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Includes full
coverage of
SQL Server 2008
in addition to
R2 coverage

Microsoft®
SQL Server
2008 R2

UNLEASHED



Microsoft SQL Server 2008 R2 Unleashed

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Introduction

Over the past decade, SQL Server has established itself as a robust and reliable database platform whose performance, scalability, and reliability meet the implementation needs of businesses and corporations from small desktop applications on up to multiterabyte enterprise-wide systems. The updates and enhancements in SQL Server 2008 and SQL Server 2008 R2 further solidify its position in the marketplace as a robust enterprise-wide database system that can compete on the same level as the other major enterprise-wide database products, providing a database engine foundation that can be highly available 7 days a week, 365 days a year.

NOTE

The position of SQL Server 2008 as a leader in the market of enterprise-wide database management systems (DBMS) was confirmed in a report released by Forrester Research on June 30, 2009 (The Forrester Wave: Enterprise Database Management Systems, Q2 2009). In this report, Forrester analyst Noel Yuhanna indicated that Microsoft along with Oracle and IBM DB2 were the leaders in the DBMS market. The report from Forrester Research indicated that Microsoft's strong commitment to its data platform starting with SQL Server 2005 and continuing with the latest iteration of the product, SQL Server 2008, had boosted Microsoft to the top of the DBMS market. Key findings in the report concluded that Microsoft received high scores in database programmability, security, availability, and application/data integration, and for delivering the best price performance for most business applications. The report also acknowledged that Microsoft "has shown increasing focus and commitment to going after the enterprise market," and that SQL Server 2008 has "enabled Microsoft to take market share in moderately sized to large enterprises, delivering good performance, scalability, security, and availability functionality." The report also indicated that "five years ago, hardly any enterprises ran multi-terabyte databases with SQL Server to support critical applications. Today, hundreds of enterprises are running 10-terabyte and larger transactional SQL Server databases."

One of the biggest challenges we face writing the *SQL Server Unleashed* series of books is how to provide comprehensive, in-depth, all-inclusive coverage of all the features of SQL Server within a single book. Over the past few releases, the number of SQL Server features and components has increased, and many of these features and components (for example, SQL Server Integration Services, Reporting Services, and .NET Framework integration) provide material enough to warrant their own separate titles. To cover each topic sufficiently would require more information than could reasonably fit in print in a single volume. Thus, we had to make some hard decisions as to what to include in print.

We decided that the printed portion of the book would provide detailed coverage of the core database server features and the day-to-day administrative and management aspects

and tools of SQL Server 2008 and 2008 R2. We want to ensure that we provide enough of the necessary information, tips, and guidelines to get you started making effective use of these features. At the same time, there is a wealth of useful information we want to provide on additional SQL Server 2008 features and major components of SQL Server, such as SQL Server Integration Services, Reporting Services, Analysis Services, T-SQL programming, and SQL Server integration with the .NET Framework. Rather than leave this valuable information out entirely, we decided to include the chapters with this material on the CD provided with this book. Also, as in the past, the CD contains all our sample scripts, databases, and other code samples and material that support the book content.

Our other main goal when writing this book was for it to be more than just a syntax reference. SQL Server Books Online is a fine resource as a syntax reference. This book attempts to pick up where Books Online leaves off, by providing, in addition to syntax where necessary, valuable insight, tips, guidelines, and useful examples derived from our many years of experience working with SQL Server. Although we do provide the core, and sometimes advanced, syntax elements for the SQL commands discussed, SQL Server Books Online provides a much more extensive syntax reference than would make sense to try to duplicate here. As a matter of fact, at times, we may even direct you to Books Online for more detail on some of the more esoteric syntax options available for certain commands.

We hope that we have succeeded in meeting the goals we set out for this book and that it becomes an essential reference and source of expert information for you as you work with the either version of SQL Server 2008.

NOTE

Although this book includes coverage of SQL Server 2008 R2, most of the material presented applies to SQL Server 2008 as well. Actually, there are few significant differences in the core product between SQL Server 2008 and SQL Server 2008 R2. Most of the new features are related to enhancements to Reporting Services. You can be comfortable using this book as a reference for either version of SQL Server 2008.

When the book discusses features available only in the R2 release, this fact is specifically spelled out in the chapter.

Who This Book Is For

This *Unleashed* book is intended for intermediate- to advanced-level users: for SQL Server administrators who want to understand SQL Server more completely to be able to effectively manage and administer their SQL Server environments, and for developers who want a more thorough understanding of SQL Server to help them write better Transact-SQL (T-SQL) code and develop more robust SQL Server applications. If you are responsible for analysis, design, implementation, support, administration, or troubleshooting of SQL Server 2008, this book provides an excellent source of experiential information for you. You can think of this as a book of applied technology. The emphasis is on the more

complex aspects of the product, including using the new tools and features, administering SQL Server, analyzing and optimizing queries, implementing data warehouses, ensuring high availability, and tuning SQL Server performance.

