KubeCon CloudNativeCon India 2026

Zero Trust for Fintech: Building Secure Banking Infrastructure With Cilium

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Topics

- Zero Trust Principal
- Banking Use Case
- Cilium Overview
- How Cilium Implement Zero Trust
- Key Takeaways

Zero Trust Principal

> ***"Never Trust, Always Verify."***
>
> *— NIST SP 800-207, Zero Trust Architecture (2020)*

No Implicit Trust

Network location does not grant access.

Always Authenticate

Every request, every session, every time.

Continuous Verification

Trust is re-evaluated, not granted once.

Banking Use Case

Three forces pushing every bank toward Zero Trust

Regulation

- PCI-DSS v4.0 — segmentation, encryption, logging
- Local rules — POJK, RBI, MAS, PSD2
- ISO 27001 and SOC 2 access-control expectations

Threat Model

- Lateral movement after a compromised pod
- Supply-chain risk in container images and CI
- Insider threat from privileged operators

Cloud-Native Reality

- Pods rescheduled across nodes every minute
- Hundreds of microservices, multi-tenant clusters
- Static IP allow-lists do not scale or stay correct

Cilium Overview

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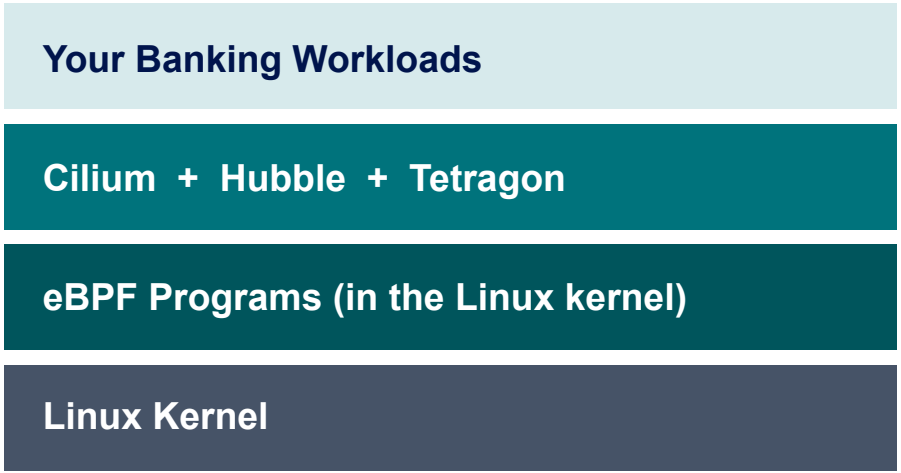
Networking, security, and observability for Kubernetes built on eBPF



- **CNCF** — Graduated project (2023)
- **L3 → L7** — Identity, IP, port, HTTP, Kafka, gRPC, DNS
- **Kernel** — Enforcement, not sidecar proxies

How Cilium Implement Zero Trust

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Identity
who am I?

K8s resources: Pod, Node, Cluster, Kube-apiserver

Network Policy
What am allowed to access?

Firewall on identity, FQDN, DNS, and HTTP / L7

Encryption
Who can read me?

WireGuard / IPsec + identity-based mTLS

Observability
What just happened?

Hubble — every flow, every drop, every L7 verb

Runtime Security
What's actually running inside the pod?

Tetragon — process, file and syscall events

Cilium Resource as Identity

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Cilium translates Kubernetes objects into a numeric security identity — policy follows the label, not the IP.

Pod

Every pod derives identity from labels (app, tier, env). Reschedules do not change it.

```
id:1234 -> app=payment,env=production
```

Node

Node has its own identity. Used for host firewall policy on the kubelet.

```
reserved:host
reserved:remote-node
```

Cluster

In Cluster Mesh, each cluster carries an ID. Cross-cluster policy, no leaked topology.

```
cluster: jakarta  ↔  cluster: mumbai
```

kube-apiserver

A reserved identity for traffic to and from the Kubernetes API server itself.

```
reserved:kube-apiserver
```

Cilium Firewall / Network Policy

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One policy language all in CiliumNetworkPolicy from L3, L4 and L7. By default, block all, and allow defined rules.

