The Massive Deployment Tools: Clonezilla and It's Family

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Jazz Wang, Thomas Tsai
http://drbl.nchc.org.tw, http://drbl.org
http://clonezilla.nchc.org.tw, http://clonezilla.org
National Center for High-Performance Computing

Outline

- Introduction to DRBL/Clonezilla
  - About DRBL/Clonezilla
  - Users in Taiwan and Worldwide
  - Related Activities
  - Success Stories
  - Testimonials
- Demo
  - DRBL
  - Clonezilla live
- Q&A

Free Software Lab

- Free software projects developed by NCHC's Free Software Lab
- Our goal is to create a Free Software Smart Classroom (FSSC) based on our HPC experience
  - DRBL, Clonezilla, DRBL-WinRoll, Tux2Live, PartClone
  - Cluster Computing – Phantom Cluster
  - Grid Computing
  - Cloud computing: DRBL-Hadoop, DRBL-Xen, DRBL-Virt, DRBL-ONE

DRBL/Clonezilla

DRBL

Diskless Remote Boot in Linux

Provides a “diskless” and/or “systemless” environment for client machines

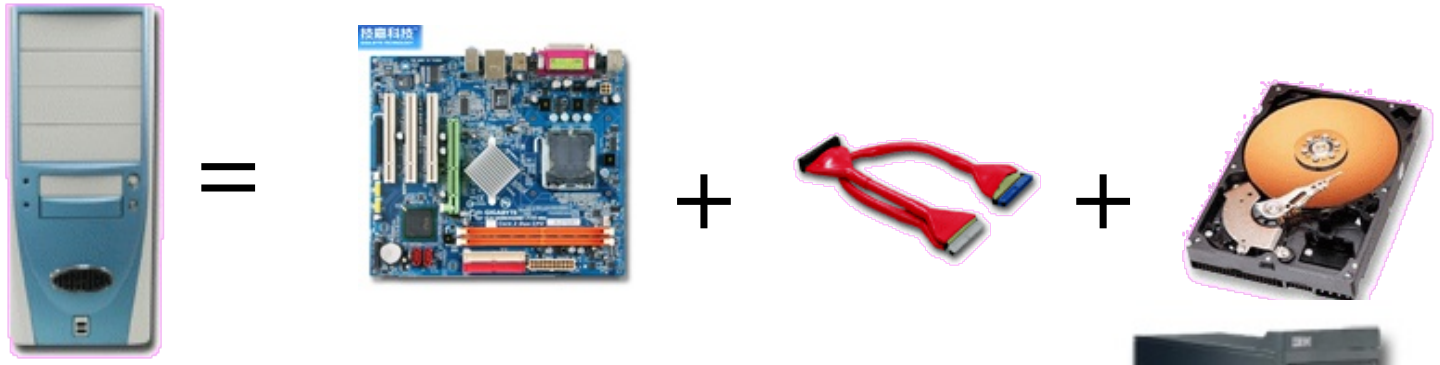
Clonezilla

A partitioning and disk cloning utility similar to Ghost and True image

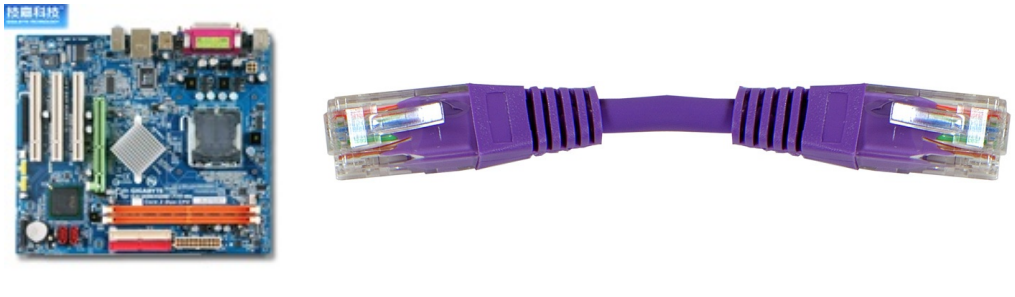
DRBL

- **Network is everywhere, cheap, and fast**
- **In DRBL**
  - **The harddrive bus cable is replaced by network cable**
  - **All DRBL clients share 1 harddrive in the server**

