Unleashing the Future of Kubernetes Networking

(How Gateway API Transforms Container Exposure)

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Why a new Specification?

Ingress Evolution

Ingress (2015)

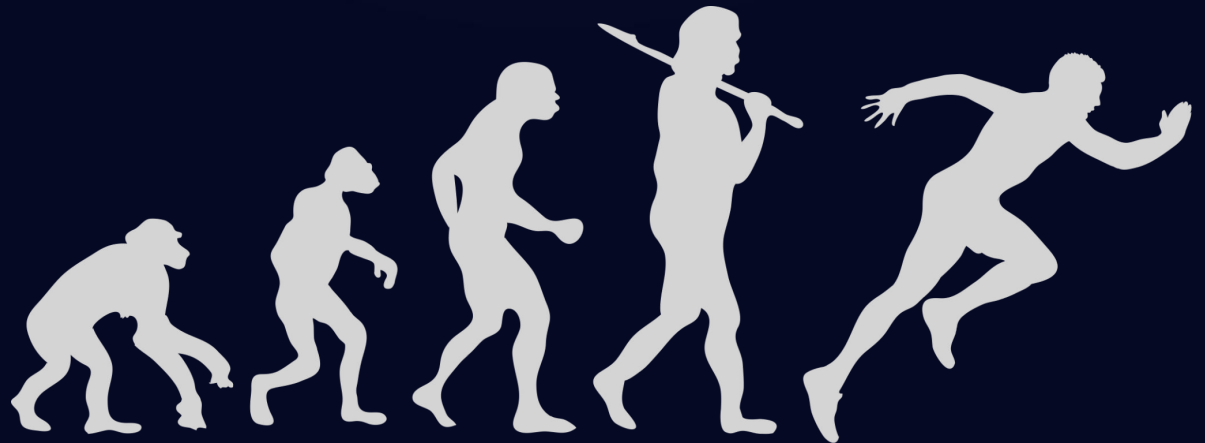
Vendor Neutral (Theoretically)
Specific Configuration using Annotations
Only HTTP
Deprecated

IngressRoute (2019)

Vendor Specific
Configuration using *spec*
HTTP/TCP/UDP
Middlewares CRD

Gateway API (2019)

Vendor Neutral (Expected)
Configuration using objects
HTTP/TCP
Next Standard
Active Roadmap
Ingress and Mesh



Ingress ❤️ Simplicity

- 🙂 HTTP routes
- 🙂 host, *, path & prefix rules
- 🙂 default backend
- 🙂 TLS

```yaml
apiVersion: networking.k8s.io/v1
kind: Ingress
metadata:
  name: example-ingress
  namespace: default
  annotations:
    kubernetes.io/ingress.class: "nginx"
    nginx.ingress.kubernetes.io/ssl-redirect: "true"
spec:
  tls:
  - hosts:
    - example.com
    secretName: example-tls
  rules:
  - host: example.com
    http:
      paths:
      - path: /
        pathType: Prefix
        backend:
          service:
            name: example-service
            port:
              number: 80
```

```yaml
apiVersion: networking.k8s.io/v1
kind: Ingress
metadata:
  name: example-ingress
  namespace: default
  annotations:
    kubernetes.io/ingress.class: "traefik"
spec:
  tls:
  - hosts:
    - example.com
    secretName: example-tls
  rules:
  - host: example.com
    http:
      paths:
      - path: /
        pathType: Prefix
        backend:
          service:
            name: example-service
            port:
              number: 80
```

Ingress ❤️ Simplicity 💔 Complexity

- 🙂 HTTP routes
- 🙂 host, *, path & prefix rules
- 🙂 default backend
- 🙂 TLS

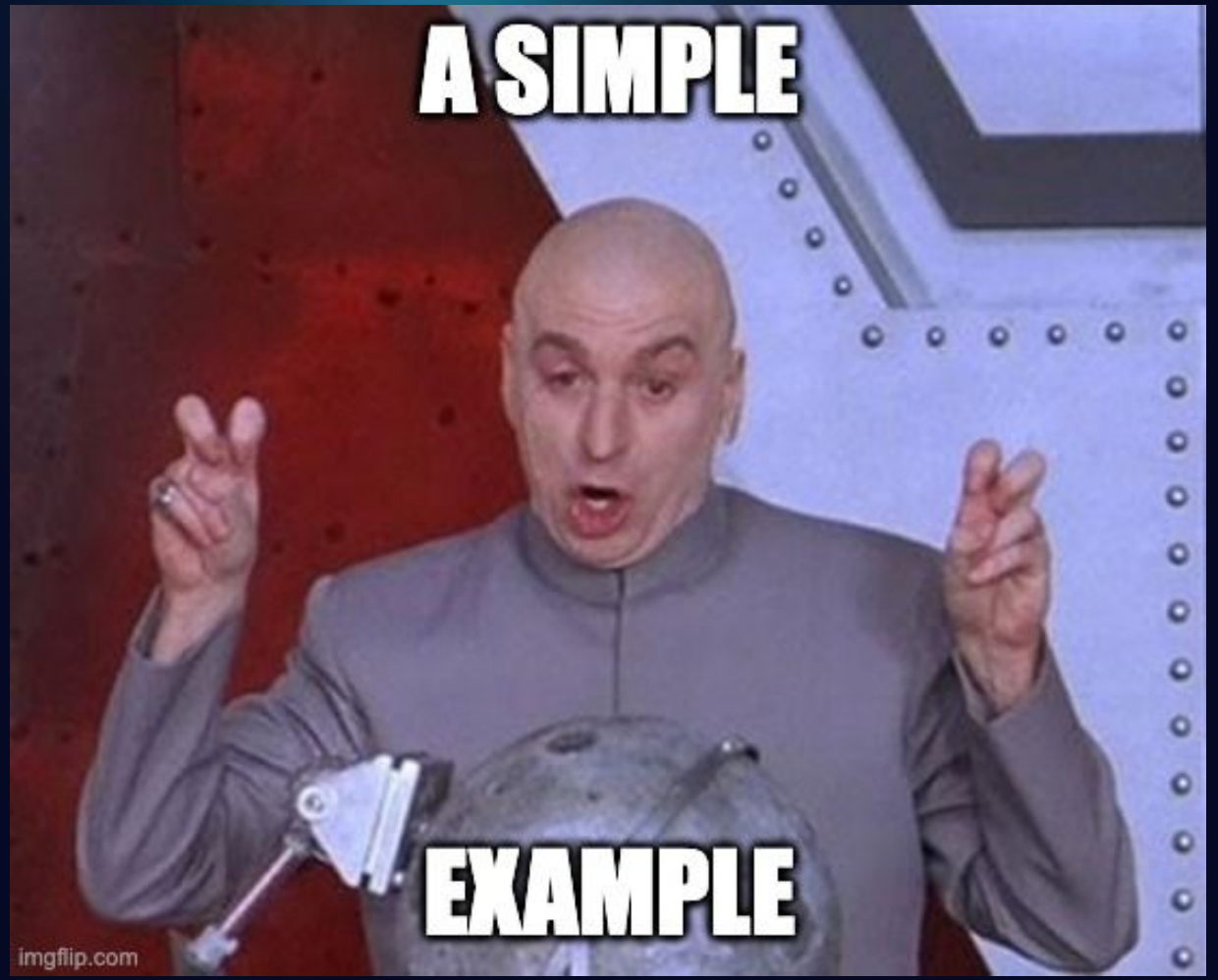
- 😩 TCP, UDP
- 😩 mTLS
- 😩 Adv Matching Rules (Method, OR/AND, Regex)

- 😩 Rate limiting / Retries / Canary
- 😩 Authentication (OAuth, JWT, etc.)
- 😩 CORS policies
- 😩 Headers/Request/Response modification
- 😩 Multi-tenancy / Namespace Isolation
- 😩 Separation of concerns
- 😩 Extensibility

