

Backups and Backup Strategies

IT managers need to plan for backups in terms of time and space required. However, most modern backup software can compress the backup files to reduce both the time required to backup, as well as the media size needed.

Regardless of the backup software or hardware that is chosen, the backup itself can come in three different methods; full, incremental or differential.

A full backup:

- ❑ Is often the starting point for all other backups
- ❑ Most comprehensive and are self-contained backup
- ❑ Takes a long time to run
- ❑ Takes a considerable amount of backup media to accomplish
- ❑ A restore from a full backup is much quicker
- ❑ Running a full backup on a regular basis to restart the incremental and differential method will help reduce the time and media size needed
- ❑ Often delegated to a weekly or monthly schedule.

An incremental backup:

- ❑ Stores all files that have changed since the last full, differential or incremental backup
- ❑ Provides a faster method of backing up information than repeatedly running full backups
- ❑ Takes the shortest amount of time to complete the backup
- ❑ Takes the least amount of backup media to accomplish
- ❑ The effort to restore from an incremental backup can be very time consuming, as multiple tapes are restored.

When restoring from incremental backup, the most recent full backup is needed, as well as every incremental backup that was made since the last full backup. For example, if a full backup was done on Friday and incremental backups on Monday, Tuesday and Wednesday, and the backed-up machine crashes Thursday morning; all four backup media would be needed; Friday's full backup plus the incremental backup for Monday, Tuesday and Wednesday.

A differential backup:

- ❑ Contains all files that have changed since the last full backup
- ❑ Shortens overall restore time compared to a full backup with incremental backups
- ❑ The upside for using full and differential backups is that only two backup media are needed to perform a complete restore.