Diskfull PC



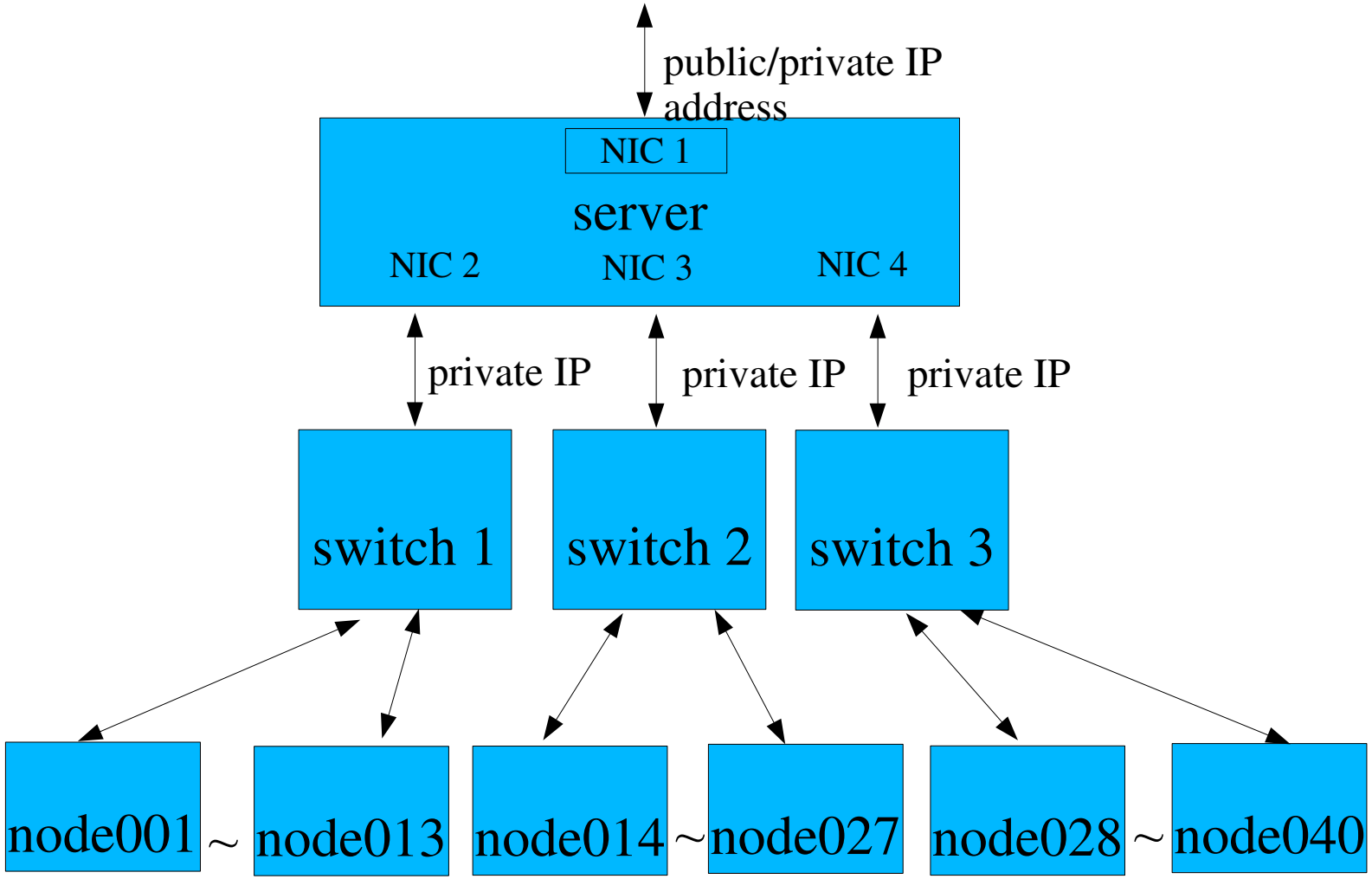
Diskless PC



Server

image source: www.mren.com.tw

DRBL Environment



DRBL

server

switch

client nodes

		pxe/etherboot	pxe/etherboot
DHCP	IP →	192.168.0.1	172.16.100.10
TFTP	kernel →	boot	boot
NFS	file system →	/, /usr, /home ...	/, /usr, /home ...
NIS	account →	user login	user login

DRBL & LTSP

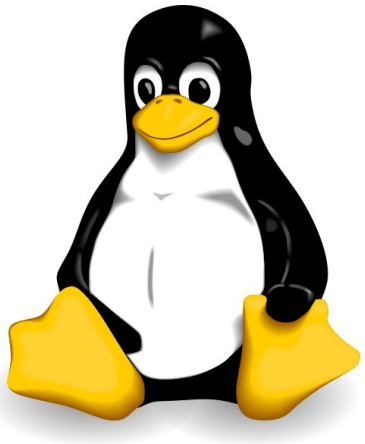
- DRBL project was started in 2002 for PC cluster, at that time LTSP does not support 'fat client' mode
- What's the differences:
  - **DRBL**: Distributed Resource <-> **LTSP**: Centralized Resource
  - **DRBL**: Powerful Client <-> **LTSP**: Thin Client
- **DRBL** allows 3D gaming and video playback in the client
- DRBL is suitable for HPC (high-performance computing) , cluster computing
    - Either diskless, systemless, or diskfull (by Clonezilla SE)

Why DRBL?

