Manage security

StorageGRID 11.8

NetApp
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You can configure various security settings from the Grid Manager to help secure your StorageGRID system.

Manage encryption

StorageGRID provides several options for encrypting data. You should review the available encryption methods to determine which ones meet your data-protection requirements.

Manage certificates

You can configure and manage the server certificates used for HTTP connections or the client certificates used to authenticate a client or user identity to the server.

Configure key management servers

Using a key management server lets you protect StorageGRID data even if an appliance is removed from the data center. After the appliance volumes are encrypted, you can't access any data on the appliance unless the node can communicate with the KMS.

> To use encryption key management, you must enable the **Node Encryption** setting for each appliance during installation, before the appliance is added to the grid.

Manage proxy settings

If you are using S3 platform services or Cloud Storage Pools, you can configure a storage proxy server between Storage Nodes and the external S3 endpoints. If you send AutoSupport packages using HTTPS or HTTP, you can configure an admin proxy server between Admin Nodes and technical support.

Control firewalls

To enhance the security of your system, you can control access to StorageGRID Admin Nodes by opening or closing specific ports at the external firewall. You can also control network access to each node by configuring its internal firewall. You can prevent access on all ports except those needed for your deployment.

Review StorageGRID encryption methods

StorageGRID provides several options for encrypting data. You should review the available methods to determine which methods meet your data-protection requirements.

The table provides a high-level summary of the encryption methods available in StorageGRID.

Encryption option	How it works	Applies to
Key management server (KMS) in Grid Manager	You configure a key management server for the StorageGRID site and enable node encryption for the appliance. Then, an appliance node connects to the KMS to request a key encryption key (KEK). This key encrypts and decrypts the data encryption key (DEK) on each volume.	Appliance nodes that have **Node Encryption** enabled during installation. All data on the appliance is protected against physical loss or removal from the data center. **Note**: Managing encryption keys with a KMS is only supported for Storage Nodes and services appliances.
Drive Encryption page in StorageGRID Appliance Installer	If the appliance contains drives that support hardware encryption, you can set a drive passphrase during installation. When you set a drive passphrase, it's impossible for anyone to recover valid data from drives that have been removed from the system, unless they know the passphrase. Before starting installation, go to **Configure Hardware** > **Drive Encryption** to set a drive passphrase that applies to all StorageGRID-managed, self-encrypting drives in a node.	Appliances that contain self-encrypting drives. All data on the secured drives is protected against physical loss or removal from the data center. Drive encryption doesn't apply to SANtricity-managed drives. If you have a storage appliance with self-encrypting drives and SANtricity controllers, you can enable drive security in SANtricity.
Drive security in SANtricity System Manager	If the Drive Security feature is enabled for an SG5700 or SG6000 storage appliance, you can use SANtricity System Manager to create and manage the security key. The key is required to access the data on the secured drives.	Storage appliances that have Full Disk Encryption (FDE) drives or self-encrypting drives. All data on the secured drives is protected against physical loss or removal from the data center. Can't be used with some storage appliances or with any services appliances.
Stored object encryption	You enable the Stored object encryption option in the Grid Manager. When enabled, any new objects that aren't encrypted at the bucket level or at the object level are encrypted during ingest.	Newly ingested S3 and Swift object data. Existing stored objects aren't encrypted. Object metadata and other sensitive data aren't encrypted.

Encryption option	How it works	Applies to
S3 bucket encryption	You issue a PutBucketEncryption request to enable encryption for the bucket. Any new objects that aren't encrypted at the object level are encrypted during ingest.	Newly ingested S3 object data only. Encryption must be specified for the bucket. Existing bucket objects aren't encrypted. Object metadata and other sensitive data aren't encrypted. Operations on buckets
S3 object server-side encryption (SSE)	You issue an S3 request to store an object and include the `x-amz-server-side-encryption` request header.	Newly ingested S3 object data only. Encryption must be specified for the object. Object metadata and other sensitive data aren't encrypted. StorageGRID manages the keys. Use server-side encryption
S3 object server-side encryption with customer-provided keys (SSE-C)	You issue an S3 request to store an object and include three request headers. • `x-amz-server-side-encryption-customer-algorithm` • `x-amz-server-side-encryption-customer-key` • `x-amz-server-side-encryption-customer-key-MD5`	Newly ingested S3 object data only. Encryption must be specified for the object. Object metadata and other sensitive data aren't encrypted. Keys are managed outside of StorageGRID. Use server-side encryption
External volume or datastore encryption	You use an encryption method outside of StorageGRID to encrypt an entire volume or datastore, if your deployment platform supports it.	All object data, metadata, and system configuration data, assuming every volume or datastore is encrypted. An external encryption method provides tighter control over encryption algorithms and keys. Can be combined with the other methods listed.

Encryption option	How it works	Applies to
Object encryption outside of StorageGRID	You use an encryption method outside of StorageGRID to encrypt object data and metadata before they are ingested into StorageGRID.	Object data and metadata only (system configuration data is not encrypted). An external encryption method provides tighter control over encryption algorithms and keys. Can be combined with the other methods listed. Amazon Simple Storage Service - Developer Guide: Protecting data using client-side encryption

Use multiple encryption methods

Depending on your requirements, you can use more than one encryption method at a time. For example:

- You can use a KMS to protect appliance nodes and also use the drive security feature in SANtricity System Manager to "double encrypt" data on the self-encrypting drives in the same appliances.
- You can use a KMS to secure data on appliance nodes and also use the Stored object encryption option to encrypt all objects when they are ingested.

If only a small portion of your objects require encryption, consider controlling encryption at the bucket or individual object level instead. Enabling multiple levels of encryption has an additional performance cost.

Manage certificates

Manage security certificates: Overview

Security certificates are small data files used to create secure, trusted connections between StorageGRID components and between StorageGRID components and external systems.

StorageGRID uses two types of security certificates:

- **Server certificates** are required when you use HTTPS connections. Server certificates are used to establish secure connections between clients and servers, authenticating the identity of a server to its clients and providing a secure communication path for data. The server and the client each have a copy of the certificate.
- **Client certificates** authenticate a client or user identity to the server, providing more secure authentication than passwords alone. Client certificates don’t encrypt data.

When a client connects to the server using HTTPS, the server responds with the server certificate, which contains a public key. The client verifies this certificate by comparing the server signature to the signature on its copy of the certificate. If the signatures match, the client starts a session with the server using the same public key.

StorageGRID functions as the server for some connections (such as the load balancer endpoint) or as the

client for other connections (such as the CloudMirror replication service).

Default Grid CA certificate

StorageGRID includes a built-in certificate authority (CA) that generates an internal Grid CA certificate during system installation. The Grid CA certificate is used, by default, to secure internal StorageGRID traffic. An external certificate authority (CA) can issue custom certificates that are fully compliant with your organization's information security policies. Although you can use the Grid CA certificate for a non-production environment, the best practice for a production environment is to use custom certificates signed by an external certificate authority. Unsecured connections with no certificate are also supported but aren't recommended.

- Custom CA certificates don't remove the internal certificates; however, the custom certificates should be the ones specified for verifying server connections.
- All custom certificates must meet the system hardening guidelines for server certificates.
- StorageGRID supports bundling of certificates from a CA into a single file (known as a CA certificate bundle).

> StorageGRID also includes operating system CA certificates that are the same on all grids. In production environments, make sure that you specify a custom certificate signed by an external certificate authority in place of the operating system CA certificate.

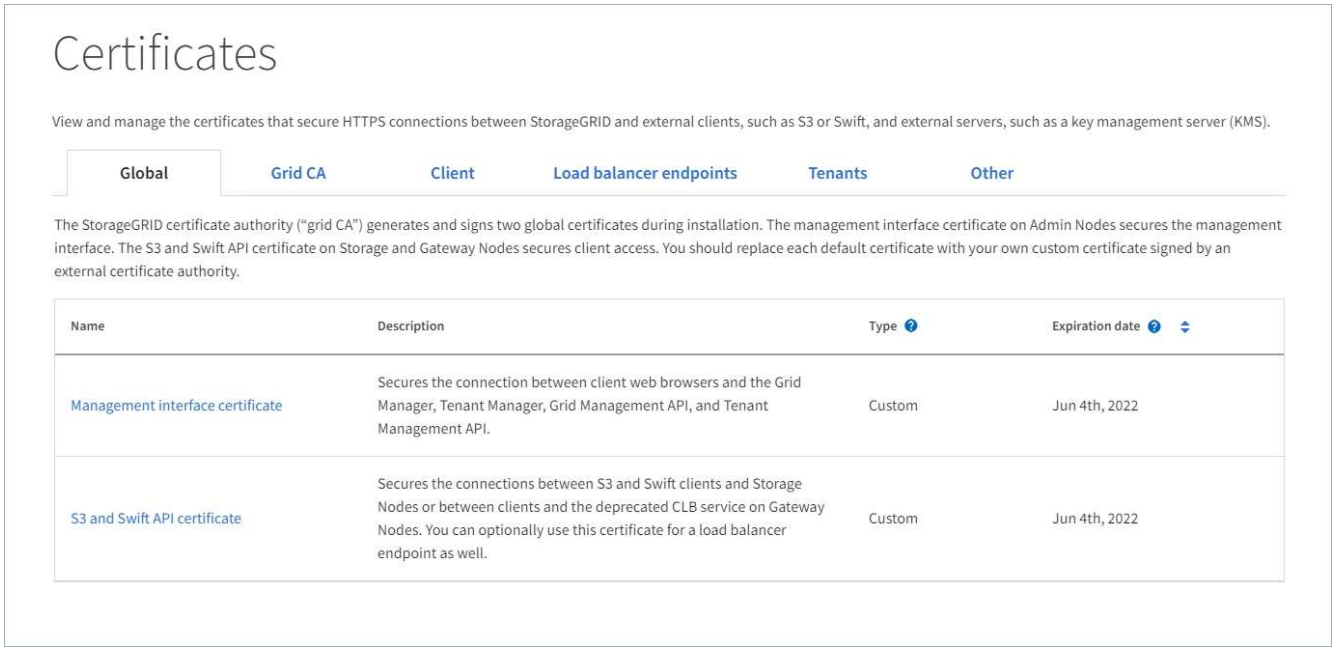
Variants of the server and client certificate types are implemented in several ways. You should have all the certificates needed for your specific StorageGRID configuration ready before you configure the system.

Access security certificates

You can access information about all StorageGRID certificates in a single location, along with links to the configuration workflow for each certificate.

Steps

1. From Grid Manager, select **CONFIGURATION** > **Security** > **Certificates**.



2. Select a tab on the Certificates page for information about each certificate category and to access the certificate settings. You can access a tab if you have the appropriate permission.

- **Global**: Secures StorageGRID access from web browsers and external API clients.
- **Grid CA**: Secures internal StorageGRID traffic.
- **Client**: Secures connections between external clients and the StorageGRID Prometheus database.
- **Load balancer endpoints**: Secures connections between S3 and Swift clients and the StorageGRID Load Balancer.
- **Tenants**: Secures connections to identity federation servers or from platform service endpoints to S3 storage resources.
- **Other**: Secures StorageGRID connections requiring specific certificates.

Each tab is described below with links to additional certificate details.

Global

The global certificates secure StorageGRID access from web browsers and external S3 and Swift API clients. Two global certificates are initially generated by the StorageGRID certificate authority during installation. The best practice for a production environment is to use custom certificates signed by an external certificate authority.

- Management interface certificate: Secures client web-browser connections to StorageGRID management interfaces.
- S3 and Swift API certificate: Secures client API connections to Storage Nodes, Admin Nodes, and Gateway Nodes, which S3 and Swift client applications use to upload and download object data.

Information about the global certificates that are installed includes:

- **Name**: Certificate name with link to managing the certificate.
- **Description**
- **Type**: Custom or default.
  You should always use a custom certificate for improved grid security.
- **Expiration date**: If using the default certificate, no expiration date is shown.

You can:

- Replace the default certificates with custom certificates signed by an external certificate authority for improved grid security:
  - Replace the default StorageGRID-generated management interface certificate used for Grid Manager and Tenant Manager connections.
  - Replace the S3 and Swift API certificate used for Storage Node and load balancer endpoint (optional) connections.
- Restore the default management interface certificate.
- Restore the default S3 and Swift API certificate.
- Use a script to generate a new self-signed management interface certificate.
- Copy or download the management interface certificate or S3 and Swift API certificate.

Grid CA

The Grid CA certificate, generated by the StorageGRID certificate authority during StorageGRID installation, secures all internal StorageGRID traffic.

Certificate information includes the certificate expiration date and the certificate contents.

You can copy or download the Grid CA certificate, but you can't change it.

Client

Client certificates, generated by an external certificate authority, secure the connections between external monitoring tools and the StorageGRID Prometheus database.

The certificate table has a row for each configured client certificate and indicates whether the certificate can be used for Prometheus database access, along with the certificate expiration date.

You can:

- Upload or generate a new client certificate.
- Select a certificate name to display the certificate details where you can:
  - Change the client certificate name.
  - Set the Prometheus access permission.
  - Upload and replace the client certificate.
  - Copy or download the client certificate.
  - Remove the client certificate.
- Select **Actions** to quickly edit, attach, or remove a client certificate. You can select up to 10 client certificates and remove them at one time using **Actions** > **Remove**.

Load balancer endpoints

Load balancer endpoint certificates secure the connections between S3 and Swift clients and the StorageGRID Load Balancer service on Gateway Nodes and Admin Nodes.

The load balancer endpoint table has a row for each configured load balancer endpoint and indicates whether the global S3 and Swift API certificate or a custom load balancer endpoint certificate is being used for the endpoint. The expiration date for each certificate is also displayed.

> Changes to an endpoint certificate can take up to 15 minutes to be applied to all nodes.

You can:

- View a load balancer endpoint, including its certificate details.
- Specify a load balancer endpoint certificate for FabricPool.
- Use the global S3 and Swift API certificate instead of generating a new load balancer endpoint certificate.

Tenants

Tenants can use identity federation server certificates or platform service endpoint certificates to secure their connections with StorageGRID.

The tenant table has a row for each tenant and indicates if each tenant has permission to use its own identity source or platform services.