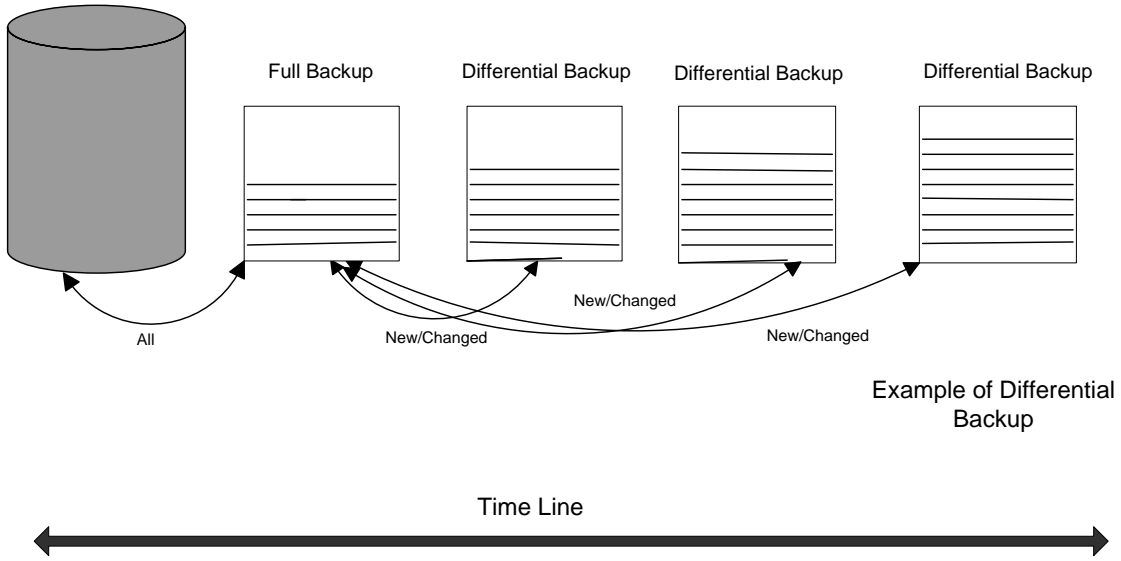
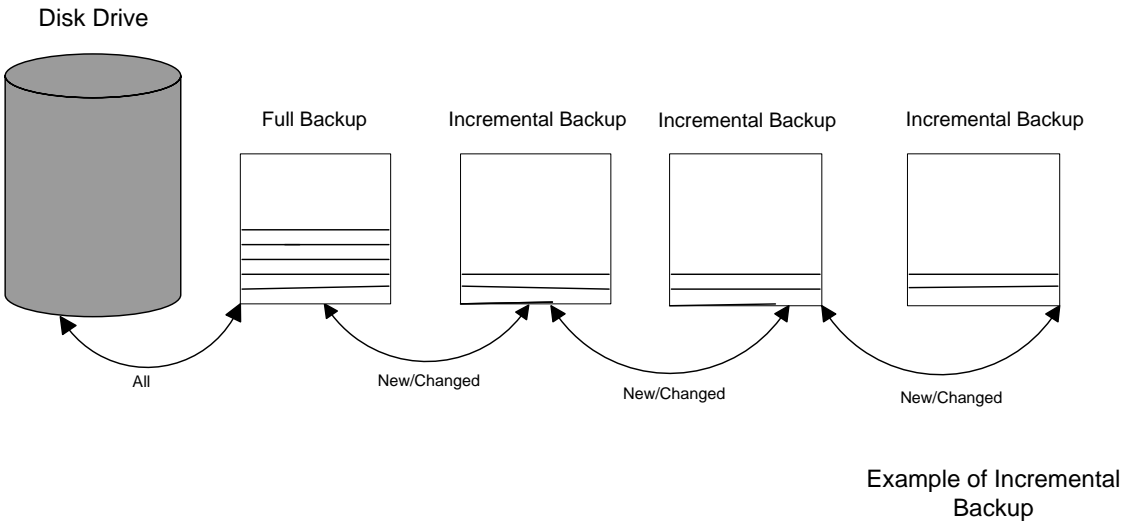
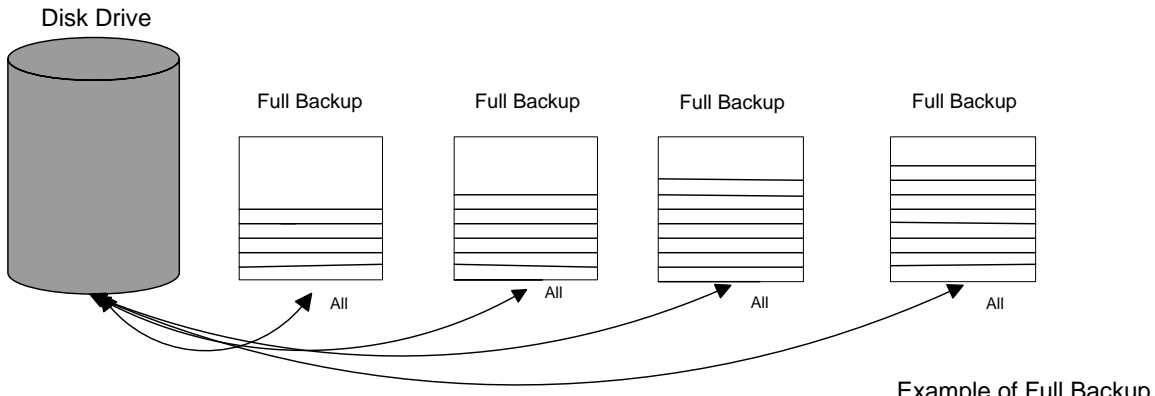
Restoring a differential backup is a faster process than restoring several incremental backup. For example, if a full backup was done on Friday and differential backups on Monday, Tuesday and Wednesday, and the backed-up machine crashes Thursday morning only two backup media days would be needed; Friday's full backup plus Wednesday's differential backups; that is, the latest full backup and the latest differential.

The difference between these three backup strategies is illustrated in *Figure 1: Comparing Backup Strategies*. Here, the full backup backs up everything up each time it is run as illustrated by the first row on the diagram.

The incremental backup backs up only new or changed items from the previous incremental backup (with a full backup starting the process). This is illustrated by the second row on the diagram.