This book is for both developers and SQL Server administrators who are new to SQL Server 2008 or SQL Server 2008 R2 as well as those who are already familiar with prior versions of SQL Server. At the beginning of each chapter is a brief summary of the major changes or new features or capabilities of SQL Server related to that topic. If you are already familiar with SQL Server, you can use this information to focus on the information in the chapters that covers the new features and capabilities in more detail.

This book is intended to provide a behind-the-scenes look into SQL Server, showing you what goes on behind the various wizards and GUI-based tools so you can learn what the underlying SQL commands are. Although the GUI tools can make your average day-to-day operations much simpler, every database administrator should learn the underlying commands to the tools and wizards to fully unlock the power and capabilities of SQL Server.

What This Book Covers

The book is divided into the following sections:

- ▶ **Part I, “Welcome to Microsoft SQL Server”**—This part introduces you to the Microsoft SQL Server 2008 environment, the various editions of SQL Server that are available, and the capabilities of each edition in the various Windows environments. In addition, it provides an overview of and introduction to the new features found in SQL Server 2008 and SQL Server 2008 R2, which are covered in more detail throughout the rest of the book.
- ▶ **Part II, “SQL Server Tools and Utilities”**—This part covers the tools and utility programs that SQL Server 2008 provides for you to administer and manage your SQL Server environments. You’ll find information on the various management tools you use on a daily basis, such as SQL Server Management Studio and the new SQLCMD command-line query tool, along with information on SQL Server Profiler. If you are not familiar with these tools, you should read this part of the book early on because these tools are often used and referenced throughout many of the other chapters in the book.
- ▶ **Part III, “SQL Server Administration”**—This part discusses topics related to the administration of SQL Server at the database server level. It begins with an overview of what is involved in administering a SQL Server environment and then goes on to cover the tasks related to setting up and managing the overall SQL Server environment, including installing and upgrading to SQL Server 2008 and SQL Server 2008 R2 as well as installing SQL Server clients. This part also includes coverage of security and user administration, database backup and restore, replication, and using the Database Mail facility. Chapters on SQL Server clustering, database mirroring, and

SQL Server high availability provide some expert advice in these areas. Task scheduling and notification using SQL Server Agent and using the new Policy Based Management feature are also discussed in this part.

- ▶ **Part IV, “SQL Server Database Administration”**—This part delves into the administrative tasks associated with creating and managing a SQL Server 2008 database, including the creation and management of database objects, such as tables, indexes, views, stored procedures, functions, and triggers. It also provides coverage of the Database Snapshots and an overview of database maintenance tasks and responsibilities.
- ▶ **Part V, “SQL Server Performance and Optimization”**—This part provides information to help you get the best performance out of SQL Server. It begins with a discussion of data structures, indexes, and performance, key items to understand to help ensure good database performance. It then builds on that information with chapters on query optimization and analysis, locking, database design and performance, and ways to manage workloads using the new Resource Governor; then it finishes with a methodology for monitoring and optimizing SQL Server performance.
- ▶ **Part VI, “SQL Server Application Development”**—This part includes a comprehensive overview of what's new in T-SQL in SQL Server 2008 and SQL Server 2008 R, T-SQL programming guidelines, tips, and tricks, and advanced stored procedure programming and optimization. In addition, chapters in this Part provide an overview of .NET integration with SQL Server and creating .NET CLR objects information, working with XML in SQL Server, and working with additional SQL Server components that are not part of the core database engine such as Web Services, Service Broker, and Full-Text Search.
- ▶ **Part VII, “SQL Server Business Intelligence Features”**—This Part includes a comprehensive overview of SQL Server 2008 R2's built-in business intelligence features: Analysis Services, Integration Services, and Reporting Services, with a specific focus on the enhancements to Reporting Services introduced with the R2 release.
- ▶ **Bonus Chapters on the CD**—This Part provides a few chapters for which there just wasn't room enough to include elsewhere in the book. These chapters provide expert advice and information on managing remote and linked servers, configuring, tuning and optimizing SQL Server, and planning for SQL Server Disaster Recovery.
- ▶ **Book Materials on the CD**—Also included on the CD are many of the code samples, scripts, databases, and other materials that supplement various chapters. This has always been one of the most valuable reasons to buy books in the *Unleashed* series. It is our goal not just to discuss a SQL technique or solution, but to also provide working samples and examples that actually do it. Learning by seeing is essential for understanding.

In addition to the included CD content, please visit the web page for this book at www.samspublishing.com periodically for any updated or additional bonus material as it becomes available.

Conventions Used in This Book

Names of commands and stored procedures are presented in a special monospaced computer typeface. We have tried to be consistent in our use of uppercase and lowercase for keywords and object names. However, because the default installation of SQL Server doesn't make a distinction between upper- and lowercase for SQL keywords or object names and data, you might find some of the examples presented in either upper- or lowercase.

