**What's New (Database Engine)**

**SQL Server 2008 R2**

[Other Versions](javascript:;)

Description: http://i.msdn.microsoft.com/Areas/Epx/Content/Images/ImageSprite.png

* [SQL Server 2008](http://msdn.microsoft.com/en-us/library/bb510411(d=printer,v=sql.100).aspx)
* [SQL Server 2012](http://msdn.microsoft.com/en-us/library/bb510411(d=printer,v=sql.110).aspx)

This latest release of the SQL Server Database Engine introduces new features and enhancements that increase the power and productivity of architects, developers, and administrators who design, develop, and maintain data storage systems.

These are the areas in which the Database Engine has been enhanced for both SQL Server 2008 R2 and SQL Server 2008.

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| **Topic** | **Description** |
| [Manageability Enhancements (Database Engine)](http://msdn.microsoft.com/en-us/library/cc645579(v=sql.105).aspx) | SQL Server 2008 R2 introduces the SQL Server Utility, which provides the ability to enroll data-tier applications and instances of SQL Server into the SQL Server Utility for centralized management and consolidation. Another addition is the data-tier application (DAC), which provides a single unit of deployment and management for the data-tier objects used by an application. |
| [Scalability and Performance Enhancements (Database Engine)](http://msdn.microsoft.com/en-us/library/cc645580(v=sql.105).aspx) | SQL Server 2008 R2 introduces Unicode compression. Data that is stored in nvarchar(n) and nchar(n) columns can be compressed by using an implementation of the Standard Compression Scheme for Unicode (SCSU) algorithm. |
| [Security Enhancements (Database Engine)](http://msdn.microsoft.com/en-us/library/cc645578(v=sql.105).aspx) | Security enhancements in the Database Engine include new encryption functions, the transparent data encryption and extensible key management features, and a clarification of DES algorithms. |
| [Features Supported by the Editions of SQL Server 2008 R2](http://msdn.microsoft.com/en-us/library/cc645993(v=sql.105).aspx) | The largest database supported by SQL Server Express has been increased from 4 GB to 10 GB. |
| [Encrypting Connections to SQL Server](http://msdn.microsoft.com/en-us/library/ms189067(v=sql.105).aspx) | SQL Server 2008 R2 enhances security by enforcing FQDN subjects for certificates. Applications that rely upon relaxed validation must take action.  SQL Server 2008 R2 supports wildcards certificates. For more information, see [KB258858](http://support.microsoft.com/kb/258858). |

These are the areas in which the Database Engine was enhanced for SQL Server 2008, but no additional enhancements were included in SQL Server 2008 R2.

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| **Topic** | **Description** |
| [Availability Enhancements (Database Engine)](http://msdn.microsoft.com/en-us/library/cc645581(v=sql.105).aspx) | The availability of Microsoft SQL Server 2008 databases is improved by enhancements to database mirroring. Database mirroring enables the creation of hot standby servers that provide rapid failover support with no loss of data from committed transactions. |
| [Programmability Enhancements (Database Engine)](http://msdn.microsoft.com/en-us/library/cc645577(v=sql.105).aspx) | Programmability enhancements in the Database Engine include new data storage features, new data types, new full-text search architecture, and numerous improvements and additions to Transact-SQL. |

# Manageability Enhancements (Database Engine)

**SQL Server 2008 R2**

[Other Versions](javascript:;)



* [SQL Server 2008](http://msdn.microsoft.com/en-us/library/cc645579(d=printer,v=sql.100).aspx)
* [SQL Server 2012](http://msdn.microsoft.com/en-us/library/cc645579(d=printer,v=sql.110).aspx)

SQL Server 2008 R2 introduces the SQL Server Utility for managing multiple instances of the SQL Server Database Engine. It also introduces a unit of management called a data-tier application (DAC) that provides an application-based view for managing the data-tier objects in the SQL Server Utility or stand-alone instances of the Database Engine.

[What's New in SQL Server 2008 R2](javascript:void(0))

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| **Note** |
| Because SQL Server 2008 R2 is a minor version upgrade of SQL Server 2008, we recommend that you also review the content in the SQL Server 2008 section. |

### SQL Server Utility

The SQL Server Utility enables:

* Creating a SQL Server utility control point (UCP): Install a single instance of the SQL Server 2008 R2 Database Engine and then promote it to be the UCP. The UCP is the central repository for configuration and performance data collected for all the instances enrolled in the SQL Server Utility. The UCP is the central reasoning point for the SQL Server Utility. It supports actions such as applying central policies, or analyzing resource utilization trends of an instance to predict when it might exceed central resource utilization polices.
* Using Utility Explorer in SQL Server Management Studio to enroll existing SQL Server 2008 R2 data-tier applications and instances of the Database Engine into the SQL Server Utility for centralized management.
* Setting central policies that tailor and control the operation of the SQL Server Utility and its dashboards.
* Using the Utility Explorer to display a dashboard and detailed viewpoints that report the resource utilization, resource health, and configuration information of all the instances enrolled in the SQL Server Utility. The dashboards let you quickly identify data-tier applications and instances of the Database Engine that are either underutilizing or overutilizing their underlying hardware resources. You can then develop a plan to maximize the use of your servers, such as consolidating underutilized instances or databases to a single server.

For more information about the SQL Server Utility, see:

* [Overview of SQL Server Utility](http://msdn.microsoft.com/en-us/library/ee210548(v=sql.105).aspx).
* [How to: Create a SQL Server Utility Control Point (SQL Server Utility)](http://msdn.microsoft.com/en-us/library/ee210579(v=sql.105).aspx).
* [How to: Enroll an Instance of SQL Server (SQL Server Utility)](http://msdn.microsoft.com/en-us/library/ee210563(v=sql.105).aspx).
* [Monitoring Instances of SQL Server in the SQL Server Utility](http://msdn.microsoft.com/en-us/library/ee210573(v=sql.105).aspx).

### Data-Tier Application Version 1.1 (DAC)

A data-tier application (DAC) simplifies the development, deployment, and management of the data-tier objects that support a multi-tier or client-server application. A DAC defines all of the Database Engine schema and instance objects, such as tables, views, and logins, required to support the application. The DAC operates as a single unit of management through the development, deployment, and management lifecycle of the associated application. The DAC also contains policies that define the deployment prerequisites for the DAC. A DAC version 1.1 can be deployed to instances of SQL Server 2008 R2 and SQL Azure.

For more information about DACs, see:

* [Designing and Implementing Data-tier Applications](http://msdn.microsoft.com/en-us/library/ee210546(v=sql.105).aspx).
* [Deploying Data-tier Applications](http://msdn.microsoft.com/en-us/library/ee210580(v=sql.105).aspx).
* [Managing Data-tier Applications](http://msdn.microsoft.com/en-us/library/ee210559(v=sql.105).aspx).
* [Upgrading Data-tier Applications](http://msdn.microsoft.com/en-us/library/ee635209(v=sql.105).aspx).
* [How to: Validate a DAC Package](http://msdn.microsoft.com/en-us/library/ee633948(v=sql.105).aspx).

### DAC Framework 1.1 Feature Pack

Visual Studio 2010 Service Pack 1 (SP1) includes a new DAC Framework 1.1 that changes the DAC upgrade from a side-by-side upgrade to an in-place upgrade. In-place upgrades are also supported on SQL Azure, while side-by-side upgrades are not. DAC Framework 1.1 also changes the format of the DAC package (.dacpac) files. While DAC Framework 1.1 supports DAC packages created using the earlier DAC Framework 1.0, clients still running DAC Framework 1.0 cannot process DAC packages created by using DAC Framework 1.1. SQL Server 2008 R2 customers can upgrade to DAC Framework 1.1 by downloading and installing the DAC Framework 1.1 [Feature Pack](http://go.microsoft.com/fwlink/?LinkId=210435). DAC Framework 1.1 is also included in SQL Server 2008 R2 Service Pack 1 and above.

For more information about performing an in-place upgrade, see [How to: Upgrade a Data-tier Application](http://msdn.microsoft.com/en-us/library/ee634742(v=sql.105).aspx).

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| **Note** |
| Changes in support for data-tier applications beginning in SQL Server 2012 may prevent your DAC version 1.1 files and applications created with SQL Server 2008 R2 from working with future versions of SQL Server. For more information, see [Discontinued Management Tools Features in SQL Server 2012](http://msdn.microsoft.com/library/cc879339.aspx). Microsoft recommends using the latest available version of the data-tier application framework (DAC v3.0 or higher). |

### Connectivity to SQL Azure

SQL Server 2008 R2 introduces the ability to connect to SQL Azure Database from the client utilities:

* The Generate and Publish Scripts Wizard can use SQL Azure as both the source and destination for the scripts it publishes. For more information, see [Using the Generate and Publish Scripts Wizard](http://msdn.microsoft.com/en-us/library/bb895179(v=sql.105).aspx).

### SQL Server PowerShell Provider

SQL Server 2008 R2 introduces new SQLSERVER:\Utility and SQLSERVER:\DAC folders to support the SQL Server Utility and data-tier applications in PowerShell scripts. For more information, see [Using the SQL Server PowerShell Provider](http://msdn.microsoft.com/en-us/library/cc281947(v=sql.105).aspx).

### Network Connectivity

The VIA protocol is deprecated. This feature will be removed in a future version of Microsoft SQL Server. Avoid using this feature in new development work, and plan to modify applications that currently use this feature..

### Exception Message Box Namespace

The [Microsoft.NetEnterpriseServers](http://msdn.microsoft.com/en-us/library/microsoft.netenterpriseservers(v=sql.105).aspx) namespace is a previously undocumented namespace that duplicates the functionality of the [Microsoft.SqlServer.MessageBox](http://msdn.microsoft.com/en-us/library/microsoft.sqlserver.messagebox(v=sql.105).aspx) namespace. This feature will be removed in a future version of Microsoft SQL Server. Avoid using this feature in new development work, and plan to modify applications that currently use this feature. Use the [Microsoft.SqlServer.MessageBox](http://msdn.microsoft.com/en-us/library/microsoft.sqlserver.messagebox(v=sql.105).aspx) namespace instead.

[What's New in SQL Server 2008](javascript:void(0))

### Database Administration

#### Auditing

SQL Server Audit is a new feature of SQL Server 2008 that lets you create customized audits of Database Engine events. SQL Server Audit uses extended events to record the information for the audit and provides the tools and processes you must have to enable, store, and view audits on various server and database objects. For more information, see [Auditing (Database Engine)](http://msdn.microsoft.com/en-us/library/cc280526(v=sql.105).aspx).

