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Administering Microsoft® SQL Server® 2012 Databases

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Module 1

Introduction to SQL Server® 2012 and Its Toolset

Contents:

Lesson 1

Introduction to the SQL Server Platform

Contents:

Question and Answers

SQL Server Instances

Question: Why might you need to separate databases by service level agreement?

Answer: Different database applications might need to meet different service level agreements, particularly in relation to recovery time objectives (RTO) and recovery point objectives (RPO).

SQL Server Editions

Question: What would be a good business case example for using a cloud-based service?

Answer: Startup companies. (Purchase too many servers and go broke. Purchase too little and go broke).

SQL Server Versions

Question: Which versions of SQL Server have you worked with?

Answer: Answers will vary by student.

Lesson 2

Working with SQL Server Tools

Contents:

Question and Answers

Demonstration 2A: Using SQL Server Management Studio

Question: When would displaying an estimated execution plan be helpful?

Answer: When troubleshooting query performance or when designing indexing strategies for a database.

Demonstration 2B: Using SQL Server Data Tools

Question: Can you suggest a situation where the ability to schedule the execution of a report would be useful?

Answer: Monthly or weekly sales reports.

Detailed Demonstration Steps

Demonstration 2A: Using SQL Server Management Studio

Detailed demonstration steps

1. Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
2. In the **Virtual Machine**, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, and click **SQL Server Management Studio**.
3. In the Connect to Server window, ensure that **Server type** is set to **Database Engine**.
4. In the **Server name** text box, type **(local)**.
5. In the **Authentication** drop-down list, select **Windows Authentication**, and click **Connect**.
6. If required, from the **View** menu, click **Object Explorer**.
7. In Object Explorer, expand **Databases**, expand **AdventureWorks**, and **Tables**. Review the database objects.
8. Right-click the **AdventureWorks** database and choose **New Query**.
9. Type the query shown in the snippet below:

```
SELECT * FROM Production.Product ORDER BY ProductID;
```

10. Note the use of Intellisense while entering it, and then click **Execute** on the toolbar. Note how the results can be returned.
11. From the **File** menu click **Save SQLQuery1.sql**. Note this saves the query to a file. In the Save File As window click **Cancel**.
12. In the **Results** tab, right-click on the cell for **ProductID 1** (first row and first cell) and click **Save Results As...**. In the **FileName** textbox, type **Demonstration2AResults** and click **Save**. Note this saves the query results to a file.
13. From the **Query** menu, click **Display Estimated Execution Plan**. Note that SSMS is capable of more than simply executing queries.
14. From the **Tools** menu, and click **Options**.
15. In the **Options** pane, expand **Query Results**, expand **SQL Server**, and expand **General**. Review the available configuration options and click **Cancel**.
16. From the **File** menu, click **Close**. In the Microsoft SQL Server Management Studio window, click **No**.
17. In the **File** menu, click **Open**, and click **Project/Solution**.
18. In the Open Project window, open the project **D:\10775A_Labs\10775A_02_PRJ\10775A_02_PRJ.ssmssln**.
19. From the **View** menu, click **Solution Explorer**. Note the contents of Solution Explorer. SQL Server projects have been supplied for each module of the course and contain demonstration steps and suggested lab solutions, along with any required setup/shutdown code for the module.
20. In the Solution Explorer, click the **X** to close it.
21. In Object Explorer, from the **Connect** toolbar icon, note the other SQL Server components that connections can be made to:
    - Database Engine, Analysis Services, Integration Services, Reporting Services

22. From the **File** menu, click **New**, and click **Database Engine Query** to open a new connection.
23. In the Connect to Database Engine window, type **(local)** in the **Server name** text box.
24. In the **Authentication** drop-down list, select **Windows Authentication**, and click **Connect**.
25. In the **Available Databases** drop-down list, click **tempdb** database. Note this will change the database that the query is executed against.
26. Right-click in the query window and click **Connection**, and click **Change Connection…**. Note: this will reconnect the query to another instance of SQL Server. In the Connect to Database Engine window, click **Cancel**.
27. From the **View** menu, click **Registered Servers**.
28. In the Registered Servers window, expand **Database Engine**, right-click **Local Server Groups**, and click **New Server Group…**.
29. In the New Server Group Properties window type **Dev Servers** in the **Group name** textbox and click **OK**.
30. Right-click **Dev Servers** and click **New Server Registration…**.
31. In the New Server Registration window, click **Server name** drop-down list, type **(local)** and click **Save**.
32. Right-click **Dev Servers** and click **New Server Registration…**.
33. In the New Server Registration window, click **Server name** drop-down list, type **.\MKTG** and click **Save**.
34. In the Registered Servers window, right-click the **Dev Servers** group and choose **New Query**.
35. Type the query as shown in the snippet below and click **Execute** toolbar icon:

```
SELECT @@version;
```

36. Close SQL Server Management Studio.
37. Click **No** in the SQL Server Management Studio window.

Demonstration 2B: Using SQL Server Data Tools

Detailed demonstration steps

1. If Demonstration 2A was not performed, revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
2. In the **Virtual Machine**, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, and click **SQL Server Data Tools**. From the **File** menu, click **New Project**. Note the available project templates (also if other languages are installed).
3. In the **Templates** pane, click **Report Server Project**, and click **OK**.
4. In Solution Explorer, right-click **Reports** and click **Add New Report**.
5. In the Report Wizard window, click **Next**.
6. In the Select the Data Source window, click **Edit**.
7. In the Connection Properties window, type **(local)** for the **Server name** and in the **Connect to a database** drop-down list, select **AdventureWorks**, and click **OK**.
8. In the Select the Data Source window, click **Next** then in the Design the Query window, for the **Query string** textbox, type the following query as shown in snippet below and click **Next**.

```
SELECT ProductID, Name, Color, Size FROM Production.Product ORDER BY ProductID;
```

9. In the Select the Report Type window, click **Next**.
10. In the Design the Table window, click **Details** four times, and click **Finish>>|**.
11. In the Completing the Wizard window, click **Finish**.
12. In the **Report1.rdl [Design]*** tab, click **Preview** and note the report that is rendered.
13. Click on the **Design** tab, from the **File** menu click **Exit**. Note if prompted do not save the changes.

Demonstration 2C: Using Books Online

Detailed demonstration steps

1. If Demonstration 2A was not performed, revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
2. In the **Virtual Machine**, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **Documentation & Community**, and click **SQL Server Documentation**.
3. Maximize the Microsoft Help Viewer window and note the basic navigation options available.
4. In the **Virtual Machine**, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, and click **SQL Server Management Studio**.
5. In the Connect to Server window, ensure that **Server type** is set to **Database Engine**.
6. In the **Server name** text box, type **(local)**.
7. In the **Authentication** drop-down list, select **Windows Authentication**, and click **Connect**.
8. From the **File** menu, click **New**, and click **Query with Current Connection**.
9. In the **SQLQuery1.sql** tab, type the query as shown in the snippet below and click **Execute** toolbar icon:

```
SELECT SUBSTRING('test string',2,7);
```

10. Click the name of the function **SUBSTRING**, then hit the F1 key to open the BOL topic for SUBSTRING.
11. Note the content of the page and scroll to the bottom to see the examples then close the Microsoft Help Viewer window.
12. Close SQL Server Management Studio, without saving any changes.
13. If your host system has Internet access available, open **Internet Explorer** in the host system and browse to the SQL Server Books Online page: **http://go.microsoft.com/fwlink/?LinkID=233780** and note the available online options.

Lesson 3

Configuring SQL Server Services

Contents:

Question and Answers

SQL Server Configuration Manager

Question: Why would a server system need to have a client configuration node?

Answer: Because client applications (including tools and utilities) need to connect to the server and to other servers.

Demonstration 3A: Using SQL Server Profiler

Question: What could you use captured trace files for?

Answer: Performance tuning, workload testing, upgrade testing.

Detailed Demonstration Steps

Demonstration 3A: Using SQL Server Profiler

Detailed demonstration steps

1. If Demonstration 2A was not performed, revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
2. In the **Virtual Machine**, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, and click **SQL Server Management Studio**.
3. In the Connect to Server window, ensure that **Server type** is set to **Database Engine**.
4. In the **Server name** text box, type **(local)**, in the **Authentication** drop-down list, select **Windows Authentication**, and click **Connect**.
5. From the **Tools** menu, click **SQL Server Profiler**.
6. In the Connect to Server window, ensure that **Server type** is set to **Database Engine**.
7. In the **Server name** text box, type **(local)**, in the **Authentication** drop-down list, select **Windows Authentication**, and click **Connect**.
8. In the Trace Properties window, click **Run**. Note this will start a new trace with the default options.
9. Switch to SQL Server Management Studio, click **New Query** toolbar icon.
10. In the Query window, type the query as shown in the snippet below, and click **Execute** toolbar icon:

```
USE AdventureWorks;
GO
SELECT * FROM Person.Contact ORDER BY FirstName;
GO
```

11. Switch to SQL Server Profiler. Note the statement trace occurring in SQL Server Profiler then from the **File** menu and click **Stop Trace**.
12. In the **Results** grid, click individual statements to see the detail shown in the lower pane.
14. Close SQL Server Management Studio and SQL Server Profiler without saving any changes.

Module Reviews and Takeaways

Review questions

Question: What is the difference between a SQL Server version and an edition?

Answer: Versions are releases of the product. Editions are levels of the product with differing capabilities.

Question: What is the purpose of the SQL Server Data Tools?

Answer: It adds templates to Visual Studio for constructing and testing business intelligence projects.

Question: Does Visual Studio need to be installed before SSDT?

Answer: No, SQL Server installation will install the partner edition of Visual Studio if Visual Studio is not already present.

Best Practices

1. Ensure that developer edition licenses are not used in production environments.
2. Develop using the least privileges possible, to avoid accidentally building applications that will not run for standard users.
3. If using an offline version of Books Online, ensure it is kept up to date.
4. Ensure that service accounts are provisioned with the least workable permissions.

Lab Review Questions and Answers

Question: Why does the Reporting Services encryption key need to be backed up?

Answer: Reporting Services encrypts sensitive information such as connection details and this key is needed if the RS databases ever need to be restored on another server.

Question: How can SQL Server be configured to use a different IP port?

Answer: SQL Server Configuration Manager network configuration provides the ability to configure ports for protocols.

Module 2

Preparing Systems for SQL Server 2012

Contents:

Lesson 1

Overview of SQL Server Architecture

Contents:

Question and Answers

SQL Server Architecture

Question: Why does SQL Server need to optimize queries?

Answer: T-SQL is a language that defines logically which data needs to be retrieved or changed. The responsibility of the query optimizer is to translate the query in a physical plan that defines the methods and indexes used to access the data and which operations will be used to process the data further.

Question: What do you imagine that cost based optimization means and can you imagine other ways that queries could be optimized (apart from cost based)?

Answer: Cost based optimization is done by calculating the costs of different ways a query can be executed and then choosing the cheapest plan. An other way of optimization would be ruled based optimization that generates a query plan based on rules implemented in the system.

CPU Usage by SQL Server

Question: Why would analyzing waits be an important instrument for monitoring SQL Server performance?

Answer: Analyzing waits provides the chance to get the information about what type of resources are preventing fast query execution. They can give a direction to search in, when trying to resolve specific problems.

Parallelism

Question: Why would parallel plans involve an overhead?

