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</tr>
<tr>
<td>Upgrading DD VE in Azure</td>
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As part of an effort to improve its product lines, we periodically release revisions of its software and hardware. Therefore, some functions described in this document might not be supported by all versions of the software or hardware currently in use. The product release notes provide the most up-to-date information on product features.

**Purpose**
This manual describes how to install, configure, and administer Data Domain Virtual Edition (DD VE) systems.

**Audience**
This manual is intended for use by both system administrators and general users of Data Domain Virtual Edition.

**Related documentation**
The following publications and websites provide additional information:

- *Data Domain Operating System Release Notes*
- *Data Domain Operating System Initial Configuration Guide*
  This manual explains configuration steps that are common to hardware and virtual Data Domain systems.
- *Data Domain Operating System OS Command Reference Guide*
  This manual explains how to administer Data Domain systems from the command line.
- *Data Domain Operating System OS Administration Guide*
  This manual explains how to administer Data Domain systems with the System Manager graphical user interface.
- *Data Domain Boost for OpenStorage Administration Guide*
  This manual explains how to use the DD Boost protocol for data transfer between backup software and Data Domain systems.
  This website lists Avamar and NetWorker software support for DD VE.

**Where to get help**
We support, product, and licensing information can be obtained as follows:

**Product information**
For documentation, release notes, software updates, or information about products, go to Online Support at [https://support.emc.com](https://support.emc.com).

**Technical support**
For technical support of this release of DD VE, go to Online Support at [https://support.emc.com](https://support.emc.com).

**Your comments**
Your suggestions will help us continue to improve the accuracy, organization, and overall quality of the user publications. Send your opinions of this document to DPAD.Doc.Feedback@emc.com.
CHAPTER 1

Introduction to DD VE

This chapter includes the following topics:

- Revision history ................................................................. 8
- What is DD VE? ............................................................... 8
- DD VE in the Cloud or on Premises: Overview ......................... 8
Revision history

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>January 2018</td>
<td>Publication of DD VE 3.1 SP1 with DD OS 6.1.1.5 release.</td>
</tr>
<tr>
<td>01</td>
<td>June 2017</td>
<td>Initial Publication of DD VE 3.1 with DD OS 6.1 release.</td>
</tr>
</tbody>
</table>

What is DD VE?

Data Domain Virtual Edition (DD VE) is a software-only protection storage appliance: a virtual deduplication appliance that provides data protection for entry, enterprise and service provider environments. Like any Data Domain system, DD VE is always paired with backup software.

DD VE runs the Data Domain Operating System (DD OS), and provides the DD OS command line interface (CLI) and the Data Domain System Manager graphical user interface (GUI) for performing all system operations.

Data Domain Virtual Edition maintains the core Data Domain features that differentiate it as the industry-leading protection storage. This includes high-speed, variable length deduplication for a 10 - 30x reduction in storage requirements, unparalleled data integrity to ensure reliable recovery, and seamless integration with leading backup and archiving applications.

DD VE also comes with DD Boost, which speeds backups by 50%, DD Encryption for enhanced security of data, and DD Replicator, which enables network efficient replication for faster time-to-DR readiness.

DD VE runs on two platforms, on premises or in the public cloud. On premises, DD VE supports VMware, Hyper-V, and VxRail. DD VE also runs in the Amazon Web Services (AWS) and Azure public cloud platforms. For more information about the features and capabilities of Data Domain systems (both physical and virtual), see the Data Domain Operating System Administration Guide.

DD VE in the Cloud or on Premises: Overview

The release of Data Domain Virtual Edition (DD VE) 3.1 (with DD OS 6.1) has in the cloud and on-premises capabilities. Customers now have the ability to deploy DD VE in the cloud to protect their applications in the cloud. For example, customers can back up and replicate data within the cloud or do so on the premises. Customers can replicate data between on-premises and cloud or between different regions in the cloud. Backup for applications running in the public cloud is also provided.
In the Cloud

DD VE enables data protection in the cloud for applications running in the cloud. The DD VE is deployed in the cloud and backup applications can use any existing backup protocols such as DDBoost or BoostFS to backup and restore data to and from the DD VE.

Data replication options that are available include:

- Replication in the cloud among DD VE instances in the same cloud. Replication may be among different available zones and regions.
- Replication in a hybrid cloud environment with your on-premises and cloud environments. Such replications among the DD VEs may be bi-directional.
- Mtree replication and managed file replication are supported, but directory replication and collection replication are not supported.

DD VE runs in Amazon Web Services (AWS) or Azure to provide these in the cloud capabilities. DD VE runs the Data Domain Operating System (DD OS), and provides the DD OS command line interface (CLI) and the Data Domain System Manager graphical user interface (GUI) for performing all system operations.

On Premises

DD VE provides the capabilities of a physical Data Domain system in a virtual machine template for VMware ESXi or Microsoft Hyper-V.

Data Domain Virtual Edition maintains the core Data Domain features that differentiate it as the industry-leading protection storage. This includes high-speed, variable length deduplication for a 10 - 30x reduction in storage requirements, unparalleled data integrity to ensure reliable recovery, and seamless integration with leading backup and archiving applications.

Note

For more information about the features and capabilities of Data Domain systems (both physical and virtual), see the Data Domain Operating System Administration Guide.
DD VE Installation

Note

Beta customers will need to upload a VMDK to AWS or Azure and convert it to the machine format required by AWS or Azure.

- For just DD VE with AWS go to: DD VE in the Cloud -- AWS on page 47
- For just DD VE with Azure go to: DD VE in the Cloud -- Azure on page 56

Note

VxRail uses VMware, therefore, the VxRail instructions are the same as for VMware.
This chapter covers the requirements for DD VE on premises including Hyper-V, VMware ESXi or VxRail 4.0. This chapter includes the following topics:

- DD VE capabilities ................................................................. 12
- DD VE management ............................................................... 13
- Supported virtual environments ............................................. 13
- Provision physical storage ....................................................... 14
- Performance Monitoring ........................................................ 15
- Configuration of other resources ............................................ 16
- Configuration requirements for DD Cloud Tier support ............... 18
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DD VE capabilities

DD VE provides the capabilities of a physical Data Domain system in a virtual machine template for VMware ESXi or Microsoft Hyper-V. DD VE is available in the following resource configurations:

- Up to 500 GB (evaluation version only)
- Up to 4 TB
- Up to 8 TB
- Up to 16 TB
- Up to 32 TB
- Up to 48 TB
- Up to 64 TB
- Up to 96 TB

Actual DD VE capacity is available in 1 TB increments starting at 1 TB, and up to 96 TB.

The following sections list supported and unsupported Data Domain protocols and features in DD VE.

Supported Data Domain protocols

- CIFS
- NFS
- Data Domain Boost (DD Boost) over IP
- Data Domain Boost (DD Boost) FS

Supported Data Domain features

- DD Boost managed file replication (MFR)
- Encryption
- Data Domain System Manager GUI for DD VE management
- Secure multitenancy (SMT) with Network Isolation Support in 6.0
- Data Domain Cloud Tier (supported in 16 TB, 64 TB, and 96 TB configurations)
- Hadoop Application Agent
- KMIP
- More restricted IPtables settings
- Managed file replication and Mtree replication
- VMware
- Hyper-V (Hyper-V HA)

Please see the DD OS Administration Guide, DD Boost OST Guide, DD Boost for Partner Integration Administration Guide for additional information on the supported protocols and features above.

Unsupported Data Domain features

- DD Boost over FC
- Extended retention
- DD High Availability (HA)--however, VMware and Hyper-V HA are supported
DD VE management

Use the VMware vSphere client software, the VMware vSphere Web client, or Hyper-V Manager to install the DD VE and define its virtual hardware: CPUs, memory, network interfaces, and virtual disks.

The DDSM GUI provides a configuration wizard to guide you through the steps required to configure DD OS after the virtual appliance is installed.

Once the DD VE is configured and running, you can access the system console to run DD OS commands by using the VMware vSphere Web client, or Hyper-V Manager. You can also administer the DD VE by using a terminal emulator or ssh command line to use the command-line interface.

The default login credentials for the DD VE instance are:
- Username: sysadmin
- Password: changeme or the password specified during deployment

**Note**

The system may panic if an RSA DPM client certificate is within 15 days of expiring.

Supported virtual environments

DD VE is supported in the following virtual environments:

- Microsoft Windows Server 2012 R2 with Hyper-V.
- VMware ESXi servers, either standalone or managed by VMware vCenter, versions 5.5, 6.0, and 6.5 with the corresponding versions of the VMware vSphere client application.

**Note**

DD VE supports virtual hardware versions of virtual machines up to the latest version of the ESXi in use, and minimum of version 9. Consult VMware latest documentation for any virtual hardware version upgrades.

<table>
<thead>
<tr>
<th>ESXi Version</th>
<th>Up to Virtual Hardware</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESXi 6.5</td>
<td>13</td>
</tr>
<tr>
<td>ESXi 6.0</td>
<td>11</td>
</tr>
<tr>
<td>ESXi 5.5</td>
<td>10</td>
</tr>
</tbody>
</table>
Note

The OpenVMTools are pre-installed on the DD VE image. When you update the DD OS software on the DD VE from within the DD OS environment, any necessary updates to the OpenVMTools get installed automatically. It is not possible to update OpenVMTools on the virtual machine from outside DD OS.

The hypervisor user should have only read-only privileges on the data center object where the server or cluster hosting the DD VE instance resides.

For information about compatibility with more recent versions of VMware or Microsoft products, visit the support portal at https://support.emc.com.

Provision physical storage

Provision storage on the ESXi or Windows Hyper-V server to host the DD VE instance.

- Provision VMware storage
- Provision Microsoft storage

Raw physical capacity needed

The table below shows the raw capacity needed to get the desired usable capacity. For raw capacities not shown in the table, use the same raw capacity in TiB as the usable capacity.

For example:

1. To get 40 TB usable capacity, you need to provision 40 TiB.
2. For 5 TB capacity with 4 TB configuration, provision 5 TiB.

Important: The capacity in vCenter or Hyper-V manager is in TiB. When you create a virtual disk in vCenter of 1 TB, a storage capacity of 1 TiB is allocated.

Note

This table does not apply to configurations with DD Cloud Tier.

<table>
<thead>
<tr>
<th>Usable Capacity (TB)</th>
<th>Raw Capacity (GiB) at each configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
</tr>
<tr>
<td>0.5</td>
<td>620</td>
</tr>
<tr>
<td>1</td>
<td>1114</td>
</tr>
<tr>
<td>2</td>
<td>2100</td>
</tr>
<tr>
<td>3</td>
<td>3072</td>
</tr>
<tr>
<td>4</td>
<td>4096</td>
</tr>
<tr>
<td>5</td>
<td>5120</td>
</tr>
<tr>
<td>6</td>
<td>6144</td>
</tr>
<tr>
<td>7</td>
<td>7168</td>
</tr>
<tr>
<td>8</td>
<td>8192</td>
</tr>
<tr>
<td>9</td>
<td>9216</td>
</tr>
</tbody>
</table>
Performance Monitoring

Data Domain recommends that you enable the performance monitoring features of the DD VE instance. If you ever need to troubleshoot a DD VE performance problem, you should begin by using the performance monitoring software to detect and resolve any performance problems on the physical storage layer.

Data Domain provides a deployment assessment tool (DAT) which runs on DD VE. It measures the underlying I/O performance and determines the size of the file system. Dat may be used to scan the available physical storage to determine if the storage meets the DD VE requirements. Table 2 on page 16 lists the required physical storage specifications for DD VE.

DD VE 3.1/DD OS 6.1 provides DAT testing for the Boost protocol only-and will skip vNVRAM values to enhance DD VE performance. You may access the DAT using CLIs or from the GUI console of the DD VE (see below):

Figure 1 Expand File System Capacity Screenshot

DAT test results

1. After a serial benchmark test, DAT will parse the list of serial log files from the parallel log file. Then, DAT will open all the serial log files one by one and will parse the performance values for the device and vNVRAM. At the end, DAT will print the average output values of all the devices tested in serial.

2. After a parallel benchmark test, DAT will parse the list of device and vNVRAM log file from the parallel log file. Then, DAT will open the device log file and vNVRAM log file one by one and will parse the performance values. At the end, DAT will print the average output value of all the devices tested in parallel.

<table>
<thead>
<tr>
<th>Conversions</th>
<th>GiB</th>
<th>TB</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.001074</td>
<td></td>
</tr>
<tr>
<td>TB</td>
<td></td>
<td>TiB</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>0.909495</td>
</tr>
</tbody>
</table>
Note

The `with-vnvram` option should be used if you are primarily using NFS to write backups. Some users use Boost to perform backups and then use NFS to get read access, if so, the use of the flag is not required.

Configuration of other resources

This section discusses resources other than storage.

**CPU resources**

For VMware environment, Initial virtual machine configuration on page 30 lists the CPU requirements. For Windows environment, the CPU reservation is configured as percentage, “Virtual Machine Reserve” should be set to 100%.

Note

Do not reduce system memory after you have created the file system in DD OS. This makes the file system unusable.

**Network adapters**

DD VE can support up to eight virtual network adapters.

For VMware environments, the ova package creates two VMXNET3 virtual network adapters by default. DHCP will be configured automatically on these two interfaces inside the DD VE. DHCP can be configured manually on any additional interfaces.

For Windows environments, DHCP will be configured automatically for up to two network interfaces. DHCP can be configured manually on any additional interfaces.

**Disk controllers**

For VMware environments, DD VE supports up to four VMware Paravirtual SCSI Controllers. Other types of SCSI controllers are not supported.

For Windows environments, DD VE supports up to four Microsoft SCSI controllers.

One SCSI Controller is configured by default. The maximum number of disks for each controller is 15 for vSphere and 64 for Hyper-V. If the environment requires more than the maximum number of disks, you may add extra SCSI HBA controllers to the DD VE system, but do not change the HBA controller type from the type of the first HBA controller. If you make changes accidentally, power off the virtual machine and restore the original settings.

**Using resource pools and vApp containers (VMware only)**

If you put DD VE systems into resource pools or vApp containers, do not override the default memory and CPU resource allocation settings. The DD VE virtual machine will fail to boot up and report an insufficient resource message if it cannot satisfy the minimum resource requirements shown in the next table.

