



ENTRUST

KeySafe 5

Keysafe 5 v1.3 Installation and Upgrade Guide

24 June 2024

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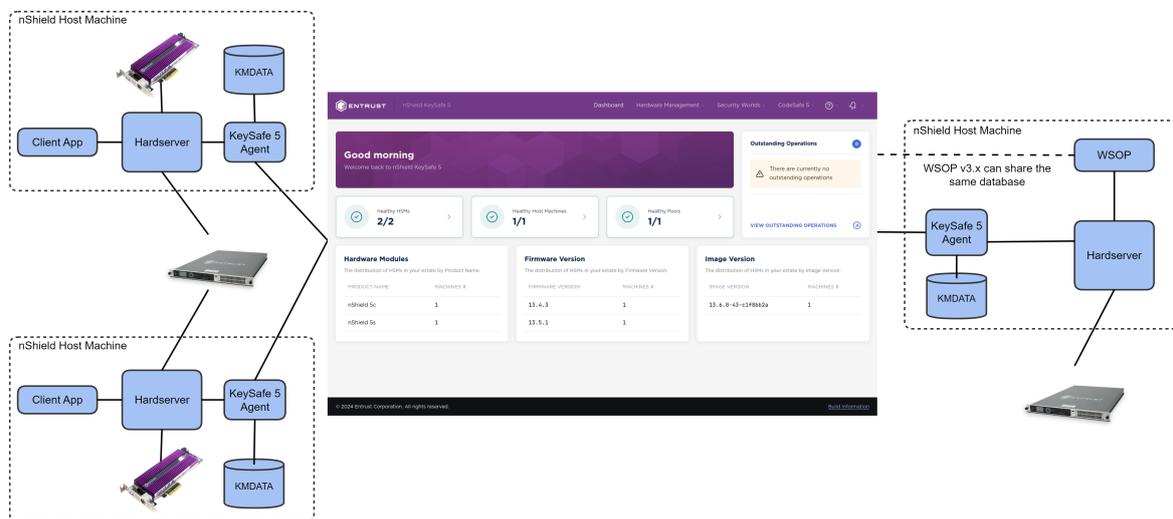
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1. Introduction

KeySafe 5 provides a centralized means to securely manage a distributed nShield HSM estate, including the creation and management of Security Worlds and associated resources (Softcards & Card Sets).

KeySafe 5 provides this capability in two forms: HTTP REST APIs for HSM Management and Security World management, and a graphical user interface. Only authenticated clients are permitted access to the service, providing assurance that your HSM and Security World data remain usable only by clients that are permitted access.

Typical KeySafe 5 deployment:



KeySafe 5 can be deployed as a Kubernetes application to manage a large estate of HSMs, or ran in single binary executable format to manage a single nShield Security World host machine and attached HSMs, see [KeySafe 5 Local](#).

For each nShield client machine that you want to manage using this platform, you must install a KeySafe 5 agent binary alongside the existing nShield hardserver. A KeySafe 5 agent is installed on the nShield Connect for nShield Connect images released with Security World v13.4 and later software.

2. Release Package

The release package is provided in `.tar.gz` format and has the following contents.

2.1. OpenAPI specifications

The API specification documents for the RESTful web services follow v3.0 of the OpenAPI specification.

- `api/codesafe-mgmt.yml` defines the CodeSafe Management API
- `api/hsm-mgmt.yml` defines the HSM Management API
- `api/sw-mgmt.yml` defines the Security World Management API

2.2. Helm charts

The KeySafe 5 Kubernetes-based deployment consists of 3 Helm charts:

- `helm-charts/nshield-keysafe5-backend-1.3.0.tgz`

This installs the backend API services (HSM Management and Security World Management).

- `helm-charts/nshield-keysafe5-ui-1.3.0.tgz`

This installs the graphical user interface for KeySafe 5.

- `helm-charts/nshield-keysafe5-istio-1.3.0.tgz`

This configures an existing Istio Ingress Gateway to allow external access (routing and authentication) to the services deployed by the other two Helm charts.

This split enables you to deploy the backend services only, if you do not need the UI, or the UI only, if you want to point it at some existing backend services already running elsewhere.

You can also use a different Kubernetes Ingress other than Istio if desired.

For more information on configuring and installing the Helm chart, see [Helm Chart Installation](#) .

2.3. Docker images

The Docker images are provided as tar archives. You can load them into a local Docker image registry using the `docker load` command, then push to a private container registry.

For example:

```
docker load < docker-images/hsm-mgmt.tar
Loaded image: hsm-mgmt:1.3.0
docker tag hsm-mgmt:1.3.0 private.registry.local/keysafe5/hsm-mgmt:1.3.0
docker login private.registry.local
docker push private.registry.local/keysafe5/hsm-mgmt:1.3.0
```

The Docker images provided are:

- `docker-images/codesafe-mgmt.tar` is the CodeSafe Management service
- `docker-images/hsm-mgmt.tar` is the HSM Management service
- `docker-images/sw-mgmt.tar` is the Security World Management service
- `docker-images/ui.tar` is the KeySafe 5 user interface

These Docker images are intended to be deployed via the provided Helm charts. See the Helm chart configuration for details of how to configure and run each image.

2.4. KeySafe 5 agent installers

You can use the Linux and Windows KeySafe 5 agent installers provided to install the KeySafe 5 agent on nShield client machines. See [KeySafe 5 Agent Installation](#) for details on configuring and installing the agent.

2.5. KeySafe 5 Local installers

You can use the Linux and Windows KeySafe 5 Local installers to install KeySafe 5 Local on nShield client machines. See [KeySafe 5 Local](#) for further details.

3. Prerequisites

The following table contains the required software version that this release of KeySafe 5 has been tested on and any minimum version requirements.

Software	Minimum version	Tested version
Kubernetes	1.27	1.29.2
MongoDB	6.0.14	7.0.7
A message bus server, either:		
RabbitMQ	3.0	3.12.13
NATS	2.10	2.10.14

In addition to the set of required software, this release of KeySafe 5 requires:

- A location for storing large objects (for example CodeSafe machines)
- An external identity provider that supports OIDC and OAuth2 for user and machine authentication.

3.1. Optional Software

KeySafe 5 is shipped with a Helm chart that configures an Istio Ingress Gateway to provide external access to the KeySafe 5 application running in Kubernetes. Other Ingress Gateways can be used, see [Configure a custom ingress provider](#).

Software	Minimum version	Tested version
Istio	1.20	1.21

3.2. Hardware Requirements

Entrust recommends the following hardware specification to ensure smooth running of KeySafe 5.

- CPU: 4 minimum (8 recommended)
- RAM: 8GB minimum
- Disk Storage: 64GB minimum
 - For optimal performance Entrust recommends use of an SSD.



Requirements will vary depending on the size of the nShield estate being managed and if services, such as MongoDB and RabbitMQ, are being hosted on the same machine as the Kubernetes cluster or externally.

3.3. Kubernetes cluster

KeySafe 5 has been tested on Kubernetes version 1.29.

3.3.1. Using namespaces

When deploying an application to a Kubernetes cluster that is shared with many users spread across multiple teams, Entrust recommends using [Namespaces](#) to isolate groups of resources.

To create a namespace for the KeySafe 5 application:

```
kubectl create namespace nshieldkeysafe5
namespace/nshieldkeysafe5 created
```

To set the namespace for a current request, use the `--namespace` flag. For example:

```
helm install --namespace=nshieldkeysafe5 my-release helm-keysafe5-backend/
kubectl --namespace=nshieldkeysafe5 get pods
```

If you are using Istio in your Kubernetes cluster, beyond acting as an API Gateway for KeySafe 5, you might also want to configure [Istio injection](#) for this Kubernetes namespace to take advantage of other Istio features. This step is not required for KeySafe 5 to function.

```
kubectl label namespace nshieldkeysafe5 istio-injection=enabled
namespace/nshieldkeysafe5 labeled
```

3.4. MongoDB

MongoDB is the persistent data store for the KeySafe 5 application data. Any sensitive Security World data stored in the database is stored in standard nShield encrypted blobs. You should restrict access to this database in the same way that you would normally restrict access to the [Key Management Data](#) directory on an nShield client machine.



The MongoDB used must be a [Replica Set](#).

If you have an existing MongoDB database you can configure the application to use this, otherwise you must securely deploy a MongoDB instance.



Entrust recommend that you configure MongoDB with authentication enabled and TLS enabled and with RBAC configured. The database user for KeySafe 5 should be given the minimum capabilities required, see [Database: User Roles](#).

3.4.1. Bitnami MongoDB Helm chart

To install MongoDB in the same Kubernetes cluster as the KeySafe 5 application, you can install the [Bitnami MongoDB Helm chart](#).

```
helm repo add bitnami https://charts.bitnami.com/bitnami
helm install mongo-chart \
  --set image.tag=7.0.7-debian-12-r0 \
  --set architecture=replicaset \
  --set auth.enabled=true \
  --set tls.enabled=true \
  --set tls.existingSecret=my-mongo-tls-secret \
  bitnami/mongodb --version 15.0.2
```

KeySafe 5 has been tested with version 15.0.2 of the Bitnami MongoDB Helm Chart.



MongoDB 5.0 and newer requires use of the AVX instruction set on processors. For more information, see [MongoDB Production Notes](#)



Monitor MongoDB for security vulnerabilities and regularly update the version of MongoDB installed to apply any required updates.

3.5. Message Bus

A message bus server is required for the interprocess communication between the KeySafe 5 backend services and KeySafe 5 agent instances running on nShield client machines.

KeySafe 5 supports the follow message bus servers:

- [RabbitMQ](#)

- [NATS](#)

3.5.1. RabbitMQ

If you have an existing RabbitMQ instance you can configure the application to use this, otherwise you must securely deploy a RabbitMQ instance.

The RabbitMQ instance should have a sufficient maximum channel count to support the number of resources managed by KeySafe 5. Use the following table to estimate the number of channels required for each resource:

Resource	Required channels
Replica count in KeySafe 5 backend Helm Chart (default value 3)	8
KeySafe 5 Agent	6
Managed HSM	2



Entrust recommend that you configure RabbitMQ with authentication enabled and TLS enabled. If the RabbitMQ instance being used is shared with other applications, then a dedicated virtual host should be created for the KeySafe 5 application. RabbitMQ users created for KeySafe 5 should only have access to that specific virtual host.

3.5.1.1. Bitnami RabbitMQ Helm chart

To install RabbitMQ in the same Kubernetes cluster as the KeySafe 5 application, you can install the [Bitnami RabbitMQ Helm chart](#).

```
helm repo add bitnami https://charts.bitnami.com/bitnami
helm install rabbit-chart \
  --set image.tag=3.12.13-debian-12-r1 \
  --set auth.username=user \
  --set auth.existingPasswordSecret=my-password-secret \
  --set auth.tls.enabled=true \
  --set auth.tls.existingSecret=my-rabbitmq-tls-secret \
  --set extraConfiguration='
channel_max = 4095
listeners.ssl.default = 5671
ssl_options.versions.1 = tlsv1.3
ssl_options.depth=0
ssl_options.verify = verify_peer
ssl_options.fail_if_no_peer_cert = true
auth_mechanisms.1 = EXTERNAL
ssl_cert_login_from = subject_alternative_name
ssl_cert_login_san_type = dns'
```

```
ssl_cert_login_san_index = 0' \  
--set plugins="" \  
--set extraPlugins="rabbitmq_auth_mechanism_ssl" \  
bitnami/rabbitmq --version 12.13.1
```

KeySafe 5 has been tested with version 12.13.1 of the Bitnami RabbitMQ Helm Chart.



Monitor RabbitMQ for security vulnerabilities and regularly update the version of RabbitMQ installed to apply any required updates.

3.5.1.2. RabbitMQ TLS authentication

If using TLS authentication between the KeySafe 5 agent and RabbitMQ, the RabbitMQ server will extract the username for incoming connections from the client's TLS certificate. For use with KeySafe 5, RabbitMQ must be configured to extract the username from the TLS certificate using one of the following options:

- The first DNS field in the SAN (`ssl_cert_login_from=subject_alternative_name, san_type=dns` and `san_index=0`)
- Common Name (`ssl_cert_login_from=common_name`)
- Distinguished Name (`ssl_cert_login_from=distinguished_name`)

3.5.2. NATS

If you have an existing NATS server you can configure the application to use this, otherwise you must securely deploy a NATS instance.



Entrust recommend that you configure NATS with authentication enabled and TLS enabled.

3.5.2.1. Bitnami NATS Helm chart

To install NATS in the same Kubernetes cluster as the KeySafe 5 application, you can install the [Bitnami NATS Helm chart](#).

```
helm repo add bitnami https://charts.bitnami.com/bitnami  
helm install nats-chart \  
--set image.repository=bitnami/nats \  
--set image.tag=2.10.4-debian-11-r0 \  
--set service.type=LoadBalancer \  
bitnami/nats --version 7.10.0
```

KeySafe 5 has been tested with version 7.10.0 of the Bitnami NATS Helm Chart.



Monitor NATS for security vulnerabilities and regularly update the version of NATS installed to apply any required updates.

3.6. Large Object Storage

A location for storing objects that are too large for a traditional database, such as CodeSafe machines, is required. This storage can be located either within the Kubernetes cluster, or externally.

To configure this storage you must specify a Persistent Volume Claim (PVC) for the `helm-keysafe5-backend` Helm Chart to use via the `objectStore.pvc` Chart parameter. If a Kubernetes namespace has been created for the KeySafe 5 application, then the PVC must be in the same namespace as the application. The PVC may use any type of storage supported by Persistent Volumes in your Kubernetes Cluster (for example, NFS). See [Persistent Volumes](#) for supported storage types.

To set the user and group IDs used by the KeySafe 5 application when accessing the object storage, configure the `podSecurityContext.runAsUser`, `podSecurityContext.runAsGroup` and `podSecurityContext.fsGroup` Chart parameters.

You should ensure that the size of the configured storage is sufficient to meet the application's needs. For this release of KeySafe 5 that should include:

- All CodeSafe 5 machine images that will be managed by KeySafe 5.

3.6.1. NFS Object Storage Configuration

To use an NFS for object storage you must know the NFS server address and the path of the directory being exported from the NFS server.

Create a Persistent Volume containing the configuration of your NFS.

```
cat << EOF | kubectl -n nshieldkeysafe5 apply -f -
apiVersion: v1
kind: PersistentVolume
metadata:
  name: nfs-pv
  labels:
    application: keysafe5
spec:
  capacity:
    storage: 2Gi
  volumeMode: Filesystem
  accessModes:
```

```
- ReadWriteMany
persistentVolumeReclaimPolicy: Recycle
storageClassName: nfs
nfs:
  path: ${NFS_PATH}
  server: ${NFS_IP}
EOF
```

Create a Persistent Volume Claim to use that Persistent Volume.

```
cat << EOF | kubectl -n nshieldkeysafe5 apply -f -
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: data-nshield-keysafe5
spec:
  storageClassName: nfs
  accessModes:
    - ReadWriteMany
  resources:
    requests:
      storage: 2Gi
  selector:
    matchLabels:
      application: keysafe5
EOF
```

3.7. External identity provider (IdP)

You need an external identity provider that supports OIDC and OAuth2 to provide user and machine authentication to KeySafe 5. This is required to gain access to the UI and authenticate commands sent to the backend services.

At the IdP, Entrust typically expects the following to be configured:

- A single OIDC public client application

This provides user identity information and an `id_token` for use by the UI.

- Multiple OAuth2 private client application

This provides machine-to-machine credentials. Typically you would want an instance of this per application identity required to limit the sharing of the `client_secret` value.

For more information, refer to [Client Types](#).

3.7.1. OIDC public client

The OIDC public client application provides user identity information and an

`id_token` for use by the UI in its calls to the backend services. It is a public client due to the UI being a client side application, and as such cannot be trusted with the `client_secret` like a server side application would be.

Entrust recommends the following settings:

Setting	Value
Grant Types	Authorization Code with PKCE
	Refresh Token
Authorization Code PKCE Code Challenge Method	S256
Scopes	openid

For more information, refer to [Authorization Code flow with PKCE](#).

