

PoINT Storage Manager



White Paper



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PoINT Storage Manager

Software to Manage Unstructured Data

Abstract

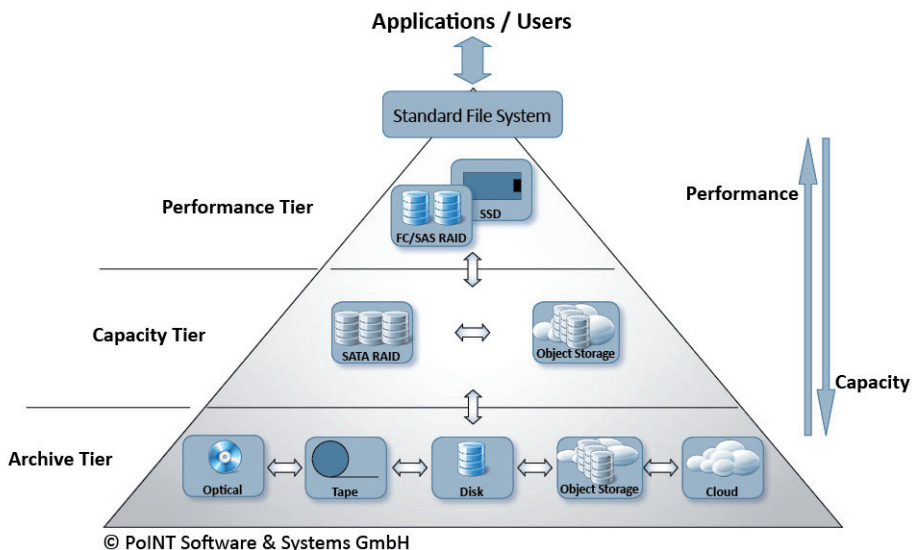
This White Paper describes the current challenge which IT departments face to maintain and manage unstructured data and how this challenge can be solved by an intelligent archiving and file tiering approach.

Today data is expanding without limits. But the majority of this data is rarely changed after initial activities and therefore becomes inactive after a short period of time. Nevertheless, typically all data is kept in expensive Tier 1 storage and needs to be covered by the backup process. This situation leads to the situation that storage costs are increasing and backup windows cannot be met.

In addition almost all organizations have to operate under regulatory compliance and have to fulfill archiving requirements.

The replacement and migration of legacy storage systems is another challenge. On one hand archiving regulations require data being reserved for multiple decades, on the other hand storage technologies become obsolete after about five years.

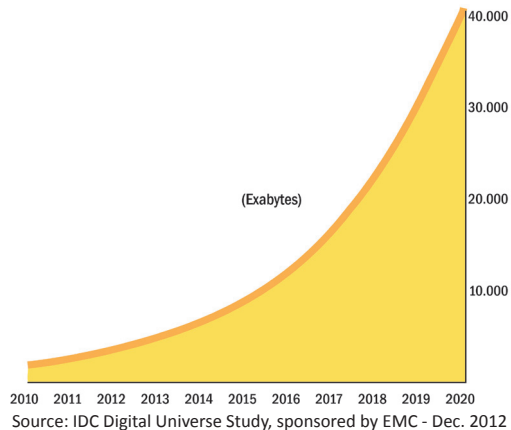
This White Paper intends to address these problems and describes how these challenges can be solved by a data and storage management solution by adding file tiering, archiving and migration to the traditional file storage infrastructure.



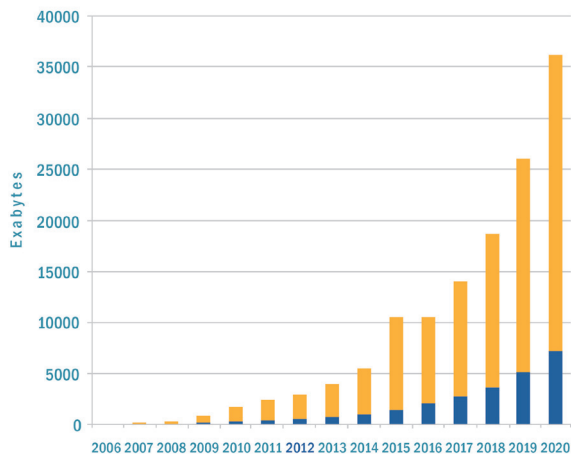
The Challenge

Growth of Unstructured Data

Companies are struggling today with an explosion of data. According to studies of IDC (“Digital Universe Study”, December 2012) the amount of data will grow by 100% about every two years to 40.000 Exabytes until 2020.



When looking in more detail what type of data is causing this data explosion it turns out that the major part (about 80%) is so called “unstructured data”. Unstructured data is growing at a greater rate than any other type of enterprise data, whereas structured data, like database content has a moderate growth. Market analysis and research (e.g. by IDC) clearly confirms this trend.



