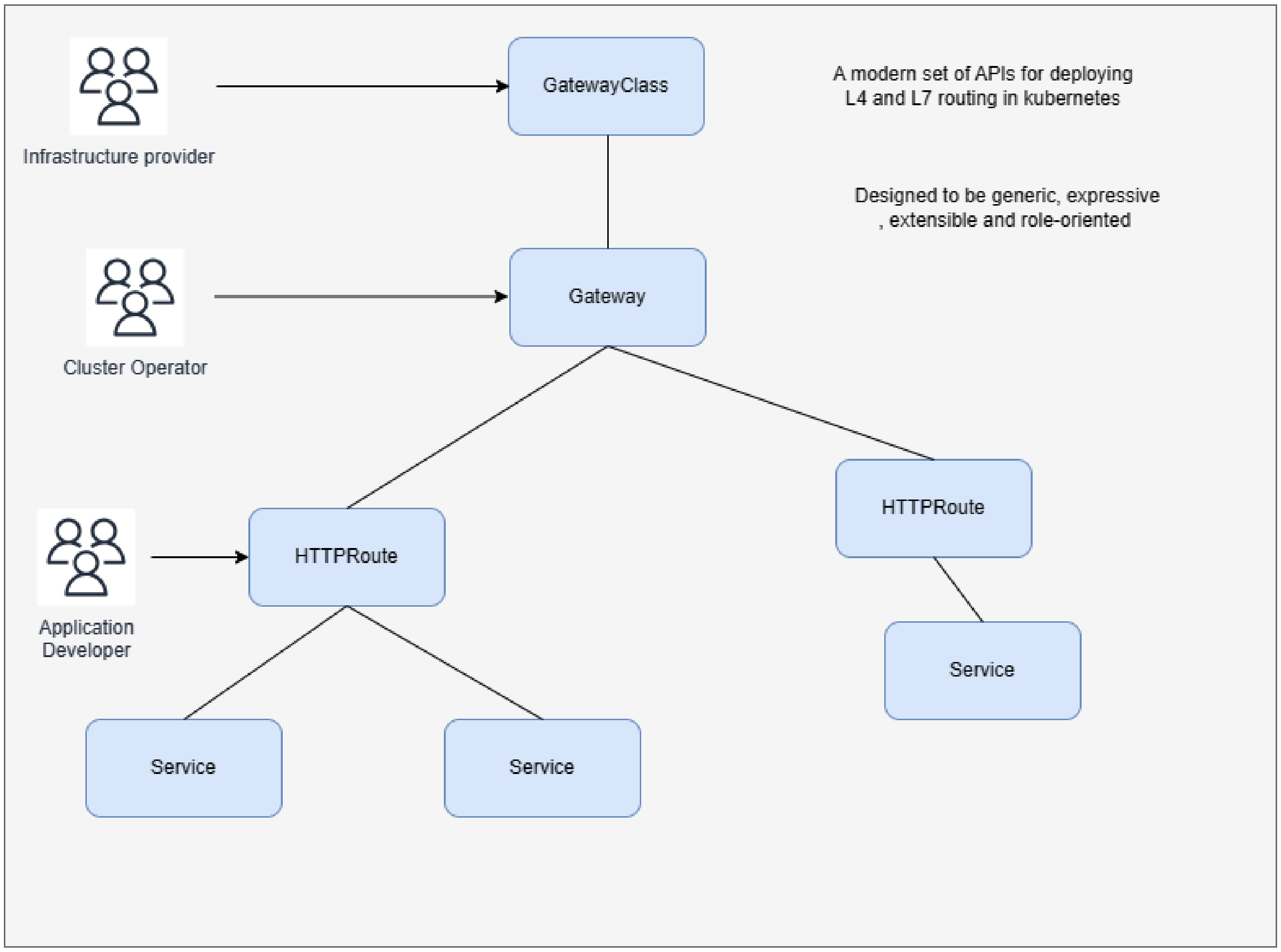
KUBERNETES API GATEWAY WITH NGINX

Version	Description	Revision date	Amendment/ Modification/ Deletion	Reviewer Name	Approver Name
1.0	Initial Version	17/12/23	Amendment	Ashish Kapoor	Himanshu

