Abstract

This paper introduces NetApp® Scale-Out Data Protection, a combined NetApp and Commvault solution that offers expanded rapid recovery support for critical data across a data fabric powered by NetApp technology. NetApp Scale-Out Data Protection takes advantage of the NetApp portfolio, and is powered by Commvault Complete Backup & Recovery software to provide NetApp Snapshot™ management, backup, and disaster recovery functionality.
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1 Executive Summary

With many organizations struggling to meet the availability and rapid recovery goals demanded by their business, NetApp and Commvault have partnered to create an appliance-like verified architecture specifically for this purpose. Running on NetApp® HCI and powered by Commvault software, the primary recovery media is fast all-flash storage, with a cloud tier based on NetApp StorageGRID® software for long-term retention. This clever design meets the most demanding recovery needs and keeps costs under control, while exceeding modern ease-of-use requirements for scalability and day-to-day management.

1.1 The Challenge

The enterprise IT landscape is going through a digital transformation as it shifts from handcrafted, single-purpose data center designs to new technologies that deliver agility, scalability, and greater efficiency. The hybrid cloud relies on the availability and resiliency of data. Enterprises require a complete data protection solution that is reliable, flexible, and easy to use. Although virtualizing an environment provides an increased level of data availability, meeting aggressive recovery point objectives (RPOs) and recovery time objectives (RTOs) becomes increasingly difficult.

Legacy and traditional approaches to backup and recovery just don’t meet the needs of the modern enterprise—they’re broken. Whether it’s because of a lack of automation that slows response times, an inability to scale cost effectively, a lack of support for today’s modern cloud environments, or an inability to meet governance regulations like the California Consumer Privacy Act (CCPA) or the European Union’s General Data Protection Regulation (GDPR), yesterday’s solutions are not addressing your needs today.

Despite these challenges, the value of your data continues to increase, making protection of your data more important than ever. You need a modern data protection solution that allows your company to innovate and grow while keeping the business running uninterrupted, proactively enabling rapid change, and applying effective governance in the face of regulatory shifts. Additionally, you want a solution that reduces administrative complexity while being delivered at the same or lower cost as your current solution.

Industry data that supports this view can be found in a survey conducted by the Enterprise Strategy Group in February 2020 (ESG 2020 Technology Spending Intentions), which showed that 64% of respondents said IT was more complex than 2 years ago. It also revealed that “improving data backup and recovery” was the #1 priority for data center modernization plans.

Ultimately, you need a data protection strategy that helps you address these challenges and increase your ability to respond across the following areas:

- **Recovery readiness**: What is your response when the business asks how ready you are to recover in the face of a disaster?
- **Data governance**: How do you adhere to complex data privacy and protection laws?
- **Constant change**: How fast can you respond to change in the business?
- **Management complexity**: How do you properly manage remote, physical, cloud, and virtual environments?
- **Optimizing costs**: How can you successfully optimize your current and future infrastructure utilization?

Additionally, as your company grows and your needs expand, you can simplify disaster recovery, development and testing, and workload migration through automation. You can also extract data insights for better data governance and business outcomes.

Commvault software also employs machine learning to help you meet your most demanding SLAs, by providing smart reports and automation.
1.2 About NetApp
NetApp is the leader in cloud data services, empowering global organizations to change their world with data. Together with our partners, we are the only ones who can help you build your unique data fabric. Simplify hybrid multicloud and securely deliver the right data, services, and applications to the right people at the right time.

1.3 About Commvault
Commvault believes in data readiness. Commvault helps organizations of all sizes intelligently manage data through solutions that store, protect, manage, and use their most critical asset—their data. Commvault software, solutions, and services are available from the company and through a global ecosystem of trusted partners. Commvault employs more than 2,300 highly skilled individuals across markets worldwide, is publicly traded on NASDAQ (CVLT), and is headquartered in Tinton Falls, New Jersey, in the United States.

1.4 Target Audience
The target audience for this solution also includes the following groups:

- Solution and cloud providers with data centers that require an easily deployable solution scaling to petabytes of data
- Channel partners, global organizations, and systems integrators who assist customers to transform and modernize their data protection solution
- Executives and IT managers who want to achieve business continuity that can scale at a low cost
- Healthcare providers and businesses with GDPR
- Disaster recovery and virtual environment administrators, engineers, and architects
- Professional services and sales engineers

2 Solution Overview
To meet these challenges, Commvault and NetApp have collaborated to create NetApp Scale-Out Data Protection, based on NetApp® HCI and Commvault Complete Backup & Recovery for NetApp storage. The solution combines NetApp HCI for easy deployment and scaling with NetApp AFF technology for high-performance backup, plus NetApp StorageGRID object storage for long-term retention. Commvault software manages the backup and recovery processes, including data tiering from flash to object storage tiers.
### 2.1 Fast, Cost-Effective, and High Capacity

Under normal circumstances, you’d be forced to compromise and pick the two features that meet your most pressing demands. However, because we’ve combined NetApp HCI, AFF, and StorageGRID with Commvault software, the normal compromises you’d expect to make for your recovery systems simply evaporate.

