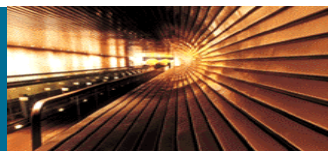
Accenture Report
Documentum 4i on NetApp® filers – Deployment Guide

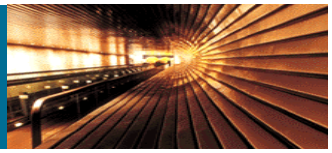


Document Purpose
This project was conducted by Accenture to research & develop a Network Appliance™ filer and Documentum 4i Deployment Guide. This document contains a summary of the findings of the project. Additional technical and execution details can be found in the appendix document.

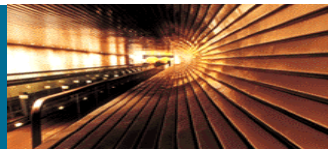
Document Name:
Accenture Report:
Documentum 4i on NetApp filers – Deployment Guide

Additional Related Documents:
Executive Summary:
Documentum 4i on NetApp filers – Deployment Guide Executive Summary
Documentum 4i on NetApp filers – Deployment Guide Appendix

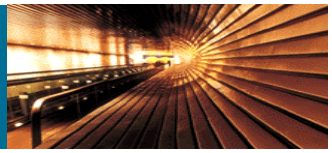
accenture
Innovation delivered.



Contents



List of Figures



1.0 Executive Summary

Accenture is the world's leading management consulting and technology services firm with over 70,000 employees and 120 trained Documentum professionals in the field. An active Accenture / Documentum Alliance offers solutions to help the Global 2000 manage critical information stored in disparate databases housed in multiple formats such as: documents, interactive web content and multimedia. Accenture has a decade of experience helping clients across multiple industries with document, web, digital asset, and enterprise content management challenges.

Accenture was engaged by Network Appliance (NetApp) to research Data Protection and Business Continuance strategies for a Documentum 4i Content Management application integrated onto a NetApp filer (network storage). Documentum Professional Services and CYA Technologies provided on-site Documentum and CYA product support for the duration of the project. This project examined how NetApp software & hardware can be used in data protection and business continuance scenarios. This project deployed a test environment that simulated the behavior of a large number of concurrent users accessing a production-ready Documentum 4i Content Management application with NetApp filers hosting the Oracle database files and Documentum content files.

In tests run against this test environment Accenture was able to successfully integrate a NetApp filer into a production-capacity Documentum 4i application environment. Additional results that were recorded during this testing were:

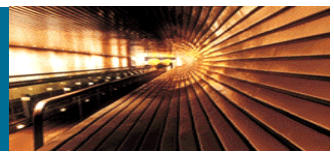
Performance – NetApp filers reduced Documentum 4i business process time by 18% when compared against direct-attached storage (DAS) arrays for document load operations (in the range of 500-5,000 documents).

Scalability – In scalability testing the DAS arrays experienced an additional time of 2% per transaction while the filer time increased by less than 1% when the document load numbers were increased from 500 to 5,000, thus improving overall application response time for end users.

Availability – In application-level failover testing, Documentum 4i deployments running against NetApp filers were able to successfully fail over to a fully operational, standby environment within as little as 4 minutes.

Rapid Data Backup – In test scenarios, Snapshot was used to demonstrate a full 30GB Docbase backup in less than 6 seconds.

Recoverability – In tests that simulated Documentum application failure due to database corruption, the NetApp and SnapMirror filer capabilities alone facilitated recovery in less than 4 minutes. This included 3.2 seconds to recover the database using SnapRestore, and 182 seconds for the database and Documentum application to recover full throughput capacity. The comparative direct- attached storage-based recovery scenario would have taken an estimated 6 hours to complete.



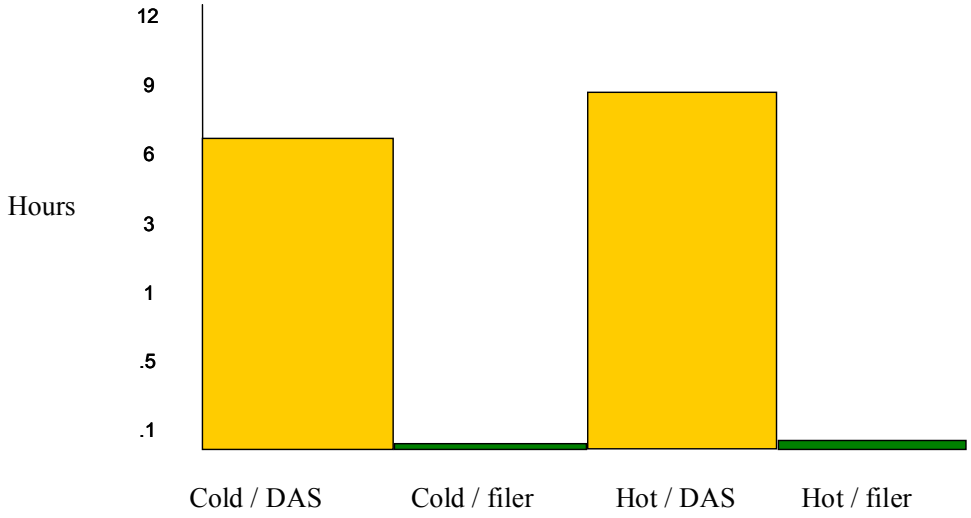
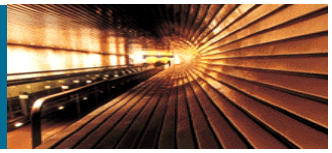


Figure 1 – Documentum 4i Backup Time DAS vs. Filer

Manageability – The NetApp filer was installed, fully integrated into the test environment and serving data in less than 2.5 hours.

The Deployment Guide project developed additional configurations based on CYA Technologies (CYA) and Open Source utilities;

- **Data Protection –** Single Object Restore. Test results validate the use of the NetApp filer as a file server for CYA HOTBackup™ backup sets in a Documentum 4i deployment.
- **Business Continuance –** CYA Virtual StandBy™. Test results validate the use of the NetApp filer and SnapMirror in a Disaster Recovery configuration. SnapMirror was used to replicate CYA HOTBackup sets to an environment running CYA Virtual StandBy. Additional configurations validated the use of SnapMirror alone to replicate data to a passive backup environment.
- **Seamless Integration –** Remote mirroring from DAS to filer using rsync. Test results validate the use of the rsync utility to replicate a Docbase from non NetApp storage (DAS) to NetApp storage at a remote location for failover and disaster recovery scenarios.



2.0 Deployment Guide Overview

2.1 Deployment Guide Objectives

The objective of the Deployment Guide project was to define and test multiple configurations of a NetApp filer in a Documentum 4i production-capacity environment. These configurations were designed to provide organizations that have either implemented Documentum 4i or are considering migrating to Documentum 4i with options regarding data storage and overall application architecture design. Most of the results of this project could also be applied to organizations that are currently employing the Documentum Enterprise Document Management System (EDMS) 98 application or who plan to deploy the upcoming Documentum 5.x version.

The objectives of the project were achieved by developing and testing multiple configurations of the storage needs of a Documentum 4i Enterprise Content Management (ECM) application within a controlled test environment. This production capacity test environment was tested with a user load of up to 150 concurrent users. Assuming a typical 10-to-1 ratio of registered users to concurrent users, this load was selected to represent Documentum installations with approximately 1,500 registered users.

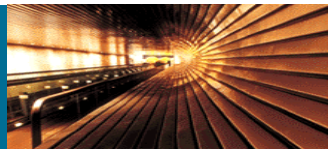
A subset of configurations was devised to measure the performance impacts of integrating a NetApp filer into a production-capacity Documentum 4i deployment. In order to achieve an objective overview of the NetApp filer storage solution within the Documentum 4i application architecture, a representative direct-attached storage (DAS) configuration was created for these performance measurement configurations. By using a comparative point of reference for these configurations it was possible to describe the application architecture differentials between the storage types.

Another set of the configurations was designed to demonstrate the feasibility of integrating NetApp with complementary technology deployments in a capacity Documentum 4i environment. These configurations tested the deployment of a NetApp filer or the combination of NetApp filer with complementary software from CYA Technologies or open source resources, to address common Documentum 4i administration issues.

2.2 Who Should Use This Deployment Guide?

The intended audiences for this Deployment Guide document are technical architects from organizations that fall into one of the following groups;

- Organizations that are planning on implementing Documentum 4i and need to understand their options for using networked storage and/or DAS for different aspects of the Documentum 4i architecture.
- Organizations that are migrating or are planning on migrating from Documentum EDMS 98 (or earlier) to Documentum 4i
- Organizations that have implemented (or are currently implementing) Documentum 4i and that need to understand how to manage database files or large numbers of content files.
- Organizations using Documentum 4i that wish to investigate ways to reduce their backup window, recover more quickly from data corruption, or explore disaster recovery solutions for Documentum.
- System Integrators and Consultants that architect or implement Documentum systems for clients and wish to offer clients storage, backup, recovery and business continuance solutions as part of a Documentum implementation.