You can:

- Select a tenant name to sign in to the Tenant Manager
- Select a tenant name to view the tenant identity federation details
- Select a tenant name to view tenant platform services details
- Specify a platform service endpoint certificate during endpoint creation

Other

StorageGRID uses other security certificates for specific purposes. These certificates are listed by their functional name. Other security certificates include:

- Cloud Storage Pool certificates
- Email alert notification certificates

- External syslog server certificates
- Grid federation connection certificates
- Identity federation certificates
- Key management server (KMS) certificates
- Single sign-on certificates

Information indicates the type of certificate a function uses and its server and client certificate expiration dates, as applicable. Selecting a function name opens a browser tab where you can view and edit the certificate details.

> You can only view and access information for other certificates if you have the appropriate permission.

You can:

- Specify a Cloud Storage Pool certificate for S3, C2S S3, or Azure
- Specify a certificate for alert email notifications
- Use a certificate for an external syslog server
- Rotate grid federation connection certificates
- View and edit an identity federation certificate
- Upload key management server (KMS) server and client certificates
- Manually specify an SSO certificate for a relying party trust

Security certificate details

Each type of security certificate is described below, with links to the implementation instructions.

Management interface certificate

Certificate type	Description	Navigation location	Details
Server	Authenticates the connection between client web browsers and the StorageGRID management interface, allowing users to access the Grid Manager and Tenant Manager without security warnings. This certificate also authenticates Grid Management API and Tenant Management API connections. You can use the default certificate created during installation or upload a custom certificate.	**CONFIGURATION** > **Security** > **Certificates**, select the **Global** tab, and then select **Management interface certificate**	Configure management interface certificates

S3 and Swift API certificate

Certificate type	Description	Navigation location	Details
Server	Authenticates secure S3 or Swift client connections to a Storage Node and to load balancer endpoints (optional).	**CONFIGURATION** > **Security** > **Certificates**, select the **Global** tab, and then select **S3 and Swift API certificate**	Configure S3 and Swift API certificates

Grid CA certificate

See the Default Grid CA certificate description.

Administrator client certificate

Certificate type	Description	Navigation location	Details
Client	Installed on each client, allowing StorageGRID to authenticate external client access. • Allows authorized external clients to access the StorageGRID Prometheus database. • Allows secure monitoring of StorageGRID using external tools.	**CONFIGURATION** > **Security** > **Certificates** and then select the **Client** tab	Configure client certificates

Load balancer endpoint certificate

Certificate type	Description	Navigation location	Details
Server	Authenticates the connection between S3 or Swift clients and the StorageGRID Load Balancer service on Gateway Nodes and Admin Nodes. You can upload or generate a load balancer certificate when you configure a load balancer endpoint. Client applications use the load balancer certificate when connecting to StorageGRID to save and retrieve object data. You can also use a custom version of the global S3 and Swift API certificate certificate to authenticate connections to the Load Balancer service. If the global certificate is used to authenticate load balancer connections, you don't need to upload or generate a separate certificate for each load balancer endpoint. **Note:** The certificate used for load balancer authentication is the most used certificate during normal StorageGRID operation.	**CONFIGURATION** > **Network** > **Load balancer endpoints**	• Configure load balancer endpoints • Create a load balancer endpoint for FabricPool

Cloud Storage Pool endpoint certificate

Certificate type	Description	Navigation location	Details
Server	Authenticates the connection from a StorageGRID Cloud Storage Pool to an external storage location, such as S3 Glacier or Microsoft Azure Blob storage. A different certificate is required for each cloud provider type.	**ILM** > **Storage pools**	Create a Cloud Storage Pool

Email alert notification certificate

Certificate type	Description	Navigation location	Details
Server and client	Authenticates the connection between an SMTP email server and StorageGRID that is used for alert notifications. • If communications with the SMTP server requires Transport Layer Security (TLS), you must specify the email server CA certificate. • Specify a client certificate only if the SMTP email server requires client certificates for authentication.	**ALERTS** > **Email setup**	Set up email notifications for alerts

External syslog server certificate

Certificate type	Description	Navigation location	Details
Server	Authenticates the TLS or RELP/TLS connection between an external syslog server that logs events in StorageGRID. **Note:** An external syslog server certificate is not required for TCP, RELP/TCP, and UDP connections to an external syslog server.	**CONFIGURATION** > **Monitoring** > **Audit and syslog server**	Use an external syslog server

Grid federation connection certificate

Certificate type	Description	Navigation location	Details
Server and client	Authenticate and encrypt information sent between the current StorageGRID system and another grid in a grid federation connection.	**CONFIGURATION** > **System** > **Grid federation**	• Create grid federation connections • Rotate connection certificates

Identity federation certificate

Certificate type	Description	Navigation location	Details
Server	Authenticates the connection between StorageGRID and an external identity provider, such as Active Directory, OpenLDAP, or Oracle Directory Server. Used for identity federation, which allows admin groups and users to be managed by an external system.	**CONFIGURATION** > **Access Control** > **Identity federation**	Use identity federation

Key management server (KMS) certificate

Certificate type	Description	Navigation location	Details
Server and client	Authenticates the connection between StorageGRID and an external key management server (KMS), which provides encryption keys to StorageGRID appliance nodes.	**CONFIGURATION** > **Security** > **Key management server**	Add key management server (KMS)

Platform services endpoint certificate

Certificate type	Description	Navigation location	Details
Server	Authenticates the connection from the StorageGRID platform service to an S3 storage resource.	**Tenant Manager** > **STORAGE (S3)** > **Platform services endpoints**	Create platform services endpoint Edit platform services endpoint

Single sign-on (SSO) certificate

Certificate type	Description	Navigation location	Details
Server	Authenticates the connection between identity federation services, such as Active Directory Federation Services (AD FS), and StorageGRID that are used for single sign-on (SSO) requests.	**CONFIGURATION** > **Access control** > **Single sign-on**	Configure single sign-on

Certificate examples

Example 1: Load Balancer service

In this example, StorageGRID acts as the server.

1. You configure a load balancer endpoint and upload or generate a server certificate in StorageGRID.
2. You configure an S3 or Swift client connection to the load balancer endpoint and upload the same certificate to the client.
3. When the client wants to save or retrieve data, it connects to the load balancer endpoint using HTTPS.
4. StorageGRID responds with the server certificate, which contains a public key, and with a signature based on the private key.
5. The client verifies this certificate by comparing the server signature to the signature on its copy of the certificate. If the signatures match, the client starts a session using the same public key.

6. The client sends object data to StorageGRID.

Example 2: External key management server (KMS)

In this example, StorageGRID acts as the client.

1. Using external Key Management Server software, you configure StorageGRID as a KMS client and obtain a CA-signed server certificate, a public client certificate, and the private key for the client certificate.
2. Using the Grid Manager, you configure a KMS server and upload the server and client certificates and the client private key.
3. When a StorageGRID node needs an encryption key, it makes a request to the KMS server that includes data from the certificate and a signature based on the private key.
4. The KMS server validates the certificate signature and decides that it can trust StorageGRID.
5. The KMS server responds using the validated connection.

Configure server certificates

Supported server certificate types

The StorageGRID system supports custom certificates encrypted with RSA or ECDSA (Elliptic Curve Digital Signature Algorithm).

> The cipher type for the security policy must match the server certificate type. For example, RSA ciphers require RSA certificates, and ECDSA ciphers require ECDSA certificates. See Manage security certificates. If you configure a custom security policy that is not compatible with the server certificate, you can temporarily revert to the default security policy.

For more information about how StorageGRID secures client connections, see Security for S3 and Swift clients.

Configure management interface certificates

You can replace the default management interface certificate with a single custom certificate that allows users to access the Grid Manager and the Tenant Manager without encountering security warnings. You can also revert to the default management interface certificate or generate a new one.

About this task

By default, every Admin Node is issued a certificate signed by the grid CA. These CA signed certificates can be replaced by a single common custom management interface certificate and corresponding private key.

Because a single custom management interface certificate is used for all Admin Nodes, you must specify the certificate as a wildcard or multi-domain certificate if clients need to verify the hostname when connecting to the Grid Manager and Tenant Manager. Define the custom certificate such that it matches all Admin Nodes in the grid.

You need to complete configuration on the server, and depending on the root certificate authority (CA) you are using, users might also need to install the Grid CA certificate in the web browser they will use to access the Grid Manager and the Tenant Manager.

To ensure that operations aren't disrupted by a failed server certificate, the **Expiration of server certificate for Management Interface** alert is triggered when this server certificate is about to expire. As required, you can view when the current certificate expires by selecting **CONFIGURATION** > **Security** > **Certificates** and looking at the Expiration date for the management interface certificate on the Global tab.

If you are accessing the Grid Manager or Tenant Manager using a domain name instead of an IP address, the browser shows a certificate error without an option to bypass if either of the following occurs:

- Your custom management interface certificate expires.
- You revert from a custom management interface certificate to the default server certificate.

Add a custom management interface certificate

To add a custom management interface certificate, you can provide your own certificate or generate one using the Grid Manager.

Steps

1. Select **CONFIGURATION** > **Security** > **Certificates**.
2. On the **Global** tab, select **Management interface certificate**.
3. Select **Use custom certificate**.
4. Upload or generate the certificate.

Upload certificate

Upload the required server certificate files.

a. Select **Upload certificate**.

b. Upload the required server certificate files:

- **Server certificate**: The custom server certificate file (PEM encoded).
- **Certificate private key**: The custom server certificate private key file (`.key`).

> EC private keys must be 224 bits or larger. RSA private keys must be 2048 bits or larger.

- **CA bundle**: A single optional file containing the certificates from each intermediate issuing certificate authority (CA). The file should contain each of the PEM-encoded CA certificate files, concatenated in certificate chain order.

c. Expand **Certificate details** to see the metadata for each certificate you uploaded. If you uploaded an optional CA bundle, each certificate displays on its own tab.

- Select **Download certificate** to save the certificate file or select **Download CA bundle** to save the certificate bundle.

  Specify the certificate file name and download location. Save the file with the extension `.pem`.

  For example: `storagegrid_certificate.pem`

- Select **Copy certificate PEM** or **Copy CA bundle PEM** to copy the certificate contents for pasting elsewhere.

d. Select **Save**.
The custom management interface certificate is used for all subsequent new connections to the Grid Manager, Tenant Manager, Grid Manager API or Tenant Manager API.

Generate certificate

Generate the server certificate files.

> The best practice for a production environment is to use a custom management interface certificate signed by an external certificate authority.

a. Select **Generate certificate**.

b. Specify the certificate information:

Field	Description
Domain name	One or more fully qualified domain names to include in the certificate. Use an * as a wildcard to represent multiple domain names.
IP	One or more IP addresses to include in the certificate.

Field	Description
Subject (optional)	X.509 subject or distinguished name (DN) of the certificate owner. If no value is entered in this field, the generated certificate uses the first domain name or IP address as the subject common name (CN).
Days valid	Number of days after creation that the certificate expires.
Add key usage extensions	If selected (default and recommended), key usage and extended key usage extensions are added to the generated certificate. These extensions define the purpose of the key contained in the certificate. **Note**: Leave this checkbox selected unless you experience connection problems with older clients when certificates include these extensions.

c. Select **Generate**.

d. Select **Certificate details** to see the metadata for the generated certificate.

   - Select **Download certificate** to save the certificate file.

     Specify the certificate file name and download location. Save the file with the extension `.pem`.

     For example: `storagegrid_certificate.pem`

   - Select **Copy certificate PEM** to copy the certificate contents for pasting elsewhere.

e. Select **Save**.
   The custom management interface certificate is used for all subsequent new connections to the Grid Manager, Tenant Manager, Grid Manager API or Tenant Manager API.

5. Refresh the page to ensure the web browser is updated.

> After uploading or generating a new certificate, allow up to one day for any related certificate expiration alerts to clear.

6. After you add a custom management interface certificate, the Management interface certificate page displays detailed certificate information for the certificates that are in use.
   You can download or copy the certificate PEM as required.

Restore the default management interface certificate

You can revert to using the default management interface certificate for Grid Manager and Tenant Manager connections.

Steps

1. Select **CONFIGURATION** > **Security** > **Certificates**.
2. On the **Global** tab, select **Management interface certificate**.
3. Select **Use default certificate**.

When you restore the default management interface certificate, the custom server certificate files you configured are deleted and can't be recovered from the system. The default management interface certificate is used for all subsequent new client connections.

4. Refresh the page to ensure the web browser is updated.

Use a script to generate a new self-signed management interface certificate

If strict hostname validation is required, you can use a script to generate the management interface certificate.

Before you begin

- You have specific access permissions.
- You have the `Passwords.txt` file.

About this task

The best practice for a production environment is to use a certificate signed by an external certificate authority.

Steps

1. Obtain the fully qualified domain name (FQDN) of each Admin Node.
2. Log in to the primary Admin Node:
   a. Enter the following command: `ssh admin@primary_Admin_Node_IP`
   b. Enter the password listed in the `Passwords.txt` file.
   c. Enter the following command to switch to root: `su -`
   d. Enter the password listed in the `Passwords.txt` file.

      When you are logged in as root, the prompt changes from `$` to `#`.
3. Configure StorageGRID with a new self-signed certificate.

   ```
   $ sudo make-certificate --domains wildcard-admin-node-fqdn --type management
   ```

   - For `--domains`, use wildcards to represent the fully qualified domain names of all Admin Nodes. For example, `*.ui.storagegrid.example.com` uses the * wildcard to represent `admin1.ui.storagegrid.example.com` and `admin2.ui.storagegrid.example.com`.
   - Set `--type` to `management` to configure the management interface certificate, which is used by Grid Manager and Tenant Manager.
   - By default, generated certificates are valid for one year (365 days) and must be recreated before they expire. You can use the `--days` argument to override the default validity period.

     > A certificate's validity period begins when `make-certificate` is run. You must ensure the management client is synchronized to the same time source as StorageGRID; otherwise, the client might reject the certificate.

     ```
     $ sudo make-certificate --domains *.ui.storagegrid.example.com --type
     management --days 720
     ```

The resulting output contains the public certificate needed by your management API client.

4. Select and copy the certificate.

   Include the BEGIN and the END tags in your selection.

5. Log out of the command shell. `$ exit`
6. Confirm the certificate was configured:
   a. Access the Grid Manager.
   b. Select **CONFIGURATION** > **Security** > **Certificates**
   c. On the **Global** tab, select **Management interface certificate**.
7. Configure your management client to use the public certificate you copied. Include the BEGIN and END tags.

