

The background of the slide features a collage of business-related images. On the left, there is a large, glowing orange cylinder. In the center, a person in a suit is drawing a diagram on a tablet with a pen. The diagram includes a lightbulb, a bar chart, a flowchart, and a world map. To the right of the person, there is a list of business terms: Innovation, Branding, Solution, Marketing, Analysis, Ideas, Success, and Management. The overall color scheme is orange and white.

Intelligent Data Management with SQL Server

Session: 5

Creating and Managing Databases

Objectives

- Explain about modification of system data
- Describe adding of filegroups and transaction logs
- Outline the process to create a database
- Describe how to drop a database
- Explain database snapshots

Modifying System Data

- Users can avail administrative tools to fully administer system and manage all users and database objects:

SSMS Administration utilities:

Is the core administrative console for SQL Server installations. It enables to perform high-level administrative functions, schedule routine maintenance tasks, and so forth.

SQL Server Management Objects (SQL- SMO) API:

Includes complete functionality for administering SQL Server in applications.

Transact-SQL scripts and stored procedures:

Use system stored procedures and Transact-SQL DDL statements.

	AddressID	AddressLine1	AddressLine2	City	StateProvinceID	PostalCode	SpatialLocation
1	1	1970 Napa Ct.	NULL	Bothell	79	98011	0xE610000010CAE8BF28BCE4474067A69189898A5EC0
2	2	9833 Mt. Dias Blv.	NULL	Bothell	79	98011	0xE610000010CD6FA851AE8D74740BC262A0A03905EC0
3	3	7494 Roundtree Drive	NULL	Bothell	79	98011	0xE610000010C18E3D4CA4DE14740DA930C7893915EC0
4	4	9538 Glenside Dr.	NULL	Bothell	79	98011	0xE610000010C813A0D5F9FDE474011A5C28A7C955EC0
5	5	1226 Shoe St.	NULL	Bothell	79	98011	0xE610000010C61C64D8ABD84740C46E2A3FD855EC0
6	6	1399 Firestone Drive	NULL	Bothell	79	98011	0xE610000010CE0B4E50458DA47402F12A5F80C975EC0
7	7	5672 Hale Dr.	NULL	Bothell	79	98011	0xE610000010C18E3D4CA4DE1474011A5C28A7C955EC0
8	8	6387 Scenic Avenue	NULL	Bothell	79	98011	0xE610000010C0028A5D93BCF4740E248962FD5975EC0
9	9	8713 Yosemite Ct.	NULL	Bothell	79	98011	0xE610000010C8A80AD742DDC4740851574F7189C5EC0
10	10	250 Race Court	NULL	Bothell	79	98011	0xE610000010C219D64AE1FE447404D862564B7625EC0
11	11	1318 Lucille Street	NULL	Bothell	79	98011	0xE610000010CCEFFB8FD0FE9474057B9479C7285EC0

Transact-SQL Query Window

Viewing System Database Data

Database applications can determine catalog and system information by using any of these approaches:

System Catalog Views	<i>Views displaying metadata for describing database objects in an SQL Server instance.</i>
SQL-SMO	<i>New managed code object model, providing a set of objects used for managing Microsoft SQL Server.</i>
Catalog Functions, Methods, Attributes, or Properties of Data API	<i>Used in ActiveX Data Objects (ADO), OLE DB, or ODBC applications.</i>
Stored Procedures and Functions	<i>Used in Transact-SQL as stored procedures and built-in functions.</i>

User-defined Databases

Using SQL Server 2019

- Users can create their own databases, also called user-defined databases, and work with them.
- The purpose of these databases is to store user data.

Creating Databases Using Transact-SQL 1-3

To create a user-defined database, the information required is as follows:

- Name of the database
- Owner or creator of the database
- Size of the database
- Files and filegroups used to store it

Following is the syntax to create a user-defined database.

```
CREATE DATABASE DATABASE_NAME
[ ON
[ PRIMARY] [ <filespec> [, ...n]
[ , <filegroup> [, ...n] ]
[ LOG ON { <filespec> [, ...n] } ]
]
[ COLLATE collation_name ]
[ ;]
```

Creating Databases Using Transact-SQL 2-3

SQL Server databases use two files - an .mdf file, known as the primary database file, containing the schema and data and a .ldf file, which contains the logs. A database may also use secondary database file, which normally uses an .ndf extension.

