Microsoft

SQL Server Configuration

Module 1

Learning Units covered in this Module

- Lesson 1: SQL Server Versions and Editions
- Lesson 2: Windows Server Configuration
- Lesson 3: SQL Server Configuration

Lesson 1: SQL Server Versions and Editions

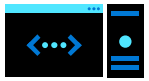
SQL Server editions

Azure-enabled with continued performance and security innovation

Express
Free, entry-level database for small web and mobile apps

Feature highlights

- Up to 4 cores of CPU
- Up to 1410 MBs of memory
- Microsoft Purview Policies
- Azure AD authentication
- Built-in query intelligence: PSP Optimization, Optimized plan forcing
- Query store on by default for new databases
- Data Lake Virtualization
- Ledger
- Timeseries support



Standard
Full featured database for mid-tier applications and data marts

Feature highlights

- Up to 24 cores of CPU
- Up to 128 GBs of memory
- Azure Synapse Link for SQL
- Link feature for Azure SQL Managed Instance (basic availability groups)
- Buffer Pool Parallel Scan
- Backups to S3-compatible object storage

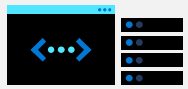
+ **Express features**

Enterprise
Mission-critical performance and intelligence for tier 1 databases

Feature highlights

- Unlimited cores of CPU
- Unlimited memory
- Azure Synapse Link for SQL (multi-threaded snapshot)
- Link feature for Azure SQL Managed Instance
- Built-in query intelligence: DOP feedback, CE Feedback, Memory Grant Feedback
- Contained Availability Group
- AVX 512 extension for batch mode

+ **Standard features**
+ **Express features**



Developer
Free to use with all the features of Enterprise Edition specifically for dev/test in non-production environments.
SQL Server 2025 includes a Developer Edition that only has Standard Edition features.

Build once and deploy across any SQL Server edition without changing your app

SQL Server continues to deliver unparalleled value

Business continuity through Azure

Seamless analytics over on-prem operational data

Visibility over your entire data estate

Most secure over the last 10 years[6]

Industry-leading performance and availability

2017 additions

- Support for Linux including Red Hat Enterprise Linux (RHEL), SUSE Linux Enterprise Server (SLES), and Ubuntu
- Support for Docker containers on Linux and Windows
- Python language support
- Support for graph data
- Automatic plan correction and adaptive query processing
- Cross platform availability groups

2019 additions

- Azure Machine Learning and Spark ML
- Support for Kubernetes deployment
- Free supported Java
- Native UTF-8 support
- In-Memory Database: Persistent Memory support
- Accelerated database recovery
- Free DR to Azure Always Encrypted with secure enclaves
- Data classification & auditing
- Vulnerability assessment

2022 additions

- Azure extension for SQL Server
- Link feature for Azure SQL Managed Instance
- Azure Synapse link for SQL
- Azure Purview policies
- SQL Server Ledger
- Large memory and concurrency scalability
- Data virtualization for any data lake
- Object storage backup and restore
- Query Store on by default with replica support
- Query Store hints
- Intelligent Query Processing NextGen
- JSON functions
- Modern T-SQL surface area
- Time series support
- Integrated acceleration & offloading

2025 additions

- Built-in AI Capabilities
- Vector Data Type and Search
- New Vector Functions
- Optimized Locking
- Reliable Failover Diagnostics
- Optional Parameter Plan Optimization
- Abort Query Hint
- Optimized sp_executesql procedure
- Accelerated Database Recovery and Resources Governor for TempDB
- Managed Identity Authentication
- Custom Password Policies on Linux
- Support for EKM with Azure Key Vault
- Support for CSV, Parquet, and Delta
- Support for JSON Data Types
- New T-SQL Aggregate Functions
- New RegEX Functions

Full list of SQL Server 2022 editions and supported features available on SQL Docs and for SQL Server 2025 What's New in SQL Server 2025 - SQL Server

SQL Server Instances

An instance of the Database Engine operates as a service that handles all application requests to work with the data in any of the databases managed by that instance.

Default Instance

- This instance has no name and is identified by the computer name alone. Only one default instance can be installed on a computer.
- The name of the services for the default instance will be MSSQLSERVER.

