

# White Paper

## FUJITSU Storage

### ETERNUS Snapshot Manager (ESM)

Efficient Snapshot Management for Fujitsu Storage ETERNUS AF all-flash and ETERNUS DX hybrid storage systems



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**Introduction**

Massive data growth motivates IT organizations to invest more in data availability and data protection. Snapshot technologies are increasingly deployed so as to reduce recovery time when storage systems are down. Fujitsu offers the ETERNUS Snapshot Manager (ESM) in order to increase the snapshot functionality for ETERNUS AF all-flash and ETERNUS DX hybrid storage systems. ESM is feature-rich software used to manage application-consistent snapshots of ETERNUS AF/DX systems. This White Paper outlines the use of snapshots and describes the benefits of ETERNUS Snapshot Manager.



**ETERNUS  
Snapshot  
Manager**

**Definition of snapshots and clones**

The idea behind snapshot technology is quite simple: a data image is captured at a particular specific moment. The snapshot allows access to a volume which has the contents defined when the snapshot is taken, irrespective of ongoing changes to the original data. This simple operation is very powerful as the snapshot image can be used as a data backup or to distribute the data for other uses. Snapshots are sometimes used to test new applications with user data.

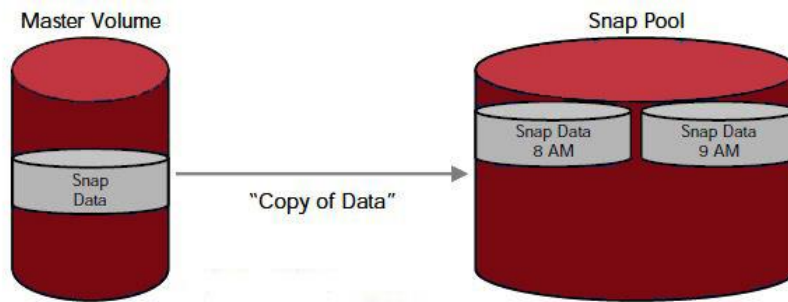


Figure 1: Snapshot

Snapshot technology today, i.e. making data copies without impacting business operations, is a core feature in building comprehensive data services and establishing key data management and protection capabilities:

- Create multiple recovery points to complement daily backups
- Ability to access data instantly in contrast to tape-based backups
- Create data copies that can be used to support key IT functions, such as remote replication, business continuity, rapid application development and support for regulatory requirements

The most significant snapshot function is the ability to capture a moment in time for a disk volume. It means that the data copy not only functions as a backup, but it also provides the opportunity to go back to a specific point-in-time in order to recover systems just before a data corruption occurred, an application failed or other significant events. This is why the speed of snapshots and lack of impact on operations is so significant. Snapshots can be run frequently and used to restore business operations instantly by rolling back to the exact point-in-time required.

There are two different ways of taking a snapshot: full or space-efficient:

- Full snapshots or clones make a full copy of the entire volume requiring allocated space that matches the size of the volume to be snapped. This is true for each full snapshot taken. For example, if you have four snapshots of one volume, disk requirements are 400% capacity of the volume that is snapped. This is not always the most efficient data protection and replication model. It is valuable for supporting disaster recovery and useful for supporting the development of new applications.
- Space-efficient snapshots capture the blocks that have changed since the last snapshot, in the same way as a traditional differential backup. This is a significantly more efficient data protection method. Space-efficient snapshots are particularly vital for point-in-time recovery. They enable administrators to make frequent snapshots and support a wider range of point-in-time recovery options. As a result, space-efficient snapshots require much less reserve space and offer better ROI for data protection than is the case with full snapshots.

