



Server Consolidation with SQL Server 2008

White Paper

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Summary: Microsoft SQL Server 2008 supports multiple options for server consolidation, providing organizations with the flexibility to choose the consolidation approach that best meets their requirements for centralizing data services management and reducing hardware and maintenance costs. By providing centralized management, auditing, and monitoring, SQL Server 2008 makes it easy to manage multiple databases and data services, significantly reducing administrative overhead in large enterprises. SQL Server 2008 provides the reassurance of industry-leading performance and scalability, and unprecedented control over server resources to maximize the performance of consolidated data services.

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

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Introduction

As organizations use ever increasing numbers of applications to manage business processes, provide new services, and gain an insight into business performance, the number of application servers and data storage servers that are required to support those applications has grown significantly. In many organizations, the hardware costs and the overhead of deploying and maintaining multiple servers throughout the enterprise is a major financial and logistical burden.

At the same time, advances in hardware and software technologies mean that modern IT systems can handle significantly greater workloads than was previously possible. This has given rise to a movement towards consolidating software services onto fewer physical servers, which results in better utilization of available hardware capacity. This reduces the costs associated with buying and maintaining servers, and enables more efficient and effective IT infrastructure management.

Microsoft® SQL Server® 2008 capabilities deliver on the following three key areas of the server consolidation vision:

Flexibility: A SQL Server 2008 consolidation solution can consist of multiple databases in a single SQL Server instance on one physical computer, multiple instances of SQL Server on one physical computer, or multiple virtual servers on one physical computer. By supporting all of these methods of consolidation, SQL Server 2008 enables organizations to choose the appropriate degree of isolation with the required performance. SQL Server 2008 also provides several tools to migrate existing data and databases to a consolidated server.

Manageability: Although the principal purpose of server consolidation is to reduce hardware, energy use, and licensing costs, you can also use it to centralize administrative functions. SQL Server 2008 provides a suite of tools to manage, administer, monitor, and troubleshoot consolidated data systems. These tools enable the centralized administration of consolidated servers and also enable the consolidation of the management function for separate servers.

Scalability and performance: When you consolidate data systems onto fewer servers, each of these servers takes on an increased workload. Higher performance hardware may resolve some issues, but you must consider potential problems when some of the database application workloads on the consolidated server use a disproportionate amount of resources and cause other workloads to underperform. There are also problems when one workload uses excessive resources and prevents other workloads from completing. SQL Server 2008 includes performance optimization features that help you identify and resolve these problems, as well as capabilities that enable you to better govern the resources available for each application workload.

Flexibility

Choosing a server consolidation strategy for database servers can present a number of considerations. Key factors in deciding on the best consolidation strategy for your data services include:

Hardware resources: Each consolidation approach has a different effect on hardware resource usage. Consider whether 32-bit or 64-bit hardware will provide the best performance and scalability for your solution. The general trend is towards the use of 64-bit hardware.

Workload isolation: While the goal of consolidation is to reduce the number of servers as much as possible, you should profile the workloads performed by different database applications, and consider whether they should be isolated from one another for performance or other reasons.

Application compatibility: Some applications may have specific requirements for data access protocols, collation, or other configuration options that might be incompatible with other applications.

Manageability: Consolidation generally simplifies management by centralizing the resources that require management. However, you must consider the effect of maintenance tasks, such as backups and index management, on the consolidated system. You must also consider the security implications of consolidation because operators with administrative rights in one database system might not require administrative rights in others.

Availability: Your consolidation strategy might affect your choice of a high-availability solution. For example, database mirroring provides failover protection at the individual database level and server clustering protects the entire instance.

Security: In some cases, it may be prudent to isolate database applications for security reasons. For example, one application might require that a feature be enabled in the database server, such as common language runtime (CLR) integration or Database Mail. If you isolate this database you can enable the required functionality while retaining a minimal surface area for other database applications.

With so many factors to consider when you design a consolidation solution, you require flexibility so you can choose the approach that best suits your specific requirements. SQL Server 2008 offers a number of consolidation approaches, and enables you to mix and match options to create the ideal solution.

