



TECHNICAL CASE STUDY

Siemens Corporate Research Leverages iSCSI to Support IBM Rational ClearCase for Software Configuration Management

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TECHNICAL REPORT

Network Appliance, a pioneer and industry leader in data storage technology, helps organizations understand and meet complex technical challenges with advanced storage solutions and global data management strategies.

Introduction

Since the approval of the iSCSI (Internet SCSI) standard by the Internet Engineering Task Force (IETF) in February 2003, customers in a variety of fields have moved quickly to adopt the protocol. While a significant amount of iSCSI information exists, there is as yet very little practical information available based on field experience. This technical case study is intended to help fill the gap between theory and practice by detailing the real-world experiences of Siemens Corporate Research (SCR) with iSCSI. SCR uses iSCSI and NetApp storage to support its software configuration management (SCM) environment.

Background

Siemens AG (www.siemens.com) is an industry-leading technology company with over 400,000 employees in 190 countries. The company is engaged in a wide variety of business areas, including information and communications, automation and control, power, transportation, medical technology, lighting, and finance. Siemens focuses on technological innovation to achieve success across its many business functions.

Siemens Corporate Research in Princeton, New Jersey, is the company's largest research institute outside of Europe. For the past 25 years, SCR has been a source of leading innovations, particularly in the fields of information technology and software, computer graphics, and advanced multimedia.

SCR uses IBM Rational ClearCase software to manage a wide variety of local development projects. ClearCase storage had tripled in just 12 months, and more and more storage was being added to individual systems to meet growth demands. This was making storage provisioning increasingly complicated and time-consuming. SCR also uses ClearCase MultiSite to collaborate with other Siemens research and development organizations around the globe, including locations in Germany and India. As a result, scheduling the amount of downtime required to back up ClearCase data was compromising operations at other sites.

The adoption of NetApp storage and iSCSI solved these problems for SCR, enabling the research institute to consolidate data and reduce the time ClearCase is offline for backups from hours to a few minutes. In addition, NetApp technology simplifies overall management, which helps the IT team control administration costs despite rapid growth.

Network Infrastructure and iSCSI Configuration

SCR went live with ClearCase and iSCSI in September 2003. The current configuration consists of a NetApp F880 running Data ONTAP™ 6.4.4 and 2TB of disk storage connected via Gigabit Ethernet to a pair of ClearCase servers. Both servers are Dell PowerEdge 2650 blade servers with dual processors and 2GB of memory. Both run Windows® 2000. One server is configured with ClearCase 6.0, while the other runs ClearCase 5.0. Most client desktops are dual-processor Dell Precision 650 systems. (All of the development work managed by ClearCase is for Windows operating systems.)

SCR uses a flat network topology for its ClearCase environment. The NetApp system and ClearCase servers connect through Gigabit Ethernet (GbE), while client systems connect to the network with Fast Ethernet (100MB per second). The iSCSI traffic between the NetApp system and ClearCase servers is currently isolated from other traffic by a virtual LAN (VLAN)

Customer Challenges

- Maximize uptime for a global SW development infrastructure
- Streamline and simplify admin of a rapidly growing ClearCase SCM environment

iSCSI Value Proposition

- Cost-effective SAN solution
- Leverages existing network infrastructure
- Utilizes familiar Ethernet and NetApp technologies

Deployment Results

- Consolidated, unified storage
- Downtime caused by backups is now negligible
- Rapid, economical deployment
- On-the-fly scalability
- Streamlined management
- Higher performance relative to direct-attached storage

implemented on a Cisco Catalyst 4003 switch. This configuration has performed well, but SCR plans to replace the VLAN with a separate GbE switch connecting servers and storage, primarily to free up ports on their primary switch.

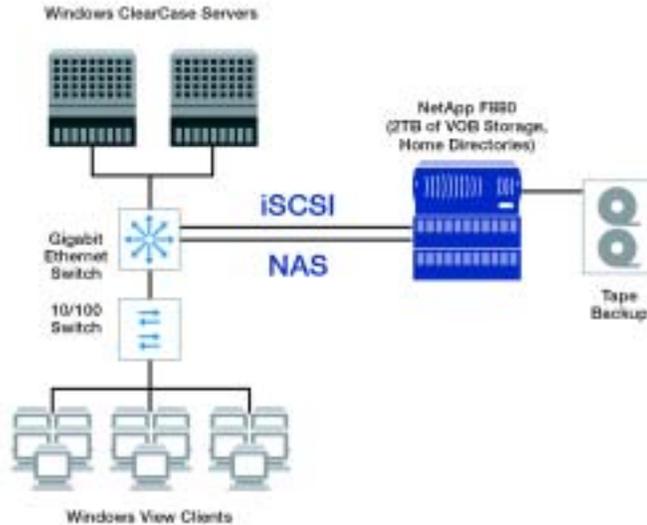


Figure 1) Current ClearCase development environment at Siemens Corporate Research in Princeton, New Jersey.