#### Backup Compression

Backup compression was introduced in SQL Server 2008 Enterprise. Beginning in SQL Server 2008 R2, backup compression is supported by SQL Server 2008 R2 Standard and all higher editions. Every edition of SQL Server 2008 can restore a compressed backup. You can change the backup compression behavior for an individual backup, backup job, or log shipping configuration. For more information, see [Backup Compression (SQL Server)](http://msdn.microsoft.com/en-us/library/bb964719(v=sql.105).aspx).

By default, backup compression significantly increases CPU usage, which can adversely impact concurrent operations. You can create low-priority compressed backups in a session whose CPU usage is limited by Resource Governor. For more information, see [How to: Use Resource Governor to Limit CPU Usage by Backup Compression (Transact-SQL)](http://msdn.microsoft.com/en-us/library/cc280384(v=sql.105).aspx).

#### Change Data Capture

Change data capture offers an effective solution to the challenge of efficiently performing incremental loads from source tables to data marts and data warehouses. Change data captures insert, update, and delete activity applied to SQL Server tables, and makes the details of the changes available in an easily consumed relational format. The change tables used by change data capture contain columns that mirror the column structure of a tracked source table, along with the metadata needed to understand the changes that have occurred. For more information, see [Basics of Change Data Capture](http://msdn.microsoft.com/en-us/library/cc645937(v=sql.105).aspx).

#### Change Tracking

SQL Server change tracking allows applications to obtain incremental changes to user tables. Where two-way synchronization is required, change tracking also allows applications to check for data conflicts. With change tracking integrated into SQL Server 2008, developers no longer have to create complicated custom change-tracking solutions.

Prior to the integration of change tracking capabilities into SQL Server, developers often created custom change tracking solutions that used a combination of triggers, timestamp columns, other additional columns, and additional tables. Now, developing synchronization applications is easier and faster.

For more information, see [Change Tracking](http://msdn.microsoft.com/en-us/library/cc280462(v=sql.105).aspx).

#### Data Collector

SQL Server 2008 introduces a data collector that you can use to obtain and save data that is gathered from several sources. The data collector provides data collection containers that you can use to determine the scope and frequency of data collection on a SQL Server server system. For more information, see [Introducing the Data Collector](http://msdn.microsoft.com/en-us/library/bb677248(v=sql.105).aspx).

#### Detecting Edition-Related Database Migration Problems

Use the [sys.dm\_db\_persisted\_sku\_features (Transact-SQL)](http://msdn.microsoft.com/en-us/library/cc280724(v=sql.105).aspx) view to identify features that would prevent a database from moving to a different edition of SQL Server 2008.

#### Events and Performance Counters

Deprecation Counters

Performance counters and trace events are available to track the usage of deprecated features. For more information, see [SQL Server, Deprecated Features Object](http://msdn.microsoft.com/en-us/library/bb510662(v=sql.105).aspx) and [Deprecated Database Engine Features in SQL Server 2008 R2](http://msdn.microsoft.com/en-us/library/ms143729(v=sql.105).aspx).

DDL Triggers and Event Notifications

The class of events on which you can create DDL triggers and event notifications is expanded to include numerous stored procedures that perform DDL-like operations. For a list of events, see [DDL Events](http://msdn.microsoft.com/en-us/library/bb522542(v=sql.105).aspx) and [DDL Event Groups](http://msdn.microsoft.com/en-us/library/bb510452(v=sql.105).aspx). Additionally, the XML schema for events is installed with the Database Engine and is also available on the Internet. For more information, see [EVENTDATA (Transact-SQL)](http://msdn.microsoft.com/en-us/library/ms173781(v=sql.105).aspx).

#### sp\_configure Options

The access check cache quota and access check cache bucket count options control the number of entries and number of hash buckets used for access check result cache. For more information, see [access check cache Options](http://msdn.microsoft.com/en-us/library/cc645588(v=sql.105).aspx).

### Server Administration

#### Central Management Servers

SQL Server 2008 introduces a new method of administering multiple servers by enabling you to designate Central Management Servers. An instance of SQL Server that is designated as a Central Management Server maintains a list registered servers. For more information, see [Administering Multiple Servers Using Central Management Servers](http://msdn.microsoft.com/en-us/library/bb895144(v=sql.105).aspx).

#### Dynamic Management Views

There are five new dynamic management views to present memory information:

* [sys.dm\_os\_memory\_brokers (Transact-SQL)](http://msdn.microsoft.com/en-us/library/bb522548(v=sql.105).aspx)
* [sys.dm\_os\_memory\_nodes (Transact-SQL)](http://msdn.microsoft.com/en-us/library/bb510622(v=sql.105).aspx)
* [sys.dm\_os\_nodes (Transact-SQL)](http://msdn.microsoft.com/en-us/library/bb510628(v=sql.105).aspx)
* [sys.dm\_os\_process\_memory (Transact-SQL)](http://msdn.microsoft.com/en-us/library/bb510747(v=sql.105).aspx)
* [sys.dm\_os\_sys\_memory (Transact-SQL)](http://msdn.microsoft.com/en-us/library/bb510493(v=sql.105).aspx)

The sys.dm\_os\_sys\_info dynamic management view has discontinued the cpu\_ticks\_in\_ms column, and has added two new columns, sqlserver\_start\_time\_ms\_ticks and sqlserver\_start\_time.

#### Hot Add CPU

SQL Server 2008 supports dynamically adding CPUs to a running system. Adding CPUs can occur physically by adding new hardware, logically by online hardware partitioning, or virtually through a virtualization layer. For more information, see [Hot Add CPU](http://msdn.microsoft.com/en-us/library/bb964703(v=sql.105).aspx).

#### Optimize for ad hoc workloads Option

The optimize for ad hoc workloads option is a new server configuration option used to improve the efficiency of the plan cache for workloads that contain many single use ad hoc batches. When this option is set to 1, the Database Engine stores a small compiled plan stub in the plan cache when a batch is compiled for the first time, instead of the full compiled plan. This helps to relieve memory pressure by not allowing the plan cache to become filled with compiled plans that are not reused. For more information, see [Setting Server Configuration Options](http://msdn.microsoft.com/en-us/library/ms189631(v=sql.105).aspx).

#### Resource Governor

Resource Governor is a feature that you can use to manage SQL Server workload and system resource consumption. Resource Governor enables you to limit the amount of CPU and memory that incoming application requests can use. For more information, see [Managing SQL Server Workloads with Resource Governor](http://msdn.microsoft.com/en-us/library/bb933866(v=sql.105).aspx).

#### SQL Server Extended Events

SQL Server 2008 introduces SQL Server Extended Events, an event infrastructure for server systems. This release of Extended Events enables you to open windows into the run time of the host process by using events as trace points. Those events can then be aggregated in memory, sent to a file, or output to Event Tracing for Windows (ETW). For more information, see [Introducing SQL Server Extended Events](http://msdn.microsoft.com/en-us/library/bb630354(v=sql.105).aspx).

### Policy-Based Management Administration

As part of Microsoft's ongoing effort to reduce the total cost of ownership, SQL Server 2008 introduces Policy-Based Management, a new framework for managing SQL Server. A policy contains a check condition, which is the state that the policy is evaluating, and a filter condition, which is the target set that is being evaluated. For example, an administrator can set policies that SQL Mail is off for all instances of SQL Server, or that tables in the Marketing schema in the AdventureWorks2008R2 database should have names that start with "mk\_pr\_".

Policy-Based Management delivers the following benefits:

* Ensures compliance with policies for system configuration.
* Prevents or monitors changes to the system by authoring policies against the configuration.
* Reduces total cost of ownership by simplifying administration tasks.
* Detects compliance issues in SQL Server Management Studio.
* Allows policies to run at the same time on multiple servers:
* Includes built-in functions and the ability to execute user-defined Transact-SQL queries and user-defined WMI/WQL queries for condition expressions that allow policies to apply to specified system states and target sets.
* Includes more than 40 out-of-the-box policies that correspond to the rules from the Best Practices Analyzer and default system state settings from Surface Area Configuration. Policies must be imported to an instance of the Database Engine. For more information, see [How to: Export and Import a Policy-Based Management Policy](http://msdn.microsoft.com/en-us/library/bb522584(v=sql.105).aspx).

In addition to importing out-of-the-box policies, new policies can be created directly from the File/New menu.

For more information and a tutorial about how to use Policy-Based Management, see [Administering Servers by Using Policy-Based Management](http://msdn.microsoft.com/en-us/library/bb510667(v=sql.105).aspx).

### SQL Server Management Studio

#### Query Editor

Transact-SQL Debugger

The Database Engine Query Editor now includes a Transact-SQL debugger similar to the Visual Studio debuggers. The Transact-SQL debugger helps you find problems in your Transact-SQL code by pausing execution on specific statements and then displaying data values and system information, such as the Transact-SQL call stack and the values stored in variables and parameters. For more information, see [Using the Transact-SQL Debugger](http://msdn.microsoft.com/en-us/library/cc646008(v=sql.105).aspx).

IntelliSense

The Database Engine Editor now provides IntelliSense functionality such as word completion, error underlining, parameter help, colorizing, Quick Info, outlining, and syntax pair matching. IntelliSense is provided for frequently used Transact-SQL elements. It will be extended to other Transact-SQL elements in future releases. For more information, see [Using IntelliSense](http://msdn.microsoft.com/en-us/library/ms174184(v=sql.105).aspx).

Database Engine Error List Window

SQL Server Management Studio includes an Error List window that displays the syntax and semantic errors generated from the IntelliSense code in the Database Engine Query Editor. For more information, see [Error List Window (Management Studio)](http://msdn.microsoft.com/en-us/library/bb895338(v=sql.105).aspx).

#### Object Explorer

The Object Explorer Details window of SQL Server Management Studio has been enhanced in the following ways:

* You can customize the columns that are displayed by the Object Explorer Details window. To see a list of possible columns for the selected object type, right-click the column headings. To reorder the display, you can drag the columns.
* The properties of a selected item appear at the bottom of the Object Explorer Details window. To see additional properties, make the status bar larger by dragging the topic border of the status bar upward.

The code editor for Transact-SQL and MDX has a color-coded status bar at the bottom. The status bar provides information about the editor connection, and changes color when a code editor has more than one connection.

You can add or remove the names of items from the title bar of the code editor windows. To customize the tab name, on the Tools menu, click Options, and then select the Text Editor and Editor Tab and Status Bar Page.

Management Studio includes an enhanced details display for items that are selected in the Object Explorer. Columns can be resized, sorted and reorganized; and new navigation buttons enable you to move to a parent object or the last object visited. You can select multiple objects in the details area to perform actions on them individually or as a group.

Synchronization from an object in Object Explorer Details now selects the individual object in Object Explorer instead of its parent object. In addition, you can select columns to display from a list of properties, and the sorting and selections stay constant as you navigate. Also, for a selected object, a list of properties is shown in a sizeable area at the bottom of the details area. For more information, see [Using Object Explorer Details and SQL Server Object Search](http://msdn.microsoft.com/en-us/library/cc646011(v=sql.105).aspx).

