EMC FOR NETWORK ATTACHED STORAGE (NAS) BACKUP AND RECOVERY USING NDMP

Abstract
This white paper provides an overview of EMC’s industry leading backup and recovery solutions for NAS systems. It also explains how EMC’s backup solutions complement snapshots for optimized data protection across the enterprise.

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Executive Summary

As the amount of unstructured data continues to grow exponentially, enterprise organizations face the daunting task of ensuring that critical data on Network Attached Storage (NAS) systems is fully protected. And in many cases, backup windows are shrinking, along with budgets and resources. Industry research confirms the data protection challenge, noting that 54% of companies experienced data loss in the last 12 months and that 74% of decision makers are not confident they can fully recover data.¹

Unfortunately, traditional backup solutions simply cannot keep up. Some methods inefficiently store data repeatedly across sites and servers, significantly expanding total storage under management and increasing costs. And traditional tape based recovery can take days or even weeks, especially if the data is stored offsite. Recovery from disk is typically faster, but often requires multiple steps, which can be tedious. And while snapshots are utilized for some applications, they are not a substitute for a comprehensive backup and recovery strategy.

Organizations need the right balance of performance, reliability, management, and cost to meet their desired recovery time and recovery point objectives. EMC delivers proven, industry leading backup and recovery solutions including EMC Avamar, EMC NetWorker, and EMC Data Domain deduplication storage systems that quickly and effectively protect critical data.

¹ EMC’s European Disaster Recovery Survey: Data Today Gone Tomorrow, How Well Companies Are Poised For IT Recovery
efficiently protect unstructured data on NAS and application servers (physical and virtual), across the entire organization.

Protecting NAS – Today’s Reality

Traditional NAS backup solutions typically rely on recurring weekly full (level-0) backups and daily incremental (level-1) backups. However, the full backups often extend beyond the available backup window, which risks leaving data unprotected. And in some cases, daily incremental backups may take as long as full backups - especially if only a portion of a large file has changed, since the whole file must be moved. The use of tape is also challenging due to unreliable media and hardware, delays in offsite shipments, and the risk of losing unencrypted tapes that contain sensitive data.

From a recovery perspective, traditional methods often involve a tedious, multi-step process, requiring restoration of the last good full and subsequent incrementals to reach the desired recovery point. And retrieving tapes from offsite storage can take days or longer with no guarantee the data is recoverable.

Also, the common practice of storing snapshots and primary data on the same NAS system can lead to data loss if the local NAS system fails, the main volume is corrupted or is destroyed and data has not been replicated offsite. And while offsite replication is often desired, large amounts of data and limited WAN bandwidth can make it difficult.

As a result, NAS consolidation and usage are often limited by the backup window, not storage capacity. And traditional backup limitations can lead to data loss, declining user productivity, constrained NAS performance, and overburdened IT staff.

EMC Backup and Recovery for NAS

Data deduplication

Unstructured enterprise data is highly redundant, with identical files or data stored within and across systems (for example, a document or presentation sent to multiple recipients across the enterprise). Edited files also have tremendous redundancy with previous versions. Traditional backup methods magnify this by storing all of the redundant data over and over again.

EMC backup and recovery solutions for NAS include Avamar, NetWorker and Data Domain systems. They can all utilize deduplication technology to eliminate redundant backup data at both the file and the sub-file data segment level. This ensures that each unique data segment is backed up and stored only once across the enterprise.

As a result, EMC solutions dramatically reduce the required network bandwidth. And the needed backup storage can be reduced by up to 30x for cost-effective, efficient disk-based recovery. Now let’s take a closer look at EMC’s industry leading backup and recovery solutions for NAS.
**EMC Avamar for NAS**

Avamar customers can easily expand their data protection umbrella to include NAS data. Avamar provides fast, daily full backups via existing network links - without the need for a dedicated, high-speed NDMP backup network. By deploying the innovative Avamar NDMP Accelerator, enterprise organizations can enjoy high-performance backup and single-step recovery for EMC Isilon, VNX, VNXe, and NetApp NAS systems.

**Avamar NDMP Accelerator**

With an Avamar NDMP Accelerator node, a level-0 backup is performed only once, during the initial full backup. Subsequent daily full backups are achieved by requesting only level-1 incremental dumps, enabling Avamar to dramatically reduce backup times and the impact on NAS resources and networks. When recovery is needed, Avamar presents the data as daily full backups. This enables efficient one-step recovery, eliminating the hassle of restoring full and subsequent incremental backups to reach the desired recovery point.

