             | • Storage preparation  
• Step by step via user | • Installation, configuration  
• pxe/etherboot required in clients |
| Usage                    | • Single machine usage  
• System recovery CD/DVD | • Mass deployment  
• Central management |
Developers

- Steven Shiau
- K. L. Huang
- Ceasar Sun
- Jazz Wang
- Thomas Tsai
- Jean-Francois Nifenecker
- Louie Chen
- Nagappan Alagappan
Language File Contributors

- German (de_DE): Michael Vinzenz.
- Spanish (es_ES): Juan Ramón Martínez and Alex Ibáñez López.
- French (fr_FR): Jean-Francois Nifenecker and Jean Francois Martinez.
- Italian (it_IT): Gianfranco Gentili.
- Brazilian Portuguese (pt_BR): Marcos Pereira da Silva Cruz.
- Russian (ru_RU): Anton Pryadko and Igor Melnikov.
- Simplified Chinese (zh_CN): Zhiqiang Zhang and Liang Qi.
Bugs Report/Patches

- cbeazer
- nj-dude
- Asou Y.S. Chang
- Manuel Borchers
- Miracle Linux corporation
- Bill Marohn
- Orgad Shaneh
- Chris Cooper
- lukas666
- John Ouzts
- Juergen Chiu
- username8
- martinr88
- Yung-Jen Yu
- jeff-aptimize
- gsusterman
- wellurs
- dersucker
- Patrick Verner
- Adam Walker
- ...

OSC Fall Tokyo, 2012
Clonezilla.org
Partners

- The following companies either embed Clonezilla in their products or promote Clonezilla:
  - Linmin
  - eRacks Open Source Systems
  - Miracle Linux

- Clonezilla/DRBL are members of OIN (Open Invention Network)
Clonezilla Users Worldwide

>5,500,000 downloads

* ~ 2012/04/30
DRBL-Winroll:
A toolkit for MS-Windows Mass Deployment

• **Goal**
  - Adjust Windows **Hostname**, **Workgroup** name, SID automatically
    - For working in MS Network (Neighborhood)/NetBIOS protocol
  - Provide **network** auto-setup function
  - Provide auto-add to **AD** domain function
  - Provide **system monitor** function in Windows clients
  - Provide **central management** via ssh command
    - Via ssh daemon

  **NEW from v1.3.0**
  - Provide **network** auto-setup function

  **NEW from v1.3.1**
  - Provide **system monitor** function in Windows clients

• **Feature**
  - Windows application : easy to install
  - Independent service : Only need a DHCP server on LAN (or use auto-network configuration )
  - Suit for mass deployment clone tool (ex: Clonezilla, Ghost, Acronis True Image)
  - Central management via ssh (ex; 'dcs' command in DRBL)
DRBL-Winroll Framework

**MS Windows**

- **winrollsrv service**
- **winroll.conf**

  * Hostname/Workgroup name adjustment
  * Network configure
  * Add client to AD
  * Renew SID

- **monitor service**
  * Collect system information by Munin Node

- **sshd service**
  * ssh authorization by key
  * execute command

**Windows registry**

**Central manage:**
- * Power-on/off

**Commands via ssh**
Cloudboot -
A framework for booting from cloud resource

Feature

- A framework: Allow PCs to boot from cloud resources
- Booting special system or utility on any computer with a wired Internet connection
  - DRBL Live, Clonezilla Live, GParted, … etc
  - Linux netinstall
- Easy to build your private Cloudboot service
- Ready for global Cloudboot
- Developing, beta version
- License - GNU General Public License (GPL)

http://cloudboot.org
Cloudboot Framework

- Based on iPXE, PHP & syslinux
- Use **iPXE Script** to access cloud boot resource. Then **PHP Script** accept command from iPXE and create **syslinux style MENU** for net-booting use.
Clonezilla

ISOLINUX 4.02 debian-20101014 EHDD Copyrig
iPXE ISO boot image
Loading ipxe.krn...ready.
iPXE initialising devices...ok

iPXE 1.0.0+ -- Open Source Network Boot Fi
Features: VLAN HTTP iSCSI DNS TFTP AoE SRP
Welcome to CLOUDBOOT
Current Network status:
net0: 52:54:00:12:34:56 using rtl8139 on P
[Link:up, TX:0 TXE:0 RX:0 RXE:0]

a) AUTO config network (Default)
b) Getting IP address from DHCP Server
c) Manual config network
d) Entering iPXE Shell
e) Config iPXE all options

