Clustering

This chapter describes clustering Threat Grid Appliances. It includes the following topics:

About Clustering Threat Grid Appliances

The ability to cluster multiple Threat Grid Appliances is available in v2.4.2 and later. Each Threat Grid Appliance in a cluster saves data in the shared file system, and has the same data as the other nodes in the cluster.

The main goal of clustering is to increase the capacity of a single system by joining several Threat Grid Appliances together into a cluster (consisting of 2 to 7 nodes). Clustering also helps support recovery from failure of one or more machines in the cluster, depending on the cluster size.

If you have questions about installing or reconfiguring clusters, contact Cisco Support for assistance to avoid possible destruction of data.

Clustering Features

Clustering Threat Grid Appliances offers the following features:

- **Shared Data** - Every Threat Grid Appliance in a cluster can be used as if it a standalone; each one is accessing and presenting the same data.

- **Sample Submissions Processing** - Submitted samples are processed on any one of the cluster members, with any other member able to see the analysis results.

- **Rate Limits** - The submission rate limits of each member are added up to become the cluster's limit.
- **Cluster Size** - The preferred cluster sizes are 3, 5, or 7 members; 2-, 4- and 6-node clusters are supported, but with availability characteristics similar to a degraded cluster (a cluster in which one or more nodes are not operational) of the next size up.
- **Tiebreaker** - When a cluster is configured to contain an even number of nodes, the one designated as the tiebreaker gets a second vote in the event of an election to decide which node has the primary database.

  Each node in a cluster contains a database, but only the database on the primary node is actually used; the others just have to be able to take over if and when the primary node goes down. Having a tiebreaker can prevent the cluster from being down when exactly half the nodes have failed, but only when the tiebreaker is not among the failed nodes.

  Odd-numbered clusters won't have a tied vote. In an odd-numbered cluster, the tiebreaker role only becomes relevant if a node (not the tiebreaker) is dropped from the cluster; it then becomes even-numbered.

Note This feature is fully tested only for clusters with two nodes.

Clustering Limitations

Clustering Threat Grid Appliances has the following limitations:

- When building a cluster of existing standalone Threat Grid Appliances, only the first node (the initial node) can retain its data. The other nodes must be manually reset because merging existing data into a cluster is not allowed.

  Remove existing data with the destroy-data command, as documented in Reset Threat Grid Appliance as Backup Restore Target

Important Do not use the Wipe Appliance feature as it will render the appliance inoperable until it's returned to Cisco for reimaging.

- Adding or removing nodes can result in brief outages, depending on cluster size and the role of the member nodes.
- Clustering on the M3 server is not supported. Contact support@threatgrid.com if you have any questions.

Clustering Requirements

The following requirements must be met when clustering Threat Grid Appliances:

- **Version** - All Threat Grid Appliances must be running the same version to set up a cluster in a supported configuration; it should always be the latest available version.
- **Clust Interface** - Each Threat Grid Appliance requires a direct interconnect to the other Threat Grid Appliances in the cluster; a SFP+ must be installed in the Clust interface slot on each Threat Grid Appliance in the cluster (not relevant in a standalone configuration).

Direct interconnect means that all Threat Grid Appliances must be on the same layer-two network segment, with no routing required to reach other nodes and no significant latency or jitter. Network topologies where the nodes are not on a single physical network segment are not supported.

- **Airgapped Deployments Discouraged** - Due to the increased complexity of debugging, appliance clustering is strongly discouraged in airgapped deployments or other scenarios where a customer is unable or unwilling to provide L3 support access to debug.
- **Data** - A Threat Grid Appliance can only be joined to a cluster when it does not contain data (only the initial node can contain data). Moving an existing Threat Grid Appliance into a data-free state requires the use of the database reset process (available in v2.2.4 or later).

Important Do not use the destructive Wipe Appliance process, which removes all data and renders the application inoperable until it's returned to Cisco for reimaging.

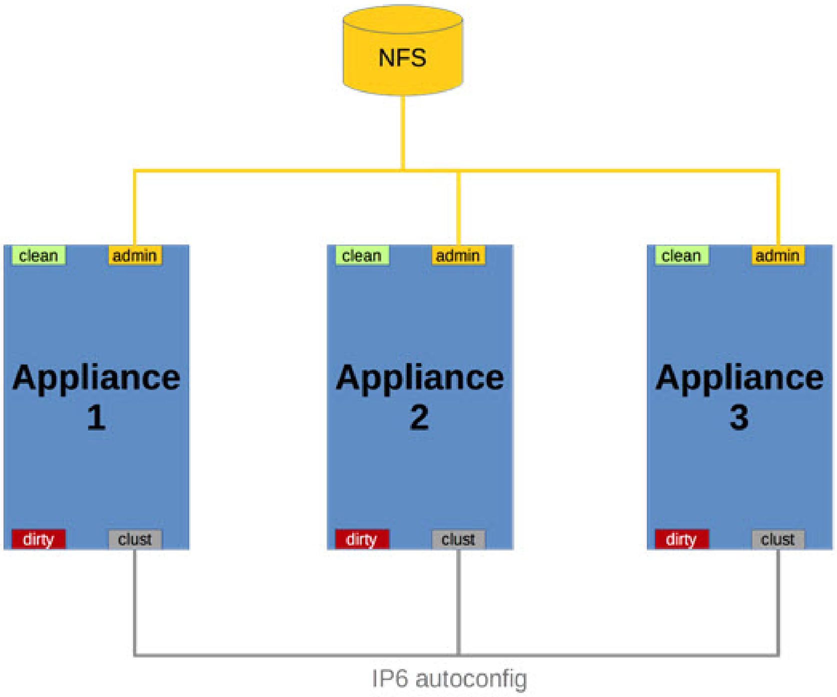
- **SSL Certificates** - If you are installing SSL certificates signed by a custom CA on one cluster node, then the certificates for all of the other nodes should be signed by the same CA.

Networking and NFS Storage

Clustering Threat Grid Appliances requires the following networking and NFS storage considerations:

- Threat Grid Appliance clusters require a NFS store to be enabled and configured. It must be available via the Admin interface, and must be accessible from all cluster nodes.
- Each cluster must be backed by a single NFS store with a single key. While that NFS store may be initialized with data from a pre-existing Threat Grid Appliance, it must not be accessed by any system that is not a member of the cluster while the cluster is in operation.
- The NFS store is a single point of failure, and the use of redundant, highly reliable equipment for that role is essential.

Figure 1: Clustering Network Diagram



Build Cluster Overview

Building a cluster in a supported manner requires that all members be on the same version, which should always be the latest available version. This may mean that all of the members have to be built standalone first to get fully updated.

If the Threat Grid Appliance has been in use as a standalone machine prior to clustering, only the data of the first member can be preserved. The others need to be reset as part of the build.

Start a new cluster with an initial node, and then join other Threat Grid Appliances to it. There are two distinct paths that are available to starting a new cluster:

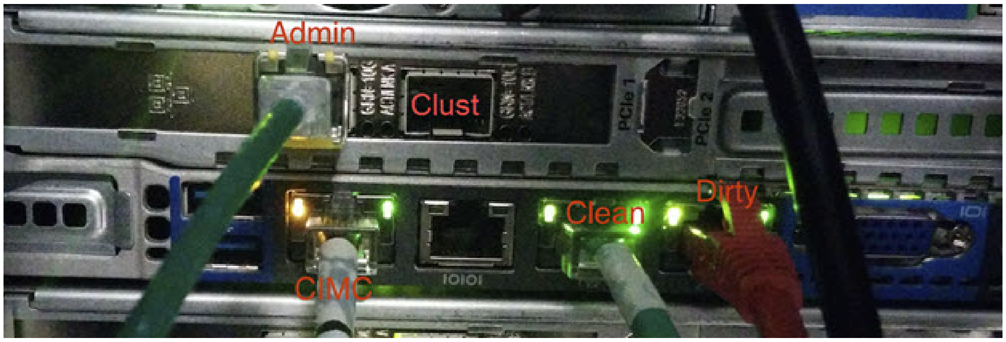
- Start a new cluster using an existing standalone Threat Grid Appliance.
- Start a new cluster using a new Threat Grid Appliance.