A differential backup backs up all new or changed items from the last time a full backup was run, as illustrated by the third row of the diagram.

Figure 1: Comparing Backup Strategies



Sample Backup Strategies

The following information is presented as best practices guidelines only. All backup routines should balance time, expense and effort against risk. Each department should develop a strategy that is appropriate to their specific requirements. However, some ideas for developing a backup strategy include:

- ❑ Develop a written backup plan that identifies:
 - What is being backed up
 - Where it is being backed up to
 - How often backups are performed
 - What is the life of the backup media
 - Who is in charge of performing backups
 - Who is in charge of backup verifications; completion of jobs and testing of media
 - Schedules of test restores
- ❑ Database and accounting files are critical information assets and should be backed up before and after any significant amount of information entry and/or use. For most departments, this means backing these files up every day.
- ❑ Virus or spyware quarantine directories should be excluded from backups.
- ❑ Work related documents and files (for example, the "My Documents" folders) and email files/folders might be backed up once a week. This frequency should reflect the level of criticality that the department associates with the information.
- ❑ Copies of backups should be stored off-site to ensure recovery against disaster such as a fire, earth quake or flood. Users typically require restoration of files recently backed up. So, one recommendation is to keep the most current set of backups onsite¹ and send the rest of the backups offsite
- ❑ It is not usually necessary to backup the complete contents of each hard drive. Most of that space is taken up the operating system and program files, which can be easily reloaded from CD or images. The only exception is if the department has a dedicated file server; it's a good practice to do a full backup
- ❑ The backup plan also needs a strategy to backup laptops and mobile devices which may not be available at regular or convenient times.
- ❑ Backups should be tested BEFORE they are needed. To ensure confidence in the backups, the backup software should allow for full read-back verification. Additionally, it is a good practice to try restoring a few files on each set of full, incremental and differential backups.

¹ Backups kept onsite should be stored in a fire proof safe for media protection

Choosing appropriate backup hardware is also key to the success of the backup plan. Considerations include:

- ❑ Determine how much information you need to backup. Inventory each machine on the network (or a representative sample) to determine the total backup space
- ❑ Be sure to leave room to add a new staff information and to plan for growth
- ❑ Choose a backup device that uses tape cartridges with a capacity that is at least twice the total amount of information you need to backup.

Sample Media Rotation Strategies

In combination with a backup method strategy, it is recommended that IT support staff also use a backup tape (or other media of choice) rotation strategy. This will prevent the same media being used repeatedly, and so risking data loss.

Figure 2: The Parent-Child Tape Backup Strategy

The Parent-Child Tape Backup Strategy			
Friday		Tape 1	Full Backup
	Monday	Tape 2	Differential Backup
	Tuesday	Tape 3	Differential Backup
	Wednesday	Tape 4	Differential Backup
	Thursday	Tape 5	Differential Backup
Friday		Tape 6	Full Backup
	Monday	Tape 2	Differential Backup
	Tuesday	Tape 3	Differential Backup
	Wednesday	Tape 4	Differential Backup
	Thursday	Tape 5	Differential Backup
Friday		Tape 7	Full Backup
	Monday	Tape 2	Differential Backup
	Tuesday	Tape 3	Differential Backup
	Wednesday	Tape 4	Differential Backup
	Thursday	Tape 5	Differential Backup
Friday		Tape 8	Full Backup
	Monday	Tape 2	Differential Backup
	Tuesday	Tape 3	Differential Backup
	Wednesday	Tape 4	Differential Backup
	Thursday	Tape 5	Differential Backup
Friday		Tape 9	Full Backup
	Monday	Tape 2	Differential Backup
	Tuesday	Tape 3	Differential Backup
	Wednesday	Tape 4	Differential Backup
	Thursday	Tape 5	Differential Backup
Friday		Tape 10	Full Backup
	Monday	Tape 2	Differential Backup
	Tuesday	Tape 3	Differential Backup
	Wednesday	Tape 4	Differential Backup
	Thursday	Tape 5	Differential Backup
Friday		Tape 1	Full Backup

The *Parent-Child Tape Backup Strategy* is an example of a 10 tape rotation strategy, which uses four tapes during the week and the others each consecutive Friday. The strategy starts on a Friday with a full system backup on Tape 1. The following Monday, Tape 2 is used to perform a differential backup (targeting the data that has changed since Friday’s full system backup). On Tuesday, Tape 3 is used to perform a differential backup (again targeting the data that has changed since Friday’s full system backup). Tapes 4 and 5 are used in the same manner for Wednesday and Thursday respectively.

