

Classic ESS: Helm Chart Installation

Important notice

This document provides a guide for deploying the Classic ESS stack via a helm chart. If you're looking for a helm-based deployment of ESS, please look at the following options:

- [ESS Community](#) (the official Matrix stack from Element for non-commercial use)
 - [ESS Pro](#) (the commercial backend distribution from Element for professional use)
-

Introduction

This document will walk you through how to get started with our Element Server Suite Helm Charts. These charts are provided to be used in environments which typically deploy applications by helm charts. If you are unfamiliar with helm charts, we'd highly recommend that you start with our Enterprise Installer.

General concepts

ESS deployment rely on the following components to deploy the workloads on a kubernetes cluster :

1. Updater : It reads an ElementDeployment CRD manifest, and generates the associated individual Element CRDs manifests linked together
2. Operator : It reads the individual Element CRDs manifests to generates the associated kubernetes workloads
3. ElementDeployment : This CRD is a simple structure following the pattern :

```
spec:
```

```
  global:
```

```
    k8s:
```

```
      # Global settings that will be applied by default to all workloads if not forced locally. This is where you will be able to configure a default ingress certificate, default number of replicas on the deployments, etc.
```

```
    config:
```

```

# Global configuration that can be used by every element component
secretName: # The global secret name. Required secrets keys can be found in the description of this field
using `kubectl explain`. Every config named `<foo>SecretKey` will point to a secret key containing the secret
targetted by this secret name.

components:
  <component name>:
    k8s:
      # Local kubernetes configuration of this component. You can override here the global values to force a
      certain behaviour for each components.
      config:
        # This component configuration
        secretName: # The component secret name containing secret values. Required secrets keys can be found in
        the description of this field using `kubectl explain`. Every config named `<foo>SecretKey` will point to a secret
        key containing the secret targetted by this secret name.
      <another component>:
        ...

```

Any change to the ElementDeployment manifest deployed in the namespace will trigger a reconciliation loop. This loop will update the Element manifests read by the Operator. It will again trigger a reconciliation loop in the Operator process, which will update kubernetes workloads accordingly.

If you manually change a workload, it will trigger a reconciliation loop and the Operator will override your change on the workload.

The deployment must be managed only through the ElementDeployment CRD.

Installing the Operator and the Updater helm charts

We advise you to deploy the helm charts in one of the deployments model :

1. Cluster-Wide deployment : In this mode, the CRDs Conversion Webhook and the controller managers are deployed in their own namespace, separated from ESS deployments. They are able to manage ESS deployments in any namespace of the cluster The install and the upgrade of the helm chart requires cluster admin permissions.
2. Namespace-scoped deployment : In this mode, only the CRDs conversion webhooks require cluster admin permissions. The Controller managers are deployed directly in the namespace of the element deployment. The install and the upgrade of ESS does not require cluster admin permissions if the CRDs do not change.

All-in-one deployment (Requires cert-manager)

When cert-manager is present in the cluster, it is possible to use the all-in-one `ess-system` helm chart to deploy the operator and the updater.

First, let's add the `ess-system` repository to helm, replace `ems_image_store_username` and `ems_image_store_token` with the values provided to you by Element.

```
helm repo add ess-system https://registry.element.io/helm/ess-system --username  
<ems_image_store_username> --password '<ems_image_store_token>' --version ~2.17.0
```

Cluster-wide deployment

When deploying ESS-System as a cluster-wide deployment, updating ESS requires ClusterAdmin permissions.

Create the following values file :

```
emsImageStore:  
  username: <username>  
  password: <password>  
  
element-operator:  
  clusterDeployment: true  
  deployCrds: true # Deploys the CRDs and the Conversion Webhooks  
  deployCrdRoles: true # Deploys roles to give permissions to users to manage specific ESS CRs  
  deployManager: true # Deploys the controller managers  
  
element-updater:  
  clusterDeployment: true  
  deployCrds: true # Deploys the CRDs and the Conversion Webhooks  
  deployCrdRoles: true # Deploys roles to give permissions to users to manage specific ESS CRs  
  deployManager: true # Deploys the controller managers
```

Namespace-scoped deployment

When deploying ESS-System as a namespace-scoped deployment, you have to deploy `ess-system` in two parts :

1. One for the CRDs and the conversion webhooks. This part will be managed with ClusterAdmin permissions. These update less often.
2. One for the controller managers. This part will be managed with namespace-scoped permissions.

In this mode, the `ElementDeployment` CR is deployed in the same namespace as the controller-managers.