Answer: Data is processed in different tasks and involves the need to gather the data together or repartition the data for further parallel operations. A good analogy is a human project. As soon as there are more people involved, management overhead occurs.

32 bit vs. 64 bit Servers

Question: Why is data caching so important for database engines like SQL Server?

Answer: Because disk I/O is much slower than accessing the data in memory. Therefore it is important to provide good and efficent caching which can reduce physical disk I/O significantly.

Overview of SQL Server Memory

Question: What is the purpose of an LRU algorithm?

Answer: To work out which pages have not been used and are candidates to be removed from memory.

Physical vs. Logical I/O

Question: Why should the logical and not the physical I/O be optimized when optimizing queries?

Answer: Because the physical I/O depends on the state of the system and buffer cache, which can be different with every execution. By minimizing the logical I/O the chance of needing to perform physical I/O is also reduced.

Detailed Demonstration Steps

Demonstration 1A: CPU and Memory Configurations in SSMS

Detailed demonstration steps

1. Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
2. In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_02_PRJ\10775A_02_PRJ.ssmssln** and click **Open**.
3. From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within **Solution Explorer**.
4. Open the **11 – Demonstration 1A.sql** script file.
5. Follow the instructions contained within the comments of the script file.

Lesson 2

Planning Server Resource Requirements

Contents:

Question and Answers

Introduction to Planning Server Resource Requirements

Question: Why is it important to perform tests for capacity planning?

Answer: Because the usage patterns on database systems are very different, which makes it very hard (or even impossible) to predict the Server Resources, even based on known parameters such as database size, user connections and others.

Planning Memory Requirements

Question: What are some of the potential symptoms of memory shortage?

Answer: Higher CPU and I/O usage.

Planning Network Requirements

Question: Why might backups interrupt or slow down user workloads?

Answer: Database backups often work with large amounts of data. When this is performed across a network, this can present a substantial load on the network.

Planning Storage and I/O Requirements

Question: Why is it better to spread a database over several disks rather than one large disk?

Answer: Because typical disk are not able to fulfil the demand of most SQL Server databases. A typical 15K RPM disk for example can only handle about 150 to 180 IOPs, where thousands of IOPs are required on many systems. SSD disks are rapidly changing this situation as many are capable of large numbers of IOPs.

Lesson 3

Pre-installation Testing for SQL Server

Contents:

Question and Answers

Overview of Pre-installation Testing

Question: Why is it important to document and archive the tests run on the system?

Answer: Beside the use of it in the planning and test phase offers a good reference for later usage, including planning for similar systems or to have reference data for later monitoring of the production system.

Introducing SQLIO

Question: What types of I/O will SQL Server mainly produce against data files of a typical OLTP system?

Answer: A big number of small random I/Os.

Detailed Demonstration Steps

Demonstration 3A: Using SQLIOSIM & SQLIO

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_02_PRJ\10775A_02_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within **Solution Explorer**.
2. Open the **31 – Demonstration 3A.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Module Reviews and Takeaways

Review questions

Question: What is main reason that causes SQL Server to need a lot of memory?

Answer: Because it needs enough memory for caching data to optimize I/O.

Question: Why is pre-installation planning and testing important?

Answer: To find the right hardware and configuration needed for the specific installation to ensure proper operation needs and reduce the need for later corrective work.

Best Practices

1. Understand the architecture of SQL Server.
2. Plan memory, CPU, network and IO requirements for the specific system.
3. Test these requirements against the available hardware.

Lab Review Questions and Answers

Question: Why is running SQLIOSim on the VM difficult?

Answer: Because the VM has a virtualized I/O subsystem that is not capable of typical I/O performance levels.

Question: Should you use SQLIOSIM or SQLIO to test the performance of a system with 8KB random reads?

Answer: SQLIO

Module 3

Installing and Configuring SQL Server 2012

Contents:

Lesson 1

Preparing to Install SQL Server

Contents:

Question and Answers

Hardware Requirements - General

Question: If you need to continue to support an older SQL Server version, what would be a good method of supporting it?

Answer: A virtualized environment.

Hardware Requirements - Memory

Question: Can you suggest a reason why a 32 bit server might still need to be implemented?

Answer: If the server requires drivers that are only available in 32 bit.

Determining File Placement

Question: How would you plan drives and file placement for your organization?

Answer: Place the tempdb database on a fast disk drive subsystem. Create the transaction log on a physically separate disk or RAID array. If you have a set of tables that is used together frequently, you should consider putting these tables on separate filegroups on separate physical drives.

Working with Collations

Question: What is the difference between an accent-sensitive collation and a non-accent-sensitive collation?

Answer: In an accent-sensitive collation, letters with accents (such as **letters with accents**, graves or umlauts) are treated as different characters.

Detailed Demonstration Steps

Demonstration 1A: Using Collations

Detailed demonstration steps

1. Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
2. In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_03_PRJ\10775A_03_PRJ.ssmssln** and click **Open**.
3. From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within **Solution Explorer**.
4. Open the **11 – Demonstration 1A.sql** script file.
5. Follow the instructions contained within the comments of the script file.

Lesson 2

Installing SQL Server

Contents:

Question and Answers

Hardware Requirements - General

Question: If you need to continue to support an older SQL Server version, what would be a good method of supporting it?

Answer: A virtualized environment.

Hardware Requirements - Memory

Question: Can you suggest a reason why a 32 bit server might still need to be implemented?

Answer: If the server requires drivers that are only available in 32 bit.

Determining File Placement

Question: How would you plan drives and file placement for your organization?

Answer: Place the tempdb database on a fast disk drive subsystem. Create the transaction log on a physically separate disk or RAID array. If you have a set of tables that is used together frequently, you should consider putting these tables on separate filegroups on separate physical drives.

Working with Collations

Question: What is the difference between an accent-sensitive collation and a non-accent-sensitive collation?

Answer: In an accent-sensitive collation, letters with accents (such as **letters with accents**, graves or umlauts) are treated as different characters.

Post-installation Checks

Question: If you discover after installation that you have used an incorrect or inappropriate service account for SQL Server, which tool do you use to correct the account?

Answer: SQL Server Configuration Manager.

Detailed Demonstration Steps

Demonstration 1A: Using Collations

Detailed demonstration steps

1. Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
2. In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_03_PRJ\10775A_03_PRJ.ssmssln** and click **Open**.
3. From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within **Solution Explorer**.
4. Open the **11 – Demonstration 1A.sql** script file.
5. Follow the instructions contained within the comments of the script file.

Demonstration 2A: Using System Configuration Checker

Detailed demonstration steps

1. Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
2. In the Virtual Machines list in Hyper-V Manager, right-click the 10775A-MIA-SQL1 virtual machine and click **Settings**.
3. In the Settings for 10775A-MIA-SQL1 window, in the **Hardware** list expand **IDE Controller 1**, and click **DVD Drive**.
4. In the **DVD Drive** properties pane, click **Image file,** and click **browse**.
5. Navigate to the file

   C:\Program Files\Microsoft Learning\1077XA\Drives\10775A-MIA-SQL1 \Virtual Hard Disks\SQLFULL_ENU.iso and click **Open**.
6. In the Settings for 10775A-MIA-SQL1 window, click **OK**.
7. In the Virtual Machine window, in the AutoPlay window (which should now have popped up) click **Run SETUP.EXE** and wait for SQL Server Setup to start.
8. In the SQL Server Installation Center window, click **System Configuration Checker** from the list of available options on the **Planning** tab.
9. In the Setup Support Rules window, note the list of rules which have been checked.
10. Click on the warning in the **Status** column for the **Microsoft .NET Application Security** rule.
11. In the Rule Check Result window, read the details of the warning and click **OK**.
12. In the Setup Support Rules window, click **OK**.

Lesson 3

Upgrading and Automating Installation

Contents:

Detailed Demonstration Steps

Demonstration 3A: Creating an Unattended Installation File

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_03_PRJ\10775A_03_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within **Solution Explorer**.
2. Open the **31 – ConfigurationFile.ini** file.
3. Review the Configuration File, in particular note the values of the following properties:
   - INSTANCEID
   - ACTION
   - FEATURES
   - QUIET
   - QUIETSIMPLE
   - INSTALLSHAREDDIR
   - INSTANCEDIR
   - INSTANCENAME
   - AGTSVCSTARTUPTYPE
   - SQLCOLLATION
   - SQLSVCACCOUNT
   - SQLSYSADMINACCOUNTS
   - TCPENABLED

Module Reviews and Takeaways

Review questions

Question: Why is the choice of collation for a server so important, when you can choose individual database collations anyway?

Answer: Temporary objects from all applications use the tempdb database. The collation of the tempdb database is based on the collation chosen for the server at installation time.

Question: Should all SQL Server services use a single domain-based service account?

Answer: No, ideally, each service would use an individual service account.

Best Practices related to a particular technology area in this module

1. Use domain-based accounts for service accounts.
2. Configure service accounts for the least possible privilege that lets them still operate.
3. Use SQL Server Configuration Manager to change service accounts as it will ensure that the correct permissions and ACLs are configured.

Lab Review Questions and Answers

Question: When the DEV instance is no longer required, what actions would be needed when removing it from the server?

Answer: Uninstall the SQL Server instance and then reconfigure the memory for the other instances.

Question: What does CI indicate as part of the name of a collation?

Answer: Case-insensitive.

Module 4

Working with Databases

Contents:

Lesson 1

Overview of SQL Server Databases

Contents:

Question and Answers

How Data Is Stored in SQL Server

Question: In what scenarios would secondary data files be useful?

Answer: If a database exceeds the maximum size for a single Windows file, you can use secondary data files so the database can continue to grow.

Determining File Placement and Number of Files

Question: Why is it important to separate data and log files on the physical level?

Answer: In case of a storage failure only part of the files are affected that gives a better chance to recovery the database up to the last transaction if for example only data files are affected by the failure. Additionally the access patterns of the file types are very different and it gives better performance if it is separated.

Ensuring Sufficient File Capacity

Question: When would it be appropriate to preset a maximum size for the database and restrict filegrowth?

Answer: You might preset a maximum size for a database and restrict filegrowth when you have a limited amount of disk storage.

System Databases Supplied with SQL Server

Question: Suggest an example of objects that you might want to create in the model database so that they are already present in all newly-created databases on the server instance.

Answer: Examples would be a custom security model or a series of common management stored procedures that are needed by utility programs that are used to manage servers within an organization.

Overview of tempdb

Question: Why could a memory bottleneck lead to higher tempdb usage?

Answer: Because SQL Server might need to page operations like hash or sort operations to tempdb, when it is low on memory.

Detailed Demonstration Steps

Demonstration 1A: Working with tempdb

Detailed demonstration steps

1. Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
2. In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_04_PRJ\10775A_04_PRJ.ssmssln** and click **Open**.
3. From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
4. Open the **11 – Demonstration 1A.sql** script file.
5. Follow the instructions contained within the comments of the script file.

Lesson 2

Working with Files and Filegroups

Contents:

Question and Answers

Creating User Databases

Question: What is the logical file name?

Answer: The logical file name is the name used to identify the database files within the database. It is used for all file operations done and must be unique with the database.

Expanding and Shrinking Database Files

Question: What are the two basic strategies for expanding a database manually?

Answer: The database files can be expanded or new files can be added to the database.

Working with Filegroups

Question: What is the advantage of storing archive data on separate filegroups?

Answer: By doing this, archive data can be put on cheaper storage and set as read-only to prevent data modification.

