Technical White Paper

Dell PowerProtect Data Manager: File System Backup and Recovery

Abstract

This white paper focuses on file system backup and recovery using Dell PowerProtect Data Manager.

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Acknowledgments

Author: Vinod Kumar Kumaresan

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Executive summary

Business Case: Challenges

Today's data protection is either too complex, requires multiple vendors, does not scale, or does not 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. One of the biggest challenges is determining how we can turn the data we protect and manage into value. Customers are challenged with backups, recovery, and ultimately the management and governance of the data they are protecting.

Solution Overview: Why PowerProtect Data Manager?

Dell PowerProtect Data Manager is the next generation data management platform to transform traditional data protection to comprehensive data management. Data Manager gives IT the trusted data protection they know from Dell Technologies, combined with operational simplicity that protects workloads and file systems running on-premises with self-service capabilities for operational efficiency and IT governance controls to ensure compliance. SaaS-based management makes it easy to monitor, analyze, and troubleshoot distributed data protection environments from anywhere.

Data Manager gives valuable insight into protected on-premises and in-cloud workloads, applications, file systems, and virtual machines. Designed with operational simplicity and agility in mind, Data Manager enables the protection of traditional workloads including Oracle, Exchange, SQL, SAP HANA, NAS, file systems, Kubernetes containers, and virtual environments.

This white paper focuses on file system backup and recovery with Data Manager, which ensures reliable and efficient data protection functionality. It also describes the file system backup architecture, backup and recovery workflows, and deployment requirements.

Audience

This white paper is intended for Dell Technologies customers, partners, and employees who are looking for file system data protection and management using Data Manager.

1 Introduction to Data Manager for File System

Data Manager offers centralized oversight of all protected file system copies. This makes it simple to track and enforce service level objective (SLO) compliance for backup and recovery, RPOs, and Storage retention lock. Data Manager discovers copies sent to protection storage, then catalogs and makes protection copies available for compliance measurement to ensure protection compliance and quality of service.

The File System Agent allows an application administrator to protect and recover data on the file system host. Data Manager integrates with the File System Agent to check and monitor backup compliance against protection policies. Data Manager File System Agent has been designed to support the file system backup, restore, and replication workflows. This white paper describes how effectively you can protect file systems using Data Manager with Dell PowerProtect DD series appliances as target storage.

1.1 Data Manager key features for file system protection and recovery

- Centralized file system backup and recovery (volume and file level) through Data Manager
- Self-service file system backup and file-level recovery (volume and file level) using command-line utility
- Block-based and File-based file system support for file system workloads. For more details on file system workloads compatibility, see section “File Systems” in the PowerProtect Data Manager support matrix
- Supports centralized file level restores of block-based file system backups.
- File level restore from Data Manager UI
    - Support restore to original or alternate host for file-based backups
    - Creation of separate directory to separate the restore files
- Support for backup of Non-LVM or physical disks
- Supports exclusion of files and folders from file system backups through use of file exclusion
- Data Manager provides support to run file system backups in parallel to reduce the time taken for backups
- No excessive metadata generation and PowerProtect DD series appliances Active Tier storage consumption has been optimized for file-based backups
- Automated host agent configuration during policy creation
- Flexibility to define and assign exclusion filter to file system protection policy for excluding certain files and folders
- **Encryption over the wire (EOW)** of file system backup and restore data - Data Manager provides EOW of data during some backup and restore operations. If enabled, encryption is automatically applied to file system workloads
- Data Manager File System Agent supports the Microsoft System State Recovery (SSR), Active Directory Restore, and bare-metal recovery (BMR) disaster-recovery mechanisms
- Data Manager File System agent now allows the selection of clustered drives and logical cluster hosts as assets and asset sources
- Starting with PowerProtect Data Manager 19.12, file indexing and search is supported for file system workloads

2 File System backup technology and models in Data Manager

2.1 Block-based backup technology

Data Manager performs a file system 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. Unlike the traditional file system backup, BBB supports high-performance backups with a predictable backup window.

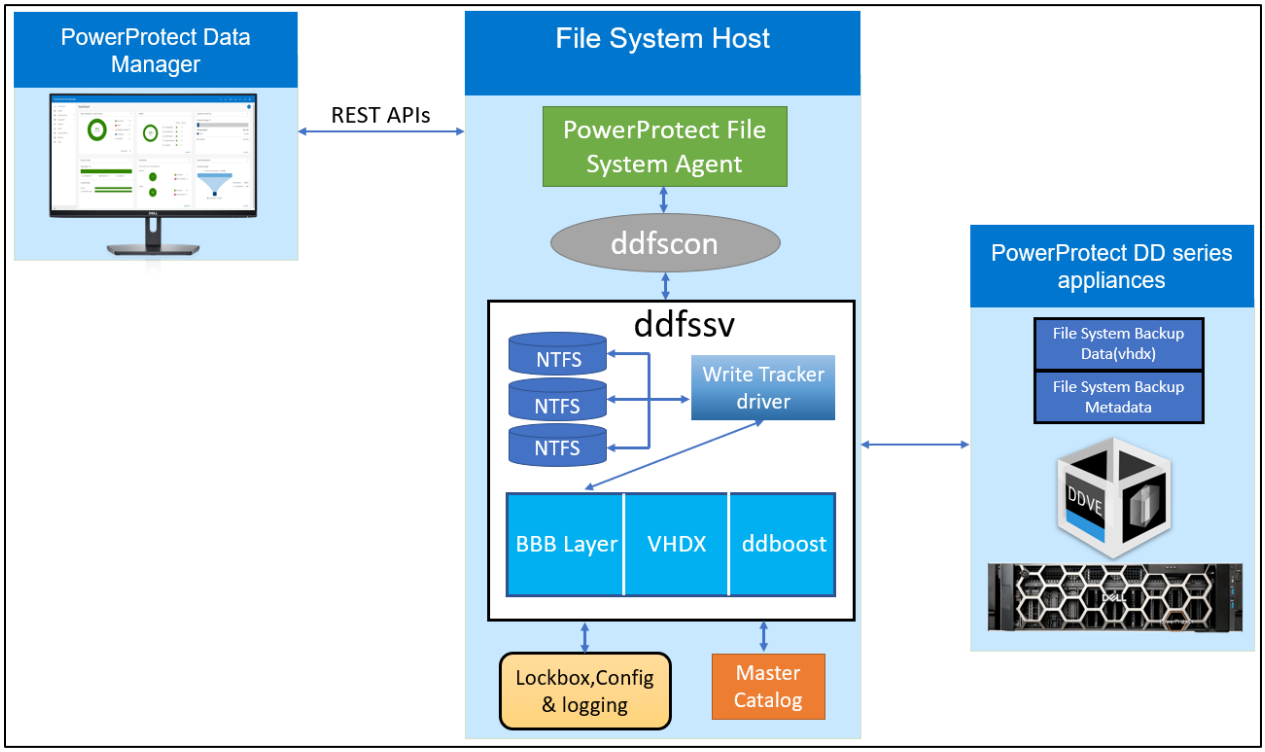


Figure 1: Data Manager Block-Based Backup Technology:

Block-based backups provide instant access to the backups. The block-based backups enable you to mount the backups by using the same file systems that you used to backup the data.

The File System Agent's block-based backups support the following capabilities:

- Mounting of a backup as a file system
- Mounting of an incremental backup
- Sparse backup support
- Backups of operating system-deduplicated file systems as source volumes on Windows
- Forever virtual full backups to DD series appliances
- DD retention lock
- Recoveries from DD series appliances

Block-based backups are useful for datasets that are under 10 TB with a single volume under 5 TB, and a daily change rate under 5%.

2.2 File-based backup technology

File-based backups (FBB) traverse through the entire directory structure of the file system to backup all the files in each directory of the file system. FBBs can provide additional capabilities such as exclusion. These backups take longer to complete when compared to block-based backups. The File System Agent performs a FBB of the protected assets when an exclusion filter is applied to a protection policy.

Note: Exclusion filters cannot be applied to self-service protection policies and to backups taken through self-service CLI.

