Dell PowerProtect Cyber Recovery Solution Guide

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Solution Guide

Abstract

This solution guide describes the components, features, and design of the Dell PowerProtect Cyber Recovery solution. It includes information about the sizing and integration of solution components and planning the solution implementation.

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Chapter 1 Executive Summary

This chapter presents the following topics:

Business case

Across industries and among organizations of every size, cyberattacks are on the rise. Cyber Security Ventures estimates that every 11 seconds a cyber or ransomware attack occurs. Attacks are virtually non-stop and the cost per attack continues to increase, with Accenture estimating that $13 million is the average cost to organizations resulting from cybercrime. As organizations become increasingly aware of the cybersecurity risks that threaten their mission-critical operations and their reputation, IT security has become an essential part of enterprise digital strategy.

Protecting your organization starts with protecting your data – against ransomware and other sophisticated cyber threats. Yet, cyber threats are becoming more sophisticated. These threats present ample opportunity for criminals using modern tools and tactics to use your critical data for various purposes or to destroy and ransom it for some benefit. Furthermore, 64 percent of organizations are concerned that they will experience a disruptive event in the next twelve months.

With cyber security, it is not a matter of “if” but “when” you will face such an attack. Due to sophisticated cyber threats, rather than focusing on preventing ransomware or cyberattacks, organizations must focus on protecting critical data or applications that enable you to recover your critical assets with integrity so that you can resume normal business operations with confidence. Yet, many organizations lack confidence in their data protection solutions. The Global Data Protection Index reported that 67 percent of IT decision makers are not confident that all business-critical data can be recovered after a destructive cyberattack.

The modern threat of cyberattacks and the importance of maintaining the confidentiality, availability, and integrity of data require modern solutions and strategies to protect vital data and systems. Because having a cyber resiliencey strategy is becoming a mandate for all organizations and governmnet leaders, this strategy can be seen as a competative advantage in today’s data-driven world.

PowerProtect Cyber Recovery solutions and services from Dell Technologies provide the highest levels of protection, integrity, and confidentiality for your most valuable data and critical business systems and are a critical component of a comprehensive Cyber Resiliency strategy. This assurance that you can quickly recover your most critical data and systems after a cyber or other disruptive event is a critical step in resuming normal business operations. A modern and powerful cyber resiliency strategy and Dell Data Protection are key to enabling our customers to increase business agility, accelerate time-to-market, improve their cloud economics, and reduce business risk.

Document purpose

This solution guide provides a holistic view of the Dell PowerProtect Cyber Recovery solution. It includes an overview of the solution’s features, key components, design, and implementation.

Scope

This guide includes an overview of the solution's features, key components, and design, as well as the solution implementation process. The Dell PowerProtect Cyber Recovery Info Hub lists the product documentation, which includes:

- Dell PowerProtect Cyber Recovery Release Notes
- Dell PowerProtect Cyber Recovery Installation Guide
- Dell PowerProtect Cyber Recovery Product Guide
- Dell PowerProtect Cyber Recovery Security Configuration Guide
- Dell PowerProtect Cyber Recovery Command-Line Interface Reference Guide
- Dell PowerProtect Cyber Recovery AWS Deployment Guide
- Dell PowerProtect Cyber Recovery Azure Deployment Guide
- Dell PowerProtect Cyber Recovery on Google Cloud Platform Deployment Guide
- Index Engines CyberSense Release Notes for PowerProtect Cyber Recovery

Audience

The audience for this guide is presales engineers, solution architects, and Customer Service engineers.

Terminology

The following table provides definitions for some of the terms used in this solution guide.

Table 1. Terminology

Term	Definition
Air-gapped	Physically isolated from an unsecure system or network.
PowerProtect Cyber Recovery policy	Combination of objects (such as Dell PowerProtect DD systems and applications) and jobs (such as synchronization, copy, and lock). A policy, which can be scheduled, orchestrates the workflow between the production environment and the Cyber Recovery vault.
PowerProtect Cyber Recovery vault	Secure location at the customer's site, which is the target for PowerProtect DD MTree replication. The Cyber Recovery vault requires at least one PowerProtect DD and a dedicated network.
Logical air gap	Physical connection but logical isolation from the network.
Sandbox	Read/write fast copy (clone) of files and directories that are in the Cyber Recovery vault.
Synchronization	PowerProtect DD MTree replication between at least one PowerProtect DD system on the production network and one PowerProtect DD system in the Cyber Recovery vault.

Note: References to PowerProtect DD systems in this documentation, in the Cyber Recovery UI, and elsewhere in the product include PowerProtect DD systems and Data Domain systems.

We value your feedback

Dell Technologies and the authors of this document welcome your feedback on the solution and the solution documentation. Contact the Dell Technologies Solutions team with your comments.

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Chapter 2 Solution Overview

This chapter presents the following topics:

Introduction

Dell PowerProtect Cyber Recovery focuses on the protection and recovery pillars that are referenced in many well-known cybersecurity frameworks. This solution is a combination of professional services and technology that provides the following key elements:

- **Planning and design**—The solution planning and design phase includes an assessment of mission-critical systems and applications, current infrastructure, cyberattack recovery time, and recovery objectives. Optional Dell Advisory Services can help organizations determine their business-critical systems and create dependency mappings with associated foundation services, metadata, and other components that are needed to bring critical business systems back online. Dell Consulting Services experts work with organizations to determine recovery objectives and design solutions that economically meet organizational requirements. These services are optional and can be carried out by the organization that is implementing the Cyber Recovery solution.
- **Isolation and replication**—Based on the outcome of the planning and design phase, a tailored Cyber Recovery solution with Dell PowerProtect DD MTree replication technology is implemented. MTree replication synchronizes data between the production environment and the air-gapped Cyber Recovery vault. Immutable restore points that are automatically created within the Cyber Recovery vault can be used for recovery and analytics after being copied to a read/write PowerProtect DD MTree.
- **Vault analytics**—The Cyber Recovery vault offers distinct advantages for analytics in an offline and controlled environment; however, the Cyber Recovery vault is not a substitute for good endpoint and cybersecurity tools. Organizations can use various existing Dell Technologies and Index Engines CyberSense, for analytics in the Cyber Recovery vault. Cyber Recovery provides a workflow to trigger the CyberSense indexing and analytics process. Because real-time protection solutions are not 100 percent effective, data that is protected in the Cyber Recovery vault might have already been attacked. Adding CyberSense analytics to the Cyber Recovery vault enables discovery of corrupt files so that they can be replaced with the last known good version. CyberSense is fully integrated with the Cyber Recovery solution for ransomware protection. Dell Technologies uses the backup workflow to copy and secure critical business records in an isolated vault using backup software such as the NetWorker, Avamar, and PowerProtect Data Manager applications. When data is replicated to the Cyber Recovery vault, CyberSense scans the backup image and generates analytics, without the need for the original backup software in the Cyber Recovery vault. Analytics examines the files and databases to uncover unusual behavior that is indicative of a cyberattack. This behavior includes file corruption, encryption of files or pages in a database, or deletions and creations.
- **Recovery**—Recovery procedures mostly follow standard processes, but special considerations apply across various scenarios. The steps usually include invoking a cyberincident response plan, performing forensics and damage assessment, preparing the recovery, cleaning out the malware, or rebuilding systems from gold-copy images of application and operating system binaries, and then recovering the data back into the production environment.

The Cyber Recovery solution provides management tools and the technology that performs the actual data recovery. It automates the creation of the restore points that are used for recovery or security analytics. Dell Implementation Services provide Cyber Recovery vault design and implementation. Dell Advisory Services can design an effective recovery strategy.

Organizations can dramatically reduce their surface of attack from inside and outside threats by removing the cyberattack recovery environment from the production network. The only required connection is a data path for periodically synchronizing the data, which is brought online only for data synchronization. This logical air gap provides another layer of defense by reducing the surface of attack.

The Cyber Recovery software automates the recovery procedure for the NetWorker and PowerProtect Data Manager applications.

