Technical White Paper

Dell EMC PowerProtect Software: File System Backup and Recovery

Abstract

This white paper focuses on file system protection and recovery using Dell EMC PowerProtect software.

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Executive summary

Business Case: Challenges

Today's data protection is either too complex, requires multiple vendors, does not scale or meet the needs of fast-growing, modern and agile organizations of all sizes. As businesses continue to consume IT resources differently, there is a need for powerful, efficient and trusted data protection to enable organizations to transform to meet future demands when modernizing their IT environment.

Solution Overview: Why PowerProtect software?

Dell EMC PowerProtect software is the next generation data management platform to transform traditional data protection to comprehensive data management. Dell EMC PowerProtect software is defined with built-in deduplication for data protection, replication and reuse. This white paper outlines on file system protection and recovery with Dell EMC PowerProtect software which ensures reliable and efficient data protection functionalities. It also discusses on the file system backup architecture, backup and recovery workflows and deployment requirements.

Dell EMC PowerProtect software gives IT the trusted data protection they know from Dell EMC combined with operational simplicity that protects workloads running on-premises with self-service capabilities for operational efficiency and IT governance controls to ensure compliance. SaaS-based management to easily monitor, analyze and troubleshoot your distributed data protection environments from anywhere.

Audience

This white paper is intended for customers, partners, and employees who want to better understand, evaluate and explore offering with Dell EMC PowerProtect software for file system backup and recovery solution.

1. Introduction

File system backup is the primitive data protection strategy for any environment. Dell EMC PowerProtect software offers efficient data management capabilities across your ever-changing IT environment, leveraging the latest evolution of our trusted protection storage architecture. With flexible deployment and simple licensing options, PowerProtect software provides you the confidence that your data is protected and available always.

PowerProtect software offers customers the ability to set protection policies, to perform backup and recovery, deduplicate workloads etc. PowerProtect software offers centralized oversight of all protected file system copies which makes it simple to track and enforce SLO compliance for backup and recovery, RPOs, Storage retention lock etc. PowerProtect software discovers copies sent to protection storage, catalogs and make protection copies available for compliance measurement to ensure protection compliance and quality of service.

Dell EMC PowerProtect software UI is a simple wizard for managing entire protection lifecycle and designed for creating protection life cycle orchestration, Automated protection policies and Service level agreements (SLA) compliance and actionable insight that optimizes efficiency. The purpose of this white paper is to show how effectively file system protection can be done using Dell EMC PowerProtect software with Dell EMC storage systems as target storage.

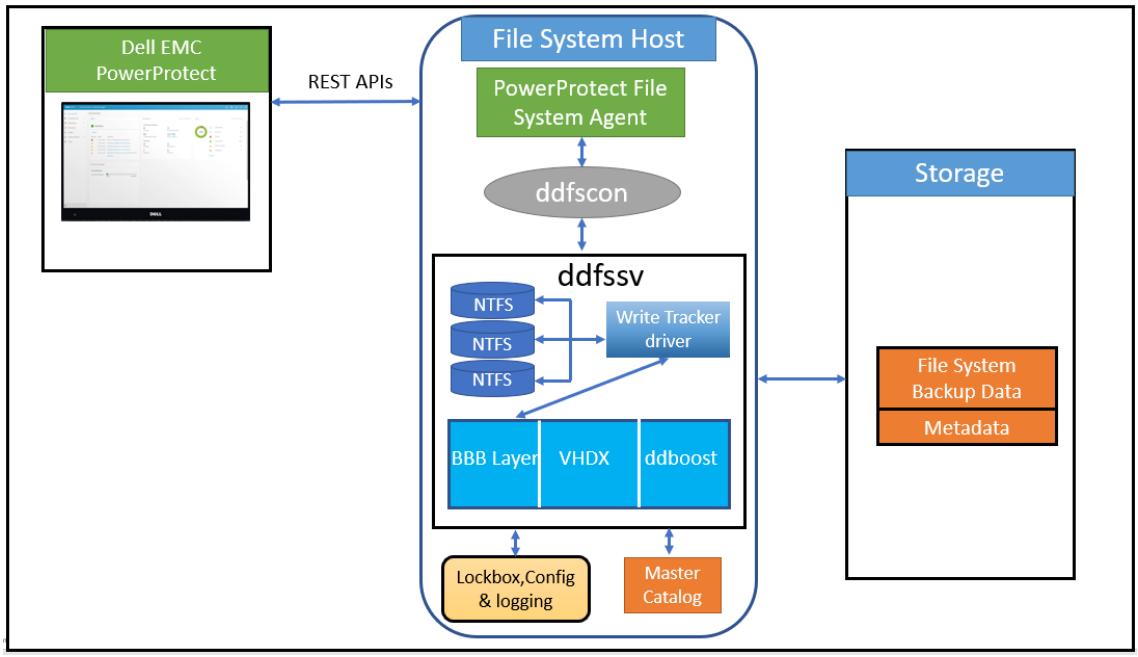
1.1 Dell EMC PowerProtect software key features for file system protection and recovery:

- Block-based file system support for windows and Linux.
- Centralized file system backup and image restore through PowerProtect Data Manager scheduler.
- Self-Service file system backup, Image and file-level restore using CLIs.
- Automated host agent configuration during policy creation.
- Supports Windows and Linux for NTFS, ReFS, CSV, Ext3, Ext4.

