



Technical Validation

# Enterprise-class Data Protection with InfiniGuard from Infinidat

## Recover Business-critical Workloads with Confidence

By Alex Arcilla, Senior Validation Analyst; and Vinny Choinski, Senior Analyst  
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## Introduction

This report documents ESG validation testing of the InfiniGuard data protection and recovery solution from Infinidat with a goal of exploring the benefits of the InfiniGuard architecture, including immutable ransomware recovery, cost-optimized backup and restore performance, and ease of deployment and management.

## Background

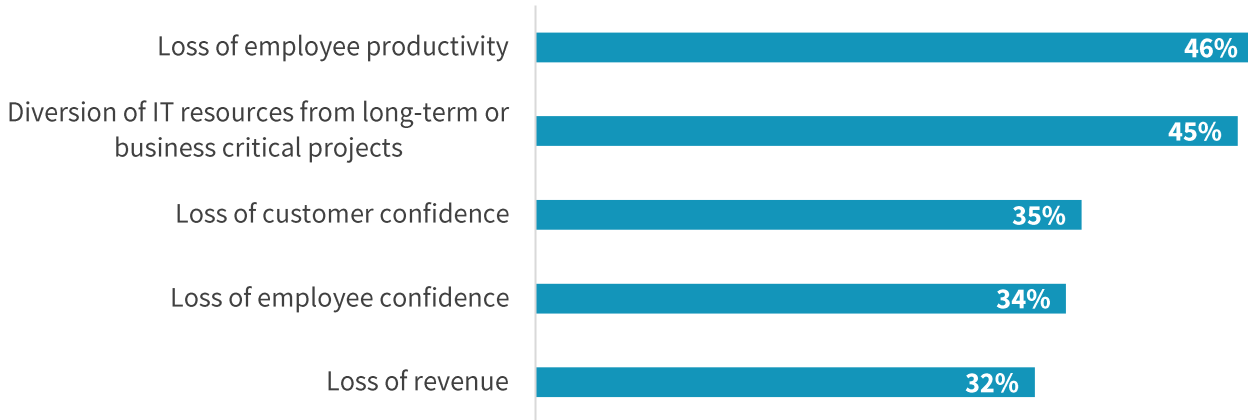
Because IT is now woven into the very fabric of modern business, IT downtime has effects that ripple far beyond just the IT department. The astronomical costs of IT downtime, whether due to a successful cyber-attack or the result of various IT system failures, are well publicized—often resulting in millions of dollars lost per incident. But less well documented are the other ways that business-critical application downtime can impact the business.

ESG research reveals that modern organizations view IT downtime from at least two different perspectives—time and business factors, such as lost revenue or productivity. The duration of an IT outage has critical consequences. In fact, for most organizations, one hour of downtime can be a very long time. 15% of ESG research survey respondents stated that their organizations can tolerate essentially no downtime for their mission-critical applications—ever. More than half (57%) reported that they cannot tolerate loss of these crucial applications for less than a full hour.<sup>1</sup>

Figure 1 shows the business impacts that organizations believe can result from application downtime or lost data. At first glance, it might seem surprising that loss of employee productivity was a much more common response than loss of business revenue or damage to brand integrity. But remember that for organizations such as hospitals, utilities, and a wide range of service industries, costs accrue when staff are idle. In fact, staff are so important to many organizations that loss of employee confidence was a more commonly cited response than loss of revenue.

**Figure 1. Top Five Impacts of Downtime or Lost Data**

Which of the following impacts to your organization could result from application downtime or lost data? (Percent of respondents, N=378)



Source: ESG, a division of TechTarget, Inc.

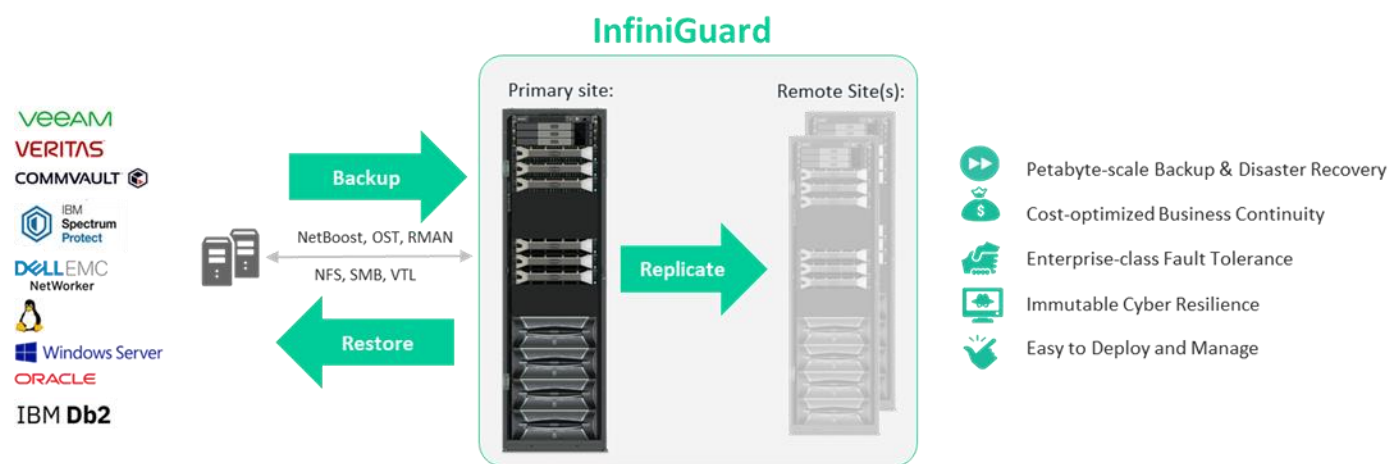
<sup>1</sup> Source: ESG Research Report, [Real-world SLAs and Availability Requirements](#), October 2020. All ESG research references and charts in this Technical Validation have been taken from this research report, unless otherwise noted.

