



*Create Fault Tolerant  
SQL Server 2008 Installations  
– Rely on SQL Server 2008 Features to Protect Data –*

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## Abstract

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Organizations relying on SQL Server databases need these databases to be available at all times. For SQL Server, this means running it in a fault tolerant configuration. Microsoft has extended the fault tolerant features of SQL Server 2008 so that they are finally easy to use and even easier to implement. These features now work very well to protect either single-site or multi-site SQL Server implementations with or without custom hardware and software tools. Each fault tolerant model requires its own implementation strategy. Read this paper to determine how best to protect your SQL environment when running SQL Server on Dell PowerEdge servers.

## About the Authors

Danielle Ruest and Nelson Ruest are technology futurists focused on datacenter optimization and continuous service availability. They are authors of multiple books, notably two books published by McGraw-Hill Osborne: "[Windows Server 2008: The Complete Reference](#)", and "[Virtualization, A Beginner's Guide](#)". They are currently working on "[Training Kit 70-652: Configuring Windows Server Virtualization with Hyper-V](#)", published by Microsoft Press. In 2008, they visited multiple cities in the U.S. and thousands of IT professionals to discuss the benefits of upgrading to SQL Server 2008.



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## Introduction

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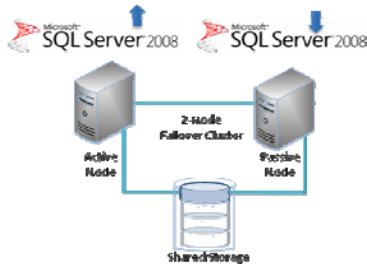
Organizations run databases for one reason: to provide streamlined access to the data they rely on to run their business. Because of this, it is important for them to create fault tolerant database infrastructures. These infrastructures either require the implementation of multiple database servers to provide data redundancy or the creation of server clusters to ensure the database service is always on. However, the creation of these infrastructures has always been complex and difficult to implement.

In comes SQL Server 2008. In the latest iteration of its database services engine, Microsoft has released new features that make it possible for organizations of all sizes to implement database protection features both at the data and the service level. However, each protection strategy requires its own implementation strategy and each addresses particular pain points in data availability. By relying in Dell PowerEdge Servers powered by multi-core processors, you can implement strategies that will help guarantee the very best levels of availability for your database services running SQL Server 2008.

This is why you should take the time to assess SQL Server 2008's powerful new feature set together with the Dell PowerEdge Server offerings. You'll quickly find that together, they can deliver the best value for constant data availability.

## Database Protection Basics

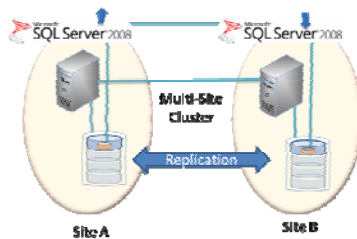
SQL Server 2008 includes both updated and new fault tolerance features. Each feature lets you configure the level of fault tolerance you need based on your organizational requirements. Three key fault tolerant strategies are available.



**Single-Site Service Protection** Traditional fault tolerance configurations for SQL Server rely on the Windows Server Failover Clustering service. In the simplest implementation of this service, organizations create single-site clusters that can include up to 16 nodes all linked to the same shared storage container. Shared storage must be in the form of a storage area network (SAN) or iSCSI target or a combination of both.

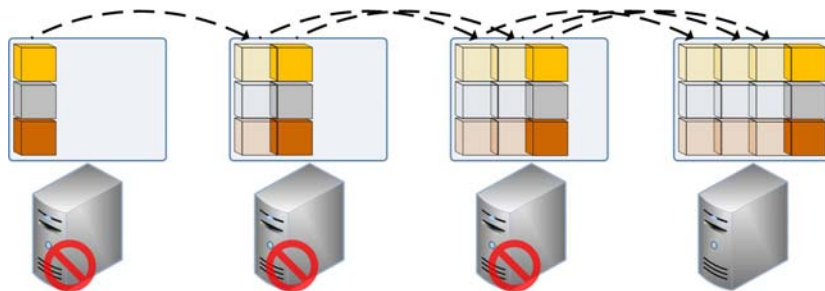
In the most common single-site cluster configuration, one node runs the SQL Server service and the other waits in stand-by mode to take over the service in the event of a hardware, operating system or application failure on the original node. This is an active-passive cluster; one node is active while the other is passive.