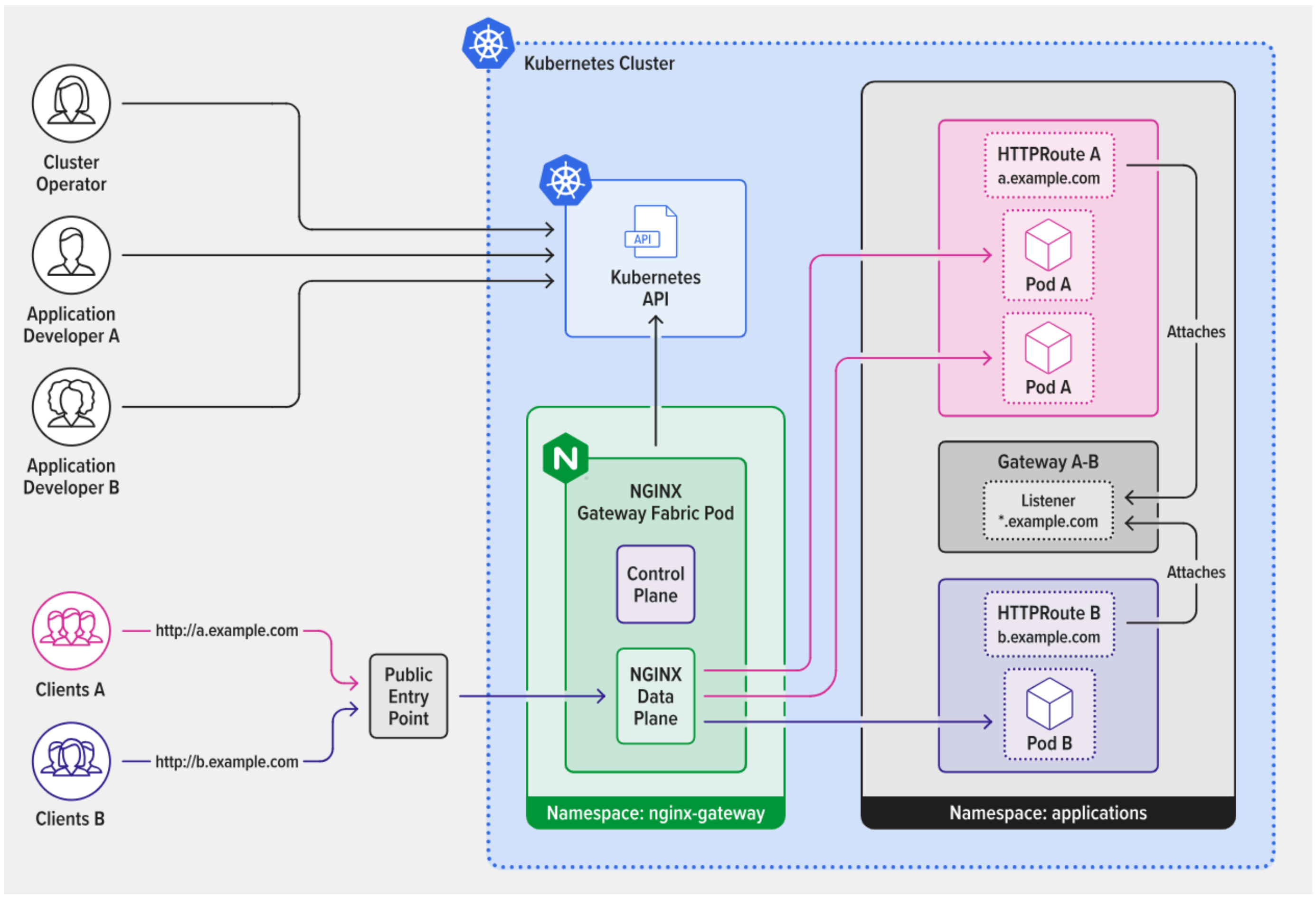
Introduction:

Gateway API is an open source project managed by the SIG-NETWORK community. It is an API (collection of resources) that model service networking in Kubernetes. These resources - GatewayClass, Gateway, HTTPRoute, TCPRoute, etc., as well as the Kubernetes Service resource - aim to evolve Kubernetes service networking through expressive, extensible, and role-oriented interfaces that are implemented by many vendors and have broad industry support.