nginx.ingress.kubernetes.io/app-root
nginx.ingress.kubernetes.io/affinity
nginx.ingress.kubernetes.io/affinity-mode
nginx.ingress.kubernetes.io/affinity-canary-behavior
nginx.ingress.kubernetes.io/auth-realm
nginx.ingress.kubernetes.io/auth-secret
nginx.ingress.kubernetes.io/auth-secret-type
nginx.ingress.kubernetes.io/auth-type
nginx.ingress.kubernetes.io/auth-tls-secret
nginx.ingress.kubernetes.io/auth-tls-verify-depth
nginx.ingress.kubernetes.io/auth-tls-verify-client
nginx.ingress.kubernetes.io/auth-tls-error-page
nginx.ingress.kubernetes.io/auth-tls-pass-certificate-to-upstream
nginx.ingress.kubernetes.io/auth-tls-match-cn
nginx.ingress.kubernetes.io/auth-url
nginx.ingress.kubernetes.io/auth-cache-key
nginx.ingress.kubernetes.io/auth-cache-duration
nginx.ingress.kubernetes.io/auth-keepalive
nginx.ingress.kubernetes.io/auth-keepalive-share-vars
nginx.ingress.kubernetes.io/auth-keepalive-requests
nginx.ingress.kubernetes.io/auth-keepalive-timeout
nginx.ingress.kubernetes.io/auth-proxy-set-headers
nginx.ingress.kubernetes.io/auth-snippet
nginx.ingress.kubernetes.io/enable-global-auth
nginx.ingress.kubernetes.io/backend-protocol
nginx.ingress.kubernetes.io/canary
nginx.ingress.kubernetes.io/canary-by-header
nginx.ingress.kubernetes.io/canary-by-header-value
nginx.ingress.kubernetes.io/canary-by-header-pattern
nginx.ingress.kubernetes.io/canary-by-cookie
nginx.ingress.kubernetes.io/canary-weight
nginx.ingress.kubernetes.io/canary-weight-total
nginx.ingress.kubernetes.io/client-body-buffer-size
nginx.ingress.kubernetes.io/configuration-snippet
nginx.ingress.kubernetes.io/custom-http-errors
nginx.ingress.kubernetes.io/custom-headers
nginx.ingress.kubernetes.io/default-backend
nginx.ingress.kubernetes.io/enable-cors
nginx.ingress.kubernetes.io/cors-allow-origin
nginx.ingress.kubernetes.io/cors-allow-methods
nginx.ingress.kubernetes.io/cors-allow-headers
nginx.ingress.kubernetes.io/cors-expose-headers
nginx.ingress.kubernetes.io/cors-allow-credentials
nginx.ingress.kubernetes.io/cors-max-age
nginx.ingress.kubernetes.io/force-ssl-redirect
nginx.ingress.kubernetes.io/from-to-www-redirect
nginx.ingress.kubernetes.io/http2-push-preload
nginx.ingress.kubernetes.io/limit-connections
nginx.ingress.kubernetes.io/limit-rps
nginx.ingress.kubernetes.io/permanent-redirect
nginx.ingress.kubernetes.io/permanent-redirect-code
nginx.ingress.kubernetes.io/temporal-redirect
nginx.ingress.kubernetes.io/temporal-redirect-code
nginx.ingress.kubernetes.io/preserve-trailing-slash
nginx.ingress.kubernetes.io/proxy-body-size
nginx.ingress.kubernetes.io/proxy-cookie-domain
nginx.ingress.kubernetes.io/proxy-cookie-path
nginx.ingress.kubernetes.io/proxy-connect-timeout
nginx.ingress.kubernetes.io/proxy-send-timeout
nginx.ingress.kubernetes.io/proxy-read-timeout
nginx.ingress.kubernetes.io/proxy-next-upstream
nginx.ingress.kubernetes.io/proxy-next-upstream-timeout
nginx.ingress.kubernetes.io/proxy-next-upstream-tries
nginx.ingress.kubernetes.io/proxy-request-buffering
nginx.ingress.kubernetes.io/proxy-redirect-from
nginx.ingress.kubernetes.io/proxy-redirect-to
nginx.ingress.kubernetes.io/proxy-http-version
nginx.ingress.kubernetes.io/proxy-ssl-secret
nginx.ingress.kubernetes.io/proxy-ssl-ciphers
nginx.ingress.kubernetes.io/proxy-ssl-name
nginx.ingress.kubernetes.io/proxy-ssl-protocols
nginx.ingress.kubernetes.io/proxy-ssl-verify
nginx.ingress.kubernetes.io/proxy-ssl-verify-depth
nginx.ingress.kubernetes.io/proxy-ssl-server-name
nginx.ingress.kubernetes.io/enable-rewrite-log
nginx.ingress.kubernetes.io/rewrite-target
nginx.ingress.kubernetes.io/satisfy
nginx.ingress.kubernetes.io/server-alias
nginx.ingress.kubernetes.io/server-snippet
nginx.ingress.kubernetes.io/service-upstream
nginx.ingress.kubernetes.io/session-cookie-change-on-failure
nginx.ingress.kubernetes.io/session-cookie-conditional-samesite-none
nginx.ingress.kubernetes.io/session-cookie-domain
nginx.ingress.kubernetes.io/session-cookie-expires
nginx.ingress.kubernetes.io/session-cookie-max-age
nginx.ingress.kubernetes.io/session-cookie-name
nginx.ingress.kubernetes.io/session-cookie-path
nginx.ingress.kubernetes.io/session-cookie-samesite
nginx.ingress.kubernetes.io/session-cookie-secure
nginx.ingress.kubernetes.io/ssl-redirect
nginx.ingress.kubernetes.io/ssl-passthrough
nginx.ingress.kubernetes.io/stream-snippet
nginx.ingress.kubernetes.io/upstream-hash-by
nginx.ingress.kubernetes.io/x-forwarded-prefix
nginx.ingress.kubernetes.io/load-balance
nginx.ingress.kubernetes.io/upstream-vhost
nginx.ingress.kubernetes.io/denylist-source-range
nginx.ingress.kubernetes.io/whitelist-source-range
nginx.ingress.kubernetes.io/proxy-buffering
nginx.ingress.kubernetes.io/proxy-buffers-number
nginx.ingress.kubernetes.io/proxy-buffer-size
nginx.ingress.kubernetes.io/proxy-busy-buffers-size
nginx.ingress.kubernetes.io/proxy-max-temp-file-size
nginx.ingress.kubernetes.io/ssl-ciphers
nginx.ingress.kubernetes.io/ssl-prefer-server-ciphers
nginx.ingress.kubernetes.io/connection-proxy-header
nginx.ingress.kubernetes.io/enable-access-log
nginx.ingress.kubernetes.io/enable-opentelemetry
nginx.ingress.kubernetes.io/opentelemetry-trust-incoming-span
nginx.ingress.kubernetes.io/use-regex
nginx.ingress.kubernetes.io/enable-modsecurity
nginx.ingress.kubernetes.io/enable-owasp-core-rules
nginx.ingress.kubernetes.io/modsecurity-transaction-id
nginx.ingress.kubernetes.io/modsecurity-snippet
nginx.ingress.kubernetes.io/mirror-request-body
nginx.ingress.kubernetes.io/mirror-target
nginx.ingress.kubernetes.io/mirror-host


LOWER CARGO FIRE PROTECTION
DISCH ARM TEST
MAIN DECK CARGO FANS
DETECTOR TEST
SQUIB TEST
ENGINE FIRE DETECTION
NORMAL BRAKE SOURCE SELECT
RECIRCULATING FANS
HYD SYS 1
HYD SYS 2
SEAT MUST BE IN FORWARD 6 INCHES OF TRAVEL DURING TAKEOFF AND LANDING

mTLS
sticky sessions
CORS



mTLS
sticky sessions
CORS

```
apiVersion: networking.k8s.io/v1
kind: Ingress
metadata:
  name: advanced-secure-ingress
  annotations:
    # Configuration mTLS
    nginx.ingress.kubernetes.io/auth-tls-verify-client: "on"
    nginx.ingress.kubernetes.io/auth-tls-secret: "default/ca-secret"
    nginx.ingress.kubernetes.io/auth-tls-verify-depth: "1"
    nginx.ingress.kubernetes.io/auth-tls-pass-certificate-to-upstream:
"true"
```

mTLS
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```
apiVersion: networking.k8s.io/v1
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metadata:
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  annotations:
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    nginx.ingress.kubernetes.io/auth-tls-verify-depth: "1"
    nginx.ingress.kubernetes.io/auth-tls-pass-certificate-to-upstream:
"true"

    # Configuration sticky sessions
    nginx.ingress.kubernetes.io/affinity: "cookie"
    nginx.ingress.kubernetes.io/session-cookie-name: "STICKYID"
    nginx.ingress.kubernetes.io/session-cookie-expires: "86400"
    nginx.ingress.kubernetes.io/session-cookie-max-age: "86400"
    nginx.ingress.kubernetes.io/session-cookie-path: "/"
```

mTLS
sticky sessions
CORS

```
…

    # Configuration sticky sessions
    nginx.ingress.kubernetes.io/affinity: "cookie"
    nginx.ingress.kubernetes.io/session-cookie-name: "STICKYID"
    nginx.ingress.kubernetes.io/session-cookie-expires: "86400"
    nginx.ingress.kubernetes.io/session-cookie-max-age: "86400"
    nginx.ingress.kubernetes.io/session-cookie-path: "/"

    # Configuration CORS
    nginx.ingress.kubernetes.io/enable-cors: "true"
    nginx.ingress.kubernetes.io/cors-allow-origin:
"https://trusted-origin.com, https://*.example.org"
    nginx.ingress.kubernetes.io/cors-allow-methods: "GET, POST"
```

mTLS
sticky sessions
CORS

```
…

    # Configuration CORS
    nginx.ingress.kubernetes.io/enable-cors: "true"
    nginx.ingress.kubernetes.io/cors-allow-origin:
"https://trusted-origin.com, https://*.example.org"
    nginx.ingress.kubernetes.io/cors-allow-methods: "GET, POST"

spec:
  ingressClassName: nginx
  tls:
  - hosts:
    - api.example.com
    secretName: tls-secret
  rules:
  - host: api.example.com
    http:
      paths:
      - path: /
        pathType: Prefix
        backend:
          service:
            name: api-service
            port:
              number: 8443
```

mTLS
sticky sessions
CORS