FreeBSD Live CD with HINHC - EMHG
FreeBSD Live CD with HINHC only
FreeBSD Live CD only
FreeBSD is a trademark of Jim Hali 1994-2006

Select from Menu (123456), or press [ENTER] (Selection=2)
4
Singlestepping (FD) is: OFF

Please insert a language
Clonezilla @ Linux Journal

- In Linux Journal, January 2011
- Report Clonezilla project and show in cover headline

Clonezilla – High Performance Open-Source Cloning

http://www.linuxjournal.com/
The Best Free Software of 2012

It's the fifth year of PCMag's look at the best stuff you don't have to pay for, and it's our biggest list of great free software yet.

By Eric Griffith  April 2, 2012  17 Comments

BACKUP/SYNC

24. Bvckup
http://www.bvckup.com/
Windows
Try not to think about how to pronounce Bvckup. Just know that when it comes to onsite backup, you now have a friend. It can handle real-time backup, copy only modified parts of files, and it doesn’t take much memory to run. Get it now; it's only free while in beta testing.

25. Create Synchronicity
http://synchronicity.sourceforge.net
Windows | Portable
This small, multi-lingual program can run locally or portably to back up or sync files you specify when you create a profile.

26. Clonezilla Live
http://www.clonezilla.org
Use case in enterprise

- Nagappan Alagappan from VMware
  - Palo Alto, CA, USA
  - “As a product company, we need to test our product in all popular operating system, when exploring different opportunity, we found Clonezilla appropriate, Reason: It support all the Linux distribution (RedHat, SUSE, Ubuntu, Mandriva) and different file system, which we use (ext3, ext4, reiserfs)”
  - Initially evaluated Clonezilla live and found a very good performance, Windows XP image restoration 7 minutes, Ubuntu 3 minutes, SUSE / RHEL 5 minutes from a NFS server.
  - Later we (in VMware) have implemented a service, which will automate the Clonezilla reimaging part, without any manual intervention.”
Use case in enterprise

- Juergen Chiu
- Canonical Ltd. Taipei, Taiwan

• Clonezilla helps me a lot in system backup, recovery and ISO image creating

"In my job, I need to handle different type of system and create the ISO image for customers. Your great tool, Clonezilla, helps me a lot in system backup, recovery and ISO image creating. I only need to download the Clonezilla zip file, and create the bootable usb key in few easy steps, then I can use that key to backup the systems and create the ISO image by the same key. And the key is just the recovery partition as I need. All procedures take me only about 1 hour to finish all stuffs. I love your tool and that is really cover all functions what I need to have in Linux system recovery scope. Clonezilla is the best all-in-one tool that I have never seen before."
Use case in enterprise

MIRACLE System Savior (MSS)

- As an Disaster Recovery Solution in enterprise:
  - Backup/Recovery systems in just few minutes.
Use case in community

- Christian, WMOC 2012, Germany
- World Masters Orienteering Championships
- Use Clonezilla and DRBL-Winroll to deploy over 20 laptop for the contest.

- “All runners carried a transponder chip on their fingers, to which the control stations they had to find and "punch" wrote timestamps. After they reached the finish line, we read out their transponder chips to check if they completed the course and calculate their times. In the tent there are five laptops with their operators and printers. Overall we had over 20 laptops in use for readout, problem handling, results printing, publishing, entries management, radio control times, speaker support etc.”

Source: Christian
Clonezilla Used in Taiwan's "National PCs"

Source: De-Wen Huang
Use case in Education
Limitations of Clonezilla

- The destination partition must be equal or larger than the source one
- Recovery Clonezilla live with multiple CDs or DVDs is not implemented yet
- Differential/incremental backup is not implemented yet
- Live imaging/cloning is not implemented yet
- Software RAID/fake RAID is not supported by default (extra manual processing is required)
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  - A Possible Solution in Cloud: Cloudbootl

- **Cases of Usages**
  - Save an image of whole disk
  - Unattended Recovery CD or USB Tool
  - Mass Deployment with Multicast by SE
  - One Image to Multi Devices Deployment

- **Q&A**
Clonezilla Live Demo (1)

Save an image

- Clonezilla Live
  - [http://clonezilla.org/clonezilla-live](http://clonezilla.org/clonezilla-live)

- A running Ubuntu 12.04 system
  - Text mode only. The whole system uses about 1.3 GB space. Using grub2 as boot loader.
  - `/dev/sda1` is used as swap partition
  - `/dev/sda2` on `/` and `/dev/sda3` on `/home` with ext4 and reiserfs

