Automated SSL Termination in EKS with Cert Manager(Lets-Encrypt)

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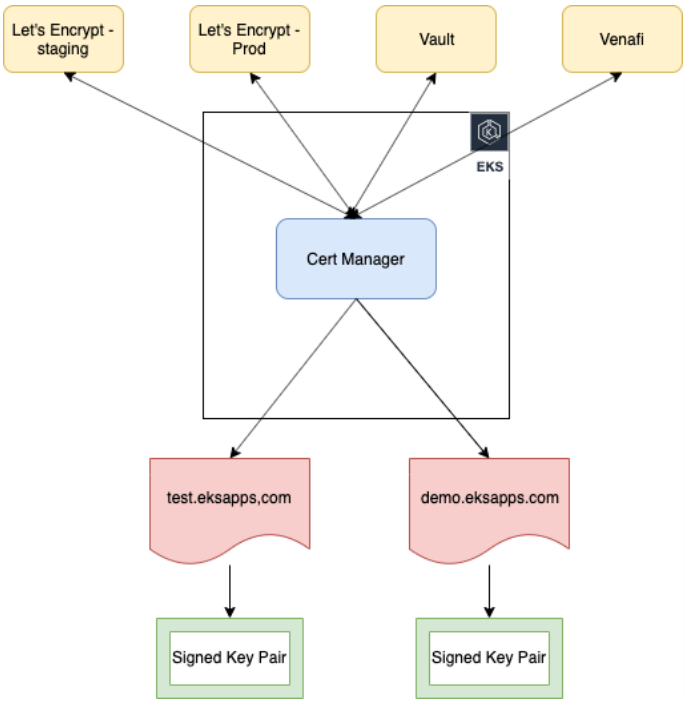
Kubernetes Cert-Manager:

cert-manager is a native Kubernetes certificate management controller.

cert-manager can help with issuing certificates from a variety of sources, such as Let's Encrypt, HashiCorp Vault, Venafi, a simple signing keypair, or self-signed. cert-manager will ensure certificates are valid and up to date, and attempt to renew certificates at a configured time before expiry.

Architecture:



Pre-Requisite:

Following are the expected perquisites for the cert manager to issue certificate dynamically.

1. Fully functional EKS cluster.
2. Domain of your own.

Installing Cert-Manager:

Follow the below steps to install cert-manager in the EKS cluster.

1. Create a separate namespace in the EKS cluster for cert-manager

⇒ **kubectl create namespace cert-manager**

```
cat <<EOF > sample-resources.yaml
apiVersion: v1
kind: Namespace
metadata:
  name: cert-manager-check
---
apiVersion: cert-manager.io/v1alpha2
kind: Issuer
metadata:
  name: test-selfsigned
  namespace: cert-manager-test
spec:
  selfSigned: {}
---
apiVersion: cert-manager.io/v1alpha2
kind: Certificate
metadata:
  name: selfsigned-cert
  namespace: cert-manager-test
spec:
  commonName: example.com
  secretName: selfsigned-cert-tls
  issuerRef:
    name: test-selfsigned
EOF
```

2. Install cert manager in the namespace with the below command.
   ⇒ **kubectl apply -f https://github.com/jetstack/cert-manager/releases/download/v0.11.0/cert-manager.yaml --validate=false**

** Reason for the –validate=false tag is to overcome the way kubectl performs resource validation on kubernetes version less that 1.15

3. Verify Installation with the below command
   ⇒ **kubectl get pods --namespace cert-manager**
   ⇒ If everything went well we will see three pods in running state as shown
   ⇒ To view the custom resources that are deployed along with cert-manager, run the following command: **kubectl get crd --all-namespaces**

Verifying Functionality:

1. Build a sample self-signed certificate issuer in the cluster with the following script

2. Execute the script with the command
   ⇒ **Kubectl apply -f sample-resources.yaml**

3. Wait for few seconds for the cert-manager to process the certificate request.
   ⇒ Execute the command to describe the generated certificate
   ⇒ **Kubectl describe cert -n cert-manager-test**

   You should see a similar output

With this we can confirm that the cert manager is installed without any errors.

Clean up test resources with the command: **kubectl delete -f sample-resources.yaml**

Configuring Issuer:

Before you can begin issuing certificates, you must configure at least one Issuer or ClusterIssuer resource in your cluster.

