EMC EFFICIENT BLOB STORAGE MANAGEMENT FOR MICROSOFT SHAREPOINT

EMC VNX, EMC Replication Manager, VMware vSphere, Microsoft SharePoint 2010, Metalogix StoragePoint

- Metalogix enables remote BLOB Storage
- Metalogix enables file share content migration to SharePoint
- EMC VNX enables tiered storage for SharePoint

EMC Solutions Group

Abstract

This white paper explains how this solution uses Metalogix StoragePoint to externalize Microsoft SharePoint BLOBs to EMC® VNX® for file storage. EMC Replication Manager protects the entire Microsoft SharePoint farm, including the remote BLOB stores within a virtualized Microsoft SharePoint 2010 environment on an EMC VNX5500.

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Executive summary

Business case

The Microsoft SharePoint market is growing steadily; more businesses are relying on SharePoint as a business-critical system. SharePoint provides a range of functionality that encompasses enterprise content management, collaboration, social networking, document management, and more. Nearly 75 percent of all businesses surveyed cite "Document Collaboration" as the most often used feature within SharePoint. Customers are interested in migrating content to SharePoint and using the rich set of functionalities available when data is managed in a structured framework.

A major inhibitor is the migration time and effort required to move content from file shares to SharePoint, and the performance and cost challenges created by storing this unstructured content in SharePoint's SQL Server-based content databases. Metalogix StoragePoint can rapidly migrate file share content into SharePoint and transparently externalize this unstructured content (also known as Binary Large Objects or BLOBs) using tiered storage to keep the Microsoft SQL Server databases lean and responsive. This offers users and administrators all the benefits of SharePoint's content management features and access controls.

One significant challenge all SharePoint users face is the requirement to store BLOBs on the most expensive tier of storage (block) when alternative, less-expensive tiers of storage (file) can be used. For example, file-based content such as PDFs, Microsoft Office documents, engineering drawings, and so on, are stored in SQL Server databases. However, BLOBs can reside on a lower-cost tier of storage and still meet service level agreements (SLAs). You also need to protect both the SharePoint farm on EMC® VNX® for block storage, and the BLOBs on VNX file storage. The EMC Replication Manager framework provides comprehensive protection for the entire SharePoint environment.

Solution overview

This is a cost-effective SharePoint content storage solution that uses a multitier storage architecture enabled by Replication Manager for protection and recovery. The solution reproduces a standard customer environment that manages structured (SharePoint) and unstructured (file shares) data as the baseline. The solution then uses StoragePoint, a software solution from Metalogix, to catalog the data into SharePoint and uses StoragePoint to move and manage the BLOBs outside of SQL Server.

This solution uses StoragePoint to enable remote BLOB storage for SharePoint 2010 data on VNX file. StoragePoint's File Share Librarian feature is used to catalog file share data into SharePoint.

Replication Manager provides protection and recovery for the entire SharePoint farm that is application consistent.

The VNX series provides a unified storage platform with block (file systems and databases) and file (BLOB) access.
This solution demonstrates StoragePoint integration as a highly efficient method for moving file share content into SharePoint and for externalizing unstructured SharePoint content to BLOB storage. The solution outlined in this white paper proves that you can:

- Use StoragePoint to improve the organization's overall storage usage and reduce the physical footprint while still meeting SLAs.
- Use StoragePoint for effectively managing the externalization of SharePoint BLOBs out of Microsoft SQL Server content databases.
- Create SharePoint metadata that points to content located on the file share.
- Migrate data into SharePoint using VNX and StoragePoint.
- Improve SharePoint farm performance by using EMC FAST Cache with VNX.
- Protect a SharePoint farm and the farm’s BLOB stores by using Replication Manager to back up and restore content.
Introduction

Purpose

This white paper provides guidance and recommendations to run remote BLOB storage for SharePoint using Metalogix StoragePoint, with VNX block and file for tiering. The white paper also describes how Replication Manager with customized scripting provides effective protection for a SharePoint farm including the farm’s remote BLOB stores.

Scope

This white paper presents design guidelines, best practices, and validated test results that were identified during the configuration and test phases of the solution.

Audience

This white paper is intended for the following, all of whom are interested in managing data in SharePoint and maximizing storage efficiency:

- EMC employees and field personnel
- EMC partners
- Mid-size to large (2 TB and up) SharePoint customers, including IT planners, storage architects, and administrators

Terminology

This paper includes the following terminology.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Binary large object (BLOB)</td>
<td>A collection of binary data stored as a single entity in a database management system. BLOBs are any files stored in the database, that is, documents, spreadsheets, media files, and so on.</td>
</tr>
<tr>
<td>BLOB store</td>
<td>External storage location for BLOBs in a SharePoint farm or environment, for example, a CIFS share. A framework for moving unstructured data from Microsoft SQL Server to an external storage system.</td>
</tr>
<tr>
<td>Content database</td>
<td>This is a Microsoft SQL Server database, resides inside the SharePoint farm, and contains content users save in SharePoint. Content can be separated into multiple content databases at the site-collection level. A content database can include one or more site collections, but a single site cannot span multiple databases. Backing up and restoring sites takes place at the content database level.</td>
</tr>
<tr>
<td>Cache dirty page</td>
<td>This is a page of FAST Cache that is valid and contains the most recent copy of data, but has not yet been synchronized with the user LUN.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>----------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Externalization</td>
<td>Externalization dissects the content stored in a SQL Server database into its two parts (metadata and BLOB), where the BLOB can then be routed to a more cost-effective tier of storage, which reduces the load on SharePoint and improves efficiency.</td>
</tr>
<tr>
<td>Remote BLOB store</td>
<td>A component that lets database administrators store binary large objects in commodity storage solutions instead of directly on the main database server.</td>
</tr>
</tbody>
</table>
Technology overview

Overview

This chapter provides an overview of the primary technologies used in this solution:

- EMC VNX
- EMC FAST Cache
- EMC Replication Manager
- Metalogix StoragePoint
- VMware vSphere®
- VMware® vCenter™

EMC VNX

The EMC VNX family delivers innovation and enterprise capabilities for file, block, and object storage in a scalable, easy-to-use solution. This storage environment combines powerful and flexible hardware with an advanced efficiency, management, and protection software to meet the demanding needs of today’s businesses.