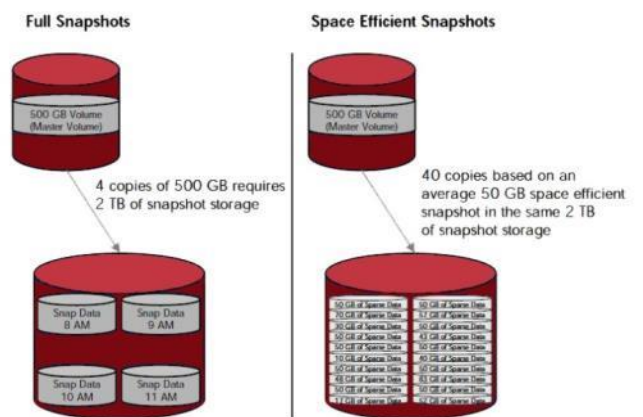


Figure 2: Full and space-efficient snapshots

Whatever type of snapshots preferred, they are useless if the data in the snapshot is not consistent. This could be the case, if a snapshot is created when an application is not in a consistent mode. An application might also be using data on different disks and this interdependency may not be known to the storage administrator who is creating the snapshot. Basically, the snapshot data can only be consistent and thus useful for later if the application is aware that a snapshot is about to be taken.

### The benefits of snapshots

Business Continuity continues to evolve in the data centers of most companies. Concepts for high availability and also for backup and recovery are becoming increasingly important and have to be planned very carefully. Technologies that were expensive and unique to enterprise customers some years ago have now become attractive to a wider range of customers. However, there are still too many choices which can result in customer confusion.

It is important to offer complete ecosystems - not just hardware or software - in order to be successful in the market of business continuity. As snapshots become increasingly attractive, business continuity solutions with included snapshot technology also become increasingly attractive.

One of the sectors with an increased demand in snapshots is backup and recovery which follows a simple approach of minimizing the amount of data to be saved so as to overcome the five main backup capability complaints:

- Backup window is too short
- Too many point solutions
- Failed backup jobs may become a big threat for corporate data
- Data restore cannot be processed in time
- Reporting is missing or incomplete.

In this context two continuity metrics have emerged and gained acceptance in the industry: Recovery Point Objective (RPO) and Recovery Time Objective (RTO). These metrics help a customer to understand how fast he can recover data and how recent his protected data is.

- Recovery Point Objective (RPO)  
The period of time you can cope with data loss (the point in time that your recovery will reflect)
- Recovery Time Objective (RTO)  
The time it takes for you to restart a failed application service.

RPO and RTO can help to evaluate the importance of data to a company.

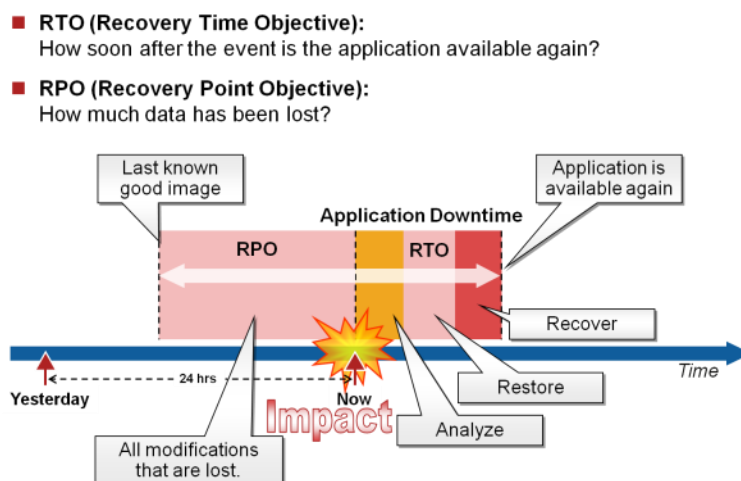


Figure 3: RTO and RPO

There are many different ways to protect and recover data. Each technology offers individual RPO and RTO metrics. In order to find the ideal combination of technologies the key is to provide exponential recoverability benefits with small incremental costs.