Named Instances

- Additional instances will have a unique name specified during installation.
- Multiple named instances can be installed on a single computer, and each is identified by the computer name and instance name.
- The name of the services will have a format of MSSQL$InstanceName

Lesson 2: Windows Server Configuration

Windows Server Configuration

Categories

- Security and Permissions
- Antivirus Exclusions
- Power Management
- Page File

Windows Server Configuration

Security and Permissions

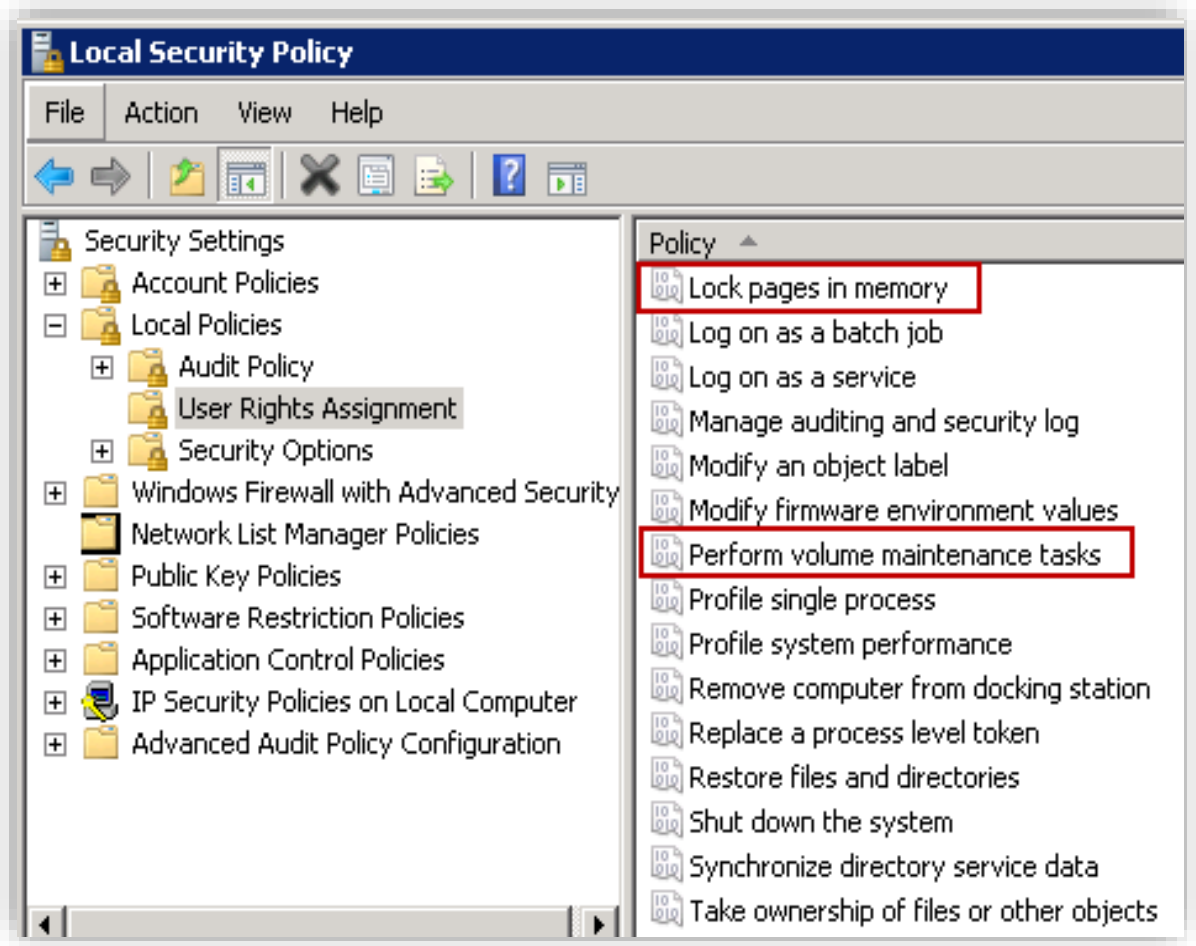
Required Permissions

- Log on as a Service
- Replace a process level token
- Bypass traverse checking
- Adjust memory quotas for a process