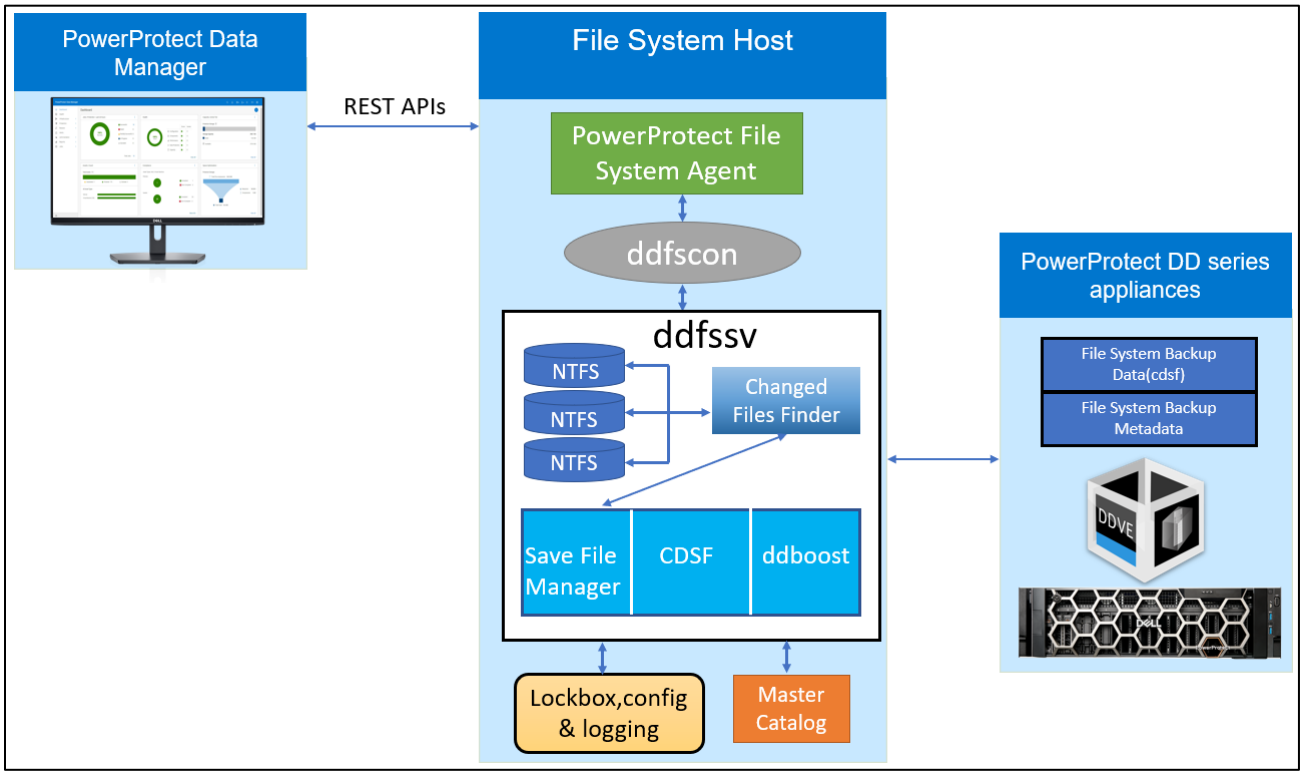


Figure 2: Data Manager File-Based Backup Technology

2.3 Data Manager models for file system protection and recovery

File system protection data zone components include Data Manager server, PowerProtect File System Agents, file server host, and storage. Data Manager 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

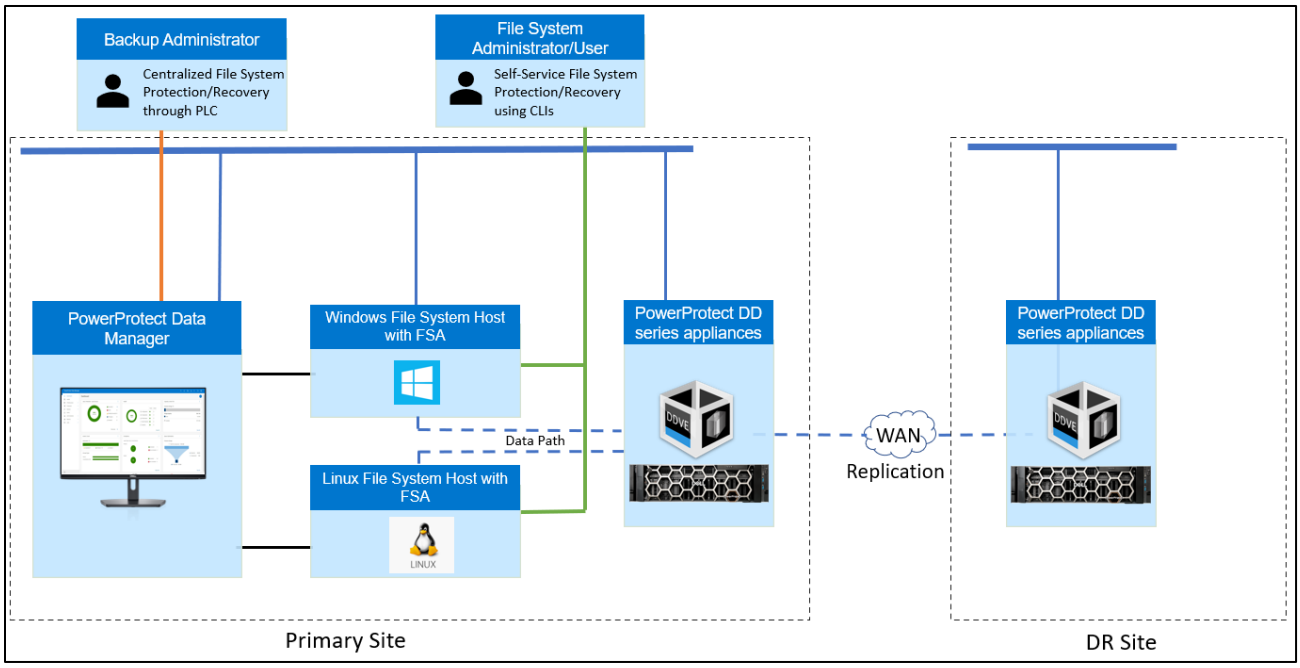


Figure 3: Data Manager models for file system protection and recovery

a) Self-service file system protection and recovery

- File system admin or user can use self-service CLI commands to perform self-service backup or restore
- For a host with File System Agent installed, a Data Manager server is required to backup file systems. However, a backup administrator or file system administrator who wants to back up file systems manually (and who uses Data Manager only for compliance purposes) can register the host to Data Manager and create a self-service protection policy to configure only the retention policy instead of a complete backup schedule.
- After a host is registered with 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-line utility.
- 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 Data Manager.

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 the centralized protection feature, Data Manager manages the entire file system backup workflow, including the schedule.
- Centralized protection is supported through protection policy. After the File System Agent is installed on the client, the client is auto discovered on Data Manager and enables the administrator to approve the client.
- Choosing the centralized protection option during protection policy creation enables Data Manager to manage all protection centrally.

2.4 Roadmap to protect a file system

The following roadmap provides the steps required to configure the File System Agent in Data Manager to run protection policies.

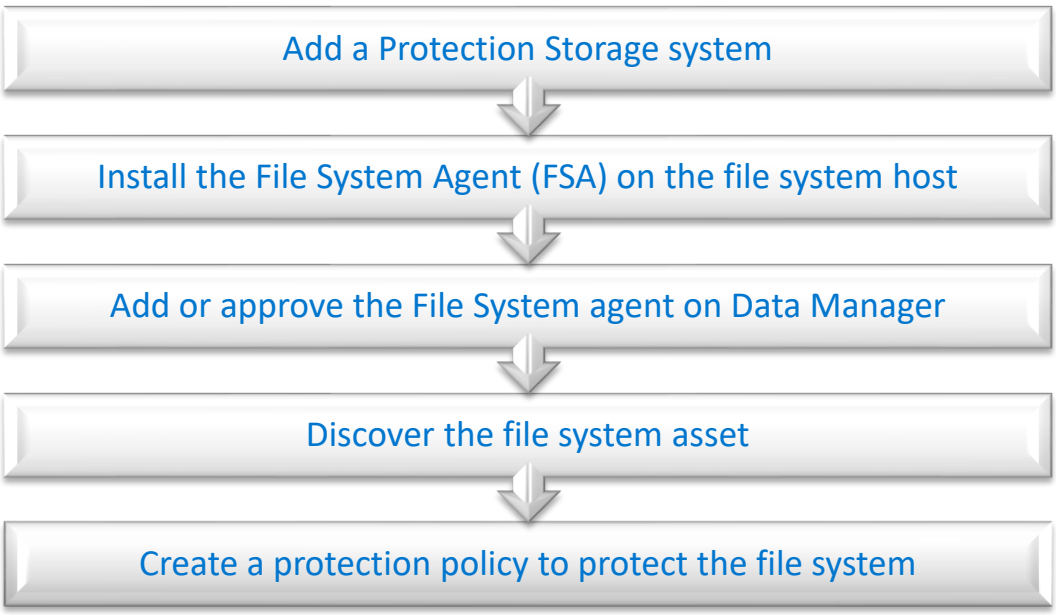


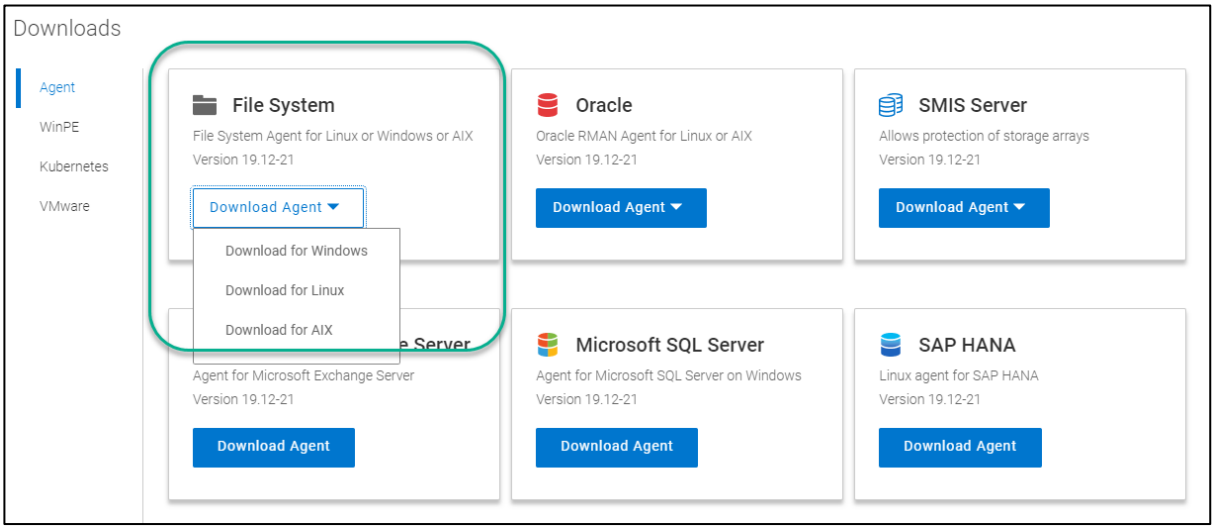
Figure 4: Roadmap to protect a file system

See *PowerProtect Data Manager File System Agent User Guide* for details about how to install, configure, and perform a file system backup/restore.

3 File System backup configurations

3.1 File System Agent

The File System Agent needs to be installed on the host that is planned to protect. The File System Agent binaries (Windows and Linux) can be downloaded on the below path from **PowerProtect Data Manager→ Settings → Agent downloads**.



See *PowerProtect Data Manager File System Agent User Guide* for details on how to install File System Agent on supported Windows and Linux hosts.