These represent a certificate authority from which signed x509 certificates can be obtained, such as Let's Encrypt, or your own signing key pair stored in a Kubernetes Secret resource. They are referenced by Certificate resources in order to request certificates from them.

An Issuer is scoped to a single namespace, and can only fulfill Certificate resources within its own namespace. This is useful in a multi-tenant environment where multiple teams or independent parties operate within a single cluster.

On the other hand, a ClusterIssuer is a cluster wide version of an Issuer. It is able to be referenced by Certificate resources in any namespace.

In this article we will use Let's Encrypt cluster-issuer to explain issuer for a cluster level scope

Configuring with Let's Encrypt Cluster-Issuer:

1. Deploy an ingress-nginx using an ELB to expose the service.
   Run the following commands to deploy the ingress controller.
   ⇒ kubectl apply -f https://raw.githubusercontent.com/kubernetes/ingress-nginx/master/deploy/static/mandatory.yaml
   ⇒ kubectl apply -f https://raw.githubusercontent.com/kubernetes/ingress-nginx/master/deploy/static/provider/aws/service-nlb.yaml

** It will take few minutes for the ingress controller to be up.

2. Verify the deployed service with the command: **kubectl get service -n ingress-nginx**
   Sample Output:

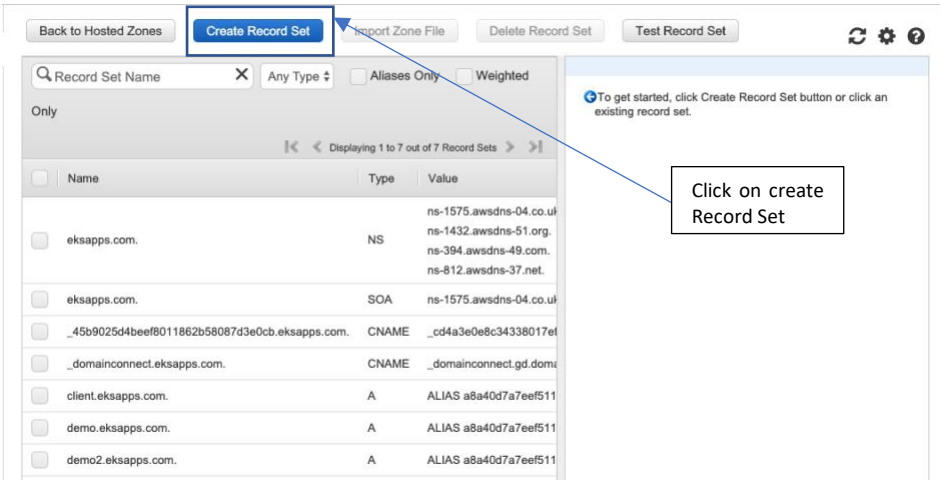
```
Genesis:~/environment $ kubectl get svc -n ingress-nginx
NAME            TYPE           CLUSTER-IP      EXTERNAL-IP                                                                PORT(S)                      AGE
ingress-nginx   LoadBalancer   172.20.247.63   a8a40d7a7eef511e9a9320e7de11db72-b1e2865cb8933f90.elb.us-east-1.amazonaws.com   80:30084/TCP,443:31856/TCP   3d12h
```

