PowerVault ME5 Freya EKT

03/27/2025

DELL Technologies

Rina Binxhiu

Agenda

Introduction

ME5 to Freya Differences

Performance

New Features

- IDFU – Intelligent Drive Firmware Update
- KMIP
- Power Vault Manager Interface

Demo

DELL Technologies

Ali Elwakhi

ME5 MLK – Freya

- Freya is the ME5 Mid-Life kicker (MLK) targeted at the entry level SAN/DAS space where the ME5 Series currently resides. It comes with all-inclusive software, incredible performance, and the same management GUI as the ME5 has today. Aligned with PowerEdge servers, it supports the same connectivity as before (32Gb FC, 25Gb iSCSI SFP+/SFP28, 10 Gb iSCSI BaseT, 12Gb SAS). It offers Enterprise-Class Software Features such as Intelligent Drive FW Update and KMIP/MAS.

Current PowerVault ME5/Freya technical overview

		ME5212[1]	ME5224[1]	ME5284	EBOD Expansion Enclosures[2] ME512	EBOD Expansion Enclosures[2] ME524	EBOD Expansion Enclosures[2] ME584
							
Starting Configurations:		2U-12 drives	2U-24 drives	5U-84 drives	2U-12 drives	2U-24 drives	5U-84 drives
Max Raw Capacity	**System**	8PB	8PB	8PB[3]	9 x 2U enclosures behind ME5012, ME5024 3 x 5U enclosures behind ME5012, ME5024, ME5084		
	22TB HDD / 7.68TB SSD	5.80PB	5.72PB	7.39PB[4]			
Min/Max Drives		2/264	2/276	28/336[3]			
Controllers		Single & Dual	Single & Dual	Dual			
Controller Memory		16GB per controller					
Media Mix		ME5012: 3.5” HDD; ME5024: 2.5” SSD; ME5084: 2.5”/3.5” HDD/SSD - (FIPS,SED)					
Protocols		16/32Gb FC, 10Gb iSCSI BaseT, 10/25Gb iSCSI Optical, 12Gb SAS			12Gb SAS Backend		
Operational Modes		Virtual (all data services) & Linear (performance-based)					
Performance		640K IOPs @ 100% Sequential Reads, 16K block size, R5, Virtual =>750K IOPs					
Throughput		12GB/s Read & 10GB/s Write =>14GB/s Read, 12GB/s Write					
HW Availability		5-9’s (Dual controller models only)					

1 Dual controller ME5212 and ME5224 models | 2 Expansion units that connect only to RAID Controller RBODs | 3 ME5 firmware is designed to support up to 8PB (4PB per controller) as higher drive capacities become available & ME4 Virtual = 2PB (so 4X) = 8PB & ME4 Linear = 4PB (so 2X) = 8PB | 4 Up to 8.0PB with 22TB HDDs or 336 drives, whichever occurs first

*No JBOD support for ME400 series

ME5 to Freya Differences

ME5 vs. Freya Controllers Hardware Features

Feature	ME5 Shipping Controllers	ME5 Freya Controllers
Performance	10GB/s Write Throughput , 640K Read IOpS	14GB/s Read – 12 GB/s Write Throughput, 750K IOPs (Processor speed change from 2.9 GHz to 3.2 GHz)
SC Memory	HEW-D with 8GByte Down on Board	HEW-D with 8GByte Down on Board (Design can support 16GByte)
Super Capacitors	25F Cells Down on Board	34F Cells Down on Board (36% more energy)
Host Interface	4-Port FC 32G (non-HPE customers) 4-Port iSCSI 25G and 10GbaseT 4-Port SAS 12G (SAS 3416)	Same FC and initial 25G iSCSI 4-Port SAS 12G (Aero SAS3816)
CPLD	MachX03, 6900 LUT, BGA400	MachX03D, 9400LUT, BGA484 (advanced security features, root of trust)
Daughterboard	None	Tick FPGA and/or open Titan (advanced security features, root of trust)
SAS Initiator	Broadcom Tomcat (SAS3406)	Broadcom Aero(SAS3816)
SAS Expander	MicroChip Belmont (PM8054) Same expander used on Pimico IOM	MicroChip Augusta (PM811) 42-port allows for local SAS wider port option

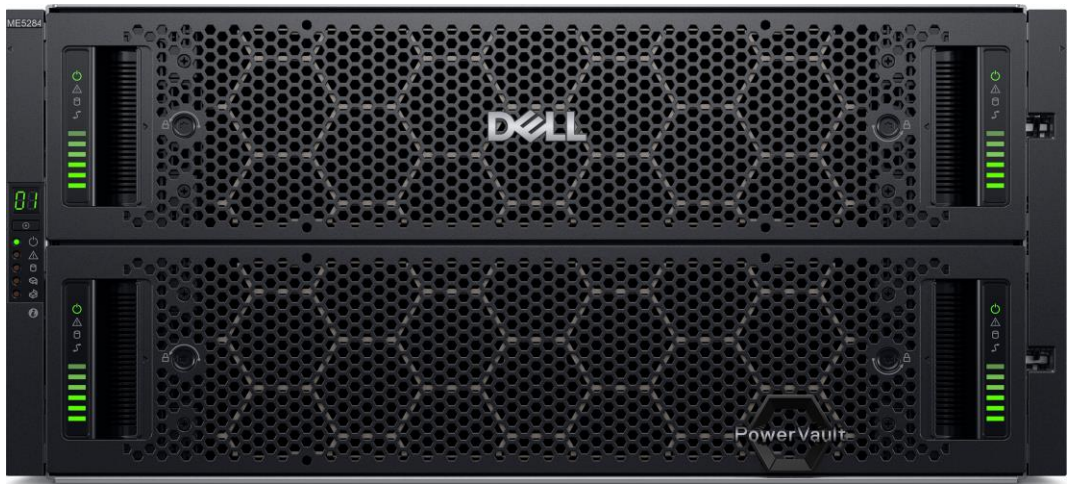
Freya Key New Requirements

- New Controllers – Continuity of Supply
- KMIP with MAS
- Intelligent drive firmware update
- Increase in performance –IOP’s and BW
- ESE Updates – Latest Version of ESE

Freya Bezels

ME52xx DELL

ME5284 DELL



ME5 vs ME5 MLK Features Comparison

		PowerVault ME5	PowerVault ME5 MLK
CPU		Intel Xeon	No change
IOPS		640K (100% Sequential Read, 16K block) [1]	**~750K**
Read / Write Throughput		12GB/s / 10GB/s	**14GB/s / 12GB/s**
Enclosure / Expansion		2U12, 2U24, 5U84 (ME412/424/484); 12Gb SAS backend	No change
Async Replication between Arrays		ME5 to/from ME5, ME5 to/from ME4	**ME5 MLK to/from ME5 MLK, ME5 MLK to/from ME5**
Interfaces: 4 ports per controller	Fibre Channel	16/32Gb	No change
	iSCSI (SFP)	10/25Gb	No change
	iSCSI (10GbaseT)	10Gb	No change
	SAS	12Gb	No change
Memory per Controller		16GB	No change
Max Virtual Pool Size (Total Usable Capacity)		4 PB per controller (8 PB total)	No change
Max Volume size		128TB	No change
Standard Density		2U12, 2U24	No change
High Density / Max Drives		5U84 / 336	No change
Capacity		8PB	No change
User Interface		Updated GUI – capacity and activity monitoring	No change
Embedded Support Assist		ESE with parity of Phone Home	No change
Key Management		At the (FIPS) drive level	**KMIP**
Power Supply		AC and DC	No change
New features			• **Intelligent Firmware updates** • **Data-in-Place upgrades (ME5 to ME5 MLK)**
Investigations			• Potential for Dell implementation of MAS (MC Auxiliary Services) plug-in framework • Any new Security requirements/enhancements • Additional Dell ecosystem support/integration

Seagate Freya Performance Run Results

IO Profile	Previous Indium Numbers	IOP's (IN310)	Avg Latency (ms) IN310	Max Latency(ms) IN310
4K Random Read	700293	813521 (16.6%)	0.31	13.39
4K 70/30 Random Read/Write	386256	458096(18.59%)	1.37	19.22
256K Sequential Read	14035	14231(1.39%)	0.66	198
256K Sequential Write	10839	11127(2.65%)	3.78	48.57

Chasis Configuration	Total Volumes	Number of Ports	Host Server	Disk Groups	Que Depth
2U24x1 960GB Seagate SSD's (Random reads and 70:30)	5 volumes per Disk group of each size 50GB	3 per Controller	Dell 840	2xR10 each of 12 Drives	32
5u81x1 18TB Seagate HDDs (Sequential Reads)	2 volumes per Disk group of each size of 50GB	3 per Controller	Dell 840	6xR5 each of 14 drives	3
5u84x1 18TB Seagate HDD's (Sequential Writes)	2 volumes per Disk group of each size of 50GB	3 per Controller	Dell 840	9xR5 each of 9 drives	9