Consolidating SQL Server Instances with Multiple Databases

One simple approach to consolidating data services with SQL Server 2008 is to use a single instance of SQL Server with multiple databases as shown in Figure 1. This approach is suitable when all of your databases have similar security, manageability, and compatibility requirements, and your hardware can provide the required level of performance and scalability for the workloads that are generated in all of the databases.



Figure 1

Consolidating Physical Servers with Multiple Instances

When you have databases with different security, manageability, or compatibility requirements, you can consolidate your data services by running multiple instances of SQL Server 2008 concurrently on a single physical computer to reduce the hardware costs, licensing costs, energy costs, and administrative overhead. This approach is illustrated in Figure 2. The instances are completely isolated from each other and changes to one instance do not affect other instances on the same computer. As well as reduced hardware costs through consolidation, you also benefit from reduced licensing costs because you only need one SQL Server license per physical processor regardless of how many instances are installed.

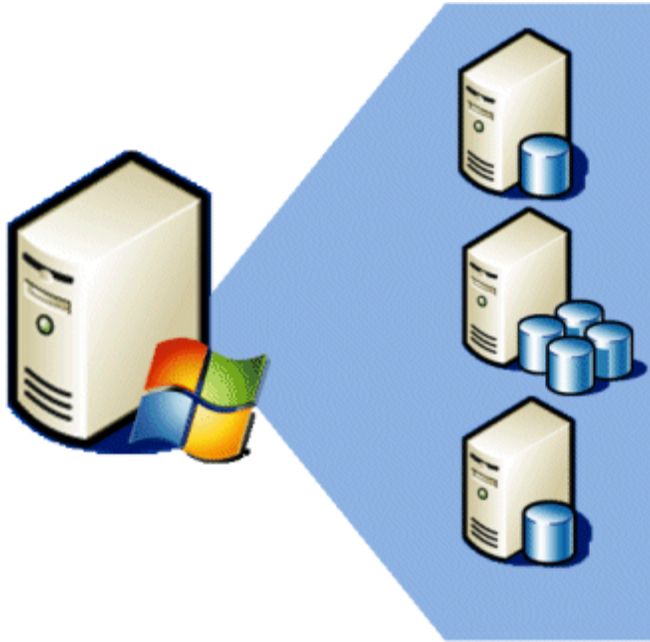


Figure 2

The number of instances supported by each edition of SQL Server 2008 is shown in the following table.

Multi-instance support in SQL Server 2008

Edition	Maximum instances
SQL Server 2008 Standard	16
SQL Server 2008 Enterprise	50
SQL Server 2008 Developer	50

Consolidating Data Services through Virtualization

For complete isolation at the operating system level, SQL Server 2008 supports server virtualization. By using Microsoft Virtual Server you can install multiple virtual operating systems on one physical computer as illustrated in Figure 3. When you use this approach with Microsoft Windows Server® 2008 with the Hyper-V role and SQL Server 2008 Enterprise, you can buy one Windows license and one SQL Server license per physical processor, regardless of how many virtual machines are installed on the physical server.

The hard disks of each virtual server exist as files on the host operating system, which makes them very easy to back up, move, or deploy, and provides an ideal environment for development and testing.

By consolidating your data services with virtualization, you achieve a good level of isolation between database solutions with different workloads, security requirements, manageability requirements, or compatibility requirements while minimizing the number of servers and licenses required and simplifying your network infrastructure.