One of the reasons that SCR chose iSCSI was to isolate ClearCase traffic from the company's Ethernet backbone. Prior to the iSCSI implementation, SCR was relying on the NetApp F880 to provide general file service to over 300 users. The system continues to perform that function today in a unified storage configuration that delivers block access for ClearCase via iSCSI and network file access for other users via the Common Internet File System (CIFS). SCR briefly implemented ClearCase over CIFS, but was concerned about critical ClearCase data sharing the same network with broadcast and other traffic.

When iSCSI was implemented, a separate Gigabit Ethernet interface was installed in the F880. The Dell 2650 ClearCase servers were configured so that one built-in GbE interface is used for iSCSI, while the other is used for normal network traffic. These steps ensure that all iSCSI data goes across dedicated interfaces and networks and is isolated from user traffic.

Servers that utilize iSCSI must be configured with an iSCSI initiator. Since the ClearCase servers have built-in network interfaces, SCR installed a software iSCSI initiator, available from Microsoft at no cost. Hardware initiators—purpose-built Ethernet interfaces that encapsulate the iSCSI network protocols in hardware—are also available. Although current performance is excellent, SCR plans on using TOE (TCP/IP offload engine) cards as soon as they are fully supported by NetApp and Microsoft.

For this environment, the configuration process required installing the iSCSI protocol license on the NetApp system and the Microsoft® software initiator and NetApp SnapDrive™ 3.0 on each Windows server. SnapDrive integrates Windows systems with NetApp storage and provides a graphical interface to configure and manage iSCSI LUNs. A SnapDrive module integrates with

Microsoft Management Console (MMC) to simplify management tasks for Windows. ClearCase software was installed on local storage on each server.

Once the appropriate hardware and software was installed and the VLAN configured, starting iSCSI only required a few additional steps:

1. The initiator group had to be configured on the F880 to include the two ClearCase servers.
2. The target portal on each ClearCase server had to be set to the VLAN IP address of the F880.

With those configuration steps complete, the iSCSI initiator automatically established a connection to the NetApp system, and LUNs were configured. “Since NetApp equipment and personnel already had a proven track record of success at SCR, we really had no concerns about adding iSCSI capability. We saw it as just an extension of the great capabilities we already had. The fact that Microsoft also supports iSCSI gave us further confidence,” says Ramesh Viswanathan, director of Computer and Network Administration at SCR.

Using iSCSI in a ClearCase Environment

Once the software was installed and configured, the ClearCase servers were configured to utilize NetApp storage via iSCSI exactly as if it were local storage, but with the added advantages of data consolidation and advanced data management provided by NetApp. SCR accesses the ClearCase database and all storage pools over iSCSI.

Migrating ClearCase data from existing storage to NetApp proved to be simple for SCR because it was in the process of deploying one brand-new ClearCase server and upgrading to a new hardware platform for its existing server. The existing server was left online until the new server was configured with iSCSI, and then ClearCase MultiSite was used to migrate all data to the new server and NetApp storage. “We recommend that anyone deploying ClearCase over iSCSI utilize this strategy if possible, since it makes it possible to migrate ClearCase data with minimal disruption to user access,” says Viswanathan. “You don’t need a high-end server with a lot of local storage. A thin blade server is sufficient and relatively economical.”

A key element for successful ClearCase deployment with iSCSI and NetApp is Snapshot™ planning. “If you plan to create Snapshot copies of your iSCSI LUNs—a feature that we find highly advantageous for accelerating backup—you should carefully plan space requirements so you can restore the LUN to a separate location within the volume. This facilitates single-element restore in a non-DR situation,” points out Ron Trickey, systems analyst, Computer and Network Administration.

In order to perform single-element restore, free space equal to the size of the LUN containing the versioned object base (VOB) storage directory must be allotted to allow for redirected restoration of the LUN. For example, if Volume A hosts a LUN containing VOB storage space, volume A should be approximately 2.25 times the size of the LUN to allow redirected restoration. In the event of VOB or element corruption, SnapRestore® is used to redirect the LUN Snapshot copy to a parallel location within the volume. The ClearCase server will then see the restored LUN as an additional drive, allowing a ClearCase administrator to perform VOB or element restores as outlined in the ClearCase Administrator’s Guide.