Q&A

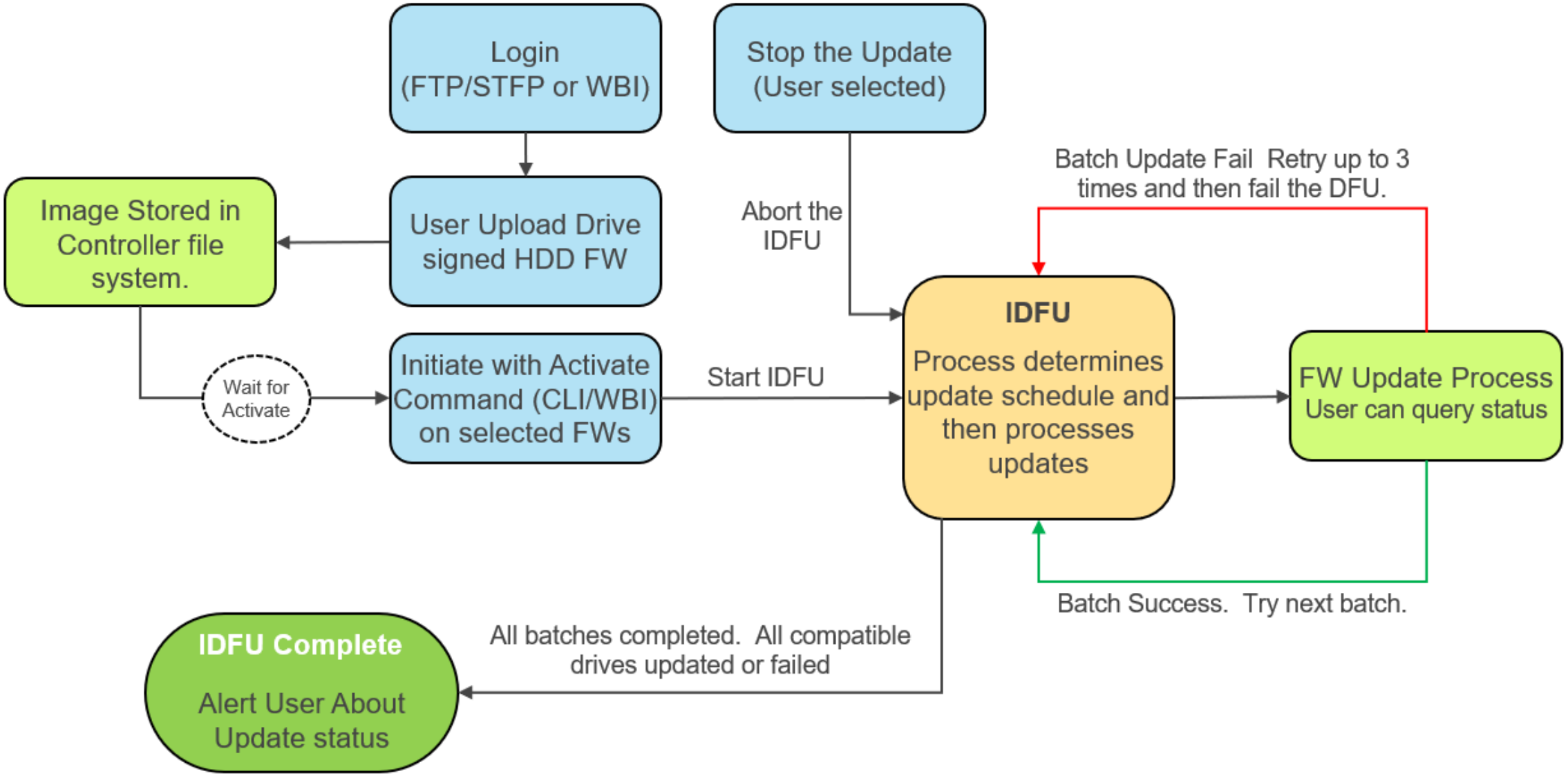
Douglas Yates

Intelligent Drive FW Update

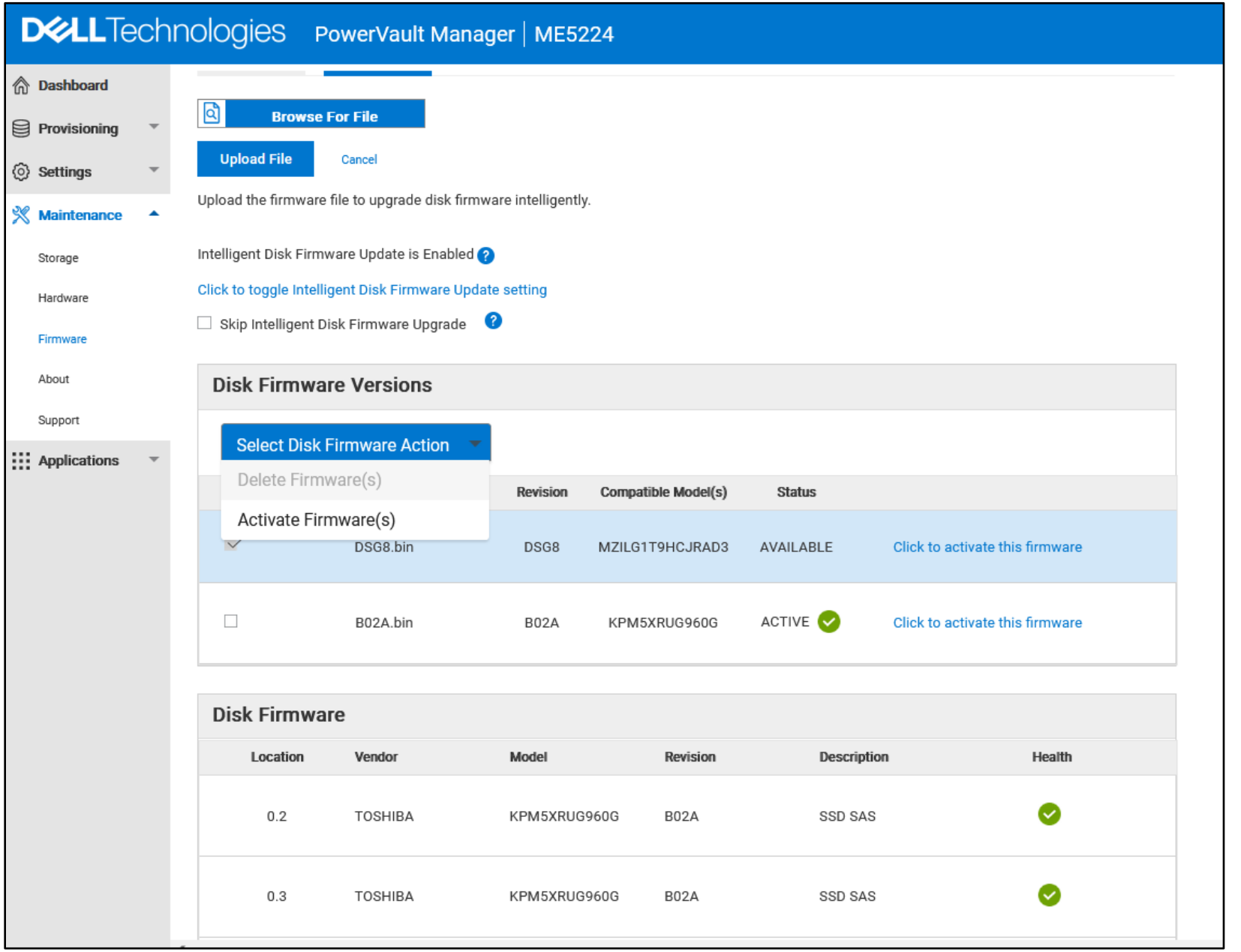
IDFU – Intelligent Drive Firmware Update

- Enables the user to upload a signed encrypted drive FW bundle file (.sfw) to the enclosure controller for activation and update of compatible drives
  - During upload, the package is validated and matches drive models to a new correct FW binary if installed revision is different than the package revision.
  - The system displays supported drives and available updates based on listed drive model numbers and FW revisions built into in the package. Only supported drives and needed dri
  - For any available updates listed, the user can select activation of the new FW image(s) on a per drive FW basis.
    - Up to 5 drive FW families can be selected at a time.
    - All drive models that are supported by a given FW, as defined by the package, will be included for update.
- The IDFU process will then schedule the drive FW updates based on the Enclosure usage conditions and number of drives requiring an operation
  - The engine will determine which drives and the number of drives to concurrently update to minimize disruption. Updates will automatically be handled in batches. Currently, 6 drives
  - The process will display progress and alert the user when all updates are complete.
- IDFU process is available through the WBI and the CLI
  - GUI and CLI additions to support new IDFU features
- Legacy Drive FW update is still available for updating specific drives if needed.
  - IDFU or Legacy update is selectable in enclosure settings

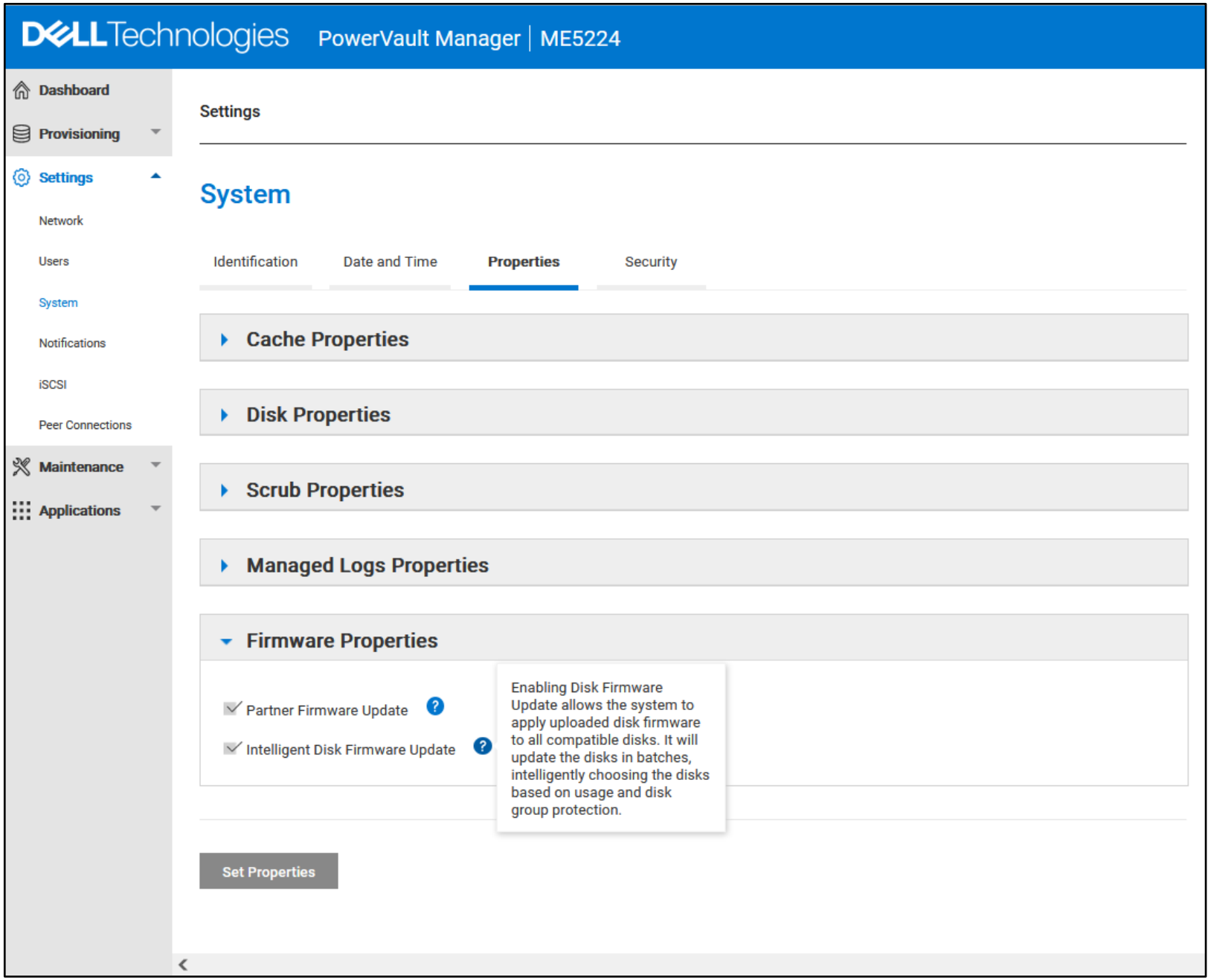
Process Flow



WBI – New Drive FW Activation



WBI – Enable/Disable IDFU



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CLI – New/Updated Commands for IDFU

- `show firmware-bundles disk`
  - Displays the active firmware files and available firmware files stored in the system's controller modules.
- `activate disk-firmware name [file]`
  - Initiates the IDFU batch update process The update then determines which drives need to be updated with the selected image(s.)
- `show disks firmware`
  - Lists the drives including FW revisions
- `set advanced-settings disk-firmware-update [on/off]`
  - Enable or disable the IDFU process. Disabled allows legacy disk FW operation.
- `show advanced-settings`
  - Shows the settings for advanced system-configuration parameters, including IDFU enabled/disabled.
- `abort disk-firmware-update`
  - Aborts the disk firmware update process. Note: The disks in the current operating batch will continue updating, subsequent batches will be aborted.
- `delete disk-firmware [name]`
  - Deletes the uploaded disk firmware image file(s) from the controller. Note: Disable IDFU process prior to issuing.