Organizations in these groups could use the results of this study to understand how to implement NetApp filer technologies within their current Documentum application architectures.

This Deployment Guide document is not intended to act as a sizing guide for hardware to be deployed within a Documentum application environment nor is it intended to be an exhaustive review of the entire suite of Documentum 4i application functionality. Additionally, the project did not develop extensive tuning and performance guidelines for the applications in the architecture although basic vendor-supplied guidelines were followed.

2.3 Description of Key Elements of Deployment Guide

2.3.1 Network Appliance Solution Overview

Network Appliance (NASDAQ: NTAP) is a recognized leader in enterprise storage and the delivery of data and content on demand. NetApp solutions empower enterprises with sustainable competitive advantage, improved profitability, and faster time-to-market by exploiting untapped value in IT infrastructures. Designed to enable enterprises to create global data management strategies today, NetApp storage solutions ensure that customers get information where it's needed, when it's needed—more efficiently, more effectively, and more reliably than with any other solution available.

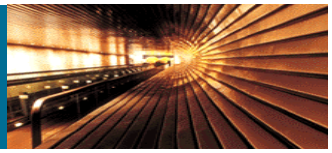
NetApp solutions tested in this project include the following:

- NetApp filers-- A robust, field-proven, highly available storage solution (>99.99% data availability) for consolidating data and simplifying data management. NetApp filers are easy to manage appliances, specifically designed for today's scalable, network-centric IT system architectures. Designed for high performance, high availability, and low total cost of ownership (TCO), NetApp filers include integrated RAID, a specialized appliance OS (Data ONTAP™), a patented file system (WAFL™), redundant hardware components, and optional clustering. NetApp filers are designed for storing both database data and content files.

- NetApp NearStore -- NearStore appliances offer cost-effective, fast-access storage for online backup and archiving. NearStore is designed to offer secondary storage for online backup, archiving, document storage and disaster recovery. NearStore offers the same OS, file system, RAID protection and ease of management as NetApp filers, but at a significantly lower cost.

- NetApp Snapshot -- NetApp Snapshot is an integral part of each filer and NearStore appliance and can make instant, read-only copies of any volume or file system in seconds. Snapshot is designed to simplify and speed up data backup operations.

- NetApp SnapRestore -- SnapRestore allows a filer or NearStore appliance to revert a volume to an earlier point in time almost instantly, greatly simplifying and speeding up recovery from data loss or data corruption.
- NetApp SnapMirror -- SnapMirror allows for simple, robust mirroring of data from one NetApp appliance to another, across any distance and using standard IP network connections. SnapMirror is designed to be used for backup consolidation, remote data sharing and remote replication of critical data for disaster recovery purposes.



More information about NetApp products and solutions can be found at http://www.netapp.com.

2.3.2 Documentum ECM Solution Overview

Documentum 4i is an Enterprise Content Management (ECM) system for powering e-Business applications, such as corporate portals. Documentum 4i manages content to allow organizations to effectively collaborate or share information with customers, partners, and employees. Documentum 4i integrates with Customer Relationship Management (CRM) systems in the front office and Enterprise Resource Planning (ERP) systems in the back office to automate and streamline e-Business applications. Documentum 4i also integrates with best-of-breed commerce and application servers to deliver content to high-volume and high-integrity Internet sites.

The Documentum 4i offering consists of the following components:

- ***Docbase -*** The Docbase is the underlying repository for content. Multiple repositories can be linked together across logical and geographic boundaries to form a single, federated content repository.

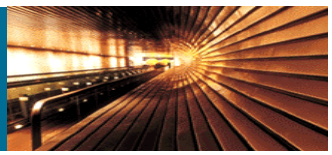
- ***4i Server -*** The server component of the system handles communications between the clients and the Docbase. The server also manages the processing of scanned input, auto rendering, and integration points.

- ***Documentum Foundation Classes (DFC) -*** This component is an object-oriented API layer written in Java, which provides interfaces to a variety of industry-standard languages and developer tools, including Java, VB, COM, C, and C++, as well as ASP and JSP technology. This layer links the various Documentum 4i clients to the services offered by the Documentum 4i server and enables easy integration with other systems. Other interfaces, such as Documentum's iTeam portal interface, can also use the DFC to communicate with the Documentum 4i Server.

- ***Developer Studio -*** This component is a GUI environment used to develop DocApps, which consist of the business rules, workflow, document lifecycles, and security for individual Docbases. The business rules are centrally stored in a data dictionary within the Documentum 4i server. Once developed, DocApps can be easily migrated between Docbases, reducing implementation times and lowering cost of ownership.

  Documentum 4i enables an organization's employees, suppliers, partners, and customers to collaborate, communicate, and share knowledge.

  The physical test environment was constructed using a 'vanilla' installation of the Documentum 4i ECM Solution. No additional configuration changes were made to the application and all users accessing the application were Intranet Clients making requests via RightSite. The overall architecture of the Documentum 4i application is shown in Figure 2;



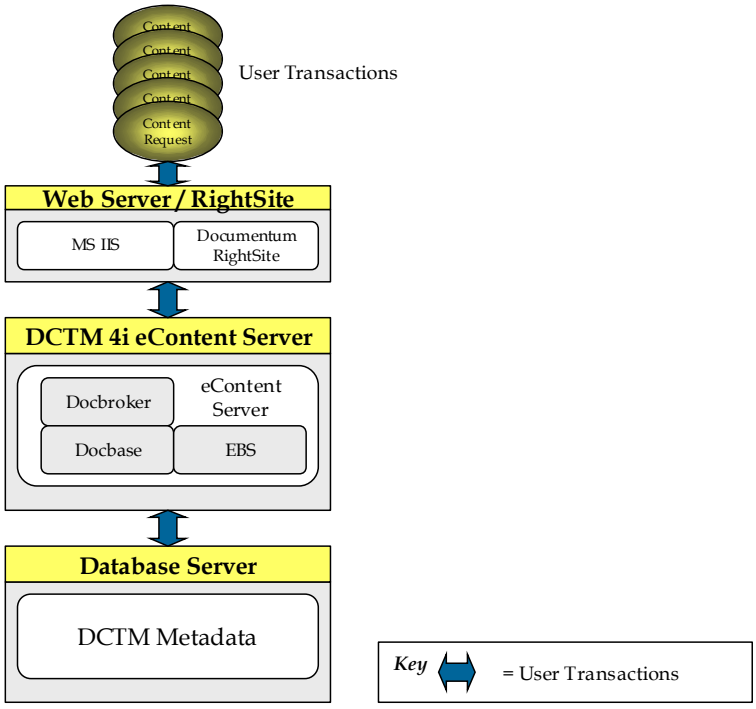


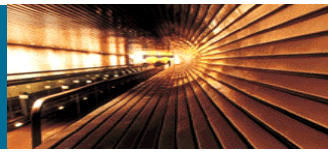
Figure 2 - Documentum 4i Application Architecture

The Documentum Enterprise Docbase was pre-populated using the Documentum Connection Pooling Benchmark Kit Document Loader. Samples documents from the Documentum Connection Pooling Benchmark Kit were used to populate the initial test environment Docbase.

The Documentum test environment that was generated using a random seeding of the following number of Documentum Objects;

- .gif – 45kb
- .html – 8kb
- .jpg – 2kb
- .pdf – 103kb
- .ppt – 129kb
- .txt – 4kb
- .doc – 79kb
- .xml – 8kb

TOTAL DOCUMENTUM OBJECTS – 650,000



2.3.3 CYA Technologies, Inc. – CYA HOTBackup™, and Virtual StandBy™

CYA Technologies provides application-aware business continuity and disaster recovery for Documentum 4i clients reliant on mission-critical content. CYA HOTBackup, the company's flagship product, protects the cross-references between content enabling the protection of e-business processes and the expedited recovery from disaster, corruption and/or accidental deletion of information.

CYA HOTBackup enables businesses in all industries that rely on mission-critical content to maintain the integrity and availability of information critical to productivity as well as customer and partner relationships. CYA HOTBackup is an available recovery solution that allows an organization to roll back its repository to a specific point-in-time and restore either single or multiple objects (even an entire repository). Mission-critical content such as drug submissions, web pages, service agreements and engineering documentation is all stored within Documentum, and is often available on-line. This critical content - whether it's shared with employees, partners, or consumers - needs to be backed up frequently and in a manner that enables quick object-level restorations of specific pages that includes content as well as all of the critical links and relationships such as author, owner, annotations, PDFs, etc. Figure 3 below shows illustrates a typical CYA HOTBackup deployment.