Accelerated Backup

The virtual elimination of downtime due to backup has been the biggest benefit of iSCSI and NetApp storage. ClearCase consists of both flat files and a database. Care must be taken to ensure that the ClearCase database is in a consistent state when backups occur. Proper

backup of ClearCase requires that each VOB to be backed up must be locked and the ClearCase services must be shut down completely to guarantee that backups are consistent. This can result in hours of downtime while data is backed up to tape.

“Because of our MultiSite connections to sites in Germany and India, the downtime required for backup was becoming a significant problem,” says Trickey. “If I shut down for backup when local activity is at a minimum, it’s the middle of the workday somewhere else, and that seriously impacts those sites.”

NetApp Snapshot technology has dramatically simplified this process. A Snapshot copy is a point-in-time image of an iSCSI LUN. Once a Snapshot copy is created, the Snapshot view of the LUN remains static until it is deleted. Snapshot copies are efficient because they don’t copy all the data in a LUN; they simply preserve original data blocks as they are overwritten. Therefore, a Snapshot copy can be created in a matter of seconds.

Trickey created a script to automate the backup process that implements the following steps:

1. All ClearCase VOBs are locked and the ClearCase services are shut down in an orderly fashion to ensure consistency.
2. A Snapshot copy is created on the NetApp system for each LUN used by the ClearCase server.
3. ClearCase is restarted, and all VOBs are unlocked.

The entire process completes in a few minutes with virtually no disruption to users at other sites. Once the process is complete, the static Snapshot copy is backed up to tape with no disruption to ClearCase operation.

iSCSI Impact

Streamlined backup processes have had an extremely significant impact, particularly for other sites that share ClearCase data with SCR. “Our counterparts in Germany noticed an enormous improvement in productivity and reduced development time since they no longer have to wait for backups to complete at SCR,” says Trickey.

One of SCR’s ClearCase servers is relatively lightly loaded, with only six VOBs, but the other is heavily loaded, with over 200 VOBs. The NetApp F880 provides data service via iSCSI for both these servers while continuing to provide file service via CIFS for up to 300 network clients. The performance and scalability of the NetApp solution have also been significant benefits. “We love being able to add drives on-the-fly. We’ve expanded VOB storage twice in the last eight months with no disruption to service,” says Trickey. “Performance was not our primary concern when we migrated to NetApp. We would have been happy if it stayed the same, but performance was noticeably faster after the migration.”

“Our developers actually commented to us that ClearCase operations were much faster after the upgrade. Obviously that translates to increased productivity, which helps developers meet or exceed deadlines on critical projects and contributes to the innovation that Siemens thrives on. Ultimately, this is critical to maintaining the company’s leadership role and competitive advantage,” says Viswanathan.

In SCM environments, reliability and data availability are critical. The NetApp solution has proven itself to SCR in this area as well. “We’ve had virtually no hardware or software problems,” adds Trickey. “We did have problems with one disk, but with NetApp RAID, all our data remained online and available. This NetApp system is a great piece of technology.”

“Consolidating our ClearCase data on NetApp has made life easier. We no longer have to babysit our storage, so we can manage more storage with fewer people. NetApp has helped us keep our headcount the same in the face of significant growth to keep costs under control,” says Viswanathan. “The enhancements to our backup operations have been critical, but we have also benefited tremendously from the data consolidation, ease of management, and improved data availability provided by NetApp storage.”

Conclusion

The success that Siemens Corporate Research has had so far demonstrates the benefits of iSCSI and NetApp technology for busy software configuration management environments. Because of the success of its operations with the NetApp F880, SCR is making significant plans to expand. “We have an additional NetApp system currently in use for other functions,” says Viswanathan. “We are planning to upgrade this system in the next few months and cluster it with our current system for even greater reliability. Although ClearCase MultiSite provides a measure of disaster recovery, we would ultimately like to add a NetApp NearStore® system at an off-site location and periodically archive our data to that site using SnapVault™ or SnapMirror® to ensure even greater data protection and disaster recovery.”

Additional Resources

NetApp offers a variety of additional information about these topics:

- **iSCSI Technology Center**
www.netapp.com/solutions/iscsi
- **iSCSI: Accelerating the Transition to Network Storage**
www.netapp.com/tech_library/3241.html
- **Performance Tuning for iSCSI:
How to Configure an iSCSI Solution to Maximize Performance**
www.netapp.com/tech_library/3251.html
- **Best Practices Guide for Data Protection with NetApp Storage Running iSCSI**
www.netapp.com/tech_library/3250.html
- **Using Network Appliance Filers with Rational ClearCase**
www.netapp.com/tech_library/3111.html
- **Rational ClearCase Backup and Restore Using a NetApp Filer in a UNIX® SAN Environment**
http://www.netapp.com/tech_library/3269.html