Service Broker Nodes in Object Explorer

Object Explorer has a new node for Service Broker conversation priorities. In addition, the other Service Broker nodes now display additional menu options, including Properties, when you right-click the nodes. For more information, see [Service Broker Object Properties F1 Help](http://msdn.microsoft.com/en-us/library/cc280433(v=sql.105).aspx).

#### Customer-Requested Improvements

SQL Server Management Studio has the following customer-requested improvements:

* In the Query Editor window, you can query multiple servers at the same time by opening query windows from registered server groups. The query results can be combined into a single results pane, or can be returned in separate results panes. For more information, see [Administering Multiple Servers Using Central Management Servers](http://msdn.microsoft.com/en-us/library/bb895144(v=sql.105).aspx).
* You can access SQL Server Profiler from the Query Editor window, from the Query menu, the Query Editor toolbar, or by pressing CTRL+ALT+P.
* You can now open tables by using a Return Top n rows option.
* You can configure the number of rows that are returned when you are opening tables.
* On the Tools/Option menu, you can specify the action that results by double-clicking tables in Object Explorer.
* You can block the table designer from re-creating tables when you are implementing design changes.
* The Object Details page can be customized with additional columns and now supports search. For more information, see [Using Object Explorer Details and SQL Server Object Search](http://msdn.microsoft.com/en-us/library/cc646011(v=sql.105).aspx).
* Additional connection parameters can be added to the connection string when you are connecting by using SQL Server Management Studio. For more information, see [Connect to Server (Additional Connection Parameters Page)](http://msdn.microsoft.com/en-us/library/cc645898(v=sql.105).aspx).

### SQL Server PowerShell Provider and Cmdlets

SQL Server 2008 introduces two PowerShell snap-in dll files that implement the following:

* A SQL Server PowerShell provider that exposes the SQL Server Management Object models as paths similar to file system paths. Each node in the path is associated with a SQL Server Management Object class.
* A set of SQL Server PowerShell cmdlets for tasks such as running **sqlcmd** scripts, evaluating policies, or encoding delimited identifiers for use in PowerShell paths.

In addition, there is a new **sqlps** utility that launches a PowerShell environment configured with the SQL Server features such as the provider and snap-ins. A PowerShell subsystem has been added to SQL Server Agent so that you can run PowerShell scripts on a schedule or in response to Database Engine events. You can launch SQL Server PowerShell sessions by right-clicking Object Explorer nodes in SQL Server Management Studio. For more information, see [SQL Server PowerShell Overview](http://msdn.microsoft.com/en-us/library/cc281954(v=sql.105).aspx).

# Scalability and Performance Enhancements (Database Engine)

**SQL Server 2008 R2**

[Other Versions](javascript:;)



* [SQL Server 2008](http://msdn.microsoft.com/en-us/library/cc645580(d=printer,v=sql.100).aspx)
* [SQL Server 2012](http://msdn.microsoft.com/en-us/library/cc645580(d=printer,v=sql.110).aspx)

Scalability and performance enhancements in the SQL Server Database Engine include filtered indexes and statistics, new table and query hints, and new query performance and processing features.

[What's New in SQL Server 2008 R2 Service Pack 1](javascript:void(0))

* Four new DMV's have been added: [sys.dm\_os\_windows\_info (Transact-SQL)](http://msdn.microsoft.com/en-us/library/hh204565(v=sql.105).aspx), [sys.dm\_server\_registry (Transact-SQL)](http://msdn.microsoft.com/en-us/library/hh204561(v=sql.105).aspx), [sys.dm\_server\_services (Transact-SQL)](http://msdn.microsoft.com/en-us/library/hh204542(v=sql.105).aspx), and [sys.dm\_server\_memory\_dumps (Transact-SQL)](http://msdn.microsoft.com/en-us/library/hh204543(v=sql.105).aspx).
* One new DMF has been added: [sys.dm\_os\_volume\_stats (Transact-SQL)](http://msdn.microsoft.com/en-us/library/hh223223(v=sql.105).aspx).
* Additional columns have been added to [sys.dm\_exec\_query\_stats (Transact-SQL)](http://msdn.microsoft.com/en-us/library/ms189741(v=sql.105).aspx) and [sys.dm\_os\_sys\_info (Transact-SQL)](http://msdn.microsoft.com/en-us/library/ms175048(v=sql.105).aspx).
* New XEvents on selected performance counters are introduced to monitor OS configurations and resource conditions related to the instance of SQL Server.

[What's New in SQL Server 2008 R2](javascript:void(0))

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| **Note** |
| Because SQL Server 2008 R2 is a minor version upgrade of SQL Server 2008, we recommend that you also review the content in the SQL Server 2008 section. |

### Unicode Compression

Unicode data that is stored in nvarchar(n) and nchar(n) columns is compressed by using an implementation of the Standard Compression Scheme for Unicode (SCSU) algorithm. For more information, see [Unicode Compression Implementation](http://msdn.microsoft.com/en-us/library/ee240835(v=sql.105).aspx).

[What's New in SQL Server 2008](javascript:void(0))

### Filtered Indexes and Statistics

In SQL Server 2008, you can use a predicate to create filtered indexes and statistics on a subset of rows in the table. In earlier versions of SQL Server, indexes and statistics were created on all of the rows in the table. Filtered indexes and statistics are especially suited for queries that select from well-defined subsets of data, such as columns with mostly NULL values, columns with heterogeneous categories of values, and columns with distinct ranges of values.

A well-designed filtered index can improve query performance, reduce index maintenance costs, and reduce index storage costs compared with full-table indexes. For more information, see [Filtered Index Design Guidelines](http://msdn.microsoft.com/en-us/library/cc280372(v=sql.105).aspx). Filtered statistics can improve query plan quality because they cover only the rows in the filtered index. The Database Engine automatically creates and maintains filtered statistics for filtered indexes. You can also create filtered statistics on a non-indexed column to improve the query plan quality for subsets of data that do not need a filtered index. For more information, see[Using Statistics to Improve Query Performance](http://msdn.microsoft.com/en-us/library/ms190397(v=sql.105).aspx).

### Table and Query Hints

#### OPTIMIZE FOR Query Hint Option Includes UNKNOWN Variable Value

The OPTIMIZE FOR query hint option is enhanced with the UNKNOWN syntax, which specifies that the Database Engine use statistical data to determine the values for one or more local variables during query optimization, instead of the initial values. The syntax can be specified for all local variables in a query, or for one or more named local variables. For more information, see [Query Hints (Transact-SQL)](http://msdn.microsoft.com/en-us/library/ms181714(v=sql.105).aspx).

#### Query Hints

Table hints can now be specified as query hints to provide advanced query performance tuning options. We recommend using a table hint as a query hint only in the context of a [plan guide](http://msdn.microsoft.com/en-us/library/ms190417(v=sql.105).aspx). For more information, see [Query Hints (Transact-SQL)](http://msdn.microsoft.com/en-us/library/ms181714(v=sql.105).aspx) and [Using the INDEX and FORCESEEK Query Hints in Plan Guides](http://msdn.microsoft.com/en-us/library/bb677261(v=sql.105).aspx).

#### Table Hints

The FORCESEEK table hint is added to provide advanced query performance tuning options. The hint specifies that the query optimizer use only an index seek operation as the access path to the data in the table or view referenced in the query. For more information, see [Using the FORCESEEK Table Hint](http://msdn.microsoft.com/en-us/library/bb510478(v=sql.105).aspx).

### Query Performance and Processing

#### Lock Escalation Option

A new LOCK\_ESCALATION option of ALTER TABLE allows you to disable lock escalation on a table. On partitioned tables, you can configure locks to escalate to the partitions instead of to the whole table. This option can improve concurrency by reducing lock contention when you are using partitioned tables. For more information, see [ALTER TABLE (Transact-SQL)](http://msdn.microsoft.com/en-us/library/ms190273(v=sql.105).aspx).

#### Optimized Bitmap Filtering

The query optimizer can place bitmap filters dynamically in parallel query plans to improve the performance of queries against a star schema. Optimized bitmap filtering can significantly improve the performance of these data warehouse queries by removing nonqualifying rows from the fact table early in the query plan. For more information, see [Optimizing Data Warehouse Query Performance Through Bitmap Filtering](http://msdn.microsoft.com/en-us/library/bb522541(v=sql.105).aspx).

#### Parallel Query Processing on Partitioned Objects

SQL Server 2008 improves query processing performance on partitioned tables for many parallel plans, changes the way parallel and serial plans are represented, and enhances the partitioning information provided in both compile-time and run-time execution plans. SQL Server 2008 automates and improves the thread partitioning strategy for parallel query execution plans on partitioned objects. For more information, see [Query Processing Enhancements on Partitioned Tables and Indexes](http://msdn.microsoft.com/en-us/library/ms345599(v=sql.105).aspx).

#### Plan Guides

The [sp\_create\_plan\_guide](http://msdn.microsoft.com/en-us/library/ms179880(v=sql.105).aspx) stored procedure has been extended to accept XML Showplan output directly in the @hints parameter instead of embedding the output in the USE PLAN hint. This simplifies the process of applying a fixed query plan as a plan guide hint. In addition, a new stored procedure, [sp\_create\_plan\_guide\_from\_handle](http://msdn.microsoft.com/en-us/library/bb964726(v=sql.105).aspx), allows you to create one or more plan guides from a query plan in the plan cache.

You can create multiple OBJECT or SQL plan guides for the same query and batch or module. However, only one of these plan guides can be enabled at any given time.

The new system function [sys.fn\_validate\_plan\_guide](http://msdn.microsoft.com/en-us/library/bb933946(v=sql.105).aspx) can be used to validate a plan guide. Plan guides can become invalid after changes such as dropping an index are made to the physical design of the database. By validating a plan guide, you can determine whether the plan guide can be used unmodified by the query optimizer.

New event classes, [Plan Guide Successful](http://msdn.microsoft.com/en-us/library/bb934169(v=sql.105).aspx) and [Plan Guide Unsuccessful](http://msdn.microsoft.com/en-us/library/bb934149(v=sql.105).aspx), make it easier to verify that plan guides are being used by the query optimizer. When SQL Server cannot produce an execution plan for a query that contains a plan guide, the query is automatically compiled without using the plan guide. The Plan Guide Unsuccessful event occurs when the initial plan guide compilation fails.

New counters, Guided Plan Executions/sec and Misguided Plan Executions/sec, in the [SQL Server, SQL Statistics Object](http://msdn.microsoft.com/en-us/library/ms190911(v=sql.105).aspx), can be used to monitor the number of plan executions in which the query plan has been successfully or unsuccessfully generated by using a plan guide.

