

Installation

1. What are the various Editions available in SQL Server 2012 version?

Below are the various editions available in Microsoft SQL Server 2012

- SQL Server 2012 Standard Edition
- SQL Server 2012 Enterprise Edition
- SQL Server 2012 Business Edition
- SQL Server 2012 Express Editions
- SQL Server 2012 Web and Developer Editions

2. What are the major differences between paid editions – Standard, Enterprise and Business Editions in SQL Server 2012?

SQL Server 2012 Capabilities	Enterprise	Business Intelligence	Standard
Maximum No. of Cores	OS Max*	16 Cores for DB – OS Max for BI	16 Core
Basic Reporting & Analytics	Yes	Yes	Yes
Enterprise data Management (Data Quality Services, Master Data Services)	Yes	Yes	No
Self-Service Business Intelligence (Power View, Power Pivot for SPS)	Yes	Yes	No
Corporate Business Intelligence (Semantic model, advanced	Yes	Yes	No

analytics)			
Advanced Security (Advanced auditing, transparent data encryption)	Yes	No	No
Data Warehousing (Columnstore, compression, partitioning)	Yes	No	No
High Availability (Always ON)	Advanced	Basic	Basic
Maximum memory utilized (per instance of SQL Server Database Engine)	OS max	64 GB	64 GB
Server Core support	Yes	Yes	Yes
Backup compression	Yes	Yes	Yes
Database snapshot	Yes	No	No
Online indexing	Yes	No	No
Data compression	Yes	No	No
Resource Governor	Yes	No	No

3. What are the minimum Software requirements to install SQL Server 2012?

- Internet Explorer 7 or a later version is required for Microsoft Management Console (MMC), SQL Server Data Tools (SSDT), the Report Designer component of Reporting Services, and HTML Help

- SQL Server 2012 does not install or enable Windows PowerShell 2.0; however Windows PowerShell 2.0 is an installation prerequisite for Database Engine components and SQL Server Management Studio.
- .NET 3.5 SP1 is a requirement for SQL Server 2012 when you select Database Engine, Reporting Services, Replication, Master Data Services, Data Quality Services, or SQL Server Management Studio, and it is no longer installed by SQL Server Setup.
- Dot NET 4.0 is a requirement for SQL Server 2012. SQL Server installs .NET 4.0 during the feature installation step. SQL Server Express does not install .NET 4.0 when installing on the Windows 2008 R2 SP1 Server core operating system. You must install .NET4.0 before you install SQL Server Express on a Windows 2008 R2 SP1 Server core operating system.

SQL Server Setup installs the following software components required by the product:

- Dot NET Framework 4 1
- SQL Server Native Client
- SQL Server Setup support files

4. What are the minimum Hardware requirements to install SQL Server 2012 Paid editions?

SQL Server Editions	Memory(RAM)	CPU
SQL Server 2012 Enterprise (64-bit) x64	1GB	1.4 GHz AMD Opteron, AMD Athlon 64, Intel Xeon with Intel EM64T support, Intel Pentium IV with EM64T support
SQL Server 2012 Business Intelligence (64-bit) x64	1GB	1.4GHz AMD Opteron, AMD Athlon 64, Intel Xeon with Intel EM64T

		support, Intel Pentium IV with EM64T support
SQL Server 2012 Standard (64-bit)	1GB	1.4GHz AMD Opteron, AMD Athlon 64, Intel Xeon with Intel EM64T support, Intel Pentium IV with EM64T support
SQL Server 2012 Enterprise (32-bit)	1GB	1GHz Pentium III-compatible processor or faster
SQL Server 2012 Business Intelligence (32-bit)	1GB	1GHz Pentium III-compatible processor or faster
SQL Server 2012 Standard (32-bit)	1GB	1GHz Pentium III-compatible processor or faster

5. Where will you find the SQL Server installation related logs?

Installation related logs are stored under the shared feature directory folder which was selected at the time of first SQL Server instance installation. E.g. If Shared Features were selected to be placed on the "C:\Program Files\Microsoft SQL Server" then logs will be created under

```
%programfiles%\Microsoft SQL Server\110\Setup  
Bootstrap\Log\<YYYYMMDD_HHMM>\
```

6. What is "ConfigurationFile.ini" file?

SQL Server Setup generates a configuration file named **ConfigurationFile.ini**, based upon the system default and run-time inputs. The **ConfigurationFile.ini** file is a text file which contains the set of parameters in name/value pairs along with descriptive comments. Many of the parameter names correspond to the screens and options which you see while installing SQL Server through the wizard. We can then

use the configuration file to install SQL Server with the same configuration instead of going through each of the installation screens.

7. What is the location of ConfigurationFile.ini file?

We can find the configuration file in the **C:\Program Files\Microsoft SQL Server\110\Setup Bootstrap\Log** folder. There will be a subfolder based on a **timestamp** of when the SQL Server 2012 installation was done.

8. What is a service account?

Based on the selected components while doing the installation we will find respective service to each component in the Windows Services. E.g. SQL Server, SQL Server Agent, SQL Analysis Services, SQL Server integration Services etc. There will be a user for each and every service through which each service will run. That user is called Service Account of that service.

Mainly we categorize the Service account as below:

Local User Account: This user account is created in the server where SQL Server is installed; this account does not have access to network resources.

Local Service Account: This is a built-in windows account that is available for configuring services in windows. This account has permissions as same as accounts that are in the users group, thus it has limited access to the resources in the server.

Local System Account: This is a built-in windows account that is available for configuring services in windows. This is a highly privileged account that has access to all resources in the server with administrator rights.

Network Service Account: This is a built-in windows account that is available for configuring services in windows. This has permissions to access resources in the network under the computer account.

Domain Account: This account is a part of our domain that has access to network resources for which it is intended to have permission. It is always advised to run SQL Server and related services under a domain account with minimum privilege need to run SQL Server and its related services.

9. Do we need to grant Administrator permissions on the Windows server to SQL Service account to run the services or not, why?

No, it is not required. It's not mandatory to grant Administrator permissions to the service account.

10. What permissions are required to install SQL Server on a server?

User through which we are installing SQL Server must have administrator permissions on the Windows server.

11. What are shared Features Directory and its usages?

This directory contains the common files used by all instances on a single computer e.g. SSMS, sqlcmd, bcp, DTExec etc. These are installed in the folder <drive>:\Program Files\Microsoft SQL Server\110\ , where <drive> is the drive letter where components are installed. The default is usually drive C.

12. What is an Instance?

An instance of the Database Engine is a copy of the **sqlservr.exe** executable that runs as an operating system service. Each instance manages its own system databases and one or more user databases. An instance is a complete copy of an SQL Server installation.

13. Type of Instance and maximum no. of instances which can be installed on a server.

There are two types of Instances.

- Default instance
- Named Instance

Each computer can run maximum of 50 instances of the Database Engine. One instance can be the default instance.

The default instance has no name. If a connection request specifies only the name of the computer, the connection is made to the default instance.

A named instance is one where you specify an instance name when installing the instance. A connection request must specify both the computer name and instance name in order to connect to the instance.

14. Can we install multiple instances on the same disk drive?

Yes, we can install multiple instances on the same disk drive because each installation creates its own folder with the below format.

MSSQL11.INSTANCENAME

15. What is a collation and what is the default collation?

Collation refers to a set of rules that determine how data is sorted and compared. Character data is sorted using rules that define the correct character sequence, with options for specifying case-sensitivity, accent marks, kana character types and character width.

Default collation: ***SQL_Latin1_General_CI_AS***

16. What is an RTM setup of SQL Server?

RTM stands for release to manufacturing.

17. What is a Service Pack, Patch, Hot fix and its difference?

Service Pack is abbreviated as SP, a service pack is a collection of updates and fixes, called patches, for an operating system or a software program. Many of these patches are often released before the larger service pack, but the service pack allows for an easy, single installation.

Patch – Publicly released update to fix a known bug/issue

Hot fix – update to fix a very specific issue, not always publicly released

18. What is the latest Service pack available for SQL Server 2012 in the market?

SQL Server 2012 Service Pack 3 (SP3)

Version: 11.0.6020.0

Release Date: 11/21/2015

19. What's the practical approach of installing Service Pack?

Steps to install Service pack in Production environments:

1. First of all raise a change order and get the necessary approvals for the downtime window. Normally it takes around 45-60 minutes to install Service pack if there are no issues.
2. Once the downtime window is started, take a full backup of the user databases and system databases including the Resource database.
3. List down all the Startup parameters, Memory Usage, CPU Usage etc and save it in a separate file.
4. Install the service pack on SQL Servers.
5. Verify all the SQL Services are up and running as expected.
6. Validate the application functionality.

Note: There is a different approach to install Service pack on SQL Server cluster instances. That will be covered in SQL Server cluster.

20. Is it mandatory to restart the Windows server after installing SQL server service pack?

No, it's not mandatory to restart Windows server after installing SQL Server service pack but it is always a good practice to do so.

21. How to check the SQL Server version and Service pack installed on the server?

```
Select convert (varchar (50), SERVERPROPERTY ('productversion')),  
Convert (varchar (50), SERVERPROPERTY ('productlevel')),  
Convert (varchar (50), SERVERPROPERTY ('edition'))
```

Or

```
Select @@VERSION
```

22. How to check SQL Server name?

```
Select @@Servername
```

23. What is a slip stream installation and its usages?

SQL Server 2008 introduced a concept that's called "Slipstream Installation". This is a way to deploy a SQL Server instance with all the needed Service pack as part of the installation. Everything will be installed in one go, hence there is no need to deploy any other service packs on the installation.

24. What is a silent installation and how can we use this feature?

The procedure to install SQL Server instance through command line using ConfigurationFile.ini file in quite mode is known as Silent installation.

25. What is the default port of a SQL Server instance?

SQL Server default instance by default listen on 1433 port.

26. Can we change the default port of SQL Server, How?

Yes, it is possible to change the Default port on which SQL Server is listening.

Step 1. Click **Start > All Programs > Microsoft SQL Server 2012 > Configuration Tools >SQL Server Configuration Manager**

Step 2. Go to **SQL Server Configuration Manager > SQL Server Network Configuration >Protocols for <Instance Name>**

Step 3. Right Click on **TCP/IP** and select **Properties**

Step 4. In **TCP/IP Properties** dialog box, go to **IP Addresses** tab and scroll down to **IPAll** group. Now change the value to static value which you want to set for SQL Server port.

27. How to get the port number where the SQL Server instance is listening?

Below are the methods using which we can get the port information.

Method 1: SQL Server Configuration Manager

Method 2: Windows Event Viewer

Method 3: SQL Server Error Logs

Method 4: sys.dm_exec_connections DMV

Method 5: Reading registry using xp_instance_regread

28. What is a Filestream?

FILESTREAM was introduced in SQL Server 2008 for the storage and management of unstructured data. The FILESTREAM feature allows storing BLOB data (example: word documents, image files, music and videos etc) in the NT file system and ensures transactional consistency between the unstructured data stored in the NT file system and the structured data stored in the table.

29. What's the location of SQL Server log files?

SQL Server error logs are stored in the below location.

Instance Root Directory\MSQL\Log

30. How many SQL Server log files can be retained in the SQL Server error logs be default?

By default, there are seven SQL Server error logs; Errorlog and Errorlog.1 through Errorlog.6. The name of the current, most recent log is Errorlog with no extension. The log is re-created every time that you restart SQL Server. When the Errorlog file is re-created, the previous log is renamed to Errorlog.1, and the next previous log (Errorlog.1) is renamed to Errorlog.2, and so on. Errorlog.6 is deleted.

31. Is it possible to increase the retention of Error log files and How?

Yes it is possible to change the no. of Error logs retention. We can follow the below steps to change the Error log file retention.

1. Open SQL Server Management Studio and then connect to SQL Server Instance
2. In **Object Explorer**, Expand **Management** Node and then right click **SQL Server Logs** and click **Configure** as shown in the snippet below.
3. In **Configure SQL Server Error Logs** window you can enter the value between 6 and 99 for the number of error logs and click **OK** to save the changes

Security Permissions

1) What is Authentication and Authorization? What is the difference between both?

Authentication is the process of verifying who you are. Logging on to a PC with a username and password is authentication.

Authorization is the process of verifying that you have access to something. Authorization is gaining access to a resource (e.g. directory on a hard disk) because the permissions configured on it allow you to access it.

2) How many type of SQL Server authentication mode supported by SQL Server 2012?

There are two type of authentication available in SQL Server.

Windows Authentication — TRUSTED connection

Windows Logins

Windows Groups

MIXED authentication — NON Trusted connection

Windows Logins

Windows Groups

SQL Server logins

3) What's the difference between Windows and Mixed mode?

Windows authentication mode requires users to provide a valid Windows username

and password to access the database server. In enterprise environments, these credentials are normally Active Directory domain credentials.

Mixed authentication mode allows the use of Windows credentials but supplements them with local SQL Server user accounts that the administrator may create and maintain within SQL Server

4) Being a DBA which authentication mode you will prefer if you are asked to give an advice for a new Application?

Windows authentication is definitely more secure as it's controlled and authenticated by Active Directory policies.

5) What are Principals?

Principals are entities that can request SQL Server resources. A Windows Login is an example of an indivisible principal, and a Windows Group is an example of a principal that is a collection. Every principal has a security identifier (SID). e.g.

Windows-level principals

- Windows Domain Login
- Windows Local Login

SQL Server-level principals

- SQL Server Login
- Server Role

Database-level principals

- Database User
- Database Role
- Application Role

6) What is a Securable?

Securables are the resources to which the SQL Server Database Engine authorization system regulates access. For example, a table is a securable. Some securables can be contained within others, creating nested hierarchies called "scopes" that can themselves be secured. The securable scopes are server, database, and schema.

7) Explain scope of securable on Server, Database and Schema level?

Securable scope: Server –The server securable scope contains the following securables:

- Endpoint
- Login
- Server role
- Database

Securable scope: Database –The database securable scope contains the following securables:

- User
- Database role
- Application role
- Assembly
- Message type
- Route
- Service
- Remote Service Binding
- Full text catalog
- Certificate
- Asymmetric key
- Symmetric key
- Contract
- Schema

Securable scope: Schema –The schema securable scope contains the following securables:

- Type
- XML schema collection
- Object – The object class has the following members:
 - o Aggregate
 - o Function
 - o Procedure
 - o Queue
 - o Synonym
 - o Table
 - o View

8) What are logins and users and its difference?

A login is the principal that is used to connect to the SQL Server instance. A user is the principal that is used to connect to a database.

The security context on the instance itself is dictated by the login, its roles and the permissions granted/denied. The security context on the database is dictated by the user, its roles and the permissions granted/denied.

9) What is a schema?

SQL Server 2005 introduced the concept of database schemas and the separation between database objects and ownership by users. An object owned by a database user is no longer tied to that user. The object now belongs to a schema – a container that can hold many database objects. Schema as a collection of database objects that are owned by a single principal and form a single namespace

10) What are Fixed Server roles and importance?

Bulk Admin: Members of this role can perform Bulk Insert operations on all the databases.

DBCreator: Members of this role can Create/Alter/Drop/Restore a database.

Disk Admin: Members can manage disk files for the server and all databases. They can handle backup devices.

Process Admin: Members of this role can manage and terminate the processes on the SQL Server.

Server Admin: Members of this role can change Server-wide configurations and shutdown SQL Server instance.

Setup Admin: Members of this role can Add/Remove Linked Servers.

Security Admin: Members of this role can create/manage Logins, including changing and resetting passwords as needed, and managing GRANT, REVOKE and DENY permissions at the server and database levels.

Sysadmin: Members of this role have Full Control on the instance and can perform any task.

Public: Public is another role just like Fixed Server Roles, that is by default granted to every login (Windows/SQL)

11) What are “View Server State”, “VIEW DATABASE STATE” permissions meant for?

Dynamic management views and functions return server state information that can be used to monitor the health of a server instance, diagnose problems, and tune performance.

There are two types of dynamic management views and functions:

Server-scoped dynamic management views and functions. These require VIEW

SERVER STATE permission on the server.

Database-scoped dynamic management views and functions. These require VIEW DATABASE STATE permission on the database.

12) What are “View Definition” permissions?

The VIEW DEFINITION permission lets a user see the meta-data of the securable on which the permission is granted. However, VIEW DEFINITION permission does not confer access to the securable itself. For example, a user that is granted only VIEW DEFINITION permission on a table can see metadata related to the table in the sys.objects catalog view. However, without additional permissions such as SELECT or CONTROL, the user cannot read data from the table.

The VIEW DEFINITION permission can be granted on the following levels:

- Server scope
- Database scope
- Schema scope
- Individual entities

13) What is a guest account?

Guest user permits access to a database for any logins that are not mapped to a specific database user. The guest user cannot be dropped but it can be disabled by revoking the CONNECT permission. The recommendation is not valid for master, msdb and tempdb system databases. If Guest user is disabled in msdb system database, it may cause some issues. Distribution database is also system database and more information about the Guest User in distribution database can be found below. It is recommended to disable guest user in every database as a best practice for securing the SQL Server.

14) Is it possible to create new User Defined Server role in 2012 or not?

Yes, it is possible to create a Server role in SQL Server 2012.