Optional Permissions

- Lock Pages In Memory
- Perform Volume Maintenance Tasks

Managed Service Accounts (MSA) and Group Managed Service Accounts (gMSA)



SQL Server Service Accounts

Partial List

- SQL Server Database Engine
- SQL Server Agent
- SQL Server Browser – Might be disabled
- SQL Server Full-text Filter Daemon Launcher
- SQL Server Launchpad – Optional
- SQL Server Integration Services – Optional
- SQL Server Analysis Services – Optional
- SQL Server Reporting Services - Optional

Types of SQL Server Service Accounts

Local or Domain User Account	Network Service Account	Virtual Service account (SQL 2012)	Managed Service account (SQL 2012)

Which one is “right”

- **Consider the principle of least privilege**
- **Accounts should have the level of access required and nothing further.**
- **Accounts should be isolated (not used by any other service)**

What is the best choice?

Largely dependent on your organizations needs, but there are recommended practices:

Non-administrative Local or Domain users	Virtual accounts (SQL 2012+)	Managed accounts (SQL 2012+)
• Local users **cannot** access domain resources. • Require regular service password management	• Auto-managed, auto-provisioned • Ideal for non-domain joined or isolated servers	• Auto-managed, manual provisioning • Ideal for domain joined servers that must access domain resources or used linked servers

Virtual Accounts

Managed local accounts

Automatically Provisioned and Managed

Default in SQL Server 2012 – specific during setup

Default instance of the Database Engine service:
NT SERVICE\MSSQLSERVER

Access network resources by using:
<domain_name>\<computer_name>$

Managed Service Accounts and gMSAs

Managed Service Accounts (MSAs)

- Limited to a single server
- Remove the need to manage a service account password
- Service Principal name (SPN) registration can be done automatically

Group Managed Service Accounts (gMSAs)

- Extend MSA functionality across multiple servers
- Supported in SQL Server 2014+
- Requires Windows Server 2012+ Active Directory Domain Controller
- Requires Windows Server 2012+

Service Account Best Practices

Separate account for each SQL Server service for each server

Use virtual service accounts, managed service accounts, or group managed service accounts

Do not grant service accounts local administrator permissions

Windows Server Configuration

Antivirus Best Practices

- Antivirus Software adds security at the cost of CPU and IO overhead.
- Proper Antivirus scanning exclusions will help in mitigating the overheads and avoid problems in SQL Server.

Data Files	Log Files	Backup files
Trace files .trc and .xel	SQL Server executables	SSAS data directories

Windows Server Configuration

Power Management

OS Power Management impacts how the CPUs work

- Lower clock speeds
- Lower voltage
- Core-parking

Balanced versus High Performance

- For SQL Server workloads, High Performance is recommended

Can be set at the OS and at the BIOS/hardware level

Check periodically – Group Policy Objects (GPOs) may push down the change

Windows Server Configuration

Page File

Page file is an extension of physical memory for Windows OS to use when running low on memory.

Paging is controlled by Windows operating system; SQL Server has no direct control over Paging.

Warning messages in SQL error logs when SQL memory has been paged out.

- *A significant part of sql server process memory has been paged out. This may result in a performance degradation. Duration: 0 seconds. Working set (KB): 1086400, committed (KB): 2160928, memory utilization: 50%*

Increasing Page file size will not improve SQL Server performance.

- Performance will suffer if SQL Buffer Pool memory has been paged out.

Size of Page file.

- Not a consideration for SQL Server workloads or performance.
- Monitor Page File performance counters to determine a more appropriate page file size.

Windows Server Configuration

Windows Server Core

Windows OS without a desktop or GUI components

Only installs necessary server components

Benefits of Windows Server Core:

- Reduced servicing
- Reduced management
- Reduced attack surface area
- Less disk space required for the OS binaries

Questions?

Knowledge Check

What is the Page File size recommendation for SQL Server machines?

True/False: Only data files should be excluded from antivirus exclusion.

What to do when you see the "*A significant part of sql server process memory has been paged out*" messages in SQL Server error logs?