```yaml
apiVersion: networking.k8s.io/v1
kind: Ingress
metadata:
  name: advanced-secure-ingress
  annotations:
    # Specify Traefik as the ingress controller
    kubernetes.io/ingress.class: "traefik"

    # mTLS Configuration
    traefik.ingress.kubernetes.io/router.tls: "true"
    traefik.ingress.kubernetes.io/router.tls.options: "default-mtls-options@kubernetescrd"

    # CORS Configuration
    traefik.ingress.kubernetes.io/router.middlewares: "default-cors-headers@kubernetescrd"

    # Sticky Sessions
    traefik.ingress.kubernetes.io/service.sticky: "true"
    traefik.ingress.kubernetes.io/service.sticky.cookie.name: "STICKYID"
    traefik.ingress.kubernetes.io/service.sticky.cookie.secure: "true"
    traefik.ingress.kubernetes.io/service.sticky.cookie.httpOnly: "true"
    traefik.ingress.kubernetes.io/service.sticky.cookie.maxAge: "86400"
```

mTLS
sticky sessions
CORS

```yaml
# Configuration TLS avec mTLS
apiVersion: traefik.containo.us/v1alpha1
kind: TLSOption
metadata:
  name: mtls-options
spec:
  clientAuth:
    secretNames:
      - ca-secret
    clientAuthType: RequireAndVerify
```

mTLS
sticky sessions
CORS

```yaml
# Middleware pour les CORS
apiVersion: traefik.containo.us/v1alpha1
kind: Middleware
metadata:
  name: cors-middleware
spec:
  headers:
    accessControlAllowMethods:
      - GET
      - POST
    accessControlAllowOriginList:
      - https://trusted-origin.com
      - https://*.example.org
```


INGRESS IS
VENDOR NEUTRAL
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Ingress Evolution

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Specific Configuration using Annotations
Only HTTP
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Vendor Specific
Configuration using *spec*
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Middlewares CRD

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Configuration using objects
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Next Standard
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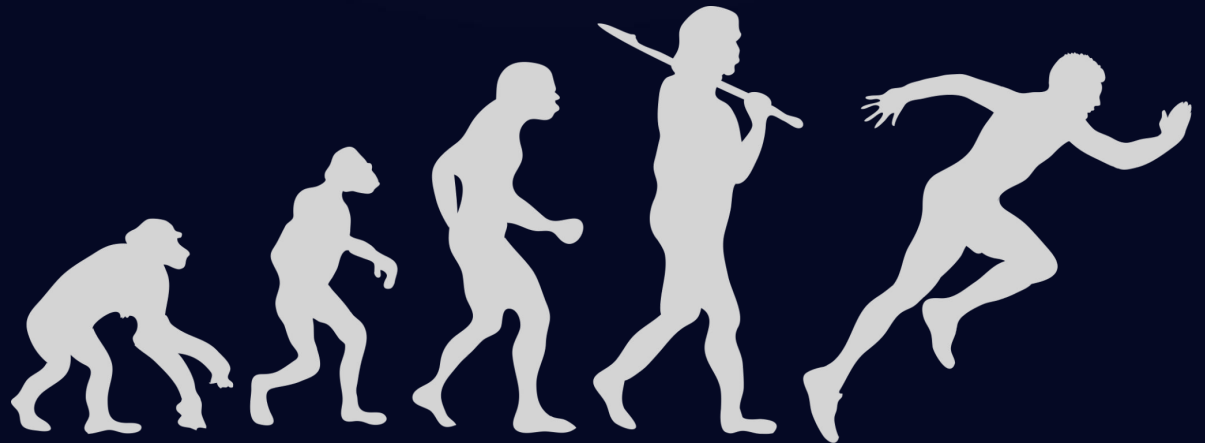
Ingress and Mesh



```yaml
apiVersion: networking.k8s.io/v1
kind: Ingress
metadata:
  name: example-ingress
  namespace: default
  annotations:
    kubernetes.io/ingress.class: "nginx"
    nginx.ingress.kubernetes.io/ssl-redirect: "true"
spec:
  tls:
  - hosts:
    - example.com
    secretName: example-tls
  rules:
  - host: example.com
    http:
      paths:
      - path: /
        pathType: Prefix
        backend:
          service:
            name: example-service
            port:
              number: 80
```

```yaml
apiVersion: traefik.io/v1alpha1
kind: IngressRoute
metadata:
  name: example-ingressroute
  namespace: default
spec:
  entryPoints:
    - websecure
  routes:
    - match: Host(`example.com`) && PathPrefix(`/`)
      kind: Rule
      services:
        - name: example-service
          port: 80
  tls:
    secretName: example-tls
```

```yaml
apiVersion: networking.k8s.io/v1
kind: Ingress
metadata:
  name: example-ingress
  namespace: default
  annotations:
    kubernetes.io/ingress.class: "nginx"
    nginx.ingress.kubernetes.io/ssl-redirect: "true"
spec:
  tls:
  - hosts:
    - example.com
    secretName: example-tls
  rules:
  - host: example.com
    http:
      paths:
      - path: /
        pathType: Prefix
        backend:
          service:
            name: example-service
            port:
              number: 80
```

```yaml
apiVersion: projectcontour.io/v1
kind: HTTPProxy
metadata:
  name: example-httpproxy
  namespace: default
spec:
  virtualhost:
    fqdn: example.com
    tls:
      secretName: example-tls
  routes:
    - conditions:
      - prefix: /
      services:
        - name: example-service
          port: 80
```

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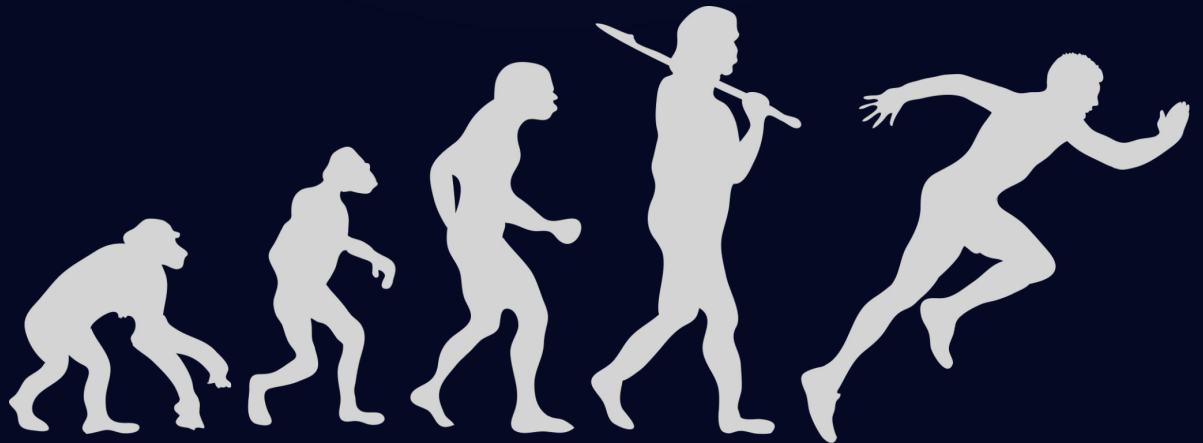
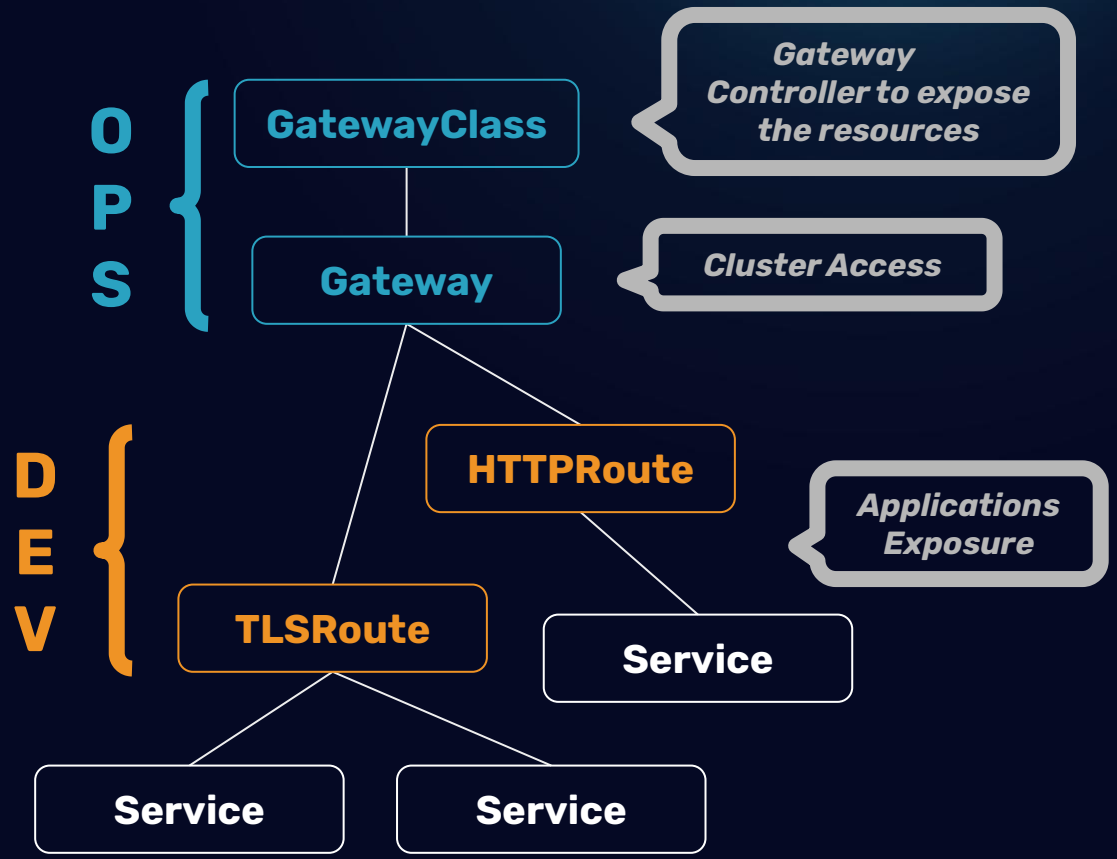


Gateway API in a few words

In Short