15) What are the security related catalog views?

Server-Level Views

sys.server_permissions

sys.sql_logins

sys.server_principals

sys.server_role_members

Database-Level Views

```
sys.database_permissions  
sys.database_role_members  
sys.database_principals
```

16) What are the extra DB roles available in msdb?

SQL Server 2005 introduced the following msdb database fixed database roles, which give administrators finer control over access to SQL Server Agent. The roles listed from least to most privileged access are:

- SQLAgentUserRole
- SQLAgentReaderRole
- SQLAgentOperatorRole

17) Which one is highest privileged role out of SQLAgentUserRole, SQLAgentReaderRole, SQLAgentOperatorRole?

SQLAgentOperatorRole is the most privileged of the SQL Server Agent fixed database roles. It includes all the permissions of SQLAgentUserRole and SQLAgentReaderRole. Members of this role can also view properties for operators and proxies, and enumerate available proxies and alerts on the server.

18) What are Fixed Database Roles?

db_datareader: The db_datareader role has the ability to run a SELECT statement against any table or view in the database.

db_datawriter: The db_datawriter role has the ability to modify via INSERT, UPDATE, or DELETE data in any table or view in the database.

db_denydatareader: The db_denydatareader role is the exact opposite of the db_datareader role: instead of granting SELECT permissions on any database object, the db_denydatareader denies SELECT permissions.

db_denydatawriter: db_denydatawriter role serves to restrict permissions on a given database. With this role, the user is preventing from modifying the data on any data via an INSERT, UPDATE, or DELETE statement

db_accessadmin: The db_accessadmin fixed database role is akin to the securityadmin fixed server role: it has the ability to add and remove users to the database.

The db_accessadmin role does not, however, have the ability to create or remove database roles, nor does it have the ability to manage permissions.

Granted with GRANT option: CONNECT

db_securityadmin: The db_securityadmin role has rights to handle all permissions

within a database. The full list is:

DENY, GRANT, REVOKE, sp_addapprole, sp_addgroup, sp_addrole,
sp_addrolemember, sp_approlepassword, sp_changegroup, sp_changeobjectowner,
sp_dropapprole, sp_dropgroup, sp_droprole, sp_droprolemember

The list includes the DENY, GRANT, and REVOKE commands along with all the store procedures for managing roles.

db_ddladmin: A user with the db_ddladmin fixed database role has rights to issue Data Definition Language (DDL) statements in order to CREATE, DROP, or ALTER objects in the database.

db_backupoperator: db_backupoperator has rights to create backups of a database. Restore permissions are not granted, but only backups can be performed.

db_owner: Equal to a sysadmin at instance level, DB_OWNER can perform any task at DB Level.

public: By default all the users in database level are granted Public Role.

19) What is the purpose of db_denydatawriter and db_denydatareader?

The deny roles are an extra safeguard that you can use to make sure that certain logins or groups will never have the type of access that is specifically denied under the role. With nesting of groups in Windows and multiple role assignments sometimes individuals inadvertently end up with excessive permissions. This is just another level that can be applied to lessen these accidental cracks in the permissions hierarchy.

20) What are Application Roles?

An application role is a database principal that enables an application to run with its own, user-like permissions. You can use application roles to enable access to specific data to only those users who connect through a particular application. Unlike database roles, application roles contain no members and are inactive by default. Application roles work with both authentication modes. Application roles are enabled by using sp_setapprole, which requires a password. Because application roles are a database-level principal, they can access other databases only through permissions granted in those databases to guest. Therefore, any database in which guest has been disabled will be inaccessible to application roles in other databases.

21) What are Orphaned Users?

A database user for which the corresponding SQL Server login is undefined or is

incorrectly defined on a server instance cannot log in to the instance. Such a user is said to be an orphaned user of the database on that server instance.

- A database user can become orphaned if the corresponding SQL Server login is dropped.
- A database user can become orphaned after a database is restored or attached to a different instance of SQL Server.
- Orphaning can happen if the database user is mapped to a SID that is not present in the new server instance.

22) How to troubleshoot issues with the Orphaned users?

This will lists the orphaned users:

```
EXEC sp_change_users_login 'Report'
```

If you already have a login id and password for this user, fix it by doing:

```
EXEC sp_change_users_login 'Auto_Fix', 'user'
```

If you want to create a new login id and password for this user, fix it by doing:

```
EXEC sp_change_users_login 'Auto_Fix', 'user', 'login', 'password'
```

23) How can SQL Server instances be hidden?

To hide an instance of the SQL Server Database Engine

1. In SQL Server Configuration Manager, expand SQL Server Network Configuration, right-click Protocols for, and then select Properties.
2. On the Flags tab, in the Hide Instance box, select yes, and then click OK to close the dialog box. The change takes effect immediately for new connections.

24) Being a DBA what all measures you will follow to make SQL SERVER more secure?

- When possible, use Windows Authentication logins instead of SQL Server logins
- Using server, database and application roles to control access to the data
- Using an un guessable SA password
- If possible, disable and rename the sa account
- Restricting physical access to the SQL Server
- Disabling the Guest account
- Minimize the number of sysadmins allowed to access SQL Server.
- Give users the least amount of permissions they need to perform their job.

- Use stored procedures or views to allow users to access data instead of letting them directly access tables.
- Don't grant permissions to the public database role.
- Remove user login IDs who no longer need access to SQL Server.
- Avoid creating network shares on any SQL Server.
- Turn on login auditing so you can see who has succeeded, and failed, to login.
- Ensure that your SQL Servers are behind a firewall and are not exposed directly to the Internet.
- Do not use DBO users as application logins
- Firewall restrictions ensure that only the SQL Server listening port is available on the database server.
- Apply the latest security updates / patches

25) What is Transparent Data Encryption?

Transparent Data Encryption (TDE) is a feature introduced in SQL Server 2008 and available in later versions for bulk encryption at the database file level (data file, log file and backup file) i.e. the entire database at rest. Once enabled for a database, this feature encrypts data into pages before it is written to the disk and decrypts when read from the disk. The best part of this feature is, as its name implies, it's completely transparent to your application. This means literally no application code changes (only administrative change to enable it for a database) are required and hence no impact on the application code\functionality when enabling TDE on a database being referenced by that application.

26) What is Service master key?

The Service Master Key is the root of the SQL Server encryption hierarchy. It is generated automatically the first time it is needed to encrypt another key. By default, the Service Master Key is encrypted using the Windows data protection API and using the local machine key. The Service Master Key can only be opened by the Windows service account under which it was created or by a principal with access to both the service account name and its password.

27) What are the types of keys used in encryption?

Symmetric Key – In Symmetric cryptography system, the sender and the receiver of a message share a single, common key that is used to encrypt and decrypt the

message. This is relatively easy to implement, and both the sender and the receiver can encrypt or decrypt the messages.

Asymmetric Key – Asymmetric cryptography, also known as Public-key cryptography, is a system in which the sender and the receiver of a message have a pair of cryptographic keys – a public key and a private key – to encrypt and decrypt the message. This is a relatively complex system where the sender can use his key to encrypt the message but he cannot decrypt it. The receiver, on the other hand, can use his key to decrypt the message but he cannot encrypt it. This intricacy has turned it into a resource-intensive process.

28) How to take backup of the Service master key?

```
BACKUP SERVICE MASTER KEY TO FILE = 'path_to_file'  
ENCRYPTION BY PASSWORD = 'password'
```

29) Is it possible to disable SA, how?

Disable the SA Login

Disabling the SA account is a good option to prevent its use. When it is disabled no one can use it in any circumstance until it is enabled. The only disadvantage is that we can't use the SA account in an emergency. We can use the below T-SQL to disable SA account.

–Query to disable the SA account.

```
ALTER LOGIN sa DISABLE;
```

30) Is it possible to Rename the SA Login

Yes we can rename the SA account which will prevent hackers/users to some extent.

–Query to check account status

```
ALTER LOGIN sa WITH NAME = [newname];
```

31) Define SQL Server Surface Area Configuration Tool

SQL Server 2005 contains configuration tools such as a system stored procedure called sp_configure or SQL Server Surface Area Configuration tool (for services and features) in order to enable/disable optional features as needed. Those features are usually installed as disabled by default. Here is the list of the features that can be enabled using the tool:

xp_cmdshell

SQL Server Web Assistant

CLR Integration

Ad hoc remote queries (the OPENROWSET and OPENDATASOURCE functions)

OLE Automation system procedures

System procedures for Database Mail and SQL Mail

Remote use of a dedicated administrator connection

Database Architecture and Database Properties

1) How many types of files are there in a SQL Server database?

SQL Server databases have three types of files:

- Primary data files
- Secondary data files
- Transaction Log files

2) Explain each type of database files?

Primary data files

The primary data file is the starting point of the database and points to the other files in the database. Every database has one primary data file. The recommended file name extension for primary data files is .mdf.

Secondary data files

Secondary data files make up all the data files, other than the primary data file. Some databases may not have any secondary data files, while others have several secondary data files. The recommended file name extension for secondary data files is .ndf.

Transaction Log file

This file holds all the log information that is used to recover the database. There must be at least one log file for each database, although there can be more than one. The recommended file name extension for log files is .ldf.

3) What is the major difference between Primary data files and secondary data files?

Primary data file contains system objects where as secondary data files contains all user defined Database objects if these are not part of the Primary File group.

One of the important difference between Primary and Secondary data files is **BOOT PAGE**. Page Number 9 is the boot page (Page type 13). Boot page is available as 9th page only in the primary data file.

4) How many maximum files can be added to a database?

32,767

5) What are file groups and Type of File Groups?

Database File groups: Database objects and files can be grouped together in file groups for allocation and administration purposes. There are two types of file groups:

Primary: The primary file group contains the primary data file and any other files not specifically assigned to another file group. All pages for the system tables are allocated in the primary file group.

User-defined: User-defined file groups are any file groups that are specified by using the FILEGROUP keyword in a CREATE DATABASE or ALTER DATABASE statement.

6) What is the default File Group in a database?

Primary File group

7) Is it possible to change the Default file group from Primary to some other user defined file group? What is the benefit of this?

Yes it is possible to change the Default File group to user defined File group. All the newly created objects will be created in User defined File group by default.

8) How many Maximum File groups can be added in a database?

32,767

9) Is it possible to add Transaction Log file in a file group?

Log files are never part of a filegroup. Log space is managed separately from data space.

10) What is the use of having multiple File Groups?

Below are the major benefits which can be achieved using multiple data files and placing these files in separate file groups on separate disk drives.

1. Disk I\O Performance
2. Easy Management and Archiving of the data
3. Benefit of doing File Group level Backups and restores
4. Usage of File Groups in Partitioning of the tables

11) Is there any benefit to add multiple log files? Yes/No, Why?

No, there is no benefit of adding multiple log files in a database as the write operations in a Transaction log files are always serial.

12) Will the below script work if yes, how?

Create database Test;

Yes, this script will work because rest of the parameters will be taken from model database and Files will be located to the respective folders which are set at the SQL Server instance level.

13) What is Database Growth and what settings are available in a database?

Each database file that is associated with your database has an auto-growth setting. There are three different settings you can use to identify how your database files will grow. They can grow by a specific size, a percentage of the current size, or not grow at all. Additionally you can set your files to unrestricted growth, which means they will keep growing as they need more space or you run out of disk space. Or you can restrict the growth of a database file to grow no larger than a specified size. Each one of these different auto-grow setting have defaults, or you can set them for each database file.

14) What are the recommended settings for transaction Log File for file growth?

If you are required to set the setting for Auto growth of Transaction log file, it should always be in a specific size instead of percentage.

15) What is a compatibility level of a database?

Compatibility level sets certain database behaviors to be compatible with the specified version of SQL Server. The default compatibility level is 110. Databases created in SQL Server 2012 are set to this level unless the **model** database has a lower compatibility level.

16) How to change the Compatibility level of a database?

```
ALTER DATABASE database_name  
SET COMPATIBILITY_LEVEL = {90 | 100 | 110}
```

'90 = SQL Server 2005

100 = SQL Server 2008 and SQL Server 2008 R2

110 = SQL Server 2012

17) What's the difference between database version and database compatibility level?

Database version

The database version is a number stamped in the boot page of a database that indicates the SQL Server version of the most recent SQL Server instance the database was attached to.

```
USE master;
GO
SELECT DatabaseProperty ('dbccpagetest', 'version');
GO
```

Database compatibility level

The database compatibility level determines how certain database behaviors work. For instance, in 90 compatibility, you need to use the OUTER JOIN syntax to do an outer join, whereas in earlier compatibility levels, you can use '*=*' and '=**'

```
SELECT name AS 'DB Name', compatibility_level AS 'Compatibility Level'
FROM master.sys.databases;
GO
```

18) What is a Page Verify option in a database?

When CHECKSUM is enabled for the PAGE_VERIFY database option, the SQL Server Database Engine calculates a checksum over the contents of the whole page, and stores the value in the page header when a page is written to disk. When the page is read from disk, the checksum is recomputed and compared to the checksum value that is stored in the page header. This helps provide a high level of data-file integrity.

19) What are the different Database states in SQL server instance?

State	Definition
ONLINE	Database is available for access. The primary filegroup is online, although the undo phase of recovery may not have been completed.
OFFLINE	Database is unavailable. A database becomes offline by

	explicit user action and remains offline until additional user action is taken. For example, the database may be taken offline in order to move a file to a new disk. The database is then brought back online after the move has been completed.
RESTORING	One or more files of the primary filegroup are being restored, or one or more secondary files are being restored offline. The database is unavailable.
RECOVERING	Database is being recovered. The recovering process is a transient state; the database will automatically become online if the recovery succeeds. If the recovery fails, the database will become suspect. The database is unavailable.
RECOVERY PENDING	SQL Server has encountered a resource-related error during recovery. The database is not damaged, but files may be missing or system resource limitations may be preventing it from starting. The database is unavailable. Additional action by the user is required to resolve the error and let the recovery process be completed.
SUSPECT	At least the primary filegroup is suspect and may be damaged. The database cannot be recovered during startup of SQL Server. The database is unavailable. Additional action by the user is required to resolve the problem.
EMERGENCY	User has changed the database and set the status to EMERGENCY. The database is in single-user mode and may be repaired or restored. The database is marked READ_ONLY, logging is disabled, and access is limited to members of the sysadmin fixed server role. EMERGENCY is primarily used for troubleshooting purposes. For example, a database marked as suspect can be set to the EMERGENCY state. This could permit the system administrator read-only access to the database. Only

	members of the sysadmin fixed server role can set a database to the EMERGENCY state.
--	---

20) How many databases can be created in SQL server instance?

32,767

21) What is auto close option?

AUTO CLOSE option:

When set to ON, the database is shut down cleanly and its resources are freed after the last user exits. The database automatically reopens when a user tries to use the database again.

When set to OFF, the database remains open after the last user exits.

22) What is auto shrink option?

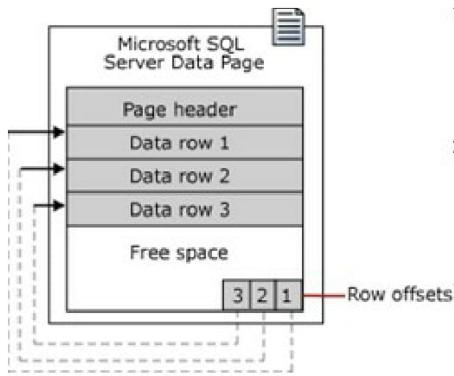
AUTO SHRINK option:

When set to ON, the database files are candidates for periodic shrinking. Both data file and log files can be shrunk automatically by SQL Server. AUTO_SHRINK reduces the size of the transaction log only if the database is set to SIMPLE recovery model or if the log is backed up.

When set to OFF, database files are not automatically shrunk during periodic checks for unused space.

23) What is page?

Page is the smallest unit of storage in SQL Server database, the page size is 8 KB. This means SQL Server databases have 128 pages per megabyte. Each page begins with a 96-byte header that is used to store system information about the page. This information includes the page number, page type, the amount of free space on the page, and the allocation unit ID of the object that owns the page



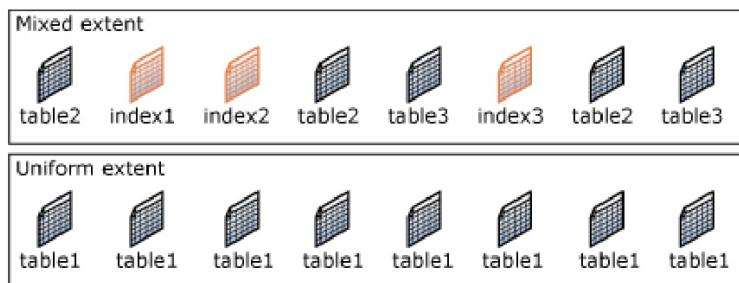
24) What is an extent?

An extent is a collection of eight physically contiguous pages.

25) Types of extent?

Uniform extents are owned by a single object; all eight pages in the extent can only be used by the owning object.

Mixed extents are shared by up to eight objects. Each of the eight pages in the extent can be owned by a different object.



26) What is the difference between single user and restricted user and restricted user option?

This option controls who and how many users can connect to a database.