2. Architecture

1. Block-Based Backup Technology:

Dell EMC PowerProtect software performs filesystem level full and incremental backup using block-based backup (BBB) technology. During the backup, the application agent scans a volume or a disk in a file system and backs up all the blocks that are in use in the file system. Block based full and incremental backups are fast backups with reduced backup times, because the backup process backs up only the occupied disk blocks and changed disk blocks respectively.



2. Lockbox:

The file system agent uses a lockbox resource on the protected host to store sensitive information. For example, the credentials that the application agent requires to access external storage infrastructure.

3. Write Tracker Driver:

This is a volume filter driver and responsible for tracking the changes in the file system. Driver internally maintains a bitmap for all the blocks of the file system. This bitmap is initialized at the time of full backup and gets reset after each backup. User mode process retrieves the list of changed blocks for incremental backup.

4. Save (ddfssv):

This component is responsible for following operations,

- Parsing the arguments
- Create the snapshot of the file system (using the underneath mechanism VSS or LVM)
- Getting the changed blocks list from WT (Write Tracker)
- Writing the file system data to integrated storage device.
- Populating the master catalog file (SQLite) with backup information

In self-service mode, this is directly started by FS admin and in centralized mode this is started by console (ddfscon)

5. Recover (ddfsrc):

This component is responsible for following operations,

- Parsing the arguments supplied from user.
- Retrieving data from integrated storage device and then perform image restore.

Note: In self-service mode, ddfsrc is directly started by file system admin and in centralized mode this is started by console(ddfscon)

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6. Console (ddfscon):

This component is responsible for handling the request from PowerProtect agent on the host and is started by PowerProtect agent for each request. This component serves following requests

Backup**:** starts (ddfssv) for backup and waits for completion. then sends response back to PowerProtect Agent.

Restore: starts (ddfsrc) for restore and waits for completion, then sends response back to PowerProtect Agent.

Discovery:

a) Host discovery- makes use of existing libraries to discover all the supported file systems (BBB) and responds back to Agent (in JSON)
b) Backup discovery- reads SQLite file and prepares the list of backups for given file system. JSON response is returned to PowerProtect Agent.
c) Configure and Re-configure- saves the backup/restore options (Integrated Storage device details- SU/USER/PASSWORD etc. into lockbox) into a configuration file on the host.

7. Admin tool (ddfsadmin.exe):

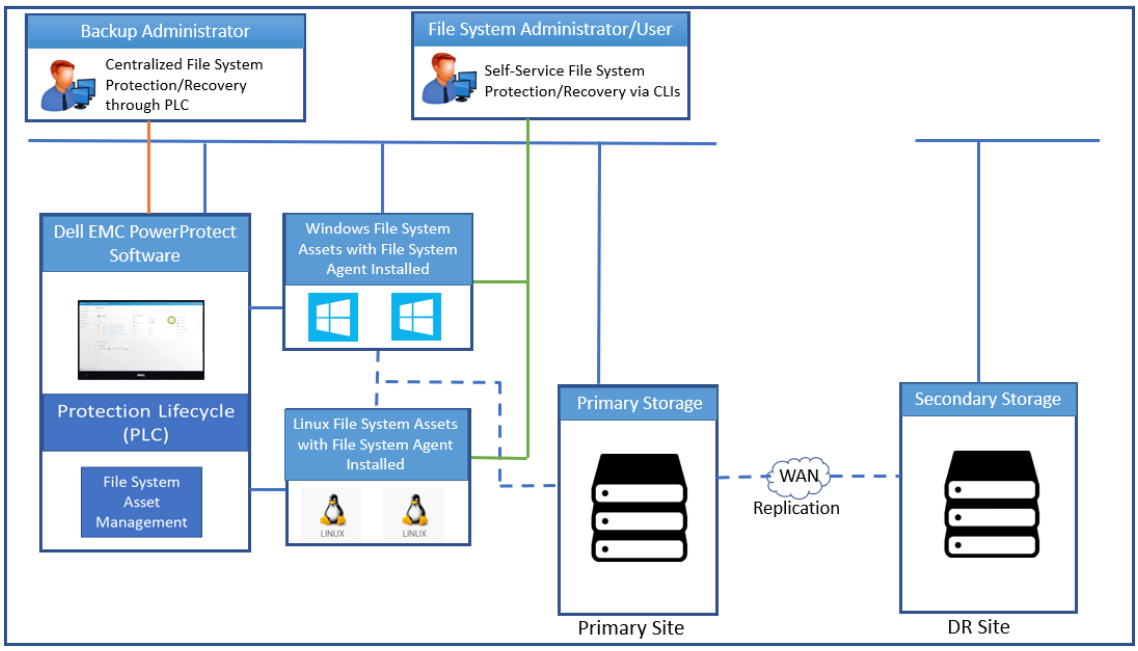
- List backups from local catalog and remote catalog. This is useful for performing self-service restores via CLI.
- Sync local SQLite file with the copy on Integrated storage.
- View, add and delete lockbox entries.

2.1 Dell EMC PowerProtect software enhanced models for file system protection and recovery:

Filesystem protection data zone components include PowerProtect Data Manager server, PowerProtect file system agents, file server host and storage. Let's go over the different service model features built for file system backup and recovery in Dell EMC PowerProtect software.