This partnership combines NetApp Scale-Out Data Protection and Commvault’s vast support for NetApp Snapshot copies from arrays and the cloud and a full set of application and virtual machine (VM) APIs. The solution provides a near-instant first line of recovery. Depending on business needs, the Snapshot copies can then be moved to the NetApp all-flash tier of the backup storage. If a system needs restoring, the all-flash NetApp recovery tier enables the VM to be quickly started by using Commvault’s LiveMount and LiveRecovery in the deduplicated backup store while the recovery is taking place. This capability can help you meet your SLAs with time to spare.

NetApp HCI is an enterprise-scale hybrid cloud infrastructure solution that delivers compute and storage resources in an agile, scalable, easy-to-manage two-rack-unit, four-node building block. The NetApp Deployment Engine (NDE) and NetApp Element® plug-in for vCenter deploys and manages NetApp HCI.

NetApp HCI is focused on helping organizations manage multiple hybrid cloud environments in an elegant and simplified manner. Commvault software adds advanced data management.

This combination creates a complete backup solution. It takes a holistic approach to data management that helps enterprises reduce risk, improve operational efficiencies, cut costs, and derive more value from their data and information.

### 2.2 Benefits

Key features of the NetApp Scale-Out Data Protection solution include:

- **Architecture:**
  - NetApp Verified Architecture guaranteeing quick and effective deployment.
  - Commvault IntelliSnap software for managing Snapshot copies uses NetApp hardware orchestration to provide enhanced RPOs and RTOs.
Complete data protection solution supporting all major operating systems, applications, and databases on virtual and physical servers, NAS shares, cloud-based infrastructures, and endpoint/mobile devices.

- **Scalability and efficiency:**
  - Scale compute, the primary recovery flash tier, and long-term storage tier components individually to meet the unique demands of your organization.
  - Perform deduplication for the NetApp flash tier and object storage tier.
  - Infinitely scale StorageGRID for long-term retention with the option to scale to public cloud.

- **API integration/automation:**
  - Full integration with VMware technologies—adds value by providing automation. The Commvault Virtual Server Agent (VSA) uses vStorage APIs for Data Protection (VADP), with support for all guest operating systems supported by VADP.
  - Reduce complexity by using prebuilt automation workflows and an extensive API library.

- **Flexibility and performance:**
  - All-flash tier for faster recoveries.
  - Granular recovery of VMs and files, including support for advanced recovery options like Live Browse, LiveMount, and LiveRecovery.
  - Built in workload portability—when restoring a VM, you can choose to restore to a different hypervisor. This capability can be used to migrate VMs to a different virtualization platform (including public cloud providers).
  -Built in backup, Snapshot management, replication, and archiving, with support for content indexing for e-discovery/search.
  - Cutting-edge end-user experience empowering users to protect, find, and recover their own data by using common tools such as web browsers, Microsoft Outlook, and File Explorer.
  - Policy-based data management: managing data according to business needs and not physical location.

- **Security:**
  - Multilayered protection from ransomware: Commvault software combines immutable recovery tiers from NetApp with proactive AI-based anomaly detection and other built-in ransomware protection technologies to detect attacks, keep your data safe, and enable fast recovery.
  - Advanced security capabilities to limit access to critical data, provide granular management capabilities, and provide single sign-on access for Active Directory users.

### 2.3 Data Fabric Integration Points

The data fabric is NetApp’s vision for the future of data management. The data fabric seamlessly connects different clouds, whether they are private, public, or hybrid environments. A data fabric unifies data management across distributed resources to allow consistency and control of data mobility, security, visibility, protection, and access.

The previous section outlined a few of the benefits of Scale-Out Data Protection. Here are some simple questions that can help determine if Scale-Out Data Protection is right for you.

- Are you tired of overrunning your data protection windows?
- Do you hate how backup processes consume precious resources?
- Do you want to give those resources back to the apps that need them?
- Do you spend lots of human hours managing, planning, and optimizing?
- Do you want to crush the complexity of multiple data silos for backup, replication, archiving?
Scale-Out Data Protection with NetApp and Commvault satisfies those needs and enables you to have completely integrated endpoints and a complete API-driven data services solution. It’s your data fabric; it’s your time.