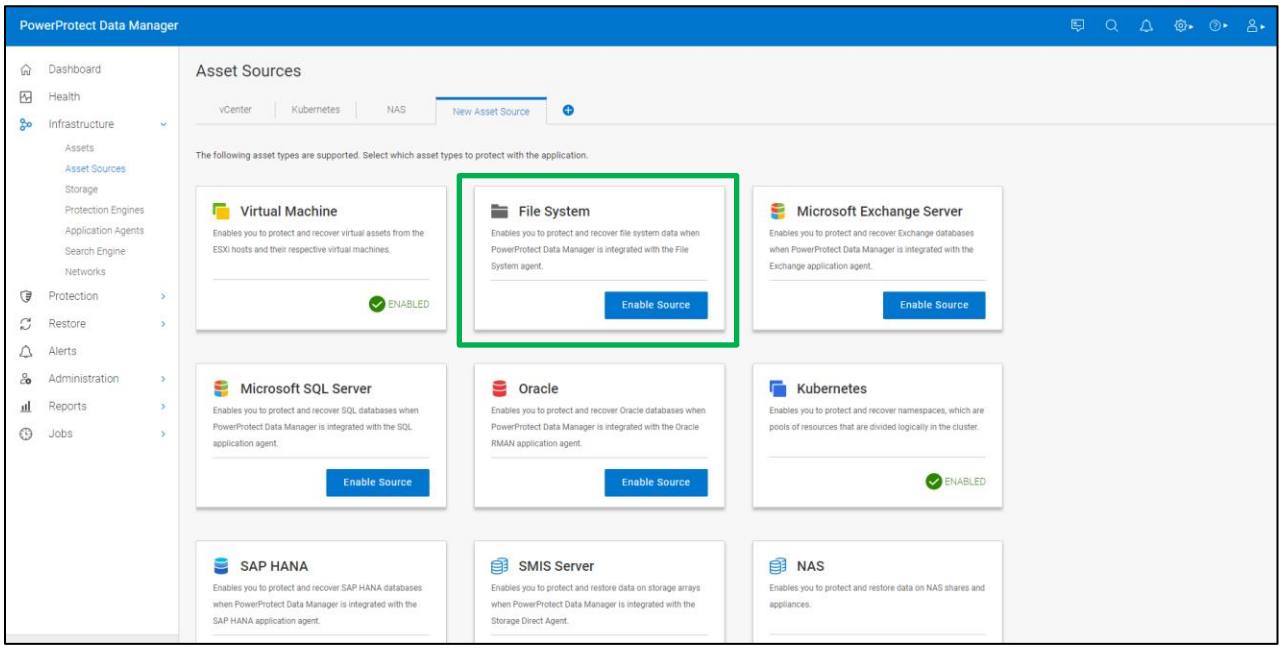
Data Manager supports the coexistence of agents on the same Windows or Linux host for the following:

- Microsoft SQL agent and the File System Agent on Windows
- Microsoft Exchange agent and the File System Agent on Windows
- Oracle RMAN agent and the File System Agent on Linux
- SAP HANA agent and the File System Agent on Linux

Software compatibility information for the Data Manager software and the File System Agent is provided in the eLab navigator, available at https://elabnavigator.dell.com/eln/modernHomeDataProtection.

3.2 Enabling File System asset source

By enabling the file system asset source, Data Manager can protect and recover file system data when Data Manager is integrated with the File System Agent.

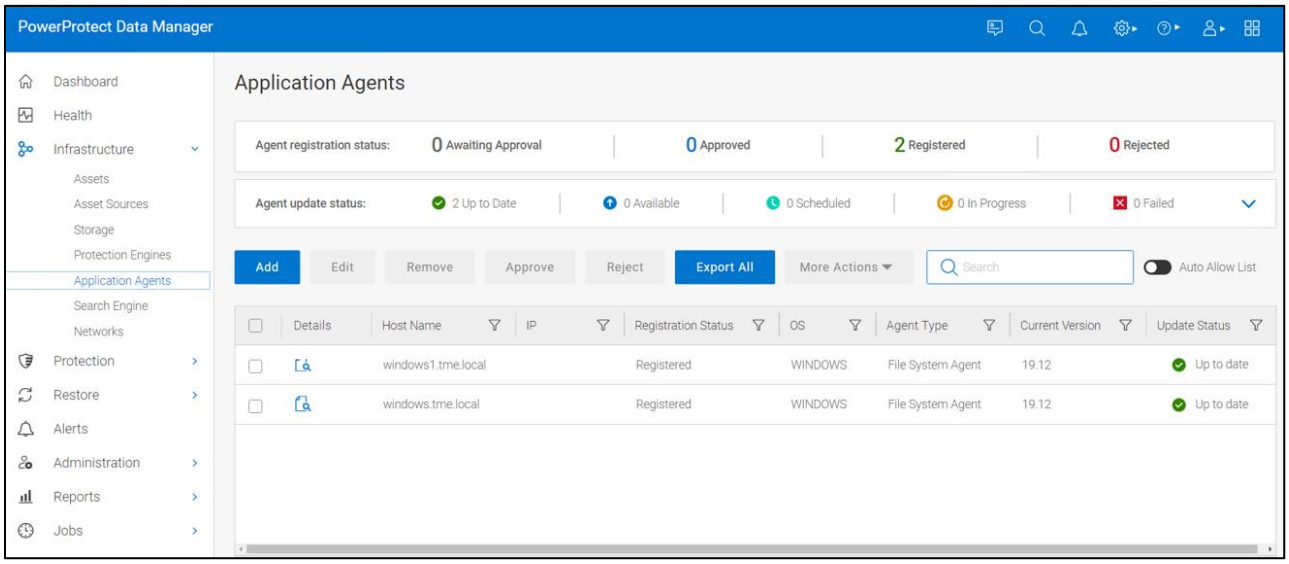


3.3 File System host configuration

After the File System Agent is installed on the file system host, File System Agent can be added, approved, and rejected for the pending agent requests. Select **Infrastructure** > **Application Agents** and click **Add** or **Approve** as required.

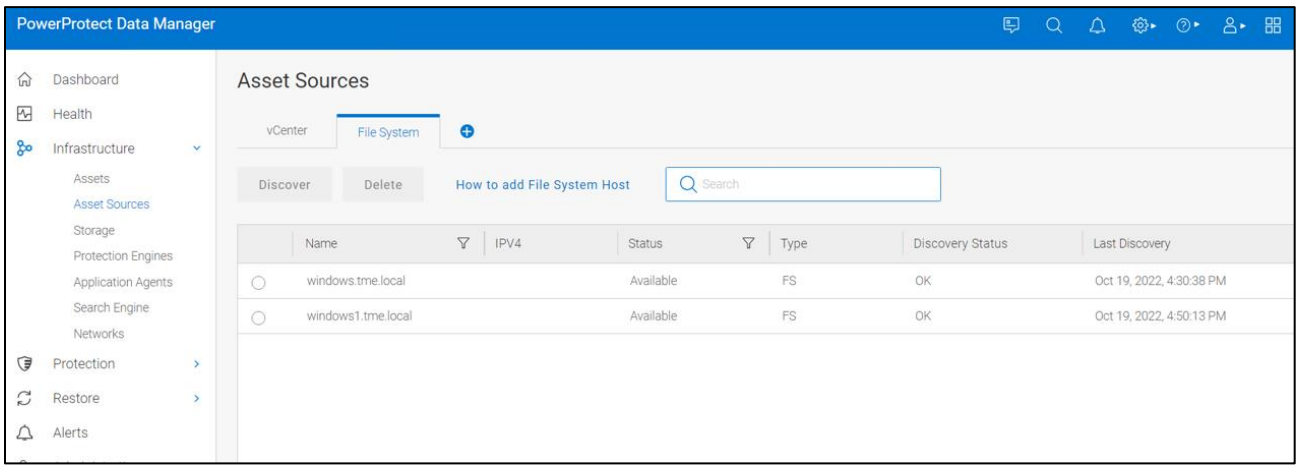
The "**Auto Allow List**" all option is disabled by default. When enabled, all preapproved application agents are automatically approved.

File System Agent registered with Data Manager:



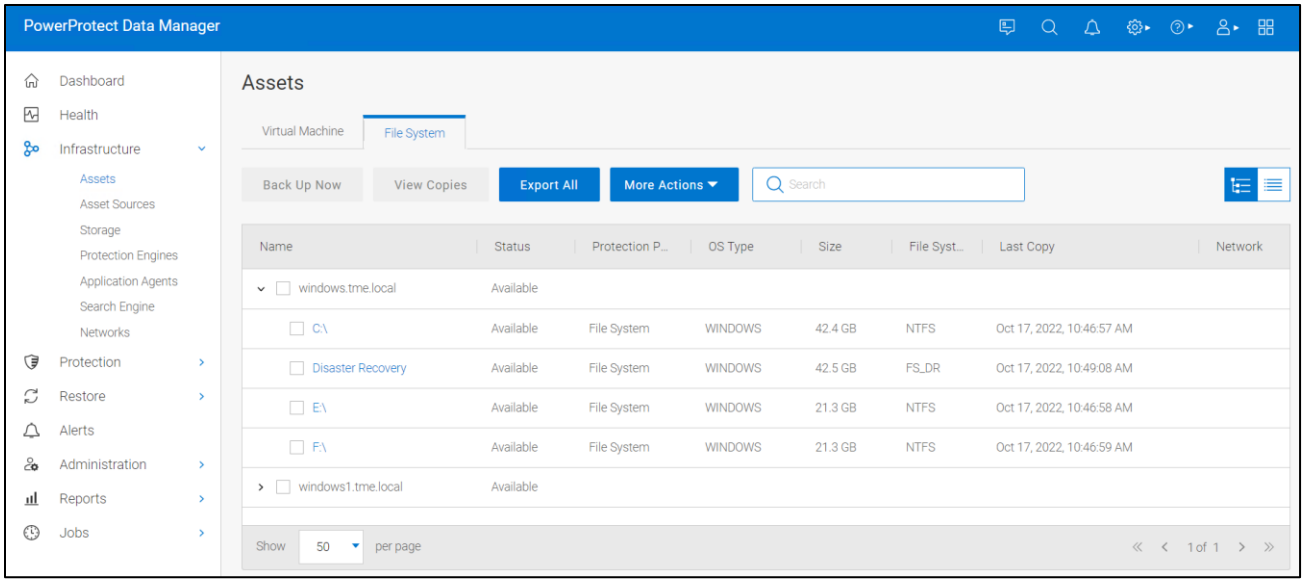
On successful registration, the file system host is listed on the **Infrastructure** > **Asset Sources** section. Asset discovery is initiated by default after registration of the file system host to Data Manager.