Dell EMC PowerProtect software for file system protection has been built with two service model features,

a) Self-Service file system protection and recovery
b) Centralized file system protection and recovery



a) Self-Service file system protection and recovery:

- File system admin or user can utilize self-service CLI commands to perform self-service backup or restore.
- For a host with file system agent installed, a PowerProtect Data Manager is required to backup file systems. However, a backup administrator or file system administrator who wants to back up file systems manually uses PowerProtect Data Manager only for compliance purposes can register the host to PowerProtect Data Manager and create a self-service protection policy to configure only the retention policy instead of a complete backup schedule.
- Once a host is registered with PowerProtect Data Manager and assets are added to a self-service protection policy, self-service or manual backups can be performed on the host's file system assets by using the (ddfssv) command.
- Self-service restore can restore from backups that were centralized or self-service and can be done to a local or remote server.

Note: To enable self-service protection, Self-Service Protection option is selected when creating the file system protection policy in the PowerProtect software UI

b) Centralized file system protection and recovery:

- Centralized file system model is built for backup administrators to perform policy-based File system backup, recovery, replication and Long-term retention of copies. With centralized protection feature PowerProtect software manages the entire file system backup workflow including the schedule.
- Centralized protection is supported through Protection Policy (PLC). Once the FS agent is installed on client the client is auto- discovered on PowerProtect software UI and enables administrator to approve the client.
- Choosing the centralized protection option during Protection Policy creation enables all protection to be managed centrally by PowerProtect software.

3. Deployment requirements for Dell EMC PowerProtect software file system

3.1 Network requirements:

- Ensure file system host and the PowerProtect Data Manager network can see/resolve each other.
- Ensure that all clocks on both the host and PowerProtect Data Manager are time-synced to the local NTP server to ensure discovery of the backups.
- Use Fully Qualified Domain Names (FQDNs) where possible.
- Confirm forward and reverse DNS lookups work for each host in the data zone.
- Ensure Port 7000 is open between File System server and PowerProtect Data Manager, and it is bi-directional.
- Ensure Port 3009 between PowerProtect Data Manager and target storage.

3.2 Filesystem agent:

The File System agent allows an application administrator to protect and recover data on the file system host. Dell EMC PowerProtect software integrates with the file system agent to check and monitor backup compliance against protection policies. PowerProtect filesystem agent has been designed to support the file system backup, restore, and replication workflows.

Windows and Linux prerequisites:

- Ensure that file system host is a 64-bit system.
- Ensure that your host is a supported OS version.
  Kindly refer the software compatibility information for the PowerProtect software is provided in the eLab navigator, available at https://elabnavigator.emc.com/eln/modernHomeDataProtection.
- Note that LVM/VxVM partitions/volumes are supported, but not physical partitions.
- Each volume group on LVM2 or VxVM must have at least 10% free space for a block-based backup to succeed.

The filesystem agent binaries (Windows and Linux) can be downloaded on the below path from PowerProtect Data Manager→ Settings → Agent downloads.

3.3 File server host:

File server hosts are the file system clients which are protected using Dell EMC PowerProtect software by installing filesystem agents on Windows and Linux clients. Once the file system agent is installed on the clients, the clients get auto discovered in PowerProtect software and the volumes on the client get populated in PowerProtect software UI as file system assets and can be viewed in the assets page.

4. Install and configure file system agent

Ensure to satisfy all the prerequisites mentioned in the above section before installing and configuring the File System Agent and adding the File System Agent to protection.

4.1 File system agent installation on Linux:

Procedure:

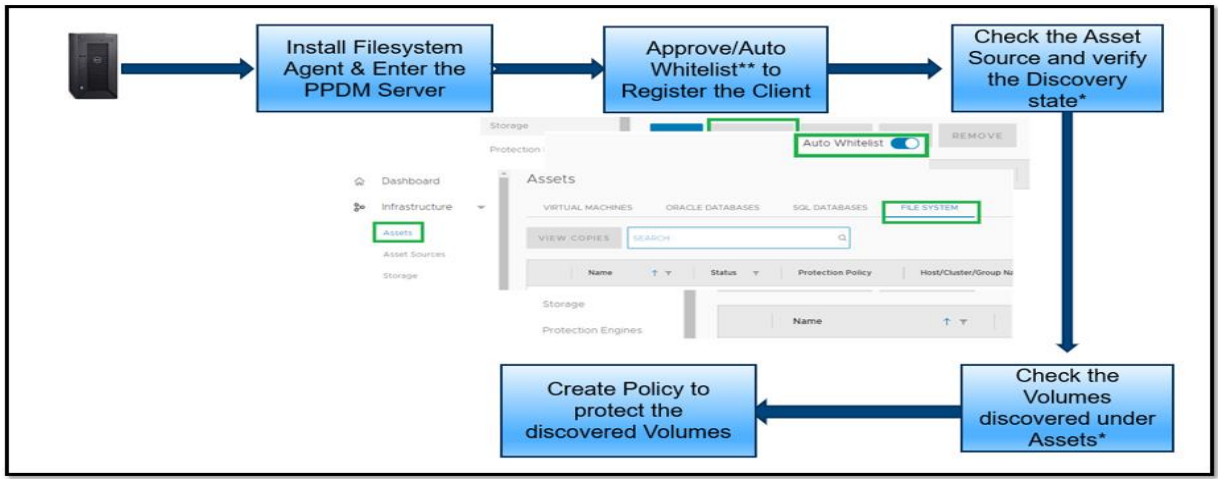
1. Download the File System agent software package to the Linux host.
2. In the PowerProtect Data Manager UI:
   a. Select Agent Downloads from the System Settings menu.
   b. Select the File System agent download package for Linux (fsagent191_linux_x86_64.tar.gz)
   c. Download the package in the location that you want to install the File System agent.
3. Untar the installer by running - gunzip * followed by tar -xvf
4. Run the installation script: install.sh
5. Three installation rpms are installed as part of the installation script.
6. Enter the PowerProtect Data Manager server IP address.