Download or copy the management interface certificate

You can save or copy the management interface certificate contents for use elsewhere.

Steps

1. Select **CONFIGURATION** > **Security** > **Certificates**.
2. On the **Global** tab, select **Management interface certificate**.
3. Select the **Server** or **CA bundle** tab and then download or copy the certificate.

Download certificate file or CA bundle

Download the certificate or CA bundle `.pem` file. If you are using an optional CA bundle, each certificate in the bundle displays on its own sub-tab.

a. Select **Download certificate** or **Download CA bundle**.

   If you are downloading a CA bundle, all the certificates in the CA bundle secondary tabs download as a single file.

b. Specify the certificate file name and download location. Save the file with the extension `.pem`.

   For example: `storagegrid_certificate.pem`

Copy certificate or CA bundle PEM

Copy the certificate text to paste elsewhere. If you are using an optional CA bundle, each certificate in the bundle displays on its own sub-tab.

a. Select **Copy certificate PEM** or **Copy CA bundle PEM**.

   If you are copying a CA bundle, all the certificates in the CA bundle secondary tabs copy together.

b. Paste the copied certificate into a text editor.

c. Save the text file with the extension `.pem`.

   For example: `storagegrid_certificate.pem`

Configure S3 and Swift API certificates

You can replace or restore the server certificate that is used for S3 or Swift client connections to Storage Nodes or to load balancer endpoints. The replacement custom server certificate is specific to your organization.

About this task

By default, every Storage Node is issued a X.509 server certificate signed by the grid CA. These CA signed certificates can be replaced by a single common custom server certificate and corresponding private key.

A single custom server certificate is used for all Storage Nodes, so you must specify the certificate as a wildcard or multi-domain certificate if clients need to verify the hostname when connecting to the storage endpoint. Define the custom certificate such that it matches all Storage Nodes in the grid.

After completing configuration on the server, you might also need to install the Grid CA certificate in the S3 or Swift API client you will use to access the system, depending on the root certificate authority (CA) you are using.

> To ensure that operations aren’t disrupted by a failed server certificate, the **Expiration of global server certificate for S3 and Swift API** alert is triggered when the root server certificate is about to expire. As required, you can view when the current certificate expires by selecting **CONFIGURATION** > **Security** > **Certificates** and looking at the Expiration date for the S3 and Swift API certificate on the Global tab.

You can upload or generate a custom S3 and Swift API certificate.

Add a custom S3 and Swift API certificate

Steps

1. Select **CONFIGURATION** > **Security** > **Certificates**.
2. On the **Global** tab, select **S3 and Swift API certificate**.
3. Select **Use custom certificate**.
4. Upload or generate the certificate.

Upload certificate

Upload the required server certificate files.

a. Select **Upload certificate**.

b. Upload the required server certificate files:

- **Server certificate**: The custom server certificate file (PEM encoded).
- **Certificate private key**: The custom server certificate private key file (`.key`).

> EC private keys must be 224 bits or larger. RSA private keys must be 2048 bits or larger.

- **CA bundle**: A single optional file containing the certificates from each intermediate issuing certificate authority. The file should contain each of the PEM-encoded CA certificate files, concatenated in certificate chain order.

c. Select the certificate details to display the metadata and PEM for each custom S3 and Swift API certificate that was uploaded. If you uploaded an optional CA bundle, each certificate displays on its own tab.

- Select **Download certificate** to save the certificate file or select **Download CA bundle** to save the certificate bundle.

  Specify the certificate file name and download location. Save the file with the extension `.pem`.

  For example: `storagegrid_certificate.pem`

- Select **Copy certificate PEM** or **Copy CA bundle PEM** to copy the certificate contents for pasting elsewhere.

d. Select **Save**.

The custom server certificate is used for subsequent new S3 and Swift client connections.

Generate certificate

Generate the server certificate files.

a. Select **Generate certificate**.

b. Specify the certificate information:

Field	Description
Domain name	One or more fully qualified domain names to include in the certificate. Use an * as a wildcard to represent multiple domain names.
IP	One or more IP addresses to include in the certificate.
Subject (optional)	X.509 subject or distinguished name (DN) of the certificate owner. If no value is entered in this field, the generated certificate uses the first domain name or IP address as the subject common name (CN).

Field	Description
Days valid	Number of days after creation that the certificate expires.
Add key usage extensions	If selected (default and recommended), key usage and extended key usage extensions are added to the generated certificate. These extensions define the purpose of the key contained in the certificate. **Note**: Leave this checkbox selected unless you experience connection problems with older clients when certificates include these extensions.

c. Select **Generate**.

d. Select **Certificate Details** to display the metadata and PEM for the custom S3 and Swift API certificate that was generated.

   - Select **Download certificate** to save the certificate file.

     Specify the certificate file name and download location. Save the file with the extension `.pem`.

     For example: `storagegrid_certificate.pem`

   - Select **Copy certificate PEM** to copy the certificate contents for pasting elsewhere.

e. Select **Save**.

   The custom server certificate is used for subsequent new S3 and Swift client connections.

5. Select a tab to display metadata for the default StorageGRID server certificate, a CA signed certificate that was uploaded, or a custom certificate that was generated.

   After uploading or generating a new certificate, allow up to one day for any related certificate expiration alerts to clear.

6. Refresh the page to ensure the web browser is updated.
7. After you add a custom S3 and Swift API certificate the S3 and Swift API certificate page displays detailed certificate information for the custom S3 and Swift API certificate that is in use.
   You can download or copy the certificate PEM as required.

Restore the default S3 and Swift API certificate

You can revert to using the default S3 and Swift API certificate for S3 and Swift client connections to Storage Nodes. However, you can't use the default S3 and Swift API certificate for a load balancer endpoint.

Steps

1. Select **CONFIGURATION** > **Security** > **Certificates**.
2. On the **Global** tab, select **S3 and Swift API certificate**.
3. Select **Use default certificate**.

   When you restore the default version of the global S3 and Swift API certificate, the custom server

certificate files you configured are deleted and can't be recovered from the system. The default S3 and Swift API certificate will be used for subsequent new S3 and Swift client connections to Storage Nodes.

4. Select **OK** to confirm the warning and restore the default S3 and Swift API certificate.

   If you have Root access permission and the custom S3 and Swift API certificate was used for load balancer endpoint connections, a list is displayed of load balancer endpoints that will no longer be accessible using the default S3 and Swift API certificate. Go to Configure load balancer endpoints to edit or remove the affected endpoints.

5. Refresh the page to ensure the web browser is updated.

Download or copy the S3 and Swift API certificate

You can save or copy the S3 and Swift API certificate contents for use elsewhere.

Steps

1. Select **CONFIGURATION** > **Security** > **Certificates**.
2. On the **Global** tab, select **S3 and Swift API certificate**.
3. Select the **Server** or **CA bundle** tab and then download or copy the certificate.

   Download certificate file or CA bundle

   Download the certificate or CA bundle `.pem` file. If you are using an optional CA bundle, each certificate in the bundle displays on its own sub-tab.

   a. Select **Download certificate** or **Download CA bundle**.

      If you are downloading a CA bundle, all the certificates in the CA bundle secondary tabs download as a single file.

   b. Specify the certificate file name and download location. Save the file with the extension `.pem`.

      For example: `storagegrid_certificate.pem`

   Copy certificate or CA bundle PEM

   Copy the certificate text to paste elsewhere. If you are using an optional CA bundle, each certificate in the bundle displays on its own sub-tab.

   a. Select **Copy certificate PEM** or **Copy CA bundle PEM**.

      If you are copying a CA bundle, all the certificates in the CA bundle secondary tabs copy together.

   b. Paste the copied certificate into a text editor.
   c. Save the text file with the extension `.pem`.

      For example: `storagegrid_certificate.pem`

Related information

- Use S3 REST API

- Use Swift REST API
- Configure S3 endpoint domain names

Copy the Grid CA certificate

StorageGRID uses an internal certificate authority (CA) to secure internal traffic. This certificate does not change if you upload your own certificates.

Before you begin

- You are signed in to the Grid Manager using a supported web browser.
- You have specific access permissions.

About this task

If a custom server certificate has been configured, client applications should verify the server using the custom server certificate. They should not copy the CA certificate from the StorageGRID system.

Steps

1. Select **CONFIGURATION** > **Security** > **Certificates** and then select the **Grid CA** tab.
2. In the **Certificate PEM** section, download or copy the certificate.

Download certificate file

Download the certificate `.pem` file.

a. Select **Download certificate**.
b. Specify the certificate file name and download location. Save the file with the extension `.pem`.

   For example: `storagegrid_certificate.pem`

Copy certificate PEM

Copy the certificate text to paste elsewhere.

a. Select **Copy certificate PEM**.
b. Paste the copied certificate into a text editor.
c. Save the text file with the extension `.pem`.

   For example: `storagegrid_certificate.pem`

Configure StorageGRID certificates for FabricPool

For S3 clients that perform strict hostname validation and don't support disabling strict hostname validation, such as ONTAP clients using FabricPool, you can generate or upload a server certificate when you configure the load balancer endpoint.

Before you begin

- You have specific access permissions.

- You are signed in to the Grid Manager using a supported web browser.

About this task

When you create a load balancer endpoint, you can generate a self-signed server certificate or upload a certificate that is signed by a known certificate authority (CA). In production environments, you should use a certificate that is signed by a known CA. Certificates signed by a CA can be rotated non-disruptively. They are also more secure because they provide better protection against man-in-the-middle attacks.

The following steps provide general guidelines for S3 clients that use FabricPool. For more detailed information and procedures, see Configure StorageGRID for FabricPool.

Steps

1. Optionally, configure a high availability (HA) group for FabricPool to use.
2. Create an S3 load balancer endpoint for FabricPool to use.

   When you create an HTTPS load balancer endpoint, you are prompted to upload your server certificate, certificate private key, and optional CA bundle.

3. Attach StorageGRID as a cloud tier in ONTAP.

   Specify the load balancer endpoint port and the fully qualified domain name used in the CA certificate you uploaded. Then, provide the CA certificate.

   > If an intermediate CA issued the StorageGRID certificate, you must provide the intermediate CA certificate. If the StorageGRID certificate was issued directly by the Root CA, you must provide the Root CA certificate.

Configure client certificates

Client certificates allow authorized external clients to access the StorageGRID Prometheus database, providing a secure way for external tools to monitor StorageGRID.

If you need to access StorageGRID using an external monitoring tool, you must upload or generate a client certificate using the Grid Manager and copy the certificate information to the external tool.

See Manage security certificates and Configure custom server certificates.

> To ensure that operations aren't disrupted by a failed server certificate, the **Expiration of client certificates configured on the Certificates page** alert is triggered when this server certificate is about to expire. As required, you can view when the current certificate expires by selecting **CONFIGURATION** > **Security** > **Certificates** and looking at the Expiration date for the client certificate on the Client tab.

> If you are using a key management server (KMS) to protect the data on specially configured appliance nodes, see the specific information about uploading a KMS client certificate.

Before you begin

- You have Root access permission.
- You are signed in to the Grid Manager using a supported web browser.
- To configure a client certificate:

    - You have the IP address or domain name of the Admin Node.
    - If you have configured the StorageGRID management interface certificate, you have the CA, client certificate, and private key used to configure the management interface certificate.
    - To upload your own certificate, the private key for the certificate is available on your local computer.
    - The private key must have been saved or recorded at the time it was created. If you don't have the original private key, you must create a new one.
- To edit a client certificate:
    - You have the IP address or domain name of the Admin Node.
    - To upload your own certificate or a new certificate, the private key, client certificate, and CA (if used) are available on your local computer.

Add client certificates

To add the client certificate, use one of these procedures:

- Management interface certificate already configured
- CA issued client certificate
- Generated certificate from Grid Manager

Management interface certificate already configured

Use this procedure to add a client certificate if a management interface certificate is already configured using a customer-supplied CA, client certificate, and private key.

Steps

1. In the Grid Manager, select **CONFIGURATION** > **Security** > **Certificates** and then select the **Client** tab.
2. Select **Add**.
3. Enter a certificate name.
4. To access Prometheus metrics using your external monitoring tool, select **Allow prometheus**.
5. Select **Continue**.
6. For the **Attach certificates** step, upload the management interface certificate.
    a. Select **Upload certificate**.
    b. Select **Browse** and select the management interface certificate file (`.pem`).
        - Select **Client certificate details** to display the certificate metadata and certificate PEM.
        - Select **Copy certificate PEM** to copy the certificate contents for pasting elsewhere.
    c. Select **Create** to save the certificate in the Grid Manager.

    The new certificate appears on the Client tab.
7. Configure an external monitoring tool, such as Grafana.

CA issued client certificate

Use this procedure to add an administrator client certificate if a management interface certificate was not configured and you plan to add a client certificate for Prometheus that uses a CA issued client certificate and private key.

Steps

1. Perform the steps to configure a management interface certificate.
2. In the Grid Manager, select **CONFIGURATION** > **Security** > **Certificates** and then select the **Client** tab.
3. Select **Add**.
4. Enter a certificate name.
5. To access Prometheus metrics using your external monitoring tool, select **Allow prometheus**.
6. Select **Continue**.
7. For the **Attach certificates** step, upload the client certificate, private key, and CA bundle files:
   a. Select **Upload certificate**.
   b. Select **Browse** and select the client certificate, private key, and CA bundle files (`.pem`).
      - Select **Client certificate details** to display the certificate metadata and certificate PEM.
      - Select **Copy certificate PEM** to copy the certificate contents for pasting elsewhere.
   c. Select **Create** to save the certificate in the Grid Manager.

      The new certificates appear on the Client tab.
8. Configure an external monitoring tool, such as Grafana.

Generated certificate from Grid Manager

Use this procedure to add an administrator client certificate if a management interface certificate was not configured and you plan to add a client certificate for Prometheus that uses the generate certificate function in Grid Manager.

Steps

1. In the Grid Manager, select **CONFIGURATION** > **Security** > **Certificates** and then select the **Client** tab.
2. Select **Add**.
3. Enter a certificate name.
4. To access Prometheus metrics using your external monitoring tool, select **Allow prometheus**.
5. Select **Continue**.
6. For the **Attach certificates** step, select **Generate certificate**.
7. Specify the certificate information:
   - **Subject** (optional): X.509 subject or distinguished name (DN) of the certificate owner.
   - **Days valid**: The number of days the generated certificate is valid, starting at the time it is generated.
   - **Add key usage extensions**: If selected (default and recommended), key usage and extended key usage extensions are added to the generated certificate.