When SINGLE_USER is specified, one user at a time is allowed to connect to the database. All other user connections are broken.

When RESTRICTED_USER is specified, only members of the db_owner fixed database role and dbcreator and sysadmin fixed server roles are allowed to connect to the database, but it does not limit their number.

When MULTI_USER is specified, all users that have the appropriate permissions to connect to the database are allowed.

27) What is a logical File and physical File name?

Each data and transaction log file in a SQL Server database has two names:

logical_file_name

The logical_file_name is the name used to refer to the physical file in all Transact-SQL statements. The logical file name must comply with the rules for SQL Server identifiers and must be unique among logical file names in the database.

os_file_name

The os_file_name is the name of the physical file including the directory path. It must follow the rules for the operating system file names.

28) What is ROW_OVERFLOW_DATA? How does it work?

ROW_OVERFLOW_DATA: Assume that a table is created with record size 12000 bytes having 4 varchar data types of size 4000 bytes. Whenever user inserts a record with size greater than 8000 (page size is 8K), then the excess data is moved to ROW_OVERFLOW_DATA pages. In simple terms, ROW_OVERFLOW_DATA pages will come in to picture only when the row size exceed page maximum limit.

29) How can we check the allocation unit of objects?

DMV sys.system_internals_allocation_units

30) What is trustworthy property of a database?

Trustworthy property: When ON, database modules (for example, user-defined functions or stored procedures) that use an impersonation context can access resources outside the database.

When OFF is specified, in an impersonation context cannot access resources outside the database.

TRUSTWORTHY is set to OFF whenever the database is attached.

31) What is Instant file initialization?

Data and log files are initialized to overwrite any existing data left on the disk from previously deleted files. Data and log files are first initialized by filling the files with zeros when you perform one of the following operations:

- Create a database.
- Add files, log or data, to an existing database.
- Increase the size of an existing file (including autogrow operations).
- Restore a database or file group.
- File initialization causes these operations to take longer. However, when data is written to the files for the first time, the operating system does not have to fill the files with zeros.

Instant file initialization is only available if the SQL Server (MSSQLSERVER) service account has been granted SE_MANAGE_VOLUME_NAME. Members of the Windows Administrator group have this right and can grant it to other users by adding them to the **Perform Volume Maintenance Tasks** security policy.

Data File and Transaction Log File Architecture

1) Explain the SQL Server Database Data File structure?

Page No :0	Page No :1	Page No :2	Page No :3	Page No :4	Page No :5	Page No :6	Page No :7	Page No :8	Page No :9	Page No :10	Page No :11	Page No :12	Page No :13
Page type :15	Page type :11	Page type :8	Page type :9	Page type :10	Page type :16	Page type :17	Page type :18	Page type :19	Page type :11	Page type :13	Page type :11	Page type :12	Page type :14
Page Header	First PFS	First GMM	First SGAM	Unused Page	Unused Page	First DCM	First BCM	IAM page	Boot page	Data page	Index page		

SQL server divides the data file into 8 KB pages and page is the smallest unit of any IO operation. SQL server refer the first page in the data file as page number 0. In all the data file first 9 pages (till page number 8) are in same order as shown below.

In the primary data file, the 10th page (Page number 9) will be the boot page which stores the metadata about the database.

2) What is a Data Page?

Data rows with all data, except text, next, image, nvarchar(max), varchar(max), varbinary(max), and xml data.

3) What is an Index Page?

Contains information related to Indexes. This holds index records in the upper levels of a clustered index and all levels of non-clustered indexes.

4) What is a Page Header?

Page number 0- the file header (page type 15). It holds the file header information. There will be only one header page for each data file and that reside in the 0th position. The header page store the file level information like file size, minimum size, max size and file growth.

5) What is PFS?

PFS page is the second page (Page Number 1) in the data file followed by file header (Page Number 0). PFS pages are used to track page level allocation. PFS page repeat after every 8088 pages

6) What is a GAM Page?

GAM pages records what extents have been allocated for any use. GAM has bit for every extent. If the bit is 1, the corresponding extent is free, if the bit is 0, the corresponding extent is in use as uniform or mixed extent.

7) How many GAM pages will be there in a 7GB data file?

A GAM page can hold information of around 64000 extents. That is, a GAM page can hold information of $(64000 \times 8 \times 8)/1024 = 4000$ MB approximately. In short, a data file of size 7 GB will have two GAM pages.

8) What is SGAM page?

SGAM (Shared Global Allocation Map) page (Page type 8). SGAM pages record what extents are currently being used as mixed extent and also have at least one unused page. SGAM has bit for every extent. If the bit is 1, the corresponding extent is used as a mixed extent and has at least one page free to allocate. If the bit is 0, the extent is either not used as a mixed extent or it is mixed extent and with all its pages being used.

9) How many SGAM pages will be there in a 7GB data file?

A SGAM page can hold information of 64000 extents. That is, a SGAM page can hold information of $(64000 \times 8 \times 8) / 1024 = 4000$ MB. In short, a data file of size 7 GB will have two SGAM page.

10) What is a DCM and its significance?

SQL Server uses DCM (Differential Changed Map) pages to track extent modified after the last full backup operation. DCM pages track the extents modified after the full backup. DCM has a bit for every extent it tracks. If the bit is 1, the corresponding extent is modified after the last full backup, if the bit is 0, there is no change in the corresponding extent after the last full backup

11) How SQL Server engine will decide which extents need to be added into a differential backup?

A differential backup process scans through DCP page to identify the extents which are modified after the last full backup and add those extents in the Differential backup.

12) What is a BCM and its significance?

This tracks the extents that have been modified by bulk logged operations since the last BACKUP LOG statement. If the bit for an extent is 1, the extent has been modified by a bulk logged operation after the last BACKUP LOG statement. If the bit is 0, the extent has not been modified by bulk logged operations.

Although BCM pages appear in all databases, they are only relevant when the database is using the bulk-logged recovery model. In this recovery model, when a

BACKUP LOG is performed, the backup process scans the BCMs for extents that have been modified. It then includes those extents in the log backup.

13) What is Boot Page?

There is one special data page that exists only once per database. It is the database boot page. The database boot page is always stored in page 9 of file 1, the first file in the primary file group.

The database boot page contains a broad variety of data about the database itself. Here you can find the internal database version, the compatibility level, the database name and the date of the last log backup.

14) How many types of Allocation units are there?

There are three types of allocation units.

IN_ROW_DATA (default): If a table is relatively simple in design (meaning record size is less than 8000 and no LOB data types are present), all records are stored in pages referred as IN_ROW_DATA pages.

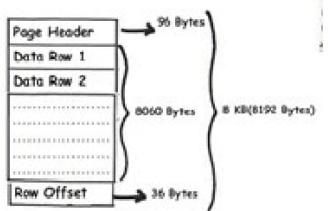
ROW_OVERFLOW_DATA: assume that a table is created with record size 12000 bytes having 4 varchar data types of size 4000 bytes. Whenever user inserts a record with size greater than 8000 (page size is 8K), then the excess data is moved to ROW_OVERFLOW_DATA pages. In simple terms, ROW_OVERFLOW_DATA pages will come into picture only when the row size exceed page maximum limit.

LOB_DATA: LOB data like text not stored along with data pages. LOB data is stored in special pages called LOB_DATA pages. 16 byte pointer in data page will be used to refer LOB_DATA page.

15) What is an IAM page?

IAM stands for Index Allocation Map: To catalog all the pages that belong to a single allocation unit, SQL Server utilizes a special type of pages, the Index Allocation Map or IAM pages. Each allocation unit has at least one IAM Page; depending on the size of the table there might be many. The page type of an IAM page is 10.

16) What are a ROW OFFSET and its importance?



Page header stored system information about the page. After the page header data row is stored serially. Row offset information is stored at the end of the page, after the data rows. Every data row has a row offset. Row offset stores information about how far the row is from the start of the page.

17) What are LOB pages?

SQL Server stores all data in 8192-byte sized blocks called pages. Several types of pages are in use within a typical database. One particularly interesting group is formed by the type-3 pages or Large Object Pages.

LOB_DATA Allocation Units

Most data types in SQL Server take up no more than 8000 bytes of storage. However, there are a few data types, which allow for larger pieces of information to be stored. Examples include the VARCHAR (MAX), VARBINARY (MAX) or XML data types.

Normal data pages that belong to a table are grouped in IN_ROW_DATA allocation units. However, if a value that is larger than 8000 bytes needs to be stored, SQL Server does not attempt to store it in those data pages anymore. It does not even store those values in the same allocation unit. Instead, Large Object data or LOB data is stored in special LOB_DATA allocation units.

18) What is a PAGE SPLIT?

Page splits are performed when there is no space in a data page to accommodate more inserts or updates. In a page split, SQL server removes some data from the

current data page and moves it to another data page. This is done in order to make space for the new rows.

19) How Page Splits impacts the database performance?

Too many page splits can decrease the performance of the SQL server because of the large number of I/O operations.

Following remedies can be taken to avoid too many page splits:-

- Rebuild indexes frequently to empty the fill factor space for more data.
- Increased the Fill factor value after observing the page split behavior

20) How can we monitor or detect Page Splits?

Number of page splits can be observed by using the Performance Monitor and watch the SQLServer: Access Methods: Page Splits/sec counter

21) What is a Fill Factor?

The fill-factor option is provided for fine-tuning index data storage and performance. When an index is created or rebuilt, the fill-factor value determines the percentage of space on each leaf-level page to be filled with data, reserving the remainder on each page as free space for future growth. For example, specifying a fill-factor value of 80 means that 20 percent of each leaf-level page will be left empty, providing space for index expansion as data is added to the underlying table. The empty space is reserved between the index rows rather than at the end of the index.

22) What is a Logical Read?

Logical Reads:

Logical read indicates total number of data pages that are found in the data cache and read from Data cache without reading anything from Disk.

23) What is a Physical read?

Physical Reads

Physical read indicates total number of data pages that are read from disk. In case no data in data cache, the physical read will be equal to number of logical read. And usually it happens for first query request. And for subsequent same query request the number will be substantially decreased because the data pages have been in data cache.

24) How can we view the content of a page?

To see the row data stored in that page, we have to use the DBCC PAGE command.
The syntax of DBCC PAGE

```
Dbcc page ('dbname' | dbid}, filenum,pagenum [, printout= {0|1|2|3}]);
```

Print opt:

- 0 – print just the page header
- 1 – page header plus per-row hex dumps and a dump of the page slot array
- 2 – page header plus whole page hex dump
- 3 – page header plus detailed per-row interpretation

```
DBCC TRACEON (3604)
GO
DBCC page ('test', 1, 114, 3)
```

25) What is a Transaction log file?

A transaction log is a physical file in which SQL server stores the details of all transactions and data modifications performed on the database. In the event of disaster, that causes SQL server to shutdown unexpectedly (Power failure/hardware failure), the transaction log is used to bring the database in a consistent state while restarting the server. On restarting the server, database goes through the recovery process.

During this recovery process, the transaction log is used to make sure that all committed transactions are written to respective data file (rolled forward) and rollback the uncommitted transaction.

Logically transaction log is a set of log records. Each record is identified by a log sequence number (LSN). The new log records are always written at the logical end of log file with a LSN which is greater than the previous one

26) What are Virtual Log files? How these are created?

SQL Server Database Engine divides each physical log file internally into a number of virtual log files. Virtual log files have no fixed size, and there is no fixed number of virtual log files for a physical log file. The Database Engine chooses the size of the virtual log files dynamically while it is creating or extending log files. The Database Engine tries to maintain a small number of virtual files. The size of the virtual files after a log file has been extended is the sum of the size of the existing log and the size of the new file increment. The size or number of virtual log files cannot be configured or set by administrators.

27) How VLFs are created SQL Server in a Transaction log file?

SQL server decides the size and number of VLF in a log file based on the size of the log file growth as given below.

Growth upto 64 MB	= 4 VLF
From 64 MB to 1 GB	= 8 VLF
Larger than 1 GB	= 16 VLF

28) What is the way to check Virtual Log file details?

```
DBCC loginfo('mydb')
```

29) What is Log Sequence No?

Every record in the SQL Server transaction log is uniquely identified by a log sequence number (LSN). LSNs are ordered such that if LSN2 is greater than LSN1, the change described by the log record referred to by LSN2 occurred after the change described by the log record LSN.

30) What is a Log Truncation?

Log truncation is essential to keep the log from filling. Log truncation deletes inactive virtual log files from the logical transaction log of a SQL Server database, freeing space in the logical log for reuse by the physical transaction log. If a transaction log were never truncated, it would eventually fill all the disk space that is allocated to its physical log files. However, before the log can be truncated, a checkpoint operation must occur. A checkpoint writes the current in-memory modified pages (known as dirty pages) and transaction log information from memory to disk. When the checkpoint is performed, the inactive portion of the transaction log is marked as reusable. Thereafter, the inactive portion can be freed by log truncation.

31) How Does Log Truncation occur?

Log truncation occurs automatically after the following events, except when delayed for some reason:

- Under the simple recovery model, after a checkpoint.
- Under the full recovery model or bulk-logged recovery model, after a log backup, if a checkpoint has occurred since the previous backup.

All about SQL Server Services

1) List out various services which are important for SQL Server and its components functionality?

- SQL Server Service
- SQL Server Agent service
- SQL Server Analysis Service
- SQL Server Browser service
- SQL Server Integration Service
- SQL Server Reporting Service
- SQL Server VSS Writer service

- Distributed Transaction Coordinator
- SQL Server Active Directory Helper
- SQL Full-Text Filter Daemon Launcher
- SQL Server Distributed Replay Client service
- SQL Server Distributed Replay Client service

2) What is SQL Server service and its importance?

SQL Server service is core of SQL Server instance. It runs the Database Engine and executes the client requests related to data processing. If this service is not running, no users can connect to the any of the database, hence users will not be able to fetch, insert, update or delete the data.

3) What is SQL Server Agent service and its importance?

SQL Server Agent is the primary scheduling engine in SQL Server. This is used to execute scheduled administrative tasks like SSIS Packages, T-SQL Scripts, Batch Files and Subscriptions etc. which are referred to as Jobs. It uses msdb database to store the configuration, processing, and metadata information. Apart from SQL Server Agent related information, msdb database also stores similar information related to Backup, Restore, Log Shipping, SSIS Packages etc.

4) What is SQL Server Analysis service and its importance?

Microsoft SQL Server Analysis Services (SSAS) delivers online analytical processing (OLAP) and data mining functionality for business intelligence applications. Analysis Services supports OLAP by letting you design, create, and manage multidimensional structures that contain data aggregated from other data sources, such as relational databases. For data mining applications, Analysis Services lets you design, create, and visualize data mining models that are constructed from other data sources by using a wide variety of industry-standard data mining algorithms.

5) What is SQL Server Integration service and its importance?

SQL Server Integration Services (SSIS) is a component of the Microsoft SQL Server database software that can be used to perform a broad range of data migration tasks. SSIS is a platform for data integration and workflow applications. It features a fast and flexible data warehousing tool used for data extraction, transformation, and loading (ETL). The tool may also be used to automate maintenance of SQL Server databases and updates to multidimensional cube data.

6) What is SQL Server Browser?

This service acts as a listener for the incoming requests for Microsoft SQL Server resources. It provides information about the list of installed SQL Server instances on the computer to the client computers/applications. It helps in browsing the list of servers, locating and connecting to the correct server.

This listener service responds to client requests with the names of the installed instances, and the ports or named pipes used by the instance.

7) What is SQL Server Reporting Services?

This service is primarily used by SQL Server Reporting Services (SSRS) for browsing and viewing the reports on Reports Server, through Report Server or Report Manager interface. It is used to manage the shared data sources, reports, shared data sets, report parts, folder, etc. hosted on the Report Server. Reporting services are managed using the Reporting Services Configuration Manager.

8) What is SQL Server VSS Writer?

The SQL Writer Service provides added functionality for backup and restore of SQL Server through the Volume Shadow Copy Service framework. When running, Database Engine locks and has exclusive access to the data files. When the SQL Writer Service is not running, backup programs running in Windows do not have access to the data files, and backups must be performed using SQL Server backup.

Use the SQL Writer Service to permit Windows backup programs to copy SQL Server data files while SQL Server is running. It must be running when the Volume Shadow Copy Service (VSS) application requests a backup or restore. To configure the service, use the Microsoft Windows Services applet. The SQL Writer Service installs on all operating systems.

9) Which types of backups are supported by SQL Write Service?

SQL Writer supports:

- Full database backup and restore including full-text catalogs
- Differential backup and restore
- Restore with move
- Copy-only backup
- Auto-recovery of database snapshot

10) Which types of backups are supported by SQL Write Service?

SQL Writer does not support:

- Log backups
- File and filegroup backup
- Page restore

11) What is Full-Text Search service?

This service is used by the full-text search feature of SQL Server. It helps in starting the filter daemon host process, which manages the full-text indexing, querying, search filtering and word processing as part of the full-text search feature.

12) What is SQL Server Active Directory Helper?