Detailed Demonstration Steps

Demonstration 2A: Creating Databases

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_04_PRJ\10775A_04_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
2. Open the **21 – Demonstration 2A.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Demonstration 2B: Altering Databases

Detailed demonstration steps

1. If Demonstration 2A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_04_PRJ\10775A_04_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
   - Open the **21 – Demonstration 2A.sql** script file and follow the instructions contained within it.
2. Open the **22 – Demonstration 2B.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Demonstration 2C: Filegroups

Detailed demonstration steps

1. If Demonstration 2A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_04_PRJ\10775A_04_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.

- Open and execute the **21 – Demonstration 2A.sql** script file.

2. Open the **23 – Demonstration 2C.sql** script file.

Lesson 3

Moving Database Files

Contents:

Question and Answers

Moving User Database Files

Question: Why is ALTER DATABASE preferred over detaching and attaching the database?

Answer: Because the database only needs to be set offline and not detached completely keeping the references in system catalog intact.

Moving System Database Files

Question: What is the biggest concern when performing these tasks?

Answer: That wrong paths are provided, which can prevent SQL Server from starting. In that case, special recovery scenarios need to be applied. (These techniques are advanced topics and are out of scope for this course).

Copying Databases

Question: What might be the main disadvantage copying a database using detach and attach of the database?

Answer: The database needs to be offline.

Detailed Demonstration Steps

Demonstration 3A: Detach and Attach

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_04_PRJ\10775A_04_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
2. Open the **31 – Demonstration 3A.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Demonstration 3B: Moving and Reconfiguring tempdb

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   a. Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   b. In the virtual machine, open the **10775A_04_PRJ SQL** Server script project within SQL Server Management Studio.
   c. From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
2. Open the **32 – Demonstration 3B.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Module Reviews and Takeaways

Review questions

Question: Why is it typically sufficient to have one log file in a database?

Answer: Log files are written sequentially. If more then one log file exists, SQL Server writes them in a circular manner, which doesn‘t provide any advantages according to performance and availability.

Question: Why should no data except temporary data should be stored in tempdb system database?

Answer: Because it is recreated with every new start of the instance.

Question: What operations can be performed online on database files?

Answer: They can be expanded, shrunk, added and dropped. To be moved the database needs to be offline.

Best Practices related to a particular technology area in this module

1. Plan and test your file layout carefully.
2. Separate data and log files on the physical level.
3. Keep the data files of a database at the same size.
4. Create the database in an appropriate size that it doesn't have to be expanded too often.
5. Shrink files only if absolutely necessary.

Lab Review Questions and Answers

Question: What is the biggest challenge where databases on a single server use different collations?

Answer: tempdb is used for temporary objects across all databases.

Question: Why should tempdb have multiple files on most systems?

Answer: To avoid contention issues.

Module 5

Understanding SQL Server 2012 Recovery Models

Contents:

Lesson 1

Backup Strategies

Contents:

Question and Answers

Determining an Appropriate Backup Strategy

Question: What would be the likely RPO and RTO requirements for the most important databases in your organization?

Answer: Answers will vary based upon the types of organization that the students work in and their experience level. A hint when discussing this with students though, is that most people will guess too stringent a set of requirements, that they simply could never justifiably afford to implement.

Choosing Appropriate Backup Media

Question: What might be the purpose of striping backups to more than one backup device on a disk?

Answer: Performance. There can be even performance gains, if all backup devices resides on the same storage, because of the implementation of the backup.

Lesson 2

Understanding SQL Server Transaction Logging

Contents:

Question and Answers

Transaction Log File Structure

Question: Why is the write performance to the log file so important for the transaction performance of a database?

Answer: Because a transaction has to be fully written to the log file before being committed to the user.

Working with Recovery Models

Question: What type of organization might find the simple recovery model to be adequate?

Answer: Any organization that is willing to lose all data since the last time they made a backup.

Capacity Planning for Transaction Logs

Question: What would be the most common reason for excessive log file growth?

Answer: The database is in full recovery mode, but no log backups are performed.

Detailed Demonstration Steps

Demonstration 2A: Logs and Full Recovery

Detailed demonstration steps

1. Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
2. In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_05_PRJ\10775A_05_PRJ.ssmssln** and click **Open**.
3. From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
4. Open the **21 – Demonstration 2A.sql** script file.
5. Follow the instructions contained within the comments of the script file.

Lesson 3

Planning a SQL Server Backup Strategy

Contents:

Question and Answers

Overview of Microsoft SQL Server Backup Types

Question: What type of database would benefit from partial backups?

Answer: Very large databases with read-only filegroups.

Full Database Backup Strategies

Question: Might a small database be a good candidate for a full database backup strategy?

Answer: Perhaps. But the database size isn't the biggest issue. While small databases can be backed up more frequently, the potential data loss is the most important consideration.

Transaction Log Backup Strategies

Question: On the slide, which transactions would be contained in the first log backup on Monday morning?

Answer: Transactions from the completion of the backup on early Monday morning until the first log backup.

Differential Backup Strategies

Question: How could you estimate the size of a differential backup?

Answer: You would need to estimate the proportion of the database that would be modified by the time the differential backup was taken and apply that proportion to the size of the used pages in the database.

Discussion: Meeting Business Recovery Requirements

Question: Imagine that you need to create a backup strategy for an online store front. Before you could design the strategy, what questions would you need to ask?

Answer: You would need to know at least the following:

1. Recovery time objective
2. Recovery point objective
3. Size of the used pages in the database
4. Rate at which data pages within the database change
5. Speed at which backups can be taken
6. Speed at which backups can be restored

Module Reviews and Takeaways

Review questions

Question: What are the unique features of transaction log restores?

Answer: Point in time recovery and the ability to restore up to the point of failure if only data files are corrupt.

Question: When might a full database backup strategy be adequate?

Answer: If it is sufficient to restore the database to the points of full database backup only, in case of a disaster.

Question: What might prevent transaction log truncation?

Answer: Long running transactions and missing transaction log backups (or other SQL Server features such as mirroring and replication but out of scope)

Best Practices

1. Plan your backup strategy carefully.
2. Plan the backup strategy in conjunction with the business needs.
3. Choose the appropriate database recovery model.
4. Plan your transaction log size based on the transaction log backup frequency.
5. Consider differential backups to speed up recovery.

Lab Review Questions and Answers

Question: Can transaction log backups be performed if a database is configured for simple recovery model?

Answer: No

Question: Can transaction log backups be performed if a database is configured for bulk-logged recovery model?

Answer: Yes

Module 6

Backup of SQL Server 2012 Databases

Contents:

Lesson 1

Backing up Databases and Transaction Logs

Contents:

Question and Answers

Performing a Full Database Backup

Question: What happens when you do not specify either INIT or NOINIT and a backup already exists on the backup device?

Answer: The backup will be appended, as NOINIT is the default option.

Working with Backup Sets

Question: What advantage could striping backups to more than one backup device on a disk provide?

Answer: Performance.

Using Backup Compression

Question: Why would both backup and restore time generally decrease when backup compression is used?

Answer: Because backups and restores are heavily dependent on IO, which can get dramatically reduced.

Performing Differential Backups

Question: Does a differential backup truncate the transaction log?

Answer: No, neither the full database backup, nor the differential backup has any influence on the transaction log. Only transaction log backups, truncate the transaction log.

Detailed Demonstration Steps

Demonstration 1A: Backing up Databases

Detailed demonstration steps

1. Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
2. In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_06_PRJ\10775A_06_PRJ.ssmssln** and click **Open**.
3. From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
4. Open the **11 – Demonstration 1A.sql** script file.
5. Follow the instructions contained within the comments of the script file.

Lesson 2

Managing Database Backups

Contents:

Question and Answers

Options for Ensuring Backup Integrity

Question: Can you guarantee that a database could be recovered, if a backup of the database can be verified?

Answer: No, verifying a backup does not and cannot verify whether the structure of the data contained within the backup set is correct.

Viewing Backup Information

Question: In what situations would SQL Server not have complete information on the backups of a database stored in msdb?

Answer: If the database was backed up on a different instance, or when the msdb was rebuilt or restored to a earlier point in time because of a failure.

Detailed Demonstration Steps

Demonstration 2A: Viewing Backup History

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_06_PRJ\10775A_06_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
2. Open the **21 – Demonstration 2A.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Lesson 3

Working with Backup Options

Contents:

Question and Answers

Copy-only Backups

Question: Can you suggest a scenario where you might use a Copy-only backup?

Answer: Taking a copy of a production database to be restored in a staging or test environment.

Tail-log Backups

Question: What is the biggest advantage of being able to perform tail-log backups even when data files are damaged?

Answer: The database can be fully recovered, without loosing any data.

Detailed Demonstration Steps

Demonstration 3A: Tail-log Backup

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_06_PRJ\10775A_06_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
2. Open the **31 – Demonstration 3A.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Module Reviews and Takeaways

Review questions

Question: Which backup types can be performed in simple recovery model?

Answer: Full database and differential backups.

Question: How can backup information be read?

Answer: It can be retrieved through the backup history in the msdb database and through explicitly accessing the backup devices with T-SQL statements

Best Practices

1. Consider using CHECKSUM to create a checksum over your backup files.
2. Use backup compression to increase backup and restore performance and safe storage space.
3. Consider mirroring your backups to increase safety.
4. Check if differential backup can speed up your restore process in full recovery mode.
5. Use COPY_ONLY for out of sequence backups.

Lab Review Questions and Answers

Question: What must be performed before you can create a differential backup of a database?

Answer: At least one full database backup must have been performed.

Question: How does a copy only backup differ from a full database backup?

Answer: A copy only backup does not affect the sequence of other backups. For example, a differential backup performed after a copy backup will still contain all data changes since the last full backup.

Module 7

Restoring SQL Server 2012 Databases

Contents:

Lesson 1

Understanding the Restore Process

Contents:

Question and Answers

Discussion: Determining Required Backups to Restore

Question: If a failure occurs at Thursday at 10:30AM, what is the restore process that should be undertaken?

Answer: The restore process above would require:

1. Attempt to create a tail-log backup
2. Restore the full database from Saturday night.
3. Restore the differential database from Tuesday night.
4. Restore all log backups from during the day Wednesday (9am, 10am, 11am, 12pm, 1pm, 2pm, 3pm, 4pm, 5pm, 6pm)
5. Restore the 9am and 10am log backups from Thursday.
6. Restore the tail-log backup (if it was successful)

Lesson 2

Restoring Databases

Contents:

Question and Answers

Phases of the Restore Process

Question: Why does SQL Server need to redo and undo transactions when only restoring a full database backup?

Answer: The full database backup is a online operation, which means that transactions can occur during the backup. Therefore the data and index pages stored on the backup device can be from different points in time and versions. To restore the database to a consistent state SQL Server needs to apply the transaction log entries saved during the full database backup to recover the database to a transactional consistent state. Which means that all transaction that committed before the recovery point are present and all uncommitted transactions are undone. The recovery point for full database backups is the end of the backup.

WITH RECOVERY Option

Question: Why is it not possible to restore additional backups to a recovered database?

Answer: Because recovering the database rolls back transactions that might be continued in the next restore, which breaks the log chain.

Restoring a Transaction Log

Question: Why is it faster to restore differential and log backups instead of restoring all log backups since the last full database backup?

Answer: Because the differential backup includes the net effect of all changes recorded in the sequence of [potentially] many transaction log backups.

WITH STANDBY Option

Question: What would be a reason to provide read-only access to a database?