## InfiniGuard Solution Overview

InfiniGuard is a petabyte-scale modern backup, restore, cyber resilience, and disaster recovery solution that reduces the cost, risk, and downtime associated with recovering business-critical application workloads after a cyber-attack, hardware failure, natural disaster, or accidental data corruption.

As shown in Figure 2, backup applications and databases (e.g., Veeam, Veritas, Commvault, IBM Spectrum Protect, Oracle RAC, IBM DB2) transfer backup and restore data to and from an InfiniGuard appliance over an Ethernet or Fibre Channel network with industry-standard protocol (NFS, SMB, VTL, NetBackup OST, Veeam data mover, and Oracle RMAN). Deduplicated capacity-efficient data is encrypted and replicated over a network connection from a primary site to one or more remote sites for disaster recovery.

**Figure 2. InfiniGuard from Infinidat**



Source: ESG, a division of TechTarget, Inc.

The Infinidat InfiniGuard 4320 is built on the InfiniBox storage platform, inheriting its performance and availability features. InfiniGuard also leverages Neural Cache on the embedded InfiniBox platform, a machine learning caching algorithm that learns about the type and amount of data backed up in order to further improve backup and recovery performance. As the three active controllers deliver data to cache, Neural Cache tracks how data is backed up and stored to disk over time. When recalling specific data from backup, Neural Cache helps to quickly reassemble data based on previous backup operations.

This model contains 20TB drives to provide up to 3.4PB of physical usable capacity (85PB+ effective capacity). For this latest InfiniGuard release, numerous hardware features were updated to enable high system availability and highly performant backup and recovery operations, including:

- Redundant switches with 16Gbps backend connectivity and 28TB Flash Cache.
- Two active data deduplication engines (DDEs) and one DDE on warm standby. Each DDE (or Linux-based server) is equipped with 768GB of DRAM and 20 CPU cores.
- Up to six 25GbE ports supported on each DDE. (A mix of both 10GbE and 25GbE ports can be supported as per customer requirements.)

All DDEs are stateless servers that play a key role in maintaining high system availability. Should one of the DDEs experience a hardware failure, organizations can simply fail over to another DDE without having to shut down operations.

To protect backups from cybersecurity threats, particularly malware and ransomware, organizations can leverage the InfiniSafe cyber resilience technology, included at no extra cost with every InfiniGuard system. The cyber resilience software addresses four key areas of cybersecurity: immutable snapshots, near-instantaneous recovery, isolated/fenced

forensic network environment (included with the InfiniGuard), and logical local and remote air gapping. To implement InfiniSafe, organizations can leverage the warm standby DDE since it is airgapped from the rest of the storage network. With InfiniGuard, organizations can easily attach immutable snapshots to this DDE, acting as the fenced forensic environment, in order to test recovery operations.

The Infinidat InfiniGuard 4320 architecture retains aspects to support optimal backup and recovery performance, including:

- **InfiniBand mesh interconnect**, which provides a high-speed communications path between the connectivity, processing, and persistent layers of the InfiniGuard architecture. Any storage node in an InfiniGuard cluster can directly access memory in any of the other nodes in the cluster via direct memory access (i.e., RDMA). This approach reduces the cost, complexity, and latency overhead of a purpose-built backup appliance that uses a switched network for internal communication.
- **Capacity reduction**, which is provided by deduplication and compression algorithms that are running on industry-standard servers in the processing layer. NetBoost source-side deduplication (currently supported for General Purpose File-system Targets on Linux and Windows Servers, Veritas NetBackup OST, Oracle RMAN, and IBM Db2) reduces network traffic, further increases backup performance, and magnifies the capacity reduction savings.