**Table 2 DD VE resource reservations**

<table>
<thead>
<tr>
<th>Resources</th>
<th>Up to 4 TB</th>
<th>Up to 8 TB</th>
<th>Up to 16 TB</th>
<th>16 TB to 32 TB</th>
<th>Up to 48 TB</th>
<th>Up to 64 TB</th>
<th>Up to 96 TB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CPU</td>
<td>2 x GHz vCPU</td>
<td>4 x GHz vCPU</td>
<td>8 x GHz vCPU</td>
<td>16 GB</td>
<td>24 GB</td>
<td>36 GB</td>
</tr>
<tr>
<td></td>
<td>Memory</td>
<td>6 GB</td>
<td>8 GB</td>
<td>16 GB</td>
<td>24 GB</td>
<td>36 GB</td>
<td>48 GB</td>
</tr>
<tr>
<td></td>
<td>Shares</td>
<td>Normal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Table 2 DD VE resource reservations (continued)

<table>
<thead>
<tr>
<th>Resources</th>
<th>Up to 4 TB</th>
<th>Up to 8 TB</th>
<th>Up to 16 TB</th>
<th>16 TB to 32 TB</th>
<th>Up to 48 TB</th>
<th>Up to 64 TB</th>
<th>Up to 96 TB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limit</td>
<td>Unlimited</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underlying storage requirements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Random IOPS</td>
<td>160</td>
<td>320</td>
<td>650</td>
<td>1280</td>
<td>1920</td>
<td>2560</td>
<td>3200</td>
</tr>
<tr>
<td>Random I/O latency</td>
<td>14 ms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sequential throughput</td>
<td>40 MB/s</td>
<td>80 MB/s</td>
<td>160 MB/s</td>
<td>320 MB/s</td>
<td>480 MB/s</td>
<td>640 MB/s</td>
<td>960 MB/s</td>
</tr>
<tr>
<td>RAID</td>
<td>RAID 5/6 or similar fault tolerance storage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCSI controllers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For Hyper-V and ESX: Up to 4 SCSI controllers.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NVRAM simulation file size</td>
<td>512 MB</td>
<td>512 MB</td>
<td>512 MB</td>
<td>1 GB</td>
<td>1 GB</td>
<td>1 GB</td>
<td>2 GB</td>
</tr>
</tbody>
</table>

- Configurations with DD Cloud Tier support have the same NVRAM size as the corresponding ones without DD Cloud Tier.

- **System disks**
  - 250 GB root disk
  - 10 GB NVRAM disk

  **Note**
  The root disk and NVRAM disk are required to deploy DD VE.

- **Data disks**
  - The minimum first data disk size: 500GiB for 64TB, Cloud 64TB, 96TB, and Cloud 96TB; 200GiB for all other configurations
  - All subsequent data disks: at least 100 GB

Whenever possible, use disks that are larger than the minimum required disk sizes. The maximum capacity of DD VE is defined by the DD VE license, and the maximum virtual disk size supported by the hypervisor.

  **Note**
  The usable capacity available on a data disk is less than the capacity specified when the disk was created because of overhead requirements. [DD VE storage guidelines](#) on page 36 provides additional details about DD VE storage overhead requirements.

| Network adapters                  | Up to 8 network adapters |
Configuration requirements for DD Cloud Tier support

To configure DD Cloud Tier for each DD VE, refer to The DD OS Administration Guide. This section discusses resources for DD Cloud Tier support for each DD VE.

**Table 3 DD VE resource reservations**

<table>
<thead>
<tr>
<th>Configuration</th>
<th>CPU</th>
<th>Memory (GiB)</th>
<th>Minimum Metadata Tier Size (GiB)</th>
<th>Metadata Tier Throughput (MB/S)</th>
<th>Metadata Tier IOPS</th>
<th>Metadata Tier Latency (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 TB</td>
<td>4</td>
<td>32</td>
<td>500</td>
<td>160</td>
<td>640</td>
<td>14</td>
</tr>
<tr>
<td>64 TB</td>
<td>8</td>
<td>60</td>
<td>500</td>
<td>640</td>
<td>2560</td>
<td>14</td>
</tr>
<tr>
<td>96 TB</td>
<td>8</td>
<td>80</td>
<td>500</td>
<td>960</td>
<td>3200</td>
<td>14</td>
</tr>
</tbody>
</table>

The minimum metadata size is a hard limit. We recommend users start with 1 TB metadata tier and use 1 TB as incremental size.

**Table 4 DD Cloud Tier Meta Data Size for DD VE**

<table>
<thead>
<tr>
<th>CU Size (TiB)</th>
<th>1~16</th>
<th>16~32</th>
<th>32~48</th>
<th>48~64</th>
<th>64~80</th>
<th>80~96</th>
<th>96~112</th>
<th>112~128</th>
<th>128~144</th>
<th>144~160</th>
<th>160~176</th>
<th>176~192</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD Size (TiB)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
</tr>
</tbody>
</table>

*The CU (TiB) size includes both cloud units.

The table above is a breakdown of recommended metadata tier size for the corresponding cloud unit (CU) size range. Refer to the *EMC Data Domain Operating System 6.0 Administration Guide* for additional information.
How to Install the DD VE on Premises

DD VE runs on two platforms, on premises or in the public cloud. On premises, DD VE supports VMware, Hyper-V, and VxRail. For more information about the features and capabilities of Data Domain systems (both physical and virtual), see the Data Domain Operating System Administration Guide.
Performing the DD VE Download

DD VE is packaged as a zip file that contains a virtual machine template (.ova for VMware, or .vhd for Microsoft) file. The zip file is available from EMC Online Support at https://www.emc.com/products-solutions/trial-software-download/data-domain-virtual-edition.htm. There are separate zip packages for VMware and Microsoft Hyper-V available for download. Customer should choose the package that best suits the customer’s environment.

Note

The 500 GiB evaluation version is also available from the EMC Trial Download page.

All capacity configurations are available from the same zip file.

DD VE requires a minimum of 760 GiB for configurations of 64TB, Cloud 64TB, 96TB, and cloud 96TB. The minimum size of the first data disk is 500 GiB. DD VE requires a minimum of 460 GiB of available storage to deploy. The 460 GiB breaks down as follows:

- System disk: 250 GiB
- NVRAM disk: 10 GiB
- First data disk: 200 GiB

Performing the DD VE Installation

Before you begin

Be sure you have downloaded the DD VE template, or know its URL, as described in Performing the DD VE Download on page 20.

Installation procedures with the vSphere client are included for:

- Installing on a VMware ESXi Server on page 20
- Installing through a VMware vCenter Server on page 21
- Installing on a Microsoft Windows 2012 R2 with Hyper-V Server on page 22
- You can also use ovftool to install the software from the command line. For help, see the VMware documentation.

Installing on a VMware ESXi Server

Table 5 on page 20 lists the information required to deploy the DD VE instance on a VMware ESXi server.

<table>
<thead>
<tr>
<th>Installation step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Username and password for the ESXi server.</td>
<td>Specify the credentials in the vSphere Client to log into the ESXi server.</td>
</tr>
<tr>
<td>Launch virtual machine deployment wizard.</td>
<td>Use the VMware deployment wizard to deploy the DD VE instance.</td>
</tr>
<tr>
<td>Choose the deployment method.</td>
<td>Deploy from a local file, or deploy from a network location.</td>
</tr>
</tbody>
</table>
Table 5 Installing DD VE on a VMware ESXi server (continued)

<table>
<thead>
<tr>
<th>Installation step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Review the VM details.</td>
<td>Review the details to this point, and proceed if they look correct.</td>
</tr>
<tr>
<td>Review the End User License Agreement (EULA).</td>
<td>Accept the EULA.</td>
</tr>
<tr>
<td>Specify a name for the DD VE virtual machine.</td>
<td>This name identifies the virtual machine on the VMware server; it does not become a host name on your LAN.</td>
</tr>
<tr>
<td>Choose a datastore to host the DD VE instance.</td>
<td>Select the datastore where the DD VE instance will reside. For best performance, Data Domain recommends that you use a dedicated datastore, one that is not shared by other virtual machines.</td>
</tr>
<tr>
<td>Review and complete the deployment.</td>
<td>Review the deployment summary and finish the wizard.</td>
</tr>
<tr>
<td>Configure the virtual machine</td>
<td>See Initial Virtual Machine Configuration with the vSphere Client.</td>
</tr>
</tbody>
</table>

The hypervisor documentation provides additional details.

Installing through a VMware vCenter Server

Table 6 on page 21 lists the information required to deploy the DD VE instance on a VMware vCenter server.

Note

When using version 5.5 of the vSphere web client to install DD VE, the system displays the following warning: The OVF package contains extra configuration options, which possess a potential security risk. Review the extra configuration options below and accept to continue the deployment. Select Accept extra configuration options to continue.

Table 6 Installing DD VE on a VMware vCenter server

<table>
<thead>
<tr>
<th>Installation step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Username and password for the vCenter server.</td>
<td>Specify the credentials in the vSphere Client to log into the vCenter server.</td>
</tr>
<tr>
<td>Launch virtual machine deployment wizard.</td>
<td>Use the VMware deployment wizard to deploy the DD VE instance.</td>
</tr>
<tr>
<td>Choose the deployment method.</td>
<td>Deploy from a local file, or deploy from a network location.</td>
</tr>
<tr>
<td>Review the VM details.</td>
<td>Review the details to this point, and proceed if they look correct.</td>
</tr>
<tr>
<td>Review the End User License Agreement (EULA).</td>
<td>Accept the EULA.</td>
</tr>
</tbody>
</table>
Table 6 Installing DD VE on a VMware vCenter server (continued)

<table>
<thead>
<tr>
<th>Installation step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specify a name for the DD VE virtual machine.</td>
<td>This name identifies the virtual machine on the VMware server; it does not become a host name on your LAN.</td>
</tr>
<tr>
<td>Select an Inventory Location.</td>
<td>Select the inventory location, or data center to assign the DD VE instance to a host or cluster.</td>
</tr>
<tr>
<td>Select a host or cluster.</td>
<td>Choose a host or cluster in the specified inventory location or data center where the DD VE instance will reside.</td>
</tr>
<tr>
<td>Choose a datastore to host the DD VE instance.</td>
<td>Select the datastore where the DD VE instance will reside. For best performance, Data Domain recommends that you use a dedicated datastore, one that is not shared by other virtual machines.</td>
</tr>
<tr>
<td>Choose the format for the virtual disks.</td>
<td>Data Domain recommends Thick Provision Lazy Zeroed to provide the best balance of performance and deployment time. Thick Provision Eager Zeroed provides the best performance, but takes a long time to deploy.</td>
</tr>
<tr>
<td>Review and complete the deployment.</td>
<td>Review the deployment summary and finish the wizard.</td>
</tr>
<tr>
<td>Configure the virtual machine</td>
<td>See Initial Virtual Machine Configuration with the vSphere Client.  Adam.</td>
</tr>
</tbody>
</table>

The hypervisor documentation provides additional details.

Installing on a Microsoft Windows 2012 R2 with Hyper-V Server

Table 6 on page 21 lists the information required to deploy the DD VE instance on a Windows server.

Note

There are three ways to perform this installation: creating a VM, running the powershell script to install DD VE on Hyper-V manager machine, or running the powershell for MS System Center.

Installing on a Microsoft Windows 2012 R2 with Hyper-V Server by creating a VM

<table>
<thead>
<tr>
<th>Installation step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Username and password for the Windows server.</td>
<td>Specify the credentials to log into the Windows server.</td>
</tr>
<tr>
<td>Launch virtual machine deployment wizard.</td>
<td>Use the Hyper-V deployment wizard to deploy the DD VE instance.</td>
</tr>
</tbody>
</table>
### Installation step | Description
--- | ---
Specify a name for the DD VE virtual machine. | This name identifies the virtual machine on the Windows server; it does not become a host name on your LAN.
Specify the amount of memory. | Assign memory to the virtual machine.
Configure networking. | Connect the DD VE virtual machine to the Hyper-V networking switch.
Select the virtual disk. | Select the .vhd file that contains the DD VE instance.
Configure the virtual machine | See Initial Virtual Machine Configuration.

The hypervisor documentation provides additional details.

**Installing on a Microsoft Windows 2012 R2 with Hyper-V Server via powershell script for Hyper-V Manager**

This installation script deploys DD VE on Hyper-V.

**Syntax:**

```powershell
```

**Example:**

```powershell
C:\PS>ddve-installer.ps1 -VMName DDVE -Configuration 4TB -VirtualMachinePath C:\DDVE -VirtualHardDiskPath C:\DDVE
```

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-VMName &lt;String&gt;</td>
<td>Specify the name of DD VE virtual machine</td>
</tr>
<tr>
<td>-Configuration &lt;String&gt;</td>
<td>Specify the configuration of the DD VE. This parameter accepts one of these values 4TB, 8TB, 16TB, 32TB, 48TB, 64TB, 96TB.</td>
</tr>
<tr>
<td>-VirtualMachinePath &lt;String&gt;</td>
<td>Specify the directory to store files for the DD VE virtual machine. This parameter is optional and wildcard characters are supported for this parameter value. If this parameter were not specified in command line, Hyper-V setting would be used for this parameter value.</td>
</tr>
<tr>
<td>-VirtualHardDiskPath &lt;String&gt;</td>
<td>Specify the directory to store virtual hard disks for the DD VE. This parameter is optional and wildcard characters are supported for this parameter value. If this parameter were not specified in command line, Hyper-V setting would be used for this parameter value.</td>
</tr>
<tr>
<td>-Force [SwitchParameter]</td>
<td>This cmdlet supports the common parameters: Verbose, Debug, ErrorAction, ErrorVariable, WarningAction, WarningVariable, OutBuffer, PipelineVariable, and OutVariable. For more information, see</td>
</tr>
</tbody>
</table>

**Performing the DD VE Installation**
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-VMName &lt;String&gt;</td>
<td>Specify the name of DD VE virtual machine.</td>
</tr>
<tr>
<td>-Configuration &lt;String&gt;</td>
<td>Specify the configuration of the DD VE. This parameter accepts one of these values 4TB, 8TB, 16TB, 32TB, 48TB, 64TB, 96TB, Cloud16TB, Cloud64TB, Cloud96TB.</td>
</tr>
<tr>
<td>-SCVMMServer &lt;String&gt;</td>
<td>Specify the system center VMM server name.</td>
</tr>
<tr>
<td>-SCVMHost &lt;String&gt;</td>
<td>Specify the Hyper-V host where DD VE will be deployed.</td>
</tr>
<tr>
<td>-SCVMNetwork &lt;String&gt;</td>
<td>Specify a VM Network.</td>
</tr>
<tr>
<td>-VirtualMachineHostname &lt;String&gt;</td>
<td>Specify the hostname of the DD VE virtual machine. This parameter is optional and wildcard characters are supported for this parameter value. If this parameter is not specified in command line, localhost would be used for this parameter value.</td>
</tr>
<tr>
<td>-VirtualMachinePath &lt;String&gt;</td>
<td>Specify the directory to store files for the DD VE virtual machine. The VirtualMachinePath folder must exist on host SCVMHost. If this parameter is not specified in command line, Hyper-V setting would be used for this parameter value.</td>
</tr>
<tr>
<td>-VirtualHardDiskPath &lt;String&gt;</td>
<td>Specify the directory to store virtual hard disks for the DD VE. The VirtualHardDiskPath folder must exist on host SCVMHost. If this parameter is not specified in command line, Hyper-V setting would be used for this parameter value.</td>
</tr>
</tbody>
</table>

Please see ddve-installer-help.txt for additional information.

**Installing on a Microsoft Windows 2012 R2 with Hyper-V Server via powershell script for MS System Center**

This installation script deploys DD VE on System Center Virtual Machine Manager (SCVMM).