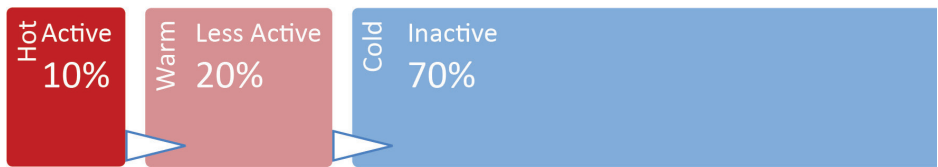
Source: IDC The Digital Universe 2010

The extreme growth of unstructured data is one of the most important challenges IT departments have to face within the next years. Simply expanding primary storage will no longer solve this problem because of economic and technical reasons.

Considering the current situation, which is driven by stagnant or even decreasing IT budgets, this leads to a growing demand for an intelligent data management concept to address this topic. Ultimately a file tiering and archiving solution is needed, as it turns out that it will be inefficient and almost impossible to store the growing amount of data only on primary storage.

Current Data Value

An analysis of unstructured data in a storage system is likely to reveal that only in the beginning of data lifetime it is accessed and updated frequently. When a data object gets older, the access frequency decreases to a level which is almost negligible, as illustrated in the following figure:

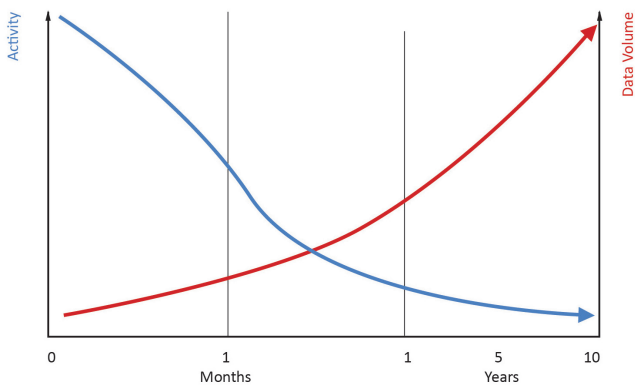


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This means that about 70% of unstructured data is inactive!

According to this analysis the status of a data object can be considered to be in one of the three stages: active (“hot”), less active (“warm”) or almost static (“cold”), ready to be archived. Although “warm” or even “cold” data is less frequently used it must be retained for a specific period of time, sometimes indefinitely and therefore the corresponding data volume is steadily growing.

The following figure shows the relation between data growth and file access activity over time:



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This leads to the requirement that data should be moved to different physical storage locations during its lifetime because it would be too expensive and would not make sense to store all data on high performance storage systems. Depending on the stage of data during its lifecycle, it needs to be relocated to the most appropriate storage device in a tiered storage architecture. This requirement can be fulfilled by data and storage management software which automatically moves data to an appropriate storage device or storage tier depending on its status and value.

Archiving and Long-Term Preservation

Besides the requirement to deal with data growth, companies also face the challenge to fulfill an increasing number of laws and regulations with regard to compliance. Compliance regulations and risk management require retention and protection of business information from premature deletion or malicious modification or destruction.

In addition to archiving because of law and regulations the process of long term preservation of data makes it necessary to maintain data over time so that it can still be found, accessed, and used in the future.

An intelligent data and storage management solution fulfills data archiving and long-term storage requirements as one of the key functions. By providing archiving capabilities such a solution reduces business risk resulting from alteration or deletion of stored data before the retention period has elapsed.

Besides regulatory requirement an increasing demand for a new concept of archiving and long-term preservation of data exist. Users and applications require random access not only to “hot” data but also to “warm” and “cold” data. File tiering and archiving software can deliver a solution by keeping archived data available and easily accessible whenever needed. Such type of long-term preservation and archiving is also called “Active Archive”.

Migration

The replacement and migration of legacy storage systems is another challenge for companies. These migrations have to be carried out without interrupting business for users and applications. In addition complex re-configurations should not be necessary as part or after the storage migration.

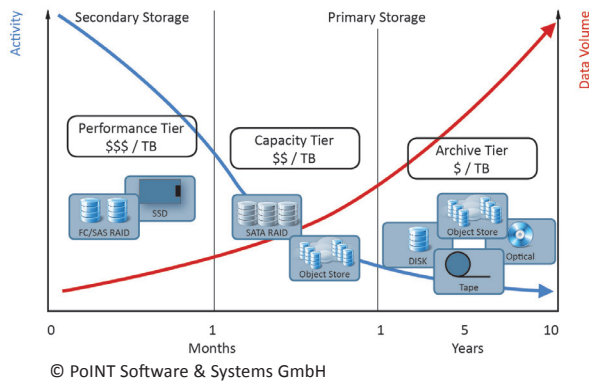
The primary reason for a storage migration is that the retention period exceeds the lifetime of the technology on which it is stored. On one hand electronically stored documents have to be secured for several decades, on the other hand storage technologies are typically obsolete after approximately five years. Furthermore support contracts for obsolete storage hardware are expensive and are getting more expensive over time. Also continuously growing data volume forces companies to replace existing storage systems with new systems of higher capacity leading to data migration from “old” to “new” storage.

A fundamental solution for this permanent migration requirement is to cover future migrations already in the overall concept of a storage infrastructure.