Dell Technologies Consulting Services

Dell Technologies offers the following Consulting Services for customers who want to deploy this solution:

- **Cyber Recovery Advisory**—A 1-week detailed exploration of the customer's most critical data assets. Deliverables include:
  - Cyber threat vectors, real-world examples of emerging cyberattacks, and strategies for recovery
  - Recovery strategic considerations, best practices, and potential solutions
  - Prioritized recommendations for cyber recovery preparedness
- **Cyber Recovery Advisory and Roadmap**—A 4-week engagement to design a customer-tailored strategy and solution. Deliverables include:
  - Cyber threat vectors, real-world examples of emerging cyberattacks, and strategies for recovery
  - Maturity rating
  - Tailored strategy and solution
  - Actionable road map for cyber recovery preparedness

Solution architecture

The following figure shows a high-level view of the Cyber Recovery solution architecture. Production data that is destined for the Cyber Recovery vault environment is stored in a production-based PowerProtect DD MTree and periodically synchronized to the PowerProtect DD system in the Cyber Recovery vault. Synchronization creates multiple immutable copies for subsequent security analysis.

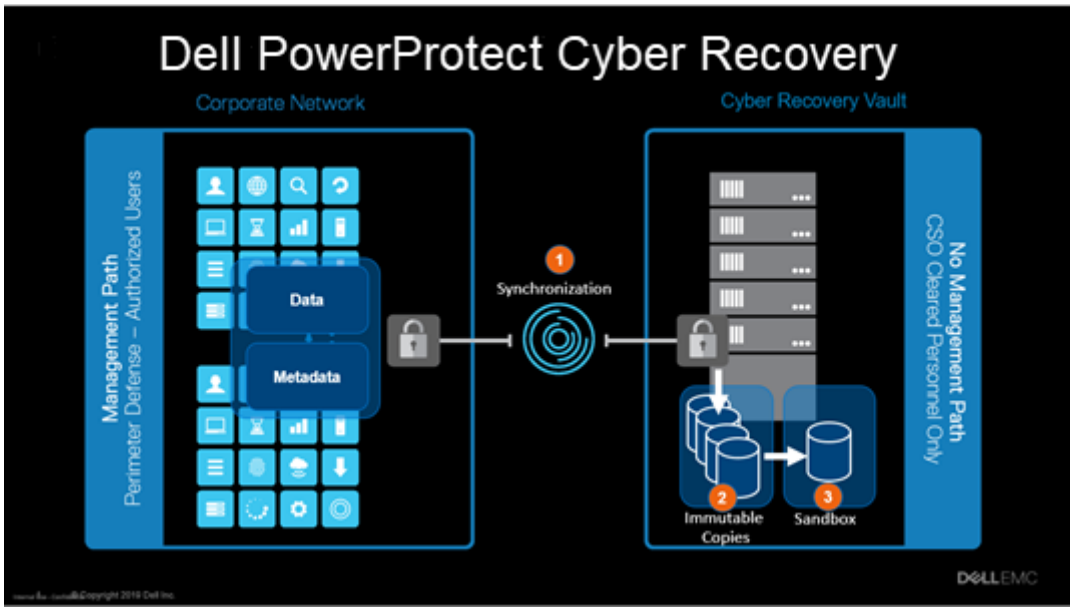


Figure 1. High-level solution architecture

As shown in the following figure, the base-level Cyber Recovery solution architecture consists of a pair of PowerProtect DD systems and the Cyber Recovery management host. In this base-level configuration, the Cyber Recovery software, which runs on the management host, enables and disables the replication Ethernet interface along with replication contexts on the PowerProtect DD system in the Cyber Recovery vault to control the flow of data from the production environment to the vault environment.

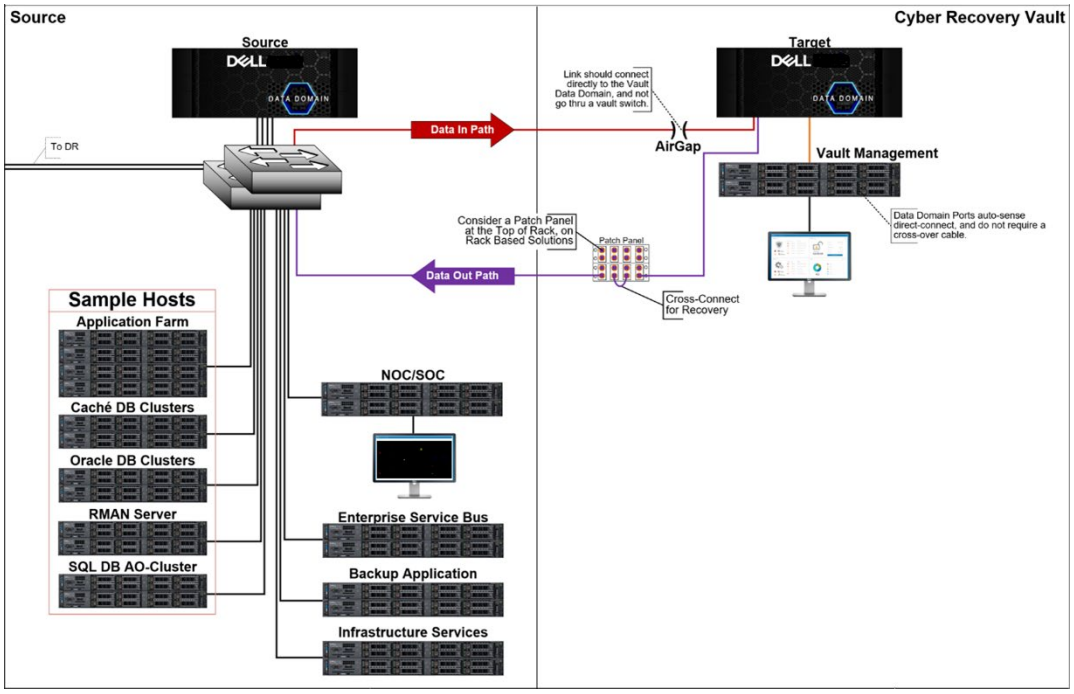


Figure 2. Base-level solution architecture

You can customize the base-level solution by:

- Using a data diode from OWL Cyber Defense Solutions for secure one-way communication from within the vault environment to the production environment for UDP Protocols such as SMTP and SNMP alerts. For more information, see OWL Data Diodes.
- Setting up a Zero Trust Network in the Vault Environment using Unisys Stealth.
- Installing a firewall on the replication data path to ensure that only expected data traffic can traverse the secure link into the vault. The link must connect directly to the Cyber Recovery vault PowerProtect DD system and not go through the Cyber Recovery vault switch.

Key components

The key components of the Cyber Recovery solution are:

- **Source (production) PowerProtect DD system**—The source PowerProtect DD system contains the production data to be protected by the Cyber Recovery solution.
- **Destination (vault) PowerProtect DD system**—The PowerProtect DD system in the Cyber Recovery vault is the replication target for the source PowerProtect DD system.
- **Cyber Recovery software**—The Cyber Recovery software orchestrates synchronization, manages, and locks the multiple data copies that are stored on the PowerProtect DD system in the Cyber Recovery vault, and orchestrates recovery. The software also governs the optional process of performing analytics on the data that is stored on the PowerProtect DD system in the Cyber Recovery vault using the CyberSense feature.
- **MTree replication**—MTree replication is a PowerProtect DD feature that copies unique data from the source PowerProtect DD MTree to the PowerProtect DD MTree in the Cyber Recovery vault.
- **Retention Lock (governance or compliance) software**—PowerProtect DD Retention Lock feature provides data immutability for a specified time. Retention Lock functionality is enabled on a per-MTree basis, and the retention time is set on a per-file basis. Retention Lock is not mandatory for Cyber Recovery but is strongly recommended as an additional cyberresiliency measure.
- **Cyber Recovery management host**—The management host is where the Cyber Recovery software is installed. This server is installed in the vault environment.
- **Recovery host**—The recovery host is a vault-environment component to which the backup application and data are recovered. Typically, the vault environment includes multiple recovery hosts.
- **Analytics/indexing host**—The analytics/indexing host is an optional but strongly recommended component in the vault environment. An analytics/indexing host with the data-analysis software that is installed provides direct integration between the Cyber Recovery software and the CyberSense software. Additional analytics/indexing hosts with different tools can also be used as needed.