- Tape backup has been a point-in-time protection option for many years. This technology is ideal due to the portability of the tape media and its infinite capacity. The challenge with tape is the recoverability of an entire system. A large-scale restore may have a long RTO (hours-to-days for full restore) with an average RPO (hours-to-days since the last complete backup). The prime benefit is having backup tapes at an alternate facility for recovery should a disaster destroy all data onsite.
- Virtual tape has emerged as an alternative to traditional tape. The concept is that a set of hard drives, typically in a protected state such as RAID, improve RTO by leveraging the fast access of the disks for recovery. When comparing traditional tape backup with virtual tape, you forfeit the infinite capacity and the portability which you enjoy with traditional tape in order to gain faster recovery.

- Disk Backup has become an alternative in recent years; there is still a trend to use more disk in back up as it helps to meet demanding SLAs. A clear advantage of disk is the speed at which backups can be performed. Another feature is reliability. When a huge amount of tape restores fail, backup-to-disk eliminates errors, improving the success of backup and restore jobs. However, disk storage is still expensive.
- Backup-to-disk with deduplication helps to implement a cost-efficient disk backup environment. Data deduplication is a specialized data compression technique for eliminating duplicate copies of repetitive data. The purpose of data deduplication is to increase the amount of information that can be stored on disk arrays and to increase the effective amount of data that can be transmitted over networks. It is also compatible with established compression systems used to compact data being written to tape or to disk, and may be combined with compression at a solution level.
- Backup to All-Flash Arrays  
At the moment the fastest and of course the most expensive type of backup media. Practical usage scenarios with meaningful advantages over hard disks are seen in short time backups with a small amount of data and minimal RTO requirements. Because of using dedup and compression technologies, especially for the restore, data are accessed in small blocks and much randomized. Doing this with minimal delay are the strengths of all flash arrays.
- Backup-to-Cloud or the use of cloud-based services is rising fast as companies seek to reap the benefits of flexible, lower cost IT services consumed on demand. Although backup and recovery services have been available via the cloud for some time, concerns about the security and reliability of services as well as data residency issues have been a barrier for some organizations. A new breed of cloud-based services has now arrived, bringing the enterprise class backup and recovery capabilities demanded by organizations.
- Snapshots and clones are another point-in-time protection and recovery option that can improve RTO and RPO for a system without significant costs. A snapshot is a "picture" of data at a certain point in time. Clones are similar to snapshots but clones make a physical copy of the data to another set of disks at a specific point in time. Snapshots and clones can be executed regularly by scheduling their execution (for example, some customers schedule an hourly snapshot). The frequency of a snapshot or clone is typically dictated by the "number" of snapshots the disk array or application supports.

As snapshots and clones have an RTO of seconds, they are ideal for complementing other backup technologies. Firstly, they create multiple recovery points, decrease the amount of data loss after a disaster (RPO) and complement daily backups with a minimum impact for the production system. Secondly, snapshots enable instant data access and minimize the time the system runs after a failure (RTO); and thirdly, snapshots create data copies that can be used to support key IT functions, such as remote replication, business continuity, rapid application development and support for regulatory requirements.

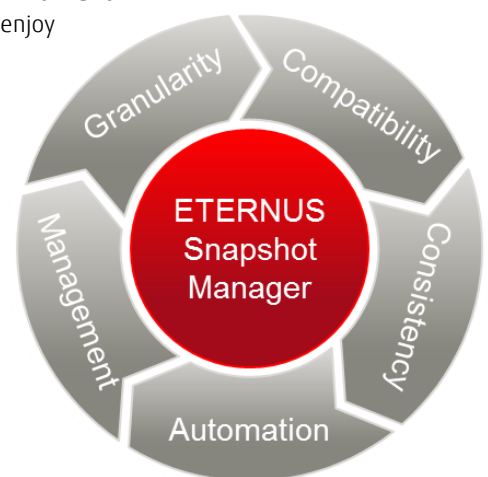
In summary, snapshots are not a complete substitution for a traditional backup and recovery concept but they complement the concept as they can recover a failed system very quickly at a specific point in time.