File system host is discovered in the **Asset Sources > File System** section.



3.4 File system asset discovery

Discovered file system assets in the **Infrastructure > Assets** section.

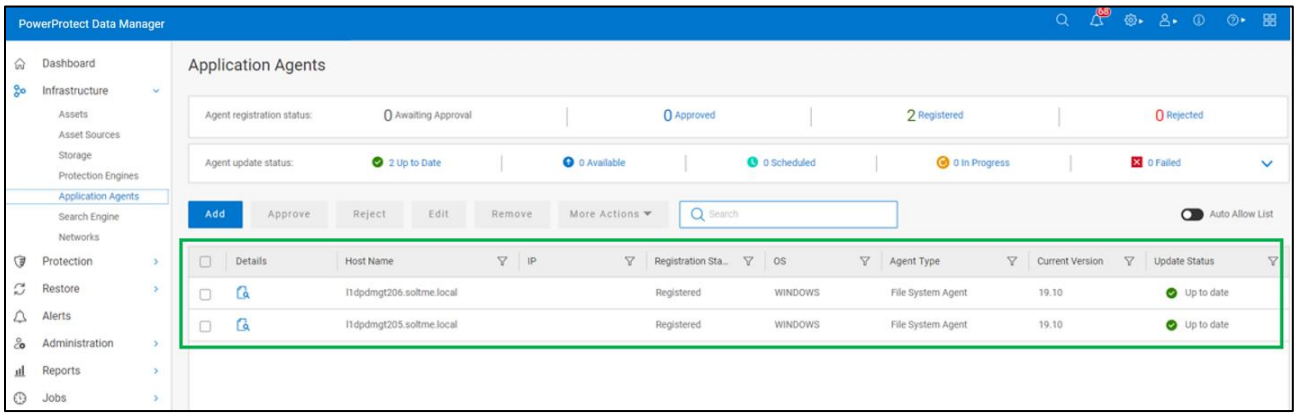


3.5 Protecting Windows clustered disks with Data Manager

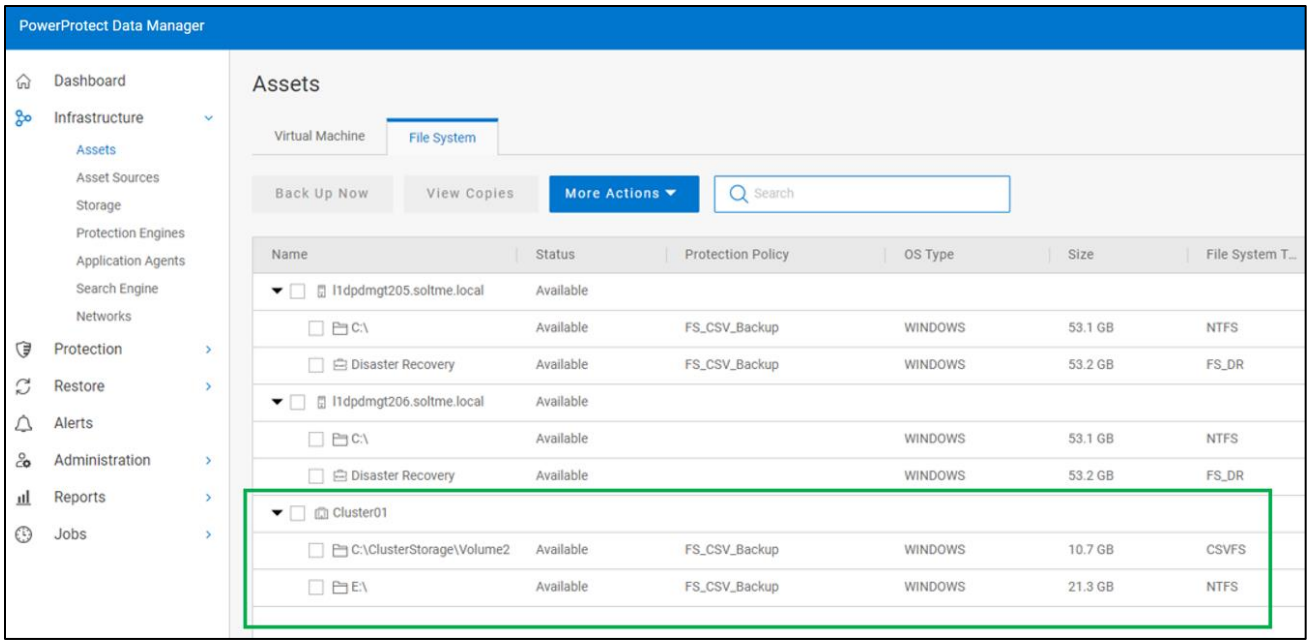
Starting with Data Manager version 19.10, the File System Agent provides support for protecting the Windows clustered file system. With this feature, customers can use the File System Agent to protect their clustered disks, like the regular file system drives.

Both BBB and FBB are supported for Windows clustered disk protection. During the failover, the backup will continue through the node that owns the cluster disks. This prevents administrators from having to manually reconfigure for data protection continuity.

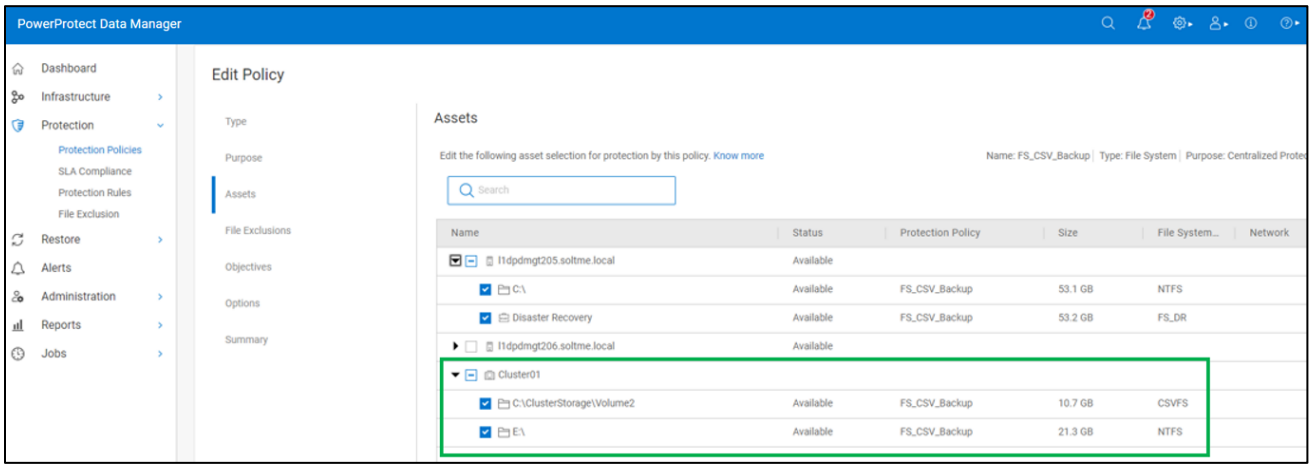
The following figure shows the **Application Agents** view for the Windows cluster nodes registered with Data Manager.



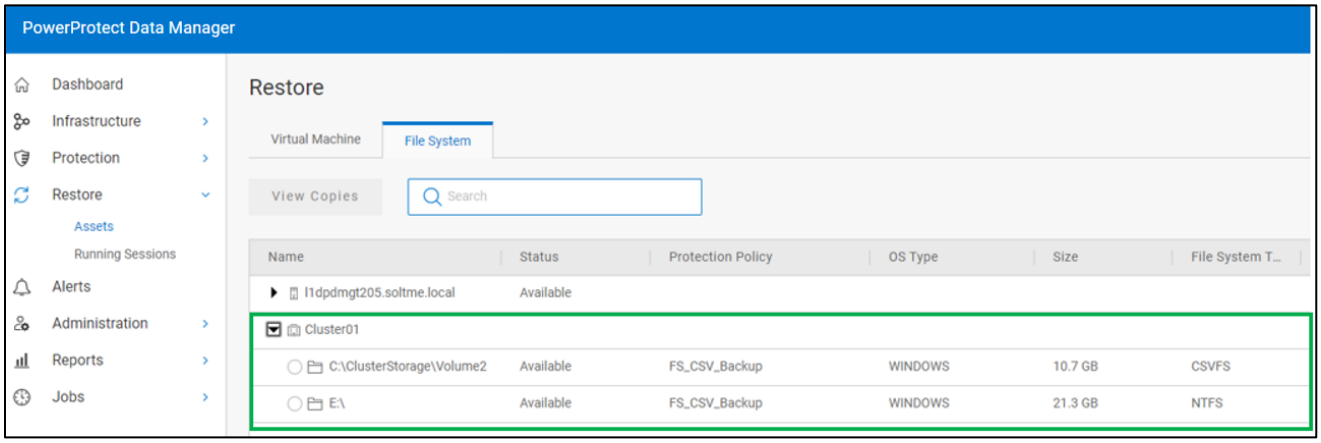
The above cluster nodes registered with Data Manager discover the clustered disks as assets, as shown below.