Disk FW Related Alerts

- 280 - Disk firmware update initiated (Informational)
  - Disk firmware update process has initiated.
  - Recommended action:
    - Do not power cycle or restart the system.
- 281 - Batch disk firmware update successful (Informational)
  - Disk firmware update process has successfully updated disks in a batch.
  - Recommended action:
    - Check in the event log for events related to this component and follow the recommended actions for those events.
- 282 - Batch disk firmware update failed (Informational)
  - Disk firmware update process has failed to updated disks in a batch.
  - Recommended action:
    - Check in the event log for events related to this component and follow the recommended actions for those events.

Disk FW Related Alerts

- 283 - Disk firmware update successful (Informational)
  - Disk firmware update process has successfully updated all compatible disks.
  - Recommended action:
    - No action is required.
- 284 - Disk firmware update failed (Informational)
  - Disk firmware update process has failed to update all compatible disks.
  - Recommended action:
    - Check that the uploaded disk firmware file is compatible with the disks in system.
    - If this issue persists with compatible disk firmware, contact technical support.

ME5 Freya
Updated Drive Compatibility

List of Validated Drives Will be
Available in ME52xx Support Matrix

DEMO

Q&A

Rina Binxhiu

KMIP

Current ME5 Drive Secure vs KMIP

- Use a passphrase
- Manual
- Stored Local
- Singular to the enclosure

Data-at-rest Encryption via Self-Encrypting Drives (SEDs)

- **Auto-Lock** – Automatically secure user data when removed and powered off
- **Instant Secure Erase** – all drive data unreadable in less than 1 second

External Key Manager

- Industry standard OASIS Key Management Interoperability Protocol (KMIP)
- Keys are stored externally providing additional level of security
- Customer's key server manages all keys automatically
- Move drives to new data center, same key server, with auto-unlocking

Storage Array KMIP Client

- Storage array auto-locks/unlocks user data on SEDs using external key manager
- Storage array performs instant secure erase when commanded using external key manager
- KMIP Client microservice powers up independently providing fast auto-unlock timing
- KMIP Client microservice versioned and released independently

KMIP Client Architecture

Configuration

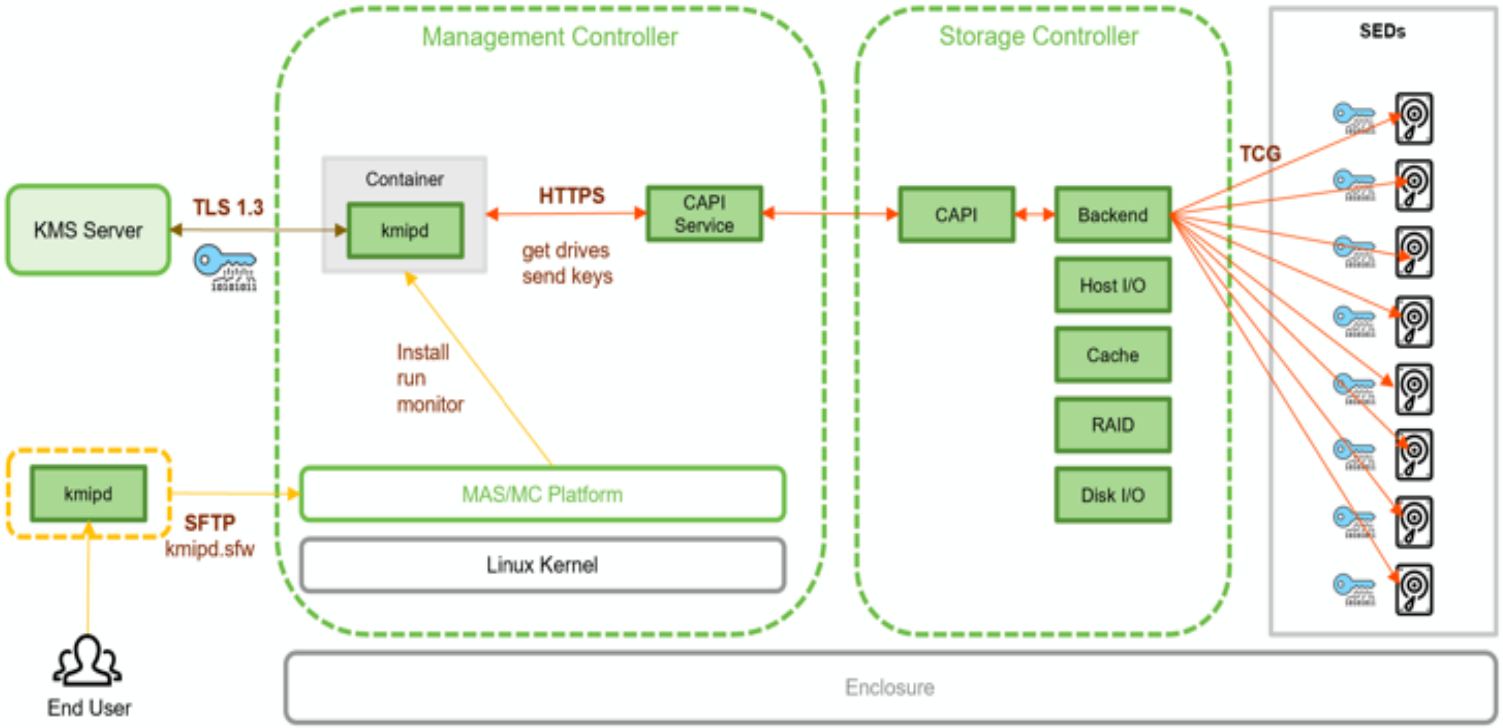
- Configure Key Management Server (KMS) Settings
  - IP / Port
- Store KMS Certificates
  - CA, Cert, Key
- Secure Drives

Automatic

- Discover SEDs
- Create/Get KMIP Keys
- Lock/Unlock SEDs

Updates

- FTP PUT kmip.sfw



KMIP Setup Requirements

- KMIP Server

  Support KMIP versions 2.0 and 1.4

- Network Connectivity

- Certificates

- Certificate names need to include letters and certain characters only

- SED Drives

  Create a User Role – Diagnostics

```
# create user base 2 interfaces wbi roles diagnostic rina_kmiptest
Enter new password: *********
Re-enter new password: *********
Success: Command completed successfully. (rina_kmiptest) - The new user was created. (2025-02-28
09:48:19)
```

Protocols & Ports

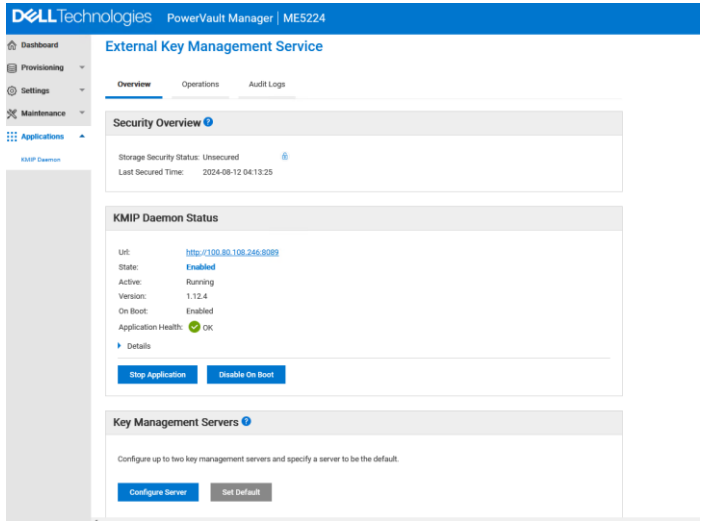
Protocol	Port	Description	Network	From	To
tls	5696	KMIP Protocol	Enterprise	kmipd	KMS
http	80	MC CLI (Console, JSON)	Local	user	MC
http	8082	kmipd web service (JSON)	Local	user	kmipd
http	8085	CAPI Web Service (JSON)	Internal	kmipd	capis

- Only secure protocols will be used in released product
- kmipd web service will NOT be accessible in released product
- capis web service will NOT be accessible in released product

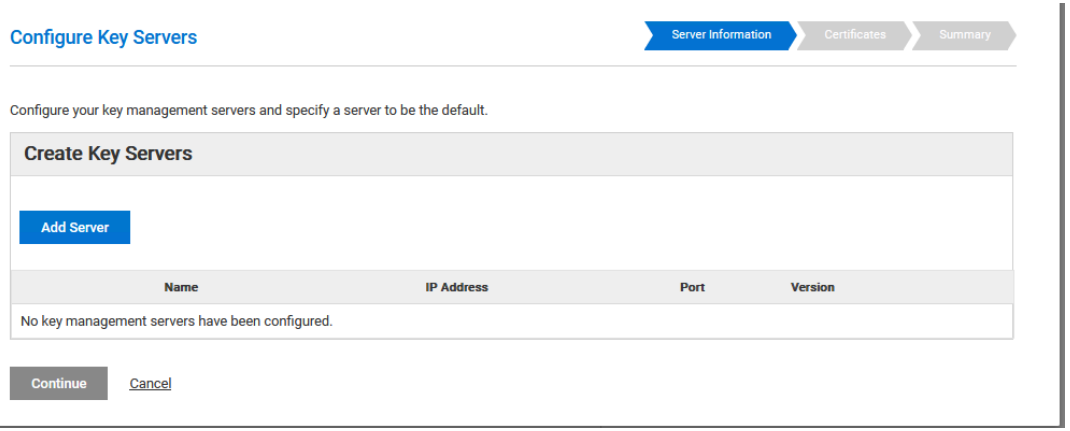
KMIP Setup - GUI

KMIP Setup Flow

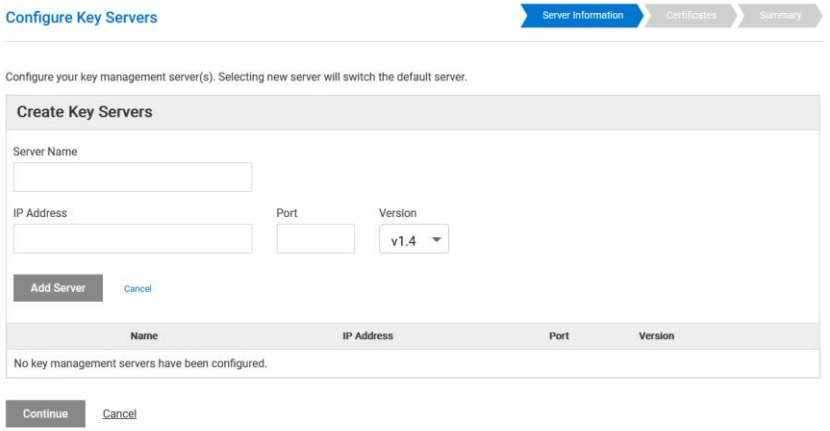
1. Log in to PowerVault Manager GUI with the Diagnostic User

