



Online Transaction Processing in SQL Server 2008

White Paper

Published: August 2007

Updated: July 2008

Summary: Microsoft SQL Server 2008 provides a database platform that is optimized for today's applications, and that can scale for any size of business. It drives cost-efficiencies by dramatically reducing downtime and enabling dynamic and proactive management that significantly reduces administrative overhead. SQL Server 2008 provides a highly secure platform that you can trust with your organization's sensitive, business-critical data.

For the latest information, see [Microsoft SQL Server 2008](#).

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Introduction

The general acceptance and growth of database usage has grown phenomenally over the past 20 years. The drop in storage and technology costs has led to large amounts of storage growth and database proliferation. Because of this readily available technology, embedded databases come with many products and enable companies to store more data for longer, so companies want to consolidate their servers.

SQL Server 2008 focuses on four key areas to meet today's OLTP database needs:

Scale and Performance. SQL Server 2008 enables companies to build a database solution with the performance and scalability capabilities that are required by today's applications.

High Availability. SQL Server 2008 provides a database application with Always-On Technologies, while minimizing the management and performance overhead of your high-availability solution.

Security. SQL Server 2008 provides an enhanced secure data platform by encrypting your valuable data, auditing changes to your data and metadata, incorporating external cryptographic keys, and encrypting and signing data in backup files.

Manageability. SQL Server 2008 enables companies to reduce the time and cost of managing their data infrastructure by providing innovative and automated policy-based administration and improved tools for performance monitoring, troubleshooting, and tuning.

Scale and Performance

The recent trend towards data center and server consolidation as well as a proliferation of remote and embedded databases, makes it important for a database server to be scalable and to perform well for a wide variety of applications. SQL Server 2008 provides a rich database environment that is capable of scaling to your data needs.

Effective Data Storage

Although disk space is generally inexpensive, there are many benefits to reducing the amount of storage space used by your database. Large data files can slow performance during reads and writes. One way SQL Server 2008 addresses this problem is with data compression. Data compression enables you to store your data more effectively, to reduce the storage requirements for your data, and to significantly improve performance for large workloads with a high disk input/output (I/O). SQL Server 2008 also provides native support out-of-the box for backup compression.

SQL Server 2008 also promotes efficient use of disk space through support for data types such as XML, VARCHAR(MAX) and VARBINARY(MAX). Additionally, the inefficient disk storage and performance degradation that can be caused by reserving space for nullable values is resolved with the support for sparse columns provided in SQL Server 2008.

SQL Server 2008 provides minimal logging when inserting large amount of data into a table that has no indexes. It offers improved performance when transferring data from a staging table to the user table.

Efficient Use of Server Memory

As databases continue to grow in size and functionality, database servers must be able to take full advantage of the memory that is installed in the server. SQL Server 2008 supports dynamic allocation of AWE-mapped memory, so can support up to 64 GB of memory with Windows Server 2003, Datacenter Edition. This enables your database to scale up effectively to meet the performance requirements of your users.

Balanced Workload Performance

Although SQL Server dynamically manages memory resources, as data systems grow and servers are consolidated, you must be able to balance performance across the different workloads on a SQL Server instance. Resource Governor is a new tool in SQL Server 2008 that provides the ability to define limits and assign priorities to the individual workloads that are running on the SQL Server instance. This feature enables companies to take advantage of server consolidation while maintaining consistent performance.

Optimal Concurrency

With larger data stores, locking at the row level can consume too many resources and slow performance. To resolve this, SQL Server 2008 provides greater control over lock escalation to allow you to escalate locks to the partition or table level, which provides better performance on large data stores.

High Availability

With the growth of the data environment, it has become even more important to achieve always-on data operations. SQL Server 2005 broke new ground with Always-On Technologies by including database mirroring and more robust backup and restore functionality. SQL Server 2008 delivers on that foundation to better serve line-of-business, mission-critical applications.