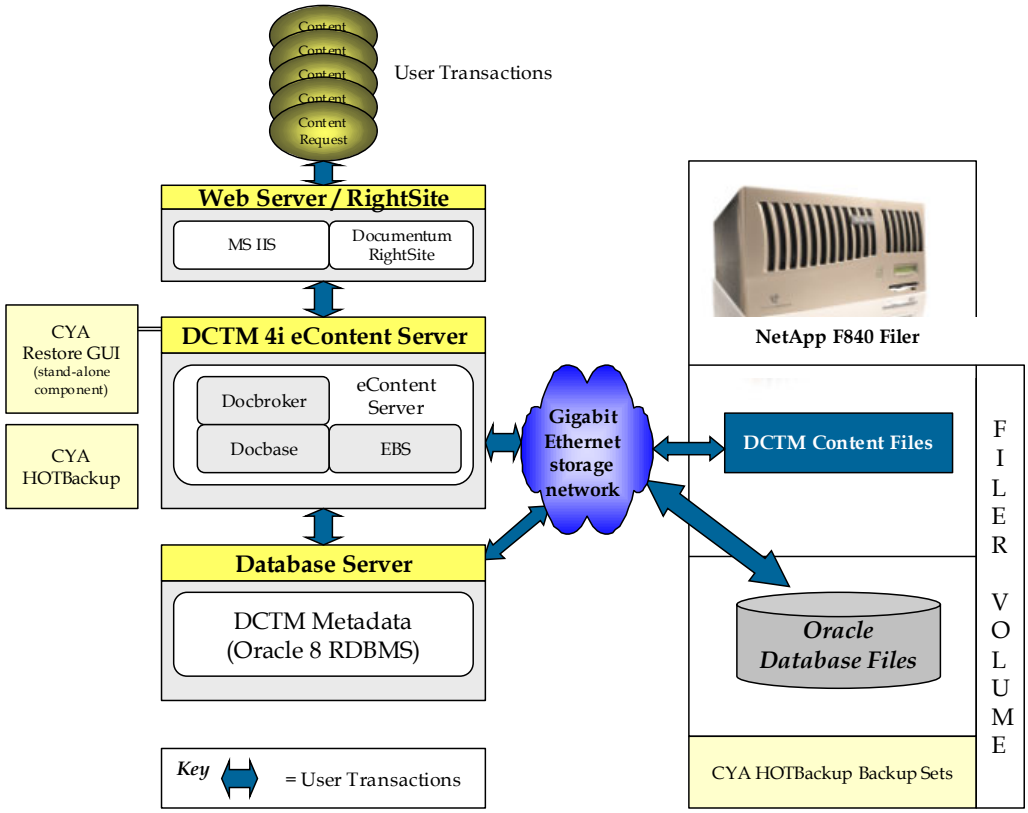
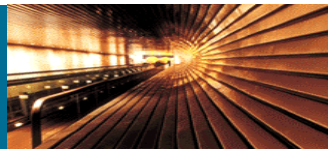


Figure 3 – A CYA HOTBackup deployment

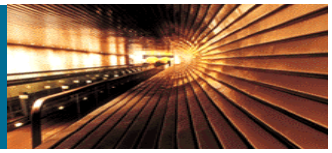


CYA Products include:

CYA HOTBackup – Enterprise, Standard & Limited Editions – incrementally backs up content and relationships allowing for object-level, point-in-time and batch restoration in a 24x7 environment while performing data integrity checking.

CYA Virtual StandBy – provides business continuity to enterprises by targeting a HOT site and incrementally sending mission-critical information from a primary sever to secondary server at an alternate location. In the event of disaster CYA Virtual StandBy enables the enterprise to quickly "failover" simply by changing an IP address.

This project used CYA HOTBackup Enterprise Edition and Virtual Standby to provide Documentum 4i Data Protection and Business Continuance deployment scenarios. CYA Technologies offer other products for Documentum that were not tested on this project. For details please visit the CYA Technologies website at: http://www.cya.com/



3.0 Deployment Guide Configurations

3.1 General Deployment Guidelines

This section contains an overview of the application architectures that were developed for the project. Prior to the start of each pair of configuration tests the test environment was inspected to ensure that the number and size of the database and other files in the DAS and NAS environments was equivalent. Additional precautions were taken to ensure that no additional external factors influenced the outcomes of the test. These included;

- Monitoring network traffic before, during, and after the test.
- Removal of nonessential processing loads from all test environment test equipment.
- Hot & cold restarts of all Microsoft Operating System-dependent test environment elements.
- Free memory checks of all test environment elements at the start of each test run.

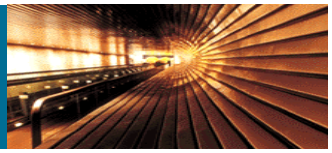
The objective of these configurations was to establish a blueprint for the implementation of a typical Documentum 4i application on a NetApp filer in a production environment. For the purposes of these tests only the configuration of the NetApp filer was captured. The details of installing the Documentum 4i application, CYA Technologies software, Microsoft Windows Load Balancing Software (WLBS) and the NetApp filer are contained in separate documentation available from each respective vendor (see Appendix for further information on these vendors). As a baseline comparison the performance measurement configurations, the Oracle database and Documentum 4i content files were mounted on a local DAS array. Based on this configuration, metrics were captured that described how the test environment performed in both networked storage and also direct-attached storage (DAS) mode.

The failover scenarios leverage the WLBS network software. Network failover statistics were derived from the benchmarking performed at Microsoft on this software. For further details see: Microsoft Library

3.1.1 Standard Test Measurement

For each configuration listed in this document a standard test measurement was applied to the application, while the test operations were being performed, to simulate a live Documentum 4i environment. The consisted of the following items;

Item	Description
Business Processes	Document Load, Document Navigate, Document View, Document Modify
Users	A peak of 150 users was applied in two sets of 75 users with a simultaneous, continual document load process.
Timescale	The test run duration varied with business process and the configuration. Metrics were reported during times of peak activity.



3.1.2 Direct-Attached Storage

The tests conducted during the Deployment Guide project utilized a direct-attached storage (DAS) array for comparison purposes. This DAS array comprised the following hardware items;

- **Sun D240 Media Tray** – connected to e4800 2 x 18GB SCSI Ultra Wide/Fast PCI HD - Hosting Solaris OS and Oracle control and executable files
- **Sun D240 Media Tray** – connected to e4800 DDS 4 Tape Drive – Back-up and recovery of Oracle data files, redo logs and index files
- **Sun D1000** – connected to e4800 8 x 18GB SCSI Ultra Wide/Fast HD - Hosting Oracle data files
- **Sun D1000** – connected to e3500 9 x 18GB SCSI Ultra Wide/Fast HD - Hosting Documentum 4i Content files
- **Sun e3500** – 2 x 18 GB FCAL – Internal storage to the application server for storage of operating system, Documentum 4i and CYA installations.
- **Sun e250** - 2 x 18 GB SCSI Ultra Wide/Fast HD – Internal storage to the standby server for storage of operating system, Documentum 4i, Oracle, and CYA installations.

3.1.3 NetApp F840 Filer Configuration

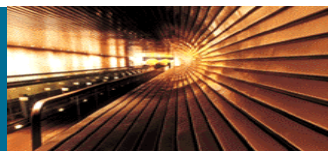
Note: All test configurations used less than 50% of available storage space on both the F840 and NearStore R100.

Model	**NetApp F840c**
OS	Data ONTAP 6.1.2
Disk Shelves	1 x DS-14 , 3 x FC9 FCAL(Copper)
Disk Drives	35 x 72GB FC
NIC	Gigabit Ethernet
FC-AL Disk Adapters	2

3.1.4 NearStore R100 Configuration

Note: All test configurations used less than 50% of available storage space on both the F840 and NearStore R100.

Model	**R100**
OS	Data ONTAP 6.2.R1 P1
Disk Shelves	7 x 12
Disk Drives	84 x 135 GB Maxtor ATA
NIC	Gigabit Ethernet (not used) / 100MB



3.2 *Documentum 4i™ Backup Using Snapshot™*

This series of tests was designed to identify a NetApp filer configuration that could simplify the manageability, and decrease the time needed for routine Documentum 4i backup operations. The application data identified for backup were the Database metadata and log files and the Documentum 4i content files. The basic configuration of the Documentum 4i application is illustrated below;

