

**Enterprise Solutions for Microsoft SQL Server 2005  
EMC CLARiiON CX3-80  
EMC Metropolitan Recovery for SQL Server 2005  
Enabled by Replication Manager and MirrorView/S**

**Reference Architecture**

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# Executive Summary

The Executive Summary contains the following sections.

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## Purpose

This document describes the reference architecture of the EMC CLARiiON CX3-80 Metropolitan Recovery for SQL Server 2005 Enabled by Replication Manager-MirrorView/S solution tested and validated by EMC® Global Solutions Operations.

The purpose of this solution is to demonstrate the capabilities of EMC hardware and software in a large Enterprise SQL Server environment. The EMC CLARiiON® CX3-80 is used for storage, and MirrorView™ Synchronous (MirrorView/S) is used for remote replication and disaster recovery of the SQL Server user and system databases and logs. Replication Manager, in conjunction with CLARiiON SnapView™ software, is used for local replication and recovery.

## The business challenge

Databases are an integral part of virtually every enterprise business. From CRM and Human Resources systems, payroll, Business Intelligence, web content, and more, designing and building a database infrastructure to support these functions and then protect the data it contains is a major challenge. These systems are "always on" and being accessed by users, while at the same time, holding more and more data. In many cases, it is no longer acceptable to take the database down for nightly backups and, in the event a restore is required, it must be restored quickly and with minimal impact to users. In addition, to maintain operations in the face of site disasters, the data must be replicated to an offsite location that can be brought online quickly, with a minimum of (sometimes zero) data loss. Together, these challenges demand a solution that offers effective, affordable, and efficient protection of this critical business function.

## The technology solution

It's important to work with an experienced provider of hardware-level backup and replication solutions—one with a strong track record and the ability to deliver layers of local and remote protection. EMC provides a range of solutions for companies of all sizes. Plus, with EMC Information Lifecycle Management (ILM), the level of protection can be increased as needs change and businesses grow.

In partnership with Microsoft and its certified partners, EMC has designed solutions for Microsoft SQL Server environments using EMC software for the

EMC CLARiiON platform. This solution features EMC protection capabilities based on EMC local and remote replication products.

This solution demonstrates how an EMC CLARiiON CX3-80 storage system can be used to design a robust SQL Server 2005 database environment. In this solution, EMC Replication Manager combines Microsoft VDI and VSS functionality with EMC SnapView software to create replicas of the database and log volumes that can be used for instant restore of the database or backed up to offline media for long-term retention. EMC MirrorView/S software is also used to synchronously replicate the database and log volumes to an identical remote site environment to provide for Disaster Recovery with no loss of data and extremely quick recovery time.

## Reference architecture key components

The EMC Metropolitan Recovery for SQL Server solution reference architecture includes components from EMC, Microsoft, Dell, and Cisco. This section briefly describes the EMC components. For details on all of the components that make up the reference architecture, see [Chapter 2](#).

### EMC SnapView

SnapView software leverages the power of EMC CLARiiON networked storage systems to create local point-in-time copies of data that can be used for testing, backup, and recovery operations. SnapView also features consistent split capabilities—to ensure data coherency for all local replication needs. With the flexibility to create pointer-based, space saving snapshots and highly functional, full-volume clones, organizations are able to meet a mix of service levels with minimal operational impact.

### EMC Replication Manager

Replication Manager automates and simplifies management of disk-based replicas. It orchestrates critical business applications, middleware, and underlying EMC replication technologies to create and manage replicas at the application level for a variety of purposes, including operational recovery, backup, restore, development, simulation, and repurposing. Customers interested in reducing backup windows, automating and simplifying backup and recovery procedures, and creating parallel access to information can implement Replication Manager to put the right data in the right place at the right time.

## EMC MirrorView/S

EMC MirrorView/Synchronous software provides highly available data protection across a campus or metro area environment. By maintaining synchronous data mirroring between EMC CLARiiON systems, MirrorView/S ensures data availability for important business functions should the primary site become unavailable. MirrorView/S is storage-system based; therefore it does not use any server cycles and uses consistency groups to ensure related volumes (such as database and logs) are mirrored in sync with each other to ensure data consistency.

## EMC CLARiiON CX3-80

The CLARiiON CX3 UltraScale™ architecture, based on a high-performance, high-availability design, enables the CX3 UltraScale series to address a broad range of application environments. The CX3 UltraScale series systems are built on a redundant modular architecture and run the FLARE® storage operating environment. The innovative UltraScale architecture incorporates state-of-the-art CPUs and the highest performing memory subsystem, leveraging low-latency, high-bandwidth PCI Express interconnect technology.