Increased Database Availability with Database Mirroring

With SQL Server 2005, Microsoft introduced database mirroring as a way to increase data protection and increase the availability of a database. Database mirroring consists of two servers that act as partners for the database mirroring session. One of these partners acts as the principal server, and the other is the mirror server, which holds a read-only copy of the database. Database mirroring is essentially a software-based redundancy solution.

Database mirroring protects the database access by providing manual or automatic failover when the principal server fails. To provide additional access to the data, you can configure the mirror server with a database snapshot that allows read-only access to the mirror copy.

A data page can become corrupt when a disk fails, or from a power outage. SQL Server 2008 Enterprise protects the integrity of the data and enables a partner node to automatically attempt to recover from these bad page errors. This attempt at recovery enables SQL Server to recover from the physical data corruption more quickly and possibly without human intervention.

Database mirroring requires the transfer of log information between the mirroring partners. Transferring a large amount of data can cause latency between the mirrored servers, as well as causing additional network traffic that affects all users and other servers. To optimize this data transfer, SQL Server 2008 uses outbound mirroring log stream compression. This compression minimizes the bandwidth that is required on the network to support database mirroring.

In many environments, it is not feasible to make changes to the client applications to make use of database mirroring. SQL Server 2008 adds transparent client redirection for database mirroring to alleviate the need to make changes to the client applications. With this feature, more companies can take advantage of database mirroring.

Failover Clustering

Many organizations require high availability solutions that protect the entire SQL Server instance, and not the individual databases. To meet this requirement, SQL Server 2008 can participate in a Microsoft Cluster Service Cluster group. A failover cluster appears to clients as a single instance of SQL Server 2008, but provides failover from one server to another when the current server becomes unavailable.

Additionally, to support mission critical applications and larger environments, SQL Server 2008 takes advantage of improvements in Windows Server 2008 clustering to provide support for clusters of up to 16 nodes.

The cluster validation tool enables companies to test the validity of their hardware configuration without having to rely on a list of whole system solutions that appear on the Window Catalog for Clustered Solution. This tool

allows companies greater flexibility in choosing the hardware for their clustering solutions.

Greater Data Access Flexibility with Replication

With replication, a company can add copies of a database at a remote site to increase site autonomy, a read-only copy of a database for reporting, or databases in a peer-to-peer replication topology with changes pertaining to each location being made at the respective location and replicated to the other locations. SQL Server 2008 supports transactional, merge, and snapshot replication to support distributed applications.

Replication has typically been an area that required a great deal of configuration and management. SQL Server 2008 provides a number of wizards and tools to assist with replication implementation and configuration.

The Peer-to-Peer Topology Wizard and Topology Viewer help database administrators to more easily setup and configure Peer-to-Peer transactional replication. The Topology Viewer helps you to visualize the existing topology. You can use the new visual designer and wizard to more easily create and modify your replication topology as shown in the following figure.