Answer: Reporting that doesn't has to be just in time, source for data warehouse loads,…

Question: What would be a limitation of the WITH STANDBY option when used to permit reporting on the second standby database in a log shipping environment?

Answer: Reporting users cannot be connected to the database during each restore operation.

Detailed Demonstration Steps

Demonstration 2A: Restoring Databases

Detailed demonstration steps

1. Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
2. In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_07_PRJ\10775A_07_PRJ.ssmssln** and click **Open**.
3. From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer. Note: The setup script for this module is intended to throw an error regarding missing files this is normal.
4. Open the **21 – Demonstration 2A.sql** script file.
5. Follow the instructions contained within the comments of the script file.

Lesson 3

Working with Point-in-time Recovery

Contents:

Question and Answers

Overview of Point-in-time Recovery

Question: What is the biggest advantage of being able to perform tail-log backups even when data files are damaged?

Answer: WITH STANDBY provides the feature to inspect the data during the restore process

STOPAT Option

Question: Why might you need to recover a database to a specific point in time?

Answer: If data was deleted through a software failure or a user error.

STOPATMARK Option

Question: Why might STOPAT not be a good choice for synchronizing the restore of several databases and that STOPATMARK might be preferred?

Answer: Because the time on the different instances might be out of sync.

Detailed Demonstration Steps

Demonstration 3A: Using STOPATMARK

Detailed demonstration steps

1. If Demonstration 2A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_07_PRJ\10775A_07_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer. Note: The setup script for this module is intended to throw an error regarding missing files this is normal.
2. Open and execute the **31 – Demonstration 3A.sql** script file from within Solution Explorer.
3. Follow the instructions contained within the comments of the script file

Lesson 4

Restoring System Databases and Individual Files

Contents:

Detailed Demonstration Steps

Demonstration 4A: Restoring a File

Detailed demonstration steps

1. If Demonstration 2A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_07_PRJ\10775A_07_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer. Note: The setup script for this module is intended to throw an error regarding missing files this is normal.
2. Open and execute the **41 – Demonstration 4A.sql** script file from within Solution Explorer.
3. Follow the instructions contained within the comments of the script file

Module Reviews and Takeaways

Review questions

Question: What are the three phases of the restore process?

Answer: Phases of a restore include the data copy phase, the redo phase and the undo phase. The data copy phase involves copying all data, log and index pages from the backup media. The redo phase applies the transactions to the data copied from the backup to be rolled forward to the recovery point. The undo phase rolls back any uncommitted transactions and makes the database available to users. After the rollback phase, subsequent backups cannot be restored.

Question: What is always performed before a database starts up and goes ONLINE?

Answer: A recovery of the database.

Best Practices related to a particular technology area in this module

1. Don't forget to backup the tail of the log before starting a restore sequence.
2. Use differential restore to speed up the restore process if available.
3. Use file level restore to speed up restores when not all database files are corrupt.
4. Perform regular database backups of master, msdb and model system databases.
5. Create a disaster recovery plan for your SQL Server and test restoring databases regularly.

Lab Review Questions and Answers

Question: Why does STANDBY mode require an operating system file?

Answer: To hold details of transactions that were undone during the recovery phase, so that they can be re-added to the log before another log restore operation is performed.

Question: If the last restore on a database was performed WITH NORECOVERY and no further transaction logs are available, how can the database be brought online?

Answer: RESTORE LOG databasename WITH RECOVERY;

Module 8

Importing and Exporting Data

Contents:

Lesson 1

Transferring Data To/From SQL Server

Contents:

Question and Answers

Overview of Data Transfer

Question: What other types of aggregation might need to be performed on data during the transformation phase?

Answer: Counting the rows that have been processed.

Available Tools for Data Transfer

Question: When would you choose SSIS over bcp?

Answer: When a large amount of rows need to be imported or transferred and no transformation needs to be performed.

Improving the Performance of Data Transfers

Question: What would the main problem with the transaction log be, if full logging occurs during a bulk-import operation?

Answer: The log file can fill up or grow significantly, increasing the transaction log backup size, slowing down performance, or cause errors if the file cannot be expanded and fills up.

Disabling & Enabling Constraints

Question: Why do referencing foreign key constraints get disabled when the referenced PRIMAY KEY or UNIQUE constraints get disabled?

Answer: Because they are depending on these constraints and could no longer be checked efficiently.

Detailed Demonstration Steps

Demonstration 1A: Disabling & Enabling Constraints

Detailed demonstration steps

1. Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
2. In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_08_PRJ\10775A_08_PRJ.ssmssln** and click **Open**.
3. From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
4. Open the **11 – Demonstration 1A.sql** script file.
5. Follow the instructions contained within the comments of the script file.

Lesson 2

Importing & Exporting Table Data

Contents:

Question and Answers

Overview of SQL Server Integration Services

Question: When it will useful to use SSIS instead of other data transfer options?

Answer: When complex transformations or flows need to be developed.

SQL Server Import/Export Wizard

Question: If additional transformations are needed above what is provided with the Import/Export Wizard, how could these be created?

Answer: Create a package using the Import/export wizard and edit it using BIDS.

Detailed Demonstration Steps

Demonstration 2A: Working with SSIS

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, open the **10775A_08_PRJ SQL** Server script project within SQL Server Management Studio.
   - Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
2. Open the 21 – Demonstration 2A.sql script file.
3. Follow the instructions contained within the comments of the script file.

Demonstration 2B: Using the Import/Export Wizard

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_08_PRJ\10775A_08_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
2. Open the **22 – Demonstration 2B.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Lesson 3

Inserting Data in Bulk

Contents:

Question and Answers

bcp Utility

Question: How could you improve the import speed of a bcp operation?

Answer: By using minimal logging, which will be used, if all requirement discussed before are met.

BULK INSERT Statement

Question: How does the BULK INSERT statement differ from bcp?

Answer: BULK INSERT runs in the process of SQL Server, can omit constraint checking and trigger firing and can be part of a user-defined transaction.

Demonstration 3B: Working with BULK INSERT

Question: Why does the first message show 199 and messages after that show 200?

Answer: The first batch contained the header row which was skipped.

OPENROWSET Function

Question: When will it make sense to use OPENROWSET instead of bcp or BULK INSERT?

Answer: When the data must be filtered before inserted into a table.

Detailed Demonstration Steps

Demonstration 3A: Working with bcp

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_08_PRJ\10775A_08_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
2. Open the **31 – Demonstration 3A.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Demonstration 3B: Working with BULK INSERT

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_08_PRJ\10775A_08_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
2. Open the **32 – Demonstration 3B.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Demonstration 3C: Working with OPENROWSET

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_08_PRJ\10775A_08_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
2. Open the **33 – Demonstration 3C.sql** script file.

3. Follow the instructions contained within the comments of the script file.

Module Reviews and Takeaways

Review questions

Question: When would you use SSIS instead of other data transfer utilities?

Answer: When complex transformations are needed.

Question: Why are minimally logged operations faster than fully logged operations?

Answer: Because less data has to written to the transaction log files.

Best Practices related to a particular technology area in this module

1. Choose the right tool for bulk-imports.
2. Use SSIS for complex transformations.
3. Use bcp or BULK INSERT for fast imports and exports.
4. Use OPENROWSET when data needs to be filtered before it gets inserted.
5. Try to achieve minimal logging to speed up data import.

Lab Review Questions and Answers

Question: What kind of information needs to be present in a format file?

Answer: The format file includes information to map columns and provide column information such as data type. The format file needs to contain correct column or record information or the command will fail.

Question: Which tool or command should you use to read an entire XML document into a column in a SQL Server table?

Answer: The BULK option in the OPENROWSET command.

Module 9

Authenticating and Authorizing Users

Contents:

Lesson 1

Authenticating Connections to SQL Server

Contents:

Question and Answers

Overview of SQL Server Security

Question: Apart from Windows users, what other types of users might want to connect to SQL Server?

Answer: Users of applications that were written using other technologies or users from non-trusted domains.

Managing Windows Logins

Question: Why would you create logins based on groups in preference to logins based on users?

Answer: To minimize administration overhead. Also, for separation of roles while implementing security. For example, a DBA should not care whether someone is a salesperson or not.

Managing SQL Server Logins and Policies

Question: Can you suggest a type of account policy that Windows provides?

Answer: Password complexity, password ageing, password history, etc.

Detailed Demonstration Steps

Demonstration 1A: Authenticating Logons and Logon Tokens

Detailed demonstration steps

1. Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
2. In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_09_PRJ\10775A_09_PRJ.ssmssln** and click **Open**.
3. From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
4. Open the **11 – Demonstration 1A.sql** script file.
5. Follow the instructions contained within the comments of the script file.

Lesson 2

Authorizing Logins to Access Databases

Contents:

Question and Answers

Authorization Overview

Question: Would you imagine that a login is a principal or a securable?

Answer: It is both. It can be assigned permissions to resources and other principals can be assigned permissions on the login, such as the ALTER permission.

Managing dbo and guest Access

Question: What is the guest user useful for?

Answer: Providing general access to specified objects to all logins on a SQL Server, without the need to create individual database users.

Detailed Demonstration Steps

Demonstration 2A: Authorizing Logins and User Tokens

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_09_PRJ\10775A_09_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
   - Open and execute the **11 – Demonstration 1A.sql** script file from within Solution Explorer.
2. Open the **21 – Demonstration 2A.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Demonstration 2B: Configuring Users with Passwords

Detailed demonstration steps

1. If Demonstration 2A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_09_PRJ\10775A_09_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
   - Open and execute the **21 – Demonstration 2A.sql** script file from within Solution Explorer.
2. Open the **22 – Demonstration 2B.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Lesson 3

Authorization Across Servers

Contents:

Question and Answers

Typical "Double-Hop" Problem

Question: If you have seen this problem with a web server, what was the user account that often appears to be connecting to SQL Server instead of the user?

Answer: Network Service

Detailed Demonstration Steps

Demonstration 3A: Working with Mismatched SIDs

Detailed demonstration steps

1. If Demonstration 1A or 2A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server** 2012, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_09_PRJ\10775A_09_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the script files **00 – Setup.sql**, **11 – Demonstration 1A.sql** , and **21 – Demonstration 2A.sql** from within Solution Explorer.
2. Open the **31 – Demonstration 3A.sql** script file and follow the instructions contained within the comments of the script file.

Module Reviews and Takeaways

Review questions

Question: How does SQL Server take advantage of Windows password Policy?

Answer: When it is running on Windows Server 2003 or later, SQL Server can use Windows password policy mechanisms.

Question: What account policy is applied on Windows XP?

Answer: Only password complexity rules are applied.

Best Practices

1. Minimize the number of SQL Server logins.
2. Ensure that expiry dates are applied to logins that are created for temporary purposes.
3. Disable logins rather than dropping them if there is any chance that they will be needed again.
4. Configure Kerberos delegation when a Windows user identity needs to be passed between systems.

Lab Review Questions and Answers

Question: What is a common scenario that requires account policy to be disabled for a SQL Server login?

Answer: A login for an application that cannot cope with password changes.

Question: What sort of login needs to be created for users in a Windows domain if that domain is not trusted by the domain that the SQL Server is part of?

Answer: A SQL Server login.

Module 10

Assigning Server and Database Roles

Contents:

Lesson 1

Working with Server Roles

Contents:

Question and Answers

Overview of Fixed Server Roles

Question: Why would the securityadmin role be powerful?

Answer: Because it could be used to set up a user and grant it high level permissions.