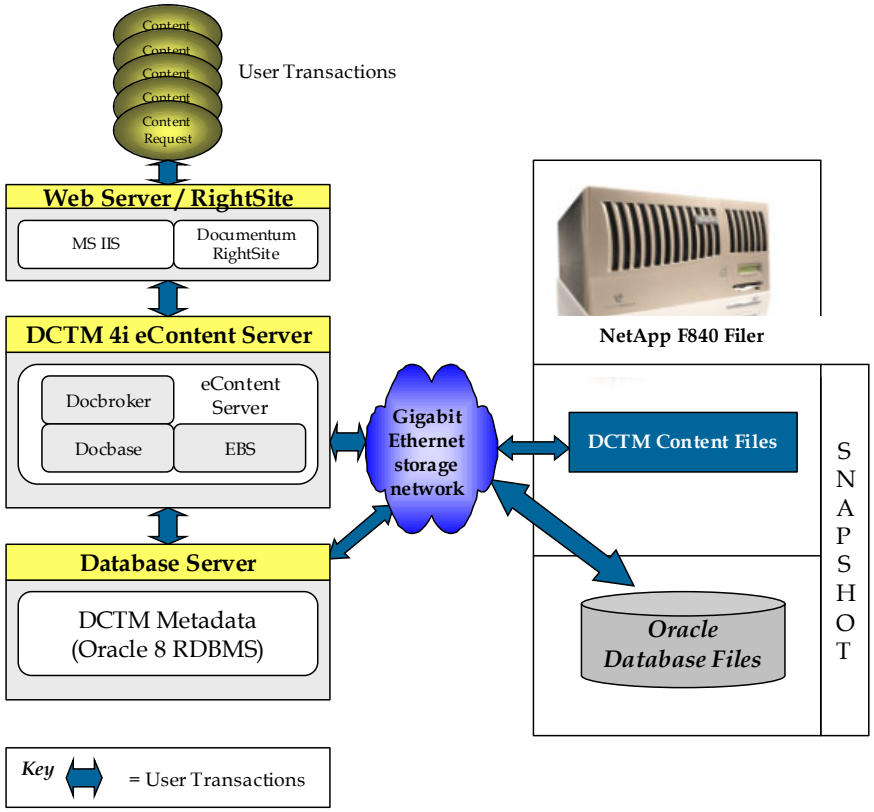
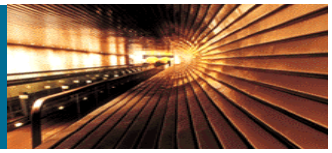


Figure 4 – Documentum 4i – Backup Configuration

Objective: The typical scenario for preventing data loss is defining a data loss tolerance and designing a backup plan that ensures the data loss tolerance is enforced with scheduled data duplication. In addition, the duration of the backup process can affect how often backups are possible. The choice between hot or cold backup is determined by the downtime tolerance of an enterprise. This configuration explores data duplication in a simulated Documentum 4i production environment with an application downtime tolerance allowing backups to be performed while the application is in a quiescent state and while the application is active and under load.

Cold Backup Approach:

- Prior to each measurement, the environment was reset to a baseline image of a 30GB Docbase.
- The standard test load was initiated for both the DAS and NAS mode.
- The eContent server and Database processes were quiesced.
- A cold backup measurement was taken.



- In the NAS configuration the Oracle data files, Oracle log files and Documentum content files were stored on NFS volumes on the NetApp F840 filer.
- In the DAS configuration, the Oracle data files, Oracle log files and Documentum content files were stored on a direct-attached SUN D1000 storage array striped mode, RAID 0 in order to provide the best performance comparison.

Hot Backup Approach:

- The Oracle database was set in Archive Log mode.
- Prior to each measurement, the environment was reset to a baseline image of a 30GB Docbase.
- The standard test load was initiated for both the DAS and NAS mode.
- The Database was put into hot backup mode and the metadata, content and log files were backed up to DAS or a filer.
- The database was then returned to a nominal state.
- In the NAS configuration the Oracle data files, Oracle log files and Documentum content files were stored on NFS volumes on the NetApp F840 filer.
- In the DAS configuration, the Oracle data files, Oracle log files and Documentum content files were stored on two direct-attached SUN D1000 storage arrays in striped mode, RAID 0 in order to provide the best performance comparison.

Key Findings:

- The results of this test show that for hot and cold backup, a 30GB Documentum 4i Docbase on a NetApp filer architecture using Snapshot experienced a large decrease in overall backup process time for the Docbase and associated database files when compared to the same Docbase hosted on a DAS array using a disk-to-disk copy.
- Using information provided by NetApp, Snapshot backups of Docbases larger than the 30GB tested would yield results with approximately the same backup time as the 30GB Docbase tested, but this information was not validated during testing on this project.
- The graph illustrated below shows the time to complete a full cold backup of DB and application data.

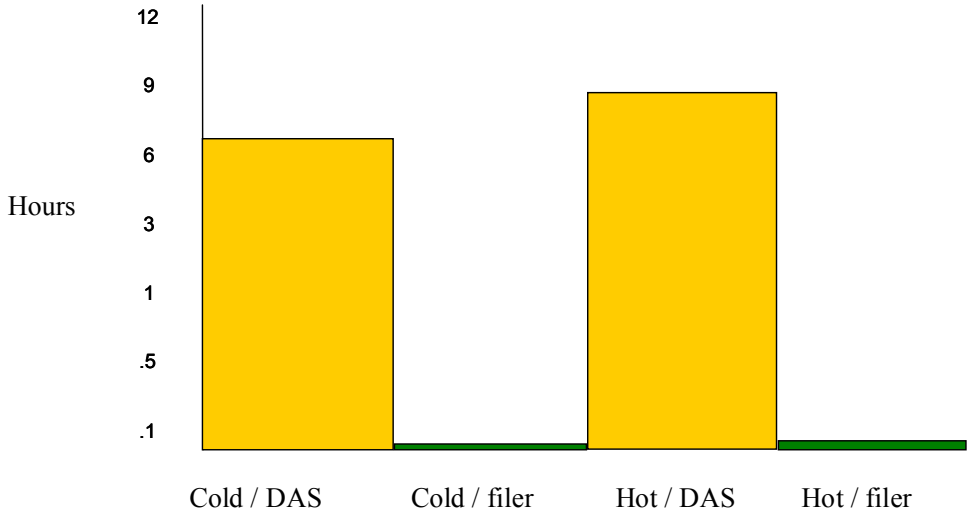
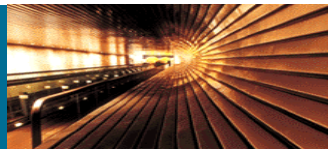


Figure 5 - Average Time to Complete a Full Database and Application Data Backup



3.3 Documentum 4i Data Recovery Using SnapRestore®

This series of tests was designed to identify a NetApp filer configuration that could increase the performance and manageability of routine Documentum 4i data recovery operations and increase availability by minimizing time to recovery (TTR). The application data identified for the recovery was backed-up database metadata and log files and the Documentum 4i content files. The basic configuration of the Documentum 4i application is illustrated below;

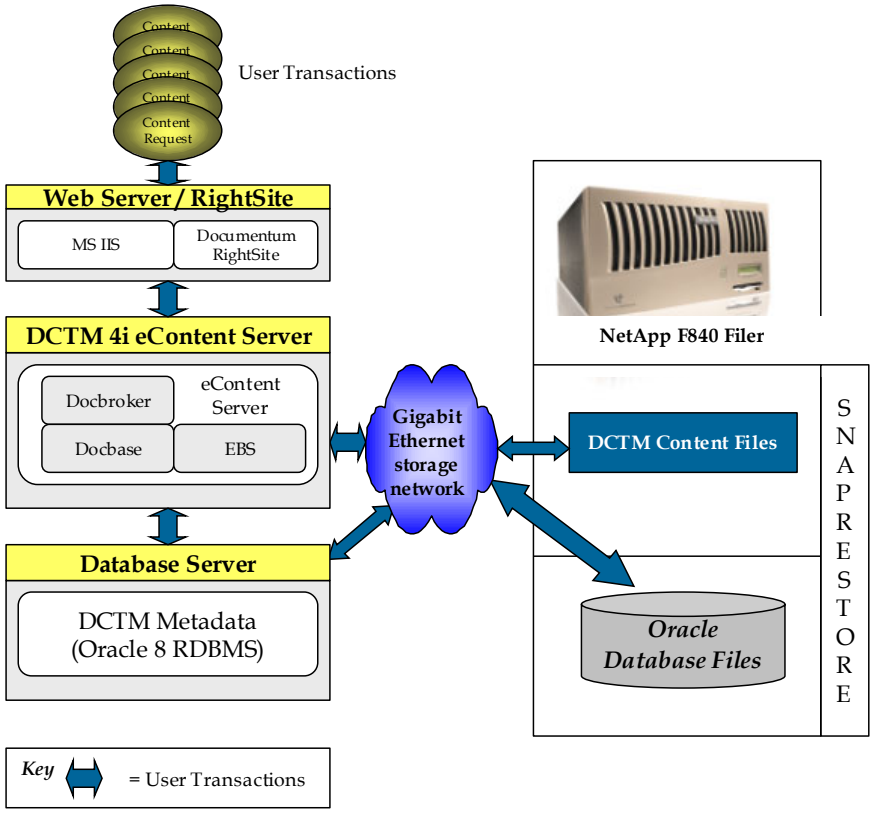
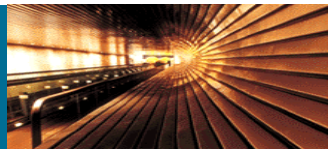


Figure 6 – Documentum 4i – SnapRestore Configuration

Objective: The typical scenario for preventing data loss is defining a data loss tolerance and designing a backup plan that ensures the data loss tolerance is enforced with scheduled data duplication. The duration of the backup process can govern the frequency that the backup process is executed. In the event of unscheduled data loss, data restoration can be addressed with a variety of techniques. The technique chosen for the restoration process depends on the granularity of the loss and the latency between the backup and current image. The Docbase administrator with a large latency tolerance may choose to perform periodic backup and rely on database recovery mechanisms in the case of data loss events. A Docbase administrator with a smaller latency tolerance may choose to perform more frequent full-backups and use full database restorations in case of data loss events. This configuration explores data restoration in a simulated Documentum 4i production environment with the demands for data restoration at the entire volume level, with a large and small latency window tolerance.