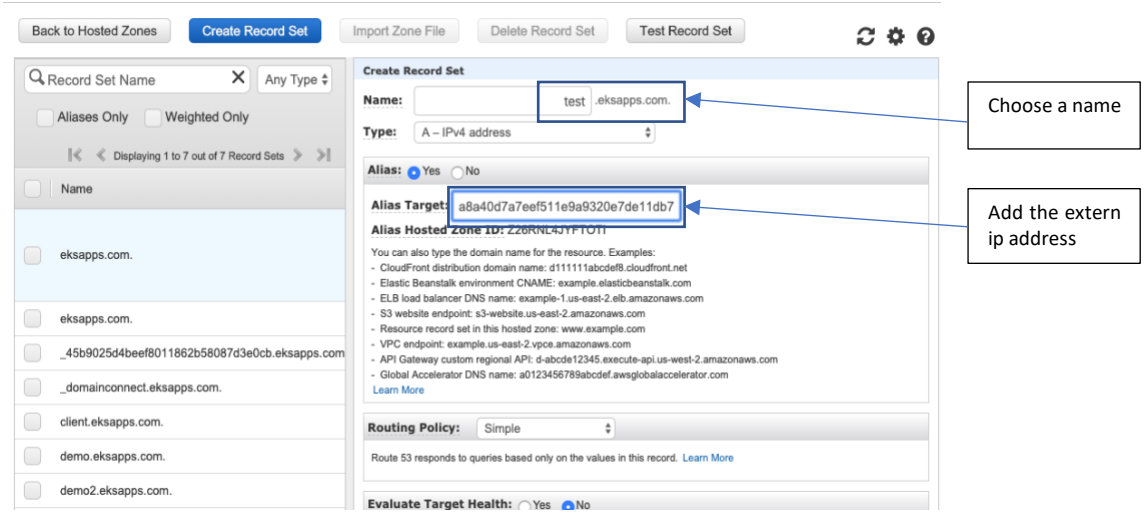
** If the external-ip is not available, please wait for few minutes for the address to be issued.

3. Once the external ip is issued, then verify if the traffic is being routed to the ingress-nginx
   Command: **curl http:// a8a40d7a7eef511e9a9320e7de11db72-b1e2865cb8933f90.elb.us-east-1.amazonaws.com**
   Sample Output:

```
Genesis:~/environment $ curl http://a8a40d7a7eef511e9a9320e7de11db72-b1e2865cb8933f90.elb.us-east-1.amazonaws.com
<html>
<head><title>404 Not Found</title></head>
<body>
<center><h1>404 Not Found</h1></center>
<hr><center>openresty/1.15.8.2</center>
</body>
</html>
```

4. Now that our NLB has been provisioned, we should point our application's DNS records at the NLBs address. In the DNS provider's console set an A record to pointing to your NLB external ip.





⇒ Click on Create button.

⇒ This will create a new entry in the DNS record set.

⇒ This will resemble following

test.eksapps.com A http://a8a40d7a7eef511e9a9320e7de11db72-b1e2865cb8933f90.elb.us-east-1.amazonaws.com

5. Create a namespace demo
   ⇒ Command: kubectl create namespace demo
6. Deploy a sample application in the demo namespace with the below deployment script

```
---
apiVersion: v1
kind: Service
metadata:
  name: appd
  namespace: demo
spec:
  type: ClusterIP
  ports:
  - port: 80
    targetPort: 8080
  selector:
    app: hello-kubernetes
---
apiVersion: apps/v1
kind: Deployment
metadata:
  name: appd
  namespace: demo
spec:
  replicas: 2
  selector:
    matchLabels:
      app: appd
  template:
    metadata:
      labels:
        app: appd
    spec:
      containers:
      - name: appd
        image: '682651395775.dkr.ecr.us-east-1.amazonaws.com/java_app_one:latest'
        resources:
          requests:
            cpu: 100m
            memory: 100Mi
        ports:
        - containerPort: 8080
```

Command: **kubectl apply -f demo-application.yml -n demo**

7. Verify the application deployment with the below command
   ⇒ **Kubectl get po,svc -n demo**

Sample output:

```
Genesis:~/environment $ kubectl get po,svc -n demo
NAME                              READY   STATUS    RESTARTS   AGE
pod/appd-6d45d68d8-2tzvx          1/1     Running   0          3d
pod/appd-6d45d68d8-47ws9          1/1     Running   0          3d
pod/appd-6d45d68d8-vjk7f          1/1     Running   0          3d
pod/appd2-7fccff49bb-6ns45        1/1     Running   0          2d1h
pod/appd2-7fccff49bb-7l6g8        1/1     Running   0          2d1h
pod/appd2-7fccff49bb-b5ksq        1/1     Running   0          2d1h
pod/client-7694bdf5b9-25mpf       1/1     Running   0          25h
pod/client-7694bdf5b9-44vzx       0/1     Pending   0          25h
pod/client-7694bdf5b9-7gn6c       1/1     Running   0          25h
pod/client-7694bdf5b9-wt8g2       0/1     Pending   0          25h

NAME              TYPE       CLUSTER-IP      EXTERNAL-IP   PORT(S)        AGE
service/appd      NodePort   172.20.85.94    <none>        80:32061/TCP   3d
service/appd2     NodePort   172.20.27.235   <none>        80:31261/TCP   2d1h
service/client    NodePort   172.20.14.93    <none>        80:30269/TCP   25h
```