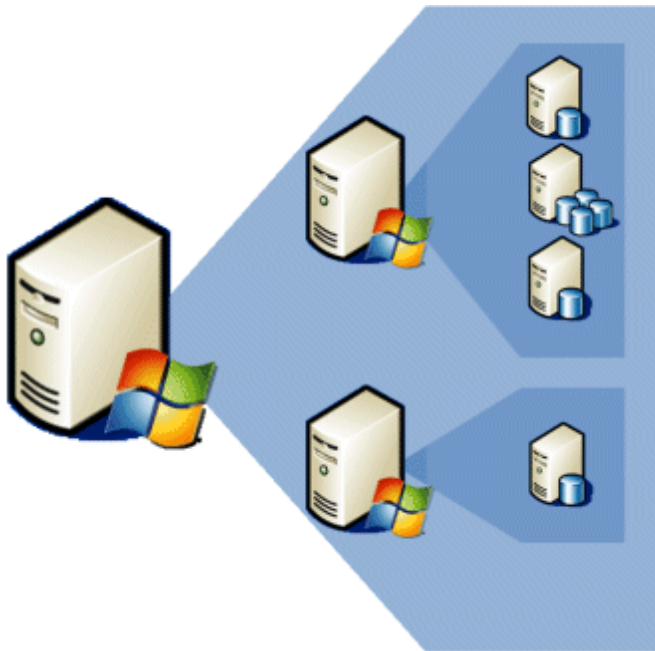


Figure 3

Migrating Databases and Data

Server consolidation often requires the movement of databases, applications, and operating systems from existing source systems to consolidated servers. SQL Server 2008 provides several tools and technologies that you can use to migrate data and databases, including backup and restore, attach and detach, and SQL Server Integration Services. To assist in migrating older databases to a consolidated SQL Server 2008 platform there is also support for directly upgrading SQL Server 2000 and SQL Server 2005 databases.

Manageability

Server consolidation provides a way to centralize administrative functions. SQL Server 2008 provides a suite of tools to manage, administer, monitor, and troubleshoot consolidated data systems. These tools enable the consolidation of management functions for all of the SQL Server instances and services throughout the enterprise.

Centralizing Management with SQL Server Management Studio

SQL Server 2008 includes SQL Server Management Studio, which is a good tool for managing consolidated data systems. By using SQL Server Management Studio you can manage multiple instances of SQL Server regardless of whether they exist on a single physical server, multiple physical servers, or multiple virtual servers.

As well as managing multiple instances of SQL Server 2008, SQL Server Management Studio can manage any version of SQL Server from SQL Server 2000 and later and any edition of SQL Server. SQL Server Management Studio also provides one central, consistent administrative interface to manage SQL Server Database Engine instances, SQL Server Analysis Services, SQL Server Integration Services, and SQL Server Reporting Services.

Centralizing Security Auditing

A key requirement of management in an enterprise is the ability to audit activity in data services and to be able to generate consistent audit reports for all database server instances. This auditing activity can benefit from consolidation, both in terms of simplifying auditing configuration so that you define auditing policies once and reuse them for multiple similar data services, and in terms of providing centralized access to auditing reports for data services across the whole enterprise.

SQL Server 2008 includes extensive auditing capabilities that enable you to log activity at both the server and database level, including changes to the data and schema. You can define auditing filters to specify the actions to audit based on actions, objects, and security principals, and specify where the auditing information should be recorded. After you configure auditing on one instance of SQL Server 2008, you can apply these settings to other instances on the server. You can consolidate the audit results for your entire organization in one place, use Reporting Services to create customized reports, and use Analysis Services to analyze the centralized audit data.

Enforcing Configuration Policy Compliance

Organizations increasingly want to enforce a set of policies to follow regulatory or best practice requirements. Previously this has involved configuring many tables, databases, and instances, and then periodically checking compliance against these policies. In SQL Server 2008 you can consolidate configuration management by using Policy-Based Management as shown in Figure 4, and applying policies to multiple servers, databases, tables, and other targets in the enterprise.