     These extensions define the purpose of the key contained in the certificate.

     > Leave this checkbox selected unless you experience connection problems with older clients when certificates include these extensions.
8. Select **Generate**.
9. Select **Client certificate details** to display the certificate metadata and certificate PEM.

> You will not be able to view the certificate private key after you close the dialog. Copy or download the key to a safe location.

- Select **Copy certificate PEM** to copy the certificate contents for pasting elsewhere.
- Select **Download certificate** to save the certificate file.

  Specify the certificate file name and download location. Save the file with the extension `.pem`.

  For example: `storagegrid_certificate.pem`

- Select **Copy private key** to copy the certificate private key for pasting elsewhere.
- Select **Download private key** to save the private key as a file.

  Specify the private key file name and download location.

10. Select **Create** to save the certificate in the Grid Manager.

    The new certificate appears on the Client tab.

11. In the Grid Manager, select **CONFIGURATION** > **Security** > **Certificates** and then select the **Global** tab.
12. Select **Management Interface certificate**.
13. Select **Use custom certificate**.
14. Upload the certificate.pem and private_key.pem files from the client certificate details step. There is no need to upload CA bundle.
    a. Select **Upload certificate** and then select **Continue**.
    b. Upload each certificate file (`.pem`).
    c. Select **Save** to save the certificate in the Grid Manager.

       The new certificate appears on the Management Interface certificate page.

15. Configure an external monitoring tool, such as Grafana.

Configure an external monitoring tool

Steps

1. Configure the following settings on your external monitoring tool, such as Grafana.
   a. **Name**: Enter a name for the connection.

      StorageGRID does not require this information, but you must provide a name to test the connection.

   b. **URL**: Enter the domain name or IP address for the Admin Node. Specify HTTPS and port 9091.

      For example: `https://admin-node.example.com:9091`

   c. Enable **TLS Client Auth** and **With CA Cert**.
   d. Under TLS/SSL Auth Details, copy and paste:
      - The management interface CA certificate to **CA Cert**
      - The client certificate to **Client Cert**

    - The private key to **Client Key**

  e. **ServerName**: Enter the domain name of the Admin Node.

     ServerName must match the domain name as it appears in the management interface certificate.

2. Save and test the certificate and private key that you copied from StorageGRID or a local file.

   You can now access the Prometheus metrics from StorageGRID with your external monitoring tool.

   For information about the metrics, see the instructions for monitoring StorageGRID.

Edit client certificates

You can edit an administrator client certificate to change its name, enable or disable Prometheus access, or upload a new certificate when the current one has expired.

Steps

1. Select **CONFIGURATION** > **Security** > **Certificates** and then select the **Client** tab.

   Certificate expiration dates and Prometheus access permissions are listed in the table. If a certificate will expire soon or is already expired, a message appears in the table and an alert is triggered.

2. Select the certificate you want to edit.
3. Select **Edit** and then select **Edit name and permission**
4. Enter a certificate name.
5. To access Prometheus metrics using your external monitoring tool, select **Allow prometheus**.
6. Select **Continue** to save the certificate in the Grid Manager.

   The updated certificate displays on the Client tab.

Attach new client certificate

You can upload a new certificate when the current one has expired.

Steps

1. Select **CONFIGURATION** > **Security** > **Certificates** and then select the **Client** tab.

   Certificate expiration dates and Prometheus access permissions are listed in the table. If a certificate will expire soon or is already expired, a message appears in the table and an alert is triggered.

2. Select the certificate you want to edit.
3. Select **Edit** and then select an edit option.

Upload certificate

Copy the certificate text to paste elsewhere.

a. Select **Upload certificate** and then select **Continue**.

b. Upload the client certificate name (`.pem`).

   Select **Client certificate details** to display the certificate metadata and certificate PEM.

   - Select **Download certificate** to save the certificate file.

     Specify the certificate file name and download location. Save the file with the extension `.pem`.

     For example: `storagegrid_certificate.pem`

   - Select **Copy certificate PEM** to copy the certificate contents for pasting elsewhere.

c. Select **Create** to save the certificate in the Grid Manager.

   The updated certificate displays on the Client tab.

Generate certificate

Generate the certificate text to paste elsewhere.

a. Select **Generate certificate**.

b. Specify the certificate information:

   - **Subject** (optional): X.509 subject or distinguished name (DN) of the certificate owner.
   - **Days valid**: The number of days the generated certificate is valid, starting at the time it is generated.
   - **Add key usage extensions**: If selected (default and recommended), key usage and extended key usage extensions are added to the generated certificate.

     These extensions define the purpose of the key contained in the certificate.

     > Leave this checkbox selected unless you experience connection problems with older clients when certificates include these extensions.

c. Select **Generate**.

d. Select **Client certificate details** to display the certificate metadata and certificate PEM.

   > You will not be able to view the certificate private key after you close the dialog. Copy or download the key to a safe location.

   - Select **Copy certificate PEM** to copy the certificate contents for pasting elsewhere.
   - Select **Download certificate** to save the certificate file.

     Specify the certificate file name and download location. Save the file with the extension `.pem`.

     For example: `storagegrid_certificate.pem`

- Select **Copy private key** to copy the certificate private key for pasting elsewhere.
- Select **Download private key** to save the private key as a file.

  Specify the private key file name and download location.

e. Select **Create** to save the certificate in the Grid Manager.

   The new certificate appears on the Client tab.

Download or copy client certificates

You can download or copy a client certificate for use elsewhere.

Steps

1. Select **CONFIGURATION** > **Security** > **Certificates** and then select the **Client** tab.
2. Select the certificate you want to copy or download.
3. Download or copy the certificate.

Download certificate file

Download the certificate `.pem` file.

a. Select **Download certificate**.
b. Specify the certificate file name and download location. Save the file with the extension `.pem`.

   For example: `storagegrid_certificate.pem`

Copy certificate

Copy the certificate text to paste elsewhere.

a. Select **Copy certificate PEM**.
b. Paste the copied certificate into a text editor.
c. Save the text file with the extension `.pem`.

   For example: `storagegrid_certificate.pem`

Remove client certificates

If you no longer need an administrator client certificate, you can remove it.

Steps

1. Select **CONFIGURATION** > **Security** > **Certificates** and then select the **Client** tab.
2. Select the certificate you want to remove.
3. Select **Delete** and then confirm.

To remove up to 10 certificates, select each certificate to remove on the Client tab and then select **Actions** > **Delete**.

After a certificate is removed, clients that used the certificate must specify a new client certificate to access the StorageGRID Prometheus database.

Configure security settings

Manage the TLS and SSH policy

The TLS and SSH policy determines which protocols and ciphers are used to establish secure TLS connections with client applications and secure SSH connections to internal StorageGRID services.

The security policy controls how TLS and SSH encrypt data in motion. In general, use the Modern compatibility (default) policy, unless your system needs to be Common Criteria-compliant or you need to use other ciphers.

Some StorageGRID services have not been updated to use the ciphers in these policies.

Before you begin

- You are signed in to the Grid Manager using a supported web browser.
- You have the Root access permission.

Select a security policy

Steps

1. Select **CONFIGURATION** > **Security** > **Security settings**.

   The **TLS and SSH policies** tab shows the available policies. The currently active policy is noted by a green check mark on the policy tile.

2. Review the tiles to learn about the available policies.

Policy	Description
Modern compatibility (default)	Use the default policy if you need strong encryption and unless you have special requirements. This policy is compatible with most TLS and SSH clients.

Policy	Description
Legacy compatibility	Use this policy if you need additional compatibility options for older clients. The additional options in this policy might make it less secure than the Modern compatibility policy.
Common Criteria	Use this policy if you require Common Criteria certification.
FIPS strict	Use this policy if you require Common Criteria certification and need to use the NetApp Cryptographic Security Module 3.0.8 for external client connections to load balancer endpoints, Tenant Manager, and Grid Manager. Using this policy might reduce performance. **Note**: After you select this policy, all nodes must be rebooted in a rolling fashion to activate the NetApp Cryptographic Security Module. Use **Maintenance** > **Rolling reboot** to initiate and monitor reboots.
Custom	Create a custom policy if you need to apply your own ciphers.

3. To see details about each policy's ciphers, protocols, and algorithms, select **View details**.
4. To change the current policy, select **Use policy**.

   A green check mark appears next to **Current policy** on the policy tile.

Create a custom security policy

You can create a custom policy if you need to apply your own ciphers.

Steps

1. From the tile of the policy that is the most similar to the custom policy you want to create, select **View details**.
2. Select **Copy to clipboard**, and then select **Cancel**.

3. From the **Custom policy** tile, select **Configure and use**.

4. Paste the JSON you copied and make any changes required.
5. Select **Use policy**.

   A green check mark appears next to **Current policy** on the Custom policy tile.

6. Optionally, select **Edit configuration** to make more changes to the new custom policy.

Temporarily revert to the default security policy

If you configured a custom security policy, you might not be able to sign in to the Grid Manager if the configured TLS policy is incompatible with the configured server certificate.

You can temporarily revert to the default security policy.

Steps

1. Log in to an Admin Node:
   a. Enter the following command: `ssh admin@Admin_Node_IP`
   b. Enter the password listed in the `Passwords.txt` file.
   c. Enter the following command to switch to root: `su -`
   d. Enter the password listed in the `Passwords.txt` file.

      When you are logged in as root, the prompt changes from `$` to `#`.

2. Run the following command:

   ```
   restore-default-cipher-configurations
   ```

3. From a web browser, access the Grid Manager on the same Admin Node.
4. Follow the steps in Select a security policy to configure the policy again.

Configure network and object security

You can configure network and object security to encrypt stored objects, to prevent certain S3 and Swift requests, or to allow client connections to Storage Nodes to use HTTP instead of HTTPS.

Stored object encryption

Stored object encryption enables the encryption of all object data as it is ingested through S3. By default, stored objects aren't encrypted but you can choose to encrypt objects using the AES-128 or AES-256 encryption algorithm. When you enable the setting, all newly ingested objects are encrypted but no change is made to existing stored objects. If you disable encryption, currently encrypted objects remain encrypted but newly ingested objects aren't encrypted.

The Stored object encryption setting applies only to S3 objects that have not been encrypted by bucket-level or object-level encryption.

For more details on StorageGRID encryption methods, see Review StorageGRID encryption methods.

Prevent client modification

Prevent client modification is a system wide setting. When the **Prevent client modification** option is selected, the following requests are denied.

S3 REST API

- DeleteBucket requests
- Any requests to modify an existing object's data, user-defined metadata, or S3 object tagging

Swift REST API

- Delete Container requests
- Requests to modify any existing object. For example, the following operations are denied: Put Overwrite, Delete, Metadata Update, and so on.

Enable HTTP for Storage Node connections

By default, client applications use the HTTPS network protocol for any direct connections to Storage Nodes. You can optionally enable HTTP for these connections, for example, when testing a non-production grid.

Use HTTP for Storage Node connections only if S3 and Swift clients need to make HTTP connections directly to Storage Nodes. You don't need to use this option for clients that only use HTTPS connections or for clients that connect to the Load Balancer service (because you can configure each load balancer endpoint to use either HTTP or HTTPS).

See Summary: IP addresses and ports for client connections to learn which ports S3 and Swift clients use when connecting to Storage Nodes using HTTP or HTTPS.

Select options

Before you begin

- You are signed in to the Grid Manager using a supported web browser.
- You have Root access permission.

Steps

1. Select **CONFIGURATION** > **Security** > **Security settings**.
2. Select the **Network and objects** tab.
3. For Stored object encryption, use the **None** (default) setting if you don't want stored objects to be encrypted, or select **AES-128** or **AES-256** to encrypt stored objects.
4. Optionally select **Prevent client modification** if you want to prevent S3 and Swift clients from making specific requests.

   > If you change this setting, it will take about one minute for the new setting to be applied. The configured value is cached for performance and scaling.

5. Optionally select **Enable HTTP for Storage Node connections** if clients connect directly to Storage Nodes and you want to use HTTP connections.

   > Be careful when enabling HTTP for a production grid because requests will be sent unencrypted.

6. Select **Save**.

Change interface security settings

The interface security settings let you control whether users are signed out if they are inactive for more than the specified amount of time and whether a stack trace is included in API error responses.

Before you begin

- You are signed in to the Grid Manager using a supported web browser.
- You have Root access permission.

About this task

The **Security settings** page includes the **Browser inactivity timeout** and **Management API stack trace** settings.

Browser inactivity timeout

Indicates how long a user's browser can be inactive before the user is signed out. The default is 15 minutes.

Browser inactivity timeout is also controlled by the following:

- A separate, non-configurable StorageGRID timer, which is included for system security. Each user's authentication token expires 16 hours after the user signs in. When a user's authentication expires, that user is automatically signed out, even if browser inactivity timeout is disabled or the value for the browser timeout has not been reached. To renew the token, the user must sign back in.
- Timeout settings for the identity provider, assuming single sign-on (SSO) is enabled for StorageGRID.

  If SSO is enabled and a user's browser times out, the user must reenter their SSO credentials to access StorageGRID again. See Configure single sign-on.

Management API stack trace

Controls whether a stack trace is returned in Grid Manager and Tenant Manager API error responses.

This option is disabled by default, but you might want to enable this functionality for a test environment. In general, you should leave stack trace disabled in production environments to avoid revealing internal software details when API errors occur.

Steps

1. Select **CONFIGURATION** > **Security** > **Security settings**.
2. Select the **Interface** tab.
3. To change the setting for browser inactivity timeout:
   a. Expand the accordion.
   b. To change the timeout period, specify a value between 60 seconds and 7 days. The default timeout is 15 minutes.
   c. To disable this feature, unselect the checkbox.
   d. Select **Save**.

      The new setting doesn't affect users who are currently signed in. Users must sign in again or refresh

their browsers for the new timeout setting to take effect.

4. To change the setting for Management API stack trace:
   a. Expand the accordion.
   b. Select the checkbox to return a stack trace in Grid Manager and Tenant Manager API error responses.

   > Leave stack trace disabled in production environments to avoid revealing internal software details when API errors occur.

   c. Select **Save**.