Create the following values file to deploy the CRDs and the conversion webhooks :

```
emslImageStore:
  username: <username>
  password: <password>

element-operator:
  clusterDeployment: true
  deployCrds: true # Deploys the CRDs and the Conversion Webhooks
  deployCrdRoles: false # Deploys roles to give permissions to users to manage specific ESS CRs
  deployManager: false # Deploys the controller managers

element-updater:
  clusterDeployment: true
  deployCrds: true # Deploys the CRDs and the Conversion Webhooks
  deployCrdRoles: false # Deploys roles to give permissions to users to manage specific ESS CRs
  deployManager: false # Deploys the controller managers
```

Create the following values file to deploy the controller managers in their namespace :

```
emslImageStore:
  username: <username>
  password: <password>

element-operator:
  clusterDeployment: false
  deployCrds: false # Deploys the CRDs and the Conversion Webhooks
  deployCrdRoles: false # Deploys roles to give permissions to users to manage specific ESS CRs
  deployManager: true # Deploys the controller managers

element-updater:
  clusterDeployment: false
  deployCrds: false # Deploys the CRDs and the Conversion Webhooks
```

```
deployCrdRoles: false # Deploys roles to give permissions to users to manage specific ESS CRs
deployManager: true # Deploys the controller managers
```

Without cert-manager present on the cluster

First, let's add the element-updater and element-operator repositories to helm, replace `ems_image_store_username` and `ems_image_store_token` with the values provided to you by Element.

```
helm repo add element-updater https://registry.element.io/helm/element-updater --username
<ems_image_store_username> --password '<ems_image_store_token>'
helm repo add element-operator https://registry.element.io/helm/element-operator --username
<ems_image_store_username> --password '<ems_image_store_token>'
```

Now that we have the repositories configured, we can verify this by:

```
helm repo list
```

and should see the following in that output:

NAME	URL
element-operator	https://registry.element.io/helm/element-operator
element-updater	https://registry.element.io/helm/element-updater

N.B. This guide assumes that you are using the `element-updater` and `element-operator` namespaces. You can call it whatever you want and if it doesn't exist yet, you can create it with: `kubectrl create ns <name>`.

Generating an image pull secret with EMS credentials

To generate an `ems-credentials` to be used by your helm chart deployment, you will need to generate an authentication token and palce it in a secret.

```
kubectrl create secret -n element-updater docker-registry ems-credentials --docker-server=registry.element.io --
docker-username=<EMSusername> --docker-password=<EMStoken>`
kubectrl create secret -n element-operator docker-registry ems-credentials --docker-server=registry.element.io --
docker-username=<EMSusername> --docker-password=<EMStoken>`
```

Generating a TLS secret for the webhook

The conversion webhooks need their own self-signed CA and TLS certificate to be integrated into kubernetes.

For example using `easy-rsa` :

```
easyrsa init-pki
easyrsa --batch "--req-cn=ESS-CA`date +%s`" build-ca nopass
easyrsa --subject-alt-name="DNS:element-operator-conversion-webhook.element-operator"\
--days=10000 \
build-server-full element-operator-conversion-webhook nopass
easyrsa --subject-alt-name="DNS:element-updater-conversion-webhook.element-updater"\
--days=10000 \
build-server-full element-updater-conversion-webhook nopass
```

Create a secret for each of these two certificates :

```
kubectl create secret tls element-operator-conversion-webhook --cert=pki/issued/element-operator-conversion-
webhook.crt --key=pki/private/element-operator-conversion-webhook.key --namespace element-operator
kubectl create secret tls element-updater-conversion-webhook --cert=pki/issued/element-updater-conversion-
webhook.crt --key=pki/private/element-updater-conversion-webhook.key --namespace element-updater
```

Installing the helm chart for the `element-updater` and the `element-operator`

Create the following values file to deploy the controller managers in their namespace :

`values.element-operator.yml` :

```
clusterDeployment: true
deployCrds: true # Deploys the CRDs and the Conversion Webhooks
deployCrdRoles: true # Deploys roles to give permissions to users to manage specific ESS CRs
deployManager: true # Deploys the controller managers
crds:
  conversionWebhook:
    caBundle: # Paste here the content of `base64 pki/ca.crt -w 0`
    tlsSecretName: element-operator-conversion-webhook
    imagePullSecret: ems-credentials
operator:
  imagePullSecret: ems-credentials
```

values.element-updater.yml :

```
clusterDeployment: true
deployCrds: true # Deploys the CRDs and the Conversion Webhooks
deployCrdRoles: true # Deploys roles to give permissions to users to manage specific ESS CRs
deployManager: true # Deploys the controller managers
crds:
  conversionWebhook:
    caBundle: # Paste here the content of `base64 pki/ca.crt -w 0`
    tlsSecretName: element-updater-conversion-webhook
    imagePullSecret: ems-credentials
  updater:
    imagePullSecret: ems-credentials
```