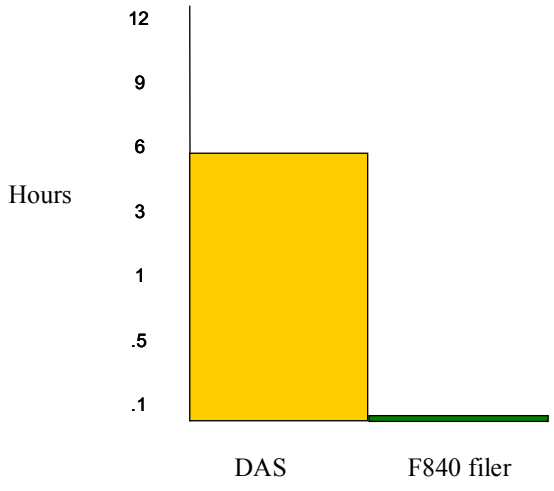
The full filer volume restore time was measured against the DAS array, but not for the incremental, small latency window recovery. As a baseline comparison for the full volume restoration configuration, the Oracle database and Documentum 4i content files were mounted on a local DAS array. Based on this configuration, metrics were captured that described how the test environment performed in both network storage and also direct-attached storage (DAS) mode.

Approach:

- Prior to each test configuration, the environment was reset to a baseline Docbase image of 30GB of content files and 7GB of metadata.
- The standard test load was initiated for both the DAS and NAS mode.
- The eContent server and Database processes were quiesced, data restored from an earlier backup and the time required for restore was measured.
- The Oracle database was restarted and mounted or, in the case of the small latency window tests, the database was rolled forward with off-line log files.
- In the NAS configuration the Oracle data files, Oracle log files and Documentum content files were stored on NFS volumes on the NetApp F840 filer.
- In the DAS configuration, the Oracle data files, Oracle log files and Documentum content files were stored on a direct-attached SUN D1000 storage array striped mode, RAID 0 in order to provide the best performance comparison.

Key Findings:

- The results of this test show that for a complete restore with a large latency window, a 30GB Documentum 4i Docbase on a NetApp filer architecture experienced a large decrease in overall restore process time for the Docbase and associated Database files when compared to the same Docbase hosted on a DAS array.
- In the case of data loss or corruption, SnapRestore reduced the recovery time for full volume restores, thus increasing overall application availability. Less time off-line in the recovery process translated to more availability for user transactions.
- Using information provided by NetApp, Snapshot backups of Docbases larger than the 30GB tested would yield results with approximately the same backup time as the 30GB Docbase tested, but this information was not validated during testing on this project.
- The graph below shows the time to complete a full restore of the database and application data.



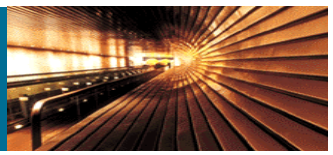


Figure 7 - Full Database and Application Data Restore

3.4 *Documentum 4i Backup Using CYA HOTBackup™*

This series of tests was designed to identify a NetApp filer configuration that, deployed in conjunction with CYA HOTBackup, could increase the flexibility of routine Documentum 4i backup operations. NetApp Snapshot and SnapRestore can reduce Documentum backup time, but cannot restore individual objects to the Docbase. Using CYA HOTBackup together with NetApp storage further reduces downtime by allowing Documentum object changes to be backed up and individual objects restored while the Documentum system is active and running. The application data identified for backup was the Database metadata and log files and the Documentum 4i content files. The basic configuration of the Documentum 4i application is illustrated below;

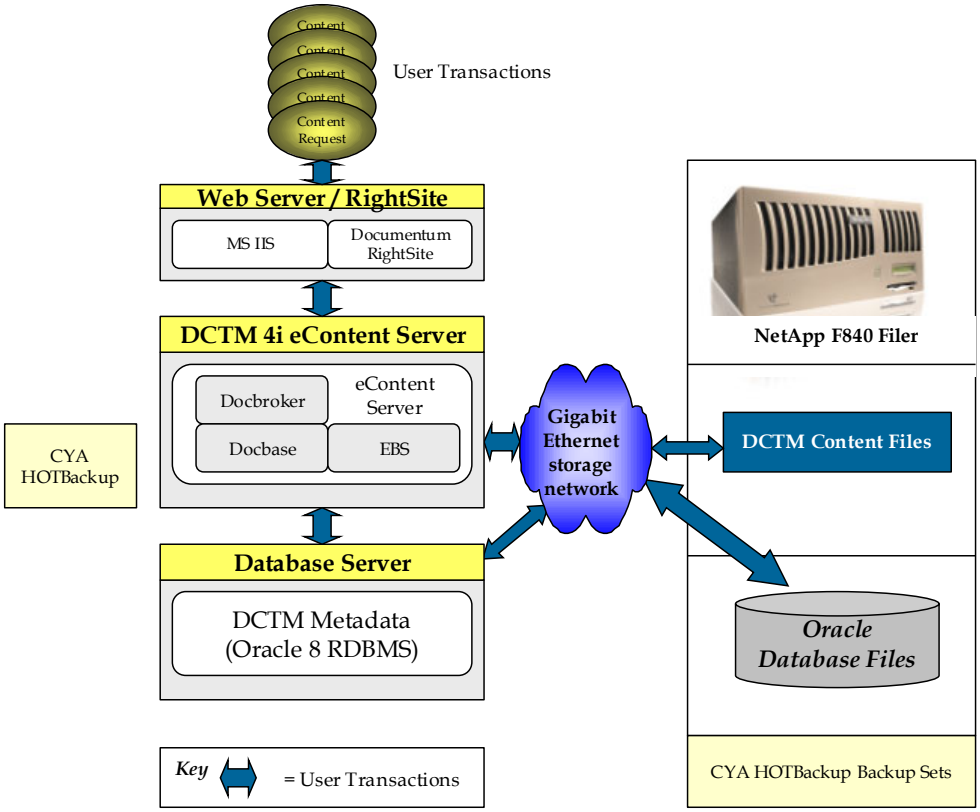
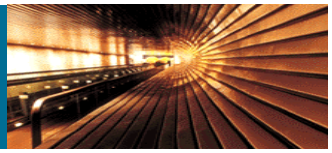


Figure 8 – Documentum 4i – CYA HOTBackup Configuration

Objective: The typical scenario for preventing data loss is defining a data loss tolerance and designing a backup plan that ensures the data loss tolerance is enforced with scheduled data duplication. This configuration explores data duplication in a simulated Documentum 4i production environment with an application downtime tolerance dictating backups to be performed while the application is active and under load. This scenario demonstrated object-level restoration. Object-level restoration provides



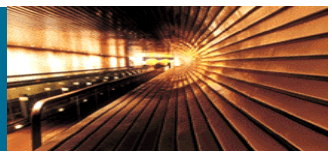
the Documentum 4i Administrator with the restoration control down to the single document level, without impacting work in progress.

Approach:

- Prior to each test configuration, the environment was reset to a baseline Docbase image of 30GB of content files and 7GB of metadata.
- The standard test load was initiated for NAS mode.
- The CYA HOTBackup process was initiated; storing the CYA HOTBackup backup set files on NFS volumes on the NetApp F840 filer.
- A data loss event was simulated by deleting documents from the Docbase.
- The deleted objects were restored using the filer-based CYA HOTBackup backup set.

Key Findings:

- The duration of the CYA HOTBackup update process is Docbase-size and content-change dependent.
- CYA HOTBackup provides a non intrusive, object-level backup mechanism that can restore deleted Documentum objects without incurring any Documentum downtime.
- The results of this test show the viability of integrating CYA HOTBackup and NetApp filer technologies to deploy a configuration offering object-level restoration capabilities.