Key features of the Cyber Recovery software

The Cyber Recovery software, which runs in the vault environment, controls the replication interface on the PowerProtect DD system in the Cyber Recovery vault as well as the PowerProtect DD data copies in the Cyber Recovery vault. The software is built on a secure microservices architecture and provides the following key features:

- HTML5-based UI built on the Dell Clarity standard
- REST API implementation
- Command-line interface
- Informative dashboards showing system alerts, Cyber Recovery vault state, and other critical details
- Ability to transmit alerts through the SMTP to an environment outside the Cyber Recovery vault
- Scheduled daily activity jobs report and telemetry data
- Cyber Recovery policy creation wizard and management, including scheduling
- Recovery assistance and the ability to easily export data to a recovery host
- Automated Recovery options for the NetWorker and PowerProtect Data Manager applications
- Integration with the CyberSense software for detection of backup client data that has been tampered with, including scheduling using traditional and delta block scanning of backup client data

Chapter 3 Solution Design

This chapter presents the following topics:

Design overview

Cyber Recovery supports several design variants based on the level of required cyber resiliency. The design that you ultimately implement depends greatly on your environment and requirements. This chapter highlights a base design and describes options that you can add to the base design. While not required, Dell Cyber Recovery Advisory Services can increase confidence that the Cyber Recovery solution meets your business objectives.

As part of a base-level design, the following environments are configured:

- **Production environment**—Production data to be protected by the Cyber Recovery solution must be stored on a PowerProtect DD MTree in the production environment.
- **Cyber Recovery vault environment**—The Cyber Recovery vault environment contains a PowerProtect DD system and the Cyber Recovery management host that runs the Cyber Recovery software. Data from the production environment enters the Cyber Recovery vault environment through PowerProtect DD MTree replication. This environment can also contain various recovery and analytics/indexing physical or virtual hosts that integrate with the solution.

The production and vault environment networks are not directly connected to each other, except for a replication data link between the PowerProtect DD systems in the two environments. The solution also provides for an optional dedicated link from the Cyber Recovery management host in the vault environment to the production network operations center or security operations center for events reporting.

The Cyber Recovery solution frequently includes the following additional Cyber Recovery vault components:

- Analytics/indexing hosts (physical or virtual) that the Cyber Recovery software can use to perform data analysis. One example is an analytics host that is installed with the CyberSense software and integrated with the Cyber Recovery software. For details, see the *Dell PowerProtect Cyber Recovery Product Guide*.
- Recovery hosts (physical or virtual) that the Cyber Recovery software can use to perform a recovery. The Cyber Recovery software can expose sandbox data copies to any host to perform in-vault recoveries of data such as data that is protected by Dell NetWorker, Dell Avamar, Dell DP4400 Integrated Data Protection Appliance, or Dell PowerProtect Data Manager software, third-party backup data, and file system data. After recovering a backup application within the vault, you can recover application data that is stored by the backup application to additional recovery hosts in the vault.
- An RSyslog server or Splunk Server installed in the vault that is used to centralize log files for archiving and troubleshooting. The RSyslog server can be configured on SUSE Linux Enterprise Server, CentOS, and Red Hat Linux Enterprise distributions.

In addition to these Cyber Recovery vault components, consider including an SMTP server in the production environment for receiving Cyber Recovery alerts. Cyber Recovery can transmit alert details through the SMTP to a mailbox. This functionality requires one-way SMTP connectivity from the Cyber Recovery management server to the SMTP

server. Alerts can be received by using one-way Owl Data Diode device. For more information, see Owl Data Diodes.

Server design considerations

Server infrastructure is installed in the vault environment and is not shared with or connected to the production environment. Keeping vault server equipment separate from the production environment helps ensure that any ongoing issues (cyberattacks, operational issues, and so on) do not propagate into the vault environment.

The following server types are part of the Cyber Recovery solution:

- Cyber Recovery management server
- Application analytics server
- Backup application recovery server
- Application recovery server

You can also implement additional server types, depending on your solution requirements.

The server infrastructure in the Cyber Recovery vault can be deployed in multiple ways:

- Discrete physical servers
- VMware ESXi with or without VSAN
- Dell VxRail appliance

The solution requirements help determine the infrastructure type to be deployed. For example, a VMware-based hyperconverged appliance such as VxRail simplifies server infrastructure management in the Cyber Recovery vault. It also makes the solution more scalable should you need to add storage or compute for larger restores or additional analytics.

Cyber Recovery management server

The Cyber Recovery management server is where the Cyber Recovery software is installed and from where the Cyber Recovery solution is managed.

For installation requirements and instructions, see the *Dell PowerProtect Cyber Recovery Installation Guide*.

Analytics server

The analytics server is a designated server that you can use to check that the data being protected by the Cyber Recovery solution on the PowerProtect DD system in the Cyber Recovery vault is recoverable and intact. The type of analytics tools that are used depends on your solution's analysis requirements. Cyber Recovery and the CyberSense feature provide direct, end-to-end analytics of certain datasets using the data stored on the PowerProtect DD system in the Cyber Recovery vault. CyberSense only reads the client backup data blocks that have changed since the previous client backup copy. Other analytics techniques might require that you rehydrate the data off the PowerProtect DD system and restore it to an application recovery server before performing analytics operations against the data. For more information, see CyberSense for Dell Technologies Cyber Recovery.

Backup application recovery server

The backup application recovery server is a designated server to which the backup application (NetWorker, Avamar, DP4400 Integrated Data Protection Appliance or PowerProtect Data Manager, or other applications or combination of applications) and backup application catalog are recovered. Multiple servers can be deployed, depending on the recovery requirements of the solution. The backup application recovery server is sized so that you can recover all backup applications that are being protected by the Cyber Recovery solution. If the Cyber Recovery solution is protecting a physical, single-node Avamar system in a production environment, a single-node Avamar system also resides in the vault for recovery purposes.

Note: Cyber Recovery does not support Avamar grids and IDPA grid models (PowerProtect DP8000 series appliances). For more information, see Chapter 4: Solution Implementation.

DP5300 and 5800 PowerProtect DP Series Appliances are not supported as a replication target in the Cyber Recovery vault; they have been qualified for production environment replication to a supported DD system target.

Application recovery server

The application recovery server is a designated server to which applications are recovered. Some applications might require that you first recover other dependent applications. The infrastructure within the Cyber Recovery vault is sized to support the recovery of the largest production application that is being protected by the Cyber Recovery solution. If an incident occurs, more than one application might have to be recovered, and choosing a balance between available capacity (compute, memory, storage) and cost would then be required.

Network design considerations

The air-gapped Cyber Recovery vault environment has both a physical and logical separation from the production environment. The separation further reduces the attack surface of the Cyber Recovery vault. The base-level design for the vault network starts with the vault having its own network switching infrastructure. No intervault communication is routable to any other environment. The only connectivity between the vault and another environment is as follows:

- Replication data link between the vault-environment and production-environment PowerProtect DD systems
- Optional dedicated link from the Cyber Recovery management host in the Cyber Recovery vault to the production network operations center or security operations center for events reporting

The Cyber Recovery software manages the replication link, and the connection is enabled only when new data must be ingested by the PowerProtect DD system in the Cyber Recovery vault. The Cyber Recovery software manages the link by enabling and disabling the replication port and replication context on the PowerProtect DD system in the Cyber Recovery vault. Therefore, the replication link on the PowerProtect DD system in the Cyber Recovery vault uses its own unique Ethernet interface. For the replication link that connects the production PowerProtect DD system to the PowerProtect DD system in the Cyber Recovery vault, we recommend using the fastest link speed possible, preferably 10 Gb/s Ethernet (GbE). The amount of data to be stored in the Cyber Recovery vault and the change rate of the data determine how long the replication connection stays live.

