# Deploy virtual machine grid nodes (VMware)

## StorageGRID software

NetApp
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## Collect information about your deployment environment

Before deploying grid nodes, you must collect information about your network configuration and VMware environment.

> ⓘ It is more efficient to perform one single installation of all the nodes, rather than installing some nodes now and some nodes later.

### VMware information

You must access the deployment environment and collect information about the VMware environment; the networks that were created for the Grid, Admin, and Client Networks; and the storage volume types you plan to use for Storage Nodes.

You must collect information about your VMware environment, including the following:

- The username and password for a VMware vSphere account that has appropriate permissions to complete the deployment.
- Host, datastore, and network configuration information for each StorageGRID node virtual machine.

> ⓘ VMware live vMotion causes the virtual machine clock time to jump and is not supported for grid nodes of any type. Though rare, incorrect clock times can result in loss of data or configuration updates.

### Grid Network information

You must collect information about the VMware network created for the StorageGRID Grid Network (required), including:

- The network name.
- The method used to assign IP addresses, either static or DHCP.
  - If you are using static IP addresses, the required networking details for each grid node (IP address, gateway, network mask).
  - If you are using DHCP, the IP address of the primary Admin Node on the Grid Network. See How grid nodes discover the primary Admin Node for more information.

### Admin Network information

For nodes that will be connected to the optional StorageGRID Admin Network, you must collect information about the VMware network created for this network, including:

- The network name.
- The method used to assign IP addresses, either static or DHCP.
  - If you are using static IP addresses, the required networking details for each grid node (IP address, gateway, network mask).

◦ If you are using DHCP, the IP address of the primary Admin Node on the Grid Network. See How grid nodes discover the primary Admin Node for more information.

• The external subnet list (ESL) for the Admin Network.

## Client Network information

For nodes that will be connected to the optional StorageGRID Client Network, you must collect information about the VMware network created for this network, including:

• The network name.

• The method used to assign IP addresses, either static or DHCP.

• If you are using static IP addresses, the required networking details for each grid node (IP address, gateway, network mask).

## Information about additional interfaces

You can optionally add trunk or access interfaces to the VM in vCenter after you install the node. For example, you might want to add a trunk interface to an Admin or Gateway Node, so you can use VLAN interfaces to segregate the traffic belonging to different applications or tenants. Or, you might want to add an access interface to use in a high availability (HA) group.

The interfaces you add are displayed on the VLAN interfaces page and on the HA groups page in the Grid Manager.

• If you add a trunk interface, configure one or more VLAN interfaces for each new parent interface. See configure VLAN interfaces.

• If you add an access interface, you must add it directly to HA groups. See configure high availability groups.

## Storage volumes for virtual Storage Nodes

You must collect the following information for virtual machine-based Storage Nodes:

• The number and size of storage volumes (storage LUNs) you plan to add. See Storage and performance requirements.

## Grid configuration information

You must collect information to configure your grid:

• Grid license

• Network Time Protocol (NTP) server IP addresses

• DNS server IP addresses

# How grid nodes discover the primary Admin Node

Grid nodes communicate with the primary Admin Node for configuration and management. Each grid node must know the IP address of the primary Admin Node on the Grid Network.

To ensure that a grid node can access the primary Admin Node, you can do either of the following when deploying the node:

- You can use the ADMIN_IP parameter to enter the primary Admin Node's IP address manually.
- You can omit the ADMIN_IP parameter to have the grid node discover the value automatically. Automatic discovery is especially useful when the Grid Network uses DHCP to assign the IP address to the primary Admin Node.

Automatic discovery of the primary Admin Node is accomplished using a multicast domain name system (mDNS). When the primary Admin Node first starts up, it publishes its IP address using mDNS. Other nodes on the same subnet can then query for the IP address and acquire it automatically. However, because multicast IP traffic is not normally routable across subnets, nodes on other subnets can't acquire the primary Admin Node's IP address directly.

> ⓘ
> If you use automatic discovery:
>
> - You must include the ADMIN_IP setting for at least one grid node on any subnets that the primary Admin Node is not directly attached to. This grid node will then publish the primary Admin Node's IP address for other nodes on the subnet to discover with mDNS.
> - Ensure that your network infrastructure supports passing multi-cast IP traffic within a subnet.