The Concept

Tiered Storage Architecture

Depending on the stage and value of data during its lifecycle, it needs to be relocated to the most appropriate storage device. The following figure illustrates which storage technology makes sense at what stage of data lifecycle:



The concept of storage tiering is that all available storage technologies can be combined intelligently into one structure. By considering the advantages of every technology regarding performance, capacity, cost and intrinsic features (e.g. WORM) an optimized storage infrastructure can be realized.

The following list presents a short overview of the major technologies existing today and their typical characteristics.

- **Flash / SSD (Solid State Disk)**

Flash Storage and Solid State Disks provide highest performance at a high price. In a tiered storage architecture this technology would typically be used for active data.



- **SAS/FC Disks**

RAID systems consisting of SAS or FC disks have lower performance figures compared to SSD but is still used today as primary storage. Costs of SAS/FC based systems are still relatively high.



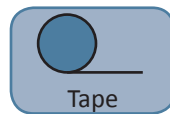
- **SATA Disks**

The performance of SATA based hard disk systems is lower than that of SAS/FC disks, however this technology has evolved as the most cost-effective drive technology over the last years.



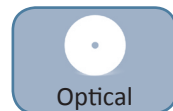
- **LTO Tape**

LTO tape technology provides the best cost per TB ratio, however this technology does not provide random access capabilities which makes it inappropriate for use as primary storage. In a tiered storage architecture this technology is well suited for replication and to some degree for archiving.



- **Blu-ray Disc (BD), Optical**

Optical, in particular Blu-ray Disc (BD) technology, fulfills best all requirements for long-term preservation. Compared to tape this technology provides random access capabilities with excellent performance figures.

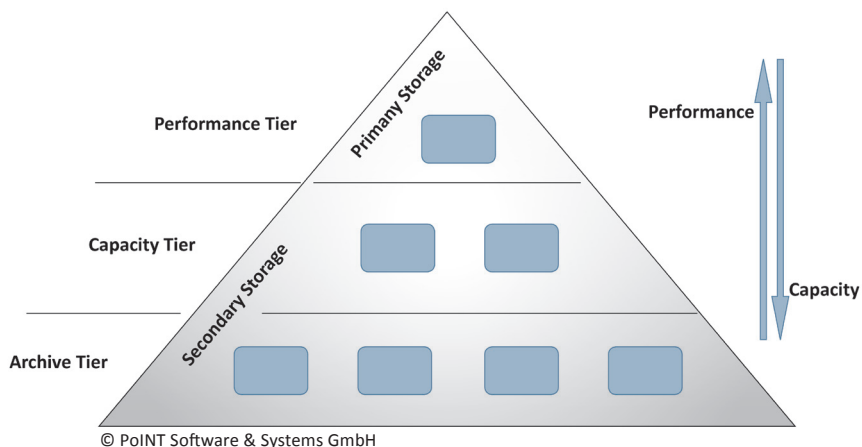


- **Cloud & Object Storage**

Object-based storage (“Object Storage”) is considered as an emerging storage technology and becomes the alternative to file and block based storage. Especially for public and private cloud infrastructures Object Storage form the fundamental base. Compared to traditional storage Object Storage excels by scalability, redundancy, its way to process metadata and simplified data protection. Therefore Object Storage is perfectly suited for inactive data and data to be archived.

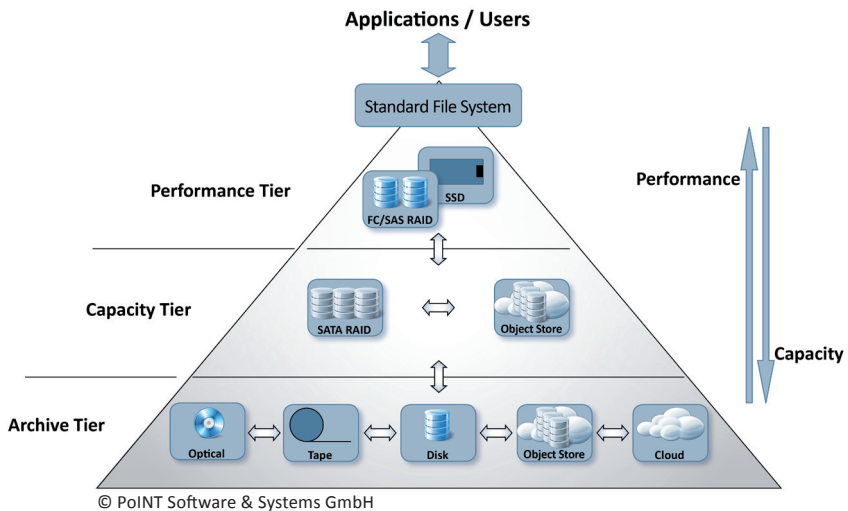


The following graphics shows a three-tiered architecture consisting of Performance, Capacity and Archive Tier:



A predefined functionality is attributed to each tier: The Performance Tier consists of high performance storage; the Capacity Tier offers high capacity always accessible; the Archive Tier is intended for long-term preservation offering additional features with respect to compliant archiving.

The following graphic illustrates usage of different storage technologies in a tiered storage model:



The topmost layer, the Performance Tier, is typically designed as primary storage and consists of high performance / highly available hard disk (e.g. FC/SAS RAID) combined with Flash/SSD. It is usually very expensive.