Combining data fabric services into a virtual consumption layer enables your data to be protected and secured throughout its lifecycle.

- File services for high-performance cache (short-term retention and quick recovery)
- Object services that use StorageGRID technology (highly durable long-term retention)
- Integrated replication services (reduce backup time, recovery time, and nearly eliminate compute resource demands)
- Data orchestration and lifecycle management with Commvault software (single integrated approach, ease of management, automatic data tiering)
- Acceleration of the journey to the cloud by expanding the integrated data protection policies to cloud workloads running on NetApp Cloud Volumes ONTAP® and Azure NetApp Files

3 Solution Design and Best Practices

3.1 Solution Configuration—Physical Setup Overview

This section illustrates the solution configuration and details the hardware and software versions used for validation testing.

Figure 2) Solution configuration.
3.2 Minimum Hardware Requirements

This section lists the hardware used for this solution and for validation testing. Hardware components used might vary according to customer requirements.

Table 1) NetApp HCI hardware minimum requirements.

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Quantity</th>
<th>CPU</th>
<th>Cores</th>
<th>Memory</th>
<th>Disk</th>
<th>Usable Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compute: NetApp H410C</td>
<td>4</td>
<td>Intel Xeon Gold 5120 CPU@ 2.20GHz (Cascade Lake)</td>
<td>24</td>
<td>512GB</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Storage: NetApp H410S</td>
<td>4</td>
<td>Intel Xeon Gold 5120 CPU@ 2.20GHz (Cascade Lake)</td>
<td>24</td>
<td>256GB</td>
<td>x24, 960GB</td>
<td>19TB</td>
</tr>
</tbody>
</table>

Table 2) Networking minimum requirements.

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Quantity</th>
<th>Speeds</th>
<th>Ports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mellanox SN2010</td>
<td>2</td>
<td>10/25GbE</td>
<td>36</td>
</tr>
</tbody>
</table>

Table 3) Primary backup target minimum requirements.

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Quantity</th>
<th>Disk</th>
<th>Usable Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>NetApp AFF</td>
<td>1</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>StorageShelf DS224C</td>
<td>1</td>
<td>x24, 3.8TB (NVMe SSD)</td>
<td>64TB</td>
</tr>
</tbody>
</table>

Table 4) Secondary backup target minimum requirements.

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Quantity</th>
<th>Disk</th>
<th>Usable Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>StorageGRID SG5712</td>
<td>4</td>
<td>x48, 4TB (NL-SAS HDD)</td>
<td>136TB</td>
</tr>
</tbody>
</table>

3.3 Minimum Software Requirements

This section lists software versions used for this solution and for validation testing. Software components used might vary according to customer requirements.

Table 5) Software versions.

<table>
<thead>
<tr>
<th>Product Family</th>
<th>Product Name</th>
<th>Product Version</th>
<th>Operating System</th>
</tr>
</thead>
<tbody>
<tr>
<td>NetApp HCI</td>
<td>Element software</td>
<td>11.7</td>
<td>n/a</td>
</tr>
<tr>
<td>NetApp ONTAP</td>
<td>1.7 P1</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Element vCenter Plug-in</td>
<td>9.7</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>VMware vSphere Enterprise Plus</td>
<td>ESXi</td>
<td>6.7.0, 10302608</td>
<td>n/a</td>
</tr>
<tr>
<td>vCenter Server Appliance</td>
<td>6.7.0, 10244857</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Mellanox</td>
<td>SN2010</td>
<td>3.7.1134</td>
<td>Onyx</td>
</tr>
</tbody>
</table>
### 3.4 Testing and Solution Validation Details

This section lists the hardware and software used for validation testing. Hardware and software components used might vary according to customer requirements.

#### Table 6) Converged infrastructure hardware requirements for the workload.

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco C220 M4</td>
<td>6</td>
</tr>
<tr>
<td>NetApp AFF</td>
<td>1</td>
</tr>
<tr>
<td>Cisco Nexus 93180YC</td>
<td>2</td>
</tr>
</tbody>
</table>

#### Table 7 FlexPod® Express software requirements for the workload.

<table>
<thead>
<tr>
<th>Product Family</th>
<th>Product Name</th>
<th>Product Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>VMware vSphere Enterprise Plus</td>
<td>ESXi</td>
<td>6.7.0 U2</td>
</tr>
<tr>
<td></td>
<td>vCenter Server Appliance</td>
<td>6.7.0.20000 U2</td>
</tr>
<tr>
<td>NetApp</td>
<td>ONTAP</td>
<td>9.7</td>
</tr>
<tr>
<td></td>
<td>vCenter Plug-in for ONTAP</td>
<td>4.3.0</td>
</tr>
<tr>
<td>Cisco</td>
<td>Nexus 93180YC</td>
<td>7.0.3.17.8</td>
</tr>
</tbody>
</table>