Code and output examples are presented separately from regular paragraphs and are also in a monospaced computer typeface. The following is an example:

```
select object_id, name, type_desc
from sys.objects
where type = 'SQ'

object_id      name                type_desc
-----
1977058079    QueryNotificationErrorsQueue    SERVICE_QUEUE
2009058193    EventNotificationErrorsQueue    SERVICE_QUEUE
2041058307    ServiceBrokerQueue            SERVICE_QUEUE
```

When syntax is provided for a command, we have followed these conventions:

Syntax Element	Definition
command	These are command names, options, and other keywords.
placeholder	Monospaced italic indicates values you provide.
{}	You must choose at least one of the enclosed options.
[]	The enclosed value/keyword is optional.
()	Parentheses are part of the command.
	You can select only one of the options listed.
,	You can select any of the options listed.
[...]	The previous option can be repeated.

Consider the following syntax example:

```
grant {all | permission_list} on object [(column_list)]
      to {public | user_or_group_name [, [...]]}
```

In this case, *object* is required, but *column_list* is optional. Note also that items shown in plain computer type, such as *grant*, *public*, and *all*, should be entered literally, as shown. Placeholders are presented in *italic*, such as *permission_list* and *user_or_group_name*. A *placeholder* is a generic term for which you must supply a specific value or values. The ellipsis (*[...]*) in the square brackets following *user_or_group_name* indicates that multiple user or group names can be specified, separated by commas. You can specify either the keyword *public* or one or more user or group names, but not both.

Some of the examples presented in this book make use of the AdventureWorks2008 and AdventureWorks2008R2 databases, which are not automatically installed with SQL Server 2008 or SQL Server 2008 R2. To install the AdventureWorks sample databases, you must first download the installer from the Microsoft SQL Server Samples and Community Projects website at <http://www.codeplex.com/sqlserversamples>.

NOTE

Most of the examples presented in this book that use the AdventureWorks database can be run in either AdventureWorks2008 or AdventureWorks2008R2. Structurally, these databases are identical. However, the following tables in AdventureWorks2008R2 have different data values for some of the columns:

- ▶ Person
- ▶ SalesPerson
- ▶ SalesOrderHeader
- ▶ SalesTerritory
- ▶ Shift
- ▶ TransactionHistory

If any of the examples use any of these tables, you may see different results depending on whether you run them in AdventureWorks2008 or AdventureWorks2008R2. When necessary, it will be stated in the chapter which version of the AdventureWorks database was used to generate the results displayed.

Although it is not necessary to install both versions of the AdventureWorks database, it is possible to install both versions in the same SQL Server instance if you wish.

For many of the examples presented in Part V, larger tables than what are available in the AdventureWorks database were needed to demonstrate many of the concepts with more meaningful examples. For many of the chapters in this part, as well as some other chapters throughout the book, the examples come from the bigpubs2008 database. A copy of the database, along with an Entity-Relationship (ER) diagram and table descriptions, is also on the CD.

To install the `bigpubs2008` database on your system so you can try the various examples, do the following:

1. Copy the `bigpubs2008.mdf` file into the SQL Server data folder where you want it to reside.
2. After copying the file to the destination folder, ensure that the Read-Only property of the `bigpubs2008.mdf` file is not enabled (this can happen when the file is copied from the CD). Right-click the file in Windows Explorer and select Properties to bring up the Properties dialog. Click the Read-Only check box to remove the check mark. Click OK to save the changes to the file attributes.
3. Attach the `bigpubs2008` database by using a command similar to the following:

```
sp_attach_single_file_db 'bigpubs2008',
N'D:\MSSQL\DATA\MSSQL.1\MSSQL\Data\bigpubs2008.mdf
```

Note that you might need to edit the path to match the location where you copied the `bigpubs2008.mdf` file.

Alternatively, you can attach the database by using SQL Server Management Studio. To do this, right-click the Databases node in the Object Explorer and select Attach. When the Attach Databases dialog appears, click the Add button, locate the `bigpubs2008.mdf` file, and click OK. In the bottom window pane, click the transaction log file entry (it should say Not Found in the message column) and click the Remove button. Next, click the OK button to attach the database. A new transaction log file is automatically created in the same folder as the `bigpubs2008.mdf` file. For more information on attaching database files, see Chapters 14, “Database Backup and Restore,” and 23, “Creating and Managing Databases.”

NOTE

In addition to the `bigpubs2008` database, the `.mdf` file for the database used for examples in Chapter 51, “SQL Server Analysis Services,” is also provided. To install the `CompSales` database, do the following:

1. Copy the `CompSales.mdf` file into the SQL Server data folder where you want it to reside.
2. Ensure that the Read-Only property of the `CompSales.mdf` file is not enabled.
3. Attach the `CompSales` database by using a command similar to the following (edit the path to match the location of the `CompSales.mdf` file on your system):

```
sp_attach_single_file_db 'CompSales',
N'D:\MSSQL\DATA\MSSQL.1\MSSQL\Data\CompSales.mdf
```

Good Luck!

