Technical Case Study:

Norsk Hydro Achieves SLA, Remote Backup, and DR Goals with Consolidation on NetApp

NetApp | TR-3502

Executive Summary

Norsk Hydro is the largest company in Norway and one of the world's leading energy and materials providers. Business areas include oil, energy, aluminum, and agricultural products. Hydro IS Partner (HISP), a subsidiary of Norsk Hydro, provides information services and IT management for a global client base and 50,000 Hydro employees in 60 countries.

HISP offers three service levels (Gold, Premium, and Standard) to key business partners and customers. To meet Service Level Agreements (SLAs) and continue to deliver efficient, cost-effective technology solutions and services, HISP had to improve its existing storage infrastructure. As is the case in many highly diversified global organizations, the company's storage infrastructure had grown organically into a difficult-to-manage mix of individual storage networks and direct-attached storage (DAS) islands.

Backup was decentralized and inconsistent, with approaches differing not only across business units, but also among Novell, UNIX®, and Windows® environments. Of particular concern was the ability to protect data at 200 remote offices where staffing and management resources are always in short supply. Disaster recovery capabilities were limited, and replicating data often meant shipping media from site to site. With various flavors of operating systems—each with its own management requirements—in place at the data center, interoperability was not an option. Growth was exacerbating the problems. Datasets were increasing more than 60% annually as internal and external user bases multiplied and the business ramped to meet expanding partner and customer requirements.

After assessing the existing storage infrastructure in light of both current issues and future requirements, HISP outlined three overarching goals: 1) utilize the company's IP infrastructure and consolidate storage to reduce complexity, streamline administration, and achieve interoperability; 2) centralize and standardize backup/recovery processes across both the data center and remote offices, and eliminate tape at remote offices; 3) implement a multi-level disaster recovery program to ensure business continuance and to meet the specific SLA requirements of Gold, Premium, and Standard client services.

An evaluation of storage vendors and architectures led to the selection and deployment of a company-wide NetApp™ solution. Key differentiating benefits of the NetApp network-attached storage (NAS) solution included cost efficiency, flexibility, and ease of integration into the existing infrastructure. In just 10 months, Norsk Hydro implemented an efficient storage infrastructure that meets corporate goals of manageability, remote-office backup/recovery, and DR for business continuance and SLAs.

Since deployment of the NetApp solution, Norsk Hydro has been able to grow its customer base by 20% without adding headcount in IT administration and operations. In fact, staffing remains consistent even as the company continues to grow storage at 80% annually. Today, a small team of administrators manages file services for 75TB of data as well as all DR processes. NetApp systems house some 15,000 user home directories. Making the transition to NetApp primary and secondary storage systems has enabled Norsk Hydro to eliminate 100 Novell servers and to offload UNIX file-serving duties. Remote-office backup has been streamlined, and DR capability across the company has been dramatically enhanced.

Technical Challenges

Norsk Hydro analyzed its existing storage infrastructure and identified three major issues:

- *Unmanageable storage diversity.* Like most enterprises, Norsk Hydro had over time deployed a variety of storage systems to accommodate varied and changing needs. A Novell environment provided file and print services for Windows desktops. A separate storage environment accommodated UNIX needs (Sun Solaris™ and IBM AIX). In a third storage environment, a SAN provided block-oriented storage for databases and other business applications running on AIX. Each of the operating and storage systems had to be managed separately using different interfaces. One of the company's major goals was to reduce the level of storage complexity by consolidating network file services for Windows and UNIX.

- *Costly, increasingly slow, and inconsistent remote-office backup/restore.* A second major challenge was managing and protecting data at more than 200 remote offices. Many of these offices lacked IT support staff or shared staff with other offices in order to address data management needs. Tape was used for data protection at the remote offices. With minimal remote staff, managing media was a significant pain point compounded by the increasing amount of tape consumed by backups. Norsk Hydro datasets were continuing to grow at a rate of 80% annually at remote offices and 60% annually at major data center sites.

  Restoration and data recovery between sites was difficult due to slow network connections to remote offices (network backup was rare), slow tape mounts, and increased media consumption. Restoration of data to a remote server was even more painful. For many offices, a restore resulted in a delay of many hours just waiting for personnel to get on-site to begin the process of physically locating and loading media.

- *Manual, time-consuming, and inadequate DR.* Norsk Hydro recognized disaster recovery as a priority but had not yet implemented online disaster recovery anywhere in the enterprise, leaving it entirely dependent on off-site tape. To provide a base level of disaster recovery, media was shipped from office to office or from data centers to off-site locations. All processes were manual and labor intensive with no automation, no scheduling, no management capabilities, no built-in failover and no built-in restoration capabilities in place. The time it would have taken to recover from tape following a major disaster affecting even a single site presented a significant and growing business risk.