The Capacity Tier is a storage layer consisting of cost-optimized storage systems and offers high capacity at a lower performance (e.g. SATA RAID). Object storage is increasingly used in this storage layer due to its high scalability. This tier is typically used to off-load the Performance Tier from less active data.

The Archive Tier is the storage layer for archiving and long-term preservation, often implemented by optical or tape technology with off-line media support. Disk-based storage systems and cloud/object storage are gaining in importance for this storage layer. Data stored in this layer is typically under retention management control and can only be modified or deleted under specific conditions, in particular not before the end of the corresponding retention period has elapsed.

The tiered storage concept extends the classic HSM (Hierarchical Storage Management) already known for decades by introducing a two-dimensional storage hierarchy. By this concept data can not only be migrated to a lower layer, but also policy-based migrated and /or replicated within one and the same layer.

Tiering Methods

In the scope of a tiered storage architecture it is necessary to distinguish between “block tiering” and “file tiering”. The following table summarized the principle differences:

Block Tiering	File Tiering
Based on frequency of block access	Based on file attributes (e.g. age) and file classification
Implemented by storage subsystem (specialized storage controller)	Implemented by management software (storage vendor neutral)
Fixed migration rules (no manual tiering)	Flexible migration engines (manual and policy driven tiering)
Restricted to a specific storage system (single vendor)	Integration of different storage systems (multi-vendor)
Device administration	Software administration

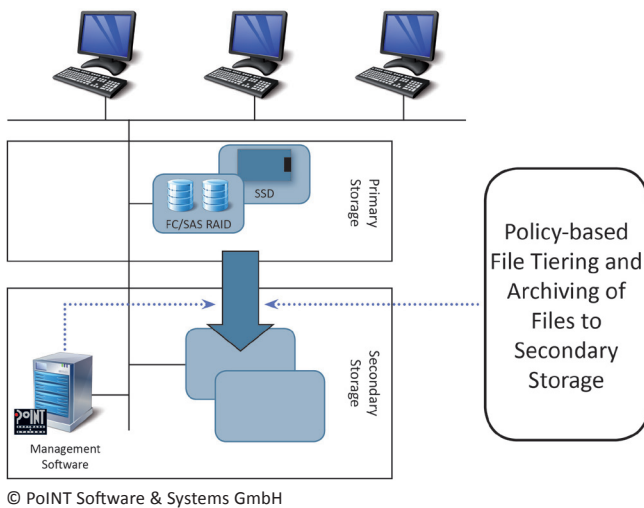
The method of block tiering can be perfectly used e.g. in primary storage subsystems using a combination of HDD and Flash. Block tiering is always offered as a proprietary solution of a specific storage system manufacturer.

File Tiering

A solution which is independent of storage technologies and manufacturers and which addresses the growth of unstructured data can only be provided by the method of automated file tiering and archiving. Only by this method all existing storage technologies (especially also Tape and Object Storage) can be covered and independence of a specific storage hardware manufacturer can be reached.

Automated file tiering and archiving as part of a tiered storage concept offer cost and administrative advantages, furthermore it is mandatory due to meet the challenges and requirements mentioned previously. Possible reasons for resistance to the introduction of a storage hierarchy have disappeared or do no longer apply. This comes from the fact that the advantages and the necessity of file tiering and archiving prevails and that this concept has been implemented homogeneously and reliably by recent software products for storage management.

The following figure illustrates the basic architecture:



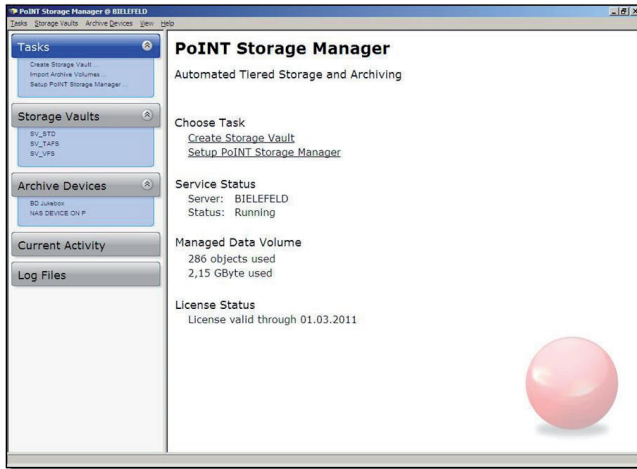
For this approach an intelligent software solution considering all above described aspects is necessary – PoINT Storage Manager is the solution.

The Solution

File Tiering and Archiving by PoINT Storage Manager

PoINT Storage Manager is a data and storage management software which implements a tiered storage architecture by policy-based file tiering and archiving covering data migration between different tiers and in one and the same tier.

PoINT Storage Manager is a Windows based software product running on a standard Windows Server (VMware supported).



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Storage Migration

An important feature of PoINT Storage Manager supports the replacement of “legacy” storage systems by transparent migration into a new storage architecture. Existing data within the storage system which has to be replaced can be migrated during normal business operation - data remains accessible even during the migration process.