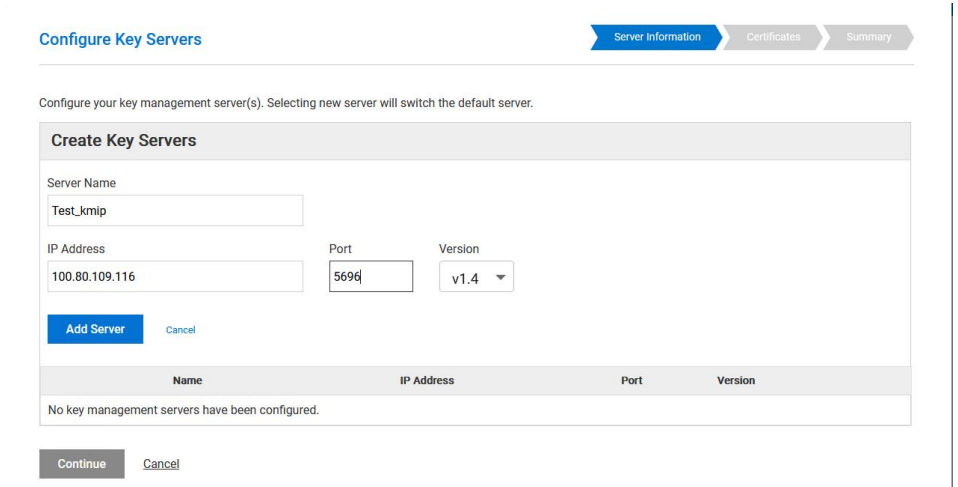


2. Add Server – To connect to the KMIP server

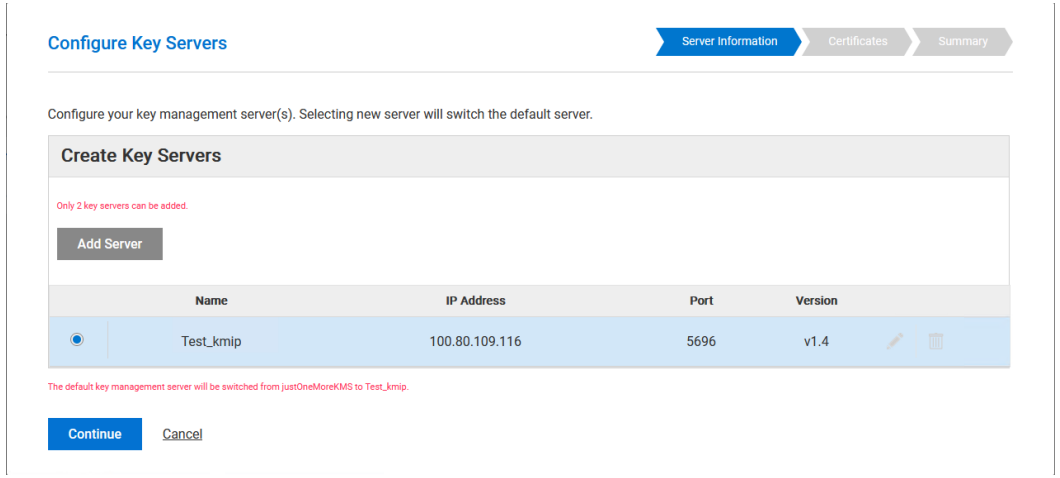


3. Add the KMIP server





4. Select the server and Continue



Private Key

Private Key: Key246.pem

Private Key Checksum: 5ff211870b61321edc2d6f5db6e1d551fa49a0b55cc286a46c01b65ecd1c4da5

Certificate Authority (CA)

Certificate Authority (CA): Certificate246.pem

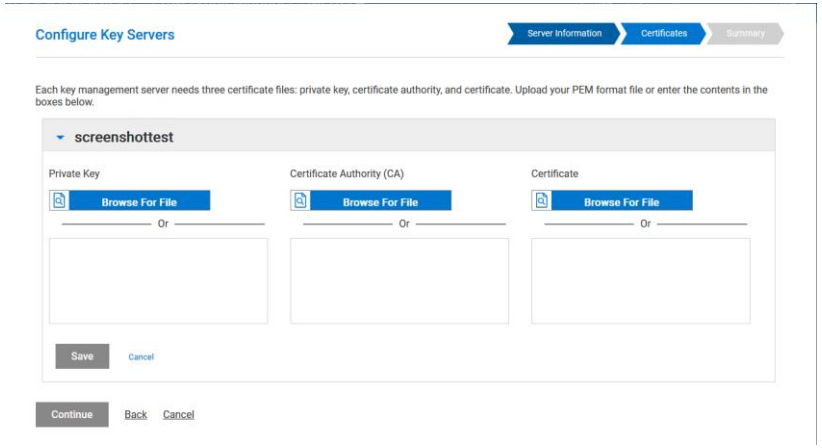
Certificate Authority (CA) Checksum: 079a665be249e9144d580ffecfd32838a5fe050d368ff2c5b301e0da4d7e24d1

Certificate

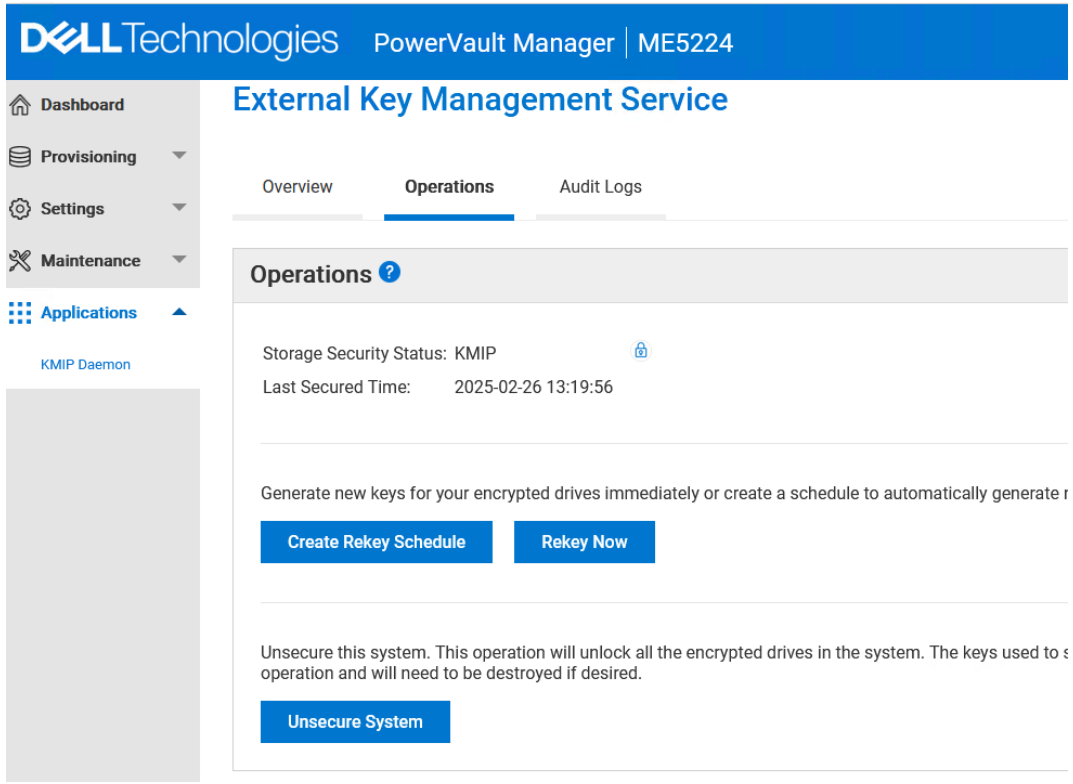
Certificate: Cert246.pem

Certificate Checksum: fdf313c91334abe16d11c54d1935dc5b5b4cc7e0979641f84e2aedada04d5824