Vault network security guidance

To secure the network links that connect the vault environment to the production environment, or any other network, we recommend that you install a firewall or other packet inspection tool on both the PowerProtect DD replication link and the SMTP link. If a hyperconverged VMware appliance is installed in the Cyber Recovery vault, the VMware NSX Distributed Firewall is a good firewall option for reducing complexity in the vault environment and protecting VMware-based infrastructure. Additionally, the VMware NSX Edge firewall is a potential software-defined option for protecting the PowerProtect DD replication link between production and vault PowerProtect DD systems at near wire speed.

The replication link between the production PowerProtect DD system and the PowerProtect DD system in the Cyber Recovery vault should transfer only PowerProtect DD replication traffic. For protocol and port details, see the *DD OS, PowerProtect DD Virtual Edition, and PowerProtect DD Management Center Security Configuration Guide*. For the events reporting link from the Cyber Recovery management server to the production network operations center or security operations center, only the trusted outbound traffic should be permitted. For protocol and port details, see the *Dell PowerProtect Cyber Recovery Security Configuration Guide*.

As an additional layer of security, a one-way VPN tunnel can be enabled for the events reporting connection. This tunnel allows only secure communications to be transmitted from the vault environment to the production environment. The VPN can be set up to allow access by specific users only. VMware NSX Edge VPN is a good option and supports IPsec and SSL. Dell Technologies' ProDeploy Plus services can install and implement these tools.

In lieu of using a VPN tunnel for transmitting event details to the production network or security operations center, you can use a data diode to provide secure one-way communications from the vault. A data diode ensures that only one-way communication is possible, reducing the possibility of the vault environment becoming compromised. For more information, see OWL Data Diodes.

If other network links are required between the production and vault environments, secure those network links to the greatest extent possible by using a firewall, VPN, or data diode.

Set up a Zero Trust Network in the Cyber Recovery vault using Unisys Stealth. Stealth is a "defense-grade" solution that uses identity-based segmentation. Network segments can be defined and managed by using an identity management system that has high business alignment, such as Active Directory or LDAP.

The Stealth principle is to trust no user or device (inside or outside the private network) and grant as little access as possible (always based on reliable identification).

Other network design considerations

When designing the network, also consider how to keep the vault environment time synchronized. If a reliable NTP time source is not available for the PowerProtect DD system in the Cyber Recovery vault, the PowerProtect DD Retention Lock functionality might not function correctly. Time-of-day clocks on Intel- and AMD-based systems are not reliable; we have observed time skews of 24 hours or more. Either an NTP source should exist within the Cyber Recovery vault or, with the appropriate security and access controls in place, an NTP source that is external to the vault should be allowed access to vault components. Your solution design requirements determine the better option. Additional options such as GPS-based systems might be available, depending on your environment.

DNS and Active Directory are commonly used critical components in any data center. In this solution, we do not recommend that production DNS or Active Directory instances extend into the vault environment. Such extension would require connectivity between vault and production components, which is not recommended. Instead, within the vault, separate DNS and Active Directory instances can be instantiated for only the vault components.

Note: Optionally, you can periodically copy production Active Directory and other foundation services into the Cyber Recovery vault along with the business-critical data to enable recovery of those components.

For DNS, using host files is another, more secure option. Regardless of whether an Active Directory instance is implemented in the vault environment or local logins are used for vault components, passwords must be unique.

In addition, consider the bandwidth that will be required to support data recovery after a cyberattack. Ensure that the bandwidth between the Cyber Recovery vault and the recovery environment is sufficient to meet your solution's recovery time objectives. If feasible, 10 GbE links, one for replication and two for recovery, should be available.

Network segmentation

The following figure shows how network segmentation can be configured within the vault. The production side of the diagram is for illustrative purposes only.

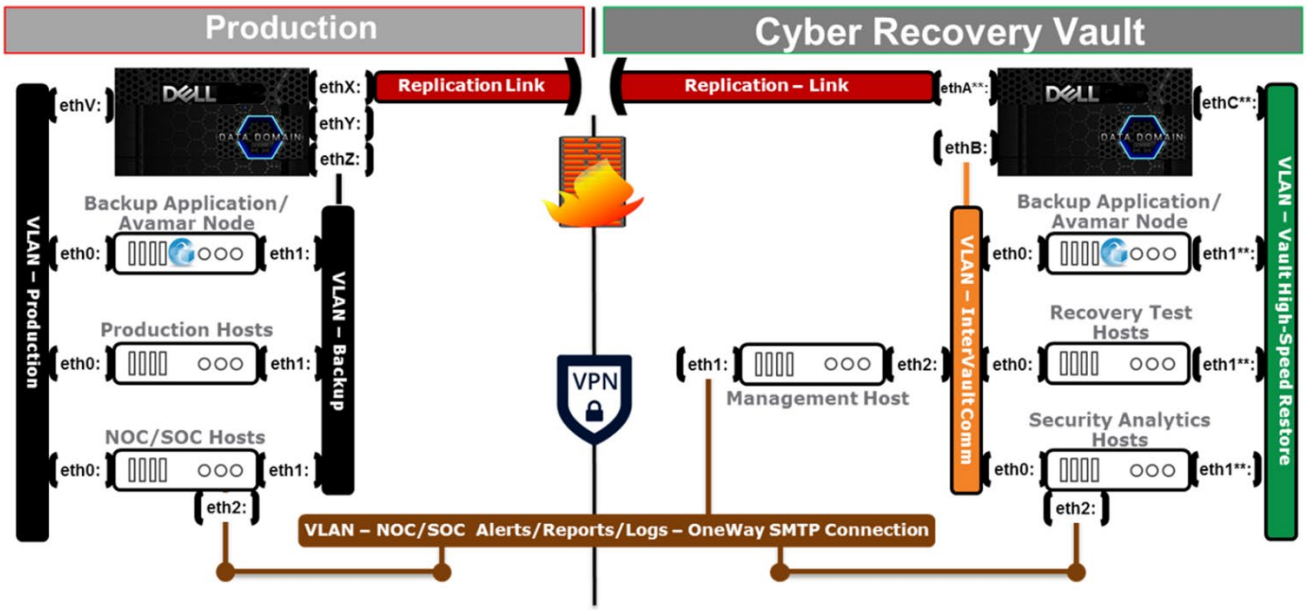


Figure 3. Example of Cyber Recovery network segmentation

As shown in the figure, the only links that connect the Cyber Recovery vault to the production environment are the replication network link and, optionally, the events-reporting network link. All connections that span both the production and vault environment should be secured by using a firewall, VPN, or data diode. Intervault communication is segmented based on the needs specified in the Cyber Recovery solution design. Unisys Stealth can also provide network segmentation in the Cyber Recovery vault.

Storage design considerations

Each Cyber Recovery solution implementation requires its own storage design review. The review determines the amount of data that is to be protected in the Cyber Recovery vault and the growth rate of the data. We recommend following the standard PowerProtect DD sizing process to determine the optimal PowerProtect DD model and capacity point. If you use PowerProtect DD Retention Lock for storage of vault-environment data copies, you must account for the duration of data-copy retention when determining the size of the PowerProtect DD system in the Cyber Recovery vault. The longer that unique data must be retained on the vault PowerProtect DD system, the more capacity the system requires.

Physical environment design considerations

A Cyber Recovery solution design must provide for sufficient physical security. The solution's vault environment is a secure enclave, and physical security is just as important as logical segmentation. An internal bad actor can take advantage of weak physical security.

We recommend installing the Cyber Recovery vault equipment in a dedicated room or cage with physical access controls. This secured room should have a limited access list with key sign-out or two-person key access. Video surveillance of entry points into the cage or room and of the equipment should be in place.

For the utmost security, the Cyber Recovery software must be accessible only by physical access to the Cyber Recovery management server and an associated keyboard and mouse. If this is not feasible, monitoring the Cyber Recovery console through the cage (if the monitor is up and showing messages) is another possibility. Additionally, in conjunction with implementing a VPN, firewall, or other security tools, you can configure a jump server within the vault environment that allows a client in the production environment to securely access the Cyber Recovery management server.