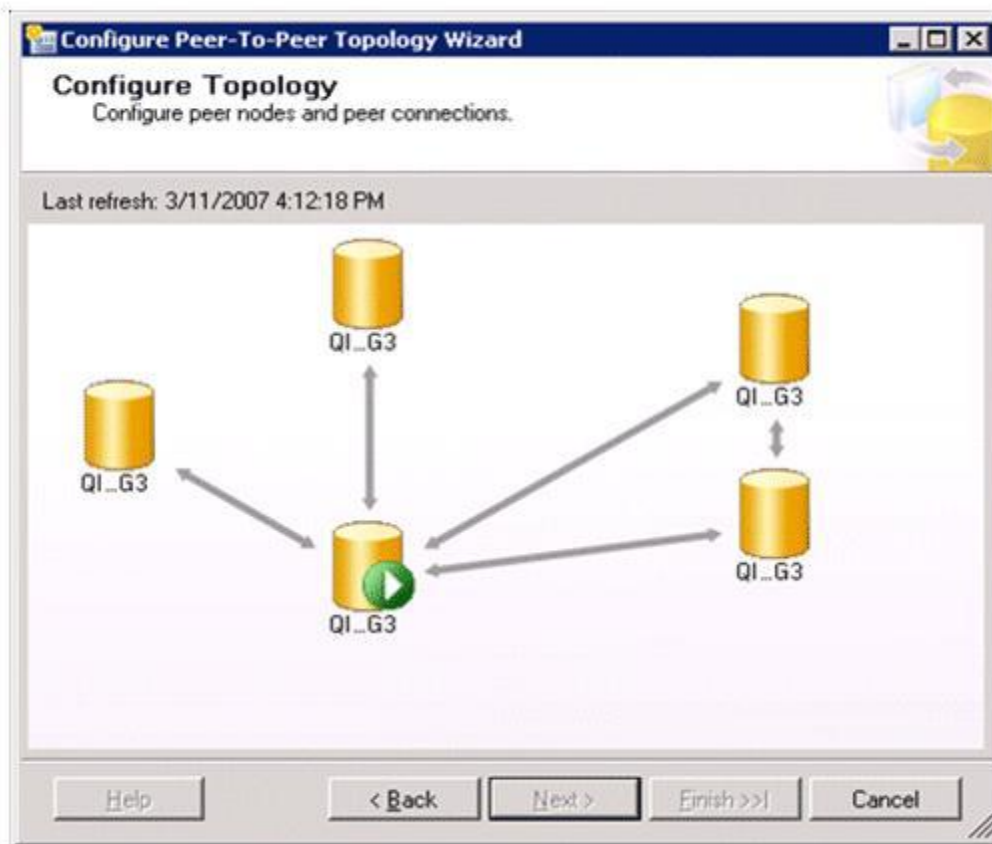


Figure 1

Additionally, in previous versions of SQL Server you had to stop data changes to the replication system while you added a new node to more than one peer in a peer-to-peer replication topology. Stopping system activity may not be feasible in mission-critical databases. SQL Server 2008 enables you to add new nodes to the replication topology without stopping system activity, so large mission critical databases can continue to function during the installation of new nodes.

Eliminate Server Shutdowns to Add Memory and Processors

When storing mission critical data, each shutdown affects your business productivity. SQL Server 2008 Enterprise supports adding memory and processors while the SQL Server service is running, so it eliminates the need for maintenance shutdowns.

Security

The increasing volume of private data that is stored, together with public awareness of security issues, and industry and governmental regulations for data storage, means that implementing a secure data solution is a major challenge for today's organizations. SQL Server includes tools to help you to configure security that is optimized to your security requirements. SQL Server 2008 builds on the security features of SQL Server 2005 and provides a secure and customizable security architecture, full event handling, flexible and secure storage with transparent data encryption, simple and consolidated enterprise encryption, and key management.

A Secure and Customizable Security Architecture

A robust permissions hierarchy allows administrators to assign permissions at a granular level, limiting access to only those users that require it. In addition to the standard permissions used to grant users access to the data, SQL Server allows administrators greater management flexibility by allowing them to assign specific permissions that are needed by assistant administrators to perform only the tasks that have been assigned to them.

SQL Server 2008 also provides password complexity and expiration policies that will better protect your data by deterring brute force attacks, and supports full encryption of sensitive communication between client applications and the server.

Full Event Auditing

With growing security concerns and government regulations, auditing has become an integral part of many database environments. Audit logs must be

able to record all events occurring on the database server, while being flexible enough to configure auditing of only required events. With SQL Server 2008, you can enable auditing at different levels, such as the server and the database level. These auditing events answer questions like, “What data was modified and by whom?” and “How many failed login attempts have occurred?”. In addition to the flexibility to configure auditing at different levels of your database platform, you can deploy auditing settings from one SQL Server to other SQL Servers in your enterprise, which makes an enterprise-wide auditing solution easier to deploy and manage.