5. Upload the Private Key, CA and Certificate

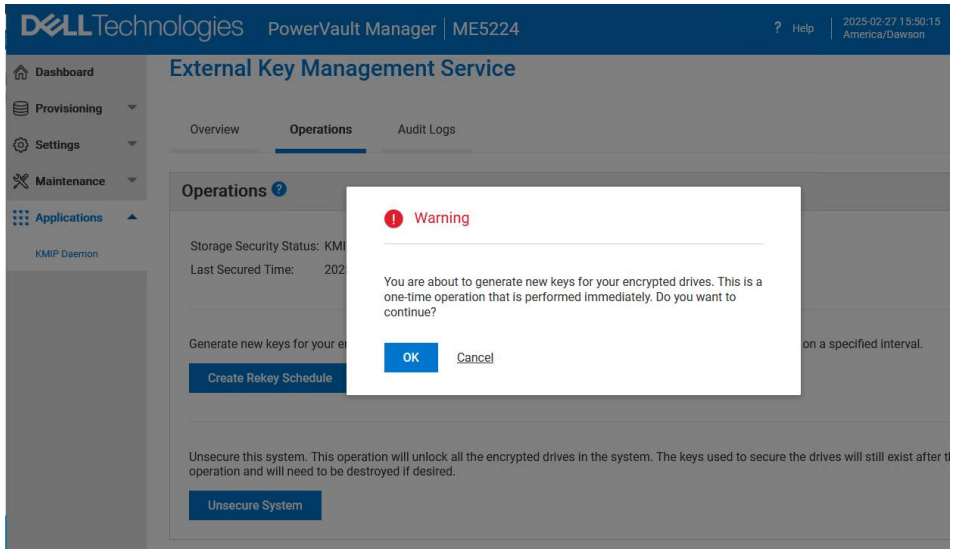


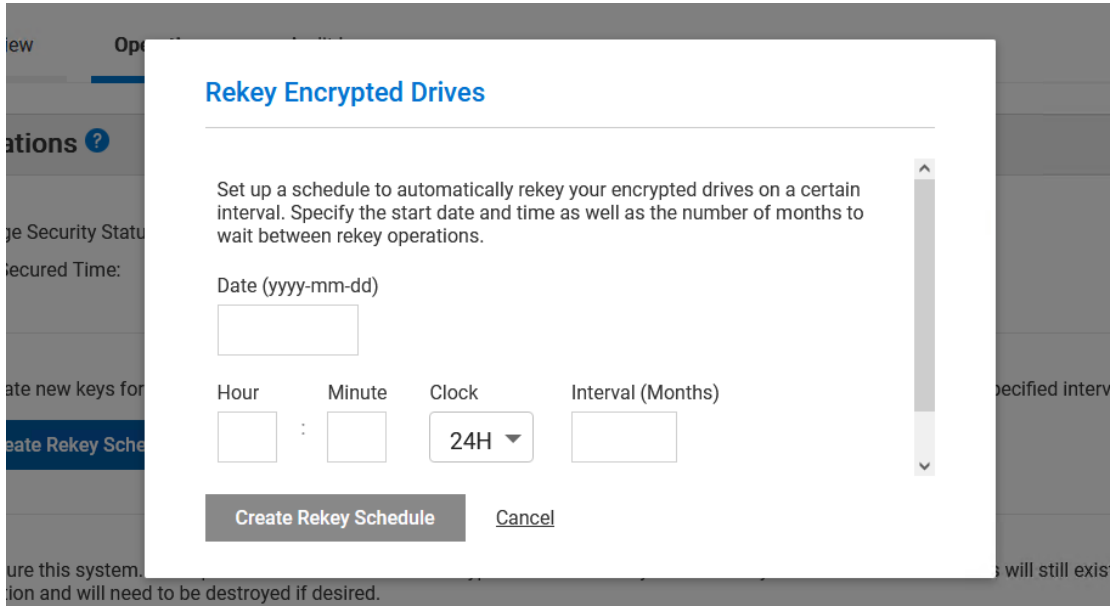
Secure the drives using KMIP



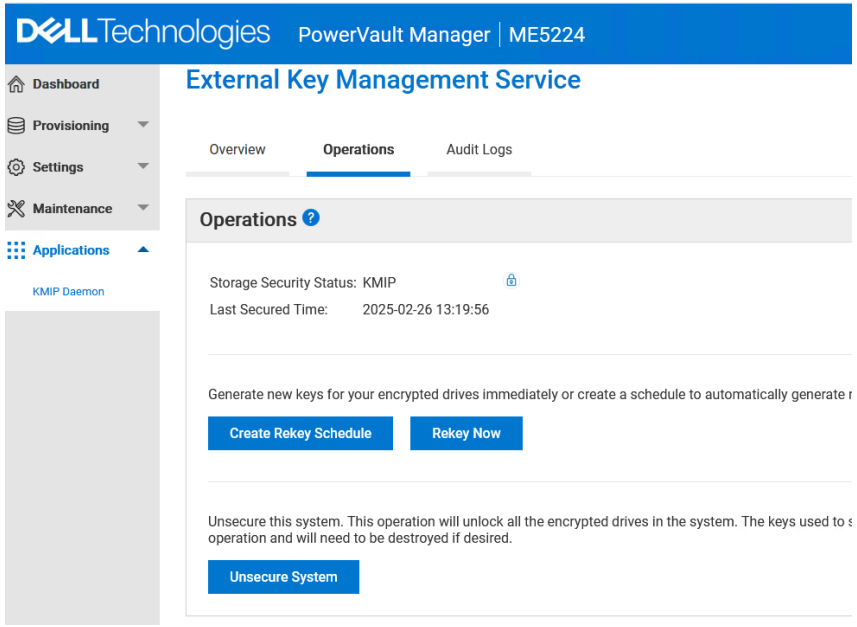
Rekey the drives using KMIP

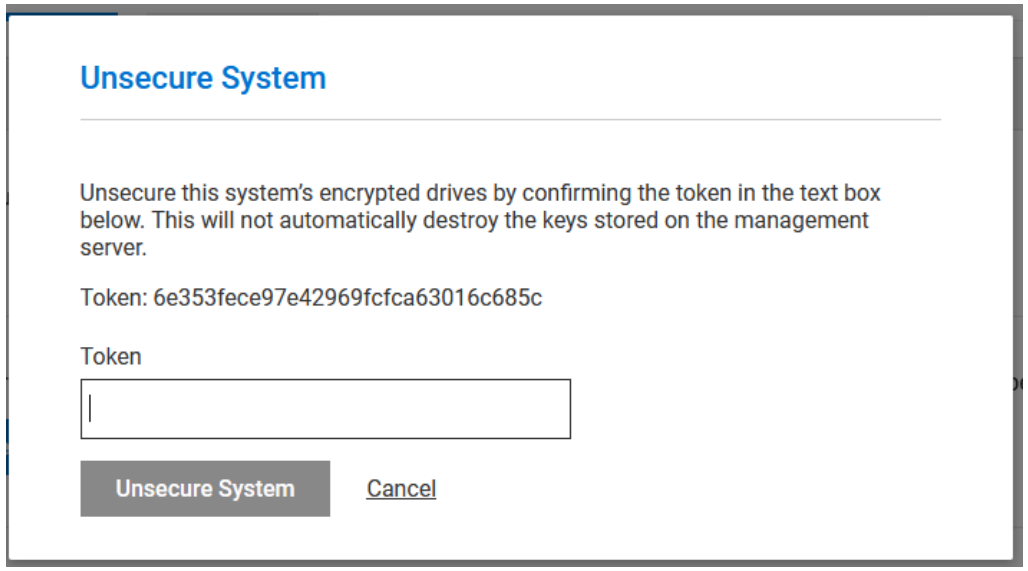
1. Login to PV Manager
2. Applications -> KMIP Deamon
3. Select the Operations Tab
4. Select Rekey to generate a new key
5. Select Create Rekey Schedule to automate the rekey process





Unsecure the drives using KMIP





The Audit Log tab is used to display the audit log. If the audit log is larger than 4 KiB, it will be truncated, and the ftp option is required to retrieve the full kmipd.log and kmipd-auditreport.log files. The audit log report is used to verify past operations performed to configure and secure a system.

KMIP Setup - CLI

Initial Setup of KMIP - CLI

Step 0	Make sure kmipd is installed and running	`show mas-services`
Step 1	Specify the IP Address, Port and Name of the Key Server using the MC CLI or API.	`send mas-service kmipd cmd-string " command=updatesettings,kms=<kms-label>,serverip=<ip>,serverport=<port>"`
Step 2	Upload the Key Server CA PEM file.	`curl -v -k --location --request POST "https://$host/api/uploadMasService" \ --header "sessionKey: $sessionid" \ --header "content-type: multipart/form-data" \ --header "datatype: json" \ --form "cert-data=@<filename>;type=text/plain" \ --form "service-name="kmipd";type=text/plain" \ --form "certificate-name="<filename>";type=text/plain" \ --form "certificate-type="ca";type=text/plain"seagate@ubuntu:~/seagit/mccli$`
Step 3	Upload the Key Server Private Key PEM file.	`curl -v -k --location --request POST "https://$host/api/uploadMasService" \ --header "sessionKey: $sessionid" \ --header "content-type: multipart/form-data" \ --header "datatype: json" \ --form "cert-data=@<filename>;type=text/plain" \ --form "service-name="kmipd";type=text/plain" \ --form "certificate-name="<filename>";type=text/plain" \ --form "certificate-type="privatekey";type=text/plain"seagate@ubuntu:~/seagit/mccli$`
Step 4	Upload the Key Server Certificate PEM file.	`curl -v -k --location --request POST "https://$host/api/uploadMasService" \ --header "sessionKey: $sessionid" \ --header "content-type: multipart/form-data" \ --header "datatype: json" \ --form "cert-data=@<filename>;type=text/plain" \ --form "service-name="kmipd";type=text/plain" \ --form "certificate-name="<filename>";type=text/plain" \ --form "certificate-type="certificate";type=text/plain"seagate@ubuntu:~/seagit/mccli$`
Step 5	Inform KMIP Client of the Key Server CA PEM file.	`send mas-service kmipd cmd-string "command=addcertificate,kms=<kms-label>,name=<filename>,type=ca"`
Step 6	Inform KMIP Client of the Key Server Private Key PEM file.	`send mas-service kmipd cmd-string "command=addcertificate,kms=<kms-label>,name=<filename>,type=privatekey"`
Step 7	Inform KMIP Client of the Key Server Certificate PEM file.	`send mas-service kmipd cmd-string "command=addcertificate,kms=<kms-label>,name=<filename>,type=cert"`
Step 8	Select the Key Server to use	`send mas-service kmipd cmd-string "command=selectkms,kms=<kms-label>"`
Step 2	Show Settings	`send mas-service kmipd cmd-string "command=showsettings"`

Secure the drives using KMIP - CLI

Step 1	Make sure kmipd is installed and running	`show mas-services`
Step 2	Secure all disk drives	`send mas-service kmipd cmd-string "command=secure,kms=<server>"`
Step 3	Show secure progress	`show mas-services kmipd details`
Step 4	Show system status	`show system`
Step 5	Show drive status	`show disks secure`
Step 6a	Show audit data. If the audit log is larger than 4 KiB, the ftp option below is required.	`send mas-service kmipd cmd-string "command=audit"`
Step 6b	Retrieve the kmipd audit log using ftp	`ftp> get logs:mas:kmipd <file.zip>'`

Unsecure the drives using KMIP - CLI

Step 1	Signal intend to unsecure	`send mas-service kmipd cmd-string "command=unsecure"`
Step 2	Unsecure disk drives	`send mas-service kmipd cmd-string " command=unsecure,token=<uuid>"`
Step 3	Remove keys from external key server	`send mas-service kmipd cmd-string "command=destroy"`

Manual Rekey System using KMIP - CLI

Step 1	Rekey	`send mas-service kmipd cmd-string "command=rekey,kms=<kms>"`

Auto Rekey System using KMIP - CLI

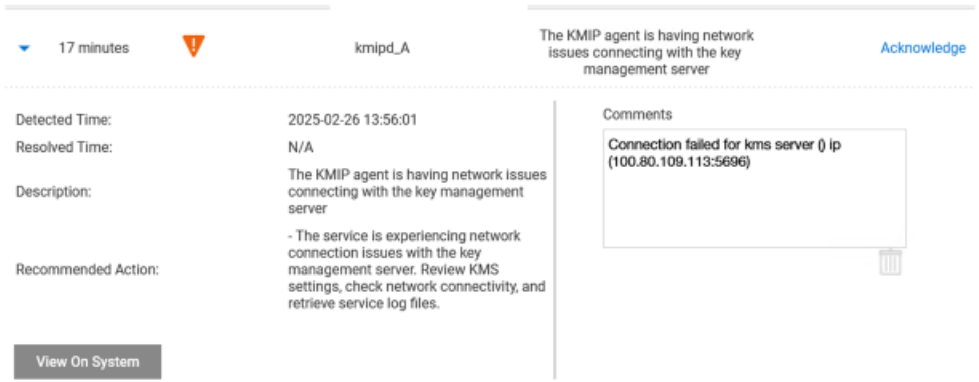
Step 1	Create Rekey Schedule	`send mas-service kmipd cmd-string "command=autorekey,kms=<kms>,op=start, year=yyyy,month=mm,day=dd,hour=hh,min=mn,interval=month"`
Step 2	Show Rekey Schedule	`send mas-service kmipd cmd-string "command=autorekey,kms=<kms>,op=show"`
Step 3	Stop the Automatic Rekey Operation	`send mas-service kmipd cmd-string "command=autorekey,kms=<kms>,op=stop"`

Neha Chowdhary

Troubleshooting

Unable to connect to KMS

Alerts



Events

Date/Time	Severity	Controller	Event Code	Message
2025-02-26 14:41:33	✕	A	683	KMIP MAS Service failed to communicate with key server. (IP address: 0.3.1740606081.0, port: 4294967295)

Additional Information:

None.