Example: C:\PS> .\ddve-installer-sc.ps1 -VMName DDVE -Configuration 4TB -SCVMMServer localhost -SCVMHost osdev-ucs30d -SCVMNetwork mktest-vmnet -NetworkAdapterCount 3
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-NetworkAdapterCount &lt;Int32&gt;</td>
<td>Specify the number of network adapters to be added to DD VE. If this parameter is not specified, 2 networks adapters are added. This parameter accepts value in range 1 to 8.</td>
</tr>
<tr>
<td>-IPAddress &lt;String&gt;</td>
<td>Specify IP address.</td>
</tr>
<tr>
<td>-Gateway &lt;String&gt;</td>
<td>Specify gateway IP address.</td>
</tr>
<tr>
<td>-Netmask &lt;String&gt;</td>
<td>Specify netmask.</td>
</tr>
<tr>
<td>-DnsServer1 &lt;String&gt;</td>
<td>Specify first DNS server IP address.</td>
</tr>
<tr>
<td>-DnsServer2 &lt;String&gt;</td>
<td>Specify second DNS server IP address.</td>
</tr>
<tr>
<td>&lt;CommonParameters&gt;</td>
<td>This cmdlet supports the common parameters: Verbose, Debug, ErrorAction, ErrorVariable, WarningAction, WarningVariable, OutBuffer, PipelineVariable, and OutVariable. For more information, see about_CommonParameters, available from the Microsoft website.</td>
</tr>
</tbody>
</table>

Please see ddve-installer-sc-help.text for additional information.

Installing the DD VE on Hyper-V using the GUI

The following highlights the key steps from the New Virtual Machine Wizard to install and configure the DD VE on Hyper-V.

**Procedure**

1. On the Hyper-V Manager screen, select the managed hyper-v server on which you wish to deploy the new DD VE.
2. Launch the New Virtual Machine Wizard.
3. Click "Next" to begin creating a DD VE virtual machine with a custom configuration.
4. On the "Specify Name and Location" page, to choose a name and location for this virtual machine. In the "Name:" section, enter: a name that will be easily identified for this virtual machine in the "<ENTER DDVE NAME HERE>" cell. Click "Next".
5. On the "Specify Generation" page, choose "Generation 1".
6. On the "Assign Memory" page, Enter the exact memory size (a multiple of 512 GB) required memory for the DD VE capacity you are creating. Refer to Initial virtual machine configuration. Then click "Next".
7. On the "Configure Networking" page, select a configured virtual switch to attach to the new DD VE. Select "Next".
8. On the "Connect Virtual Hard Disk", select "Use an existing virtual hard disk" and enter the path to the .vhd file extracted from the DD VE OS download.
Verify your configuration and select "Finish".

9. On the "Summary" page review your configuration and select "Finish" to deploy your new DD VE VM.

You will see the successful completion message such as, "You have successfully completed the New Virtual Machine Wizard. You are about to create the following virtual machine."

Configuring the DD VE on Hyper-V using the GUI

The following highlights the key steps from the New Virtual Hard Disk Wizard to configure the newly installed DD VE on Hyper-V.

**Procedure**

1. Once the VM is deployed, it will be displayed in the Hyper-V manager on the under “virtual Machines” list.

2. Select the new DD VE VM and select the Settings tab to begin configuration of CPU, Vnvrnm, and Storage.

3. Select the ”add hardware” > “processor” tab and add the correct amount of CPU as required for your DD VE capacity. Refer to Initial virtual machine configuration to make your selection then click “Apply”.


Note

Do not add any restrictions to CPU resources.

4. Begin disk configuration by adding a 10 GB virtual disk for vnram. All disks should be thick provisioned (lazy zero).

5. Select Add hardware and create the first disk. Select the first SCSI controller under IDE controller 1 and click the Add button, then select "New Disk" tab. Then the New Virtual Hard Disk Wizard will open.

6. Attach the first 10GB virtual disk (vnram) to the first SCSI controller under IDE controller 1. Vnram must be set to location zero, then hit “New” button to launch disk configuration wizard.
7. Select the disk format to use for the virtual hard disk on the "Choose Disk Format" page. Select "VHDX".

8. Select the type of disk on the "Choose Disk Type" page. "Fixed size" offers the greatest performance, however you may select "Dynamically expanding" instead. Select Next.

9. On the Specify Name and Location page, name the first disk as a vnram disk. This ensures that this vnram disk resides on the highest performing physical storage.
   - For example, for Name enter "NEW DDVE vnram.vhdx"
   - For Location, enter "D:\PremiumRAIDStorage\Hyper-V\Virtual Hard Disks"
   - Then select Next.

10. On the Configure Disk page, select the option "Create a new blank virtual hard disk". Enter 10 for the "size" to create a 10G B disk for vnram. verify your configuration then select Finish.

11. On the Completing the New Virtual hard Disk Wizard summary page. You will see a successful completion message and a window that says "Creating the new virtual hard disk". Verify the configuration then click Next.

12. Next add more virtual disks for backup data. Use the same disk creation wizard to create up to 14 data disks for user data. The data disks should be attached to SCSI controller beginning at location 1.
13. On the Specify Name and Location page, specify the name and location of the virtual hard disk file.
   - Name: New DDVE data01.vhdx
   - Location: D:\PremiumRAIDstorage\Hyper-V\Virtual Hard Disks\

14. Continue within disk creation wizard. Keep in mind that using several smaller disks can offer better overall performance than fewer larger disks.
   - Select "Create a new blank virtual hard disk"
   - Size: 500 GB

15. At this stage, you have created the minimum configuration for a functioning DD VE:
   a. OS disk now attached at IDE controller zero.
   b. Vnvram disk attached at the first scsi controller : location zero.
   c. Data storage disk attached at first scsi controller : location one.
   d. For larger capacity DD VE, additional scsi controllers can be added, however no performance gain is expected.

16. Select your new DD VE and select Start. Then configure the new VM as you would for any other DD appliance.
Initial virtual machine configuration

The DD VE template does not include any storage, so you need to add data disks to the system. The procedure in this section explains how to add the disks before you start the virtual machine.

Note
You can add the first or additional virtual data disks while the virtual machine is running, provided that you do not also need to add more virtual memory to support the additional disks. DD VE supports virtual disk hot-plugging, but not CPU, memory, HBA card or NIC card hot-plugging.

Depending on the amount of disk space, you may also need to add memory to the virtual machine. The next table shows the supported storage configurations and their virtual CPU and memory requirements.

<table>
<thead>
<tr>
<th>Hardware configuration</th>
<th>Storage capacity range (TB)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Up to 500 GB</td>
</tr>
<tr>
<td>CPU Topology</td>
<td>1 socket with 2 cores</td>
</tr>
<tr>
<td>Reservation</td>
<td>2 x 1.5 GHz</td>
</tr>
<tr>
<td>Memory Topology</td>
<td>6 GB</td>
</tr>
<tr>
<td>Reservation</td>
<td></td>
</tr>
</tbody>
</table>

The system displays an error message if you attempt to configure a higher capacity with fewer memory and CPU resources than the amounts listed in the table above. The `system vresource show requirements` command lists the virtual resources available on the host.
Adding NICs

When initially deployed, DD VE is provisioned with two VMXNET3 NICs which can be configured as required. Additional NIC cards can be added up to a maximum of:

- DD VE 3.1: 8 NICs total

**Note**

The following applies specifically to VMware:

- Additional NICs can only be of type VMXNET3. NICs of type VMXNET2 and E1000(E) can be added to the DD VE virtual machine, but will not be visible or usable within DD OS on the appliance.
- DD VE does not support hot add of NICs. A VMXNET3 NIC can be added while DD VE is powered on, the NIC will not be visible or usable within the DD OS on the appliance until the DD VE appliance is restarted.
- DD VE does not support hot remove of NICs. Any attempt to remove a NIC while the DD VE appliance is powered on will cause ESXi/vSphere to report the following error: The guest operating system did not respond to a hot-remove request for device ethernet3 in a timely manner. The DD VE appliance must be powered off before NICs can be removed.

Adding disks and memory

**Before you begin**

Make sure you have enough licensed capacity available to add new capacity to DD VE. Since the GUI cannot detect AWS storage, you will need to configure the storage from the DD command line.

When adding additional capacity, make sure the DD VE instance has enough memory to support the new capacity.

*Initial virtual machine configuration* on page 30 describes the amount of memory required to support DD VE capacity.

**Note**

Two storage types are supported: GP2 and ST1. For best performance, use GP2. However, ST1 can be used if the IOPS (burst and base) meet the needs.

New storage for the DD VE must meet the following requirements:

- The minimum size of the first data disk is 477 GiB (512 GB).
- The minimum size of any subsequent data disks is 94 GiB (100 GB).
Note

Data disk capacity varies based on the use case:

- Evaluation purposes: data disk capacity is 0.5T GP2
- Cost sensitive: 1T GP2 + multiple 2+T ST1 (1T GP2 for the first disk, following disks may be 2T+ ST1 type EBS)
- Performance: multiple 1-3TB GP2

After you finish

To add additional storage or memory in the future, follow the requirements above. It is not necessary to shut down the virtual machine before adding storage.

Note

The virtual disk cannot be expanded. Create a new virtual disk to add additional storage to the virtual machine.

Setting Up NTP Time Synchronization

By default, NTP is disabled on the DD VE system. If you need to enable NTP on the DD VE, follow these steps:

Note

Skip this task if you are going to join the DD VE to an Active Directory domain. Because the Windows domain controller obtains the time from an external source, NTP must be configured. See the Microsoft documentation on how to configure NTP for the Windows operating system version or service pack that is running on your domain controller. After joining the domain, the system time is periodically synchronized with the domain controller time. When the host joins the Active Directory, the DD VE displays a warning if multiple time sources are in use.

Later, while performing initial configuration of the DD VE system, enable NTP by selecting the appropriate options from the configuration wizards. If you do not use the wizards to perform initial configuration, you can use the `ntp enable` command on the DD OS command line. Enabling NTP with the `ntp enable` command automatically disables synchronizing the time on the guest to the host time.

To reenable synchronizing the guest time to the host time, run the `ntp disable` command.

Note

NTP is disabled by default. The `ntp reset` command also deactivates NTP on the guest.

Upgrading DD VE

Upgrading from DD VE 3.0

Upgrading DD VE to a higher capacity
If the higher capacity does NOT need additional resources (refer to Table 2 on page 16), follow these steps.

1. Add the needed hard disks for the new capacity
2. Configure the newly added data disks using the CLI command `storage add dev tier active<device ID>` (Or, use DD SM GUI)
3. Expand the file system using the CLI command `filesys expand`

If the higher capacity will require DD VE to have higher resources, follow these steps to upgrade DD VE to a higher capacity.

1. Shutdown DD VE
2. Increase the memory to support the higher capacity configuration (refer to Table 2 on page 16)
3. Increase the number of CPUs for the higher capacity configuration (refer to Table 2 on page 16)
4. Increase the CPU reservations (refer to Table 2 on page 16)
5. Add the needed hard disks for the new capacity
6. Power on the DD VE
7. Add the license for the new capacity
8. Configure the newly added data disks using the CLI command `storage add dev tier active<device ID>`
9. Expand the file system using the CLI command `filesys expand`

Powering on the virtual machine
If the installation is successful, you should be able to power on the DD VE virtual machine and log into the system.

Procedure
1. From the Hyper-V or VMware, power on the DD VE virtual machine.

   Note
   There may be a delay of several minutes until the DD OS prompt appears, depending on your hardware and configuration.

2. Optionally, open the virtual machine console to view the boot and initialization process. You should see the CLI prompt to log in for a successful boot.
3. Note the IP Address assigned to the system by DHCP and shown in the previous figure.
   You can use this address to configure or administer the system outside the hypervisor.

After you finish
The next step is the initial system configuration in DD OS. See the Data Domain Operating System Initial Configuration Guide for detailed instructions.
Note

To shut down the DD VE virtual machine, shut down the guest operating system from the DDSH with the command `system poweroff` or `system reboot` for reboot. Do not reset or power off the DD VE virtual machine, which will perform a hard reset of the system rather than an orderly shutdown. Currently, the Guest OS shutdown and Guest OS reboot features in the hypervisor also cannot guarantee an orderly shutdown and reboot.

The hypervisor documentation provides additional details.

Define the Data Domain System Information for Your Site

An installation requires information unique to your site. Before starting the installation, provide values for the system information listed below.

Note

Data Domain recommends that you print the tables in this section and record the information.

<table>
<thead>
<tr>
<th>Table 7 System Setup Worksheet for DD VE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information</td>
</tr>
<tr>
<td>A fully qualified host name for the system:</td>
</tr>
<tr>
<td>The DNS domain name:</td>
</tr>
<tr>
<td>A default gateway IP address (if you are not using DHCP):</td>
</tr>
<tr>
<td>DNS server IP addresses (if you are not using DHCP):</td>
</tr>
<tr>
<td>• Primary</td>
</tr>
<tr>
<td>• Secondary</td>
</tr>
<tr>
<td>• Tertiary</td>
</tr>
<tr>
<td>If you will enable CIFS access, enter the information for your CIFS authentication method:</td>
</tr>
<tr>
<td>For Workgroup authentication:</td>
</tr>
<tr>
<td>• Workgroup name:</td>
</tr>
<tr>
<td>• Backup user name:</td>
</tr>
<tr>
<td>• Password:</td>
</tr>
<tr>
<td>For Active Directory authentication:</td>
</tr>
<tr>
<td>• Realm name:</td>
</tr>
<tr>
<td>• Domain admin name:</td>
</tr>
<tr>
<td>• Password</td>
</tr>
</tbody>
</table>
Table 7 System Setup Worksheet for DD VE (continued)

<table>
<thead>
<tr>
<th>Information</th>
<th>Your Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Host name from which to administer the system:</td>
<td></td>
</tr>
<tr>
<td>Administrator’s email address (or admin group alias):</td>
<td></td>
</tr>
<tr>
<td>Mail server (SMTP) host name:</td>
<td></td>
</tr>
<tr>
<td>Hypervisor server name:</td>
<td></td>
</tr>
<tr>
<td>(Optional) Physical location of the hypervisor server:</td>
<td></td>
</tr>
<tr>
<td>Time zone name (default is US/Pacific):</td>
<td></td>
</tr>
<tr>
<td>Serial number (SN) provided to you by Data Domain:</td>
<td></td>
</tr>
<tr>
<td>Virtual machine unique ID (after initial configuration, use the system show serialno command to display this ID):</td>
<td></td>
</tr>
</tbody>
</table>

Use this table to enter Ethernet connectivity information. By default, DHCP is enabled on both ports.

Table 8 Ethernet Connectivity Worksheet

<table>
<thead>
<tr>
<th>Ethernet Connectivity</th>
<th>Enable</th>
<th>Use DHCP</th>
<th>IP Address (if no DHCP)</th>
<th>Netmask (if no DHCP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ethV0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ethV1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ethV2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ethV3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ethV4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ethV5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ethV6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ethV7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Initial System Configuration

You can connect to the system to perform the initial system configuration with the command-line configuration wizard, or the DDSM Configuration Wizard.