3.5 *Documentum 4i Object-level Recovery Using CYA HOTBackup*

This test was designed to identify a NetApp filer configuration that could increase the performance and manageability of routine Documentum 4i data recovery operations and increase availability by minimizing time to recovery (TTR) using CYA Technologies solutions. The application data identified for backup was the Database metadata and log files and the Documentum 4i content files. The basic configuration of the Documentum 4i application is illustrated below;

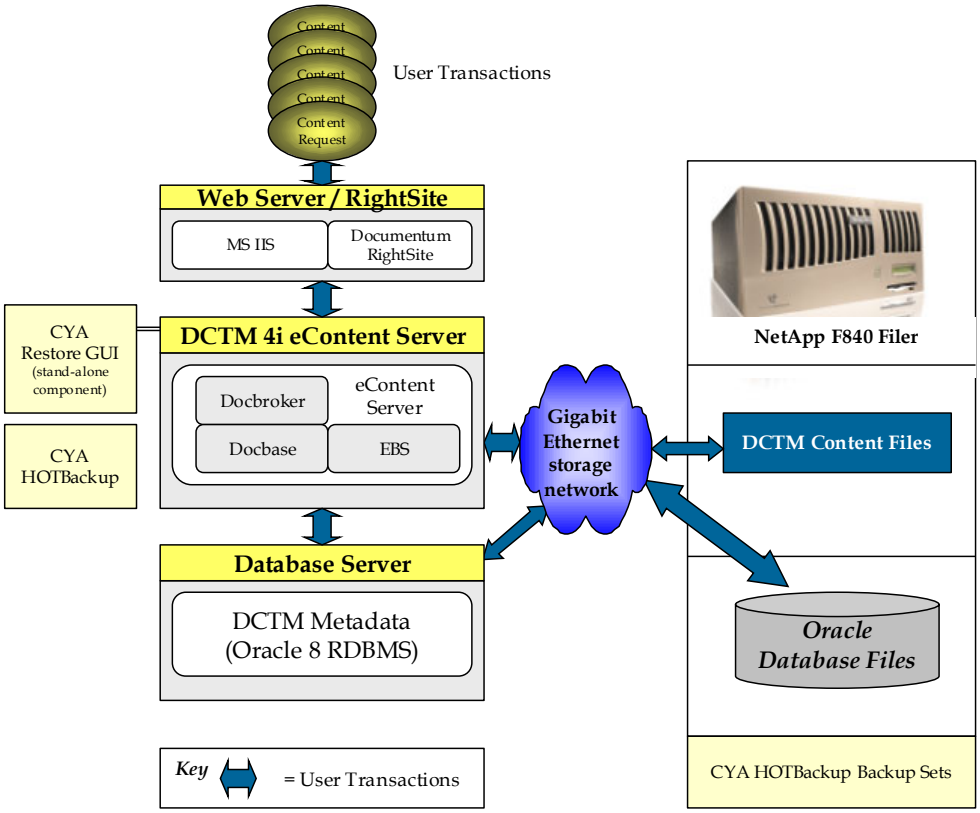
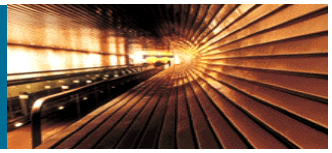


Figure 9 – CYA Single Object Restore Configuration

Objective: The typical scenario for preventing data loss is defining a data loss tolerance and designing a backup plan that ensures the data loss tolerance is enforced with scheduled data duplication. This configuration explores data restoration in a simulated Documentum 4i production environment with the application downtime tolerance dictating minimal impact to the active application. The active and under load restore also required object-level restoration. Object-level restoration provides the Documentum 4i Administrator with the restoration control down to the single document level, without impacting work in progress.

Approach:

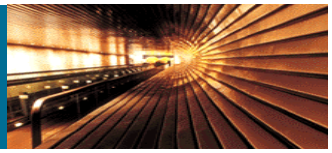
- Prior to each test configuration, the environment was reset to a baseline Docbase image of 30GB of content files and 7GB of metadata.
- The standard test load was initiated for NAS mode.



- The CYA HOTBackup process was initiated; which stored the backup-set files on NFS volumes on the NetApp F840 filer.
- A data loss event was simulated by deleting documents from the Docbase.
- The CYA HOTBackup restore capability was used to restore the deleted object content file.

Key Findings:

- Object level restoration provides document-specific recovery.
- Work in progress is uncompromised when object-level restoration is used.
- The results of this test show the viability of integrating CYA HOTBackup and NetApp filer technologies to deploy a configuration offering object-level restoration capabilities.



3.6 *Documentum 4i Mirroring for Failover Using SnapMirror*

Disaster Recovery (DR) Documentum 4i configurations can be created using a variety of technologies and approaches. This configuration explores software based DR configurations using a SnapMirror and NetApp filer solutions for storage. This configuration utilizes a strategy incorporating a mirrored application environment with no shared components.

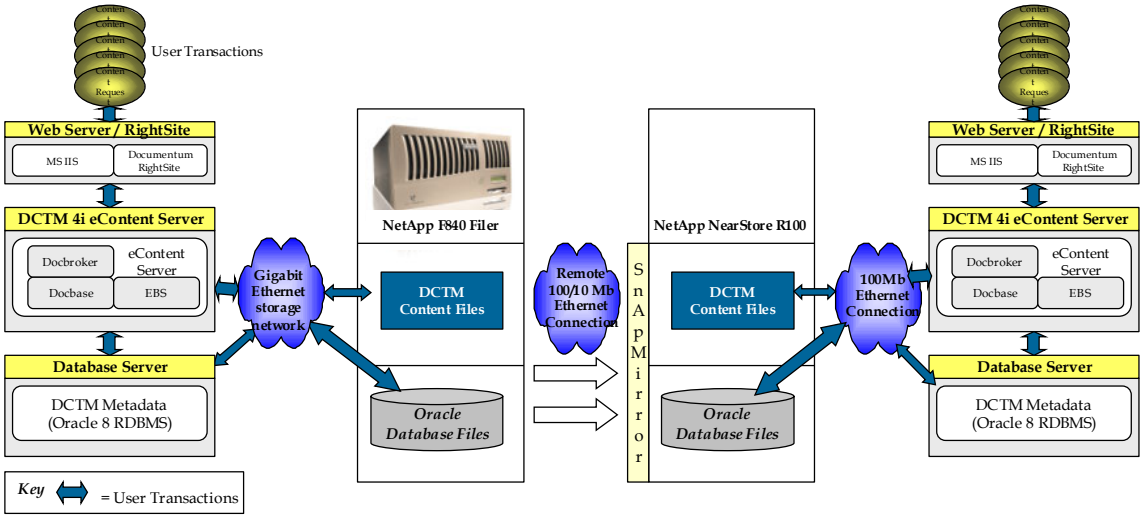


Figure 10 – Mirrored Test Environment Using SnapMirror

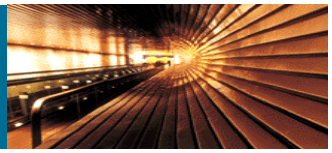
Objective: The typical scenario for preventing downtime is defining a downtime tolerance and designing an application architecture that ensures the downtime tolerance is enforced by use of redundancy and failover capabilities. This configuration explores failover capabilities in a simulated Documentum 4i production environment with the application downtime tolerance dictating minimal impact to the active application. This configuration explores active/passive strategies using SnapMirror to support the update of a passive environment, which can be failed over to in the event of a "catastrophic failure." Some Documentum 4i deployments may require the ability to continue serving mission-critical content after experiencing the loss of a data center or other site-wide disaster. Such business continuance scenarios typically involve mirroring to a remote, standby Documentum 4i environment.

Failure can occur at many levels in the architecture due to;

- Unplanned network connectivity outages to any or all of the application tiers
- Unplanned power outages to any or all of the application tiers
- Unplanned failure of the hardware/software on any or all of the application tiers
- Unplanned, site-wide disaster that destroys the primary data center

In all of these cases the application should be resilient enough to continue processing, with minimal and in some cases virtually no perceived application downtime.

Approach:

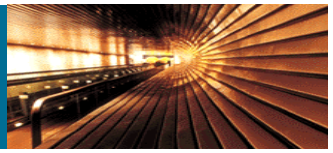


- This configuration deployed a NearStore R100 storage device as the backup storage solution.
- WLBS was used to provide a Web tier on a virtual IP with failover capability.
- The Oracle database files and Documentum 4i content was stored on a NetApp F840 filer.
- The database and content files were mirrored on a one-minute interval to a filer in the standby environment.
- During execution of the standard test suite a failure was simulated and one of the Web servers was forced into a quiescent state.
- The SnapMirror link was broken and the standby database and application servers started.
- The full application load was then directed to the second e-Content server for verification of failover.

Key Findings:

- In tests conducted with WLBS and SnapMirror, the complete failover time was under 4 minutes.
- Test execution validated the viability of the WLBS and SnapMirror configuration.
- The application performed nominally and ran under a verification load following the switch over to the standby environment.
- Mirroring content and metadata across machines requires that the environment on the machines be identical in particular, UNIX password files, database configuration files, paths, environmental variables and kernel settings.

Note:
Because this test simulated a Documentum 4i failover scenario requiring only low concurrent user load after failover, both the eContent and database server were hosted on the same machine, which was significantly less powerful than the machines used in the primary environment. Likewise, while the standby Documentum configuration stored both content and metadata files on the R100, Network Appliance does not recommend running Oracle (or any other database) instances directly from a NearStore R100 appliance. The R100 does not provide the same levels of performance and availability as a standard Network Appliance enterprise filer and is not intended to support high-transaction workloads. Failover scenarios that require the ability to support higher workloads or run for extended periods of time may require more powerful Document 4i eContent and/or database server hardware, multiple servers or SnapMirror replication to a Network Appliance filer instead of a NearStore. In addition, the WLBS solution provides network-level failover only. The requirements of some Documentum deployments might require a more comprehensive failover solution.