The migration functions of PoINT Storage Manager do also support migration from and replacement of existing primary storage systems by “Migrate after Stubbing”. This method first builds the directory structure of the system to be replaced via stubs in the new storage system. Thereafter applications can access data from the new system while migration is carried out in background. As an obvious advantage an immediate redirection of clients and applications to the new system is available.

Following this approach no storage systems have to be configured in Capacity or Archive Tier, instead Primary Storage to be replaced and the new Primary Storage are configured in the Performance Tier.

Fast Installation and Intuitive Administration

PoINT Storage Manager can be installed within minutes leading the administrator through the configuration process by an intuitive and easy to use GUI. Configuration parameters are specified within a scope of a Storage Vault. This comprises settings for primary and secondary devices, tiering and archiving methods (see section below), policies and additional options.

Multi-Tenancy

Up to 64 separated Storage Vaults can be defined supporting very complex infrastructures with many different storage devices. The Storage Vault concept of PoINT Storage Manager allows separating data between different customers for multi-tenancy.

Conforming to Standards

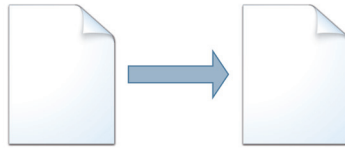
PoINT Storage Manager uses and supports standardized formats and methods (e.g. UDF, LTFS, CIFS) for storing files on secondary storage devices. No proprietary formats are used. This approach protects customer investments and does not lead into a vendor dependency.

Tiering and Archiving Methods

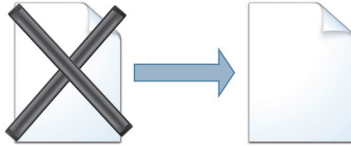
The following diagram illustrates the tiering and archiving methods supported by PoINT Storage Manager:

Primary Storage Secondary Storage

- Copying

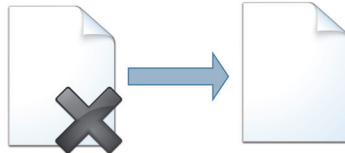


- Moving



- Stubbing

Replacement by
transparent Link



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The “Stubbing” method provides the functionality of “transparent file tiering and archiving”. For more details refer to below sections “Single Path Access” and “Transparent File Tiering”. This method requires that the corresponding primary storage system provides an interface or protocol for stubbing (see section “Supported Storage Systems”). The methods “Copying” and “Moving” are supported for all CIFS/NFS accessible primary storage systems.

Policies

Migration and archiving of files is carried out automatically by PoINT Storage Manager by means of “Policies” defined and configured by the administrator according to customer’s requirements. It is essential for the management of the multi-tiered storage architecture of PoINT Storage Manager that different policies can be specified for automated tiering (migration and archiving). Recall Policies are available to allow retrieval of frequently used data back into the Performance Tier.

Data Protection and Security

Data managed by PoINT Storage Manager can be secured and protected in manifold manner. Automated and application transparent data replication ensures that data is redundantly stored on the configured storage systems. As a consequence failure of one system cannot result in a complete data loss. Parallel usage of different storage technologies (e.g. hard disk and tape) and their specific advantages is very important for secure data storage. Especially in the context of removable media and cloud storage separated (“off-site”) storage of data is important.

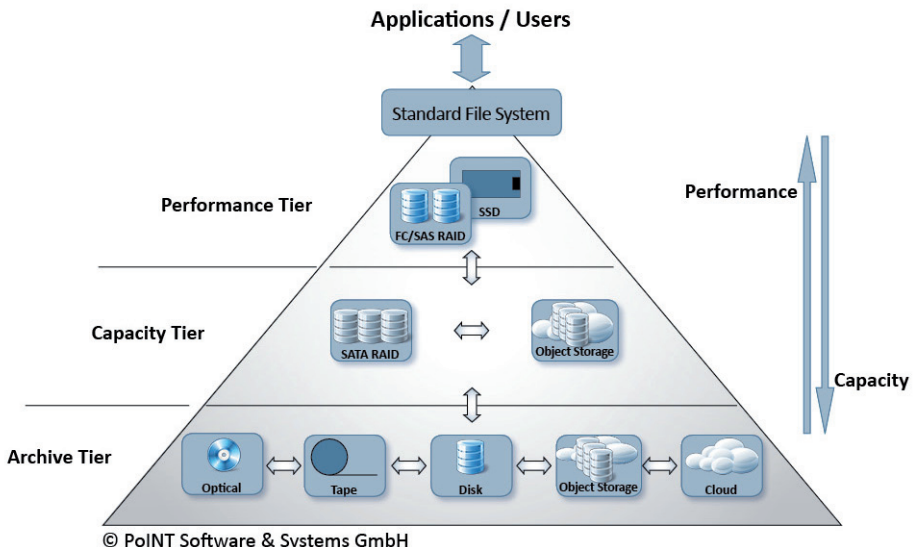
Disaster Recovery is supported as integral part of PoINT Storage Manager. A special Data Retrieval module provides for restoration if a completely new storage environment has to be set up.