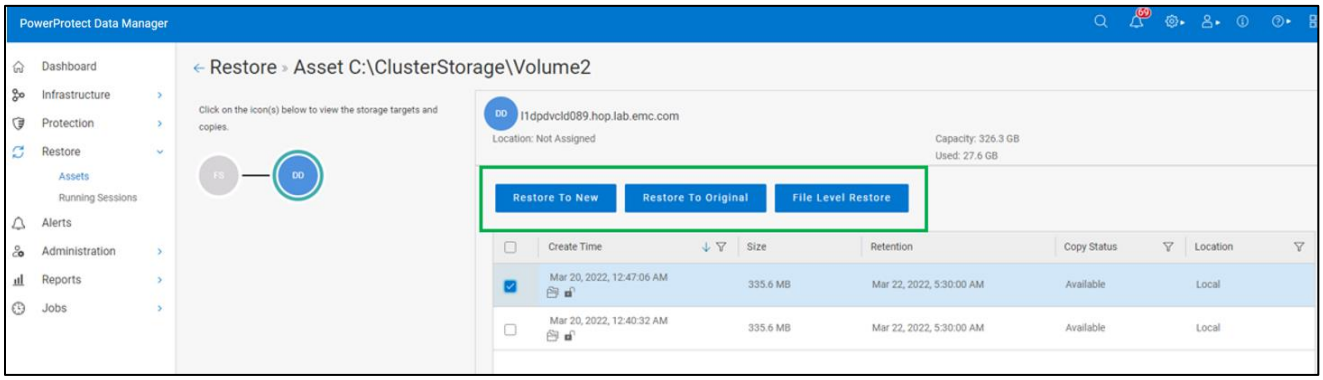
A file system protection policy can be created to back up the cluster assets, in the same way of protecting the regular file system drives.



Backup copies available for Windows cluster assets.



Once the backup is successful, Data Manager provides the option to perform FLR and Image level restore to the original, or to an alternate location, from the backup copy.

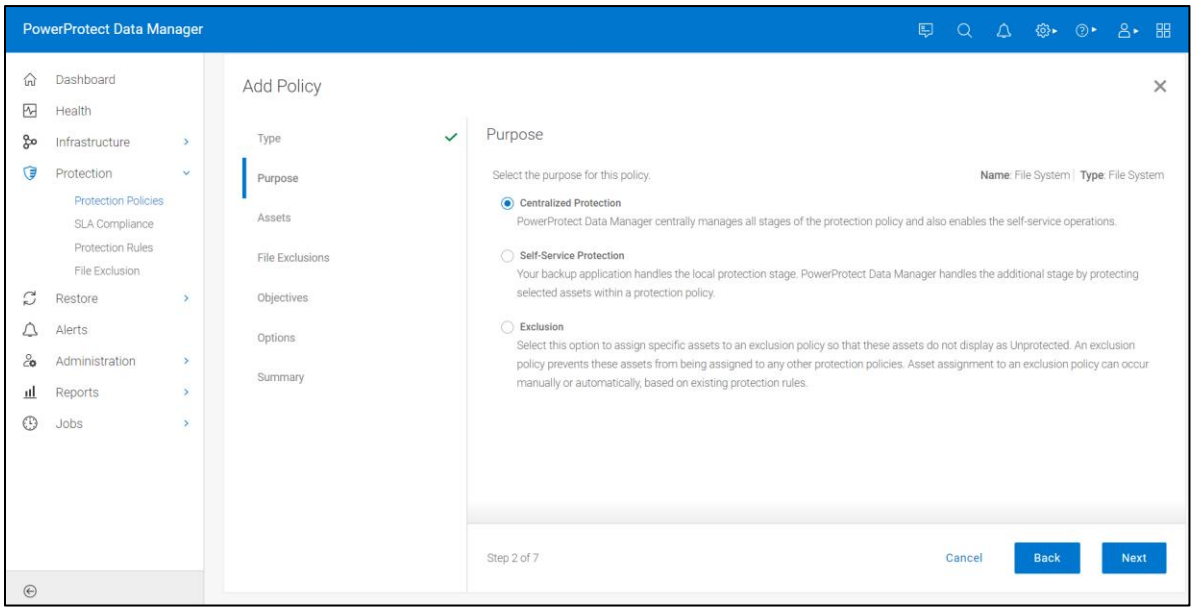


4 File system protection policy

A file system protection policy can be created from Data Manager UI to protect file system data.

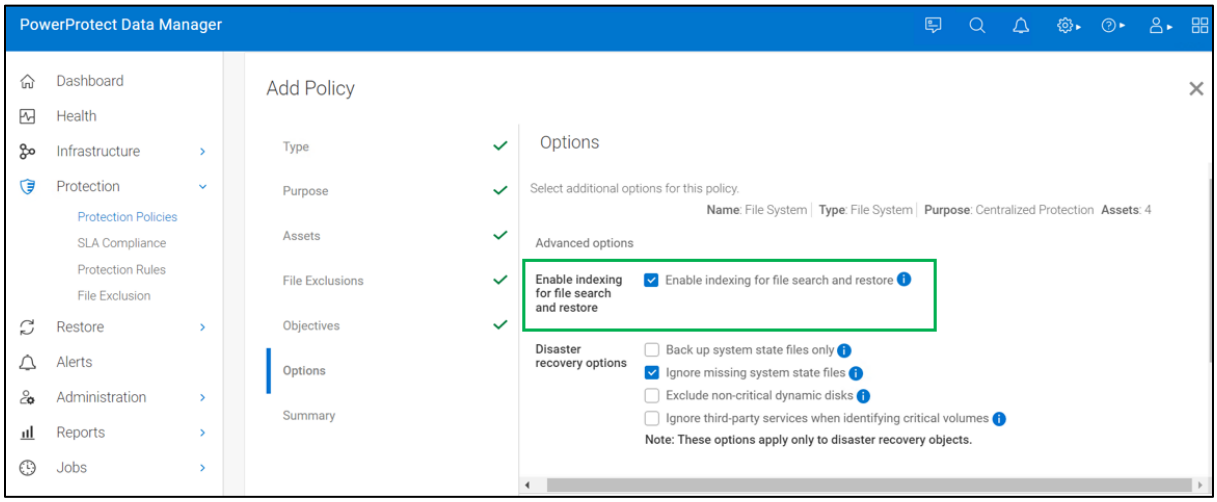
Protection life cycle policy defines a set of objectives that apply for a specific duration. Data Manager provides centralized and self-service protection options to specify one of the following "Purposes" for the protection policy to back up Linux/Windows file systems. These objectives drive configuration, active protection, and data management operations that satisfy Service Level Agreements (SLAs).

For file system protection, you can select one of three types:



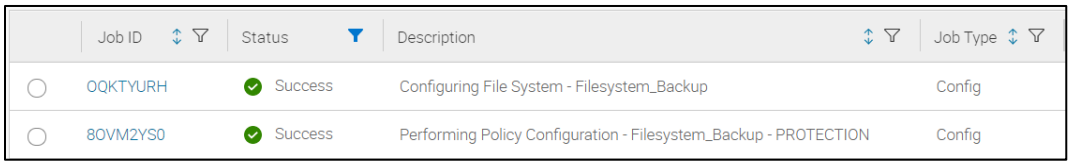
- **Centralized Protection** - To use Data Manager to manage all protection centrally.
- **Self-Service Protection** - To use the file system to create local backup protection. Data Manager creates a protection policy and manages extra stages.
- **Exclusion** - If there are assets within the protection policy to exclude from data protection operations.

Option to enable indexing for file search and restore from the protection policy, when one or more search nodes are deployed with PowerProtect Data Manager.



After the policy configuration is complete, an informational message appears to confirm that Data Manager has saved the protection policy. Initially there will be two configuration tasks running:

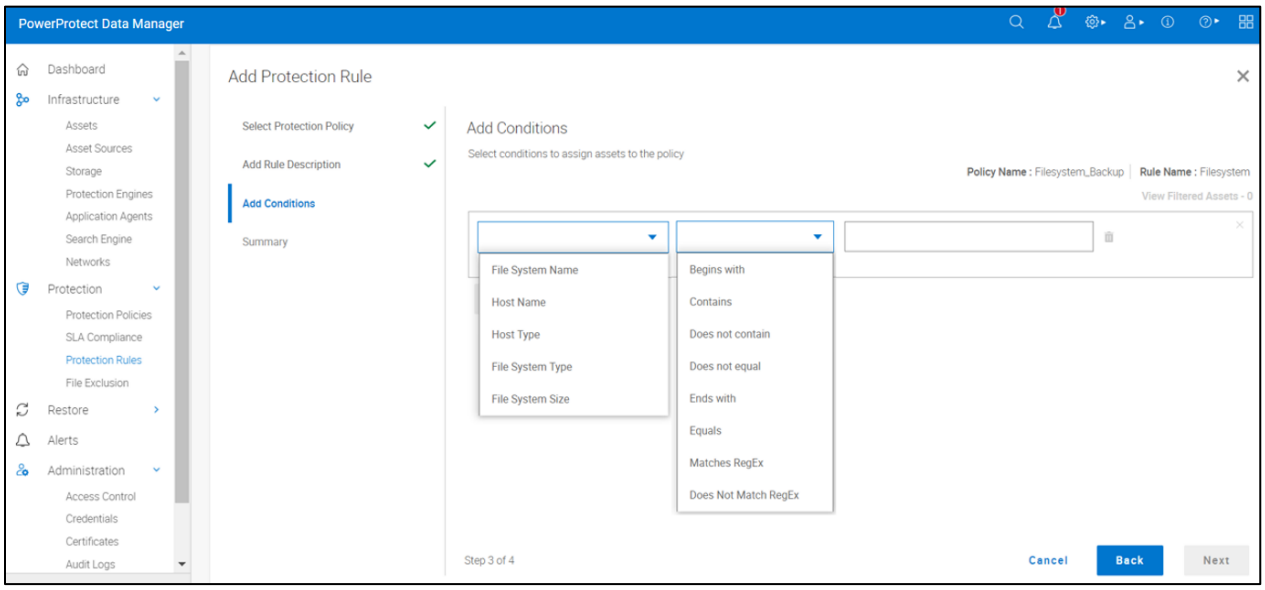
- The first task will create a storage-unit on DD series appliance.
- The second task will update the agent lockbox on the file system host and add the new storage-unit credentials.