Detailed Demonstration Steps

Demonstration 1A: Assigning Server Roles

Detailed demonstration steps

1. Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
2. In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_10_PRJ\10775A_10_PRJ.ssmssln** and click **Open**.
3. From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
4. Open the **11 – Demonstration 1A.sql** script file.
5. Follow the instructions contained within the comments of the script file.

Lesson 2

Working with Fixed Database Roles

Contents:

Question and Answers

Assigning Users to Roles

Question: Can you think of an example of a command that could be executed by a member of the db_ddladmin role?

Answer: CREATE TABLE.

Detailed Demonstration Steps

Demonstration 2A: Managing Roles and Users

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_10_PRJ\10775A_10_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
   - Open and execute the **11 – Demonstration 1A.sql** script file from within Solution Explorer.
2. Open the **21 – Demonstration 2A.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Lesson 3

Creating User-defined Database Roles

Contents:

Detailed Demonstration Steps

Demonstration 3A: Working with User-defined Database Roles

Detailed demonstration steps

1. If Demonstration 1A or 2A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_10_PRJ\10775A_10_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the script files **00 – Setup.sql**, **11 – Demonstration 1A.sql** , and **21 – Demonstration 2A.sql** from within Solution Explor**er**.
2. Open the **31 – Demonstration 3A.sql** script file.
3. Follow the instructions contained within the comments of the script file to execute each T-SQL batch contained in the file.

Demonstration 3B: Working with Application Roles

Detailed demonstration steps

1. If Demonstration 1A, 2A or 3A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_10_PRJ\10775A_10_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the script files **00 – Setup.sql**, **11 – Demonstration 1A.sql** , **21 – Demonstration 2A.sql**, and **31 – Demonstration 3A.sql** from within Solution Explorer.
2. Open the **32 – Demonstration 3B.sql** script file.
3. Follow the instructions contained within the comments of the script file to execute each T-SQL batch contained in the file.

Module Reviews and Takeaways

Review questions

Question: Is it possible to create new database roles in SQL Server 2012?

Answer: Yes.

Question: Which function allows you to determine in T-SQL code whether or not a user is a member of a Windows group?

Answer: IS_MEMBER.

Best Practices

Avoid granting more permissions than are necessary. It is very common to see SQL Server systems where excessive permissions have been granted. Often the installers for applications will assume the need for much higher level permissions than should be necessary. Users should push back on vendors who do this. Even better, make appropriate security and permissions configuration a criterion for vendors to meet.

Lab Review Questions and Answers

Question: What is the biggest challenge when assigning permissions to users?

Answer: Avoiding excessive permission grants.

Question: Why do users often get granted more permissions than they need to do their work?

Answer: Either existing permissions are not fine-grained enough or users are aiming for ease of administration to the detriment of security.

Module 11

Authorizing Users to Access Resources

Contents:

Lesson 1

Authorizing User Access to Objects

Contents:

Question and Answers

What Are Securables?

Question: Can you suggest a reason why a Login is a securable? What types of permissions would be needed on a Login?

Answer: The ability to ALTER a login is needed. For example, a password might need to be reset on a SQL Server Login.

GRANT, REVOKE, DENY

Question: If a user cannot perform an action without permission, why is there any need to DENY a permission?

Answer: Because users may inherit permissions from groups they are members of.

Securing Tables and Views

Question: Why would there be a need for a permission to refer a table in a foreign key reference?

Answer: Because the table cannot be dropped while a foreign key reference is in place. If no permission was needed, other users could stop you from dropping your own table by setting a reference to it. Also, via a brute force dictionary attack, it might be possible to work out which values exist in a table that you cannot access.

Detailed Demonstration Steps

Demonstration 1A: Authorizing User Access to Objects

Detailed demonstration steps

1. Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
2. In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_11_PRJ\10775A_11_PRJ.ssmssln** and click **Open**.
3. From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
4. Open the **11 – Demonstration 1A.sql** script file.
5. Follow the instructions contained within the comments of the script file.

Lesson 2

Authorizing Users to Execute Code

Contents:

Question and Answers

Securing Managed Code

Question: Which permission set should be rarely allowed?

Answer: UNSAFE

Detailed Demonstration Steps

Demonstration 2A: Authorizing Users to Execute Code

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_11_PRJ\10775A_11_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
2. Open the **21 – Demonstration 2A.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Lesson 3

Configuring Permissions at the Schema Level

Contents:

Question and Answers

Granting Permissions at the Schema Level

Question: Why would granting permissions at the schema level be easier to manage?

Answer: Far fewer permissions would need to be managed.

Demonstration 3A: Configuring Permissions at the Schema Level

Question: The user has EXECUTE at the schema level and DENY at the procedure level. Should execution be permitted?

Answer: No.

Detailed Demonstration Steps

Demonstration 3A: Configuring Permissions at the Schema Level

Detailed demonstration steps

1. If Demonstration 1A or 2A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_11_PRJ\10775A_11_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** and **21 – Demonstration 2A.sql** script files from within Solution Explorer.
2. Open the **31 – Demonstration 3A.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Module Reviews and Takeaways

Review questions

Question: What permission needs to be assigned to a function before it can be used in a CHECK constraint?

Answer: REFERENCES.

Question: What permission should be assigned to a schema to allow a user to read the data in all the tables, views and table-valued functions?

Answer: SELECT.

Best Practices

1. Always assign the least possible privileges that users need.
2. Test code as a standard user instead of testing as an administrator.
3. Use EXECUTE AS and REVERT for quick testing of user permissions.

Lab Review Questions and Answers

Question: What makes fixed database roles of limited usefulness for most practical security architectures?

Answer: The permissions are not granular.

Question: When should permissions be assigned directly to a user?

Answer: When group membership is not appropriate. (The user needs different permissions to other members of the groups that the user is a member of).

Module 12

Auditing SQL Server Environments

Contents:

Lesson 1

Options for Auditing Data Access in SQL Server

Contents:

Question and Answers

Common Criteria Audit Option

Question: Why is there a need to make a change for GRANT as the column-level overriding DENY at the table-level?

Answer: In the previous module, it was noted that a column GRANT permission overrides a table DENY permission, and that this behavior was an anomaly maintained for backward compatibility. Enabling the common criteria compliance enabled option, changes this behavior.

Demonstration 1A: Using DML Triggers for Auditing

Question: Can DML triggers be used to audit the reading of data in a table?

Answer: No, there are no SELECT triggers.

Detailed Demonstration Steps

Demonstration 1A: Using DML Triggers for Auditing

Detailed demonstration steps

1. Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
2. In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_12_PRJ\10775A_12_PRJ.ssmssln** and click **Open**.
3. From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
4. Open the **11 – Demonstration 1A.sql** script file.
5. Follow the instructions contained within the comments of the script file.

Lesson 2

Implementing SQL Server Audit

Contents:

Question and Answers

Audit Actions and Action Groups

Question: Why would no option exist for disabling the auditing of audit changes?

Answer: This avoids situations where an administrator could disable an audit while performing a covert action.

Defining Audit Targets

Question: Why would many SQL Server DBAs have difficulty working with audit entries in the Windows security event log?

Answer: Many SQL Server administrators would not have access to this log and could not see the results of their audit. Note that this might be a desirable outcome.

Creating Audits

Question: Why is it recommended to select the option to shut down server on audit failure?

Answer: To avoid actions occurring without being audited.

Creating Server Audit Specifications

Question: Why would enabling logging of failed logins have potential risks to availability?

Answer: It opens the possibility of a denial of service (DOS) attack. A server could be stopped because of a large number of login attempts from an attacker.

Demonstration 2A: Using SQL Server Audit

Question: What are the three possible event targets for SQL Server Audit?

Answer: File, Windows Application Log, Windows Security Log.

Detailed Demonstration Steps

Demonstration 2A: Using SQL Server Audit

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_12_PRJ\10775A_12_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
2. Open the **21 – Demonstration 2A.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Lesson 3

Managing SQL Server Audit

Contents:

Question and Answers

Potential SQL Server Audit Issues

Question: Why would audits be identified by a GUID as well as a name?

Answer: Because databases could be moved between servers and the same name could exist on multiple servers.

Demonstration 3A: Viewing the Output of a File-based Audit

Question: Why are there two entries in the audit log?

Answer: Because changes to the auditing are also always logged.

Detailed Demonstration Steps

Demonstration 3A: Viewing the Output of a File-based Audit

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_12_PRJ\10775A_12_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
2. Open the **31 – Demonstration 3A.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Module Reviews and Takeaways

Review questions

Question: What are the three targets for SQL Server audits?

Answer: Files, application log and security log.

Question: When common criteria compliance is enabled in SQL Server, what changes about column-level permissions?

Answer: Column-level permission grants no longer override a table-level deny.

Question: You may wish to audit actions by a DBA. How would you know if the DBA stopped the audit while performing covert actions?

Answer: Changes to the audit status are logged.

Best Practices

1. Choose the option to shut down SQL Server on audit failure. There is usually no point in setting up auditing and then having situations where events can occur but are not audited. This is particularly important in higher-security environments.
2. Make sure that file audits are placed on drives with large amounts of free disk space and make sure that the available disk space is monitored on a regular basis.

Lab Review Questions and Answers

Question: What is the advantage of auditing at the schema level rather than the table level?

Answer: It avoids the need for many audit specification entries.

Question: What is the disadvantage of auditing at the schema level rather than the table level?

Answer: It may lead to auditing too many objects.

Module 13

Automating SQL Server 2012 Management

Contents:

Lesson 1

Automating SQL Server Management

Contents:

Question and Answers

Benefits of Automating SQL Server Management

Question: What tasks need to be automated on the systems in your organization?

Answer: The answers may vary based on the experience and systems of the audience but would at least typically involve the automation of backups or the use of database maintenance plans.

Available Options for Automating SQL Server Management

Question: Can you think of events that might occur on a SQL Server system that you would want to be alerted about?

Answer: The answers may vary based on the experience and systems of the audience but examples would be disk errors or database corruption.

Overview of SQL Server Agent

Question: Why should SQL Server Agent service be always configured to start up automatically?

Answer: Because no jobs would run and no alerts would fire if it is stopped.

Detailed Demonstration Steps

Demonstration 1A: Working with SQL Server Agent

Detailed demonstration steps

1. Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
2. In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_13_PRJ\10775A_13_PRJ.ssmssln** and click **Open**.
3. From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
4. Open the **11 – Demonstration 1A.sql** script file.
5. Follow the instructions contained within the comments of the script file.

Lesson 2

Working with SQL Server Agent

Contents:

Question and Answers

Defining Jobs, Job Step Types and Job Categories

Question: Can you think of a use for job categories?

Answer: For easier management and monitoring, if there are many jobs defined on the system. You may also wish to script all jobs in a certain category.

Creating Job Steps

Question: Which operations should not be grouped together in a job?

Answer: Tasks that are independent from each other, or tasks that should run on different schedules.

Scheduling Jobs for Execution

Question: What could be changed if the database in the example above does not need hourly backups during weekend?

Answer: Add a third schedule for the weekend and change the two schedules to run only from Monday to Friday.

Scripting Jobs

Question: In which scenarios might it be useful to script more than one job at a time?

Answer: When all jobs need to be transferred to a new system.

Detailed Demonstration Steps

Demonstration 2A: Scripting Jobs

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_13_PRJ\10775A_13_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
2. Open the **21 – Demonstration 2A.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Lesson 3

Managing SQL Server Agent Jobs

Contents:

Question and Answers

Viewing Job History

Question: How would a corrupt msdb database affect SQL Server Agent?

