

# Getting Started with the Enterprise Helm Charts

## 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 `kubectrl 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>'
```

## 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 :

emsImageStore:

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 :

emsImageStore:

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: `kubectl 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 place it in a secret.

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

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

Run the helm install command :

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

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

## Using the ess-stack helm-chart

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>'
```

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
      postgresPassword: # postgres password
      registrationSharedSecret: # registration shared secret

# globalOptions contains the global properties of the ElementDeployment 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
  k8s:
    ingress:
      fqdn: # synapse fqdn
wellKnownDelegation:
  config: {}
  k8s: {}

```

# Writing your own ElementDeployment CR

Here is a small sample to deploy the basic components using your own certificate files. This is provided as an example, as ElementDeployment supports a whole range of configuration option that you can explore in :

- The documentation website at <https://ess-schemas-docs.element.io>
- the GUI
- through `kubectl explain` command : `kubectl explain elementdeployment.matrix.element.io.spec.components`

```

apiVersion: matrix.element.io/v1alpha1
kind: ElementDeployment
metadata:
  name: <element_deployment_name>
  namespace: <target namespace>
spec:
  global:

```

k8s:

ingresses:

ingressClassName: "public"

workloads:

dockerSecrets:

- name: dockerhub

url: docker.io

- name: element-registry

url: registry.element.io

storage:

storageClassName: "standard"

secretName: global

config:

genericSharedSecretSecretKey: genericSharedSecret

domainName: "deployment.tld"

components:

elementWeb:

secretName: external-elementweb-secrets

k8s:

ingress:

tls:

mode: certfile

certificate:

certFileSecretKey: eleweb.tls

privateKeySecretKey: eleweb.crt

fqdn: element-web.tld

synapse:

secretName: external-synapse-secrets

config:

maxMauUsers: 100

media:

volume:

size: 1

postgresql:

host: "<postgresql server>"

user: "<user>"

database: "<db>"

passwordSecretKey: pgpassword

sslMode: disable

k8s:

```

ingress:
  fqdn: synapse.tld
tls:
  mode: certfile
  certificate:
    certFileSecretKey: synapse.tls
    privateKeySecretKey: synapse.crt
wellKnownDelegation:
  secretName: external-wellknowndelegation-secrets
k8s:
  ingress:
    tls:
      mode: certfile
      certificate:
        certFileSecretKey: wellknown.tls
        privateKeySecretKey: wellknown.crt

```

To inject secret values in the CR, you will have to create the following secrets :

- name: global with data key genericSharedSecret containing any random value. It will be used as a seed for all secrets generated by the updater.
- name: external-elementweb-secrets with data keys eleweb.tls containing element web private key and eleweb.crt containing element web certificate.
- name: external-synapse-secrets with data keys synapse.tls containing synapse private key and synapse.crt containing synapse certificate. You will also need pgpassword with the postgres password. All attributes pointing to Secret Keys have a default value, and in this example we are relying on the default values of config.macaroonSecretKey : macaroon , config.registrationSharedSecretSecretKey : registrationSharedSecret , config.signingKeySecretKey : signingKey and the config.adminPasswordSecretKey pointing to adminPassword in the secret key.
- name: external-wellknowndelegation-secrets with data keys wellknown.tls containing well known delegation private key and wellknown.crt containing well known delegation certificate.

Once the CRD and the Secrets deployed to the namespace, the Updater will be able to create all the resources handled by the Operator, which will then deploy the workloads on your kubernetes cluster.

## Loading docker secrets into kubernetes in preparation of deployment

*N.B. This guide assumes that you are using the element-onprem namespace for deploying Element. You can call it whatever you want and if it doesn't exist yet, you can create it with: `kubect! create ns element-onprem`.*

Now we need to load secrets into kubernetes so that the deployment can access them. If you built your own CRD from scratch, you will need to follow our Element Deployment CRD documentation.

```
kubectrl create secret -n element-onprem docker-registry ems-image-store --docker-server=registry.element.io --  
docker-username=<EMSusername> --docker-password=<EMStoken>
```

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

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

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Revision #25

Created 12 July 2023 17:47:38 by Karl Abbott

Updated 27 November 2024 12:07:50 by Kieran Mitchell Lane