If you have purchased this book, you are on your way to getting the most from SQL Server 2008 or SQL Server 2008 R2. You have already chosen a fine platform for building database applications, one that can provide outstanding performance and rock-solid reliability and availability at a reasonable cost. With this book, you now have the information you need to make the best of it.

Many of us who worked on this book have been using SQL Server since it was first released. Writing about each new version challenges us to reassess our understanding of SQL Server and the way it works. It's an interesting and enjoyable process, and we learn a lot writing each of these books. We hope you get as much enjoyment and knowledge from reading this book as we have from writing it.

CHAPTER 3

Examples of SQL Server Implementations

IN THIS CHAPTER

- ▶ Application Terms
- ▶ OLTP Application Examples
- ▶ DSS Application Examples

As you will see in this chapter, companies use SQL Server for many types of applications and on most tiers now. Gone are the days when you would second guess yourself choosing to use SQL Server over a competing database engine (such as Oracle or DB2 on a UNIX platform) to ensure you got optimal transactional throughput, high availability, and the highest performance. In fact, SQL Server outnumbers both of these database vendors in installed sites globally. Microsoft SQL Server has arrived!

The *SQL Server Unleashed* team has gathered a few showcase SQL Server-based applications to give you an example of what is possible with SQL Server in both the online transaction processing (OLTP) world and in the decision support systems (DSS)/business intelligence (BI) realms. Each example in this chapter comes from real-life database applications running in production environments at major organizations around the world. In general, all the examples in this book come from our direct customer experiences. We often translate those real-life customer implementations into AdventureWorks2008 or bigpubs2008 database terms so that you can easily re-create them for your own use.

This chapter describes two OLTP applications: one is a traditional ERP system using SQL Server as the database layer, and the other is an online shopping system with shopping carts and both high-availability and high-performance requirements.

On the DSS/BI side, this chapter presents a traditional conformed-dimension star schema data warehouse implementation for a high-tech company and then shows you what this looks like implemented as an online analytical processing (OLAP) cube created by Analysis Services.

Under the DSS/BI examples, this chapter describes a hybrid distributed reporting example that uses multiple SQL Server technologies to get the most out of a complex application environment in the healthcare industry.

Application Terms

Online transaction processing, or OLTP, is a class of applications that facilitate and manage transaction-oriented processing, typically for data entry, complex business processes (such as order entry), and retrieval transactions. The term *transaction* in the context of computer or database transactions is a finite set of changes that are grouped together and can be undone together if any one piece does not complete (or fails). Often, however, we speak of transactions as a business “unit of work” that can span multiple database transactions as one logical business transaction. The term *OLTP* has also been used to refer to processing in which the system responds immediately to user requests. An automated teller machine (ATM) application for a bank is a classic example of this type of OLTP transaction.

In many applications, efficient OLTP applications may depend on sophisticated transaction management software and/or database optimization tactics to facilitate the processing of large numbers of concurrent users and updates to an OLTP-oriented database. In a geographic-distributed database system, OLTP brokering programs are used to distribute transaction processing among multiple computers on a network. These days, central OLTP is often underneath the covers and integrated into most service-oriented architectures (SOAs) and exposed as web services that can be easily orchestrated for different application functionality.

Decision support systems (DSS) have been around since the late 1960s, beginning with model-driven DSS and running the gamut of financial planning systems, spreadsheets, and massive multidimensional databases more recently. We speak of data warehouses, data marts, executive information systems, OLAP cubes, and business intelligence when referring to DSS. All enable complex decision support capabilities, multidimensional data analysis, online analytical processing, business intelligence, spatial DSS, and complex querying and reporting capabilities.

DSS system categories are

- ▶ Data analysis systems that support the manipulation, aggregation, and transformation of data for a specific task or purpose

- ▶ Pure analysis information systems that enable a series of decision-oriented databases and small models
- ▶ Complex accounting and financial models that calculate and forecast behavior based on business events and financial results
- ▶ Predictive models that estimate the consequences of actions on the basis of simulation models
- ▶ Optimization models that provide insight and possible actions a business can take by generating an optimal solution consistent with a series of constraints

6

Microsoft has the capability to fully address the first three types and is only now venturing into predictive and optimization modeling. The examples in this chapter illustrate a classic data warehouse (star schema/snowflake, multidimensional, measures/facts), a small distributed data mart, and an OLAP cube.

For each example in this chapter, we try to describe the overall purpose of the application, the major use cases, and the technology and architecture on which they were deployed. Where appropriate, we might showcase a data model diagram, a relational schema, or a distributed topology that gives you some insight into why the implementation was done a specific way. You are likely to recognize some use cases that may be the same in your environment and therefore possibly apply the same techniques or solutions to serve you as well.

