

System backup and restore

Backup

It is often used in computing to indicate the existence of a copy of one or more files stored in different storage devices.

If for any reason the original files are lost, the stored backup can be restored to recover the lost data.

Since the information is the most valuable asset of the company and this information is stored in the company's databases, it is of fundamental importance that we have a well-defined strategy to protect this very valuable asset.

We must worry not only about data loss, but also about unauthorized access or even information theft.

Note: If a competitor manages to hack into your network and copy strategic data you're in big trouble.

Problems in sight:

- Invasions and hacker attacks.
- Loss of information due to virus problems.
- Improper access to information.
 - DELETE FROM Customer
- Natural disasters.
 - Fires
 - Floods
- Hardware failures
- Actions of vandalism or urban violence

One factor that we must take into account when building our backup/restore and

data protection strategy is the value of the information being protected. If the information to be protected is of strategic value to the company, and the data must always be available and it is impossible to imagine losing them; it is clear that the expenses to protect this information will be high, but more easily justified.

Note: The level of investment in security and backup is proportional to the importance of the data to the business.

We must identify data availability requirements when choosing our backup/restore strategy. Let's assume the requirement is: data must be available 100% of the time. In this case, it is fully justifiable to use two or more servers with identical copies of the data, in such a way that, if one of them has problems, one of the others can take its place.

In this situation, the simple use of tape backup does not meet the availability requirement, as the data would be unavailable during the restore time from tape to the database.

- RAID.
- Snapshot.
- Mirroring.
- Replication.

- Companies Use Operating System Images
- Applications stay in the cloud
- If using local server, system backup is required.
- OneDrive
- Google docs
- Use an external hard drive
- Most sensitive DOCS more than one type of backup.

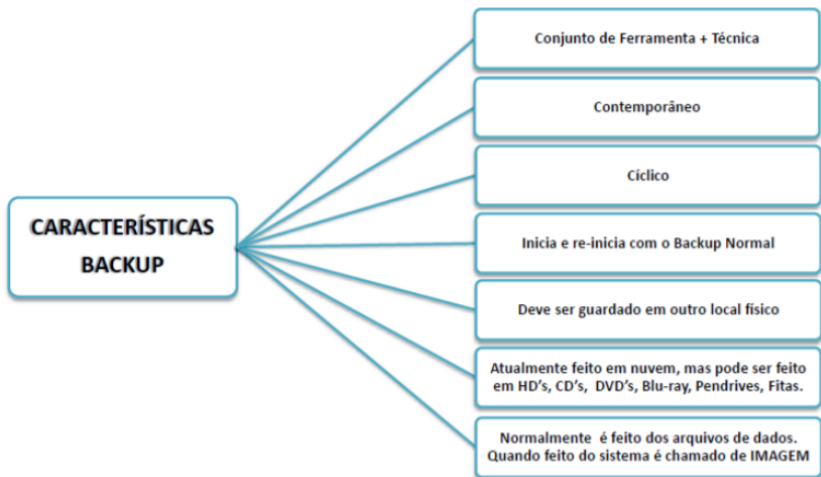
Some issues to consider when setting up our backup/restore strategy: →
Planning

- What are the availability requirements? Should the Database be online 24 hours a day, seven days a week, or can it be taken offline at certain times?
- What is the cost of shutting down business operations due to unavailability of data? What is the cost – financial and for the company's image – when the company's website is unavailable due to problems with the database?
- In case of a hardware failure, what is the acceptable time until normality is

restored?

➤ Does your company have a dedicated DBA or is the service outsourced? Who is responsible for backup routines? Who is responsible for verifying that backup/restore procedures are being performed in accordance with the proposed strategy?

Recommendation: “It is not enough to do the backup, we need a test and simulation strategy to restore the data, as the backup is often completed without problems, but when it comes to restoring the data, the problems occur. Therefore, a routine of testing restoration from backups should be part of our backup strategy.”



■ Also known as a dump, a database backup is the operation of copying data to a physical backup device. The same can be done through the Enterprise Manager or with the BACKUP command.

■ To perform a backup, it is not necessary to stop SQL or even disconnect your users, however, performing it with connected users causes a sudden drop in performance.

There are 4 different types of backups with SQL Server:

1. Full Backup: In this type of backup, the entire database is backed up.

2. **Backup Log:** In this case, the Transaction Log is backed up.
3. **Differential Backup:** when using differential backup, only information that has been modified since the last full backup will be backed up.
4. **File and Filegroup:** A database can consist of several files, and these files can be copied individually.

Filegroup backup and data file backup can be a solution for very large Databases where even a differential backup would not fit in the backup time window.

Backup/Restore Strategies

Let's look at some theoretical examples of backup/restore strategies, where we consider the different types of backups: complete, differential, and transaction log.

Example 01:

The daily full backup of the database. Let's consider the backup schedule described in Table 1.

Tabela 1 Backup completo do Banco de Dados

| Dia | Backup/horário(s) |
|---------------|-------------------|
| Segunda-feira | Completo às 23h |
| terça-feira | Completo às 23h |
| Quart-feira | Completo às 23h |
| Quinta-feira | Completo às 23h |
| Sexta-feira | Completo às 23h |
| Sábado | Completo às 23h |
| Domingo | Completo às 23h |

■ **Hipótese:** Na quinta-feira, às 9 horas da manhã o Banco de Dados é corrompido.