While organizations can conduct system management and backup/recovery operations via a management GUI, Infinidat has also released the InfiniGuard CLI. In addition to conducting all backup and recovery functions, network diagnostics (such as *ping*, *traceroute*, and *MTU size*) can be performed to check storage area network health.<sup>2</sup>

With the Infinidat InfiniGuard 4320, organizations can benefit from:

- **Enterprise-class data protection performance** that delivers up to 181 TB/hour of backup performance, with NetBoost, to help customers meet the ever more stringent SLAs of the modern enterprise.
- **Cost-optimized business continuity** provided with a combination of technologies, including Neural Cache and data reduction.
- **Enterprise-class fault tolerance** that ensures data protection services will continue running after multiple concurrent hardware or media failures.
- **Immutable cyber resilience** that enables the quick and safe recovery of one or more application workloads after a cyber-attack (e.g., ransomware).
- **Ease of deployment and management**, Ease of deployment and management, enabled with plug and play interoperability for popular enterprise-class backup and database applications.
- **The InfiniGuard Cyberstorage Resilience Guarantee**, which includes two SLAs. Infinidat guarantees the immutability of the snapshot during the retention period and that the snapshot will be recovered in 20 minutes, regardless of the snapshot's size (Infinidat also offers cyber storage resilience guarantees on the InfiniBox and InfinBox SSA II platforms).

## ESG Technical Validation

ESG validated the capabilities and value of the InfiniGuard backup and disaster recovery solution via a combination of demonstrations, remote test sessions, performance testing audits, and conversations with customers. The balance of this report explores the benefits of the InfiniGuard architecture, including immutable ransomware recovery, cost-optimized performance, and ease of deployment and management.

## Real-world Recovery Performance

Performance has always been an important component of any good enterprise-class data protection solution. However, many of the recent innovations in this space have been focused on hero backup performance numbers and storage

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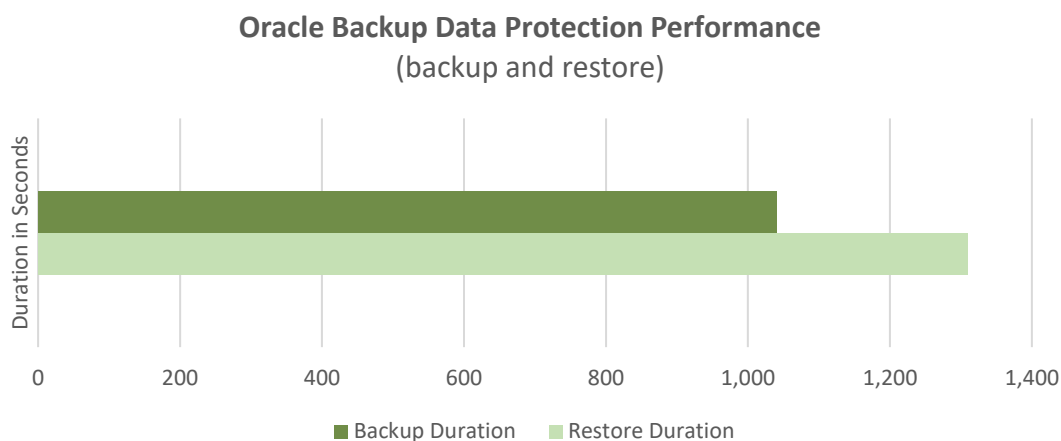
<sup>2</sup> Infinidat has stated that, going forward, additional CLI functionality will be added.

efficiency, often at the expense of recoverability at scale. In this section of the report, we explore some real-world recovery scenarios delivered by an InfiniGuard data protection storage solution with up to 85PB+ of effective data protection storage capacity that can scale up to 181 TB/hour of backup throughput.

### ESG Testing

As shown in Figure 3, ESG compared backup and restore performance in a lab environment for a database workload. The idea was to demonstrate how close InfiniGuard could come to delivering equal backup and restore performance. We leveraged a Linux server running a two terabyte Oracle Database with columnar compression and transparent data encryption enabled. We compared a first full backup to a full database recovery on the same Linux server connected over a 10GbE network to a NetBoost-enabled share on an InfiniGuard target.

**Figure 3. Backup and Restore Performance**



Source: ESG, a division of TechTarget, Inc.