When your hardware includes enough spare resources, you can create active-active clusters where each node runs its own SQL Server implementation but also acts as a stand-by node for the others. While this configuration offers fault tolerance for the SQL Server service, it does nothing for the SQL Server data. If the shared storage container fails, then all nodes will lose data. This is why you should rely on SAN features to protect data through disk and volume redundancy.



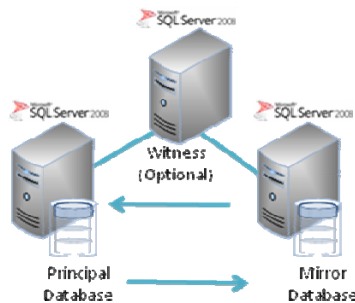
**Multi-Site Service Protection** Windows Server also supports the creation of multi-site failover clusters. In this configuration, cluster nodes do not rely on shared storage because each node is located in a different site. In many cases, organizations rely on direct-attached storage (DAS) to create the cluster although you can also use SANs, iSCSI or both to provide additional storage protection. In this model, however, all data containers must include the same data in order to support a failover. Because of this, you must use a replication engine to ensure that all copies of the data are in synch in real-time. Since SQL Server does not include this feature, you must rely on a third-party replication tool. This is one good reason for using SAN storage since the SAN engine will often include the ability to perform offsite replication of logical unit (LUN) contents.

When you protect SQL Server through failover clusters, you protect an entire instance of SQL Server and therefore, all of the databases that instance contains. Each time you create a SQL Server failover cluster, you create a fault tolerant instance of SQL. You can create several fault tolerant instances on each cluster, however, you must make sure the cluster nodes include enough resources to support each instance (see Figure 1). Remember that each instance can have different management, security, configuration and auditing settings.



**Figure 1. Nodes must have spare resources to support each instance of SQL Server**

Failover clusters provide a very powerful protection mechanism for SQL Server instances, but they also have special requirements. Single-site failover clusters need shared storage containers and multi-site clusters require a replication tool of some sort. Because of this, fault tolerance through the clustering service may be out of reach of smaller organizations.



**Single- or Multi-Site Data Protection** This is why the Microsoft SQL Server team also developed a database mirroring engine in SQL Server 2005 and enhanced it in the latest version of SQL Server. With database mirroring, you can apply fault tolerance at the database, not the instance, level. Database mirroring does not require any special hardware or software tools because it is an embedded feature of SQL Server.

In order to mirror databases, the SQL Server database must be using the full recovery model. Then, you can mirror the database to any other SQL Server instance. The mirrored configuration includes two required and one optional components:

- The **Principal Database** is the production database you want to protect. It is live and in use by your organization.
- The **Standby or Mirror Database** is generated from a restored backup of the principal database and is running on another instance of SQL Server. It also receives mirror updates from the principal database.
- The **Witness** is an optional component that can be used to determine which of the instances running the databases is principal and which is standby.

Ideally, you would run the same version and edition of SQL Server on each server to keep the configuration as simple as possible. Database mirroring offers both single-site and multi-site fault tolerance since the mirrored database can be in any location. In addition, you can configure the mirrored database to automatically pick up the service should the primary database fail for any reason. In fact, the witness role can help determine when the database should be made available by the standby system in the event of failures on the principal system.

An additional advantage of the mirrored database is that it can be used to provide additional functionality such as reporting services. You can also perform backups from the mirrored copy avoiding any performance impacts on the production database.