Infrastructure provider
GatewayClass
A modern set of APIs for deploying L4 and L7 routing in kubernetes
Designed to be generic, expressive , extensible and role-oriented
Cluster Operator
Gateway
HTTPRoute
Application Developer
HTTPRoute
Service
Service
Service

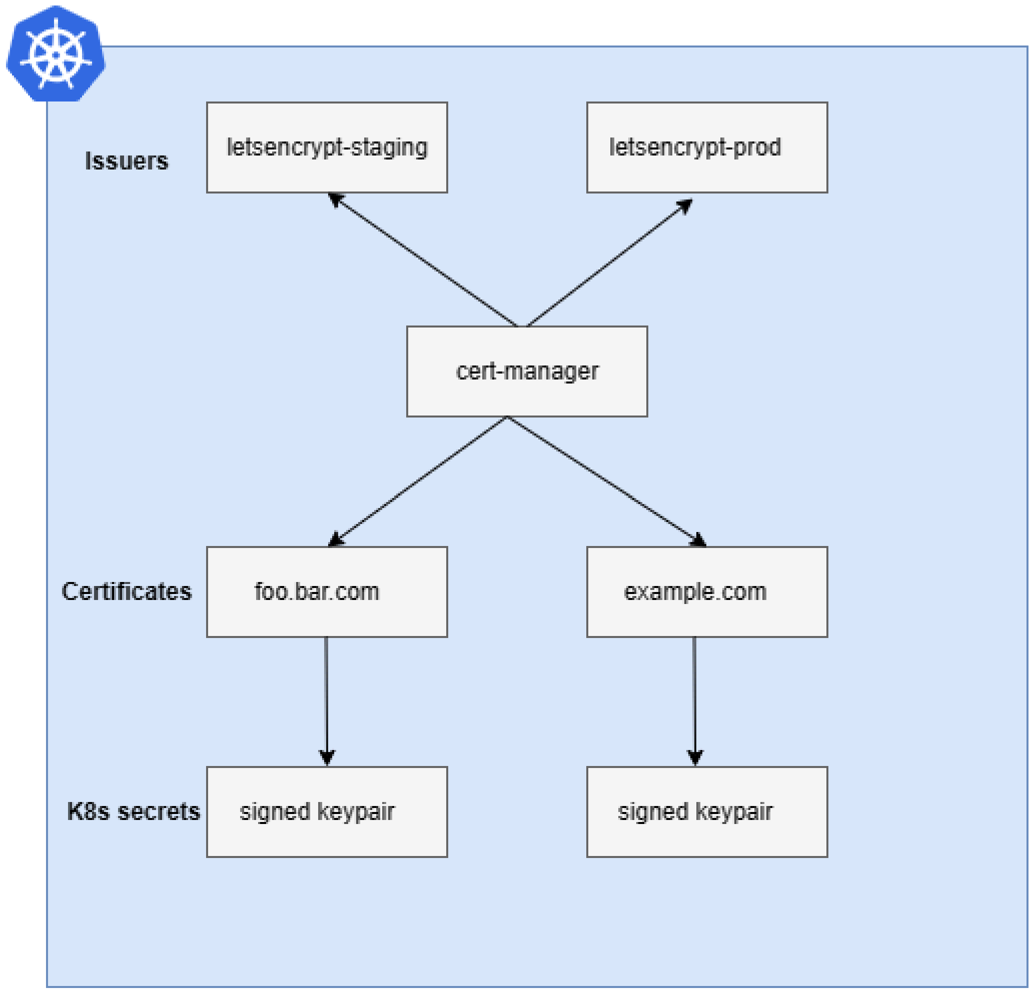
NGINX Gateway Fabric:

NGINX Gateway Fabric is an open-source project that provides an implementation of the Gateway API using NGINX as the data plane. The goal of this project is to implement the core Gateway APIs -- Gateway, GatewayClass, HTTPRoute, TCPRoute, TLSRoute, and UDPRoute -- to configure an HTTP or TCP/UDP load balancer, reverse-proxy, or API gateway for applications running on Kubernetes. NGINX Gateway Fabric supports a subset of the Gateway API.