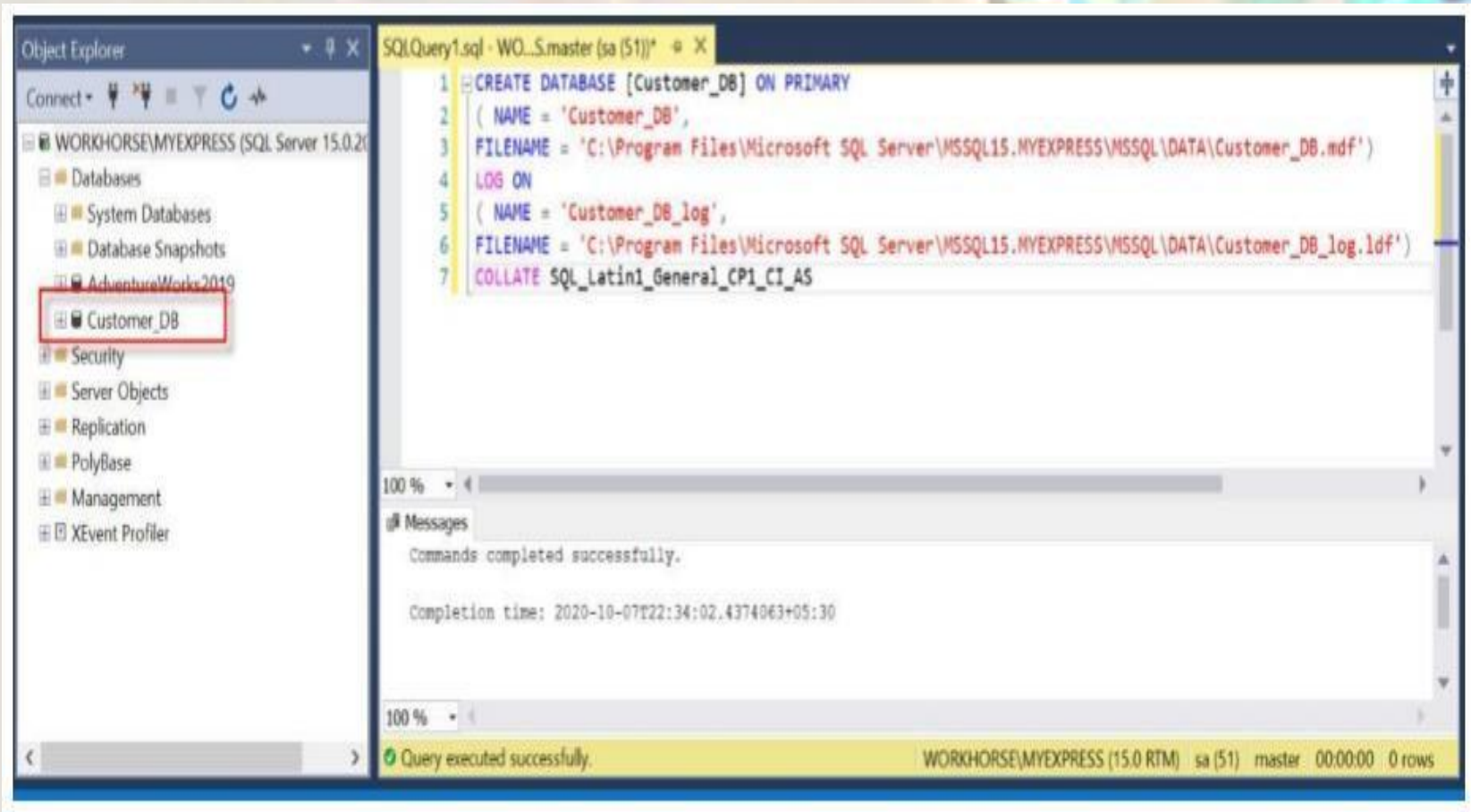
MDF stands for Master Database File.

- It contains main information of a database that are part of the server.
- This extension also points to various other files.
- Plays a crucial role in information storage.

LDF stands for Log Database File.

- Stores information related to transaction logs for main data file.
- Keeps track of changes that have been made in the database.