4.2 File system agent installation on Windows:

Procedure:

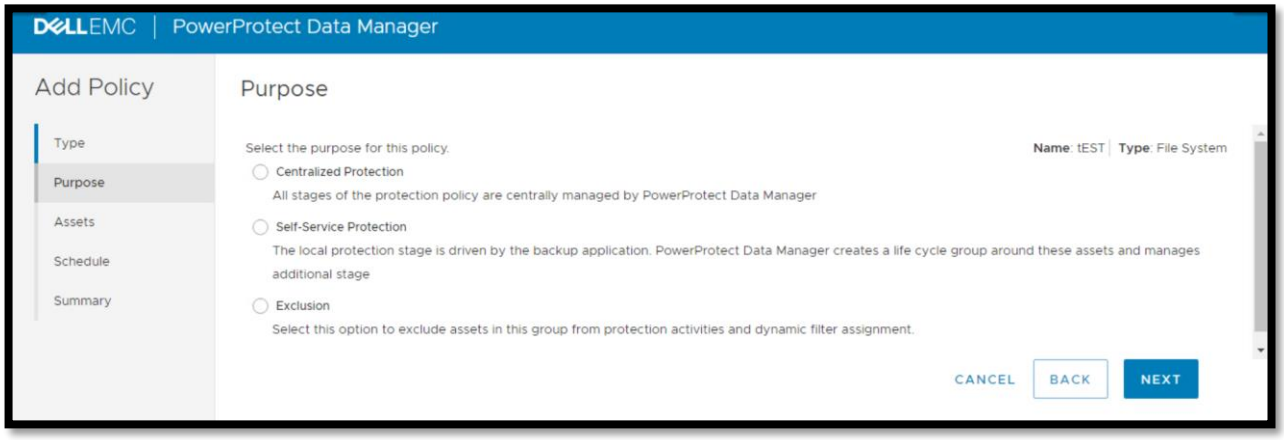
1. Download the File System agent software package.
2. In the PowerProtect Data Manager UI:
   a. Select Agent Downloads from the System Settings menu.
   b. Select the File System agent download package for Windows (fsagent191_win_x64.zip)
   c. Download the package in the location that you want to install the File System agent.
3. Open the fsagent-19.1.0.0.exe installation file.
4. Follow the wizard installation steps to provide the installation location and the PowerProtect Data Manager IP address.
5. Click install and click finish.

4.3 Roadmap to protect a File System:



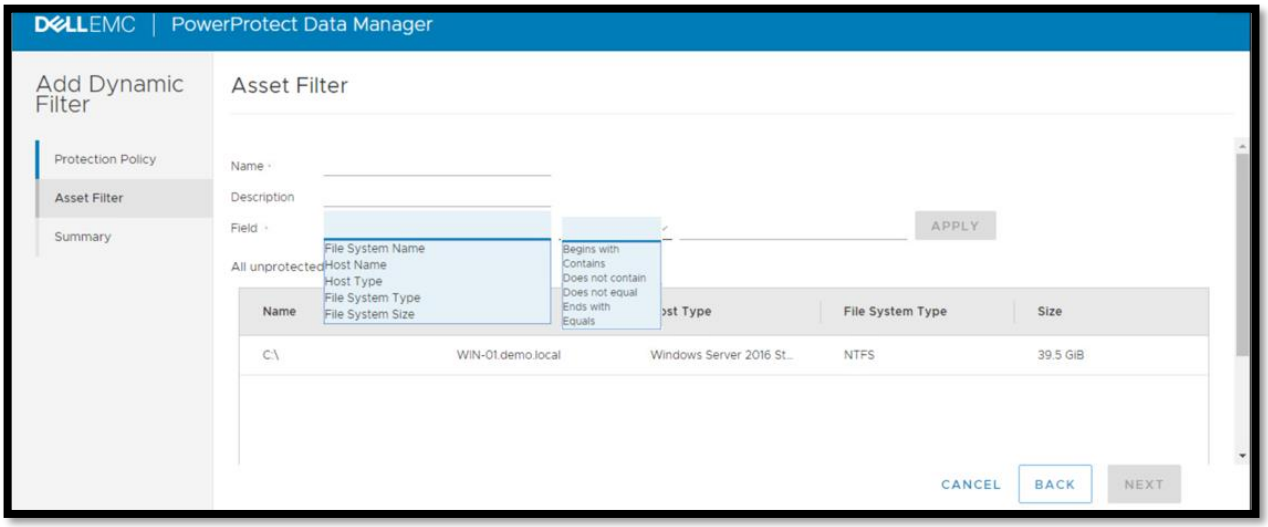
5. File system protection policy:

Protection lifecycle policy defines set of objectives that apply to specific duration. Dell EMC PowerProtect software provides options like centralized protection and self-service protection to specify one of the following "Purposes" for the protection policy to back up Linux/Windows file system. These objectives drive configuration, active protection and data management operations that satisfy Service Level Agreements.



5.1 Dynamic Filter:

- Dynamic filters automatically determine which assets get assigned to protection policies when the assets are discovered.
- A protection policy must exist prior to creating the dynamic filter and an asset can only belong to one protection policy.
- Dynamic filters must specify a storage asset type as File System.