- Use Clonezilla live to save the whole disk as an image
  - Use sshfs as repository
Clonezilla Live Demo (2)
Unattended recovery CD or USB flash drive

- Scenario: your customer need a recovery solution
- How:
  - Have **an image ready** first
  - Use a machine with RAM >= 768 MB
    - Boot Clonezilla live
    - Mount the image repository
    - Select "recovery-iso-zip" option then follow the steps

```
Clonzilla: Select mode |
*Clonezilla is free (GPL) software, and comes with ABSOLUTELY NO WARRANTY*
This software will overwrite the data on your hard drive when restoring! It is recommended to backup important files before restoring! ***
//Hint! From now on, if multiple choices are available, you have to press space key to mark your selection. An asterisk (*) will be shown when the selection is done///
Select mode:

savedisk       Save_local_disk_as_an_image
saveparts      Save_local_partitions_as_an_image
restoredisk    Restore_an_image_to_local_disk
restoresparts  Restore_an_image_to_local_partitions
recovery-iso-zip Create_recovery_Clonezilla_live
chk-img-restorable Check_the_image_restorable_or_not
exit           Exit. Enter command line prompt

<Ok>            <Cancel>
```
Clonezilla Live Demo

Mass Deployment with Multicast by SE

- Scenario: to deploy PCs in computer classroom with one image
- How:
  - Have an image ready first
  - Select multicast to restore disk
  - Installation and configuration ready with Clonezilla SE (DRBL Live)
    - Boot DRBL live,
    - Configure Clonezilla SE environment: network / sshfs as image repository
    - Choose "multicast" and "restoredisk" option then follow the steps
Clonezilla Live Demo
One Image to Multi Devices Deployment

- Scenario: to deploy USB sticks with same image one time
- How:
  - Have an image ready first
  - Use sshfs as image repository
    - Mount 4 hard disk to simulate USB sticks
    - Boot DRBL Live CD,
    - Mount the image repository
    - Choose "1-2-mdisks" and "restoredisk" option then follow the steps
Future Work/Wishlist

- Software RAID/FakeRAID support
- File-based imaging
- Recovery Clonezilla live with multiple CDs or DVDs
- More file systems support, ZFS, Minix...
- Encryption file system support. Encryption for the image
- Scheduling
- VLAN setting
- ISCSI source disk
- Password protection
- LVM without partition
- GUI
- ...

Other projects we have...

- DRBL (Diskless Remote Boot in Linux)
- DRBL-winroll
- Tux2live
- Partclone
- Tuxboot
- Cloudboot (beta)

Other cloud relative in NCHC

- Ezilla
- Haduzilla
- Crawlzilla
Our Booth...

- 展示スペース, 2F, Room 206
- More detail for:
  - Other projects
  - Demonstrations
  - Instructions
  - Others ....
Reference

- Clonezilla
  - http://clonezilla.org
- DRBL
  - http://drbl.org
- DRBL-Winroll
  - http://www.drbl-winroll.org
- Debian Live
  - http://live.debian.net/manual/
- Syslinux
  - http://syslinux.zytor.com
- Gparted
  - http://gparted.sf.net
Questions ?

Great!  ?????
Appendix
Bare Metal Recovery

- The term “Bare Metal” refers to a computer that does not contain an operating system and data.
- Bare Metal Recovery/Restore
  - It means to the process of restoring data to a "bare metal" component
  - Typically the process includes reinstalling the operating system and software applications and then, if possible, restoring data and configurations.
- When need to do?
  - Mass deployment
  - Disaster recovery
  - Hardware replacement/crash
  - ....
Bare Metal Recovery (cont')

- **Available types:**
  - **Block-based** (image) recovery (e.g. 'dd')
  - **File-based** recovery (e.g. 'cp', 'tar', 'rsync'...)
  - **Mix both**: combine file base with block information

- **Use different tool for different purpose**
  - Save a lot of time if choose right toolkit
Terminology

- **Raw copying***
  - A possibility to perform sector-by-sector copying of a whole partition

- **Smart copying***
  - A possibility to distinguish which portions of the partition really contain data and to copy these only

- **Live copying***
  - A drive or volume can be copied/imaged while it is in use, avoiding the need for booting into a separate operating system or Live CD.