Clust Interface Setup

Each appliance in the cluster requires an additional SFP+ for the Clust interface.

Install a SFP+ module in the fourth (non-Admin) SFP port.

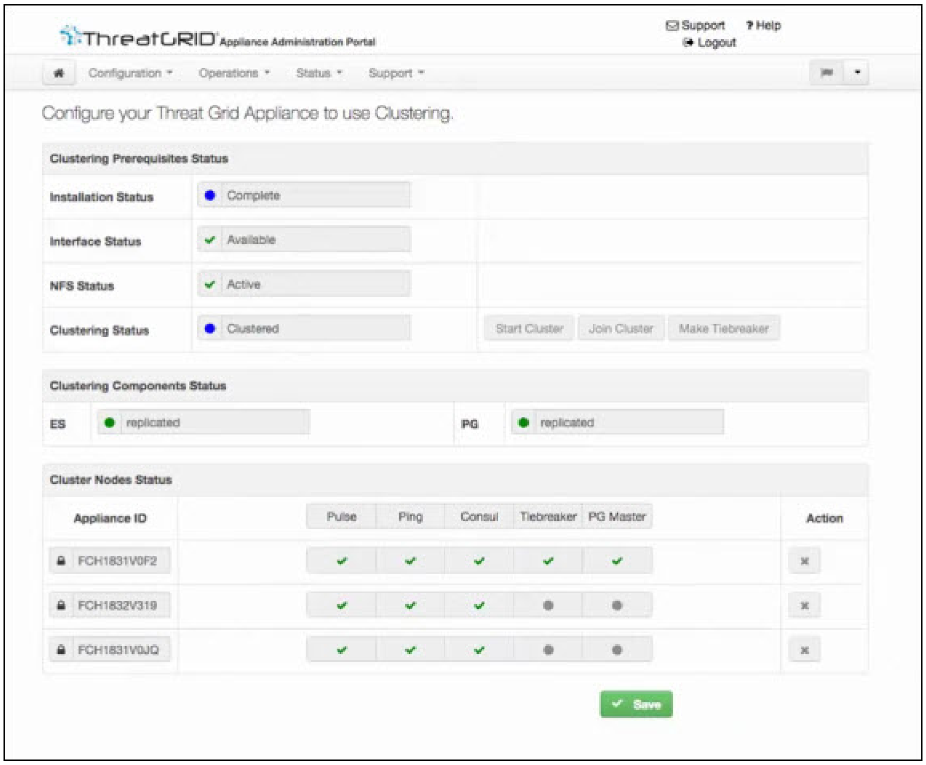
Figure 2: Clust Interface Setup for Cisco UCS M4 C220



Clustering Configuration

Clusters are configured and managed in the OpAdmin portal on the **Clustering** page **(Configuration > Clustering)**. This section describes the fields on the **Clustering** page to gain an understanding of an active and healthy cluster (the screenshot shows a cluster with three nodes).

Figure 3: Clustering Configuration for Active Cluster



Configure your Threat Grid Appliance to use Clustering.

Clustering Prerequisites Status

Installation Status	● Complete
Interface Status	✓ Available
NFS Status	✓ Active
Clustering Status	● Clustered

Clustering Components Status

ES	● replicated	PG	● replicated

Cluster Nodes Status

Appliance ID	Pulse	Ping	Consul	Tiebreaker	PG Master	Action
FCH1831V0F2	✓	✓	✓	✓	✓	×
FCH1832V319	✓	✓	✓	●	●	×
FCH1831V0JQ	✓	✓	✓	●	●	×

Clustering Prerequisites Status

- **Installation Status** - The installation status of the Threat Grid Appliance; the status must be **Complete** (fully set up and configured).
- **Interface Status** - The status of the Clust network interface.

- **NFS Status** - The status of NFS; the status must be **Available**.
- **Clustering Status** - Indicates whether the Threat Grid Appliance is a cluster node or standalone:
    - **Standalone (unsaved)** - Not yet configured as explicitly part of a cluster or as a standalone Threat Grid Appliance; you make this selection in the initial setup wizard if the prerequisites for clustering have been met.
    - **Standalone** - Configured as a standalone node; cannot be configured as part of a cluster without a reset.
    - **Clustered** - Is clustered with one or more other Threat Grid Appliances.

Clustering Components Status

- **ES** - Elasticsearch, the service used for queries that require search functionality.
- **PG** - PostgreSQL, the service used for queries that require up-to-date, definitive data (such as account lookups).

Both services are described with one of the following status values:

- **Replicated** - Everything is working properly. Additionally, everything required to take over on failure is also in place. The appliance is able to tolerate failure and continue working. Being in a replicated state does not mean that a failure will have zero downtime. Rather, a failure should entail zero data loss and constrained downtime (less than a minute in normal circumstances, with the exception of any active analysis on the specific cluster node that fails).

  Maintenance operations that bring down nodes should only be performed when the cluster is in the replicated state.

  For a fully replicated cluster, recovery should be automatic and require less than a minute to complete in any normal scenario.
- **Available** - Everything is working properly and the referenced service is available for use (that is, it can service API and user requests), but it is not replicated.
- **Unavailable** - The service is known to be non-functional.

Status Colors:

- **Green** - Replicated
- **Yellow** - Available
- **Red** - Unavailable
- **Grey** - Unknown

For more information, see the *Threat Grid Appliance Clustering FAQ* on Cisco.com.

Cluster Nodes Status

A green checkmark indicates the node is running and healthy.

A red X indicates that something is either not running yet or it's not healthy.

- **Pulse** - Indicates whether the node is actively connected to and using the NFS store (not during initial setup, but while running services).
- **Ping** - Describes whether the cluster node can be seen over the Clust interface.
- **Consul** - Indicates whether the node is participating in the consensus store. This requires both a network connection over Clust and a compatible encryption key.
- **Tiebreaker** - Designates the node as the tiebreaker, which will cast the deciding vote in an election to decide the cluster's primary node. See Designate Tiebreaker Node.
- **Keep Standalone** - Indicates that the Threat Grid Appliance should not be configured as a node in a cluster. Selecting this option allows the user to complete the OpAdmin configuration Wizard process for a non-clustered Threat Grid Appliance.

Start Cluster of Thread Grid Appliances

When you build a cluster of Threat Grid Appliances, you must start the cluster with the first node being either an existing standalone Threat Grid Appliance or a new appliance. Refer to the appropriate section for starting the cluster based on your environment.

Start Cluster with Existing Standalone Appliance

You can start building a cluster from an existing standalone Threat Grid Appliance. This method allows you to preserve existing data from one machine and use it to start a new cluster. An existing backup must be available on NFS from which the cluster is started.

Note All other nodes to be joined to the cluster must have data removed before joining; the data from additional nodes cannot be merged into the cluster.

Note In releases prior to v2.4.3, standalone Threat Grid Appliances with data backed up to NFS no longer require a database reset and restore-from-backup to become the initial node of a new cluster. If you have a Threat Grid Appliance with an earlier version, we suggest that you upgrade to v2.4.3 or later and then perform a reset operation prior to initializing a new cluster.

Perform the following steps to start a cluster for the first node:

Procedure

Step 1 Fully update the Threat Grid Appliance to the latest version. Depending on which version is currently running, this may require more than one update cycle to reach the latest version.

