

Essay no 1: "Documentation"

Hans Kristian Flaatten
TDT4285 Planlegging og drift av IT-systemer,
Norwegian University of Science and Technology,
`hanskrfl@stud.ntnu.no`

May 14, 2012

1 Introduction

This is a documentation - with respect to the system administrator - of the backup solution deployed with all newer versions of the Mac OS X operating system; Time Machine. The document includes test-, monitoring- and maintenance routines as well as a description of the inner workings of Time Machine.

2 System description

Time Machine - Mac OS X's built-in backup solution since version 10.5 (2007). It comes with a graphical user interface, which will not be paid much attention to by this document. As long as it's possible I will try to document with regards to the command line utility *tmutil* [3] as it's more convenient for system administrators.

2.1 System specification

Mac Mini running Mac OS X 10.7.3, 2 x 500 GB HDD 750 RPM SATA Journalled HFS+ formatted disks; *disk1* "Machintosh HD" and *disk2* "Machintosh HD2" with the latter serving as a Time Machine Volume.

2.2 Setup

Upon enabling Time Machine for the first time a volume is assigned for storing backups. This volume will hereby be referred to as *Time Machine Volume* and will automatically be excluded from being backed up. Upon completing the setup; Time Machine copies all files and directories onto the Time Machine Volume.

2.3 Sub System Operation

The Time Machine daemon (*backupd*) starts at system boot and performs a backup, by default, once an hour. It is possible to have such a frequent backup strategy, without disrupting other services, because Time Machine utilizes the journaling in the HFS+ file system. This allows it to only back up modified files since last backup, thus saving only *delta* copies on the Time Machine Volume. This is very similar to how many version control systems such as Subversion and GIT works.

Each time *backupd* performs a backup it creates a new folder on the Time Machine Volume using the following naming convention:

```
/Time Machine Volume/Backups.backupdb/Machine Name/YYYY-MM-DD-HHMMSS/
```

Time Machine utilizes hard links to make each backup folder on the Time Machine Volume look like a complete snapshot of the entire system, but in fact, only one of each unique file is kept on the Time Machine Volume. This enables us to browse the Time Machine Volume manually in a straight forward fashion without using a special GUI.

3 Testing

3.1 Hardware Test

The command `diskutil [1]` is used to modify, verify and repair local disks. To verify that the Time Machine Volume is in great shape hardware wise the following command can be executed:

```
$ diskutil verifyVolume disk2
```

The command above should return it's findings after 5-10 minutes of activity. The following result indicates that the volume's file system structure is working correctly:

```
> The volume Macintosh HD2 appears to be OK
```

However, if any errors are reported an attempt to resolve them can be done by repairing the logical structure of the volume:

```
$ diskutil repairVolume disk2
```

Disk errors like this are good indicators that something might be terrible wrong with the hard drive itself. Replacing the drive should be considered at this point, regardless of how old the drive is, in order to avoid a sudden disruption of the service.

