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World 2012

1

Sync, Clone, and Snapshot ...

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XW12

2



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3

Overview and Introduction



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4

Overview

- Preamble
- Overview and Introduction
- Syncing with rsync
- Cloning with CCC
- Snapshotting with rsnapshot
- Summary
- Q & A



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5

School of IS Curtin University

- Teaching
 - Introduction to Business IS and IT
 - Object-Oriented Analysis & Design
- Research
 - Agile & Lean Software Engineering
 - Teaching and Learning Research



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6

Running Code Productions

www.runningcode.com.au

- Professional Training & Mentoring
 - Cocoa, WebObjects, Java, OO, Unix, ...
- Software Consulting Services
 - Architecture, analysis, design, development ...
- Early Stage Startups
 - Online Payments, ...



Disclaimers

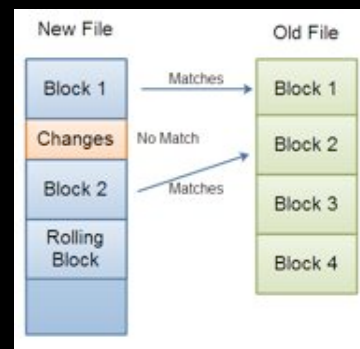
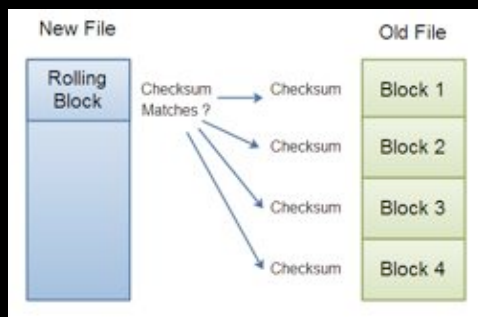
- These tools are known to change
- Please read the manual pages
- I am not a professional SA
- Intro to Intermediate Level
- YMMV

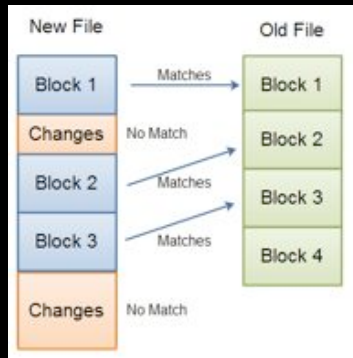
Syncing

... with rsync ...

Rsync

- A fast, versatile, remote (and local) file-copying tool
- `$ rsync [options] SRC... [DEST]`
- Uses a delta-transform to reduce transfer times by sending only changes to files ...
- Heaps of options ... see man page ...
- Compresses, filters, pattern rules, batch mode, ...





<http://jakob.jenkov.com/>

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13

Other Features

- support for copying links, devices, owners, groups, and permissions
- exclude and exclude-from options similar to GNU tar
- a CVS exclude mode for ignoring the same files that CVS would ignore
- can use any transparent remote shell, including ssh or rsh
- does not require super-user privileges
- pipelining of file transfers to minimize latency costs
- support for anonymous or authenticated rsync daemons (ideal for mirroring)

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14

Remote Shell or Daemon

- rsync requires software running on the source and target
- Two options:
 1. Run an instance of rsync in remote shell
 2. Run rsync daemon permanently on target

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15

1. Run Remote Shell

- Used when destination path contains “.”

Pull: rsync [OPTION...] [USER@]HOST:SRC... [DEST]

Push: rsync [OPTION...] SRC... [USER@]HOST:DEST

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16

2. Contact Rsync Daemon

- Used when the destination path contains “:”
OR when “rsync://...” URL is used
 - rsync --daemon running on remote host
- Pull:** rsync [OPTION...] [USER@]HOST::SRC... [DEST]
rsync [OPTION...] rsync://[USER@]HOST[:PORT]/SRC... [DEST]
- Push:** rsync [OPTION...] SRC... [USER@]HOST::DEST
rsync [OPTION...] SRC... rsync://[USER@]HOST[:PORT]/DEST

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17

Starting rsync daemon

\$ rsync --daemon

or use launchd

Configuration file /etc/rsyncd.conf

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18

Sample Config File

```
motd file = /etc/rsyncd.motd
log file = /var/log/rsyncd.log
pid file = /var/run/rsyncd.pid
lock file = /var/run/rsync.lock

[simple_path_name]
path = /rsync_files_here
comment = My Very Own Rsync Server uid = nobody
gid = nobody
read only = no
list = yes
auth users = username
secrets file = /etc/rsyncd.scr
```



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19

Directory and Contents or Just Contents?