The EMC CLARiiON CX3-80, the industry's most powerful midrange storage system, is ideal for tiered storage, backup-to-disk and data warehousing. The CX3-80 can support 2 Gb/s LC/FC disk drives, 2 Gb/s Fibre Channel disk drives, and 4 Gb/s Fibre Channel disk drives in the same system, scales up to 239 TB, and supports highly available connectivity for up to 256 hosts.

## Reference Architecture Overview

This section discusses the environment profile and hardware and software resources used in the solution.

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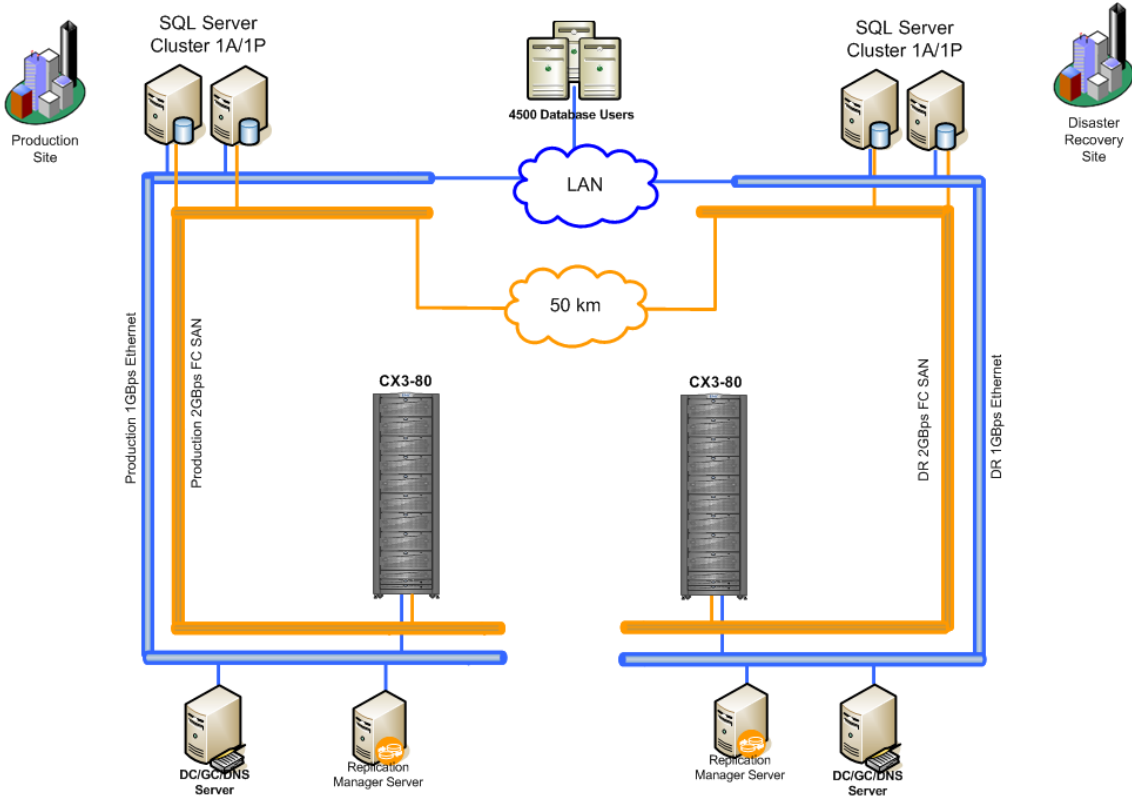
## Environment profile

The solution is described by the parameters and assumptions listed in [Table 1](#).

**Table 1**      **Environment profile**

Parameter	Value
Number of concurrent users	4,500
Read/write ratio	Approximately 2:1
Database profile	OLTP
Database size	Approximately 800 GB
SQL Server 2005 cluster configuration	2 nodes (1 active/1 passive) (each site)
Database instances	1
Databases	1
File groups (files)	1 (4)
Production data RAID type	RAID 1/0
Physical drive size	146 GB
Drive speed	15k rpm
Production clone RAID type	RAID 5
Physical drive size	300 GB
Drive speed	10k rpm
Number of local replicas	2
MirrorView/S replication link	1 x 2 Gb FC
Distance between local and remote sites	50 km

Figure 1 illustrates the overall architecture of the solution.



**Figure 1 SQL Server 2005 environment**

## Hardware resources

The hardware resources used in this environment are listed in [Table 2](#).

Equipment	Quantity	Configuration
EMC CX3-80	2	Rel. 3.24.08.5.011 42 146 GB 15k drives 15 300 GB 10k drives
Enterprise Class FC switch	2	Cisco MDS 9509 V2.2 (b2)
SQL Servers	4	Dell 6850: 4 CPU, 3 GHz, 32 GB RAM, 2 HBA (QLA2340)
Domain controllers	2	Dell 2850, 2 CPU, 3 GHz, 4 GB RAM
Replication Manager servers	2	Dell 2850; 2 CPU, 3 GHz, 4 GB RAM
Enterprise network switch	2	Cisco Catalyst 6500 Class

## Software resources

The software resources used in the solution are listed in [Table 3](#).

