DELLTechnologies

DISK LIBRARY FOR MAINFRAME (DLm)

Cloud Storage for Data Protection and Long-Term Retention

ABSTRACT

Dell Disk Library for mainframe (DLm) is an industry-leading virtual tape library for IBM zSystems and Unisys mainframes. DLm supports private cloud storage using Dell ECS as an option for storing virtual tape volumes for Long-Term Retention. This white paper explains the options for connecting DLm as of release 5.5 to the cloud and the customer use cases satisfied by using cloud storage.

July 2022

Revisions

Date	Description
July 2019	Initial release for DLm version 5.1
February 2020	Updated to reflect the DD branding change from Data Domain to PowerProtect and newly supported models 6900, 9400, 9900 as appropriate
October 2020	Updated to release 5.3 for the model 8500, adding Amazon S3 & AWS GovCloud support
July 2021	Updated to release 5.4 for the model 8500, adding PowerScale and Isilon storage options, S3 interface between the VTEs and ECS storage and usability enhancements.
July 2022	Rebranded Dell and updated to release 5.5 DLm8500 which doubles the amount of PowerProtect DD or legacy Data Domain storage.

Acknowledgements

TABLE OF CONTENTS

Executive Summary

Disk Library for mainframe (DLm) is an industry-leading virtual tape library (VTL) for IBM and Unisys mainframe computers. Unlike other leading VTLs for mainframes, DLm is a "disk-only" solution storing tape volume (VOLSER) images on disk storage attached to the DLm virtual tape emulation. DLm does not use or provide support for traditional robotic tape libraries and does not store VOLSERs on physical cartridge tape. DLm's unique advantage is in providing deduplication and / or fast access storage as well as a higher availability architecture vs. other virtual tape offerings.

Beginning with DLm release 4.5, Disk Library for mainframe offers direct attachment to cloud storage. The customer data sent to the cloud is needed for regulatory reasons and considered eligible for DLm's Long-Term Retention process. Beginning with DLm release 5.3, Disk Library for mainframe adds Amazon S3 support to the DLm model 8500, enabling AWS cloud services, including AWS GovCloud, popular with US Federal Systems customers.

This white paper overviews the cloud capabilities and services DLm offers and discusses the use cases that cloud storage can address. It also offers decision makers insight into how companies can use DLm with private (Dell ECS) and public (AWS) cloud storage to provide a cost-effective storage strategy for protecting their corporate mainframe data by leveraging virtual tape with the cloud.

Audience

This white paper is intended for mainframe storage administrators, IT architects and decision makers.

Disk Library for mainframe Overview

Disk Library for mainframe (DLm) is a virtual tape library for IBM and Unisys mainframes. DLm has been offered by Dell since 2008.

Beginning with Release 5.0, DLm for cloud attachment was restricted to a single model, the DLm8500, which starts as a single rack mount system with four 16 Gb FICON interfaces capable of emulating one to 512 virtual tape drives. For large enterprises, DLm can scale up to 24 16Gb FICON interfaces and multiple racks of High Availability storage.

As shown in Figure 1, DLm8500 supports PowerMax, PowerProtect DD, PowerScale, Isilon as well as legacy Data Domain and/or VNX legacy storage systems for use as primary virtual library storage space. VMAX is another primary storage option. Mainframes can scale their total virtual tape library capacity from a few TBs to many PBs of storage, depending on the backend storage array(s) selected. For example, using a PowerProtect DD9800, DLm can scale total usable capacity from 48 TB to over 2 PB, BEFORE deduplication, which can typically be 10:1. Combine that usable capacity with data compression rates of better than 3 to 1, and a single DLm solution can satisfy a very wide variety of demands.