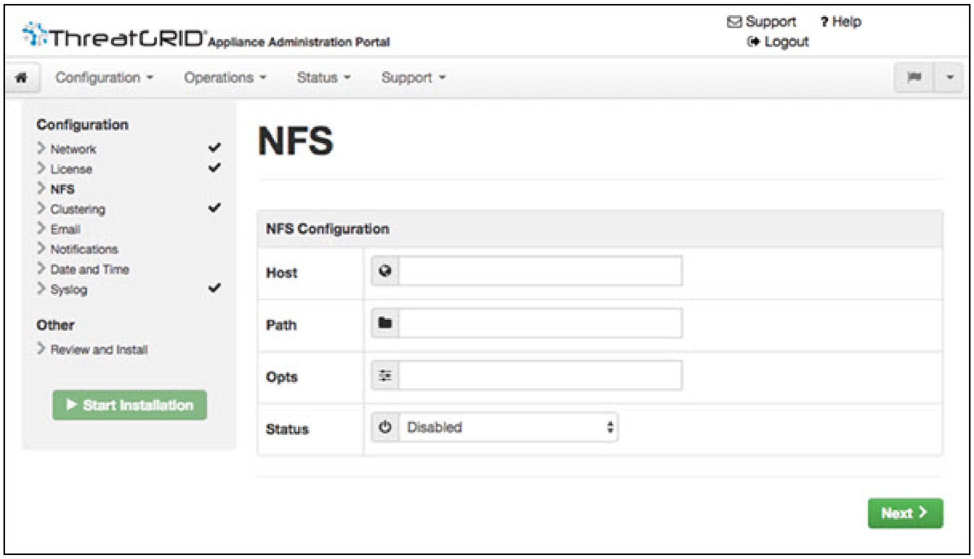
Step 2 If not already done, set up backup of the machine to NFS:

Note

This step describes the default Linux NFS server implementation, which you may need to adjust depending on your own server setup.

a) In the OpAdmin portal, click **Configuration** > **NFS** to open the **NFS** page.

Figure 4: NFS Configuration



NFS

NFS Configuration

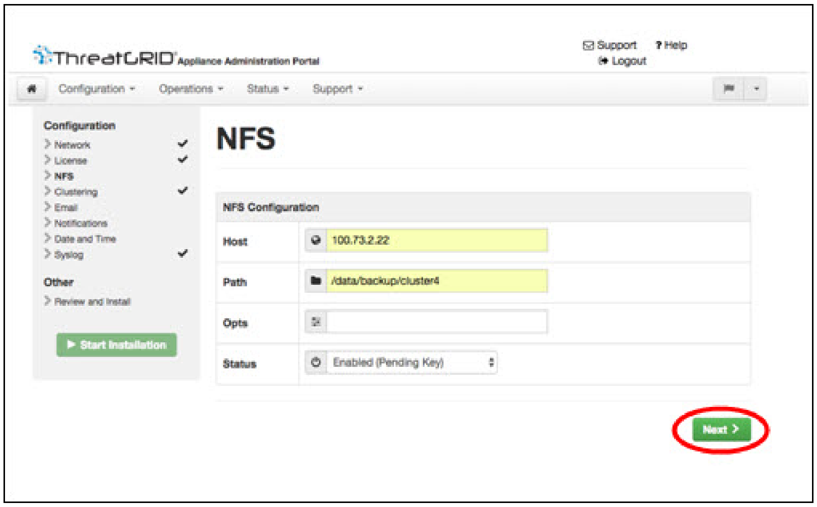
Host	
Path	
Opts	
Status	Disabled

b) Complete the following fields:

- **Host** - The NFSv4 host server. We recommend using the IP address.
- **Path** - The absolute path to the location on the NFS host server where files will be stored. This does not include the Key ID suffix, which will be added automatically.
- **Opts** - NFS mount options to be used, if this server requires any deviations from standard Linux defaults for NFSv4.
- **Status** - Choose **Enabled (Pending Key)** from the drop-down list.

c) Click **Next**.

Figure 5: NFS Configuration Enabled (Pending Key)



NFS

NFS Configuration

Host	100.73.2.22
Path	/data/backup/cluster4
Opts	
Status	Enabled (Pending Key)

The page refreshes and **Generate** button becomes available.

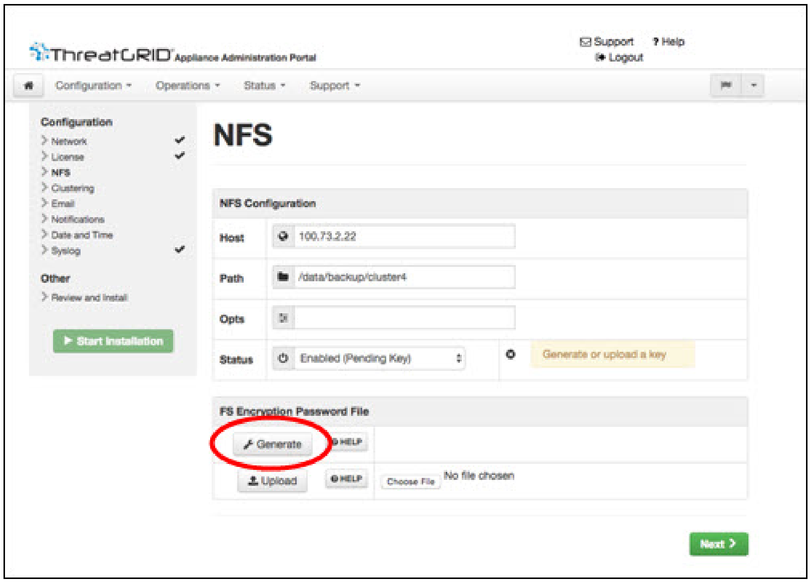
The first time you configure this page, the **Remove** and **Download** the encryption key buttons become visible.

The **Upload** button is available if you have NFS enabled but no key created. Once you create a key, the **Upload** button changes to **Download**. If you delete the key, the **Download** button becomes **Upload** again.

Note
If the key correctly matches the one used to create a backup, the **Key ID** displayed in OpAdmin after upload should match the name of a directory in the configured path. Backups cannot be restored without the encryption key. The configuration process includes the process of mounting the NFS store, mounting the encrypted data, and initializing the appliance's local datastores from the NFS store's contents.

d) Click **Generate** to generate a new NFS encryption key.

Figure 6: Generate a New NFS Encryption Key



NFS

NFS Configuration

Host	100.73.2.22
Path	/data/backup/cluster4
Opts	
Status	Enabled (Pending Key)

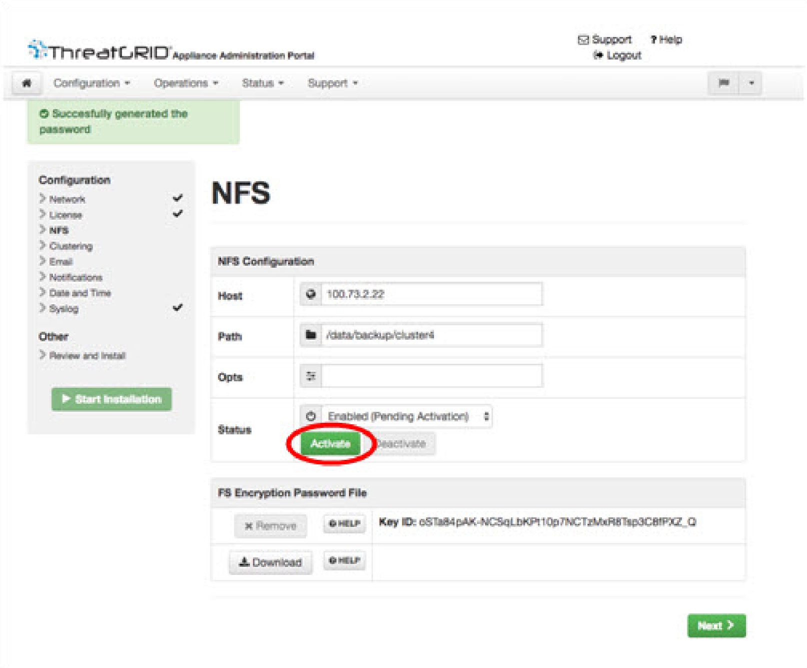
Generate or upload a key

FS Encryption Password File

No file chosen

e) Click **Next**. The page refreshes and the **Key ID** is displayed, and the **Activate** and **Download** buttons become available.