3.7 *Documentum 4i Failover Using CYA Virtual StandBy™*

Disaster Recovery (DR) Documentum 4i configurations can be created using a variety of technologies and approaches. This configuration explores software based Business Continuance configurations using a NetApp filer for storage and mirroring capability, and CYA Virtual StandBy for object-level mirroring and a virtual active environment capability. This configuration strategy uses two stand-alone applications

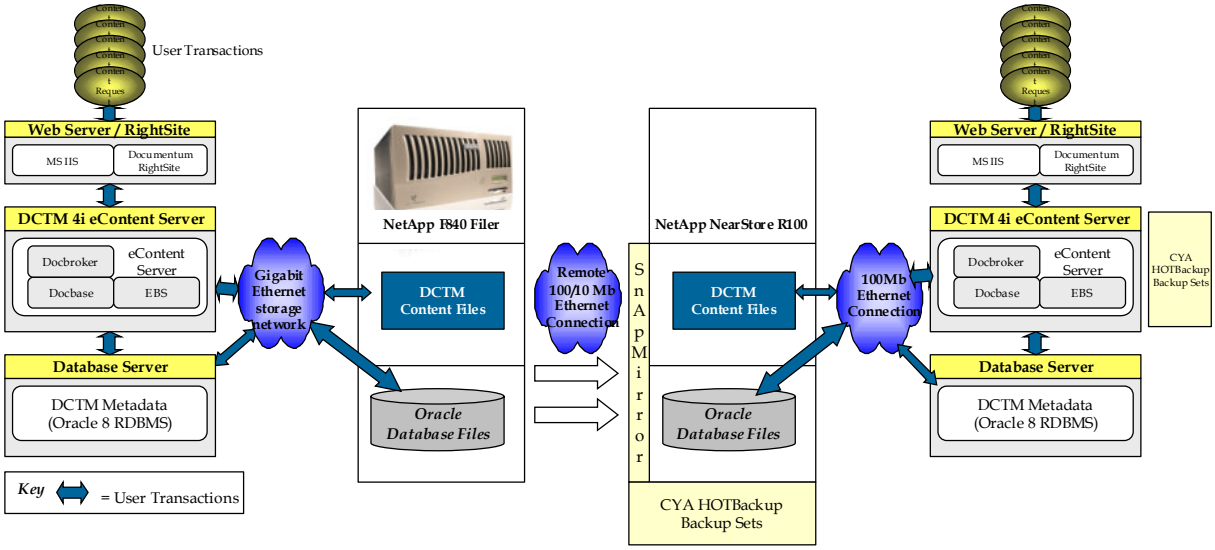


Figure 11 – Mirrored Test Environment with CYA Virtual StandBy

Objective: The typical scenario for preventing downtime is defining a downtime tolerance and designing an application architecture that ensures the downtime tolerance is enforced by use of redundancy and failover capabilities. This configuration explores failover capabilities in a simulated Documentum 4i production environment with the application down time tolerance dictating minimal impact to the active application. This configuration explores an active/passive deployment to demonstrate the feasibility of integrating SnapMirror and CYA Virtual StandBy technologies to provide increased Business Continuance capabilities.

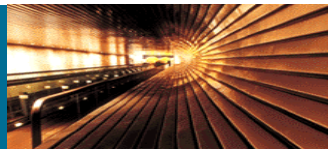
Failure can occur at many levels in the architecture due to;

- Unplanned network connectivity outages to any or all of the application tiers
- Unplanned power outages to any or all of the application tiers
- Unplanned failure of the hardware/software on any or all of the application tiers
- Unplanned, site-wide disaster that destroys the primary data center

In all of these cases the application should be resilient enough to continue processing, with minimal and in some cases virtually no perceived application downtime.

Approach:

- This configuration deployed a NearStore R100 storage device as the backup storage solution.

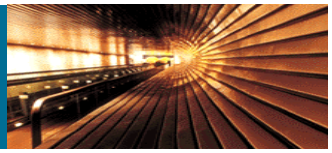


- In this test CYA HOTBackup was deployed to capture a hot image of the primary Documentum 4i environment.
- SnapMirror was used to mirror the CYA HOTBackup backup set to the failover environment and the CYA VSB process maintained an up-to-date and active standby environment.
- The SnapMirror link was broken and a failover induced via the CYA Virtual StandBy GUI.
- Test metrics were taken from the test environment to establish the time taken to fail over to the new environment.
- The full application load was then directed to the second e-Content server for verification of failover.

Key Findings:

- Test execution validated the viability of the WLBS, SnapMirror and CYA VSB configuration.
- In tests conducted with WLBS, SnapMirror and CYA Virtual StandBy, the complete failover time was under 3 minutes for an environment with a net change of 20 additional documents.
- The application performed nominally and ran under a verification load following the switch over to the CYAVSB environment.
- It is necessary to synchronize the CYA HOTBackup process and the SnapMirror process to ensure the CYA HOTBackup process is complete before the backup set is mirrored to the Standby environment.

Note:
Because this test simulated a Documentum 4i failover scenario requiring only low concurrent user load after failover, both the eContent and database server were hosted on the same machine, which was significantly less powerful than the machines used in the primary environment. Likewise, while the standby Documentum configuration stored both content and metadata files on the R100, Network Appliance does not recommend running Oracle (or any other database) instances directly from a NearStore R100 appliance. The R100 does not provide the same levels of performance and availability as a standard Network Appliance enterprise filer and is not intended to support high-transaction workloads. Failover scenarios that require the ability to support higher workloads or run for extended periods of time may require more powerful Document 4i eContent and/or database server hardware, multiple servers or SnapMirror replication to a Network Appliance filer instead of a NearStore appliance. In addition, the WLBS solution provides network-level failover only. The requirements of some Documentum deployments might require a more comprehensive failover solution.



3.8 *Documentum 4i Mirroring for Failover Using NearStore and Rsync*

Disaster Recovery (DR) Documentum 4i configurations can be created using a multitude of technologies and approaches. This configuration explores open-source, software-based DR configurations using a utility called rsync (available at http://samba.anu.edu.au/rsync/) and a NetApp filer for storage. This configuration is most applicable to environments with significant investments in non NetApp storage and can be used to bridge between non NetApp storage and NetApp storage. This configuration utilizes a strategy incorporating a mirrored application environment, and no shared components.

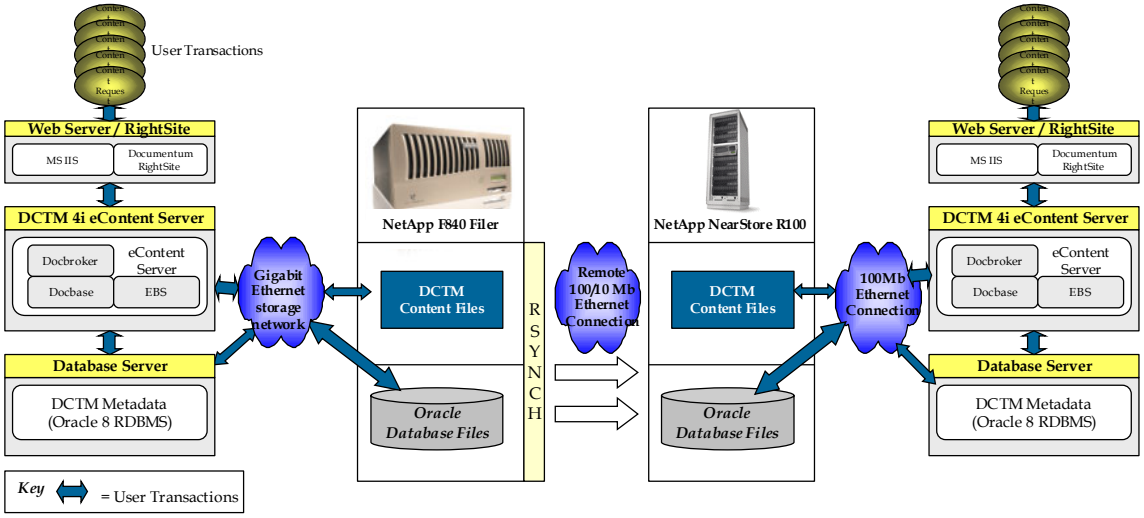


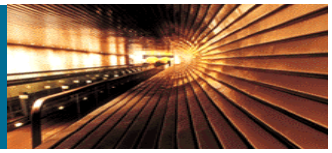
Figure 12 – Mirrored Test Environment Using rsync

Objective: The typical scenario for preventing downtime is defining a downtime tolerance and designing an application architecture that ensures the downtime tolerance is enforced by use of redundancy and failover capabilities. This configuration explores failover capabilities in a simulated Documentum 4i production environment with the application downtime tolerance dictating minimal impact to the active application and a heterogeneous storage environment. The rsync utility can be used to synchronize any two mountable file systems. This configuration explores active/passive strategies to demonstrate the feasibility of using rsysnc to support the update of a passive environment using a filer for storage, which can be failed over to in the event of a catastrophic failure. The NetApp SnapMirror technology requires that both the mirror source and targets be NetApp filers or NearStore products. Documentum 4i deployments that require Docbase mirroring from a non NetApp storage solution to a NetApp filer may use the following configuration.