Figure 1 Typical DLm8500 Deployment

Primary Site

Secondary Site

DLm8500

DLm8500

DLm8500

PowerMax 8000

PowerProtect

PowerProtect
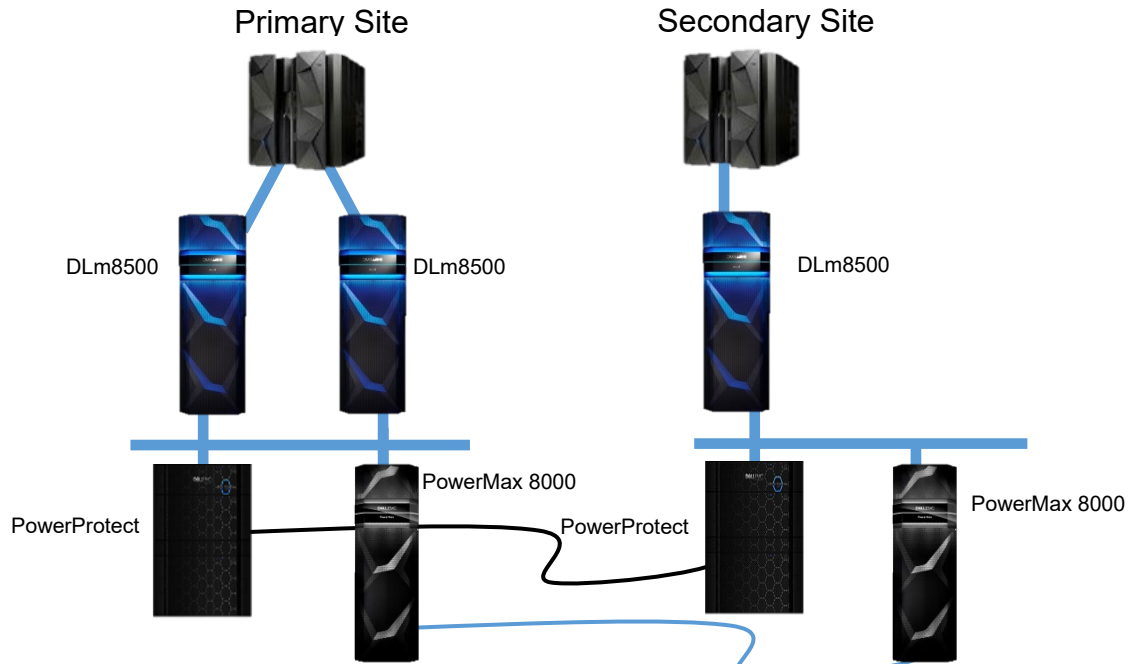
PowerMax 8000

Up to two PowerScale, Isilon, or up to four
PowerProtect DD, Data Domain per DLm8500, or
up to two PowerMax 2500, 8000, 8500, VNX,

DLm8500 Architecture

As shown below in Figure 2, the DLm8500 architecture consists of three distinct components, Virtual Tape Engines (VTEs) providing the mainframe connectivity and tape emulation, one or more file services providing shared access to storage for multiple VTEs, and the physical storage itself.

Figure 2. DLm8500 Architecture
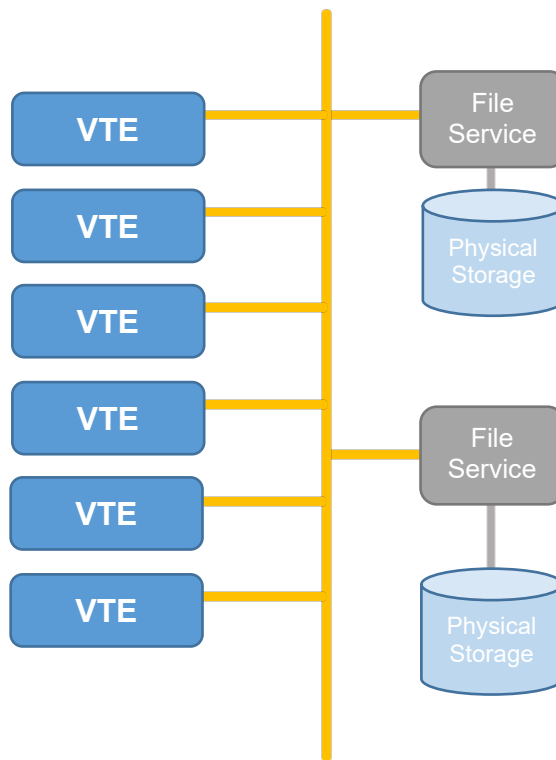
Each VTE provides 4 16Gb FICON interfaces and emulates up to 512 tape drives.   Multiple file service engines provide shared access to the storage so that a tape volume (VOLSER) written by a drive in one VTE can be later accessed by a drive in a different VTE.

A DLm tape library is made up of multiple shared filesystems exported from one or more file services. A small DLm could be a single filesystem managed by a single file service.   A large DLm library could be made up of potentially hundreds of filesystems being managed by multiple file service engines.

Filesystems can be organized into storage classes within the library allowing tape volumes to be separated into groups based on storage class.   For example, an application's tapes (such as payroll) could be separated into their own filesystems by writing those tapes to a different storage class.   A common use for storage classes is to separate production tapes requiring data protection from work tapes requiring no protection. Filesystems in a production storage class would be replicated to a remote DR site, while filesystems in a work class would not be replicated.   Individual filesystems can hold thousands of individual tape volumes.

Cloud Storage Overview

Beginning with DLm release 4.5, DLm offers support for cloud storage to be used in conjunction with storage options (PowerMax, PowerProtect, PowerScale / Isilon, legacy Data Domain, legacy VNX, PowerMax) within the DLm itself (RPQ Only).