### What the Numbers Mean

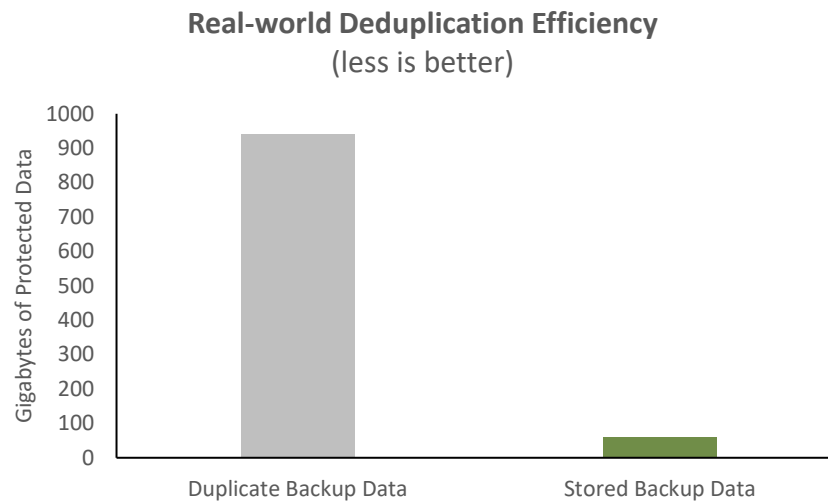
- Historically, full restore durations are typically a minimum of **50%** longer than a full backup. InfiniGuard outperformed this metric with only a small **21%** difference in duration between the Oracle Database full backup and full restore.
- The backup duration of 17 minutes and 20 seconds represents the results of full backup leveraging the NetBoost Protocol.
- The restore duration of 21 minutes and 50 seconds represents the results of complete Oracle database recovery.
- It should be noted that, with the NetBoost protocol, even the first full backup benefited from some level of client-side deduplication for improved performance. As the InfiniGuard deduplication index builds after each new backup, subsequent data protection operations should yield even higher performance results.

Next, we analyzed and audited the production environment of an organization that has deployed InfiniGuard. The customer is in the shipping and logistics industry and runs a multi-site configuration with two active data centers and one DR location. The customer migrated to InfiniGuard from a client server backup application with a mix of disk and tape targets. They have now migrated to a

***“We can run an instant recovery for any size application server in our environment from deduplicated InfiniGuard storage, and our users don’t notice a performance impact.”***

mostly virtual environment and leverage Veeam and InfiniGuard for backup, recovery, and DR. This new solution simplified the data protection storage infrastructure and now allows them to take advantage of improved deduplication and features like instant recovery. Even though the customer is leveraging both deduplication and immutable data snapshots, they are still able to leverage Veeam instant recovery capabilities to restore servers of any size in the environment in minutes with no discernable impact to production performance. As shown in **Error! Reference source not found.**, data collected from the field from multiple customers and audited by ESG shows the solution is delivering a significant reduction in the amount of storage needed for protection. Call home system support data that was audited showed up to **31.8:1** data reduction with an average of **16:1** across the sample client set.

**Figure 4. Protection Storage Efficiency**

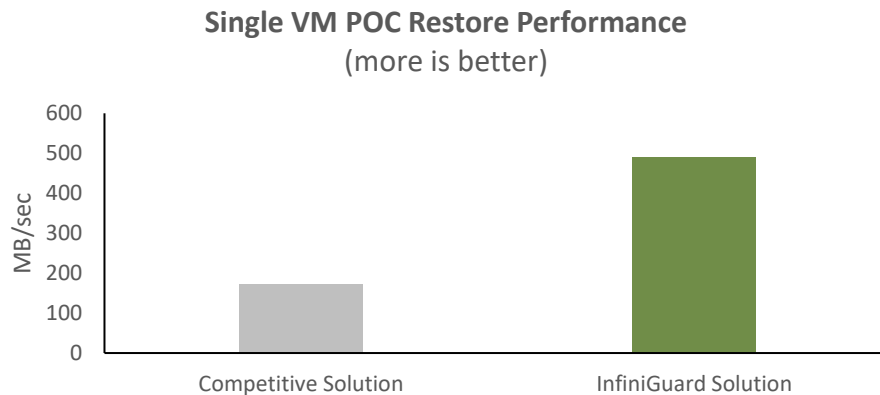


Source: ESG, a division of TechTarget, Inc.

### What the Numbers Mean

- Because of deduplication, on average, only 60 GB of data needed to be stored with InfiniGuard to protect a terabyte of production data.
- InfiniGuard data reduction reduced the amount of backup data that needed to be stored by up to **97%**.

Finally, we audited the results of an ongoing proof of concept (PoC) evaluation. A financial firm focused on college-level educational services was considering replacing their existing purpose-built backup appliances with InfiniGuard. As shown in Figure 5, we compared the restore throughput for a single production VM single stream recovery to InfiniGuard's restore throughput.

**Figure 5. Protection Storage Efficiency**

Source: ESG, a division of TechTarget, Inc.

### What the Numbers Mean

- The InfiniGuard solution delivered 284% more throughput than the competitive solution.
- ESG expects that the InfiniGuard throughput advantage would be even greater for a multi-streamed restore of larger VMs.

### Why This Matters

According to ESG research, more than half of the organizations surveyed cannot tolerate an hour of downtime for their mission-critical applications. Organizations also reported that, on average, one in three applications is essential to the business, which, in turn, means more stringent SLAs. From the same research, only 22% of respondents reported that they always meet their recovery SLAs.