- DRBL Features:
  - NFS-based diskless GNU/Linux
  - SAN-based diskless MS Windows, GNU/Linux (SAN: Storage Area Network), SAN Boot includes AoE (ATA over Ethernet) and iSCSI
  - Memory-based diskless mode
    - For small size GNU/Linux, e.g. DSL, PuppyLinux, Clonezilla live, Gparted live
    - FreeDOS
  - Clonezilla Server Edition (SE)
  - A single command is required to switch the client environment
    - DRBL, FreeDOS, OS in local HD, memtest...
  - Linux network installation
- Not suitable for older machines and/or thin clients
- //**NOTE**// From version 5 (released '07), fat client mechanism is supported in LTSP

What is Clonezilla?

- A partitioning and disk cloning utility similar to Ghost® and True image®
- A bare metal recovery tool for



*1

*2

*3

Microsoft Windows

*4

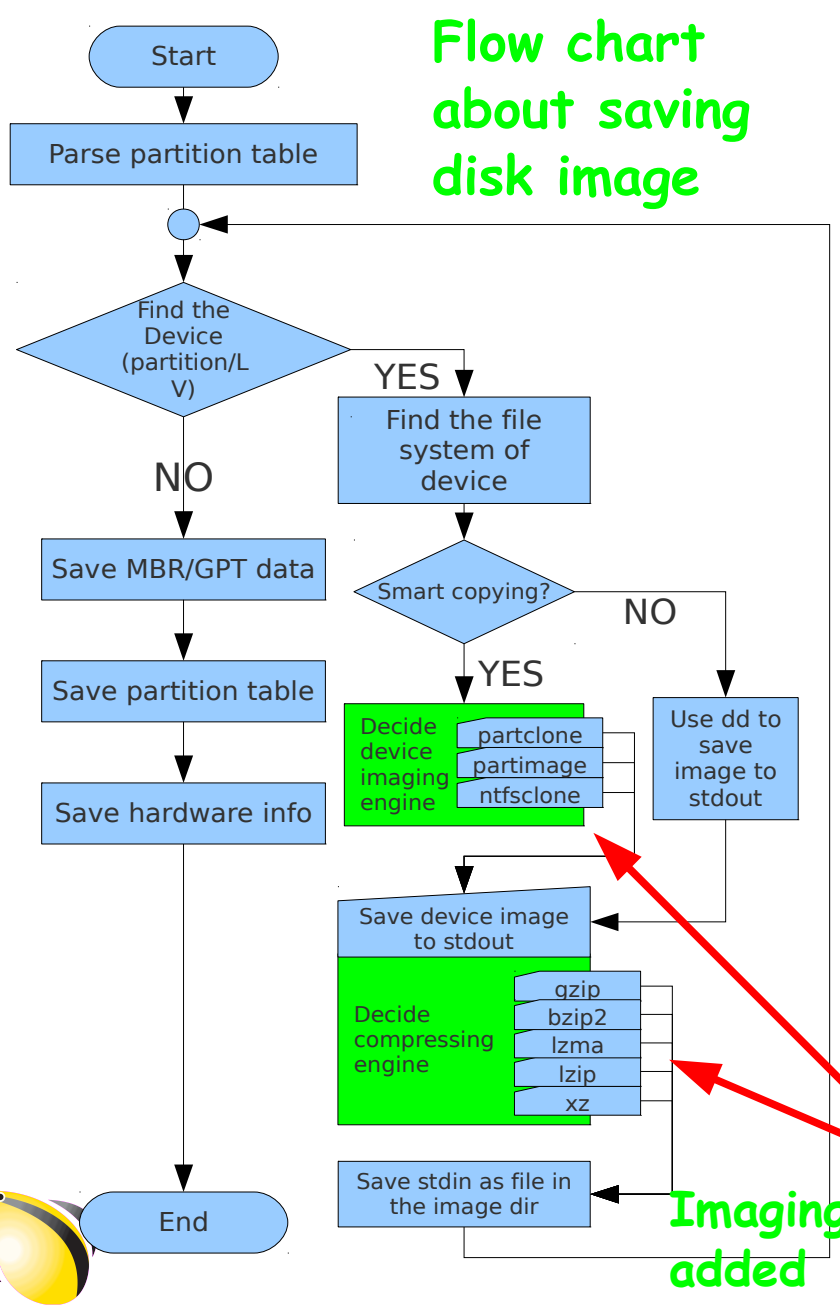
*Logo source: (1) Larry Ewing, Simon Budig and Anja Gerwinski, (2) Apple (3) Marshall Kirk McKusick, (4) Microsoft