CertManager :

cert-manager adds certificates and certificate issuers as resource types in Kubernetes clusters, and simplifies the process of obtaining, renewing and using those certificates.



Prerequisites:

Before you begin the Istio deployment process, make sure you have the following prerequisites:

- AWS CLI and kubectl installed
- Helm
- Amazon EKS cluster

Deploy NGINX Gateway Fabric

- To install the Gateway API resources, run the following:

```
 kubectl apply -f
https://github.com/kubernetes-sigs/gateway-api/releases/download/v1.0
.0/standard-install.yaml
```

- Create namespace **nginx-gateway**

- Install from the OCI registry

```
helm install ngf oci://ghcr.io/nginxinc/charts/nginx-gateway-fabric
--create-namespace -n nginx-gateway
```

```
kubectl wait --timeout=5m -n nginx-gateway
deployment/ngf-nginx-gateway-fabric --for=condition=Available
```

Expose NGINX Gateway Fabric

Gain access to NGINX Gateway Fabric by creating either a NodePort service or a LoadBalancer service in the same namespace as the controller. The service name is specified in the --service argument of the controller.

Create a LoadBalancer Service

```
kubectl apply -f
https://raw.githubusercontent.com/nginxinc/nginx-gateway-fabric/v1.0.
0/deploy/manifests/service/loadbalancer-aws-nlb.yaml
```

Install cert manager

Add helm repo

```
helm repo add jetstack https://charts.jetstack.io
```

Update your local Helm chart repository cache:

```
helm repo update
```

Install *CustomResourceDefinitions*

```
kubectl apply -f
https://github.com/cert-manager/cert-manager/releases/download/v1.13.
3/cert-manager.crds.yaml
```

Install cert-manager

```
helm install   cert-manager jetstack/cert-manager   --namespace
cert-manager   --create-namespace   --version v1.13.2   --set
"featureGates={UseCertificateRequestBasicConstraints=true}"
```

Configuring DNS01 Challenge Provider

ROUTE 53 :

Set up an IAM Role

cert-manager needs to be able to add records to Route53 in order to solve the DNS01 challenge. To enable this, create a IAM policy with the following permissions:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": "route53:GetChange",
      "Resource": "arn:aws:route53:::change/*"
    },
    {
      "Effect": "Allow",
      "Action": [
        "route53:ChangeResourceRecordSets",
        "route53:ListResourceRecordSets"
      ],
      "Resource": "arn:aws:route53:::hostedzone/*"
    },
    {
      "Effect": "Allow",
      "Action": "route53:ListHostedZonesByName",
      "Resource": "*"
    }
  ]
}
```

IAM role trust policy

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": "sts:AssumeRoleWithWebIdentity",
      "Principal": {
        "Federated":
"arn:aws:iam::<aws-account-id>:oidc-provider/oidc.eks.<aws-region>.am
azonaws.com/id/<eks-hash>"
      },
      "Condition": {
        "StringEquals": {
          "oidc.eks.<aws-region>.amazonaws.com/id/<eks-hash>:sub":
"system:serviceaccount:<namespace>:<service-account-name>"
        }
      }
    }
  ]
}
```

Service annotation

Annotate the ServiceAccount created by cert-manager:

```
apiVersion: v1
kind: ServiceAccount
metadata:
  annotations:
    eks.amazonaws.com/role-arn:
arn:aws:iam::XXXXXXXXXXX:role/cert-manager
```