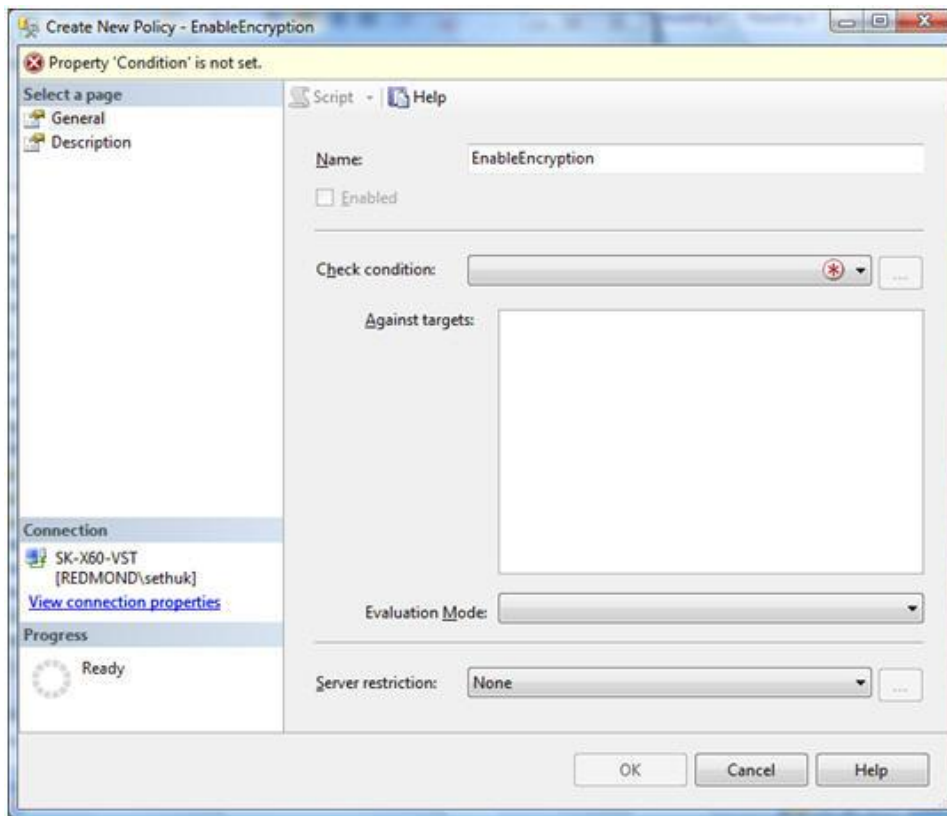


Figure 4

Policy-Based Management enables you to:

- Ensure compliance with policies for system configuration.
- Monitor or prevent changes to the system by authoring policies for the desired configuration.
- Scale management across multiple servers.
- Reduce total cost of ownership by simplifying administration tasks.

You can proactively enforce policies by using triggers or, on a schedule, by using SQL Server Agent. Additionally, you can use ad hoc execution to check or configure target objects against policies in real time.

Centralizing and Consolidating Monitoring

SQL Server generates valuable data to assist in performance tuning and troubleshooting. Although this is extremely useful, it can also be time consuming to use multiple tools to identify problems. SQL Server 2008 includes Management Data Warehouse and a suite of tools to help you troubleshoot, tune, and monitor the state of one or more instances of SQL Server 2008. The centralized management of data collection, storage and reporting of the various performance metrics can help in consolidation planning and ongoing operations.

Scalability and Performance

Optimizing the scalability and performance of consolidated data services can be challenging. The consolidated servers must be equipped with high-performance hardware, multiple fast processors, and a large amount of memory. SQL Server 2008 provides a number of options for managing consolidated server scalability and performance.

Controlling Resource Utilization

SQL Server 2008 includes Resource Governor, which enables organizations to define resource limits and set priorities for different workloads. This enables them to differentiate workloads on a consolidated server and control the use of memory and processor resources to prevent runaway queries or large workloads from adversely affecting the performance of mission-critical workloads. This ability to proactively control use of resources provides more predictable performance of consolidated data services.

Scaling Up Consolidated Servers

SQL Server 2008 Enterprise supports highly scalable database servers through the ability to take advantage of multi-processor systems and support for address windowing extensions (AWE) on the 32-bit releases of Windows Server 2003 and Windows Server 2008 Enterprise or Datacenter Edition, which enables it to take advantage of up to 64-bit memory. When installed on the 64-bit release of Windows Server 2008 Enterprise or Datacenter Edition, SQL Server 2008 can use up to 2 terabytes of memory.

SQL Server Enterprise also provides optimal performance and scalability by providing several features to improve concurrency and prevent locks caused by one process blocking other processes on the server. The locking system in SQL Server 2008 provides greater concurrency and improved lock escalation compared to previous releases. You can organize tables and indexes into partitions on a disk and switch in and out of these partitions individually to reduce contention and improve overall performance.