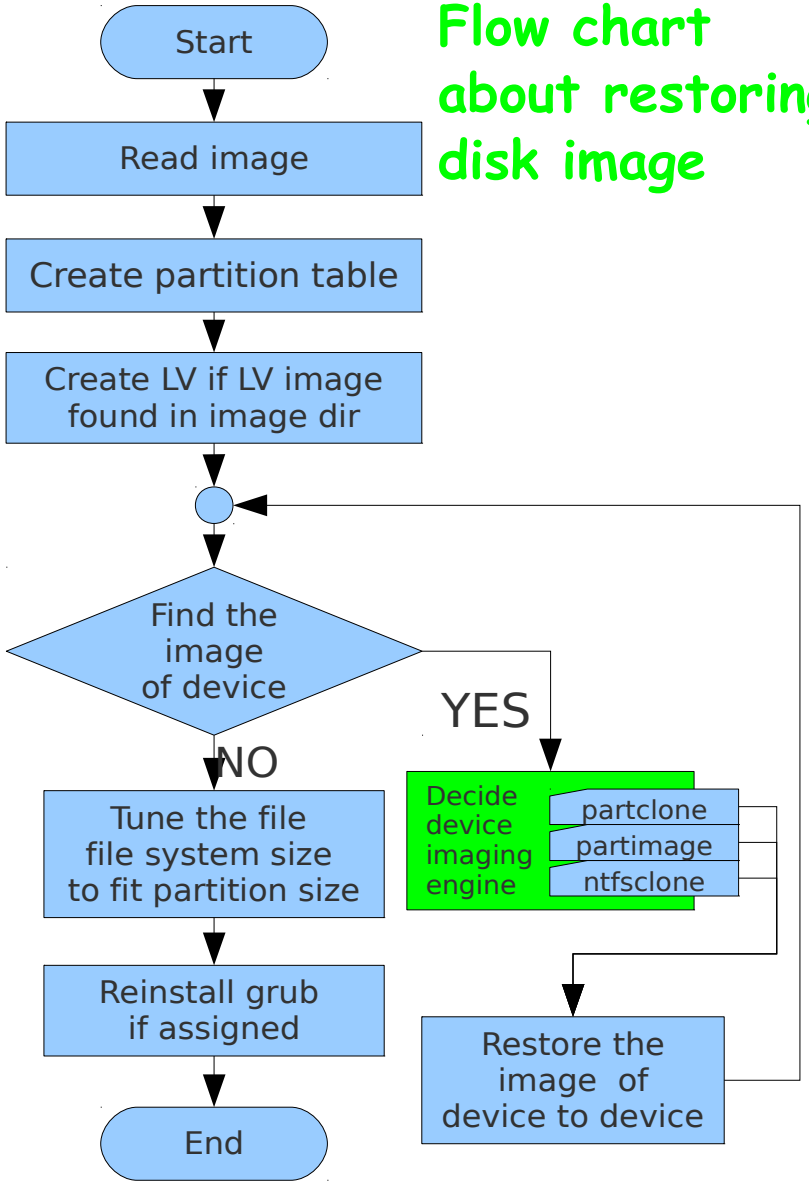
Bare Metal Recover Tools

	URL	Version
Clonezilla live	clonezilla.org	1.2.6-40
FOG	www.fogproject.org	0.29
Fsarchiver	fsarchive.org	0.6.10
G4L	g4l.sourceforge.net	0.34
Mondo Rescue	www.mondorescue.org	2.2.9.4
Partimage	partimage.org	0.6.9
Acronis® True Image	www.acronis.com	2011
Norton Ghost™	www.symantec.com	15.0

Open Source Software
Proprietary Software

Open and Flexible Architecture of Clonezilla

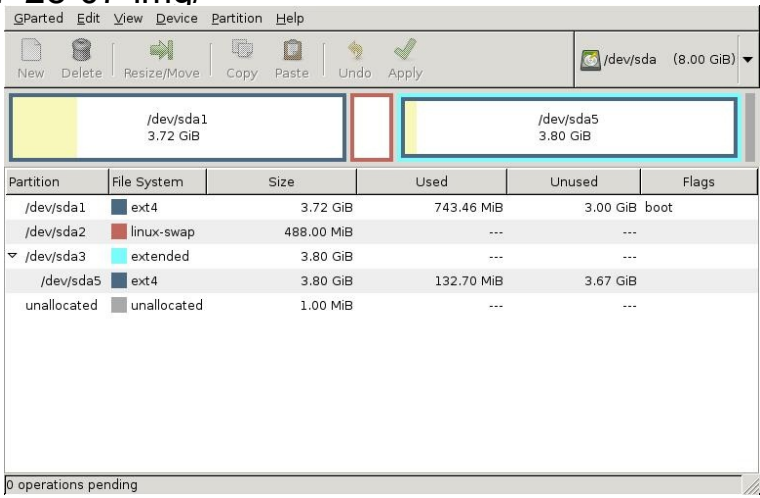




Imaging and compressing engines can be easily added

Open and Flexible Architecture of Clonezilla – Image format

```
root@debian:~# ls -alFh /home/partimag/lucid-2010-07-28-07-img/
total 220M
drwxr-xr-x 2 root root  512  07:12 ./
drwxr-xr-x 7 root root  168  07:12 ../
-rw-r--r-- 1 root root  420  07:12  disk
-rw-r--r-- 1 root root   34K  07:12  Info-dmi.txt
-rw-r--r-- 1 root root   18K  07:12  Info-lshw.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------- 1 root root  216M  07:12  sda1.ext4-ptcl-img.gz.aa
-rw------- 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
```