Configure key management servers

Configure key management servers: Overview

You can configure one or more external key management servers (KMS) to protect the data on specially configured appliance nodes.

> StorageGRID supports only certain key management servers. For a list of supported products and versions, use the NetApp Interoperability Matrix Tool (IMT).

What is a key management server (KMS)?

A key management server (KMS) is an external, third-party system that provides encryption keys to StorageGRID appliance nodes at the associated StorageGRID site using the Key Management Interoperability Protocol (KMIP).

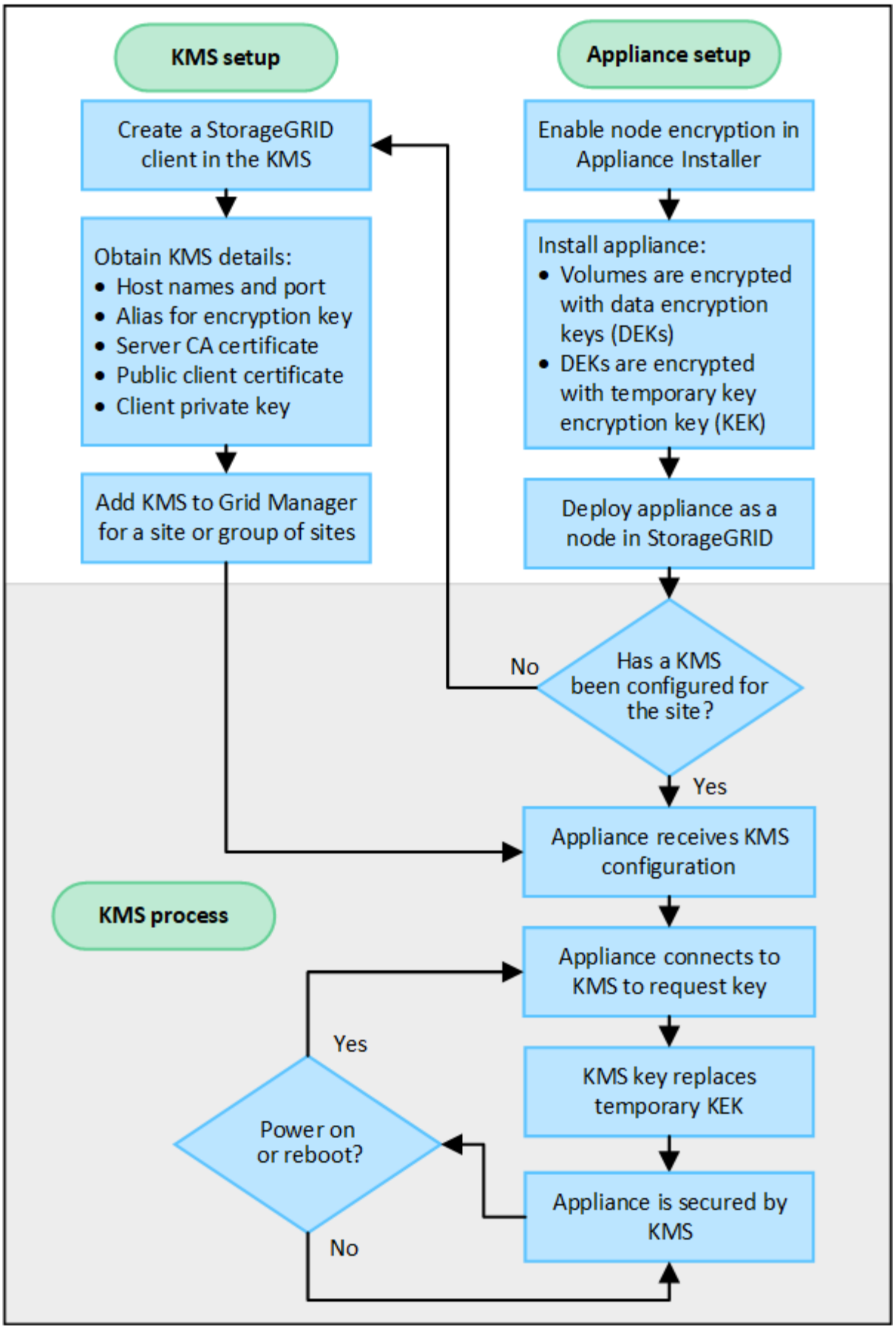
You can use one or more key management servers to manage the node encryption keys for any StorageGRID appliance nodes that have the **Node Encryption** setting enabled during installation. Using key management servers with these appliance nodes lets you protect your data even if an appliance is removed from the data center. After the appliance volumes are encrypted, you can't access any data on the appliance unless the node can communicate with the KMS.

> StorageGRID does not create or manage the external keys used to encrypt and decrypt appliance nodes. If you plan to use an external key management server to protect StorageGRID data, you must understand how to set up that server, and you must understand how to manage the encryption keys. Performing key management tasks is beyond the scope of these instructions. If you need help, see the documentation for your key management server or contact technical support.

Overview of KMS and appliance configuration

Before you can use a key management server (KMS) to secure StorageGRID data on appliance nodes, you must complete two configuration tasks: setting up one or more KMS servers and enabling node encryption for the appliance nodes. When these two configuration tasks are complete, the key management process occurs automatically.

The flowchart shows the high-level steps for using a KMS to secure StorageGRID data on appliance nodes.



The flowchart shows KMS setup and appliance setup occurring in parallel; however, you can set up the key

management servers before or after you enable node encryption for new appliance nodes, based on your requirements.

Set up the key management server (KMS)

Setting up a key management server includes the following high-level steps.

Step	Refer to
Access the KMS software and add a client for StorageGRID to each KMS or KMS cluster.	Configure StorageGRID as a client in the KMS
Obtain the required information for the StorageGRID client on the KMS.	Configure StorageGRID as a client in the KMS
Add the KMS to the Grid Manager, assign it to a single site or to a default group of sites, upload the required certificates, and save the KMS configuration.	Add a key management server (KMS)

Set up the appliance

Setting up an appliance node for KMS use includes the following high-level steps.

1. During the hardware configuration stage of appliance installation, use the StorageGRID Appliance Installer to enable the **Node Encryption** setting for the appliance.

   > You can't enable the **Node Encryption** setting after an appliance is added to the grid, and you can't use external key management for appliances that don't have node encryption enabled.

2. Run the StorageGRID Appliance Installer. During installation, a random data encryption key (DEK) is assigned to each appliance volume, as follows:
   - The DEKs are used to encrypt the data on each volume. These keys are generated using Linux Unified Key Setup (LUKS) disk encryption in the appliance OS and can't be changed.
   - Each individual DEK is encrypted by a master key encryption key (KEK). The initial KEK is a temporary key that encrypts the DEKs until the appliance can connect to the KMS.
3. Add the appliance node to StorageGRID.

See Enable node encryption for details.

Key management encryption process (occurs automatically)

Key management encryption includes the following high-level steps that are performed automatically.

1. When you install an appliance that has node encryption enabled into the grid, StorageGRID determines if a KMS configuration exists for the site that contains the new node.
   - If a KMS has already been configured for the site, the appliance receives the KMS configuration.
   - If a KMS has not yet been configured for the site, data on the appliance continues to be encrypted by the temporary KEK until you configure a KMS for the site and the appliance receives the KMS configuration.

2. The appliance uses the KMS configuration to connect to the KMS and request an encryption key.
3. The KMS sends an encryption key to the appliance. The new key from the KMS replaces the temporary KEK and is now used to encrypt and decrypt the DEKs for the appliance volumes.

> Any data that exists before the encrypted appliance node connects to the configured KMS is encrypted with a temporary key. However, the appliance volumes should not be considered protected from removal from the data center until the temporary key is replaced by the KMS encryption key.

4. If the appliance is powered on or rebooted, it reconnects to the KMS to request the key. The key, which is saved in volatile memory, can't survive a loss of power or a reboot.

Considerations and requirements for using a key management server

Before configuring an external key management server (KMS), you must understand the considerations and requirements.

Which version of KMIP is supported?

StorageGRID supports KMIP version 1.4.

Key Management Interoperability Protocol Specification Version 1.4

What are the network considerations?

The network firewall settings must allow each appliance node to communicate through the port used for Key Management Interoperability Protocol (KMIP) communications. The default KMIP port is 5696.

You must ensure that each appliance node that uses node encryption has network access to the KMS or KMS cluster you configured for the site.

Which versions of TLS are supported?

Communications between the appliance nodes and the configured KMS use secure TLS connections. StorageGRID can support either the TLS 1.2 or TLS 1.3 protocol when it makes KMIP connections to a KMS or KMS cluster, based on what the KMS supports and which TLS and SSH policy you are using.

StorageGRID negotiates the protocol and cipher (TLS 1.2) or cipher suite (TLS 1.3) with the KMS when it makes the connection. To see which protocol versions and ciphers/cipher suites are available, review the `tlsOutbound` section of the grid's active TLS and SSH policy (**CONFIGURATION** > **Security Security settings**).

Which appliances are supported?

You can use a key management server (KMS) to manage encryption keys for any StorageGRID appliance in your grid that has the **Node Encryption** setting enabled. This setting can only be enabled during the hardware configuration stage of appliance installation using the StorageGRID Appliance Installer.

> You can't enable node encryption after an appliance is added to the grid, and you can't use external key management for appliances that don't have node encryption enabled.

You can use the configured KMS for StorageGRID appliances and appliance nodes.

You can't use the configured KMS for software-based (non-appliance) nodes, including the following:

- Nodes deployed as virtual machines (VMs)
- Nodes deployed within container engines on Linux hosts

Nodes deployed on these other platforms can use encryption outside of StorageGRID at the datastore or disk level.

When should I configure key management servers?

For a new installation, you should typically set up one or more key management servers in the Grid Manager before creating tenants. This order ensures that the nodes are protected before any object data is stored on them.

You can configure the key management servers in the Grid Manager before or after you install the appliance nodes.

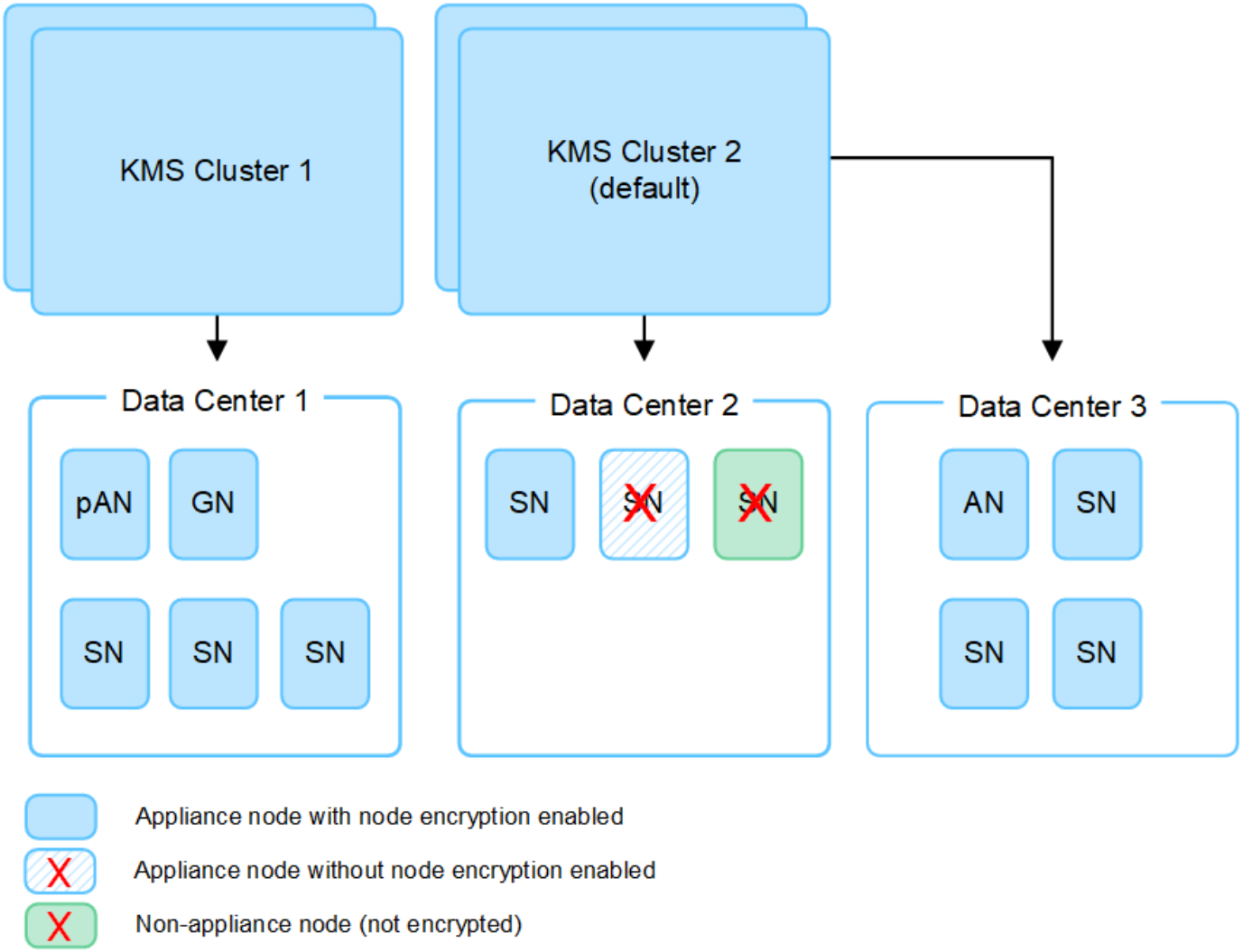
How many key management servers do I need?

You can configure one or more external key management servers to provide encryption keys to the appliance nodes in your StorageGRID system. Each KMS provides a single encryption key to the StorageGRID appliance nodes at a single site or at a group of sites.

StorageGRID supports the use of KMS clusters. Each KMS cluster contains multiple, replicated key management servers that share configuration settings and encryption keys. Using KMS clusters for key management is recommended because it improves the failover capabilities of a high availability configuration.

For example, suppose your StorageGRID system has three data center sites. You might configure one KMS cluster to provide a key to all appliance nodes at Data Center 1 and a second KMS cluster to provide a key to all appliance nodes at all other sites. When you add the second KMS cluster, you can configure a default KMS for Data Center 2 and Data Center 3.