3.7.2. OAuth2 private client

The OAUTH2 private client provides client credentialing for machine-to-machine authentication by applications that do not hold user identification. This requires the use of the `client_secret` value, which must be securely held.

You would typically want a separate private client instance for each application for which you provide access, resulting in a separate `client_id` and `client_secret` for each application. This eases management of the `client_secret` by reducing the number of applications that have knowledge of it. It also provides easy identification of which application is doing what at the KeySafe 5 end.

Entrust recommend the following settings:

Setting	Value
Grant Type	Client Credentials

For more information, refer to [Client Credentials](#).

4. Helm Chart Installation

To install the KeySafe 5 REST APIs you must install the [helm-keysafe5-backend](#) chart.

To install the KeySafe 5 graphical user interface you must also install the [helm-keysafe5-ui](#) chart.

To expose these services externally to the Kubernetes cluster, see [Configure external access to KeySafe 5](#).

If you are upgrading an existing KeySafe 5 install, see [Helm Chart Upgrade](#).

4.1. Helm

[Helm](#) is a package manager for Kubernetes.



As with `kubectl` you can apply a namespace to the Kubernetes resources created by a Helm chart by specifying `--namespace my-namespace` when using `helm`.

To install the chart with the release name `my-release`:

```
helm install my-release helm-keysafe5-backend/
```

List all releases using `helm list`.

To upgrade or modify the existing `my-release` deployment, configure the chart parameters and then run:

```
helm upgrade --install my-release helm-keysafe5-backend/
```

To uninstall or delete the `my-release` deployment:

```
helm delete my-release
```

4.2. helm-keysafe5-backend

The `keysafe5-backend` Helm chart deploys Kubernetes Services for the KeySafe 5 REST APIs.

- codesafe-mgmt (nShield CodeSafe Management Service API)
- hsm-mgmt (nShield HSM Management Service API)
- sw-mgmt (nShield Security World Management Service API)

This Helm chart installs the KeySafe 5 services into a Kubernetes cluster but does not configure external access to the services. See [Configure external access to KeySafe 5](#).

4.2.1. Kubernetes Secrets

The helm-keysafe5-backend Helm chart expects to be provided with pre-existing Kubernetes Secrets for the Database and AMQP connections.

For more information, refer to [Kubernetes Secrets](#).

Purpose	Description	Secret Type
MongoDB SCRAM Auth	The username and password pairing used to authenticate with the MongoDB server	kubernetes.io/basic-auth
MongoDB TLS Certificates	TLS certificates used to connect to the MongoDB server. Can also be used as authentication if X509 auth is enabled	Opaque
AMQP SCRAM Auth	The username and password pairing used to authenticate with the AMQP server	kubernetes.io/basic-auth
AMQP TLS Certificates	TLS certificates used to connect to the AMQP server	Opaque

Because TLS secrets have the **Opaque** type, the filenames they are created with are critical. Entrust expects the following:

- CA certificate to be named **ca.crt**.
- TLS certificate to be named **tls.crt**.
- TLS key file to be named **tls.key**.

Your certificates will need to adhere to X.509 v3, sometimes known as a multiple-domain certificates, or SAN certificates. The X.509 extension Subject Alternative Name (SAN) allows specifying multiple hostnames, and has replaced Common Name as the source of the hostname.

4.2.2. Configuration

To deploy the application, configure the chart with:

- The Docker images to use for `codesafe-mgmt`, `hsm-mgmt` and `sw-mgmt`.
- Database connection configuration.
- Message Bus connection configuration.
- A reference to the Persistent Volume Claim, in the same Kubernetes namespace, to use for large object storage.

For further details on the configurable values of the Helm chart, see the [README.md](#) in the root directory of the Helm chart. For example, you may wish to:

- Increase or decrease the verbosity of the logging in the backend services.
- Change the period of time before a resource liveness health check is marked as failing. For example, if you have decreased the rate at which KeySafe 5 agents report to the central platform, you will want to increase the `health.livenessFailurePeriod` value.

An example install:

```
helm install my-release \
  --create-namespace --namespace nshieldkeysafe5 \
  --set database.type=mongo \
  --set database.mongo.hosts="mongo-chart-mongodb-0.mongo-chart-mongodb-
headless.mongons.svc.cluster.local:27017,mongo-chart-mongodb-1.mongo-chart-mongodb-
headless.mongons.svc.cluster.local:27017" \
  --set database.mongo.replicaSet=rs0 \
  --set database.mongo.auth.type=pwd \
  --set database.mongo.auth.existingSecret=my-mongo-credentials-secret \
  --set database.mongo.tls.enabled=true \
  --set database.mongo.tls.existingSecret=my-mongo-tls-secret \
  --set messageBus.URL="rabbit-chart-rabbitmq-0.rabbit-chart-rabbitmq-headless.rabbitns.svc.cluster.local:5671" \
  --set messageBus.auth.type=pwd \
  --set messageBus.auth.existingSecret=my-amqp-credentials-secret \
  --set messageBus.tls.enabled=true \
  --set messageBus.tls.existingSecret=my-amqp-tls-secret \
  --set messageBus.type="amqp"
  --set objectStore.pvc=data-nshield-keysafe5 \
  --set logging.level=info \
  --set logging.format=json \
helm-keysafe5-backend/
```

4.3. helm-keysafe5-ui

The `keysafe5-ui` Helm chart deploys a Kubernetes Service for the KeySafe 5 Graphical User Interface.

The chart deploys the web front-end of KeySafe 5. For the UI to be usable it must point to a deployed KeySafe 5 back-end services endpoint (as installed by `helm-keysafe5-backend`).



This Helm chart installs the KeySafe 5 UI into a Kubernetes cluster, but does not configure external access to the service. (See [Configure external access to KeySafe 5.](#))

4.3.1. Configuration

To deploy the application, configure the chart with:

- The Docker image to use for the `ui` container.
- OIDC Identity Provider config, if Authentication is enabled.
- The location of the KeySafe 5 back-end services API that this UI displays information for.

For further details on the configurable values of the Helm chart, see the [README.md](#) in the root directory of the Helm chart.

An example install:

```
# Untar the chart and copy your OIDC provider config file into the config directory
tar -xf helm-charts/nshield-keysafe5-ui-1.3.0.tgz -C helm-charts
cp my-oidc-provider-config.json helm-charts/nshield-keysafe5-ui/config/OIDCProviders.json

# Install the chart
helm install keysafe5-ui \
  --create-namespace --namespace nshieldkeysafe5 \
  --set svcEndpoint="https://XXX.XXX.XXX.XXX" \
  --set authMethod=oidc \
  --wait --timeout 10m \
  helm-charts/nshield-keysafe5-ui
```



Because the OIDC Provider configuration is volume mapped into the Kubernetes application, you must untar the packaged Helm chart so that you can copy in the `OIDCProviders.json` file to the correct location before installing the chart.

4.3.2. Configure UI authentication

If `authMethod` is set to `oidc` then you must provide an OIDC configuration file detailing the accepted Identity Providers.

Copy the OIDC configuration file to `config/OIDCProviders.json` in the root directory of the Helm chart before installing the Helm chart. This file is a JSON document. You can find an example file at `config/OIDCProviders.json.example`.

The configuration document is a JSON list of individual provider configurations.

An example of provider configuration:

```
{
  "name": "Example Provider",
  "authority": "https://example-auth-provider.com/auth/auth",
  "client_id": "8acc1449-7275-4524-b25f-4a60dddddfe8d",
  "redirect_uri": "https://example-keystore5.com/callback",
  "response_type": "code",
  "scope": "openid",
  "post_logout_redirect_uri": "https://example-keystore5.com/",
  "issuer": "https://example-auth-provider.com/auth",
  "authorization_endpoint": "https://example-auth-provider.com/auth/callback/authorize",
  "token_endpoint": "https://example-auth-provider.com/auth/token",
  "jwks_uri": "https://example-auth-provider.com/auth/keys",
  "end_session_endpoint": "https://example-auth-provider.com/auth/logout",
  "userinfo_endpoint": "https://example-auth-provider.com/auth/userinfo",
  "iconSVG": "login.svg"
}
```

To display a custom icon for the provider in the user interface, copy an SVG-format image to the `config` directory and reference the file name under the key `iconSVG` in the provider configuration.

4.4. Configure external access to KeySafe 5

To enable external access to the services installed by `helm-keystore5-backend` and `helm-keystore5-ui`, you need to configure a Kubernetes Ingress Gateway to route requests to the appropriate Kubernetes Services.

If you use Istio, you can use the `helm-keystore5-istio` Helm chart to configure an existing Istio Ingress Gateway. Alternatively, you can configure your own Ingress Gateway. (See [Configure a custom ingress provider.](#))

4.4.1. helm-keystore5-istio

The `keystore5-istio` Helm chart creates an Istio Gateway and VirtualService for the KeySafe 5 back-end services and user interface to be accessible externally from the Kubernetes cluster.

The chart:

- Routes HTTP requests to the KeySafe 5 application running in the same Kubernetes cluster.
- Authenticates requests, if authentication is enabled (default) and an Identity Provider (IdP) is configured.
- Applies CORS policy to requests to limit Cross-Origin Resource Sharing.

- Applies security related HTTP Headers to responses including automatically applying the Content-Security-Policy header to help reduce Cross Site Scripting (XSS) risks.
- Limits TLS protocol used to TLS v1.2 and higher.
- Limits ciphers supported by the gateway.

4.4.2. Configure helm-keysafe5-istio

For further details of the configurable values of the Helm chart, see the [README.md](#) in the root directory of the Helm chart.

An example install:

```
helm install keysafe5-istio \
  --create-namespace --namespace=nshieldkeysafe5 \
  --set requireAuthn=true \
  --set httpsEnabled=true \
  --set portNumber=443 \
  --set issuer[0].authIssuer="https://foobar.auth0.com" \
  --set issuer[0].authJWksURI="https://www.googleapis.com/oauth2/v1/certs" \
  --set issuer[0].authAudiences[0]="https://keysafe5.location" \
  --wait --timeout 1m \
  helm-charts/nshield-keysafe5-istio-1.3.0.tgz
```

4.4.3. helm-keysafe5-istio port number

If the port number changes to something other than 443 or 80, you need to open a port on the Istio Ingress Gateway. You can do this using your own `istioctl install` manifest. For more information, refer to <https://istio.io/latest/docs/setup/install/istioctl/>.

4.4.4. helm-keysafe5-istio authentication

Authentication can be provided by any [OpenID Connect](#) Provider, such as [Entrust Identity As A Service](#).

If `requireAuthn` is `true`, then at least one `authIssuer` must be configured.

An example configuration:

```
issuers:
  - authIssuer: 'https://foobar.auth0.com'
    authJWksURI: 'https://www.googleapis.com/oauth2/v1/certs'
    authJWks: ''
    authAudiences:
```

```
- 'https://keysafe5.location'
```

For each `authIssuer`, `authAudiences` and one of `authJWksURI` or `authJWks` must be specified.

Key	Description
<code>authIssuer</code>	Identifies the issuer that issued the JWT. A JWT with different iss claim will be rejected.
<code>authAudiences</code>	Identifies the list of JWT audiences that are allowed access. A JWT containing any of these audiences will be accepted.
<code>authJWksURI</code>	URL of the provider's public key set to validate signature of the JWT. For more information, refer to https://openid.net/specs/openid-connect-discovery-1_0.html#ProviderMetadata .
<code>authJWks</code>	JSON Web Key Set of public keys to validate signature of the JWT. For more information, refer to https://auth0.com/docs/jwks .

For additional information, refer to <https://istio.io/latest/docs/reference/config/security/jwt/#JWTRule>.



Once authenticated, a user has full access to view and manage the HSM and Security World resources accessible from the platform. No authorization policy is applied to requests.

4.4.5. Enable HTTPS for helm-keysafe5-istio

Configuring a TLS certificate for the Istio Gateway requires creating a Kubernetes secret.

To create a Kubernetes secret from an existing TLS private key and certificate:



You must create the Kubernetes Secret in the same namespace as the Istio Ingress Gateway.

```
kubectl --namespace istio-system create secret tls keysafe5-server-credential \
  --cert=path/to/cert/file \
  --key=path/to/key/file
```

4.5. Configure a custom ingress provider

If you do not want to use Istio, you can configure your own Kubernetes Ingress.



If you configure your own Ingress to the application, then it is your responsibility to configure routing to the services and any authentication or authorization to access the services.

Each part of the KeySafe 5 application is exposed as a Kubernetes Service.

`helm-keysafe5-backend` exposes the following Kubernetes Services for serving requests to the RESTful APIs:

ClusterIP Port	API endpoints
18080	/mgmt/v1/hsms /mgmt/v1/hosts /mgmt/v1/pools /mgmt/v1/feature-certificates
18081	/mgmt/v1/worlds
18082	/codesafe/v1

`helm-keysafe5-ui` exposes a Kubernetes Service called `keysafe5-ui-svc` on ClusterIP port `8080` for accessing the graphical user interface of KeySafe 5.

5. KeySafe 5 Agent Installation

The KeySafe 5 agent runs alongside the existing hardserver and enables the central management platform to manage all HSMs and Security Worlds visible to the hardserver.



The KeySafe 5 agent is a privileged client of the hardserver. For more information on privileged clients, see the nShield Security World Software documentation.

The connection between the agent and the central monitoring platform is via a message bus (RabbitMQ or NATS). It is configured in the KeySafe 5 agent configuration file.

Ensure the system clock of the KeySafe 5 agent is synchronized with the central platform.

The KeySafe 5 agent ensures that all key management data, with the exception of keys, is synchronized between the nShield client machine and a central (MongoDB) database.

This means that when resources, such as Card Sets or Softcards, appear in the `kmdata/local` directory on a client machine, they are automatically stored in the central database. It also means that when a Card Set or Softcard is created via the new management tools, the resource also appears in `kmdata/local` on any host machine that is in the right Security World.

The Card Set or Softcard can then be used with the traditional nShield tools on each nShield client machine.



If a resource is deleted via the KeySafe 5 application then it will be removed from `kmdata/local` for all client machines, and Connects, running a KeySafe 5 agent. If the resource is deleted locally on a nShield client machine then that deletion is not synchronized to other client machines in the same Security World.

The KeySafe 5 agent will also report on the status of CodeSafe 5 machines/certificates visible to the agent, and allow these resources to be managed via KeySafe 5. The amount of time taken for the agent to publish a CodeSafe 5 update message will increase by several seconds per CodeSafe 5 resource (machine or certificate) in the system. This means that in systems with many CodeSafe 5 machines/certificates present, KeySafe 5 will be slower to reflect

local changes in the state of these resources.

If you are upgrading an existing KeySafe 5 Agent install, see [Agent Upgrade](#).

5.1. Install on Linux

1. Untar the KeySafe 5 agent install package to the root directory of the machine. The agent install package can be found in `keysafe5-agent` directory of the KeySafe 5 release package.

This unpacks the agent and associated scripts into the `/opt/nfast/` directory.

```
cd /
sudo tar -xf /path/to/keysafe5-1.3.0-Linux-keysafe5-agent.tar.gz
```

2. Configure this KeySafe 5 agent instance as described in [Agent Configuration](#) and [Message Bus authentication](#).
3. Run the appropriate install script depending on the state of the hardserver:
 - If the hardserver is running, use the KeySafe 5 specific install script so the hardserver is not restarted.

```
sudo /opt/nfast/keysafe5/sbin/install
```

- When the hardserver is not running, use the nShield install script to install both the KeySafe 5 agent and the hardserver.

```
sudo /opt/nfast/sbin/install
```



The agent must point to a working message bus (either RabbitMQ or NATS) otherwise it will fail to start.

The installer creates the following items, as required:

- Either a SysV-style init script or systemd script for automatically starting and stopping the service.
- The `keysafe5d` user.

This user is dedicated to running the `keysafe5-agent` service, and is a member of the `nfast` and `nfastadmin` groups.

The KeySafe 5 agent is not affected by the standard nShield `/opt/nfast/sbin/init.d-ncipher` script. To stop, start, or restart the KeySafe 5 agent

you may either:

- Use `/opt/nfast/scripts/init.d/keysafe5-agent`, or
- Use your standard init system scripts, addressing the `nc_keysafe5-agent` service.