#### NetApp HCI

#### Table 8) Minimum NetApp HCI hardware requirements.

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Quantity</th>
<th>Memory</th>
<th>Disk</th>
<th>Usable Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compute node: NetApp H615C</td>
<td>8</td>
<td>512GB</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Storage node: NetApp H610S</td>
<td>4</td>
<td>256GB</td>
<td>x24, 960GB</td>
<td>42.25TB</td>
</tr>
<tr>
<td>Network: Mellanox</td>
<td>2</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>
Table 9) Traditional converged infrastructure hardware requirements for the workload.

<table>
<thead>
<tr>
<th>Product Family</th>
<th>Product Name</th>
<th>Product Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>VMware vSphere Enterprise Plus</td>
<td>ESXi</td>
<td>6.7.0 U2</td>
</tr>
<tr>
<td></td>
<td>vCenter Server Appliance</td>
<td>6.7.0.20000 U2</td>
</tr>
<tr>
<td>NetApp</td>
<td>NDE</td>
<td>1.7 P1</td>
</tr>
<tr>
<td></td>
<td>vSphere Plug-in for NetApp SolidFire®</td>
<td>4.3.0</td>
</tr>
<tr>
<td>Mellanox</td>
<td>Onyx</td>
<td>9.4.2000</td>
</tr>
</tbody>
</table>

### 4 Sizing

Consult your NetApp data protection technical marketing engineer for specific sizing for your environment. NetApp technical marketing engineers can use the Commvault Total Backup Storage Calculator tool to estimate the backup infrastructure requirements. The tool requires Commvault Partner Portal access. Sign up for access if needed.

#### 4.1 Commvault Sizing Inputs

The following tasks can be used to perform discovery for sizing of the data protection solution:

- Identify the system or application/database workloads and corresponding front-end capacity (in terabytes [TB]) that will need to be protected.
- Identify the VM/file workload and similar front-end capacity (TB) that will need to be protected.
- Identify short-term and long-term retention requirements.
- Identify the daily % change rate for the datasets just mentioned.
- Identify projected data growth over the next 12, 24, and 36 months.
- Define the RTO and RPO for data protection/recovery according to business needs.

When this information is available, the backup infrastructure sizing can be done with breakdown of required storage capacities for AFF and the StorageGRID tier.

#### 4.2 NetApp HCI

For this solution, the Commvault management server (CommServe) and MediaAgent VMs are deployed on a NetApp HCI system with four compute and four storage nodes. The system provides 112 total virtual CPU (vCPU) cores, 19TB of usable capacity, and 200,000 total IOPS supporting small, medium, large, and extra-large system requirements.

Here are the overall system requirements for NetApp HCI and Commvault. Consult your NetApp data protection technical marketing engineer for specific sizing for your environment.

- For CommServe server sizing, see Hardware Specifications for the CommServe Server.
- For NetApp HCI specifications, see the NetApp HCI datasheet.
- For MediaAgent sizing, see the Deduplication Building Block Guide.
Table 10) NetApp HCI hardware total requirements.

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Quantity</th>
<th>Total Cores</th>
<th>Total Memory</th>
<th>Disk</th>
<th>Usable Capacity</th>
<th>Total IOPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compute: NetApp H410C</td>
<td>4</td>
<td>112</td>
<td>2TB</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Storage: NetApp H410S</td>
<td>4</td>
<td>n/a</td>
<td>n/a</td>
<td>x24, 960GB</td>
<td>19 TB</td>
<td>200,000</td>
</tr>
</tbody>
</table>

Table 11) Commvault software total system requirements.

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
<th>Datastore</th>
<th>Size</th>
<th>Total</th>
<th>Total Required IOPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CommServe Server</td>
<td>1</td>
<td>OS</td>
<td>500GB</td>
<td>500GB</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SQL</td>
<td>500GB</td>
<td>500GB</td>
<td>n/a</td>
</tr>
<tr>
<td>MediaAgent</td>
<td>4</td>
<td>vCPU</td>
<td>16</td>
<td>64</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RAM</td>
<td>128GB</td>
<td>512</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OS</td>
<td>500GB</td>
<td>2TB</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Index cache</td>
<td>2TB</td>
<td>8TB</td>
<td>200+</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DDB</td>
<td>2TB</td>
<td>8TB</td>
<td>200 to 80,000K</td>
</tr>
</tbody>
</table>

4.3 StorageGRID

To perform StorageGRID sizing, you must understand the workload:
- Usable capacity after data protection applied
- Average object size
- Object count
- Performance requirements

StorageGRID capacity and performance scales by adding more nodes. Understanding your workload will determine which model or a mix of models will provide the most value. To size a system for your workload, consult a StorageGRID solution architect.

