

Protecting Microsoft SQL Server using HP OpenView Storage Mirroring



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Executive summary

Database management systems (DBMSs) are the hidden engines behind some of your most critical information applications. The types of critical business applications that depend on DBMSs include:

- Enterprise Resource Management (ERP)
- Customer Relationship Management (CRM)
- Accounting
- Sales force automation
- Order tracking
- Inventory management
- Technical support and customer service help desks

In most cases, all the data for these business systems is stored in a DBMS. This means that if the DBMS is damaged, not only is the application unavailable, but all the current and historical data is at risk. One of the most common DBMSs for Microsoft® Windows® servers is Microsoft SQL Server. Depending on your environment, your Microsoft SQL Server might be your most critical application.

Like most database management systems, SQL Server stores all the data in a handful of database files. If one of these files is damaged or corrupted, all the data it contains is lost. The end result—a serious failure of one system could close the doors of your business for days—even permanently.

This white paper discusses data protection strategies for SQL Server and answers the following questions:

- What does it mean to protect a DBMS?
- What are the alternatives?
- How do you compare the costs and advantages of different solutions?
- Why should you consider HP software?

What does it mean to protect a DBMS?

There are two phases to a DBMS protection strategy:

1. Data protection—Ensure you have a second copy of the data.
2. Data availability—Prepare the redundant data and application to be brought online in case the primary becomes unavailable.

Each phase might be easy or difficult, depending on your existing technology, procedures, and objectives.

For example, most SQL Server administrators already back up their databases, typically to tape. For some, it might appear that this satisfies step 1; however, with further discussion, it is likely that this will not meet their particular business needs. At some point, typically during nighttime off-hours, database administrators back up their DBMSs, most likely to tape, creating a second copy of the database. But, how good is that data at noon the next day? Any data that has been entered into the database since the backup probably does not exist anywhere else and would have to be manually re-created.

To determine if a particular data protection strategy is appropriate, you first must understand the key data recovery metrics and then define your recovery objectives using these metrics.

The first key metric is Recovery Point Objective (RPO). RPO defines how much data will be lost in the recovery procedure. If a single disk drive in a RAID 5 array fails, you would lose no data—this is an RPO of zero. If the entire disk array fails and you must restore from tape, you will lose all the data added to the database since the backup. This is an RPO of 12 to 24 hours, assuming the last backup is usable.

According to Forrester Research, most large online businesses average one to five hours of downtime every month, losing \$8,000 or more per hour.

The second critical metric is Recovery Time Objective (RTO). RTO measures how long the entire recovery process takes. If a virus corrupts a database and you must restore it from tape, you might be able to accomplish this in an hour or two, often longer, depending on the size of the database. This is an RTO of around two hours. If an entire server must be replaced, the RTO might be greater than 24 hours, depending on how long it takes to replace the drive, retrieve the tapes, and restore the data. After you have quantified your recovery objectives, you are likely to discover that traditional tape backup will not be good enough to achieve your RTO and RPO goals for your critical DBMS applications—especially when you consider that you must protect against multiple types of failure scenarios, including individual server or device failure and site-wide disaster.

- **Individual server failure scenario**—Even if the repair is simple, the RTO from tapes, especially if they are stored off-site, can be unacceptably long. In addition, the RPO in this scenario is likely to be very poor because you will lose all data since the backup was taken. If your business cannot tolerate the downtime or data loss, then you need a high-availability (HA) solution. HA solutions are designed to recover from a single server or device failure with very low RTO and RPO and ensure data and applications remain seamlessly available.
- **Site-wide disaster scenario**—In this scenario, the entire data center is unavailable. This disaster can come in the form of a natural disaster, power outage, industrial accident, or even peripheral emergencies that might not directly affect your facility but prevent access to it. Disaster recovery (DR) solutions should provide a very low RPO, meaning little to no loss of data, and often, but not always, a low RTO, allowing your business to be back online as soon as possible. These solutions generally involve copying data off-site and can provide for starting and running the application at the remote location.