Operations such as creating, deleting, enabling, disabling, or scripting plan guides can be performed by using SQL Server Management Studio. Plan guides appear under the Programmability folder in Object Explorer.

#### Hash Values for Finding and Tuning Similar Queries

When searching for resource-intensive queries, you should consider how to find and tune similar queries that individually consume minimal system resources, but collectively consume significant system resources. The [sys.dm\_exec\_query\_stats](http://msdn.microsoft.com/en-us/library/ms189741(v=sql.105).aspx) and [sys.dm\_exec\_requests](http://msdn.microsoft.com/en-us/library/ms177648(v=sql.105).aspx) catalog views provide query hash and query plan hash values that you can use to help determine the aggregate resource usage for similar queries and similar query execution plans. For more information, see [Finding and Tuning Similar Queries by Using Query and Query Plan Hashes](http://msdn.microsoft.com/en-us/library/cc645887(v=sql.105).aspx).

# Security Enhancements (Database Engine)

**SQL Server 2008 R2**

[Other Versions](javascript:;)



* [SQL Server 2008](http://msdn.microsoft.com/en-us/library/cc645578(d=printer,v=sql.100).aspx)
* [SQL Server 2012](http://msdn.microsoft.com/en-us/library/cc645578(d=printer,v=sql.110).aspx)

Security enhancements in the SQL Server Database Engine include support for Extended Protection.

[What's New in SQL Server 2008 R2](javascript:void(0))

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| **Note** |
| Because SQL Server 2008 R2 is a minor version upgrade of SQL Server 2008, we recommend that you also review the content in the SQL Server 2008 section. |

### Extended Protection

Support for Extended Protection for Authentication by using channel binding and service binding is available for operating systems that support Extended Protection. For more information, see [Connecting to the Database Engine Using Extended Protection](http://msdn.microsoft.com/en-us/library/ff487261(v=sql.105).aspx).

[What's New in SQL Server 2008](javascript:void(0))

Security enhancements in the Database Engine include new encryption functions, the addition of the transparent data encryption and the extensible key management features, and a clarification of DES algorithms.

### Encryption Functions

The following new functions are useful when you are encrypting objects: [is\_objectsigned](http://msdn.microsoft.com/en-us/library/cc627401(v=sql.105).aspx), [asymkeyproperty](http://msdn.microsoft.com/en-us/library/cc627393(v=sql.105).aspx), [symkeyproperty](http://msdn.microsoft.com/en-us/library/cc645882(v=sql.105).aspx), [CRYPT\_GEN\_RANDOM](http://msdn.microsoft.com/en-us/library/cc627408(v=sql.105).aspx), [KEY\_NAME](http://msdn.microsoft.com/en-us/library/cc645960(v=sql.105).aspx), and [sys.fn\_check\_object\_signatures](http://msdn.microsoft.com/en-us/library/cc645921(v=sql.105).aspx).

### Transparent Data Encryption

Transparent data encryption (TDE) introduces a new database option that encrypts the database files automatically, without needing to alter any applications. This prevents unauthorized users from accessing a database, even if they obtain the database files or database backup files. For more information about database encryption, see [Understanding Transparent Data Encryption (TDE)](http://msdn.microsoft.com/en-us/library/bb934049(v=sql.105).aspx).

### Extensible Key Management

The extensible key management (EKM) feature allows third-party enterprise key management and hardware security module (HSM) vendors to register their devices in SQL Server. Once registered, SQL Server users can use the encryption keys stored on these modules, as well as leveraging the advanced encryption features that these modules support, such as bulk encryption/decryption and many key management functions such as key aging and key rotation. This feature also allows data protection from database administrators (except members of the sysadmin group). Data can be encrypted and decrypted using Transact-SQL cryptographic statements, and SQL Server uses the external EKM device as the key store. For more information on extensible key management, see [Understanding Extensible Key Management (EKM)](http://msdn.microsoft.com/en-us/library/bb895340(v=sql.105).aspx).

### Clarification Regarding DES Algorithms

The DES algorithm names are clarified and TRIPLE\_DES\_3KEY is now available. For more information, see [CREATE SYMMETRIC KEY (Transact-SQL)](http://msdn.microsoft.com/en-us/library/ms188357(v=sql.105).aspx).

### Deprecation of the RC4 Algorithm

The RC4 algorithm is deprecated. This feature will be removed in a future version of Microsoft SQL Server. Do not use this feature in new development work, and modify applications that currently use this feature as soon as possible. Use another algorithm such as AES. For more information, see [CREATE SYMMETRIC KEY (Transact-SQL)](http://msdn.microsoft.com/en-us/library/ms188357(v=sql.105).aspx).

### Security Checklists

Books Online includes security checklists to help evaluate your Database Engine configuration and practices. For more information, see [Security Checklists for the Database Engine](http://msdn.microsoft.com/en-us/library/ff848778(v=sql.105).aspx).

**Features Supported by the Editions of SQL Server 2008 R2**

**SQL Server 2008 R2**

[Other Versions](javascript:;)



* [SQL Server 2008](http://msdn.microsoft.com/en-us/library/cc645993(d=printer,v=sql.100).aspx)
* [SQL Server 2012](http://msdn.microsoft.com/en-us/library/cc645993(d=printer,v=sql.110).aspx)

Use the following tables to determine which features are supported by the different editions of SQL Server 2008 R2.

|  |
| --- |
| **Note** |
| SQL Server is available in an Evaluation edition for a 180-day trial period. For more information, see the SQL Server [Trial Software Web Site](http://go.microsoft.com/fwlink/?LinkId=51646). |

|  |
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| **Note** |
| For features supported by Evaluation and SQL Server Developer, see the SQL Server Datacenter feature set. The features supported by SQL Server Datacenter, SQL Server Developer, and Evaluation are the same. |

To navigate to the table for a SQL Server technology, click on its link:

[Scalability and Performance](http://msdn.microsoft.com/en-us/library/cc645993(d=printer,v=sql.105).aspx#Scalability)

[High Availability](http://msdn.microsoft.com/en-us/library/cc645993(d=printer,v=sql.105).aspx#High_availability)

[Virtualization Support](http://msdn.microsoft.com/en-us/library/cc645993(d=printer,v=sql.105).aspx#Virtualization)

[Replication](http://msdn.microsoft.com/en-us/library/cc645993(d=printer,v=sql.105).aspx#Replication)

[Enterprise Security](http://msdn.microsoft.com/en-us/library/cc645993(d=printer,v=sql.105).aspx#Enterprise_security)

[Single Instance RDBMS Management](http://msdn.microsoft.com/en-us/library/cc645993(d=printer,v=sql.105).aspx#RDBMS_mgmt)

[Application and Multi-Instance Management](http://msdn.microsoft.com/en-us/library/cc645993(d=printer,v=sql.105).aspx#Multi-instance_mgmt)

[Management Tools](http://msdn.microsoft.com/en-us/library/cc645993(d=printer,v=sql.105).aspx#Mgmt_tools)

[Development Tools](http://msdn.microsoft.com/en-us/library/cc645993(d=printer,v=sql.105).aspx#Dev_tools)

[Programmability](http://msdn.microsoft.com/en-us/library/cc645993(d=printer,v=sql.105).aspx#Programmability)

[Spatial and Location Services](http://msdn.microsoft.com/en-us/library/cc645993(d=printer,v=sql.105).aspx#Spatial)

[Complex Event Processing (StreamInsight)](http://msdn.microsoft.com/en-us/library/cc645993(d=printer,v=sql.105).aspx#CEP)

[Integration Services](http://msdn.microsoft.com/en-us/library/cc645993(d=printer,v=sql.105).aspx#SSIS)

[Integration Services-Advanced Adapters](http://msdn.microsoft.com/en-us/library/cc645993(d=printer,v=sql.105).aspx#SSIS_AA)

[Integration Services-Advanced Transforms](http://msdn.microsoft.com/en-us/library/cc645993(d=printer,v=sql.105).aspx#SSIS_AT)

[Data Warehouse](http://msdn.microsoft.com/en-us/library/cc645993(d=printer,v=sql.105).aspx#Data_warehouse)

[Analysis Services](http://msdn.microsoft.com/en-us/library/cc645993(d=printer,v=sql.105).aspx#SSAS)

[Analysis Services-Advanced Analytic Functions](http://msdn.microsoft.com/en-us/library/cc645993(d=printer,v=sql.105).aspx#SSAS_AAF)

[Data Mining](http://msdn.microsoft.com/en-us/library/cc645993(d=printer,v=sql.105).aspx#Data_mining)

[Reporting](http://msdn.microsoft.com/en-us/library/cc645993(d=printer,v=sql.105).aspx#Reporting)

[Business Intelligence Clients](http://msdn.microsoft.com/en-us/library/cc645993(d=printer,v=sql.105).aspx#BI_clients)

[Master Data Services](http://msdn.microsoft.com/en-us/library/cc645993(d=printer,v=sql.105).aspx#MDS)

[Scalability and Performance](javascript:void(0))

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Feature Name** | **Datacenter** | **Enterprise** | **Standard** | **Web** | **Workgroup** | **Express with Advanced Services** | **Express with Tools** | **Express** |
| Number of CPUs | OS maximum1 | 8 | 4 | 4 | 2 | 1 | 1 | 1 |
| Maximum memory utilized | OS maximum | 2 TB | 64 GB | 64 GB | 4 GB | 1 GB | 1 GB | 1 GB |
| Maximum database size | 524 PB | 524 PB | 524 PB | 524 PB | 524 PB | 10 GB | 10 GB | 10 GB |
| IA64 hardware support | Yes | Yes |  |  |  |  |  |  |
| Resource governor | Yes | Yes |  |  |  |  |  |  |
| Table and index partitioning | Yes | Yes |  |  |  |  |  |  |
| Parallel index operations | Yes | Yes |  |  |  |  |  |  |
| Parallel consistency checks (DBCC) | Yes | Yes |  |  |  |  |  |  |
| Enhanced read-ahead scan | Yes | Yes |  |  |  |  |  |  |
| Scalable shared databases | Yes | Yes |  |  |  |  |  |  |
| Direct query of index views using NOEXPAND hint | Yes | Yes | Yes |  |  |  |  |  |
| Automatic indexed view maintenance | Yes | Yes | Yes |  |  |  |  |  |
| Automatic use of indexed views by query optimizer | Yes | Yes |  |  |  |  |  |  |
| Distributed Partitioned Views | Yes | Yes | Partial. Distributed Partitioned Views are not updatable | Partial. Distributed Partitioned Views are not updatable | Partial. Distributed Partitioned Views are not updatable | Partial. Distributed Partitioned Views are not updatable | Partial. Distributed Partitioned Views are not updatable | Partial. Distributed Partitioned Views are not updatable |

1 Support for Windows Server 2012 was added in a cumulative update for SQL Server 2008 SP3. Although Windows Server 2012 supports 64 physical processors and 640 logical processors, not all of the SQL Server 2008 or 2008 R2 services were retrofitted to support the additional processing capability of Windows Server 2012. Specifically, Analysis Services does not support more than 64 logical processors in either SQL Server 2008 or SQL Server 2008 R2.