5 Scaling

5.1 Commvault

NetApp Scale-Out Data Protection allows the flexibility to scale out compute and storage independently. The Commvault CommServe and MediaAgent VMs running on NetApp HCI can be scaled as the data volumes to be protected grow.

See Commvault documentation for recommended specifications for the CommServe and MediaAgent VMs. For the NetApp Scale-Out Data Protection solution, the extra-large CommServe and MediaAgent specifications are recommended.

Review these Commvault documentation links for additional reference:
- Recommended specifications for the CommServe VM
- Recommended specifications for MediaAgent VM
• Recommended specifications for the Virtual Server Agent VM
For more details, see the CommCell performance tuning and scalability guides.

5.2 NetApp HCI
Expanding your NetApp HCI installation is easy. Using the NetApp Hybrid Cloud Control manageability suite, you can expand NetApp HCI storage and compute resources either separately or at the same time. NetApp HCI detects the existing network configuration and offers you configuration options within the existing networks and virtual LANs (VLANs).
For more information, see Expanding Your NetApp HCI Installation.

5.3 AFF System
With your AFF system, to get more capacity, you can hot-add disk shelves with IOM12 modules to an existing stack of disk shelves with IOM12 modules. Alternatively, you can hot-add a stack of disk shelves with IOM12 modules directly to a SAS host bus adapter (HBA) or an onboard SAS port on the controller.
For more information about shelf expansions, see SAS Shelves with IOM12 Modules.

5.4 StorageGRID
You can expand a NetApp StorageGRID system by adding storage to storage nodes, adding new grid nodes to an existing site, or adding a new data center site. You can perform expansions without interrupting the operation of your current system.
For more information about expanding the StorageGRID system, see StorageGRID 11.3 Expansion Guide.

6 Solution Deployment
This section provides an overview of deploying backup and recovery with Commvault on NetApp HCI. Completing all sizing and proper planning exercises is key for a successful deployment of this backup solution.

6.1 NetApp HCI
NetApp Deployment Engine
NetApp HCI simplifies Day 0 deployment with the NetApp Deployment Engine (NDE), completing over 400 deployment and configuration tasks in a fraction of the time it takes to deploy manually. When deployment is complete, the NetApp HCI system provides compute and storage for the Commvault management server and MediaAgents.
Complete the prerequisite steps and deployment steps provided in the Setting up and using NetApp HCI 1.7P1.

Post-Deployment Checklist
In vCenter, add the required distributed port-groups for the following VLANs:
• In-band management traffic
• VLANs from nonrouted private virtual environments (optional)
NetApp Element OS Plug-in for vCenter was used to provision datastores for Commserve and Media Agents.
For the latest details on the Element Plug-in for vCenter Server, see the NetApp HCI VCP 4.3 User Guide.

The following operating system deployment was used for the Commvault backup components.

Table 12) Operating system deployment used for the Commvault backup components.

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
<th>OS</th>
<th>CPU</th>
<th>RAM</th>
<th>Datastore</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commvault Server</td>
<td>1</td>
<td>Windows Server 2016</td>
<td>16</td>
<td>128GB</td>
<td>OS</td>
<td>500GB</td>
</tr>
<tr>
<td>MediaAgent</td>
<td>4</td>
<td>Windows Server 2016</td>
<td>16</td>
<td>128GB</td>
<td>SQL</td>
<td>500GB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Index cache</td>
<td>500GB</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DDB</td>
<td>1TB</td>
</tr>
</tbody>
</table>

6.2 NetApp ONTAP Deployment and Configuration Overview

The following steps are required for providing a backup target that uses either NFS or CIFS:

- Complete AFF A300 Systems Installation and Setup Instructions on the NetApp AFF array.
- Complete cluster administration to provision clusters, networking, physical, and logical storage.
- Complete either NFS, CIFS, or iSCSI configuration that will be used to connect to MediaAgents:
  - Provisioning for NAS protocols
  - Provisioning for SAN protocols

6.3 NetApp StorageGRID Deployment and Configuration

For this proof of concept, we chose a single site instance consisting of four SG5712 storage nodes with 4TB drives, load balancer node, and admin node deployed as VMware VMs. This configuration represents a typical entry-level system, optimized for cost-effective object storage.

For the data protection policy, StorageGRID implements integrated lifecycle policy or information lifecycle management (ILM) to manage and protect data. ILM rules are evaluated in a policy from top to bottom. We implemented the ILM policy shown in the following table.

Table 13) StorageGRID ILM policy.