■ **Recuperação do Banco de Dados:** Nesta situação somente poderemos restaurar os dados na situação em que estes estavam na quarta-feira, às 23 horas, que foi o horário do último backup completo. Todas as alterações realizadas, entre as 23 horas de quarta-feira e o momento em que o Banco de Dados foi corrompido, serão perdidas. ■ **Procedimento de restore:** Restaurar o último backup completo disponível, que neste caso é o backup da quarta-feira.

Example 02:

Full backup combined with transaction log backup: In this strategy we make a full backup of the Database at more spaced periods, say **once or twice a week**. Between one full backup and another, transaction log backups are taken. Let's consider the backup schedule described in Table 2.

Tabela 2 Backup completo do banco de Dados mais backup do log de transações.

| Dia | Backup/Horário(s) |
|---------------|-------------------------------------|
| Sábado | Completo às 23h |
| Domingo | Backup do log às 9h, 12h, 15h e 18h |
| Segunda-feira | Backup do log às 9h, 12h, 15h e 18h |
| Terça-feira | Backup do log às 9h, 12h, 15h e 18h |
| Quarta-feira | Backup do log às 9h, 12h, 15h e 18h |
| Quinta-feira | Backup do log às 9h, 12h, 15h e 18h |
| Sexta-feira | Backup do log às 9h, 12h, 15h e 18h |
| Sábado | Completo às 23h |

■ **Hypothesis:** On Thursday, at 9:30 am the Database is corrupted.

■ **Database Recovery:** In this situation we will be able to restore the data to the situation it was in on Thursday, at 9:00 am, which was the time of the last backup of the transaction log. All changes made between 9:00 am and 9:30 am on Thursday, and the time the Database was corrupted, will be lost.

■ **Restore Procedure:** Restore the full Saturday 23:00 backup and all transaction log backups, in the correct sequence, up to the Thursday 9:00

transaction log backup.

Note that in this situation we would have to restore 18 backups:

- A complete Saturday +
- Four backups of the Sunday Log (9:00 am, 12:00 pm, 3:00 pm and 6:00 pm)
- +
- Four backups of Monday's Log (9:00 am, 12:00 pm, 3:00 pm and 6:00 pm)
- +
- Four backups of Tuesday's Log (9am, 12pm, 3pm and 6pm) +
- Fourth Wednesday Log backups (9:00 am, 12:00 pm, 3:00 pm and 6:00 pm)
- +
- A backup of the Thursday (9:00 am) Log.

Example03:

Full backup combined with differential backup and transaction log backup. Let's consider the backup schedule described in Table 3.

Tabela 3 Utilizando backups completos, diferencial e do Log.

| Dia | Backup/horário(s) |
|---------------|---|
| Sábado | Completo às 23h |
| Domingo | Backup do Log (9h, 12h, 15h e 18h) |
| Segunda-feira | Backup do Log (9h, 12h, 15h e 18h) |
| Terça-feira | Backup do Log (9h, 12h, 15h e 18h) |
| Quarta-feira | Backup do Log (9h, 12h, 15h e 18h) Backup diferencial às 23h |
| Quinta-feira | Backup do Log (9h, 12h, 15h e 18h) |
| Sexta-feira | Backup do Log (9h, 12h, 15h e 18h) |
| Sábado | Diferencial às 23h |
| Domingo | Backup do Log (9h, 12h, 15h e 18h) |
| ... | |

- **Hypothesis:** On Thursday at 9:30 am, the Database is corrupted.
- **Database Recovery:** In this situation we will be able to restore the data to the situation it was in on Thursday, at 9:00 am, which was the time of the last backup of the transaction log. All changes made between 9:00 am and 9:30 am on Thursday, and the time the Database was corrupted, will be lost.

■ **Restore Procedure:** Restore the Saturday full backup at 11:00 pm, then restore the Wednesday differential backup at 11:00 pm, and the Thursday transaction log backup at 9:00 am.

Note that in this situation we would have to restore three backups:

- A complete Saturday +
- A differential from Wednesday (11pm) +
- A backup of the log from Thursday (9:00 am)

It is quite clear that the use of differential backup greatly facilitates the Database restoration process.

A backup device is a concept that associates a physical backup device such as a tape driver or a volume on a hard disk.

- **Backup disk devices:** This device type is associated with a file on disk.
- **Tape backup devices:** these are device backups associated with a tape drive.

Recovery model

The recovery model is a property of the database, which affects how backup and restore operations for a database are performed. Backup and restore operations will be performed in different ways depending on the recovery model configured for the database.

- **Full recovery model:** a database configured to use this model keeps in the transaction log a record of all data operations performed on the database. (SELECT INTO, CREATE INDEX, ...)
- **Bulk-Logged recovery model:** A database configured for this model records a minimal amount of bulk operations, such as creating indexes and bulk importing data. (improves performance for mass update).
- **Simple recovery:** A database configured for this model writes a minimal amount of information to the transaction log, just information to maintain database consistency.

Scheduling Tasks

We can automate a number of administrative tasks by creating jobs. A job is an administrative task, made up of one or more steps, which is scheduled to run automatically, at specified dates and times, in the job settings.

We normally schedule, for automatic execution, those routine tasks that the DBA must perform, such as backups, maintenance of indexes and any other tasks that have to be performed periodically. This frees the DBA from a series of repetitive administrative tasks.

For the task execution to work correctly, the SQL Server Agent service must be running. Ideally, this service should be set to start automatically.