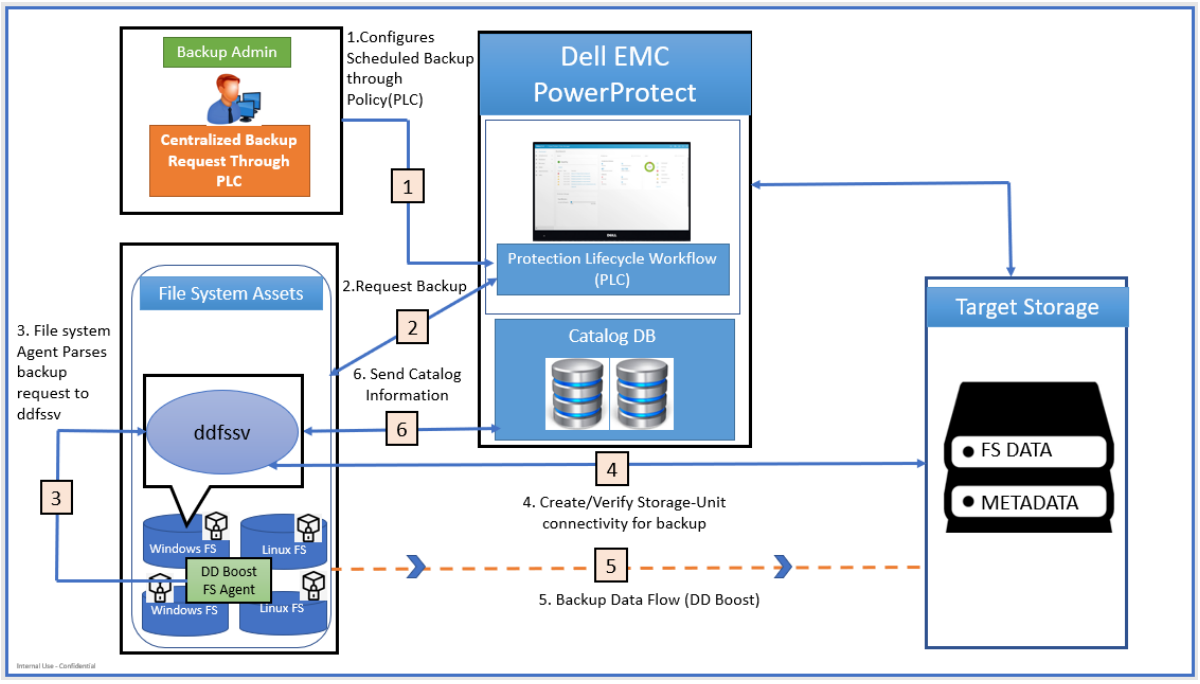


6. Dell EMC PowerProtect software file system backup:

Dell EMC PowerProtect software provides ability to discover, manage, monitor data protection and replication for file system assets through integration with the file system agent. File system assets are protected in Dell EMC PowerProtect software with centralized and self-service file system protection features.

Dell EMC PowerProtect software self-service protection enables user to perform backup and restore using self-service CLI workflow for Windows and Linux assets. With agility and self-service feature, data owners perform backup and recovery within native applications. Select this type to use the file system to create local backup protection. self-service file system protection is achieved using DD Boost FS agent.

6.1 Centralized - File system backup workflow:



1. File system backup configuration is done by backup administrator through protection lifecycle policy on PowerProtect software UI.

2. At the time of scheduled backup, the PowerProtect agent requests the file system agent to perform save operation for file system data.

3. File system agent parses the backup job request and converts into (ddfssv) utility commands and performs save operation.

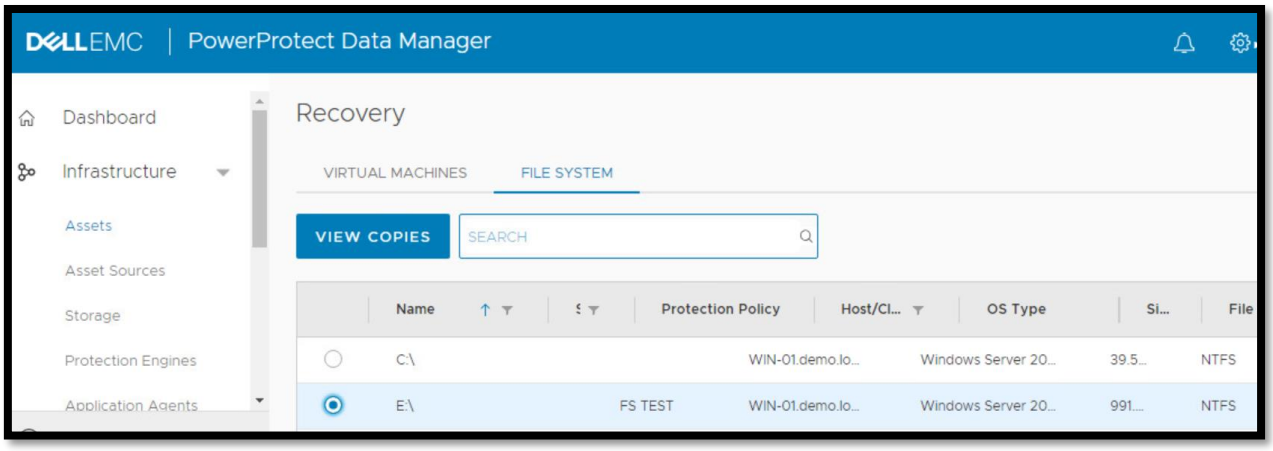
4. File system agent creates/verifies the storage-unit on the target storage.