See *PowerProtect Data Manager File System Agent User Guide* for detailed steps on how to create a protection policy for file system backup.

4.1 Protection rule for file system

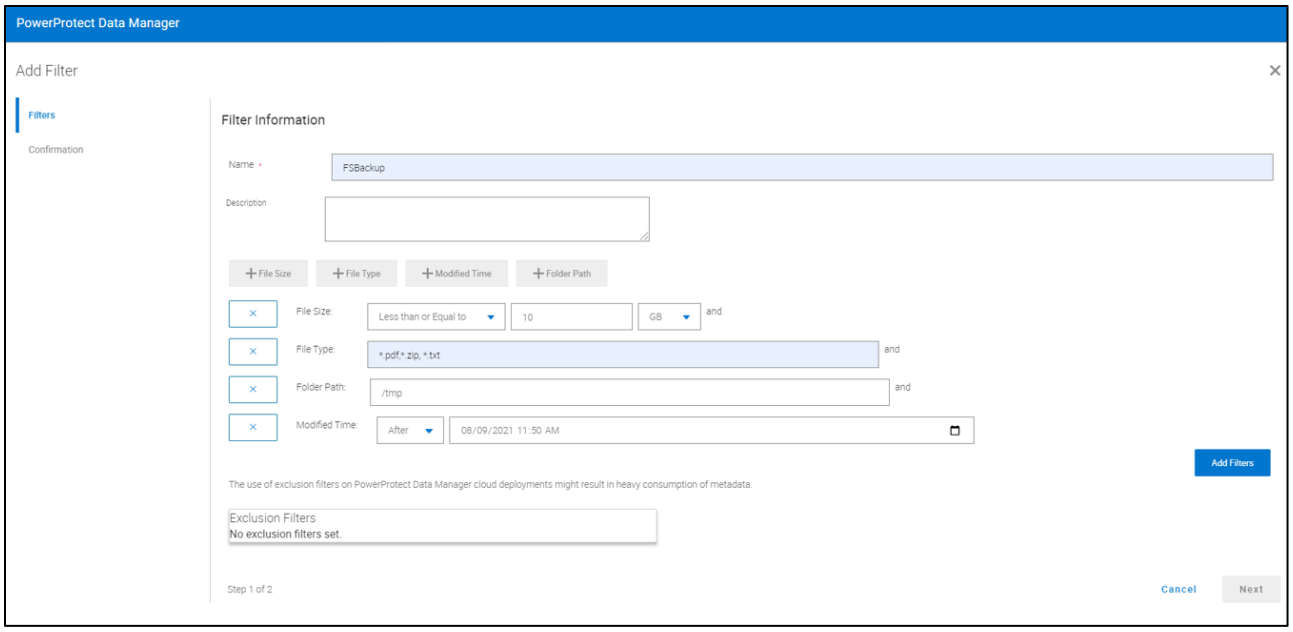
A protection rule automatically determines which assets get assigned to protection policies when the assets are discovered. A protection policy must exist prior to creating the dynamic filter. An asset can only belong to one protection policy.



4.2 Exclusion filters for file system data protection

Data Manager provides the option to exclude data (file system files and folders) from assets that are assigned to protection policies. File system exclusion filters can be defined and applied to a protection policy to exclude certain files and folders from file system data protection.

An exclusion filter provides the following options for excluding file and folders from a file system backup.



Exclusion Filter Conditions	
Conditions	**Description**
File Type	For example - .txt, .xlsx, .pdf
Modified Time	File/Folder modification time
File Size	File/Folder size
Folder Path	File/Folder path

After the filters are created, filters can be applied during the new file system protection policy creation or it can be applied to an existing file system protection policy. For verification, backup logs provide details of the files and folders which are excluded from backup according to the filter defined.

4.3 File system parallel backup settings

Data Manager enables running file system backups in parallel to reduce the time taken for backups. This setting defines the maximum concurrent network sessions from the client to DD series appliance at any given time. The number of streams to use for the backup can be specified in the configuration file `.ddfssv.fsagentconfig` or through the self-service CLI. However, it is best to set the parallelism value in the configuration file because the parallelism value provided in the configuration file takes precedence over the parallelism value that is provided in the CLI.

Note: Backup parallelism is only available on supported Windows systems. Because the parallelism setting is defined at the host level, the parallelism setting must be set on every Windows host where parallel file system backups are enabled. This value must be an integer. The default value is 8.

See *PowerProtect Data Manager File System Agent User Guide* for details on how to specify the number of streams to use for the backup in the `.ddfssv.fsagentconfig` file in the `C:\Program Files\DPSAPPS\fsagent\settings` directory on the file system host or by using the command-line option.

5 Data Manager File System Backup

Data Manager enables discovering, managing, monitoring data protection, and replicating file system assets through integration with the File System Agent. File system assets are protected in Data Manager with centralized and self-service file system protection features.

Data Manager self-service protection enables users to perform backup and restore using a self-service CLI workflow for Windows and Linux assets. With agility and self-service feature, data owners can perform backup and recovery within native applications.

5.1 Centralized file system backup workflow

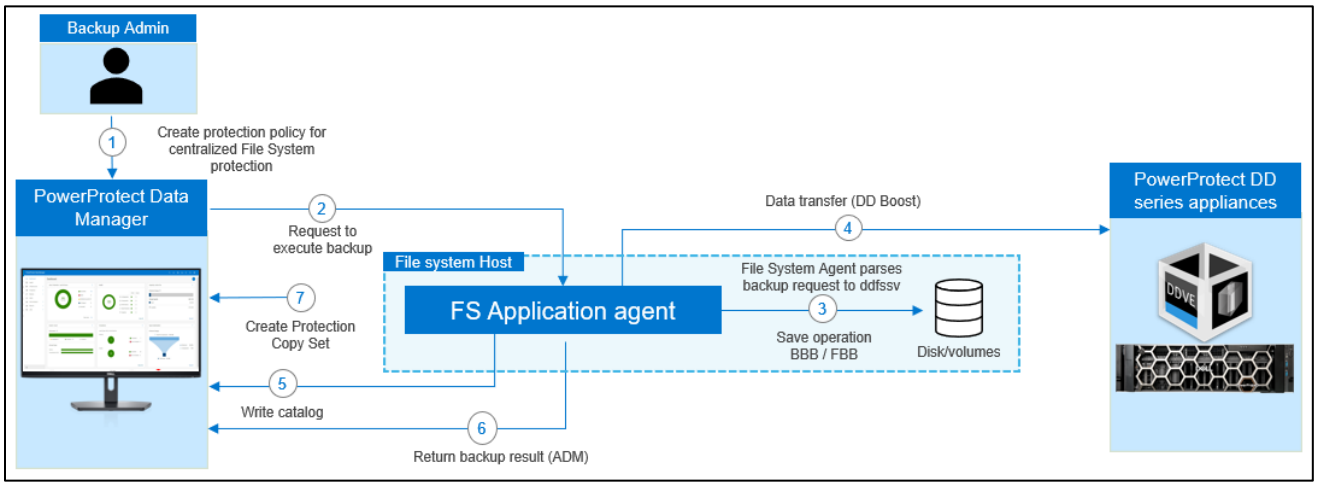


Figure 5: Centralized file system backup workflow

1. Protection policy is created for centralized File System protection.
2. At the time of scheduled backup, the Data Manager requests the File System Agent to perform save operation for the file system data.
3. File System Agent parses the backup job request and converts into (ddfssv) utility commands to perform save operation.
4. File System Agent verifies DD series appliance connectivity and writes the file system data to the storage-unit created on the DD series appliance.
   (Waits for 15 minutes)
5. File System Agent writes the catalog details to catalog database on Data Manager.
6. ADM agent retrieves the result from FS agent and updates the backup status to Data Manager.
7. Creates and maintains Protection Copy Set (PCS) in Elasticsearch database

5.2 Self-service file system backup workflow

A host with the File System Agent installed requires Data Manager to back up the file systems. To back up file systems manually and use Data Manager, the file system host needs to be registered with Data Manager and a self-service protection policy needs to be created. Data Manager discovers these backups and enables centralized restore operations. You can also perform a manual restore operation.

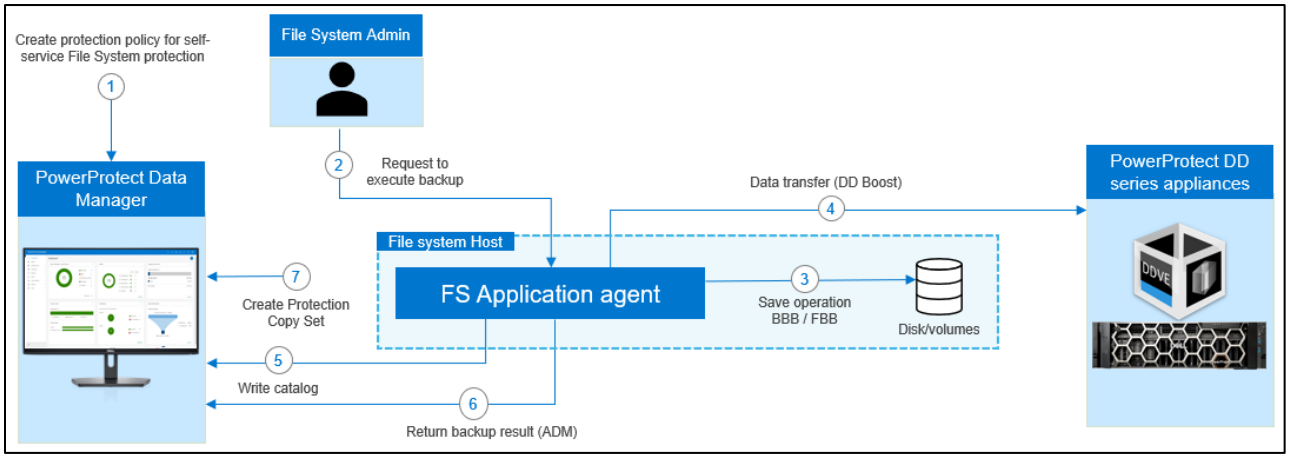


Figure 6: Self-service file system backup workflow

1. Protection policy is created for self-service File System protection.
2. File system administrator launches the (ddfssv) utility using command line on the file system host and inputs the below details to initiate backup.
   Backup schedule (Full, Incremental)
   Storage IP address
   Storage Username
   Storage password
3. (ddfssv) utility performs save operation.
4. File System Agent verifies DD series appliance connectivity and writes the file system data to the storage-unit created on the DD series appliance.
   (Waits for 15 minutes)
5. File System Agent writes the catalog details to catalog database on Data Manager.
6. ADM agent retrieves the result from FS agent and updates the backup status to Data Manager.
7. Creates and maintains Protection Copy Set (PCS) in Elasticsearch database

6 Data Manager File System Restore

When file systems are protected within a protection policy in a Data Manager, the file system data can be recovered using the centralized restore functionality or by directly using the self-service restore feature.