[High Availability](javascript:void(0))

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Feature Name** | **Datacenter** | **Enterprise** | **Standard** | **Web** | **Workgroup** | **Express with Advanced Services** | **Express with Tools** | **Express** |
| Log shipping | Yes | Yes | Yes | Yes | Yes |  |  |  |
| Database mirroring2 | Yes | Yes | Yes (single thread, synchronous only) | Witness only | Witness only | Witness only | Witness only | Witness only |
| Automatic corruption recovery from mirror | Yes | Yes | Yes |  |  |  |  |  |
| Log stream compression | Yes | Yes | Yes |  |  |  |  |  |
| Number of Failover clustering nodes | Operating system maximum1 | Operating system maximum1 | 2 nodes |  |  |  |  |  |
| Backup compression | Yes | Yes | Yes3 |  |  |  |  |  |
| Mirrored backups | Yes | Yes |  |  |  |  |  |  |
| Database snapshots | Yes | Yes |  |  |  |  |  |  |
| Fast recovery | Yes | Yes |  |  |  |  |  |  |
| Online indexing | Yes | Yes |  |  |  |  |  |  |
| Online page and file restore | Yes | Yes |  |  |  |  |  |  |
| Online configuration of Peer to Peer nodes | Yes | Yes |  |  |  |  |  |  |
| Hot add memory and CPU support | Yes | Yes |  |  |  |  |  |  |

1Windows Server 2003 supports a maximum of 8 failover cluster nodes. Windows Server 2008 supports a maximum of 16 failover cluster nodes.

2Asynchronous database mirroring is supported only by SQL Server 2005 Enterprise Edition SP1 and later versions.

3Backup compression for Standard edition of SQL Server is supported only in SQL Server 2008 R2 or higher versions.

[Virtualization Support](javascript:void(0))

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Feature Name** | **Datacenter** | **Enterprise** | **Standard** | **Web** | **Workgroup** | **Express with Advanced Services** | **Express with Tools** | **Express** |
| Hypervisor support | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Guest failover clustering support for virtualization | Yes | Yes | Yes |  |  |  |  |  |
| Hyper-V live migration | Yes | Yes | Yes |  |  |  |  |  |
| Application mobility | Yes | Yes |  |  |  |  |  |  |

[Replication](javascript:void(0))

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Feature Name** | **Datacenter** | **Enterprise** | **Standard** | **Web** | **Workgroup** | **Express with Advanced Services** | **Express with Tools** | **Express** |
| Snapshot replication | Yes | Yes | Yes | Subscriber only | Yes | Subscriber only | Subscriber only | Subscriber only |
| Merge replication | Yes | Yes | Yes | Subscriber only | Restricted¹ | Subscriber only | Subscriber only | Subscriber only |
| Transactional replication | Yes | Yes | Yes | Subscriber only | Restricted¹ | Subscriber only | Subscriber only | Subscriber only |
| SQL Server change tracking | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Publishing data from SQL Server to non SQL Server subscribers | Yes | Yes | Yes |  |  |  |  |  |
| Publishing data from Oracle to SQL Server | Yes | Yes |  |  |  |  |  |  |
| Peer to Peer replication | Yes | Yes |  |  |  |  |  |  |

¹If an instance of Workgroup is used as a Publisher, it supports a maximum of 25 subscriptions to all merge publications, and five subscriptions to all transactional publications. It supports an unlimited number of subscriptions to snapshot publications.

[Enterprise Security](javascript:void(0))

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Feature Name** | **Datacenter** | **Enterprise** | **Standard** | **Web** | **Workgroup** | **Express with Advanced Services** | **Express with Tools** | **Express** |
| Windows Integrated Authentication (including Kerberos) | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Integration with Microsoft baseline security analyzer | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| C2 compliant audit mode1 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Common criteria compliance | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Data encryption and key management | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Module signing | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Transport Layer Security channel encryption | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Windows password policy support | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| User-schema separation | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Login triggers and connection endpoints | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Secure configuration through policy-based management | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| SQL Server audit (fine-grained auditing) | Yes | Yes |  |  |  |  |  |  |
| Transparent database encryption | Yes | Yes |  |  |  |  |  |  |
| Extensible key management | Yes | Yes |  |  |  |  |  |  |

1For a description of this feature see, [c2 audit mode Option](http://msdn.microsoft.com/en-us/library/ms187634(v=sql.105).aspx).

[Single Instance RDBMS Management](javascript:void(0))

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Feature Name** | **Datacenter** | **Enterprise** | **Standard** | **Web** | **Workgroup** | **Express with Advanced Services** | **Express with Tools** | **Express** |
| Policy-Based Management | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| PowerShell support | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| SQL Server Management Object (SMO) | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| SysPrep support1 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| SQL Server connection director | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Dedicated admin connection | Yes | Yes | Yes | Yes | Yes | Yes (Under trace flag) | Yes (Under trace flag) | Yes (Under trace flag) |
| Policy automation (check on schedule and change) | Yes | Yes | Yes | Yes | Yes |  |  |  |
| Maintenance plans | Yes | Yes | Yes | Yes | Yes |  |  |  |
| Database mail | Yes | Yes | Yes | Yes | Yes |  |  |  |
| Performance data collector | Yes | Yes | Yes | Yes | Yes |  |  |  |
| System Center Operations Manager Management Pack | Yes | Yes | Yes | Yes | Yes |  |  |  |
| Plan guides | Yes | Yes | Yes | Yes | . |  |  |  |
| User instances |  |  |  |  |  | Yes | Yes | Yes |

1 SysPrep is supported for stand-alone instances of Database Engine and Reporting Services. For more information, see [Considerations for Installing SQL Server Using SysPrep](http://msdn.microsoft.com/en-us/library/ee210754(v=sql.105).aspx).

[Application and Multi-Instance Management](javascript:void(0))

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Feature Name** | **Datacenter** | **Enterprise** | **Standard** | **Web** | **Workgroup** | **Express with Advanced Services** | **Express with Tools** | **Express** |
| Support for data-tier application (DAC) operations - extract, deploy, upgrade | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Able to enroll for multi-instance management. | Yes1 | Yes2 | Yes | Yes | Yes |  |  |  |
| Multi-instance dashboard views and drilldowns | Yes | Yes2 |  |  |  |  |  |  |
| Policy-based resource utilization evaluation | Yes | Yes2 |  |  |  |  |  |  |

1 Supports a SQL Server utility control point with a maximum of 200 managed instances of SQL Server. For more information, see [Overview of SQL Server Utility](http://msdn.microsoft.com/en-us/library/ee210548(v=sql.105).aspx).

2 Supports a SQL Server utility control point with a maximum of 25 managed instances of SQL Server. For more information, see [Overview of SQL Server Utility](http://msdn.microsoft.com/en-us/library/ee210548(v=sql.105).aspx).

[Management Tools](javascript:void(0))

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Feature Name** | **Datacenter** | **Enterprise** | **Standard** | **Web** | **Workgroup** | **Express with Advanced Services** | **Express with Tools** | **Express** |
| SQL Server Configuration Manager | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| SQL CMD (command prompt tool) | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| SQL Server Migration Assistant1 | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| SQL Server Management Studio2 | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |
| SQL Server Agent | Yes | Yes | Yes | Yes | Yes |  |  |  |
| Database Engine Tuning Advisor | Yes | Yes | Yes | Yes | Yes |  |  |  |
| SQL Server Profiler | Yes | Yes | Yes | Yes | Yes | No3 | No3 | No3 |
| Analysis Services, PowerPivot IT operation dashboard | Yes | Yes |  |  |  |  |  |  |

1For more information about SQL Server Migration Assistant, see [Migrate to SQL Server](http://go.microsoft.com/fwlink/?LinkId=133453) on the SQL Server web site.

2For more information about SQL Server Management Studio Express see, [SQL Server Management Studio Express](http://msdn.microsoft.com/en-us/library/ms365247(v=sql.105).aspx).

3SQL Server Workgroup, SQL Server Web, SQL Server Express, SQL Server Express Tools,and SQL Server Express Advanced can be profiled using SQL Server Standard and SQL Server Enterprise editions

[Development Tools](javascript:void(0))

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Feature Name** | **Datacenter** | **Enterprise** | **Standard** | **Web** | **Workgroup** | **Express with Advanced Services** | **Express with Tools** | **Express** |
| Microsoft Visual Studio Integration | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| IntelliSense (Transact-SQL and MDX) | Yes | Yes | Yes |  | Yes | Yes | Yes | No  (SSMS is not installed with this edition) |
| Business Intelligence Development Studio | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| SQL query, edit and design tools | Yes | Yes | Yes |  | Yes |  |  |  |
| Version control support | Yes | Yes | Yes |  | Yes |  |  |  |
| MDX edit, debug, and design tools | Yes | Yes | Yes |  |  |  |  |  |

[Programmability](javascript:void(0))

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Feature Name** | **Datacenter** | **Enterprise** | **Standard** | **Web** | **Workgroup** | **Express with Advanced Services** | **Express with Tools** | **Express** |
| Entity Framework support | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Common language runtime (CLR) integration | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Native XML support | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| XML indexing | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| MERGE and UPSERT capabilities | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| FILESTREAM support | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Date and Time data types | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Internationalization support | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Full-text search | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| Specification of language in query | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| Service Broker (messaging) | Yes | Yes | Yes | Client only | Yes | Client only | Client only | Client only |
| XML/A support | Yes | Yes | Yes |  |  |  |  |  |
| Web services (HTTP/SOAP endpoints) | Yes | Yes | Yes |  |  |  |  |  |
| T-SQL endpoints | Yes | Yes | Yes |  |  |  |  |  |

[Spatial and Location Services](javascript:void(0))

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Feature Name** | **Datacenter** | **Enterprise** | **Standard** | **Web** | **Workgroup** | **Express with Advanced Services** | **Express with Tools** | **Express** |
| Planar and geodetic data types | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Spatial indexes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Advanced spatial libraries | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Import/export of industry-standard spatial data formats | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Spatial results tab within SQL Server Management Studio | Yes | Yes | Yes | Yes | Yes | Yes | Yes |  |

[Complex Event Processing (StreamInsight](javascript:void(0))

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Feature** | **Datacenter** | **Enterprise** | **Standard** | **Web** | **Workgroup** | **Express with Advanced Services** | **Express Tools** | **Express** |
| Premium edition | Yes |  |  |  |  |  |  |  |
| Standard edition |  | Yes | Yes |  |  |  |  |  |

For more information about the editions of StreamInsight, see [Choosing a StreamInsight Edition](http://msdn.microsoft.com/en-us/library/ff518551(v=sql.105).aspx).