OLTP Application Examples

The following sections describe what the major Enterprise Resource Planning (ERP) vendor SAP AG has implemented using SQL Server for its database layer.

OLTP ERP Example

SAP business solutions are composed of a comprehensive range of products that empower an enterprise with a flexible, end-to-end solution. A critical challenge in implementing an SAP solution is the selection of a data platform to deliver the advanced features and capabilities needed to support the most demanding workloads. The Microsoft SQL Server database software (either SQL Server 2008 or SQL Server 2005) is the relational database management system (RDBMS) of choice for deploying secure, reliable, highly available, high-performing, and scalable SAP installations. Plus, SQL Server high-availability features can minimize downtime for any SAP implementation.

The company's flagship applications are the NetWeaver-based SAP ERP/Business Suites and SAP R/3 industry solutions. Since 1993, SAP and Microsoft have been working together to provide a deeply integrated Microsoft platform with SAP solutions. Microsoft is currently

the most selected platform for R/3 and SAP application deployments: more than 56,000 SAP application installations run on Windows, which is more than all other platforms combined. Of these, more than 23,000 SAP application installations worldwide are running with SQL Server as the RDBMS. In fact, this \$11.5 billion company uses its own software for its internal ERP purposes completely deployed on the Microsoft SQL Server platform.

As you can see in Figure 3.1, SAP's ERP footprint is a three-tier architecture consisting of a variety of client types, a horizontally scalable application server tier, and a highly available, high-performance database tier.

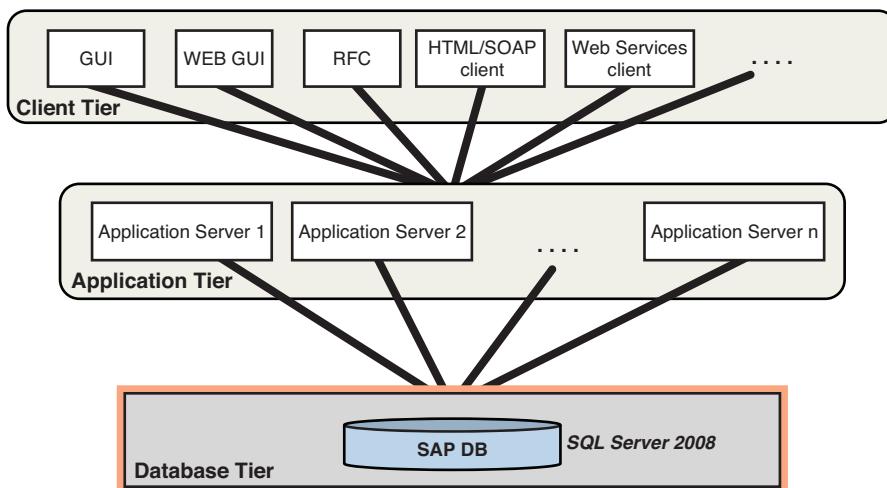


FIGURE 3.1 SAP mult-tier architecture with SQL Server as the database layer.

The SAP multilayered client/server architecture is composed of three levels:

- ▶ **Client/Presentation Tier**—This tier supports SAP graphic user interfaces (GUIs) such as SAP GUI, SAP WebGUI, and other products that connect to the SAP NetWeaver Application Server using one of the supported interfaces. The client tier also includes applications to access SAP using Web Services. For example, applications including smart clients and Microsoft Office applications can integrate SAP data, such as when the Microsoft Excel spreadsheet software is used with Web Services. Applications that use the SAP RFC interface are also part of the presentation tier. Especially in the Microsoft world, connecting to the application tier via RFC became common with the SAP .NET connector, which offers a bandwidth of .NET classes and methods that are mapped to SAP Business Application Programming Interfaces (BAPIs) that are accessible via RFC.

- ▶ **Application Tier**—This tier can contain multiple SAP NetWeaver Application Server instances. However, it needs to contain at least one application instance. If multiple instances are used in one system, each application instance is typically run on separate server hardware or virtual machines. The application tier and database tier can run on the same server hardware on small-scale systems and in some very large hardware configurations. The complete processing of the business transactions and workflow is handled on the application side. No business logic is pushed down for execution into the database layer. The database tier is used for data storage only. Technically, an SAP application instance is a collection of processes called *work processes* in SAP terminology. Based on a configuration profile for each individual instance, these work processes fulfill different tasks and requests. To share user contexts and user data, the work processes of one instance share larger areas of memory. The business logic itself was originally programmed in a 4GL language called ABAP; it has now been supplemented by the possibility to code business logic in Java as well.
- ▶ **Database Tier**—This tier supports the SAP database, including the SAP Business Suite or R/3 and other SAP applications hosted on SQL Server. The database tier typically runs one database schema for each SAP product using separate server hardware. The database servers can be connected to a storage area network (SAN), Network Attached Storage (NAS), or locally attached storage.

