This white paper provides a demonstration of standard features supported by the Fujitsu ETERNUS® DX Storage Products, highlighting features designed for integration with VMware®.
Introduction

The introduction of server virtualization, such as VMware, has had a significant impact on other infrastructure domains, namely network and storage. Server virtualization is no longer just a topic for server operators; it also affects the management of storage and networking equipment. The relationship to storage is simple as the physical representation of virtual servers (virtual machines - VMs) is just files - files that are in most cases stored on external storage arrays. Server operations have to deal mostly with storage. This can create administrative complexity as additional knowledge has to be acquired. It also requires more procedural alignment between the various experts and a lot of information has to be exchanged.

This White Paper demonstrates some of the key benefits of using the Fujitsu ETERNUS DX storage arrays in a VMware virtualized environment. Included are links to video demonstrations of these key features in action.
**XCOPY feature of vStorage® APIs for Array Integration (VAAI)**

As virtual machines are physical files which are located on an external storage system, many VMware-related activities result in the handling of data. This can be done more efficiently on the storage system directly instead of running it via a network to a server and then back to storage, thus saving server performance and network bandwidth. This is possible due to the integration of ETERNUS DX systems with vStorage APIs for Array Integration (VAAI).

Frequent storage-related operations are copying activities, e.g. cloning virtual machines, creating a virtual machine from a template or executing store vMotion® activities within the storage system.

Greater speed and efficiency is achieved by integrating VMware VAAI with the Extended Copy function of the ETERNUS DX. On the server side a command triggers the Extended Copy functionality which is then processed on the ETERNUS system. Not only does this offload tasks from a VMware ESX server to the storage system, but there is another big advantage for productive operations. While being copied, a file is typically not available for productive use. A virtual machine that is to be copied is thus available much faster. Tests have demonstrated time reductions of 60% for the copy process and an 80% reduction of the CPU load on the server side (depending on the individual configuration).

Another typical example is the creation of virtual machines. The allocated disk space is overwritten with zeros in the creation process. This task can also be offloaded from the server to the storage system. Tests show that the traffic of data blocks from server to storage is significantly reduced and the CPU load for this task was reduced by 84%.

![Figure 1 - VAAI](image)

For a detailed demonstration of the XCOPY feature running on a Fujitsu ETERNUS DX200 S3 storage array please see the video link:

**XCOPY with ETERNUS DX Storage**
Extreme Cache Pool

Extreme Cache Pool, a secondary cache built from dedicated drive enclosure based SSDs, provides flash-drive class performance for significantly accelerated Read access of servers and applications.

Using intelligent algorithms, frequently accessed data is detected and automatically placed on fast SSDs – thus avoiding time consuming retrieval from spinning disks.

Extreme Cache Pool offers Read performance and latency comparable to all-flash arrays while leveraging the cost advantages of conventional disk arrays. The feature can be activated separately for each volume, helping to achieve an even better cost/benefit ratio.

Figure 2 – Extreme Cache Pool

In the following demonstration we show one of the many ways in which the Fujitsu ETERNUS storage arrays can provide added benefits in a VMware virtualized environment. In this case we demonstrate how the Extreme Cache Pool feature can reduce the time spent on a common phenomenon called a boot storm.

For a detailed demonstration of using Extreme Cache Pool on a Fujitsu ETERNUS DX200 S3 storage array, please see the video link:

Extreme Cache Pool with VMware
Automated Storage Tiering (AST)

AST refers to the ability of the storage array to move chunks of data between different disk types and RAID levels to meet the right balance between performance and cost-effective space usage thus avoiding so-called hot spots. In general, the main advantage of AST is in moving frequently accessed data to high speed drives such as SSDs and less frequently accessed data to cost-effective disks with large capacities. This helps storage administrators find a fair balance between performance, capacity and cost.