Cyber Recovery software limitations and considerations

The Cyber Recovery software has its own design considerations that must be understood before a Cyber Recovery solution is implemented. Considerations include:

- Cyber Recovery supports up to five PowerProtect DD systems in the Cyber Recovery vault and a total of up to 32 policies over the five DD systems.
- Each production PowerProtect DD MTree that is protected by using a Cyber Recovery policy requires three or more MTrees on the Cyber Recovery vault PowerProtect DD for the following purposes:
  - One as the replication destination
  - One or more for Retention Locked copies
  - One or more for read/write sandboxes

  Note: The CyberSense feature requires its own sandbox MTree in addition to any other sandbox MTrees.

- The solution supports MTree replication only, and the replication contexts must be set up before you create Cyber Recovery policies.

For details about the software design considerations, see the *Dell PowerProtect Cyber Recovery Product Guide*.

Mechanisms for data protection

The Cyber Recovery software controls data synchronization from the production environment to the vault environment by using PowerProtect DD MTree replication. After the datasets and their associated MTrees to be protected by the Cyber Recovery solution are determined, replication contexts are set up between the production and vault PowerProtect DD systems. MTree replication is designed so that all data within an MTree is replicated securely between two PowerProtect DD systems. After the initial synchronization is completed and all data is copied to the vault PowerProtect DD system, each subsequent synchronization operation copies only new and changed data segments. There is no limit to the number of MTree replication contexts that the solution supports; however, there are limits to the number of MTrees that each PowerProtect DD model supports.

The Cyber Recovery software manages the synchronization of MTree replication contexts as well as the number of data copies it creates for each replication context on the PowerProtect DD system in the Cyber Recovery vault. The data copies that the Cyber Recovery software creates are possible recovery points if an incident occurs. If the PowerProtect DD system in the Cyber Recovery vault is licensed with either Retention Lock governance or compliance, the Cyber Recovery software can apply a Retention Lock for all files in the MTree based on the Cyber Recovery policy specifications. Retention Lock provides data immutability and is key to the Cyber Recovery software operations on the PowerProtect DD system in the Cyber Recovery vault. Enabling Retention Lock on data copies within the vault ensures that data copies can be trusted for recovery. The duration of the Retention Lock and the amount of data to which the Retention Lock is applied must be carefully understood. The PowerProtect DD system in the Cyber Recovery vault might reach capacity more quickly than planned if you disregard the values that are used during sizing. The two types of Retention Locks, governance and compliance, should be weighed against each other's requirements. Compliance is stricter and more secure; it should be implemented.

The Cyber Recovery solution uses the following additional mechanisms to further protect the data being stored in the Cyber Recovery vault:

- Replication traffic in and out of the vault is encrypted using PowerProtect DD encryption.
- Other data being sent to the production environment, such as Cyber Recovery alerts, can be encrypted using other tools.
- The PowerProtect DD system in the Cyber Recovery vault is disconnected (air-gapped) from the production network most of the time. The PowerProtect DD system in the Cyber Recovery vault is connected to the production PowerProtect DD system only during the data synchronization operation.
- The Cyber Recovery vault is set up as a separate security zone by using a VPN tunnel and a DMZ.

- Access to the Cyber Recovery vault is limited using least-access-privilege concepts.
- Temporary access for recovery testing is set up just before testing and brought down immediately after testing.
- The Cyber Recovery vault functions as an enclave and can operate without production IT services. Power and HVAC can be common to the rest of the environment.
- The data and binaries that are stored in the Cyber Recovery vault can be analyzed forensically and in a nonexecutable format.
- Two-factor authentication can be implemented for access to critical vault components.

Chapter 4 Solution Implementation

This chapter presents the following topics:

Planning and sizing the environment

Proper sizing of a Cyber Recovery solution requires gathering many details about the environment and determining the business-level solution requirements. Although not all-inclusive, this section addresses some of these considerations. Dell Consulting Services can assist you in sizing and implementing the Cyber Recovery solution.

Protection objectives

Each organization implementing Cyber Recovery needs to determine the Cyber Recovery metrics and goals to regulate recovery; different metrics are used for Cyber Recovery than are used for traditional business continuity and disaster recovery. Organizations need to set time and recovery objectives to ensure a predictable recovery from an event.

The following figure shows the data protection metrics that are key to ensure that the Cyber Recovery solution is properly sized and that the solution meets your design objectives:

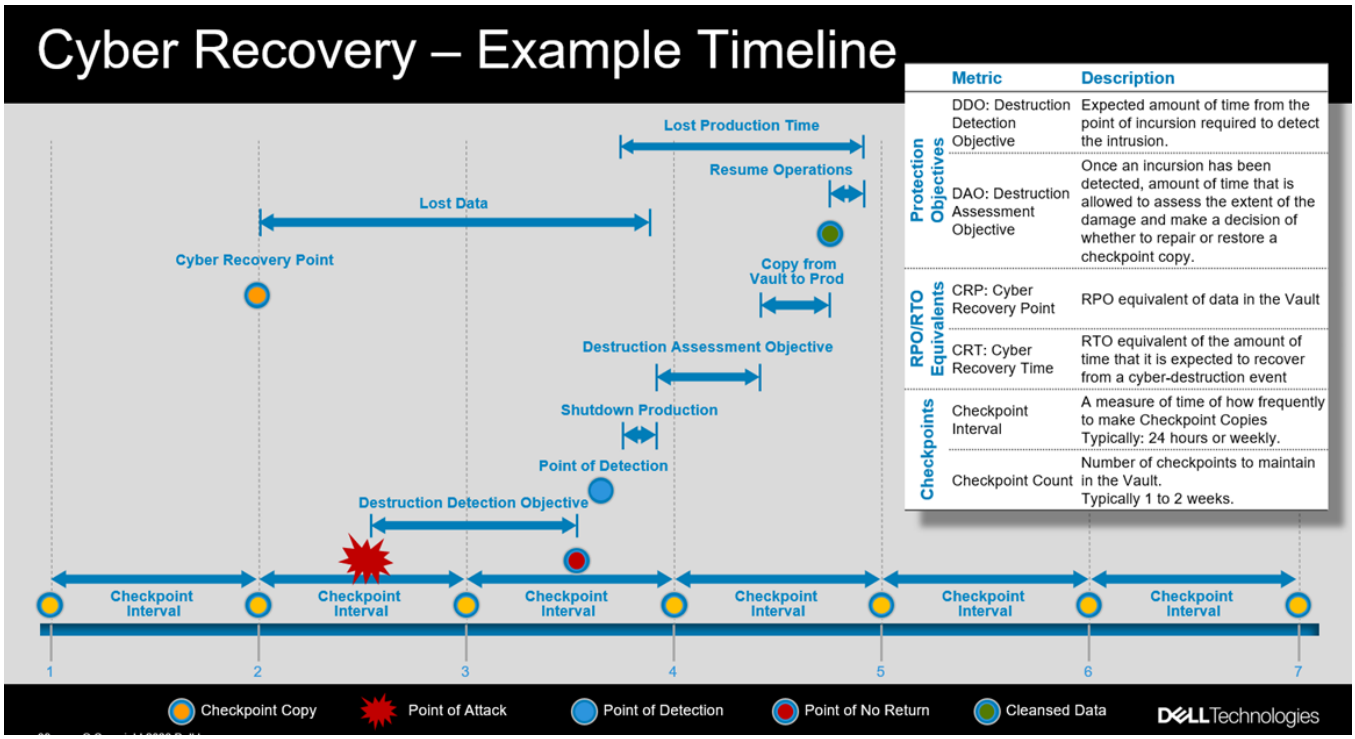


Figure 4. Data protection metrics

- **Destruction detection objective (DDO)**—The amount of time between the point of incursion and when the incursion is detected. Cyber Recovery mechanisms (including analytics) must operate within the DDO rolling window.
- **Destruction assessment objective (DAO)**—The amount of time that is allotted to the cybersecurity team to assess damage after an incursion is discovered. The purpose of the assessment is to determine the amount of destruction and if the data can be cleansed or if a fallback to a previous data copy is required.
- **Cyber recovery point (CRP)**—The point in time to which you can return after a destructive cyberattack. This metric is analogous to a recovery point objective in a

disaster recovery scenario. The CRP most commonly spans from days to months, depending on the dataset that is being protected by Cyber Recovery.