5.2. Install on Windows

The KeySafe 5 Agent requires the hardserver TCP ports be enabled. To do this, either:

- Run `config-serverstartup.exe --port 9000 --privport 9001`, or
- Edit the file (located at `%NFAST_KMDATA%\config\config`) and set `nonpriv_port=9000` and `priv_port=9001`.

After enabling the hardserver TCP ports, you must restart the hardserver service.

If those ports are not available and different ports are set, then the environment variables `NFAST_SERVER_PORT` and `NFAST_SERVER_PRIVPORT` must also be set appropriately as described in the nShield documentation. They may be set globally in System Environment Variables, or only for this service by adding a `Multi-String Value` named `Environment` under `Computer\HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\nShield KeySafe 5 Agent`, and to `Value data` adding the lines `NFAST_SERVER_PORT=port-number` and `NFAST_SERVER_PRIVPORT=port-number`. You may need to restart the computer after adding the System Environment Variables.

1. Launch the `Keysafe5-agent.msi` installer. The installer is in the `keysafe5-agent` directory of the KeySafe 5 release package.

This msi creates the nShield KeySafe 5 agent service but does not start it.

2. Populate the KeySafe 5 agent configuration file as described in [Agent Configuration](#) and [Message Bus authentication](#).

The nShield KeySafe 5 agent service will not start if the certificates are not installed.

3. Populate the `messagebus` authentication files.
4. Start the nShield KeySafe 5 agent service using Windows Service Manager.

5.3. Agent Configuration

The KeySafe 5 agent configuration file is located at `%NFAST_DATA_HOME%/keysafe5/conf/config.yaml`.

The install contains an example configuration file at `%NFAST_DATA_HOME%/keysafe5/conf/config.yaml.example`. Make a copy of it at the same location and rename the copy to `%NFAST_DATA_HOME%/keysafe5/conf/config.yaml`.



Unless configured otherwise, `%NFAST_DATA_HOME%` is located at `/opt/nfast` on Linux and `%ProgramData%\nCipher` on Windows.

Configuration Key	Description	Example Value
<code>override_hostname</code>	Set the hostname for this agent. This appears as the Host resource name in KeySafe 5. The hostname is set by the operating system if not overridden here. This is not related to the hostname used by TLS authentication.	<code>hostname</code>
<code>logging.level</code>	Minimum severity level of log statements to output. Valid values: <code>trace</code> , <code>debug</code> , <code>info</code> , <code>warning</code> , <code>error</code> . The default is to output at <code>info</code> level and above.	<code>info</code>
<code>logging.format</code>	Format of the log statements. Valid values: <code>json</code> , <code>logfmt</code> . The default is to output in <code>json</code> format.	<code>json</code>
<code>logging.file.enabled</code>	To enable log output to file, set to <code>true</code> . The default is to output to file (<code>true</code>).	<code>true</code>
<code>logging.file.path</code>	The absolute path of the file that logs should be written to. The default is <code>/opt/nfast/log/keysafe5-agent.log</code> on Linux and <code>%ProgramData%\nCipher\Log Files\KeySafe5-agent.log</code> on Windows.	<code>/opt/nfast/log/keysafe5-agent.log</code>
<code>message_bus.type</code>	The type of the message bus connection of the keysafe5 agent.	<code>amqp</code>
<code>message_bus.url</code>	The URL points to the message bus service with its IP address or DNS name, including the port number. IPv6 addresses must be in the form <code>[host]:port</code> . If required, a virtual host may be specified at the end of the address. This parameter is required, there is no default.	<code>127.0.0.1:5671/nshieldvhost</code>
<code>message_bus.auth_type</code>	Authentication method for the message bus connection. Valid values: <code>none</code> , <code>pwd</code> , <code>tls</code> . The default is to use TLS authentication.	<code>tls</code>

Configuration Key	Description	Example Value
<code>message_bus.tls_username_location</code>	<p>For auth_type 'tls', the message bus username is encoded in a field of the X.509 certificate. When a RabbitMQ server is configured to allow X.509 authentication, it is specified which field to extract the username from within the certificate. This agent configuration item identifies which field of the certificate contains the username and should match the setting on the RabbitMQ server.</p> <p>Valid values: <code>DistinguishedName</code>, <code>CommonName</code>, <code>SAN-DNS-Field0</code> (the first DNS field in the Subject Alternative Name of the certificate).</p>	<code>SAN-DNS-Field0</code>
<code>message_bus.disable_tls</code>	To disable Mutual TLS for the message bus connection, set to <code>true</code> . The default is to use Mutual TLS (<code>false</code>). Entrust recommends that this is always set to <code>false</code> .	<code>false</code>
<code>message_bus.min_protocol_version</code>	The minimum TLS protocol version that is used by the message bus connection of the keysafe5 agent. The default is <code>TLSV1_2</code> .	<code>TLSV1_2</code>
<code>message_bus.cipherSuites</code>	The available ciphersuites for the message bus connection of the keysafe5 agent. The defaults are <code>ECDHE-ECDSA-AES128-GCM-SHA256</code> , <code>ECDSA-AES128-GCM-SHA256</code> , <code>ECDSA-AES256-GCM-SHA384</code> , <code>ECDSA-RSA-AES256-GCM-SHA384</code> , <code>ECDSA-CHACHA20-POLY1305</code> , <code>ECDSA-RSA-CHACHA20-POLY1305</code>	<code>ECDSA-ECDSA-AES128-GCM-SHA256</code>
<code>kmdata_network_mount</code>	If any directory within the kmdata directory on this machine is mounted as a network share (e.g. NFS or SMB) this configuration should be set to true. For example, if this configuration is set to false, the agent will not be able to detect changes in the kmdata/local directory, if the directory is an NFS mount. This setting updates the agent to use a method of detecting file modifications/additions/removals that works for network mounted directories.	<code>false</code>
<code>kmdata_poll_interval</code>	The rate at which the agent polls the <code>kmdata</code> directory to look for changes. The format is as used for <code>update_interval</code> . The default is once a second.	<code>1s</code>

Configuration Key	Description	Example Value
<code>update_interval</code>	The period of time between publishing data updates. The interval string is a sequence of decimal numbers, each with optional fraction and a unit suffix, such as "300ms", "1.5h" or "2h45m". Valid time units are "ns", "us" (or "µs"), "ms", "s", "m", "h". The default is once a minute.	1m
<code>max_update_message_response_time</code>	The maximum amount of time to allow the central platform to pull update messages sent by this agent. Update messages published by this agent will expire after the lower of this time, or the configured <code>update_interval</code> . This setting impacts the freshness of the data processed by the central platform. The default is 1 minute.	1m
<code>health_interval</code>	The period of time between checking the underlying service health and attempting recovery if necessary. The format is as used for <code>update_interval</code> . The default is once a minute.	1m
<code>recovery_interval</code>	The <code>recovery_interval</code> specifies how often recovery of the connections to external services should be performed. The default is 5 seconds.	5s
<code>codesafe_update_interval</code>	The period of time between publishing CodeSafe 5 data updates. The format is as used for <code>update_interval</code> . The default is once every 5 minutes.	3m
<code>codesafe_cache_period</code>	The <code>codesafe_cache_period</code> specifies how often the CodeSafe 5 certificate cache will expire. The caching is performed to negate performance impacts of running unnecessary CodeSafe 5 certificate commands. Cache expiry may be performed earlier if approaching a time where a certificates validity status may change, that is, when it is approaching <code>NotBefore</code> or <code>NotAfter</code> . The cache is invalidated if there is a change in CodeSafe 5 certificates. The format is as used for <code>update_interval</code> . The default is 60 minutes.	60m

Configure the KeySafe 5 agent's message bus connection to use the same instance used by the central management platform that you want to connect to.

5.4. Message Bus authentication

You can configure the authentication method for the message bus connection as one of the following options:

- **none** No authentication.
- **pwd** Username and password authentication.
- **tls** X.509 certificate authentication.



Entrust recommends **tls** as the message bus authentication method. Entrust recommends restricting access to files containing sensitive authentication details. On Linux, the KeySafe 5 agent installer will create the required files with appropriate permissions.

5.4.1. Password authentication

To configure password authentication, set **message_bus.auth_type** to **pwd** in the configuration file. Locate the plaintext username and password in the following files on disk:

- **%NFAST_DATA_HOME%/keysafe5/conf/messagebus/auth/username** should contain the username to use for the message bus connection.
- **%NFAST_DATA_HOME%/keysafe5/conf/messagebus/auth/password** should contain the password to use for the message bus connection.



The username must contain the KeySafe 5 agent's hostname (set either by **override_hostname** in the agent configuration file, or defaults to the machine's hostname). If the username does not contain the KeySafe 5 agent's hostname then the agent will not start.

5.4.2. TLS

You must create the **%NFAST_DATA_HOME%/keysafe5/conf/messagebus/tls** directory manually so that you can store the TLS key and certificates for the agent's connection to the message bus there in the following files:

- ca.crt** The CA certificate.
- tls.key** The agent's private key.
- tls.crt** A valid certificate of the key signed by the Certificate Authority.

Your certificates will need to adhere to X.509 v3, sometimes known as a multiple-domain certificates, or SAN certificates. The X.509 extension Subject Alternative Name (SAN) allows specifying multiple hostnames, and has replaced Common Name as the source of the hostname.

The username extracted from the TLS client certificate (`tls.crt`) is defined by the agent configuration item `messageBus.tls_username_location`. By default, this is set to `SAN-DNS-Field0` (the first DNS field in the Subject Alternative Name of the certificate) but can optionally be set to `Distinguished Name` or `CommonName` to match the [TLS authentication settings](#) on the RabbitMQ server.



The extracted certificate username must contain the KeySafe 5 agent's hostname (set either by `override_hostname` in the agent configuration file, or defaults to the machine's hostname). If the username does not contain the KeySafe 5 agent's hostname then the agent will not start.

5.4.2.1. Generating a KeySafe 5 agent private key and TLS certificate

To generate a private key and certificate signing request (CSR) for a specific KeySafe 5 agent, use `%NFAST_HOME%/keysafe5/bin/ks5agenttls`.

1. Generate the agent's private key

On Linux:

```
$ /opt/nfast/keysafe5/bin/ks5agenttls -keypath=/opt/nfast/keysafe5/conf/messagebus/tls/tls.key -keygen  
Private key has been generated and saved to /opt/nfast/keysafe5/conf/messagebus/tls/tls.key
```

When configuring message bus TLS for this KeySafe 5 agent, the key should be saved to `/opt/nfast/keysafe5/conf/messagebus/tls/tls.key` with file permissions and ownership as documented in the KeySafe 5 Installation Guide

On Windows the command to write to

`%NFAST_DATA_HOME%\keysafe5\conf\messagebus\tls\tls.key` is:

```
%NFAST_HOME%\bin\ks5agenttls.exe -keypath=C:\ProgramData\nCipher\keysafe5\conf\messagebus\tls\tls.key  
-keygen
```

This will generate an ECDSA P-521 private key and save it to the file pointed to by the `keypath` option. If `keypath` is not specified the file `tls.key` is saved to the current directory.

2. Generate the CSR

On Linux:

```
/opt/nfast/keysafe5/bin/ks5agenttls -keypath=/opt/nfast/keysafe5/conf/messagebus/tls/tls.key -csrgen
CSR has been generated and saved to ks5agent_demohost.csr
```

On Windows the command is:

```
%NFAST_HOME%\bin\ks5agenttls.exe -keypath=C:\ProgramData\nCipher\keysafe5\conf\messagebus\tls\tls.key
-csrgen
```

This will generate a certificate signing request and save it to `ks5agent_<agent_hostname>.csr` (where `<agent_hostname>` is the value of `override_hostname` in the KeySafe 5 agent configuration file, if set, or the host machines host name). Alternatively, the CSR can be printed to the console, rather than saved to a file, by specifying `-csr-stdout`.

The generated CSR requests a certificate that contains the agent hostname as the CommonName and as a DNS SubjectAlternativeName (SAN).

3. Create a TLS Certificate for this KeySafe 5 agent

The CSR should be provided to a KeySafe 5 administrator who, in a secure location/environment, creates a message bus service client TLS certificate using the CA trusted by the message bus server.

If using a RabbitMQ instance installed by the `deploy.sh` script then the agent certificate can be generated on the central platform on which the `deploy.sh` script was run. Run the `agentcert.sh` script that is shipped alongside the deployment scripts from the preserved directory in which the script was run.

```
./agentcert.sh ks5agent_demohost.csr 365
Certificate generated to ks5agent_demohost.crt. Valid for 365 days
CA Certificate available at /path/to/internalCA/cacert.pem

RabbitMQ will need to be configured to allow access for the user 'ks5agent_demohost':
export RUN_RABBIT="kubectl -n rabbitns exec rabbit-chart-rabbitmq-0 -c rabbitmq -- "
${RUN_RABBIT} rabbitmqctl add_user ks5agent_demohost ephemeralpw
${RUN_RABBIT} rabbitmqctl set_permissions -p nshieldvhost ks5agent_demohost '.*' '.*' '.*'
${RUN_RABBIT} rabbitmqctl clear_password ks5agent_demohost
```



If you get a message about a lack of permissions opening `/etc/rancher/k3s/k3s.yaml` you can set up `kubectl` access by running:

```
mkdir -p ${HOME}/.kube
sudo /usr/local/bin/k3s kubectl config view --raw > ${HOME}/.kube/config
chmod 600 ${HOME}/.kube/config
```

```
export KUBECONFIG=${HOME}/.kube/config
```

You may append the `export KUBECONFIG=${HOME}/.kube/config` to your shell's configuration file.

4. The KeySafe 5 administrator should then configure the RabbitMQ server to allow the user specified in this TLS certificate to access the appropriate virtual host in RabbitMQ.

```
rabbitmqctl add_user ks5agent_demohost ephemeralpw
rabbitmqctl set_permissions -p nshieldvhost ks5agent_demohost '.*' '.*' '.*'
rabbitmqctl clear_password ks5agent_demohost
```

5. Configure the KeySafe 5 agent

The resulting TLS certificate and accompanying CA certificate, along with the agent's private key should be stored within

`%NFAST_DATA_HOME%/keysafe5/conf/messagebus/tls` in the following files:

- `ca.crt` - The CA certificate.
- `tls.key` - The agent's private key.
- `tls.crt` - A valid certificate of the key signed by the Certificate Authority.

5.5. KeySafe 5 agent on network-attached HSMs

A KeySafe 5 agent is installed on the nShield Connect for nShield Connect images released with Security World v13.4 and later software. This agent allows an nShield Connect to be monitored and managed without, or in addition to, the Connect being enrolled to a nShield host machine (a machine with nShield Security World software installed) which also has a KeySafe 5 agent installed.

By default, the KeySafe 5 agent on the nShield Connect is disabled. It must be configured to communicate with the central KeySafe 5 platform, and enabled. The agent can only be configured via the nShield Connect serial console.