In this strategy, the week day tapes are referred to as daily backups, since using the differential backups; only the last full backup and last daily backup will need to be used to completely restore a system.

Finally, IT support staff should also use an archival or monthly backup strategy. An example of this would be the *Grand Parent-Parent-Child Tape Backup Strategy*. This is an example of a 22 tape rotation strategy, which builds directly on top of the *Parent-Child Tape Backup Strategy* in that it uses a sub-set of 10 tapes; four tapes during the week and the others each consecutive Friday.

However, there are 12 additional tapes which are used for monthly full backups. These 12 tapes will be kept indefinitely, will not be reused, and should be stored at an appropriate off-site location.

Figure 4 illustrates the *Grand Parent-Parent-Child Tape Backup Strategy*. This is very similar to the *Parent-Child Tape Backup Strategy* illustrated in Figure 2. However, each fourth Friday, a monthly full backup is performed instead of the weekly full backup. As per Figure 3, at the end of the first month, Tape 11 is used. Then at the end of the second month, Tape 12 is used, and so on.

Figure 3: Tape Usage in the Grand Parent-Parent-Child Tape Backup Strategy

Month 1	Tape 11
Month 2	Tape 12
Month 3	Tape 13
Month 4	Tape 14
Month 5	Tape 15
Month 6	Tape 16
Month 7	Tape 17
Month 8	Tape 18
Month 9	Tape 19
Month 10	Tape 20
Month 11	Tape 21
Month 12	Tape 22

Figure 4: The Grand Parent-Parent-Child Tape Backup Strategy

The Grand Parent-Parent-Child Tape Backup Strategy			
Friday		Tape 1	Full Backup
	Monday	Tape 2	Differential Backup
	Tuesday	Tape 3	Differential Backup
	Wednesday	Tape 4	Differential Backup
	Thursday	Tape 5	Differential Backup
Friday		Tape 6	Full Backup
	Monday	Tape 2	Differential Backup
	Tuesday	Tape 3	Differential Backup
	Wednesday	Tape 4	Differential Backup
	Thursday	Tape 5	Differential Backup
Friday		Tape 7	Full Backup
	Monday	Tape 2	Differential Backup
	Tuesday	Tape 3	Differential Backup
	Wednesday	Tape 4	Differential Backup
	Thursday	Tape 5	Differential Backup
Friday		Tape 11	Monthly Full Backup
	Monday	Tape 2	Differential Backup
	Tuesday	Tape 3	Differential Backup
	Wednesday	Tape 4	Differential Backup
	Thursday	Tape 5	Differential Backup
Friday		Tape 8	Full Backup
	Monday	Tape 2	Differential Backup
	Tuesday	Tape 3	Differential Backup
	Wednesday	Tape 4	Differential Backup
	Thursday	Tape 5	Differential Backup
Friday		Tape 9	Full Backup
	Monday	Tape 2	Differential Backup
	Tuesday	Tape 3	Differential Backup
	Wednesday	Tape 4	Differential Backup
	Thursday	Tape 5	Differential Backup
Friday		Tape 10	Full Backup
	Monday	Tape 2	Differential Backup
	Tuesday	Tape 3	Differential Backup
	Wednesday	Tape 4	Differential Backup
	Thursday	Tape 5	Differential Backup
Friday		Tape 12	Monthly Full Backup
	Monday	Tape 2	Differential Backup
	Tuesday	Tape 3	Differential Backup
	Wednesday	Tape 4	Differential Backup
	Thursday	Tape 5	Differential Backup
Friday		Tape 1	Full Backup