Software	Version	Configuration
Microsoft Windows 2003 Enterprise Edition	2003 SP2 64-bit	Cluster (1 active/ 1 passive nodes)
Microsoft SQL Server Enterprise Edition	2005 SP2 64-bit	Cluster (1 active/ 1 passive nodes)
EMC PowerPath®	4.5.1	
EMC Replication Manager	5.0 SP2	
Qlogic 2340	Miniport 9.1.2.15 BIOS 1.47 Kb 916048	
EMC ADMSnap	6.24	
EMC Solutions Enabler	6.4 Series	
EMC Navisphere® CLI	6.24	

**Table 3      Software (continued)**

<b>Software</b>	<b>Version</b>	<b>Configuration</b>
EMC Navisphere Agent	6.24	
EMC MirrorView/S	6.24	
EMC CX3-80 FLARE®	Release 24	



## Solution Details

This section provides additional details about the solution.

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## Storage design

The storage design is centered around the concept of designing for performance and then capacity. This means that the first priority is providing enough disk spindles to yield acceptable read and write latency for database I/O operations. Once the performance demands are met, then additional spindles can be added to provide for the required capacity if needed. Typically, the number of spindles required for performance provides plenty of capacity for its associated database. Database I/O requirements are driven by concurrent user load, application transaction mix (read/write ratio), and database profile (OLTP, Data Warehouse). Additional factors include local replication requirements to ensure that backups and restores happen fast enough, and remote replication latencies so that the application is not slowed down.

This solution uses a set of 38 disks, which supports database and log storage for 4,500 concurrent users on an 800 GB OLTP database replicating to a remote site. Additional spindles were used for system databases, cluster quorum drives, and clones.

## Replication Manager design

Replication Manager allows the creation of instant replicas inside the CLARiiON storage system, which can then be mounted to another server and backed up with no impact to the SQL Server. After eight hours of activity from 4,500 users, a Replication Manager backup job created replicas of the database and log volumes at a rate of 12 GB/minute while under a 50 percent off-peak user load. Using Microsoft's Virtual Device Interface (VDI), Replication Manager jobs put user transactions on hold for only a few seconds while taking a Volume Shadow Copy Service (VSS) snapshot on the filesystem level. Database transactions resume after that point.

When a recovery is needed, Replication Manager allows for the protected restoration of a database—regardless of the size—in approximately three minutes. At that point, the log backups can be replayed into the database to bring it up to date or to a point before database corruption occurred.

The msdb and master databases were also backed up via Replication Manager pre-replication functionality.

## MirrorView/S design

In this solution, EMC MirrorView/S is used to replicate the user and system database and log files from the production site to the remote site for disaster recovery. This synchronous replication solution means that there is no data loss

in the event of a primary site failure. Replicating the system database files means that system changes at the production site (such as adding and deleting users) do not have to be reapplied manually at the remote site in the event of a failover). The copy of the data at the remote site is a consistent, restartable copy of the production database. The solution has been validated over a distance of 50 kilometers between sites.

If a disaster were to occur, the process to fail over to the remote site (and back to the production site when it's back online) is performed using standard CLARiiON and SQL Server procedures.

## SQL Server design

The design goals of the SQL Server are good performance and reliability for an OLTP application supporting 4500 users (see [Table 1 on page 10](#)). Reliability requirements were met by installing SQL Server on an active/passive MSCS cluster, providing protection against server hardware failure. Reliability is further enhanced by replicating the SQL Server environment to an alternate site as described in the section “[MirrorView/S design](#)”.

Performance goals are enhanced by placing the user database in a single primary filegroup consisting of a primary file and three secondary files each on their own LUN. This provides parallel file access for better I/O performance, as SQL Server allocates file space proportionally across the multiple files.

The database recovery model is set to **Full**. A single transaction log file on its own LUN is used and backed up regularly to minimize the space the changes require.



## Conclusion

Building an Enterprise SQL Server environment that encompasses local backup as well as remote site disaster recovery is a complicated endeavor. This reference architecture depicts a validated design using an EMC CX3-80 storage system, EMC Replication Manager, and EMC MirrorView/S. This solution provides effective protection for databases, which are a critical business infrastructure.

EMC can help accelerate assessment, design, implementation, and management while lowering the implementation risks and cost of a backup/disaster recovery solution for a Microsoft SQL Server 2005 environment.

To learn more about this and other solutions, contact an EMC representative or visit [www.EMC.com/solutions/microsoft](http://www.EMC.com/solutions/microsoft).