Identity (L3 / L4)

Control which identity a pod can reach use toEndpoints / fromEndpoints

```
toEndpoints:
- matchLabels:
    k8s:io.kubernetes.pod.namespace: payment
    app: payment
toPorts:
- ports: [{ port: "8080" }]
```

FQDN (egress allow-list)

Pods may only reach approved external domains

```
toFQDNs:
- matchName: "api.swift.com"
- matchPattern: "*.cncf.com"
toPorts:
- ports: [{ port: "443" }]
```

CIDR

Control which CIDR a pod can reach

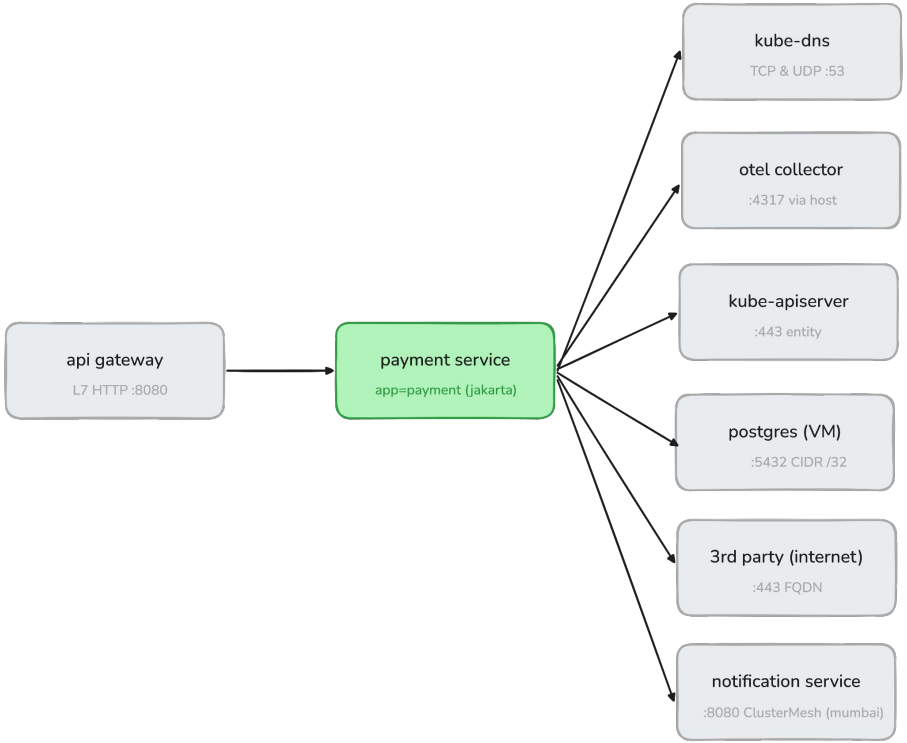
```
toCIDRSet:
- cidr:172.21.89.10/32
toPorts:
- ports: [{ port: "5432" }]
```

HTTP / L7 (verb · path · header)

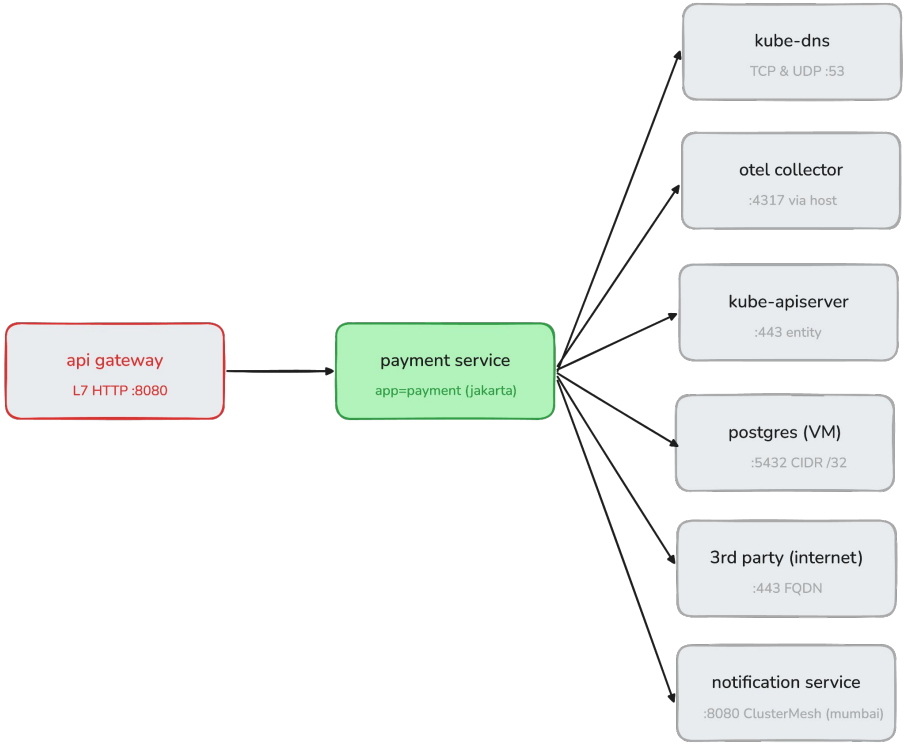
Only GET /balance and POST /transfer

```
toPorts:
- ports: [{ port: "8080" }]
  rules:
    http:
    - { method: "GET",  path: "/balance"  }
    - { method: "POST", path: "/transfer" }
```