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

Comparison – General Info

	Interface	Provides Live USB	Provides Live CD	Live copying	Differen-tial backup	Based on	License
Clonezilla	TUI	Y	Y	N	N	partclone	GPL
FOG	GUI	N	N	N	N	partimage	GPL
Fsarchiver	CML	Y	Y	Y	Y		GPL
G4L	TUI	Y	Y	N	N	g4u, dd, partimage , ntfsclone	GPL
Mondo Rescue	TUI	Y	Y	Y	Y	afio, mondi	GPL
Partimage	TUI	Y	Y	N	N		GPL
True Image	GUI	Y	Y	Y	Y	Proprietary	Proprietary
Ghost	GUI	Y	Y	Y	Y	Proprietary	Proprietary

Comparison – General Info

	Smart copy full disk (No LVM2, no firmware RAID)	Smart copy full disk with LVM2	Smart copy full disk with firmware RAID	Raw copying	Without server	Server/ client
Clonezilla	Y	Y	N	Y	Y	Y
FOG	Y	N	N	Y	N	Y
Fsarchiver	N	N	N	N	Y	N
G4L	N	N	N	Y	N	Y
Mondo Rescue	Y	Y	N	Y	Y	N
Partimage	N	N	N	N	Y	Y
True Image	Y	Y	N	Y	Y	Y
Ghost	Y	N	N	Y	Y	Y

Comparison – Smart Copying File Systems of Linux

	ext2/3	ext4	reiserfs	reser4	xfs	jfs	btrfs
Clonezilla	Y	Y	Y	Y	Y	Y	Y
FOG	Y	N	Y	N	Y	Y	N
Fsarchiver	Y	Y	Y	Y	Y	Y	Y
G4L	Y	N	Y	N	Y	Y	N
Mondo Rescue	Y	Y	Y	Y	Y	Y	Y
Partimage	Y	N	Y	N	Y	Y	N
True Image	Y	Y	N	N	N	N	N
Ghost	Y	N	N	N	N	N	N

Comparison – Smart Copying File systems of Other Oses



	HFS+ (Mac)	FAT (MS Win)	NTFS (MS Win)	UFS+ (*BSD)	VMFS (Vmware Esx(i))
Clonezilla	Y	Y	Y	Y	Y
FOG	N	Y	Y	N	N
Fsarchiver	N	N	Y	N	N
G4L	N	Y	Y	N	N
Mondo Rescue	N	Y	N	N	N
Partimage	N	Y	Y	N	N
True Image	N	Y	Y	N	Y
Ghost	N	Y	Y	N	N

Proprietary Software vs. Free Software

- Pros and Cons for using Proprietary Software
  - Pros
    - You know WHOM you pay, so you can ask for support from them
    - Average good quality in the QC and the GUI
  - Cons
    - Cost
    - Normally no good support for non-mainstream Oses
    - No freedom to use, copy, modify and redistribute

- Clonezilla is a good choice, because of its
  - open and flexible architecture
  - support for a wide variety of file systems

* Photos source: http://en.wikipedia.org/wiki/United_States_dollar , Larry Ewing, Simon Budig and Anja Gerwinski, Apple,

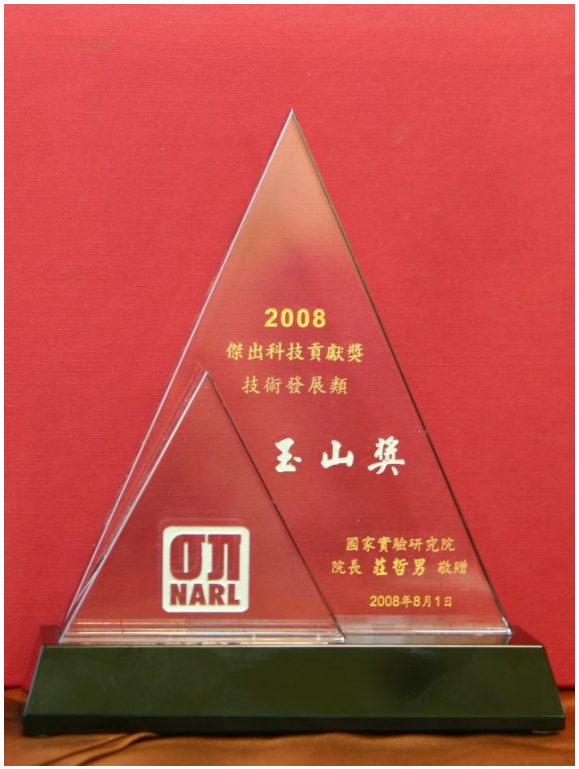
International Free Software Contest

- DRBL is the winner in the 'Public Sector Software' category at Les Trophees du Libre 2007 in France
  - Finals and awards ceremony: Nov. 29th, 2007
  - http://www.freesoftwareawards.com or http://tropheesdulibre.com/?lang=en

Intrnl. Free Software Contest, France, Nov/07

National Applied Research Laboratories Award

- DRBL/Clonezilla team is the winner in the category 'Technology Development' for 2008



National Award in Taiwan

Executive Yuan

The 2008 Award for Outstanding Contributions in Science and Technology

Project of the Month, January 2010

Project of the Month, January 2010

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 2.4 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"