ESG validated that InfiniGuard helps address data protection performance challenges at enterprise scale by combining high performance InfiniBox storage with enterprise-class deduplication technology. Based on our evaluation of test results, we found that InfiniGuard delivers the fast data recovery performance that is needed to help meet recovery SLAs.

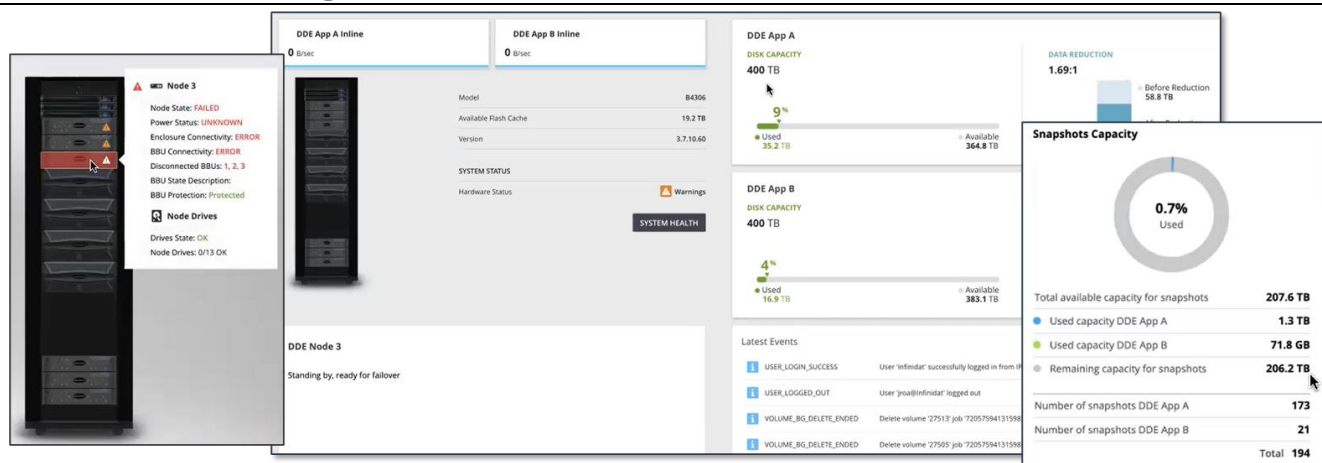
### System Management and Recovery from Snapshots

InfiniGuard is easy to manage via an intuitive HTML5 GUI that makes typically complex backup, replication, and recovery operations simpler.

### ESG Testing

ESG began with a quick tour of the InfiniGuard management interface. Figure 6 shows 1PB of storage with two deduplication engines—DDE App A & DDE App B, with 400TB each—plus 200TB set aside for snapshots. Note how the available capacity and deduplication for each volume can be monitored with this intuitive user interface. If jobs were running, all the activity would be showing against the two active deduplication engines on the top left. We can also view the number of snapshots, as well as the capacity they consume on both DDEs.

Figure 6. InfiniGuard Management Interface Overview



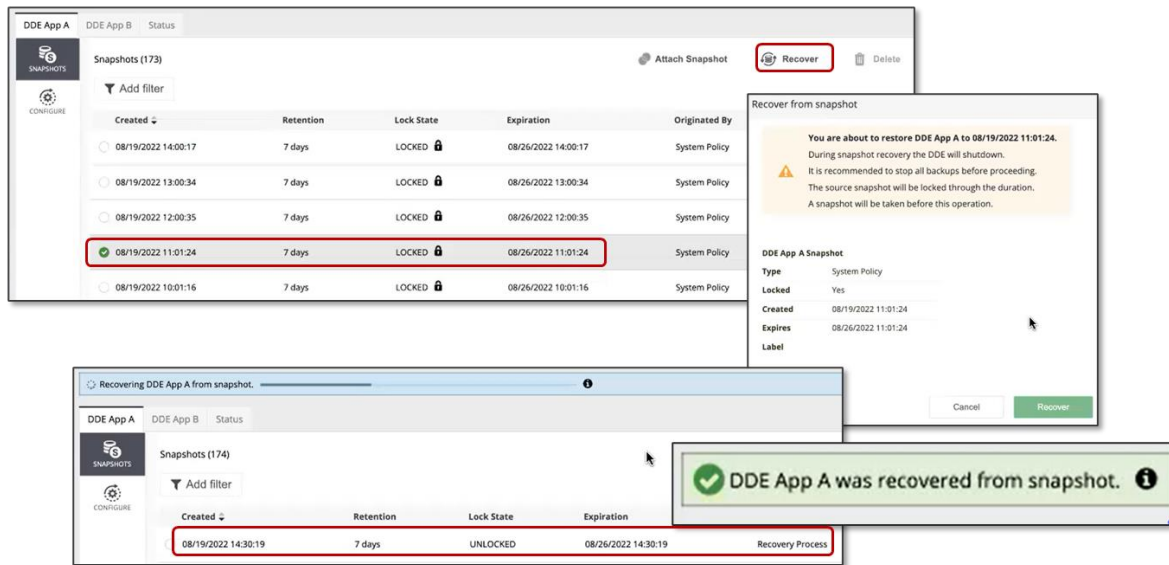
Source: ESG, a division of TechTarget, Inc.