  Implementing adequate backup/restore and DR functionality was critical to meeting SLA terms. Customers contract for a specific service level based upon their business needs and how critical their data is. The Gold service level includes a 99.9% uptime requirement, Premium stipulates 99%, and Standard customers expect 97%. Each level has separate architectural requirements and varying levels of disaster recovery capabilities. For instance, Premium and Gold services mirror data to the DR site, but only the Gold service provides direct or priority access to the mirror in the event of a disaster.

The Existing Environment

Figure 1 illustrates the original storage topology that consisted of three independently managed, stand-alone infrastructures, including a Tivoli Storage Manager (TSM) backup environment deployed at the Norsk Hydro main data centers, and a mixture of tape-based solutions at remote sites.

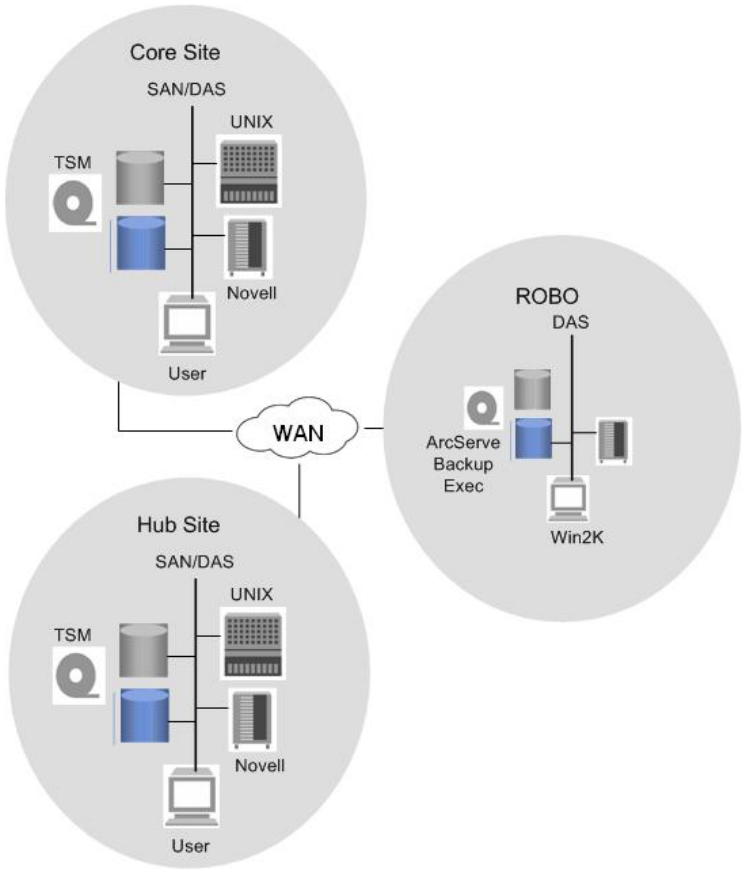

Figure 1: Historical Topology

Some 100 Novell servers (with approximately 16TB of uncompressed storage capacity) provided file and print services for 15,000 users. Typical data types in this environment included shared folders, common project areas, and Microsoft® Office application data. Backend storage for these servers was provided via direct- or SAN-attached storage.

On the UNIX side, IBM AIX servers (AIX 5.3) and Sun Solaris servers (Solaris 8 and 9) provided the bulk of the compute capacity for file serving, seismic data processing (mineral/oil exploration), and processing of engineering application data. The UNIX storage backend also consisted of mostly SAN-attached capacity with a separate storage pool allocated to each server. The UNIX systems supported approximately 1,500 technical users and 20TB of data (growing more than 5TB per year). Applications included Web applications, proxy servers, e-mail servers, and geological applications. There were also requirements for SAP users to access data via Web applications running on UNIX servers. Business applications such as Oracle™ Database, Lotus Notes, and SAP run on IBM AIX servers. This critical infrastructure supported approximately 8,000 Notes users and 15,000 SAP users.

For backup and recovery within its major data centers, Norsk Hydro utilized IBM Tivoli Storage Manager. All high-bandwidth (Gigabit Ethernet) sites utilized TSM backups over the LAN. Backups were initially staged to disk, then moved to tape for long-term storage. Norsk Hydro used a variety of backup solutions to meet the needs of its various remote offices. Since low bandwidth between major data centers and many of the remote locations made significant data transfer over wide area networks impractical, all backups at remote offices were dependent on local tape. A local tech support person was available for tape restores and other hands-on work, although this shared resource typically roamed among multiple sites. Bandwidth and staffing

limitations made backup/restore at remote sites particularly problematic. It was common for even single file restores to take hours. Consequently, not all single-file requests were considered and, too often, user requests were denied. When an entire Novell server had to be restored, the process could be as long as 10 hours. Furthermore, the total cost of the tape backup solution was twice the cost of maintaining the rest of the server environment. Other problems included no co-location of tape resources, an excessive number of tapes, very long tape mounts, and increasingly lengthy restore times that threatened to impact SLAs.