Creating Databases Using Transact-SQL 3-3



The screenshot displays the SQL Server Enterprise Manager interface. On the left, the 'Object Explorer' pane shows the 'Databases' folder expanded, with 'Customer_DB' highlighted and circled in red. The main pane shows the 'SQLQuery1.sql' script with the following Transact-SQL code:

```
1 CREATE DATABASE [Customer_DB] ON PRIMARY
2 ( NAME = 'Customer_DB',
3 FILENAME = 'C:\Program Files\Microsoft SQL Server\MSSQL15.MYEXPRESS\MSSQL\DATA\Customer_DB.mdf')
4 LOG ON
5 ( NAME = 'Customer_DB_log',
6 FILENAME = 'C:\Program Files\Microsoft SQL Server\MSSQL15.MYEXPRESS\MSSQL\DATA\Customer_DB_log.ldf')
7 COLLATE SQL_Latin1_General_CP1_CI_AS
```

Below the script, the 'Messages' pane shows the execution results:

```
Commands completed successfully.

Completion time: 2020-10-07T22:34:02.4374063+05:30
```

The status bar at the bottom indicates 'Query executed successfully.' and provides details about the connection: 'WORKHORSE\MYEXPRESS (15.0 RTM) sa (51) master 00:00:00 0 rows'.

Customer_DB Database

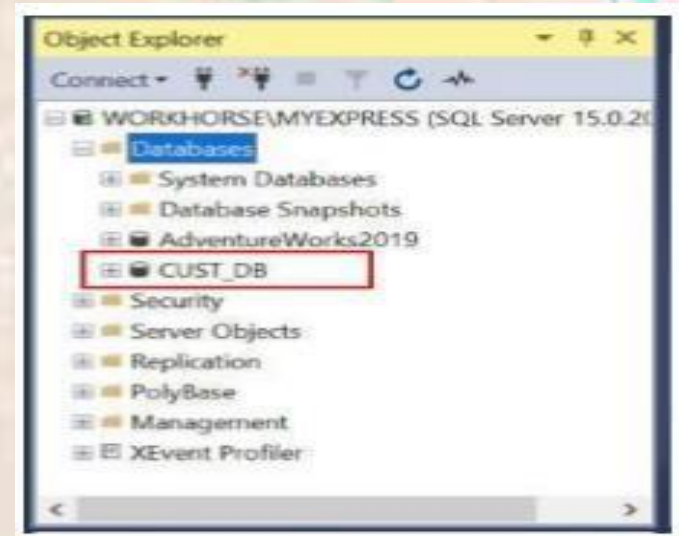
Modifying Databases

A user-defined database does the following:

- It grows or diminishes
- Its size expands or shrinks automatically or manually

```
ALTER DATABASE database_name
{
<add_or_modify_files>
| <add_or_modify_filegroups>
| <set_database_options>
| MODIFYNAME=new_database_name
| COLLATE collation_name
}
[;]
```

Syntax to modify a database



New Database Name CUST_DB

Ownership of Databases

In SQL Server 2019, ownership of a user-defined database can be changed.

- Ownership of system databases cannot be changed.
- The system procedure `sp_changedbowner` is used to change the ownership of a database.

```
sp_changedbowner[@loginame=] 'login'
```

Setting Database Options

Database-level options determine the characteristics of the database that can be set for each database

The options are unique to each database, so they do not affect other databases

Option Type	Description
Automatic options	Controls automatic behavior of database.
Cursor options	Controls cursor behavior.
Recovery options	Controls recovery models of database.
Miscellaneous options	Controls ANSI compliance.
State options	Controls state of database, such as online/offline and user connectivity.

Databases Options in SQL Server 2019

Filegroups 1-3

In SQL Server, data files are used to store database files

- For the sake of performance further subdivided into filegroups
- Used to group related files that together store a database object

Filegroup	Description
Primary	The filegroup that consists of the primary file. All system tables are placed inside the primary filegroup.
User-defined	Any filegroup that is created by the user at the time of creating or modifying databases.