Failure can occur at many levels in the architecture due to;

- Unplanned network connectivity outages to any or all of the application tiers
- Unplanned power outages to any or all of the application tiers
- Unplanned failure of the hardware/software on any or all of the application tiers
- Unplanned, site-wide disaster that destroys the primary data center

In all of these cases the application should be resilient enough to continue processing, with minimal and



in some case virtually no perceived application downtime.

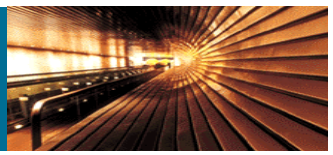
Approach:

- This configuration deployed a NearStore R100 storage device as the backup storage solution.
- WLBS was used to provide a Web tier on a virtual IP with failover capability.
- The Oracle database files and Documentum 4i content were stored on a SUN D1000 storage array striped mode, RAID 0 in order to provide the best performance comparison.
- The database and content files were mirrored, using rsync, on a one-minute interval to a filer in the failover environment.
- During execution of the standard test suite one of the Web servers was forced into a quiescent state. The full application load was then directed to the second e-Content server for verification of failover.

Key Findings:

- Test execution validated the viability of the WLBS, rsync configuration.
- In tests conducted with WLBS and rsync the complete failover time was under 4 minutes.
- The application performed nominally and ran under a verification load following the switch over to the Standby environment.
- Using rsync to mirror content and metadata across machines requires that the environment on the machines be identical, in particular, UNIX password files, database configuration files, paths, environmental variables and kernel settings.
- Using rsync to mirror to a filer requires the use of NFS mounts to the target filer, that is to say the server function of the rsync utility, which transfers data over sockets, cannot be used with a filer configuration at this time.

Note:
Because this test simulated a Documentum 4i failover scenario requiring only low concurrent user load after failover, both the eContent and database server were hosted on the same machine, which was significantly less powerful than the machines used in the primary environment. Likewise, while the standby Documentum configuration stored both content and metadata files on the R100, Network Appliance does not recommend running Oracle (or any other database) instances directly from a NearStore R100 appliance. The R100 does not provide the same levels of performance and availability as a standard Network Appliance enterprise filer and is not intended to support high-transaction workloads. Failover scenarios that require the ability to support higher workloads or run for extended periods of time may require more powerful Document 4i eContent and/or database server hardware, multiple servers or SnapMirror replication to a Network Appliance filer instead of a NearStore appliance. In addition, the WLBS solution provides network-level failover only. The requirements of some Documentum deployments might require a more comprehensive failover solution.



3.9 *Documentum 4i Docbase™ Load Performance on NetApp Filers*

As data requirements increase at a rapid pace, IT managers look for innovative ways to leverage scarce resources and provide users with reliable, high-performance access to information. They must scale infrastructures worldwide to provide users with access anytime, anywhere. And they must protect the corporation's data as a corporate asset. The selection of storage solution for the enterprise is a complex issue. In this configuration the Documentum 4i application was exercised against a load process, simulating a continuous document load.

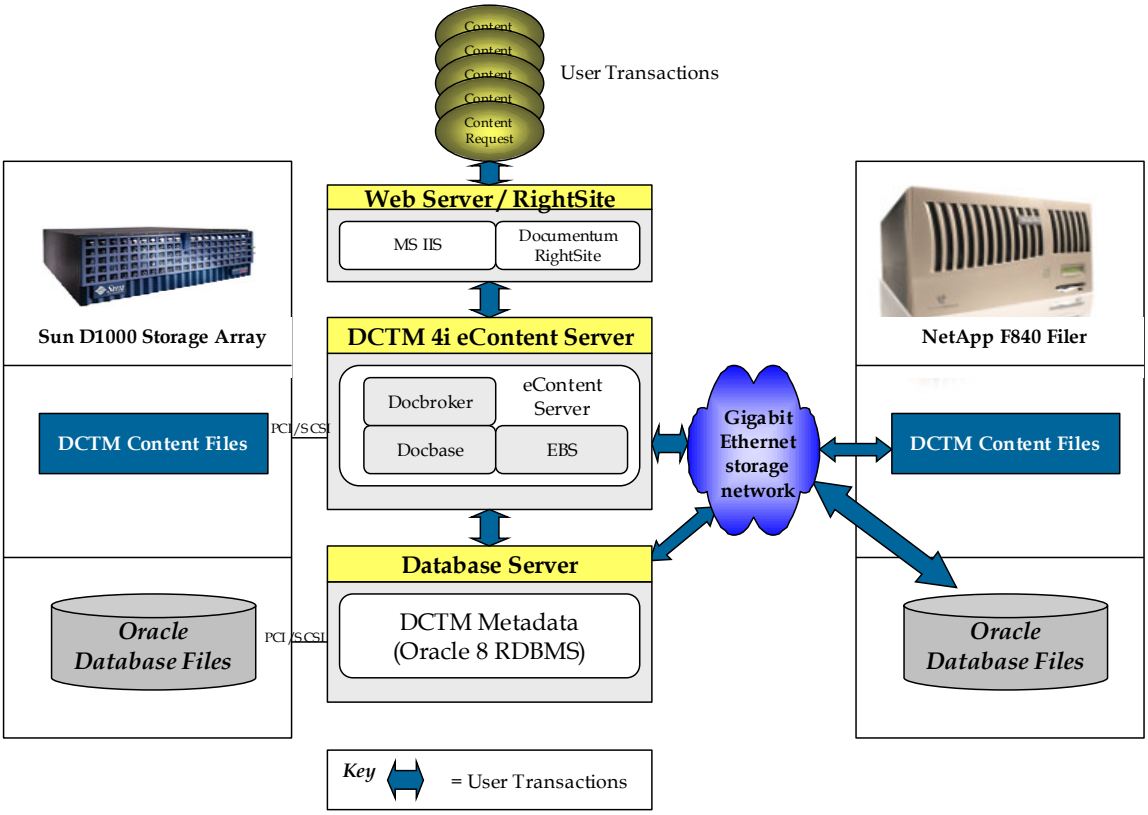
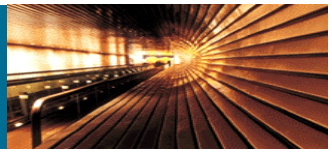


Figure 13 - NetApp Filer-Based Documentum 4i Environment

Objective: Slow storage can have several impacts on application performance; performance of backup operations, the performance of application response time and the performance impacts of backup operations on application response times. In addition, slow storage can mitigate the value added by high-end server processors. The typical scenario for addressing slow storage is a combination of high-end storage solutions and RAID technologies. This configuration explores the performance impact of a NetApp filer-based environment on Document 4i application performance.

Approach:



- Prior to each test configuration, the environment was reset to a baseline Docbase image of 30GB of content files and 7GB of metadata.
- In the NAS configuration the Oracle data files, Oracle log files and Documentum content files were stored on NFS volumes on the NetApp F840 filer.
- In the DAS configuration, the Oracle data files, Oracle log files and Documentum content files were stored on a direct-attached SUN D1000 storage array striped mode, RAID 0 in order to provide the best performance comparison.
- A load of 500, 2,000 and 5,000 documents were loaded and measured for each configuration.

Results:

- The results of this test show for a document load process on the NetApp filer for the range from 500 – 5,000 documents there was an 18% decrease in transaction time compared to the DAS-based configuration.
- In scalability testing the DAS arrays experienced an additional time of 2% per transaction while the filer time increased by less than 1% when the document load numbers were increased from 500 to 5,000, thus improving overall application response time for end users.

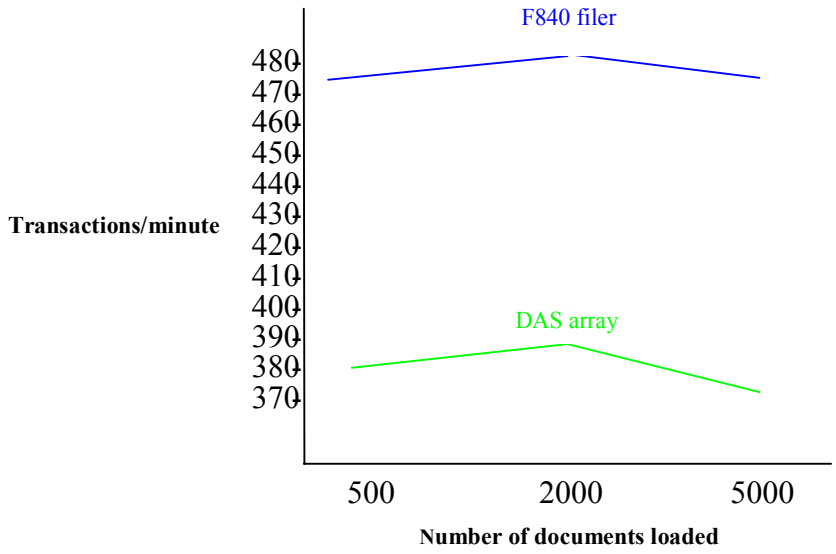


Figure 14 - NetApp Filer Performance Impact on Document Load