The aim of the Automated Storage Tiering function in ETERNUS DX is to optimize the use of the storage infrastructure by simultaneously improving performance and utilization:

- Move frequently used data onto fast disks for access performance
- Move less frequently used data onto low-cost disks for a better cost-performance ratio

The function performs in a cycle of three steps:

- Data usage is monitored during a user-defined time interval
- Data usage is analyzed
- Data is relocated between disks according to a defined relocation policy based on the analyzed data usage

Figure 3 shows the environment for the ETERNUS DX Optimization option, which includes the Automated Storage Tiering feature.

![Figure 3 – Automated Storage Tiering](image)

For a detailed demonstration of the Server Manager with the Fujitsu ETERNUS DX600 S3 storage array, please see the video link:

ETERNUS DX Automated Storage Tiering with VMware
Automated Quality of Service (auto QoS)

The array based Quality of Service option, supported by the Fujitsu ETERNUS DX storage arrays, just limits the IOPS (input/output operations per second) for specific volumes in a static way and requires a lot of expertise and continuous tuning to find the optimum settings. To ease these tasks the ETERNUS SF automated Quality of Service management option (auto QoS) lets administrators set values based on performance requirements, in a simpler manner, and then dynamically adjusts the values with the result of continuous performance monitoring.

This feature makes setting up the QoS function simple for the user. Furthermore, the automatic tuning ensures that the values used are more accurate, resulting in better service level fulfillment.

Auto QoS gives administrator the possibility of setting predefined target response times.

**Figure 4 – Auto QoS Target Response Time Settings**

The setting of a target response time for a given volume is simpler than calculating the IOPS level but it can still be overwhelming for users that do not have a complete view of their environment’s activity. As an alternative, ETERNUS SF also allows the ability to choose, for each volume, a level of service making the configuration even simpler. By specifying “Low”, “Middle”, or “High” to the volume, ETERNUS SF will share the available storage I/O bandwidth automatically based on those settings.

**Figure 5 – Auto QoS Priority Settings**
In the following demonstration we will show how auto QOS can be used to prevent a single volume from using excessive performance in a storage pool and thereby restricting the performance of a higher priority application. This shows one of the main benefits of the Automated Quality of Service feature provided by the ETERNUS DX storage array in cooperation with the ETERNUS SF software.

For a detailed demonstration of Automated Quality of Service with the Fujitsu ETERNUS DX200 S3 storage array, please see the video link:

Automated Quality of Service Demo

ETERNUS vCenter Plugin

The ETERNUS vCenter® Plugin extends the user interface of VMware vSphere® Web Client allowing it to display system information for Fujitsu ETERNUS DX disk storage systems without having to use an additional management tool. The VMware administrator thus obtains the required storage system information in order to provision and operate virtual machines from the vSphere Web Client. The plugin can be downloaded for free.

Important features:
- When setting up a new virtual machine, the available storage capacity is displayed
- When tuning performance, the plugin provides detailed information about read/write IOPS, and for Read and Write throughput (i.e. how much data is transferred per second)
- For troubleshooting or optimization, the administrator can take a complete look at the path from one particular virtual machine via the SAN switches to the disk type and down to the storage LUN, and thus obtain an end-to-end view of all the instances involved
- A new storage LUN for virtual machines can be created in the vSphere Web Client. Creating a new storage LUN without this vCenter Plugin must be done from the ETERNUS Web GUI (this function is only available in the vSphere Web Client version)

For a detailed demonstration of the ETERNUS vCenter Plugin with the Fujitsu ETERNUS DX200 S3 storage array, please see the video link:

VMware Plugin Demo
VVOL

VMware VVOL (Virtual Volume) is a new storage management technology added to VMware vSphere 6.0. Conventional storage operations using VMFS (Virtual Machine File System) required complicated volume assignments and operations while taking into account resource allocations for virtual machines due to multiple VMDK (virtual disk) assignments to a single storage volume (LUN). In storage operations using VVOLs, a storage volume is assigned to each VMDK of the virtual machine to allow the storage system to manage the storage for each virtual machine.

By allowing the storage to be used by each virtual machine, functions such as backup and performance management that were previously performed only for storage volumes can be set for each virtual machine. In addition, reducing the administrative workload that is caused by separating the storage administrators from the virtual machine administrators is possible.