Furthermore PoINT Storage Manager offers block-based encryption functionality (AES256 and CBC). Different storage configurations can be encrypted by individual “Encryption Keys” which additionally increases data security.

Besides data encryption PoINT Storage Manager also supports functions for data authentication. The implementation is based on the SHA-1 standard and enables data authentication to check for and identify possible manipulations of archived data. “Authentication Check Jobs” generate detailed protocols and reports documenting the results.

Single Path Access

One essential feature is the “Single Path Access”, which offers standard and transparent file access to the Performance Tier – independent from the current physical data storage location.

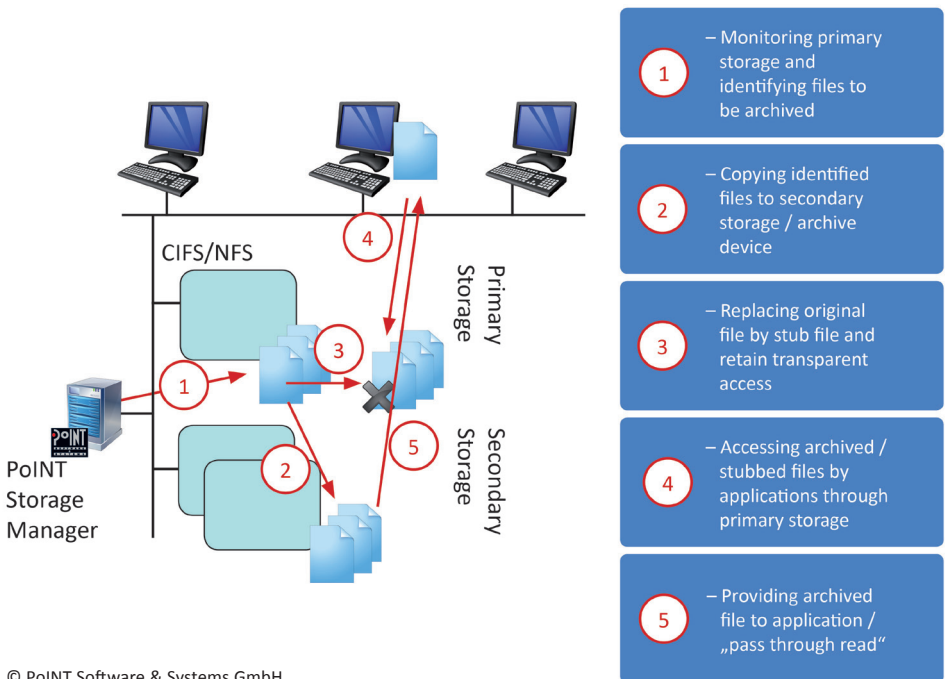


PoINT Storage Manager implements a tiered storage architecture homogeneously in an existing infrastructure. The “Single Path Access” concept assures that access to data via existing primary storage remains, thus no changes of existing applications are necessary.

Transparent File Tiering

PoINT Storage Manager implements “Single Path Access” through primary storage as part of the Performance Tier by applying the methods for transparent data migration provided by the related storage systems manufacturer. PoINT Storage Manager automatically moves data to “lower” tiers (Capacity Tier, Archive Tier) according to the policies defined by the administrator and ensures uninterrupted transparent file access to all data via primary storage.

The following figure illustrates the principal workflow:



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By this mechanism PoINT Storage Manager carries out a policy-based migration of files into the Capacity Tier and/or Archive Tier. The view of the primary storage file system does not change for users and applications, including access authorization (e.g. ACLs) and metadata. Access to migrated files is redirected automatically by the corresponding primary storage system to PoINT Storage Manager to supply the requested data from secondary storage.

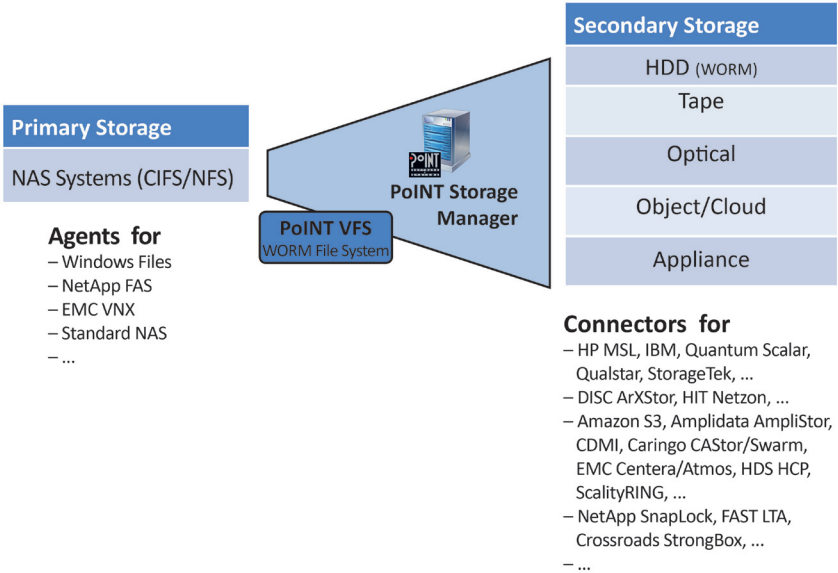
In addition to the above mentioned mechanism standard NAS systems with a CIFS/NFS interface can be integrated as primary storage in a tiered storage architecture implemented by PoINT Storage Manager. For these systems PoINT Storage Manager offers policy-based file copying (replication) into the Capacity and/or Archive Tier. Optionally the source files are deleted after they have been successfully copied.