The VNX series is designed to meet the high-performance, high-scalability requirements of midsize and large businesses.

The VNX array model used in this solution is VNX5500. This solution also applies to EMC VNX5300, EMC VNX5700, and EMC VNX7500 models.

EMC FAST Cache

A caching tier is a large-capacity secondary cache that uses Flash drives positioned between the storage processor’s Dynamic Random Access Memory (DRAM) based primary cache and hard-disk drives (HDDs). EMC FAST Cache is a nondisruptive, read/write cache that extends the VNX’s existing cache by up to 2 TB. FAST Cache monitors incoming I/O for access frequency and automatically copies frequently accessed data in 64k chunks from the back-end drives into the cache. FAST Cache is easy to administer and cost-effectively provides immediate performance benefits to the system.

EMC Replication Manager

EMC Replication Manager manages EMC point-in-time replication technologies through a centralized management console. Replication Manager coordinates the entire data replication process—from discovery and configuration to the management of application-consistent, disk-based replicas. Auto-discover your replication environment and enable streamlined management by scheduling, recording, and cataloging replica information including auto-expiration. With Replication Manager, you can put the right data in the right place at the right time—on-demand or based on schedules and policies that you define. This application-centric product allows you to simplify replica management with application consistency.

Application plug-ins

Microsoft SQL Server Virtual Device Interface (VDI) creates replicas of Microsoft SQL Server databases in the SharePoint farm. Replication Manager prepares the target storage for replication by synchronizing the production with target storage. It then uses VDI to freeze I/O to the database. When the target storage is split from the production storage, VDI is used to thaw the I/O.
Windows VSS framework is used to obtain the layout of the SharePoint farm from the SharePoint VSS Writer when creating an application set. VSS (Volume Shadow Copy Service) is used to coordinate various components to create a consistent point-in-time copy of data called shadow copies.

**Metalogix StoragePoint**

Metalogix StoragePoint is used for BLOB storage offload to SharePoint. StoragePoint improves SharePoint performance and scalability by offloading content from the underlying Microsoft SQL Server database to an alternate tier of storage in this solution. StoragePoint installs quickly and easily into SharePoint Central Administration and enables you to manage SharePoint BLOBs transparently from a single SharePoint interface.

**StoragePoint File Share Librarian**

StoragePoint’s File Share Librarian enables you to move the control of file-share content to SharePoint. The file shares are used like any other storage endpoint. The file-share metadata, associated folder hierarchy, and supporting information is catalogued, replicated, and placed under the control of SharePoint, which enables users to search, manage, and access file-share content just like any other document within SharePoint.

**VMware vSphere**

VMware vSphere uses the power of virtualization to transform data centers into simplified cloud computing infrastructures, and enables IT organizations to deliver flexible and reliable IT services. vSphere virtualizes and aggregates the underlying physical hardware resources across multiple systems and provides pools of virtual resources to the data center.

As a cloud operating system, vSphere manages large collections of infrastructure (such as CPUs, storage, and networking) as a seamless and dynamic operating environment, and also manages the complexity of a data center.

**VMware vCenter**

IT management is simplified with VMware vCenter virtualization and cloud management solutions. vCenter solutions help you accelerate IT service delivery, transform operational efficiency, automatically assure compliance, and reduce business risks.

**VMware vCenter Server**

By using VMware vCenter Server, you can view, configure, and manage key elements like hosts, clusters, resource pools, datastores, networks, and virtual machines. vCenter Server aggregates physical resources from multiple VMware ESXi™ hosts and presents a central collection of simple and flexible resources for you to provision to virtual machines in the virtual environment.

vCenter Server has the following characteristics:

- Centralized management
- Operational automation
- Secure access control
- Availability and resource management
• High levels of security
• Automated energy efficiency
Architecture

This chapter provides details on the configuration of this solution.

The solution was configured as follows:

- All the virtual machines used the VNX5500 for disk storage and management. The virtual machines are split between the ESX servers.
- We used converged networking, Fibre Channel over Ethernet (FCoE), to significantly reduce the connectivity complexity and port count for this solution, from server to VNX storage connectivity.
- A 1 TB file share was visible from the VNX5500 file as a CIFS share. This was populated with documents similar to the existing SharePoint farm.
- Only the boot LUNs were on a shared virtual machine file system (VMFS) volume. All other LUNs were Raw Device Mappings (RDMs). This was a requirement of Replication Manager for SharePoint.
- All ContentDBs, SearchDBs, TempDBs, ConfigDBs, the Metalogix StoragePointDB, and their associated logs were on separate raw LUNs to enable Replication Manager to do granular (per database) restores.
- Replication Manager required the server that was running the Search Administration role to have a Replication Manager-protected RDM. We used an index server for this role.
- Each ContentDB had a corresponding BLOB store created on VNX file and shared using CIFS. This was where the externalized content was sent. The BLOB stores shared the same disks as the file share data.