### Fujitsu Storage ETERNUS Snapshot Manager

Fujitsu ETERNUS Snapshot Manager (ESM) is used by IT departments to manage the flood of information. Customers needing a snapshot solution and a significant boost in storage performance will enjoy using a perfect tool, namely ESM. It enables administrators to take application-consistent hardware snapshots of ETERNUS AF all-flash and ETERNUS DX hybrid storage arrays and to generate a detailed catalog of the recorded data. The result is a granular, rapid and coherent restore of productive data and meta data from physical and virtual environments. Moreover, ESM's central console offers numerous automation options for fast, streamlined and accurate snapshot management.

The key features of Fujitsu ETERNUS Snapshot Manager are:

- Compatibility
- Consistency
- Automation
- Management
- Granularity



### Compatibility

Snapshot support for industry's broadest application and file systems  
Benefits:

- Improves data availability and business productivity
- Eliminates multiple management and operational costs
- Reduces administration efforts and IT resources

Existing snapshot tools diversify in functionality, automation, scripting requirements, hardware support and application awareness. Each data base or application has its own backup characteristics which must be considered and the snapshot management can be difficult and expensive. The administrator must perform many manual tasks and scripts to generate and recover application-consistent snapshots. Based on these facts the snapshot management can be very complex and it is more difficult to realize the full potential of snapshots.

The ETERNUS Snapshot Manager streamlines and simplifies snapshot management. It provides a complete view into snapshot data across applications, devices and operating systems, cutting administrative overhead and improving access, availability and IT efficiency. ESM eliminates the chaos of multiple management tools and processes and reduces operational costs.

The software quickly creates and retains application-aware snapshots of market leading databases (Microsoft® Exchange®, SQL, SAP, Oracle etc.) and major operating systems (Windows, Linux, VMware, Solaris,...). Broader service level commitments can be met without the complexity of multiple tools. ESM also speeds up virtualization adaption and easily scales VM environments. Hundreds of virtual machines can be protected in minutes.

ESM is compatible with any other backup tool for additional data management and protection, such as creating secondary data copies from the snapshot data to disk or tape.

ESM enhances productivity, reduces costs and redeploys resources to other value-add priorities by eliminating multiple solutions and manual processes.

### Consistency

Coherent data handling for applications and generation of index and catalog of snapshot data

Benefits:

- Improves data availability and business productivity
- Increases protection for mission-critical data with low production impact
- Simplifies application protection and speeds up recovery processes to minimize business disruption

ESM automates and integrates application intelligence with the snapshot abilities of ETERNUS AF and ETERNUS DX arrays. Agents are available for a broad range of applications so that ESM can connect to the ETERNUS AF/DX storage arrays on which the application runs and to discover volume/disk configurations for the snapshot operations. These capabilities are mandatory to quiesce the application and to coordinate the snapshot operations across multiple ETERNUS AF, ETERNUS DX arrays and ETERNUS Storage Cluster through a single console.

When a scheduled protection job for the defined application runs, the agent quiesces the selected applications and automatically creates a set of persistent snapshots within the productive storage system. When a successful snapshot creation is confirmed, the production host returns to full production side operations. This allows a consistent data image to be created in minutes with RPOs aligning with the frequency of schedule. A content-aware indexing of the snapshot enables the administrator to quickly find and recover individual files, volumes or whole VMs using intelligent search functions across a collection of indexed snapshots.

The application-awareness increases protection for mission-critical data with minimal impact on the running application and production systems. The feature improves data availability and business productivity with whole volume or granular and consistent recovery. The ESM simplifies application protection and speeds up recovery process to minimize business disruption.