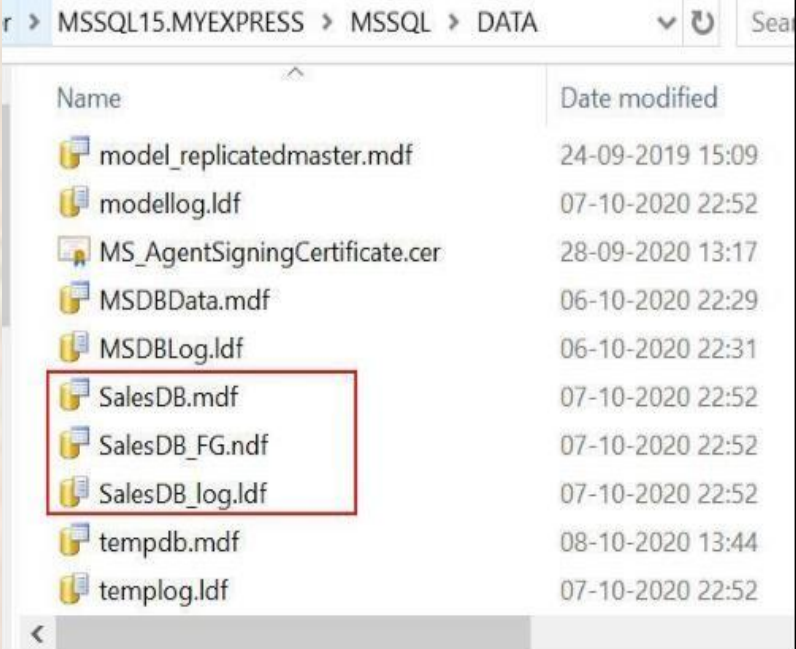
Filegroups in SQL Server 2019

Filegroups 2-3

Adding Filegroups to an existing database

- Filegroups can be created when the database is created for the first time or can be created later when more files are added to the database.
- However, files cannot be moved to a different filegroup after the files have been added to the database.

- A file cannot be a member of more than one filegroup at the same time.
- A maximum of 32,767 filegroups can be created for each database.
- Filegroups can contain only data files.
- Transaction log files cannot belong to a filegroup.



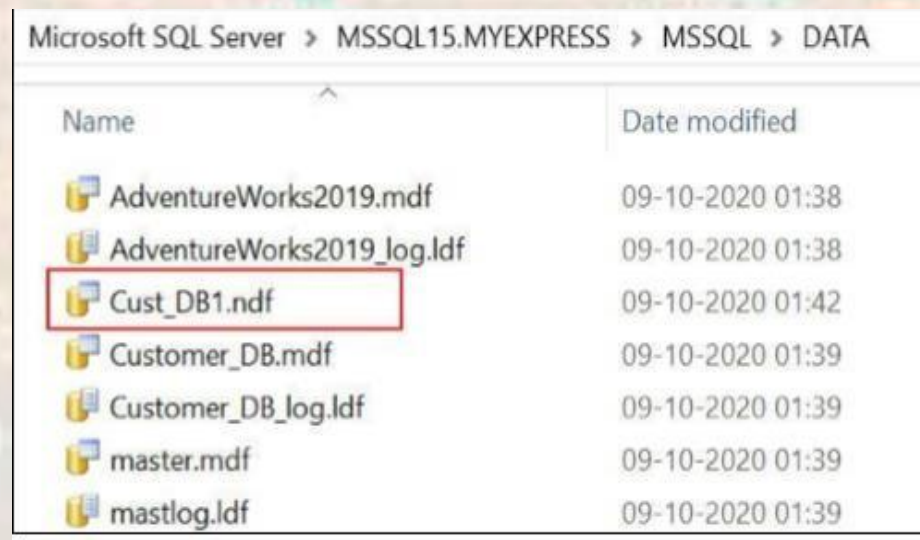
r > MSSQL15.MYEXPRESS > MSSQL > DATA			▼	↺	Search
Name		Date modified			
model_replicatedmaster.mdf		24-09-2019 15:09			
modellog.ldf		07-10-2020 22:52			
MS_AgentSigningCertificate.cer		28-09-2020 13:17			
MSDBData.mdf		06-10-2020 22:29			
MSDBLog.ldf		06-10-2020 22:31			
SalesDB.mdf		07-10-2020 22:52			
SalesDB_FG.ndf		07-10-2020 22:52			
SalesDB_log.ldf		07-10-2020 22:52			
tempdb.mdf		08-10-2020 13:44			
templog.ldf		07-10-2020 22:52			








Filegroup Added When Creating SalesDB Database

Filegroups 3-3

Default Filegroup

Objects are assigned to the default filegroup when they are created in the database. The PRIMARY filegroup is the default filegroup.