```
# GATEWAY API #
###############

# GATEWAYCLASS

kind: GatewayClass
metadata:
  name: traefik-controller
spec:
  controllerName: "traefik.io/gateway-controller"
  …

---

# GATEWAY

kind: Gateway
metadata:
  name: traefik-gw
spec:
  gatewayClassName: traefik-controller
  listeners:
  - name: web
    port: 443
    protocol: HTTP
    hostname: "example.com"


---

# HTTPROUTE

kind: HTTPRoute
metadata:
  name: myhttproute
spec:
  parentRefs:
  - name: traefik-gw
  hostnames:
  - example.com
  rules:
  - matches:
    …
    filters:
    …
```

```yaml
apiVersion: networking.k8s.io/v1
kind: Ingress
metadata:
  name: myingress
  annotations:
    traefik.ingress.kubernetes.io/router.entrypoints:
websecure
    traefik.ingress.kubernetes.io/router.tls: true
    traefik.ingress.kubernetes.io/router.middlewares:
addHeader@kubernetescrd, ipAllowList@kubernetescrd
spec:
  rules:
    - host: example.com
      http:
        paths:
          - path: /bar
            pathType: Exact
            backend:
              service:
                name: whoami
                port:
                  number: 80
  tls:
  - secretName: supersecret
---
apiVersion: traefik.io/v1alpha1
kind: Middleware
metadata:
  name: addHeader
spec:
  headers:
    customRequestHeaders:
      my-header-name: "my-header-value"
```

INGRESS

```yaml
---
apiVersion:
gateway.networking.k8s.io/v1
kind: Gateway
metadata:
  name: traefik-gw
spec:
  gatewayClassName:
traefik-controller
  listeners:
  - name: websecure
    port: 443
    protocol: HTTPS
    hostname: "example.com"
    tls:
      mode: Terminate
      certificateRefs:
        - kind: Secret
          name: supersecret
```

```yaml
---
apiVersion:
gateway.networking.k8s.io/v1
kind: HTTPRoute
metadata:
  name: myhttproute
spec:
  parentRefs:
  - name: traefik-gw
  hostnames:
  - example.com
  rules:
  - matches:
    - path:
      type: Path
      value: /bar
    backendRefs:
    - name: whoami
      port: 80
    filters:
      - type: RequestHeaderModifier
        requestHeaderModifier:
          add:
            - name: my-header-name
              value: my-header-value
```

GATEWAY API

Let’s dive in the concepts!

Ops Resources

Gateway Controller, GatewayClass

Gateway Controller

- Many Implementations

Gateway Controller

- Many Implementations
- Support Levels
  - Core
  - Extended
  - Implementation-specific

Gateway Controller

- Many Implementations
- Support Levels
- Conformance Tests

Gateway API Conformance v1.0.0	EnvoyGateway
Gateway API Conformance v1.2.1	Traefik Proxy

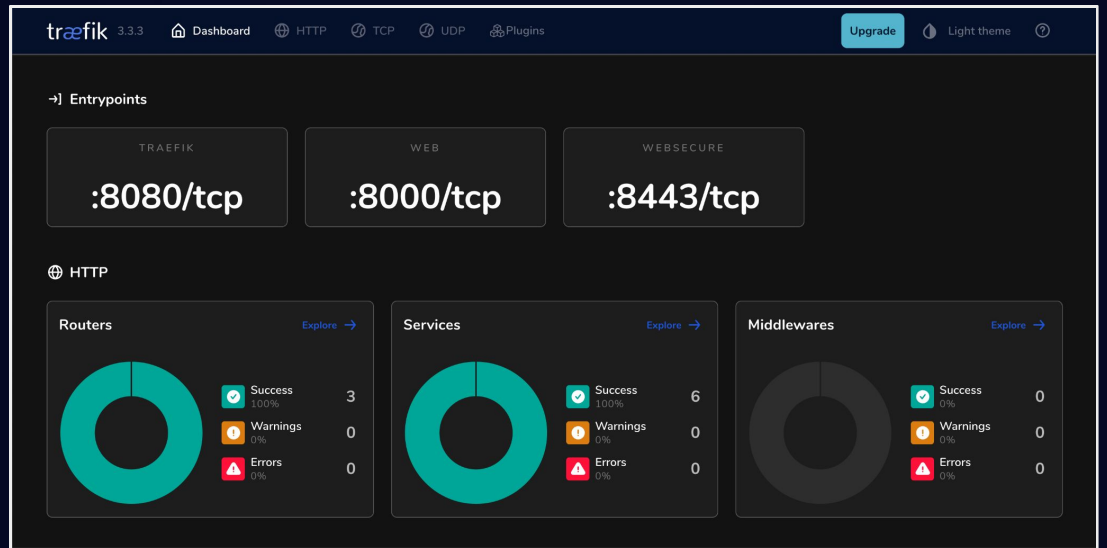
Gateway Controller

- Many Implementations
- Support Levels
- Conformance Tests
- Choose the best for you!

træfik proxy

A lightweight, Gateway Controller.

Open Source • Traffic Management • Security • Observability



Traefik Installation - Helm

- GatewayAPI CRD
- GatewayClass
- Gateway

```
$ helm upgrade --install --namespace traefik traefik
traefik/traefik --create-namespace --set
providers.kubernetesGateway.enabled=true
```

Traefik Installation - Helm

- GatewayAPI CRD
- GatewayClass
- Gateway opt-out

```
$ helm upgrade --install --namespace traefik traefik
traefik/traefik --create-namespace --set
providers.kubernetesGateway.enabled=true --set
gateway.enabled=false
```

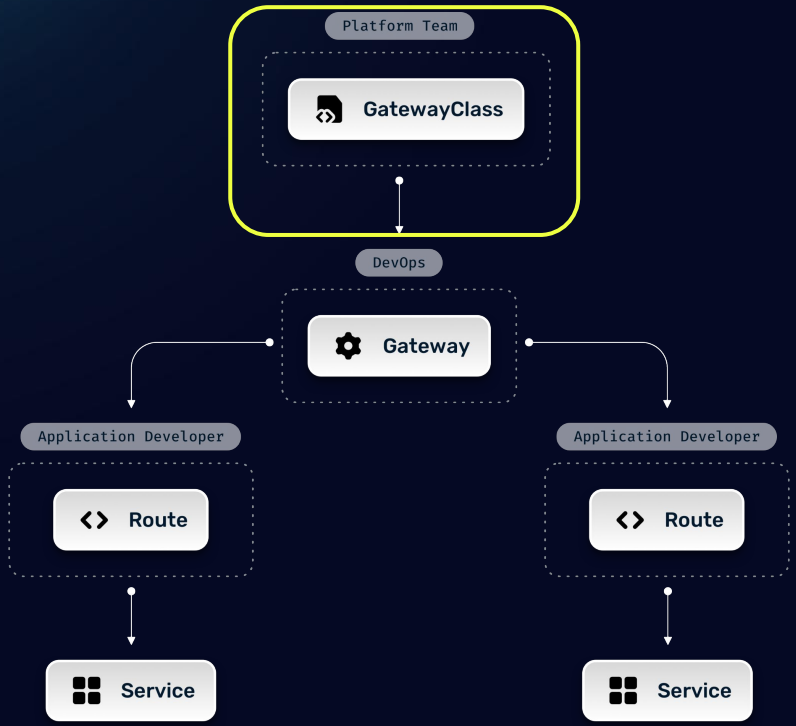
Traefik Installation - Helm

- GatewayAPI CRD
- GatewayClass
- Gateway opt-out

```
$ helm upgrade --install --namespace traefik traefik
traefik/traefik --create-namespace --set
providers.kubernetesGateway.enabled=true --set
gateway.enabled=false

traefik with docker.io/traefik:v3.3.5 has been
deployed successfully on traefik namespace !