The Solution: NetApp for Storage Consolidation, Backup, and DR

After assessing requirements and meeting with top storage-solution contenders, Norsk Hydro selected a NetApp solution based on breadth of solution, seamless integration, cost efficiencies, and the ability to deliver critical functionality in each of the key areas.

Storage consolidation

Norsk Hydro selected NetApp as both primary and secondary storage for CIFS and NFS users/applications, citing:

- Ease of implementation and maintenance
- Utilization of IP protocol
- Availability of NetApp Snapshot™ technology
- Superior NFS and CIFS performance
- UNIX/Windows interoperability with non-native access to data
- Smooth integration with Microsoft Active Directory
- Integrated anti-virus support

Backup/Restore

In the area of backup functionality, NetApp provided key functionality such as:

- Support for and interoperability with IBM Tivoli Storage Manager
- Data mobility among multiple storage platforms and protocols (including NetApp SnapVault® and SnapMirror® software, ndmpcopy, etc.)
- Compliance with Network Data Management Protocol (NDMP) for local backups and restores
- Broad support for tape peripherals

Utilizing NetApp technology in these areas enabled HISP to achieve its goals to:

- Reduce the number of administrators performing backup/restore and DR functions
- Permit user-driven restores
- Reduce the level of data redundancy
- Limit the number of different operating systems to be backed up
- Provide faster file and file-system restoration times
- Move away from tape
- Protect data on remote-office servers

A major factor in the selection of NetApp was the open systems capability integrated into NetApp SnapVault software. NetApp SnapVault uses a block-level incremental approach that allows Windows data residing at remote locations to be fully protected across low-bandwidth WAN connections. This functionality reduced the need for tape backup at remote sites while also centralizing and consolidating the overall backup infrastructure. Today, single-file restores can be performed much more quickly than tape. NetApp SnapVault software also allows retention of a large number of file-system images for greater protection.

Disaster recovery

NetApp SnapMirror software serves as the foundation for online disaster recovery. In addition to low maintenance, the NetApp solution features:

- Efficient replication/mirroring technology
- The ability to quickly establish mirrored relationships, make mirrored destinations available immediately, and provide read-only copies

- Mirrored (read-only) and secure destination data volumes that serve as a place for replicated content to be accessed by the local client
- WAN-friendly technology with the ability to throttle bandwidth
- Incremental updates done at a physical block level (not file level) for efficient use of WAN bandwidth
- The ability to mirror primary Snapshot copies from the source data volumes to destination volumes

Secondary (Near-line) Storage

An essential element in the successful implementation of the Norsk Hydro storage architecture was the availability of cost-effective near-line storage. NetApp NearStore® systems met requirements in this area, serving as both backup and DR targets. Management and backup requirements met by the NetApp solution include:

- Integration with the Tivoli TME 10 Enterprise Management Framework for monitoring and reporting functions
- Support for built-in, proactive “call home” functionality
- Support for remote administration via Web interface, telnet, rsh, ssh, and CLI
- Support for simple expansion/reduction of disk resources (this reduced the requirement for the specialized skill set traditionally required for editing complicated partition/disk layouts, bin files, etc.)
- Seamless reconfiguration of the storage hardware
- Easy installation of new storage resources (arrays, shelves, disks)
- Report on, monitor, and manage the entire NetApp system environment using NetApp DataFabric® Manager (DFM) software; DFM’s ability to provide a charge-back mechanism proved particularly useful, enabling Norsk Hydro to accurately record and bill business units according to periodic consumption rates

NetApp Deployment

Norsk Hydro installed a variety of NetApp primary and secondary storage systems for a total storage capacity of 75TB. The NetApp systems replace 100 Novell servers, off-load UNIX file serving duties, and provide a platform for advanced data protection and disaster recovery. Protection extends to desktop systems, and all NetApp systems are managed from NetApp DataFabric Manager software.

Norsk Hydro takes full advantage of the integrated NetApp Snapshot technology that enables regularly scheduled creation of incremental point-in-time copies within the same storage system. The current Snapshot schedule at Hydro creates eight hourly and seven nightly Snapshot copies in primary data centers and 30 nightly Snapshot copies at its Business Continuance Center (BCC) in Oslo, Norway. Snapshot copies enable users to restore their own data from Snapshot directories. HISP estimates that 90% of restores are done from Snapshot copies at the primary data center.

NetApp SnapVault software provides highly efficient, high performance disk-based backup between primary storage systems and NetApp NearStore systems. With its open systems capabilities, SnapVault can back up either NetApp primary storage systems or storage on standard servers running Windows or other operating systems. NetApp SnapVault has been deployed on all Windows servers in Norsk Hydro remote offices and is currently responsible for protection of 3.5TB of remote data at more than 200 remote offices. (The SnapVault agent is installed on the local (C:) drive on the Windows servers.) NetApp SnapMirror software is used in conjunction with SnapVault to replicate SnapVault secondary data to the DR facility.

Norsk Hydro utilizes a combination of products and recovery solutions in order to enable its current bare metal recovery solution. NetApp Open Systems SnapVault in conjunction