1 In this white paper, "we" refers to the EMC Solutions engineering team that validated the solution.
Figure 1 shows the overall logical architecture of the solution.

In the logical architecture, we moved the BLOBs in the ContentDBs on VNX block storage to VNX file storage using StoragePoint. We then added the file share data into SharePoint and migrated it to the BLOB store with StoragePoint. This left us with a small VNX block footprint while moving the BLOBS to a lower tier of storage.
Figure 2 shows the overall physical architecture of the solution.

**Figure 2. Physical architecture**

The hardware used to validate the solution is listed in Table 2.

**Table 2. Hardware**

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Used for</th>
<th>Quantity</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESXi servers</td>
<td>VMware SharePoint</td>
<td>2</td>
<td>• 256 GB of RAM</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• 1 x 32-core, 1 x 16-core</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• 146 GB RAID 1 internal HDDs</td>
</tr>
<tr>
<td>Management server</td>
<td>VMware vCenter Server</td>
<td>1</td>
<td>• 16 GB of RAM</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• 8-core</td>
</tr>
</tbody>
</table>
Software resources

The software used to validate the solution is listed in Table 3.

Table 3. Software

<table>
<thead>
<tr>
<th>Software</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microsoft Windows Server</td>
<td>2008 R2 SP1 Enterprise Edition</td>
</tr>
<tr>
<td>Microsoft SharePoint Server</td>
<td>2010 SP1 Enterprise Edition</td>
</tr>
<tr>
<td>Microsoft SQL Server</td>
<td>2008 R2 SP1 Enterprise Edition</td>
</tr>
<tr>
<td>Metalogix StoragePoint</td>
<td>3.4</td>
</tr>
<tr>
<td>EMC Replication Manager</td>
<td>5.4.2</td>
</tr>
<tr>
<td>EMC Solutions Enabler</td>
<td>7.3.1</td>
</tr>
<tr>
<td>EMC Admsnap</td>
<td>2.30.0.0</td>
</tr>
<tr>
<td>EMC FAST Suite</td>
<td>31</td>
</tr>
<tr>
<td>VMware vSphere</td>
<td>5.0.0</td>
</tr>
<tr>
<td>VMware ESX Server</td>
<td>5i</td>
</tr>
</tbody>
</table>

Virtual allocation of resources

Table 4 lists the virtual allocation of hardware resources used in the environment.

Table 4. Virtual allocation of hardware resources

<table>
<thead>
<tr>
<th>Virtual machine role</th>
<th>Quantity</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web front end (WFE)</td>
<td>4</td>
<td>4 vCPUs, 6 GB RAM</td>
</tr>
<tr>
<td>Application</td>
<td>1</td>
<td>2 vCPUs, 6 GB RAM</td>
</tr>
<tr>
<td>Index</td>
<td>2</td>
<td>4 vCPUs, 8 GB RAM</td>
</tr>
<tr>
<td>Microsoft SQL</td>
<td>1</td>
<td>8 vCPUs, 64 GB RAM</td>
</tr>
<tr>
<td>DC</td>
<td>1</td>
<td>2 vCPUs, 4 GB RAM</td>
</tr>
</tbody>
</table>
Figure 3 shows the disk layout for the solution.

As Figure 3 shows, the first enclosure 0_0 was only used in the FAST Cache scenario, and only one hot spare was configured and used on enclosure 0_1. One 16-disk 2 TB Near-Line Serial Attached SCSI (NL-SAS) RAID 6 storage pool was used for the VNX file shares.

The boot LUNs for all the virtual machines were on a 25-disk, serial-attached SCSI (SAS) 600 GB RAID 5 storage pool with the SharePoint ContentDB data, log LUNs, TempDB and SearchDB LUNs, and the SharePoint configuration databases.

Four hot spares were configured: two 600 GB SAS and two 2 TB NL-SAS.
Figure 4 shows the network layout of the solution.

We attached the VNX5500 and ESX servers to the 10 Gb FCoE network.

The client load was generated from the 1 Gb network in the same way as in a normal production environment. The client load used a public network to connect to the virtual machines on the ESX servers.
This solution was validated with the environment profile listed in Table 5.

### Table 5. Environment profiles

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Quantity/Type/Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>SharePoint—Total user count</td>
<td>45,000 with 4 WFEs</td>
</tr>
<tr>
<td></td>
<td>25,000 with 2 WFEs</td>
</tr>
<tr>
<td>SharePoint—Total data</td>
<td>4.3 TB to 5.3 TB</td>
</tr>
<tr>
<td>SharePoint—ContentDB sizes</td>
<td>4 TB</td>
</tr>
<tr>
<td></td>
<td>1 TB (migrated from a file share)</td>
</tr>
<tr>
<td></td>
<td>200 GB</td>
</tr>
<tr>
<td></td>
<td>100 GB</td>
</tr>
<tr>
<td>SharePoint—Number of ContentDBs</td>
<td>3 to 4</td>
</tr>
<tr>
<td>SharePoint—Document size range</td>
<td>200 KB to 2 MB, average 335 KB</td>
</tr>
<tr>
<td>SharePoint—Total site collection count</td>
<td>3 to 4</td>
</tr>
<tr>
<td>SharePoint—Size per site</td>
<td>10 GB to 400 GB</td>
</tr>
<tr>
<td>SharePoint—Sites per site collection</td>
<td>10 to 100</td>
</tr>
<tr>
<td>SharePoint—Total site count</td>
<td>130</td>
</tr>
<tr>
<td>SharePoint—Usage profiles (%browse/%search/%modify/%download)</td>
<td>60%/10%/10%/20%</td>
</tr>
<tr>
<td>SharePoint—User concurrency</td>
<td>10%</td>
</tr>
<tr>
<td>Disk type</td>
<td>Block: 600 GB SAS–10k RAID 5</td>
</tr>
<tr>
<td></td>
<td>File: 2 TB NL-SAS–7.2k RAID 6</td>
</tr>
</tbody>
</table>
This chapter describes, through test scenarios, the progression of a generic large SharePoint farm with a file share to an externalized SharePoint farm protected with Replication Manager and all BLOBs externalized to a lower storage tier.

