System backup strategy

As a Linux Administrator how will you manage your company’s backup strategy?

Esirigho

Git-Gotech  DMV

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What’s the Difference Between Incremental, Differential, and Other Backups?

Incremental and differential backups are two strategies for making regular and frequent copies of your data for disaster recovery. IT systems in any company can go down unexpectedly due to unforeseen circumstances, such as power outages, natural events, or security issues. A data backup is essential so you don't lose critical information for your operations. At the same time, data volume may make it impractical to take a full data backup at every instant. A differential backup strategy only copies data changes since the last full backup. On the other hand, an incremental data backup strategy copies data changes since the last backup.

Full vs. incremental vs. differential backup — how they work.

There are three main data backup strategies, which we will detail next.

Full backup

When your backup software takes a full backup, it copies the entire dataset, regardless of whether any changes were made to the data. This type of backup is generally taken less frequently for practical reasons. For instance, it can be time-consuming and takes up a large amount of storage space. Alternatives to full data backups include differential or incremental backups.

Incremental backup

An incremental backup only copies modified data since the last backup. For example, if you took a full back up on Sunday, your incremental backup on Monday would only copy changes since the Sunday backup. On Tuesday, it would only copy changes to the backup image file since the Monday backup.

Differential backup

A differential backup strategy copies only newly added and changed data since the last full backup. If your last full backup was on Sunday, a backup on Monday would copy all changes since Sunday. If you took another backup on Tuesday, it would also copy all changes since Sunday. The backup file size would increase progressively until the next full backup.

Key differences: incremental vs. differential backup

Incremental and differential backup strategies offer different trade-offs depending on the backup performance you want to achieve. Next, we give key differentiating factors.

Backup speed

Differential backups require more time to complete than incremental backups since the backup image file size increases daily.

In contrast, the incremental backup process is usually quicker and more efficient due to consistently small backup files.

Storage space utilization

Incremental backups require less storage space.

Differential backups take more storage space as time from the last full backup increases. A differential backup strategy aims to reduce restore time by trading off on storage space.

Implementation cost

Generally, an incremental backup saves you both backup storage space and network bandwidth. In the long run, a full backup paired with frequent incremental backups is the more cost-effective option.

In contrast, differential backups get costlier over time, and you’re required to take full backups more frequently to increase efficiency.

Data restoration speed

While incremental backups are cost-efficient, it can time-consuming and complex to restore data. It requires the first full backup and all subsequent incremental backups to restore data. For example, a crash on Wednesday would require you to go through all backups from Sunday to Tuesday, identify changes, and restore them cumulatively. The process gets more complex as time from the last full backup increases.

On the other hand, restoring from differential backups only requires the first full and the latest differential backup. It’s also much faster.

When to use differential vs. incremental backup

When you decide whether to use differential or incremental backup, you might consider multiple factors based on your requirements and budget.

Frequency of data changes

Incremental backups are more suitable if your organization deals with a substantial amount of data that undergoes frequent changes. It can save you on both time and backup costs.

On the other hand, if you opt for differential backups, costs could add up quickly.

Business requirements

To decide the best backup type to implement for your organization, you should consider available resources and your company's backup and data recovery policy.

For instance, product data is critical to an ecommerce application—and you may use differential backups to provide faster restore times and minimal downtime.

However, you may choose to archive image files or video data with just one full data backup if it doesn’t change over time.

Synthetic vs. incremental forever backup

There are other backup data strategies apart from incremental and differential backups.

Synthetic full backup

A synthetic full backup compares the data that has changed at the source with the original full backup and all incremental backups to create the next full synthesized backup. Instead of storing only the incremental backup file, the backup server consolidates changes with the last full backup and creates a synthetic full backup. The process is invisible to your end users.

In a synthetic full backup, you don’t save on storage space, but you do save on network bandwidth. You only send incremental changes to the server instead of sending all your data. The server uses the data it already has to create the full backup copy.

Incremental forever backup

All other backup strategies discussed in this guide include taking periodic full backups. However, if you implement an incremental forever backup, you only take an initial full backup. Subsequently, you take a sequence of incremental (forever) backups indefinitely.

The backup server stores all backup sets on a tape library or a large disk array. It automates the restoration process, so it mimics restoration from a full backup.

Summary of differences: full vs. incremental vs. differential backup

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| Backup types | Data | Backup speed | Storage space | Restoration speed |
| Active full | Copies all data. | Slow. | Substantial. | Fast. |
| Incremental | Copies only the changed data since last backup. | Faster than differential. | Smaller than differential. | Slower than differential as it requires a full backup plus all incremental backups. |
| Differential | Copies changed data since last full backup. | Slower than incremental but faster than active full backup. | Gets larger especially with subsequent backups. | Faster than incremental as it requires just the full and last differential. |
| Synthetic full | Copies changed data incrementally but consolidates changes with the last full backup to create a synthetic full backup. | Faster than active full as it copies only incremental changes. | About the same storage as active full. | Similar to active full. |
| Incremental forever | Creates one full, then subsequent (forever) incrementals. | Faster than synthetic full as it never creates subsequent full backups. | Takes less space than active and synthetic full. | Offers faster restoration than active and synthetic full. |