- **Cyber recovery time (CRT)**—The amount of time it takes to recover from an incident.
- **Cyber Recovery synchronization interval**—The frequency at which data is copied from the production environment to the Cyber Recovery vault. This interval is based on the established recovery point objective (RPO) for the Cyber Recovery solution. For example, for an RPO of 24 hours, each day Cyber Recovery would synchronize data from the production PowerProtect DD system to the PowerProtect DD system in the Cyber Recovery vault. In doing so, Cyber Recovery creates a point-in-time copy on the PowerProtect DD system in the Cyber Recovery vault for potential recovery. How long the copy is retained depends on the specific requirements of the solution but typically ranges from 1 week to 1 month.

Cyber Recovery data copy count—The number of data copies held in the Cyber Recovery vault. The data copy count, coupled with the Cyber Recovery synchronization interval, roughly translates to how far back in time data can be recovered. For example, with a 24-hour synchronization interval and seven data copy retained, data from the past 7 days can possibly be used for recovery.

What to protect

In addition to determining the objectives for the Cyber Recovery solution, you must characterize the data to be protected. The Cyber Recovery solution can protect any data that can be stored on a PowerProtect DD MTree. If Cyber Recovery is to protect an entire backup application and its backup data, the backup software must be able to store both its backup catalog (metadata) and backup data on one or more PowerProtect DD MTrees.

Note: For Cyber Recovery to support Avamar data protection, the Avamar system must store its checkpoint on a PowerProtect DD MTree, which is an option for all Avamar Virtual Edition and Avamar single-node implementations. If the Avamar system is not configured in such a way, you cannot reconstitute and restore Avamar protected data within the vault. Because Avamar grids store their checkpoints locally on the grid and not on a PowerProtect DD MTree, Cyber Recovery cannot replicate Avamar grid metadata into the Cyber Recovery vault using MTree replication. As a result, immutable copies of Avamar grid checkpoints cannot be created in the Cyber Recovery vault system using the standard Cyber Recovery workflow. To enable Cyber Recovery to protect a subset of Avamar grid data, you can migrate specific datasets from a grid to an Avamar single-node or Avamar Virtual Edition instance and configure the instance to store its checkpoint on a PowerProtect DD MTree.

To identify and characterize the data to be protected and to ensure that a thorough analysis is performed, you can use optional Dell Consulting Services. Details to be determined include:

- Mission-critical and business-critical applications that must be protected
- Characteristics and dependencies of each application, including host platform, location and amount of data, and Cyber Recovery objectives and metrics; in addition, any dependencies on core infrastructure services (such as DNS, LDAP, and Active Directory) that must be protected to ensure a successful recovery
- Data, such as application binaries, boot images, and backup catalog, that must be protected

These details, along with the previously defined objectives, help determine the ideal size of the PowerProtect DD system in the Cyber Recovery vault and an estimate of the time that will be required for data replication on an operational basis. The information also helps determine networking and compute requirements for the vault.

Recovery requirements and the type of data to be protected help determine the data synchronization frequency and data retention time. For example, for the greatest recovery flexibility, you might categorize data to be protected in one of the following backup streams:

- Full-application and file-system backups, including image-level (if possible) and application-specific data
- Binary and executable backups, including base-level operating system distributions and application builds

The following figure illustrates these two backup streams.

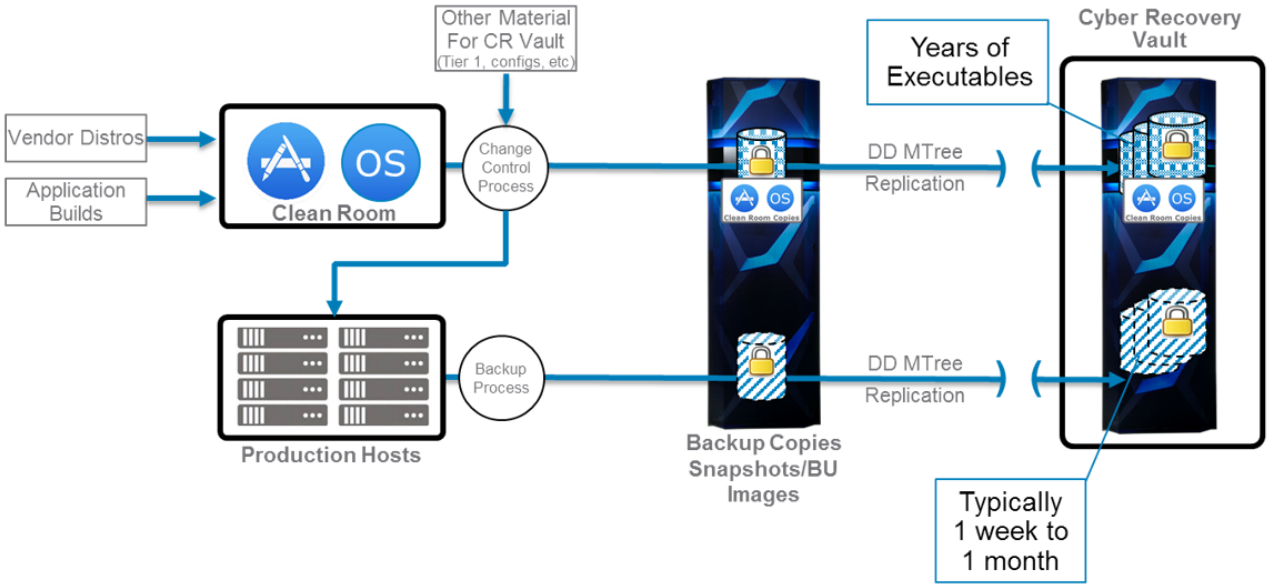


Figure 5. Example of multiple backup streams for ease of recovery

Note: The recommended method to transfer other data such as software binaries and upgrade packages to the Cyber Recovery vault is through a dedicated MTree replication context between the production-environment and vault-environment PowerProtect DD systems.

In the production environment, backups of applications and their data, including image-level backups, are typically performed daily. Backups are made to one or more PowerProtect DD MTrees on the production PowerProtect DD system. During solution sizing, the production MTrees to be protected are identified based on which applications and critical data must be protected in the Cyber Recovery vault. If an MTree contains a large of amount of data and the Cyber Recovery solution must protect only a subset of the data, we recommend copying the desired subset to a separate MTree. Dell backup software can perform this operation with limited overhead. The Cyber Recovery software enables you to specify on an MTree basis the data synchronization frequency and retention time.

In addition to protecting application data, we recommend that you also protect binaries and executables to enable full reconstruction of an application if needed. If the production environment is subject to a destructive cyberattack that infects base-level operating system and application components, a complete re-creation of application hosts, beginning at the operating system level, might be necessary. Because ransomware executables and files can remain dormant within operating system binaries for a long time, the retention period for such data is typically measured in years.

Data analytics techniques

After the Cyber Recovery objectives and metrics are determined and the data to be protected is defined, a plan to confirm the validity of the vault data should be crafted. The list of techniques in this section is not all-inclusive, but it provides an overview of the types of analytics options that are available. Some of the analytics techniques require third-party software and associated infrastructure to run the software. The Cyber Recovery software and CyberSense provide automated analysis of backup data in a native format directly off the vault PowerProtect DD system.

System-level analytics

System-level analytics focuses on analyzing that data copies are successfully created on the PowerProtect DD system in the Cyber Recovery vault. The goal is to ensure that the steps involved in synchronizing the data and creating immutable (Retention Locked) copies were completed successfully. System-level analytics provide assurance that the restore point is recoverable. This type of analytics also identifies health issues that are related to the overall Cyber Recovery vault infrastructure and the Cyber Recovery software. System-level tools perform the required level of analysis and issue alerts when needed.