<table>
<thead>
<tr>
<th>Rule</th>
<th>Qualifiers</th>
<th>Ingest Behavior</th>
<th>Rule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erasure code 2+1</td>
<td>Object over 200KB</td>
<td>Balanced</td>
<td>No</td>
</tr>
<tr>
<td>2 copy</td>
<td>All objects</td>
<td>Dual commit</td>
<td>Yes</td>
</tr>
</tbody>
</table>

This policy applies 2+1 erasure coding to any object 200KB or larger. Any object smaller than that size gets the default 2-copy rule.

For the Amazon Simple Storage Service (Amazon S3) bucket configuration, the bucket created for Commvault was set to the consistency level "available."
6.4 Commvault Deployment and Configuration

To validate the NetApp Scale-Out Data Protection solution, Commvault infrastructure components (that is, CommServe and MediaAgent) were deployed as Windows VMs on NetApp HCI. One CommServe and four MediaAgent VMs were used as part of the testing.

Before installing the Commvault software, review the following requirements:

- **System Requirements for the CommServe Server**
- **System Requirements for the MediaAgent**

Other packages that are installed along with the Commvault software might require a license. To review the list of packages, see Additional Packages Installed with the CommServe Server.

For more information about licensing, see License Administration.

To install the Commvault CommServe and MediaAgent components, follow the steps in the Commvault documentation. You must install the Command Center package to have access to the Command Center and Web Console interfaces.

After you complete the core setup, the Guided Setup page appears on the navigation pane of the Command Center. On the Guided Setup page, you can configure backup and recovery for file servers, VMs, laptop and desktop computers, and databases. For the configuration procedure, refer to Configuring Solutions in the Command Center.

To add the NetApp AFF system as a disk target that uses CIFS/NFS, proceed to configuring disk storage. You can add a NetApp StorageGRID bucket as a cloud storage target for Commvault. To begin adding a StorageGRID bucket, proceed to configuring cloud storage. To start protecting data, create one or more server backup plans according to RPO/RTO needs. Review the NetApp system requirements for protecting primary workloads on NetApp technology.

7 Solution Testing and Validation

We validated this solution with Commvault by scaling up the infrastructure and conducting performance and functional testing for the initial workload. Commvault’s CommServe was deployed on the first NetApp HCI cluster and Commvault MediaAgents on the second NetApp HCI cluster. The test workload ran on traditional converged infrastructure. The primary backup target was the NetApp AFF system, and the secondary backup target as NetApp StorageGRID.

This solution was tested to validate full functionality and scale and to ensure that the system could grow to meet demands. It was also validated with load to ensure that it performed as expected.

In this lab, we used scripts that generated random data in a series of files. This approach ensured that the deduplication engine wouldn’t be matching against an extremely high series of individual blocks and that there would be no cross-matching from client to client.

There were four types of operations performed in the lab:

- **Full or baseline:**
  - Baseline operations are a one-time operation per client. The Commvault MediaAgent has no other protected datasets, in the case of this lab from these clients or any other, therefore all data blocks will be transferred and stored for protection.
  - This operation will typically be the slowest because all client data must be transferred to the MediaAgent. Because this is a one-time event and is not continual, the baseline operation isn’t used in the metrics for calculating the long-term speeds of the solution.

- **Full-on-full operations:**
  - The full-on-full protection operations are the only operation that are done with no data change rates.
- Full-on-full protection operations are significantly faster than baseline operations, because there is no data transferred. Of course, the faster the clients, the faster the full-on-full operations are.

- Incremental:
  - Each incremental operation has a 1% data change rate associated with it.
  - Only the changed or “unique” blocks of data are sent across the network.

- DASH Full:
  - DASH Full operations provide the outcome of a traditional synthetic full operation without having to reprocess all the data. The previous baseline and incremental operations store all the relevant blocks that need to be protected but also store the metadata and index information about the changes during each operation. Processing these indexes and metadata components creates a new full protection point without having to reread and rehydrate all the backed-up data to protect it again.

7.1 MediaAgent Tests

Validations were run on the virtual MediaAgents to ensure that loads generated by normal operation would not strain the underlying NetApp HCI environment enough to decrease overall performance. These tests included Commvault’s SDB2 simulation tool and IOMeter. The tests were performed on a single MediaAgent and then simultaneously on two MediaAgents. Then the tests were scaled up to four MediaAgents simultaneously to ensure that as the Commvault infrastructure grew, the underlying NetApp HCI environment could handle the additional load. With all four MediaAgents running under load, the underlying infrastructure was able to meet the demand and had no impact on overall solution performance, leaving additional resources for growth of the Commvault environment.