Items related to storage operations such as backup policies and the priority level of Automated QoS can be easily set as policies from vCenter Server. Simply by applying storage policies when creating the virtual machines, the VMware administrator can easily assign storage that match the requirements of the virtual machines without the need to coordinate with the storage administrator. In this way, operational efficiency can be improved.

In addition, with the Fujitsu original user-friendly policy setting screens, various storage functions can be easily set.
For a detailed demonstration of setting storage policies and creating a VM on a Fujitsu ETERNUS DX200 S3 storage array, please see the video link: [VVOL Policy and VM Creation](#).

For a detailed demonstration of single file restore for a VM using VVOL on a Fujitsu ETERNUS DX200 S3 storage array, please see the video link: [VVOL Single Item Restore](#).

For a detailed demonstration of recovery of a VM using VVOL on a Fujitsu ETERNUS DX200 S3 storage array, please see the video link: [VVOL Clone Recovery](#).
Summary and Conclusion

The Fujitsu ETERNUS DX product family is the perfect choice for customers looking for a flexible storage solution that adapts as the business needs change. The powerful performance ETERNUS DX hardware architecture, with unified block and file data access, ensures efficient storage consolidation while delivering the desired performance.

Fujitsu offers innovative advanced software functions through the uniform management software, ETERNUS SF, which reduces the total cost of ownership, simplifies monitoring and management and helps achieve business continuity. These functions include automated Quality of Service Management, which allows maintaining stringent Service Level Agreements. The functions also include Thin Provisioning with zero space reclamation and Automated Flexible Tiering which simplify storage management. The Fujitsu ETERNUS DX storage systems are the better alternative for storage solutions – The Business-centric Storage.

ETERNUS DX Online Storage Family

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<tr>
<th>Architecture</th>
<th>Flexible and seamless family design with uniform storage management</th>
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<tr>
<td>Segment</td>
<td>Entry-level, Scalable unified entry-level and midrange systems, High-end</td>
</tr>
<tr>
<td>Maximum Storage Capacity</td>
<td>288 TB, 864 TB, 1,584 TB, 3,168 TB, 6,336 TB, 13,824 TB</td>
</tr>
<tr>
<td>Maximum Disk Drives</td>
<td>92, 144, 264, 528, 1,056, 4,608</td>
</tr>
<tr>
<td>Storage Controllers</td>
<td>1 or 2, 1 or 2, 1 or 2, 2, 2, 2-24</td>
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<tr>
<td>Maximum Cache Memory</td>
<td>4 GB, 8 GB (Block), 16 GB (Unified), 16 GB (Block), 32 GB (Unified), 64 GB (Block), 96 GB (Unified), 128 GB (Block), 192 GB (Unified), 6,144 GB</td>
</tr>
<tr>
<td>Second-level Cache</td>
<td>800 GB, 800 GB, 5.6 TB, 5.6 TB, 67.2 TB</td>
</tr>
<tr>
<td>Host Interface Type</td>
<td>4/8 Gbit/s FC, 1/10 Gbit/s iSCSI, 3/6 Gbit/s SAS, 8/16 Gbit/s FC, 10 Gbit/s FCoE, 1/10 Gbit/s iSCSI, 6 Gbit/s SAS, 1/10 Gbit/s Ethernet, 8/16 Gbit/s FC, 10 Gbit/s FCoE, 1/10 Gbit/s iSCSI, 1/10 Gbit/s Ethernet, 8/16 Gbit/s FC, 10 Gbit/s FCoE, 1/10 Gbit/s iSCSI</td>
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<td>ETERNUS SF Software Suite</td>
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<td>Quality of Service</td>
<td>I/O Control Automated management of service level agreements (SLA management)</td>
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<td>Expandability</td>
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<td>Efficiency</td>
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<td>Replication</td>
<td>Remote Equivalent Copy (REC)</td>
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<td>Data Integrity</td>
<td>Reliability/RAID protection with Block Check Codes</td>
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<tr>
<td>Encryption</td>
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<td>Redundancy</td>
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<td>Virtualization</td>
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Figure 8 - ETERNUS DX Online Storage Family
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