Figure 5 shows the sequence of testing that was done for this solution.

**Deployment**

**Introduction to deployment**

This chapter describes, through test scenarios, the progression of a generic large SharePoint farm with a file share to an externalized SharePoint farm protected with Replication Manager and all BLOBs externalized to a lower storage tier.

**Sequence of test runs**

Figure 5 shows the sequence of testing that was done for this solution.

**Figure 5. Testing sequence flowchart**
Introduction
We ran these tests with four WFEs and then two WFEs to set two performance baselines of two different scales of large SharePoint farms on SAS disks.

Design
The SharePoint farm was designed as a medium-large farm with four WFEs, two crawl servers, one SQL Server, and an application server.

The entire farm, including boot volumes for the virtual machines and content databases, was stored on a single large storage pool.

The farm consisted of three ContentDBs (4 TB, 100 GB, and 200 GB respectively). There was a separate Common Internet File System (CIFS) file share for users that had 1 TB of content shared from the VNX file.

Configuration
We designed the storage for performance and sized it for capacity; it consisted of 25 SAS 600 GB disks in a RAID 5 storage pool. This storage pool could contain the entire farm which used a total space of just under 10 TB but the SAS disks could support approximately 2,800 IOPS which was several times the IOPS produced by the farm.

The boot LUNs shared a single VMFS file system. All other LUNs were RDMs. Database LUNs and their log LUNs were also separate. The search databases (SearchDB, Property Store, and Crawl Store) shared an RDM. This enabled us to use Replication Manager to protect the farm and do ContentDB-level restores.

Results
The limiting factor on the farm was the WFE CPUs, which averaged 90.09 percent for two WFEs and 89.53 percent for four WFEs.

This supports a user count at 10 percent concurrency of more than 25,000 with two WFEs and more than 45,000 for with four WFEs. Using four WFEs instead of two WFEs did not double the performance, because of other factors such as search response times, back-end response times, and so on.

Baseline performance

Scenario 1: Baseline with FAST Cache

Introduction
We ran these tests to compare the impact of using FAST Cache on the SharePoint farm to the baseline performance.

Design
We used FAST Cache to show its benefits in terms of increased user count and lower latencies for the SharePoint farm.

Configuration
FAST Cache was configured with eight 100 GB Flash drives in mirrored pairs. FAST Cache was enabled on the SharePoint farm storage pool and allowed to warm up until the cache dirty pages were above 70 percent.
Results
The limiting factor on the SharePoint farm was the WFE CPUs, which averaged 83.12 percent with four WFEs.

This improved the user count by 13 percent but also improved average test times by more than 12 percent for four WFEs.

Introduction
All BLOBS were externalized to NL-SAS disks using StoragePoint. Each ContentDB was externalized consecutively.

Design
The VNX file storage was designed to spread the load across 16 NL-SAS disks. These are enough to support the IOPS load of the externalized BLOBS. We used two Data Movers for redundancy.

Configuration
The VNX file storage was designed for IOPS performance based on the workload from the baseline tests. It consisted of 16 NL-SAS 2 TB disks in a RAID 6 Storage Pool. Four LUNs were created and Automated Volume Manager (AVM) was used to create file systems across the LUNs. The CIFS shares were created across the file systems.

The VNX file network was connected to the 10 Gb ports on the FCoE switches.

The basic process for the externalization of BLOBS is:

1. Install Metalogix StoragePoint.
2. Create storage end points for your BLOB stores.
3. Create storage profiles that dictate how BLOBs are externalized.
4. Create storage profile timer jobs.
5. Click Analyze and Estimate to display an estimate of the space savings that will result from running the externalize job.
6. Click Save to save the configured job schedule or choose to run the job immediately.

For the complete process, see page 76 of the Metalogix StoragePoint Installation and Administration Guide.
Figure 6 shows the StoragePoint BLOB externalization.

Results

The externalization of the 100 GB database took one hour. Externalization is quicker on smaller databases.

Figure 7 shows the results of the externalization of the 4 TB of content in ContentDB5000. It took 3 days, 4 hours, and 40 minutes to complete with all seven SharePoint servers running four threads each. There was no user load on the farm during this externalization.

![Externalization Results Table](image)
Introduction
We ran this test during the externalization of the 200 GB ContentDB to a remote BLOB store on VNX file to determine the impact of externalization with user load. All other ContentDBs had already been externalized at this point.

Note  BLOB externalization is a one-time event used to permanently remove the BLOBs from the Microsoft SQL Server database. New BLOBs do not enter this database.

Design
We externalized the BLOB content on the ContentDB under load to show the effects of BLOB externalization on the farm.

Initially, three servers performed the externalization process to show the impact, then one server continued the externalization. Metalogix StoragePoint enables you to start externalization with any number of servers (if they are part of the SharePoint farm). You can disable externalization on servers that you do not want to run, without interrupting the running job.

Configuration
We started the test with three servers performing externalization. Figure 8 shows that tce-sp-index-01 and tce-sp-index-02 were in an aborted state. This was a full-load four-WFE test.