When auditing is deployed across the enterprise, the Auditing Data Collector consolidates auditing reports to provide rich analysis of trends across the enterprise.

Flexible and Secure Storage with Transparent Data Encryption

In SQL Server 2005, key-based encryption capabilities are supported, but encrypted columns are not able to be indexed or searched. Also, client applications need to be modified to access the encrypted data. SQL Server 2008 provides transparent data encryption (TDE) which can be implemented at the database level to encrypt an entire database, a data file, or a log file without the need to make changes to the client applications. Data is encrypted and decrypted as it is written to and read from the disk. This implementation enables you to create indexes and search the contents of the encrypted data including Full-Text Searches of encrypted data, allowing more companies to take advantage of data encryption.

Simple and Consolidated Enterprise Encryption and Key Management

In SQL Server 2005, encryption keys are stored with the data and managed completely within SQL Server. In addition to this native SQL key management, SQL Server 2008 supports third party cryptographic providers, third party key management software, and Hardware Security Modules (HSMs). This enables you to simplify and consolidate encryption and key management across applications and services within your organization.

Manageability

Growing product capabilities, a move towards server consolidation, and increasing remote databases add to the complexity of data management.

Policy-Based Management of SQL Servers and Databases

With a growing number of databases and users, administrators need the proactive management capabilities provided by policies. Policy-Based Management in SQL Server 2008 provides the ability to define configuration policies and apply them to servers, databases, tables, and other targets across the enterprise. These policies can prevent or monitor changes to the system. After the policies are created, they reduce the amount of time database administrators spend on daily maintenance tasks.

You can use triggers to enforce these policies proactively, use Service Broker to handle policy application after changes occur, or you can use the SQL Server Agent to schedule policy enforcement. SQL Server 2008 also allows you to use ad hoc execution to check objects against policies in real time.

Consolidated Server Administration with SQL Server Management Studio

SQL Server Management Studio provides an integrated environment that you can use to access, manage, configure, and develop your databases and database servers. SQL Server Management Studio provides a graphical environment in addition to rich scripting capabilities. You can use this application to manage local and remote servers. SQL Server Management Studio is designed for database administrators of all skill levels.

Centralized Collection and Management of Server and Database Statistics

To be able to troubleshoot performance issues, you must have the correct data and it must be easily accessible. SQL Server 2008 fills this need with Performance Data Collection, tools designed to troubleshoot, tune, and monitor the state of one or more instances of SQL Server. By using these tools, database administrators can troubleshoot and tune performance issues faster.

The three basic functional areas of Performance Data Collection include:

- Low overhead data collection from multiple sources such as SQL Trace, System Monitor, Dynamic Management Views (DMVs), and logs.
- A centralized data management warehouse to store the collected data. This feature helps administrators compare historical and baseline data, so they can see trends and make predictions for future performance requirements.
- Integrated Reporting Services capabilities to present all of the relevant troubleshooting information in one place and guide the user to the root cause of an issue by drilling-down from a high-level abstracted overview to specific data.

Conclusion

SQL Server 2008 is a comprehensive data platform that is secure, reliable, and scalable for your mission-critical applications, and meets the needs of the new generation of database growth. It provides a rich set of services and tools for any data type or device. Improved use of resources, enhanced locking, and optimized data storage provide better performance and scalability. SQL Server 2008 provides an innovative, policy-based infrastructure, which simplifies the management of your data platform, with improved performance monitoring and reporting tools in Performance Studio. Finally, SQL Server 2008 provides high availability with improved database mirroring and fail-over clustering, and takes advantage of the features that are offered when installed on Windows Server 2008.

For more information:

Microsoft SQL Server 2008

<http://www.microsoft.com/sql/>

SQL Server Developer Center

<http://msdn2.microsoft.com/sqlserver>

SQL Server TechCenter

<http://technet.microsoft.com/sqlserver>

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