- **Smart copy full disk**
  - A possibility to distinguish which portions of the disk really contain data and to copy these only

* The descriptions are from http://en.wikipedia.org/wiki/Comparison_of_disk_cloning_software
## Bare Metal Recover Tools

<table>
<thead>
<tr>
<th>Tool</th>
<th>URL</th>
<th>Version</th>
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<tbody>
<tr>
<td>Clonezilla live</td>
<td>clonezilla.org</td>
<td>1.2.8-46</td>
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<tr>
<td>FOG</td>
<td><a href="http://www.fogproject.org">www.fogproject.org</a></td>
<td>0.30</td>
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<tr>
<td>Fsarchiver</td>
<td><a href="http://www.fsarchiver.org">www.fsarchiver.org</a></td>
<td>0.6.12</td>
</tr>
<tr>
<td>G4L</td>
<td>g4l.sourceforge.net</td>
<td>0.37</td>
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<tr>
<td>Mondo Rescue</td>
<td><a href="http://www.mondo">www.mondo</a> Rescue.org</td>
<td>2.2.9.6</td>
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<tr>
<td>Partimage</td>
<td>partimage.org</td>
<td>0.6.9*</td>
</tr>
<tr>
<td>Acronis® True Image</td>
<td><a href="http://www.acronis.com">www.acronis.com</a></td>
<td>2011</td>
</tr>
<tr>
<td>Norton Ghost™</td>
<td><a href="http://www.symantec.com">www.symantec.com</a></td>
<td>15.0</td>
</tr>
</tbody>
</table>

**Free /Open Source Software**

**Proprietary Software**
• About these comparisons:
  Please let us know if the information in comparisons is not correct.
# Comparison – General Info

<table>
<thead>
<tr>
<th>Interface</th>
<th>Provides Live USB</th>
<th>Provides Live CD</th>
<th>Live copying</th>
<th>Differential backup</th>
<th>Based on</th>
<th>License</th>
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<tbody>
<tr>
<td>Clonezilla</td>
<td>TUI</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>partclone</td>
</tr>
<tr>
<td>FOG</td>
<td>GUI</td>
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<td>N</td>
<td>N</td>
<td>N</td>
<td>partimage</td>
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<td>Fsarchiver</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>GPL</td>
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<td></td>
<td>Smart copy full disk (No LVM2, no firmware RAID)</td>
<td>Smart copy full disk with LVM2</td>
<td>Smart copy full disk with firmware RAID</td>
<td>Raw copying</td>
<td>Without server</td>
<td>Server/client</td>
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<td>N</td>
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<td>Y</td>
<td>Y</td>
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</tbody>
</table>
# Comparison – **Smart** Copying File Systems of Linux

<table>
<thead>
<tr>
<th></th>
<th>ext2/3</th>
<th>ext4</th>
<th>reiserfs</th>
<th>reser4</th>
<th>xfs</th>
<th>jfs</th>
<th>btrfs</th>
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<tbody>
<tr>
<td>Clonezilla</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>FOG</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Fsarchiver</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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<tr>
<td>G4L</td>
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<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>Mondo Rescue</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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<td>Y</td>
</tr>
<tr>
<td>Partimage</td>
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<td>Y</td>
<td>N</td>
<td>Y</td>
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<tr>
<td>True Image</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
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</tbody>
</table>
## Comparison – **Smart** Copying File systems of Other Oses

<table>
<thead>
<tr>
<th></th>
<th>HFS+ (Mac)</th>
<th>FAT (MS Win)</th>
<th>NTFS (MS Win)</th>
<th>UFS (*BSD)</th>
<th>VMFS (Vmware Esx(i))</th>
</tr>
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<tbody>
<tr>
<td>Clonezilla</td>
<td>Y</td>
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<td>Partimage</td>
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<td>Y</td>
</tr>
<tr>
<td>Ghost</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>
Advanced Usage
with Clonezilla Live
Clonezilla Live Demo (2)

Restore an image

- A running Ubuntu 12.04 system
  - Text mode only. The whole system uses about 1.3 GB space
  - /dev/sda1 on / (grub2) and /dev/sda5 on / with ext4
  - /dev/sda3 is used as swap partition

- Destroy the whole system by:
  - dd if=/dev/zero of=/dev/sda1 bs=1M count=10
  - dd if=/dev/zero of=/dev/sda3 bs=1M count=10
  - dd if=/dev/zero of=/dev/sda bs=1M count=10

- Recover the whole system by Clonezilla live with a previous saved image via sshfs
Pre-process and post-process when restoring a system

- Boot parameters provide a mechanism to preset some options => Set in the config file of isolinux, syslinux, pexelinux or grub.
- Besides the boot parameters from Debian live, Clonezilla also provides `ocs_prerun*` and `ocs_postrun*` parameters
- `ocs_prerun*` is for pre-process, right before Clonezilla job is run and `ocs_postrun*` is for post-process, right after the Clonezilla job is done.
- **Limitation**: No double quotation mark ("”) or single quotation mark (’’) in your command.