Figure 7: Activate the NFS Configuration



Succesfully generated the password

NFS

NFS Configuration

Host: 100.73.2.22

Path: /data/backup/cluster4

Opts:

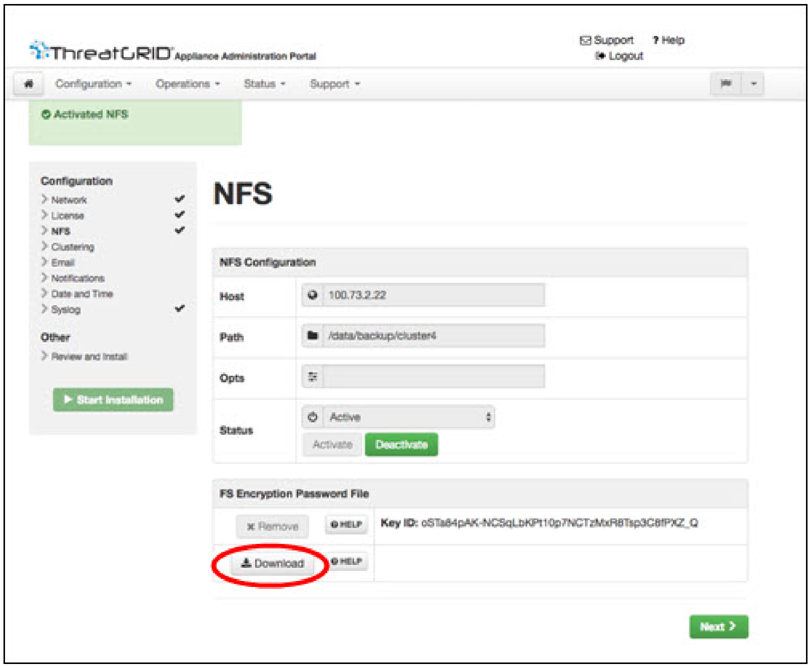
Status: Enabled (Pending Activation)

FS Encryption Password File

Key ID: oSTa84pAK-NCSqLbKPt10p7NCTzMxR8Tsp3C8fPXZ_Q

f) Click **Activate**. This will take a few seconds (the status indicator is located in the lower left corner). The **Status** becomes **Active**.

Figure 8: NFS Active



Activated NFS

NFS

NFS Configuration

Host: 100.73.2.22

Path: /data/backup/cluster4

Opts:

Status: Active

FS Encryption Password File

Key ID: oSTa84pAK-NCSqLbKPt10p7NCTzMxR8Tsp3C8fPXZ_Q

g) Click **Download** to download the backup encryption key. Save the generated file in a secure location. You will need the key for joining additional nodes to the cluster.

Important
If this step is missed, all data will be lost in the following steps.

Step 3 Complete the configuration, as needed, and reboot the Threat Grid Appliance to apply the NFS backup configuration.

Step 4 Perform a backup.

Note
If you do the backup at least 48 hours in advance, as recommended, and there are no service notices indicating problems with the backup, then the following manual steps are unnecessary.

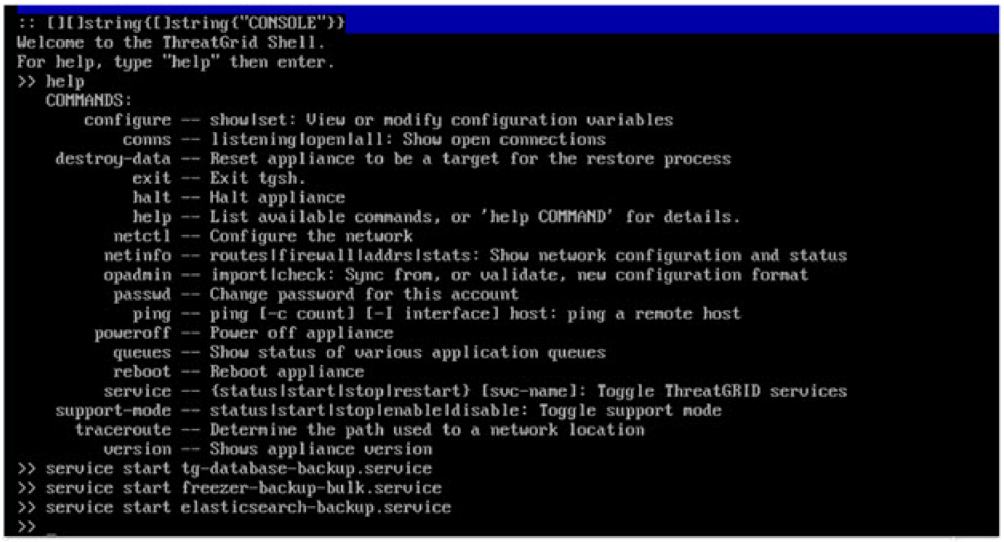
Backup and other service notices are available in the Threat Grid portal UI from the icon in the upper-right corner. If you see a service notice **There is no PostgreSQL backup yet**, then DO NOT PROCEED.

If you do the backup immediately after reboot, then you will need to manually initiate a backup of all data to NFS to ensure it's complete. Performing the manual backup commands is only necessary if you are setting up backup immediately before rebuilding the standalone box into a cluster.

a) Open **tgsh** and enter the following commands:

```
service start tg-database-backup.service
service start freezer-backup-bulk.service
service start elasticsearch-backup.service
```

Figure 9: Initiating a Backup of All Data to NFS



```
:: [][]string{[]string{"CONSOLE"}}
Welcome to the ThreatGrid Shell.
For help, type "help" then enter.
>> help
   COMMANDS:
       configure -- show|set: View or modify configuration variables
           conns -- listening|open|all: Show open connections
    destroy-data -- Reset appliance to be a target for the restore process
            exit -- Exit tgsh.
            halt -- Halt appliance
            help -- List available commands, or 'help COMMAND' for details.
          netctl -- Configure the network
         netinfo -- routes|firewall|addrs|stats: Show network configuration and status
         opadmin -- import|check: Sync from, or validate, new configuration format
          passwd -- Change password for this account
            ping -- ping [-c count] [-I interface] host: ping a remote host
        poweroff -- Power off appliance
          queues -- Show status of various application queues
          reboot -- Reboot appliance
         service -- {status|start|stop|restart} [svc-name]: Toggle ThreatGRID services
    support-mode -- status|start|stop|enable|disable: Toggle support mode
      traceroute -- Determine the path used to a network location
         version -- Shows appliance version
>> service start tg-database-backup.service
>> service start freezer-backup-bulk.service
>> service start elasticsearch-backup.service
>> _
```

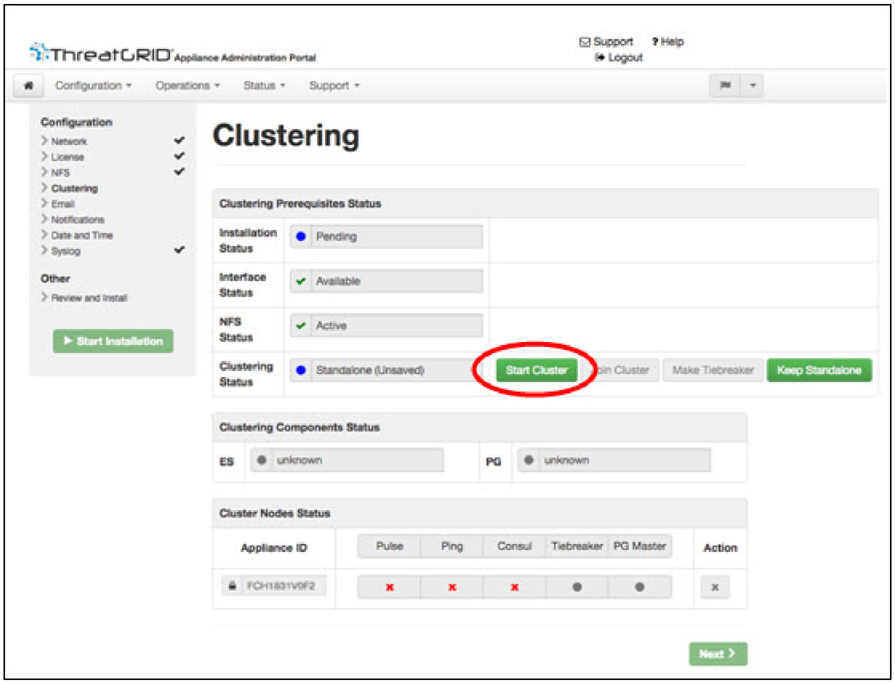
b) Wait about 5 minutes after the last command returns.