ISSUER

Issuers, and ClusterIssuers, are Kubernetes resources that represent certificate authorities (CAs) that are able to generate signed certificates by honoring certificate signing requests.

```
apiVersion: cert-manager.io/v1
kind: ClusterIssuer
metadata:
  name: tea
spec:
  acme:
    server: https://acme-staging-v02.api.letsencrypt.org/directory
    privateKeySecretRef:
      name: teacerts
    solvers:
    - selector:
        dnsZones:
          - "teacoffe.api.trialanderror.in.net"
      dns01:
        route53:
          region: us-east-1
          hostedZoneID: <HSER4954309F> # optional, see policy above
          role: arn:aws:iam::0123456:role/xyz
```

- ClusterIssuer Definition:

- Configures a cert-manager ClusterIssuer named "tea" for managing TLS certificates in a Kubernetes cluster.
- Uses the ACME protocol with a Let's Encrypt staging server for testing.
- Specifies a Kubernetes Secret ("teacerts") for storing the private key.

- ACME Configuration:

- Utilizes the ACME protocol for automated certificate management.
- Sets the ACME server URL to Let's Encrypt staging server.
- References a Kubernetes Secret ("teacerts") to securely store the private key.
- DNS01 Challenge Solver Configuration:

- Implements DNS01 challenge solver for proving domain ownership during certificate issuance.
- Targets the DNS zone "teacoffe.api.trialanderror.in.net."
- Configures Amazon Route 53 as the DNS provider with specific settings like region, hosted zone ID, and IAM role.

Deploy sample *Httpbin.org* application

```
Kubectl apply -f sampleapp.yaml
```

GATEWAY

```
apiVersion: gateway.networking.k8s.io/v1
kind: Gateway
metadata:
  name: gateway
  annotations:
    cert-manager.io/cluster-issuer: coffe
spec:
  gatewayClassName: nginx
  listeners:
  - name: http
    hostname: "teacoffe.api.trialanderror.in.net"
    port: 80
    protocol: HTTP
  - name: https
    hostname: "teacoffe.api.trialanderror.in.net"
    port: 443
    protocol: HTTPS
    tls:
      mode: Terminate
      certificateRefs:
      - kind: Secret
        name: cafe-secret
```

- Gateway Definition:

- Declares a Kubernetes resource of type Gateway in the gateway.networking.k8s.io/v1 API version.
- Names the Gateway resource "gateway" and associates it with the cert-manager ClusterIssuer named "coffe" using annotations.
- Specifies the gatewayClassName as "nginx" to indicate the class of the Ingress controller responsible for handling this Gateway.

- Listeners Configuration:

- Defines two listeners, one for HTTP on port 80 and another for HTTPS on port 443.
- The HTTP listener is named "http" and configured to handle traffic on the hostname "teacoffe.api.trialanderror.in.net" using the HTTP protocol.
- The HTTPS listener is named "https" and also handles traffic on the same hostname but using the HTTPS protocol.

- TLS Termination Configuration:

- For the HTTPS listener, specifies TLS termination using the tls section.
- mode: Terminate indicates that TLS termination should occur at the Gateway, and unencrypted traffic is forwarded internally.
- Refers to a TLS certificate stored in a Kubernetes Secret named "cafe-secret" using certificateRefs.
- The referenced Secret is expected to contain the necessary TLS certificate and private key for securing the HTTPS communication on the specified hostname

HTTPROUTE

```yaml
---
apiVersion: gateway.networking.k8s.io/v1
kind: HTTPRoute
metadata:
  name: api
spec:
  parentRefs:
  - name: gateway
  hostnames: ["teacoffe.api.trialanderror.in.net"]
  rules:
  - matches:
    - path:
        type: PathPrefix
        value: /
    backendRefs:
    - name: api
      port: 8000

---
apiVersion: gateway.networking.k8s.io/v1
kind: HTTPRoute
metadata:
  name: http-filter-1
spec:
  parentRefs:
    - name: gateway
  hostnames:
    - teacoffe.api.trialanderror.in.net
  rules:
    - filters:
        - type: RequestRedirect
```

```
          requestRedirect:
            scheme: https
```