8. Create a file letsencrypt-prod.yml and paste the script

```
apiVersion: cert-manager.io/v1alpha2
kind: ClusterIssuer
metadata:
  name: letsencrypt-prod
spec:
  acme:
    # The ACME server URL
    server: https://acme-v02.api.letsencrypt.org/directory
    # Email address used for ACME registration
    email: <email address>
    # Name of a secret used to store the ACME account private key
    privateKeySecretRef:
      name: letsencrypt-prod
    # Enable the HTTP-01 challenge provider
    solvers:
    - http01:
        ingress:
          class: nginx
```

Create this resource with the command: **kubectl apply -f letsencrypt-prod.yml**

9. To Verify the cluster issuer creation.
   ⇒ Command: **kubectl describe clusterissuer letsencrypt-prod**

⇒ Similar status should be observed with **Type: Ready**

```
. . .
Status:
  Acme:
    Last Registered Email:  jaisai@gmail.com
    Uri:                    https://acme-v02.api.letsencrypt.org/acme/acct/69491521
  Conditions:
    Last Transition Time:  2019-10-15T20:22:36Z
    Message:               The ACME account was registered with the ACME server
    Reason:                ACMEAccountRegistered
    Status:                True
    Type:                  Ready
```

10. As everything looks good, lets create an ingress for the deployed application.
    Copy the below script to a file **ingress-tls-final.yml**

```
---
apiVersion: extensions/v1beta1
kind: Ingress
metadata:
  name: appd
  namespace: demo
  annotations:
    kubernetes.io/ingress.class: "nginx"
    cert-manager.io/cluster-issuer: letsencrypt-prod
  labels:
    app: appd
spec:
  tls:
  - hosts:
    - demo.eksapps.com
    secretName: letsencrypt-prod
  rules:
  - host: demo.eksapps.com
    http:
      paths:
      - path: /
        backend:
          serviceName: appd
          servicePort: 80
```

This annotation shows that we are using cluster-issuer and the issuer is letsencrypt-prod

Secret we will be creating and using for this domain

Domain we will be using

⇒ Create this ingress with the command: **kubectl apply -f ingress-tls-final.yml**

⇒ This will create a certificate and secret.

i. That can be verified with the command: **kubectl get cert letsencrypt-prod -n demo**

Sample Status:

```
NAME               READY   SECRET             AGE
letsencrypt-prod   True    letsencrypt-prod   5d19h
```

ii. Status of the cert can be seen with the command
kubectl describe cert letsencrypt-prod -n demo

Sample Status:

```
. . .
Spec:
  Dns Names:
    demo.eksapps.com
  Issuer Ref:
    Group:     cert-manager.io
    Kind:      ClusterIssuer
    Name:      letsencrypt-prod
  Secret Name:  letsencrypt-prod
Status:
  Conditions:
    Last Transition Time:  2019-10-16T14:40:11Z
    Message:               Certificate is up to date and has not
expired
    Reason:                Ready
    Status:                True
    Type:                  Ready
  Not After:               2020-01-14T13:40:10Z
```

iii. Similar way we can see the status of the secret with the command
kubectl describe secret letsencrypt-prod -n demo
Sample Status:

```
Name:         letsencrypt-prod
Namespace:    demo
Labels:       <none>
Annotations:  cert-manager.io/alt-names:
demo.eksapps.com,demo2.eksapps.com
              cert-manager.io/certificate-name: letsencrypt-prod
              cert-manager.io/common-name: demo.eksapps.com
              cert-manager.io/ip-sans:
              cert-manager.io/issuer-kind: ClusterIssuer
              cert-manager.io/issuer-name: letsencrypt-prod
              cert-manager.io/uri-sans:

Type:  kubernetes.io/tls

Data
====
ca.crt:   0 bytes
tls.crt:  3586 bytes
tls.key:  1679 bytes
```

11. As the cert and secret are created, they are assigned to the ingress.
    Now we can open the browser and reach the website over
    https://demo.eksapps.com