Note that you can't use a KMS for non-appliance nodes or for any appliance nodes that did not have the **Node Encryption** setting enabled during installation.



What happens when a key is rotated?

As a security best practice, you should periodically rotate the encryption key used by each configured KMS.

When the new key version is available:

- It is automatically distributed to the encrypted appliance nodes at the site or sites associated with the KMS. The distribution should occur within an hour of when the key is rotated.
- If the encrypted appliance node is offline when the new key version is distributed, the node will receive the new key as soon as it reboots.
- If the new key version can't be used to encrypt appliance volumes for any reason, the **KMS encryption key rotation failed** alert is triggered for the appliance node. You might need to contact technical support for help in resolving this alert.

Can I reuse an appliance node after it has been encrypted?

If you need to install an encrypted appliance into another StorageGRID system, you must first decommission the grid node to move object data to another node. Then, you can use the StorageGRID Appliance Installer to clear the KMS configuration. Clearing the KMS configuration disables the **Node Encryption** setting and removes the association between the appliance node and the KMS configuration for the StorageGRID site.

With no access to the KMS encryption key, any data that remains on the appliance can no longer be accessed and is permanently locked.

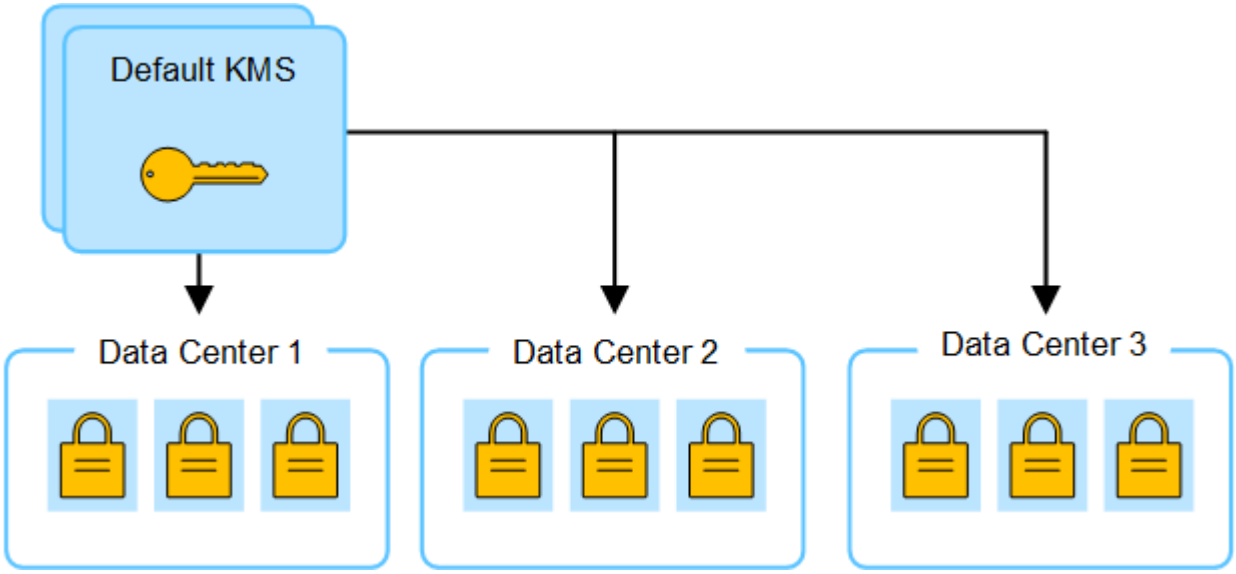
Considerations for changing the KMS for a site

Each key management server (KMS) or KMS cluster provides an encryption key to all appliance nodes at a single site or at a group of sites. If you need to change which KMS is used for a site, you might need to copy the encryption key from one KMS to another.

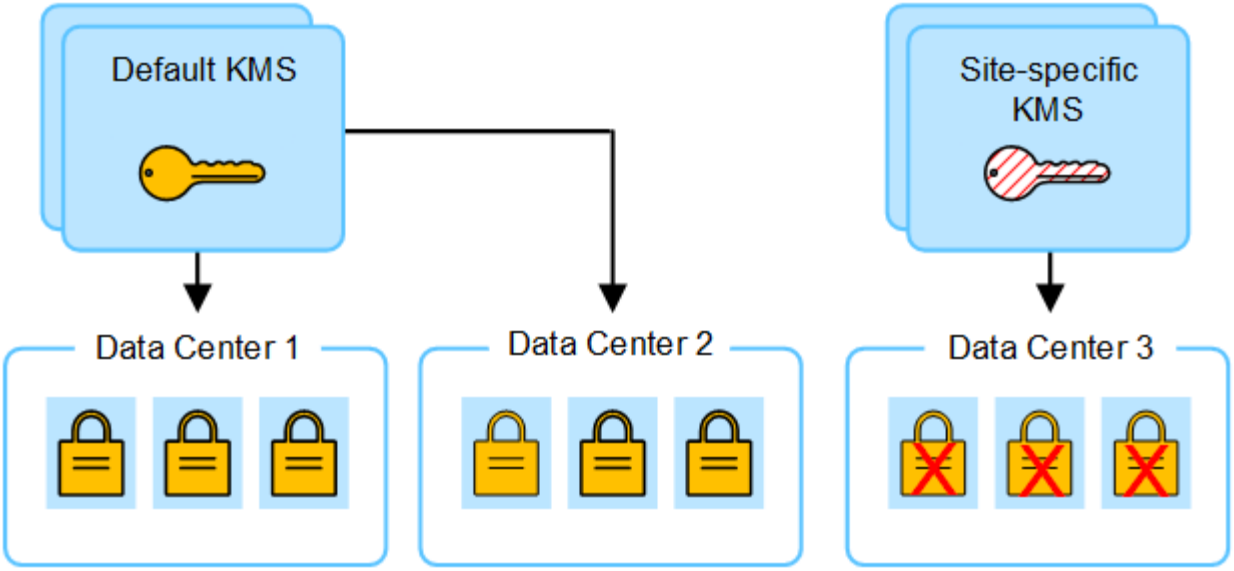
If you change the KMS used for a site, you must ensure that the previously encrypted appliance nodes at that site can be decrypted using the key stored on the new KMS. In some cases, you might need to copy the current version of the encryption key from the original KMS to the new KMS. You must ensure that the KMS has the correct key to decrypt the encrypted appliance nodes at the site.

For example:

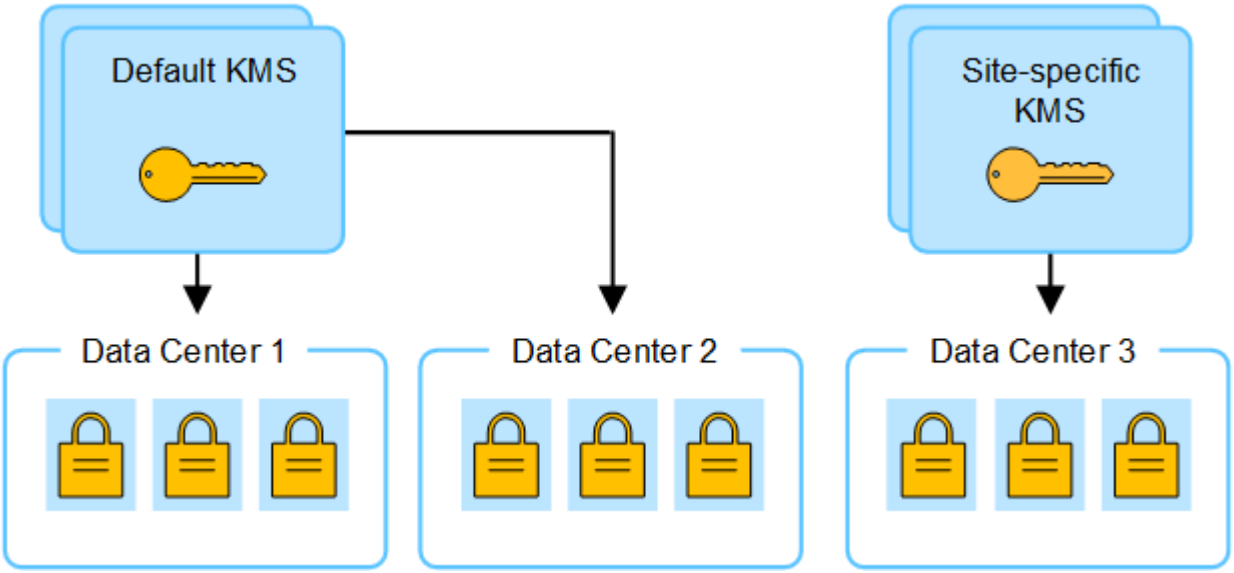
1. You initially configure a default KMS that applies to all sites that don't have a dedicated KMS.
2. When the KMS is saved, all appliance nodes that have the **Node Encryption** setting enabled connect to the KMS and request the encryption key. This key is used to encrypt the appliance nodes at all sites. This same key must also be used to decrypt those appliances.



3. You decide to add a site-specific KMS for one site (Data Center 3 in the figure). However, because the appliance nodes are already encrypted, a validation error occurs when you attempt to save the configuration for the site-specific KMS. The error occurs because the site-specific KMS does not have the correct key to decrypt the nodes at that site.



4. To address the issue, you copy the current version of the encryption key from the default KMS to the new KMS. (Technically, you copy the original key to a new key with the same alias. The original key becomes a prior version of the new key.) The site-specific KMS now has the correct key to decrypt the appliance nodes at Data Center 3, so it can be saved in StorageGRID.



Use cases for changing which KMS is used for a site

The table summarizes the required steps for the most common cases for changing the KMS for a site.

Use case for changing a site's KMS	Required steps
You have one or more site-specific KMS entries, and you want to use one of them as the default KMS.	Edit the site-specific KMS. In the **Manages keys for** field, select **Sites not managed by another KMS (default KMS)**. The site-specific KMS will now be used as the default KMS. It will apply to any sites that don't have a dedicated KMS. Edit a key management server (KMS)

Use case for changing a site's KMS	Required steps
You have a default KMS and you add a new site in an expansion. You don't want to use the default KMS for the new site.	1. If the appliance nodes at the new site have already been encrypted by the default KMS, use the KMS software to copy the current version of the encryption key from the default KMS to a new KMS. 2. Using the Grid Manager, add the new KMS and select the site. Add a key management server (KMS)
You want the KMS for a site to use a different server.	1. If the appliance nodes at the site have already been encrypted by the existing KMS, use the KMS software to copy the current version of the encryption key from the existing KMS to the new KMS. 2. Using the Grid Manager, edit the existing KMS configuration and enter the new host name or IP address. Add a key management server (KMS)

Configure StorageGRID as a client in the KMS

You must configure StorageGRID as a client for each external key management server or KMS cluster before you can add the KMS to StorageGRID.

> These instructions apply to Thales CipherTrust Manager and Hashicorp Vault. For a list of supported products and versions, use the NetApp Interoperability Matrix Tool (IMT).

Steps

1. From the KMS software, create a StorageGRID client for each KMS or KMS cluster you plan to use.

   Each KMS manages a single encryption key for the StorageGRID appliances nodes at a single site or at a group of sites.

2. Create a key using one of the following two methods:
   - Use the key management page of your KMS product. Create an AES encryption key for each KMS or KMS cluster.

     The encryption key must be 2,048 bits or more, and it must be exportable.

   - Have StorageGRID create the key. You will be prompted when you test and save after uploading client certificates.
3. Record the following information for each KMS or KMS cluster.

   You need this information when you add the KMS to StorageGRID:

   - Host name or IP address for each server.
   - KMIP port used by the KMS.
   - Key alias for the encryption key in the KMS.
4. For each KMS or KMS cluster, obtain a server certificate signed by a certificate authority (CA) or a certificate bundle that contains each of the PEM-encoded CA certificate files, concatenated in certificate

chain order.

The server certificate allows the external KMS to authenticate itself to StorageGRID.

- The certificate must use the Privacy Enhanced Mail (PEM) Base-64 encoded X.509 format.
- The Subject Alternative Name (SAN) field in each server certificate must include the fully qualified domain name (FQDN) or IP address that StorageGRID will connect to.

> When you configure the KMS in StorageGRID, you must enter the same FQDNs or IP addresses in the **Hostname** field.

- The server certificate must match the certificate used by the KMIP interface of the KMS, which typically uses port 5696.

5. Obtain the public client certificate issued to StorageGRID by the external KMS and the private key for the client certificate.

   The client certificate allows StorageGRID to authenticate itself to the KMS.

Add a key management server (KMS)

You use the StorageGRID Key Management Server wizard to add each KMS or KMS cluster.

Before you begin

- You have reviewed the considerations and requirements for using a key management server.
- You have configured StorageGRID as a client in the KMS, and you have the required information for each KMS or KMS cluster.
- You are signed in to the Grid Manager using a supported web browser.
- You have the Root access permission.

About this task

If possible, configure any site-specific key management servers before configuring a default KMS that applies to all sites not managed by another KMS. If you create the default KMS first, all node-encrypted appliances in the grid will be encrypted by the default KMS. If you want to create a site-specific KMS later, you must first copy the current version of the encryption key from the default KMS to the new KMS. See Considerations for changing the KMS for a site for details.

Step 1: KMS details

In Step 1 (KMS details) of the Add a Key Management Server wizard, you provide details about the KMS or KMS cluster.

Steps

1. Select **CONFIGURATION** > **Security** > **Key management server**.

   The Key management server page appears with the Configuration details tab selected.

2. Select **Create**.

   Step 1 (KMS details) of the Add a Key Management Server wizard appears.