This service enables the integration with the Active Directory. Irrespective of number of instances of SQL Servers installed on a computer, there is always only one instance of SQL Server Active Directory Helper service. This service is automatically started by SQL Server when required and is stopped once the operation is completed. This service is required whenever an SQL Server object needs to be created in the Active Directory to register an instance of SQL Server.

13) What is Distributed Transaction Coordinator?

This service coordinates distributed transactions between two or more database servers. Client applications use this service to work with data from multiple sources in one transaction. There is always only one instance of MSDTC service running on a computer irrespective of how many SQL server instances are installed. This service should be running on each of the servers which handle distributed transactions. This service is not a part of SQL Server installation. This service is installed with Windows OS installation.

14) How to check how many SQL Server instances are installed on a Window Server?

There are multiple ways through which we can check the No. of SQL Server instances which are running on a server like:

- Check the SQL services for different Instances
- SQL Server Configuration Manager **Start- all programs – Microsoft SQL Server 2008 R2 -> configuration tools -> Microsoft SQL Server configuration Manager**
- List out SQL Services from Net Start command
- Using PowerShell commands
- Reading the Registry Keys, **Regedit-> HKEY_LOCAL_MACHINE->SOFTWARE ->Microsoft ->Microsoft SQL Server -> Installed Instance**

15) What are the different ways to start and Stop SQL Server services?

There are different ways through which we can start or stop SQL Server services.

- a) Go to Services -> Look for SQL server service related to the Instance

Named Instance: SQL Server (Instance Name)

Default Instance: SQL Server (MSSQLServer)

- b) Right Click on the SQL Server instance in management studio and click on restart
- c) Go to SQL Server Configuration Manager (SQLServermanager10.msc) and right click on the services and click restart.
- d) Net stop command
- e) use "Net START" command to list all the running services
- f) Use "Net STOP MSSQL\$instancename" to stop the SQL Service for a particular instance

16) List out the Service Display name, Service Name and Executable for SQL Serve related services?

Comm on Name	Service Display Name	Service Name	ExecutableName
Distributed Transaction Coordinator (DTC)	Distributed Transaction Coordinator	MSDTC	msdtc.exe
SQL Server	SQL Server (MSSQLSERVER)	MSSQLSERVER	sqlservr.exe
	SQL Server (Named Instance)	MSSQL\$NamedInstance	

SQL Server Active Directory Helper	SQL Active Directory Helper Service	MSSQLServerADHelper100	SQLADHLP.EXE
SQL Server Agent	SQL Server Agent (MSSQLSERVER)	SQLSERVERAGENT	SQLAGENT.EXE
	SQL Server Agent (Named Instance)	SQLAgent\$NamedInstance	
SQL Server Analysis Services	SQL Server Analysis Services (MSSQLSERVER)	MSSQLServerOLAPService	msmdsrv.exe
	SQL Server Analysis Services (Named Instance)	MSOLAP\$NamedInstance	
SQL Server Browser	SQL Server Browser	SQLBrowser	sqlbrowser.exe

SQL Server Full Text Search	SQL Full-text Filter Daemon Launcher (MSSQLSERVER)	MSSQLFDLauncher	
	SQL Full-text Filter Daemon Launcher (Named Instance)	MSSQLFDLauncher\$NamedInstance	flauncher.exe
SQL Server Integration Services	SQL Server Integration Services 10.0	MsDtsServer100	MsDtsSrvr.exe
SQL Server Reporting Services	SQL Server Reporting Services (MSSQLSERVER)	Report Server	
	SQL Server Reporting Services (Named Instance)	ReportServer\$NamedInstance	ReportingServicesService.exe
SQL Server	SQL Server	SQLWriter	

VSS Writer	VSS Writer		
------------	------------	--	--

17) What are the default parameters of SQL Server service start up process and from where these parameters can be changed?

Master database data and log file and error log files are the default parameters which are passed to SQL Server service.

-dC: \Program Files\Microsoft SQL Server\MSSQL11.MSSQLSERVER\MSSQL\DATA\master.mdf;

-eC:\Program Files\Microsoft SQL Server\MSSQL11.MSSQLSERVER\MSSQL\Log\ERRORLOG;

-IC: \Program Files\Microsoft SQL Server\MSSQL11.MSSQLSERVER\MSSQL\DATA\mastlog.ldf

We can add trace flags and other parameters to the startup process from SQL Server Configuration manager.

18) How to start the SQL Server with minimal configuration?

If there are any configuration problems that prevent the server from starting, you can start an instance of Microsoft SQL Server by using the minimal configuration startup option. This is the startup option **-f**. Starting an instance of SQL Server with minimal configuration automatically puts the server in single-user mode.

19) How to start SQL Server with single user model?

Under certain circumstances, we may have to start an instance of SQL Server in single-user mode by using the **startup option -m**. For example, you may want to change server configuration options or recover a damaged master database or other system database. Both actions require starting an instance of SQL Server in single-user mode.

20) What are trace flags and how can we apply trace flags on a SQL Server instance?

Trace flags are used to temporarily set specific server characteristics or to switch off a particular behavior. For example, if trace flag 3205 is set when an instance of SQL Server starts, hardware compression for tape drivers is disabled. Trace flags are frequently used to diagnose performance issues or to debug stored procedures or complex computer systems.

21) How the trace flags are enabled?

Trace flags are enabled at different levels.

- Global
- Session

Instance level

We can use the -T option in the startup configuration for the SQL Server Service to enable trace at instance level.

Session Level

We can use the DBCC TRACEON and DBCC TRACEOFF commands to enable it on a session level.

22) How do I know what Trace Flags are turned on at the moment?

We can use the DBCC TRACESTATUS command

23) Name some of the Important Trace flags and their functionality?

Trace Flag: 1204

This trace flag lets SQL Server to log detailed deadlock information to SQL Server Error Log in text format. In SQL Server 2008, this trace flag is only available at the Global Level (i.e. applies to the SQL Server instance). In my experience, it is worth turning this trace flag on, only for debugging purposes.

Trace Flag: 1222

Similar to trace flag 1204, this trace flag lets SQL Server to log detailed deadlock information to SQL Server Error Log in XML format.

Trace Flag: 3226

In an environment where database backup is frequently performed, it is a good idea to turn trace flag 3226 on, to suppress an entry to the SQL Server Error Log for each backup. This is beneficial as the bigger the log, the harder it is to find other messages. However, you will need to ensure that none of your scripts or systems rely on the backup entry detail on the SQL Server Error Log.

24) What are the mandatory databases to bring SQL Services up?

Master, model, resource db, tempdb location.

25) Which system database is associated with SQL Server agent service?

Msdb

26) What is Protocol is used by SQL Server Browser service?

SQL Server Browser service uses UDP protocol.

27) Which Port no. is used by SQL Server Browser service ?

1434

28) What will happen if SQL Server Browser service is stopped?

If the SQL Server Browser service is not running, the following connections do not work:

- If we have just one instance installed on machine and it is running on default port 1433, then status of SQL Server Browser service does not make any difference in our connection parameters.
- If there are more than one instances running on the same machine, in that case either we have to start SQL Server Browser service or provide the port

number along with IP (or server name) and instance name, to access any other instance than default.

- If SQL Server Browser service is stopped and IP along with port number is not provided then connection will be refused.
- If SQL Server instance is configured using dynamic ports then browser service is required to connect to correct port number.
- Also our named instances will not be published in the list of SQL Server instances on the network (which could be a good thing)

29) What is the high Level SQL Server start up process?

- The service is authenticated by verifying the credentials provided in the logon account and the service is started.
- **PID** is allocated at windows level
- Authentication mode details are verified i.e. either MIXED or WINDOWS
- Information of the startup parameters is captured i.e. mdf location of master database, SQL Server error log location and ldf file location
- Some memory and CPU settings done at windows level, this is an informational message only
- Starts the master database
- model is the next database to start
- set the port related information
- Tempdb is recreated each time when we restart sql server
- Start msdb and other user databases based on dbid

30) What is Distributed Replay?

Distributed Replay is a new functionality of Microsoft SQL Server 2012. It helps you assess the impact of future upgrades (SQL Server, hardware, OS) or SQL Server tunings by replaying a trace captured from a productive SQL Server environment to a new SQL Server test environment.

This new functionality is similar to SQL Server Profiler, but with more possibilities: e. g. replaying the trace from multiple clients (up to sixteen), use a stress or synchronization mode, configure options like think time, or connect time etc.

31) What are the various components involved in Distributed Replay Concepts?

The following components make up the Distributed Replay environment:

Distributed Replay administration tool: A console application, DReplay.exe, used to communicate with the distributed replay controller. Use the administration tool to control the distributed replay.

Distributed Replay controller: A computer running the Windows service named SQL Server Distributed Replay controller. The Distributed Replay controller orchestrates the actions of the distributed replay clients. There can only be one controller instance in each Distributed Replay environment.

Distributed Replay clients: One or more computers (physical or virtual) running the Windows service named SQL Server Distributed Replay client. The Distributed Replay clients work together to simulate workloads against an instance of SQL Server. There can be one or more clients in each Distributed Replay environment.

Target server: An instance of SQL Server that the Distributed Replay clients can use to replay trace data. We recommend that the target server be located in a test environment.

All about SQL Server Agent and Its Components

1) What is SQL server Agent? What are its benefits?

SQL Server Agent is a Microsoft Windows service that executes scheduled administrative tasks, TSQL Statements, SSIS packages, Reports subscriptions etc.

2) What are various components of SQL Server Agent service?

- Jobs
- Schedules
- Operators
- Alerts

3) What is a SQL Server job?

A job is a specified series of actions that SQL Server Agent performs. We can use jobs to define an administrative task that can be run one or more times and monitored for success or failure. A job can run on one local server or on multiple remote servers.

We can run jobs in several ways:

- According to one or more schedules.
- In response to one or more alerts.
- By executing the `sp_start_job` stored procedure.

Each action in a job is a job step. For example, a job step might consist of running a Transact-SQL statement, executing an SSIS package, or issuing a command to an Analysis Services server. Job steps are managed as part of a job

4) What is an Operator?

An operator defines contact information for an individual responsible for the maintenance of one or more instances of SQL Server. In some enterprises, operator responsibilities are assigned to one individual. In enterprises with multiple servers, many individuals can share operator responsibilities. An operator does not contain security information, and does not define a security principal.

SQL Server can notify operators of alerts through one or more of the following:

- E-mail
- Pager (through e-mail)
- net send

5) What is a Schedule?

A schedule specifies when a job runs. More than one job can run on the same schedule, and more than one schedule can apply to the same job. A schedule can define the following conditions for the time when a job runs:

- Whenever SQL Server Agent starts.
- Whenever CPU utilization of the computer is at a level you have defined as idle.
- One time, at a specific date and time.
- On a recurring schedule.

6) What is an Alert?

An alert is an automatic response to a specific event. For example, an event can be a job that starts or system resources that reach a specific threshold. You define the conditions under which an alert occurs.

An alert can respond to one of the following conditions:

- SQL Server events
- SQL Server performance conditions
- Microsoft Windows Management Instrumentation (WMI) events on the computer where SQL Server Agent is running
- An alert can perform the following actions:
- Notify one or more operators

- Run a job

7) Which database contains information about the jobs and other components which are required for the execution of scheduled jobs by SQL Server Agent?

System database- msdb

8) Which tables can be Queries to get details about the Jobs and its steps?

Below are some examples of the tables in msdb database which contains information about the Jobs and its steps.

- sysjobs

Stores the information for each scheduled job to be executed by SQL Server Agent.

- sysjobsteps

Contains the information for each step in a job to be executed by SQL Server Agent.

9) Which table contains information about the SQL Server jobs schedule?

- sysjobschedules

It contains schedule information for jobs to be executed by SQL Server Agent

10) Which tables will give you the Job history related information?

dbo.sysjobhistory

11) How can we grant permissions on the SQL Server agent jobs and which roles are available?

SQL Server contains 3 fixed database roles on the MSDB database, which gives administrators fine control over access to SQL Server Agent. The SQL Server Agent node in SSMS is visible only to users in one of these 3 roles (except sysadmins,

who can see everything irrespective of role membership). Here is an explanation of the roles, in order from the most restrictive to least restrictive:

SQLAgentUserRole – Users in this role are granted view/edit/delete/execute access to only jobs owned by them. Users in this role cannot view any jobs owned by system administrators, or by users in the other two roles. Grant this role when you want users to only see jobs owned by them.

SQLAgentReaderRole – Users in this role get all the privileges of the SQLAgentUserRole, i.e. they get access to owned jobs. In addition to that, they can also view (but not modify or execute) all jobs on SQL Server Agent, irrespective of ownership. Grant this role when you want users to be able to view, but not execute, all jobs in the system, but modify/execute only jobs owned by them.

SQLAgentOperatorRole – Users in this role get all the privileges of the SQLAgentReaderRole. In addition to that, they can also execute, or enable/disable any job in the system. However, users in this role can modify only owned jobs. Grant this role for super users who can view/execute all jobs on the system.

12) Difference between the permissions of above three roles?

Action	SQLAgentUserRole	SQLAgentReaderRole	SQLAgent Operator Role
Create/modify/delete	Only owned jobs	Only owned jobs	Only owned jobs
View List	Only owned jobs	All jobs	All jobs
Enable/Disable	Only owned jobs	Only owned jobs	All jobs
View Properties	Only owned jobs	All jobs	All jobs
Edit Properties	Only owned jobs	Only owned jobs	Only owned jobs
Start / Stop	Only owned jobs	Only owned jobs	All jobs
View job history	Only owned jobs	All jobs	All jobs

Delete job history	No	No	Only owned jobs
Change Ownership	No	No	No

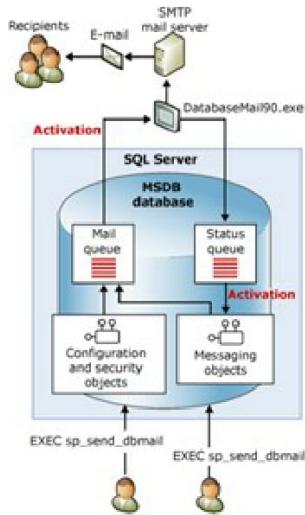
13) Is SQL Mail option is available in SQL Server 2012 or not? If not what is the replacement of SQL mail?

SQL Mail has been removed in SQL Server 2012 version. It has been replaced by Database Mail option.

14) What is a Database Mail?

Database Mail is an enterprise solution for sending e-mail messages from the SQL Server Database Engine. Using Database Mail, our database applications can send e-mail messages to users. The messages can contain query results, and can also include files from any resource on your network.

15) What is the Database Mail Architecture?



Database Mail is designed on a queued architecture that uses service broker technologies. When users execute `sp_send_dbmail`, the stored procedure inserts an item into the mail queue and creates a record that contains the e-mail message. Inserting the new entry in the mail queue starts the external Database Mail process.

(DatabaseMail.exe). The external process reads the e-mail information and sends the e-mail message to the appropriate e-mail server or servers. The external process inserts an item in the Status queue for the outcome of the send operation. Inserting the new entry in the status queue starts an internal stored procedure that updates the status of the e-mail message. Besides storing the sent, or unsent, e-mail message, Database Mail also records any e-mail attachments in the system tables. Database Mail views provide the status of messages for troubleshooting, and stored procedures allow for administration of the Database Mail queue.

16) How to enable Database mail?

Database Mail is not active by default. To use Database Mail, We must explicitly enable Database Mail by using either the Database Mail Configuration Wizard, the sp_configure stored procedure, or by using the Surface Area Configuration facet of Policy-Based Management.

17) What is a Database Mail Account?

A Database Mail account contains the information that Microsoft SQL Server uses to send e-mail messages to an SMTP server. Each account contains information for one e-mail server.

A Database Mail supports three methods of authentication to communicate with an SMTP server:

Windows Authentication: Database Mail uses the credentials of the SQL Server Database Engine Windows service account for authentication on the SMTP server.

Basic Authentication: Database Mail uses the username and password specified to authenticate on the SMTP server.

Anonymous Authentication: The SMTP server does not require any authentication. Database Mail will not use any credentials to authenticate on the SMTP server.

18) What is a Database Mail Profile?

A Database Mail profile is an ordered collection of related Database Mail accounts. Applications that send e-mail using Database Mail specify profiles, instead of using

accounts directly. Separating information about the individual e-mail servers from the objects that the application uses improves flexibility and reliability: profiles provide automatic failover, so that if one e-mail server is unresponsive, Database Mail can automatically send mail to another e-mail server. Database administrators can add, remove, or reconfigure accounts without requiring changes to application code or job steps.

Profiles also help database administrators control access to e-mail. Membership in the DatabaseMailUserRole is required to send Database Mail. Profiles provide additional flexibility for administrators to control who sends mail and which accounts are used.

19) What is the difference between Public profile and Private Profile?

Public profiles are available for all members of the DatabaseMailUserRole database role in the msdb database. They allow all members of the DatabaseMailUserRole role to send e-mail using the profile.

Private profiles are defined for security principals in the msdb database. They allow only specified database users, roles, and members of the sysadmin fixed server role to send e-mail using the profile. By default, a profile is private, and allows access only to members of the sysadmin fixed server role. To use a private profile, sysadmin must grant users permission to use the profile. Additionally, EXECUTE permission on the sp_send_dbmail stored procedure is only granted to members of the DatabaseMailUserRole. A system administrator must add the user to the DatabaseMailUserRole database role for the user to send e-mail messages.