Results
Figure 9 shows that when all three servers were running the externalization process, the passed tests per second decreased. When only the application server continued the externalization process, the passed tests per second increased again.
Figure 9. Externalization under load

Under no load and using all seven SharePoint servers, this externalization took 2 hours and 6 minutes to complete. At full capacity and using only one server, externalization took 13 hours and 34 minutes to complete.

Note While it is not required, EMC strongly recommends that you perform externalization during operational windows where users and other bulk processes are not using the same system resources or accessing the same content.

Scenario 4: Storage reclaim

Introduction

After full externalization, we reclaimed the space used by the ContentDBs, which could then be used for other purposes.

Design

The ContentDBs were 4.3 TB, 214 GB, and 100 GB. We wanted to reclaim the space used after externalization. The original LUN sizes were 5 TB, 250 GB, and 150 GB for a total of 5.4 TB. The reclaimed space could be used for other applications.

Configuration

The ContentDB BLOBS were fully externalized, therefore there was a large amount of free space inside the content databases. We first did a database shrink on each content database, which left no free space.

We configured autogrowth and set it to 10 percent. We configured this as an example of the amount of space that can be saved. Microsoft best practices recommend setting at least 10 percent free space for each database.

After the database shrink, we ran index defragmentations on all ContentDBs.
Notes

- SharePoint 2010 databases do not automatically shrink data files, although many activities create unused space in the database. Shrink operations should be executed rarely and only after executing an operation that removes a very large quantity of data from a database, and then only when that free space is not anticipated to be used again. Datafile shrink operations cause heavy index fragmentation and are extremely resource-intensive.

- Index fragmentation occurs when the logical order of pages in a table or index (as defined by the index key) is not the same as the physical order of the pages in the data files. Index fragmentation can be the result of many inserts, updates, or deletes to a table.

- Index fragmentation can result in performance degradation and inefficient space utilization, and indexes may become quickly fragmented on even moderately used databases.

- Before implementing an index fragmentation maintenance plan, you need to understand which tables and indexes are most fragmented and then create a maintenance plan to rebuild or reorganize those indexes.

- If the performance of a heavily fragmented database or table is not measurably improved by frequent defragmentation, you can check the performance of the I/O subsystem.

When we reduced the number of SAS disks to five from the original 25, and used the 16 NL-SAS disks for the BLOB stores, this enabled approximately 1,200 IOPS, which is twice the farm’s IOPS requirements and saves 20 SAS disks for other requirements in the VNX.

Results

Table 6 shows the reduction achieved by shrinking the ContentDBs after externalization. These significant results are specific to our dataset but are also indicative of most customer datasets.

Table 6. Scenario 4: Reduction of content database size

<table>
<thead>
<tr>
<th>ContentDB size (GB)</th>
<th>Reduction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before shrink</td>
<td>After shrink</td>
</tr>
<tr>
<td>4,000</td>
<td>446</td>
</tr>
<tr>
<td>214</td>
<td>2.84</td>
</tr>
<tr>
<td>100</td>
<td>9</td>
</tr>
</tbody>
</table>

Source: Microsoft’s white paper Database Maintenance for Microsoft SharePoint 2010 Products
Introduction
We added a separate 1.5 TB file share on VNX file with 1 TB of content to the SharePoint farm using StoragePoint.

Design
A customer may want to add file share content to SharePoint without physically moving the files. File Share Librarian catalogs the file share metadata without moving the actual files. It also enables you to either keep the existing file share available and let users connect to it through SharePoint or restrict users to only connect through SharePoint. Because our plan was eventual full migration to SharePoint, we chose to restrict access to SharePoint only for the file share.

Configuration
The file share was a CIFS share using VNX file and using the same 16 NL-SAS disks as the BLOB stores.

We set File Share Librarian to catalog the file share and present it as a new ContentDB in SharePoint. We added a new database to the Microsoft SQL Server and connected it as a new ContentDB in SharePoint.

File Share Librarian adds the links in the ContentDB to the file share data, based on where you want the data to reside in SharePoint. We chose a site inside a site collection.

Once File Share Librarian has catalogued a file share, if you want to upload new content, you need to enable a shared system cache.

The basic process to catalog file share data into SharePoint is:

1. Enter a name for the File Share Librarian job.
2. For Access Mode:
   a. If the file share will no longer be available to users after the content is catalogued, select SharePoint Only.
   b. If users will continue to access, update, add, or delete files directly from the file share, select SharePoint and File Share.
3. Enter the UNC path of the file share to be catalogued in File Share to Catalog and click Validate.
4. Select the Promote folder permissions to SharePoint containers? checkbox.
5. Click Change to select the SharePoint Destination Container.
6. Enter the settings to schedule the job.
7. Click Save to save the settings or click Catalog File Share Now.

For the complete process, see pages 112-113 of the Metalogix StoragePoint Installation and Administration Guide.

Scenario 5: Adding file share to SharePoint using File Share Librarian
Results
We used one SharePoint farm server for the cataloguing with a thread count of 20. One TB of content was catalogued in a day. The file share was accessible while the SharePoint content was updating.

Introduction
We ran this test to show a customer environment where a file share, which was cataloged and converted into a SharePoint BLOB store using File Share Librarian, is migrated to a secondary-target BLOB store.

Design
There are different types of migrations with StoragePoint. We chose to migrate the data directly from the file share to a SharePoint file share, which was then used as a BLOB store for the content.