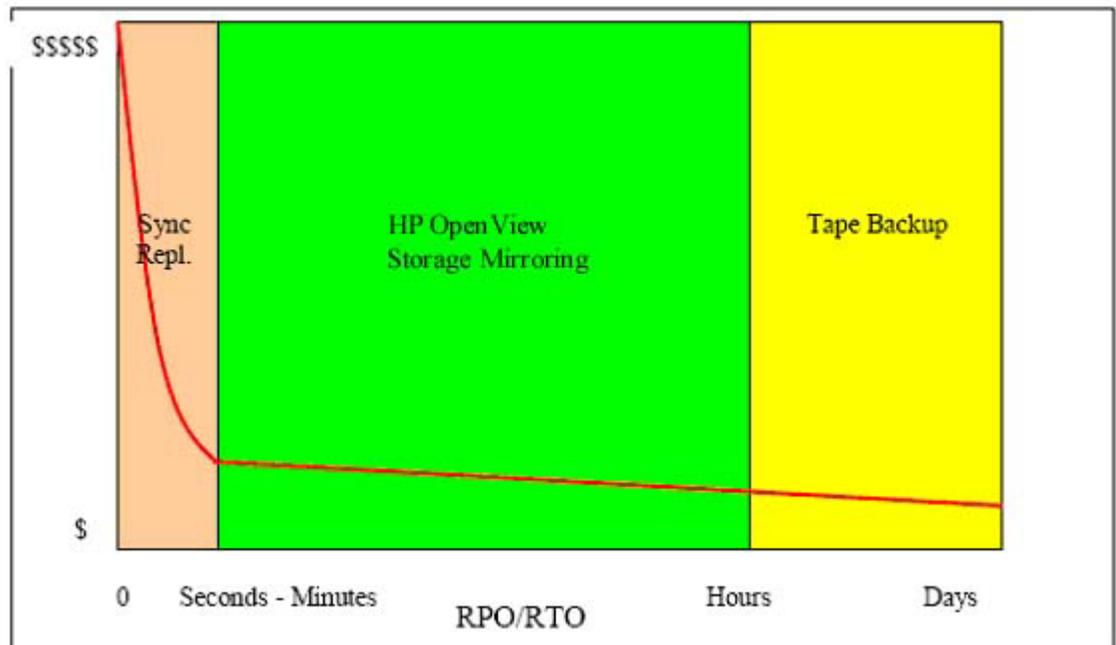
What are the alternatives when low RPO and RTO are required?

When the RPO and RTO must be kept low, hardware-based synchronous replication is a potential data protection alternative. Synchronous replication is usually accomplished by connecting two storage area network (SAN) disk subsystems through fiber optic cable. Synchronous replication or mirroring can provide zero data loss (RPO) and, with proper configuration, an RTO measured in minutes. However, these hardware-based solutions are very expensive to purchase and operate and have distance limitations of about 10 miles (these solutions are typically inadequate for DR because locations that are within 10 miles of each other could be impacted by the same crisis). Generally, this level of RPO cannot be cost justified because most business data does not require this level of protection.

Replication for the masses

HP OpenView Storage Mirroring provides asynchronous replication technology that fills the vast middle ground between tape backup and synchronous mirroring solutions. Data protection solutions based on Storage Mirroring can be configured to provide RTO and RPO measured in minutes and often in seconds, with low purchase and operational costs. Without a distance limitation, Storage Mirroring is equally capable of providing HA and DR solutions. Figure 1 shows that Storage Mirroring provides dramatically improved protection with only a moderate additional cost compared to tape solutions.

Figure 1. RPO and RTO relative to cost



What about the built-in replication capabilities of SQL Server?

The built-in replication feature of SQL Server is designed to publish periodically updated read-only copies of selected data. It is not designed to provide data protection or application availability to the entire database.