### Automation

Automated operation and management

Benefits:

- Improves RPOs and RTOs by allowing for more frequent copies and faster restores
- Ease of use
- Frees up administration and IT resources
- Eliminates risk, improves business agility and increases efficiency

ESM simplifies, automates and standardizes all snapshot management tasks, including object, application and database recovery. The software eliminates scripting and manual mapping of file systems and applications. Existing script-based tools are replaced with an intuitive point-and-click interface, pull-down menu and wizards. The administrator can configure, create, retire, mount, dismount, monitor, mine, retain, revert and restore in the same way regardless of application and/or operating system platforms. The scheduling of snapshots is very easy and saves valuable administration time. The system views all scheduled jobs and provides several browse options. For example the administrator can browse the latest generated snapshot or look for information at a specify browse time. An integrated reporting function shows e.g. which and how much data of a specific server is stored.

This enables the application specialists to run ESM without support of specialized backup or storage experts and the automated processes improve RPOs and RTOs by allowing for more frequent copies and faster restores.

In summary the automation feature frees up administration and IT resources, eliminates risk, increases efficiency and improves business agility.

### Management

Single console with central GUI for multiple storage arrays

Benefits:

- Ease of use
- Enhances productivity, lowers infrastructure and operational costs
- Reduces risk, eliminates multiple management points

The ESM console offers storage administrators unique and central snapshot management throughout the ETERNUS AF and ETERNUS DX series, from entry-level systems up to the high-end models.

Multiple management points belong to the past. From a single console, ESM manages hardware snapshots and catalogs the content for granular recovery for the whole environment. The snapshot management technology leverages the efficiency of hardware-based snapshots to speed recovery, eliminate scripting and lower infrastructure costs. This guarantees lower operational costs, reduced risks and enhanced productivity.

### Granularity

Fast identification and recovery of individual files of indexed snapshots

Benefits:

- Allows granular and consistent recovery of applications and files
- Improves data availability and business productivity
- Ensures a fast and simple recovery process

The recovery of snapshots is often at the whole snapshot or VM level. The administrator uses ESM to decide which way to recover data from a snapshot:

- Snap revert which recovers the whole snapshot. This feature is the fastest restore option and can be instrumental in meeting highest RTO requirements.
- Granular recovery is used to restore only single files or applications. After the snapshot creation the snapshot is mounted to the ESM management server for indexing the contents of the snapshots. The generated index makes the snapshot browse-able and facilitates the restore of single files, e-mails or objects across physical and virtual environments.

Both, granular recovery and snap revert, improve data availability and business productivity.

### How it works

The ETERNUS Snapshot Manager consists of two parts:

- The ESM Manager runs on a Windows server (we recommend a Fujitsu PRIMERGY server) and controls the complete snapshot process (snapshot scheduling, mounting, dismounting and recovery).
- The ESM Agent runs on the production servers and is available in dedicated versions representing the applications running on it.