System health is displayed in the top center of the interface where an indicator currently shows “peak health” as the status. To drill down deeper, “**System Health**” is selected from the left side bar to display a three-dimensional model of InfiniGuard. We could click on a warning, as shown on the left-hand side of Figure 6, alerting us to a failed controller. (We should note that the testing proceeded even though that one DDE failed.)

System snapshots can also be made immutable, giving users added protection and recoverability from a cyber-attack. Events are logged and event rules can be set with alerts using SNMP or SMTP. System users are managed using an Active Directory via LDAP.

We then examined the ease of restoring a DDE to a previously created snapshot. In Figure 7, we navigated to the list of available snapshots for DDE A. We selected the snapshot created on 8/19/2022 at 11:01:24 and clicked on “Recover” in the upper right-hand corner. A pop-up window appeared to ensure that we wanted to proceed before we initiated the recovery. In less than five minutes, a new snapshot appeared, dated 8/19/2022 at 14:30:19 (military time). While the recovery process lasted approximately 20 minutes, the data was actually available since the storage volumes are already mounted to the DDE. The remaining time was spent on the actual Linux-server reboot and re-establishing network connections. Should the need arise to access data prior to a recovery process, end-users can return to the data at that point in time, without concern that data was lost. Business continuity is ensured.



**Figure 7. Recovery from Previously Created Snapshot**

Source: ESG, a division of TechTarget, Inc.

## Why This Matters

When optimizing overall availability of storage infrastructure, organizations must consider the ease of restoring data protection appliances with clean snapshots, along with overall system management. Complicating these operations incurs unnecessary application downtime.

ESG validated the ease of conducting management and data restoration operations with the Infinidat InfiniGuard 4320. We examined how an administrator can easily assess the overall health and status of the InfiniGuard appliance using InfiniGuard's GUI. We also observed how quickly the InfiniGuard 4320 restored a DDE from a previously created snapshot using a simplified and straightforward workflow. ESG also noted that Infinidat will continue to adhere to brief recovery times (less than 20 minutes) with the InfiniGuard Cyberstorage Recovery Guarantee.

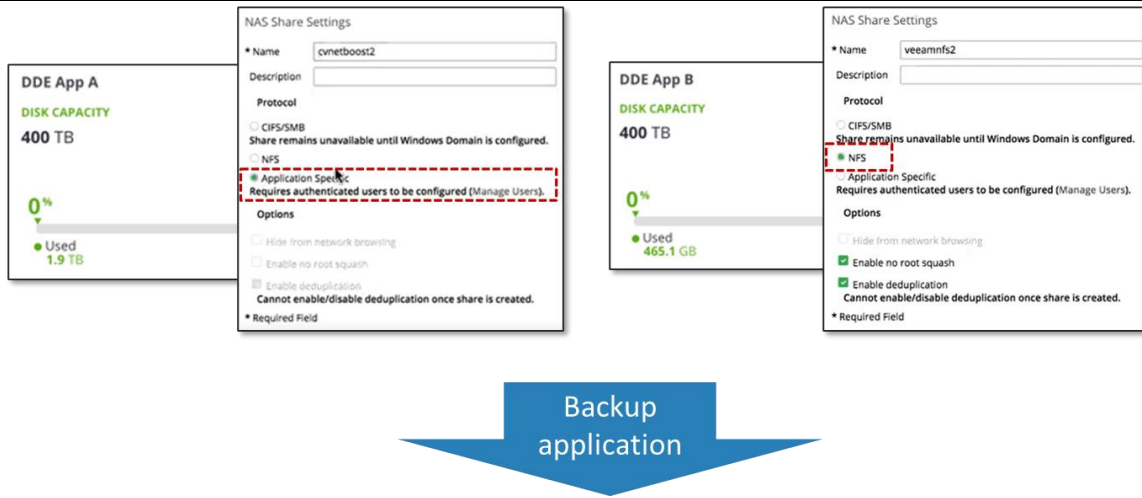
## Data Protection Integration

To ensure that organizations do not disrupt existing data backup and recovery workflows, Infinidat has designed the InfiniGuard 4320 to support most major backup applications already deployed in the data center. InfiniGuard works with these solutions to enhance their performance while providing advanced deduplication and compression technologies

## ESG Testing

ESG first provisioned InfiniGuard shares for data protection applications, as shown in Figure 8. To create two NAS shares, we began by naming each share and then choosing a protocol. Protocol options include CIFS, SMB, and NFS or are application-specific. These two shares were created on DDE A and B. The "Configure" option was used to configure replication settings, including the type of replication, the IP address of the remote InfiniGuard appliance, and access credentials. In our case, we chose an "application-specific" protocol for DDE A and the NFS protocol for DDE B.