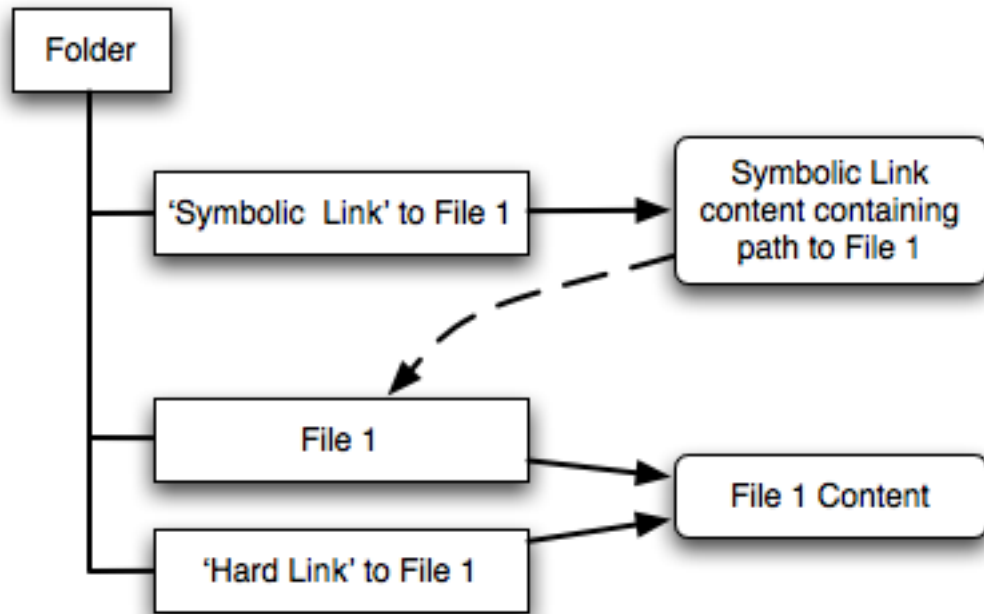


Figure 1: How hard links works in the Time Machine Volume

3.2 Time Machine Test

Create a new file with the current time and date in a directory which has not been excluded from being backed up. To confirm that the backup service is in fact working correctly you can then force a new backup in the following way:

```
$ tmutil startbackup -b
```

Upon success this command will report how much data has been copied over to the backup volume. Delete the newly created file and restore it from the Time Machine backup using the following command where *src* refers to the :

```
$ tmutil restore src dst
```

Confirm that the file has been successfully restored by viewing it's content, confirming that it contains the time of date just a moment ago.

4 Monitoring

4.1 Hardware Monitoring

With the following command you can easily view disk space usage in bytes, and percentage of total capacity, for all the disks available to the system:

```
$ df -h | grep /dev/
```

The syslog [2] (/var/log/system.log) contains messages from the file system, hardware faults and errors. These are indicators that hardware failures already may have happened or are close by.

4.2 Time Machine Monitoring

The backupd process is logged as *com.apple.backupd* in the *syslog* [2]. Displaying the latest log entries can be done this way:

```
$ syslog -F '$Time $Message' -k Sender com.apple.backupd | tail
```

If the latest backup was successfully complete the last line in the corresponding output must be on the following format:

```
>MM DD HH:MM:SS Backup completed successfully.
```

A typical error may look like this; in this case the the Time Machine Volume was not available at the time *backupd* attempted to initiate a new backup:

```
> com.apple.backupd[393]: Starting standard backup
> com.apple.backupd[393]: Error -35 while resolving alias target
> com.apple.backupd[393]: Backup failed with error: 19
```

If you only want the to know the time and date of when the last backup took place, it can be done in the following way:

```
$ tmutil latestbackup
```

Since Time Machine automatically delete old versions to free up disk space, if necessary, it can be smart to check when the oldest system backup was taken:

```
$ tmutil listbackups | head -1
```

5 Maintenance

5.1 Hardware Maintenance

Today's hard drives has no user serviceable parts. Therefor no hard drive should be allowed to exceed more then 3 years in service. Whenever a disk reaches three years it should be replace with a new one to prevent a sudden disruption in the service possible data loss.

5.2 Time Machine Maintenance

Verifying that important files and directories are not being excluded from the backup is utmost essential. Time Machine, by default, backs up the entire system, with some exceptions, but users can opt to explicitly exclude files and directories. Time Machine does not provide a command line tool to check all backup exclusions, hence this is best done through the System Preferences, Time Machine (third row). Choose the backup volume and press the option button to view the exclusions.

To find exclusions added by applications the following command can be run. It is often added for good reasons so removing any of these are not considered necessary.

```
$ mdfind "com_apple_backup_excludeItem = 'com.apple.backupd'"
```

Alternatively to check a specific directory if any of it's files or folders are excluded the following command can be run [6]:

```
$ tmutil isexcluded *
```

References

- [1] Apple Inc., *diskutil(8) Mac OS X Manual Page*, May 15, 2009, <http://developer.apple.com/library/mac/#documentation/Darwin/Reference/ManPages/man8/diskutil.8>
- [2] Apple Inc., *syslog(1) Mac OS X Manual Page*, October 18, 2004 <https://developer.apple.com/library/mac/#documentation/darwin/reference/manpages/man1/syslog.1.html>
- [3] Apple Inc., *tmutil(8) Mac OS X Manual Page*, July 15, 2011 <http://www.manpagez.com/man/8/tmutil/>

- [4] Rob Griffiths, *Keep an eye on Time Machine*, January, 2008, <http://www.macworld.com/article/131534/2008/01/tmeye.html>
- [5] Charles, *Mass Deploying Time Machine in Mac OS X Lion*, August 10, 2011, <http://krypted.com/mac-os-x/mass-deploying-time-machine/>.
- [6] Devin Lane, *Time Machine Exclusions*, October 31, 2007, <http://shiftedbits.org/2007/10/31/time-machine-exclusions/>.