Each SAP application process establishes two connections to SQL Server (as shown in Figure 3.2). There is no sharing of connections between the different SAP processes of an instance. SAP does not use connection pooling. Every one of the processes establishes

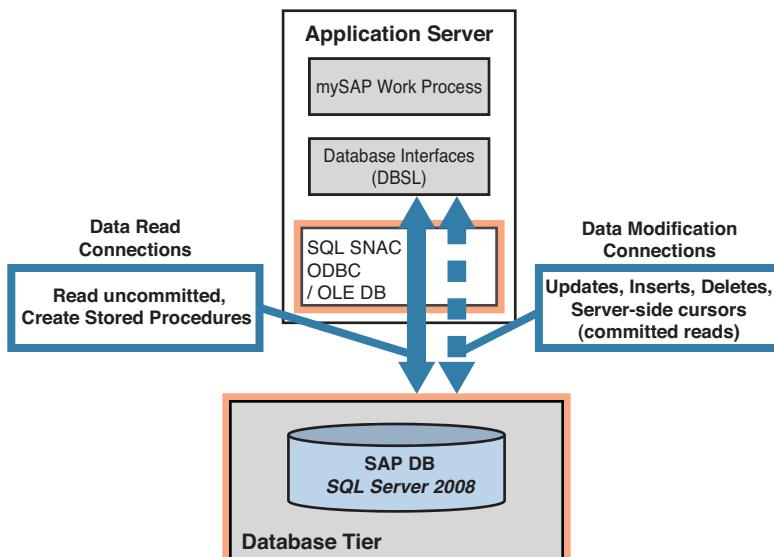


FIGURE 3.2 SAP multiple connections to SQL Server.

connections at startup and keeps them until the process is shut down or restarted. SAP uses Multiple Active Result Sets (MARS) and multiple open client-side cursors that can use the same connection. Each connection is used for different purposes. One performs uncommitted reads of the data or creates stored procedures as needed. The other connection is for data modifications such as updates, inserts, deletes, and server-side cursors. The application tier has been optimized around using these connections.

We featured this ERP application because SAP has proven to the world how rock solid SQL Server is and that the smallest company to companies as large as SAP itself can safely and confidently deploy on SQL Server without hesitation.

OLTP Shopping Cart Example

This shopping cart example features an Internet-based e-commerce implementation for a leading health and vitamin retailer. At the center of this high-availability application is the shopping cart and a global ordering and fulfillment capability. Approximately 5,000 to 10,000 users are online concurrently at any one time, and this application supports up to 50 million hits per day. A key to this application is that it is “stateless,” and all database calls are extremely simple and shallow. This web-facing application is built on JRUN but features SQL Server at the database layer, as shown in Figure 3.3.

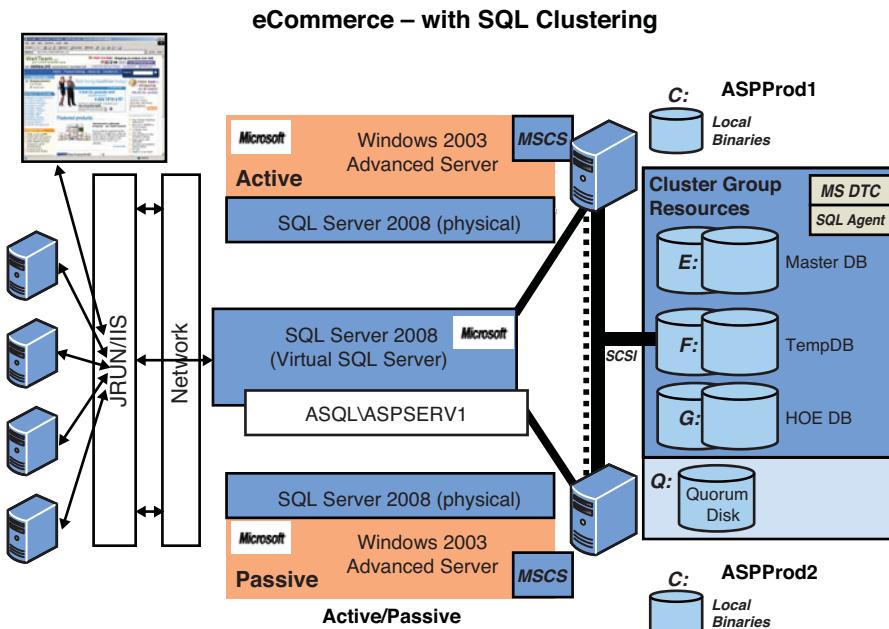


FIGURE 3.3 An e-commerce Internet application with a SQL Server database tier.