$ kubectl -n traefik describe deployment traefik
...
      Args:
      --entryPoints.web.address=:8000/tcp
      --entryPoints.websecure.address=:8443/tcp
      --entryPoints.websecure.http.tls=true
      --providers.kubernetesgateway
...
```

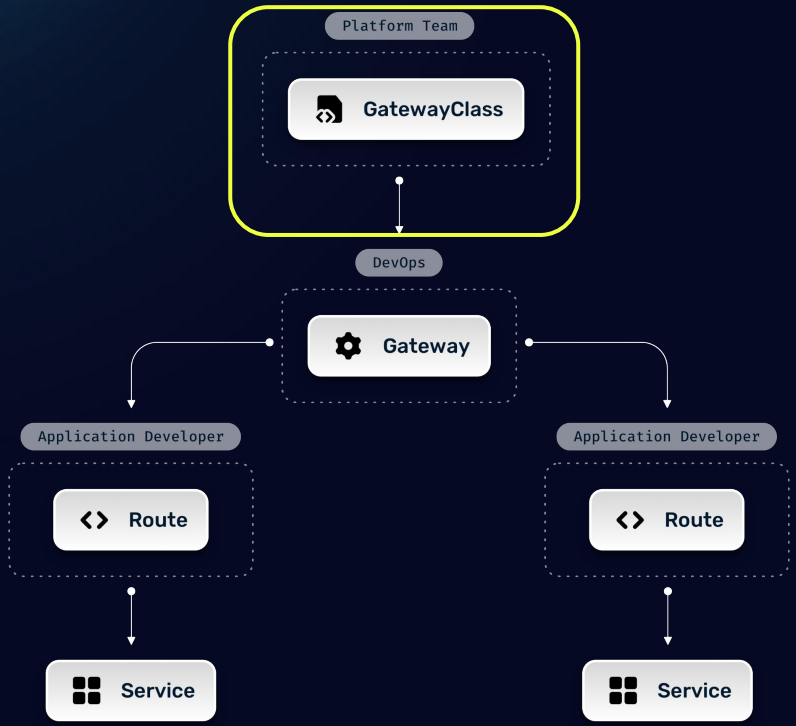
GatewayClass

- Similar to IngressClass
- Define Gateway Controller to use



GatewayClass

- Similar to IngressClass
- Define Gateway Controller to use
- Multi-Tenancy



GatewayClass

- Specifications:
  - `controllerName`

    Controller linked to the GatewayClass

```
$ kubectl get gatewayclasses.gateway.networking.k8s.io traefik -o yaml

apiVersion: gateway.networking.k8s.io/v1
kind: GatewayClass
metadata:
  name: traefik
spec:
  controllerName: traefik.io/gateway-controller
```

GatewayClass

- Specifications:
  - `controllerName`
  - `parametersRef`

    Controller Configuration Resource

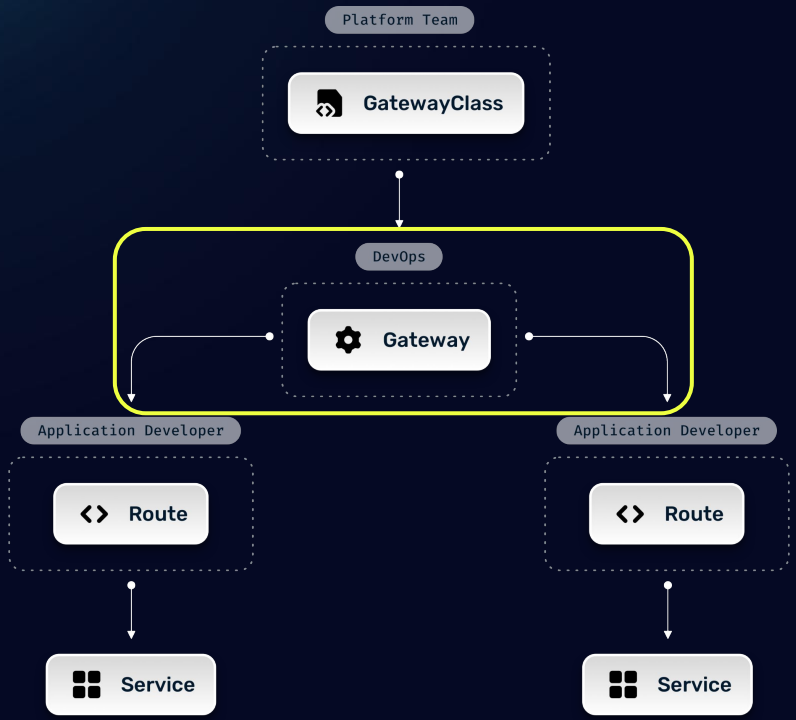
```
$ kubectl get
gatewayclasses.gateway.networking.k8s.io traefik -o
yaml

apiVersion: gateway.networking.k8s.io/v1
kind: GatewayClass
metadata:
  name: traefik
spec:
  controllerName: example.net/gateway-controller
  parametersRef:
       group: example.net
       kind: Config
       name: internet-gateway-config
```

DevOps Resources

Gateway, Listener

Gateway

- Entrypoints on the cluster
- Rules to reach the cluster
- Rules to expose the routes



Gateway

- Specifications
  - `GatewayClassName`

    GatewayClass used for the Gateway

```yaml
# 01-gateway.yaml
apiVersion: gateway.networking.k8s.io/v1
kind: Gateway
metadata:
  name: traefik-gateway
  namespace: traefik
spec:
  gatewayClassName: traefik
```

Gateway

- Specifications
  - `gatewayClassName`
  - `listeners`
    - Key Concept
    - List of entrypoints
    - How to reach the backends

```yaml
# 01-gateway.yaml
apiVersion: gateway.networking.k8s.io/v1
kind: Gateway
metadata:
  name: traefik-gateway
  namespace: traefik
spec:
  gatewayClassName: traefik
  listeners:
    - name: web
      port: 8000
      protocol: HTTP
      hostname: "example.com"
      allowedRoutes:
        namespaces:
          from: Same
```

Listener

- Specification
  - `port`

    Port to listen

```yaml
# 01-gateway.yaml
apiVersion: gateway.networking.k8s.io/v1
kind: Gateway
metadata:
  name: traefik-gateway
  namespace: traefik
spec:
  gatewayClassName: traefik
  listeners:
    - name: web
      port: 8000
      protocol: HTTP
      hostname: "example.com"
      allowedRoutes:
        namespaces:
          from: Selector
          selector:
            matchLabels:
              access: public
        kinds:
          - kind: HTTPRoute
```

Listener

- Specification
  - `port`
  - `protocol`
    - Protocol expected
    - HTTP, HTTPS
    - TCP/TLS, UDP (experimental)

```yaml
# 01-gateway.yaml
apiVersion: gateway.networking.k8s.io/v1
kind: Gateway
metadata:
  name: traefik-gateway
  namespace: traefik
spec:
  gatewayClassName: traefik
  listeners:
    - name: web
      port: 8000
      protocol: HTTP
      hostname: "example.com"
      allowedRoutes:
        namespaces:
          from: Selector
          selector:
            matchLabels:
              access: public
        kinds:
          - kind: HTTPRoute
```

Listener

- Specification
  - port
  - protocol
  - hostname

    Request HostName / SNI

```yaml
# 01-gateway.yaml
apiVersion: gateway.networking.k8s.io/v1
kind: Gateway
metadata:
  name: traefik-gateway
  namespace: traefik
spec:
  gatewayClassName: traefik
  listeners:
    - name: web
      port: 8000
      protocol: HTTP
      hostname: "example.com"
      allowedRoutes:
        namespaces:
          from: Selector
          selector:
            matchLabels:
              access: public
        kinds:
          - kind: HTTPRoute
```

Listener

- Specification
  - `port`
  - `protocol`
  - `hostname`
  - `hostname, allowedRoutes`

    Restriction on the attached routes

```yaml
# 01-gateway.yaml
apiVersion: gateway.networking.k8s.io/v1
kind: Gateway
metadata:
  name: traefik-gateway
  namespace: traefik
spec:
  gatewayClassName: traefik
  listeners:
    - name: web
      port: 8000
      protocol: HTTP
      hostname: "example.com"
      allowedRoutes:
        namespaces:
          from: Selector
          selector:
            matchLabels:
              access: public
        kinds:
          - kind: HTTPRoute
```

Listener - HTTPS / TLS

- Specification
  - `tls.mode`
    - Terminate