# Deploy a StorageGRID node as a virtual machine

You use VMware vSphere Web Client to deploy each grid node as a virtual machine. During deployment, each grid node is created and connected to one or more StorageGRID networks.

If you need to deploy any StorageGRID appliance Storage Nodes, see Deploy appliance Storage Node.

Optionally, you can remap node ports or increase CPU or memory settings for the node before powering it on.

**Before you begin**
- You have reviewed how to plan and prepare for installation, and you understand the requirements for software, CPU and RAM, and storage and performance.
- You are familiar with VMware vSphere Hypervisor and have experience deploying virtual machines in this environment.

> ⓘ
> The `open-vm-tools` package, an open-source implementation similar to VMware Tools, is included with the StorageGRID virtual machine. You don't need to install VMware Tools manually.

- You have downloaded and extracted the correct version of the StorageGRID installation archive for VMware.

> ⚠
> If you are deploying the new node as part of an expansion or recovery operation, you must use the version of StorageGRID that is currently running on the grid.

- You have the StorageGRID Virtual Machine Disk (`.vmdk`) file:

```
NetApp-SG-version-SHA.vmdk
```

- You have the `.ovf` and `.mf` files for each type of grid node you are deploying:

| Filename | Description |
| --- | --- |
| `vsphere-primary-admin.ovf`<br><br>`vsphere-primary-admin.mf` | The template file and manifest file for the primary Admin Node. |
| `vsphere-non-primary-admin.ovf`<br><br>`vsphere-non-primary-admin.mf` | The template file and manifest file for a non-primary Admin Node. |
| `vsphere-storage.ovf`<br><br>`vsphere-storage.mf` | The template file and manifest file for a Storage Node. |
| `vsphere-gateway.ovf`<br><br>`vsphere-gateway.mf` | The template file and manifest file for a Gateway Node. |

- The `.vdmk`, `.ovf`, and `.mf` files are all in the same directory.
- You have a plan to minimize failure domains. For example, you should not deploy all Gateway Nodes on a single vSphere ESXi host.

> ⚠️ In a production deployment, don't run more than one Storage Node on a single virtual machine. Do not run multiple virtual machines on the same ESXi host if that would create an unacceptable failure-domain issue.

- If you are deploying a node as part of an expansion or recovery operation, you have the instructions for expanding a StorageGRID system or the recovery and maintenance instructions.
- If you are deploying a StorageGRID node as a virtual machine with storage assigned from a NetApp ONTAP system, you have confirmed that the volume does not have a FabricPool tiering policy enabled. For example, if a StorageGRID node is running as an virtual machine on a VMware host, ensure the volume backing the datastore for the node does not have a FabricPool tiering policy enabled. Disabling FabricPool tiering for volumes used with StorageGRID nodes simplifies troubleshooting and storage operations.

> ⓘ Never use FabricPool to tier any data related to StorageGRID back to StorageGRID itself. Tiering StorageGRID data back to StorageGRID increases troubleshooting and operational complexity.

**About this task**

Follow these instructions to initially deploy VMware nodes, add a new VMware node in an expansion, or replace a VMware node as part of a recovery operation. Except as noted in the steps, the node deployment procedure is the same for all node types, including Admin Nodes, Storage Nodes, and Gateway Nodes.

If you are installing a new StorageGRID system:

- You can deploy nodes in any order.

- You must ensure that each virtual machine can connect to the primary Admin Node over the Grid Network.

- You must deploy all grid nodes before configuring the grid.

If you are performing an expansion or recovery operation:

- You must ensure that the new virtual machine can connect to all other nodes over the Grid Network.

If you need to remap any of the node's ports, don't power on the new node until the port remap configuration is complete.

**Steps**

1. Using VCenter, deploy an OVF template.

   If you specify a URL, point to a folder containing the following files. Otherwise, select each of these files from a local directory.

   ```
   NetApp-SG-version-SHA.vmdk
   vsphere-node.ovf
   vsphere-node.mf
   ```

   For example, if this is the first node you are deploying, use these files to deploy the primary Admin Node for your StorageGRID system:

   ```
   NetApp-SG-version-SHA.vmdk
   vsphere-primary-admin.ovf
   vsphere-primary-admin.mf
   ```

2. Provide a name for the virtual machine.

   The standard practice is to use the same name for both the virtual machine and the grid node.