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 enough space available on the target volume for the restore

6.1 Centralized file system restore workflow

A file system host image-level restore allows recovering data from backups of file systems performed in Data Manager.

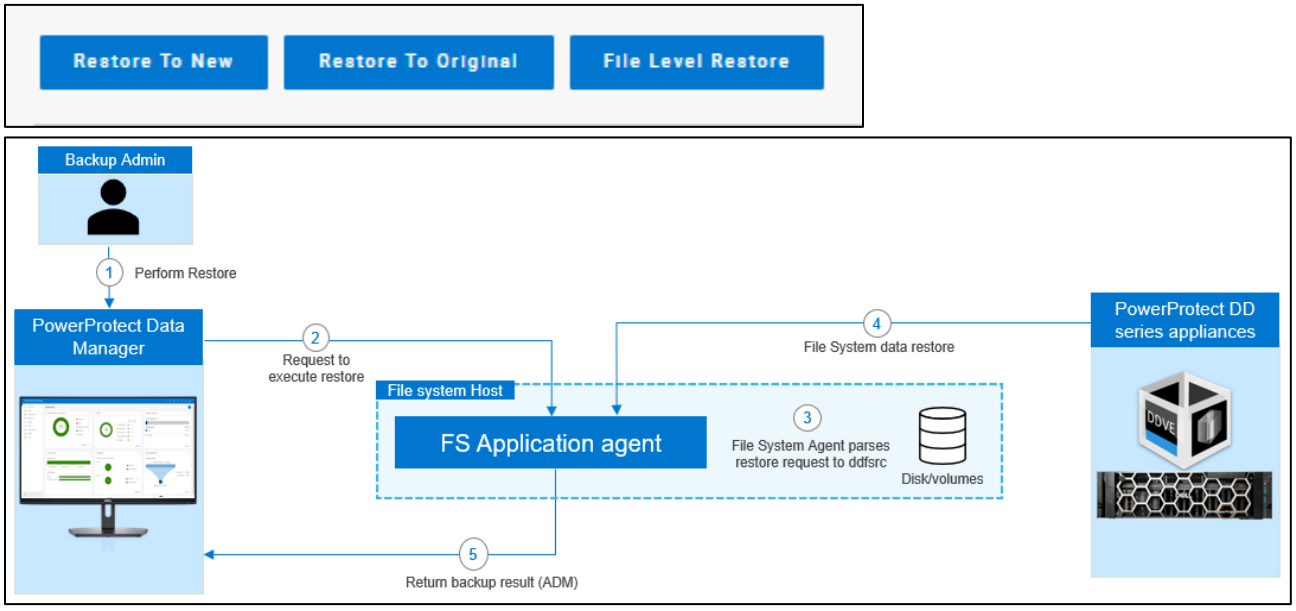


Figure 7: Centralized file system restore workflow

1. Backup administrator creates the recovery job on Data Manager UI with below UI inputs,
   Source file system backup
   Destination file system
   Restore options
   Restore file location
2. Data Manager requests its ADM agent to dispatch the restore operation to File System Agent.
3. File System Agent parses the recovery job request and converts into (ddfsrc) utility commands and executes the restore operation based on inputs provided.
4. File System Agent verifies DD series appliance connectivity and the requested file system data is restored to the specified destination.
5. ADM agent retrieves the result from File System Agent and updates the restore status to Data Manager.

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

6.2 Self-service file system restore workflow

Self-service image-level restores of file systems can be performed by using the ddfsrc command.

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, the (ddfsadmin) backup command can be used to query a list of all the local backups taken for a host and obtain the ID of the save set for 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.

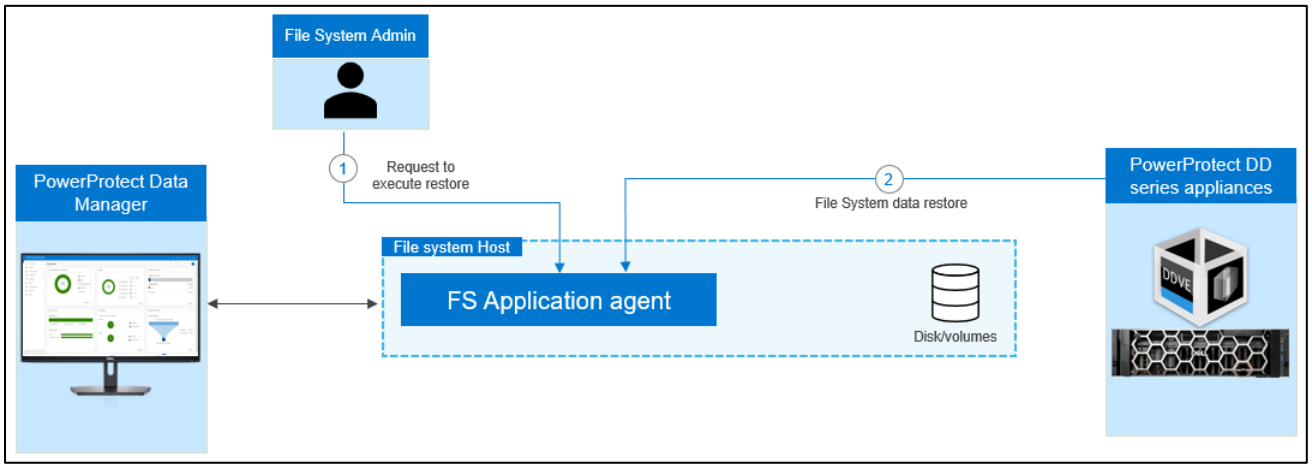


Figure 8: Self-service file system restore workflow

1. File system administrator launches the ddfsrc command-line utility and below details to be entered as input, Once the inputs are validated and executed the ddfsrc utility performs recover operation.
   Source file system backup
   Destination file system
   Restore options
   Restore file Location
2. File System Agent verifies DD series appliance connectivity and the requested file system data is restored to the specified destination.

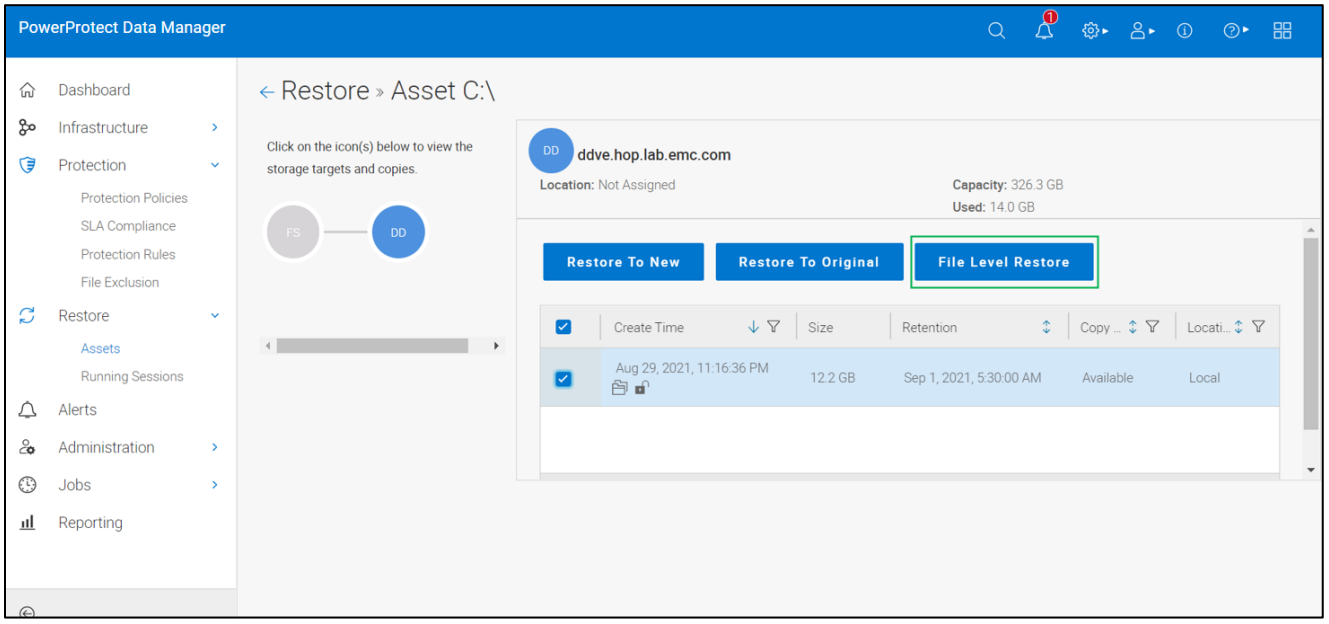
The self-service restore feature provides the following options to restore the data:

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

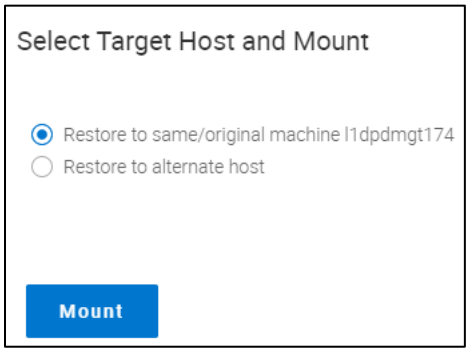
6.3 Centralized file-level restore of file systems

Data Manager provides the option to restore files and folders from file system backup through Data Manager centralized console.