5.5.1. ks5agent command (only on serial console network-attached HSMs)

The KeySafe 5 agent is configured and managed on the Connect using the `ks5agent` Serial Console command.

```
(cli)help ks5agent

Manage the KeySafe 5 agent

USAGE
  ks5agent
  ks5agent enable
  ks5agent disable
  ks5agent version
  ks5agent logs [tail [linecount]]
  ks5agent cfg [message_bus.url=x.x.x:5671]
  ks5agent resetcfg
  ks5agent mbscr
  ks5agent mbtls [ca.crt|tls.crt] [data]
  ks5agent mbuser
  ks5agent mbpwd

OPTIONS
  enable      Start the KeySafe 5 agent (setting will persist on reboot)
  disable     Stop the KeySafe 5 agent
  version     Show version information for the KeySafe 5 agent
  logs        Display the KeySafe 5 agent log file
  cfg         Configure the KeySafe 5 agent
  resetcfg    Restore the KeySafe 5 agent configuration file back to the default values for this Connect
  mbscr       Generate a Certificate Signing request for creation of KeySafe 5 agent TLS certificate
  mbtls       Show/set the TLS certificates for the KeySafe 5 Agent message bus connection
  mbuser      Show the agent's username for message bus password or TLS based authentication
  mbpwd       Configure the password for the agent to use for message bus password-based authentication

If no action is specified, the current status of the KeySafe 5 agent will be displayed.
```

5.5.1.1. ks5agent cfg

The agent configuration can be displayed and set using the `ks5agent cfg` command.

```
(cli)ks5agent cfg
override_hostname: nshield_module_AAAA-AAAA-AAAA
logging:
  level: info
  format: json
  file:
    enabled: false
    path: /opt/nfast/log/keysafe5-agent.log
message_bus:
  type: amqp
  url: 127.0.0.1:5671
  auth_type: tls
  tls_username_location: SAN-DNS-Field0
  disable_tls: false
  minProtocolVersion: TLSV1_2
  cipherSuites:
    - ECDHE-ECDSA-AES128-GCM-SHA256
    - ECDHE-RSA-AES128-GCM-SHA256
    - ECDHE-ECDSA-AES256-GCM-SHA384
    - ECDHE-RSA-AES256-GCM-SHA384
    - ECDHE-ECDSA-CHACHA20-POLY1305
    - ECDHE-RSA-CHACHA20-POLY1305
kmdata_network_mount: false
```

```

kmdata_poll_interval: 1s
update_interval: 1m
max_update_message_response_time: 1m
health_interval: 1m
recovery_interval: 5s
codesafe_update_interval: 3m
codesafe_cache_period: 60m

(cli)ks5agent cfg message_bus.url=<IPADDRESS>:5671/nshieldvhost update_interval=2m
override_hostname: nshield_module_AAAA-AAAA-AAAA
logging:
  level: info
  format: json
  file:
    enabled: false
    path: /opt/nfast/log/keysafe5-agent.log
message_bus:
  url: <IPADDRESS>:5671/nshieldvhost
  auth_type: tls
  tls_username_location: SAN-DNS-Field0
  disable_tls: false
  minProtocolVersion: TLSV1_2
  cipherSuites:
    - ECDHE-ECDSA-AES128-GCM-SHA256
    - ECDHE-RSA-AES128-GCM-SHA256
    - ECDHE-ECDSA-AES256-GCM-SHA384
    - ECDHE-RSA-AES256-GCM-SHA384
    - ECDHE-ECDSA-CHACHA20-POLY1305
    - ECDHE-RSA-CHACHA20-POLY1305
kmdata_network_mount: false
kmdata_poll_interval: 1s
update_interval: 2m
max_update_message_response_time: 1m
health_interval: 1m
recovery_interval: 5s
codesafe_update_interval: 3m
codesafe_cache_period: 60m

```



The agent configuration values for `override_hostname`, `logging.file` and `kmdata_network_mount` are fixed and can not be set on nShield Connect. The value for `override_hostname` will be set to `nshield_module_{esn}`.

Multiple configuration items may be set with a single command.

```
ks5agent cfg message_bus.url=0.0.0.0:5671/nshieldvhost update_interval=5m
```

If no configuration update is provided, the contents of the KeySafe 5 agent config file are displayed.

To update a configuration item, use the format `key=value` using a `.` character for nested configuration items. Examples:

```

ks5agent cfg update_interval=5m
ks5agent cfg logging.level=debug
ks5agent cfg message_bus.url=0.0.0.0:5672

```

If the agent is currently running, it will be restarted to pick up the change in configuration.

By default, you can only set values for keys that already exist in the configuration file. To force setting a key that does not currently exist in the configuration file, specify **--force**.

```
ks5agent cfg newkey=value --force
```

Running the **ks5agent resetcfg** command will reset the agent configuration to the default configuration for this agent on the nShield Connect.

5.5.1.2. Message bus authentication for ks5agent

The message bus authentication method is configured using the **ks5agent cfg** command and setting the **message_bus.auth_type** configuration item.

```
ks5agent cfg message_bus.auth_type=tls
ks5agent cfg message_bus.auth_type=pwd
ks5agent cfg message_bus.auth_type=none
```

The username for password or TLS based authentication can be displayed using the **ks5agent mbuser** command.

```
(cli)ks5agent mbuser
ks5agent_nshield_module_AAAA-AAAA-AAAA
```

5.5.1.2.1. Password authentication

To configure password based authentication, use the **ks5agent mbpwd** command. This command will display the username that will be used for message bus authentication, and then prompt for the password to be input.

```
(cli)ks5agent mbpwd
Configuring password to use for KeySafe 5 agent message bus user 'ks5agent_nshield_module_AAAA-AAAA-AAAA'
This should match the passphrase configured for the user on the message bus server
New passphrase:
Confirm passphrase:
passphrase set
```

5.5.1.2.2. TLS

TLS certificate authentication is configured with the following workflow:

1. Generate a CSR for this agent using the `ks5agent mbcsr` Serial Console command on the nShield Connect.
2. Generate a TLS certificate using this CSR.
 - If using a RabbitMQ instance installed by the `deploy.sh` script, then the agent certificate can be generated using the `agentcert.sh` script that is shipped alongside the deployment scripts. See [Generating a KeySafe 5 agent private key and TLS certificate](#).
 - If using the NATS server with KeySafe 5 Local, the agent certificate may be generated using `keysafe5-local-admin`. See [Adding KeySafe 5 Agents to KeySafe 5 Local](#)
3. Store the TLS certificate for this agent and the CA certificate using the `ks5agent mbtls` Serial Console command on the nShield Connect. These certificates must be entered in base64 encoded format. To create suitable input on a Unix system you can run `base64 --wrap=0 tls.crt`.

```
(cli)ks5agent mbcsr
<output will contain the CSR>

# Obtain a TLS certificate for the above CSR

(cli)ks5agent mbtls ca.crt <base64encoded_data>
Saved ca.crt

(cli)ks5agent mbtls tls.crt <base64encoded_data>
Saved tls.crt
```

5.5.1.3. Status

To show the current status of the KeySafe 5 agent on the nShield Connect, run the `ks5agent` Serial Console command with no arguments.

```
(cli)ks5agent
KeySafe 5 agent is disabled
```

The agent can be enabled and disabled using the `ks5agent enable` and `ks5agent disable` commands. This setting will persist over reboots.

To identify the version of agent installed on the Connect, use the `ks5agent version` command.

```
(cli)ks5agent version
1.3.0-4fa2054c
```

5.5.2. Logging

The agent logs of the KeySafe 5 agent running on the nShield Connect may be obtained by using the `ks5agent logs` Serial Console command.

By default, this will print the entire contents of the agent log file to the console. To display just the last 10 lines of the log file, use `ks5agent logs tail`. To display the last `n` lines of the log file, use `ks5agent logs tail <n>` where `<n>` is the number of lines to display.

```
(cli)ks5agent logs
(cli)ks5agent logs tail
(cli)ks5agent logs tail 20
```

If the nShield Connect is configured to append logs to the RFS, or configured to send logs to a Remote Syslog server, then the KeySafe 5 agent logs will be sent with these logs. For more information about configuring logging on the Connect, see the *nShield Connect User Guide*.

6. Upgrade

This chapter details how to update an existing KeySafe 5 install to the latest version.



If the environment that is being upgraded contains a WSOP3.x instance, it must be upgraded to at least WSOP v3.3.0 prior to upgrading KeySafe 5.

When upgrading KeySafe 5 it is recommended to first update the Helm charts installed in the central platform and then update all KeySafe 5 Agent installs on host machines being managed by KeySafe 5.

6.1. Upgrading from KeySafe 5 1.2

To upgrade the release of a Helm Chart we do a `helm upgrade` command, see [Helm Upgrade](#)

List all installed releases using `helm list -A`.

```
$ helm list -A
NAME                NAMESPACE      REVISION  UPDATED                                 STATUS  CHART
APP VERSION
keysafe5-backend    nshieldkeysafe5 1          2024-04-25 15:59:40.995994525 +0100 BST deployed nshield-
keysafe5-backend-1.2.0 1.2.0
keysafe5-istio      nshieldkeysafe5 1          2024-04-25 15:58:09.344300669 +0100 BST deployed nshield-
keysafe5-istio-1.2.0 1.2.0
keysafe5-ui         nshieldkeysafe5 1          2024-04-25 15:57:42.260802671 +0100 BST deployed nshield-
keysafe5-ui-1.2.0   1.2.0
mongo-chart         mongons         1          2024-04-25 15:55:05.825098514 +0100 BST deployed mongodb-
12.1.31             5.0.10
rabbit-chart        rabbitns        1          2024-04-25 15:58:19.881365343 +0100 BST deployed rabbitmq-
11.16.2             3.11.18
```



Ensure all pods are healthy prior to performing an upgrade, unhealthy pods can prevent helm from fully completing an upgrade.

The process involves upgrading the charts in the following order:

1. keysafe5-backend
2. keysafe5-ui
3. keysafe5-istio
4. mongo-chart
5. rabbit-chart

6.1.1. Unpack the source

```
mkdir ~/keysafe5-upgrade
tar -C ~/keysafe5-upgrade -xf nshield-keysafe5-1.3.0.tar.gz
cd ~/keysafe5-upgrade
```

6.1.2. Docker Images

The Docker images need to be loaded onto a Docker registry that each node in your Kubernetes cluster can pull the images from. See [Docker Images](#) for more details.

6.1.3. Upgrading the KeySafe 5 backend

The parameters used for the running Helm chart need to be retrieved into a file called `keysafe5-backend-values.yaml`.

```
helm -n nshieldkeysafe5 get values --all --output yaml keysafe5-backend > keysafe5-backend-values.yaml
```

This file will need updating with the new KeySafe 5 1.3 settings. To rename the `amqp` block to `messageBus` you may use `sed`:

```
sed -i -es'/^amqp/messageBus/' keysafe5-backend-values.yaml
```

If there are other changes you wish to make, you may do so.

```
helm upgrade --install keysafe5-backend \
  --namespace=nshieldkeysafe5 \
  --wait --timeout 3m \
  --values keysafe5-backend-values.yaml \
  --set hsm_mgmt.image=${DOCKER_REGISTRY}/keysafe5/hsm-mgmt:1.3.0 \
  --set sw_mgmt.image=${DOCKER_REGISTRY}/keysafe5/sw-mgmt:1.3.0 \
  --set codesafe_mgmt.image=${DOCKER_REGISTRY}/keysafe5/codesafe-mgmt:1.3.0 \
  helm-charts/nshield-keysafe5-backend-1.3.0.tgz
```

6.1.4. Upgrading the KeySafe 5 UI, and Istio

The same process as for the backend is also used for the UI, and Istio:

```
helm -n nshieldkeysafe5 get values --all --output yaml keysafe5-ui > keysafe5-ui-values.yaml
helm -n nshieldkeysafe5 get values --all --output yaml keysafe5-istio > keysafe5-istio-values.yaml
```

You may make changes to the yaml files before upgrading though this is not

required.

```
helm upgrade --install keysafe5-ui \
  --namespace=nshieldkeysafe5 \
  --wait --timeout 3m \
  --values keysafe5-ui-values.yaml \
  --set ui.image=${DOCKER_REGISTRY}/keysafe5/mgmt-ui:1.3.0 \
  --set ui.pullPolicy=Always \
  helm-charts/nshield-keysafe5-ui-1.3.0.tgz

helm upgrade --install keysafe5-istio \
  --namespace=nshieldkeysafe5 \
  --wait --timeout 3m \
  --values keysafe5-istio-values.yaml \
  helm-charts/nshield-keysafe5-istio-1.3.0.tgz
```

6.2. Agent Upgrade

To update the KeySafe 5 Agent installed on a machine:

- Take a backup of the Agent config directory located at `%NFAST_DATA_HOME%/keysafe5/conf`.
- Uninstall the existing KeySafe 5 Agent as detailed in the KeySafe 5 Installation Guide for the currently installed version of the product.
- Install the new KeySafe 5 Agent as detailed in chapter *KeySafe 5 Agent Installation*.

The configuration between the KeySafe 5 Agent v1.2 and v1.3 has changed. You may either configure the Agent afresh, or use the new example configuration file to create a new configuration file, with values from the old configuration. The existing keys may be reused, but note the new directory structure.

6.3. Upgrading supporting software

KeySafe 5 1.2 recommended RabbitMQ 3.11.19 and MongoDB 5.0.19. This section details how to upgrade the software from these versions to the latest recommended compatible versions.

6.3.1. MongoDB 5.0.19 to 7.0.7

Upgrading from MongoDB 5.0 to MongoDB 7.0 requires an interim upgrade to version 6.

To update a non-Kubernetes existing MongoDB install to a MongoDB 7.0 install,

see the official documentation at [Upgrade to the Latest Revision of MongoDB](#).

To update a MongoDB 5.0.19 install deployed via Bitnami Helm Charts:

First ensure that MongoDB is running.

```
helm list -A
```

We need to fetch the existing helm chart's settings

```
helm -n mongons get values --output yaml mongo-chart > mongo-chart-values.yaml
```

We also need to fetch the root password, and the replicaset key. They need to be passed to the new MongoDB instance, and to run commands on the MongoDB server.

```
MONGODB_ROOT_PASSWORD=$(kubectl get secret --namespace mongons mongo-chart-mongodb -o jsonpath="{.data.mongodb-root-password}" | base64 -d)
MONGODB_REPLICA_SET_KEY=$(kubectl get secret --namespace mongons mongo-chart-mongodb -o jsonpath="{.data.mongodb-replica-set-key}" | base64 -d)
```

Now we will upgrade the chart, also picking up the existing chart's settings.

```
helm upgrade mongo-chart bitnami/mongodb \
  --namespace mongons \
  --set architecture=replicaset \
  --set auth.replicaSetKey="$MONGODB_REPLICA_SET_KEY" \
  --set auth.rootPassword="$MONGODB_ROOT_PASSWORD" \
  --set image.tag=6.0.10-debian-11-r8 \
  --wait --timeout 3m \
  --values mongo-chart-values.yaml \
  --version 13.18.5
```

This will take about a minute, but once it succeeds the KeySafe 5 backend services will fail, then restart as its database broke communications.

Once `kubectl -n nshieldkeysafe5 get pods` shows that the KeySafe 5 backend services are running again, it is safe to continue.

We will now set the FeatureCompatibilityVersion to **6.0** to ensure that we can upgrade to MongoDB 7.0.

We create a simple script to allow us to run commands directly on the database. These are different to the ones shown when upgrading MongoDB, but that is because we use TLS.

```
RUN_MONGO="kubectl -n mongons exec --stdin=true mongo-chart-mongodb-0 0 --"
RUN_MONGO_ADMIN="$RUN_MONGO mongosh admin --tls --tlsCAFile /certs/mongodb-ca-cert --tlsCertificateKeyFile _____"
```

```
/certs/mongodb.pem --host 127.0.0.1 --authenticationDatabase admin -u root -p $MONGODB_ROOT_PASSWORD"
```

Using this we can now update the FeatureCompatibilityVersion.

```
$RUN_MONGO_ADMIN --eval 'db.adminCommand({setFeatureCompatibilityVersion: "6.0"})'
```

Now we may upgrade MongoDB to version 7.0.

Again, fetch the existing helm chart's settings

```
helm -n mongons get values --output yaml mongo-chart > mongo-chart-values.yaml
```

The password and replicaset key have not changed, so we can upgrade.

```
helm upgrade mongo-chart bitnami/mongodb \  
  --namespace mongons \  
  --wait --timeout 3m \  
  --set image.tag=7.0.7-debian-12-r0 \  
  --values mongo-chart-values.yaml \  
  --version 15.0.2
```

After this has finished, wait until the KeySafe 5 backend services are running again.

Obtain details of newly deployed helm charts

```
helm list -A
```

And finally for MongoDB, update the FeatureCompatibilityVersion.

```
$RUN_MONGO_ADMIN --eval 'db.adminCommand({setFeatureCompatibilityVersion: "7.0", confirm: true})'
```

6.3.2. RabbitMQ 3.11.19 to 3.12.13

To update a non-Kubernetes existing RabbitMQ install, see the official documentation at [Upgrading RabbitMQ](#).