Recommended Action:

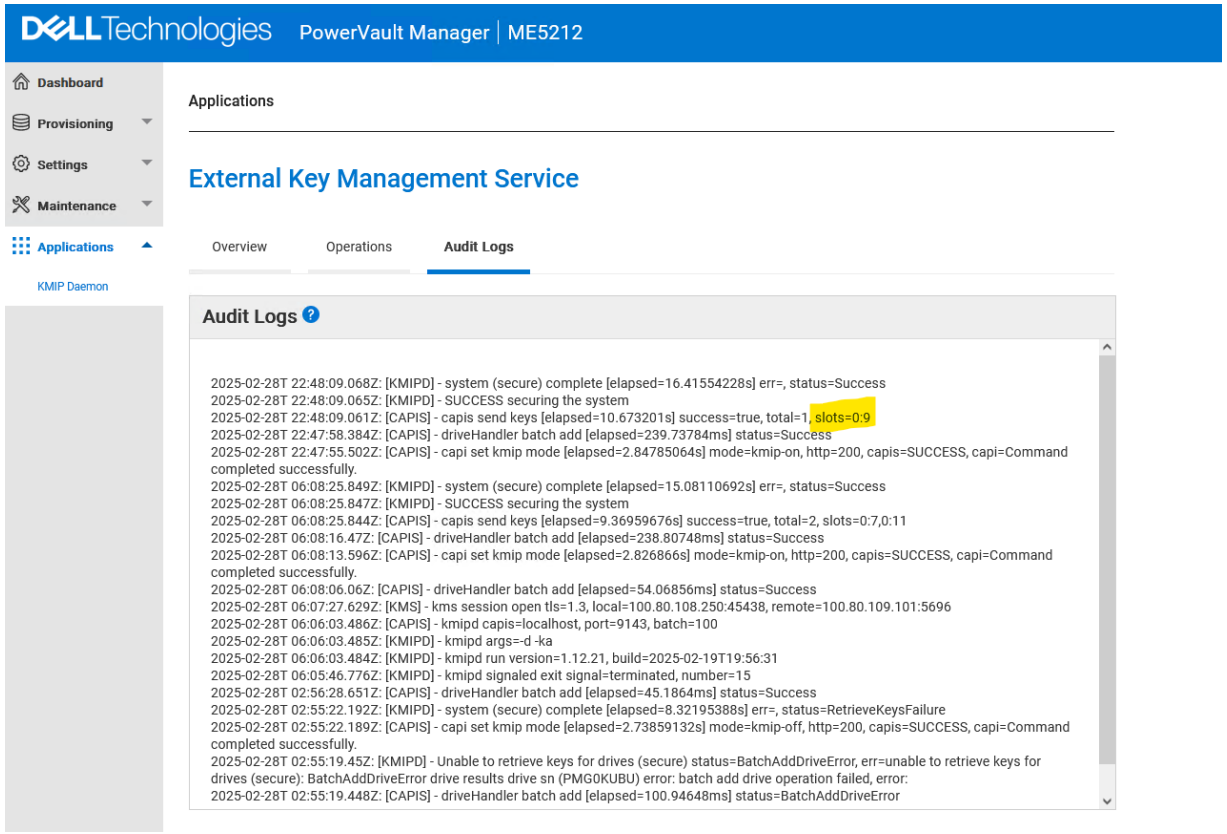
- Verify KMIP key server configuration settings and network connectivity.

Date/Time	Severity	Controller	Event Code	Message
2025-02-26 14:39:03	✕	A	683	KMIP MAS Service failed to communicate with key server. (IP address: 0.3.1740605938.0, port: 4294967295)

Audit Logs

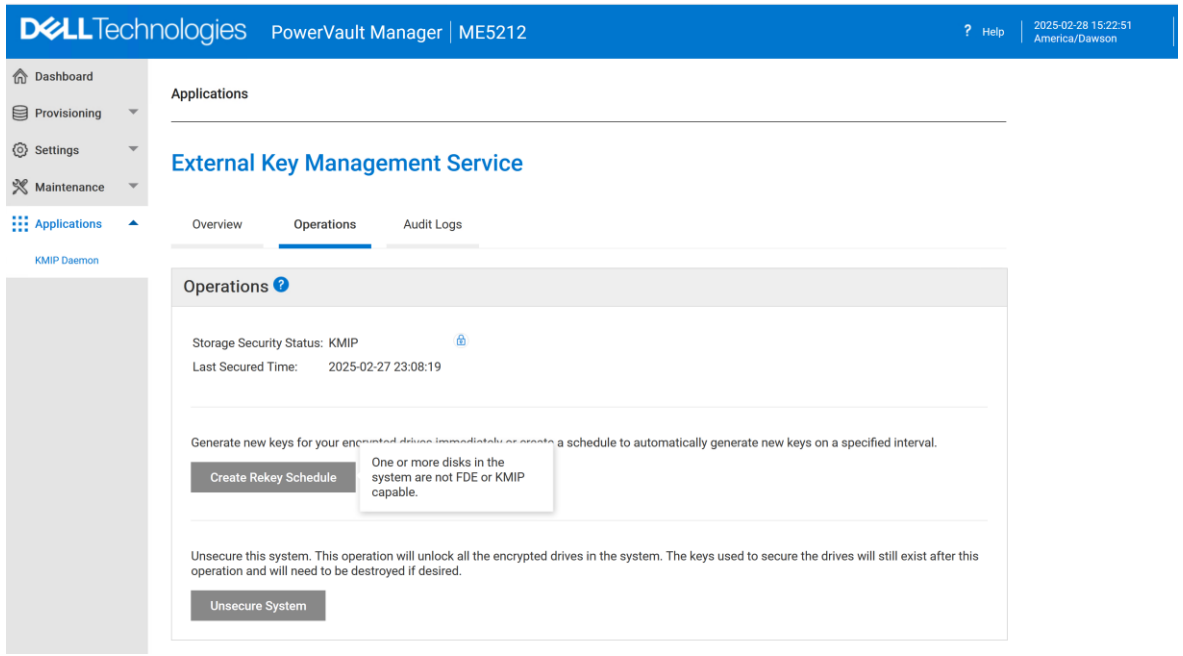
2025-02-26T 23:07:48.755Z: [KMIPD] - system (unlock) complete [elapsed=2m14.315752843s] err=unable to retrieve keys for drives (unlock): SessionError could not open a session with the KMIP Server, error: TLS Dial failure: dial tcp 100.80.109.113:5696: connect: connection timed out
2025-02-26T 23:07:48.749Z: [KMIPD] - Unable to retrieve keys for drives (unlock) status=SessionError, err=unable to retrieve keys for drives (unlock): SessionError could not open a session with the KMIP Server, error: TLS Dial failure: dial tcp 100.80.109.113:5696: connect: connection timed out
2025-02-26T 23:05:25.395Z: [KMIPD] - system (unlock) complete [elapsed=2m14.282076915s] err=unable to retrieve keys for drives (unlock): SessionError could not open a session with the KMIP Server, error: TLS Dial failure: dial tcp 100.80.109.113:5696: connect: connection timed out
2025-02-26T 23:05:25.389Z: [KMIPD] - Unable to retrieve keys for drives (unlock) status=SessionError, err=unable to retrieve keys for drives (unlock): SessionError could not open a session with the KMIP Server, error: TLS Dial failure: dial tcp 100.80.109.113:5696: connect: connection timed out
2025-02-26T 23:03:02.034Z: [KMIPD] - system (unlock) complete [elapsed=2m14.282150429s] err=unable to retrieve keys for drives (unlock): SessionError could not open a session with the KMIP Server, error: TLS Dial failure: dial tcp 100.80.109.113:5696: connect: connection timed out
2025-02-26T 23:03:02.029Z: [KMIPD] - Unable to retrieve keys for drives (unlock) status=SessionError, err=unable to retrieve keys for drives (unlock): SessionError could not open a session with the KMIP Server, error: TLS Dial failure: dial tcp 100.80.109.113:5696: connect: connection timed out

Insert FIPS drive to secured system



- Drive is automatically secured after being inserted.
- Check your KMS for new keys

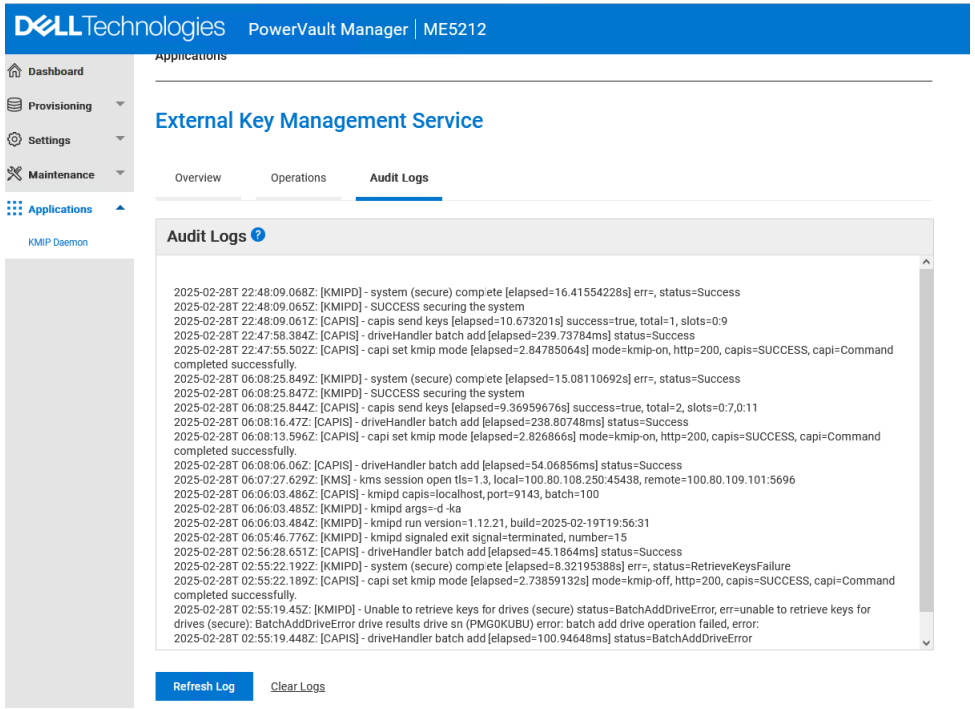
Insert Non-FIPS drive into secured system