```yaml
# 01-gateway.yaml
apiVersion: gateway.networking.k8s.io/v1
kind: Gateway
metadata:
  name: traefik-gateway
  namespace: traefik
spec:
  gatewayClassName: traefik
  listeners:
    - name: websecure
      port: 8443
      protocol: HTTPS
      hostname: "secure.example.com"
      allowedRoutes:
        namespaces:
          from: Same
      tls:
        mode: Terminate
        certificateRefs:
        - kind: Secret
          name: example-cert
    - name: tls-passthrough
      port: 9444
      protocol: TLS
      hostname: "secure-sni.example.com"
      tls:
        mode: Passthrough
```

Listener - HTTPS / TLS

- Specification
  - `tls.mode`
    - Terminate
    - Passthrough (only TLS)

```yaml
# 01-gateway.yaml
apiVersion: gateway.networking.k8s.io/v1
kind: Gateway
metadata:
  name: traefik-gateway
  namespace: traefik
spec:
  gatewayClassName: traefik
  listeners:
    - name: websecure
      port: 8443
      protocol: HTTPS
      hostname: "secure.example.com"
      allowedRoutes:
        namespaces:
          from: Same
      tls:
        mode: Terminate
        certificateRefs:
        - kind: Secret
          name: example-cert
    - name: tls-passthrough
      port: 9444
      protocol: TLS
      hostname: "secure-sni.example.com"
      tls:
        mode: Passthrough
```

Listener - HTTPS / TLS

- Specification
  - `tls.mode`
  - `tls.certificateRefs`

    Only for TLS termination

```yaml
# 01-gateway.yaml
apiVersion: gateway.networking.k8s.io/v1
kind: Gateway
metadata:
  name: traefik-gateway
  namespace: traefik
spec:
  gatewayClassName: traefik
  listeners:
    - name: websecure
      port: 8443
      protocol: HTTPS
      hostname: "secure.example.com"
      allowedRoutes:
        namespaces:
          from: Same
      tls:
        mode: Terminate
        certificateRefs:
        - kind: Secret
          name: example-cert
    - name: tls-passthrough
      port: 9444
      protocol: TLS
      hostname: "secure-sni.example.com"
      tls:
        mode: Passthrough
```

Dev Resources

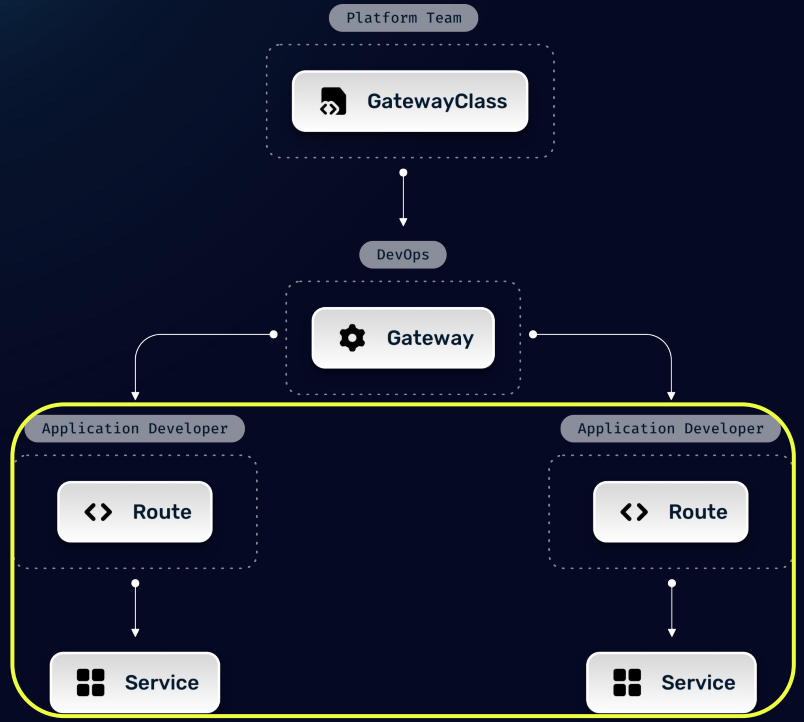
Routes, Filters

Routes

- Routing to Service
- Operations on the requests/responses

Routes

- Routing to Service
- Operations on the requests/responses
- Protocol oriented
  - HTTPRoute, GRPCRoute
  - TCPRoute/TLSRoute (experimental)
  - UDPRoute (experimental)



HTTPRoute

- Specification
  - `parentsRef`

    Gateways to expose the Route

```yaml
# 02-httproute.yaml
apiVersion: gateway.networking.k8s.io/v1
kind: HTTPRoute
metadata:
  name: who-httproute
  namespace: who
spec:
  parentRefs:
    - name: traefik-gateway
      kind: Gateway
      namespace: traefik
      sectionName: websecure
  hostnames:
    - "example.com"
  rules:
    - matches:
      - path:
          type: Exact
          value: /healthz
      backendRefs:
        - name: my-backend
          port: 8080
```

HTTPRoute

- Specification
  - `parentsRef`
  - `hostnames`

    List of hostnames to match

```yaml
# 02-httproute.yaml
apiVersion: gateway.networking.k8s.io/v1
kind: HTTPRoute
metadata:
  name: who-httproute
  namespace: who
spec:
  parentRefs:
    - name: traefik-gateway
      kind: Gateway
      namespace: traefik
      sectionName: websecure
  hostnames:
    - "example.com"
    - "*.example.com"
  rules:
    - matches:
      - path:
          type: Exact
          value: /healthz
      backendRefs:
        - name: my-backend
          port: 8080
```

HTTPRoute

- Specification
  - `parentsRef`
  - `hostnames`
  - `rules.matches`

Request Matchers
(path, header, method, queryParam)

```yaml
# 02-httproute.yaml
apiVersion: gateway.networking.k8s.io/v1
kind: HTTPRoute
metadata:
  name: who-httproute
  namespace: who
spec:
  parentRefs:
    - name: traefik-gateway
      kind: Gateway
      namespace: traefik
      sectionName: websecure
  hostnames:
    - "example.com"
  rules:
    - matches:
      - path:
          type: PathPrefix
          value: /api
        method: GET
        headers:
          - name: x-app-version
            value: "v2"
      - path:
          type: Exact
          value: /healthz
      backendRefs:
        - name: my-backend
          port: 8080
```

HTTPRoute

- Specification
  - `parentsRef`
  - `hostnames`
  - `rules.matches`
  - `rules.backendRefs`

    Backends to reach

```yaml
# 02-httproute.yaml
apiVersion: gateway.networking.k8s.io/v1
kind: HTTPRoute
metadata:
  name: who-httproute
  namespace: who
spec:
  parentRefs:
    - name: traefik-gateway
      kind: Gateway
      namespace: traefik
      sectionName: websecure
  hostnames:
    - "example.com"
  rules:
    - matches:
      - path:
          type: Exact
          value: /healthz
      backendRefs:
        - name: main-backend
          port: 8080
          weight: 80
        - name: canary-backend
          port: 8080
          weight: 20
```

HTTPRoute

- Specification
  - `parentsRef`
  - `hostnames`
  - `rules.matches`
  - `rules.backendRefs`
  - `rules.filters`

    Operations on requests/responses

```yaml
# 02-httproute.yaml
apiVersion: gateway.networking.k8s.io/v1
kind: HTTPRoute
metadata:
  name: who-httproute
  namespace: who
spec:
  parentRefs:
    - name: traefik-gateway
      kind: Gateway
      namespace: traefik
      sectionName: websecure
  hostnames:
    - "example.com"
  rules:
    - matches:
      - path:
          type: Exact
          value: /healthz
      backendRefs:
        - name: my-backend
          port: 8080
      filters:
        - type: RequestHeaderModifier
          requestHeaderModifier:
            add:
              - name: x-added-header
                value: added-by-gateway
```

HTTP Filters

- **Core Filters**
  Filters the Controllers MUST provide