Project name: Clonezilla

Date founded: July 2004

Project page: https://sourceforge.net/projects/clonezilla/

Project Leader

Steven Shiau
Occupation: Researcher at the NCHC, Taiwan
Location: Hsinchu, Taiwan
Education: M. S. (Nuclear Engineering), National Tsing Hua University, Taiwan

Key Developers

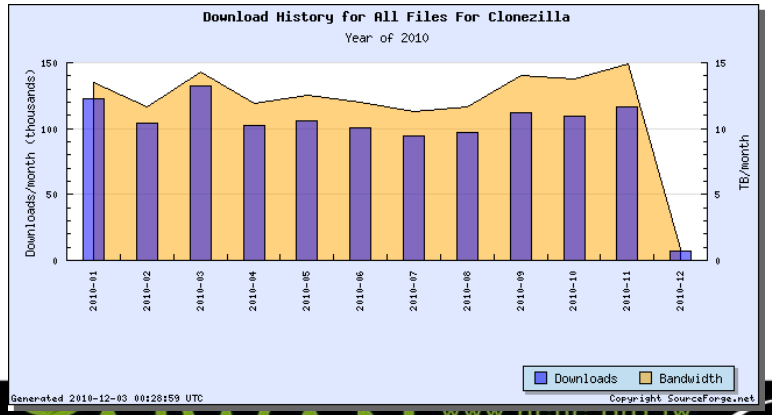
Blake, Kuo-Lien Huang
Occupation: Open source hobbyist
Education:M. S.
Location: Hsinchu, Taiwan

Chenkai (Ceasar) Sun
Occupation: Associate Researcher at the NCHC, Taiwan
Education:M. S. (Department of Management Information System) National Sun Yat-Sen University, Kaohsiung, Taiwan
Location: Hsinchu, Taiwan

Yao-Tsung (Jazz) Wang
Occupation: Associate Researcher at the NCHC, Taiwan

Clonezilla

Clonezilla on 2010 Jan's Linux Journal,
5 pages introduction to Clonezilla SE and Clonezilla live.
On the cover page:
Clonezilla – High Performance Open-Source Cloning



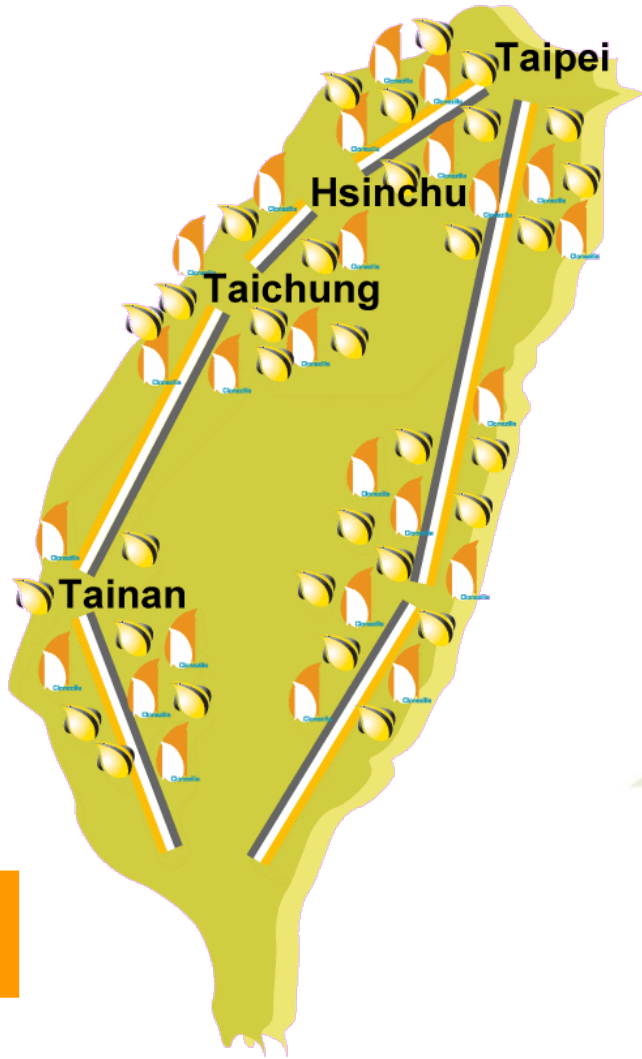
Date (UTC)	Rank	Downloads	Project Web Hits	Tracker opened (closed)	Forum Posts
Dec 2010 *	24	7259	3818	0 (0)	9
Nov 2010	19	116409	54991	8 (2)	279
Oct 2010	18	109299	53209	3 (3)	265
Sep 2010	20	112318	23865	3 (0)	260
Aug 2010	20	97041	18784	6 (6)	330
Jul 2010	18	94321	17468	1 (1)	300
Jun 2010	16	100353	18191	5 (1)	312
May 2010	18	105519	17904	5 (0)	393
Apr 2010	14	102175	18583	7 (2)	340
Mar 2010	20	132196	30223	6 (5)	393
Feb 2010	19	103756	25595	5 (1)	349
Jan 2010	23	123078	33061	2 (0)	413

DRBL/Clonezilla Use In Taiwan

- ✓ **Public Sector:**

Primary/High schools	295
Universities	95
Local governments	35
Hospitals	3
TV stations	1

- ✓ **SMBs** 124
- ✓ **Misc.** 2



Known sites > 500!!!