Step 5 In the Threat Grid portal UI, check for service notices. If any notices indicate a backup process failure, such as a warning that there is no PostgreSQL backup yet, then DO NOT PROCEED.

Important
Do not continue unless these processes have completed successfully.

Step 6 Navigate to **Configuration** > **Clustering**.

Figure 10: Start Cluster



Clustering

Clustering Prerequisites Status	
Installation Status	● Pending
Interface Status	✓ Available
NFS Status	✓ Active
Clustering Status	● Standalone (Unsaved)

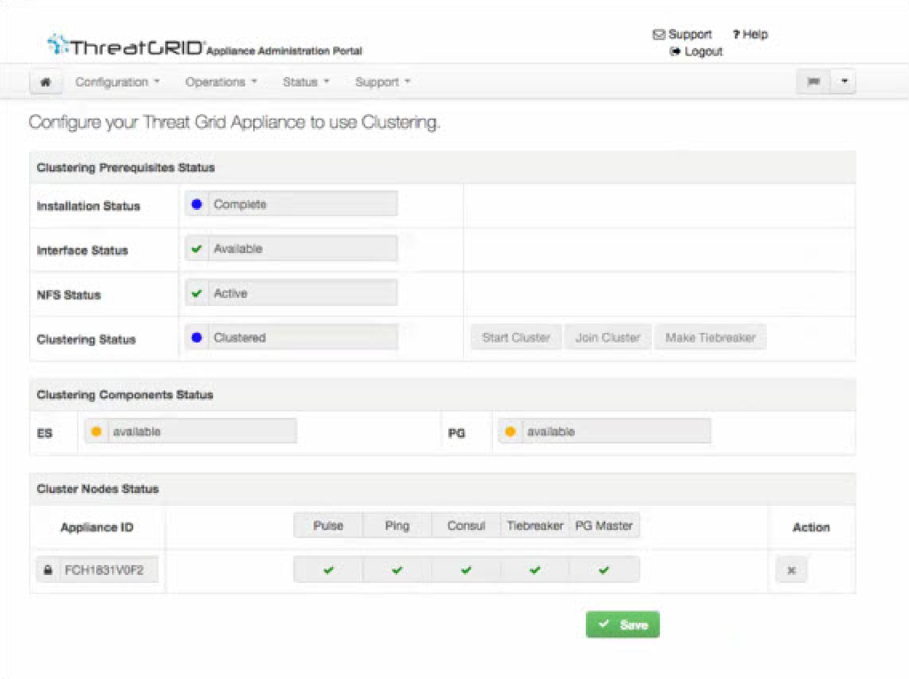
Clustering Components Status			
ES	● unknown	PG	● unknown

Appliance ID	Pulse	Ping	Consul	Tiebreaker	PG Master	Action
FCH1831V0F2	✕	✕	✕	●	●	✕

Step 7 Click **Start Cluster**.

Step 8 On the confirmation dialog, click **OK**. The **Clustering Status** changes to **Clustered**.

Figure 11: Clustering Status - Clustered



Configure your Threat Grid Appliance to use Clustering.

Clustering Prerequisites Status	
Installation Status	● Complete
Interface Status	✓ Available
NFS Status	✓ Active
Clustering Status	● Clustered

Clustering Components Status			
ES	● available	PG	● available

Appliance ID	Pulse	Ping	Consul	Tiebreaker	PG Master	Action
FCH1831V0F2	✓	✓	✓	✓	✓	✕

Once the data restore is complete, return to the **Clustering** page to check the health of the new cluster.

Step 9 Finish the installation. This initiates a restore of the data in cluster mode.

What to do next

Now you can begin joining other Threat Grid Appliances to the new cluster, as described in Join Threat Grid Appliances to Cluster.

Start Cluster with New Appliance

This method of starting a cluster can be used for new Threat Grid Appliances that are shipped with cluster-capable versions of the software, or for existing Threat Grid Appliances that have had their data reset.

Note Remove existing data with the `destroy-data` command, as documented in Reset Threat Grid Appliance as Backup Restore Target. Do not use the Wipe Appliance feature.

Procedure

Step 1 Set up and begin the OpAdmin configuration as normal.

Step 2 In OpAdmin, click **Configuration** > **NFS**.

Note
See the figures in Start Cluster with Existing Standalone Appliance.

Step 3 Configure the **Network** and **License**.

Step 4 On the NFS configuration page, complete the following fields:

- **Host** - The NFSv4 host server. We recommend using the IP address.
- **Path** - The absolute path to the location on the NFS host server where the files will be stored. This does not include the Key ID suffix, which will be added automatically.
- **Opts** - NFS mount options to be used, if this server requires any deviations from standard Linux defaults for NFSv4.
- **Status** - Choose **Enabled (Pending Key)** from the drop-down list.

Step 5 Click **Next**.

The page refreshes; the **Generate** and **Activate** buttons become available.

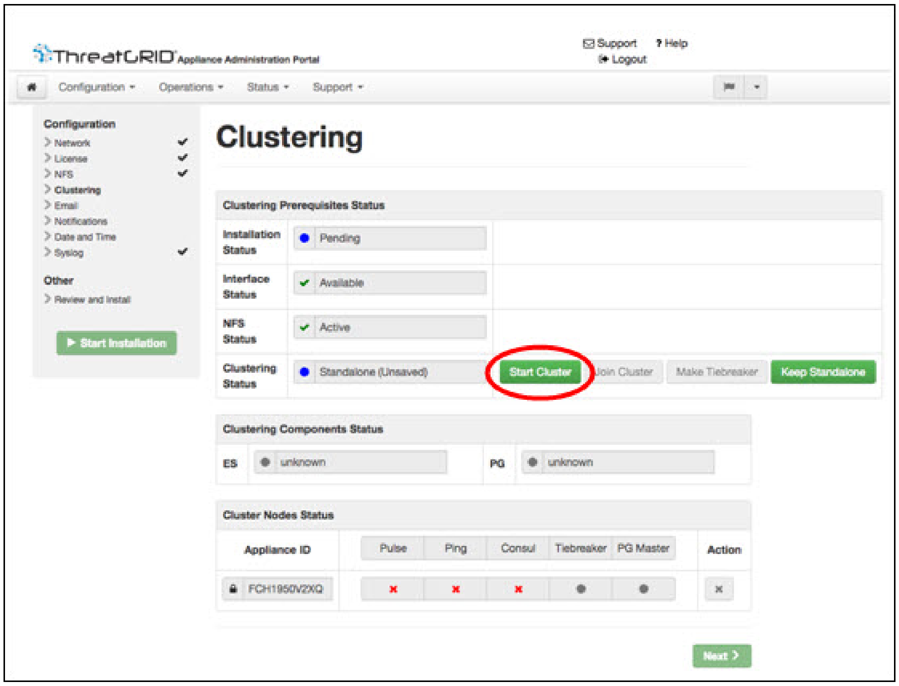
Step 6 Click **Generate** to generate a new NFS encryption key.

Step 7 Click **Activate**.

The **Status** changes to **Active**.

Step 8 Click **Download** to download a copy of the encryption key for safekeeping. You will need the key for joining additional nodes to the cluster.