This e-commerce application is just a part of a much larger Application Service Provider (ASP) platform. This ASP company houses hundreds of other companies' applications in multiple data centers around the globe. To ensure high availability, this ecommerce application was built on a two-node Active/Passive SQL Clustering configuration. In the four years that this application has been running, the database tier has achieved a 99.99% uptime with rolling updates at both the operating system and SQL Server levels. The OLTP database on SQL Server is approximately 10TB and utilizes log shipping to create a reasonably current disaster recovery (DR) copy (that has never been utilized!). Ninety percent of the reporting is done off the DR copy (approximately one-hour old data on average). This is fully within the service-level requirements needed by the health and vitamin company.

It's important to note here is that if availability falls below 99.99 (four 9s), the ASP company must pay fairly large financial penalties as a part of its agreement with its customers. Each physical server in the cluster is a Dell 8 CPU server with 256GB RAM on SQL Server 2008 Enterprise editions on Windows 2003 Advanced Servers. This has been a rock-solid implementation from the very start.

DSS Application Examples

The DSS/BI examples start with a traditional star schema data warehouse deployment for a Silicon Valley high-tech company. The same data has also been deployed as an OLAP cube created by Analysis Services.

The last example, describes a hybrid distributed reporting system that, uses multiple SQL Server technologies such as data replication, database mirroring, and database snapshots to get the most out of a complex healthcare industry application environment.

DSS Example One

A Silicon Valley computer company implemented a traditional data warehouse using a star schema approach. A star schema provides multiple paths (dimensions) to the central data facts. As you can see in Figure 3.4, a decision support user can get to the Sales Units, Sales Price, and Sales Returns through Geographic, Time, and Product dimensions. This allows the user to ask questions such as "What were net sales for North America for a particular month for a specific computer product?" SQL Server Integration Services (SSIS) packages populate this data warehouse and conformed dimensions on a daily basis with deltas (new data changes only). The data warehouse is unavailable for about one hour each night as daily updates are rolled into this deployment.

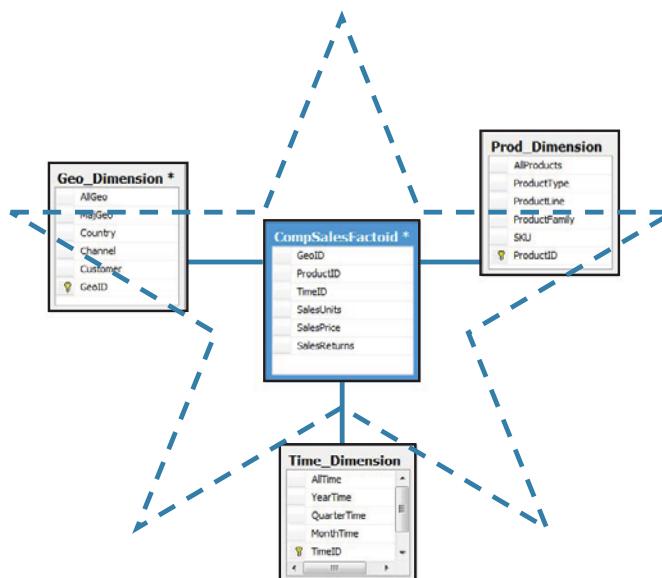


FIGURE 3.4 Star schema data warehouse for global computer sales.

This SQL Server instance is isolated from the OLTP application where the data is sourced. There are about 500–600 data warehouse users of this data globally. This data warehouse is approaching 5TB in size.

DSS Example Two

The same Silicon Valley computer company also implemented some of the same data in a more complex Analysis Services OLAP cube for data mining purposes. The company had many things it did not know about its sales data and wanted to do complex trending and forecasting to better understand the demand for products worldwide. Figure 3.5 shows the OLAP cube built in Analysis Services for this complex business intelligence purpose. Several demand forecasting and product sales trending models were developed to allow this company to predict sales by each of its products for each geographic region.