DHCP is enabled on the DD VE system by default. If the DHCP service is available, the DD VE system will receive IP addresses from the DHCP server.
Note

DHCP is only activated automatically for the first network interface card (NIC) which is built into the virtual machine template. Any extra NICs must be configured manually by following instructions here https://docs.microsoft.com/en-us/azure/virtual-network/virtual-network-network-interface-vm.

Using the GUI

Access DDSM by entering the IP address of the DD VE into a web browser, and logging in.

The GUI Configuration Wizard contains six sections: Networking, File System, System Settings, DD Boost, CIFS, and NFS.

Configuring DD VE in Data Domain System Manager on page 37 describes how to configure the DD VE from the GUI.

Using the CLI

Access the CLI by using `ssh` or a terminal emulator to access the DD OS command line.


Provisioning the storage with the CLI on page 41 describes how to configure the DD VE manually with the CLI instead of using the configuration utility.

**DD VE storage guidelines**

Be aware of the following virtual storage guidelines for DD VE before deploying a DD VE instance.

DD VE licenses are sold in Terabytes (TB), but VMware disk sizes are actually measured in Tebibytes (TiB). 1 TB is equal to 0.97 TiB or 1.02 TB is equal to 1 TiB. Because of this, DD VE allows a 10% buffer to reach the licensed capacity measured in TB. Additionally, Hyper-V manager also uses GiB for "GB" in its GUI.

**Table 9** TB to TiB equivalents

<table>
<thead>
<tr>
<th>Licensed capacity in TB</th>
<th>Licensed capacity in TiB</th>
<th>Maximum capacity with buffer in TB</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 TB</td>
<td>3.6 TiB</td>
<td>4.4 TB</td>
</tr>
<tr>
<td>8 TB</td>
<td>7.3 TiB</td>
<td>8.8 TB</td>
</tr>
<tr>
<td>16 TB</td>
<td>14.6 TiB</td>
<td>17.6 TB</td>
</tr>
<tr>
<td>32 TB</td>
<td>29.2 TiB</td>
<td>35.2 TB</td>
</tr>
<tr>
<td>48 TB</td>
<td>43.8 TiB</td>
<td>52.8 TB</td>
</tr>
<tr>
<td>64 TB</td>
<td>58.4 TiB</td>
<td>70.4 TB</td>
</tr>
<tr>
<td>96 TB</td>
<td>87.6 TiB</td>
<td>105.6 TB</td>
</tr>
</tbody>
</table>

Individual virtual disks are subject to overhead that reduce their amount of usable capacity to amounts lower than their specified capacity.

- The first data disk is subject to 120 GB of base overhead, with 5.6% of the remaining capacity reserved for RAID-on-LUN
- All subsequent data disks are subject to 5.6% overhead reserved for RAID-on-LUN
**Table 10** Virtual disk overhead calculations

<table>
<thead>
<tr>
<th>Disk</th>
<th>Overhead calculation</th>
<th>Usable capacity examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>First data disk (200 GB or more)</td>
<td>(Total capacity - 120 GB) * 0.944</td>
<td>• 200 GB disk: 75.5 GB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 300 GB disk: 169.9 GB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 400 GB disk: 264.3 GB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 500 GB disk: 358.7 GB</td>
</tr>
<tr>
<td>All subsequent data disks (100 GB or more)</td>
<td>Total capacity * 0.944</td>
<td>• 100 GB disk: 94.4 GB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 200 GB disk: 188.8 GB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 300 GB disk: 283.2 GB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 400 GB disk: 377.6 GB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 500 GB disk: 472 GB</td>
</tr>
</tbody>
</table>

**Configuring DD VE in Data Domain System Manager**

DD VE licensing and configuration can be accomplished through the Configuration Wizard in Data Domain System Manager. After the initial installation of a DD VE instance, the Configuration Wizard automatically appears after the licensing screen on the first launch of DDSM.

**Note**

The DAT is not supported for cloud DD VE.

Enter the DD VE virtual machine IP address into a web browser to launch Data Domain System Manager. Log in with the following credentials:

- Username: sysadmin
- AWS default password: the instance ID

**DD VE licensing**

The *Apply Your License* window is the first screen that appears when DDSM is launched for the first time. The DD VE instance is locked until a license file is applied.

Click *Browse*, locate the license file for a purchased capacity license or the evaluation license included with the DD VE download, then click *Apply*.

**Note**

If you begin the configuration with the evaluation license, but wish to purchase a license later, you will need the Node Locking ID for the DD VE instance. Click *Administration > Licenses* to view the Node Locking ID.
When you obtain the original license file name the server, do not enter the comma in the license file name. DD OS will not accept the name if the comma is used.

**DD VE configuration**

After applying the DD VE license, the Configuration Wizard begins automatically. The wizard assists in configuring the following aspects of the DD VE:

- Networking
  - DHCP or manual settings
  - Virtual interface ethV0 and ethV1 configuration
  - DHCP or manual DNS configuration
Figure 5 Configuration Wizard - Network

- File system

**Note**

DD VE supports a maximum of six MTrees active at a given time, however up to 100 MTrees can be created on DD VE.

- Create virtual storage devices
- Optionally enable the DDFS automatically after creating it
Figure 6 Configuration Wizard - File System

- **System settings**
  - Update the sysadmin password
  - Optionally configure alert and autosupport email settings

Figure 7 Configuration Wizard - System Settings

- **DD Boost**
  - Create a Boost storage-unit, and assign a user ID to own it
Provisioning the storage with the CLI

**Before you begin**

See Disk (Spindle) Group Configuration on page 73.

**Procedure**

1. Log into the system with the user name of `sysadmin`.  
   The default password is `changeme`.  
   At the first login, use the `elicense` command to add a DD VE license.
2. Type control-C to exit the configuration utility.
3. Confirm that virtual disk dev3 exists and has the expected size:
   
   ```bash
   # disk show hardware
   ``
   
   The output should include a line similar to the following example:
   
   ```
   dev3 VMware Virtual disk 1.0 (unknown) 256.00 GiB SAS n/a
   ``
   
   The first two virtual disks (dev1 and dev2) are used for the system software and cannot be used for storage. The `disk show state` command shows System Dev for these system disks.
4. Choose to run DAT tool test (optional):
   
   ```
   # disk benchmark start dev3
   # disk benchmark watch
   # disk benchmark show
   ``
   
   You can monitor the test's progress by entering this command. Once the test is complete, you can use this command to see the test's result.
5. Add the storage disk to the active storage tier:
   
   ```bash
   # storage add dev3
   ```
If you are adding more than one virtual disk, repeat the storage add command for each disk. For guidelines on specifying the optional spindle-group argument, see Configuring Disk (Spindle) Groups.

6. Create the file system:
   
   ```
   # filesys create
   ```

   The "filesys create" may take longer to complete if the hypervisor's storage is slow and does not meet the criteria.

7. Enable the file system:
   
   ```
   # filesys enable
   ```

**After you finish**

You can now complete the initial system configuration. See Completing Initial Configuration with the Command-Line.

Completing Initial Configuration with the Command-Line

**Procedure**

1. Enter the `config setup` command to start the configuration utility.
2. When prompted, enter the Name, and Domain Name of the system.
3. When prompted, configure the initial IP port.

   You can:

   - Choose DHCP.
   - Enter a static IP address and Net Mask.
4. When prompted, either exit the configuration utility and continue configuring the system using the Graphical User Interface, or continue using the CLI configuration utility.

   The list entries in the utility can be comma-separated, space-separated, or both.

   - At each prompt, enter a value, OR
   - Enter a question mark (?) for more details, OR
   - Press Enter to accept the value displayed in braces.

   Follow the configuration utility instructions for entering appropriate values. At the end of each configuration section, you can choose to: *Save, Cancel, or Retry* (restart the input entry as the beginning of the current section).

   **Note**

   If you need to enable NTP, you can do so with the configuration utility.

Configure the System for Data Access

The DD VE system provides the DD Boost protocol. You need to configure one or more protocols for data access, depending on your environment. You also need to configure the clients for accessing the DD VE with the protocol of your choice.

If you did not configure data access with the configuration wizard, use the instructions in this section.
Configuration of optional software and internal licenses

If you need to configure optional software features, you need to install and activate those licenses before you configure those features. See DD VE capabilities on page 12 for information about features and licenses that are available to for DD VE. A separate license is required for DD Cloud Tier.

Information about installing licenses and configuring optional software can be found in the Data Domain Administration Guide. Refer to the applicable Data Domain Operating System Release Notes for the most up-to-date information on product features, software updates, software compatibility guides, and information about our products, licensing, and service. Access the latest documents at https://support.emc.com.

Optional Additional System Configuration

See the Data Domain Operating System Initial Configuration Guide for help performing typical but optional initial system configuration tasks. Below is a summary of the DD OS CLI commands for some common tasks.

Note

Any system command that accepts a list, such as a list of IP addresses, accepts entries separated by either commas or spaces. See the Data Domain Operating System Command Reference Guide for command details.

Add users to the email list that reports system problems:

```
# alerts notify-list add group-name
```

Add users to the system report email list:

```
# autosupport add {alert-summary|asup-detailed} emails email-list
```

Enable FTP or TELNET:

```
# adminaccess enable {ftp|telnet}
```

Add remote hosts to use FTP:

```
# adminaccess ftp add <host list>
```

Add a user:

```
# user add name [role {admin|user}]
```

Change a user’s password:

```
# user change password username
```

To enable remote management, refer to the Data Domain Operating System Administration Guide for details.
To Shut Down The System:

```
# system poweroff
```
CHAPTER 3

DD VE in the Cloud -- All providers

This chapter covers the requirements of DD VE in the cloud regardless of which provider you use. This chapter covers the following topics:

- Supported cloud environments
- DD VE capabilities
- DD VE in the Cloud -- AWS
- DD VE in the Cloud -- Azure
- Setting Up NTP Time Synchronization
- Upgrading DD VE
- Initial System Configuration
- Define the Data Domain System Information for Your Site
- Configuration of optional software and internal licenses
Supported cloud environments

DD VE is supports the following cloud environments.

**Amazon Web Services (AWS)**

DD VE is supported in the Amazon Web Services (AWS) virtual environment:

- AWS is available via AMI with specific AWS accounts. DD VE instance types may be upgraded on AWS console or using script.

**Azure**

DD VE is supported in the Azure cloud environment. Azure deploys and configures DD VE through the Azure CLI or Azure web portal. The Azure Agent is pre-installed on the DD VE image. When you update the DD OS software on the DD VE from within the DD OS environment, any necessary updates to the Azure Agent will be installed automatically. It is not possible to update the Azure Agent on the virtual machine from outside DD OS. For information about compatibility with more recent versions of Azure products, visit the support portal at [https://support.emc.com](https://support.emc.com)

DD VE capabilities

DD VE provides the capabilities of a cloud Data domain system using the following cloud providers and resource configuration sizes.

<table>
<thead>
<tr>
<th>Cloud Provider</th>
<th>Resource Configuration Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amazon Web Services (AWS)</td>
<td>8 TB or 16 TB</td>
</tr>
<tr>
<td>Azure</td>
<td>up to 7 TB</td>
</tr>
<tr>
<td></td>
<td>up to 15 TB</td>
</tr>
</tbody>
</table>

*Note*

Actual DD VE capacity is available in 1 TB increments starting at 1 TB, and up to 15 TB.

The following sections list supported and unsupported Data Domain protocols and features in DD VE.

**Supported Data Domain protocols**

- Data Domain Boost (DD Boost) over IP
- Data Domain Boost (DD Boost) FS

**Supported Data Domain features**

- DD Boost managed file replication (MFR)
- Encryption
- MTree replication
- Data Domain System Manager GUI for DD VE management
- Secure multitenancy (SMT) with Network Isolation Support in 6.0
- DD Boost for Big Data
- KMIP
• More restricted IPtables settings

Note

DD VE 3.1 now supports these replication capabilities:
  • Managed file replication and Mtree replication
  • Replication across availability zones and regions
  • Bidirectional replication between on-prem and AWS

Please see the DD OS Administration Guide, DD Boost OST Guide, DD Boost for Partner Integration Administration Guide for additional information on the supported protocols and features above.

Unsupported Data Domain features
  • Cloud Tier
  • Gov/C2S cloud regions
  • DD Boost over FC
  • Extended retention
  • DD High Availability (HA)--however, VMware and Hyper-V HA are supported
  • NDMP
  • VTL
  • Collection replication
  • Directory replication
  • Instant access
  • Retention lock

DD OS commands related to these unsupported features, and commands for hardware features that are not applicable to a virtual machine, are not supported on the DD VE platform.

DD VE in the Cloud -- AWS

This section provides specific configurations for DD VE on AWS.

Specifications for DD VE in AWS

The tables below show the instance types and storage volumes needed by DD VE. Both GP2 and ST1 are available for AWS.

Table 11  Infrastructure requirements

<table>
<thead>
<tr>
<th>Config.</th>
<th>Instance Type</th>
<th>Block Storage Volumes</th>
<th>Network Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Root Disk</td>
<td>NVRAM Disk</td>
</tr>
<tr>
<td>8 TB</td>
<td>m4.xlarge</td>
<td>GP2/250GB</td>
<td>GP2/10GB</td>
</tr>
<tr>
<td>16 TB</td>
<td>m4.2xlarge, m4.4xlarge</td>
<td>GP2/250GB</td>
<td>GP2/10GB</td>
</tr>
</tbody>
</table>
### Table 12 Stream Counts

<table>
<thead>
<tr>
<th>Config. Capacity (TiB)</th>
<th>Stream Counts</th>
<th>Burst Throughput</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Config. (TiB)</td>
<td>Read</td>
</tr>
<tr>
<td>8 - m4.xlarge</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>24</td>
</tr>
<tr>
<td>16 - m4.2xlarge</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>40</td>
</tr>
<tr>
<td>16- m4.4xlarge</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>40</td>
</tr>
</tbody>
</table>

**Note**

1. This table is for running DD VE in AWS using ST1 EBS volume. If GP2 is used, the maximum stream count can be supported regardless of the amount of capacity provisioned. (Assume a minimum 1TB GP2 is used.)

2. For m4.4xlarge, we recommend using GP2 EBS volume. However, we provide the above information for customers who use ST1.
DD VE management

Use the AWS client software to install the DD VE and define its virtual hardware: CPUs, memory, network interfaces, and virtual disks.

The DDSM GUI provides a configuration wizard to guide you through the steps required to configure DD OS after AWS installed.

Once the DD VE is configured and running, you can access the system console to run DD OS commands by using the AWS Web client. You can also administer the DD VE by using a terminal emulator or `ssh` command line to use the command-line interface.

The default login credentials for the DD VE instance are:

- Username: sysadmin
- AWS default password: the instance ID

**Note**

The system may panic if an RSA DPM client certificate is within 15 days of expiring.

Deploying DD VE in AWS

This version of DD VE allows for cloud manageability, the creation of virtual machines, and .

This section lists the information required to deploy the DD VE instance in AWS.

**BACKUP IN PUBLIC CLOUD**

**DD VE IN AWS**

**Use Cases**
- Backup for applications running in the public cloud
- Replicate protection data from on-prem to public cloud

**Features**
- Support AWS public cloud
- About 16TB usable capacity per instance
- Active Tier on Block Storage
- Replication
  - Within two regions of the public cloud
  - Between on-prem and cloud
- Encryption (at rest and over the wire)
- DDBoost and BoostFS support
- Backup SW, NW, DDEA, NBU, AVAMAR, JAVE

Using Amazon Web Services (AWS) Marketplace Amazon Machine Image (AMI)

You may choose to create the Amazon Machine Image (AMI) in one of two ways: one is through the Amazon Web Services (AWS) portal, the other is through the CLI. To deploy DD VE from the AWS Marketplace, perform the following steps.

**Before you begin**

If you do not already have an AWS account, contact the AWS administrator.

**Procedure**

1. Log into the AWS.Amazon.com account.
2. Select AMI download for Dell EMC DD VE.
3. Complete steps in the AWS wizard to launch.
Using the CLI to create Amazon Web Services (AWS) Marketplace Amazon Machine Image (AMI)

You may choose to create the Amazon Machine Image (AMI) in one of two ways: one is through the Amazon Web Services (AWS) portal, the other is through the CLI. To create an Amazon Machine Image (AMI) using the CLI, perform the following steps.

Before you begin

If you do not already have an AWS account, contact the AWS administrator.

Procedure

1. Configure AWS CLI in the terminal
   - After you install AWS CLI, open a terminal and configure the AWS credentials by running the `aws configure` command. In the following example, Oregon region (us-west-2) is configured.

   ```bash
   aws configure
   AWS Access Key ID: <your own aws access key id>
   AWS Secret Access Key: <your own aws secret access key>:
   Default region name: us-west-2
   Default output format: json
   ```
   - Refer to link to find desired regions and availability zones: http://docs.aws.amazon.com/awsec2/latest/userguide/using-regions-availability-zones.html

2. Download and install the AWS CLI tool, which is available for Windows and Linux (http://docs.aws.amazon.com/cli/latest/userguide/installing.html).

3. Verify that the tool is installed by opening a terminal, shell, or command prompt and entering the following command: `aws help`

   The AWS help text should be displayed:
4. Using the command line tool, run `aws configure` and paste in the access key ID and secret key when prompted. Subsequent logins have default values based on the last successful login. The region setting is where the DD VE is uploaded and deployed, and the default output format should be JSON.

5. Download DD VE VMDK (VM disk image file format) for AWS from the Online Support site to the same system where the AWS CLI is installed.

6. Copy VMDK to s3 bucket:
   a. Enter:
   ```
   aws s3 cp <*.rpm> s3://<your-bucket
   ```

7. Import snapshot with the VMDK that has been uploaded to an S3 bucket:

   ```
   aws ec2 import-snapshot --cli-input-json file://import1.json
   ```

   The output will display:

   ```
   "SnapshotTaskDetail":{
     "Status": "active",
     "Description": "My snapshot",
     "Format": "VMDK"
     "DiskImageSize": 0.0,
     "UserBucket": {
       "S3Bucket": "ddve-cloud-automation",
       "S3Key": "ddve-aws-0.6120.12.0-578179-osdisk.vmdk"
     },
     "Progress": "3",
     "StatusMessage": "pending"
   },
   "Description": "My snapshot"
   "ImportTaskId": "import-snap-fggu50t3"
   ```

8. Import json files. Json files should be in the UTF-8 format. The sample `import1.json` content will be like below.
   a. Import1.json and a4.json are the json file examples, these need to be created before running CLI.

   Sample Import1.json file
Sample Import1.json file:

```json
{
   "Description": "My snapshot",
   "DiskContainer": {
      "Description": "ddveGA",
      "Format": "vmdk",
      "UserBucket": {
         "S3Bucket": "ddve-image-bucket",
         "S3Key": "ddve-aws-6.1.0.5-567091-osdisk.vmdk"
      }
   },
   "RoleId": "vmimport"
}
```

Sample a4.json file

```json
{
   "Architecture": "x86_64",
   "BlockDeviceMappings": [ 
      { "DeviceName": "/dev/sda1",
        "VirtualName": "root",
        "Ebs": { 
           "DeleteOnTermination": true,
           "SnapshotId": "snap-0d552be8d7e9ebec7",
           "VolumeType": "gp2"
        }
      }
   ],
   "Description": "Some AMI",
   "Name": "MYAMI-aru",
   "RootDeviceName": "/dev/sda1",
   "VirtualizationType": "hvm"
}
```

9. Check output to obtain SnapshotID:

```bash
aws ec2 describe-import-snapshot-tasks --import-task-ids
"import-snap-ffsdseob"
```

10. Use this SnapshotID to register the AMI in AWS and give it a name.

   a. Select "Create Image from EBS Snapshot" in AWS from "Actions" dropdown menu.

   b. Select "Hardware-assisted virtualization" from dropdown menu as your "Virtualization Type".

Deploying and Configuring DD VE in Amazon Web Services (AWS)

To deploy the DD VE in Amazon Web Services (AWS), follow these steps.

**Before you begin**

In AWS, DD VE should be deployed within a private subnet of the VPC. (It should not be deployed on a public subnet of VPC or a public IP address.) Before deploying the DD VE in AWS, you should have set up VPC, allocate corresponding subnet, set up Security Group. Provisioning for the subnet ID, security group, and the key pair (optional) should be completed first.
**Procedure**

1. Create the DD VE head unit, sign in to the AWS Management Console https://aws.amazon.com/ service in management web console
2. After login, click EC2 service in management web console
3. Choose the DD VE AMI: In EC2 Dashboard, click AMIs, select the AMI from the list, and the click Launch
4. Select the instance type
   a. The only option available for 8 TiB DD VE is m4.xlarge
   b. There are two options for 16TiB DD VE: m4.2xlarge or m4.4xlarge
   c. Select the instance type, click " Next: Configure Instance Details " button
5. Configure VPC, subnet
   a. In the Network column, select the VPC
   b. In the Subnet column, select the subnet ID
   c. Click " Add Storage " button to proceed
6. Add storage-- NvRAM disk (required) and data disk (optional)
   a. To add the NvRAM disk, click Add New Volume
   b. In the Volume Type field, specify EBS
   c. In the Device filed, make sure it is /dev/sdb
   d. In the Size field, specify 10 GiB
   e. In the Volume Type field, specify General Purpose SSD (GP2)
   f. Optional: you could choose to add data disk at this time.
      Note: Data disk capacity varies based on the use case.
      • Evaluation purposes: data disk capacity is 0.5T GP2
      • Cost sensitive: 1T GP2 + multiple 2+T ST1 (1T GP2 for the first disk, following disks may be 2T+ ST1 type EBS)
      • Performance: multiple 1-3TB GP2
   g. To add data disk, click Add New Volume button
   h. In the Volume Type field, specify EBS
      i. In the size field, specify the disk size the size could range from 500 GiB to 3TiB (3072GiB) (See data disk capacity note above)
      j. In the Volume type field, specify GP2 type or ST1 (for cost sensitive customer)
      k. In the Availability Zone, specify the Availability Zone ID of existing DD VE instance. Click "Create" Button.
7. Name the DD VE
   a. Enter "Name" in the Key column
   b. Specify the DD VE name for this DD VE instance in the "Value" column
   c. Click "Next: Configure Security Group" button
8. Specify the security group
9. In the Volume type field, specify GP2 type or ST1 (for cost sensitive customer).
10. In the Availability Zone, specify the Availability Zone ID of existing DD VE instance. Click "Create" Button.
11. Review and launch: Review the details, and then select Launch
12. Specify the key pair (optional)
   • Select the pre-provisioned key pair for this DD VE instance.
   • Click "Launch Instances" button to launch the DD VE
13. Add storage--data disk. You can add more data disk storage to this DD VE instance. The size of a single data disk can be from 500 GiB to 3 TiB (3072 GiB) (See data disk capacity note above)
14. In the AWS web console click EC2 service and select Instances in the panel, identify the instance ID, the Availability Zone ID of the DD VE instance, and the device name of existing data disks (e.g. /dev/xvdc).
15. In the EC2 web console, click "Elastic Block Store" Volumes, click "Create Volume" button.
16. In the output "Create Volume" dialog window, in the Volume Type field, specify GP2 or ST1 (for cost sensitive customer).

**Note**
If this DD VE has attached data disks earlier, this "Volume Type" should be same as the volume type of the existing data disks

17. In the size field, specify the disk size. The size could range from 500 GiB to 3TiB (3072GiB)
18. In the Availability Zone, specify the Availability Zone ID of existing DD VE instance. Click "Create" Button.
   • Specify name for this EBS volume
   • In this "Volumes" window, identify this new EBS volume, click the "Name" column and specify the name for this EBS volume
19. Attach the EBS volume to the DD VE instance.
   • Select this EBS Volume, click the "Action" pull down menu, and click "Attach Volume"
20. In the "Instances" column, specify the DD VE instance ID
21. In the "Device" column, specify the device name to be "/dev/xvd[X]. The "X" should be the next character of last device name of existing data disks.

**Note**
If this DD VE has attached data disks earlier, this "Volume Type" should be same as the volume type of the existing data disks.

22. Click "Attach" button to add this data disk to DD VE instance.
23. Repeat the step 13 to 22 if you want to add more data disks to the DD VE.
Upgrade the DD VE instance type (optional)

Procedure

1. Gracefully shutdown DD VE instance. Run DDSH command:
   ```
   system poweroff
   ```

2. Change the instance type
   a. Login onto AWS management web console, click EC2 to EC2 dashboard,
      click instances and select the instance to be upgraded. Make sure it is in the
      stopped state.
   b. Click Actions button, in the pull-down menu select Instance Settings and
      click Change Instance Type
   c. Specify the instance type.

   Note
   
   The options for 8/16TiB DD VE are as below:
   - 8TiB DDVE: m4.xlarge
   - 16TiB DDVE: m4.2xlarge, m4.4xlarge
   - We do not support instance type downgrade.

   d. Start the instance: Click the "Action" button, in the pull-down menu, select
      Instance State and click "Start".

   e. Root disk is /dev/sdal

   f. When converting from VMDK to AMI, although we have specified it to be
      
      ```
      /dev/xvda
      ```
      
      but the result is still
      
      ```
      /dev/sdal
      ```
      
      For additional information: [https://aws.amazon.com/](https://aws.amazon.com/)

Naming Disks in AWS

Procedure

1. NvRAM and data disk is /dev/xvd[b|c|d..]

2. When attaching more EBS(s) to root disk, if specifying it to be
   
   ```
   /dev/xvdb[cdefg...]
   ```
   
   it is displayed as
   
   ```
   /dev/xvdb[cdefg...]
   ```

   Note
   
   - The root disk will always be 
     ```
     /dev/sda
     ```
     even if you specify 
     ```
     /dev/xvda
     ```
     as the device name.
   - Other disks will always be 
     ```
     /dev/xvdX
     ```
     even if you specify 
     ```
     /dev/sdX
     ```
     as the device name.
Adding disks and memory

Before you begin
Make sure you have enough licensed capacity available to add new capacity to DD VE. Since the GUI cannot detect AWS storage, you will need to configure the storage from the DD command line.

When adding additional capacity, make sure the DD VE instance has enough memory to support the new capacity.

Initial virtual machine configuration on page 30 describes the amount of memory required to support DD VE capacity.

Note
Two storage types are supported: GP2 and ST1. For best performance, use GP2. However, ST1 can be used if the IOPS (burst and base) meet the needs.

New storage for the DD VE must meet the following requirements:
- The minimum size of the first data disk is 477 GiB (512 GB).
- The minimum size of any subsequent data disks is 94 GiB (100 GB).

Note
Data disk capacity varies based on the use case:
- Evaluation purposes: data disk capacity is 0.5T GP2
- Cost sensitive: 1T GP2 + multiple 2+T ST1 (1T GP2 for the first disk, following disks may be 2T+ ST1 type EBS)
- Performance: multiple 1-3TB GP2

After you finish
To add additional storage or memory in the future, follow the requirements above. It is not necessary to shut down the virtual machine before adding storage.

Note
The virtual disk cannot be expanded. Create a new virtual disk to add additional storage to the virtual machine.

DD VE in the Cloud -- Azure

This section provides specific configurations for DD VE on Azure.

Specifications for DD VE in Azure

The tables below show the instance types and storage volumes needed by DD VE. Standard HDD storage is used for all volumes. Azure DD VE has a different max capacity for optimizing the instance type cost.
Table 13  Infrastructure requirements

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Instance Type</th>
<th>Block Storage Volumes</th>
<th>Network Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Root Disk</td>
<td>NVRAM Disk</td>
</tr>
<tr>
<td>7TB</td>
<td>Standard_F4</td>
<td>Standard/250GB</td>
<td>Standard/10GB</td>
</tr>
<tr>
<td>15TB</td>
<td>Standard_F8</td>
<td>Standard/250GB</td>
<td>Standard/10GB</td>
</tr>
</tbody>
</table>

Table 14 Stream Counts

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Write Steam</th>
<th>Read Stream</th>
<th>Repl Source</th>
<th>Repl Dest</th>
<th>Mixed Stream</th>
<th>Max Mtree</th>
</tr>
</thead>
<tbody>
<tr>
<td>7TB</td>
<td>20</td>
<td>16</td>
<td>20</td>
<td>20</td>
<td>30</td>
<td>6</td>
</tr>
<tr>
<td>15TB</td>
<td>45</td>
<td>30</td>
<td>45</td>
<td>45</td>
<td>60</td>
<td>6</td>
</tr>
</tbody>
</table>

DD VE management

The DDSM GUI provides a configuration wizard to guide you through the steps required to configure DD OS after Azure is installed.

Once the DD VE is configured and running, you can also administer the DD VE by using a terminal emulator or ssh command line to use the command-line interface.

The default login credentials for the DD VE instance are:

- Username: sysadmin
- Azure default password: changeme (or the password specified during deployment)

Note

You will be asked to enter your choice of a password for sysadmin-- if you choose SSH key pair authentication during deployment from Azure Marketplace.

Note

The system may panic if an RSA DPM client certificate is within 15 days of expiring.
Deploying the DD VE in Azure

Includes the information required to deploy the DD VE instance in Azure.

BACKUP IN PUBLIC CLOUD

DD VE IN AZURE

Use Cases

- Backup for applications running in the public cloud
- Replicate protection data from on-prem to public cloud

Features

- Supports Azure public cloud
- About 15TB usable capacity per instance
- Active Tier on Block Storage
- Replication
  - Within two regions of the public cloud
  - Between on-prem and cloud
- Encryption (at rest and over the wire)
- DDBoost and BoostFS support
- Backup SW-NW, DOBEA, AVSANAR, JAVE

Creating DD VE from a template

The Azure template is a JSON file, used in Azure Resource Manager Mode (ARM) to deploy the VM. It defines all the resources required by a VM (VM name, instance type, user name / password, virtual network, subnetwork, etc.). To begin deployment of a VM, run one command to start. Azure will parse the template and finish the deployment.

Note

Please install Azure PowerShell or Azure CLI on your PC before deployment.

- To install Azure PowerShell on Windows, see this tutorial: https://docs.microsoft.com/en-us/powershell/azure/overview?view=azurermps-3.8.0.
- To install Azure CLI on Windows, Linux or Mac OS, see this tutorial: https://docs.microsoft.com/en-us/cli/azure/install-azure-cli.

Note

Please generate a SSH key pair before deployment. See this tutorial: https://docs.microsoft.com/en-us/azure/virtual-machines/linux/mac-create-ssh-keys.

1. Download DD VE image from Support site
2. Unzip the file and you will get the VHD file, evaluation license, and JSON template file.
3. Launch Windows Powershell
4. Upload the VHD image to Azure
   - Login to Azure: Login-AzureRMAccount
   - If you have multiple subscriptions, choose one: Select-AzureRmSubscription - SbsubscriptionId YourSubID
   - Upload VHD image to Azure: Add-AzureRmVhd - ResourceGroupName - Destination - LocalFilePath - NumberOfUploadThreads
5. Customize the template: Edit the template by specifying the following variables according to your environment and save it as your own template

- storageAccountName
- VhdImageUri
- virtualNetworkName
- subnet1Name

6. Deploy DDVE

a. Launch Windows Powershell

b. Login to Azure: Login-AzureRMAccount

c. If you have multiple subscriptions, choose one: Select-AzureRmSubscription -SubscriptionId YourSubID

d. Start to deploy DD VE: New-AzureRmResourceGroupDeployment -Name YourDeployName -ResourceGroupName YourResourceGroupName -TemplateFile YourTemplateFile

e. Input the following parameters

- vmName: Name of the DDVE (Maximum length of the name is 10)
- sshKeyData: Copy and paste the SSH public key (SSH public key file as a string)
- vmSize: Standard_F4 or Standard_F8
- sysadminPassword: the password for sysadmin

f. After the deployment is complete, you can find the DD VE in the Azure portal.

Note

Password requirements:

1. The password must have 3 of the following: 1 lower case character, 1 upper case character, 1 number, and 1 special character
2. The password must be between 12 and 72 characters long

Creating DD VE from Azure Marketplace

DD VE is available in Azure marketplace. You can deploy a DD VE from the Marketplace with several steps.

1. Begin Azure deployment: Login to the Azure portal, search for Dell EMC to find Data domain Virtual Edition in Azure Marketplace, and start the deployment

2. Configure basic settings

- **Name**: the name for DD VE. (Maximum length of the name is 10)
- **VM disk type**: only HDD is supported
- **User name**: must be "sysadmin"
- **Authentication type**: Both SSH public Key and Password authentication are supported.
  - **SSH public key**: Copy and paste the SSH public key. Please change the default password of "sysadmin" at the first login.
  - **Password**: the password for sysadmin
- **Subscription**: specify a subscription.
3. Choose VM size: Select standard F4 or standard F8 based on DD VE capacity

4. Configure option features

- Storage
  - Use managed Disks: Not
- Storage Account: Specify the storage account
- Network: Specify the virtual network, subnet, network security group and public IP address (Suggest to deploy DD VE in private subnet and leave the public IP address as "None" for security consideration)
- Extensions: No extensions
- High availability: None
- Monitoring
  - Boot Diagnostics: Enabled
  - Guest OS diagnostics: Disabled
  - Diagnostics storage account: Specify the storage account to save the diagnostics logs

5. Review the summary: Review the configuration summary for creating the DD VE and make changes if necessary

6. Buy: Click "Purchase" button. The Azure portal will start the DD VE deployment.

---

**Note**

The Azure publishing process will take several days. The latest DD VE version will be available in the Marketplace several days after the official GA announcement.

---

**Adding NICs for DD VE**

When initially deployed, DD VE is provisioned with one NIC. You cannot add existing NICs to a new VM, or create a VM with multiple NICs using the Azure portal. You can do both using the CLI or PowerShell. Please refer to [https://docs.microsoft.com/en-us/azure/virtual-network/virtual-network-network-interface-vm](https://docs.microsoft.com/en-us/azure/virtual-network/virtual-network-network-interface-vm)

Additional NIC cards can be added up to a maximum of:

- For standard_F4, 2 is the maximum NIC cards
- For standard_F8, 4 is the maximum NIC cards

---

**Adding disks**

Make sure you have enough licensed capacity available to add new capacity to DD VE. When adding additional capacity, make sure the DD VE instance can support the new capacity. If the new capacity is more than the DD VE instance supported capacity, please upgrade the DD VE instance.

---