Figure 12: Clustering Configuration Page



Clustering

Clustering Prerequisites Status

Installation Status	● Pending
Interface Status	✓ Available
NFS Status	✓ Active
Clustering Status	● Standalone (Unsaved)

Clustering Components Status

ES	● unknown	PG	● unknown

Cluster Nodes Status

Appliance ID	Pulse	Ping	Consul	Tiebreaker	PG Master	Action
FCH1950V2XQ	×	×	×	●	●	×

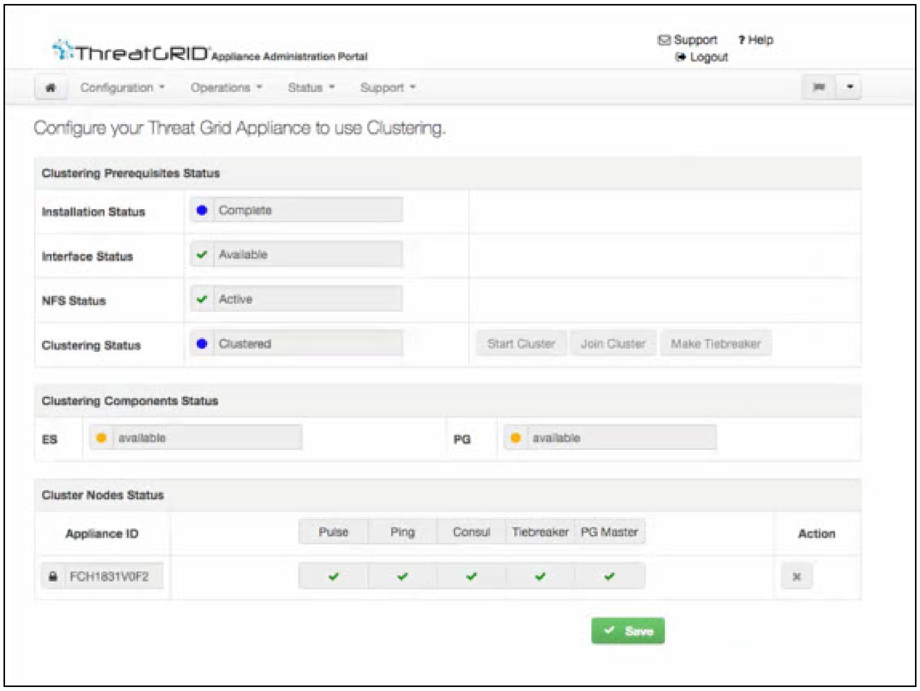
Step 9 On the **Clustering** page, click **Start Cluster**, and then click **OK** on the confirmation dialog.

The **Clustering Status** changes to **Clustered**.

Step 10 Complete the remaining steps in the wizard and click **Start Installation**. This initiates a restore of the data in cluster mode.

Step 11 Open the **Clustering** page and check the health of the new cluster.

Figure 13: Clustering Status: Clustered



Configure your Threat Grid Appliance to use Clustering.

Clustering Prerequisites Status

Installation Status	● Complete	
Interface Status	✓ Available	
NFS Status	✓ Active	
Clustering Status	● Clustered	Start Cluster Join Cluster Make Tiebreaker

Clustering Components Status

ES	● available	PG	● available

Cluster Nodes Status

Appliance ID	Pulse	Ping	Consul	Tiebreaker	PG Master	Action
FCH1831V0F2	✓	✓	✓	✓	✓	✕

✓ Save

What to do next

Proceed to Join Threat Grid Appliances to Cluster.

Join Threat Grid Appliances to Cluster

This section describes how to join new and existing Threat Grid Appliances to a cluster.

Note A Threat Grid Appliance can be joined to an existing cluster only when it contains no data; unlike the initial appliance, which may contain data.

Also, it is critically important that the Threat Grid Appliance that is joining a cluster has the latest software version installed (all nodes in a cluster must be running the same version). This may require setting up the Threat Grid Appliance and update it, then reset the date and join it to the cluster.

Add one node at a time, and wait for Elasticsearch (ES) and PostGres (PG) to reach the state of **Replicated** before adding the next node. The **Replicated** status is expected in clusters of two or more nodes.

Note The wait for the state change for ES and PG to reach **Replicated** does not apply to the single-node case. If you are initializing a single-node cluster from a backup, you should wait for the restore to be completed and the application to be visible in the UI before adding the second node.

When joining a Threat Grid Appliance to a cluster, the NFS and clustering must be configured during the initial setup.

Join Existing Appliance to Cluster

Perform the following steps to join an existing Threat Grid Appliance to a cluster:

Procedure

Step 1 Update the Threat Grid Appliance to the latest version. This may require several update cycles depending on the current version that is installed. All nodes in a cluster must be the same version.

Step 2 Run the `destroy-data` command in **tgsh** to remove all data; when joining an existing Threat Grid Appliance to a cluster, all data must be removed prior to being merged into the cluster. See Reset Threat Grid Appliance As Backup Restore Target.

After running the `destroy-data` command on an existing Threat Grid Appliance, it basically becomes a new node, and joining it to a cluster follows the same steps as joining a new Threat Grid Appliance.

What to do next

Proceed to Join New Appliance to Cluster.

Join New Appliance to Cluster

Perform the following steps to join a new Threat Grid Appliance to a cluster:

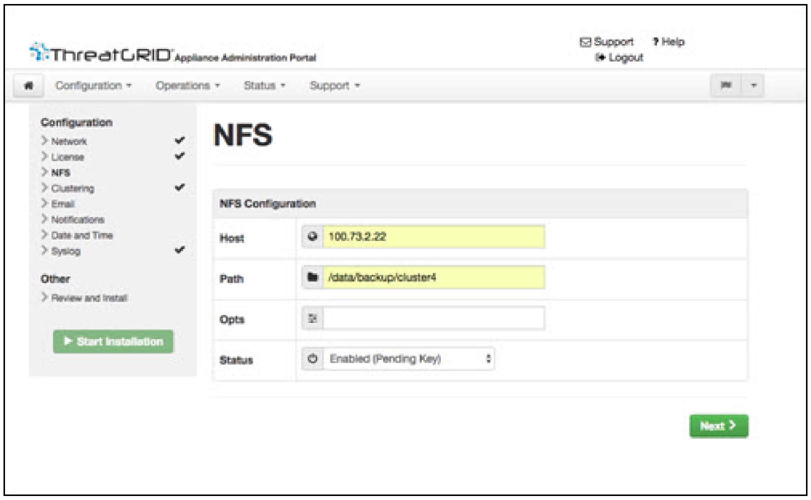
Procedure

Step 1 Set up and begin the OpAdmin configuration as normal.

Step 2 In OpAdmin, click **Configuration** > **NFS** and specify the **Host** and **Path** to match what was set in the first node in the cluster.

Step 3 In the **Status** drop-down list, choose **Enabled (Pending Key)**.

Figure 14: NFS for Joining a Cluster



NFS

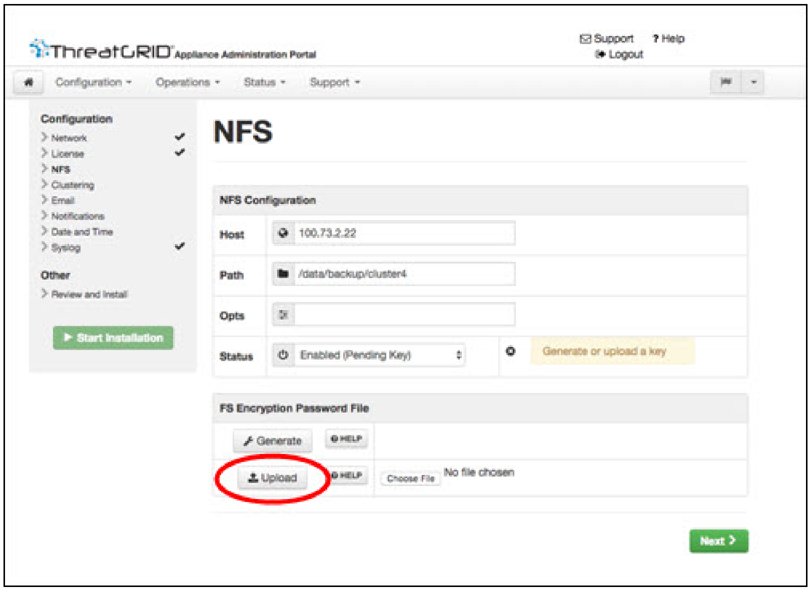
NFS Configuration

Host	100.73.2.22
Path	/data/backup/cluster4
Opts	
Status	Enabled (Pending Key)

Step 4 Click **Next**. The page refreshes and the **Upload** button becomes available.