- NO TRAILING SLASH ON SRC
\$ rsync SRC ...
 - Copy the specified directory (and its contents)
- TRAILING SLASH ON SRC/
\$ rsync SRC/ ...
 - Copy the contents of the specified directory
 - SRC folder is not created at the destination



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20

Rsync on Mac OS X

- There's history ...
- Version provided
- RsyncX
- See Carbon Copy Cloner
- See Rsnapshot.pl



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21

Solutions using Rsync

Name	Linux	Mac OS	Windows	Comments
BackupAssist	No	No	Yes	Direct mirror or with history, VSS
Back In Time	Yes	No	No	
Cowsync	No	No	Yes	Rsync for Windows (based on Cygwin)
BackupClayDrive	No	Yes	No	Local whole disk backup
OSynchronosa	No	No	Yes	
LuckyBackup	Yes	Yes	No	
gadmin-rsync	Yes	No	No	Part of GadminTools
Grsync	Yes	Yes	Yes	
QutSync	Yes	No	Yes	
PureSync	No	No	Yes	
DataCopy	No	No	Yes	
Vintersync	No	No	Yes	VSS Shadow Copies, Email Reports, Scheduler, NTFS Permissions, Centralised.
Syncofy	Yes	No	Yes	
Backuplist+	No	Yes	No	
Ripcord Backup	No	Yes	No	
RsyncK	No	Yes	No	
rRsync	No	Yes	No	
Duplicati	Yes	Yes	Yes	VSS, LVM snapshots, Scheduler
FoderWatch	No	Yes	No	Supports real-time and on-demand syncing
rdiff-backup	Yes	Yes	Yes	supports History
Get Backup	No	Yes	No	Partial sync, comparison between sync, scheduler, disk cloning
Ursync	Yes	Yes	Yes	File synchronizer using Rsync algorithm



<http://en.wikipedia.org/wiki/Rsync> XW12

22

Issues?

- Stops on errors
 - Need to start from beginning again ...
- Synchronisation is only in one direction
 - Unless you do it in both directions ...



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23

In the transporter room ...



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24

Cloning

... with CCC ...

Carbon Copy Cloner (CCC)

- Clone, Synchronize, Backup, Schedule
- Uses rsync & asr (and diskutil and)
- Full shareware (with Edu discounts)
- Mac OS X Only
- Mike Bombich
- <http://www.bombich.com/>

CCC Cloning

- Bootable clone (if System Disk)
- Great for migrating to new hard disk
- Supports block-level disk-to-disk clones

CCC Incremental Backup

- Smart and fast incremental syncing
- Hard drives, network shares, disk images
- Well thought out default settings
- Uses rsync

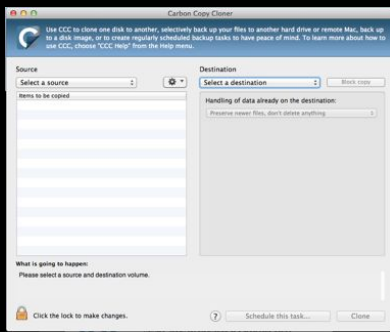
CCC Schedule

- Scheduled hourly, daily, weekly, monthly
- When disk mounted (name or UUID)
- Email notifications on completion
- Will wake and sleep ...

CCC General

- Simple, well thought-out, interface
- Non-proprietary backups (HFS+)
- Cloning Coach

DEMO



DEMO

Underlying tech ...