Answer: SQL Server Agent cannot start since all of its configuration is stored there.

Querying SQL Server Agent-related System Tables and Views

Question: Why would querying the job history tables be important?

Answer: You could implement a system that checks for failed jobs on all SQL Server instances in the organization.

Troubleshooting Failed Jobs

Question: When migrating a job from test to production, what else would be required apart from moving the job itself?

Answer: Making sure that all dependent objects are also transferred and that the security is setup correctly.

Detailed Demonstration Steps

Demonstration 3A: Viewing Job History and Resolving Failed Jobs

Detailed demonstration steps

1. If Demonstration 2A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_13_PRJ\10775A_13_PRJ.ssmssln** and click **Open**.
   - Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
   - From the **View** menu, click **Solution Explorer**. Open the script file **21 – Demonstration 2A.sql** and follow the steps in the script file.
2. Open the **31 – Demonstration 3A.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Module Reviews and Takeaways

Review questions

Question: What functions do you currently perform manually that could be placed in a job?

Answer: Answers will vary, but they will probably include data transfers, pre-calculating data for reports, archiving backup files,….

Question: How long is the job history kept in msdb?

Answer: By default the limit is 1000 rows in total and 100 per job, but that value should be customized as needed.

Best Practices

1. Use SQL Agent jobs to schedule routine jobs.
2. Create custom categories to group your jobs.
3. Script your jobs for remote deployment.
4. Use job history to review job and job step outcomes.
5. Use Job Activity Monitor to real time monitor jobs.

Lab Review Questions and Answers

Question: How do you configure SQL Server Agent to notify you that a particular job has failed?

Answer: Create an operator and configure a notification in the job.

Question: Can one job include different types of job steps?

Answer: Yes

Module 14

Configuring Security for SQL Server Agent

Contents:

Lesson 1

Understanding SQL Server Agent Security

Contents:

Question and Answers

Overview of SQL Server Agent Security

Question: What would cause a SQL Server Agent service account to need sysadmin privileges on the SQL Server instance?

Answer: One example would be to read and write configuration.

SQL Server Agent Roles

Question: Why should you be careful giving access to non sysadmin fixed roles members?

Answer: Because they can gain additional permissions, through the permissions of the SQL Server Agent and proxy accounts.

Discussion: SQL Server Agent Job Dependencies

Question: What SQL Server resources would SQL Server Agent Jobs potentially depend upon?

Answer: Answers will vary but should include databases, tables, views, stored procedures, functions.

Question: What resources outside of SQL Server might SQL Server Agent jobs depend upon?

Answer: Answers will vary but might include local paths and shares, remote SQL Server systems, Analysis Services, SSIS Packages, network services, local processes.

Question: What identity is needed for accessing the external resources?

Answer: Whatever Windows identity is needed for the resource. That can be a challenge for a SQL Server login.

Assigning Security Contexts to Agent Job Steps

Question: Why should a proxy account be used, even when the owner of the step is a member of the sysadmin fixed server role?

Answer: To minimize the permissions that need to be granted to a single job step execution account.

SQL Server Agent Security Troubleshooting

Question: What might be the cause of a job that runs perfectly well on a test system but then fails when run on a production system?

Answer: There are may reasons including a) It might be running as the wrong user b) It might be accessing local files or folders.

Detailed Demonstration Steps

Demonstration 1A: Assigning a Security Context to Job Steps

Detailed demonstration steps

1. Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
2. In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_14_PRJ\10775A_14_PRJ.ssmssln** and click **Open**.
3. From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
4. Open the **11 – Demonstration 1A.sql** script file.
5. Follow the instructions contained within the comments of the script file to execute each T-SQL batch contained in the file.

Lesson 2

Configuring Credentials

Contents:

Question and Answers

Overview of Credentials

Question: How does SQL Server accesses resources outside SQL Server, when the user is connected using a Windows login?

Answer: It impersonates the Windows User account of the user.

Managing Credentials

Question: What happens when the Windows user password that a credential maps to changes or expires?

Answer: The credential will stop working and the credential secret needs to be changed.

Detailed Demonstration Steps

Demonstration 2A: Configuring Credentials

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_14_PRJ\10775A_14_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
2. Open the **21 – Demonstration 2A.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Lesson 3

Configuring Proxy Accounts

Contents:

Question and Answers

Overview of Proxy Accounts

Question: When should Proxy Accounts be used?

Answer: Whenever SQL Server Agent service account default permissions aren’t enough or when users other than sysadmins need to use step types other than T-SQL.

Working with Built-in Proxy Accounts

Question: Why should Proxy Accounts not be assigned to all subsystems as a general rule?

Answer: Because it would enable the usage of the proxy for purposes other than those it was intended to be used for.

Managing Proxy Accounts

Question: Why would Credentials be stored in the master database instead of the msdb database?

Answer: Because they are SQL Server objects and SQL Server Agent isn't the only place that they can be used.

Detailed Demonstration Steps

Demonstration 3A: Configuring Proxy Accounts

Detailed demonstration steps

1. If Demonstrations 2A were not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_14_PRJ\10775A_14_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
   - Open the **21 – Demonstration 2A.sql** script file from within Solution Explorer and follow the instructions contained within the file.
2. Open the **31 – Demonstration 3A.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Module Reviews and Takeaways

Review questions

Question: What account types can be used to start SQL Server Agent service?

Answer: The built-in accounts Local Service and Network Service or a custom windows domain account can be used.

Question: What can credentials be used for?

Answer: To provide SQL Server logins access to external resources and to use them for SQL Server Agent proxies.

Best Practices related to a particular technology area in this module

1. Use a Windows domain user to start SQL Server Agent service account.
2. Use an account with least privileges.
3. Create Proxy Accounts with least permissions assigned for job execution.

Lab Review Questions and Answers

Question: What do you need to do when the password for a credential expires?

Answer: Change the password using ALTER CREDENTIAL.

Question: Can credentials use external encryption providers?

Answer: Yes

Module 15

Monitoring SQL Server 2012 with Alerts and Notifications

Contents:

Lesson 1

Configuring Database Mail

Contents:

Question and Answers

Overview of Database Mail

Question: Why must mail administrators be included in discussions, when planning a database mail configuration?

Answer: Because of security and to avoid spam, most SMTP servers are configured to disallow receiving SMTP mails or relaying them from other servers. Specific configuration of the Mail Server and/or authentication might be needed on the SMTP server.

Database Mail Profiles

Question: If a user has access to several profiles, which profile is used when no profile is specified?

Answer: The private default profile, that is defined for the user. If none is specified the default public profile.

Database Mail Security

Question: Why can't database mail be used with a remote SMTP server when using the Local Service account for the database engine?

Answer: Because the Local Service account is not allowed to access the network.

Detailed Demonstration Steps

Demonstration 1A: Configuring Database Mail

Detailed demonstration steps

1. Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
2. In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_15_PRJ\10775A_15_PRJ.ssmssln** and click **Open**.
3. From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
4. Open the **11 – Demonstration 1A.sql** script file.
5. Follow the instructions contained within the comments of the script file.

Lesson 2

Monitoring SQL Server Errors

Contents:

Question and Answers

What Is in an Error?

Question: In which language is an error raised?

Answer: In the language specified for the login. If the language is not available, the message is sent in English.

Error Severity

Question: In which of the error number ranges shown on the slide, would you expect to see a syntax error?

Answer: 11-16 as it can be corrected by the user, raised it. Actually it is level 15.

Detailed Demonstration Steps

Demonstration 2A: Cycling the Error Log

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_15_PRJ\10775A_15_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
2. Open the **21 – Demonstration 2A.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Lesson 3

Configuring Operators, Alerts and Notifications

Contents:

Question and Answers

Overview of SQL Server Alerts

Question: What events are you familiar with that should have a configured alert?

Answer: Answer may vary but should include high severity levels, transaction log and database full.

Create an Alert

Question: What type of alert would be needed to monitor free space in file the system?

Answer: WMI Alerts.

Configuring Alert Actions

Question: If notifications should be sent to a pager email address, what else should be configured?

Answer: A fail safe operator.

Troubleshooting Alerts and Notifications

Question: Why might an error message not be written to the application log?

Answer: The message is not marked to be logged in Application log. Use sp_altermessage to change.

Detailed Demonstration Steps

Demonstration 3A: Configuring SQL Server Agent Operators

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_15_PRJ\10775A_15_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
2. Open the **31 – Demonstration 3A.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Demonstration 3B: Configuring Alerts and Notifications

Detailed demonstration steps

1. If Demonstration 1A or 3A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_15_PRJ\10775A_15_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
   - Open the script file **11 – Demonstration 1A.sql** and follow the instructions in that file.
   - Open the script file **31 – Demonstration 3A.sql** and follow the instructions in that file.
2. Open the **32 – Demonstration 3B.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Module Reviews and Takeaways

Review questions

Question: What is an Operator in SQL Server Agent terminology?

Answer: A person or group that can be notified of an event.

Question: What is the lowest error severity that appears as an error message in SSMS?

Answer: 11

Best Practices

1. Use Database Mail and not SQL Mail.
2. Configure different profiles for different usage scenarios.
3. Provide limited access to the ability to send emails from the database engine.
4. Implement a retention policy for database mail log and mail auditing.
5. Create operators to send notifications about Jobs and Alerts.
6. Define Alerts for severe error messages.

Lab Review Questions and Answers

Question: SQL Server has Database Mail and SQL Mail. Which should you configure?

Answer: Database Mail. (SQL Mail is deprecated)

Question: Why is the option to use NET SEND for notifications not very useful?

Answer: The messenger service is mostly disabled on systems today. The popup messages are not likely to be received.

Module 16

Performing Ongoing Database Maintenance

Contents:

Lesson 1

Ensuring Database Integrity

Contents:

Question and Answers

Discussion: Ensuring Database Integrity

Question: What is database integrity?

Answer: Physical and logical integrity of the database. The pages are intact and linked correctly and the data in the pages is consistent.

Question: What techniques are you currently using to check and maintain database integrity?

Answer: Answers will vary but DBCC CHECKDB should be one of the options.

Overview of DBCC CHECKDB

Question: Why is it vital to run DBCC CHECKDB regularly?

Answer: Because it is the only way to ensure database integrity. Running it regularly prevents situation with corrupt data that cannot be recovered anymore, even with a backup as the corruption also exists on them.

DBCC CHECKDB Options

Question: Which DBCC CHECKDB option might be used on very large production systems?

Answer: PHYSICAL_ONLY as it covers most of the possible corruptions and then perform a full check less frequently.

DBCC CHECKDB Repair Options

Question: Why would it be preferable to restore a database rather than using REPAIR_ALLOW_DATA_LOSS?

Answer: Because no data loss occurs.

Detailed Demonstration Steps

Demonstration 1A: Using DBCC CHECKDB

Detailed demonstration steps

1. Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
2. In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_16_PRJ\10775A_16_PRJ.ssmssln** and click **Open**.
3. From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
4. Open the **11 – Demonstration 1A.sql** script file.
5. Follow the instructions contained within the comments of the script file.

Lesson 2

Maintaining Indexes

Contents:

Question and Answers

How Indexes Affect Performance

Question: When might a table scan be more efficient than using the index?

Answer: An example would be when all the data in a table needs to be accessed in no particular order.

Index Fragmentation

Question: Why does fragmentation affect performance?