5. On successful verification with target storage, File system agent writes the file system data directly to the storage-unit created on the target storage using DD Boost.

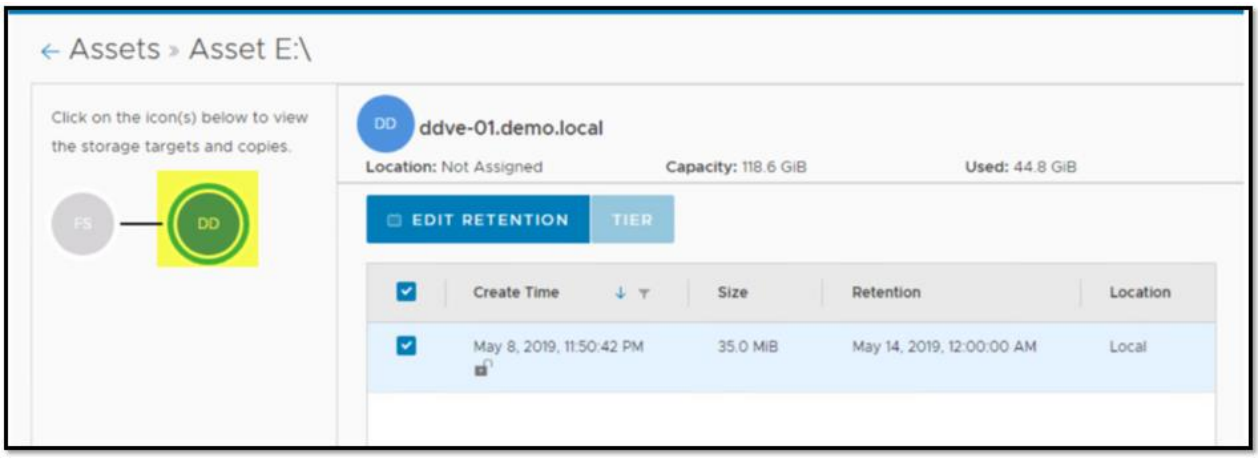
6. File system agent sends the catalog details to catalog database on PowerProtect Data Manager.

Once the backup completes successfully the backup copies residing on the storage device can be viewed from PowerProtect software UI as shown below:

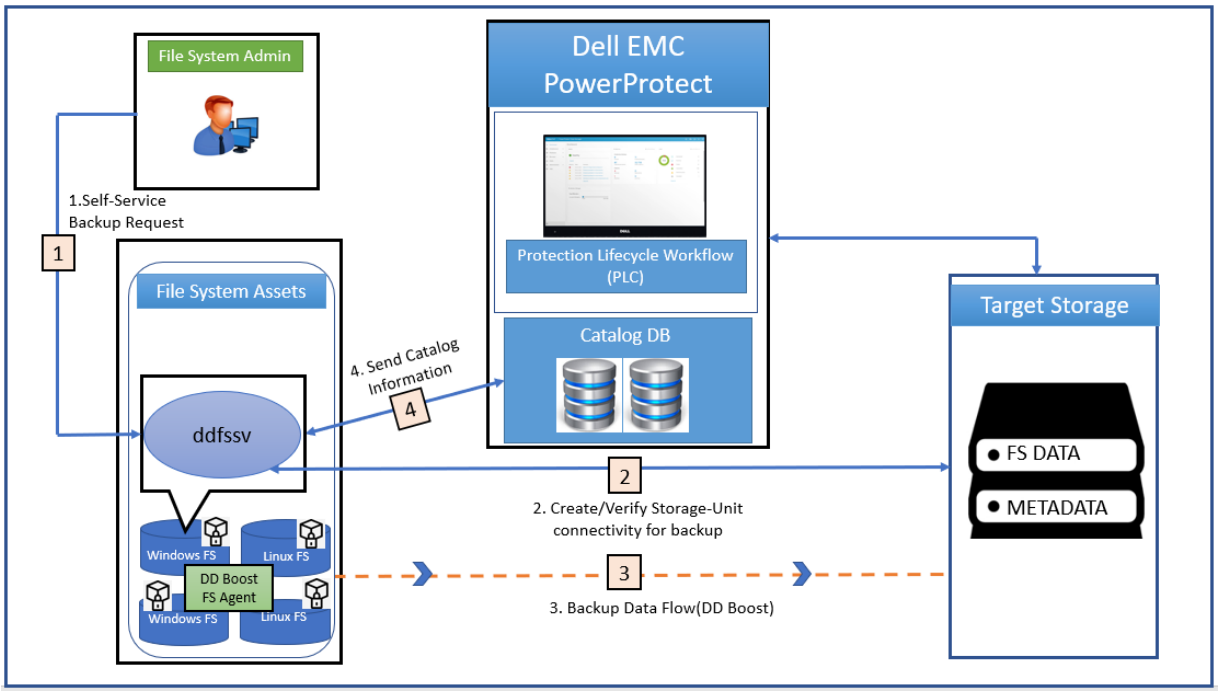
1. Select →Assets → File System



2. Select the required file system and click view copies for backup



6.2 Self-Service - File system backup workflow:



1. File System administrator launches the (ddfssv) utility via command line on the file system server and inputs the below details to initiate backup.

Backup schedule (Full, Incremental)
Storage IP address
Storage user name
Storage password
Storage unit

2. (ddfssv) utility creates/verifies the storage-unit connectivity with the target storage and performs save operation.