To update a RabbitMQ 3.11.3 install deployed via Bitnami Helm Charts:

```
# Obtain details of currently deployed helm charts  
# Substitute chart and namespace values in the commands below as required  
helm list -A  
  
# Fetch current rabbitmq helm chart deployed values  
helm -n rabbitns get values --output yaml rabbit-chart > rabbit-chart-values.yaml
```

```
# Upgrade helm chart based on existing deployed values
helm upgrade --install rabbit-chart \
  --namespace=rabbitns \
  --values rabbit-chart-values.yaml \
  --set image.tag=3.12.13-debian-12-r1 \
  --set service.type=LoadBalancer \
  --set extraPlugins="rabbitmq_auth_mechanism_ssl" \
  --wait --timeout 10m \
  bitnami/rabbitmq --version 12.13.1

# Obtain details of newly deployed helm charts
helm list -A
```

6.3.3. Istio

The version of Istio installed aligns with the software version of [istioctl](#).

For details of how to upgrade Istio, see [Upgrade Istio](#).

7. Uninstall

7.1. Central platform

To fully remove the KeySafe 5 application from your Kubernetes cluster, use `helm uninstall`. This uninstalls all KeySafe 5 Helm charts.

You can use `helm list` to see which charts are installed. If you do not know the namespace, use `--all-namespaces` to show charts from all namespaces.

```
$ helm list -n nshieldkeysafe5 --short
keysafe5-backend
keysafe5-istio
keysafe5-ui
```

And to delete them

```
helm uninstall keysafe5-ui --namespace=nshieldkeysafe5
helm uninstall keysafe5-istio --namespace=nshieldkeysafe5
helm uninstall keysafe5-backend --namespace=nshieldkeysafe5
```



KeySafe 5 application data remains in your MongoDB database after uninstalling the application. To clear this data from the database, remove the databases that were defined by `codesafe_mgmt.dbName`, `hsm_mgmt.dbName`, and `sw_mgmt.dbName` in the `helm-keysafe5-backend` chart.

7.2. KeySafe 5 agent

Before uninstalling the nShield KeySafe 5 agent, Entrust recommends that you back up any configuration files and certificates from the installation.

7.2.1. Linux

To remove the KeySafe 5 agent from a Linux host run the KeySafe 5 uninstaller:

```
sudo /opt/nfast/keysafe5/sbin/install -u
```

Then proceed to remove the following files and directories:

- `/opt/nfast/keysafe5/bin/ks5agenttls`

- `/opt/nfast/keysafe5/conf/config.yaml.example`
- `/opt/nfast/keysafe5/sbin/install`
- `/opt/nfast/lib/versions/keysafe5-agent-atv.txt`
- `/opt/nfast/sbin/keysafe5-agent`
- `/opt/nfast/scripts/install.d/12keysafe5-agent`
- `/opt/nfast/log/keysafe5-agent.log`

The current configuration, stored in `/opt/nfast/keysafe5/conf`, may also be removed.



The agent log file will be located in a different location if you have changed the default value of `logging.file.path` in the agent configuration file.

If required, you can also remove the `keysafe5d` user that was created as part of the installation.

7.2.2. Windows

To remove the KeySafe 5 agent from a Windows host:

1. Stop the KeySafe 5 agent service using **Windows Service Manager**.
2. Open the **Control Panel** and select **Programs and Features**.
3. Select the **nShield KeySafe 5 Agent** package.
4. Select **Uninstall** and follow the on-screen instructions.

To remove any configuration files, delete the `%NFAST_DATA_HOME%\keysafe5` directory and remove the log file located at `C:\ProgramData\nCipher\Log Files\KeySafe5-agent.log`



The agent log file will be located in a different location if you have changed the default value of `logging.file.path` in the agent configuration file.

8. Security Guidance

Your nShield HSM protects the confidentiality and integrity of your Security World keys. KeySafe 5 allows an authorized client to remotely configure and manage an estate of nShield HSMs. All network traffic between KeySafe 5 and clients using the UI, the REST API, or both, passes through a secure channel. This TLS based secure channel is set up using token-based client authentication. The administrator of the KeySafe 5 system must remain diligent concerning the entities who are given access to the system and the secure configuration of the system.

Entrust recommends the following security-related actions for KeySafe 5 deployments:

- Ensure that log levels are set appropriately for your environment.

More verbose log levels might expose information that is useful for auditing users of KeySafe 5, but the log information also reveals which REST API operations were performed. While this log information might be useful for diagnostics, it could also be considered sensitive and should be suitably protected when stored.
- Rotate the logs regularly. The log files could grow quickly if left unattended for a long time. The system administrator is responsible for log rotation.
- Verify the integrity of the KeySafe 5 tar file before executing it. You can verify the integrity of this file with the hash provided with the software download.
- Suitably protect the network environment of KeySafe 5 to maintain its availability, for example using firewalls and intrusion detection and prevention systems.
- Ensure that the KeySafe 5 platform's system clock is set accurately and only authorized system administrators can modify it so that the platform correctly interprets certificate and token lifetimes.
- Ensure that only authorized system administrators have access to the KeySafe 5 system, and only trusted software is run on the platform hosting KeySafe 5.
- Take standard virus prevention and detection measures on the platform hosting KeySafe 5.
- The system administrator should consider whether threats in the KeySafe 5 deployment environment would justify the encryption of the sensitive configuration data held in Kubernetes secrets, see [Kubernetes documentation](#).

9. Manual Install

The following steps provide a step-by-step guide to installing KeySafe 5 and its dependencies into an existing Kubernetes cluster.

An alternative to this guide is the KeySafe 5 Quick Start Guide which provides a scripted means of installing KeySafe 5.

These steps install KeySafe 5 and its dependencies. They should be followed to set up a demo environment for evaluation purposes and should *not* be used for production environments.

Please see [Hardening The Deployment](#) for steps to harden the deployment. Entrust recommends these steps as a minimum and that additional hardening may be required dependent on your own requirements.

A production deployment will have as a minimum the following:

- Maintained and patched versions of all the dependencies.
- A secure CA with TLS v1.3 support for certificates. The deploy script can provide a local insecure CA.
- A secure Kubernetes installation. The deploy script can install K3s locally.
- A secure MongoDB database. The deploy script can provide a replicated MongoDB with X.509 authentication running in Kubernetes.
- A secure RabbitMQ message broker. The deploy script can provide a RabbitMQ with X.509 authentication running in Kubernetes.
- A secure means of large object storage. The deploy script can provide local object storage within the Kubernetes cluster or be configured for using an NFS for object storage.
- HTTPS secured by a trusted certificate for the KeySafe 5 endpoints. The deploy script will enable HTTPS connections with a self-signed insecure certificate.
- Require authentication to access KeySafe 5. OIDC & OAUTH2 are currently supported in KeySafe 5. The deploy script will not set up authenticated access.



This set of commands are an example of how to install KeySafe

5. They may need modification to suit your environment.

9.1. Unpack the release

```
mkdir ~/keysafe5-install
tar -xf nshield-keysafe5-1.3.0.tar.gz -C ~/keysafe5-install
cd ~/keysafe5-install
```

9.2. Docker images

The Docker images need to be loaded onto a Docker registry that each node in your Kubernetes cluster can pull the images from.

1. Load the Docker images to your local Docker, for example:

```
docker load < docker-images/codesafe-mgmt.tar
docker load < docker-images/hsm-mgmt.tar
docker load < docker-images/sw-mgmt.tar
docker load < docker-images/ui.tar
```

2. Set the `DOCKER_REGISTRY` variable to the registry in use, for example:

```
export DOCKER_REGISTRY=localhost:5000
```



If you are using a single-machine Kubernetes distribution like K3s, you may be able to create a simple unauthenticated local private Docker registry by following the instructions in [Distribution Registry](#). However this registry is only accessible by setting the name to `localhost` which will not work for other configurations.

3. Log in to the registry to ensure that you can push to it:

```
docker login $DOCKER_REGISTRY
```

4. Tag the Docker images for the registry, for example:

```
docker tag codesafe-mgmt:1.3.0 $DOCKER_REGISTRY/keysafe5/codesafe-mgmt:1.3.0
docker tag hsm-mgmt:1.3.0 $DOCKER_REGISTRY/keysafe5/hsm-mgmt:1.3.0
docker tag sw-mgmt:1.3.0 $DOCKER_REGISTRY/keysafe5/sw-mgmt:1.3.0
docker tag mgmt-ui:1.3.0 $DOCKER_REGISTRY/keysafe5/mgmt-ui:1.3.0
```

5. Push the KeySafe 5 images to the registry, for example:

```
docker push $DOCKER_REGISTRY/keysafe5/codesafe-mgmt:1.3.0
docker push $DOCKER_REGISTRY/keysafe5/hsm-mgmt:1.3.0
docker push $DOCKER_REGISTRY/keysafe5/sw-mgmt:1.3.0
docker push $DOCKER_REGISTRY/keysafe5/mgmt-ui:1.3.0
```

9.3. Set up a Certificate Authority

You should use your existing CA for a production system. This is simply used as an example for the purposes of having a working demo system.

Either OpenSSL 3.0 or OpenSSL 1.1.1 may be used to create the CA, and the CA may be created in a directory of your choosing. In these examples, `/home/user/keysafe5-install/internalCA` is the example directory used. In that directory, create the file `internalCA.conf` with the contents:

```
[ ca ]
default_ca = CA_default # The default ca section

[ CA_default ]

dir = /home/user/keysafe5-install/internalCA # The directory of the CA
database = $dir/index.txt # index file.
new_certs_dir = $dir/newcerts # new certs dir

certificate = $dir/cacert.pem # The CA cert
serial = $dir/serial # serial no file
#rand_serial = yes # for random serial#'s
private_key = $dir/private/cakey.pem # CA private key
RANDFILE = $dir/private/.rand # random number file

default_days = 15 # how long to certify for
default_crl_days= 5 # how long before next CRL
default_md = sha256 # Message Digest
policy = test_root_ca_policy
x509_extensions = certificate_extensions
unique_subject = no
# This copy_extensions setting should not be used in a production system.
# It is simply used to simplify the demo system.
copy_extensions = copy

[ test_root_ca_policy ]
commonName = supplied
stateOrProvinceName = optional
countryName = optional
emailAddress = optional
organizationName = optional
organizationalUnitName = optional
domainComponent = optional

[ certificate_extensions ]
basicConstraints = CA:false

[ req ]
default_bits = 4096
default_md = sha256
```

```
prompt = yes
distinguished_name = root_ca_distinguished_name
x509_extensions = root_ca_extensions

[ root_ca_distinguished_name ]
commonName = hostname

[ root_ca_extensions ]
basicConstraints = CA:true
keyUsage = keyCertSign, cRLSign
subjectKeyIdentifier = hash
authorityKeyIdentifier = keyid:always,issuer
basicConstraints = critical,CA:true
```

Remember to update the `dir` value to the directory in which the `internalCA.conf` and the other CA files will be stored. The certificates generated, unless overridden on the command line, will be valid for 15 days as specified in `default_days`.

To generate the long-term CA key and random number source, create a directory called `private`, then place them in that directory:

```
mkdir ~/keysafe5-install/internalCA/private
openssl genrsa -out ~/keysafe5-install/internalCA/private/cakey.pem 4096
openssl rand -out ~/keysafe5-install/internalCA/private/.rand 1024
```

The CA needs a self-signed certificate; as this is a short-term demo it will be valid for 90 days:

```
openssl req -x509 -new -nodes \
  -key internalCA/private/cakey.pem \
  -subj "/CN=internalCA" -days 90 \
  -out internalCA/cacert.pem \
  -config internalCA/internalCA.conf
cp internalCA/cacert.pem ca.crt
```

And finally, to finish off the configuration:

```
mkdir internalCA/newcerts
echo 01 > internalCA/serial
touch internalCA/index.txt
```

9.4. Install and set up the supporting software

9.4.1. Kubernetes namespace

Create a namespace in Kubernetes for KeySafe 5 installation.

```
kubectl create namespace nshieldkeysafe5
```

9.4.2. Istio



These instructions assume that only Istio will be used for ingress, and no other ingress controller is installed.

If Istio is not already installed, you may install a version aligned with the software version of `istioctl` with:

```
istioctl install -y
```

9.4.3. RabbitMQ

Entrust recommends that you use your standard secure RabbitMQ installation, along with your policies for authentication and virtual hosts on your production system; this is only a demo system.

First, you must generate the TLS keys and guest password. You must add the network addresses through which RabbitMQ will be accessed to the certificate, and are very dependent on the configuration of the Kubernetes cluster.

```
openssl genrsa -out ~/keysafe5-install/rabbit.key 4096
export DNS1="*.rabbit-chart-rabbitmq-headless.rabbitns.svc.cluster.local"
export DNS2=rabbit-chart-rabbitmq.rabbitns.svc
export DNS3=rabbitmq.rabbitns.svc.cluster.local
```

If you know the external IP address that will be allocated by Kubernetes, then set `HOSTIP` to that address. Otherwise set it to a temporary address.

```
export HOSTIP=127.0.0.1
openssl req -new -key ~/keysafe5-install/rabbit.key \
  -out ~/keysafe5-install/rabbitmq.csr \
  -subj "/CN=rabbitmq" \
  -addext "keyUsage=digitalSignature" \
  -addext "extendedKeyUsage=serverAuth" \
  -addext "subjectAltName=DNS:rabbitmq,DNS:${DNS1},DNS:${DNS2},DNS:${DNS3},IP:${HOSTIP}"
openssl ca -config ~/keysafe5-install/internalCA/internalCA.conf \
  -out rabbit.crt \
  -in rabbitmq.csr -batch
rm rabbitmq.csr
```

This will create a certificate that is valid for the default time period as set in the configuration file.

We now transfer the key and certificate into a Kubernetes secret for the RabbitMQ service:

```
kubectl create namespace rabbitns
```

```
kubectl create secret generic rabbitmq-certificates \
  --namespace=rabbitns \
  --from-file=ca.crt \
  --from-file=tls.crt=rabbit.crt \
  --from-file=tls.key=rabbit.key \
kubectl -n rabbitns create secret generic rabbitmq-pw \
  --from-literal=rabbitmq-password=guest
```

Then install RabbitMQ. This can take a few minutes.

```
helm repo add bitnami https://charts.bitnami.com/bitnami && helm repo update
helm install rabbit-chart \
  --namespace=rabbitns \
  --set image.tag=3.12.13-debian-12-r1 \
  --set auth.username=guest \
  --set auth.existingPasswordSecret=rabbitmq-pw \
  --set auth.tls.enabled=true \
  --set auth.tls.existingSecret=rabbitmq-certificates \
  --set replicaCount=2 \
  --set service.type=LoadBalancer \
  --set extraConfiguration='
  listeners.ssl.default = 5671
  ssl_options.versions.1 = tlsv1.3
  ssl_options.depth=0
  ssl_options.verify = verify_peer
  ssl_options.fail_if_no_peer_cert = true
  auth_mechanisms.1 = EXTERNAL
  ssl_cert_login_from = subject_alternative_name
  ssl_cert_login_san_type = dns
  ssl_cert_login_san_index = 0' \
  --set plugins="" \
  --set extraPlugins="rabbitmq_auth_mechanism_ssl" \
  --wait --timeout 10m \
  bitnami/rabbitmq --version 12.13.1
```

Add the virtual host that will be used for KeySafe 5 communication.

```
export RUN_RABBIT="kubectl -n rabbitns exec rabbit-chart-rabbitmq-0 -c rabbitmq -- "
export RABBIT_VHOST=nshieldvhost
${RUN_RABBIT} rabbitmqctl add_vhost ${RABBIT_VHOST}
```

Then add and configure the X.509 user for the KeySafe 5 application to communicate with RabbitMQ.

```
export KS5_USER=ks5
${RUN_RABBIT} rabbitmqctl add_user $KS5_USER "ephemeralpw"
${RUN_RABBIT} rabbitmqctl set_permissions -p $RABBIT_VHOST $KS5_USER ".*" ".*" ".*"
${RUN_RABBIT} rabbitmqctl clear_password $KS5_USER
```

You should then create the X.509 key and certificate (valid for the default time period) for this user.

```
openssl genrsa -out $KS5_USER.key 4096
openssl req -new -key $KS5_USER.key -out $KS5_USER.csr \
  -subj "/CN=${KS5_USER}" \
  -addext "keyUsage=digitalSignature" \
```

```

-addext "extendedKeyUsage=clientAuth" \
-addext "subjectAltName=DNS:${KS5_USER}"
openssl ca -config ~/keysafe5-install/internalCA/internalCA.conf \
-out ${KS5_USER}.cert -in ${KS5_USER}.csr -batch
rm ${KS5_USER}.csr
kubectl create secret generic ks5-messagebus-tls \
--namespace nshieldkeysafe5 \
--from-file=ca.crt \
--from-file=tls.crt=ks5.crt \
--from-file=tls.key=ks5.key

```

Now remove access for the default `guest` user.

```

${RUN_RABBIT} rabbitmqctl delete_user guest

```

We need to set up a variable to hold the `RABBIT_URL` using the external IP address and port:

```

ipaddr=$(kubectl get svc -n rabbitns rabbit-chart-rabbitmq -o "jsonpath={.status.loadBalancer.ingress[0].ip}")
port=$(kubectl get service -n rabbitns rabbit-chart-rabbitmq -o "jsonpath={.spec['ports'][(?(@.name=='amqp-tls')].port}")
export RABBIT_URL="$ipaddr:$port/${RABBIT_VHOST}"

```

The variable `RABBIT_URL` holds the url required to connect to RabbitMQ from an external client.