Answer: If pages are only half full, twice as many pages need to be read to access the same amount of data.

FILLFACTOR and PAD_INDEX

Question: While you could avoid many page splits by setting a FILLFACTOR of 50, what would be the downside of doing this?

Answer: Reading the whole table would now need twice as many pages to be read. I/O is typically the biggest bottleneck in SQL Server systems today so this might be very counter-productive.

Question: When would a FILLFACTOR of 100 be useful?

Answer: Read-only data.

Question: What is the significance of applying a FILLFACTOR on a clustered index versus a non-clustered index?

Answer: FILLFACTOR on a clustered index is applied to the data pages, so it's really applying FILLFACTOR to a table. FILLFACTOR on a non-clustered index applies to pages of clustering keys, or row pointers if a heap.

Ongoing Maintenance of Indexes

Question: What is typically the best option to defragment big indexes and tables (clustered indexes)?

Answer: Reorganizing as it uses less resources.

Online Index Operations

Question: When would online index operations be most important?

Answer: When there are no available maintenance hours for the database and user access is needed for 24 hours a day.

Updating Statistics

Question: Why might you decide to update statistics out of hours instead of automatically?

Answer: That there is smaller chance that they get outdated during peak hours and need to be rebuild then.

Detailed Demonstration Steps

Demonstration 2A: Maintaining Indexes

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_16_PRJ\10775A_16_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
   - Open and execute the **11 – Demonstration 1A.sql** script file.
2. Open the **21 – Demonstration 2A.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Lesson 3

Automating Routine Database Maintenance

Contents:

Question and Answers

Overview of SQL Server Database Maintenance Plans

Question: What types of maintenance tasks should be automated?

Answer: Will vary, but will include backups, integrity checks, and index-related tasks.

Monitoring Database Maintenance Plans

Question: Are maintenance plan history records cleaned up automatically?

Answer: No a retention policy needs to be implemented as part of a maintenance plan.

Detailed Demonstration Steps

Demonstration 3A: Configuring a Database Maintenance Plan

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_16_PRJ\10775A_16_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
   - Open and execute the **11 – Demonstration 1A.sql** script file.
2. Open the **31 – Demonstration 3A.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Module Reviews and Takeaways

Review questions

Question: What regular tasks should be implemented for read only databases?

Answer: Backup and consistency checking. Updating statistics or rebuilding/reorganizing indexes is not possible on read-only databases and should be done before making the database read-only.

Question: What option should you consider using when running DBCC CHECKDB against large production databases?

Answer: PHYSICAL_ONLY for regular executions and perform full checks less regularly.

Best Practices

1. Run DBCC CHECKDB regularly.
2. Synchronize DBCC CHECKDB with your backup strategy.
3. Consider RESTORE before repairing if corruption occurs.
4. Defragment your indexes when necessary.
5. Update statistics on schedule, if you don’t want it to occur during normal operations.
6. Use Maintenance Plans to implement regular tasks.

Lab Review Questions and Answers

Question: If you need to perform additional options that are not provided in the database maintenance plan wizard, what options could you use?

Answer: Edit the plan in BIDS and add the extra options, or add scheduled tasks in SQL Server Agent.

Question: If you need to execute a maintenance plan with timing that cannot be accommodated by a single schedule, what can you do?

Answer: Add another schedule.

Module 17

Tracing Access to SQL Server 2012

Contents:

Lesson 1

Capturing Activity Using SQL Server® Profiler and Extended Events Profiler

Contents:

Question and Answers

Overview of SQL Server Profiler

Question: Where would the ability to replay a trace be useful?

Answer: There are several different scenarios, but commonly, load testing or testing that code still works before an upgrade.

Available Tracing Output Options

Question: What might be an advantage of saving events in a SQL Server table?

Answer: They can be easy analyzed using T-SQL.

Commonly Used Trace Events

Question: Why would events that are raised on completion of batches or statements often be more interesting than events that are raised when batches or statements start?

Answer: For performance tuning as the Completed events also include Resource Usage and Duration statistics.

Commonly Used Trace Columns

Question: What information would the TextData column return?

Answer: The answer depends upon the selected event, but for Batch and Statement events it returns the T-SQL code that was executed. For a deadlock graph, it returns the XML that describes the event.

Filtering Traces

Question: What filter would you use to locate long running batches or statements?

Answer: A filter on the Duration column.

Working with Trace Templates

Question: How do SQL Server Profiler templates help you trace activity?

Answer: Templates can be used to reduce the time to setup a trace, and can be easily moved to other SQL Servers.

Demonstration 1A: Capturing Activity Using SQL Server Profiler

Question: Why is there only one Batch Starting event and one Batch Completed event for the workload we ran?

Answer: Because all the statements are part of one batch.

Detailed Demonstration Steps

Demonstration 1A: Capturing Activity Using SQL Server Profiler

Detailed demonstration steps

1. Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
2. In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_17_PRJ\10775A_17_PRJ.ssmssln** and click **Open**.
3. From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
4. Open the **11 – Demonstration 1A.sql** script file.
5. Follow the instructions contained within the comments of the script file.

Demonstration 1B: Capturing Activity Using Extended Events Profiler

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_17_PRJ\10775A_17_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
2. Open the **12 – Demonstration 1B.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Lesson 2

Improving Performance with the Database Engine Tuning Advisor

Contents:

Question and Answers

Overview of Performance Tuning

Question: When would you know that performance tuning is complete?

Answer: It's not likely that you would ever know that. Performance tuning tends to be an ongoing process.

Available Options for Performance Tuning

Question: Which tools might be useful for real time monitoring?

Answer: Performance Monitor, Activity Monitor, SSMS Reports and Dynamic Management Objects.

Introduction to the Database Engine Tuning Advisor

Question: Why is it important to tune an entire workload rather than individual queries?

Answer: Because a single query might not be executed very often and have little impact on the overall server load. Also, changes to improve the performance of one query might impact the performance of other queries adversely.

Database Engine Tuning Advisor Options

Question: What is the disadvantage of limiting the analysis time?

Answer: Not all recommendations can be found.

Demonstration 2A: Using the Database Engine Tuning Advisor

Question: Should you immediately apply the recommendations made by DETA to your server?

Answer: No

Detailed Demonstration Steps

Demonstration 2A: Using the Database Engine Tuning Advisor

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_17_PRJ\10775A_17_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
2. Open the **21 – Demonstration 2A.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Lesson 3

Working with Tracing Options

Contents:

Question and Answers

SQL Trace vs. SQL Server Profiler

Question: Which option would have less impact on a traced system?

a) SQL Trace with output to a file

b) SQL Profiler with output to a table

Answer: a) SQL Trace with output to a file

Replaying Traces

Question: When might it be a good idea to test systems using the replay functionality?

Answer: When it is not possible to test the real application with a realistic workload.

Default Trace

Question: Should the default trace be kept enabled?

Answer: Yes. It may be needed by Product Support.

Combining Traces with Performance Monitor Logs

Question: What is the main advantage of using this feature?

Answer: That peak Performance Counter values can be directly correlated to SQL trace events.

Detailed Demonstration Steps

Demonstration 3A: Configuring SQL Trace

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_17_PRJ\10775A_17_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
2. Open the **31 – Demonstration 3A.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Demonstration 3B: Combining Traces with Performance Monitor Logs

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_17_PRJ\10775A_17_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
2. Open the **32 – Demonstration 3B.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Module Reviews and Takeaways

Review questions

Question: What is the main purpose of Database Engine Tuning Advisor?

Answer: To optimize indexes based on a workload.

Question: What can be used to test a workload after configuration changes?

Answer: The replay functionality of SQL Server Profiler.

Best Practices

1. Use SQL Server Profiler to perform short traces for debugging and other purposes.
2. Use SQL Trace for large and long running traces.
3. Use SQL Server Profiler to define traces and script them for SQL Trace.
4. Import trace data into a database table for advanced analysis.
5. Use Database Engine Tuning Advisor to analyze the database based on a workload rather than focusing on individual queries.

Lab Review Questions and Answers

Question: If you need to perform additional options that are not provided in the database maintenance plan wizard, what options could you use?

Answer: In situations where you need to minimize the impact on the system being traced.

Question: If you need to execute a maintenance plan with timing that cannot be accommodated by a single schedule, what can you do?

Answer: By filtering on database ID or database name. Note: that filtering on database ID would be more efficient than filtering on the name but less portable.

Module 18

Monitoring SQL Server 2012

Contents:

Lesson 1

Monitoring Activity

Contents:

Question and Answers

Overview of Dynamic Management Views and Functions

Question: Why would you want to use dynamic management views to view current activity?

Answer: Because dynamic management views can show current activity and health information that is not always available elsewhere.

Viewing Activity Using Dynamic Management Views

Question: What types of resources might SQL Server need to wait for?

Answer: There are more then 400 wait types, but the most common wait types are related to locks, memory, CPU, I/O.

Working with Activity Monitor in SQL Server® Management Studio

Question: Why is it important to monitor waits?

Answer: It is important to monitor waits because while waiting is necessary, excessive waits lead to performance problems.

Working with Performance Monitor

Question: Why is Performance Monitor useful when determining performance issues?

Answer: It can return a view of the state of the whole Windows system and not only the SQL Server process.

Working with SQL Server Counters

Question: Why might it be useful to query sys.dm_os_performance_counters to access SQL Server counters rather than using Performance Monitor?

Answer: When you want to store the counter values in a database.

Detailed Demonstration Steps

Demonstration 1A: Viewing Activity Using Dynamic Management Views

Detailed demonstration steps

1. Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
2. In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_18_PRJ\10775A_18_PRJ.ssmssln** and click **Open**.
3. From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
4. Open the **11 – Demonstration 1A.sql** script file.
5. Follow the instructions contained within the comments of the script file.

Demonstration 1B: Working with Activity Monitor in SQL Server Management Studio

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_18_PRJ\10775A_18_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
2. Open the **12 – Demonstration 1B.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Demonstration 1C: Working with Performance Monitor

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_18_PRJ\10775A_18_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
2. Open the **13 – Demonstration 1C.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Lesson 2

Capturing and Managing Performance Data

Contents:

Question and Answers

Overview of Data Collector

Question: Can Data Collector be used for real time monitoring?

Answer: No, the purpose of Data Collector is long time monitoring and analysis.

Designing a Data Collector Topology

Question: Is it possible to configure all of the data collector features on a single instance?

Answer: Yes it is possible but not recommended for Enterprise Environments.

Configuring Data Collector

Question: What might be interesting to include as a custom collection set?

Answer: Application run-time statistics or any other application specific metrics.

Data Collector Security

Question: If the SQL Server Agent service account does not have sufficient privileges to access the management data warehouse to upload the data, what configuration changes could you make to allow this?

Answer: An agent proxy that has a login on the remote system that is member of the mdw_writer role.

Monitoring Data Collector

Question: Why is it better to use the Data Collector logs than the data collector job history for troubleshooting Data Collector?

Answer: Because it provides much more detailed data

Detailed Demonstration Steps

Demonstration 2A: Configuring Data Collector

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_18_PRJ\10775A_18_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
2. Open the 21 – Demonstration 2A.sql script file.
3. Follow the instructions contained within the comments of the script file.

Lesson 3

Analyzing Collected Performance Data

Contents:

Question and Answers

Overview of Data Collector Reports

Question: What period would the Data Collector reports cover?

Answer: All periods where data collection has occurred up but limited by the retention periods that are configured.