3. Enter the following information for the KMS and the StorageGRID client you configured in that KMS.

Field	Description
KMS name	A descriptive name to help you identify this KMS. Must be between 1 and 64 characters.
Key name	The exact key alias for the StorageGRID client in the KMS. Must be between 1 and 255 characters. **Note**: If you haven't created a key using your KMS product, you'll be prompted to have StorageGRID create the key.
Manages keys for	The StorageGRID site that will be associated with this KMS. If possible, you should configure any site-specific key management servers before configuring a default KMS that applies to all sites not managed by another KMS. • Select a site if this KMS will manage encryption keys for the appliance nodes at a specific site. • Select **Sites not managed by another KMS (default KMS)** to configure a default KMS that will apply to any sites that don't have a dedicated KMS and to any sites you add in subsequent expansions. **Note:** A validation error will occur when you save the KMS configuration if you select a site that was previously encrypted by the default KMS but you did not provide the current version of original encryption key to the new KMS.
Port	The port the KMS server uses for Key Management Interoperability Protocol (KMIP) communications. Defaults to 5696, which is the KMIP standard port.
Hostname	The fully qualified domain name or IP address for the KMS. **Note:** The Subject Alternative Name (SAN) field of the server certificate must include the FQDN or IP address you enter here. Otherwise, StorageGRID will not be able to connect to the KMS or to all servers in a KMS cluster.

4. If you are configuring a KMS cluster, select **Add another hostname** to add a hostname for each server in the cluster.
5. Select **Continue**.

Step 2: Upload server certificate

In Step 2 (Upload server certificate) of the Add a Key Management Server wizard, you upload the server certificate (or certificate bundle) for the KMS. The server certificate allows the external KMS to authenticate itself to StorageGRID.

Steps

1. From **Step 2 (Upload server certificate)**, browse to the location of the saved server certificate or certificate bundle.
2. Upload the certificate file.

   The server certificate metadata appears.

   > If you uploaded a certificate bundle, the metadata for each certificate appears on its own tab.

3. Select **Continue**.

Step 3: Upload client certificates

In Step 3 (Upload client certificates) of the Add a Key Management Server wizard, you upload the client certificate and the client certificate private key. The client certificate allows StorageGRID to authenticate itself to the KMS.

Steps

1. From **Step 3 (Upload client certificates)**, browse to the location of the client certificate.
2. Upload the client certificate file.

   The client certificate metadata appears.

3. Browse to the location of the private key for the client certificate.
4. Upload the private key file.
5. Select **Test and save**.

   If a key doesn't exist, you are prompted to have StorageGRID create one.

   The connections between the key management server and the appliance nodes are tested. If all connections are valid and the correct key is found on the KMS, the new key management server is added to the table on the Key Management Server page.

   > Immediately after you add a KMS, the certificate status on the Key Management Server page appears as Unknown. It might take StorageGRID as long as 30 minutes to get the actual status of each certificate. You must refresh your web browser to see the current status.

6. If an error message appears when you select **Test and save**, review the message details and then select **OK**.

   For example, you might receive a 422: Unprocessable Entity error if a connection test failed.

7. If you need to save the current configuration without testing the external connection, select **Force save**.

   > Selecting **Force save** saves the KMS configuration, but it does not test the external connection from each appliance to that KMS. If there is an issue with the configuration, you might not be able to reboot appliance nodes that have node encryption enabled at the affected site. You might lose access to your data until the issues are resolved.

8. Review the confirmation warning, and select **OK** if you are sure you want to force save the configuration.

   The KMS configuration is saved but the connection to the KMS is not tested.

Manage a KMS

Managing a key management server (KMS) involves viewing or editing details, managing certificates, viewing encrypted nodes, and removing a KMS when it is no longer needed.

Before you begin

- You are signed in to the Grid Manager using a supported web browser.
- You have the required access permission.

View KMS details

You can view information about each key management server (KMS) in your StorageGRID system, including key details and the current status of the server and client certificates.

Steps

1. Select **CONFIGURATION** > **Security** > **Key management server**.

   The Key management server page appears and shows the following information:

   - The Configuration details tab lists any key management servers that are configured.
   - The Encrypted nodes tab lists any nodes that have node encryption enabled.

2. To view the details for a specific KMS and perform operations on that KMS, select the name of the KMS. The details page for the KMS lists the following information:

Field	Description
Manages keys for	The StorageGRID site associated with the KMS. This field displays the name of a specific StorageGRID site or **Sites not managed by another KMS (default KMS).**
Hostname	The fully qualified domain name or IP address of the KMS. If there is a cluster of two key management servers, the fully qualified domain name or IP address of both servers are listed. If there are more than two key management servers in a cluster, the fully qualified domain name or IP address of the first KMS is listed along with the number of additional key management servers in the cluster. For example: `10.10.10.10 and 10.10.10.11` or `10.10.10.10 and 2 others`. To view all hostnames in a cluster, select a KMS and select **Edit** or **Actions** > **Edit**.

3. Select a tab on the KMS details page to view the following information:

Tab	Field	Description
Key details	Key name	The key alias for the StorageGRID client in the KMS.
	Key UID	The unique identifier of the latest version of the key.
	Last modified	The date and time of the latest version of the key.
Server certificate	Metadata	The metadata for the certificate, such as serial number, expiration date and time, and the certificate PEM.
	Certificate PEM	The contents of the PEM (privacy enhanced mail) file for the certificate.
Client certificate	Metadata	The metadata for the certificate, such as serial number, expiration date and time, and the certificate PEM.
	Certificate PEM	The contents of the PEM (privacy enhanced mail) file for the certificate.

4. As often as required by your organization's security practices, select **Rotate key**, or use the KMS software, to create a new version of the key.

   When key rotation is successful, the Key UID and Last modified fields are updated.

   > If you rotate the encryption key using the KMS software, rotate it from the last used version of the key to a new version of the same key. Don't rotate to an entirely different key.
   >
   > Never attempt to rotate a key by changing the key name (alias) for the KMS. StorageGRID requires all previously used key versions (as well as any future ones) to be accessible from the KMS with the same key alias. If you change the key alias for a configured KMS, StorageGRID might not be able to decrypt your data.

Manage certificates

Promptly address any server or client certificate issues. If possible, replace certificates before they expire.

> You must address any certificate issues as soon as possible to maintain data access.

Steps

1. Select **CONFIGURATION** > **Security** > **Key management server**.
2. In the table, look at the value for Certificate expiration for each KMS.
3. If Certificate expiration for any KMS is Unknown, wait up to 30 minutes and then refresh your web browser.
4. If the Certificate expiration column indicates that a certificate has expired or is nearing expiration, select the KMS to go to the KMS details page.
   a. Select **Server certificate** and verify the value for the "Expires on" field.
   b. To replace the certificate, select **Edit certificate** to upload a new certificate.

c. Repeat these sub-steps and select **Client certificate** instead of Server certificate.

5. When the **KMS CA certificate expiration**, **KMS client certificate expiration**, and **KMS server certificate expiration** alerts are triggered, note the description of each alert and perform the recommended actions.

> It might take StorageGRID as long as 30 minutes to get updates to the certificate expiration. Refresh your web browser to see the current values.

View encrypted nodes

You can view information about the appliance nodes in your StorageGRID system that have the **Node Encryption** setting enabled.

Steps

1. Select **CONFIGURATION** > **Security** > **Key management server**.

   The Key Management Server page appears. The Configuration Details tab shows any key management servers that have been configured.

2. From the top of the page, select the **Encrypted nodes** tab.

   The Encrypted nodes tab lists the appliance nodes in your StorageGRID system that have the **Node Encryption** setting enabled.

3. Review the information in the table for each appliance node.

Column	Description
Node name	The name of the appliance node.
Node type	The type of node: Storage, Admin, or Gateway.
Site	The name of the StorageGRID site where the node is installed.
KMS name	The descriptive name of the KMS used for the node. If no KMS is listed, select the Configuration details tab to add a KMS. Add a key management server (KMS)
Key UID	The unique ID of the encryption key used to encrypt and decrypt data on the appliance node. To view an entire key UID, select the text. A dash (--) indicates the key UID is unknown, possibly because of a connection issue between the appliance node and the KMS.

Column	Description
Status	The status of the connection between the KMS and the appliance node. If the node is connected, the timestamp updates every 30 minutes. It can take several minutes for the connection status to update after the KMS configuration changes. **Note:** Refresh your web browser to see the new values.

4. If the Status column indicates a KMS issue, address the issue immediately.

   During normal KMS operations, the status will be **Connected to KMS**. If a node is disconnected from the grid, the node connection state is shown (Administratively Down or Unknown).

   Other status messages correspond to StorageGRID alerts with the same names:

   - KMS configuration failed to load
   - KMS connectivity error
   - KMS encryption key name not found
   - KMS encryption key rotation failed
   - KMS key failed to decrypt an appliance volume
   - KMS is not configured

   Perform the recommended actions for these alerts.

   > You must address any issues immediately to ensure that your data is fully protected.

Edit a KMS

You might need to edit the configuration of a key management server, for example, if a certificate is about to expire.

Before you begin

- If you plan to update the site selected for a KMS, you have reviewed the considerations for changing the KMS for a site.
- You are signed in to the Grid Manager using a supported web browser.
- You have the Root access permission.

Steps

1. Select **CONFIGURATION** > **Security** > **Key management server**.

   The Key management server page appears and shows all key management servers that have been configured.

2. Select the KMS you want to edit, and select **Actions** > **Edit**.

   You can also edit a KMS by selecting the KMS name in the table and selecting **Edit** on the KMS details page.

3. Optionally, update the details in **Step 1 (KMS details)** of the Edit a Key Management Server wizard.

Field	Description
KMS name	A descriptive name to help you identify this KMS. Must be between 1 and 64 characters.
Key name	The exact key alias for the StorageGRID client in the KMS. Must be between 1 and 255 characters. You only need to edit the key name in rare cases. For example, you must edit the key name if the alias is renamed in the KMS or if all versions of the previous key have been copied to the version history of the new alias.
Manages keys for	If you are editing a site-specific KMS and you don't already have a default KMS, optionally select **Sites not managed by another KMS (default KMS)**. This selection converts a site-specific KMS to the default KMS, which will apply to all sites that don't have a dedicated KMS and to any sites added in an expansion. **Note:** If you are editing a site-specific KMS, you can't select another site. If you are editing the default KMS, you can't select a specific site.
Port	The port the KMS server uses for Key Management Interoperability Protocol (KMIP) communications. Defaults to 5696, which is the KMIP standard port.
Hostname	The fully qualified domain name or IP address for the KMS. **Note:** The Subject Alternative Name (SAN) field of the server certificate must include the FQDN or IP address you enter here. Otherwise, StorageGRID will not be able to connect to the KMS or to all servers in a KMS cluster.

4. If you are configuring a KMS cluster, select **Add another hostname** to add a hostname for each server in the cluster.
5. Select **Continue**.

   Step 2 (Upload server certificate) of the Edit a Key Management Server wizard appears.

6. If you need to replace the server certificate, select **Browse** and upload the new file.
7. Select **Continue**.

   Step 3 (Upload client certificates) of the Edit a Key Management Server wizard appears.

8. If you need to replace the client certificate and the client certificate private key, select **Browse** and upload the new files.
9. Select **Test and save**.

   The connections between the key management server and all node-encrypted appliance nodes at the affected sites are tested. If all node connections are valid and the correct key is found on the KMS, the key management server is added to the table on the Key Management Server page.

10. If an error message appears, review the message details, and select **OK**.

For example, you might receive a 422: Unprocessable Entity error if the site you selected for this KMS is already managed by another KMS, or if a connection test failed.

11. If you need to save the current configuration before resolving the connection errors, select **Force save**.

> Selecting **Force save** saves the KMS configuration, but it does not test the external connection from each appliance to that KMS. If there is an issue with the configuration, you might not be able to reboot appliance nodes that have node encryption enabled at the affected site. You might lose access to your data until the issues are resolved.

The KMS configuration is saved.

12. Review the confirmation warning, and select **OK** if you are sure you want to force save the configuration.

The KMS configuration is saved, but the connection to the KMS is not tested.

Remove a key management server (KMS)

You might want to remove a key management server in some cases. For example, you might want to remove a site-specific KMS if you have decommissioned the site.

Before you begin

- You have reviewed the considerations and requirements for using a key management server.
- You are signed in to the Grid Manager using a supported web browser.
- You have the Root access permission.

About this task

You can remove a KMS in these cases:

- You can remove a site-specific KMS if the site has been decommissioned or if the site includes no appliance nodes with node encryption enabled.
- You can remove the default KMS if a site-specific KMS already exists for each site that has appliance nodes with node encryption enabled.

Steps

1. Select **CONFIGURATION** > **Security** > **Key management server**.

   The Key management server page appears and shows all key management servers that have been configured.

2. Select the KMS you want to remove, and select **Actions** > **Remove**.

   You can also remove a KMS by selecting the KMS name in the table and selecting **Remove** from the KMS details page.

3. Confirm the following is true:
   - You are removing a site-specific KMS for a site that has no appliance node with node encryption enabled.
   - You are removing the default KMS, but a site-specific KMS already exists for each site with node encryption.
4. Select **Yes**.

The KMS configuration is removed.

Manage proxy settings

Configure storage proxy

If you are using platform services or Cloud Storage Pools, you can configure a non-transparent proxy between Storage Nodes and the external S3 endpoints. For example, you might need a non-transparent proxy to allow platform services messages to be sent to external endpoints, such as an endpoint on the internet.

> Configured storage proxy settings do not apply to Kafka platform services endpoints.

Before you begin

- You have specific access permissions.
- You are signed in to the Grid Manager using a supported web browser.

About this task

You can configure the settings for a single storage proxy.

Steps

1. Select **CONFIGURATION** > **Security** > **Proxy settings**.
2. On the **Storage** tab, select the **Enable storage proxy** checkbox.
3. Select the protocol for the storage proxy.
4. Enter the hostname or IP address of the proxy server.
5. Optionally, enter the port used to connect to the proxy server.

   Leave this field blank to use the default port for the protocol: 80 for HTTP or 1080 for SOCKS5.

6. Select **Save**.

   After the storage proxy is saved, new endpoints for platform services or Cloud Storage Pools can be configured and tested.

   > Proxy changes can take up to 10 minutes to take effect.

7. Check the settings of your proxy server to ensure that platform service-related messages from StorageGRID will not be blocked.
8. If you need to disable a storage proxy, clear the checkbox, and select **Save**.

Configure admin proxy settings

If you send AutoSupport packages using HTTP or HTTPS, you can configure a non-transparent proxy server between Admin Nodes and technical support (AutoSupport).

For more information about AutoSupport, see Configure AutoSupport.

Before you begin

- You have specific access permissions.
- You are signed in to the Grid Manager using a supported web browser.

About this task

You can configure the settings for a single admin proxy.