Recovery > Assets > File Level Restore



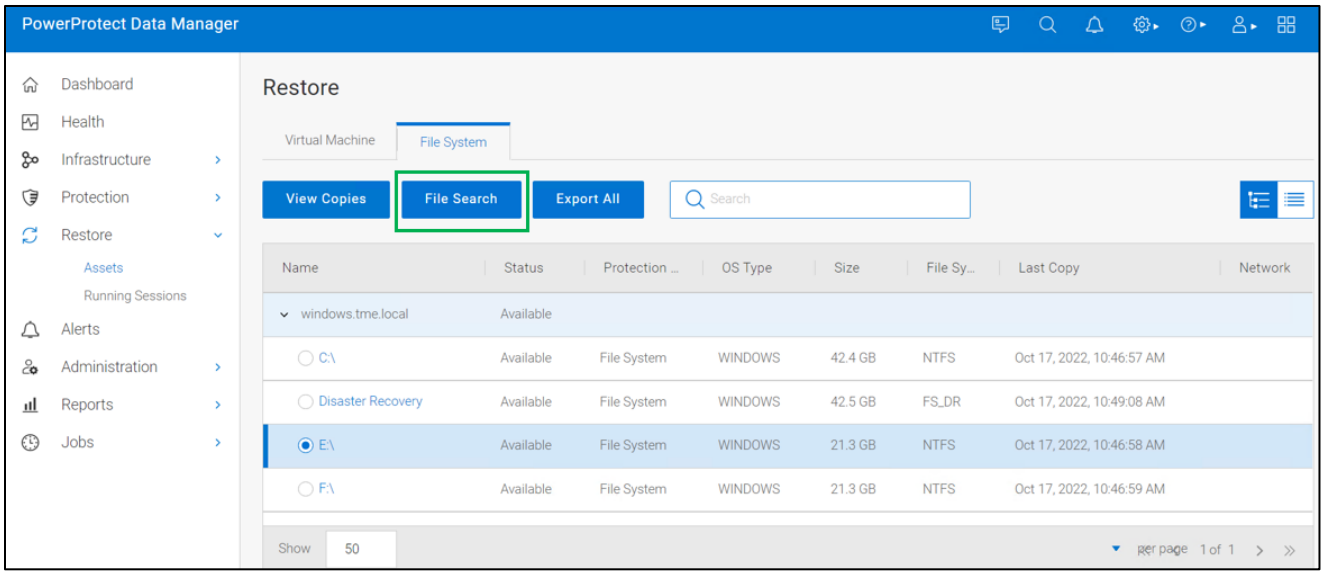
File and folder level restore can be done to the same or alternate host, where the alternate host needs to be registered with Data Manager.



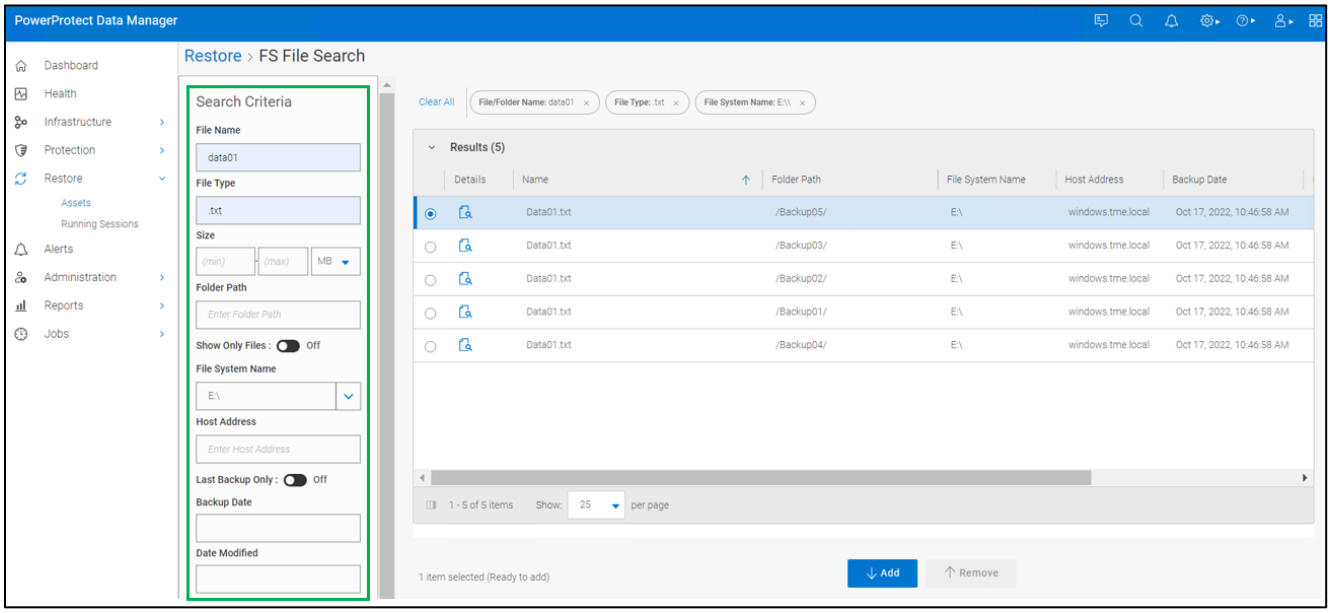
6.4 Search support for file system workloads

Starting with PowerProtect Data Manager 19.12, file indexing and search is supported for file system workloads. As a prerequisite, one or more search nodes must be deployed. Indexing for file search and the restore option is enabled from the protection policy.

When the file system backup is completed, the **File Search** option is available to search and restore the required files.

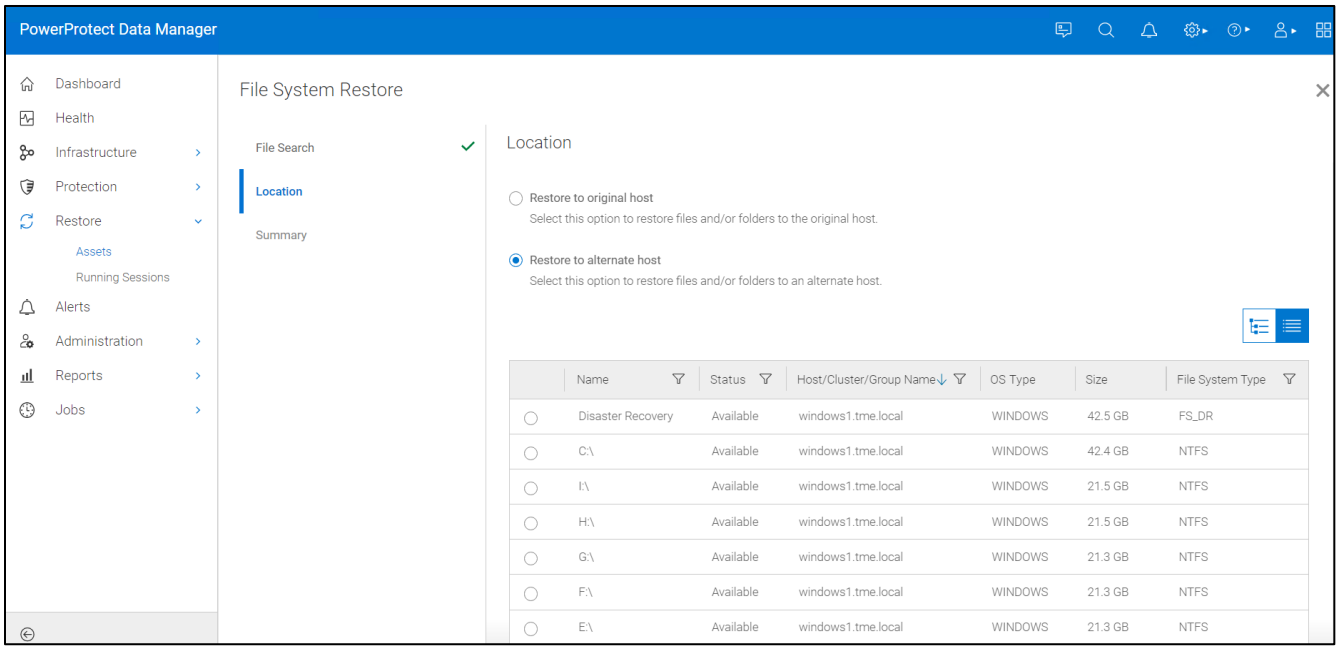


The "**FS File Search**" window provides the ability to search for the required files using the different search criteria options.



File search and restore options:

- Restore to original host - Select this option to restore files and/or folders to the original host.
- Restore to alternate host - Select this option to restore files and/or folders to an alternate host.



6.5 Self-service file-level restore of file systems

Self-service file-level restores of file systems can be performed using the ddfsrc command with the -I option. A file that contains the list of file(s) to be restored is created before executing the command. The location of this file is given as an input to the -I option.

For more details on performing self-service file-level restore of file systems, see *PowerProtect Data Manager File System Agent User Guide*.

A Technical support and resources

Dell.com/support is focused on meeting customer needs with proven services and support.

The Data Protection Info Hub provides expertise that helps to ensure customer success with Dell data protection products.

A.1 Related resources

- PowerProtect Data Manager File System User Guide
- PowerProtect Data Manager Administration and User Guide
- PowerProtect Data Manager Deployment Guide
- PowerProtect Data Manager Compatibility Matrix