The SQL Server built-in recovery capability, called log shipping, assumes that a recent copy of the database exists, possibly on tape, and can be restored on another server to create the baseline copy of the database. After the baseline is established, SQL Server periodically sends a log of recent transactions. These transactions can be applied to the copy of the database to bring it up to date. This updated copy of the database can then be used to replace the failed production system if needed.

Typical challenges with log shipping include:

- Data integrity cannot be maintained across multiple databases
- Potentially significant processing overhead during production hours
- Logs cannot be shipped more often than once per minute and are typically shipped less often, increasing the amount of lost data after an outage (RPO)
- Transactions not logged are not included
- Advanced administrative skill required
- No automatic failover mechanism
- Tracks data changes only, not schema, security, or other database changes

In contrast, Storage Mirroring automatically includes all changes to the data, including:

- Schema updates
- Security configuration
- Bulk transactions
- Real-time replication to the replica
- Automatic, transparent failover
- Changes to the SQL Server configuration not required to get complete protection

Delivering SQL Server HA and DR solutions

Complete protection of SQL Server requires an HA solution and a DR solution. Each solution must have a defined RTO and RPO, and the solution architect must balance the cost of achieving those values against the cost of downtime and lost data. This section examines several scenarios and identifies the type of HP solution for each.

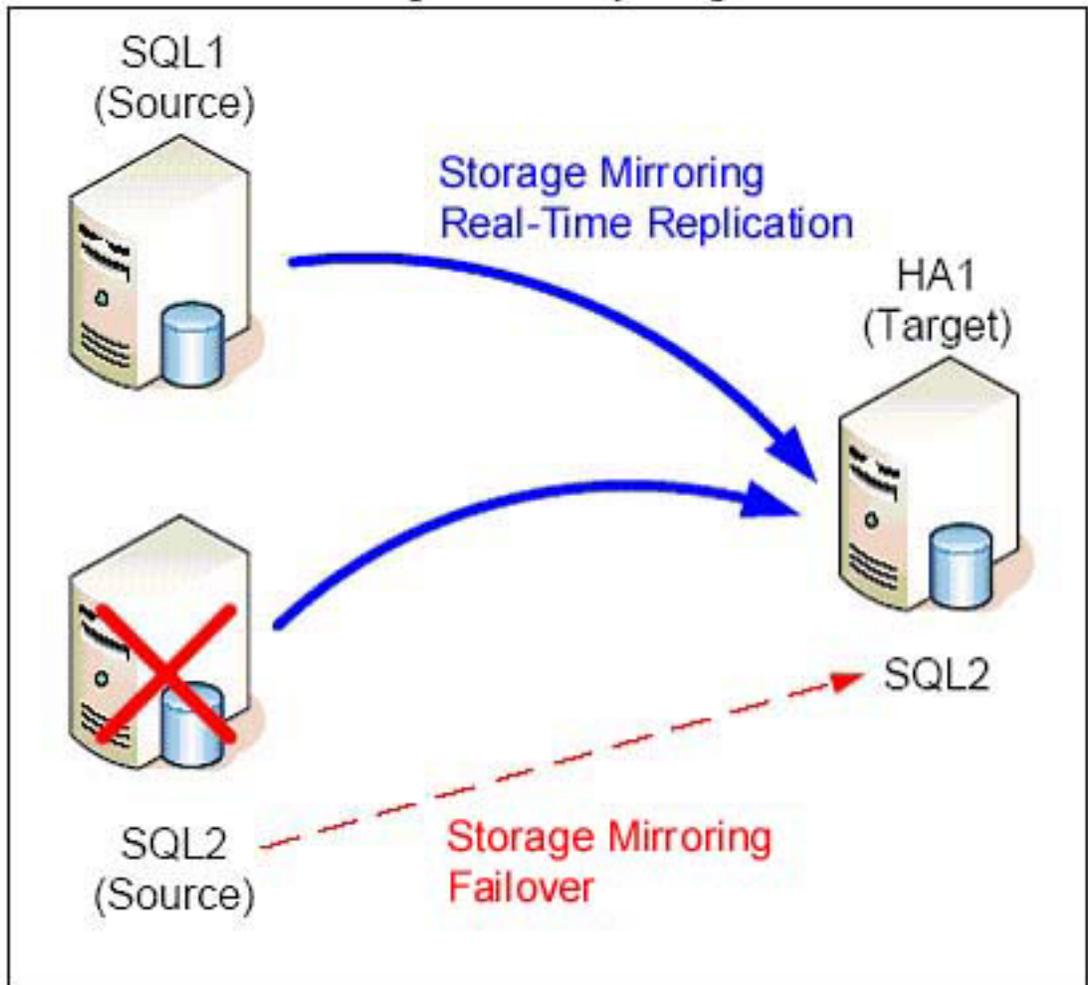
“A rolling blackout or earthquake could cost us \$145,000 a day in lost productivity if our people do not have access to a mission-critical application on our server. With HP OpenView Storage Mirroring, even disaster can’t keep us down for more than five minutes; access is uninterrupted.”