Disk Usage Report

Question: What might be a good custom report that could be created based on disk usage data?

Answer: A report that shows the trend for every volume used on the system to predict storage need per volume.

Server Activity Report

Question: Why is it important that data collection also tracks the memory usage of other processes running on the system?

Answer: To be able to identify external memory pressure and the process responsible for it.

Query Statistics Report

Question: What is meant by the term "expensive queries"?

Answer: Long running queries, queries that use a lot of I/O, CPU or memory resources, but also small and fast queries that are executed quite often and use a lot of resources because of the number of executions.

Detailed Demonstration Steps

Demonstration 3A: Viewing the Disk Usage Report

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the **virtual machine**, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the **Connect to Server** window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_18_PRJ\10775A_18_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
   - Open and follow the instructions in the **21 – Demonstration 2A.sql** script file.
2. Open the **31 – Demonstration 3A.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Demonstration 3B: Viewing the Server Activity Report

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_18_PRJ\10775A_18_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
   - Open and follow the instructions in the **21 – Demonstration 2A.sql** script file.
2. Open the **32 – Demonstration 3B.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Demonstration 3C: Viewing the Query Statistics Report

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_18_PRJ\10775A_18_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.

- Open and follow the instructions in the **21 – Demonstration 2A.sql** script file.

2. Open the **33 – Demonstration 3C.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Module Reviews and Takeaways

Review questions

Question: Why is it better to have a central management data warehouse for data collection, than local installations?

Answer: To have a single point for performance analysis, but also to offload the storage from production systems.

Question: What are Dynamic Management Objects?

Answer: Dynamic Management Views and Functions that are virtual objects that provide access to state information of the SQL Server

Best Practices

1. Use Dynamic Management Objects to perform real-time monitoring and troubleshooting.
2. Use Activity Monitor for easy access to the most relevant information.
3. Use Performance Monitor to gather metrics for Windows and SQL Server.
4. Create a central Management Data Warehouse to hold historical performance information.
5. Set up data collection to gather performance data of your SQL Server Instances.

Lab Review Questions and Answers

Question: How can you locate long running expensive queries using the Data Collector reports?

Answer: Sort the queries by duration.

Question: When performance counters have multiple instances, how do you view the total for all instances?

Answer: By choosing the Total value from the list of instances.

Module 19

Managing Multiple Servers

Contents:

Lesson 1

Working with Multiple Servers

Contents:

Question and Answers

Overview of Central Management Servers

Question: What is the main advantage of using a central management server instead of standard registered servers in SSMS?

Answer: The registrations can be created and maintained centrally.

Executing Multi-server Queries

Question: What happens if the user has no permissions to execute a statement on one of the servers of a multi-server query?

Answer: The statement will be executed on all other servers and return an error on the one where the permission problem exists.

Detailed Demonstration Steps

Demonstration 1A: Executing Multi-server Queries

Detailed demonstration steps

1. Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
2. In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_19_PRJ\10775A_19_PRJ.ssmssln** and click **Open**.
3. From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
4. Open the **11 – Demonstration 1A.sql** script file.
5. Follow the instructions contained within the comments of the script file.

Lesson 2

Virtualizing SQL Server

Contents:

Question and Answers

Discussion: Advantages and Disadvantages of Virtualizing SQL Server

Question: Do you use virtualization of SQL Server in your environment?

Answer: Answers will vary depending upon the experience of students. Currently, only a small percentage of students are likely to say that they are using it in production environments.

Question: If you are using virtualization, why are you using it?

Answer: For most, it will be either to have multiple machines for testing environments or for consolidation of older servers.

Question: What are the main advantages provided by virtualization?

Answer: Consolidating many servers onto one platform. Ability to separate workloads onto different servers and tune server resources. Ability to roll back after testing. Additional high availability and migration options.

Question: What are the main concerns with virtualizing SQL Server?

Answer: The answer almost always is performance.

Overview of SQL Server Virtualization

Question: What advantage would Live Migration provide over other options such as SQL Server Failover Clustering?

Answer: Live migration maintains user connections during the move to the other server.

Common Virtualization Scenarios

Question: Why would virtualization be very useful when testing applications?

Answer: You can easily rollback the changes that were made.

Considerations for Virtualizing SQL Server

Question: What differences would exist between the needs of a virtualized SQL Server and a non-virtualized SQL Server in terms of I/O requirements?

Answer: No differences exist. Virtualized SQL Server systems have the same I/O requirements as non-virtualized servers.

Lesson 3

Deploying and Upgrading Data-tier Applications

Contents:

Question and Answers

Data-tier Application Overview

Question: What is a disadvantage of deploying upgrades via T-SQL scripts?

Answer: Error handling is difficult and often no overall database model exists without building a database from a seed script and applying all the upgrade scripts.

Deploying Data-tier Applications

Question: Why is it important to review a dacpac file before deployment?

Answer: To check for unwanted code, that might be contained within the dacpac file, especially when received from third party untrusted sources.

Upgrading Data-tier Applications

Question: What is the main advantage over .dacpac based upgrades compared to script-based upgrade?

Answer: The upgrade is either completed or it is not and the database is never left in an undefined state.

Extracting Data-tier Applications

Question: What is the main purpose of extracting data-tier applications?

Answer: To create a dacpac file from an existing database, to pass to developers to enable further development using data-tier applications.

Detailed Demonstration Steps

Demonstration 3A: Working with Data-tier Applications

Detailed demonstration steps

1. If Demonstration 1A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
   - In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_19_PRJ\10775A_19_PRJ.ssmssln** and click **Open**.
   - From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
2. Open the **31 – Demonstration 3A.sql** script file.
3. Follow the instructions contained within the comments of the script file.

Module Reviews and Takeaways

Review questions

Question: What must be considered, when executing multi-server queries?

Answer: That different permissions might apply on the different instances, or some servers might be unavailable.

Question: What is the purpose of Live Migration as part of Hyper-V?

Answer: To migrate a virtualized partition without interrupting operations.

Best Practices

1. Use Central Management Server to maintain a central configuration of registered servers and groups.
2. Use multi-server queries to run batches against several servers concurrently.
3. Consider virtualization for high availability, consolidation, better hardware utilization, and test environments.
4. Consider the use of data-tier application for departmental database applications.

Lab Review Questions and Answers

Question: At what stage is the server selection policy checked when deploying a data-tier application?

Answer: Before any changes are made.

Question: Can multi-server queries be used with servers that you need to connect to using SQL Server authentication?

Answer: No, you must connect using Windows logins.

Module 20

Troubleshooting Common SQL Server 2012 Administrative Issues

Contents:

Lesson 1

SQL Server Troubleshooting Methodology

Contents:

Question and Answers

Discussion: Characteristics of Good Troubleshooters

Question: What characteristics have you observed in people that you consider to be good troubleshooters?

Answer: Answers will vary but common characteristics are:

- Follows a repeatable and logical methodology
- Stays calm even in stressful situations
- Is able to continually subdivide problems to move towards a solution
- Knows about available tools and knows how to use them
- Ensures the problem really is resolved

Question: What characteristics do you notice in people that are poor troubleshooters?

Answer: Answers will vary but common characteristics are:

- Follows a haphazard approach that does not follow a logical path
- Becomes more illogical the more that stress is applied
- Makes assumptions that are not supportable
- Quickly decides upon a cause for problems, without justification, and then tries to justify the selection of the cause
- Assumes problems are resolved without justification

Applying a Troubleshooting Methodology

Question: How do you know that a problem is resolved?

Answer: When the user that reported the problem is satisfied that the problem is resolved.

Lesson 2

Resolving Service-related Issues

Contents:

Question and Answers

Troubleshooting Service-related Issues

Question: What should be reviewed first when a service-related issue happens with SQL Server?

Answer: The Windows and SQL Server logs.

SQL Server Error Log

Question: What is the problem with the instance startup in the example shown in the slide?

Answer: SQL Server cannot find the primary data file for the master database.

Windows Event Logs

Question: Which Windows log would logon failures for the SQL Server service appear in?

Answer: The Windows system log.

Detailed Demonstration Steps

Demonstration 2A: Troubleshooting Service-related Issues

Detailed demonstration steps

1. Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
2. In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_20_PRJ\10775A_20_PRJ.ssmssln** and click **Open**.
3. From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
4. Open the **21 – Demonstration 2A.sql** script file.
5. Follow the instructions contained within the comments of the script file.

Lesson 3

Resolving Login and Connectivity Issues

Contents:

Question and Answers

Troubleshooting Connectivity Issues

Question: Why should a local connection be tested first?

Answer: To ensure that the SQL Server service or the Login used are not the reason for the connection problems.

Troubleshooting Login Failures

Question: Can a SQL Server Login be created and enabled when SQL Server is configured for Windows Authentication only?

Answer: Yes, but it cannot be used for authentication.

Lesson 4

Resolving Concurrency Issues

Contents:

Question and Answers

Core Concurrency Concepts

Question: Why would SELECT statements acquire locks in most cases?

Answer: To prevent the data from being changed during the read operation.

Troubleshooting Blocking

Question: What do you suspect that "excessive" blocking might refer to?

Answer: An example would be a program that is not returning an error but is not making any progress. Another might be web pages that are timing out while accessing the database, without returning an error from the database.

Troubleshooting Deadlocks

Question: Have you experienced deadlocking problems in your current environment? If so, how did you determine that deadlocks were a problem, and how was it resolved?

Answer: Answers will vary but users have often seen deadlock related error messages.

Detailed Demonstration Steps

Demonstration 4A: Troubleshooting Blocking

Detailed demonstration steps

1. If Demonstration 2A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
2. In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_20_PRJ\10775A_20_PRJ.ssmssln** and click **Open**.
3. From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
4. Open the **41 – Demonstration 4A.sql** script file from within **Solution Explorer**.
5. Follow the instructions contained within the comments of the script file.

Demonstration 4B: Troubleshooting Deadlocks

Detailed demonstration steps

1. If Demonstration 2A was not performed:
   - Revert the virtual machines as per the instructions in D:\10775A_Labs\Revert.txt.
2. In the virtual machine, click **Start**, click **All Programs**, click **Microsoft SQL Server 2012**, click **SQL Server Management Studio**. In the Connect to Server window, type **Proseware** and click **Connect**. From the **File** menu, click **Open**, click **Project/Solution**, navigate to **D:\10775A_Labs\10775A_20_PRJ\10775A_20_PRJ.ssmssln** and click **Open**.
3. From the **View** menu, click **Solution Explorer**. Open and execute the **00 – Setup.sql** script file from within Solution Explorer.
4. Open the **42 – Demonstration 4B.sql** script file.
5. Follow the instructions contained within the comments of the script file.

Module Reviews and Takeaways

Review questions

Question: What can be used to monitor blocking issues?

Answer: Data Collector for long term monitoring, Activity Monitor and DMVs for real time monitoring

Question: What happens when a deadlock occurs?

Answer: SQL Server detects it, defines a victim and rolls back its transaction and issues error 1205

Best Practices

1. Monitor your system and store historical data using Data Collector for example for easier troubleshooting.
2. Clearly identify underlying problems rather than fighting symptoms.
3. Apply deadlock monitoring using SQL Trace.

Lab Review Questions and Answers

Question: What advantage would monitoring for deadlock errors using SQL Trace have over using SQL Server Profiler?

Answer: A light-weight long-running trace could be used to locate periodic deadlock issues.

Question: What is the first place you should look for information when the SQL Server service will not start?

Answer: Windows system log.

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