Run the helm install command :

```
helm install element-operator element-operator/element-operator --namespace element-operator -f
values.yaml --version ~2.17.0
helm install element-updater element-updater/element-updater --namespace element-updater -f values.yaml --
version ~2.17.0
```

Now at this point, you should have the following 4 containers up and running:

```
[user@helm ~]$ kubectl get pods -n element-operator
```

NAMESPACE	NAME	READY	STATUS	RESTARTS	AGE
element-operator	element-operator-controller-manager-c8fc5c47-nzt2t	2/2	Running	0	6m5s
element-operator	element-operator-conversion-webhook-7477d98c9b-xc89s	1/1	Running	0	6m5s

```
[user@helm ~]$ kubectl get pods -n element-updater
```

NAMESPACE	NAME	READY	STATUS	RESTARTS	AGE
element-updater	element-updater-controller-manager-6f8476f6cb-74nx5	2/2	Running	0	106s
element-updater	element-updater-conversion-webhook-65ddcbb569-qzbfs	1/1	Running	0	81s

Generating the ElementDeployment CR to Deploy

Element Server Suite

The `ess-stack` helm chart is available in the `ess-system` repository :

```
helm repo add ess-system https://registry.element.io/helm/ess-system --username  
<ems_image_store_username> --password '<ems_image_store_token>'
```

You can install it using the following command against your values file. See below for the value file configuration.

```
helm install ess-system/ess-stack --namespace element-onprem -f values.yaml --version ~2.17.0
```

It will deploy an ElementDeployment CR and its associated secrets from the chart values file.

The values file will contain the following structure :

- Available Components & Global settings can be found under <https://ess-schemas-docs.element.io>
- For each `SecretKey` variable, the value will point to a secret key under `secrets`. For example, `components.synapse.config.macaroonSecretKey` is `macaroon`, so a `macaroon` secret must exist under `secrets.synapse.content`.

emsImageStore:

username: <username>

password: <password>

secrets:

global:

content:

genericSharedSecret: # generic shared secret

synapse:

content:

macaroon: # macaroon

adminPassword: # synapse admin password

postgresPassword: # postgres password

telemetryPassword: # your ems image store password

registrationSharedSecret: # registration shared secret

python3 -c "import signedjson.key; signing_key = signedjson.key.generate_signing_key(0);

print(f'{{signing_key.alg}} {{signing_key.version}} {{signedjson.key.encode_signing_key_base64(signing_key)}}\n')

signingKey: # REPLACE WITH OUTPUT FROM PYTHON COMMAND ABOVE

globalOptions contains the global properties of the ELe mentDeployment CRD

globalOptions:

config:

domainName: # your base domain

k8s:

ingresses:

tls:

mode: certmanager

certmanager:

issuer: letsencrypt

workloads:

replicas: 1

components:

elementWeb:

k8s:

ingress:

fqdn: # element web fqdn

synapse:

config:

media:

volume:

size: 5Gi

postgresql:

database: # postgres database

host: # postgres host

port: 5432

user: # postgres user

telemetry:

username: <your ems image store username>

instanceId: <your ems image store username>

k8s:

ingress:

fqdn: # synapse fqdn

wellKnownDelegation:

config: {}

k8s: {}

Checking deployment progress

To check on the progress of the deployment, you will first watch the logs of the updater:

```
kubectrl logs -f -n element-updater element-updater-controller-manager-<rest of pod name>
```

You will have to tab complete to get the correct hash for the element-updater-controller-manager pod name.

Once the updater is no longer pushing out new logs, you can track progress with the operator or by watching pods come up in the `element-onprem` namespace.

Operator status:

```
kubectrl logs -f -n element-operator element-operator element-operator-controller-manager-<rest of pod name>
```

Watching reconciliation move forward in the `element-onprem` namespace:

```
kubectrl get elementdeployment -o yaml | grep dependentCRs -A20 -n element-onprem -w
```

Watching dependent CRs errors :

```
kubectrl get <dependentCR>/<name> -o yaml
```

Watching pods come up in the `element-onprem` namespace:

```
kubectrl get pods -n element-onprem -w
```

Revision #1

Created 4 June 2025 09:18:26 by Kieran Mitchell Lane

Updated 4 June 2025 09:18:26 by Kieran Mitchell Lane