If the variable `ipaddr` contains a different value from `HOSTIP` above, we will need to create a new certificate for the correct IP address, and point a new RabbitMQ to it. This is the same process used for upgrading the RabbitMQ certificate when it expires.

First, we create a new certificate, then a new secret from it (using the same secret key that we created earlier):

```

openssl req -new -key ~/keysafe5-install/rabbit.key \
-out ~/keysafe5-install/rabbitmq.csr \
-subj "/CN=rabbitmq" \
-addext "keyUsage=digitalSignature" \
-addext "extendedKeyUsage=serverAuth" \
-addext "subjectAltName=DNS:rabbitmq,DNS:${DNS1},DNS:${DNS2},DNS:${DNS3},IP:${ipaddr}"
openssl ca -config ~/keysafe5-install/internalCA/internalCA.conf \
-out rabbit2.crt \
-in rabbitmq.csr -batch
rm rabbitmq.csr
kubectl create secret generic rabbitmq-certificates-1 \
--namespace=rabbitns \
--from-file=ca.crt \
--from-file=tls.crt=rabbit2.crt \
--from-file=tls.key=rabbit.key

```

Then we "upgrade" RabbitMQ, pointing it at the new secrets. This can also take a few minutes.

```
helm -n rabbitns get values --all --output yaml rabbit-chart > rabbit-chart-values.yaml
helm upgrade --install rabbit-chart \
  --namespace=rabbitns \
  --values rabbit-chart-values.yaml \
  --set auth.tls.existingSecret=rabbitmq-certificates-1 \
  --wait --timeout 10m \
  bitnami/rabbitmq --version 12.13.1
```

9.4.4. MongoDB

Entrust recommends that you use your standard secure MongoDB Replica Set installation. This is just an example, and not production-ready.

By default the Bitnami MongoDB chart will create its own CA, and generate TLS keys for each of its servers from this CA. As we have an existing CA to use, we will pass the private key and certificate to MongoDB to use as its CA.

```
kubectl create namespace mongons
kubectl create secret generic mongodb-ca-certificates \
  --namespace mongons \
  --from-file=mongodb-ca-cert=ca.crt \
  --from-file=mongodb-ca-key=internalCA/private/cakey.pem
```

Now we install the MongoDB chart, using the CA secret above. This may take a few minutes.

```
helm install mongo-chart \
  --set image.tag=7.0.7-debian-12-r0 \
  --set architecture=replicaset \
  --set auth.enabled=true \
  --set auth.username={dummyuser} \
  --set auth.passwords={dummyspassword} \
  --set auth.databases={authdb} \
  --set tls.enabled=true \
  --set tls.mTLS.enabled=true \
  --set tls.autoGenerated=false \
  --set tls.existingSecret=mongodb-ca-certificates \
  --namespace=mongons \
  --wait --timeout 10m bitnami/mongodb --version 15.0.2
```

There will be a message listing the MongoDB server addresses. Save the addresses to environment variables for use later.

```
export MONGO1=mongo-chart-mongodb-0.mongo-chart-mongodb-headless.mongons.svc.cluster.local:27017
export MONGO2=mongo-chart-mongodb-1.mongo-chart-mongodb-headless.mongons.svc.cluster.local:27017
export MONGODB=${MONGO1},${MONGO2}
```

We now need to create a TLS key and certificate for securing communications between the backend services and MongoDB.

```

export MONGOUSER="ks5-mongo-user"
openssl genrsa -out $MONGOUSER.key 4096
openssl req -new -key $MONGOUSER.key -out $MONGOUSER.csr \
  -subj "/CN=${MONGOUSER}" \
  -addext "keyUsage=digitalSignature" \
  -addext "extendedKeyUsage=clientAuth" \
  -addext "subjectAltName=DNS:${MONGOUSER}"
openssl ca -config ~/keysafe5-install/internalCA/internalCA.conf \
  -out ${MONGOUSER}.crt -in ${MONGOUSER}.csr -batch
rm ${MONGOUSER}.csr
kubectl create secret generic ks5-mongotls \
  --namespace nshieldkeysafe5 \
  --from-file=ca.crt \
  --from-file=tls.crt=${MONGOUSER}.crt \
  --from-file=tls.key=${MONGOUSER}.key

```

The database tables and access for **MONGOUSER** also need to be set up. For this we will pass commands to mongosh running on the database server itself as the root user.

```

export MONGODB_ROOT_PASSWORD=$(kubectl get secret --namespace mongons \
  mongo-chart-mongodb -o jsonpath="{.data.mongodb-root-password}" \
  | base64 --decode)
export MONGO_TLSUSER=$(openssl x509 -in $MONGOUSER.crt -subject -noout | cut -f2- -d= | tr -d '[:space:]')
echo $MONGO_TLSUSER

```

Make a note of the **MONGO_TLSUSER** as you will need it shortly.

We need to start the mongosh command prompt.

```

kubectl -n mongons exec \
  --stdin=true mongo-chart-mongodb-0 0 -- \
  mongosh admin --tls \
  --tlsCAFile /certs/mongodb-ca-cert \
  --tlsCertificateKeyFile /certs/mongodb.pem \
  --host 127.0.0.1 \
  --authenticationDatabase admin \
  -u root -p $MONGODB_ROOT_PASSWORD

```

At the command prompt enter these database commands to create the tables.

```

db.createRole(
  {
    role: "hsm-mgmt-db-user",
    privileges: [
      {
        "resource": {"db": "hsm-mgmt-db", "collection": ""},
        "actions": ["createIndex", "find", "insert", "remove", "update"]
      },
    ],
    roles: []
  }
)
db.createRole(
  {
    role: "sw-mgmt-db-user",
    privileges: [

```

```

        {
          "resource": {"db": "sw-mgmt-db", "collection": ""},
          "actions": ["createIndex", "dropCollection", "find", "insert", "remove", "update"]
        },
      ],
      roles: []
    }
  )
  db.createRole(
    {
      role: "codesafe-mgmt-db-user",
      privileges: [
        {
          "resource": {"db": "codesafe-mgmt-db", "collection": ""},
          "actions": ["createIndex", "find", "insert", "remove", "update"]
        },
      ],
      roles: []
    }
  )
)

```

We now need to create the user with access to the database. Replace **CN=ks5-mongo-user** with the value you got for **MONGO_TLSUSER**, and enter it into the prompt.

```

use $external
x509_user = {
  user : "CN=ks5-mongo-user",
  roles : [
    {"role": "codesafe-mgmt-db-user", "db": "admin" },
    {"role": "hsm-mgmt-db-user", "db": "admin" },
    {"role": "sw-mgmt-db-user", "db": "admin" },
  ]
}
db.createUser(x509_user)

```

Type **exit** to exit the mongosh prompt.

9.4.5. Object Storage

For large object storage, create a Persistent Volume Claim, in the **nshieldkeysafe5** Kubernetes namespace (the same namespace that we will deploy the application to).

9.4.5.1. Cluster-local Object Storage

If your Kubernetes cluster only has 1 worker node, you can choose to use local storage.

```

cat << EOF | kubectl -n nshieldkeysafe5 apply -f -
  apiVersion: v1
  kind: PersistentVolumeClaim
  metadata:
    name: data-nshield-keysafe5

```

```
spec:
  accessModes:
    - ReadWriteOnce
  storageClassName: local-path
  resources:
    requests:
      storage: 2Gi
EOF
```

9.4.5.2. NFS Object Storage

If your Kubernetes cluster has more than 1 worker node, you must use a type of storage that supports distributed access, such as NFS. For details on creating a PVC for NFS object storage, please see [NFS Object Storage Configuration](#).

9.5. Install KeySafe 5

Bringing all the secrets and URLs created above, install KeySafe 5.



The commands below assume that a login is not required to pull from the Docker Registry.

```
# Get Ingress IP address
export INGRESS_IP=$(kubectl --namespace istio-system get svc -l app=istio-ingressgateway -o
jsonpath='{.items[0].status.loadBalancer.ingress[0].ip}')

# Install the KeySafe 5 backend services
helm install keysafe5-backend \
  --namespace=nshieldkeysafe5 \
  --set codesafe_mgmt.image=$DOCKER_REGISTRY/keysafe5/codesafe-mgmt:1.3.0 \
  --set hsm_mgmt.image=$DOCKER_REGISTRY/keysafe5/hsm-mgmt:1.3.0 \
  --set sw_mgmt.image=$DOCKER_REGISTRY/keysafe5/sw-mgmt:1.3.0 \
  --set database.type=mongo \
  --set database.mongo.hosts="$MONGO1\,$MONGO2" \
  --set database.mongo.replicaSet=rs0 \
  --set database.mongo.auth.type=tls \
  --set database.mongo.auth.authDatabase=authdb \
  --set database.mongo.tls.enabled=true \
  --set database.mongo.tls.existingSecret=ks5-mongotls \
  --set messageBus.type=amqp \
  --set messageBus.URL=${RABBIT_URL} \
  --set messageBus.auth.type=tls \
  --set messageBus.tls.enabled=true \
  --set messageBus.tls.existingSecret=ks5-messagebus-tls \
  --set objectStore.pvc=data-nshield-keysafe5 \
  --wait --timeout 10m \
  helm-charts/nshield-keysafe5-backend-1.3.0.tgz

# Install the KeySafe 5 UI
helm install keysafe5-ui \
  --namespace=nshieldkeysafe5 \
  --set ui.image=$DOCKER_REGISTRY/keysafe5/mgmt-ui:1.3.0 \
  --set svcEndpoint="https://${INGRESS_IP}" \
  --set authMethod=none \
  --wait --timeout 10m \
  helm-charts/nshield-keysafe5-ui-1.3.0.tgz
```

```
# Create the TLS secret for the Istio Ingress Gateway
openssl genrsa -out istio.key 4096
openssl req -new -key istio.key -out istio.csr \
  -subj "/CN=${HOSTNAME}" \
  -addext "keyUsage=digitalSignature" \
  -addext "extendedKeyUsage=serverAuth" \
  -addext "subjectAltName=DNS:${HOSTNAME},IP:${INGRESS_IP}"
openssl ca -config ~/keysafe5-install/internalCA/internalCA.conf \
  -out istio.crt -in istio.csr -batch
kubectl -n istio-system create secret tls \
  keysafe5-server-credential --cert=istio.crt --key=istio.key

# Configure Istio Ingress Gateway for KeySafe 5
helm install keysafe5-istio \
  --namespace=nshieldkeysafe5 \
  --set tls.existingSecret=keysafe5-server-credential \
  --set requireAuth=false \
  --wait --timeout 1m \
  helm-charts/nshield-keysafe5-istio-1.3.0.tgz
```

9.6. Access KeySafe 5

You can now access KeySafe 5 at [https://\\$INGRESS_IP](https://$INGRESS_IP).

For example, you could send curl requests as demonstrated below.

```
curl -X GET --cacert ca.crt https://$INGRESS_IP/mgmt/v1/hsms | jq
curl -X GET --cacert ca.crt https://$INGRESS_IP/mgmt/v1/hosts | jq
curl -X GET --cacert ca.crt https://$INGRESS_IP/mgmt/v1/pools | jq
curl -X GET --cacert ca.crt https://$INGRESS_IP/mgmt/v1/feature-certificates | jq
curl -X GET --cacert ca.crt https://$INGRESS_IP/mgmt/v1/worlds | jq
curl -X GET --cacert ca.crt https://$INGRESS_IP/codesafe/v1/images | jq
curl -X GET --cacert ca.crt https://$INGRESS_IP/codesafe/v1/certificates | jq
```

You can access the Management UI in a web browser at [https://\\$INGRESS_IP](https://$INGRESS_IP).

9.7. Configure KeySafe 5 Agent machines

To configure a host machine to be managed and monitored by this deployment, run the KeySafe 5 agent binary on the KeySafe 5 Agent machine containing the relevant Security World or HSMs.



Configure this KeySafe 5 agent to communicate with the RabbitMQ server installed previously.

Ensure no firewall rules are blocking the AMQP port communication between the machine exposing the AMQP port from Kubernetes and the machine running the agent.

After copying over the agent tar file, extract it and start configuring:

```
sudo tar -C / -xf keysafe5-1.3.0-Linux-keysafe5-agent.tar.gz
export KS5CONF=/opt/nfast/keysafe5/conf
sudo cp $KS5CONF/config.yaml.example $KS5CONF/config.yaml
```

Edit the `config.yaml`, replacing the `message_bus url 127.0.0.1:5671` with the value of `$RABBIT_URL` that was produced setting up the services. Typically the `127.0.0.1` would be replaced by the `INGRESS_IP`, and a `/nshieldvhost` appended to it.

Create the `messagebus/tls` directory and copy the `ca.crt` file copied from the `keysafe5-install` directory on the demo machine into it.

```
mkdir -p $KS5CONF/messagebus/tls
cp ca.crt $KS5CONF/messagebus/tls/
```

Create the private key and a certificate signing request (CSR) for this specific KeySafe 5 agent.

```
sudo /opt/nfast/keysafe5/bin/ks5agenttls --keypath=$KS5CONF/messagebus/tls/tls.key --keygen
sudo /opt/nfast/keysafe5/bin/ks5agenttls --keypath=$KS5CONF/messagebus/tls/tls.key --csrgen
```

The CSR should be provided to a KeySafe 5 administrator who, in a secure location/environment, creates a RabbitMQ service client TLS certificate using the CA trusted by the RabbitMQ server.

For this installation we copy the CSR to the demo machine, into the `keysafe5-install` directory, then sign it using OpenSSL.

```
openssl ca -config ~/keysafe5-install/internalCA/internalCA.conf \
-in ks5agent_demohost.csr \
-out ks5agent_demohost.crt -batch
```

RabbitMQ uses the first DNS name as provided in the `subjectAltName` field of the certificate. This is usually the basename of the file, but you may retrieve it using the following command:

```
export x509user=$(openssl x509 -in ks5agent_demohost.crt -noout -ext subjectAltName | tail -n1 | cut -f2 -d:)
echo $x509user
```

Using the username printed in the output of the previous command, configure the RabbitMQ server to allow access for this X.509 user in the appropriate virtual host.

```
export RUN_RABBIT="kubectl -n rabbitns exec rabbit-chart-rabbitmq-0 -c rabbitmq -- "
${RUN_RABBIT} rabbitmqctl add_user $x509user "ephemeralpw"
```

```
 ${RUN_RABBIT} rabbitmqctl set_permissions -p $RABBIT_VHOST $x509user ".*" ".*" ".*"  
 ${RUN_RABBIT} rabbitmqctl clear_password $x509user
```

Transfer the resulting certificate `ks5agent_demohost.crt` to the nShield Agent machine at `/opt/nfast/keysafe5/conf/messagebus/tls/tls.crt`.