7.2 Solution Validation Tests

Several jobs were run to validate that the most common operations ran successfully. The following tables describe the tests that were run. All the tests used a range of 500 to 1,000 VMs with a 50/50 split of Windows and Linux VMs with 25 reader sets within the software.

Table 14) VSA streaming operations.

<table>
<thead>
<tr>
<th>Test Number</th>
<th>Test Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Run full VM backup to AFF</td>
</tr>
<tr>
<td>2</td>
<td>Run incremental VM backup to AFF</td>
</tr>
<tr>
<td>3</td>
<td>Run DASH full VM backup to AFF</td>
</tr>
<tr>
<td>4</td>
<td>Auxcopy from AFF to StorageGRID</td>
</tr>
<tr>
<td>5</td>
<td>Full VM restore from AFF</td>
</tr>
<tr>
<td>6</td>
<td>File-level restore from VM from AFF</td>
</tr>
<tr>
<td>7</td>
<td>Full VM restore from StorageGRID</td>
</tr>
<tr>
<td>8</td>
<td>File-level from VM from StorageGRID</td>
</tr>
<tr>
<td>9</td>
<td>Live-mount VM from AFF</td>
</tr>
<tr>
<td>10</td>
<td>Live recovery of VM from AFF</td>
</tr>
</tbody>
</table>
Table 15) VSA IntelliSnap operations.

<table>
<thead>
<tr>
<th>Test Number</th>
<th>Test Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Run full VM IntelliSnap backup of a datastore</td>
</tr>
<tr>
<td>2</td>
<td>Run incremental IntelliSnap VM backup of datastore</td>
</tr>
<tr>
<td>3</td>
<td>Run backup copy to AFF</td>
</tr>
<tr>
<td>4</td>
<td>Full VM restore from primary Snapshot copy</td>
</tr>
<tr>
<td>5</td>
<td>File-level restore from primary Snapshot copy</td>
</tr>
<tr>
<td>6</td>
<td>Full VM revert from primary Snapshot copy</td>
</tr>
<tr>
<td>7</td>
<td>Live-mount a VM from primary Snapshot copy</td>
</tr>
<tr>
<td>8</td>
<td>Live-mount several VMs from primary Snapshot copy</td>
</tr>
<tr>
<td>9</td>
<td>Live recovery of VM from primary Snapshot copy</td>
</tr>
<tr>
<td>10</td>
<td>Live recovery of several VMs from primary Snapshot copy</td>
</tr>
</tbody>
</table>

7.3 Load Testing

We ran various scenarios to generate loads on all systems. We wanted to test end-to-end functionality under loads to further validate that the solution can grow without sacrificing performance. The following tests focus on the back-end infrastructure. We’ve briefly described some of the tests we used to provide load on all the systems.

The following tests were run to test load on StorageGRID. During the tests, the average auxcopy from the AFF to StorageGRID ranged from 2TB/hour. to 7TB/hour with peaks reaching up to 23TB/hour.

Table 16) Load testing on StorageGRID.

<table>
<thead>
<tr>
<th>Test Number</th>
<th>Test Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Run 500 VM backup multistream</td>
</tr>
<tr>
<td>2</td>
<td>Run auxcopy to StorageGRID</td>
</tr>
<tr>
<td>3</td>
<td>Run 500 VM backup multistream</td>
</tr>
<tr>
<td>4</td>
<td>Run auxcopy to StorageGRID</td>
</tr>
<tr>
<td>5</td>
<td>Run 1,000 VM backup multistream</td>
</tr>
<tr>
<td>6</td>
<td>Run auxcopy to StorageGRID</td>
</tr>
</tbody>
</table>

The following tests were run to produce load on the MediaAgents. The object was to ensure that as more resources were consumed, the MediaAgents could sustain the required performance and would continue to do so. The CPU and memory load were generated to produce 50% load on the MediaAgents while performing backup operations. A baseline backup was performed with 1,000 VMs; the backup had an average baseline throughput of 2.8TB/hour.

Table 17) Load testing on MediaAgents.

<table>
<thead>
<tr>
<th>Test Number</th>
<th>Test Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Run CPU load on all Mas; run 1,000 VM backup</td>
</tr>
</tbody>
</table>
The following tests were run to ensure that any background process such as data aging (the process of removing data beyond its retention off disk) would not significantly affect other operations.