[Integration Services](javascript:void(0))

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Feature** | **Datacenter** | **Enterprise** | **Standard** | **Web** | **Workgroup** | **Express with Advanced Services** | **Express Tools** | **Express** |
| SQL Server Import and Export Wizard | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Built-in data source connectors | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Integration Services designer and runtime | Yes | Yes | Yes |  |  |  |  |  |
| Basic tasks and transformations in addition to those used by the Import and Export Wizard | Yes | Yes | Yes |  |  |  |  |  |
| Log providers and logging | Yes | Yes | Yes |  |  |  |  |  |
| Basic data profiling tools | Yes | Yes | Yes |  |  |  |  |  |
| Programmable object model for extensibility | Yes | Yes | Yes |  |  |  |  |  |

[Integration Services - Advanced Adapters](javascript:void(0))

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Feature Name** | **Datacenter** | **Enterprise** | **Standard** | **Web** | **Workgroup** | **Express with Advanced Services** | **Express with Tools** | **Express** |
| High performance Oracle destination | Yes | Yes |  |  |  |  |  |  |
| High performance Teradata destination | Yes | Yes |  |  |  |  |  |  |
| SAP BW source and destination | Yes | Yes |  |  |  |  |  |  |
| Data mining model training destination adapter | Yes | Yes |  |  |  |  |  |  |
| Dimension processing destination adapter | Yes | Yes |  |  |  |  |  |  |
| Partition processing destination adapter | Yes | Yes |  |  |  |  |  |  |

[Integration Services - Advanced Transforms](javascript:void(0))

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Feature Name** | **Datacenter** | **Enterprise** | **Standard** | **Web** | **Workgroup** | **Express with Advanced Services** | **Express with Tools** | **Express** |
| Persistence (high performance) lookups | Yes | Yes |  |  |  |  |  |  |
| Data mining query transformation | Yes | Yes |  |  |  |  |  |  |
| Fuzzy grouping and lookup transformations | Yes | Yes |  |  |  |  |  |  |
| Term extractions and lookup transformations | Yes | Yes |  |  |  |  |  |  |

[Data Warehouse](javascript:void(0))

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Feature Name** | **Datacenter** | **Enterprise** | **Standard** | **Web** | **Workgroup** | **Express with Advanced Services** | **Express with Tools** | **Express** |
| Auto-generate staging and data warehouse schema | Yes | Yes | Yes |  |  |  |  |  |
| Change data capture | Yes | Yes |  |  |  |  |  |  |
| Data compression | Yes | Yes |  |  |  |  |  |  |
| Star join query optimization | Yes | Yes |  |  |  |  |  |  |
| Automatic use of indexed views by query optimizer | Yes | Yes |  |  |  |  |  |  |
| Scalable read-only AS configuration | Yes | Yes |  |  |  |  |  |  |
| Proactive caching | Yes | Yes |  |  |  |  |  |  |
| Parallel query processing on partitioned tables and indices | Yes | Yes |  |  |  |  |  |  |
| Partitioned cubes | Yes | Yes |  |  |  |  |  |  |
| Distributed partitioned cubes | Yes | Yes |  |  |  |  |  |  |

[Analysis Services](javascript:void(0))

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Feature Name** | **Datacenter** | **Enterprise** | **Standard** | **Web** | **Workgroup** | **Express with Tools** | **Express with Advanced Services** | **Express** |
| SQL Server Analysis Services backup | Yes | Yes | Yes |  |  |  |  |  |
| Dimension, attribute relationship, aggregate, and cube design | Yes | Yes | Yes |  |  |  |  |  |
| Translations | Yes | Yes | Yes |  |  |  |  |  |
| Personalization extensions | Yes | Yes | Yes |  |  |  |  |  |
| SQL Server PowerPivot for SharePoint | Yes | Yes |  |  |  |  |  |  |

[Analysis Services - Advanced Analytic Functions](javascript:void(0))

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Feature Name** | **Datacenter** | **Enterprise** | **Standard** | **Web** | **Workgroup** | **Express with Tools** | **Express with Advanced Services** | **Express** |
| Financial aggregations | Yes | Yes |  |  |  |  |  |  |
| Partitioned cubes and distributed partitioned cubes | Yes | Yes |  |  |  |  |  |  |
| Custom rollups | Yes | Yes |  |  |  |  |  |  |
| Semi-additive measures | Yes | Yes | No1 |  |  |  |  |  |
| Writeback dimensions | Yes | Yes |  |  |  |  |  |  |
| Linked measures and dimensions | Yes | Yes |  |  |  |  |  |  |
| Binary and compressed XML transport | Yes | Yes | Yes |  |  |  |  |  |
| Account intelligence | Yes | Yes |  |  |  |  |  |  |
| Perspectives | Yes | Yes |  |  |  |  |  |  |
| Scalable shared databases | Yes | Yes |  |  |  |  |  |  |

1The LastChild semi-additive measure is supported in Standard edition, but other semi-additive measures, such as None, FirstChild, FirstNonEmpty, LastNonEmpty, AverageOfChildren, and ByAccount, are not. Additive measures, such as Sum, Count, Min, Max, and non-additive measures (DistinctCount) are supported on all editions.

[Data Mining](javascript:void(0))

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Feature Name** | **Datacenter** | **Enterprise** | **Standard** | **Web** | **Workgroup** | **Express with Tools** | **Express with Advanced Services** | **Express** |
| Comprehensive set of data mining algorithms | Yes | Yes | Yes |  |  |  |  |  |
| Integrated data mining tools: wizards, editors, model viewers, query builder | Yes | Yes | Yes |  |  |  |  |  |
| Cross validation | Yes | Yes |  |  |  |  |  |  |
| Advanced configuration and tuning options for data mining algorithms | Yes | Yes |  |  |  |  |  |  |
| Support for pipeline data mining and text mining with Integration Services | Yes | Yes |  |  |  |  |  |  |
| Support for plug-in algorithms | Yes | Yes |  |  |  |  |  |  |
| Parallel model processing | Yes | Yes |  |  |  |  |  |  |
| Sequence prediction | Yes | Yes |  |  |  |  |  |  |

[Reporting](javascript:void(0))

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Feature Name** | **Datacenter** | **Enterprise** | **Standard** | **Web** | **Workgroup** | **Express with Advanced Services** | **Express with Tools** | **Express** |
| Reporting Services memory limits | OS Maximum | OS Maximum | OS Maximum | 4 GB | 4 GB (x64) OS Maximum (x32) | 4 GB |  |  |
| Allowed catalog DB SQL Server edition | SQL Server Standard, SQL Server Enterprise and SQL Server DataCenter | SQL Server Standard, SQL Server Enterprise and SQL Server DataCenter | SQL Server Standard, SQL Server Enterprise and SQL Server DataCenter | SQL Server Web | SQL Server Workgroup | SQL Server Express |  |  |
| Allowed data source SQL Server edition | All | All | All | SQL Server Web | SQL Server Workgroup | SQL Server Express |  |  |
| Report server | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| Report Designer | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| Report Manager | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| Reports as data feeds | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| Enhanced gauges and charting | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| Maps and map layers | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| Custom authentication | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| Export to Excel, Word, PDF, and images | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| Role Based Security | Yes | Yes | Yes | Yes | Yes | Yes |  |  |
| Create Custom Roles | Yes | Yes | Yes | No (Fixed roles only) | No (Fixed roles only) | No (Fixed roles only) |  |  |
| Model support | Yes | Yes | Yes | Yes | Yes |  |  |  |
| Model Item Security | Yes | Yes | Yes |  |  |  |  |  |
| Infinite click-through | Yes | Yes | Yes |  |  |  |  |  |
| E-mail and file share subscriptions and scheduling | Yes | Yes | Yes |  |  |  |  |  |
| Report history, executing snapshots, and caching | Yes | Yes | Yes |  |  |  |  |  |
| SharePoint integration | Yes | Yes | Yes |  |  |  |  |  |
| Shared component library | Yes | Yes | Yes |  |  |  |  |  |
| Remote and non-relational data source support | Yes | Yes | Yes |  |  |  |  |  |
| Data source, delivery, and rendering extensibility | Yes | Yes | Yes |  |  |  |  |  |
| Report definition customization extension (RDCE) | Yes | Yes | Yes |  |  |  |  |  |
| Data-driven report subscriptions | Yes | Yes |  |  |  |  |  |  |
| Scale out deployment (Web farms) | Yes | Yes |  |  |  |  |  |  |

[Business Intelligence Clients](javascript:void(0))

The following software client applications are available on the Microsoft Downloads center and are provided to assist you with creating business intelligence documents that run on a SQL Server instance. When you host these documents in a server environment, use an edition of SQL Server that is supported for that document type. The following table identifies which SQL Server edition contains the server features required to host the documents created in these client applications.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Feature Name | Datacenter | Enterprise | Standard | Web | Workgroup | Express with Advanced Services | Express with Tools | Express |
| Report Builder 3.0 | Yes | Yes | Yes |  | Yes |  |  |  |
| Excel 2007 and Visio 2007 Add-in support | Yes | Yes | Yes |  |  |  |  |  |
| PowerPivot for Excel | Yes | Yes |  |  |  |  |  |  |

[Master Data Services](javascript:void(0))

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Feature Name** | **Datacenter** | **Enterprise** | **Standard** | **Web** | **Workgroup** | **Express with Advanced Services** | **Express with Tools** | **Express** |
| Master Data Services database | Yes | Yes |  |  |  |  |  |  |
| Master Data Manager Web application | Yes | Yes |  |  |  |  |  |  |
| Master Data Services Web service | Yes | Yes |  |  |  |  |  |  |

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| **NoteNote** |
| Master Data Services is available on only the 64-bit editions of SQL Server 2008 R2 Datacenter and SQL Server 2008 R2 Enterprise. |

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| Stay Up to Date with SQL Server Install, and Upgrade information  For the latest downloads, articles, videos and troubleshooting information from Microsoft, as well as selected solutions from the community, visit the [SQL Server Setup page](http://go.microsoft.com/fwlink/?LinkId=199249)  For automatic notification of these updates, subscribe to the RSS feeds available on the page. |

**Encrypting Connections to SQL Server**

**SQL Server 2008 R2**

[Other Versions](javascript:;)



* [SQL Server 2008](http://msdn.microsoft.com/en-us/library/ms189067(d=printer,v=sql.100).aspx)
* [SQL Server 2005](http://msdn.microsoft.com/en-us/library/ms189067(d=printer,v=sql.90).aspx)

SQL Server supports Secure Sockets Layer (SSL) and is compatible with Internet Protocol security (IPSec).