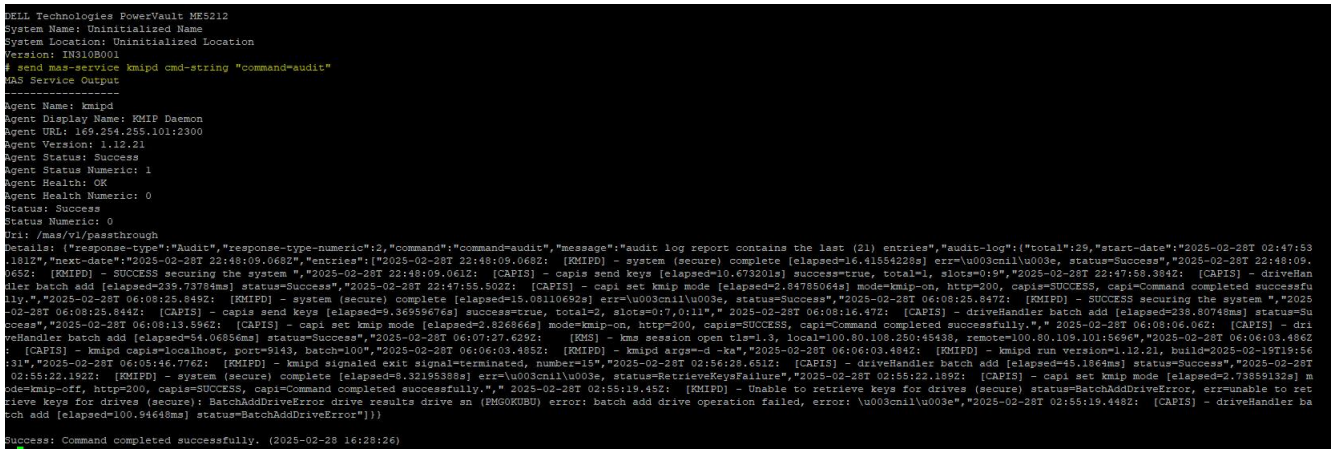


*picture to be updated

KMIP Logs

- Can be downloaded separately from the controller logs





ftp> get logs:mas:kmipd <file.zip>

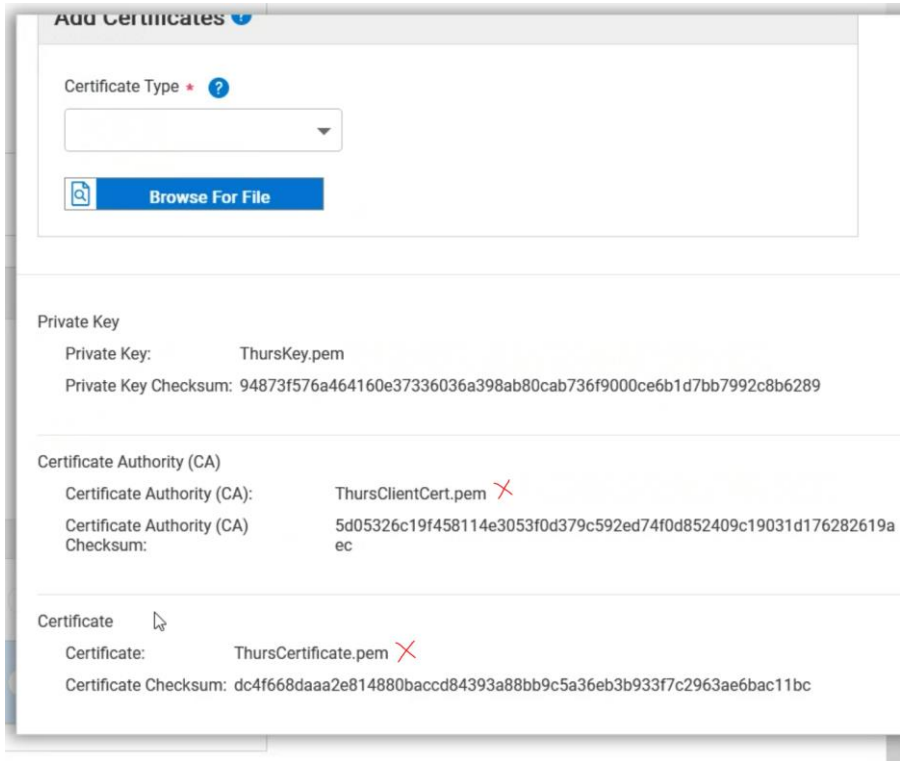
The KMIP Client iterates through all stored audit items and produces a Console, XML or JSON report.

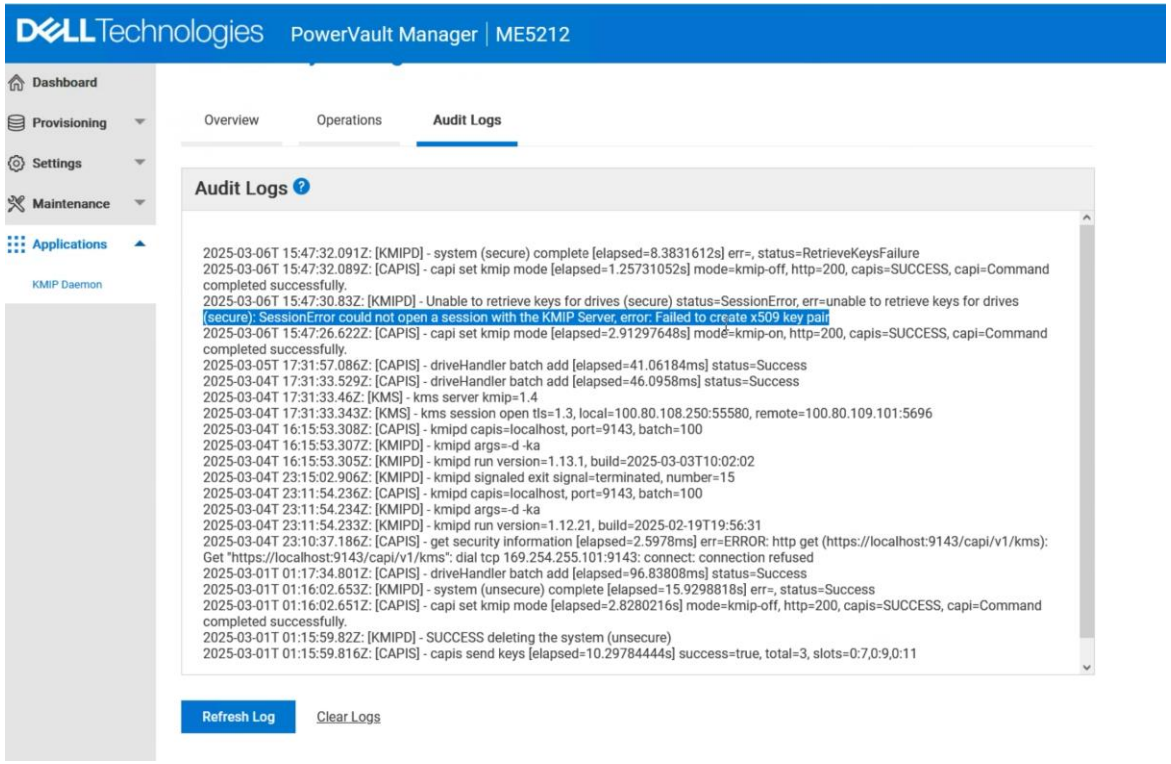
The audit report contains a record of all interactions with the KMIP Server and will detail the drive serial number and KMIP unique identifier but will NOT contain any cryptographic key information. The end user will have to use drive serial number and KMIP unique identifier to debug any key issues.

When the FTP option is used, the zip file contains the kmipd.log and kmipd-auditreport.log files.

Mismatch cert/wrong cert

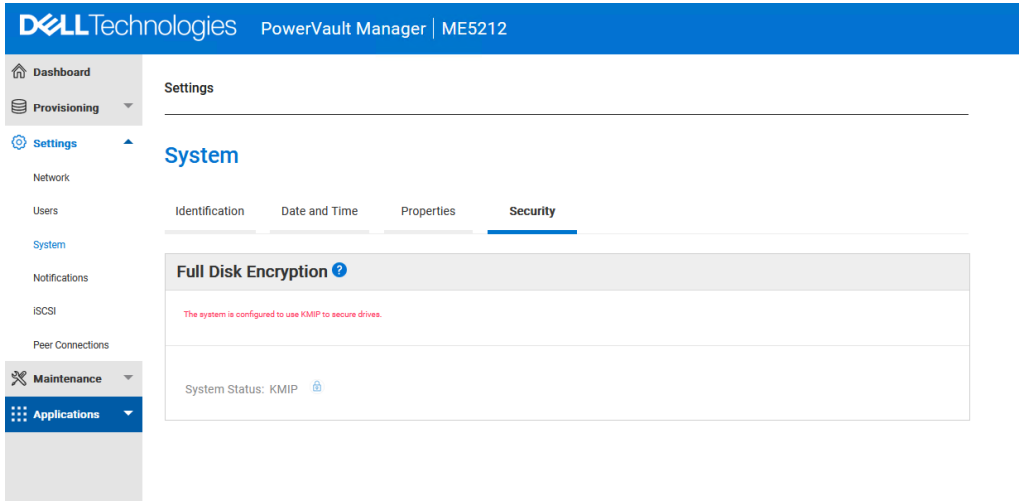
Use Case: CA & Client Certificate are switched.