**Table 18) Load-testing background process.**

<table>
<thead>
<tr>
<th>Test Number</th>
<th>Test Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Run auxcopy to StorageGRID</td>
</tr>
<tr>
<td>9</td>
<td>Run mem load on all Mas; run 1,000 VM backup</td>
</tr>
<tr>
<td>10</td>
<td>Run auxcopy to StorageGRID</td>
</tr>
<tr>
<td>11</td>
<td>Run CPU and mem load on all Mas; run 1,000 VM backup</td>
</tr>
<tr>
<td>12</td>
<td>Run auxcopy to StorageGRID</td>
</tr>
</tbody>
</table>

The following tests were run to simulate data buildup on the storage targets to ensure that performance was not affected as the back-end storage was consumed. Using the same baseline as before (1,000 VMs at 2.8TB/hour), even as capacity was filling up, tests showed that the average throughputs remained the same at about an average of 2.8TB/hour.

**Table 19) Load-testing back-end storage.**

<table>
<thead>
<tr>
<th>Test Number</th>
<th>Test Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Age-off data from AFF from test 1 and 3; run 1,000 VM backup</td>
</tr>
<tr>
<td>14</td>
<td>Age-off data from StorageGRID test 2 and 4</td>
</tr>
<tr>
<td>15</td>
<td>Restore multiple VMs from AFF</td>
</tr>
<tr>
<td>16</td>
<td>Restore multiple VMs from StorageGRID</td>
</tr>
<tr>
<td>17</td>
<td>Live-mount multiple VMs from AFF</td>
</tr>
<tr>
<td>18</td>
<td>Run Datagen on AFF to consume 50% capacity</td>
</tr>
<tr>
<td>19</td>
<td>Run Datagen on StorageGRID to consume 50% capacity</td>
</tr>
<tr>
<td>20</td>
<td>Run 1000 VM back multistream</td>
</tr>
<tr>
<td>21</td>
<td>Run auxcopy to StorageGRID</td>
</tr>
<tr>
<td>22</td>
<td>Run Datagen on AFF to consume 90% capacity</td>
</tr>
<tr>
<td>23</td>
<td>Run Datagen on StorageGRID to consume 90% capacity</td>
</tr>
<tr>
<td>24</td>
<td>Run 1,000 VM backup multistream</td>
</tr>
<tr>
<td>25</td>
<td>Run auxcopy to StorageGRID</td>
</tr>
<tr>
<td>26</td>
<td>Age-off all data from AFF</td>
</tr>
<tr>
<td>27</td>
<td>Run 1,000 VM backup</td>
</tr>
<tr>
<td>28</td>
<td>Age-off all data from StorageGRID</td>
</tr>
<tr>
<td>29</td>
<td>Run auxcopy of data from test 27</td>
</tr>
</tbody>
</table>
Comparison tests were also run between the virtual MediaAgents and physical MediaAgents by using the same 1,000 VMs. The four virtual Windows MediaAgents on NetApp HCI performed backups at an average of 2.7TB/hour; the four physical Windows MediaAgents performed backups at an average of 2.6TB/hour. Restores were also tested using 100 VMs with the same four virtual MediaAgents for an average of 1.3TB/hour; the four physical MediaAgents also restored at an average of 1.3TB/hour. Using these results as a comparison, the virtual and the physical MediaAgents results were nearly identical.

8 Conclusion

NetApp Scale-Out Data Protection with Commvault provides fast recovery and infinite scalability, meeting the ever-changing needs of enterprise customers. With Scale-Out Data Protection, you can easily move, manage, protect, and orchestrate data across the data fabric. The solution enables you to transform your data protection solution while providing a solid foundation to be data ready against threats like ransomware or natural disasters. For more information, contact your NetApp account team.

Acknowledgments

The authors would like to thank the following people for their support and contribution to the creation of this document:

- Michael Phelan, product manager, NetApp
- Alex Goldblatt, senior product manager, NetApp
- Steven Pruchniewski, technical marketing engineer, NetApp
- Charlotte Anderson, solutions engineer, NetApp
- Sucheth Ramgiri, technical lead, Commvault

Where to Find Additional Information

To learn more about the information that is described in this document, review the following documents and websites:

- Solutions Catalog for NetApp HCI
- NetApp HCI datasheet
- Maintaining Hardware
- NetApp HCI Documentation Center
- NetApp Active IQ®
- NetApp Element Plug-in for vCenter Server 4.3
- Commvault product portfolio feature matrix
- Getting Started with NetApp Storage Array
  http://documentation.commvault.com/commvault/v11_sp18/article?p=33739.htm
- Commvault Sizing Best Practices
- Commvault Certifications and Compliance
- Commvault Security Best Practices
- Ransomware Protection
- Commvault Documentation

Version History

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Document Version History</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version 1.0</td>
<td>April 2020</td>
<td>James Bradshaw, Jeannine Walter, Savita Kumari, Bryan Clarke, Nigel Tozer, Sarbjit Singh</td>
</tr>
</tbody>
</table>
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TR-4831-0420