For enterprise environments that have multi-site deployments, Avamar's intuitive interface and at-a-glance dashboard views make it easy to manage backup, recovery, and disaster recovery from a single location. And data can be encrypted in-flight and at rest for security.

Avamar eliminates backup bottlenecks and provides the freedom to consolidate storage and optimize NAS systems - without limiting the number and size of files or volumes due to potential backup performance limitations.
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Avamar delivers fast, daily full backups for NAS and flexible, scalable storage on Avamar Data Store and/or Data Domain systems.

EMC NetWorker for NAS
NetWorker also efficiently protects NAS, including EMC Isilon, VNX, VNXe, NetApp and other NAS systems. NetWorker enables organizations to reduce costs by bringing management and control of the entire information environment into one central offering. To backup data on NAS systems, NetWorker customers typically utilize the direct NDMP or remote NDMP method.

Direct NDMP Method
When utilizing the direct NDMP method (also referred to as 2-way NDMP), NetWorker controls the backup process and the NAS system writes data to a direct attached Fibre Channel device (e.g. a Data Domain system). With this approach, the NDMP data does not traverse the network, which eliminates network congestion.
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Figure 2. Direct NDMP NAS backup method with NetWorker and Data Domain storage. Backup data can be efficiently replicated offsite daily for disaster recovery.

Direct NDMP with Isilon Backup Accelerator

For Isilon NAS environments, NetWorker can seamlessly integrate with the Isilon Backup Accelerator, which enables customers to leverage their existing investment in SAN infrastructure. With this approach, NetWorker communicates with the Isilon system via NDMP over the Local Area Network (LAN). NetWorker instructs the Isilon Backup Accelerator, which is also a NDMP tape server, to start backing up data to a Data Domain system attached to the Backup Accelerator via Fibre Channel. The Backup Accelerator is an integral part of the Isilon IQ cluster and communicates with the other nodes in the cluster over the internal InfiniBand network.

The NetWorker Server controls the media management. File History, which includes information about files and directories, is transferred from the Isilon Backup Accelerator via NDMP and sent via the LAN to NetWorker where it is maintained in a catalog.

In the example below, an Isilon Backup Accelerator is installed along with a Data Domain system configured as a tape library (or any supported Fibre attached tape or virtual tape library).

Figure 3. Direct NDMP NAS backup method with Isilon storage and Isilon Backup Accelerator. NetWorker manages the process and data is stored on Data Domain.
Remote NDMP Method

When utilizing the remote NDMP method (also referred to as 3-way NDMP), NetWorker controls the backup process and emulates an NDMP tape server. The NAS system sends data via an IP network to the NetWorker Server. NetWorker uses NDMP over the LAN to instruct the NAS system to start backing up data to the NetWorker server, which is attached via LAN or directly attached to the storage device. The NetWorker Server controls the media management and File History, which is information about files and directories, is transferred from the NAS system via NDMP and over the LAN to NetWorker where it is maintained in a catalog.

![Remote NDMP NAS backup method, controlled by NetWorker with data efficiently stored on Data Domain systems.](image)

Remote NDMP with Isilon

When protecting Isilon NAS systems, the remote NDMP method does not require an Isilon Backup Accelerator. In the following diagram Data Domain or any supported tape library can be the backup target, allowing organizations to leverage existing LAN backup infrastructure.

![Remote NDMP NAS backup method for Isilon does not require an Isilon Backup Accelerator.](image)
Integration with EMC Data Domain Deduplication Storage Systems

Avamar and NetWorker environments can utilize Data Domain systems for enhanced performance and scalability with industry-leading protection storage. By integrating with Data Domain, the backup data deduplication process is efficient and easy to manage. And by storing only the new, unique sub-file variable length data segments on Data Domain systems, the amount of data stored to disk is dramatically reduced in most cases.

Backup data can also be asynchronously replicated daily between multiple Data Domain systems to meet disaster recovery objectives. The entire backup, recovery, and replication process is managed via the Avamar or NetWorker interface, simplifying management of the backup infrastructure. WAN efficient replication eliminates the need for tape-based solutions for disaster recovery.