3. On successful verification and authentication, the file system agent writes the file system data directly to the storage-unit created on target storage using DD Boost.

4. File system agent sends the catalog details to catalog database on PowerProtect Data Manager.

7. Dell EMC PowerProtect software file system restore:

When file systems are protected within a protection policy in a PowerProtect software, we can recover the file system data using the centralized restore functionality or directly using the self-service restore feature.

Prerequisites for file system restores:

Before performing centralized or self-service file system restores:

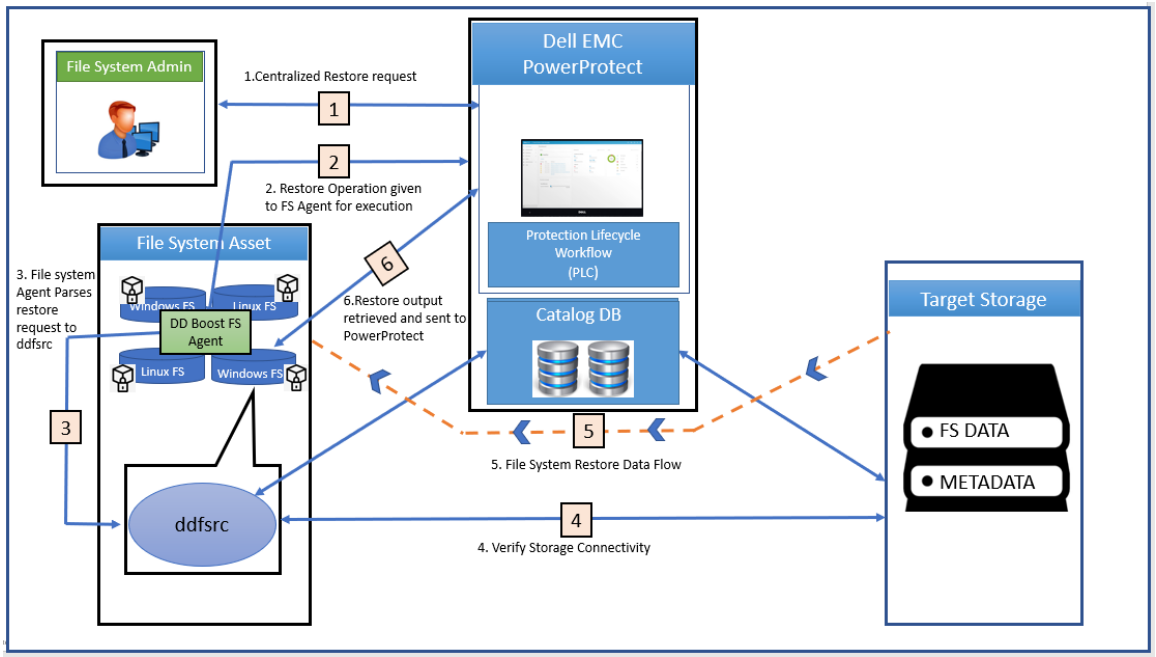
- Ensure that the target or destination volume is not a system volume.
- Ensure that the file system agent is not installed and running on the target volume.
- Ensure that there is sufficient space on the target volume for the restore.

7.1 Centralized - File system restore workflow:

A file system host image-level restore allows you to recover data from backups of file systems performed in PowerProtect Data Manager.

Note: If the destination file system asset already contains some data, this data will be overwritten.

Below workflow describes centralized file system restore workflow



1. Dell EMC PowerProtect software constructs the recovery job details based on the below UI inputs provided by backup administrator.

Source file system backup
Destination file system
Restore options
Restore file location
Storage information

2. PowerProtect Data Manager requests its agent to dispatch this operation to file system agent.

3. File system agent parses the recovery job request and converts into (ddfsrc) utility commands and executes the command based on inputs provided.

4.File system agent verifies the storage-unit connectivity on the target storage and retrieves the required data.

5.Requested file system data is restored to the destination mentioned by file system administrator or user.

6.The utility then returns the result back as return code and standard output which will be retrieved by PowerProtect agent and reports back to PowerProtect Data Manager for the restore status.

7.2 Self-Service - File system restore workflow:

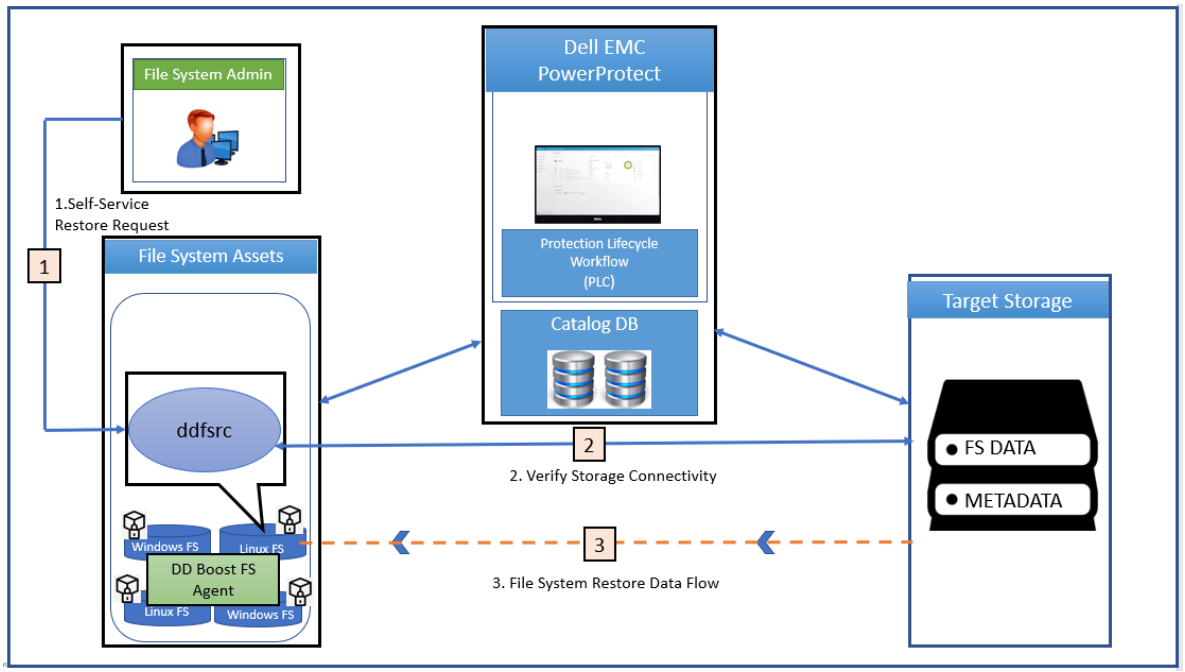
We can perform self-service image-level restores of file systems by using the ddfsrc command.