Configuration
The file share and the new SharePoint BLOB store were both on VNX file CIFS shares on the same 16 NL-SAS disks.
We ran the migration with all seven SharePoint servers and four threads each.
To migrate file share data to a SharePoint BLOB store:

1. Note the Timer Job Scope of the selected Storage Profile.
2. Select the Source Endpoint (where the BLOBs are moving from).
3. Select a Destination Endpoint (where the BLOBs are moving to).
4. Enter a date in Schedule this process to run or click the Calendar icon to pick the date from a calendar.
5. Select a time from the supplied time list box.
6. Click Save to save the configured job schedule or click Migrate Content Now.

For the complete process, see page 78 of the Metalogix StoragePoint Installation and Administration Guide.
Figure 10 shows the StoragePoint BLOB migration.

Results

Figure 11 shows that the migration took 1 day and 17 minutes to complete. The BLOBs in the SharePoint BLOB store were the raw documents (for example, XLSX, DOCX) instead of hashes.
Scenario 7: Performance test of 5.4 TB including migrated data

Introduction
We ran these tests with four WFEs and two WFEs to compare to the performance baselines of a large SharePoint farm with 1 TB of file share content added.

Design
We designed the SharePoint farm as a large farm with four WFEs, two crawl servers, one SQL Server, and one application server. This farm changed from a 4.3 TB SharePoint farm with a 1 TB file share to a 5.4 TB SharePoint farm. The file share no longer existed, and the data could only be accessed through SharePoint.

Configuration
The farm, including boot volumes for the virtual machines and ContentDBs, was stored on a single large storage pool. The ContentDB BLOBs (5.4 TB) were stored on VNX file CIFS shares.

Results
We found the limiting factor on the farm was the WFE CPUs, which averaged 89.95 percent for two WFEs and 91.58 percent for four WFEs.

This supports a user count at 10 percent concurrency of more than 25,000 with two WFEs and more than 45,000 for four WFEs.

The average test time for Search was slightly over 3 seconds at 3.11 seconds.

Scenario 8: Replication Manager protection

Introduction
We set up Replication Manager to protect the entire SharePoint farm.

Design
The SharePoint farm and BLOB stores must be protected. There is currently no way to fully synchronize the block and file parts so that the protection is from a single point in time. Our block snaps were therefore completed before the file snaps, and there is a small time difference between the two.

Configuration
The boot LUNs shared a single VMFS data store. All other LUNs were RDMs. Database LUNs and their log LUNs were separate from each other. The search databases (SearchDB, Property Store, and Crawl Store) shared an RDM, as did the search logs. The StoragePoint database and log LUNs were also separate RDMs.

Figure 12 shows that each backup was configured as a Replication Manager job. The separate jobs were linked on successful completion of the previous job.

<table>
<thead>
<tr>
<th>Name</th>
<th>Application Set</th>
<th>Host</th>
</tr>
</thead>
<tbody>
<tr>
<td>SharePoint-Job</td>
<td>SharePoint</td>
<td>Multi-host</td>
</tr>
<tr>
<td>StoragePoint</td>
<td>StoragePoint</td>
<td>tce-sp-sql-01</td>
</tr>
</tbody>
</table>

Figure 12. Replication Manager protection jobs
The SharePoint farm and StoragePoint database were protected using EMC SnapView™ snaps, while the BLOB stores were protected using EMC SnapSure™ snaps. As shown in Figure 13, we wrote a script for creating snaps on the VNX file BLOB stores.

```bash
#!/bin/bash
PATH=$PATH:$HOME/bin
export PATH
NAS_DB=/nas
export NAS_DB
MANPATH=/usr/share/man:/usr/man:$NAS_DB/man
export MANPATH
PATH=$PATH:$NAS_DB/bin
export PATH
/nas/bin/fsckpt RBStore -name FSckpt5000 -create >> /home/nasadmin/FsOut
/nas/bin/fsckpt RBStore150 -name FSckpt150 -create >> /home/nasadmin/FsOut
/nas/bin/fsckpt RBStore250 -name FSckpt250 -create >> /home/nasadmin/FsOut
/nas/bin/fsckpt RBStore1500 -name FSckpt1500 -create >> /home/nasadmin/FsOut
```

Figure 13. Script for snap creation

The order of the protections was:

1. SharePoint farm
2. StoragePoint database
3. BLOB stores

You need to protect in this order so that the StoragePoint database is as close to being in sync with the SharePoint farm databases as possible. This ensures that StoragePoint's orphan control can identify and clean up any orphaned documents.

Results

The job took 33 minutes to finish, with each snap set taking less than 10 seconds. Replication Manager discovery and cleanup processes took up most of the time. The time difference between the SharePoint farm and the BLOB store snaps was 11 minutes and 55 seconds. Table 7 shows the snap creation times and durations.

<table>
<thead>
<tr>
<th>Data protected</th>
<th>Start time</th>
<th>End time</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>SharePoint farm and search</td>
<td>7:45:26</td>
<td>7:49:04</td>
<td>3 minutes 38 seconds</td>
</tr>
<tr>
<td>StoragePoint</td>
<td>7:57:08</td>
<td>7:57:09</td>
<td>1 second</td>
</tr>
<tr>
<td>BLOB stores</td>
<td>7:57:21</td>
<td>7:58:12</td>
<td>51 seconds</td>
</tr>
</tbody>
</table>
Introduction
We set up Replication Manager to restore each ContentDB separately, including its associated BLOB store.

Design
The SharePoint farm and BLOB stores were protected by Replication Manager and could be restored to the granularity of a single ContentDB.

Configuration
Because all SharePoint LUNs were RDMs, Replication Manager could restore them individually. The StoragePoint database and log LUNs were also separate RDMs.

The order of the restores was:
1. Single ContentDB BLOB store
2. StoragePoint database
3. Single ContentDB

Figure 14 shows that the BLOB store was manually restored from SnapSure snaps in EMC Unisphere®.