20) What is a SQL Server Agent Proxy Account?

SQL Server agent jobs run with the account assigned to SQL Agent service. In case if we have to perform some task which requires some elevated permissions we can use SQL Server Agent Proxy. Proxy is about having additional security. We can specify the job step for which we need a different security context to be using the security context of the specified proxy.

21) Can we have multiple schedules for a single job?

Yes, we can run a job with multiple schedules.

22) Is it possible to get and change all the schedules information of all the jobs in a single window? If yes then from where?

Yes, we can list all the schedules of all the jobs from below option.

Click on SQL Server Agent à Jobs Right Click on Jobs Click on Manage Schedules

23) Is it possible to run an SSIS package from a job step? How?

Yes, it is possible to run an SSIS package by selecting the Type as SQL Server Integration Services Package in the Step.

24) Can we run Operating system command in the SQL Server jobs?

Yes, it is possible to run it using Operating System Type in the job step.

25) What is Notification property in SQL Server job properties?

These settings can be used to setup the notification with regard to failure or success of the job.

E-mail

Select this option to send e-mail when the job completes. After selecting this option, choose the operator to notify and the condition that will trigger the notification: When the job succeeds; when the job fails; or When the job completes.

Page

Select this option to send e-mail to an operator's pager when the job completes. After selecting this option, specify the operator to notify and the condition that will trigger the notification: When the job succeeds; when the job fails; or when the job completes.

Net send

Select this option to use net send to notify an operator when the job completes. After selecting this option, specify the operator to notify and the condition that will

trigger the notification: When the job succeeds; when the job fails; or when the job completes.

Write to the Windows Application event log

Select this option to write an entry in the application event log when the job completes. After selecting this option, specify the condition that will cause the entry to be written: When the job succeeds; when the job fails; or when the job completes.

Automatically delete job

Select this option to delete the job when the job completes. After selecting this option, specify the condition that will trigger deletion of the job: When the job succeeds; When the job fails; or When the job completes.

26) What are maintenance jobs for a SQL Server database?

Jobs which runs Database maintenance tasks like"

Index Rebuild\Reorganize tasks

Update stats tasks

Database shrink activities

27) Sometimes there is no History available for the Failure or Success of a job? What could be the reason for the same?

By default SQL Server doesn't hold a very long job history for your server. The defaults that SQL Server comes with are as follows:

That is the reason sometimes we are not able to get the job history details due to purging of the job history.

28) How can we change the Job History Retention?

Yes, We can change the retention of the job history. Right Click on SQL Server Agent à Click on Properties à History. There are options to set the maximum job history log size.

29) What could be the reason if your Database Mail working fine but No SQL Agent Alerts are working?

Database Mail is part of the SQL Server Service which means that the SQL Server Agent cannot automatically know that it's present and active and which settings to use. Therefore although you may have set up your Operators and are able to select them within the Notifications tab of a scheduled task, you still have to tell the SQL Server Agent which email account and profile it can use.

Check on "Enable mail profile" option and mention the profile name which needs to be used under the Alert System tab of SQL Server agent properties and Restart the SQL Server agent service.

30) What is Fail Safe Operator? How can we enable this?

We can enable a fail-safe operator feature that will receive all emails in the event that SQL Server Agent cannot communicate with the system tables in the msdb database. This is accomplished by recording the information about the fail-safe operator in the registry. The fail-safe operator will also receive notifications if you have scheduled operators to only receive notifications during certain time periods and a notification occurs outside of that range. For example, if no operators are set to receive notifications on Sunday, the notification will automatically go to the fail-safe operator.

To enable a fail-safe operator, right-click SQL Server Agent and select Properties from the context menu. Then select the Alert System page as shown in the following image.

Select the Enable fail-safe operator checkbox and then choose the appropriate operator and notification method. Click OK to save the changes.

31) What is the reason when SQL Server Agent fails to start because of the error 15281 which is a very common error?

When you start to restart SQL Agent sometimes it will give following error.

SQL Server blocked access to procedure 'dbo.sp_get_sqlagent_properties' of component 'Agent XPs' because this component is turned off as part of the security configuration for this server. A system administrator can enable the use of 'Agent XPs' by using sp_configure. For more information about enabling 'Agent XPs', search for 'Agent XPs' in SQL Server Books Online. (Microsoft SQL Server, Error: 15281)

To resolve this issue we have to enable Agent XPs option at the SQL Server instance level using below script.

```
sp_configure 'show advanced options', 1;
GO
RECONFIGURE;
GO
sp_configure 'Agent XPs', 1;
GO
RECONFIGURE
GO
```

All about SQL Server System Databases and Recovery Model

1) What are system databases?

When we install Microsoft SQL Server, five system databases are automatically created for each SQL Server instance. These system databases allow the database engine and administrative applications to properly manage the system:

- master
- model
- msdb
- tempdb
- Resource (SQL Server 2005 and higher only)

2) What is master database?

The Master database is the heart and soul of SQL Server. It basically records all the system level information. Every instance of SQL Server will have an independent Master database; as it captures instance level configuration information. The information which is captured in the Master database includes SQL Server instance level configurations, linked server configurations, SQL Server Logins, Service Broker Endpoints, System Level Stored Procedures, and System level Functions etc. The system and user databases related information such as name and location for user and system database are captured in Master database.

If master database is corrupted or if it is not available then the SQL Server Service will not start. In SQL Server 2005 and later versions the system objects are stored in Resource Database rather than in Master Database. The Master database is created using Simple Recovery Model.

3) What is model database?

The Model database is basically used as a template when creating databases in SQL Server. Basically SQL Server takes a copy of Model database whenever a user tries to create a new database in SQL Server. This also means that if a user creates any tables, stored procedures, user defined data types or user defined functions within a Model database; then those objects will be available in every newly created database on that particular instance of SQL Server.

If the Model database is damaged or corrupted then SQL Server Service will not start up as it will not be able to create the tempdb database.

4) What is msdb database?

SQL Server Agent uses MSDB database to store information related to the configuration of SQL Server Agent Jobs, Job schedules, Alerts, Operators etc. MSDB also stores information related to configuration of Service Broker, Log Shipping, database backups and restore information, Maintenance Plan Configuration, Configuration of Database Mail, Policy Bases Information of SQL Server 2008 etc.

If the MSDB database is corrupted or damaged then scheduling information used by SQL Server Agent will be lost. This will result in the failure of all scheduled activities.

5) What is tempdb database?

The tempdb database is considered a global resource that all connections and all users can access. The tempdb database holds user-created temporary database objects, such as temporary tables and temporary stored procedures. This database is also used heavily by the database engine to serialize intermediate results and to hold other temporary data and objects that are generated during processing.

Tempdb is always recreated from when the SQL Server service is first started.

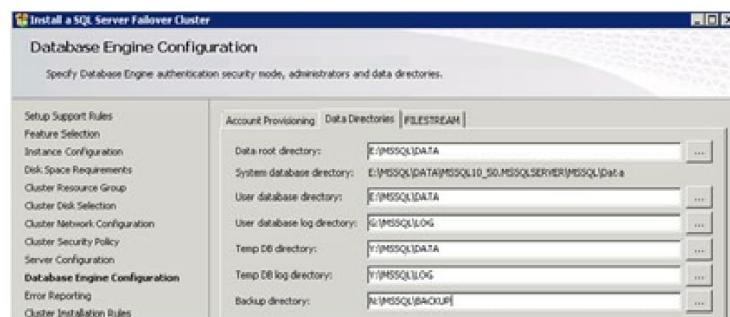
Because tempdb is so heavily used by the system, many system-wide performance optimizations are necessarily focused on making tempdb as efficient as possible.

6) What is resource database?

The Resource database is a read only, hidden system database that contains all the SQL Server system objects such as sys.objects which are physically available only in the Resource database, even though they logically appear in the SYS schema of every database. The Resource Database does not contain any user data or any user metadata. By design, the Resource database is not visible under SQL Server Management Studio's Object Explorer | Databases | System Databases Node.

The DBA shouldn't rename or move the Resource Database file. If the files are renamed or moved from their respective locations then SQL Server will not start. The other important thing to be considered is not to put the Resource Database files in a compressed or encrypted NTFS file system folders as it will hinder the performance and will also possibly prevent upgrades.

7) What is the location of system databases?



We can specify the location of system database under **Data Root Directory option**.

8) What is the location of resource database?

The physical file names of the Resource database are mssqlsystemresource.mdf and mssqlsystemresource.ldf. These files are located in <drive>:\Program Files\Microsoft SQL Server\MSSQL11.<instance_name>\MSSQL\Binn\. Each instance of SQL Server has one and only one associated mssqlsystemresource.mdf file, and instances do not share this file.

9) What are the typical objects that are created in the Tempdb database?

There are three different types of objects stored in tempdb.

- Internal Objects:
 1. Intermediate runs for sort.
 2. Intermediate results for hash join and hash aggregates.
 3. XML variables or other large object (LOB) data type variables. (text, image, ntext, varchar(max), varbinary(max))
 4. Queries that need a spool to store intermediate results.
 5. Keyset cursors to store the keys.
 6. Static cursors to store a query result.
 7. Service Broker to store messages in transit.
 8. INSTEAD OF triggers to store data for internal processing.
 9. DBCC CHECK internally uses a query that may need to spool intermediate results.
 10. Query notification and event notification use Service Broker.

- Version Store:
 1. Snapshot Isolation / Read Committed Snapshot Isolation
 2. Triggers (After Triggers). Instead of triggers doesn't generate versions.
 3. MARS (Multiple Active Result Sets)
 4. Index Rebuilds
- User Objects:
 1. User defined tables and indexes
 2. Local and global temporary tables, bulk insert and BCP intermediate results
 3. Index rebuilds with "SORT IN TEMPDB" option.

10) What is the database that has the backup and restores system tables? What are the backup and restore system tables? What does each of the tables do?

The MSDB database is the database with the backup and restores system tables.
Here are the backup and restore system tables and their purpose:

backupfile – contains one row for each data file or log file backed up
backupmediafamily – contains one row for each media family
backupmediaset – contains one row for each backup media set
backupset – contains one row for each backup set
restorefile – contains one row for each restored file
restorefilegroup – contains one row for each restored filegroup
restorehistory – contains one row for each restore operation

11) How to check the version of Resource database?

```
SELECT SERVERPROPERTY ('ResourceVersion');
GO
```

12) How to determine when the Resource database was last updated?

```
SELECT SERVERPROPERTY ('ResourceLastUpdateDateTime');
GO
```

13) What is the system databases created when we configure Reporting services?

ReportServer and ReportServerTempdb

14) How to move model database?

- Determine the logical file names of the msdb and model database and their current physical location on the disk.

```
USE master
Go
SELECT DB_NAME (database_id) AS "Database Name", name AS "Logical File
Name",
Physical_name AS "Physical File Location",
State_desc AS "State"
FROM sys.master_files WHERE database_id IN (DB_ID (N'model'))
Go
```

- For each file to be moved, run the following statement by providing the logical file name and the new physical location of where the file will be moved to.

```
ALTER DATABASE database_name MODIFY FILE (NAME = logical_name, FILENAME
= 'new_path\os_file_name')
```

- Stop the instance of SQL Server.
- Move the physical files to the new location.
- Start the SQL Server instance.
- Verify the location using the script used in step a.

15) How to move msdb database?

- a. Determine the logical file names of the msdb and model database and their current physical location on the disk.

```
USE master
Go
SELECT DB_NAME (database_id) AS "Database Name", name AS "Logical File
Name",
Physical_name AS "Physical File Location",
State_desc AS "State"
FROM sys.master_files WHERE database_id IN (DB_ID ('msdb'))
Go
```

- b. For each file to be moved, run the following statement by providing the logical file name and the new physical location of where the file will be moved to.

```
ALTER DATABASE msdb MODIFY FILE (NAME = logical_name, FILENAME =
'new_path\os_file_name')
```

- c. Stop the instance of SQL Server.
- d. Move the physical files to the new location.
- e. Start the SQL Server instance.
- f. Verify the location using the script used in step a.
- g. Verify that Service Broker is enabled for the msdb database by running the following query.

```
USE master
Go
SELECT is_broker_enabled FROM sys.databases
WHERE database_id = DB_ID ('msdb');
Go
If is_broker_enabled is not 1 then enable the service broker.
ALTER DATABASE msdb SET ENABLE_BROKER WITH ROLLBACK IMMEDIATE;
Go
```

16) How to move tempdb database?

- a. Determine the logical file names of the msdb and model database and their current physical location on the disk.

```
• USE master  
• Go  
• SELECT DB_NAME(database_id) AS "Database Name", name AS "Logical File  
Name",  
• physical_name AS "Physical File Location",  
• state_desc AS "State"  
• FROM sys.master_files WHERE database_id IN (DB_ID(N'msdb'))
```

```
Go
```

- b. For each file to be moved, run the following statement by providing the logical file name and the new physical location of where the file will be moved to.

```
ALTER DATABASE tempdb MODIFY FILE (NAME = logical_name, FILENAME =  
'new_path\os_file_name')
```

- c. Restart the instance of SQL Server.
- d. f. Verify the location using the script used in step a.
- e. delete the old Tempdb database files from the old location.

17) How to move master database?

1. Open **SQL Server Configuration Manager**.
2. In the **SQL Server Services** node, right-click the instance of SQL Server for example,  SQL Server (MSSQLSERVER) and choose **Properties**.
3. Open **Startup Parameters** dialog.
4. Edit the **Startup Parameters** values to point to the planned location for the master database data and log files, and click **OK**. Moving the error log file is optional.

- In the **SQL Server (*instance_name*) Properties** dialog box, click the **Startup Parameters**
- The parameter value for the data file must follow the -d parameter and the value for the log file must follow the -l the following example shows the parameter values for the default location of the master data and log files.

```
-dC:\Program Files\Microsoft SQL  
Server\MSSQL11.MSSQLSERVER\MSSQL\DATA\master.mdf  
  
-eC:\Program Files\Microsoft SQL  
Server\MSSQL11.MSSQLSERVER\MSSQL\LOG\ERRORLOG  
  
-IC:\Program Files\Microsoft SQL  
Server\MSSQL11.MSSQLSERVER\MSSQL\DATA\mastlog.ldf
```

- If the planned relocation for the master data and log file is F:\MSSQL\Data, the parameter values would be changed as follows:

```
-dF:\MSSQL\Data\master.mdf  
  
-eC:\Program Files\Microsoft SQL  
Server\MSSQL11.MSSQLSERVER\MSSQL\LOG\ERRORLOG  
  
-IF:\MSSQL\Data\mastlog.ldf
```

5. Stop the instance of SQL Server.

```
C:\> net stop SQLSERVERAGENT[SQLPROD1]  
  
C:\> net stop MSSQLSERVER[SQLPROD1]
```

6. Move the master.mdf and mastlog.ldf files to the new location.

```
C:\> move "C:\Program Files\Microsoft SQL  
Server\MSSQL11.MSSQLSERVER\MSSQL\DATA\master.mdf"  
F:\MSSQL\Data\  
  
1 file(s) moved.[SQLPROD1]  
  
C:\> move "C:\Program Files\Microsoft SQL  
Server\MSSQL11.MSSQLSERVER\MSSQL\DATA\mastlog.ldf"  
F:\MSSQL\Data\  
  
1 file(s) moved.
```

7. Restart the instance of SQL Server.

```
C:\> net start MSSQLSERVER[SQLPROD1]  
  
C:\> net start SQLSERVERAGENT[SQLPROD1]
```

8. Verify the file change for the master database.

18) Is it important to take the system database backups?

Yes, it is very important to take system database backups except tempdb.

19) Is it possible to take the tempdb database backup?

No, it's not possible to take tempdb backup and it's not required.

20) How to restore model database?

Model Database can be restores same as any other user defined database from its backup.

```
RESTORE DATABASE [model] FROM DISK = N'E:\model.bak'  
WITH FILE = 1, NOUNLOAD, REPLACE, STATS = 10  
GO
```

21) How to restore msdb database?

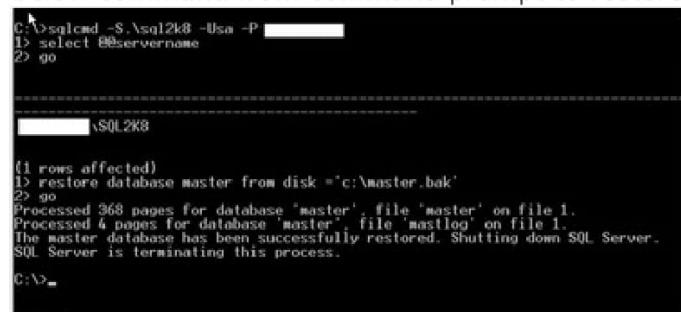
- Stop SQL Server agent service
- Run the below command to restore the msdb database.

```
RESTORE DATABASE [msdb] FROM DISK = N'E:\msdb.bak'  
WITH FILE = 1, NOUNLOAD, REPLACE, STATS = 10  
GO
```

- Start SQL Server agent service

22) How to restore master database?