Note that this restore is not supported in the following scenarios:

- When the restore destination is the C:\ volume, which can result in the operating system becoming unavailable.
- When the restore destination is a volume with the File System agent installed.

Before running the (ddfsrc) command to perform a self-service image-level restore of file Systems, you can use the (ddfsadmin) backup command to query a list of all the local backups taken for a host and obtain the ID of the save set you want to restore, Specify the ID of the save set as an input to the ddfsrc command. If restoring to the original host, the password will be picked up from the lockbox.

Below workflow describes self-service file system restore workflow



1. File system administrator or user launches the ddfsrc utility via command line of the file system server and the below details to be entered as input, Once the above inputs are validated and executed the ddfsrc utility performs recover operation.

Source file system backup
Destination file system
Restore options
Restore file Location
Storage information

2. ddfsrc checks and verifies the storage-unit connectivity with target Storage.

3. On successful authentication the requested restore data is restored to the mentioned file system server destination provided by file system administrator or user.

Self-Service restore feature provides below options to restore the data,

- Restore to same host and same location
- Restore to same host and different location
- Restore to different host & location

7.3 Self-service file-level restore of file systems

We can perform self-service file-level restores of File Systems using the ddfsrc command with the -I option.

Before executing the command, create a file that contains the list of file(s) to be restored. Provide the location of this file as an input to the -I option.

For more details on performing Self-service file-level restore of file systems,

Kindly refer - *PowerProtect_ Data _Manager_Administration_and User_Guide - Version 19.1*

Conclusion

A comprehensive software backup solution is required to meet today's demanding SLAs and data protection for file system protection, replication and reuse. Dell EMC PowerProtect software provides the best-in-class data protection solution for file system backup with De-duplication technology. File system administrators and users can utilize the self-service feature for performing protection and recovery.

In Summary, below are the key highlights of Dell EMC PowerProtect software for file system backup and recovery,

Self-service and agility

- Control in the hands of the file system administrator with file system managed backup and recovery through file system agent.

Centralized governance & automation

- Central backup catalogue and SLO compliance tracking of retention, copies, recovery objectives and more.
- Automatic asset discovery, storage provisioning and protection plans allow for greater control over your environment

Performance

- Meet SLOs for large, mission-critical workloads with direct data paths leveraging leading de-duplication technology

Dell EMC PowerProtect software is not only for application owners. IT gives central IT the oversight they need to manage compliance and governance policies and maintain service level objectives (SLOs).

Troubleshooting

1. Application Agent and File System Agent Co-existence:

PowerProtect Data Manager version 19.1 supports the coexistence of the Microsoft SQL application agent with the file system agent on Windows, and the Oracle agent with the file system agent on Linux, which allows you to protect the SQL or Oracle database with the host file system. The following co-existence scenarios are supported:

- Both agents in managed mode (registered to PowerProtect Data Manager).
- The SQL or Oracle agent in standalone mode, with the file system agent registered to PowerProtect Data Manager.

Note: Version 19.1 of each agent must be installed if both agents are registered to PowerProtect Data Manager. In the single agent co-existence scenario (SQL or Oracle agent in standalone mode), the file system agent is supported in managed mode only.

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2. Issue during File System Discovery:

It is recommended to use different mount points for each drive. Reusing mount points might cause unexpected issues during file system discovery.

3. Restore Application Copies failed. Failed to communicate with host <hostname>

After the PowerProtect Data Manager server is recovered the following steps are needed for FSA to recover copies from the replica site, Although the FSA client may appear to be in registered state, the following error is thrown

Error:

Restore Application Copies failed. Failed to communicate with host <hostname>

Solution:

- Unregister the FSA agents and register them to the new PowerProtect Data Manager server.
- Approve the client on the new PowerProtect Data Manager server
- Perform restore - the restore operation of an FSA Copy should be successful.

References

For additional information, the following resources are recommended:

Product documentation:

PowerProtect_ Data _Manager_Administration_and User_Guide

Describes how to configure and maintain Dell EMC PowerProtect Software.

PowerProtect E-LAB Navigator

Provides compatibility information, including specific software and hardware configurations that PowerProtect supports. To access E-LAB Navigator, go to https://elabnavigator.emc.com/eln/modernHomeDataProtection.