What type of service accounts can be used to have the password managed automatically by the domain controller?

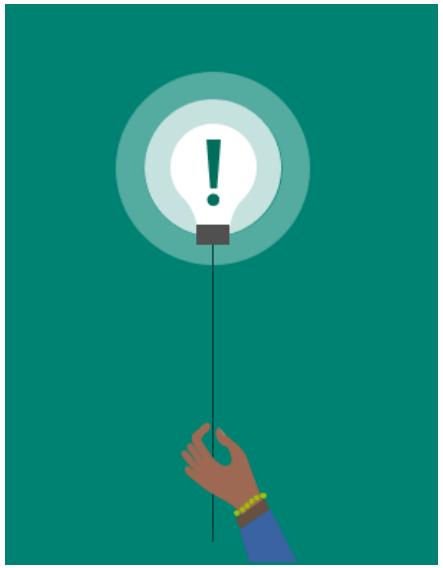
Which version of SQL Server introduced support for Group Managed Service Accounts for failover clusters?

Lesson 3: SQL Server Configuration

Objectives

After completing this learning, you will be able to:

- Explain various SQL Server configuration settings and best practices related to
  - Processor configuration.
  - Memory configuration.
  - Other important configuration settings.



SQL Server Configuration

Tools Used To Configure A SQL Server Instance

- SQL Server Management Studio
- SQL Server Configuration Manager
- sp_configure
- ALTER SERVER CONFIGURATION (transact-SQL)
- Registry

SQL Server Configuration

Processor Configuration Settings And Best Practices

Affinity Mask	• Assigns CPUs for SQL Server use • Set via sp_configure or Alter Server Configuration • Only required in specific scenarios
Max Degree of Parallelism (MAXDOP)	• Maximum number of processors that are used for the execution of a query in a parallel plan. This option determines the number of threads that are used for the query plan operators that perform the work in parallel.
Cost Threshold for Parallelism	• Queries with a cost that is higher than this value will use parallelism • Only required when dealing with excessive parallelism
Max Worker Threads	• Number of threads SQL Server can allocate • Recommended value is 0. SQL Server will dynamically set the Max based on CPUs and CPU architecture. (512 + (Processors -4) *16)

SQL Server Configuration

MAXDOP Setting and Best Practices

Best Practice Recommendations (documented in): KB 2806535

Server with single NUMA node	Less than or equal to 8 logical processors	Keep MAXDOP at or below # of logical processors
Server with single NUMA node	Greater than 8 logical processors	Keep MAXDOP at 8
Server with multiple NUMA nodes	Less than or equal to 16 logical processors per NUMA node	Keep MAXDOP at or below # of logical processors per NUMA node
Server with multiple NUMA nodes	Greater than 16 logical processors per NUMA node	Keep MAXDOP at half the number of logical processors per NUMA node with a MAX value of 16