Note
If the key correctly matches the one used to create a backup, the **Key ID** displayed in OpAdmin after upload should match the name of a directory in the configured path. Backups cannot be restored without the encryption key. The configuration process includes the process of mounting the NFS store, mounting the encrypted data, and initializing the appliance's local datastores from the NFS store's contents.

Figure 15: Upload the NFS Encryption Key



NFS

NFS Configuration

Host	100.73.2.22
Path	/data/backup/cluster4
Opts	
Status	Enabled (Pending Key) — Generate or upload a key

FS Encryption Password File

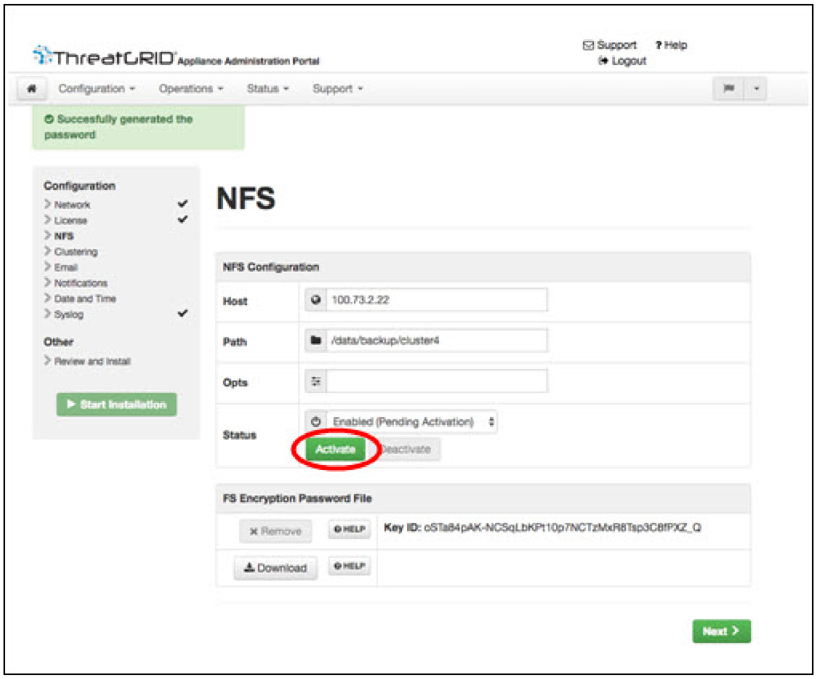
No file chosen

Step 5 Click **Upload** and choose the NFS encryption key you downloaded from the first node when you started the new cluster.

Step 6 Click **Next**.

The page refreshes; the **Key ID** is displayed and the **Activate** button is enabled.

Figure 16: Activate the NFS Encryption Key of the Joining Appliance



Succesfully generated the password

NFS

NFS Configuration

Host	100.73.2.22
Path	/data/backup/cluster4
Opts	
Status	Enabled (Pending Activation)

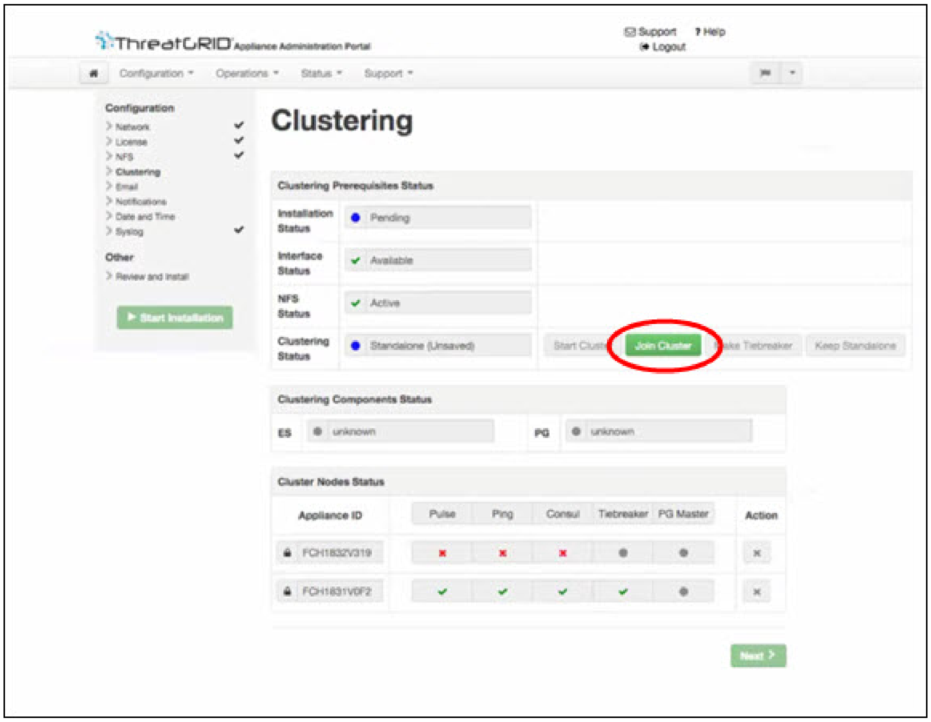
FS Encryption Password File

Key ID: oSTa84pAK-NCSqLbKPt10p7NCTzMxR8Tsp3C8fPXZ_Q

Step 7 Click **Activate**. The **Status** changes to **Active** after a few seconds (lower left corner).

Step 8 Click **Next** to continue to the **Clustering** page.

Figure 17: Join Cluster



Clustering

Clustering Prerequisites Status

Installation Status	● Pending
Interface Status	✓ Available
NFS Status	✓ Active
Clustering Status	● Standalone (Unsaved)

Clustering Components Status

ES	● unknown	PG	● unknown

Cluster Nodes Status

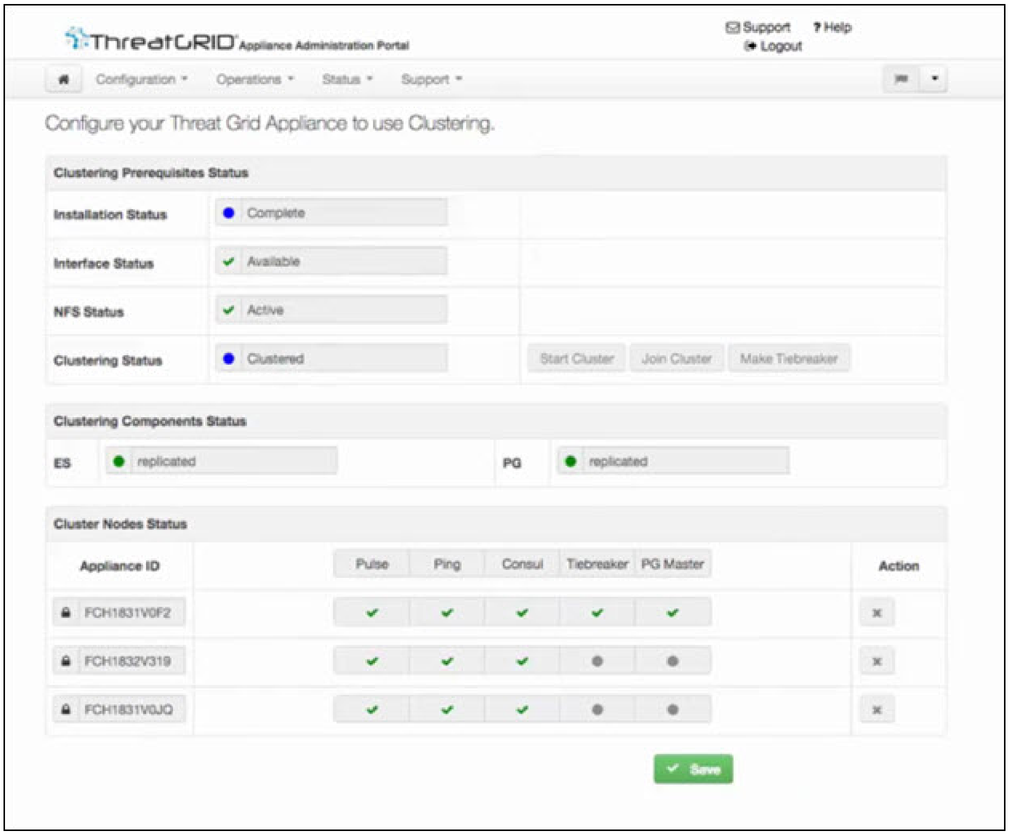
Appliance ID	Pulse	Ping	Consul	Tiebreaker	PG Master	Action
FCH1832V319	✗	✗	✗	●	●	×
FCH1831V0F2	✓	✓	✓	✓	●	×

Step 9 Click **Join Cluster** and then click **OK** on the confirmation dialog.