- Start the SQL Server Instance in single user mode using -m parameter in the SQL Server configuration manager for SQL Service.
- Issue the below command from command prompt to restore the master



The screenshot shows a command prompt window titled 'SQL2k8'. The command entered is:

```
C:\>sqlcmd -S.\sql2k8 -Usa -P  
1> select @@servername  
2> go  
  
-----  
|SQL2k8|  
  
(1 rows affected)  
1> restore database master from disk = 'c:\master.bak'  
2> go  
Processed 368 pages for database 'master', file 'master' on file 1.  
Processed 4 pages for database 'master', file 'mastlog' on file 1.  
The master database has been successfully restored. Shutting down SQL Server.  
SQL Server is terminating this process.  
C:\>
```

database.

23) Is it possible to rename any of system databases?

No, it's not possible to rename any system database.

24) What is the default owner of master, model, tempdb and msdb database? Is it possible to change the owner of system databases?

Default owner of system databases is sa, We can't change the default owner of master, model, tempdb and distributor databases.

25) What are the recommended Data files settings for tempdb?

- Pre allocate space for all tempdb files by setting the file size to a value large enough to accommodate the typical workload in the environment. This prevents tempdb from expanding too frequently, which can affect performance. The tempdb database should be set to autogrow, but this should be used to increase disk space for unplanned exceptions.
- Create as many files as needed to maximize disk bandwidth. Using multiple files reduces tempdb storage contention and yields significantly better scalability. However, do not create too many files because this can reduce performance and increase management overhead. As a general guideline, create one data file for each CPU on the server (accounting for any affinity mask settings) and then adjust the number of files up or down as necessary. Note that a dual-core CPU is considered to be two CPUs.
- Make each data file the same size; this allows for optimal proportional-fill performance.
- Put the tempdb database on a fast I/O subsystem. Use disk striping if there are many directly attached disks.
- Put the tempdb database on disks that differ from those that are used by user databases.

26) What is recovery model in SQL Server?

SQL Server backup and restore operations occur within the context of the recovery model of the database. Recovery models are designed to control transaction log maintenance. A recovery model is a database property that controls how transactions are logged, whether the transaction log requires (and allows) backing up, and what kinds of restore operations are available.

27) How many types of Recovery models we have in SQL Server?

Three recovery models exist: simple, full, and bulk-logged. Typically, a database uses the full recovery model or simple recovery model. A database can be switched to another recovery model at any time.

28) Difference between Full, Bulk Logged and Simple recovery model?

Recovery model	Description	Work loss exposure	Recover to point in time?
Simple	No log backups. (Only Full and Differential backups) Automatically reclaims log space to keep space requirements small, essentially eliminating the need to manage the transaction log space.	Changes since the most recent backup are unprotected. In the event of a disaster, those changes must be redone.	Can recover only to the end of a backup.
Full	Requires log backups. No work is lost due to a lost or damaged data file. Can recover to an arbitrary point in time (for example, prior to application or user error).	Normally none. If the tail of the log is damaged, changes since the most recent log backup must be redone..	Can recover to a specific point in time, assuming that your backups are complete up to that point in time.
Bulk logged	Requires log backups. An adjunct of the full recovery model that permits high-performance bulk copy operations. Reduces log space usage by using minimal logging for most bulk operations. For more information, see	If the log is damaged or bulk-logged operations occurred since the most recent log backup, changes since that last backup must be redone. Otherwise, no work is lost.	Can recover to the end of any backup. Point-in-time

29) How can you setup a default recovery model for all newly created databases as simple?

We can setup the recovery model of model database as simple to make sure that newly created database's recovery is automatically configured as simple.

30) How to change the recovery model of a database?

```
USE [master]
GO
ALTER DATABASE [AdventureWorks] SET RECOVERY SIMPLE
GO
```

Note: It is always advisable to take a full backup of the database immediately after changing the database recovery model.

31) Recovery model of system databases?

System database	Recovery model	Comments
master	Simple	For backwards compatibility with earlier versions of Microsoft SQL Server, the recovery model of master can be set to FULL or BULK_LOGGED. However, BACKUP LOG is not supported for master. Therefore, even if the recovery model of master is changed to full or bulk-logged, the database continues to operate as if it were using the simple recovery model.
model	User configurable	Newly created user databases use the same recovery model as the model database. If you want your new databases to use the simple recovery model, change the recovery model of model to SIMPLE. Best practice: We recommend that you create only full database backups of model , as required. Because model is small and rarely changes,

		backing up the log is unnecessary.
msdb	Simple (default)	If you want to use the backup and restore history information in msdb when you recover user databases, we recommend that you use the full recovery model for msdb . Additionally, consider placing the msdb transaction log on fault tolerant storage.
Resource	—	The recovery model is irrelevant. SQL Server backup cannot back up the Resource database. Note You can perform a file-based or a disk-based backup on the Resource database by treating <code>Mssqlsystemresource.mdf</code> as if it were a binary (.exe) file. But you cannot use SQL Server restore on these backups.
tempdb	Simple	The simple recovery model is required; therefore, tempdb log space is always automatically reclaimed. You cannot backup tempdb .

Database Backups and Restore

1) What are database backups?

A Database backup is a copy of SQL Server data that can be used to restore and recover the data in case of any failure. A backup of SQL Server data is created at the level of a database or one or more of its files or filegroups. There is another option to take Transaction Log backups when the database recovery model of a database is Full.

2) Types of Database backups?

We have below type of backup available in SQL Server 2012.

- Full Backup
- Differential Backup
- Transaction Log Backup
- Copy-Only Backup
- File or Filegroup Backup

3) What is Full Database backup?

A full backup is a backup of the entire database that contains all the data and log file records needed to recover the database to the point in time when backup completed. Full backup should be a part of backup strategy for all the business-critical databases.

Full database backup contains the complete set of data needed to restore and recover a database to a consistent state. It serves as a baseline for all other backups.

```
--Back up the AdventureWorks as full backup  
BACKUP DATABASE AdventureWorks TO DISK = N'D:\AdventureWorks.bak'
```

4) What is Differential Backup?

Differential backup backs up only the data that has changed since the last full backup. A differential backup is not a stand-alone backup it needs a full backup to act as a baseline. For larger databases differential backups is common in order to save space and reduce the backup time.

In addition to being smaller and faster than full backup, a differential backup makes the restore process simpler. When you restore using differentials you must first restore the full backup followed by the most recent differential backup that was taken.

```
--Back up the AdventureWorks as differential backup  
BACKUP DATABASE AdventureWorks TO DISK = N'c:\AdventureWorksDiff.bak' WITH  
DIFFERENTIAL
```

5) What is Transaction Log Backup?

Log backups can be taken only if the recovery model of the database is Full recovery or Bulk-logged recovery. Simple recovery model does not allow transaction log backup because the log file is truncated automatically upon database checkpoints.

Log backups are taken between full backups to allow point-in-time recovery with the exception of log backups containing bulk-logged records. Without Transaction log backups you can restore data only till the time when the full or differential backup was taken.

```
--Back up the AdventureWorks transaction log  
BACKUP LOG AdventureWorks TO DISK = N'c:\AdventureWorksLog.trn'
```

6) What is File or File Group backup?

Using the file or filegroup backup you can backup an entire filegroup or files within the filegroup. These backups are essential when the database size is so large that backups must be done in parts because it takes too long to backup the entire database. Another potential benefit of having filegroup backups is that if the disk on which a particular file resides fails and is replaced, just the file can be restored instead of the entire database.

```
BACKUP DATABASE AdventureWorks FILEGROUP='PRIMARY', FILEGROUP  
='Secondary'  
TO DISK ='D:\AdventureWorks_FileGroup.bak'
```

7) What is COPY ONLY Backup?

Copy-only backups are introduced in SQL Server 2005 and are used to create a full database or transaction log backup without breaking the log chain. A copy-only full backup can't be used as a basis for a differential backup, nor can you create a differential copy only backup.

```
--Back up the AdventureWorks database as copy only  
BACKUP DATABASE AdventureWorks TO DISK = N'c:\AdventureWorks.bak' WITH  
COPY_ONLY  
--Back up the AdventureWorks transaction log as copy only  
BACKUP LOG AdventureWorks TO DISK = N'c:\AdventureWorksLog.trn' WITH  
COPY_ONLY
```

8) What are Split Backups?

SQL Server have one more feature to database backups can split to multiple files. Using this way SQL Server run the multiple thread of database backups for each files and can be completed faster comparatively with less time and IO.

```
BACKUP DATABASE AdventureWorks  
TO DISK = 'C:\AdventureWorks_1.bak'  
DISK = 'D:\AdventureWorks_2.bak',  
DISK = 'E:\AdventureWorks_3.bak'  
GO
```

9) What is Mirrored backup?

Mirrored database backups can be used to create multiple copies of the database backups on different locations.

```
BACKUP DATABASE AdventureWorks  
TO DISK = 'C:\AdventureWorks.bak'  
MIRROR TO DISK = 'D:\AdventureWorks_mirror.bak'  
GO
```

10) What is Tail log backup?

A tail-log backup captures any log records that have not yet been backed up (the tail of the log) to prevent work loss and to keep the log chain intact. Before you can recover a SQL Server database to its latest point in time, you must back up the tail of its transaction log. The tail-log backup will be the last backup of interest in the recovery plan for the database.

Tail log backup is taken in below ways:

```
If the database is online follow below syntax:
```

```
BACKUP LOG [database name] TO [backup device] WITH NORECOVERY  
If the database is offline (example a corrupted database which does not start]  
BACKUP LOG [database name] TO [backup device] WITH  
CONTINUE_AFTER_ERROR
```

11) What is Native Backup Compression?

Database backup compression helps in creating a database backup in a compressed format (Supported SQL Server 2008 onwards based on the Edition). Enabling database backups to use compression can be done in one of two ways. You can either configure all backups for the instance to be compressed (it is disabled by default), or you can issue the WITH COMPRESSION command for a specific database backup.

12) How can you enable Database compression on all the native backups?

Backup compression can be enabled at the SQL Server instance level as below.

```
USE master;  
GO  
EXEC sp_configure 'show advanced option', '1';  
RECONFIGURE  
GO  
EXEC sp_configure 'backup compression default', '1';  
RECONFIGURE WITH OVERRIDE;  
GO  
EXEC sp_configure 'show advanced option', '0';  
RECONFIGURE  
GO
```

13) Is it possible to add password to a backup file in SQL Server 2012 version?

WITH password option is not available any more with SQL Server 2012 onwards.

14) In which recovery model, Transaction Log backups are possible?

Transaction Log backups are possible in Full and Bulk Logged recovery model.

15) What all operations are minimally logged when the database is in Bulk Logged Recovery mode?

- Bulk import operations (bcp, BULK INSERT, and INSERT... SELECT). For more information about when bulk import into a table is minimally logged.
- SELECT INTO operations.
- Partial updates to large value data types, using the .WRITE clause in the UPDATE statement when inserting or appending new data. Note that minimal logging is not used when existing values are updated.
- WRITETEXT and UPDATETEXT statements when inserting or appending new data into the text, ntext, and image data type columns. Note that minimal logging is not used when existing values are updated.
- CREATE INDEX operations (including indexed views).
- ALTER INDEX REBUILD or DBCC DBREINDEX operations.
- DROP INDEX new heap rebuild (if applicable).

16) How do you know if your database backups are restorable?

We can use RESTORE VERIFY ONLY command to make sure that the Database backups are restorable.

17) What is the database that has the backup and restores system tables?

Msdb database contains information about the backup restore.

18) What are the backup and restore system tables? What does each of the tables do?

Here are the backup and restore system tables and their purpose:

- backupfile – contains one row for each data file or log file backed up
- backupmediafamily – contains one row for each media family
- backupmediaset – contains one row for each backup media set

- backupset – contains one row for each backup set
- restorefile – contains one row for each restored file
- restorefilegroup – contains one row for each restored filegroup
- restorehistory – contains one row for each restore operation

19) For differential backups, how is the data determined for those backups?

DCM page contains information about the extent which is changed after the Full backup. Diff. backup process reads information about the changed extents and those extents are added in the differential backup.

20) In a situation with full, differential and transaction log backups being issued for a database, how can an out of sequence full backup be issued without interrupting the LSN's?

Backup with COPY ONLY option can be used in such a situation.

21) How can I verify that backups are occurring on a daily basis?

We can verify the backup history of the database that backups are happening or not. Backupset table in msdb

22) What is the meaning of the values in Type column in backupset table.

This column tells us about the backup type.

Backup type. Can be:

- D = Database
- I = Differential database
- L = Log
- F = File or filegroup

- G =Differential file
- P = Partial
- Q = Differential partial

23) What are the permissions required to perform backup?

The user must be a member of either of the below roles

Backup:

- sysadmin – fixed server role
- db_owner – fixed database role
- db_backupoperator – fixed database role

24) Is there any option to prevent All successful SQL Server backup entries from writing to the SQL Server Error Log?

Yes – We can enable the trace flag 3226.

25) Assume that we have to take a backup of the database with a backup size of 90 GB. There is no space available in a single disk drive instead there are 4 different drives where we have 25 GB free space on each drive. How can you perform the backup to three different drives?

We can take backup in split backups.

```
BACKUP DATABASE AdventureWorks
TO DISK = 'D:\Backup\AdventureWorks1.bak',
DISK = 'E:\Backup\AdventureWorks2.bak',
DISK = 'F:\Backup\AdventureWorks3.bak',
DISK = 'G:\Backup\AdventureWorks4.bak'
```

26) Explain the below Backup script?

```
USE master
GO
BACKUP DATABASE [Test] TO
DISK = N'D:\ Backups\ test_full_native_1.bak'
WITH FORMAT, INIT,
NAME = N'test- Full Database Backup',
SKIP, NOREWIND, NOUNLOAD, STATS = 10
GO
```

- **FORMAT** – This option tells SQL Server whether or not to overwrite the media header information. The **FORMAT** option will erase any information in a backup set that already exists when the backup is initialized (**NOFORMAT** will preserve it).
- **INIT** – By default, when scripting a backup generated by the Backup wizard, this parameter will be set to **NOINIT**, which lets SQL Server know not to initialize a media set when taking the backup and instead append any new backup data to the existing backup set. However, since we adopt the rule of one backup per backup set, it's useful to use **INIT** instead, to make sure that, if a command gets run twice, we overwrite the existing set and still end up with only one backup in the set.
- **NAME** – The **NAME** parameter is simply used to identify the backup set. If it is not supplied, the set will not record a name.
- **SKIP** – Using the **SKIP** parameter will cause SQL Server to skip the expiration check that it normally does on the backup set. It doesn't care if any backups existing in the backup set have been marked for availability to be overwritten.
- **NOREWIND** – This parameter will cause SQL Server to keep a tape device open and ready for use when the backup operation is complete. This is a performance boost to users of tape drives since the tape is already at the next writing point instead of having to search for the correct position. This is obviously a tape-only option.
- **NOUNLOAD** – When backing up to a tape drive, this parameter instructs SQL Server not to unload the tape from the drive when the backup operation is completed.

27) What are the Backup and Restore Enhancements?

An enhancement introduced in SQL Server 2012 SP1 Cumulative Update 2 is enable backup and restore from the Windows Azure Blob storage service from SQL Server using TSQL

28) What are the limitations with Windows Azure Blob storage service?

The following are limitations specific to this release:

- The maximum backup size supported is 1 TB.
- In this implementation, you can issue backup or restore statements by using TSQL or SMO. A backup to or restoring from the Windows Azure Blob storage service by using SQL Server Management Studio Backup or Restore wizard is not currently enabled.

29) What are the restrictions on the Database backups operations?

Some typical examples include the following:

- You request a file backup of specific files, but one of the files is not online. The operation fails. To back up the online files, you can omit the offline file from the file list and repeat the operation.
- You request a partial backup, but a read/write filegroup is offline. Because all read/write filegroups are required for a partial backup, the operation fails.
- We request a full database backup, but one filegroup of the database is offline. Because all filegroups are implicitly included in a full database backup, this operation fails. To back up this database, you can use a file backup and specify only the filegroups that are online.

30) What all operations are prohibited when the database backups are running?

Operations that cannot run during a database backup or transaction log backup include the following:

- File-management operations such as the ALTER DATABASE statement with either the ADD FILE or REMOVE FILE options.
- Shrink database or shrink file operations. This includes auto-shrink operations.
- If you try to create or delete a database file while a backup operation is in progress, the create or delete operation fails.

31) What is Back up WITH CHECKSUM?

SQL Server supports three types of checksums: a checksum on pages, a checksum in log blocks, and a backup checksum. When generating a backup checksum, BACKUP verifies that the data read from the database is consistent with any checksum or torn-page indication that is present in the database.

The BACKUP statement optionally computes a backup checksum on the backup stream; if page-checksum or torn-page information is present on a given page, when backing up the page, BACKUP also verifies the checksum and torn-page status and the page ID, of the page. When creating a backup checksum, a backup operation does not add any checksums to pages. Pages are backed up as they exist in the database, and the pages are unmodified by backup.

32) What are the Best Practices recommendations related to SQL Server Database backups?