Figure 14.  Restore from snaps
We restored the ContentDB and StoragePoint database in Replication Manager from the SnapView snaps.
Results
The job took 14 minutes 30 seconds to finish, but the restore steps were not automated and had to be done manually. Table 8 shows the restore times and durations.

Table 8. Scenario 9: Restore times and durations

<table>
<thead>
<tr>
<th>Data protected</th>
<th>Start time</th>
<th>End time</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLOB store</td>
<td>8:48:02</td>
<td>8:48:18</td>
<td>16 seconds</td>
</tr>
<tr>
<td>StoragePoint</td>
<td>8:52:45</td>
<td>8:54:07</td>
<td>1 minute 22 seconds</td>
</tr>
<tr>
<td>ContentDB</td>
<td>08:59:47</td>
<td>9:03:22</td>
<td>3 minutes 35 seconds</td>
</tr>
</tbody>
</table>
Validation and testing

Introduction to validation and testing

The results in this chapter show testing from the baseline to a fully externalized SharePoint farm with a migrated file share on a lower tier of disks. Testing of this solution validates the functionality of VNX, FAST Cache, StoragePoint, and StoragePoint’s File Share Librarian.

Test methodology

We used Microsoft Visual Studio Team System (VSTS) to simulate the load on the SharePoint farm. A client load emulation tool provided by KnowledgeLake Inc. was used to ensure that the SharePoint farm was operating at the optimal performance level.

All users adhered to a Microsoft heavy-user profile, which specifies 60 requests per hour. A think time of zero percent was applied to all tests. “0% think time” is the elimination of typical user decision-making time when browsing, searching, or modifying data using Microsoft Office SharePoint Server. Every user request is completed from start to finish without a pause, which generates a continuous workload on the system.

The maximum user capacity is derived from the following formula:

\[ \# = \frac{\text{seconds per hour}}{\text{RPH}} \times \text{Concurrency\%} \times \text{RPS} \]

Examples:

- \[\frac{3,600}{60} \times 1\% \times 34.15 = 204,900\]
- \[\frac{3,600}{60} \times 10\% \times 34.15 = 20,490\] (supported user capacity for 10 percent concurrency)

The response times for each organization are detailed in Table 9.

<table>
<thead>
<tr>
<th>Test type</th>
<th>Action</th>
<th>Percentage</th>
<th>Response time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Browse</td>
<td>User browse</td>
<td>60</td>
<td>Less than 3 seconds</td>
</tr>
<tr>
<td>Search</td>
<td>Unique value search</td>
<td>10</td>
<td>Less than 3 seconds</td>
</tr>
<tr>
<td>Modify</td>
<td>Metadata modify and upload</td>
<td>10</td>
<td>Less than 3 seconds</td>
</tr>
<tr>
<td>Download</td>
<td>Download a document</td>
<td>20</td>
<td>Less than 3 seconds</td>
</tr>
</tbody>
</table>

We ran full performance tests with four WFEs and then with two WFEs to show different loads on the farm.

Notes about test results

Benchmark results are highly dependent on workload, specific application requirements, and system design and implementation. Relative system performance will vary as a result of these and other factors. Therefore, this workload should not be
used as a substitute for a specific customer application benchmark when critical capacity planning and/or product evaluation decisions are contemplated.

All performance data contained in this report was obtained in a rigorously controlled environment. Results obtained in other operating environments may vary significantly.

EMC Corporation does not warrant or represent that a user can or will achieve similar performance expressed in transactions per minute.

Summary of test results

Figure 15 shows the movement of content from VNX block to VNX file as we externalized the farm. It also shows the reduction in throughput for the ContentDBs and BLOB stores due to externalization. The lower IOPS is due to most of the throughput going to VNX file instead of VNX block. The average write size for a ContentDB on VNX block was 8 KB. The average write size for the BLOB store on VNX file was 24 KB. This accounts for the reduction in IOPS between the baseline and later test runs. Combined IOPS is calculated by adding the average block and file IOPS during the test runs.

Figure 15. Combined IOPS (4 WFEs)
Figure 16 illustrates the movement of data by showing the amount of space used for each scenario. After externalization, the Block ContentDB space is still used by Microsoft SQL Server until storage reclaim is done and the databases are shrunk. Cataloguing and migrating the 1 TB of file share data increases the size of the block storage usage as well as the BLOB stores on the VNX file space.

Table 10 shows that baseline with FAST Cache improves user count and reduces average test times. FAST Cache can be used on SharePoint farms to improve performance.

<table>
<thead>
<tr>
<th>Test</th>
<th>Passed tests/sec</th>
<th>% improved user count</th>
<th>Average test times (seconds)</th>
<th>% improved test times</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Browse</td>
<td>Search</td>
</tr>
<tr>
<td>Baseline</td>
<td>70.28</td>
<td>0</td>
<td>0.87</td>
<td>1.79</td>
</tr>
<tr>
<td>Baseline with FAST Cache</td>
<td>101</td>
<td>13.36</td>
<td>0.55</td>
<td>1.47</td>
</tr>
</tbody>
</table>
Table 11 shows the Replication Manager protection times including the durations for each component to be protected.

**Table 11. Protection times and durations**

<table>
<thead>
<tr>
<th>Data protected</th>
<th>Start time</th>
<th>End time</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>BLOB stores</td>
<td>7:57:21</td>
<td>7:58:12</td>
<td>51 seconds</td>
</tr>
</tbody>
</table>

Table 12 shows the Replication Manager restore times for a single ContentDB including the durations for each component to be restored.