[Secure Sockets Layer (SSL)](javascript:void(0))

Microsoft SQL Server can use Secure Sockets Layer (SSL) to encrypt data that is transmitted across a network between an instance of SQL Server and a client application. The SSL encryption is performed within the protocol layer and is available to all SQL Server clients except DB Library and MDAC 2.53 clients.

SSL can be used for server validation when a client connection requests encryption. If the instance of SQL Server is running on a computer that has been assigned a certificate from a public certification authority, identity of the computer and the instance of SQL Server is vouched for by the chain of certificates that lead to the trusted root authority. Such server validation requires that the computer on which the client application is running be configured to trust the root authority of the certificate that is used by the server. Encryption with a self-signed certificate is possible and is described in the following section, but a self-signed certificate offers only limited protection.

The level of encryption used by SSL, 40-bit or 128-bit, depends on the version of the Microsoft Windows operating system that is running on the application and database computers.

Enabling SSL encryption increases the security of data transmitted across networks between instances of SQL Server and applications. However, enabling encryption does slow performance. When all traffic between SQL Server and a client application is encrypted using SSL, the following additional processing is required:

* An extra network roundtrip is required at connect time.
* Packets sent from the application to the instance of SQL Server must be encrypted by the client Net-Library and decrypted by the server Net-Library.
* Packets sent from the instance of SQL Server to the application must be encrypted by the server Net-Library and decrypted by the client Net-Library.

[Configuring SSL for SQL Server](javascript:void(0))

The following procedure describes how to configure SSL for SQL Server.

To configure SSL

1. Install a certificate in the Windows certificate store of the server computer.
2. Click Start, in the Microsoft SQL Server program group, point to Configuration Tools, and then click SQL Server Configuration Manager.
3. Expand SQL Server Network Configuration, right-click the protocols for the server you want, and then click Properties.

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| **Note** |
| This is the Protocols for <instance\_name> section in the left pane of the tool, not a specific protocol in the right pane. |

1. On the Certificate tab, configure the Database Engine to use the certificate.
2. On the Flags tab, view or specify the protocol encryption option. The login packet will always be encrypted.
   * When the ForceEncryption option for the Database Engine is set to Yes, all client/server communication is encrypted and clients that cannot support encryption are denied access.
   * When the ForceEncryption option for the Database Engine is set to No, encryption can be requested by the client application but is not required.
   * SQL Server must be restarted after you change the ForceEncryption setting.

Credentials (in the login packet) that are transmitted when a client application connects to SQL Server are always encrypted. SQL Server will use a certificate from a trusted certification authority if available. If a trusted certificate is not installed, SQL Server will generate a self-signed certificate when the instance is started, and use the self-signed certificate to encrypt the credentials. This self-signed certificate helps increase security but it does not provide protection against identity spoofing by the server. If the self-signed certificate is used, and the value of the ForceEncryption option is set to Yes, all data transmitted across a network between SQL Server and the client application will be encrypted using the self-signed certificate

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| **Caution** |
| SSL connections that are encrypted by using a self-signed certificate do not provide strong security. They are susceptible to man-in-the-middle attacks. You should not rely on SSL using self-signed certificates in a production environment or on servers that are connected to the Internet. |

[Certificate Requirements](javascript:void(0))

For SQL Server to load a SSL certificate, the certificate must meet the following conditions:

* The certificate must be in either the local computer certificate store or the current user certificate store.
* The current system time must be after the **Valid from** property of the certificate and before the **Valid to** property of the certificate.
* The certificate must be meant for server authentication. This requires the **Enhanced Key Usage** property of the certificate to specify **Server Authentication (1.3.6.1.5.5.7.3.1)**.
* The certificate must be created by using the **KeySpec** option of **AT\_KEYEXCHANGE**. Usually, the certificate's key usage property (**KEY\_USAGE**) will also include key encipherment (**CERT\_KEY\_ENCIPHERMENT\_KEY\_USAGE**).
* The **Subject** property of the certificate must indicate that the common name (CN) is the same as the host name or fully qualified domain name (FQDN) of the server computer. If SQL Server is running on a failover cluster, the common name must match the host name or FQDN of the virtual server and the certificates must be provisioned on all nodes in the failover cluster.
* SQL Server 2008 R2 and the SQL Server 2008 R2 Native Client support wildcard certificates. Other clients might not support wildcard certificates. For more information, see the client documentation and [KB258858](http://support.microsoft.com/kb/258858).

[SQL Server Native Client Certificate Requirements](javascript:void(0))

Applications that use "SERVER=shortname; ENCRYPT=yes" with certificate whose **Subjects** specify Fully Qualified Domain Names (FQDN's) have connected in the past due to relaxed validation. SQL Server 2008 R2 enhances security by enforcing an exact match of the subjects for certificates. Applications that rely upon relaxed validation must take one of the following actions:

* Use the FQDN in the connection string.
  + This option does not require recompiling the application if the SERVER keyword of the connection string is configured outside the application.
  + This option does not work for applications that have their connection strings hardcoded.
  + This option does not work for applications that use Database Mirroring since the mirrored server replies with a simple name.
* Add an alias for the shortname to map to the FQDN.
  + This option works even for applications that have their connection strings hardcoded.
  + This option does not work for applications that use Database Mirroring since the providers don’t look up aliases for received failover partner names.
* Have a certificate issued for shortname.
  + This option works for all applications.

[Encryption on a Cluster](javascript:void(0))

If you want to use encryption with a failover cluster, you must install the server certificate with the fully qualified DNS name of the failover clustered instance on all nodes in the failover cluster. For example, if you have a two-node cluster, with nodes named **test1.*your company*.com** and **test2. *your company*.com** and a failover clustered instance of SQL Server named **fcisql**, you must obtain a certificate for **fcisql.*your company*.com** and install the certificate on both nodes. To configure the failover cluster for encryption, you can then select the ForceEncryption check box on the Protocols for <server> property box of SQL Server Network Configuration.

[Internet Protocol Security (IPSec)](javascript:void(0))

SQL Server data can be encrypted during transmission by using IPSec. IPSec is provided by the client and server operating systems and requires no SQL Server configuration. For information about IPSec, see your Windows or networking documentation.

# Availability Enhancements (Database Engine)

**SQL Server 2008 R2**

[Other Versions](javascript:;)



* [SQL Server 2008](http://msdn.microsoft.com/en-us/library/cc645581(d=printer,v=sql.100).aspx)
* [SQL Server 2012](http://msdn.microsoft.com/en-us/library/cc645581(d=printer,v=sql.110).aspx)

0 out of 2 rated this helpful - [Rate this topic](http://msdn.microsoft.com/en-us/library/cc645581(d=printer,v=sql.105).aspx#feedback)

|  |
| --- |
| **NoteNote** |
| For SQL Server 2008 R2, there have been no changes to the content that is listed in this topic. |

The availability of SQL Server 2008 databases is improved by enhancements to database mirroring. Database mirroring enables the creation of hot standby servers that provide rapid failover support with no loss of data from committed transactions.

[Database Mirroring](javascript:void(0))

### Performance Enhancements

Performance enhancements include the following:

* Write-ahead on the incoming log stream on the mirror server.

In SQL Server 2008, when receiving incoming log records, the mirror server writes them to disk asynchronously. At the same time, the mirror server processes log records that have already been written to disk.

* Improved use of log send buffers.

In SQL Server 2005, every log-flush operation on the principal server reserves a whole database mirroring log send buffer for its log records. In SQL Server 2008, if the most recently used log cache contains sufficient free space for the log records of the next log-flush operation, they are appended to that log cache. Otherwise, a new log cache is allocated.

* Compression of the stream of transaction log records.

The principal server compresses the stream of transaction log records before sending it to the mirror server. This log compression occurs in all mirroring sessions.

* Compression of stream data for which at least a 12.5 percent compression ratio can be achieved.
* Page read-ahead during the undo phase.

After a failover, the new mirror server must undo every change for which a page was written to disk locally but for which the log record might not have reached the former mirror server (the new principal server). To undo such changed pages, the mirror server must first request and receive the corresponding pages from the new principal server. Performance of this part of the undo phase is enhanced in SQL Server 2008. Early in the undo phase, the mirror server sends read-ahead hints to the principal server to indicate which pages will be requested later. After receiving a read-ahead hint for a page, the principal server puts that page in its send buffer. On receiving the corresponding page request, the principal server can respond immediately.

### Automatic Recovery from Corrupted Pages

A database mirroring partner running on SQL Server 2008 or later versions automatically tries to resolve certain types of errors that prevent reading a data page. The partner that is unable to read a page requests a fresh copy from the other partner. If this request succeeds, the unreadable page is replaced by the copy, which usually resolves the error. For more information, see [Automatic Page Repair During a Database Mirroring Session](http://msdn.microsoft.com/en-us/library/bb677167(v=sql.105).aspx).

# Programmability Enhancements (Database Engine)

**SQL Server 2008 R2**

[Other Versions](javascript:;)



* [SQL Server 2008](http://msdn.microsoft.com/en-us/library/cc645577(d=printer,v=sql.100).aspx)
* [SQL Server 2012](http://msdn.microsoft.com/en-us/library/cc645577(d=printer,v=sql.110).aspx)

2 out of 2 rated this helpful - [Rate this topic](http://msdn.microsoft.com/en-us/library/cc645577(d=printer,v=sql.105).aspx#feedback)

|  |
| --- |
| **Note** |
| For SQL Server 2008 R2, there have been no changes to the content that is listed in this topic. |

Programmability enhancements in the Database Engine include new data storage features, new data types, new full-text search architecture, and numerous improvements and additions to Transact-SQL.

[Data Storage](javascript:void(0))

### Compressed Storage of Tables and Indexes

SQL Server 2008 supports on-disk storage compression in both row and page format for tables, indexes, and indexed views. Compression of partitioned tables and indexes can be configured independently for each partition. For more information, see [Creating Compressed Tables and Indexes](http://msdn.microsoft.com/en-us/library/cc280449(v=sql.105).aspx).

### FILESTREAM Storage

FILESTREAM storage enables SQL Server applications to store unstructured data, such as documents and images, on the file system. This enables client applications to use the rich streaming APIs and performance of the file system while maintaining transactional consistency between the unstructured data and corresponding structured data. For more information, see [Designing and Implementing FILESTREAM Storage](http://msdn.microsoft.com/en-us/library/bb895234(v=sql.105).aspx).