The **Clustering Status** changes to **Clustered**.

Step 10 Finish the installation. This will initiate a restore of the data in cluster mode.

Figure 18: Active and Healthy 3-Node Cluster



Configure your Threat Grid Appliance to use Clustering.

Clustering Prerequisites Status

Installation Status	● Complete
Interface Status	✓ Available
NFS Status	✓ Active
Clustering Status	● Clustered

Clustering Components Status

ES	● replicated	PG	● replicated

Cluster Nodes Status

Appliance ID	Pulse	Ping	Consul	Tiebreaker	PG Master	Action
FCH1831V0F2	✓	✓	✓	✓	✓	×
FCH1832V319	✓	✓	✓	●	●	×
FCH1831V0JQ	✓	✓	✓	●	●	×

Step 11 Repeat the Step 1 through Step 10 for each node you want to join to the cluster.

Designate Tiebreaker Node

When a cluster is configured to contain an even number of nodes, the one designated as the tiebreaker gets a second vote in the event of an election to decide which node has the primary database.

Each node in a cluster contains a database, but only the database on the primary node is actually used; the others just have to be able to take over if and when the primary node goes down. Having a tiebreaker can prevent the cluster from being down when exactly half the nodes have failed, but only when the tiebreaker is not among the failed nodes.

We recommend that clusters contain three, five, or seven nodes. Having tiebreaker support is part of an ongoing effort to mitigate the loss of reliability in moving from a standalone Threat Grid Appliance to a two-node cluster.

When a cluster is completely healthy and the current node is not the tiebreaker, the **Make Tiebreaker** button is active on the **Clustering** page.

To designate a node as the tiebreaker, click **Make Tiebreaker**. There will be a brief service disruption, after which the current node will be the one which is not allowed to fail, and the other node can be shut down without breaking the cluster.

In the event of a permanent failure of the tiebreaker node where you are unable to modify the designation ahead of time, either reset the surviving node and restore from backup, or contact support@threatgrid.com for assistance.

Remove Cluster Node

To remove a node from a cluster, click the **Remove** icon (X) in the **Action** column in the **Cluster Nodes Status** pane on the **Clustering** page.

- Removing a node from the cluster indicates that it should no longer be considered part of the cluster, rather than a node that is temporarily down. You should remove a Threat Grid Appliance when it is being decommissioned; either being replaced with different hardware or will be rejoined to a cluster only after its data has been reset.

- Removing a node indicates to the system that you are not going to re-add a node, or if you do re-add it, it has been reset.

- A node is not marked as having been permanently removed from a cluster if it has pulse (is actively writing to NFS), or is active on consul (part of the consensus store).

To replace a still-live node (in a cluster with less than seven nodes), add the new node, wait for the cluster to go green, then remove the old one offline using the **Remove** button. This alerts the system that it's not coming back.

When you first take the node offline, the cluster status changes to yellow. After you click **Remove**, the status reverts back to green (since the cluster will resize such that it no longer expects the now-removed node to be present).

Resize Cluster

When a node is removed from a cluster using the **Remove** icon, the cluster resizes; this may affect the number of failures it is expected to tolerate. If a cluster is resized in such a way as to change the number of expected failure tolerances (as defined in Failure Tolerances), it will force an Elasticsearch restart, which will cause a brief service interruption.

Exception: This does not include a system other than the PostgreSQL master being rebooted or having a transient failure. Disruption should be minimal in that case except for clients actively using that node, or if samples are running on it.

If you add a Threat Grid Appliance that was not already part of the cluster, or if you click **Remove**, and this changes the cluster size such that the number of tolerated failures is changed, then there will be a brief interruption as the rest of the cluster reconfigures.

Failure Tolerances

In the event of a failure, clustered Threat Grid Appliances will not lose any data, with the exception of any analysis being actively run by the failed node, and will recover service with a minimal (less than one minute) service disruption period and no user involvement.

Most failures will recover in less than a minute if the number of available nodes is not smaller than the number shown in the **Nodes Required** column in the **Failure Tolerances** table; or will recover after the number of available nodes increases to meet that count. This is true if the cluster was in a healthy state prior to failures (as indicated by services listed as **Replicated** on the **Clustering** page).

The number of failures a cluster of a given size is expected to tolerate is shown in the following table.

Table 1: Failure Tolerances

Cluster Size	Failures Tolerated	Nodes Required
1	0	1
2	1*	1*
3	1	2
4	1	3
5	2	3
6	2	4
7	3	4

These figures represent best-case scenarios. If the cluster is not showing green across the board when all nodes are up, then it may not be able to tolerate the full failure count indicated.

For example, if you have a 5-node cluster size with 2 failures tolerated, 3 nodes required, and all 5 appliances are actively processing data, the cluster will be able to reconfigure itself and continue operation without human administrative action if up to 2 failures take place.

Another consideration, in a 5-, 6-, or 7-node cluster, the +1 in the number of failures tolerated means that the percentage of nodes that can fail is higher, which is particularly important because the number of nodes acts as a multiplier to the failure rate. (If you have two nodes, and each has a hardware fault once every 10 years, then you just change your hardware fault rate to once every 5 years.)

Failure Recovery

Most failures recover automatically. If not, you should contact Threat Grid Support (support@threatgrid.ccom), or restore the data from backups. See Restore Backup Content for more information.

API/Usage Characteristics

Status of samples submitted to any node in a cluster may be queried from any other node in the cluster; there is no need to track to which individual node a submission took place.

Processing of sample submissions made to one node will be split across all nodes in the cluster; there is no need to actively load-balance from the client side.

Operational/Adminstrative Characteristics

In a cluster with two nodes, one of the nodes is the tiebreaker and acts as a single-point-of-failure. However, the other node may be removed from the cluster without ill effect (beyond transient failures during cutover). When a 2-node cluster is healthy (both nodes are fully operational), the tiebreaker designation may be modified by the user, to alter which of the nodes is a single point of failure.

Service may be temporarily disrupted during a failover event; samples which were actively running during a failover will not be automatically rerun.

In the context of clustering, capacity refers to throughput, not storage. A cluster with three nodes prunes data to the same maximum storage levels as a single Threat Grid Appliance. Consequently, a cluster of three 5000-sample appliances, with a total 15,000-samples/day rate limit, will (when used at full capacity), have retention minimums of 33 percent shorter than the 10,000-sample/day estimates provided in the *Threat Grid Appliance Data Retention Notes* on Cisco.com.

Sample Deletion

Support for deleting samples is available on Threat Grid Appliances (v2.5.0 or later):

- The **Delete** option is available in the **Actions** menu in the samples list.
- The **Delete** button is available in the upper-right corner of the sample analysis report.

Note It may take up to 24 hours for backup copies of deleted samples to be removed from all nodes.

Deleted samples are removed from the shared NFS store immediately; removed from the node processing the deletion request immediately, but the other nodes will lag until the nightly cron job is run. In clustered mode, the NFS store is considered the primary source for samples, so even if the sample is not physically removed from other nodes, it should no longer be retrievable from any of them.

In Threat Grid Appliance v2.7 and later, sample deletion is extended to include artifacts, which matches the behavior of the cloud product.