```yaml
# 02-httproute.yaml
apiVersion: gateway.networking.k8s.io/v1
kind: HTTPRoute
metadata:
  name: who-httproute
  namespace: traefik
spec:
  parentRefs:
    - name: traefik-gateway
      kind: Gateway
      namespace: traefik
      sectionName: websecure
  hostnames:
    - "example.com"
  rules:
    - matches:
      - path:
          type: Exact
          value: /healthz
      backendRefs:
        - name: my-backend
          port: 8080
      filters:
        - type: ResponseHeaderModifier
          responseHeaderModifier:
            add:
            - name: X-Header-Add-1
              value: header-add-1
```

HTTP Filters

- **Core Filters**
  Filters the Controllers MUST provide
- **Extended Filters**
  Filters the Controllers CAN provide

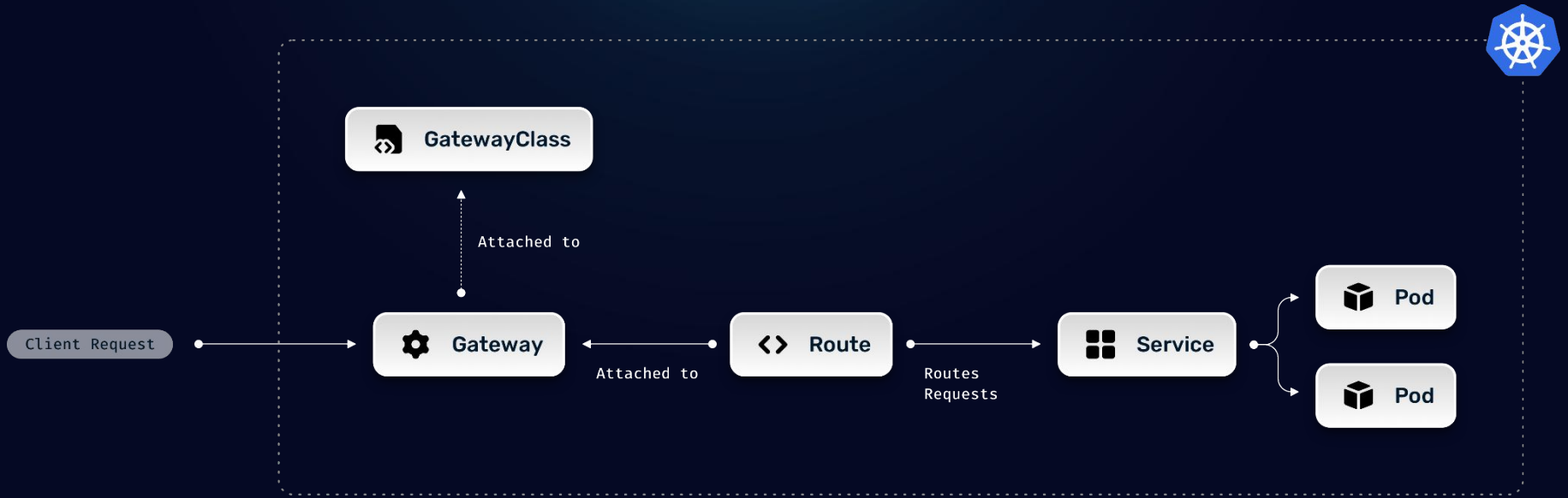
```yaml
# 02-httproute.yaml
apiVersion: gateway.networking.k8s.io/v1
kind: HTTPRoute
metadata:
  name: who-httproute
  namespace: traefik
spec:
  parentRefs:
    - name: traefik-gateway
      kind: Gateway
      namespace: traefik
      sectionName: websecure
  hostnames:
    - "example.com"
  rules:
    - matches:
      - path:
          type: Exact
          value: /healthz
      backendRefs:
        - name: my-backend
          port: 8080
      filters:
        - type: URLRewrite
          urlRewrite:
            hostname: "backend.svc.cluster.local"
```

HTTP Filters

- **Core Filters**
  Filters the Controllers MUST provide
- **Extended Filters**
  Filters the Controllers CAN provide
- **ExtensionRef Filters**
  Additional filters

```yaml
# 02-httproute.yaml
apiVersion: gateway.networking.k8s.io/v1
kind: HTTPRoute
metadata:
  name: who-httproute
  namespace: traefik
spec:
  parentRefs:
    - name: traefik-gateway
      kind: Gateway
      namespace: traefik
      sectionName: websecure
  hostnames:
    - "example.com"
  rules:
    - matches:
      - path:
          type: Exact
          value: /healthz
      backendRefs:
        - name: my-backend
          port: 8080
      filters:
        - type: ExtensionRef
          extensionRef:
            group: traefik.io
            kind: Middleware
            name: rate-limit
```

To sum-up

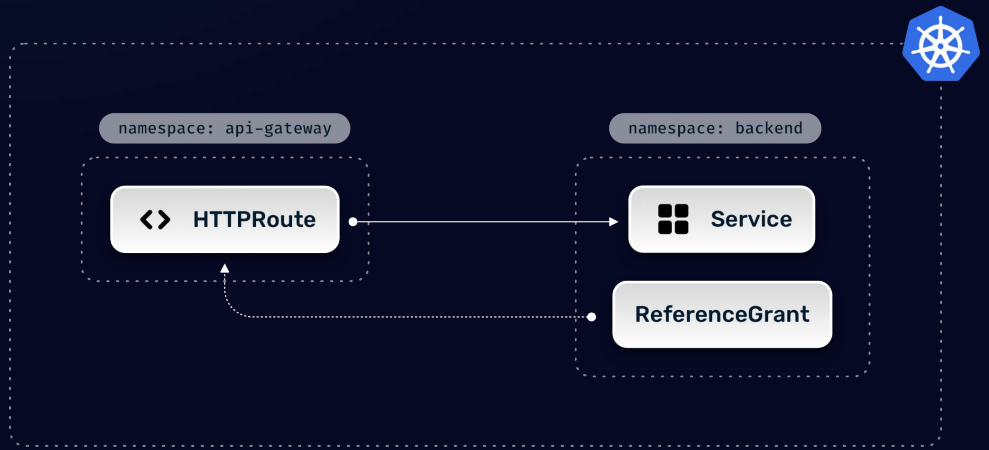

GatewayClass
Attached to
Client Request
Gateway
Attached to
Route
Routes
Requests
Service
Pod
Pod

Expose your first HTTPRoute!

Let’s dig deeper!

ReferenceGrant

- Cross Namespace Reference 🎉



ReferenceGrant

- **Cross Namespace Reference** 🎉
- Route -> Service

```yaml
# 03-ref-grant.yaml
apiVersion: gateway.networking.k8s.io/v1beta1
kind: ReferenceGrant
metadata:
  name: allow-prod-traffic
  namespace: targeted-ns
spec:
  from:
  - group: gateway.networking.k8s.io
    kind: HTTPRoute
    namespace: prod
  to:
  - kind: Service
    group: ""
```

ReferenceGrant

- **Cross Namespace Reference** 🎉
- Route -> Service
- Gateway -> TLS Secret

```yaml
# 03-ref-grant.yaml
apiVersion: gateway.networking.k8s.io/v1beta1
kind: ReferenceGrant
metadata:
  name: tls-termination
  namespace: route-ns
spec:
  from:
  - group: gateway.networking.k8s.io
    kind: Gateway
    namespace: traefik
  to:
  - kind: Secret
    group: ""
```

ReferenceGrant

- **Cross Namespace Reference** 🎉
- Route -> Service
- Gateway -> TLS Secret

⚠️ Gateway -> Route cross namespace using allowedRoutes

```yaml
# 03-ref-grant.yaml
apiVersion: gateway.networking.k8s.io/v1beta1
kind: ReferenceGrant
metadata:
  name: tls-termination
  namespace: route-ns
spec:
  from:
  - group: gateway.networking.k8s.io
    kind: Gateway
    namespace: traefik
  to:
  - kind: Secret
    group: ""
```

ReferenceGrant

- Deployed in the child object namespace

```yaml
# 03-ref-grant.yaml
apiVersion: gateway.networking.k8s.io/v1beta1
kind: ReferenceGrant
metadata:
  name: allow-prod-traffic
  namespace: targeted-ns
spec:
  from:
  - group: gateway.networking.k8s.io
    kind: HTTPRoute
    namespace: prod
  to:
  - kind: Service
    group: ""
```

ReferenceGrant

- Deployed in the child object namespace
- Specifications
  - From
    Kind of parent object + namespace

```yaml
# 03-ref-grant.yaml
apiVersion: gateway.networking.k8s.io/v1beta1
kind: ReferenceGrant
metadata:
  name: allow-prod-traffic
  namespace: targeted-ns
spec:
  from:
  - group: gateway.networking.k8s.io
    kind: HTTPRoute
    namespace: prod
  to:
  - kind: Service
    group: ""
```

ReferenceGrant

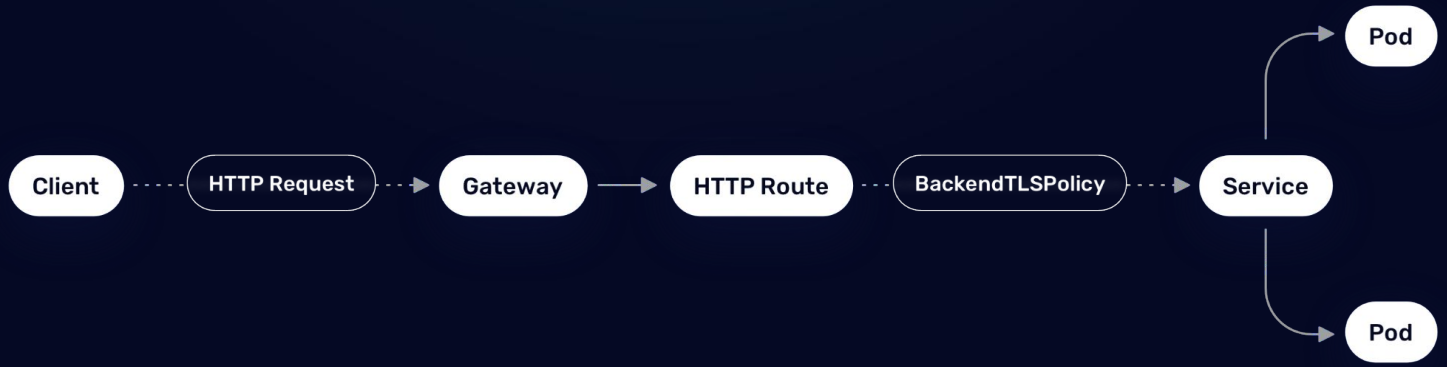
- Deployed in the targeted namespace
- Specifications
  - From
  - To

    Kind of child object (+ name)