Robb Good, Vice President, Director of Information Systems, Sundt Construction, Inc.

Scenario 1—HA using HP OpenView Storage Mirroring

HP OpenView Storage Mirroring is designed for many-to-one replication between Windows server platforms across an IP network. A single target server on the same LAN can provide HA for one large production server or several smaller production servers. With the continuous replication and built-in failover capabilities within Storage Mirroring, the target server can stand in for failed servers in a matter of seconds. The target server will appear on the network with the same identity, same SQL Server configuration, and data that is within a few seconds of the the failed server. This solution provides users with near-instant access to their data often without ever knowing there was a failure.

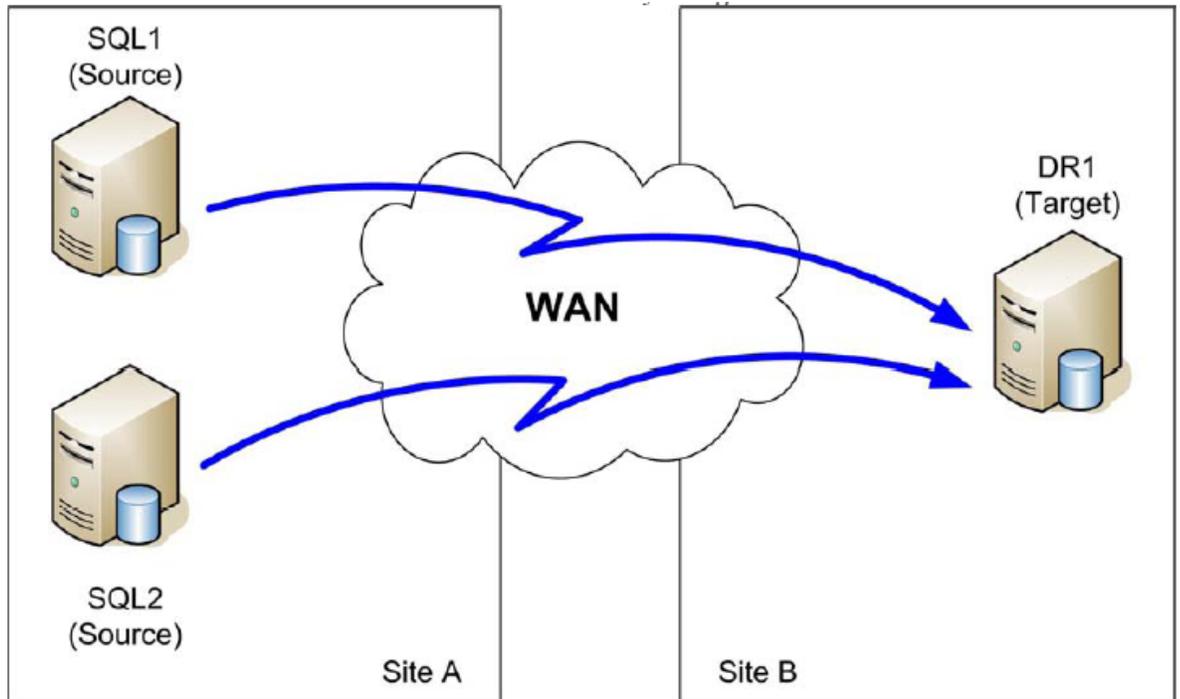
Figure 2.