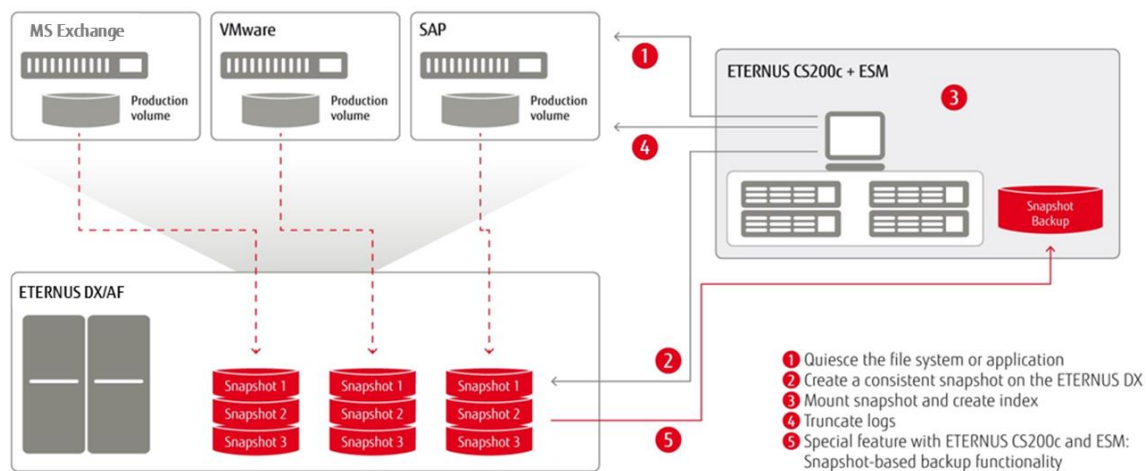


Figure4: How ESM works

The principle operation of ESM is as follows:

1. The agent quiesces the selected file system or application to bring it into a consistent state
2. After stabilizing the application, ETERNUS AF respectively ETERNUS DX creates a hardware-based consistent snapshot or clone which is stored on a specific part of the ETERNUS array. After confirming the successful snapshot creation, the application can continue to work.
3. The next steps in the process run in background without impact on the production system. The ESM Manager mounts the snapshot or clone, creates an index and generates a detailed catalog of the stored snapshot data. This enables the administrator to quickly find and recover individual files, volumes or whole VMs using intelligent search functions across a collection of indexed snapshots.
4. The agent deletes (truncate) the log files having taken the snapshot successfully.
5. STEP 5 is only available in combination with Fujitsu Storage ETERNUS CS200c:  
The ETERNUS CS200c Powered by Commvault features together with the ESM license the snapshot-based backup:  
The integrated backup appliance ETERNUS CS200c takes over the function of the ESM manager and manages the ETERNUS AF/DX hardware snapshots. This combination additionally offers the backup function to store a copy of the created snapshot on the ETERNUS CS200c appliance.

The catalog generated by the snapshot process enables a granular, fast and coherent recovery of production and meta data for physical and virtual systems without restoring the complete contents of the disk.

Granular recovery technology can significantly reduce the time and resources spent backing up and recovering data. For example, Microsoft Exchange has become one of today's most critical business applications and losing access to this data for even a short period of time can be damaging to any business. The ability to quickly recover an Exchange server in the event of failure and to easily recover individual mail boxes or messages should be the cornerstone of any backup and disaster recovery solution.

ESM offers a rich set of central control and administration options to guarantee a fast, secure and compliant snapshot management. ESM supports Windows, Linux/Unix and VMware/Hyper-V operating systems and Microsoft, Oracle and SAP based business applications. For detailed technical specification see the datasheet on [www.fujitsu.com/fts/esm](http://www.fujitsu.com/fts/esm)

### Integration into the ETERNUS AF/DX environment

Several things are important to know:

- ESM is optimized for ETERNUS AF and ETERNUS DX and can control and manage some embedded Advanced Copy functions of ETERNUS AF/DX
- The customer needs one ESM license per ETERNUS AF/DX storage system; all agents for supported file systems, applications or media agents are included in this ESM license. There is no limitation for server and capacity.
- The ESM license can be expanded by additional license keys for multiple ETERNUS AF/DX arrays respectively ETERNUS Storage Cluster.
- Fujitsu offers maintenance support packs and professional service for configuration and installation.
- The ETERNUS Snapshot Manager is based on the Commvault IntelliSnap Technology.

The embedded Advanced Copy functions offer two distinct data copy modes for ETERNUS AF/DX systems:

- Snapshot high-speed copy: SnapOPC, SnapOPC+
- Synchronous high-speed copy (Clone): EC

Snapshot high-speed copy creates a snapshot of data, while Synchronous high-speed copy provides a full copy of original data.