```yaml
# 03-ref-grant.yaml
apiVersion: gateway.networking.k8s.io/v1beta1
kind: ReferenceGrant
metadata:
  name: allow-prod-traffic
  namespace: targeted-ns
spec:
  from:
  - group: gateway.networking.k8s.io
    kind: HTTPRoute
    namespace: prod
  to:
  - kind: Service
    group: ""
    name: my-svc
```

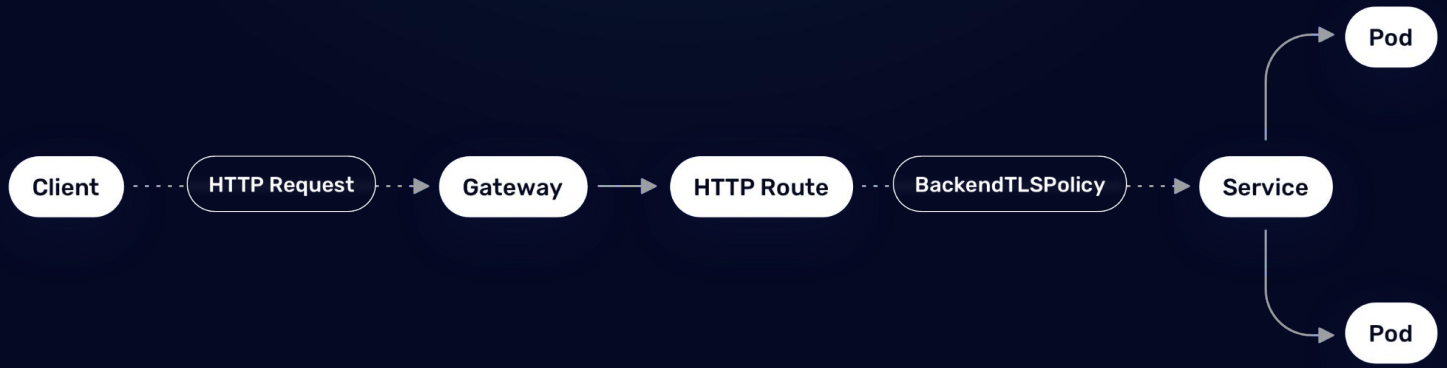
BackendTLSPolicy

- **TLS Termination on the backend…**



BackendTLSPolicy

- **TLS Termination on the backend… Keeping HTTP capabilities!**



BackendTLSPolicy

- Specifications
  - `validation.hostname`
    Request SNI

```yaml
# 04-backend-tls-policy.yaml
kind: BackendTLSPolicy
apiVersion: gateway.networking.k8s.io/v1alpha3
metadata:
  name: whoami-policy
  namespace: traefik
spec:
  validation:
    hostname: whoami.docker.localhost
    caCertificateRefs:
      - group: ""
        kind: ConfigMap
        name: internal-ca
  targetRefs:
    - group: ""
      kind: Service
      name: whoami-tls
```

BackendTLSPolicy

- Specifications
  - `validation.hostname`
  - `validation.caCertificateRefs`
    CA Root backend certificates

```yaml
# 04-backend-tls-policy.yaml
kind: BackendTLSPolicy
apiVersion: gateway.networking.k8s.io/v1alpha3
metadata:
  name: whoami-policy
  namespace: traefik
spec:
  validation:
    hostname: whoami.docker.localhost
    caCertificateRefs:
      - group: ""
        kind: ConfigMap
        name: internal-ca
  targetRefs:
    - group: ""
      kind: Service
      name: whoami-tls
```

BackendTLSPolicy

- Specifications
  - `validation.hostname`
  - `validation.caCertificateRefs`
  - `targetRefs`

    Services/Pods to connect to

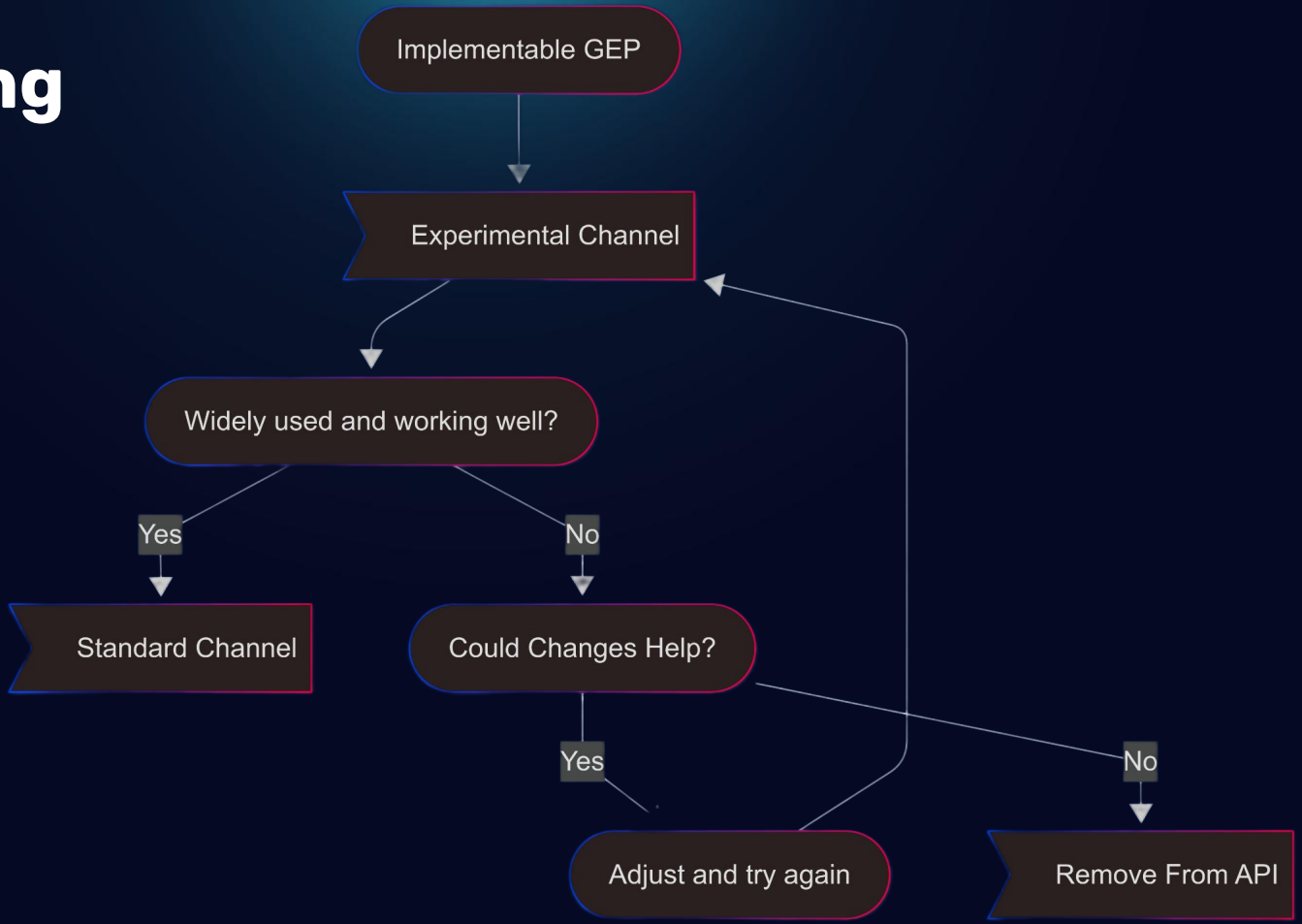
```yaml
# 04-backend-tls-policy.yaml
kind: BackendTLSPolicy
apiVersion: gateway.networking.k8s.io/v1alpha3
metadata:
  name: whoami-policy
  namespace: traefik
spec:
  validation:
    hostname: whoami.docker.localhost
    caCertificateRefs:
      - group: ""
        kind: ConfigMap
        name: internal-ca
  targetRefs:
    - group: ""
      kind: Service
      name: whoami-tls
```

Everything together!

What’s Next?

Versioning

Gateway Enhancement Proposal



Current Limitations

- mTLS w/ backend servers: GEP-3155
- Stickiness: GEP-1619
- CORS filter: GEP 1767
- BackendTLSPolicy: GEP-1897
- Granular observability

More experiments 🧪🧪🧪

v1.3.0 RC1

- CORS filters, XListenerSets (Standard Mechanism to Merge Gateways), and XBackendTrafficPolicy (Retry Budgets) → Experimental Channel
- Percentage-based request mirroring → Standard Channel
- Improvements to OverlappingTLSConfig & BackendTLSPolicy
- Upgrade to Kubernetes v1.32 and Go v1.24
- Documentation improvements

→ Full Changelog

Thank you!

emilevauge

nmengin

træfiklabs