3. Place the virtual machine in the appropriate vApp or resource pool.

4. If you are deploying the primary Admin Node, read and accept the End User License Agreement.

   Depending on your version of vCenter, the order of the steps will vary for accepting the End User License Agreement, specifying the name of the virtual machine, and selecting a datastore.

5. Select storage for the virtual machine.

   If you are deploying a node as part of recovery operation, perform the instructions in the storage recovery step to add new virtual disks, reattach virtual hard disks from the failed grid node, or both.

   When deploying a Storage Node, use 3 or more storage volumes, with each storage volume being 4 TB or larger. You must assign at least 4 TB to volume 0.

(i) The Storage Node .ovf file defines several VMDKs for storage. Unless these VMDKs meet your storage requirements, you should remove them and assign appropriate VMDKs or RDMs for storage before powering up the node. VMDKs are more commonly used in VMware environments and are easier to manage, while RDMs might provide better performance for workloads that use larger object sizes (for example, greater than 100 MB).

(i) Some StorageGRID installations might use larger, more active storage volumes than typical virtualized workloads. You might need to tune some hypervisor parameters, such as `MaxAddressableSpaceTB`, to achieve optimal performance. If you encounter poor performance, contact your virtualization support resource to determine whether your environment could benefit from workload-specific configuration tuning.

6. Select networks.

   Determine which StorageGRID networks the node will use by selecting a destination network for each source network.

   ◦ The Grid Network is required. You must select a destination network in the vSphere environment. +
     The Grid Network is used for all internal StorageGRID traffic. It provides connectivity among all nodes in the grid, across all sites and subnets. All nodes on the Grid Network must be able to communicate with all other nodes.

   ◦ If you use the Admin Network, select a different destination network in the vSphere environment. If you don't use the Admin Network, select the same destination you selected for the Grid Network.

   ◦ If you use the Client Network, select a different destination network in the vSphere environment. If you don't use the Client Network, select the same destination you selected for the Grid Network.

   ◦ If you use an Admin or Client network, nodes do not have to be on the same Admin or Client networks.

7. For **Customize Template**, configure the required StorageGRID node properties.

   a. Enter the **Node name**.

      (i) If you are recovering a grid node, you must enter the name of the node you are recovering.

   b. Use the **Temporary installation password** drop-down to specify a temporary installation password, so that you can access the VM console or the StorageGRID Installation API, or use SSH, before the new node joins the grid.

      (i) The temporary installation password is only used during node installation. After a node has been added to the grid, you can access it using the node console password, which is listed in the `Passwords.txt` file in the Recovery Package.

      ▪ **Use node name**: The value you provided for the **Node name** field is used as the temporary installation password.

      ▪ **Use custom password**: A custom password is used as the temporary installation password.

      ▪ **Disable password**: No temporary installation password will be used. If you need to access the VM to debug installation issues, see Troubleshoot installation issues.

   c. If you selected **Use custom password**, specify the temporary installation password you want to use in the **Custom password** field.

   d. In the **Grid Network (eth0)** section, select STATIC or DHCP for the **Grid network IP configuration**.

- If you select STATIC, enter the **Grid network IP**, **Grid network mask**, **Grid network gateway**, and **Grid network MTU**.

- If you select DHCP, the **Grid network IP**, **Grid network mask**, and **Grid network gateway** are automatically assigned.

e. In the **Primary Admin IP** field, enter the IP address of the primary Admin Node for the Grid Network.

> (i) This step does not apply if the node you are deploying is the primary Admin Node.

If you omit the primary Admin Node IP address, the IP address will be automatically discovered if the primary Admin Node, or at least one other grid node with ADMIN_IP configured, is present on the same subnet. However, it is recommended to set the primary Admin Node IP address here.

f. In the **Admin Network (eth1)** section, select STATIC, DHCP, or DISABLED for the **Admin network IP configuration**.

- If you don't want to use the Admin Network, select DISABLED and enter **0.0.0.0** for the Admin Network IP. You can leave the other fields blank.

- If you select STATIC, enter the **Admin network IP**, **Admin network mask**, **Admin network gateway**, and **Admin network MTU**.