**Note**

Azure provides two types of disk storage: Premium and Standard. DD VE only supports Standard HDD as data disks. Also, you won't need to add a NvRAM disk. After deploying the DD VE in Azure, the 10GB NvRAM disk will be automatically created using the JSON file.

New storage for the DD VE must meet the following requirements:
The minimum size of the first data disk is 477 GiB (512 GB).

The minimum size of any subsequent data disks is 1 TB.

After you finish

To add additional storage in the future, follow the requirements above. It is not necessary to shut down the virtual machine before adding storage.

Note

The virtual disk cannot be expanded. Create a new virtual disk to add additional storage to the virtual machine.

Upgrading DD VE in Azure

Upgrading DD VE to a higher capacity

If the higher capacity is supported by current DD VE configuration (standard_F4), follow these steps.

1. Add the needed hard disks for the new capacity
2. Configure the newly added data disks using the CLI command `storage add dev tier active<device ID>` (Or, use DD SM GUI).
3. Expand the file system using the CLI command `filesys expand`

If the higher capacity is not supported by the current DD VE configuration (Standard_F4), please resize the DD VE instance from standard_F4 to standard_F8 through Azure portal.

Setting Up NTP Time Synchronization

By default, NTP is disabled on the DD VE system. If you need to enable NTP on the DD VE, follow these steps:

Note

Skip this task if you are going to join the DD VE to an Active Directory domain. Because the Windows domain controller obtains the time from an external source, NTP must be configured. See the Microsoft documentation on how to configure NTP for the Windows operating system version or service pack that is running on your domain controller. After joining the domain, the system time is periodically synchronized with the domain controller time. When the host joins the Active Directory, the DD VE displays a warning if multiple time sources are in use.

Later, while performing initial configuration of the DD VE system, enable NTP by selecting the appropriate options from the configuration wizards. If you do not use the wizards to perform initial configuration, you can use the `ntp enable` command on the DD OS command line. Enabling NTP with the `ntp enable` command automatically disables synchronizing the time on the guest to the host time.

To reenable synchronizing the guest time to the host time, run the `ntp disable` command.

Note

NTP is disabled by default. The `ntp reset` command also deactivates NTP on the guest.
Upgrading DD VE

Upgrading from DD VE 3.0

Upgrading DD VE to a higher capacity
If the higher capacity does NOT need additional resources (refer to Table 2 on page 16), follow these steps.
1. Add the needed hard disks for the new capacity
2. Configure the newly added data disks using the CLI command `storage add dev tier active<device ID>` (Or, use DD SM GUI)
3. Expand the file system using the CLI command `filesys expand`

If the higher capacity will require DD VE to have higher resources, follow these steps to upgrade DD VE to a higher capacity.
1. Shutdown DD VE
2. Increase the memory to support the higher capacity configuration (refer to Table 2 on page 16)
3. Increase the number of CPUs for the higher capacity configuration (refer to Table 2 on page 16)
4. Increase the CPU reservations (refer to Table 2 on page 16)
5. Add the needed hard disks for the new capacity
6. Power on the DD VE
7. Add the license for the new capacity
8. Configure the newly added data disks using the CLI command `storage add dev tier active<device ID>`
9. Expand the file system using the CLI command `filesys expand`

Initial System Configuration

You can connect to the system to perform the initial system configuration with the command-line configuration wizard, or the DDSM Configuration Wizard.

DHCP is enabled on the DD VE system by default. If the DHCP service is available, the DD VE system will receive IP addresses from the DHCP server.

Note
DHCP is only activated automatically for the first network interface card (NIC) which is built into the virtual machine template. Any extra NICs must be configured manually by following instructions here https://docs.microsoft.com/en-us/azure/virtual-network/virtual-network-network-interface-vm.

Using the GUI
Access DDSM by entering the IP address of the DD VE into a web browser, and logging in.

The GUI Configuration Wizard contains six sections: Networking, File System, System Settings, DD Boost, CIFS, and NFS.
Configuring DD VE in Data Domain System Manager on page 37 describes how to configure the DD VE from the GUI.

**Using the CLI**

Access the CLI by using `ssh` or a terminal emulator to access the DD OS command line.


Provisioning the storage with the CLI on page 41 describes how to configure the DD VE manually with the CLI instead of using the configuration utility.

### Configuring DD VE in Data Domain System Manager

DD VE licensing and configuration can be accomplished through the Configuration Wizard in Data Domain System Manager. After the initial installation of a DD VE instance, the Configuration Wizard automatically appears after the licensing screen on the first launch of DDSM.

**Note**

The DAT is not supported for cloud DD VE.

Enter the DD VE virtual machine IP address into a web browser to launch Data Domain System Manager. Log in with the following credentials:

- Username: sysadmin
- AWS default password: the instance ID

**DD VE licensing**

The **Apply Your License** window is the first screen that appears when DDSM is launched for the first time. The DD VE instance is locked until a license file is applied.

Click **Browse**, locate the license file for a purchased capacity license or the evaluation license included with the DD VE download, then click **Apply**.

**Note**

If you begin the configuration with the evaluation license, but wish to purchase a license later, you will need the Node Locking ID for the DD VE instance. Click **Administration > Licenses** to view the Node Locking ID.
Figure 9 DD VE Node Locking ID

Note
When you obtain the original license file name the server, do not enter the comma in the license file name. DD OS will not accept the name if the comma is used.

DD VE configuration
After applying the DD VE license, the Configuration Wizard begins automatically. The wizard assists in configuring the following aspects of the DD VE:

- Networking
  - DHCP or manual settings
  - Virtual interface ethV0 and ethV1 configuration
  - DHCP or manual DNS configuration
Figure 10 Configuration Wizard - Network

- File system

**Note**

DD VE supports a maximum of six MTrees active at a given time, however up to 100 MTrees can be created on DD VE.

- Create virtual storage devices
- Optionally enable the DDFS automatically after creating it
Figure 11 Configuration Wizard - File System

- System settings
  - Update the sysadmin password
  - Optionally configure alert and autosupport email settings

Figure 12 Configuration Wizard - System Settings

- DD Boost
  - Create a Boost storage-unit, and assign a user ID to own it
Configure the System for Data Access

The DD VE system provides the DD Boost protocol. You need to configure one or more protocols for data access, depending on your environment. You also need to configure the clients for accessing the DD VE with the protocol of your choice.

If you did not configure data access with the configuration wizard, use the instructions in this section.

**DD Boost (DD VE includes the DD Boost for cloud or on premises)**

For setting up the Data Domain DD Boost feature, see the *Data Domain Boost for OpenStorage Administration Guide* or *Data Domain Boost for Partner Integration Administration Guide* available at https://support.emc.com.

**Application Integration**

For information about how to integrate the Data Domain system with backup software, see the documentation for the applicable application at the Data Domain Integration Documentation section on the Data Domain Support web site https://support.emc.com.

Define the Data Domain System Information for Your Site

An installation requires information unique to your site. Before starting the installation, provide values for the system information listed below.

**Note**

Data Domain recommends that you print the tables in this section and record the information.
<table>
<thead>
<tr>
<th>Information</th>
<th>Your Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>A fully qualified host name for the system:</td>
<td></td>
</tr>
<tr>
<td>The DNS domain name:</td>
<td></td>
</tr>
<tr>
<td>A default gateway IP address (if you are not using DHCP):</td>
<td></td>
</tr>
<tr>
<td>DNS server IP addresses (if you are not using DHCP):</td>
<td></td>
</tr>
<tr>
<td>• Primary</td>
<td></td>
</tr>
<tr>
<td>• Secondary</td>
<td></td>
</tr>
<tr>
<td>• Tertiary</td>
<td></td>
</tr>
<tr>
<td>If you will enable CIFS access, enter the information for your CIFS</td>
<td></td>
</tr>
<tr>
<td>authentication method:</td>
<td></td>
</tr>
<tr>
<td>For Workgroup authentication:</td>
<td></td>
</tr>
<tr>
<td>• Workgroup name:</td>
<td></td>
</tr>
<tr>
<td>• Backup user name:</td>
<td></td>
</tr>
<tr>
<td>• Password</td>
<td></td>
</tr>
<tr>
<td>For Active Directory authentication:</td>
<td></td>
</tr>
<tr>
<td>• Realm name</td>
<td></td>
</tr>
<tr>
<td>• Domain admin name:</td>
<td></td>
</tr>
<tr>
<td>• Password</td>
<td></td>
</tr>
<tr>
<td>Host name from which to administer the system:</td>
<td></td>
</tr>
<tr>
<td>Administrator’s email address (or admin group alias):</td>
<td></td>
</tr>
<tr>
<td>Mail server (SMTP) host name:</td>
<td></td>
</tr>
<tr>
<td>Hypervisor server name:</td>
<td></td>
</tr>
<tr>
<td>(Optional) Physical location of the hypervisor server:</td>
<td></td>
</tr>
<tr>
<td>Time zone name (default is US/Pacific):</td>
<td></td>
</tr>
<tr>
<td>Serial number (SN) provided to you by Data Domain:</td>
<td></td>
</tr>
<tr>
<td>Virtual machine unique ID (after initial configuration, use the system</td>
<td></td>
</tr>
<tr>
<td>show serialno command to display this ID):</td>
<td></td>
</tr>
</tbody>
</table>

Use this table to enter Ethernet connectivity information. By default, DHCP is enabled on both ports.
Table 16 Ethernet Connectivity Worksheet

<table>
<thead>
<tr>
<th>Ethernet Connectivity</th>
<th>Enable</th>
<th>Use DHCP</th>
<th>IP Address (if no DHCP)</th>
<th>Netmask (if no DHCP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ethV0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ethV1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ethV2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ethV3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ethV4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ethV5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ethV6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ethV7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Configuration of optional software and internal licenses

If you need to configure optional software features, you need to install and activate those licenses before you configure those features. See DD VE capabilities on page 12 for information about features and licenses that are available to for DD VE. A separate license is required for DD Cloud Tier.

Information about installing licenses and configuring optional software can be found in the Data Domain Administration Guide. Refer to the applicable Data Domain Operating System Release Notes for the most up-to-date information on product features, software updates, software compatibility guides, and information about our products, licensing, and service. Access the latest documents at https://support.emc.com.
CHAPTER 4

DD VE Administration - on premises and in cloud

This chapter covers the following topics:

- Served Licensing Model for DD VE ................................................................. 72
- Adding virtual storage .................................................................................. 72
- Optional Additional System Configuration .................................................. 74
- Extensions to DD OS for DD VE ................................................................. 74
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- Performance Troubleshooting .................................................................... 85
- Migrating DD VE ......................................................................................... 85
Served Licensing Model for DD VE

DD VE licensing
DD VE 3.1 features the Served Licensing Model for DD VE which provides the solution for managing licensing for the deployment of DD VE(s). This solution is only available for virtual systems, not physical systems at this time. The sales ordering process will remain the same. Licenses are retrieved, by the customer, from the Software Licensing Central (SLC) portal. This allows you to deploy the license server software (the hardware server is not provided) by downloading this license, loading it into the license server, and configuring the DD VE to talk to the license server. Refer to the applicable Data Domain Operating System Release Notes for the most up-to-date information on product features, software updates, software compatibility guides, and information about products, licensing, and service.

How to configure: the served licensing model
The served licensing model is introduced with the DD OS 6.1 release.

Table 17 Existing license server information on license server supported platforms

<table>
<thead>
<tr>
<th>Environment</th>
<th>System</th>
</tr>
</thead>
<tbody>
<tr>
<td>vCloud</td>
<td>Linux</td>
</tr>
<tr>
<td>AWS</td>
<td>Linux</td>
</tr>
<tr>
<td></td>
<td>Windows</td>
</tr>
<tr>
<td>Azure</td>
<td>Linux</td>
</tr>
<tr>
<td></td>
<td>Windows</td>
</tr>
</tbody>
</table>

Note
The CLIs elicense checkout and elicense checkin are used to obtain licenses from the DD VE.

- If you experience an "invalid key magic" issue after a headswap, run the DDSH command `ddboost user revoke token-access sysadmin`.
- If you experience a certificate authentication issue after a headswap, detach and re-attach the DD from the AV-server. The AV-server will then regenerate the certificate and import it to DD.

Note
If the system has already been configured to use license server and some served licenses have already been checked out, after the system upgrade, those licenses may go into grace period and some unexpected alerts may be generated. You can run `telnet <license-server-ip> <license-server-port>` to verify the connection between the DD VE and the license server. If the connection is good, licenses become "served" again in 24 hours.

Adding virtual storage

Additional virtual storage can be added using the GUI or the CLI.
Note

DD VE does not support the use of VMware RDM volumes.

Note

It is not possible to extend a virtual disk if it has already been used by the file system. Instead, expand the storage by adding a new virtual disk.

Using the GUI

- In DDSM, click Hardware > Storage > Configure Storage to add additional devices to the DD VE active tier.
- Since the GUI cannot detect AWS storage, you will need to configure the storage from the Data Domain command line.

Note

If no addable devices exist, create new virtual disks as described in Adding disks and memory on page 31.

After adding the storage, click Data Management > File System > Expand Capacity > Next to launch the DAT to verify the hardware supporting the virtual storage meets the requirements for DD VE.

Using the CLI

When you add a new virtual data disk to an existing DD OS file system, use the filesys expand command instead of the filesys create command. For instructions and restrictions, see Initial Virtual Machine Configuration with the vSphere Client.

Disk (Spindle) Group Configuration

DD VE 3.1 supports 16 spindle-groups. We recommend that virtual disks from the same storage be configured with the same spindle-group number. Virtual disks with different storage should be configured with a different spindle-group number. However, or DD VE in AWS or Azure, by default, disks are assigned with different spindle-groups. The best practice is NOT to assign spindle-group manually.

Note

DD VE 3.1 supports up to 58 virtual disks on VMware and supports up to 120 virtual disks on Hyper-V.

Load and capacity balancing in DD OS depends on correct assignment of virtual disks to disk (spindle) groups. You do this by specifying the optional spindle-group argument to the storage add command. The command syntax is:

```
# storage add devdisk-id spindle-group 1
```

For example, if three disks are configured on DD VE, dev3 and dev4 are from the same storage, and dev5 is from a different storage.

```
# storage add dev3 spindle-group 1
# storage add dev4 spindle-group 1
# storage add dev5 spindle-group 2
```
Note

The `storage add` command does not support multiple devices in one command line. As a workaround you may:

- Use

  ```
  # storage add dev3,dev4,dev5
  ```

  or

- Use

  ```
  # storage add dev3-5
  ```

---

Optional Additional System Configuration

See the *Data Domain Operating System Initial Configuration Guide* for help performing typical but optional initial system configuration tasks. Below is a summary of the DD OS CLI commands for some common tasks.

Note

Any system command that accepts a list, such as a list of IP addresses, accepts entries separated by either commas or spaces. See the *Data Domain Operating System Command Reference Guide* for command details.

Add users to the email list that reports system problems:

```
# alerts notify-list add group-name
```

Add users to the system report email list:

```
# autosupport add {alert-summary|asup-detailed} emails email-list
```

Enable FTP or TELNET:

```
# adminaccess enable {ftp|telnet}
```

Add remote hosts to use FTP:

```
# adminaccess ftp add <host list>
```

Add a user:

```
# user add name [role {admin|user}]
```

Change a user’s password:

```
# user change password username
```

To enable remote management, refer to the *Data Domain Operating System Administration Guide* for details.

To Shut Down The System:

```
# system poweroff
```

---

Extensions to DD OS for DD VE

Several DD OS commands are supported on the DD VE platform only. This section describes these commands.
Storage performance evaluation

Manage virtual disk performance benchmark tests.

Storage performance can be evaluated in two ways:

- With the DAT in DDSM
- With the `disk benchmark` command in the DD OS CLI

DAT

In addition to being part of the DDSM Configuration Wizard, DAT can be run as part of the process of adding new devices to expand the file system on the DD VE instance.

**Note**

Running DAT before expanding the file system requires the presence of at least one device to add to the active storage tier. Also, benchmark should not be run when virtual disks are absent.

In DDSM, click **Data Management > File System > Expand Capacity**.

Click **Configure** to add devices to the active tier, or click **Next** if you have already added the devices to the active tier.

Run the DAT to analyze the underlying storage performance.

**disk benchmark**

`disk benchmark requirements`

Displays the currently configured recommended performance characteristics by disk capacity.

`disk benchmark start <dev-list>`

Start a performance benchmark test on one or more data disks in series or in parallel.

- Specify `dev[3-5]+dev7+dev[10-12]` to test the specified devices in sequence, one after the other.
- Specify `dev(3-5) dev7 dev(10-12)` to test the specified devices in parallel.

**Example 1**

Test `dev3`. When that test finishes, test `dev4`.

```
# disk benchmark start dev[3-4]
```

Test `dev3` and `dev4` in parallel.

```
disk benchmark start dev(3-4)
```

Start two series of tests in parallel. The two series of tests are `dev3` followed by `dev4`, and `dev5` followed by `dev6`.