Microsoft SQL Server > MSSQL15.MYEXPRESS > MSSQL > DATA		
Name		Date modified
 AdventureWorks2019.mdf		09-10-2020 01:38
 AdventureWorks2019_log.ldf		09-10-2020 01:38
 Cust_DB1.ndf		09-10-2020 01:42
 Customer_DB.mdf		09-10-2020 01:39
 Customer_DB_log.ldf		09-10-2020 01:39
 master.mdf		09-10-2020 01:39
 mastlog.ldf		09-10-2020 01:39

New FileCust_DB1 Created

Transaction Log 1-2

Recovery of individual transactions

An incomplete transaction is rolled back in case of an application issuing a ROLLBACK statement or the Database Engine detecting an error. The log records are used to roll back the modifications.

Recovery of all incomplete transactions when SQL Server is started

If a server that is running SQL Server fails, the databases may be left in an inconsistent state. When an instance of SQL Server is started, it runs a recovery of each database.

Rolling a restored database, file, filegroup, or page forward to the point of failure

The database can be restored to the point of failure after a hardware loss or disk failure affecting the database files.

Supporting transactional replication

The Log Reader Agent monitors the transaction log of each database configured for replications of transactions.

Supporting standby server solutions

The standby-server solutions, database mirroring, and log shipping depend on the transaction log.

Transaction Log 2-2

Working of Transaction Logs:

A database in SQL Server has at least one data file and one transaction log file. Data and transaction log information are kept separated, preferably on separate drives.

The rollback of each transaction is executed using following ways:

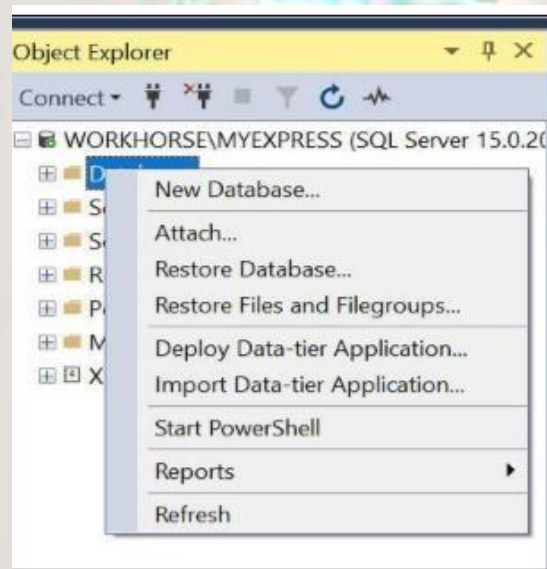
- A transaction is rolled forward when a transaction log is applied.
- A transaction is rolled back when an incomplete transaction is backed out.

Adding Log files to a database

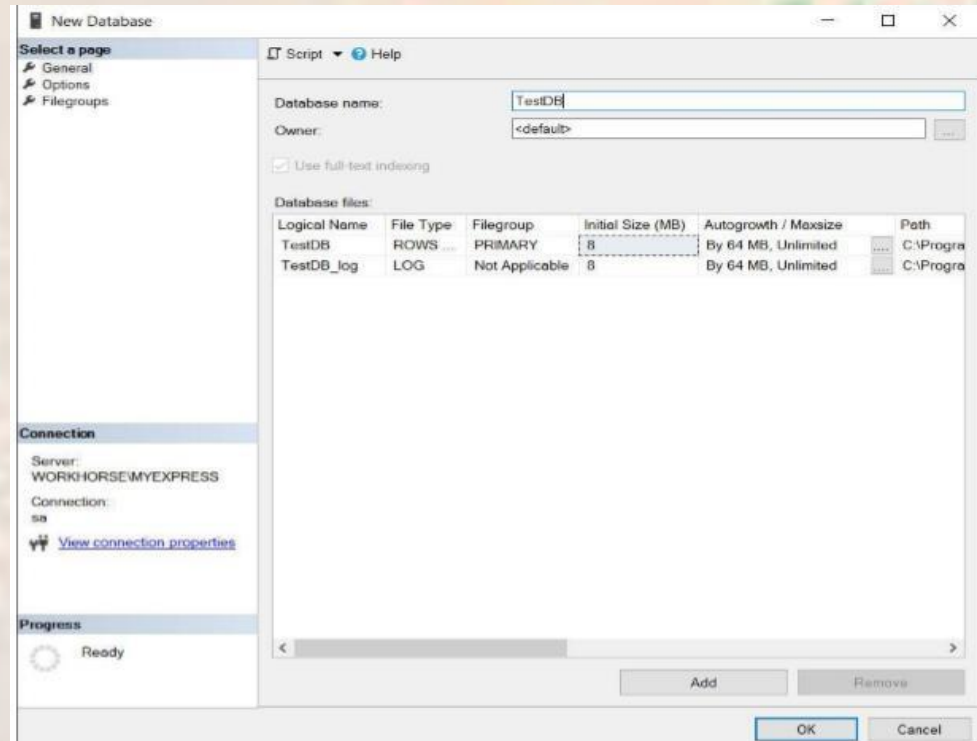
```
ALTER DATABASE database_name
{
  ...
}
[;]
<add_or_modify_files>::=
{
  ADD FILE <filespec> [, ...n]
  [ TO FILEGROUP { filegroup_name | DEFAULT } ]
  | ADD LOG FILE <filespec> [, ...n]
  | REMOVE FILE logical_file_name
  | MODIFY FILE <filespec>
}
```