Scenario 2—DR using HP OpenView Storage Mirroring

The most fundamental feature of a DR solution is that the target servers are placed at a remote location to which production data is continuously copied. Data Protection solutions based on HP OpenView Storage Mirroring can protect against an entire data center or regional failure by allowing data to be copied many miles away. By using Storage Mirroring with existing facilities and WAN links, you can implement and operate a high-quality DR solution at a very low cost. This DR solution has no distance limitations, so the recovery center can be placed as far away as necessary to avoid common risks.

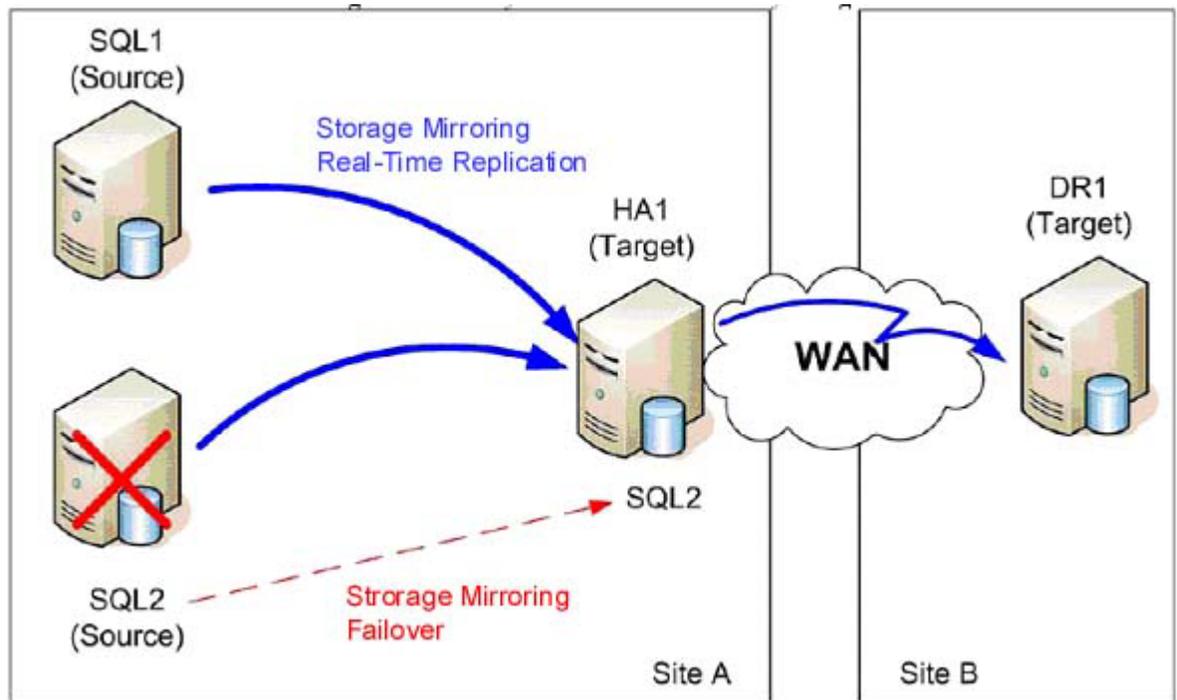
Figure 3.



Scenario 3—HA and DR using HP OpenView Storage Mirroring

HP OpenView Storage Mirroring supports combinations of many-to-one and chained configurations to deliver a combined HA and DR solution. The HA server at Site A provides low RPO and RTO protection against an individual server failure, while the DR solution provides remote replication to one or more servers at a remote facility that is accessible through the WAN and provides protection against an entire site failure.

Figure 4.