SQL Server 2008 also offers other fault tolerance options such as log shipping and replication, but the three mentioned above display the most popular fault tolerant implementations of SQL Server database engines.

## Determine your Fault Tolerant Configuration

Creating fault tolerant configurations for your SQL Servers is really only a matter of determining your organizational needs and determining which fault tolerant model best fits those needs. You should consider the following when building your solution:

- Do you need single or multi-site protection for your data stores?
- Do you need to protect entire database instances or single databases only?
- Do you have or are you ready to acquire custom hardware to protect the data stores themselves?
- Do you have or are you ready to acquire a third-party replication engine to protect your SQL Server systems?
- Do you have the proper versions of SQL Server to implement your solution of choice?

The answer to these questions will guide you towards the best implementation. The answer to the last question will help determine which solution best fits your needs. Use the values in Table 1 to help determine which version of SQL Server 2008 supports the solution you choose to implement.

Feature	SQL Server Enterprise	SQL Server Standard	SQL Server Workgroup	SQL Server Web	SQL Server Express
Database Mirroring	Full	Single-thread	Witness only	Witness only	Witness only
Single-site Clustering	16 nodes	2 nodes			
Multi-site Clustering	16 nodes	2 nodes			
Backup Log Shipping	Yes	Yes	Yes	Yes	Yes
Mirrored Backups	Yes				
Fast Recovery	Yes				

Next, you should consider which platform to run your SQL Servers on. Running SQL Server on x64 servers—servers running 64-bit processors—will provide the utmost in growth potential as well as deliver the very best performance. Dell offers several PowerEdge Servers that have been specifically designed to run SQL Server in fault tolerant configurations. Models come in 2U or 4U form factors. Consider the Dell PowerEdge R900 or the R905 for scaled up SQL Server implementations. Both offer 4 sockets for powerful quad-core processors in a 4U configuration. For scaled out SQL Server implementations, consider the Dell PowerEdge R710 or the 2970. Both use the smaller 2U form factor and support 2 sockets running quad-core processors.

Dell also offers several shared storage options in support of single-site data protection. Take for example, the Dell Equallogic PS6000S iSCSI SAN can provide top-level performance in an affordable and easy access low latency and high I/O storage device. The PS6000S is an ideal complement to any fault tolerant SQL Server configuration. Remember: if you want your SQL Servers to be always on, then you must choose the right components and match them to the right fault tolerant configuration.

Database mirroring is the poor man's failover clustering and offers unprecedented fault tolerance for organizations of all sizes. Larger organizations that want instant-on fault tolerance and real-time data protection will want to look to failover clustering to create more comprehensive fault tolerance installations. If data availability is something that is important to your organization, then take the time to examine these options to determine which best suits your needs.



## Additional Information

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SQL Server 2008 Home Page

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

SQL Server on Dell PowerEdge Servers

[www.dell.com/sql](http://www.dell.com/sql)

Dell PowerEdge R900 Server

<http://www.dell.com/content/products/productdetails.aspx/server-poweredge-r900?c=us&l=en&s=biz&cs=555>

Dell PowerEdge R905 Server

[http://www.dell.com/content/products/productdetails.aspx/pedge\\_r905?c=us&l=en&s=biz&cs=555](http://www.dell.com/content/products/productdetails.aspx/pedge_r905?c=us&l=en&s=biz&cs=555)

Dell PowerEdge R710 Server

<http://www.dell.com/content/products/productdetails.aspx/server-poweredge-r710?c=us&cs=555&l=en&s=biz>

Dell PowerEdge 2970 Server

[http://www.dell.com/content/products/productdetails.aspx/pedge\\_2970\\_rack?c=us&cs=555&l=en&s=biz](http://www.dell.com/content/products/productdetails.aspx/pedge_2970_rack?c=us&cs=555&l=en&s=biz)

Dell Equallogic PS6000S iSCSI SAN

<http://www.dell.com/content/products/productdetails.aspx/storage-equallogic-ps6000s?c=us&l=en&s=biz&cs=555>