On the nShield Agent machine, if the hardserver is already running, use the KeySafe 5 install script to not restart it when installing the KeySafe 5 agent.

```
sudo /opt/nfast/keysafe5/sbin/install
```

Otherwise, use the nShield install script which will start both the nShield Security World software and the KeySafe 5 agent.

```
sudo /opt/nfast/sbin/install
```

9.8. Uninstall

9.8.1. KeySafe 5 services

```
helm --namespace nshieldkeysafe5 uninstall keysafe5-istio  
helm --namespace nshieldkeysafe5 uninstall keysafe5-backend  
helm --namespace nshieldkeysafe5 uninstall keysafe5-ui  
helm --namespace rabbitns uninstall rabbit-chart  
helm --namespace mongons uninstall mongo-chart
```

9.8.2. KeySafe 5 Agent

To uninstall the KeySafe 5 agent, run the KeySafe 5 uninstaller, then remove the files manually.

```
sudo /opt/nfast/keysafe5/sbin/install -u  
rm -f /opt/nfast/lib/versions/keysafe5-agent-atv.txt  
rm -f /opt/nfast/sbin/keysafe5-agent  
rm -f /opt/nfast/scripts/install.d/12keysafe5-agent  
rm -f /opt/nfast/keysafe5/sbin/install  
rm -f /opt/nfast/keysafe5/bin/ks5agenttls  
rm -f /opt/nfast/keysafe5/conf/config.yaml.example
```

The configuration for KeySafe 5 Agent is stored in the conf directory which can also be deleted.

```
rm -rf /opt/nfast/keysafe5/conf
```

10. Hardening The Deployment

To harden the demo deployment there are a number of steps to follow. The documentation below requires modifying the configuration of the Helm charts installed by following the Manual Install steps or running the `deploy.sh` script. To obtain the installed configuration for each installed Helm chart, run the following commands:

```
helm -n nshieldkeysafe5 get values --all --output yaml keysafe5-backend > keysafe5-backend-values.yaml
helm -n nshieldkeysafe5 get values --all --output yaml keysafe5-ui > keysafe5-ui-values.yaml
helm -n nshieldkeysafe5 get values --all --output yaml keysafe5-istio > keysafe5-istio-values.yaml
```



Documentation for each configurable value in the KeySafe 5 Helm charts can be found by untarring the chart.tgz and viewing the contents of either README.md or the default values.yaml file.

10.1. Certificates

The Manual Install steps and `deploy.sh` script will generate a local Certificate Authority, and install a number of short-lived demo certificates. These certificates must be replaced to continue using the system after their expiry.

Your new certificates will need to adhere to X.509 v3, sometimes known as a multiple-domain certificates, or SAN certificates. The X.509 extension Subject Alternative Name (SAN) allows specifying multiple hostnames, and has replaced Common Name as the source of the hostname.

10.1.1. External KeySafe 5 Server TLS Certificate

To update the TLS certificate used for the KeySafe 5 Server (for HTTPS connections to the REST API or User Interface) you must create a Kubernetes Secret containing the new certificate/private key and redeploy the `keysafe5-istio` Helm chart.

For more information on enabling HTTPS for helm-keysafe5-istio, see the Helm Chart Installation section of the Installation Guide.

The Manual Install steps and `deploy.sh` script create a Kubernetes Secret called `keysafe5-server-credential`. You can either delete the existing Secret as shown below, or use a different name for the Secret containing your new TLS certificate.

```
kubectl --namespace istio-system delete secret keysafe5-server-credential

kubectl --namespace istio-system create secret tls keysafe5-server-credential \
  --cert=path/to/cert/file \
  --key=path/to/key/file
```

Before running `helm upgrade`, set the following values in your `keysafe5-istio-values.yaml`:

- `httpsEnabled=true`
- `tls.existingSecret=keysafe5-server-credential` (or the name you used when creating the Kubernetes Secret containing your certificate/private key)

```
helm upgrade --install keysafe5-istio \
  --namespace=nshieldkeysafe5 \
  --values keysafe5-istio-values.yaml \
  --wait --timeout 1m \
  helm-charts/nshield-keysafe5-istio-1.3.0.tgz
```

10.1.2. Internal Certificates

The Manual Install steps and `deploy.sh` script create a Certificate Authority, and install KeySafe 5 using TLS authorised by the CA for the communications between the central platform and MonogDB/RabbitMQ.

You can refresh these internal certificates by running the `updateinternalcerts.sh` script, specifying the number of days for which the new certificates will be valid.

The help for `updateinternalcerts.sh` is shown with the `-h` option:

```
Usage: ./updateinternalcerts.sh [OPTION]... [SERVER] DAYS
Generate certificates for SERVER that expire in DAYS days and update the
KeySafe 5 internal TLS certificates for a deployment created by deploy.sh

SERVER                One of "mongodb" or "rabbitmq".
                      If the server is not specified then both will
                      be updated.

DAYS                  Number of days before the generated certificates
                      expire

-n, --namespace=NAMESPACE
                      The deploy script normally uses nshieldkeysafe5
                      as the namespace for the KeySafe 5 servers,
                      mongons for MongoDB, and rabbits for RabbitMQ.
                      However you can override these to use a single
                      namespace for all the servers. If that is the
                      case, then use this option.

Certificate Addresses

The certificates contain names and IP addresses that verify the connection.

The backend servers use Kubernetes internal addressing to access the servers,
and this script will set these up.
```

MongoDB is only used by the backend services so does not require an external address.

RabbitMQ is also accessed by the KeySafe 5 Agents through an external address. This script will use the IP address provided by the loadbalancer, but you may override this with a different IP address or DNS name.

```
-r, --rabbitmq=ADDRESS    The external address for RabbitMQ
-m, --mongodb=ADDRESS    The external address for MongoDB
```

When you update the certificates for RabbitMQ the script will generate an updated `agent-config.tar.gz` and `agent-config.zip` files containing the updated TLS certificates. You must then update all nShield client machines with a KeySafe 5 agent installed to use the updated certificates and restart the agent so that the new configuration is applied.

Examples

Refresh certificates for both servers for the next 30 days, and set a DNS entry for RabbitMQ

```
./updateinternalcerts.sh -r rabbitmq.example.com 30
```

Refresh just MongoDB for the next 4 weeks

```
./updateinternalcerts.sh mongodb 28
```

This script will update both MongoDB and RabbitMQ TLS certificates, though you may choose to update only one set of TLS certificates by specifying only that server.



The `updateinternalcerts.sh` script must be run from a directory containing the KeySafe 5 Helm charts (for example, from the root directory of the untarred KeySafe 5 package). If the CA, created when the original deploy script was run, is not available then a new one will be created and used.



If both certificates have expired when running `updateinternalcerts.sh`, updating the certificates of only one service may return an error. In this case re-running `updateinternalcerts.sh` without specifying any server will update both server certificates at once, and will usually solve the problem.

If an error occurs during certificate update you can restore the previous setup by rolling back Helm chart installations to a previous release, see Helm Chart Upgrade in the Upgrade section of the Installation Guide.

10.1.2.1. MongoDB TLS Certificates

The Manual Install steps and `deploy.sh` script installs the Bitnami MongoDB Helm chart with TLS enabled for the connections between KeySafe 5 and the MongoDB

server and also with TLS used for authentication. These certificates will initially be valid for 30 days from the time the process was run.

You can refresh the MongoDB certificates by running the `updateinternalcerts.sh` script, specifying the number of days the new certificates will be valid for.

```
updateinternalcerts.sh mongodb 365
```

This script will:

- Generate the new TLS certificates
- Update the MongoDB helm chart to use the new certificates
- Update the `keysafe5-backend` helm chart to use the new certificates

You may specify an external address with the `-m` parameter but this is usually not required.

10.1.2.2. RabbitMQ

The Manual Install steps and `deploy.sh` script installs the Bitnami RabbitMQ Helm chart with TLS enabled.

You can refresh the RabbitMQ certificates by running the `updateinternalcerts.sh` script, specifying the number of days the new certificates will be valid for.

```
updateinternalcerts.sh rabbitmq 365
```

This script will:

- Generate the new TLS certificates
- Update the RabbitMQ helm chart to use the new certificates
- Update the `keysafe5-backend` helm chart to use the new certificates
- Output a new `agent-config.tar.gz` that contains the agent configuration file and TLS certificates for authentication to RabbitMQ

The external address that will be put into the certificate, and the configuration file, will be the IP address of the Ingress service provided by the Kubernetes server. If you wish to use a different IP address or DNS name, this can be passed in with the `-r` parameter.

You will need to update your client machines with a KeySafe 5 agent installed to use the updated config and restart the agent so that the new configuration is

applied.

```
sudo tar xf agent-config.tar.gz -C /opt/nfast/keysafe5/
/opt/nfast/scripts/init.d/keysafe5-agent restart
```

10.2. Authentication

If you chose to install the demo deployment without authentication you should enable authentication for accessing the KeySafe 5 REST API and User Interface.

For how to configure authentication for the KeySafe 5 REST APIs see [Helm Chart Installation: helm-keysafe5-istio authentication](#) in the Installation Guide.

To update the `keysafe5-istio` Helm chart installed by the demo deployment, set the following values in `keysafe5-istio-values.yaml`.

- `requireAuthn=true`
- `issuer[0].authIssuer="https://foobar.auth0.com"`
- `issuer[0].authJWKSURI="https://www.googleapis.com/oauth2/v1/certs"`
- `issuer[0].authAudiences[0]="https://keysafe5.location"`

Then run `helm upgrade`.

```
helm upgrade --install keysafe5-istio \
  --namespace=nshieldkeysafe5 \
  --values keysafe5-istio-values.yaml \
  --wait --timeout 1m \
  helm-charts/nshield-keysafe5-istio-1.3.0.tgz
```

To update the `keysafe5-ui` Helm chart installed by the demo deployment, set the following values in `keysafe5-ui-values.yaml`:

- `authMethod=oidc`

Untar the chart and copy your OIDC provider config file (`OIDCProviders.json`) into the config directory:

For more details on how to populate `OIDCProviders.json` and how to configure authentication for the KeySafe 5 User Interface see [Helm Chart Installation: Configure UI authentication](#) in the Installation Guide.

```
tar -xf helm-charts/nshield-keysafe5-ui-1.3.0.tgz -C helm-charts
cp my-oidc-provider-config.json helm-charts/nshield-keysafe5-ui/config/OIDCProviders.json
```

Then run `helm upgrade`:

```
helm upgrade --install keysafe5-ui \  
  --namespace=nshieldkeysafe5 \  
  --values keysafe5-ui-values.yaml \  
  --wait --timeout 3m \  
helm-charts/nshield-keysafe5-ui
```

10.3. K3s

If not using your own Kubernetes cluster, the `deploy.sh` script will create one using K3s. To harden this K3s install follow the official documentation at [K3s Hardening Guide](#).



The `deploy.sh` script installs K3s with `traefik` and `metrics-server` explicitly disabled.

11. KeySafe 5 Local

There is a Local installation available for KeySafe 5 for managing a single machine through its local graphical desktop environment. If you have an internal nShield HSM you may set up the Agent configuration to communicate with the KeySafe 5 Local installation. You may also configure remote nShield Connect HSMs to communicate with the KeySafe 5 Local installation.

11.1. Installation

11.1.1. Linux



Only users that are members of the `nfastadmin` group may use KeySafe 5 Local. Add your local users who will be using the system to this group before we begin, and ensure that this is reflected in the output of `id -Gn`. You may need to log out, and then log back in again for changes to group membership to apply.

1. Extract the KeySafe 5 Local package to the root of the filesystem:

```
sudo tar -C / -xf /path/to/keysafe5-local-1.3.0-linux.tar.gz
```

2. Ensure any running services using the nShield HSMs have been cleanly shut down.
3. Run the nShield Security World install script:

```
sudo /opt/nfast/sbin/install
```

This will set up the log files along with the local directory as writeable to users in the `nfastadmin` group.

11.1.2. Windows

To install KeySafe 5 Local, double-click on `keysafe5-local.msi`.



You must have [Microsoft WebView2](#) installed to run KeySafe 5 in Windows.

11.2. Configuration

11.2.1. Linux

The configuration file is located in `/opt/nfast/keysafe5/local/config` and named `config.yaml`. There is an example configuration file named `config.yaml.example` located in the same place. If one does not already exist, the `install` process above will copy the `config.yaml.example` over to a new `config.yaml` that you may modify. Do not modify the `known_clients` section as there is a tool that will add to this.

If any of the paths are modified, ensure that new paths are created with the right permissions, writeable to users who will be permitted to run KeySafe 5 Local.

The databases are stored in the `database_directory`, and this directory should be part of your backup routine.

Running `/opt/nfast/bin/keysafe5-local-admin init` will set up the TLS keys for securing communication between KeySafe 5 Agents and KeySafe 5 Local.

11.2.2. Windows

The configuration file is located in `%NFAST_DATA_HOME%\keysafe5\local\conf\config.yaml`. There is an example configuration file named `config.yaml.example` located in the same place. The easiest approach is to copy the `config.yaml.example` to `config.yaml` and then modify anything as required.

The databases are stored in the `database_directory`, and this directory should be part of your backup routine.

Running `%NFAST_HOME%\bin\keysafe5-local-admin init` from an Administrator command prompt will set up the TLS keys for securing communication between KeySafe 5 Agents and KeySafe 5 Local.

11.3. Running

11.3.1. Linux

KeySafe 5 Local should be available in the desktop environment's application launcher, usually under *System*. Otherwise, it may be launched from the command

line as `/opt/nfast/bin/keysafe5-local`.

11.3.2. Windows

KeySafe 5 Local should be available in the Start menu, under *Entrust nShield Security World*.

11.4. Adding HSMs to KeySafe 5 Local

For KeySafe 5 Local to manage local and remote HSMs, a KeySafe 5 Agent running alongside the HSM must be configured to communicate with KeySafe 5 Local.



KeySafe 5 Local may be configured to communicate with any number of KeySafe 5 Agents running on HSMs, but only with one KeySafe 5 Agent that is running on a host machine. That host machine agent must be on the same machine as the KeySafe 5 Local instance.

If configuring a KeySafe 5 Agent on HSM to communicate with KeySafe 5 Local, then the port used for agent communications must be open to incoming connections in your firewall configuration for the machine running KeySafe 5 Local. This port is specified in the KeySafe 5 Local configuration. By default, this is port 18084.

11.4.1. Adding KeySafe 5 Agents to KeySafe 5 Local

The steps below provide an example for configuring the KeySafe 5 Agent on the host machine that is running KeySafe 5 Local. For configuring a KeySafe 5 Agent on a network-attached HSM, see [KeySafe 5 agent on network-attached HSMs](#).

1. Configure the KeySafe 5 Agent to communicate with KeySafe 5 Local. In the KeySafe 5 Agent configuration file:
 - a. Set `message_bus.type` to `nats`.
 - b. Set `message_bus.url` to the IP address the host running KeySafe 5 Local (or 127.0.0.1 if this is the same machine). The port of the url should match the `agent_comms` port set in the KeySafe 5 Local configuration file.
 - c. Set `message_bus.auth_type` to `tls` to enabled TLS authentication.

```
message_bus:
```

```
type: nats
url: 127.0.0.1:18084
auth_type: tls
```

2. Produce a TLS private key and Certificate Signing Request (CSR) for this Agent using `ks5agenttls`. See [Generating a KeySafe 5 agent private key and TLS certificate](#). If you did not initially generate the private key to the KeySafe 5 Agent configuration directory, ensure that the TLS private key is saved to `tls.key` in the correct directory on the KeySafe 5 Agent machine.

```
cp tls.key /opt/nfast/keysafe5/conf/messagebus/tls/tls.key
```

3. Copy the CSR produced by `ks5agenttls` to the KeySafe 5 Local machine, and run `keysafe5-local-admin sign` with the file.

```
keysafe5-local-admin sign <path_to_csr_file>
```

A `tls.crt` and `ca.crt` will be written to the current directory and the KeySafe 5 Agent will automatically be added to the list of known clients in KeySafe 5 Local's configuration file.