[Diagram: `ocs_prerun*` to `Clonezilla jobs` to `ocs_postrun*`]
Pre-a-process and post-process when restoring a system (cont')

- The order to run is:
  - ocs_prerun1, ocs_prerun2, ocs_prerun3...
  - ocs_postrun1, ocs_postrun2, ocs_postrun3...

- Examples
  - To do a file system check for 1st partition, use:
    ocs_prerun1="fsck /dev/sda1"
  - To lease an IP address from a DHCP server:
    ocs_prerun1="dhclient -v eth0"
  - To mount a file system and modify a file after restoring:
    ocs_postrun1="mount /dev/sda1 /mnt" ocs_postrun2="sed -i -e "s/old/new/ /etc/hostname" ocs_postrun3="umount /mnt"

- Boot parameters doc are available on http://clonezilla.org
Unattended recovery with a file server

- **Scenario:** You have **a file server** and want to use **a CD of Clonezilla (no image included)** to restore different machines

- **How**
  - **Have an image ready** on the file server first
  - **Use boot parameters** to make that, e.g. for NFS server:
    - `append initrd=/live/initrd.img boot=live config noswap nolocales edd=on nomodeset noprompt ocs_prerun1="dhclient -v eth0"
      ocs_prerun2="sleep 2" ocs_prerun3="mount -t nfs 192.168.120.254:/home/partimag /home/partimag"
      ocs_live_run="ocs-sr -g auto -e1 auto -e2 -b -r -j2 -p reboot restoredisk squeeze-updated-20110711 sda" ocs_live_extra_param="" ocs_live_keymap="NONE"
      ocs_live_batch="no" ocs_lang="en_US.UTF-8" vga=788 ip=frommedia nosplash
    - Here we preset (1) the keymap as default (NONE, i.e. US keymap), (2) the language as English (en_US.UTF-8), (3) configure the network, (4) mount the image repository on NFS server, and (5) run the restoring command
Unattended recovery with a file server (cont')

- The complete command for `ocs_live_run` can be gotten from the Clonezilla wizard

```bash
Choose the target disk(s) to be overwritten (ALL DATA ON THE ENTIRE DISK WILL BE LOST AND REPLACED!!)

The disk name is the device name in GNU/Linux. The first disk in the system is "hda" or "sda", the 2nd disk is "hdb" or "sdb"... Press space key to mark your selection. An asterisk (*) will be shown when the selection is done:

sda 8590MB VMware Virtual I ata-VMware_Virtual_IDE_Hard_Drive_00000000000000000000
sdb 18.3GB VMware Virtual I ata-VMware_Virtual_IDE_Hard_Drive_11000000000000000000

<Ok> <Cancel>
```

**Next time you can run this command directly:**

```
/opt/drb1/sbin/ocs-sr -g auto -e1 auto -e2 -c -r -j2 -p true restoredisk squeeze-updated-20110711 sd
```

This command is also saved as this file name for later use if necessary: /tmp/ocs-squeeze-updated-20110711-2011-07-12-08-57
Press "Enter" to continue...
A customized live CD for remote troubleshooting

- Scenario: Your customer want you to do a remote troubleshooting, however, he knows nothing about GNU/Linux.

- How
  - For remote troubleshooting, you need
    - Network connection after booting
    - Password for the account “user” need to be changed (The default password is “live”)
    - Ssh service is started automatically
      - append initrd=/live/initrd.img boot=live config noswap nolocales edd=on nomodeset noprompt ocs_prerun1="dhclient -v eth0" ocs_prerun2="sleep 2" usercrypted=WwLqQXIdMIzoo ocs_daemonon="ssh" ocs_live_run="/bin/bash" ocs_live_keymap="NONE" ocs_live_batch="no" ocs_lang="en_US.UTF-8" vga=788 ip=frommedia nosplash
  - The encrypted password of “user” was obtained by
    - echo YOUR_PASSWORD | mkpasswd -s
Serial console and PXE booting usage