Reliability

Avamar Data Store and Data Domain deduplication storage systems both deliver reliable protection storage to help ensure backup data can be recovered when needed. For example, Avamar uses a patented redundant array of independent nodes (RAIN) architecture that provides high availability across Avamar servers. In addition, Avamar system integrity is verified twice daily via internal system checkpoints and data recoverability is also verified daily.

Data Domain storage systems utilize the Data Domain Data Invulnerability Architecture, which provides the industry's best defense against data integrity issues. Key capabilities include end-to-end data verification, fault avoidance and containment, continuous fault detection and as well as a self-healing file system. Data Domain also implements a proprietary implementation of RAID-6, which protects against up to two disk failures per RAID set.

Best Practices for NAS Data Protection

Backup and Snapshots for Optimal Protection

Snapshots are one piece of an overall data protection strategy. They bring value when the Recovery Point Objective (RPO) is shorter than the traditional backup schedule, and when traditional recovery takes longer than the Recovery Time Objective (RTO). For specific applications, snapshots can provide point-in-time copies to quickly revert corrupted or deleted data blocks. And snapshots can be configured to occur many times per day in order to provide more granular RTOs and RPOs. These point-in-time copies allow for near-immediate restores from data blocks maintained for very short retention periods.

However, snapshots can also put data at risk, especially if stored on the same array as the primary data, since failure or corruption could result in complete data loss. And in some cases, the number of snapshots can be limited, they can require pre-allocated space on expensive storage, and may require a specific vendor's storage
system. Also, data deduplication may only occur within a given volume or file system container, not globally, which limits the benefit. And blocks referenced by snapshots of the volume prior to deduplication may not be candidates for deduplication, limiting the overall value and savings.

An ideal data protection solution improves SLAs, RPO/RTO, NAS system utilization, and productivity while reducing costs and the risk of data loss. EMC offers solutions that can be applied to a variety of datacenter and remote office locations. Data protection best practices include daily backups, snapshots for some applications, and offsite replication for disaster recovery to meet business and operational objectives.

The immediate cost and operational efficiencies realized with the combined snapshot, deduplicated backup, and backup data replication architecture include:

- Improved SLAs with the ability to perform fast, daily full backups, one-step recovery, and disaster recovery via existing networks
- More granular recovery points and shorter recovery times
- Data Domain systems for increased scalability and performance
- Increased NAS productivity and use by removing backup bottlenecks and reducing the required backup window
- Sub-file backup data deduplication to reduce required network bandwidth, storage, datacenter floor space, power, and cooling
- Tiered service offerings can reduce the amount of data requiring additional protection (such as replication, multiple snapshots and long-term retention)
- Less reliance on proprietary vendor snapshot management solutions for maintaining backup data reduces vendor lock-in and provides flexibility

**Conclusion**

EMC delivers proven, industry leading backup and recovery solutions that quickly and efficiently protect unstructured data on NAS systems (including EMC Isilon, VNX, VNXe, NetApp) and other servers (physical and virtual) across the enterprise. By eliminating backup bottlenecks and improving recovery performance, EMC provides the freedom to consolidate storage and optimize NAS systems—without the hassle of limiting the number and size of files or volumes due to backup performance limitations.

For existing Avamar environments, customers can easily expand their data protection umbrella to include NAS systems. By deploying the innovative Avamar NDMP Accelerator, customers can enjoy fast, daily full backups via existing network links - without the need for a dedicated, high-speed NDMP backup network. And backup data can be efficiently stored to Avamar Data Store or Data Domain systems.
NetWorker also efficiently protects NAS, enabling organizations to reduce costs by bringing management and control of the entire information environment into one central offering. NetWorker customers typically utilize the direct NDMP or remote NDMP methods to protect their NAS environments.

Both Avamar and NetWorker environments can leverage Data Domain systems for increased scalability, flexibility, and performance. And backup data can be efficiently replicated offsite daily for disaster recovery. By deploying EMC data protection solutions, IT managers can reduce the amount of time and resources spent on NAS backup and also lower their total cost of ownership.

EMC enables data protection best practices, which include daily backups, snapshots for some applications, and offsite replication for disaster recovery to meet business and operational goals. This allows companies to optimize their desired recovery point and time objectives, while ensuring data is readily available when needed. And flexible licensing options, including the EMC Data Protection Suite, make it easy to purchase, deploy, and maintain industry leading backup and recovery solutions across the enterprise.