Managing System Resources Dynamically

As you consolidate more systems onto fewer servers, these consolidated servers might require increased resources to cope with the workload, but often these servers must run continuously so you must keep downtime to an absolute minimum. SQL Server 2008 Enterprise supports hot-add memory and CPU when running on Windows Server 2008, so you can add memory modules or CPUs without shutting down the server. This reduces downtime by enabling system administrators to add resources to scale-up a server without having to stop database services.

Maximizing Storage with Data Compression and Backup Compression

Consolidated systems must often support very large volumes of data, which leads to increased costs. Large data volumes can also reduce the performance of a system because much of its workload can involve moving data. SQL Server 2008 supports data compression, which enables you to store your data more effectively, reduces the cost of storage on a consolidated system, and significantly improves performance for large I/O-bound workloads.

Many sites also keep one or more complete backup cycles on disk for fast recovery, and this directly translates to costs in terms of storage hardware. Backup compression addresses these concerns on both fronts: the size of the backup is reduced substantially, depending on the content of the data being compressed, and the overall time to back up and restore is similarly reduced. Backup compression comes at the cost of CPU so this may have an impact on your online workload.

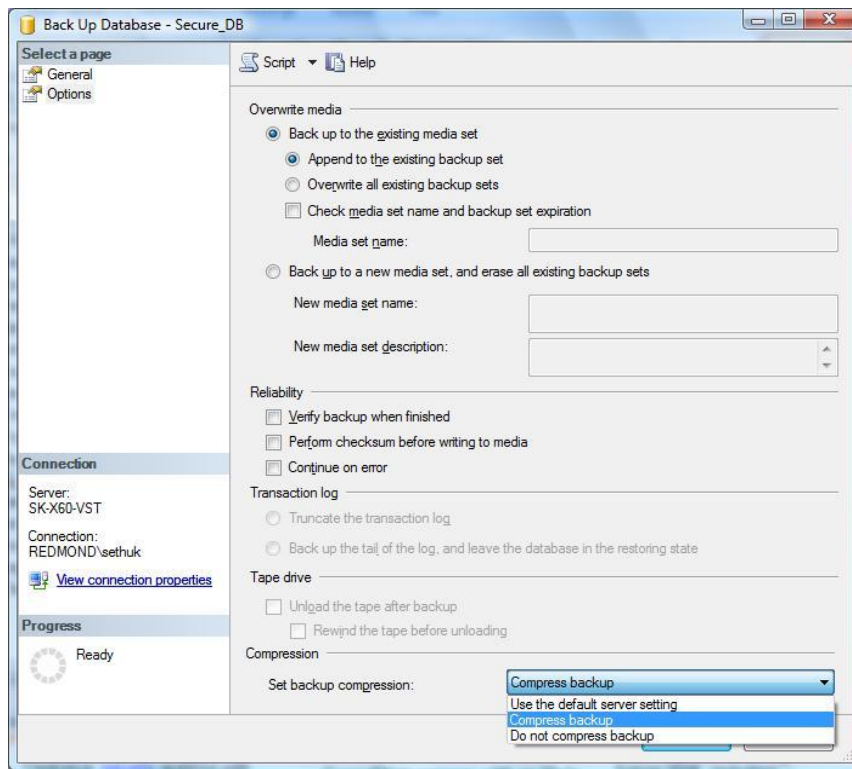


Figure 5

Conclusion

SQL Server 2008 reduces hardware and maintenance costs by providing a flexible server consolidation solution that enables organizations to centralize data services on fewer servers. SQL Server 2008 provides support for Windows Server 2008 Hyper-V virtualization. For multiple service instances on a single physical server, it has the tools and functionality necessary for migrating distributed data to a consolidated data center. By providing a centralized data services management interface and policy-based management, SQL Server makes it easy for organizations with multiple data stores to reduce management overhead. Finally, the industry-leading performance of SQL Server 2008 and the ability to explicitly control how server resources are used enables you to consolidate your data services while providing the scalability and performance your applications need.

For more information:

Microsoft SQL Server 2008

<http://www.microsoft.com/sqlserver/2008/en/us/default.aspx>

SQL Server Developer Center

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

SQL Server TechCenter

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

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