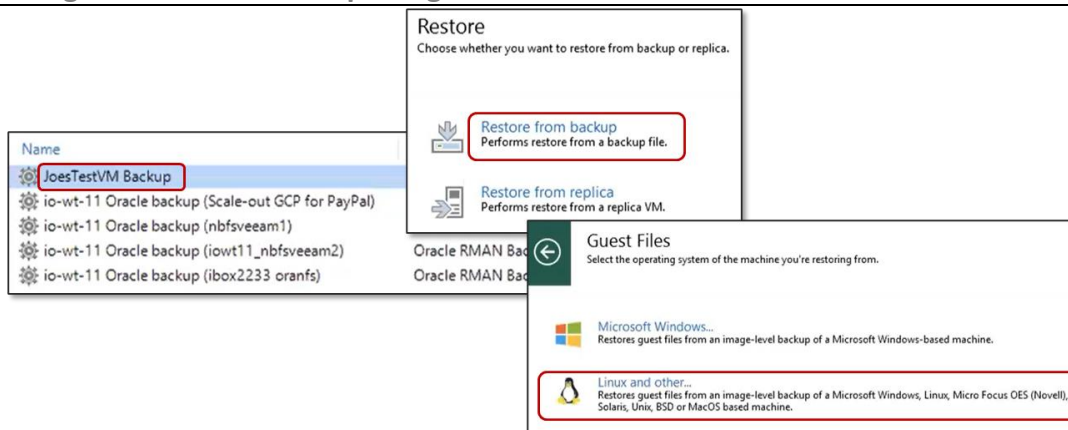
**Figure 8. Provisioning InfiniGuard Shares for Data Protection Applications**



Source: ESG, a division of TechTarget, Inc.

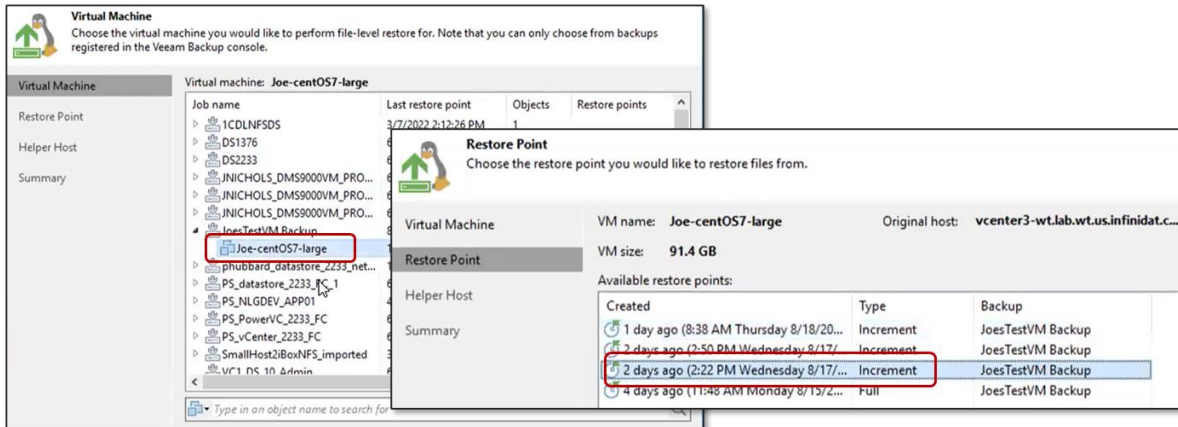
ESG then observed the level of granularity when restoring data from backup using InfiniGuard in conjunction with Veeam. Using the Veeam management interface, we began with a test VM, “JoeTest VM Backup,” on which a backup was completed. The VM was located on the Linux server named “joe-centOS7-large.” The backup repository named “dde1veeamnfs1” was mounted on this server. As shown in Figure 9, we initiated a restore operation from a backup stored in a guest file located on a Linux server.

**Figure 9. Initiating Restore from Backup using Veeam**



Source: ESG, a division of TechTarget, Inc.

Using a wizard-driven process, we chose the server containing the snapshots, “joe-centOS7-large,” and chose the incremental backup created on 8/17/2022 (see Figure 10).

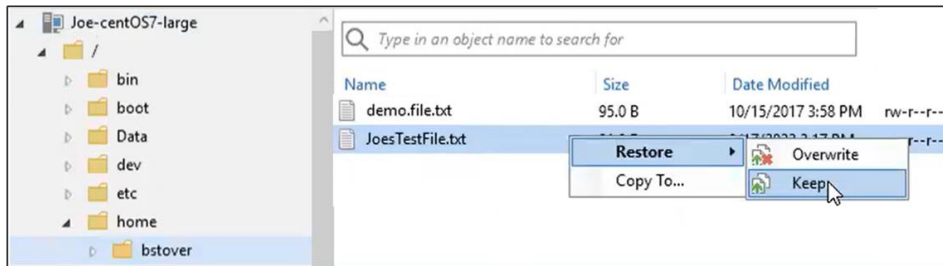
**Figure 10. Initiating Restore from Backup using Veeam**


Source: ESG, a division of TechTarget, Inc.