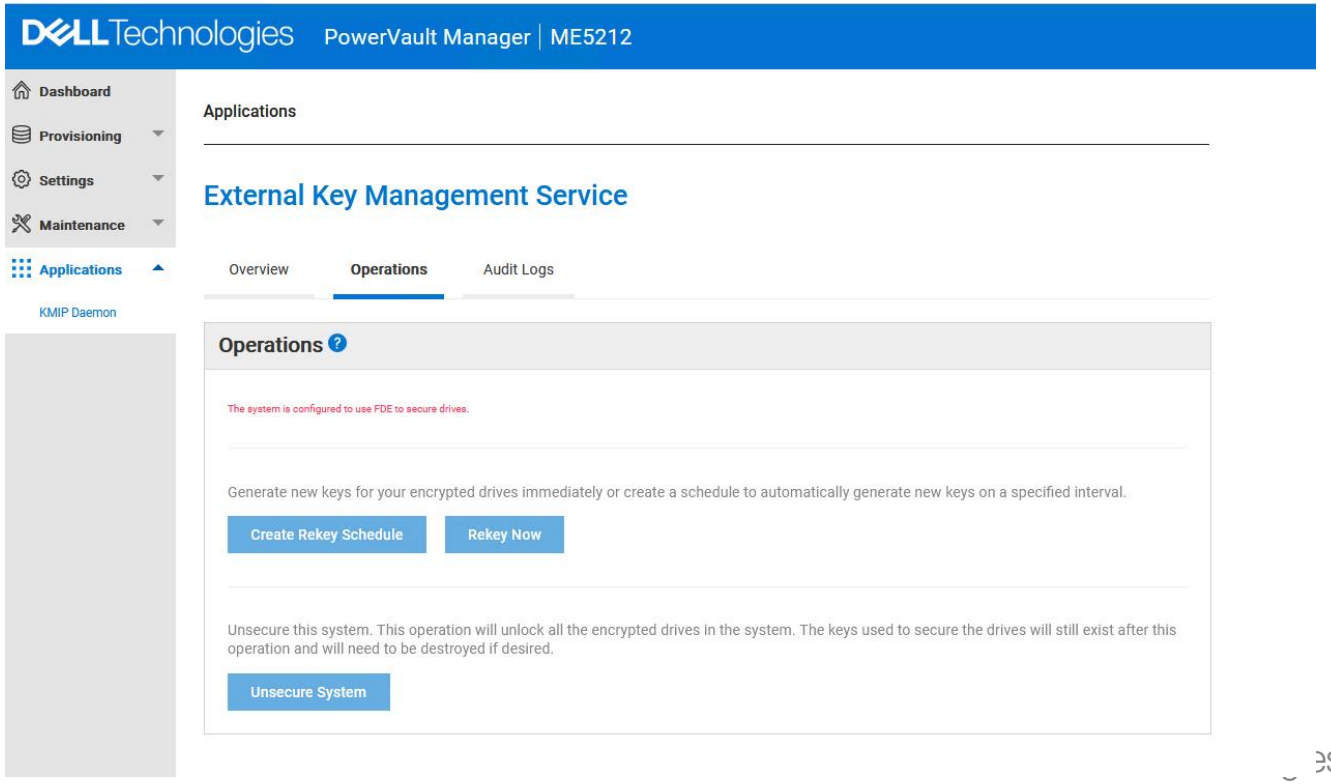




FDE to KMIP & vice-versa

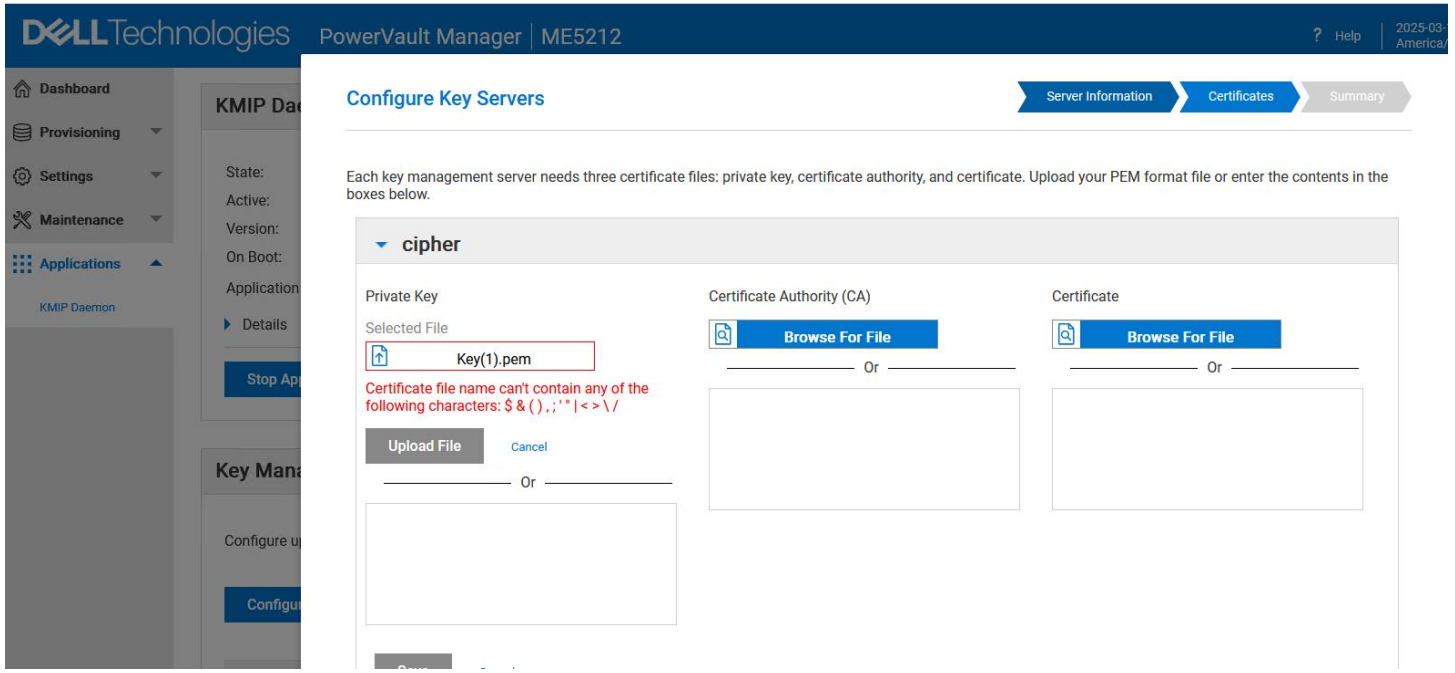
- FDE and KMIP work are mutually exclusive.
- When system is KMIP secured, FDE commands are rejected.
- When system is FDE secured, KMIP commands are rejected.





Certificate Instructions

- Things to keep in mind:
  - PEM format file
  - Allowed characters



* For IBM Guardium Key Lifecycle Manager, Certificate Authority (CA) file needs to be renamed from .cer to .pem for successful upload.

Failover Scenarios

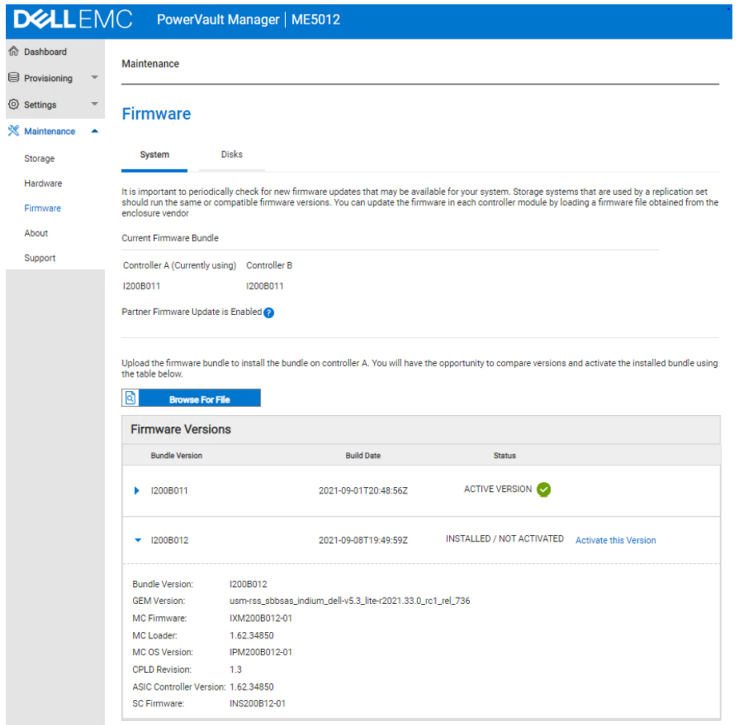
- Controller Failover:
  - The KMS certificates & private key must be uploaded to both the primary and secondary controller to ensure uninterrupted secure connection during failover.

- KMS Failover
  - The KMS agents need to be configured in a cluster node on the key management tool.
  - On the controller side, you would configure the two servers that are in a cluster but use the same certificates and private key from the primary server for redundancy.

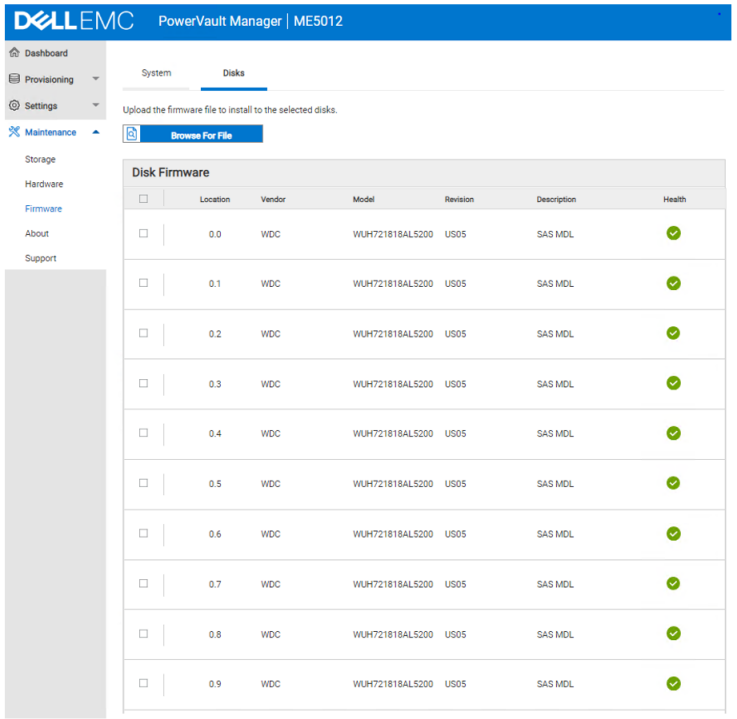
Q&A

Back up slides

Firmware



- System:
  - Holds two controller images Active/Not Activated
    - Browse for File to upload new images.
    - Activate the Version to start Firmware Download.
      - ✓ Health Check. Will not proceed with Degraded health.
      - ✓ Transfer to Partner if PFU enabled
      - ✓ Partner update / Reboot
      - ✓ Local update / Reboot
      - ✓ Cleanup



- Disks:
  - Browse for File to upload new images
  - Select Disks to update
  - Upload File to begin update process to disk(s)

DEMO

Add CUP
Add .bins
Delete .bins
>5 .bin - reload
No match load.