Backup is an important component of a sound disaster recovery strategy. Here are some best practices you can follow to ensure you have a good backup in place:

- Make sure you are not storing your backups in the same physical location as the database files. When your physical drive goes bad, you should be able to use the other drive or remote location that stored the backups in order to perform a restore. Keep in mind that you could create several logical volumes or partitions from a same physical disk drive. Carefully study the disk partition and logical column layouts before choosing a storage location for the backups.

- Make sure you have a proper backup schedule established according to the needs of the application and business requirements. As the backups get old, the risk of data loss is higher unless you have a way to regenerate all the data till the point of failure.
- Make sure to actually restore the backups on a test server and verify that you can restore with all the options and conditions you need to use during a planned or un-planned downtime.
- Use the verification options provided by the backup utilities [BACKUP TSQL command, SQL Server Maintenance Plans, your backup software or solution, etc].
- Use advanced features like BACKUP CHECKSUM to detect problems with the backup media itself.

33) Can we have multiple copies of the database backup is a single file?

Yes we can save multiple copies of database backup in a single file.

34) Name any 2-3 Third party SQL Server database backup tools?

There are many tools available in the market for SQL server backups like

- SQL Litespeed (Dell)
- SQL Backup Pro (Redgate)
- SQL Safe Backup (Idera)

35) How many copies are allowed when taking a backup using MIRROR Backup option?

Three copies are allowed in a Mirror backup apart from the original copy.

36) What are the common issues you faced in Database backup?

There could be multiple reasons like:

- Permissions issues if the backups are configured to be taken on a share location
- Backup file used by the tape backups due to which backup process is not able to overwrite the backup file.
- Full backup is not taken before initiating a Diff. of Transaction log backup
- Not enough space available on the target location

37) What is RTO?

Recovery Time Objective (RTO) is the amount of time which data or hardware is desired to be restored after a data corruption or hardware failure.

38) What is RPO?

Recovery Point Objective (RPO) describes a point in time that data can be restored from. For instance, if there is data corruption, Data loss or unavailability, at what point in time can a valid copy of the data be restored from? RPO is usually measured as minutes, hours, days, weeks, etc...

39) What is TDE (Transparent Data Encryption) method in SQL Server?

TDE provides the ability to encrypt an entire database and to have the encryption be completely transparent to the applications that access the database. TDE encrypts the data stored in both the database's data file (.mdf) and log file (.ldf) using either Advanced Encryption Standard (AES) or Triple DES (3DES) encryption. In addition, any backups of the database are encrypted. This protects the data while it's at rest as well as provides protection against losing sensitive information if the backup media were lost or stolen.

40) Which versions of SQL Server support TDE?

TDE requires SQL Server 2012 Enterprise edition. It's not available in SQL Server 2012 Standard or Business Intelligence editions. TDE is also available in SQL Server 2008 and SQL Server 2008 R2 Datacenter and Enterprise editions.

41) Is there a performance impact for using TDE?

Yes, some performance overhead is involved in using TDE. The encryption and decryption process do require additional CPU cycles. The overhead for using TDE ranges from about 3 percent to 30 percent, depending on the type of workload.

SQL Server instances with low I/O and low CPU usage will have the least performance impact. Servers with high CPU usage will have the most performance impact.

42) How can you enable TDE in SQL server?

TDE can be enabled on the database using below steps:

1. Create a master key for the database.
2. Create a certificate that's protected by the master key.
3. Create a special key that's used to protect the database. This key is called the database encryption key (DEK) and you secure it using the certificate.
4. Enable encryption.

-- The master key must be in the master database.

```
USE master;
GO
-- Create the master key.
CREATE MASTER KEY ENCRYPTION
BY PASSWORD='YourPassword';
GO
-- Create a certificate.
CREATE CERTIFICATE MySQLCert
WITH SUBJECT='MyDatabase DEK';
GO
-- Use the database to enable TDE.
USE MyDatabase
GO
-- Associate the certificate to MyDatabase.
CREATE DATABASE ENCRYPTION KEY
WITH ALGORITHM = AES_128
ENCRYPTION BY SERVER CERTIFICATE MySQLCert;
GO
-- Encrypt the database.
ALTER DATABASE MyDatabase
SET ENCRYPTION ON;
```

GO

43) What is a MASTER KEY?

A master key is a symmetric key that is used to create certificates and asymmetric keys.

44) What is the below error?

```
Msg 33111, Level 16, State 3, Line 2
Cannot find server certificate with thumbprint..
Msg 3013, Level 16, State 3, Line 2
RESTORE DATABASE is terminating abnormally
```

This issue occurs when somebody try to restore the database backup of TDE database on a different SQL Server instance.

45) What are the Advantages of using TDE?

- Performs real-time I/O encryption and decryption of the data and log files
- Encrypts the Entire Database in rest
- No architectural changes needed
- No application code changes are required and the user experience is the same
- Easy to implement
- DBAs can still see the data

46) What are the Disadvantages of using TDE?

- Not granular – Cannot just encrypt specific tables/columns
- Not good for high CPU bottleneck servers
- Not protected through communication/networks

47) What is MAXTRANSFERSIZE option in Backup database command?

MAXTRANSFERSIZE: specifies the largest unit of transfer in bytes to be used between SQL Server and the backup media. The possible values are multiples of 64 KB ranging up to 4194304 bytes (4 MB). The default is 1 MB.

48) What is BUFFERCOUNT option in Backup database command?

BUFFERCOUNT specifies the total number of I/O buffers to be used for the backup operation. The total space that will be used by the buffers is determined by: *buffercount * maxtransfersize*.

49) What is a log chain?

A continuous sequence of log backups is called a log chain. A log chain starts with a full backup of the database. Usually, a new log chain is only started when the database is backed up for the first time or after the recovery model is switched from simple recovery to full or bulk-logged recovery.

Unless you choose to overwrite existing backup sets when creating a full database backup, the existing log chain remains intact. With the log chain intact, you can restore your database from any full database backup in the media set, followed by all subsequent log backups up through your recovery point. The recovery point could be the end of the last log backup or a specific recovery point in any of the log backups.

50) Whether Full or Differential backups clear the Transaction Log or not?

No, Full or Differential backup do not clear Transaction logs.

51) Is it possible in any situation when differential backup grows more than the Full backup?

Yes, it is possible in case when you do not take Full backup of the database for months and change in the databases grow more than the size of the Full backup.

52) Is it mandatory to take a Full backup if we switch the recovery model of a database?

Yes, It is mandatory to take a Full backup of the database after switching the recovery model of the database to initiate the log chain. Otherwise Diff. or Transaction logs will fail.

53) What are the options to deal with over growing transaction log file?

We have below options to deal with the over growing transaction log file:

Freeing disk space so that the log can automatically grow.

- Backing up the log.
- Adding a log file on a separate disk drive.
- Increasing the size of a log file
- killing a long-running transaction

54) How does the database recovery model impact database backups?

Database recovery model deals with the retention of the transaction log entries. Database recovery model decides if transaction log backups need to be triggered on a regular basis in order to keep the transaction log small or the Transaction logs will be truncated automatically.

- Simple – Committed transactions are removed from the log when the check point process occurs.
- Bulk Logged – Committed transactions are only removed when the transaction log backup process occurs.
- Full – Committed transactions are only removed when the transaction log backup process occurs.

55) What is Windows Azure Blob storage service Database backups?

SQL Server 2012 SP1 CU2, enables SQL Server backup and restore directly to the Windows Azure Blob service. Backup to cloud offers benefits such as availability, limitless geo-replicated off-site storage, and ease of migration of data to and from

the cloud. In this release, you can issue BACKUP or RESTORE statements by using tsql or SMO. Back up to or restore from the Windows Azure Blob storage service by using SQL Server Management Studio Backup or Restore Wizard is not available in this release

56) What is a SQL Server Credential?

A SQL Server credential is an object that is used to store authentication information required to connect to a resource outside of SQL Server. Here, SQL Server backup and restore processes use credential to authenticate to the Windows Azure Blob storage service. The Credential stores the name of the storage account and the storage account access key values. Once the credential is created, it must be specified in the WITH CREDENTIAL option when issuing the BACKUP/RESTORE statements.

57) What is SQL command to create SQL Server Credential?

```
CREATE CREDENTIAL mycredential  
WITH IDENTITY= 'mystorageaccount'  
--this is the name of the storage account you specified when creating a storage  
account, SECRET = '<storage account access key>'  
-- this should be either the Primary or Secondary Access Key for the storage  
account to access cloud --account
```

58) What is the command to place the database backup on a Windows Azure Blob storage service?

```
BACKUP DATABASE AdventureWorks2012  
TO URL =  
'https://mystorageaccount.blob.core.windows.net/mycontainer/AdventureWorks201  
2_1.bak'  
URL =  
'https://mystorageaccount.blob.core.windows.net/mycontainer/AdventureWorks201  
2_2.bak'  
WITH CREDENTIAL = 'mycredential',  
STATS = 5  
GO
```

59) What are the Benefits with Windows Azure Blob storage service?

- Flexible, reliable, and limitless off-site storage: Storing your backups on Windows Azure Blob service can be a convenient, flexible, and easy to access off-site option.
- No overhead of hardware management
- Cost Benefits: Pay only for the service that is used. Can be cost-effective as an off-site and backup archive option.

60) Suppose I have a Database maintenance plan which runs every 15 minutes to take the Transaction Logs backup of all user defined databases. One of the members of DBA team created a new database in the morning at 09:10 AM and the DB maintenance job started failing. What could be the reason?

This job is failing because we did not take a full database backup of the newly created database. We need to take a full backup of a database to initiate the log chain.

61) What is the below error related to Differential backup?

Msg 3035, Level 16, State 1, Line 1 Cannot perform a differential backup for database "backup_test", because a current database backup does not exist.

Differential Backup is failing because we did not take a full backup of the database after creation of the database or switching the Recovery model of the database.

62) How will check the content of a backup file?

```
RESTORE HEADERONLY
FROM DISK = N'C:\AdventureWorks-FullBackup.bak'
GO
```

63) What is the Backup strategy in your environment?

It's very open ended Question:

As per my understanding, normally Organizations follow below standards

Prod/QA Environment:

For Small size databases (<200 GB)

- Full Backup – Daily
- Differential Backups – NA
- Transaction Log backups – Every 10-15 minutes depending upon the RPO

For Large size databases (>=200 GB)

- Full Backup – Weekly
- Differential Backups – Daily
- Transaction Log backups – Every 10-15 minutes depending upon the RPO

Again it all depends upon the criticality of the database e.g. for Data warehousing databases it may be possible that there is no requirement of Transaction log backups.

64) From a best practices perspective, what is your backup retention policy?

Again it all varies on organization's policies. As a general practice it's always better to keep the database backups on the shared location (In the Data Center) at least for 2-3 days. Daily backups should be written to tape backups and should be retained for a month or so. Also as a preventive measure there should be monthly or bi monthly backups with a retention policy of minimum one year.

65) What is the below error related to Permission issue for database backup?

```
Msg 3201, Level 16, State 1, line 1
Cannot open backup device '\\*****\\*****\master.bak'.
Operating system error 53(The network path was not found.).
```

This error is due the insufficient permissions of Service Account on the Shared location.

66) What are Database Maintenance Plans?

Database Maintenance Plans allow us to automate many database administration tasks in Microsoft SQL Server. Maintenance plans create a workflow of the tasks required to make sure that our database is optimized, regularly backed up, and free of inconsistencies.

67) What are the Benefits of Database Maintenance Plans?

SQL Server 2012 maintenance plans provide the following features:

- Workflow creation using a variety of typical maintenance tasks. You can also create your own custom Transact-SQL scripts.
- Conceptual hierarchies. Each plan lets you create or edit task workflows. Tasks in each plan can be grouped into subplans, which can be scheduled to run at different times.
- Support for multiserver plans that can be used in master server/target server environments.
- Support for logging plan history to remote servers.
- Support for Windows Authentication and SQL Server Authentication. When possible, use Windows Authentication.

68) What all options we have in a Database maintenance plans which helps a DBA to keep the database healthy?

We have below options in the Maintenance Wizard.

1. Check Database Integrity – checks the logical and physical integrity of all objects in the database

2. Shrink Database – shrinks the files and the logs in the specified database on a file-by-file basis. It pools log files. Physically shrinking makes the file smaller and truncates a file in the backup.
3. Reorganize Index – uses minimal system resources and defragments indexes of tables and views by reordering the pages to match the logical order
4. Rebuild Index – drops and recreates the index reclaiming space and reorders the index rows in contiguous pages
5. Update Statistics – updating statistics ensures queries run with up-to-date statistics, but they also require queries to be recompile, can result in a performance trade-off
6. Clean Up History – deletes entries in the history tables
7. Execute SQL Server agent job – Windows service that runs scheduled jobs
8. Backup Database (Full) – Backs up the entire database, but as databases grow, the backup takes longer and requires more storage. The best solution is to use in conjunction with differential backups.
9. Backup Database (Differential) – used to back up only the data that has changed since the last full backup
10. Backup Database (Transaction Log) – used to back up individual transaction logs, which can be individually restored since the last full backup
11. Maintenance clean up task – performs housekeeping functions

69) In which Database all the Maintenance Plans are stored?

Msdb database contains information about all the Database Maintenance plans.

70) In which table all the Maintenance Plans meta data is stored?

- sysdbmaintplan_databases: Contains one row for each database that has an associated upgraded database maintenance plan.

- sysdbmaintplan_history: Contains one row for each upgraded database maintenance plan action performed.
- sysdbmaintplan_jobs: Contains one row for each upgraded database maintenance plan job.
- Sysdbmaintplans: Contains one row for each upgraded database maintenance plan.

71) Is it possible to change the Database Maintenance plan once it's configured?

Yes we can change the Database Maintenance plan anytime.

72) Can we execute TSQL Statement using Database Maintenance Tasks?

Yes, we can run TSQL Statement in a Database Maintenance Plan.

73) Can we run a SQL Server Agent job using Database Maintenance Tasks?

Yes, we run a SQL Server Agent job in a Database Maintenance Plan.

74) What is History Cleanup Task in Database Maintenance Plan?

The History Cleanup task deletes entries in the following history tables in the SQL Server msdb database.

- backupfile
- backupfilegroup
- backupmediafamily
- backupmediaset
- backupset
- restorefile

- restorefilegroup
- restorehistory

By using the History Cleanup task, a package can delete historical data related to backup and restore activities, SQL Server Agent jobs, and database maintenance plans.

75) Which system stored procedures are used by History Cleanup Task?

It uses **sp_purge_jobhistory** and **sp_delete_backuphistory** statements.

76) What is Notify Operator task in Database Maintenance Plan?

The Notify Operator task sends notification messages to SQL Server Agent operators. A SQL Server Agent operator is an alias for a person or group that can receive electronic notifications.

77) How can we be notified if a native SQL Server database backup or restore fails via the native tools?

- Setup SQL Server Alerts to notify SQL Server Agent Operators on a failure condition.
- Include RAISERROR or TRY\catch logic in your backup or restore code to send an email on a failure condition.

78) What are some common errors related to backup failures?

ID	Category	Error	Severity	Description
1	Backup Success	18264	10	Database backed up: Database: %1, creation date(time): %2(%3), pages dumped: %4!d!, first LSN: %5, last LSN: %6, number of dump devices: %9!d!, device information: (%10).

2	Backup Failure	18204	16	%1: Backup device '%2' failed to %3. Operating system error = %4.
3	Backup Failure	18210	16	%1: %2 failure on backup device '%3'. Operating system error %4.
4	Backup Failure	3009	16	Could not insert a backup or restore history/detail record in the msdb database. This may indicate a problem with the msdb database. The backup/restore operation was still successful.
5	Backup Failure	3017	16	Could not resume interrupted backup or restore operation. See the SQL Server error log for more information.
6	Backup Failure	3033	16	BACKUP DATABASE cannot be used on a database opened in emergency mode.
7	Backup Failure	3201	16	Cannot open backup device '%ls'. Device error or device off-line. See the SQL Server error log for more details.

79) What are the phases of Database restore process?

A restore is a multiphase process. The possible phases of a restore include the data copy, redo (roll forward), and undo (roll back) phases:

- The data copy phase involves copying all the data, log, and index pages from the backup media of a database to the database files.

- The redo phase applies the logged transactions to the data copied from the backup to roll forward that data to the recovery point. At this point, a database typically has uncommitted transactions and is in an unusable state. In that case, an undo phase is required as part of recovering the database.
- The undo phase, which is the first part of recovery, rolls back any uncommitted transactions and makes the database available to users. After the roll back phase, subsequent backups cannot be restored.