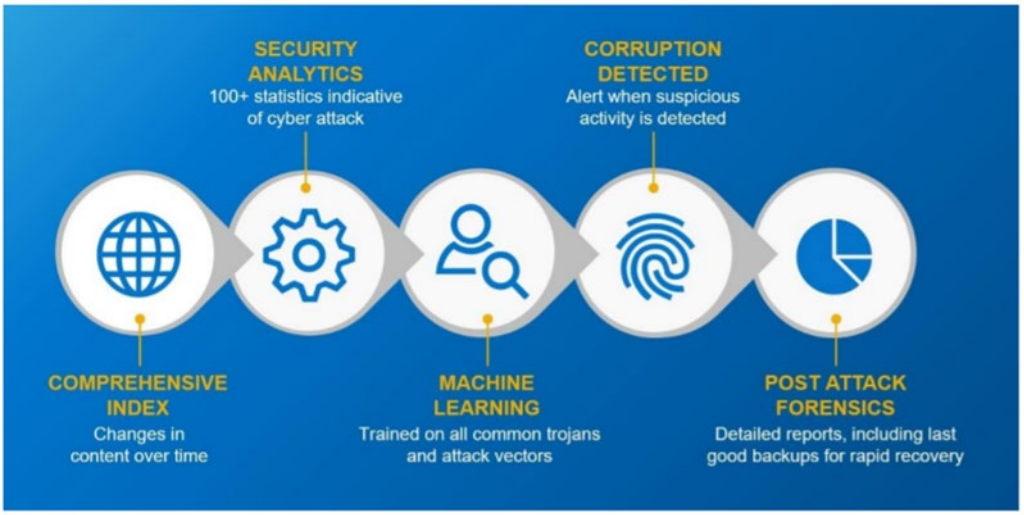
Full-content analytics

Cyber threats are increasingly becoming more sophisticated by how they penetrate the data center. Even with the most advanced security products deployed, organizations are still at risk of having data attacked and corrupted by bad actors. CyberSense adds a last line of defense to your existing security solutions, finding corruption that occurs when an attack has successfully breached the data center.

CyberSense uses data backups to observe how data changes over time and then uses analytics to detect signs of corruption indicative of a ransomware attack. Machine learning then examines over 200 content-based statistics to find corruption with up to 99.5 percent confidence, helping you protect your business-critical infrastructure and content. CyberSense detects mass deletions, encryption, and other suspicious changes in core infrastructure (such as Active Directory, DNS, and so on), user files, and critical production databases resulting from common attacks. If CyberSense detects signs of corruption, an alert is generated that includes additional information.

When suspicious behavior occurs, CyberSense provides postattack forensic reports to diagnose the cyberattack further. The report provides details about the statistics used with the analytics and the attack vector used for the attack. With CyberSense, when data corruption is detected, a list of the last known good backup datasets is available to support rapid recovery and minimize business interruption.

CyberSense is the only product on the market that delivers full-content-based analytics on all the protected data. This capability sets CyberSense apart from other solutions that take a high-level view of the data and use analytics that look for obvious signs of corruption based on metadata. Metadata-level corruption is not difficult to detect; for instance, changing a file extension to `.encrypted` or radically changing the file size. These types of attacks do not represent the sophisticated attacks that cybercriminals are using today.



CyberSense goes beyond metadata-only solutions because it is based on full-content analytics that provide up to 99.5 percent confidence in detecting data corruption. It audits files and databases for attacks that include content-only based corruption of the file structure or partial encryption inside a document or page of a database. These attacks cannot be found using analytics that do not scan inside the file to compare how it changes over time. Without full-content-based analytics, the number of false negatives is significant, providing a false sense of confidence in your data integrity and security.

Recovery techniques

If a destructive cyberattack requires a recovery, a plan must be formulated that specifies how data will be recovered and what infrastructure must exist in the vault to support the recovery operation. This section presents two of several potential scenarios.

Restoring data and application binaries in the Cyber Recovery vault

You can restore data and application binaries in the Cyber Recovery vault as follows:

1. Identify the restore points that were created before the attack occurred.
2. Using the forensic findings, identify the malware and where it has been persisted. If binaries or operating system images have been compromised, decide whether to cleanse the malware from the backup image and then restore the binaries from the vault PowerProtect DD system. If you are not confident that cleansing will be successful, select a backup that was taken before the infection. If no clean copies of binaries exist in the generational backup images, you can rebuild using the Cyber Recovery vault copies.
3. Apply security patches if possible.
4. Restore the data to a recovery host that is located within the Cyber Recovery vault using the disaster recovery runbook for the associated application. Segment

the application from the rest of the Cyber Recovery vault infrastructure and then launch the application. Determine if the recovery process has eliminated the effects of the offending malware. This step is important when there is concern that the cyberattack was based on multiple malware strains.

5. Test-run production applications using the Cyber Recovery vault compute.

6. Cleanse or re-image the production environment and connect the recovery host to production (either logically or through physical shipment). Then copy the application and data back to the original production servers.

The following figure illustrates the restore process.

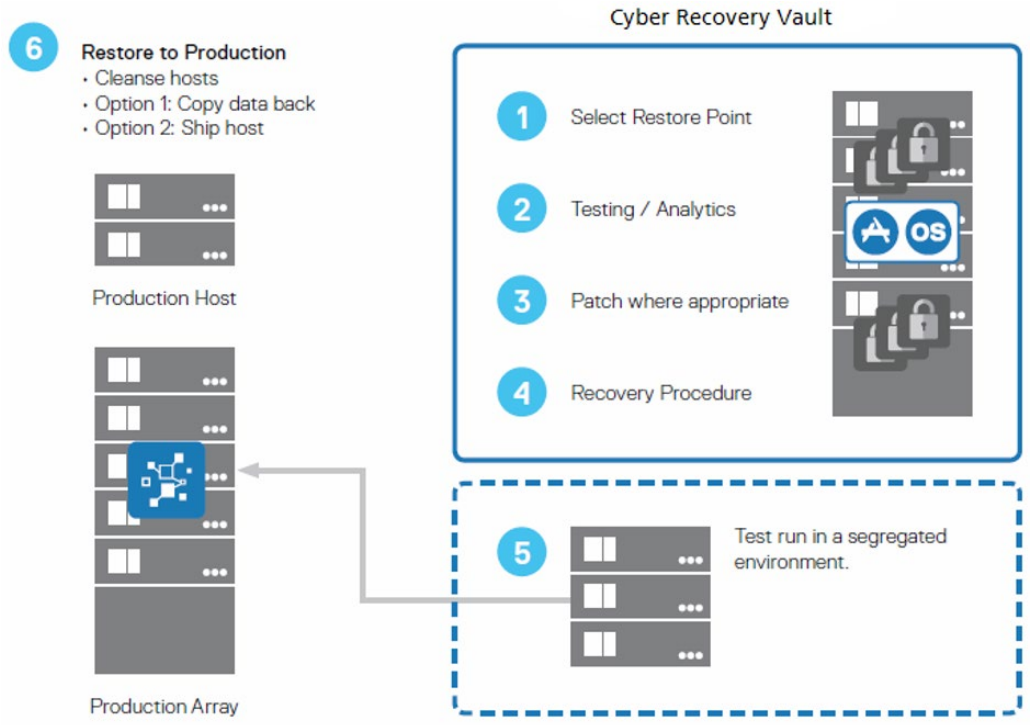


Figure 6. Process for restoring data and application binaries

Completely rebuilding from the Cyber Recovery vault

Completely rebuilding from the Cyber Recovery vault is more comprehensive and conservative, but it is a slower recovery method. This method also minimizes concerns around dormant malware. The high-level steps for a complete rebuild are as follows:

1. Reformat the production systems based on the damage and forensics assessment that was done as part of the incident response.

2. Rebuild the binaries by restoring the appropriate Cyber Recovery vault data copies. This recovery process is consistent with the previous scenario. Apply security patches if possible and distribute them to freshly formatted hosts.

3. Recover the application and data to the original production environment by locating and restoring the appropriate copy, restoring configuration files, restoring data, and performing application recovery using the disaster recovery runbook for the application.