- Block-Level Copy
 - CCC uses Apple Software Restore (asr)
- Incremental Sync / Copy
 - CCC uses included version of rsync

CCC and Mac OS X Filesystem Compatibility

- Rsync 3 version patched to support HFS+ enhancements (metadata)
- Passes extended Backup Bouncer Test Suite

http://www.bombich.com/groups/ccc/wiki/7ba51/Improvements_to_Backup_Bouncer.html

Backup Bouncer

- Test suite for backup programs
- Use to compare efficacy of tools

<https://github.com/n8gray/Backup-Bouncer>
<http://www.n8gray.org/code/backup-bouncer/>

```
bash-3.2# ./bouncer verify -d /Volumes/Source/ /Volumes/Target/
```

```
Verifying: basic-permissions ... ok
Verifying: timestamps ... ok
Verifying: symlinks ... ok
Verifying: symlink-ownership ... ok
Verifying: hardlinks ... ok
Verifying: resource-forks ...
Sub-test: on files ... ok
Sub-test: on hardlinked files ... ok
Verifying: finder-flags ... ok
Verifying: finder-locks ... ok
Verifying: creation-date ... ok
Verifying: bsd-flags ... ok
Verifying: extended-attrs ...
Sub-test: [ on files ] ... ok
Sub-test: creation time ... ok
Sub-test: modification time ... ok
Sub-test: [ on locked files ] ... ok
Sub-test: creation time ... ok
Sub-test: modification time ... ok
Sub-test: [ on directories ] ... ok
Sub-test: creation time ... ok
Sub-test: modification time ... ok
```

```
...bash-3.2# ./bouncer verify -d /Volumes/Source/ /Volumes/Target/
```

```
Sub-test: modification time ... ok
Sub-test: [ on symlinks ] ... ok
Sub-test: creation time ... ok
ok
Verifying: hfs-compression ...
Sub-test: decmpfs xattr ... preserved
Sub-test: UF_COMPRESSED flag ... set
Sub-test: file contents ... match
Sub-test: creation time ... ok
Sub-test: modification time ... ok
Sub-test: hard link inode ... ok
Sub-test: hard link decmpfs xattr ... preserved
Sub-test: hard link UF_COMPRESSED flag ... set
Sub-test: hard link modification time ... ok
ok
Verifying: hfs-compression_large ...
Sub-test: decmpfs xattr ... preserved
Sub-test: UF_COMPRESSED flag ... set
Sub-test: file contents ... match
Sub-test: creation time ... ok
Sub-test: modification time ... ok
Sub-test: hard link inode ... ok
```

```

... bash-3.2# ./bbouncer verify -d /Volumes/Source/ /Volumes/Target/
Sub-test: hard link inode ... ok
Sub-test: hard link decmpfs xattr ... preserved
Sub-test: hard link UF_COMPRESSED flag ... set
Sub-test: hard link modification time ... ok
ok
Verifying: access-control-lists ...
Sub-test: on files ... ok
Sub-test: on locked files ... ok
Sub-test: on dirs ... ok
Sub-test: on non-inherited acls ... ok
Sub-test: on inherited acls ... ok
ok
Verifying: fifo ... ok
Verifying: devices ... ok
Verifying: combo-tests ...
Sub-test: xattrs + rsrc forks ... ok
Sub-test: lots of metadata ... ok
ok

```

Example Uses

- Laptop Disk Clone
 - Keeping a bootable copy of a laptop disk volume (or volumes)
 - Time Machine used as well ...
- Mirroring Folders
 - iTunes, iPhoto, ...

Comparison with other tools ...

- SuperDuper
- ...

Snapshotting

... with rsnapshot ...

Rsnapshot

www.rsnapshot.org

- Automated backup based on rsync
- Multiple snapshots of filesystems
- Uses hard links to save space
- Restore using rsync
- Perl script

Underlying tech ...

- Rsync uses hard links for unchanged files (creates new directories)

```
date="date +%Y-%m-%dT%H:%M:%S"
```

```
rsync -aP --link-dest=$HOME/Backups/current /path/to/important_files $HOME/Backups/back-$date
```

```
rm -f $HOME/Backups/current
```

```
ln -s $HOME/Backups/back-$date $HOME/Backups/current
```

- Compare with Time Machine (TM)
 - HFS+ has to simulate hard links?
 - TM uses hard links to directories

Configuration File

- Tab delimited (not spaces)
- Filesys trees are specified in rsync module format



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43

Scheduling

- Launchd
- Crontab (deprecated)
- ?