Cloud storage consists of Dell ECS directly connected to DLm or to Amazon AWS via the Amazon S3 protocol. As shown in Figure 2, DLm exports multiple file systems onto the internal DLm network to be used by ECS or AWS.

Like any other DLm file system, Cloud file systems are assigned to a storage class within the DLm, allowing individual tape volumes to be directed to the Cloud based on storage class / use case.

DLm release 4.5 also introduced a new Long-Term Retention (LTR) attribute that can be assigned to any filesystem in a DLm virtual library. Filesystems designated as "LTR" are managed differently by the virtual tape emulation software, as will be explained later in this white paper.
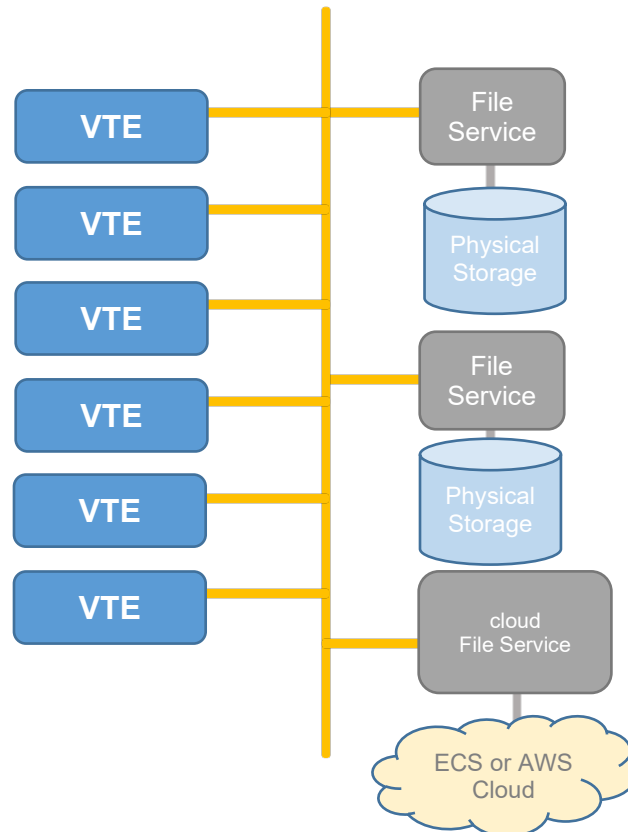
Figure 3. An Additional File Service within DLm8500 for Cloud

Each tape volume (VOLSER) written to a DLm from the mainframe is stored as an individual file in one of the many filesystems making up the virtual tape library.

Policy Management

DLm release 4.5 introduces a VTE-based Policy Manager. Customers have the opportunity to create their policies to provide DLm criteria to move data from one Tier of storage to another. Then the Policy Manager runs periodically within one (or more) of the DLm VTEs identifying VOLSERs (files) to be moved from one storage class to another.

As shown in Figure 5, the Policy Manager allows a DLm library to be set up using two tiers of storage.   In such a configuration tape volumes (VOLSERs) would normally be written, read, and modified in tier one storage. Once an individual VOLSER has become inactive (based on the customer's defined policy in DLm), the Policy Manager will identify it as inactive based on the number of days since it was last mounted and will automatically move the VOLSER from tier one to tier two storage (the policies used to move tapes are configured by the customer).

Once a VOLSER has been placed on tier two storage it will still be available for access and modification in response to a named mount from the application.

Setting the Long-Term Retention (LTR) attribute on a tier two filesystem will prevent new tape volumes from being directly allocated to the filesystem and will prevent tier two LTR filesystems from being unnecessarily searched for VOLSERs in response to a named mount. LTR filesystems will only be searched for a VOLSER when the VOLSER cannot be found in any of the filesystems not designated as LTR.
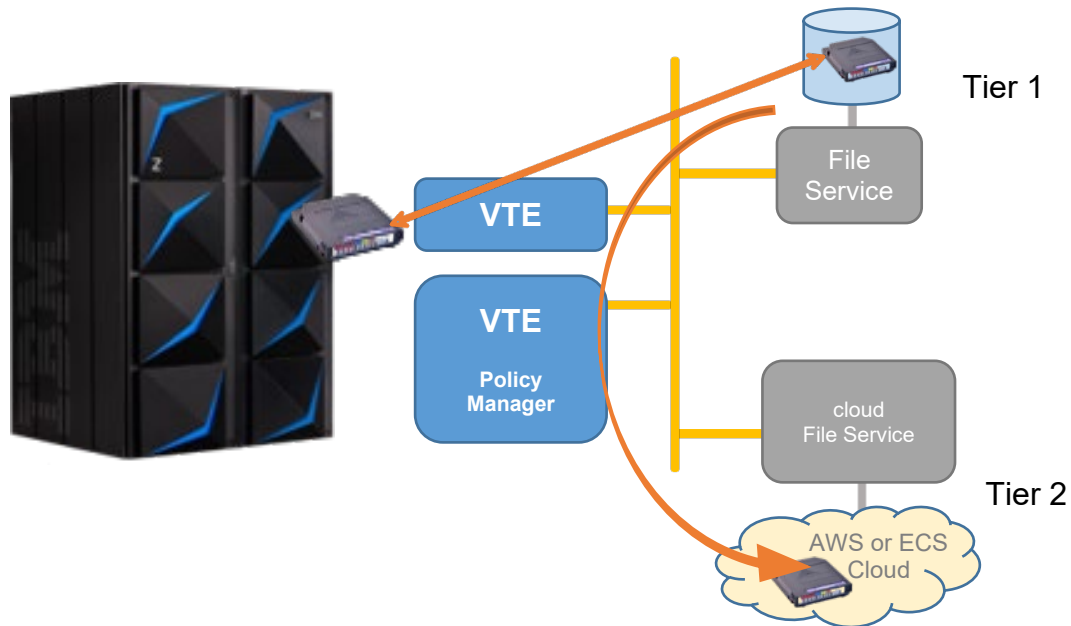