Before performing our restoration, we deleted a file named “*JoestestFile.txt*” from the “*bstover*” directory on the “*joe-centOS7-large*” server (see Figure 11). From the Veeam interface, we navigated to the “*bstover*” directory associated with this snapshot, right clicked on “*JoestestFile.txt*,” and chose “*Restore*.” Once the operation completed, we confirmed that the file was restored using the InfiniGuard CLI. From here, we could then navigate back to the InfiniGuard GUI and restore the entire DDE with the most up-to-date data.

**Figure 11. Restoring an Individual File from an Incremental Backup**

```
[root@Joe-centOS7-large bstover]# ls
demo.file.txt  JoestestFile.txt
[root@Joe-centOS7-large bstover]# rm -rf JoestestFile.txt
[root@Joe-centOS7-large bstover]# ls
demo.file.txt
```



```
[root@Joe-centOS7-large bstover]# ls
demo.file.txt  JoestestFile.txt
[root@Joe-centOS7-large bstover]#
```

Source: ESG, a division of TechTarget, Inc.

## Why This Matters

To optimize efficiency in conducting backup and recovery operations, it is critical that data protection software and secondary storage work seamlessly with minimal integration effort. Otherwise, organizations risk incurring unnecessary operational overhead and, subsequently, unwanted downtime if recovery is delayed.

ESG validated that InfiniGuard is easy to deploy, manage, and integrate with leading backup software. ESG observed that it is also easy to protect backup data sets with immutable snapshots. Overall, InfiniGuard made it easy to monitor, manage, and report on the infrastructure and improved operational efficiency.

## The Bigger Truth

Now more than ever, organizations are looking at their data protection strategies through a new lens. They are evaluating old practices with a focus on cost-effectively improving the speed and reliability of their backup, cyber resilience, and disaster recovery infrastructure.

The aging architecture of industry-leading purpose-built backup appliances is struggling to cost-effectively meet the modern data protection needs of business-critical application workloads at petabyte scale. Legacy solutions were developed more than 20 years ago with a goal of shrinking backup windows and reducing the cost of disk-based data protection. Since then, most organizations realized that, while backup performance is important, recovery time is even more crucial, especially after a cyber-attack. With these goals in mind, many organizations are struggling to cost-justify an upgrade of a sprawling mix of legacy purpose-built backup appliances to the latest generation of all-flash appliances.

InfiniGuard leverages the purpose-built primary storage architecture of InfiniBox to cost-effectively meet the secondary storage needs of organizations that are struggling to deliver backup and recovery services at petabyte scale. The InfiniGuard architecture uses disk instead of flash for deep storage capacity, a DRAM caching layer that is thousands of times faster than disk for performance acceleration of in-flight and hot data, and an SSD caching layer for warm data. The InfiniGuard architecture builds upon the field-proven InfiniBox architecture with the addition of state-of-the-art deduplication and compression technologies (including optional host-side deduplication), interoperability with market-leading backup and database vendors, and an all-inclusive capacity-on-demand pricing model. This unique architecture enables InfiniGuard to provide extremely fast recovery times without compromising on backup windows and cost.

Additionally, Infinidat's cyber storage resilience software, InfiniSafe, is included with all InfiniGuard platforms for free. InfiniSafe provides a comprehensive cyber resilience technology that includes immutable snapshots, local and remote logical air-gapping, a fenced/isolated forensic environment, and rapid recovery. Infinidat backs its InfiniSafe solution with two SLA cyber storage guarantees: one on the immutability of the snapshot and one on the recovery of immutable snapshots in 20 minutes or less.

ESG has validated that InfiniGuard is easy to deploy and manage with industry-leading backup software applications and databases. An instant recovery from an immutable InfiniGuard snapshot with Veeam backup software provided quick and safe recovery. Performance testing with a 2TB Oracle database confirmed that InfiniGuard exceeds expectations and delivers enterprise-class levels of backup and restore speeds. A customer that ESG spoke with indicated that their backup and restore speeds improved by 284% and their backup storage capacity was reduced by up to 97% (~32:1 reduction) after upgrading to InfiniGuard.

If your organization is struggling to cost-justify an upgrade of a legacy purpose-built data protection appliance to meet data recovery and cyber resilience service level agreements at petabyte scale, it would be a smart move to take a serious look at the Infinidat InfiniGuard 4320.

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[contact@esg-global.com](mailto:contact@esg-global.com)



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