Creating Databases Using SSMS 1-2

When a database is created, data files should be as large as possible based on maximum amount of data, which is expected in the database.

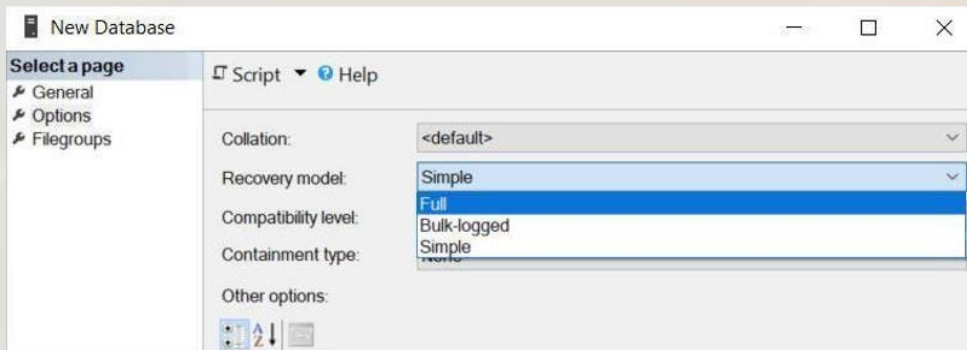


New Database Option

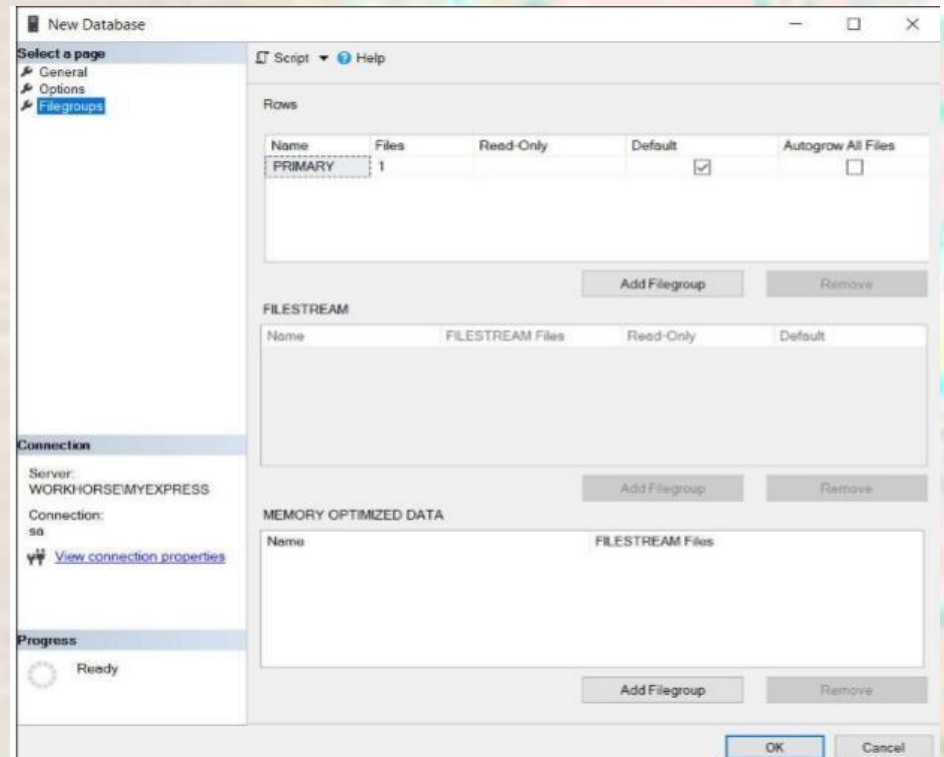


New Database Window

Creating Databases Using SSMS 2-2



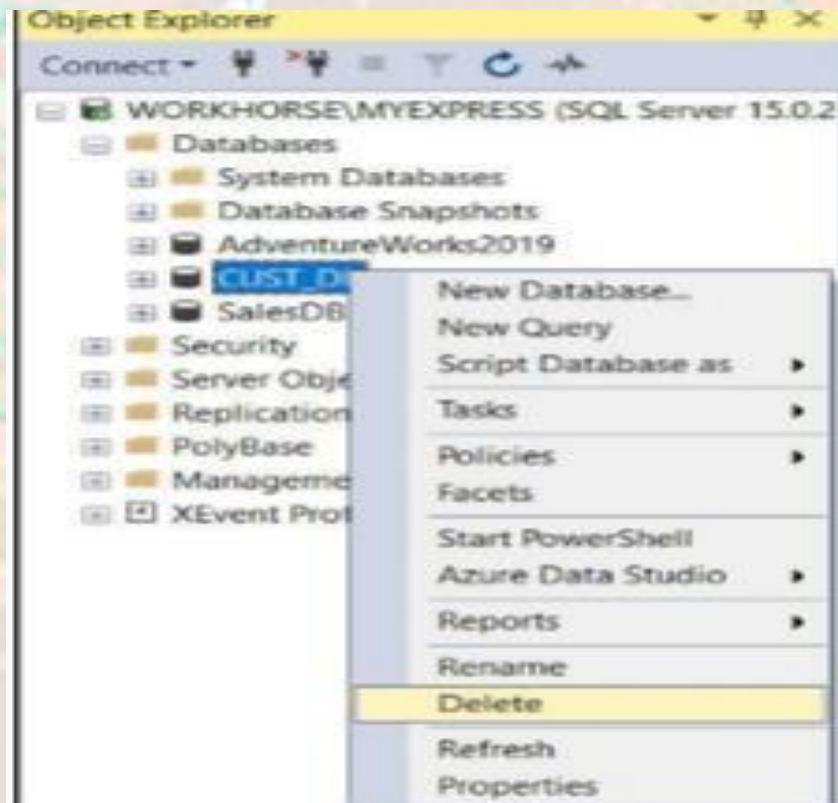
Recovery Model



Adding a Filegroup

Dropping a Database

A full backup of the database must be taken before dropping a database. A deleted database can be re-created only by restoring a backup.



Delete a Database

Creating Database Snapshots

Database snapshot feature was first introduced in Microsoft SQL Server 2005

- It is a feature that provides a read-only, static view of a SQL Server database.
- If a user makes a mistake in a source database, the source database can be reverted to the previous state when the snapshot was created.

Advantages

- Provide a convenient, read-only copy of data.
- When queried, no deterioration of performance.
- Snapshot files are small and are very quick to create.

Disadvantages

- Snapshot backup cannot be created.
- Snapshot must exist on the same database server as that of the source database.
- A new user cannot be granted access to the data in a snapshot.

Summary

- SQL Server uses system databases to support different components of the DBMS.
- The SQL Server data files are used to store database files, which are further subdivided into filegroups for the sake of performance.
- Databases can be created and dropped using SSMS or Transact-SQL.
- The CREATE DATABASE statement with various options can be used to create databases.
- ALTER DATABASE and DROP DATABASE are used to modify and delete a database respectively.
- A transaction log in SQL Server records all transactions and the database modifications made by each transaction.
- Objects are assigned to the default filegroup when they are created in the database. The PRIMARY filegroup is the default filegroup.
- A database snapshot is a read-only, static view of a SQL Server database.