DRBL/Clonezilla Users Worldwide

>2,300,000 DRBL/Clonezilla Downloads

Testimonials

- Kristian Hermansen
- Cisco Systems, Boston, MA, Sept. '07
- Cloned a 5GB image to 64 machines in 5 under minutes!!!
  - "I used Clonezilla in the design of our Cisco Computational Cloud Cluster to multicast a 5 GB disk image to 64 machines simultaneousl y and all in under five minutes! Amazing! Th anks Clonezilla!"

Testimonials

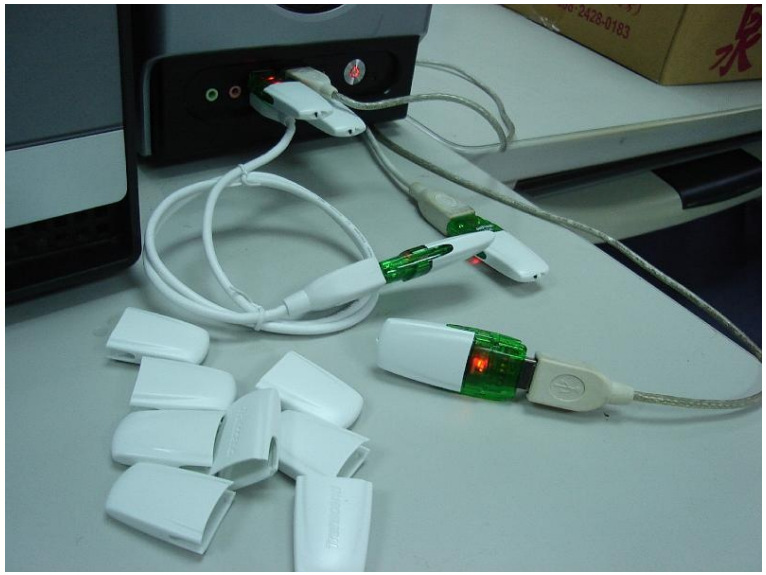
- Barny Sanchez
- Information Systems Security, Southbridge, Massachusetts
- Cloned 1,084 systems using DRBL (Clonezilla SE)
  - "I've used DRBL to clone 1,084 systems so far! It was simple! All I had to do was divide each system into groups of 80-100 PCs and then use multicasting to do the cloning.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

Testimonials

- 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 cr eate the ISO image for customers. Your great tool, Clonezil la, helps me a lot in system backup, recovery and ISO ima ge creating. I only need to download the Clonezilla zip file, and create the bootable usb key in few easy steps, then I c an use that key to backup the systems and create the ISO i mage by the same key. And the key is just the recovery par tition as I need. All procedures take me only about 1 hour t o finish all stuffs. I love your tool and that is really cover all f unctions what I need to have in Linux system recovery sco pe. Clonezilla is the best all-in-one tool that I have never se en before."

Testimonials

- Alvin Su
- Shen-Mei Elementary School, Taiwan
- Cloned more than 100 USB flash drives , each with 3 GB OS and data. Every batch 8 USB flash drives, ~ 30 mins



Clonezilla Used in Taiwan's "National PCs"

Source: De-Wen Huang

Success Stories

Da-Feng Elementary School, Taipei, Taiwan

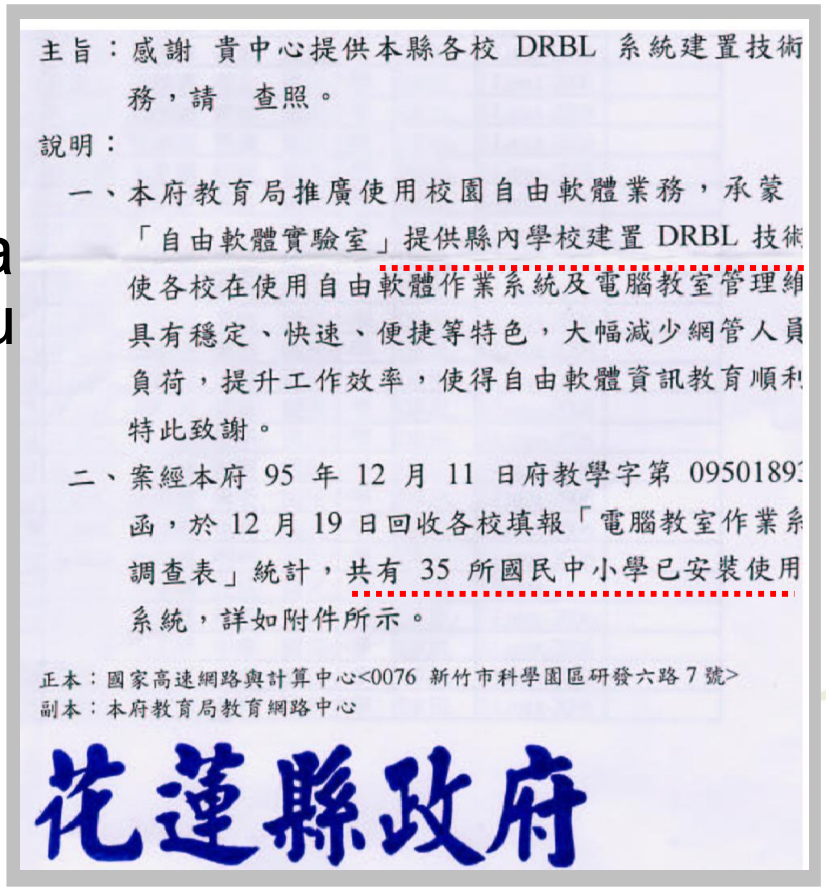
- DRBL/Clonezilla is used to manage computer classroom
- Special Report: Linux in Education, 2006 on distrowatch.com
- DRBL/Clonezilla press conference @ Da-Feng Elementary School 07/04/07