### New Collations

SQL Server 2008 introduces new collations that are in full alignment with collations that Windows Server 2008 provides. These 80 new collations are denoted by \*\_100 version references. These collations provide users with the most up-to-date and linguistically accurate cultural sorting conventions. For more information, see [Collation and Unicode Support](http://msdn.microsoft.com/en-us/library/ms143503(v=sql.105).aspx) and [Working with Collations](http://msdn.microsoft.com/en-us/library/ms187582(v=sql.105).aspx).

### Partition Switching on Partitioned Tables and Indexes

Partitioning data enables you to manage and access subsets of your data quickly and efficiently while maintaining the integrity of the entire data collection. Now you can use partition switching to quickly and efficiently transfer subsets of your data by switching a partition from one table to another.

For information about partition switching concepts, and to see sample code that implements partition switching, see [Transferring Data Efficiently by Using Partition Switching](http://msdn.microsoft.com/en-us/library/ms191160(v=sql.105).aspx) and [Partition Switching When Indexed Views Are Defined](http://msdn.microsoft.com/en-us/library/bb964715(v=sql.105).aspx).

### Sparse Columns and Column Sets

Sparse columns are ordinary columns that have an optimized storage format for null values. Consider using sparse columns when at least 20 percent to 40 percent of the values in a column will be NULL. For more information, see [Using Sparse Columns](http://msdn.microsoft.com/en-us/library/cc280604(v=sql.105).aspx).

Tables that use sparse columns can designate a column set to return all sparse columns in the table. A column set is an untyped XML representation that combines all the sparse columns of a table into a structured output. For more information, see [Using Column Sets](http://msdn.microsoft.com/en-us/library/cc280521(v=sql.105).aspx).

### Spatial Data Storage, Methods, and Indexing

Spatial data represents information about the physical location and shape of geometric objects. These objects can be point locations or more complex objects such as countries, roads, or lakes.

For more information, see [Working with Spatial Data (Database Engine)](http://msdn.microsoft.com/en-us/library/bb933876(v=sql.105).aspx), [geometry Data Type Method Reference](http://msdn.microsoft.com/en-us/library/bb933973(v=sql.105).aspx), and [geography Data Type Method Reference](http://msdn.microsoft.com/en-us/library/bb933802(v=sql.105).aspx).

Spatial indexes improve the efficiency of certain set-oriented operations on spatial objects (spatial data). A spatial index reduces the number of objects on which relatively costly spatial operations need to be applied. For more information, see [Working with Spatial Indexes (Database Engine)](http://msdn.microsoft.com/en-us/library/bb895265(v=sql.105).aspx).

### Wide Tables

Wide tables are tables that contain one or more column sets. A wide table can contain up to 30000 columns, 1000 indexes, and 30000 statistics. For more information, see [Special Table Types](http://msdn.microsoft.com/en-us/library/ms186986(v=sql.105).aspx).

[Data Types](javascript:void(0))

### Date and Time Data Types

SQL Server 2008 introduces four new date and time data types. These types enable applications to have separate types for date or time, increased year range, increased fractional second precision and time-zone offset support. For more information, see [Using Date and Time Data](http://msdn.microsoft.com/en-us/library/ms180878(v=sql.105).aspx).

### hierarchyid Data Type

SQL Server 2008 introduces a new system-provided data type to encapsulate hierarchical relationships. Use hierarchyid as a data type to create tables with a hierarchical structure or to reference the hierarchical structure of data in another location. Use hierarchical methods to query and perform work with hierarchical data by using Transact-SQL.

Examples where the hierarchyid type makes it easier to store and query hierarchical data include the following:

* An organizational structure
* A file system
* A set of tasks in a project
* A taxonomy of language terms
* A graph of links between Web pages

The related SqlHierarchyId CLR data type is available for client applications. For more information, see [Using hierarchyid Data Types (Database Engine)](http://msdn.microsoft.com/en-us/library/bb677173(v=sql.105).aspx).

### Spatial Data Types

SQL Server 2008 introduces two spatial data types: geometry and geography. The geometry data type supports planar, or Euclidean (flat-earth), data. The geography data type stores ellipsoidal (round-earth) data, such as GPS latitude and longitude coordinates. These new data types support the storage and manipulation of spatial data objects such as linestrings, points, and polygons. For more information, see [Working with Spatial Data (Database Engine)](http://msdn.microsoft.com/en-us/library/bb933876(v=sql.105).aspx).

### User-Defined Table Type

The Database Engine introduces a new user-defined table type that supports representing table structures for use as parameters in stored procedures and functions, or in a batch or the body of a stored procedure or function. You can create unique constraints and primary keys on user-defined table types.

For more information, see [User-Defined Table Types](http://msdn.microsoft.com/en-us/library/bb522526(v=sql.105).aspx).

### User Defined Types (UDT)

The maximum size of a UDT has been increased to 2147483647 bytes.

[Full-Text Search](javascript:void(0))

SQL Server 2008 Enterprise full-text search introduces a new full-text architecture. Full-text search is now a fully integrated feature of a database. As a result, full-text search has been significantly enhanced in the following areas:

* Full-text catalogs are integrated into the database, rather than being stored in the file system, so moving a database now automatically moves the full-text catalogs.
* SQL Server 2005 noise words have been replaced by stopwords. Configuration of stopwords is managed by a new set of stoplist objects. These objects are associated with the database and moved around with it. This maintains the stopword configuration intact during manageability operations such as backup and restore, detach and attach, and copying a database with the Copy Database Wizard. For more information, see [Stopwords and Stoplists](http://msdn.microsoft.com/en-us/library/ms142551(v=sql.105).aspx).
* Query and indexing performance have improved dramatically in some specific scenarios as a result of integration with other important query components such as the query optimizer. For more information, see [Performance Tuning and Optimization of Full-Text Indexes](http://msdn.microsoft.com/en-us/library/ms142560(v=sql.105).aspx).
* New tools help you understand the raw content of a full-text index and the behavior of a specific word breaker in a given query term or phrase. For more information, see [sys.dm\_fts\_index\_keywords (Transact-SQL)](http://msdn.microsoft.com/en-us/library/cc280900(v=sql.105).aspx), [sys.dm\_fts\_index\_keywords\_by\_document (Transact-SQL)](http://msdn.microsoft.com/en-us/library/cc280607(v=sql.105).aspx) and [sys.dm\_fts\_parser (Transact-SQL)](http://msdn.microsoft.com/en-us/library/cc280463(v=sql.105).aspx). These and other new dynamic management views and stored procedures facilitate troubleshooting full-text search issues. For information about these troubleshooting resources, see [Troubleshooting Full-Text Search](http://msdn.microsoft.com/en-us/library/ms142487(v=sql.105).aspx).
* A new family of word breakers improves word-breaking accuracy and extends the set of languages available for full-text search. For more information, see [Word Breakers and Stemmers](http://msdn.microsoft.com/en-us/library/ms142509(v=sql.105).aspx).

For more information, see [Behavior Changes to Full-Text Search in SQL Server 2008 R2](http://msdn.microsoft.com/en-us/library/ms143272(v=sql.105).aspx), [Deprecated Full-Text Search Features in SQL Server 2008 R2](http://msdn.microsoft.com/en-us/library/cc646010(v=sql.105).aspx), [Breaking Changes to Full-Text Search in SQL Server 2008 R2](http://msdn.microsoft.com/en-us/library/ms143709(v=sql.105).aspx) and [Full-Text Search Architecture](http://msdn.microsoft.com/en-us/library/ms142541(v=sql.105).aspx).

[Transact-SQL](javascript:void(0))

### Compatibility Level

ALTER DATABASE SET COMPATIBILITY\_LEVEL replaces sp\_dbcmptlevel for setting the database compatibility level. For more information, see [ALTER DATABASE Compatibility Level (Transact-SQL)](http://msdn.microsoft.com/en-us/library/bb510680(v=sql.105).aspx).

### Compound Operators

Operators that perform an operation and set a variable to the result, for example SET @x += 2, are available. For more information, see [Compound Operators (Transact-SQL)](http://msdn.microsoft.com/en-us/library/cc645922(v=sql.105).aspx).

### CONVERT Function

The CONVERT function is enhanced to allow conversions between binary and character hexadecimal values. For more information, see [CAST and CONVERT (Transact-SQL)](http://msdn.microsoft.com/en-us/library/ms187928(v=sql.105).aspx).

### Date and Time Functionality

SQL Server 2008 includes support for the ISO week-date system. For more information, see [DATEPART (Transact-SQL)](http://msdn.microsoft.com/en-us/library/ms174420(v=sql.105).aspx).

### GROUPING SETS

The GROUPING SETS, ROLLUP, and CUBE operators are added to the GROUP BY clause. There is a new function, GROUPING\_ID(), that returns more grouping-level information than the existing GROUPING() function. The non-ISO compliant WITH ROLLUP, WITH CUBE, and ALL syntax is deprecated. For more information, see [Using GROUP BY with ROLLUP, CUBE, and GROUPING SETS](http://msdn.microsoft.com/en-us/library/bb522495(v=sql.105).aspx).

### MERGE Statement

This new Transact-SQL statement performs INSERT, UPDATE, or DELETE operations on a target table based on the results of a join with a source table. The syntax allows you to join a data source with a target table or view, and then perform multiple actions based on the results of that join. For more information, see [MERGE (Transact-SQL)](http://msdn.microsoft.com/en-us/library/bb510625(v=sql.105).aspx).

### SQL Dependency Reporting

SQL Server 2008 introduces a new catalog view and system functions to provide consistent and reliable SQL dependency reporting. You can use [sys.sql\_expression\_dependencies](http://msdn.microsoft.com/en-us/library/bb677315(v=sql.105).aspx), [sys.dm\_sql\_referencing\_entities](http://msdn.microsoft.com/en-us/library/bb630351(v=sql.105).aspx), and [sys.dm\_sql\_referenced\_entities](http://msdn.microsoft.com/en-us/library/bb677185(v=sql.105).aspx) to report on cross-server, cross-database, and database SQL dependencies for both schema-bound and non-schema-bound objects. For more information, see [Reporting SQL Dependencies](http://msdn.microsoft.com/en-us/library/bb677168(v=sql.105).aspx).

### Table-Valued Parameters

The Database Engine introduces a new parameter type that can reference user-defined table types. Table-valued parameters can send multiple rows of data to a SQL Server statement or routine (such as a stored procedure or function) without creating a temporary table. For more information, see [Table-Valued Parameters (Database Engine)](http://msdn.microsoft.com/en-us/library/bb510489(v=sql.105).aspx).

### Transact-SQL Row Constructors

Transact-SQL is enhanced to allow multiple value inserts within a single INSERT statement. For more information, see [INSERT (Transact-SQL)](http://msdn.microsoft.com/en-us/library/ms174335(v=sql.105).aspx).