The following figure illustrates the rebuild process:

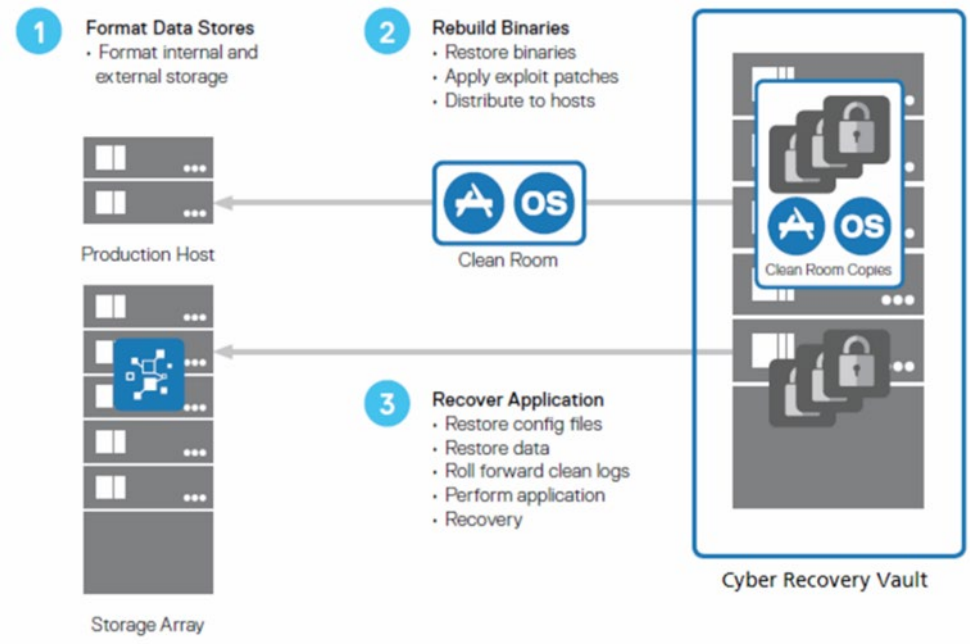


Figure 7. Process for rebuilding from the Cyber Recovery vault

Depending on the applications that are being protected by Cyber Recovery and on the extent of damage from the attack, the recovery process might vary. This guide does not address all nuances of the analytics and recovery plans, which are highly dependent on the environment and the solution requirements. Dell Consulting Services can provide customization details.

Testing the recovery

In addition to performing the recovery, you need a plan to enable authorized individuals to test the application recovery. How those individuals carry out the test can vary. If a jump box is configured within the vault environment, a user can log in to that server and then access the vault infrastructure to recover data. If a jump box is not configured, the user must be physically present within the vault environment to have access to the necessary equipment.

Setting up the core components

Setting up the core solution components involves:

1. Setting up the production and vault environments as described in this guide. Solution components—PowerProtect DD systems and Networker, Avamar, or PowerProtect Data Manager software, or both—must be at the minimum or greater supported code level. For details, see the *Dell PowerProtect Cyber Recovery Installation Guide*.
2. Identifying the MTrees on the PowerProtect DD system in the production environment and then setting up the replication context between the PowerProtect DD systems in the production and vault environments. If Cyber Recovery is to protect a backup application, the backup catalog (metadata), in addition to the

backup data, must be replicated to the PowerProtect DD system in the Cyber Recovery vault.

3. Ensuring that the PowerProtect DD system in the Cyber Recovery vault has at least two interfaces enabled and in use—one for replication traffic and the other for management by the Cyber Recovery software in the vault.
4. Installing and configuring the Cyber Recovery software on the Cyber Recovery management server in accordance with the guidelines in the *Dell PowerProtect Cyber Recovery Installation Guide*.
5. Ensuring that all data is secured both physically and logically, as described in Chapter 3: Solution Design, after it has been copied to the vault.

Hardening the solution

During solution implementation, ensure that all components in the vault are secured as best as they can be. Dedicated security guidelines might be available for some products that are installed in the vault environment; if so, follow the guidelines and lock down the products as best as possible. For example, disable unused ports and nonessential protocols, and use unique and limited-access credentials. Dell Services provides an offering that ensures that the PowerProtect DD system is secured in accordance with best practices.

Cyber Recovery vault on Amazon Web Services

You can deploy the Cyber Recovery vault on Amazon Web Services (AWS), which is distributed using the shared AMI concept directly through Dell Technologies or AWS Marketplace.

For more information, contact your Dell Technologies sales representative.

Cyber Recovery vault on Microsoft Azure

You can deploy the Cyber Recovery vault on Microsoft Azure, which is distributed using a shared VM concept directly through Dell Technologies or Azure Marketplace.

For more information, contact your Dell Technologies sales representative.

Cyber Recovery vault on Google Cloud Platform

You can deploy the Cyber Recovery vault on Google Cloud Platform, which is distributed using a shared VM concept directly through Dell Technologies or Google Cloud Marketplace.

For more information, contact your Dell Technologies sales representative

Sheltered Harbor certification

Sheltered Harbor was created to protect customers, financial institutions, and public confidence in financial systems if a catastrophic event like a cyberattack causes critical systems—including backups—to fail. Implementing the Sheltered Harbor standard prepares institutions to provide customers with timely access to balances and funds in this worst-case scenario.

Dell PowerProtect Cyber Recovery for Sheltered Harbor is a Sheltered Harbor-endorsed solution for achieving compliance with data vaulting standards and certification, planning for operational resilience and recovery, and protecting critical data.

The following figure shows how the Sheltered Harbor solution protects against a cyberattack:

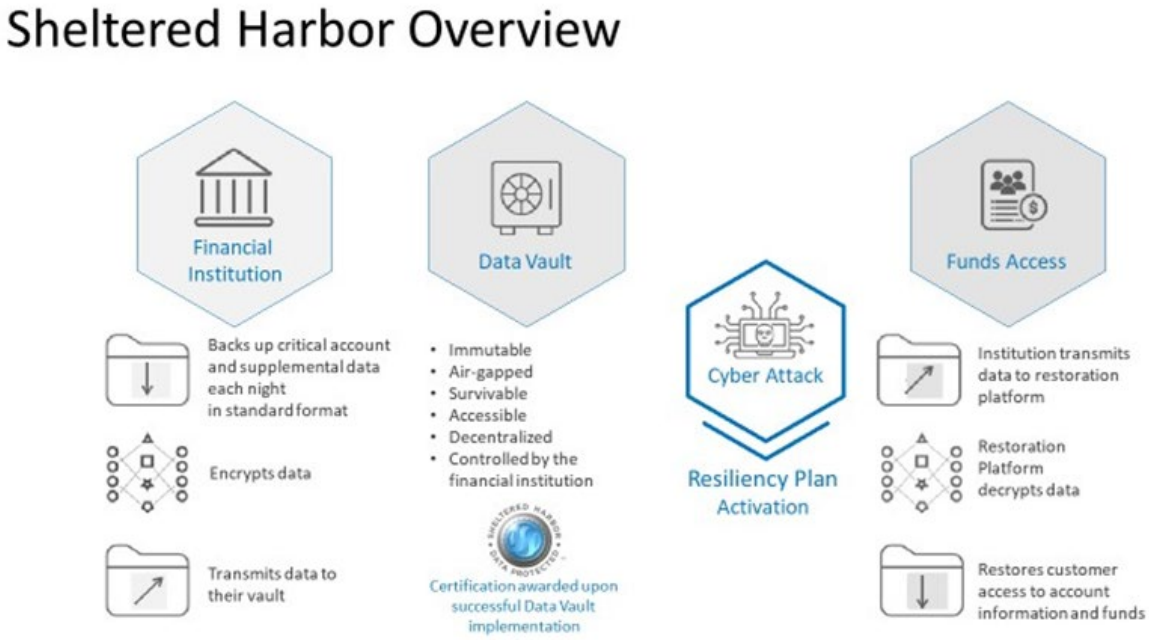


Figure 8. Sheltered Harbor solution overview

Dell Technologies is an early and committed member of the Sheltered Harbor initiative. The Dell PowerProtect Cyber Recovery for Sheltered Harbor solution meets all technical product requirements for participants implementing the Sheltered Harbor standard.

For more information, go to Sheltered Harbor and contact your Dell Technologies sales representative.