4. Copy `tls.crt` and `ca.crt` to the correct directory on the KeySafe 5 Agent machine.

```
cp tls.crt /opt/nfast/keysafe5/conf/messagebus/tls/tls.crt
cp ca.crt /opt/nfast/keysafe5/conf/messagebus/tls/ca.crt
```

5. Restart KeySafe 5 Local to apply the changes to KeySafe 5 Local's configuration.



Because the KeySafe 5 Agent communicates directly with KeySafe 5 Local, updates from the KeySafe 5 Agent will only be received and processed while KeySafe 5 Local is running.

11.5. Application Logs

You can find application logs at:

- **Linux:** `/opt/nfast/log/keysafe5-local-*.log`
- **Windows:** `%NFAST_LOGDIR%\KeySafe5-local-*.log`

This path is configurable by setting `logging.file.path` in the KeySafe 5 Local

configuration file.

11.6. Database backup

The database can be backed up by stopping KeySafe 5 Local and creating a backup of the SQLite database files found in the configured `database_directory`.

By default, you can find the database file at:

- **Linux:** `/opt/nfast/kmdata/databases`
- **Windows:** `%NFAST_KMDATA%\databases`

11.7. Uninstalling

11.7.1. Linux

To uninstall, first run the main uninstall script `sudo /opt/nfast/sbin/install -u`. This will remove the desktop environment shortcuts. The files added by the tar.gz are:

- `/opt/nfast/keysafe5/local/config/config.yaml.example`
- `/opt/nfast/scripts/install.d/20keysafe5-local`
- `/opt/nfast/bin/keysafe5-local`
- `/opt/nfast/bin/keysafe5-local.png`
- `/opt/nfast/bin/keysafe5-local-admin`
- `/opt/nfast/lib/versions/keysafe5-local-atv.txt`

There are additional files and directories that may have been created that may also be removed:

- `/opt/nfast/keysafe5/local`
- `/opt/nfast/kmdata/databases`
- `/opt/nfast/log/keysafe5-local-*.log`

11.7.2. Windows

To uninstall, you may use *Uninstall a program* from *Control Panel* to uninstall nShield KeySafe 5 Local.

There are additional files and directories that may have been created that may

also be removed:

- %NFAST_DATA_HOME%\keysafe5\local
- %NFAST_DATA_HOME%\Key Management Data\databases
- %NFAST_DATA_HOME%\Log Files\keysafe5-local-*.log

12. Troubleshooting

12.1. Central platform

To view the KeySafe 5 application service logs, see [Obtaining Logs](#).

If a Kubernetes resource is not working as expected, use `kubectl describe` to display any errors with that resource.

```
$ kubectl describe -n nshieldkeysafe5 pod nshield-keysafe5-0
[. . .]
Warning FailedMount 6s (x8 over 70s) kubelet          MountVolume.Setup failed for volume "keysafe5-
messagebus-tls-volume" : secret "ks5-amqptls" not found
```

You can also use `kubectl get events` to detect errors.

```
kubectl get events --all-namespaces
```

For more information on debugging Kubernetes applications, see the Kubernetes documentation [here](#).

12.2. KeySafe 5 agent

If the agent fails to start, ensure that the configuration file is present at `%NFAST_DATA_HOME%/keysafe5/conf/config.yaml`.

If the configuration file is present but the agent still fails to start, see the [Logging: KeySafe 5 agent](#) section for instructions on accessing the log.

Ensure that the `message_bus` type is set appropriately.

If you are using AMQP, ensure that both the port number and vhost is set.

If you are using TLS, ensure that the private key and certificate files are present in `%NFAST_DATA_HOME%/keysafe5/conf/messagebus/tls`.

If you are using TLS authentication with AMQP, ensure that the username is specified in the X509 field expected by RabbitMQ, and the level of indirection configured on the RabbitMQ server is correct (see [RabbitMQ: Certificate Chains and Verification Depth](#)).

13. Obtaining Logs

13.1. Central platform

The KeySafe 5 application is configured to log to `stdout`. This means you can view logs by running standard `kubectl` commands.

To get the KeySafe 5 backend services logs run `kubectl get pods`



By default, the KeySafe 5 backend Helm chart will create multiple replicas of each service. The below example commands only retrieves the logs from the first replica of each service.

```
kubectl -n nshieldkeysafe5 logs nshield-keysafe5-0 codesafe-mgmt
kubectl -n nshieldkeysafe5 logs nshield-keysafe5-0 hsm-mgmt
kubectl -n nshieldkeysafe5 logs nshield-keysafe5-0 sw-mgmt
```

To get the KeySafe 5 UI logs.

```
UI_POD=$(kubectl -n nshieldkeysafe5 get pods -l app=keySAFE5-ui-app -o jsonpath='{.items[0].metadata.name}')
kubectl logs -n nshieldkeysafe5 $UI_POD
```

Because all logs are directed to `stdout`, you can integrate the application logs with third-party log monitoring tools such as [Prometheus](#) or [Splunk](#).

13.2. KeySafe 5 agent

13.2.1. Linux

The KeySafe 5 agent log file is located at `/opt/nfast/log/keySAFE5-agent.log`, unless configured otherwise.

13.2.2. Windows

The KeySafe 5 agent log file is located at `%NFAST_LOGDIR%\KeySafe5-agent.log`, unless configured otherwise.

The KeySafe 5 Windows Service actions are emitted to the Windows event log under the `nShieldKeySafe5` source identifier.

You can use the `nshieldeventlog` utility to extract these log entries and output them to the console or a text file.

```
nshieldeventlog.exe --source=nShieldKeySafe5
```

As required, specify the following parameters.

- `-c` | `--count`: The number of records read from the event log.

The default is `10000`

- `-f` | `--file`: The output filename.

See the nShield Security World Software documentation for more information on the `nshieldeventlog` utility.

14. Database

All persistent data for KeySafe 5 is stored in the database.

For the Kubernetes deployment of KeySafe 5, MongoDB is used as the database.

For the Local deployment of KeySafe 5, SQLite is used as the database. For more information on the Local Deployment, see [KeySafe 5 Local](#)

14.1. MongoDB database

KeySafe 5 stores data in three different databases within MongoDB. One database for storing HSM Management related data, one database for storing Security World Management related data and one for storing CodeSafe Management related data.

The names of the databases used within MongoDB are defined by the `helm-keysafe5-backend` Helm chart.

Key	Description	Default value
codesafe_mgmt.dbName	Name of the database to use for storing persistent CodeSafe data	codesafe-mgmt-db
hsm_mgmt.dbName	Name of the database to use for storing persistent HSM data	hsm-mgmt-db
sw_mgmt.dbName	Name of the database to use for storing persistent Security World data	sw-mgmt-db

14.1.1. Collections

14.1.1.1. HSM Management database

KeySafe 5 stores nShield HSM related data in the following collections:

- hsms
- hsmoperations
- pools
- hosts
- hardservers

- features
- config
- images

14.1.1.2. Security World Management database

KeySafe 5 stores nShield Security World data in the following collections:

- worlds
- versions

For each Security World known to KeySafe 5, the following collections are automatically created, where each collection name is prefixed by the ID of the Security World database record that the collection corresponds to:

- <id>_actions
- <id>_authorizations
- <id>_authorized_pools
- <id>_cards
- <id>_cardsets
- <id>_domains
- <id>_groups
- <id>_keys
- <id>_module_certs
- <id>_operations
- <id>_p11objects
- <id>_softcards
- <id>_secrets

14.1.1.3. CodeSafe Management database

KeySafe 5 stores nShield CodeSafe related data in the following collections:

- images
- machines
- certificates
- certificatetestatus
- operations

- steps

14.1.2. User roles

MongoDB has the notion of roles, where each role has a defined set of allowed actions. A user of a MongoDB database can be given a role which then determines what the user can and cannot do to the data.

For details about MongoDB roles, see the [MongoDB documentation](#).

From a security point of view we want to give KeySafe 5 as a user of the MongoDB database the least privileges which suffice for the functionality it requires from the MongoDB database.

The documentation below details the minimum privileges required for a KeySafe 5 MongoDB user for each database created by KeySafe 5.

14.1.2.1. HSM Management database

The following actions are required by KeySafe 5 for the operation of MongoDB for the HSM Management collections:

- createIndex
- find
- insert
- remove
- update

The MongoDB administrator will configure the HSM Management database with the following actions and privileges for KeySafe 5 `hsm-mgmt-db-user` role:

```
use admin
db.createRole(
  {
    role: "hsm-mgmt-db-user",
    privileges: [
      {
        "resource": {"db": "hsm-mgmt-db", "collection": ""},
        "actions": ["createIndex", "find", "insert", "remove", "update"]
      },
    ],
    roles: []
  }
)
```

14.1.2.2. Security World Management database

As KeySafe 5 creates new collections in the Security World Management Database as new Security Worlds are introduced to the system, RBAC (Role-based access control) must be applied at the database level rather than individual collections.

The following actions are required by KeySafe 5 for the operation of MongoDB for the Security World Management collections:

- createIndex
- dropCollection
- find
- insert
- remove
- update

The MongoDB administrator will configure the Security World Management database with the following actions and privileges for KeySafe 5 `sw-mgmt-db-user` role:

```
use admin
db.createRole(
  {
    role: "sw-mgmt-db-user",
    privileges: [
      {
        "resource": {"db": "sw-mgmt-db", "collection": ""},
        "actions": ["createIndex", "dropCollection", "find", "insert", "remove", "update"]
      },
    ],
    roles: []
  }
)
```

14.1.2.3. CodeSafe Management database

The following actions are required by KeySafe 5 for the operation of MongoDB for the CodeSafe Management collections:

- createIndex
- find
- insert
- remove
- update

The MongoDB administrator will configure the CodeSafe Management database

with the following actions and privileges for KeySafe 5 `codesafe-mgmt-db-user` role:

```
use admin
db.createRole(
  {
    role: "codesafe-mgmt-db-user",
    privileges: [
      {
        "resource": {"db": "codesafe-mgmt-db", "collection": ""},
        "actions": ["createIndex", "find", "insert", "remove", "update"]
      },
    ],
    roles: []
  }
)
```

14.1.2.4. Creating a MongoDB user with the user-defined roles

The MongoDB administrator may create a user for the KeySafe 5 application to access the KeySafe 5 databases by using the `db.createUser` command in the MongoDB shell.

```
ks5_user = {
  "user" : "ks5username",
  "roles" : [
    {"role": "codesafe-mgmt-db-user", "db": "admin" },
    {"role": "hsm-mgmt-db-user", "db": "admin" },
    {"role": "sw-mgmt-db-user", "db": "admin" },
  ]
}
> db.createUser(ks5_user)
```

Note that when using TLS authentication for MongoDB, the username needs to match the subject of the client certificate.

14.1.3. Authentication methods

KeySafe 5 supports the following authentication mechanisms for access to the MongoDB server:

- No authentication
- SCRAM
- X.509 certificate authentication

The type of authentication is specified by `database.mongo.auth.type` value in the `helm-keysafe5-backend` Helm chart.

14.1.3.1. No authentication

This option is used during development. It should not be used during production.

14.1.3.2. SCRAM

Using Salted Challenge Response Authentication Mechanism (SCRAM), MongoDB verifies the supplied credentials against the MongoDB's username, password and authentication database.

In the `helm-keysafe5-backend` Helm chart:

- `database.mongo.auth.type` must be set to `pwd`.
- `database.mongo.auth.existingSecret` must be set to the name of an existing Kubernetes Secret that contains the username and password to use (the Secret must contain a value for `username` and `password` keys).
- `database.mongo.auth.authDatabase` must be set to the name of MongoDB's authentication database.

14.1.3.3. X.509 certificate authentication

KeySafe 5 can use X.509 certificates instead of usernames and passwords to authenticate to the MongoDB database.

In the `helm-keysafe5-backend` Helm chart:

- `database.mongo.auth.type` must be set to `tls`.
- `database.mongo.tls.enabled` must be set to `true`.
- `database.mongo.tls.existingSecret` must be set to the name of an existing Kubernetes Secret that contains the TLS certificates to use (the Secret must contain the keys `tls.crt`, `tls.key` and `ca.crt`).

14.1.4. Backup

To be able to restore the KeySafe 5 application, Entrust recommends that you regularly backup the MongoDB database as suggested in the [MongoDB documentation](#).

14.1.5. Maintenance



The KeySafe 5 application (`helm-keysafe5-backend` Helm chart) does not support having database collections removed while the

| application is running.

If deleting collections, or replacing the MongoDB server that KeySafe 5 uses, then please stop the `helm-keysafe5-backend` Helm chart before performing database maintenance and restart the application once the database maintenance is complete.

15. Metrics

The KeySafe 5 metrics endpoints return metrics in [OpenMetrics](#) text format (HTTP content-type "application/openmetrics-text"). This format is defined by the [OpenMetrics Specification](#).

The following metric endpoints are available in this release of KeySafe 5.

Endpoint	Minimum KeySafe 5 version	Description	Metric Labels
/codesafe/v1/metrics	1.2	SEE Machine statistics for all running CodeSafe 5 machines	<ul style="list-style-type: none"> • uuid (Local machine UUID) • esn • package_name • direction (only applicable to metrics for the network link for an SEE Machine)

15.1. Integrations

Data from KeySafe 5 metrics endpoints can be imported into any observability tool capable of consuming the OpenMetrics format.

For most tools this consists of configuring your tooling to poll the metrics HTTP endpoint at a certain interval by providing the API endpoint to query along with any necessary authentication.

This section provides basic guidance for a selection of common tools. For more detailed instructions, consult the documentation for your specific tooling.

15.1.1. Prometheus

For [Prometheus](#) you must configure a [scrape config](#) to directly consume the KeySafe 5 metrics data into Prometheus.

An example scrape config for polling an unauthenticated KeySafe 5 CodeSafe metrics endpoint:

```
scrape_configs:
  - job_name: KeySafe 5 CodeSafe
    scrape_interval: 300s
    static_configs:
      - targets: ["example.keysafe5deployment.com"]
        metrics_path: "/codesafe/v1/metrics"
```

```
scheme: https
```

15.1.2. Elastic Stack

Integration with the [Elastic Stack](#) (Elasticsearch and Kibana) can be achieved by using the OpenMetrics integration within Kibana. This involves configuring [Metricbeat](#) to report the metrics data to Elasticsearch via polling the KeySafe 5 metrics endpoint.

For more details, search for OpenMetrics in [Elastic integrations](#) or follow the step-by-step OpenMetrics integration guide within Kibana.

15.1.3. Splunk

For [Splunk](#) there is not currently a direct OpenMetrics integration. One possible approach is to configure an [HTTP Event Collector](#) and use an intermediary script to poll the KeySafe 5 metrics endpoint, then translate the API responses from KeySafe 5 into a format that can be submitted to the HTTP Event Collector endpoint in Splunk.

16. Supported TLS Cipher Suites

This appendix and the helm values.yaml file both use the OpenSSL project's identifiers for TLS Cipher Suites.

Recommended Cipher Suites: The Default List

The following TLS Cipher Suites are supported by KeySafe 5, and are configured for use by default. It is strongly recommended that this default set of cipher suites, or a subset of it, is used.

- ECDHE-ECDSA-AES128-GCM-SHA256
- ECDHE-RSA-AES128-GCM-SHA256
- ECDHE-ECDSA-AES256-GCM-SHA384
- ECDHE-RSA-AES256-GCM-SHA384
- ECDHE-ECDSA-CHACHA20-POLY1305
- ECDHE-RSA-CHACHA20-POLY1305

Less Secure Cipher Suites: Not Recommended

The following TLS Cipher Suites are supported by KeySafe 5, but only if explicitly configured for use by the user. These are less secure cipher suites and should only be configured for use after a thorough threat analysis of the operating environment.

- ECDHE-RSA-AES256-SHA
- ECDHE-RSA-AES128-SHA
- ECDHE-ECDSA-AES256-SHA
- ECDHE-ECDSA-AES128-SHA
- AES256-GCM-SHA384
- AES128-GCM-SHA256
- AES256-SHA
- AES128-SHA
- DES-CBC3-SHA

TLSv1.3 Cipher Suites: Not Configurable

The following TLS Cipher Suites are supported by KeySafe 5 and cannot be explicitly configured. These are all secure TLSv1.3 cipher suites.

- TLS_AES_256_GCM_SHA384

- TLS_CHACHA20_POLY1305_SHA256
- TLS_AES_128_GCM_SHA256