Scenario 4—HA and DR within MS Clusters

HP OpenView Storage Mirroring provides the same level of DR protection for Microsoft clusters as it does for stand-alone servers. Although a cluster might be protected from an individual server or disk failure, it is not protected from a site failure and should still be considered for remote replication. Storage Mirroring is designed to work within Microsoft cluster environments to ensure appropriate data from active resources is replicated to an off-site DR location, regardless of which cluster node controls the resource.

Meeting other data protection, availability, migration, and distribution needs

In addition to protecting your SQL Server data, HP OpenView Storage Mirroring can provide powerful solutions for many data protection, availability, migration, and distribution challenges.

Scenario 5—NAS to SAN storage migration

As more environments move from direct attached storage to network attached storage (NAS) or a SAN, the question of how the actual migration will occur becomes more frequent. Using the same techniques previously outlined for data protection, it is possible to migrate from local storage to a NAS, a server using a SAN, or a NAS gateway to the SAN. In all cases, the fundamental requirement is that the data is moved from one Windows platform (with local storage) to another Windows platform (with more manageable storage), like that of a Windows-powered NAS (or storage server). A huge advantage of using Storage Mirroring for migrations is that the data is continuously updated on the new server or storage, enabling users to be cut over at any time. It is not necessary to stop all user access to move the data. Plus, because the replica can be write-enabled, users do not have to be moved all at once.

Scenario 6—Branch office server to centralized data center

Even in the enterprises for which protecting the corporate data has become a standard, branch offices tend to still be isolated to tape solutions. This forces non-IT personnel to be responsible for tape rotations and cleanings. The result is higher personnel costs and lower restore reliability. By efficiently replicating the byte-level changes within the data at the branch offices using Storage Mirroring, it is possible to bring the branches' data back to a centralized data center. This provides DR for the branches and allows backups to be managed by IT personnel at the centralized facility, using more advanced tape technologies.

Scenario 7—Small office server-to-server protection

Large enterprises can have multiple data centers and myriad server technologies, but the typical small office relies heavily on few servers, often with limited IT resources or personnel. When the primary server fails, the office productivity can grind to a halt. Storage Mirroring provides a simple and cost-effective way to fail over to a second machine, either in the same office or even at an employee's home. The result is rapid availability of the data—and the small office continues doing business.

“Storage Mirroring was the optimum solution that integrated smoothly with our core application. In fact, the flexibility of Storage Mirroring made it the only option.”

Christina Surmenean, Senior Vice President and CIO, CNA Trust

Scenario 8—Consolidate backup operations

Today's corporations are increasing their business day because geographic and national boundaries no longer limit effective commerce. This environment results in an ever-shrinking backup window. However, the redundant copies of files on Storage Mirroring target servers can be backed up at any time, even when the original copy of data is in use. Without expensive and application-specific backup agents, the second copy of the data can be put to tape using existing tape technology attached to the redundant server. And perhaps even better, the backup can be done at local disk or tape speeds, instead of a media server backing up multiple application servers. This capability increases the backup window and ensures files are not missed when they are in use.

Scenario 9—Data distribution

Many replication needs are not based around data protection or availability. Like the migration solutions previously discussed, some business goals must get the data to an alternate location. Storage Mirroring can provide a corporation with a master content server and then ensure that all regional locations and branch offices receive the replicated files—regardless of whether it is a custom application or simply the Human Resources directory for vacation forms and business card requests.

Why HP?

HP delivers one of the broadest product portfolios in the industry. HP OpenView Software, HP StorageWorks hardware, and HP ProLiant server product lines are second to none at providing best-in-class functionality in any operating environment. All of these HP software and hardware solutions coupled with HP Services provide a more synergistic and powerful solution that enables an Adaptive Enterprise. Customers gain more control of their data center and overall business with more stability, efficiency, and adaptability, which all lead to increased RoIT.

For more information

For more information on HP OpenView Storage Mirroring, including information on how to migrate your existing servers, replicate data for business continuity, and improve and centralize backups, visit <http://www.hp.com>.

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