- Scenario: A cluster with serial console only, no VGA connection

- For serial console, 2 boot parameters are required to redirect the screen output:
  - **live-getty** and **console**, e.g. append them to the previous case:
  - append initrd=/live/initrd.img boot=live config noswap nolocales edd=on nomodeset noprompt ocs_prerun1="dhclient -v eth0" ocs_prerun2="sleep 2" usercrypted=WwLqQXIdMIzoo ocs_daemonon="ssh" ocs_live_run="/bin/bash" live-getty console=ttyS0,38400n81 ocs_live_keymap="NONE" ocs_live_batch="no" ocs_lang="en_US.UTF-8" vga=788 ip=frommedia nosplash
What if boot parameters can not do?

- In this case, modify the root file system. The difference is, it's a read-only file system.
- How → copy then rebuild
  - Unsquashfs the root file system “filesystem.squash” of Clonezilla live, modify it.
    - mkdir ~/zip-tmp ~/squashfs-tmp
    - unzip clonezilla-live-1.2.12-55-i686-pae.zip -d ~/zip-tmp
    - cp ~/zip-tmp/live/filesystem.squashfs ~/squashfs-tmp
    - cd ~/squashfs-tmp; sudo unsquashfs filesystem.squashfs
    - Modify the files in squashfs-root, e.g. add some files.
What if boot parameters can not do? (cont')

- Rebuild the new filesystem.squashfs and replace the original one, then rebuild clonezilla-live zip file:
  - `sudo mksquashfs squashfs-root filesystem.squashfs.new -b 1024k -comp xz -Xbcj x86 -e boot`
  - `sudo cp filesystem.squashfs.new ~/zip-tmp/live/filesystem.squashfs`
  - `cd ~/zip-tmp ; sudo zip -r ../clonezilla-live.new.zip ./*`
Clonezilla

Clonezilla is a partition or disk clone tool similar to Norton Ghost. It saves and restores only the used blocks in the hard drive. Two types of Clonezilla are available: Clonezilla live and Clonezilla SE (Server Edition). The filesystem supported by Clonezilla are: ext2, ext3, ext4, reiserfs, xfs, jfs of GNU/Linux, FAT, NTFS of MS Windows, and HFS+ of Mac OS. Therefore you can clone GNU/Linux, MS windows and Intel-based Mac OS whether they be 32-bit (x86) or 64-bit (x86-64) OS. For these file systems, only the used blocks in the partition are saved and restored. For unsupported file systems, a sector-to-sector copy is done by dd in Clonezilla.

Why and how did you get started?
On the 29th of March, 2003, the computers in the computer classrooms at the National Center for High-Performance Computing (NCHC, http://www.nchc.org.tw) were all upgraded. However, the deployment software did not support the new hardware. That’s why we started the Clonezilla project. In the beginning, we started the Clonezilla server edition first, then, in 2007, Clonezilla live was created.

Who is the software’s intended audience?
System administrators, that being, PC cluster administrators, computer classroom administrators, and of course anyone who needs a tool to clone or image his/her computer.

What are a couple of notable examples of how people are using your software?
* The National Computer Centre Wonen, Netherlands, used Clonezilla to, “clone a 3 GB image to 27 machines with an average speed was 2.1 GB/min.”

* Cisco Systems used DRBL, “…in the design of our Cisco Computational Cloud cluster to multicast a 5 GB disk image to 64 machines simultaneously.”

* Information Systems Security, Southbridge, Massachusetts, USA, said, “So far, I have cloned 1,084 systems using DRBL. By carefully following the instructions on the DRBL website, and using multicasting and dividing the number of systems into groups of 80-100 PCs at the time, it took me somewhere between 16-38 minutes for each group of PCs, using images of various operating systems that averaged 1 GB in size. DRBL has reduced the recovery/cloning factor by more than 500% as compared with the previous commercial solution [we were] using.”
Use case in enterprise

- Barny Sanchez
- Information Systems Security, Southbridge, Massachusetts
- Cloned 1,084 systems using DRBL (Clonezilla SE)
  - "I've used DRBL to clone 1,084 systems so far! It was simple! All I had to do was divide each system into groups of 80-100 PCs and then use multicasting to do the cloning. It took anywhere from 16-38 minutes to clone each system. The images of various operating systems averaged 1 GB in size. DRBL has reduced the recovery/cloning fact or by more than 500% as compared to the commercial solution I used previously! You can imagine how happy my project managers are!"