**Exploring SQL Server Backup Types**

**Part 1: Research – SQL Server Backup Types**

**1. Full Backup**

* **When Used**: As a base for all other backups. Typically scheduled weekly.
* **What It Includes**: Entire database including system tables and user data.
* **Pros**:
  + Simplifies restore
  + Single file contains complete data
* **Cons**:
  + Time-consuming for large databases
  + High storage usage
* **Real-World Scenario**: A **banking system** uses full backups every Sunday to ensure complete data recovery baseline.

**2. Differential Backup**

* **When Used**: Mid-week or daily after a full backup.
* **What It Includes**: All data changed since the last full backup.
* **Pros**:
  + Faster than full backup
  + Requires less space
* **Cons**:
  + Dependent on last full backup
  + Multiple files needed during recovery
* **Real-World Scenario**: An **e-learning platform** uses nightly differential backups to protect progress and submissions.

**3. Transaction Log Backup**

* **When Used**: In FULL recovery model, taken frequently (e.g., hourly).
* **What It Includes**: All transactions since last log backup.
* **Pros**:
  + Enables point-in-time recovery
  + Small in size
* **Cons**:
  + Requires careful restore sequencing
  + Not possible in SIMPLE recovery model
* **Real-World Scenario**: A **ticketing system** uses transaction log backups every hour to prevent data loss during high-traffic events.

**4. Copy-Only Backup**

* **When Used**: For ad-hoc or one-off backups without affecting the backup chain.
* **What It Includes**: Same as a full or log backup, but doesn’t affect backup sequence.
* **Pros**:
  + Safe for manual backups
  + Doesn’t interfere with scheduled backups
* **Cons**:
  + Cannot be used as part of differential or log chain
* **Real-World Scenario**: A **development team** copies production data for testing without disrupting the regular backup chain.

**5. File/Filegroup Backup**

* **When Used**: For very large databases using multiple filegroups.
* **What It Includes**: Selected files or filegroups.
* **Pros**:
  + Optimized for large DBs
  + Enables partial restores
* **Cons**:
  + Complex management
  + Recovery across filegroups must be consistent
* **Real-World Scenario**: A **research database** with petabytes of genomic data stored in separate filegroups.

**Step 1: Create Test Database**

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| -- Step 1: Create Test Database  CREATE DATABASE TrainingDB;  GO  USE TrainingDB;  GO  CREATE TABLE Students (  StudentID INT PRIMARY KEY,  FullName NVARCHAR(100),  EnrollmentDate DATE  );  INSERT INTO Students VALUES  (1, 'Sara Ali', '2023-09-01'),  (2, 'Mohammed Nasser', '2023-10-15'); |
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**Step 2: Perform Backup Operations**

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| -- Step 2.1: Full Backup  BACKUP DATABASE TrainingDB TO DISK = 'C:\Program Files\Microsoft SQL Server\MSSQL16.MSSQLSERVER\MSSQL\Backup\TrainingDB\_Full1.bak'; |
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| -- Step 2.2: Insert New Data  INSERT INTO Students VALUES (3, 'Fatma Said', '2024-01-10'); |
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| -- Step 2.3: Differential Backup  BACKUP DATABASE TrainingDB TO DISK = 'C:\Program Files\Microsoft SQL Server\MSSQL16.MSSQLSERVER\MSSQL\Backup\TrainingDB\_Diff.bak' WITH DIFFERENTIAL; |
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| -- Step 2.4: Transaction Log Backup  ALTER DATABASE TrainingDB SET RECOVERY FULL;  BACKUP LOG TrainingDB TO DISK = 'C:\Program Files\Microsoft SQL Server\MSSQL16.MSSQLSERVER\MSSQL\Backup\TrainingDB\_Log.trn'; |
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| -- Step 2.5: Copy-Only Backup  BACKUP DATABASE TrainingDB TO DISK = 'C:\Program Files\Microsoft SQL Server\MSSQL16.MSSQLSERVER\MSSQL\Backup\TrainingDB\_CopyOnly.bak' WITH COPY\_ONLY; |
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**Part 3: Real-World Scenario Simulation**

**Backup Frequency:**

* **Full Backup**: Every Sunday @ 2:00 AM
* **Differential Backup**: Every Sunday @ 2:00 AM
* **Transaction Log Backup**: Every hour (24x7)

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| **HospitalDB Backup Plan** | |
| **Backup Frequency:** | * **Full Backup**: Every Sunday at 2:00 AM * **Differential Backup**: Every Sunday at 2:00 AM * **Transaction Log Backup**: Every hour (24x7) |
| **Folder Structure & Naming Convention:** | * **Full:** 'C:\Program Files\Microsoft SQL Server\MSSQL16.MSSQLSERVER\MSSQL\Backup\HospitalDB\_Full\_YYYYMMDD.bak * **Differential:** 'C:\Program Files\Microsoft SQL Server\MSSQL16.MSSQLSERVER\MSSQL\Backup\HospitalDB\_Diff\_YYYYMMDD.bak * **Log:** 'C:\Program Files\Microsoft SQL Server\MSSQL16.MSSQLSERVER\MSSQL\Backup\HospitalDB\_Log\_YYYYMMDD\_HH.trn |
| ALTER DATABASE HospitalDB SET RECOVERY FULL;  -- Weekly Full Backup (Sunday)  BACKUP DATABASE HospitalDB  TO DISK = 'C:\HospitalBackups\Full\HospitalDB\_Full\_20250601.bak'  WITH INIT, COMPRESSION, NAME = 'Weekly Full Backup';  -- Daily Differential Backup (Mon–Sat)  BACKUP DATABASE HospitalDB  TO DISK = 'C:\HospitalBackups\Differential\HospitalDB\_Diff\_20250602.bak'  WITH DIFFERENTIAL, INIT, COMPRESSION, NAME = 'Nightly Diff Backup';  -- Hourly Transaction Log Backup  BACKUP LOG HospitalDB  TO DISK = 'C:\HospitalBackups\Logs\HospitalDB\_Log\_20250602\_08.trn'  WITH INIT, COMPRESSION, NAME = 'Hourly Log Backup'; | |