```
# disk benchmark start dev(3-4) dev(5-6)
```

`disk benchmark show { [[detailed] test-id] | all | requirements}`

Print disk performance benchmark test results and report a recommended capacity for the tested configuration. With no arguments, the command prints information about the most recent test for every disk. Specify a `test-id` to see information about a single test. Specify `all` to see a table of previous and currently running tests. Specify `requirements` to see a table of performance goals.
Note

The `disk benchmark show` command shows the results of the test of storage performance on the host system to determine which DD VE capacity configurations can be supported on the host.

disk benchmark start
Conducts a test of storage performance.
disk benchmark stop
Stop all running tests.
disk benchmark watch
Display the ongoing results of all tests in progress.

**perf**

Collect and show DD VE performance statistics.

`perf disable trace event-regexp [module {default | ddfs}]`
Disable tracing of specified events.

`perf enable trace event-regexp [module {default | ddfs}]`
Enable tracing of the specified events.

`perf start histogram [module {default | ddfs}]`
Start collecting performance histograms. This command may reduce performance marginally.

`perf start stats`
Start printing statistics. This command may reduce performance marginally.

`perf start trace [allow-wrap] [module {default | ddfs}]`
Start tracing events. This command may reduce performance marginally.

`perf status trace event-regexp [module {default | ddfs}]`
Shows whether tracing is enabled or disabled for the specified events.

`perf stop histogram histogram-filename [module {default | ddfs}]`
Stop collecting histograms and write the collected histograms to the specified file.

`perf stop stats`
Stop printing statistics.

`perf stop trace trace-filename [module {default | ddfs}]`
Stop tracing events and write the collected traces to the specified file.

**system vresource**

Display details about the virtual CPU and memory resources on the DD VE host.

`system vresource show [current | requirements]`
Display details about the virtual CPU and memory resources on the DD VE host.
## DD VE-only commands

The following commands only work on DD VE, and are not supported on physical Data Domain systems.

### Table 18 DD VE-only commands

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>disk benchmark [detailed] &lt;test-id&gt;</code></td>
<td>Create a disk benchmark test, and specify a unique ID for the test. Use the <code>detailed</code> option to collect more advanced information.</td>
</tr>
<tr>
<td><code>disk benchmark show all</code></td>
<td>List all the disk benchmark tests stored on the system.</td>
</tr>
<tr>
<td><code>disk benchmark show requirements</code></td>
<td>Displays the physical storage requirements for running DD VE.</td>
</tr>
</tbody>
</table>
| `disk benchmark start <dev-list>` | Start disk benchmarking tests on the specified device or group of devices. For the `<dev-list>` parameter:  
  - Specify `dev[3-5]+dev7+dev[10-12]` to test the specified devices in sequence, one after the other.  
  - Specify `dev(3-5) dev7 dev(10-12)` to test the specified devices in parallel. |
| `disk benchmark stop` | Stop all disk benchmarking. |
| `disk benchmark watch` | Displays information about an in-progress disk benchmarking test, including the test being run, the device being tested, and the percent complete. This command blocks the system until the test completes, or the user types `Ctrl + C`. |
| `elicense checkout feature-license <feature-name-list>` | Allows user to check out the features of licences for EMC License Server installation |
| `elicense checkout capacity-license <feature-name> value <n> {TB|GB}` | Allows user to check out the capacity of licences for EMC License Server installation |
| `elicense checkin {<feature-name-list> | all}` | Allows user to check in features for licences for EMC License Server installation |
| `elicense license-server set server {<ipaddr> | <hostname>} port <port-number>` | |
| `elicense license-server reset` | |
| `elicense license-server show` | |
| `system vresource show [requirements]` | Displays the file system capacity, the number of virtual CPUs, and the amount of memory assigned to the virtual machine running the DD VE Administration - on premises and in cloud |
Table 18 DD VE-only commands (continued)

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>vserver config set</td>
<td>DD VE supports the hypervisor’s functionality to collect performance statistics from the hypervisor. These performance statistics can be used to troubleshoot the DD VE performance problems. To do that, users need to specify the vServer information (hostname or IP address) and the credential information (username and password). The vServer can be a vCenter server, an ESXi host for vSphere, a Hyper-V server, or an SVCMM server for Hyper-V. Once this information is configured, DD VE will collect performance statistics from the vServer every 5 minutes.</td>
</tr>
<tr>
<td>vserver config reset</td>
<td>Reset the vServer credentials for DD VE to their default values.</td>
</tr>
<tr>
<td>vserver config show</td>
<td>Display the vServer credentials for DD VE.</td>
</tr>
</tbody>
</table>

Modified DD OS Commands

The behavior of the following commands has been modified on the DD VE platform:

Table 19 Modified DD OS Commands

<table>
<thead>
<tr>
<th>Command</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>alert</td>
<td>The tenant-unit parameter is not supported.</td>
</tr>
<tr>
<td>compression</td>
<td>The tenant-unit parameter is not supported.</td>
</tr>
<tr>
<td>config setup show</td>
<td>Arguments for configuring features not available in DD VE have been removed.</td>
</tr>
<tr>
<td>ddbboost clients show active</td>
<td>The tenant-unit parameter is not supported.</td>
</tr>
<tr>
<td>ddbboost file-replication show active</td>
<td>The tenant-unit parameter is not supported.</td>
</tr>
<tr>
<td>ddbboost file-replication show detailed-file-history</td>
<td>The tenant-unit parameter is not supported.</td>
</tr>
<tr>
<td>ddbboost file-replication show file-history</td>
<td>The tenant-unit parameter is not supported.</td>
</tr>
<tr>
<td>ddbboost option reset</td>
<td>The fc parameter is not supported.</td>
</tr>
</tbody>
</table>
Table 19 Modified DD OS Commands (continued)

<table>
<thead>
<tr>
<th>Command</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>ddboost option show</td>
<td>The fc parameter is not supported.</td>
</tr>
<tr>
<td>ddboost storage-unit create</td>
<td>The tenant-unit parameter is not supported.</td>
</tr>
<tr>
<td>ddboost storage-unit modify</td>
<td>The tenant-unit parameter is not supported.</td>
</tr>
<tr>
<td>ddboost storage-unit show</td>
<td>The tenant-unit parameter is not supported.</td>
</tr>
<tr>
<td>ddboost streams show active</td>
<td>The tenant-unit parameter is not supported.</td>
</tr>
<tr>
<td>ddboost streams show history</td>
<td>The tenant-unit parameter is not supported.</td>
</tr>
<tr>
<td>disk rescan</td>
<td>The &lt;encllosure-ID&gt;.&lt;disk-ID&gt; parameter is not supported.</td>
</tr>
<tr>
<td>disk show state</td>
<td>DD VE system disks show the System Dev state.</td>
</tr>
<tr>
<td>disk show stats</td>
<td>The DD VE format for this command is disk show stats [dev &lt;n&gt;]</td>
</tr>
<tr>
<td>disk status</td>
<td>The Spare row has been removed from the output. The System row has been added.</td>
</tr>
<tr>
<td>enclosure show all</td>
<td>The [&lt;enclosure&gt;] parameter is not supported.</td>
</tr>
<tr>
<td>enclosure show controllers</td>
<td>The [&lt;enclosure&gt;] parameter is not supported.</td>
</tr>
<tr>
<td>enclosure show cpus</td>
<td>The [&lt;enclosure&gt;] parameter is not supported.</td>
</tr>
<tr>
<td>enclosure show io-cards</td>
<td>The [&lt;enclosure&gt;] parameter is not supported.</td>
</tr>
<tr>
<td>enclosure show memory</td>
<td>The [&lt;enclosure&gt;] parameter is not supported.</td>
</tr>
<tr>
<td>filesystems encryption keys delete</td>
<td>The [tier {active</td>
</tr>
<tr>
<td>filesystems encryption keys show</td>
<td>The [tier {active</td>
</tr>
<tr>
<td>filesystems fastcopy</td>
<td>The [retention-lock] parameter is not supported.</td>
</tr>
<tr>
<td>filesystems show compression</td>
<td>The [tier {active</td>
</tr>
</tbody>
</table>
### Table 19 Modified DD OS Commands (continued)

<table>
<thead>
<tr>
<th>Command</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>filesys show space</code></td>
<td>The tier {active</td>
</tr>
<tr>
<td><code>mtree create</code></td>
<td>The tenant-unit parameter is not supported.</td>
</tr>
<tr>
<td><code>mtree list</code></td>
<td>The tenant-unit parameter is not supported.</td>
</tr>
<tr>
<td><code>mtree show compression</code></td>
<td>The tenant-unit and tenant-unit parameters are not supported.</td>
</tr>
<tr>
<td><code>mtree show performance</code></td>
<td>The tenant-unit parameter is not supported.</td>
</tr>
<tr>
<td><code>net create interface</code></td>
<td>The &lt;virtual-ifname&gt; parameter is not supported.</td>
</tr>
<tr>
<td><code>net destroy</code></td>
<td>The &lt;virtual-ifname&gt; parameter is not supported.</td>
</tr>
<tr>
<td><code>perf</code></td>
<td>The vtl option is not supported on any perf command.</td>
</tr>
<tr>
<td><code>storage add</code></td>
<td>The tier, enclosure, and disk parameters are not supported.</td>
</tr>
<tr>
<td><code>storage remove</code></td>
<td>The tier, enclosure, and disk parameters are not supported.</td>
</tr>
<tr>
<td><code>storage show</code></td>
<td>The archive option is not supported.</td>
</tr>
<tr>
<td><code>system show stats</code></td>
<td>NVRAM statistics are not reported, because DD VE systems do not have physical NVRAM.</td>
</tr>
<tr>
<td><code>quota</code></td>
<td>The tenant-unit parameter is not supported.</td>
</tr>
<tr>
<td><code>replication</code></td>
<td>MTree replication is the only type of replication supported.</td>
</tr>
<tr>
<td><code>snapshot</code></td>
<td>The tenant-unit parameter is not supported.</td>
</tr>
</tbody>
</table>

### Unsupported DD OS Commands

The following DD OS commands and command options are not supported on the DD VE platform.
<table>
<thead>
<tr>
<th>Unsupported Command or Command Option</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>adminaccess https generate certificate</td>
<td>Deprecated. Use adminaccess certificate generate instead.</td>
</tr>
<tr>
<td>alerts add</td>
<td>Deprecated. Use alerts notify-list add instead.</td>
</tr>
<tr>
<td>alerts del</td>
<td>Deprecated. Use alerts notify-list del instead.</td>
</tr>
<tr>
<td>alerts notify-list option set group-name tenant-alert-summary {enabled</td>
<td>Deprecated. Use alerts notify-list option set group-name tenant-alert-summary instead.</td>
</tr>
<tr>
<td>alerts notify-list option reset group-name tenant-alert-summary</td>
<td></td>
</tr>
<tr>
<td>alerts reset</td>
<td>Deprecated. Use alerts notify-list reset instead.</td>
</tr>
<tr>
<td>alerts show alerts-list</td>
<td>Deprecated. Use alerts notify-list show instead.</td>
</tr>
<tr>
<td>alerts test</td>
<td>Deprecated. Use alerts notify-list test instead.</td>
</tr>
<tr>
<td>archive</td>
<td></td>
</tr>
<tr>
<td>authorization</td>
<td></td>
</tr>
<tr>
<td>autosupport display</td>
<td>Deprecated. Use autosupport show report instead.</td>
</tr>
<tr>
<td>autosupport reset support-list</td>
<td>Deprecated. Use autosupport show { all</td>
</tr>
<tr>
<td>autosupport show support-list</td>
<td></td>
</tr>
<tr>
<td>cifs set authentication nt4</td>
<td>Deprecated. Use cifs set authentication active-directory instead.</td>
</tr>
<tr>
<td>cluster</td>
<td></td>
</tr>
<tr>
<td>ddboost fc</td>
<td></td>
</tr>
<tr>
<td>ddboost option reset fc</td>
<td></td>
</tr>
<tr>
<td>ddboost option show fc</td>
<td></td>
</tr>
<tr>
<td>ddboost show image-duplication</td>
<td>Deprecated. Use ddboost file-replication show instead.</td>
</tr>
<tr>
<td>ddboost user option set user default-tenant-unit tenant-unit</td>
<td></td>
</tr>
<tr>
<td>ddboost user option reset user [default-tenant-unit]</td>
<td></td>
</tr>
<tr>
<td>disk add devdisk-id [spindle-group 1-16]</td>
<td>Deprecated. Use storage add instead.</td>
</tr>
<tr>
<td>disk add enclosure enclosure-id</td>
<td>Deprecated. Use storage add instead.</td>
</tr>
<tr>
<td>disk expand</td>
<td>Deprecated. Use storage add instead.</td>
</tr>
<tr>
<td>disk failenclosure-id.disk-id</td>
<td></td>
</tr>
</tbody>
</table>
### Table 20 Unsupported Commands and Command Options (continued)

<table>
<thead>
<tr>
<th>Unsupported Command or Command Option</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>disk multipath</td>
<td></td>
</tr>
<tr>
<td>disk port</td>
<td></td>
</tr>
<tr>
<td>disk rescan [enclosure-id.disk-id]</td>
<td></td>
</tr>
<tr>
<td>disk show detailed-raid-info</td>
<td>Deprecated. Use <code>disk show state</code> and <code>storage show</code> instead.</td>
</tr>
<tr>
<td>disk show failure-history</td>
<td></td>
</tr>
<tr>
<td>disk show raid-info</td>
<td>Deprecated. Use <code>disk show state</code> and <code>storage show</code> instead.</td>
</tr>
<tr>
<td>disk show reliability-data</td>
<td></td>
</tr>
<tr>
<td>disk unfail</td>
<td></td>
</tr>
<tr>
<td>enclosure beacon</td>
<td></td>
</tr>
<tr>
<td>enclosure show all [enclosure]</td>
<td>This command is supported, but not with the <code>enclosure</code> argument.</td>
</tr>
<tr>
<td>enclosure show chassis</td>
<td></td>
</tr>
<tr>
<td>enclosure show controllers enclosure</td>
<td>This command is supported, but not with the <code>enclosure</code> argument.</td>
</tr>
<tr>
<td>enclosure show cpus [enclosure]</td>
<td>This command is supported, but not with the <code>enclosure</code> argument.</td>
</tr>
<tr>
<td>enclosure show fans</td>
<td></td>
</tr>
<tr>
<td>enclosure show io-cards [enclosure]</td>
<td>This command is supported, but not with the <code>enclosure</code> argument.</td>
</tr>
<tr>
<td>enclosure show memory [enclosure]</td>
<td>This command is supported, but not with the <code>enclosure</code> argument.</td>
</tr>
<tr>
<td>enclosure show nvramp</td>
<td></td>
</tr>
<tr>
<td>enclosure show powersupply</td>
<td></td>
</tr>
<tr>
<td>enclosure show summary</td>
<td></td>
</tr>
<tr>
<td>enclosure show temperature-sensors</td>
<td></td>
</tr>
<tr>
<td>enclosure show topology</td>
<td></td>
</tr>
<tr>
<td>enclosure test topology</td>
<td></td>
</tr>
<tr>
<td>filesystems archive</td>
<td></td>
</tr>
<tr>
<td>filesystems clean update-stats</td>
<td>Deprecated. Use <code>filesystems show space</code> instead.</td>
</tr>
<tr>
<td>filesystems encryption</td>
<td></td>
</tr>
<tr>
<td>filesystems encryption passphrase change</td>
<td>Deprecated. Use <code>system passphrase change</code> instead.</td>
</tr>
<tr>
<td>filesystems retention-lock</td>
<td>Deprecated. Use <code>mtree retention-lock</code> instead.</td>
</tr>
<tr>
<td>filesystems show compression tier</td>
<td>The <code>tier</code> option is not supported.</td>
</tr>
</tbody>
</table>
### Table 20 Unsupported Commands and Command Options (continued)

<table>
<thead>
<tr>
<th>Unsupported Command or Command Option</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>filesys show history</td>
<td>Deprecated. Use <code>filesys show compression daily</code> instead.</td>
</tr>
<tr>
<td>filesys show space</td>
<td></td>
</tr>
<tr>
<td>ipmi</td>
<td>The <code>archive-unit</code> and <code>tier</code> options are not supported in DD VE.</td>
</tr>
<tr>
<td>license</td>
<td>The <code>license</code> commands are not supported because DD VE uses new <code>elicense</code> commands.</td>
</tr>
<tr>
<td>mtree retention-lock</td>
<td></td>
</tr>
<tr>
<td>mtree show compression <code>mtree_path</code> tier</td>
<td></td>
</tr>
<tr>
<td>net aggregate</td>
<td></td>
</tr>
<tr>
<td>net config <code>ifname</code> type cluster</td>
<td></td>
</tr>
<tr>
<td>net create interface <code>virtual-ifname</code></td>
<td></td>
</tr>
<tr>
<td>net create interface <code>physical-ifname</code> vlan vlan-id</td>
<td></td>
</tr>
<tr>
<td>net create virtual <code>vethid</code></td>
<td></td>
</tr>
<tr>
<td>net destroy <code>virtual-ifname</code></td>
<td></td>
</tr>
<tr>
<td>net destroy <code>vlan-ifname</code></td>
<td></td>
</tr>
<tr>
<td>net failover</td>
<td></td>
</tr>
<tr>
<td>net modify <code>virtual-ifname</code> bonding {aggregate</td>
<td>failover}</td>
</tr>
<tr>
<td>net set portnaming</td>
<td></td>
</tr>
<tr>
<td>ndmp</td>
<td></td>
</tr>
<tr>
<td>ndmpd</td>
<td></td>
</tr>
<tr>
<td>nfs option enable <code>report-replica-as-writable</code></td>
<td>Deprecated. Use <code>filesys option enable report-replica-as-writable</code></td>
</tr>
<tr>
<td>nfs option reset <code>report-replica-as-writable</code></td>
<td>Deprecated. Use <code>filesys option reset report-replica-as-writable</code></td>
</tr>
<tr>
<td>nfs option show <code>report-replica-as-writable</code></td>
<td>Deprecated. Use <code>filesys option show report-replica-as-writable</code></td>
</tr>
<tr>
<td>perf * module vtl</td>
<td></td>
</tr>
<tr>
<td>san</td>
<td></td>
</tr>
<tr>
<td>snapshot add schedule <code>name</code> [days days] time time [,time...] [retention period]</td>
<td>Deprecated. Use <code>snapshot schedule create</code> instead.</td>
</tr>
<tr>
<td>snapshot add schedule <code>name</code> [days days] time <code>every</code> mins [retention period]</td>
<td>Deprecated. Use <code>snapshot schedule create</code> instead.</td>
</tr>
</tbody>
</table>
Table 20 Unsupported Commands and Command Options (continued)

<table>
<thead>
<tr>
<th>Unsupported Command or Command Option</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>snapshot add schedule name [days days] time-time [every hrs</td>
<td>mins] [retention period]</td>
</tr>
<tr>
<td>snapshot del schedule {name</td>
<td>all}</td>
</tr>
<tr>
<td>snapshot modify schedule name [[days days]</td>
<td>time time [,time...]</td>
</tr>
<tr>
<td>snapshot modify schedule name [[days days]</td>
<td>time time every {mins</td>
</tr>
<tr>
<td>snapshot modify schedule name [[days days]</td>
<td>time time-time [every {hrs</td>
</tr>
<tr>
<td>snapshot reset schedule</td>
<td>Deprecated. Use snapshot schedule reset instead.</td>
</tr>
<tr>
<td>snapshot show schedule</td>
<td>Deprecated. Use snapshot schedule show instead.</td>
</tr>
<tr>
<td>storage add enclosure enclosure-id</td>
<td></td>
</tr>
<tr>
<td>storage add disk enclosure-id.disk-id</td>
<td></td>
</tr>
<tr>
<td>storage remove enclosure enclosure-id</td>
<td></td>
</tr>
<tr>
<td>storage remove disk enclosure_id.disk-id</td>
<td></td>
</tr>
<tr>
<td>system firmware</td>
<td></td>
</tr>
<tr>
<td>system option set console</td>
<td></td>
</tr>
<tr>
<td>system retention-lock</td>
<td></td>
</tr>
<tr>
<td>system sanitize</td>
<td></td>
</tr>
<tr>
<td>system show anaconda</td>
<td></td>
</tr>
<tr>
<td>system show controller-inventory</td>
<td></td>
</tr>
<tr>
<td>system show nvram</td>
<td></td>
</tr>
<tr>
<td>system show nvram-detailed</td>
<td></td>
</tr>
<tr>
<td>system show oemid</td>
<td></td>
</tr>
<tr>
<td>system upgrade continue</td>
<td></td>
</tr>
<tr>
<td>user</td>
<td></td>
</tr>
<tr>
<td>user change priv</td>
<td>Deprecated, with no replacement.</td>
</tr>
<tr>
<td>vtl lunmask</td>
<td>Deprecated. Use vtl group instead.</td>
</tr>
<tr>
<td>vtl lunmask add</td>
<td>Deprecated. Use vtl group add instead.</td>
</tr>
<tr>
<td>vtl lunmask del</td>
<td>Deprecated.</td>
</tr>
<tr>
<td>vtl lunmask show</td>
<td>Deprecated. Use vtl group show instead.</td>
</tr>
</tbody>
</table>
Performance Troubleshooting

You can check DD VE performance statistics with the native tools available in VMware vCenter or ESXi, or Microsoft Hyper-V.

You can also use the `perf show` and `disk benchmark` commands in DD OS to monitor and benchmark performance. See Extensions to DD OS for DD VE on page 74 for information about these commands.

CPU Performance
The two key statistics for CPU performance are:

- CPU usage: CPU usage as a percentage during the interval
- CPU ready: the percentage of time that the virtual machine was ready, but could not get scheduled to run on the physical CPU. This counter might not be displayed by default.

If these counters are high, there may be a performance problem on the hypervisor host.

Memory Performance
The key statistic for memory performance is memory swapping, the current amount of guest physical memory swapped out to the virtual machine’s swap file. This value should always be zero. If it is not, there is a memory resource contention on the hypervisor host, which is likely to have a severe impact on DD VE performance.

Virtual Disk Performance
The key statistics for virtual disk performance are:

- I/O throughput: a decrease in these values indicates a performance issue.
- I/O latency: an increase in read and write latency values indicates a performance problem.

Failed commands: an increase in the average number of outstanding read and write requests indicates a performance problem.

Note
The controls and names for these statistics and counters are quite different in some versions of the vSphere client, and between VMware and Microsoft hypervisors. See your hypervisor documentation for help displaying these statistics in your environment.

Migrating DD VE

The virtual machine running DD VE supports live migration and cold migration in VMware vCenter environments. The virtual machine running DD VE supports live migration in Hyper-V environments. DD VE supports live migration and cold migration.

Note
After changing the virtual host, verify the network adapters are connected with the correct network label, otherwise the virtual machine will not be able to acquire an IP address. The system generates a warning when a virtual machine host does not have the network label available.
Note

DD VE uses dynamic mac address on Hyper-V platform. When you perform DD VE migration on Hyper-V, the mac address may change. Use DHCP so that IP address will change. However, if you want to keep the MAC address, you can configure DD VE with static mode before migration. For additional information, see *Hyper-V and Dynamic MAC Address Regeneration* at https://blogs.msdn.microsoft.com and *Understanding MAC Address Behavior During Hyper-V Live Migration* at http://www.virtualizationadmin.com