DistroWatch.com 重拾電腦操作的樂趣，使用Linux！

source: distrowatch.com

Success Stories
Hualien County, Taiwan

- Used Clonezilla Server Edition (SE) to clone GNU/Linux
- 145 schools (131 Primary/Jr.; 14 Senior High) use as of June '08
- Letter of Commendation from Hualien County Government



主旨：感謝 貴中心提供本縣各校 DRBL 系統建置技術
務，請 查照。

說明：

一、本府教育局推廣使用校園自由軟體業務，承蒙
「自由軟體實驗室」提供縣內學校建置 DRBL 技術
使各校在使用自由軟體作業系統及電腦教室管理維
具有穩定、快速、便捷等特色，大幅減少網管人員
負荷，提升工作效率，使得自由軟體資訊教育順利
特此致謝。

二、案經本府 95 年 12 月 11 日府教學字第 0950189
函，於 12 月 19 日回收各校填報「電腦教室作業系
調查表」統計，共有 35 所國民中小學已安裝使用
系統，詳如附件所示。

正本：國家高速網路與計算中心<0076 新竹市科學園區研發六路 7 號>
副本：本府教育局教育網路中心

花蓮縣政府

Use case in enterprise

- Nagappan Alagappan from VMware
- Palo Alto, CA, USA
  - Before Clonezilla we were using Symantec Altiris, but it worked fine only for Windows and RedHat, it doesn't work for Ubuntu / SUSE
  - As a product company, we need to test our product in all popular operating system, when exploring dif ferent opportunity, we found Clonezilla appropriat e, Reason: It support all the Linux distribution (Re dHat, SUSE, Ubuntu, Mandriva) and different file system, which we use (ext3, ext4, reiserfs)

Use case in enterprise

- Initially evaluated Clonezilla live and found a very good performance, Windows XP image restoration 7 minutes, Ubuntu 3 minutes, SUSE / RHEL 5 min utes from a NFS server
- Later we (in VMware) have implemented a service , which will automate the Clonezilla reimaging par t, without any manual intervention, which have sav ed our life and ofcourse money, as Clonezilla is Fr ee Software !

Use case in enterprise

- When a new (internal) build is released (at least one build a day), Basic Acceptance Test (BATS in short) will be executed. The process is: Install a new OS image in a single test machine (pool o f 70 machines), download the latest build, downl oad the test scripts to execute, start the test, pu blish the result and release the machine back to pool, if all the tests in BATS are passed
- VMware has proudly contributed back the code t o Clonezilla team and will be happy to support a nyone who wants to use in their environment

DRBL Demo

- Diskless client (NFS-based)
- Diskless client (Memory-based, small Linux)
  - DSL
  - PuppyLinux
  - Gparted Live
  - Clonezilla Live
- Diskless MS windows (SAN-based)
  - AoE boot: MS windows XP
- DRBL Live
  - DRBL Live 1.0.0-9

Demo

- Restore A System by The Open Source Tool – Clonezilla live
- A running Ubuntu 10.10 system
  - Text mode only. The whole system uses about 900 MB of 8 GB disk space
  - /dev/sda1: /boot (for grub2, ext4)
  - /dev/sda2: / (btrfs)
  - /dev/sda5: /home (btrfs)
  - /dev/sda7: /usr (btrfs)

Clonezilla Live

- Destroy the whole system by:
  - dd if=/dev/zero of=/dev/sda1 bs=1M count=30
  - dd if=/dev/zero of=/dev/sda5 bs=1M count=30
  - dd if=/dev/zero of=/dev/sda7 bs=1M count=30
  - dd if=/dev/zero of=/dev/sda2 bs=1M count=30
  - dd if=/dev/zero of=/dev/sda bs=1M count=30
- Recover the whole system by Clonezilla live with a previous saved image

Questions ?