Pass Through on Read Access

When processing read requests the “Pass Through” mechanism of PoINT Storage Manager ensures that content of migrated files is directly delivered from lower tiers to the application. Retrieved files do not have to be restored again in the Performance Tier¹. This Pass Through mechanism offers significant advantages in performance and concerning storage requirements since applications do only get the required blocks of a file instead of the complete contents.

Agents and Connectors

The following diagram illustrates how primary and secondary storage is organized by PoINT Storage Manager.



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The integration of primary storage is implemented by “Agents”, whereas secondary storage is utilized by “Connectors”. In addition PoINT Storage Manager provides a CIFS interface through PoINT VFS (see section “CIFS Access by PoINT VFS”).

¹ as usual within other data management solutions

The following storage systems are supported by PoINT Storage Manager Agents for transparent file migration:

- **Microsoft Windows NTFS/ReFS based storage**

For hard disk based systems using Windows NTFS or ReFS file system the “PoINT TAFS Agent” can be implemented for replacing moved files by “Windows Reparse Points”, which are an integral part of Windows NTFS and Windows ReFS. Thus transparent access to migrated files is for Windows NTFS/ReFS based storage systems available.

- **NetApp FAS**

PoINT Storage Manager implements file migration for NetApp FAS systems by the “PoINT NetApp FAS Agent”. Migrated files are replaced by “Stubs”, still accessible transparently by the NetApp WAFL file system taking advantage of FPolicy. PoINT Storage Manager supports NetApp ONTAP 7-Mode as well as Cluster Mode (cDOT).

- **EMC Celerra/VNX**

Transparent file migration for EMC Celerra and EMC VNX is based on EMC File-Mover API and implemented as part of PoINT Storage Manager by the “PoINT EMC FileMover Agent”. Migrated files are replaced by “Stubs” maintaining transparent file access.

The list of Agents and Connectors for storage systems is constantly extended. In addition Agents for specific applications are available under request. Please contact PoINT Software & Systems for the latest list of available Agents and Connectors.

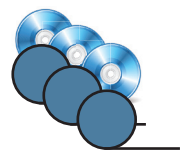
Native Tape Support with LTFS

PoINT Storage Manager provides native support for tape devices of virtually all vendors which makes additional software products or appliances for this purpose dispensable. PoINT Storage Manager supports tape devices directly via Fibre Channel, iSCSI and LAN and includes a connector for StorageTek ACSLS (Automated Cartridge System Library Software).

PoINT Storage Manager supports MTF (Microsoft Tape Format) and LTFS (Linear Tape File System) as standard tape formats. Especially LTFS ensures exchangeability of LTO tapes between different platforms.

Offline Data Management

PoINT Storage Manager offers an off-line data management system for enhanced administration of removable media such as tapes and optical discs, which are typically used with libraries. A comprehensive set of functions is available for searching objects on off-line media. As media stored “off-line” do not spend energy this method leads to additional cost savings of energy.



Native Cloud & Object Storage Support

PoINT Storage Manager integrates Cloud & Object Storage homogeneously into an existing storage infrastructure and exploits the benefits of Cloud & Object Storage use without a need for costly changes and adaptations. PoINT Storage Manager does not only combine traditional local storage technologies into a homogeneous tiered storage architecture but includes also Cloud & Object Storage. The concept of PoINT Storage Manager makes a combination of Cloud & Object Storage with alternative technologies (like tape or optical) possible, e.g. for replication purposes. The list of supported Cloud & Object Storage systems and interfaces include all major vendors. Cloud & Object Storage support has been implemented by means of software adapters (“Connectors”) which are using the corresponding Cloud & Object Storage related interfaces to connect homogeneously to Capacity and/or Archive Tier. PoINT Storage Manager offers for hybrid cloud configurations the corresponding conditions such that an external cloud storage service can be used not only as sole storage entity, but in addition to “on-site” storage systems.



CIFS Access by PoINT VFS

PoINT VFS (Virtual File System) is an integral part of PoINT Storage Manager and implements a native Windows file system. It provides standard CIFS access to the storage devices (including tape, optical, and Cloud & Object Storage) of tiered storage environment implemented by PoINT Storage Manager.

Software Development Kit

The Software Development Kit (SDK) can be used by system integrators to incorporate the functionality of PoINT Storage Manager into their applications by a suitable Application Programming Interface (API). This API provides control of policy-based file tiering and archiving as well as comprehensive query and administrative functions.