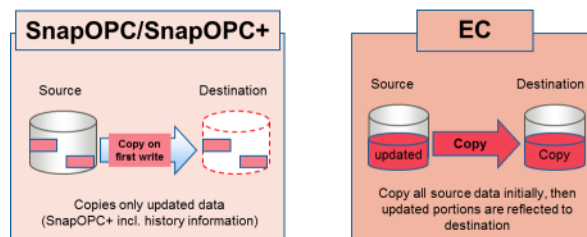


Figure 5: Supported advanced copy functions of ETERNUS AF/DX

- SnapOPC = Copy of updated data  
This Copy-on-Write function creates a copy of the data prior to the update. Only the modified portions are copied, therefore it requires less copy volume capacity compared to a full backup. SnapOPC is ideal for backup operations for systems with relatively few updates, such as file servers. The ESM software additionally provides history information.
- SnapOPC+ = Copy of updated data only as history information  
The feature SnapOPC+ is a Copy-on-Write function, like SnapOPC and copies the data only prior to it being updated on the business volume. In addition, SnapOPC+ provides generation management of the updated data done by the ETERNUS AF/DX hardware. The difference between SnapOPC+ and SnapOPC is that SnapOPC+ updates data only as history information while SnapOPC stores the data redundantly. Logging as history information SnapOPC+ needs smaller disk capacity for the copy volume. With these AdvancedCopy functions (SnapOPC, SnapOPC+) once an initial copy has been made, it is possible to perform differential copying, which copies only the modified portions.
- EC = Equivalent Copy:  
A Mirror Suspend function that always creates a synchronized copy of a business data volume on a copy volume (mirroring). The business volume and copy volume are synchronized, but can be separated at any required time (mirror suspend). Suspend/Resume functions can be used to re-establish the mirror by copying only data updated since the mirror was suspended. With additional backup software the copy volume can be backed up to a tape device while business operations continue on the business volume.

## ESM support for ETERNUS Storage Cluster

When it comes to mission-critical data that must be available around the clock, a disaster-proof configuration is an absolute must. The Fujitsu Storage ETERNUS AF and ETERNUS DX series as the [ETERNUS Storage Cluster](#) offer a number of functions that safeguard businesses against disasters without complexity or high costs:

- The failover to the surviving system or the secondary site takes place automatically during a disaster; it is fully transparent to the hosts and applications and does not need any actions by system administrators
- All application accesses are maintained in real time
- All systems in the high-availability environment can be run productively during normal standard operations.

The ETERNUS Storage Cluster also supports a manual failover process which is required in the event of planned power shutdowns, DR tests and non-disruptive upgrades.

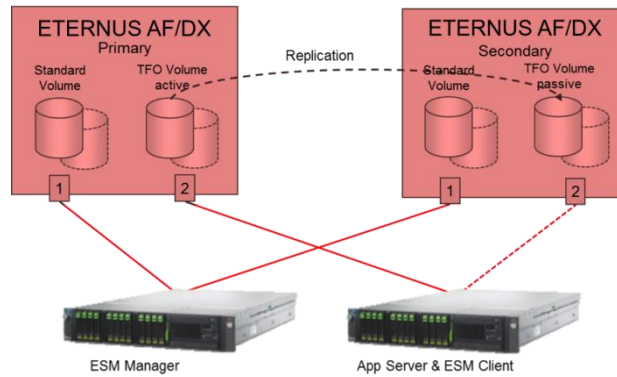


Figure 6: ESM with ETERNUS Storage Cluster

Several things are important to know:

- The customer needs two ESM licenses for ETERNUS Storage Cluster, one license per ETERNUS array
- Both cluster nodes must be configured in the ETERNUS Snapshot Manager
- Supported features
  - Local snapshots (SnapOPC, SnapOPC+)
  - Synchronous REC sessions: snapshot creation on source volume will automatically trigger snapshot on second array (replication target)



## Upgrade Option to Commvault Software

As already mentioned the ETERNUS Snapshot Manager offers an easy upgrade path to the Commvault Software.