Steps

1. Select **CONFIGURATION** > **Security** > **Proxy settings**.

   The Proxy Settings page appears. By default, Storage is selected in the tab menu.

2. Select the **Admin** tab.
3. Select the **Enable Admin Proxy** checkbox.
4. Enter the hostname or IP address of the proxy server.
5. Enter the port used to connect to the proxy server.
6. Optionally, enter a username and password for the proxy server.

   Leave these fields blank if your proxy server does not require a username or a password.

7. Select one of the following:
   - If you want to secure the connection to the admin proxy, select **Verify certificate**. Upload a CA bundle to verify the authenticity of SSL certificates presented by the admin proxy server.

     > AutoSupport on Demand, E-Series AutoSupport through StorageGRID, and Update Path determination on the StorageGRID Upgrade page will not work if a proxy certificate is verified.

     After you upload the CA bundle, its metadata appears.

   - If you don't want to validate certificates when communicating with the admin proxy server, select **Do not verify certificate**.
8. Select **Save**.

   After the admin proxy is saved, the proxy server between Admin Nodes and technical support is configured.

   > Proxy changes can take up to 10 minutes to take effect.

9. If you need to disable the admin proxy, clear the **Enable Admin Proxy** checkbox, and then select **Save**.

Control firewalls

Control access at external firewall

You can open or close specific ports at the external firewall.

You can control access to the user interfaces and APIs on StorageGRID Admin Nodes by opening or closing specific ports at the external firewall. For example, you might want to prevent tenants from being able to

connect to the Grid Manager at the firewall, in addition to using other methods to control system access.

If you want to configure the StorageGRID internal firewall, see Configure internal firewall.

Port	Description	If port is open…
443	Default HTTPS port for Admin Nodes	Web browsers and management API clients can access the Grid Manager, the Grid Management API, the Tenant Manager, and the Tenant Management API. **Note:** Port 443 is also used for some internal traffic.
8443	Restricted Grid Manager port on Admin Nodes	• Web browsers and management API clients can access the Grid Manager and the Grid Management API using HTTPS. • Web browsers and management API clients can't access the Tenant Manager or the Tenant Management API. • Requests for internal content will be rejected.
9443	Restricted Tenant Manager port on Admin Nodes	• Web browsers and management API clients can access the Tenant Manager and the Tenant Management API using HTTPS. • Web browsers and management API clients can't access the Grid Manager or the Grid Management API. • Requests for internal content will be rejected.

Single sign-on (SSO) is not available on the restricted Grid Manager or Tenant Manager ports. You must use the default HTTPS port (443) if you want users to authenticate with single sign-on.

Related information

- Sign in to the Grid Manager
- Create tenant account
- External communications

Manage internal firewall controls

StorageGRID includes an internal firewall on each node that enhances the security of your grid by enabling you to control network access to the node. Use the firewall to prevent network access on all ports except those necessary for your specific grid deployment. The configuration changes you make on the Firewall control page are deployed to each node.

Use the three tabs on the Firewall control page to customize the access you need for your grid.

- **Privileged address list**: Use this tab to allow selected access to closed ports. You can add IP addresses

or subnets in CIDR notation that can access ports closed using the Manage external access tab.

- **Manage external access**: Use this tab to close ports that are open by default, or reopen ports previously closed.
- **Untrusted Client Network**: Use this tab to specify whether a node trusts inbound traffic from the Client Network.

  The settings on this tab override the settings in the Manage external access tab.

  - A node with an untrusted Client Network will accept only connections on load balancer endpoint ports configured on that node (global, node interface and node type bound endpoints).
  - Load balancer endpoint ports *are the only open ports* on untrusted Client Networks, regardless of the settings on the Manage external networks tab.
  - When trusted, all ports opened under the Manage external access tab are accessible, as well as any load balancer endpoints opened on the Client Network.

> The settings you make on one tab can affect the access changes you make on another tab. Be sure to check the settings on all tabs to ensure your network behaves in the way you expect.

To configure internal firewall controls, see Configure firewall controls.

For more information about external firewalls and network security, see Control access at external firewall.

Privileged address list and Manage external access tabs

The Privileged address list tab enables you to register one or more IP addresses that are granted access to grid ports that are closed. The Manage external access tab enables you to close external access to selected external ports or all open external ports (external ports are ports that are accessible by non-grid nodes by default). These two tabs often can be used together to customize the exact network access you need to allow for your grid.

> Privileged IP addresses don’t have internal grid port access by default.

Example 1: Use a jump host for maintenance tasks

Suppose you want to use a jump host (a security hardened host) for network administration. You could use these general steps:

1. Use the Privileged address list tab to add the IP address of the jump host.
2. Use the Manage external access tab to block all ports.

> Add the privileged IP address before you block ports 443 and 8443. Any users currently connected on a blocked port, including you, will lose access to Grid Manager unless their IP address has been added to the Privileged address list.

After you save your configuration, all external ports on the Admin Node in your grid will be blocked for all hosts except the jump host. You can then use the jump host to perform maintenance tasks on your grid more securely.

Example 2: Limit access to the Grid Manager and Tenant Manager

Suppose you want to limit access to the Grid Manager and Tenant manager (preset ports) for security reasons.

You could use these general steps:

1. Use the toggle on the Manage external access tab to block port 443.
2. Use the toggle on the Manage external access tab to allow access to port 8443.
3. Use the toggle on the Manage external access tab to allow access to port 9443.

After you save your configuration, hosts will not be able to access port 443, but they can still access the Grid Manager through port 8443 and the Tenant Manager through port 9443.

> Ports 443, 8443, and 9443 are the preset ports for Grid Manager and Tenant Manager. You can toggle any port to limit access to a specific Grid Manager or Tenant manager.

Example 3: Lock down sensitive ports

Suppose you want to lock down sensitive ports and the service on that port (for example, SSH on port 22). You could use the following general steps:

1. Use the Privileged address list tab to grant access only to the hosts that need access to the service.
2. Use the Manage external access tab to block all ports.

> Add the privileged IP address before you block access to any ports assigned to access Grid Manager and Tenant manager (preset ports are 443 and 8443). Any users currently connected on a blocked port, including you, will lose access to Grid Manager unless their IP address has been added to the Privileged address list.

After you save your configuration, port 22 and SSH service will be available to hosts on the privileged address list. All other hosts will be denied access to the service no matter what interface the request comes from.

Example 4: Disable access to unused services

At a network level, you could disable some services that you don't intend to use. For example if you will not provide Swift access, you would perform the following general steps:

1. Use the toggle on the Manage external access tab to block port 18083.
2. Use the toggle on the Manage external access tab to block port 18085.

After you save your configuration, the Storage Node no longer allows Swift connectivity, but continues to allow access to other services on unblocked ports.

Untrusted Client Networks tab

If you are using a Client Network, you can help secure StorageGRID from hostile attacks by accepting inbound client traffic only on explicitly configured endpoints.

By default, the Client Network on each grid node is *trusted*. That is, by default, StorageGRID trusts inbound connections to each grid node on all available external ports.

You can reduce the threat of hostile attacks on your StorageGRID system by specifying that the Client Network on each node be *untrusted*. If a node's Client Network is untrusted, the node only accepts inbound connections on ports explicitly configured as load balancer endpoints. See Configure load balancer endpoints and Configure firewall controls.

Example 1: Gateway Node only accepts HTTPS S3 requests

Suppose you want a Gateway Node to refuse all inbound traffic on the Client Network except for HTTPS S3 requests. You would perform these general steps:

1. From the Load balancer endpoints page, configure a load balancer endpoint for S3 over HTTPS on port 443.
2. From the Firewall control page, select Untrusted to specify that the Client Network on the Gateway Node is untrusted.

After you save your configuration, all inbound traffic on the Gateway Node's Client Network is dropped except for HTTPS S3 requests on port 443 and ICMP echo (ping) requests.

Example 2: Storage Node sends S3 platform services requests

Suppose you want to enable outbound S3 platform services traffic from a Storage Node, but you want to prevent any inbound connections to that Storage Node on the Client Network. You would perform this general step:

- From the Untrusted Client Networks tab of the Firewall control page, indicate that the Client Network on the Storage Node is untrusted.

After you save your configuration, the Storage Node no longer accepts any incoming traffic on the Client Network, but it continues to allow outbound requests to configured platform services destinations.

Example 3: Limiting access to Grid Manager to a subnet

Suppose you want to allow Grid Manager access only on a specific subnet. You would perform the following steps:

1. Attach the Client Network of your Admin Nodes to the subnet.
2. Use the Untrusted Client Network tab to configure the Client Network as untrusted.
3. When you create a management interface load balancer endpoint, enter port and select the management interface that the port will access.
4. Select **Yes** for Untrusted Client Network.
5. Use the Manage external access tab to block all external ports (with or without privileged IP addresses set for hosts outside that subnet).

After you save your configuration, only hosts on the subnet you specified can access the Grid Manager. All other hosts are are blocked.

Configure internal firewall

You can configure the StorageGRID firewall to control network access to specific ports on your StorageGRID nodes.

Before you begin

- You are signed in to the Grid Manager using a supported web browser.
- You have specific access permissions.
- You have reviewed the information in Manage firewall controls and Networking guidelines.
- If you want an Admin Node or Gateway Node to accept inbound traffic only on explicitly configured

endpoints, you have defined the load balancer endpoints.

> When changing the configuration of the Client Network, existing client connections might fail if load balancer endpoints have not been configured.

About this task

StorageGRID includes an internal firewall on each node that enables you to open or close some of the ports on the nodes of your grid. You can use the Firewall control tabs to open or close ports that are open by default on the Grid Network, Admin Network, and Client Network. You can also create a list of privileged IP addresses that can access grid ports that are closed. If you are using a Client Network, you can specify whether a node trusts inbound traffic from the Client Network, and you can configure the access of specific ports on the Client Network.

Limiting the number of ports open to IP addresses outside of your grid to only those that are absolutely necessary enhances the security of your grid. You use the settings on each of the three Firewall control tabs to ensure only the needed ports are open.

For more information about using firewall controls, including examples, see Manage firewall controls.

For more information about external firewalls and network security, see Control access at external firewall.

Access firewall controls

Steps

1. Select **CONFIGURATION** > **Security** > **Firewall control**.

   The three tabs on this page are described in Manage firewall controls.

2. Select any tab to configure the firewall controls.

   You can use these tabs in any order. The configurations you set on one tab don't limit what you can do on the other tabs; however, configuration changes you make on one tab might change the behavior of ports configured on other tabs.

Privileged address list

You use the Privileged address list tab to grant hosts access to ports that are closed by default or closed by settings on the Manage external access tab.

Privileged IP addresses and subnets don't have internal grid access by default. Also, load balancer endpoints and additional ports opened in the Privileged address list tab are accessible even if blocked in the Manage external access tab.

> Settings on the Privileged address list tab can't override settings on the Untrusted Client Network tab.

Steps

1. On the Privileged address list tab, enter the address or IP subnet you want to grant access to closed ports.
2. Optionally, select **Add another IP address or subnet in CIDR notation** to add additional privileged clients.

> Add as few addresses as possible to the privileged list.

3. Optionally, select **Allow privileged IP addresses to access StorageGRID internal ports**. See StorageGRID internal ports.

> This option removes some protections for internal services. Leave it disabled if possible.

4. Select **Save**.

Manage external access

When a port is closed in the Manage external access tab, the port can't be accessed by any non-grid IP address unless you add the IP address to the privileged address list. You can only close ports that are open by default, and you can only open ports that you have closed.

> Settings on the Manage external access tab can't override settings on the Untrusted Client Network tab. For example, if a node is untrusted, port SSH/22 is blocked on the Client Network even if it is open on the Manage external access tab. Settings on the Untrusted Client Network tab override closed ports (such as 443, 8443, 9443) on the Client Network.

Steps

1. Select **Manage external access**. The tab displays a table with all of the external ports (ports that are accessible by non-grid nodes by default) for the nodes in your grid.
2. Configure the ports you want open and closed using the following options:
   - Use the toggle beside each port to open or close the selected port.
   - Select **Open all displayed ports** to open all ports listed in the table.
   - Select **Close all displayed ports** to close all ports listed in the table.

> If you close Grid Manager ports 443 or 8443, any users currently connected on a blocked port, including you, will lose access to Grid Manager unless their IP address has been added to the Privileged address list.

> Use the scroll bar on the right side of the table to be sure you have viewed all available ports. Use the search field to find the settings for any external port by entering a port number. You can enter a partial port number. For example, if you enter a **2**, all ports that have the string "2" as part of their name are displayed.

3. Select **Save**

Untrusted Client Network

If the Client Network for a node is untrusted, the node only accepts inbound traffic on ports configured as load balancer endpoints and, optionally, additional ports you select on this tab. You can also use this tab to specify the default setting for new nodes added in an expansion.

> Existing client connections might fail if load balancer endpoints have not been configured.

The configuration changes you make on the **Untrusted Client Network** tab override the settings on the **Manage external access** tab.

Steps

1. Select **Untrusted Client Network**.
2. In the Set New Node Default section, specify what the default setting should be when new nodes are added to the grid in an expansion procedure.
   - **Trusted** (default): When a node is added in an expansion, its Client Network is trusted.
   - **Untrusted**: When a node is added in an expansion, its Client Network is untrusted.

     As required, you can return to this tab to change the setting for a specific new node.

     > This setting does not affect the existing nodes in your StorageGRID system.

3. Use the following options to select the nodes that should allow client connections only on explicitly configured load balancer endpoints or additional selected ports:
   - Select **Untrust on displayed nodes** to add all nodes displayed in the table to the Untrusted Client Network list.
   - Select **Trust on displayed nodes** to remove all nodes displayed in the table from the Untrusted Client Network list.
   - Use the toggle beside each node to set the Client Network as Trusted or Untrusted for the selected node.

     For example, you could select **Untrust on displayed nodes** to add all nodes to the Untrusted Client Network list and then use the toggle besides an individual node to add that single node to the Trusted Client Network list.

     > Use the scroll bar on the right side of the table to be sure you have viewed all available nodes. Use the search field to find the settings for any node by entering the node name. You can enter a partial name. For example, if you enter a **GW**, all nodes that have the string "GW" as part of their name are displayed.

4. Select **Save**.

   The new firewall settings are immediately applied and enforced. Existing client connections might fail if load balancer endpoints have not been configured.