SQL Server Configuration

Memory Settings and Best Practices

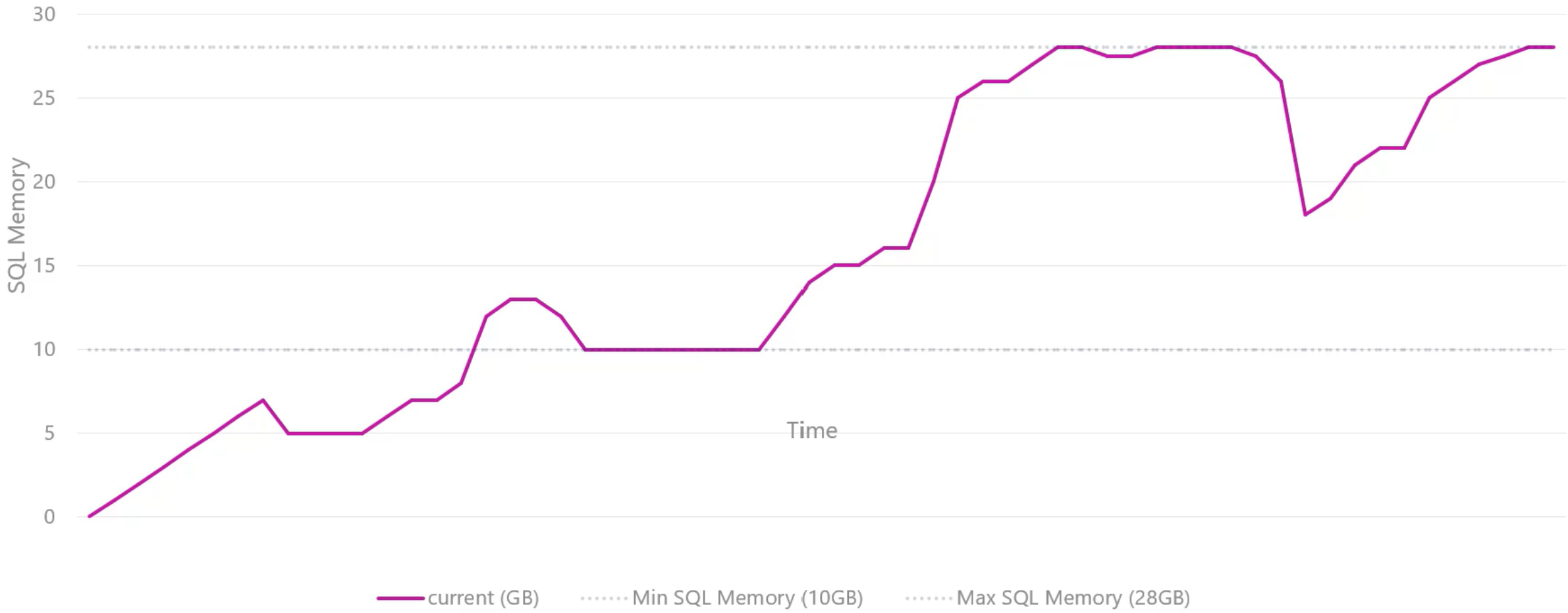
Min Server Memory and Max Server Memory

- Controls most of the memory allocated by SQL Server
- Can be left at default; however, most recommendations are to set to Max Server Memory to allow for memory to be available for all other services on the system
- Cluster Considerations
  - How many instances may run on one node at any given time?

Lock Pages in Memory

- Used to help ensure that SQL Server memory is not paged out

Dynamic Memory Management



SQL Server Configuration

Other important configuration settings

Backup Compression Default	• All backups taken on the SQL Server instance will be compressed.
Priority Boost	• Raises the priority of sqlservr.exe at the OS level. • Leave at 0 unless directed by Microsoft Support.
Lightweight Pooling	• Enables Fiber mode. Leave to 0 unless directed by Microsoft Support.
Recovery Interval	• The maximum ideal time, in seconds, that SQL Server will spend during the recovery process for a given database after restart, crash or failover.
Optimize for ad-hoc workloads	• Avoid plan cache pollution with lots of Adhoc SQL statements.

SQL Server Configuration Manager

SQL Server Service and Network Configuration

Changing the Accounts Used by the Services

Change startup parameters (such as to add trace flags)

Enable Availability Groups and Filestream features

Manage Server & Client Network Protocols

- Enable/Disable specific network protocol: TCP/IP, Named Pipes or Shared Memory
- Change the order in which protocols are used
- Force protocol encryption
- Define and manage server aliases

SQL Server Configuration

ALTER SERVER CONFIGURATION

Processes affinity configuration and to replace the affinity mask sp_configure options.

Extends the usage to control diagnostic logging and failover clustering properties.

Extends the usage to control the Buffer Pool Extensions feature with this command.

Allows for the SOFT NUMA option to control Soft NUMA configuration.

Allows the MEMORY_OPTIMIZED option to enable or disable memory-optimized tempdb metadata and hybrid buffer pool.

Demonstration

ALTER SERVER
CONFIGURATION command

Questions?

Knowledge Check

What is an easy way to find out which settings in sp_configure which can be changed without recycling SQL Service?

Which SQL Server tool can be used to enforce TCP/IP protocol encryption?

What is the recommended value for Priority Boost configuration option?

What is the recommend value for MAXDOP server configuration option for a server with single NUMA node and 12 logical processors?

If you leave the Max_Worker_threads option to its default setting of 0, how many threads will SQL Server use?