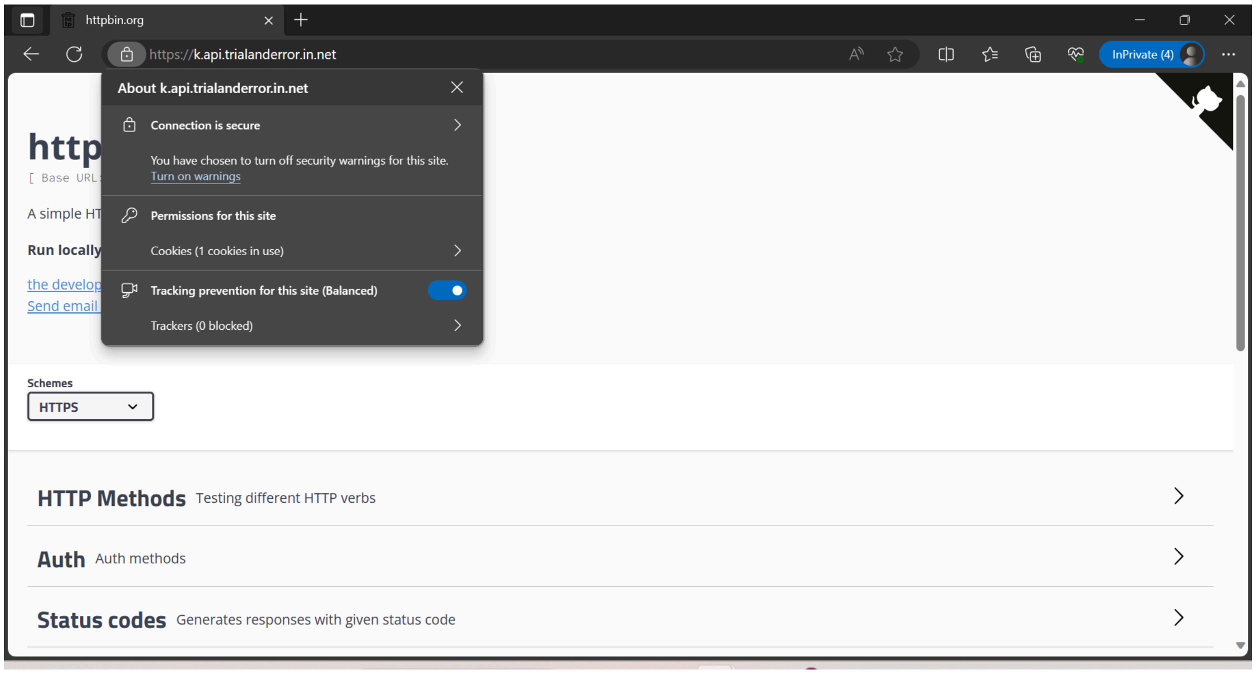
- HTTPRoute for API Endpoint:

- Defines a Kubernetes resource of type HTTPRoute in the gateway.networking.k8s.io/v1 API version.
- Names the HTTPRoute "api" and associates it with the previously defined Gateway named "gateway" using parentRefs.
- Specifies that this route is intended for the hostname "teacoffe.api.trialanderror.in.net."
- Configures a rule for matching any path (PathPrefix "/") and directs traffic to a backend service named "api" on port 8000.

- HTTPRoute for HTTPS Redirect:

- Declares another HTTPRoute named "http-filter-1" associated with the "gateway" resource.
- Targets the same hostname "teacoffe.api.trialanderror.in.net."
- Implements a rule with a filter of type RequestRedirect to enforce HTTPS redirection.
- The scheme: https directive ensures that any incoming HTTP requests to the specified hostname are redirected to HTTPS for enhanced security.

Access the application from the nlb created by service



About k.api.trialanderror.in.net

Connection is secure

You have chosen to turn off security warnings for this site.
Turn on warnings

Permissions for this site

Cookies (1 cookies in use)

Tracking prevention for this site (Balanced)

Trackers (0 blocked)

HTTP Methods Testing different HTTP verbs

Auth Auth methods

Status codes Generates responses with given status code