Figure 4. DLm's Policy Manager Controls Two Tiers of Storage

Beginning with release 5.1, DLm offers several additional long-term retention operational benefits to using ECS over the prior release:

a. Allow configuring '0' days in policy "move after" field.
b. Changed maximum number of "move after" days from 730 (2 years) to 19999 (47 years).
c. Migration policy changes can now be reconfigured non-disruptively (no Virtuent restart required).
d. Added MIGRATE FAILURES LIST and MIGRATE FAILURES CLEAR to examine and clear list of previously failed migrations, so that they can be retried without restarting Virtuent (virtual tape engine firmware).
e. Significant performance improvement of the post-migration file-validation process.
f. Single, simple, "restore" command to restore tape volumes from ECS

Cloud Storage for Long-Term Retention of Tape Data

All mainframe customers have some data that must be retained for very long periods of time, typically five to seven years. Some companies using mainframes are bound legally to store data indefinitely; the term for this is "legal hold." Historically, physical tape was used for long term retention (LTR). However, as cloud storage becomes less expensive, along with the advantage of being near-line accessible, using DLm and cloud storage to satisfy LTR requirements becomes an attractive solution

The LTR use case is characterized by:

- Predominately inactive tape volumes (volumes that are infrequently mounted and/or used).
- The rate at which data is moved from primary storage to cloud storage does not demand high transfer rates.
- Possibly high and ever-expanding capacity requirements.
- The data should be accessible at any time via the mainframe, albeit with relaxed response times.

Finally, for tape volumes requiring legal hold, operations staff can provide a list of VOLSERs to the Policy Manager and these tapes will be automatically moved to cloud storage for long-term retention.

Example Configurations

Assume your maximum ingest rate is ~300 MB/sec. and your total uncompressed storage requirements are less than 100 TBs.   Disk Library for mainframe offers several alternatives to satisfy these requirements:

1. One or two DLm8500s with PowerProtect DD storage or legacy VNX storage (if existing from an older DLm) OR
2. A DLm8500 with one or two Virtual Tape Engines with PowerMax storage.

All three of these alternatives will satisfy your requirements. However, the data protection for these solutions vary.

If you decide to use PowerMax, PowerProtect DD, PowerScale / Isilon, legacy Data Domain, legacy VNX, along with cloud storage, then you will need to provide your own data protection for this solution. DLm data protection with these storage alternatives typically involves replication of the storage to a remote location away from your primary data center.   You will need to provide replication bandwidth and manage data replication to insure your DLm is adequately protected.

Alternatively, you can configure the solution with ECS providing the data protection. DLm data compression can reduce your 100TB storage requirement typically by a factor of 3-to-1 allowing your entire DLm repository to be storage in approximately ½ the physical space.

Summary

DLm provides a tape-on-disk solution where tape volume images are stored on disk rather than physical cartridge tape. Disk Library for mainframe (DLm) is a field-proven virtual tape library for IBM and/or Unisys mainframes.

A recent addition to the Dell mainframe solutions portfolio (R5.4) added the option of connecting to ECS via the S3 protocol. Release 5.3 enabled Amazon AWS connectivity using the Amazon S3 protocol as well as support for IBM-compatible Transparent Cloud Tiering. In either case, DLm acts as a gateway allowing files written to a shared filesystem to be stored to the cloud.

Using DLm Virtual Tape Engines provides the ability for mainframe applications to easily store data to the cloud by simply writing a tape volume to DLm. No software or operational changes need to be made to the existing tape storage infrastructure other than defining the retention policy for a tape volume.