Supported Storage Systems

PoINT Storage Manager supports the following storage system types within the different tiers:

Performance Tier

- Hard-Disk- / Flash-based DAS/SAN with Windows NTFS/ReFS
e.g. HP EVA, Windows based NAS
- Hard-Disk-/Flash-based NAS with “stubbing functionality”
e.g. NetApp FAS, EMC Celerra / VNX
- Storage systems with file system access
e.g. NAS systems with CIFS/NFS Share

Capacity Tier

- Storage systems with file system access
e.g. Hard-Disk based NAS with CIFS/NFS Share
- Object Storage (via NAS gateways)
e.g. Amazon S3, Amplidata Himalaya, Caringo CASTor/Swarm, EMC Atmos, EMC Centera, Hitachi HCP, NetApp StorageGRID, NetApp StorageGRID Web-scale, Scality RING

Archive Tier

- NAS with file system access and special WORM functionality
e.g. EMC Data Domain, NetApp FAS incl. SnapLockTM, FAST LTA, PoINT Jukebox Manager based NAS Jukeboxes
- Cloud and Object Storage
e.g. Amazon S3, Amplidata Himalaya, Caringo CASTor / Swarm, EMC Atmos, EMC Centera, Hitachi HCP, NetApp StorageGRID, NetApp StorageGRID Web-scale, Scality RING
- Tape systems (Single Drives, Libraries)
e.g. HP MSL Series, Spectra Logic T-Series, Quantum Scalar Series, Sun StorageTek ACSLS based libraries
- Optical systems (Single Drives, Jukeboxes, Autoloaders and Libraries)
e.g. Jukeboxes from DISC, HIT; Disc production systems from ADR, All Pro Solutions, LSK, Rimage, TEAC.

The contents of files migrated from primary storage are stored in secondary storage configured in the Capacity Tier². Optionally files and directories keep their original name and structure. Read/write capabilities as from primary storage's view remains consistent for files migrated to lower tiers.

Storage systems configured by PoINT Storage Manager in Archive Tier are used for long-term preservation. Files stored in this layer are typically protected against modifications (WORM). Alternately, these files may be managed in versions ("versioning") to maintain all versions of an archived file in the Archive Tier. For optimization reasons files to be archived are packed per archive job into a container ("Archive Volume") and stored in Archive Tier. Depending on the storage device configured in Archive Tier data to be archived can also be stored in the native file format.

² Valid for storage systems with file system access

Conclusion

PoINT Storage Manager Version 5.1 utilizes primary storage more effectively and reduces related needs for additional capacity by identifying the “Performance Tier” and off-loading / archiving inactive or “cold” data to lower-cost “Capacity and Archive Tiers” while maintaining transparent access to all data via the “Performance Tier” as primary storage. As a side effect data backup and recovery operations can be completed more rapidly when primary storage holds less data.

By this approach PoINT Storage Manager not only reduces acquisition costs for new storage hardware but also optimizes the backup process. Migrated data does not have to be protected once again – it is already stored redundantly in secondary storage building Capacity and/or Archive Tier – both, storage capacity (e.g. less number of tapes) and required time for backup are reduced.

In addition, PoINT Storage Manager can help to reduce business risks by providing a long-term storage and a storage repository (“Archive Tier”) in which stored information cannot be altered nor deleted until the compliance retention period has elapsed.

In a tiered storage architecture managed by PoINT Storage Manager the entire system may consist of a combination of different storage technologies, able to make use of technology-specific advantages e.g.

- Performance Tier with SAS RAID and/or Flash;
- Capacity Tier with SATA RAID or (private) Cloud & Object Storage (via NAS gateways);
- Archive Tier with LTO tape or Cloud & Object Storage.

The tiered storage concept of PoINT Storage Manager provides the following advantages and benefits:

- efficient usage of expensive primary storage by migration of inactive data to less expensive secondary storage (Capacity and Archive Tier);
- permanent availability of active data through primary storage in the Performance Tier;
- fast installation and ease of use in configuration and administration;
- reduced management effort by high degree of automation (“policy-based management”);
- continuous operation of applications and “transparent” data migrations;
- cost savings by reduced backup data volume;
- fulfillment of long-term storage and compliance requirements by the Archive Tier;
- continuous operation during replacement of storage systems by background migration;
- cost savings since tape, optical, object and cloud systems are supported natively which makes related third party software products dispensable.



Visions Made in Germany.

We are specialized in the development of software solutions for storage and management of data using all available mass storage technologies like cloud and object storage, hard disk, magnetic tape and optical. Close collaboration with leading hardware manufacturers enables an early support of innovative storage technologies. Besides complete solutions PoINT also offers its know-how as Toolkits, which can be easily integrated in other applications by the programming interface. Furthermore we project entire storage solutions and provide consultancy with our long-term and versatile experience.

PoINT products are distributed in more than 25 countries world-wide and have been installed successfully in more than two million installations. Our customers range from end users expecting a compact and secure solution to large corporations, which comply with our solutions their complex demands by providing the necessary reliability and perfection.

Our product portfolio:

- PoINT Storage Manager - Enterprise Edition
- PoINT Storage Manager - Archive Edition
- PoINT Storage Manager - Migration Edition
- PoINT Jukebox Manager
- PoINT Publisher NG



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