- If you select STATIC, enter the **Admin network external subnet list**. You must also configure a gateway.

- If you select DHCP, the **Admin network IP**, **Admin network mask**, and **Admin network gateway** are automatically assigned.

g. In the **Client Network (eth2)** section, select STATIC, DHCP, or DISABLED for the **Client network IP configuration**.

- If you don't want to use the Client Network, select DISABLED and enter **0.0.0.0** for the Client Network IP. You can leave the other fields blank.

- If you select STATIC, enter the **Client network IP**, **Client network mask**, **Client network gateway**, and **Client network MTU**.

- If you select DHCP, the **Client network IP**, **Client network mask**, and **Client network gateway** are automatically assigned.

8. Review the virtual machine configuration and make any changes necessary.

9. When you are ready to complete, select **Finish** to start the upload of the virtual machine.

10. If you deployed this node as part of recovery operation and this is not a full-node recovery, perform these steps after deployment is complete:

a. Right-click the virtual machine, and select **Edit Settings**.

b. Select each default virtual hard disk that has been designated for storage, and select **Remove**.

c. Depending on your data recovery circumstances, add new virtual disks according to your storage requirements, reattach any virtual hard disks preserved from the previously removed failed grid node, or both.

Note the following important guidelines:

- If you are adding new disks you should use the same type of storage device that was in use before node recovery.

- The Storage Node .ovf file defines several VMDKs for storage. Unless these VMDKs meet your storage requirements, you should remove them and assign appropriate VMDKs or RDMs for

storage before powering up the node. VMDKs are more commonly used in VMware environments and are easier to manage, while RDMs might provide better performance for workloads that use larger object sizes (for example, greater than 100 MB).

11. If you need to remap the ports used by this node, follow these steps.

You might need to remap a port if your enterprise networking policies restrict access to one or more ports that are used by StorageGRID. See the networking guidelines for the ports used by StorageGRID.

> (i)    Don't remap the ports used in load balancer endpoints.

    a. Select the new VM.

    b. From the Configure tab, select **Settings** > **vApp Options**. The location of **vApp Options** depends on the version of vCenter.

    c. In the **Properties** table, locate PORT_REMAP_INBOUND and PORT_REMAP.

    d. To symmetrically map both inbound and outbound communications for a port, select **PORT_REMAP**.

> (i)    If only PORT_REMAP is set, the mapping that you specify applies to both inbound and outbound communications. If PORT_REMAP_INBOUND is also specified, PORT_REMAP applies only to outbound communications.

      i. Select **Set Value**.

      ii. Enter the port mapping:

```
<network type>/<protocol>/<default port used by grid node>/<new port>
```

        `<network type>` is grid, admin, or client, and `<protocol>` is tcp or udp.

        For example, to remap ssh traffic from port 22 to port 3022, enter:

```
client/tcp/22/3022
```

        You can remap multiple ports using a comma-separated list.

        For example:

```
client/tcp/18082/443, client/tcp/18083/80
```

      iii. Select **OK**.

    e. To specify the port used for inbound communications to the node, select **PORT_REMAP_INBOUND**.

> (i)    If you specify PORT_REMAP_INBOUND and don't specify a value for PORT_REMAP, outbound communications for the port are unchanged.

      i. Select **Set Value**.

      ii. Enter the port mapping:

```
<network type>/<protocol>/<remapped inbound port>/<default inbound port used by grid node>
```

        `<network type>` is grid, admin, or client, and `<protocol>` is tcp or udp.

For example, to remap inbound SSH traffic that is sent to port 3022 so that it is received at port 22 by the grid node, enter the following:

```
client/tcp/3022/22
```

You can remap multiple inbound ports using a comma-separated list.

For example:

```
grid/tcp/3022/22, admin/tcp/3022/22
```

     iii. Select **OK**

12. If you want to increase the CPU or memory for the node from the default settings:

    a. Right-click the virtual machine, and select **Edit Settings**.

    b. Change the number of CPUs or the amount of memory as required.

       Set the **Memory Reservation** to the same size as the **Memory** allocated to the virtual machine.

    c. Select **OK**.

13. Power on the virtual machine.

**After you finish**

If you deployed this node as part of an expansion or recovery procedure, return to those instructions to complete the procedure.