80) What is a simple Database restore command from Full Backup?

```
RESTORE DATABASE [Restore_test]
FROM DISK = N'H:\MSSQL\Backup\Restore_test.bak'
WITH FILE = 1,
MOVE N'Restore_test_data' TO N'H:\MSSQL\Data\Restore_dat1.mdf',
MOVE N'Restore_test_log' TO N'H:\MSSQL\Log\Restore_log1.ldf',
REPLACE, STATS = 10
GO
```

81) What is a simple Database restore command from Full & Differential Backup?

```
RESTORE DATABASE [Restore_test]
FROM DISK = N'H:\MSSQL\Backup\Restore_test.bak'
WITH FILE = 1,
MOVE N'Restore_test_data' TO N'H:\MSSQL\Data\Restore_dat1.mdf',
MOVE N'Restore_test_log' TO N'H:\MSSQL\Log\Restore_log1.ldf',
REPLACE, STATS = 10, NORECOVERY
GO
```

```
RESTORE DATABASE [Restore_test]
FROM DISK = N'H:\MSSQL\Backup\Restore_test_Differential.bak'
WITH FILE = 1,
MOVE N'Restore_test_data' TO N'H:\MSSQL\Data\Restore_dat1.mdf',
MOVE N'Restore_test_log' TO N'H:\MSSQL\Log\Restore_log1.ldf',
REPLACE, STATS = 10, RECOVERY
GO
```

82) What is the Difference between WITH RECOVERY and WITH NORECOVERY parameter?

- RESTORE WITH RECOVERY is the default behavior which leaves the database ready for use by rolling back the uncommitted transactions. Additional transaction logs cannot be restored. Select this option if you are restoring all of the necessary backups now.
- RESTORE WITH NORECOVERY which leaves the database non-operational, and does not roll back the uncommitted transactions. Additional transaction logs can be restored. The database cannot be used until it is recovered.

83) What is WITH STANDBY Mode?

This option leaves the database in read-only mode. It undoes uncommitted transactions, but saves the undo actions in a standby file so that recovery effects can be reverted.

84) What is the below Error related the Database Restore?

Msg 3159, Level 16, State 1, Line 1
 The tail of the log for the database "Retsore_test" has not been backed up. Use BACKUP LOG WITH NORECOVERY to backup the log if it contains work you do not want to lose. Use the WITH REPLACE or WITH STOPAT clause of the RESTORE statement to just overwrite the contents of the log.

This error indicates that the Database already exists in the target SQL Server Instance. We have to use WITH REPLACE option to perform the database restore.

85) Why there is a requirement to restore the database?

Requirement of Database restore:

- In case of Database corruption, data issue or Disaster recovery
- In case of Database refresh from production to QA and Dev environment
- In case of upgrade from lower version to upper version in side by side upgrade

86) What all steps are involved in the Database restore process?

We normally get a request in the below format.

Source Server & Source Database

Target Server & Target Database

1. First of all we have to extract the permissions of the Target database so that we can retain the permissions of the database after the DB restore from production.
2. Perform the database restore from the source database backup.
3. Once the restore is done then we have to drop the users on the target database which is restored
4. Apply the permissions using the script which was extracted in the first step.
5. Check and resolve any kind of Orphaned users

87) What are Marked Transactions?

SQL Server supports inserting named marks into the transaction log to allow recovery to that specific mark. Log marks are transaction specific and are inserted only if their associated transaction commits. As a result, marks can be tied to specific work, and you can recover to a point that includes or excludes this work.

88) What are the permissions required to perform Database Restore?

The user must be a member of either of the below roles

- Sysadmin – fixed server role
- Dbcreator – fixed server role
- db_owner – fixed database role

89) Is it possible to restore a Database backup of SQL Server 2012 to SQL Server 2008 / 2008 R2?

No it's not possible to restore the upper version database backup to lower version.

90) What is RESTORE FILELISTONLY option?

This SQL returns a result set containing a list of the database and log files contained in the backup set in SQL Server.

```
RESTORE FILELISTONLY FROM AdventureWorksBackups  
WITH FILE=1;  
GO
```

91) What is RESTORE LABELONLY option?

It returns a result set containing information about the backup media identified by the given backup device.

```
RESTORE LABELONLY FROM DISK='C:\Backup\Adv_Full.bak'
```

MediaName	NULL
MediaSetId	23979995-927B-4FEB-9B5E-8CF18356AB39
FamilyCount	1
FamilySequenceNumber	1
MediaFamilyId	86C7DF2E-0000-0000-0000-000000000000
MediaSequenceNumber	1
MediaLabelPresent	0
MediaDescription	NULL
SoftwareName	Microsoft SQL Server
SoftwareVendorId	4608
MediaDate	1/3/07 8:15 PM
MirrorCount	1

92) What is Point in Time recovery?

Point in Time Recovery option gives us the ability to restore a database prior to an event that occurred that was detrimental to your database. In order for this option to work, the database needs to be either in the FULL or Bulk-Logged recovery model and you need to be doing transaction log backups.

High level steps to perform a point in time recovery.

1. Take a tail log backup of the database which needs to be restored
2. Restore the most recent full backup with the NORECOVERY clause
3. Restore the most recent differential backup with the NORECOVERY clause
4. Restore all of the subsequent transaction log backups with the NORECOVERY clause except the last tail log backup
5. Restore the last tail log backup with the RECOVERY clause and a STOPAT statement if the entire transaction log does not need to be applied

93) What is piecemeal Restore?

A piecemeal restore sequence restores and recovers a database in stages at the filegroup level, beginning with the primary and all read-write, secondary filegroups. Piecemeal restore process allows us to restore the primary filegroup first and the database can be online and the remaining filegroups can be restored while the recovery the transactions are running on primary. Mostly suitable for data warehousing databases.

94) What are Partial Backups in SQL Server?

Partial backups are useful whenever you want to exclude read-only filegroups. A partial backup resembles a full database backup, but a partial backup does not contain all the filegroups. Instead, for a read-write database, a partial backup contains the data in the primary filegroup, every read-write filegroup, and, optionally, one or more read-only files. A partial backup of a read-only database contains only the primary filegroup.

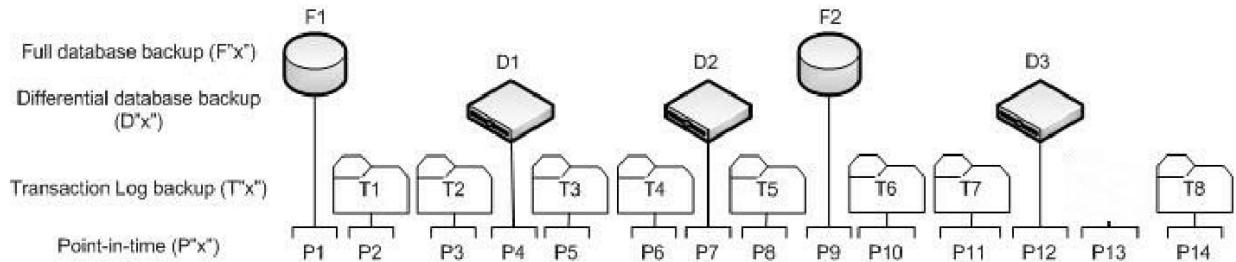
95) What is the command to take a Partial backup?

```

BACKUP DATABASE DBPartial READ_WRITE_FILEGROUPS
TO DISK = N'C:\SQLBackups\DBPartial_PARTIAL_Full.bak'
GO

```

Backup scenario:



96) What are the options to restore the database till Point 8 i.e. P8?

- Option 1: F1 > D2 > T5
- Option 2: F1 > D1 > T3 > T4 > T5
- Option 3: F1 > T1 > T2 > T3 > T4 > T5

97) What are the options to restore the database till Point 10 i.e. P10?

- Option 1: F2 > T6
- Option 2: F1 > D2 > T5 > T6
- Option 3: F1 > D1 > T3 > T4 > T5 > T6
- Option 4: F1 > T1 > T2 > T3 > T4 > T5 > T6

98) What are the options to do a point in time recovery P13?

- Option 1: F2 > D3 > T8 with STOPAT Time stamp of P13
- Option 2: F2 > T6 > T7 > T8 with STOPAT Time stamp of P13
- Option 3: F1 > D2 > T5 > T6 > T7 > T8 with STOPAT Time stamp of P13

- Option 4: F1 > D1 > T3 > T4 > T5 > T6 > T7 > T8 with STOPAT Time stamp of P13
- Option 5: F1 > T1 > T2 > T3 > T4 > T5 > T6 > T7 > T8 with STOPAT Time stamp of P13

99) What is the below error?

Msg 3004, Level 16, State 1, Line 19

The primary filegroup cannot be backed up as a file backup because the database is using the SIMPLE recovery model. Consider taking a partial backup by specifying READ_WRITE_FILEGROUPS.

Msg 3013, Level 16, State 1, Line 1

BACKUP DATABASE is terminating abnormally

Below SQL statements will throw an error if you are trying to take a Partial backup with simple recovery model of the database.

```
BACKUP DATABASE Database_name FILEGROUP = 'PRIMARY' TO DISK =
'PATH:\Database_name.bak'
```

Instead of this use READ_WRITE_FILEGROUPS parameter to take a partial backup.

```
BACKUP DATABASE Database_name READ_WRITE_FILEGROUPS TO DISK =
'PATH\Database_name.bak'
```

100) What is the below error?

Msg 3023, Level 16, State 2, Line 1

Backup and file manipulation operations (such as ALTER DATABASE ADD FILE) on a database must be serialized. Reissue the statement after the current backup or file manipulation operation is completed.

This error occurs when we try to run a backup, shrink, or alter database command in SQL Server in parallel.

101) what is the below error?

Msg 3024, Level 16, State 0, Line 1

You can only perform a full backup of the master database. Use BACKUP DATABASE to back up the entire master database.

Msg 3013, Level 16, State 1, Line 1

BACKUP DATABASE is terminating abnormally.

When you try to take a differential backup of the master database you will get this error. Be design differential backup of master database is not allowed.

102) what is the below error?

Msg 3033, Level 16, State 0, Line 1

BACKUP DATABASE cannot be used on a database opened in emergency mode.

We can't take the database backup if the database is in emergency mode.

103) what is the below error?

The database was backed up on a server running version 10.50.1600. That version is incompatible with this server, which is running version 10.00.1600. Either restore the database on a server that supports the backup, or use a backup that is compatible with this server.

Msg 3013, Level 16, State 1, Line 1

RESTORE DATABASE is terminating abnormally.

This error occurs when we try to restore the database from upper version to lower version. It is not possible to do a database restore with the backup file of upper version.

104) What is the below error?

Server: Msg 3101, Level 16, State 1, Line 1

Database in use. The system administrator must have exclusive use of the database to run the restore operation.

Server: Msg 3013, Level 16, State 1, Line 1

Backup or restore operation terminating abnormally.

This error occurs when the target database is in use and exclusive access is not granted. We have to kill all the connections on the database to overcome this issue.

105) What is the below error?

Msg 1834, Level 16, State 1, Line 1
The file 'C:\Program Files\Microsoft SQL Server\MSSQL.1\MSSQL\Data\AdventureWorks_Data.mdf' cannot be overwritten. It is being used by database 'AdventureWorks'.

Msg 3156, Level 16, State 4, Line 1
File 'AdventureWorks_Data' cannot be restored to 'C:\Program Files\Microsoft SQL Server\MSSQL.1\MSSQL\Data\AdventureWorks_Data.mdf'. Use WITH MOVE to identify a valid location for the file.

This issue occurs when we try to restore the database with a file location which contains files with the same name or the source database file location are on a drive letter or folder which is not available on the target server. To resolve this issue we can use "WITH MOVE" option.

106) What is the below error?

Error : Msg 3117, Level 16, State 4 The log or differential backup cannot be restored because no files are ready to rollforward

This error happens when Full back up is not restored before attempting to restore differential backup or full backup is restored with WITH RECOVERY option. Make sure database is not in operational conditional when differential backup is attempted to be restored.

107) What is the below error?

Msg 3154, Level 16, State 4, Line 1
The backup set holds a backup of a database other than the existing 'admin_test3' database.
Msg 3013, Level 16, State 1, Line 1
RESTORE DATABASE is terminating abnormally.

This issue occurs when we want to restore an existing database. To successfully perform the database restore we have to use WITH REPLACE option in the restore command.

108) What is the below error?

```
Server: Msg 3168, Level 16, State 1, Line 1
The backup of the system database on device d:\temp\master.bak cannot be
restored because it was created by a different version of the server (134217904)
than this server (134217920).
Server: Msg 3013, Level 16, State 1, Line 1
RESTORE DATABASE is terminating abnormally.
```

We cannot restore a backup of a system database (master, model, or msdb) on a server build that is different from the build on which the backup was originally performed. An attempt to perform such a restore causes the above error message.

109) What is the below error?

```
"This backup cannot be restored using WITH STANDBY because a database upgrade
is needed. Reissue the RESTORE without WITH STANDBY."
```

SQL Server does support restoring earlier version databases on later versions it also allows you to restore t-logs from earlier versions to later. The databases get upgraded along the way when you perform restores of databases but , the upgrade doesn't happen until recovery of the database occurs and for that reason can't use STANDBY mode in this situation.

Use NORECOVERY instead of Standby.

110) How can we kill or take an exclusive access of the database?

```
ALTER DATABASE [adb] SET RESTRICTED_USER WITH ROLLBACK IMMEDIATE
```

```
ALTER DATABASE [adb] SET SINGLE_USER WITH ROLLBACK IMMEDIATE
```

Or Write a cursor or loop to kill the DB connections

```
DECLARE @cmdKill VARCHAR(50)
DECLARE killCursor CURSOR FOR
SELECT 'KILL ' + Convert(VARCHAR(5), p.spid)
FROM master.dbo.sysprocesses AS p
WHERE p.dbid = db_id('MyDB')
OPEN killCursor
```

```
FETCH killCursor INTO @cmdKill
WHILE 0 = @@fetch_status
BEGIN
EXECUTE (@cmdKill)
FETCH killCursor INTO @cmdKill
END
CLOSE killCursor
DEALLOCATE killCursor
```

111) Why Database restores from upper version to lower version is not allowed?

Database servers get changed with service packs and new releases. New object types get added and the lower versions cannot understand these object types.

In order to avoid such conflicts and problems – Higher end database restorations cannot be performed directly on lower end database servers.

112) Is there any alternate method of restoring the database from Upper version to lower version?

There is no proper method of restore the database from upper version to lower version. However we can use below techniques to perform this task:

- Script out the database Objects and create these on the target database
- Use SQL Server Import Export Wizard to copy data from source server to destination server (only Data)
- Copy data to destination tables using BCP (only Data)

113) Is it possible to attach the Data and log files of upper version to lower version SQL Server instance?

No, It is not possible.

114) What are Mirrored Backup Media Sets?

Mirrored backup media sets are supported only in the Enterprise edition of SQL Server.

Mirroring a media set increases backup reliability by reducing the impact of backup-device malfunctions. These malfunctions are very serious because backups are the last line of defense against data loss. As database grows, the probability increases that a failure of a backup device or media will make a backup non restorable. Mirroring backup media increases the reliability of backups by providing redundancy.

115) Is it possible to mark Primary File Group as Read only?

No it's not possible to make Primary File Group read only.

116) How to make the File Group read only?

Filegroups can be marked as read-only. Any existing filegroup, except the primary filegroup, can be marked as read-only. A filegroup marked read-only cannot be modified in any way. Read-only filegroups can be compressed.

```
ALTER DATABASE ReadFilegroup MODIFY FILEGROUP Test1FG1 Read_Only;
```

117) What are the benefits of Read only file groups?

- Can be compressed (using NTFS compression)
- During recovery you don't need to apply logs to recover a read-only file group
- Protection of data from accidental modifications

118) How to script out the user permissions of the database before the database restore?

Please refer to the below URL to get a SQL Script to extract the user permissions.

<http://dbathings.com/database-permissions-extraction-script/>

119) How can you mount a database from MDF file even if you don't have the transaction log?

The only time that you can do this is when the DB was shut down cleanly before the log file was lost. It's still not a good idea. While attaching a data file without the log file may be possible in some circumstances, it is not a recommended approach and is only for cases when the log file has been damaged or lost due to hardware problems and there are no backups available. Of course, you cannot have a database without a log file, so SQL Server just recreates a log file when you attach the database. Attaching a data file without the log file breaks the log chain and may render the database transactionally or structurally inconsistent depending on the state of the database before the log file was lost.

120) What is Piecemeal Restore of Database (Simple Recovery Model)?

A piecemeal restore sequence restores and recovers a database in stages at the filegroup level, starting with the primary and all read/write, secondary filegroups.

- Partial restore of the primary and filegroups A and C.

```
RESTORE DATABASE adb FILEGROUP='A', FILEGROUP='C'  
FROM partial_backup  
WITH PARTIAL, RECOVERY;
```

At this point, the primary and filegroups A and C are online. All files in filegroup B are recovery pending, and the filegroup is offline.

- Online restore of filegroup B.

```
RESTORE DATABASE adb FILEGROUP='B' FROM backup WITH RECOVERY;
```

121) Is it possible to perform a point in time recovery with Bulk Logged recovery model?

Yes, it is possible to perform a point in time recovery with Bulk logged recovery model till the time we don't perform any minimal logged operation on the database.

122) How to recover a database that is in the “restoring” state?

```
RESTORE DATABASE AdventureWorks WITH RECOVERY  
GO
```

123) What are the important points which need to be taken care when we restore the database from lower version to upper version?

- Change the compatibility mode of the database
- Run Update Usage command
- If possible (Time permits) run Index rebuild and Update statistics

124) How to change the database owner of the database?

```
EXEC sp_changedbowner 'Myuser';
```