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44

Rsnapshot Commands

- Daily
 - /usr/bin/rsnapshot -c /etc/rsnapshot/xyz.rsnapshot.conf daily 2>&1 | /usr/local/bin/rsnapreport.pl | mail -s "XYZ Daily Backup" admin
- Weekly
 - /usr/bin/rsnapshot -c /etc/rsnapshot/xyz.rsnapshot.conf weekly 2>&1 | /usr/local/bin/rsnapreport.pl | mail -s "XYZ Weekly Backup" admin



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45

Hourly Example

```
[root@localhost ~]# rsnapshot -v hourly
echo 1842 > /var/run/rsnapshot.pid
/bin/rm -rf /.snapshots/hourly.5/
mv /.snapshots/hourly.4/ /.snapshots/hourly.5/
mv /.snapshots/hourly.3/ /.snapshots/hourly.4/
mv /.snapshots/hourly.2/ /.snapshots/hourly.3/
mv /.snapshots/hourly.1/ /.snapshots/hourly.2/
/bin/cp -a1 /.snapshots/hourly.0 /.snapshots/hourly.1/
/usr/bin/rsync -a --delete --numeric-ids --relative --delete-excluded /etc \
/.snapshots/hourly.0/localhost/
/usr/bin/rsync -a --delete --numeric-ids --relative --delete-excluded /home \
/.snapshots/hourly.0/localhost/
/usr/bin/rsync -a --delete --numeric-ids --relative --delete-excluded \
/usr/local /.snapshots/hourly.0/localhost/
touch /.snapshots/hourly.0/
rm -f /var/run/rsnapshot.pid
[root@localhost ~]#
```



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46

Daily Example

```
[root@localhost ~]# rsnapshot -v daily
echo 1842 > /var/run/rsnapshot.pid
/bin/rm -rf /.snapshots/daily.6/
mv /.snapshots/daily.5/ /.snapshots/daily.6/
mv /.snapshots/daily.4/ /.snapshots/daily.5/
mv /.snapshots/daily.3/ /.snapshots/daily.4/
mv /.snapshots/daily.2/ /.snapshots/daily.3/
mv /.snapshots/daily.1/ /.snapshots/daily.2/
mv /.snapshots/daily.0/ /.snapshots/daily.1/
mv /.snapshots/hourly.5/ /.snapshots/daily.0/
rm -f /var/run/rsnapshot.pid
[root@localhost ~]#
```



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47

Disk Usage

```
[root@localhost ~]# rsnapshot du example.com/home/
5.2G /.snapshots/hourly.0/example.com/home/
5.4M /.snapshots/hourly.1/example.com/home/
12M /.snapshots/hourly.2/example.com/home/
5.3M /.snapshots/hourly.3/example.com/home/
5.4M /.snapshots/hourly.4/example.com/home/
4.9M /.snapshots/hourly.5/example.com/home/
5.4M /.snapshots/daily.0/example.com/home/
728M /.snapshots/daily.1/example.com/home/
4.8M /.snapshots/daily.2/example.com/home/
4.8M /.snapshots/daily.3/example.com/home/
6.2M /.snapshots/daily.4/example.com/home/
4.8M /.snapshots/daily.5/example.com/home/
4.8M /.snapshots/daily.6/example.com/home/
6.0G total
```



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48

Rsnapshot Reporting

rsnapreport.pl

- Perl script to report on execution of rsnapshot (e.g. to email to admin)

SOURCE	TOTAL FILES	FILES TRANS	TOTAL MB	MB TRANS	LIST GEN TIME	FILE XFER TIME
laptop:/	59076	1353	17279.45	7169.38	20.361 second	0.000 seconds

Example Use

- Pulling files from multiple Linux boxes onto Mac OS X
- Pushing Mac OS X to another Mac OS X box

Remote Rsync

without Password

... with PKA ...

Automated

Remote Operations

- Usually require login with username and password (e.g. rsyn)
- To automate these operations requires passwordless login

Public Key

Authentication (PKA)

- Create public and private keys with
\$ ssh-keygen
- Copy key to the remote host using
\$ ssh-copy-id

Summary

Syncing, Cloning, Snapshotting, ...

Summary

Rsync
Carbon Copy Cloner
Rsnapshot

Thanks to AUC

- Supporting Apple Developers
- Supporting Apple System Administrators
- Supporting Apple Creatives
- Supporting Me

Thanks

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