**Table 12. Restore times and durations**

<table>
<thead>
<tr>
<th>Data protected</th>
<th>Start time</th>
<th>End time</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLOB store</td>
<td>8:48:02</td>
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<td>ContentDB</td>
<td>08:59:47</td>
<td>9:03:22</td>
<td>3 minutes 35 seconds</td>
</tr>
</tbody>
</table>

Average test times were degraded after externalization, because response times to a lower tier are slower when you move from a 25-disk SAS tier to a 16-disk NL-SAS tier. On the four-WFE tests, average test times were 35 percent slower. On the two-WFE tests, average test times were 43 percent slower.

Index defragmentations of the databases improved the performance of the SharePoint farm after BLOB externalization.

There was no need to change the SharePoint farm by adding more servers. The user count remained the same after externalization, shrink, and index defragmentations.

We saw an improved user count after externalization and several index defragmentations, but the average test times, which are indicative of user actions, were slower. Because we used a lower tier of storage for the externalized BLOBS, users had to wait longer for their requests to be serviced. Search and Modify were the most impacted user actions.

These response times correlate with the LUN response times on the baseline as compared to the VNX file LUNs. The baseline SAS LUNs had an average response time of 4.5 milliseconds, while the VNX file NL-SAS LUNs used for the BLOB stores had an average response time of 8 milliseconds.

**Solution benefits**

**Tiering with VNX file**

Moving SharePoint data from an expensive capacity-calculated tier (25-disk SAS) to a lower-cost performance-calculated tier (16-disk NL-SAS) gives cost savings and better use of available resources. After externalization we could reduce the number of SAS
disks from 25 to 5 and still meet the IOPS requirements, thereby saving 20 SAS disks that could be used for other requirements on the VNX.

Moving SharePoint BLOBs from block to VNX CIFS file shares is another advantage of the tiering strategy.

After moving the BLOB data from the ContentDBs, we reclaimed the space on the SAS disks with space savings of 90 percent.

**Caching data**

FAST Cache shows an improvement in performance for a SharePoint farm. In our tests, FAST Cache improved the average test times by about ten percent.

**Protection**

Replication Manager provides full-farm protection including remote BLOB storage. The protection jobs took 33 minutes. The difference in the timestamp for the SharePoint farm and the timestamp for the BLOB store was 12 minutes.

Replication Manager also enables single ContentDB restores including its BLOB store. Manual restore took 14 minutes and 30 seconds.

**Moving data**

StoragePoint offers the ability to easily externalize all SharePoint BLOBs with the option to externalize by criteria, including size, age, type, and so on.

StoragePoint enables you to migrate file share data into the ContentDB or to another file share. This flexibility lets you migrate from the file share data directly to the BLOB store.

StoragePoint enables you to add file-share data into SharePoint while retaining the original file share.

Externalization, cataloguing, and migration are invisible to farm users, therefore these tasks can be run during normal farm activity without user impact, if the tasks are not run on busy farm servers.

Externalization can be run on all servers in the farm but impacts farm performance. Either downtime should be arranged or externalization should be run on servers that will not affect farm performance, for example application server.

System cache in StoragePoint has to be turned on to upload files after StoragePoint has catalogued files into a ContentDB.

The StoragePoint database is created on installation, and it can reside on any SQL Server to which a SharePoint farm server can connect. The preference is to use the same SQL Server as the SharePoint farm.

Capacity is based on the size of the jobs that are being run. The 4 TB ContentDB externalization grew the StoragePoint database to approximately 100 GB. The growth is caused by the worker jobs that are added in batches. The completed batches are also recorded until the job is done.
The database does not require high performance. In externalization, on average, it only generated ten IOPS.

After the job is completed, the completed batches are removed from the StoragePoint database. You have to manually shrink the database.

You must separate all ContentDB, Search, StoragePoint database, SharePoint Config databases, and all logs for these databases onto different raw devices to protect them with Replication Manager and to enable granular restores.
**Conclusion**

**Summary**

You can use Metalogix StoragePoint to externalize Microsoft SharePoint BLOBs to VNX file. With Replication Manager, you can protect an entire SharePoint farm including the remote BLOB stores within a virtualized SharePoint environment.

**Findings**

This solution shows StoragePoint integration as a highly efficient method for moving SharePoint data to BLOB storage, and:

- Frees BLOB content that would normally be contained in a Microsoft SQL Server database, using StoragePoint for remote BLOB storage to reduce the organization’s overall storage costs and physical footprint without compromising performance or SharePoint workflow and processes.

- Uses tiering between SAS and NL-SAS disks, and tiering between VNX block and VNX file, to ensure reliable performance while reducing the need for higher-cost tiers.

- Uses StoragePoint to effectively manage the externalization of SharePoint BLOBs out of SQL Server content databases.

- FAST Cache improves SharePoint farm performance.

- Replication Manager protects a SharePoint farm and the farm's BLOB stores.

- Moving the BLOBs to a lower tier increases the average response times and needs to be taken into account in planning.

- Use VNX block and file as a tiering strategy to reduce costs while maintaining performance.
References

White papers
For additional information, see the white papers listed below.

- *EMC Replication Manager Version 5.0 Technology–A Detailed Review*
- *Replication Manager and Microsoft SharePoint–A Detailed Review*
- *EMC Virtual Infrastructure for Microsoft SharePoint Server 2010*

Product documentation
For additional information, see the product documents listed below.

- *Configuring and Managing CIFS on VNX*
- *Managing Volumes and File Systems with VNX AVM*
- *EMC FAST Cache–A Detailed Review*

Other documentation
For additional information, see the documents listed below.

- *Metalogix StoragePoint Installation and Administration Guide*