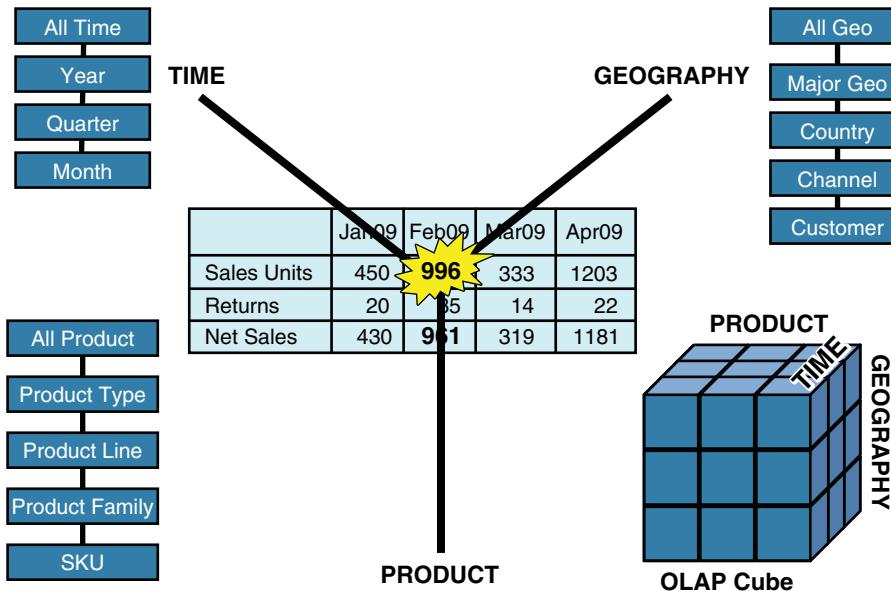


FIGURE 3.5 Multidimensional OLAP cube in Analysis Services.

DSS Example Three

This last example features a multitechnology hybrid data reporting solution that provides real-time reporting along with point-in-time reporting for a major healthcare organization in the Pacific Northwest. This solution starts with real-time data replication from its online transactional systems where all hospital transactions are taking place. This includes patient events, medications administered, surgeries done, hospital charges, and so on. By distributing this data to a highly available two-node SQL Cluster, the hospital is able to realize all its real-time reporting requirements that center around providing all known information for a particular patient in the hospital at any time. Figure 3.6 shows this OLTP-to-SQL cluster real-time, continuous data replication and the real-time reporting enabled by this data distribution.

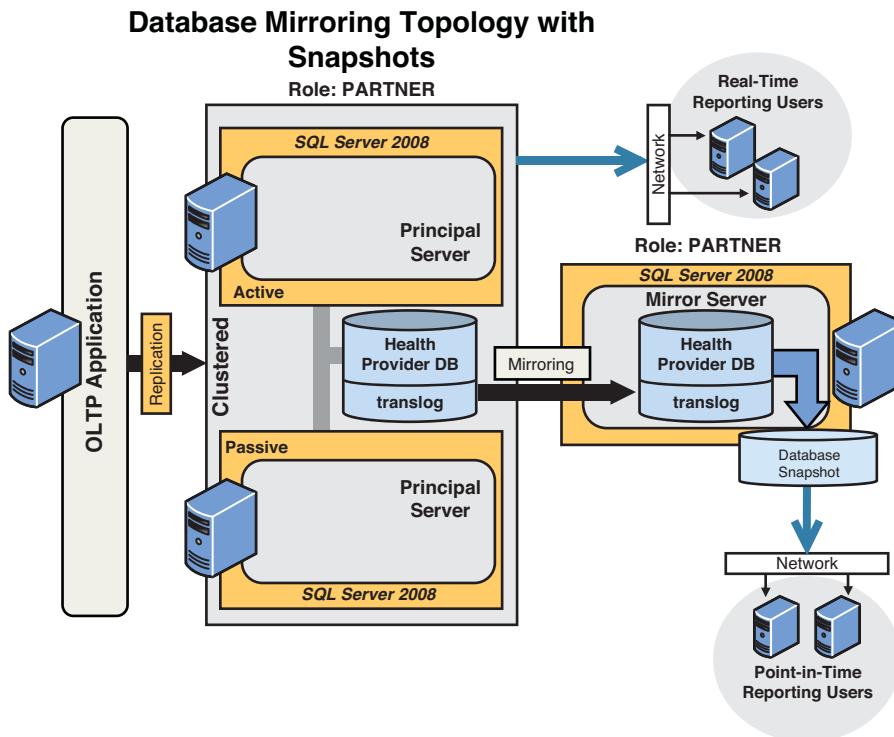


FIGURE 3.6 Hybrid SQL Server reporting configuration.

Another major reporting requirement for this health organization is not a real-time requirement, but rather a leisurely hourly snapshot, point-in-time reporting requirement. A much larger group of users must be served by this noncritical reporting need and cannot impact the real-time reporting environment in any way. To satisfy this point-in-time, noncritical reporting need, the health organization leveraged SQL Server database mirroring from the replicated SQL Server Health Provider DB. From the mirror, hourly database snapshots are created to satisfy all the point-in-time reporting needs of the organization. This configuration has been extremely stable since the SQL Server 2005 deployment.

Summary

3

This chapter described some truly interesting SQL Server-based implementations. These examples reflect how major software vendors such as SAP have utilized SQL Server as the core of their ERP data tier, how Internet-based companies rely on SQL Server to host their e-commerce applications, and how SQL Server can be used to fulfill various decision support and business intelligence needs of major corporations. We selected these examples because they are rock solid and reflect potentially similar scenarios that you may be faced with. It is this flexibility and reliability that will allow you to be successful as well.

The next chapter delves into the functionality of the SQL Server Management Studio environment.

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