The Commvault Software allows organizations to keep pace with massive data growth and complexity while navigating environments that are constantly changing to meet the demands of risk mitigation, mobility, cloud and big data. By leveraging a single unified platform, the software simplifies an IT organization’s ability to manage data across its lifecycle with integrated modules for Backup & Recovery, Archive, Replication, Resource Management and Search.

Commvault data platform enables the user to analyze, backup, recover, replicate, archive and search data and information across the enterprise and across any storage device – from data centers to desktops to laptops and in the cloud. The software enables policy-based automation, while integrated role-based access ensures secure management. The built-in alerting and reporting provide operational oversight across data management operations.

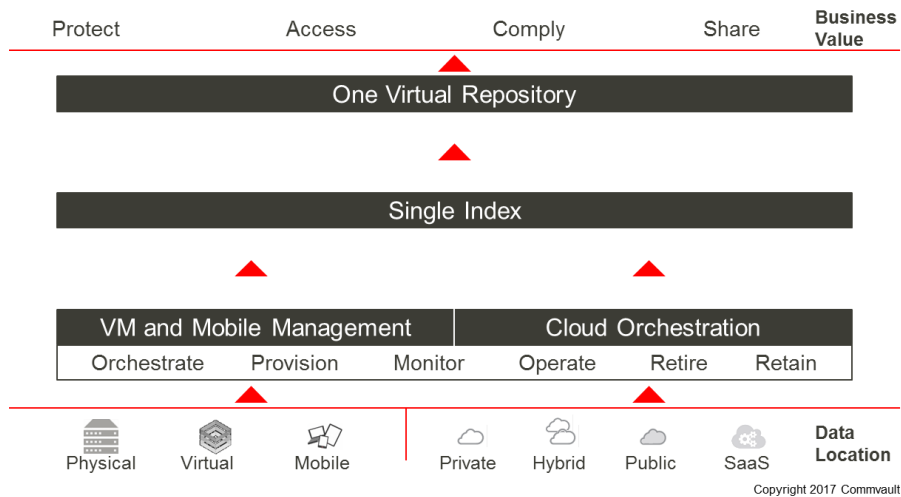


Figure 7: Commvault Software – single unified platform

### Partnership Fujitsu and Commvault

Commvault was formed in 1988 as a development group within Bell Labs, and later designated as a strategic business unit of AT&T Network Systems. In 1996, it was incorporated as an independent company. Commvault's corporate headquarter is located in Oceanport, New Jersey in the United States.



Since 1996 Commvault has experienced tremendous growth, pioneered numerous industry-shaping innovations, and established itself as a respected data and information management leader.

Several years consecutively Commvault has been positioned in the "Leaders" quadrant of Gartner Inc.'s "Magic Quadrant: Enterprise Backup/Recovery Software. For more information see: [www.commvault.com](http://www.commvault.com)

Since April 1st, 2011 FUJITSU is a global "Strategic Technology Alliance Partner" of Commvault. Based on a worldwide strategic cooperation agreement FUJITSU as an OEM provider not only delivers through its sales channels in EMEA but also implements and supports Commvault Software with his unique infrastructure including both 1st and 2nd level support.

As a result of this successful partnership, Commvault awarded FUJITSU several times as Partner of the Year, EMEA.

Fujitsu offers tailor-made solutions using the global ETERNUS storage family and the Commvault Software.

Thanks to the partnership, Fujitsu is expanding the deep integration between Commvault Software and Fujitsu Storage ETERNUS and Fujitsu Integrated System PRIMEFLEX . The strong collaboration provides Fujitsu's enterprise customers with an extended choice of enterprise-class data protection solutions.

Fujitsu's integrated backup appliance [ETERNUS CS200c](#) and the [Commvault HyperScale™ Appliance](#) offer all-in-one backup and archive solutions for businesses of all sizes.

As part of the OEM partnership, Fujitsu offers its own pre- and post-sales services as well as maintenance services for Commvault Software and for the whole infrastructure.

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