Cilium Firewall / Network Policy

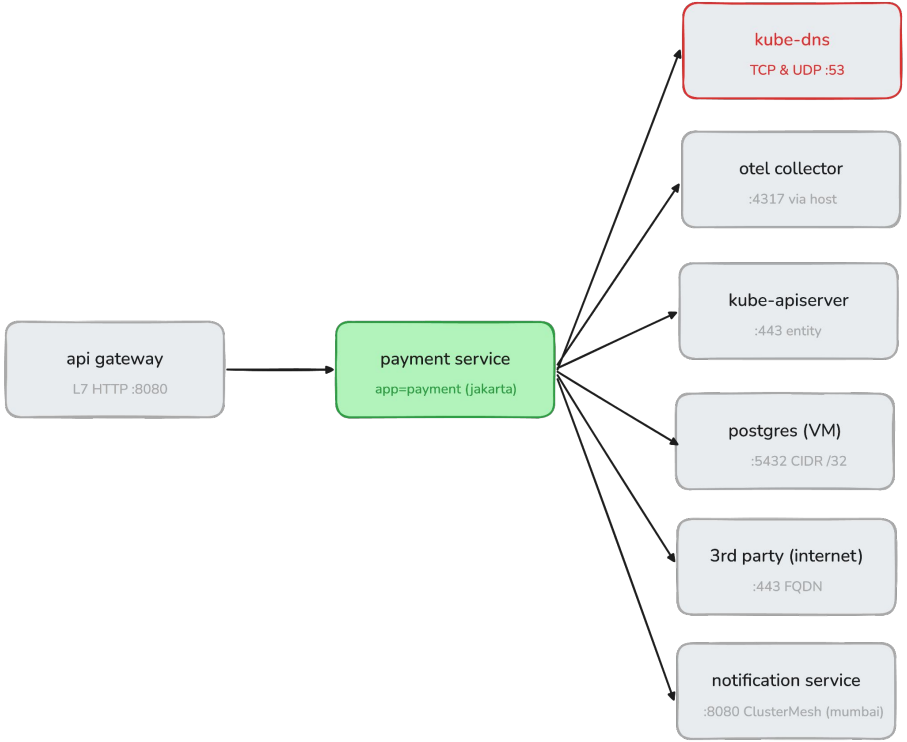


Cilium Firewall / Network Policy



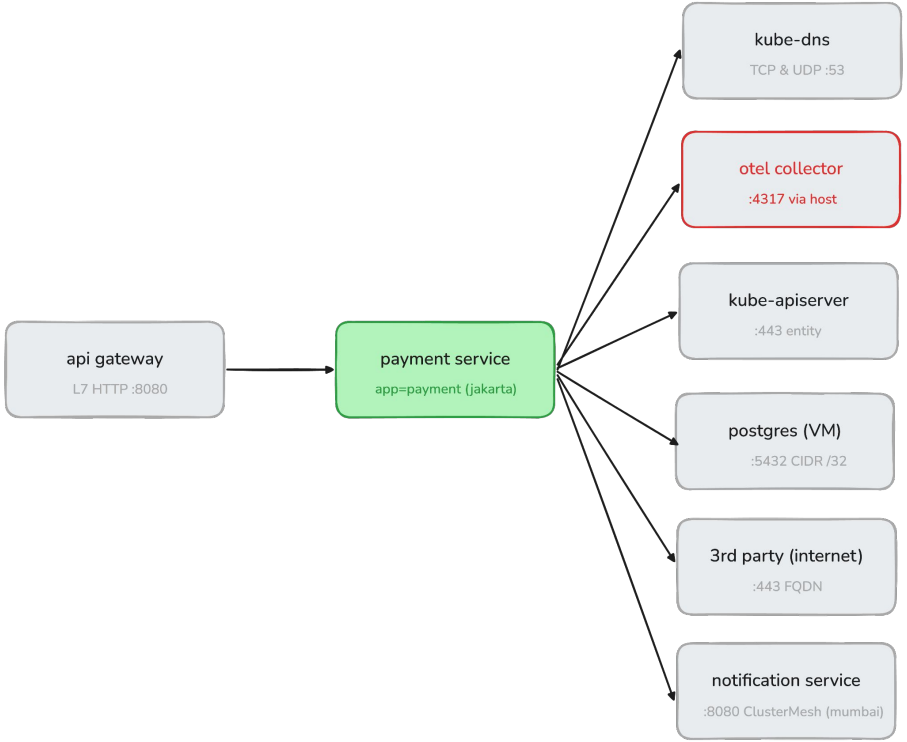

```
....
ingress:
  # API gateway -> payment, L7 HTTP only
  - fromEndpoints:
      - matchLabels:
          io.kubernetes.pod.namespace:
ingress-gateway
          app: api-gateway
    toPorts:
      - ports:
          - port: "8080"
            protocol: TCP
        rules:
          http:
            - method: "GET"
              path: "/balance"
            - method: "POST"
              path: "/transfer"
....
```

Cilium Firewall / Network Policy



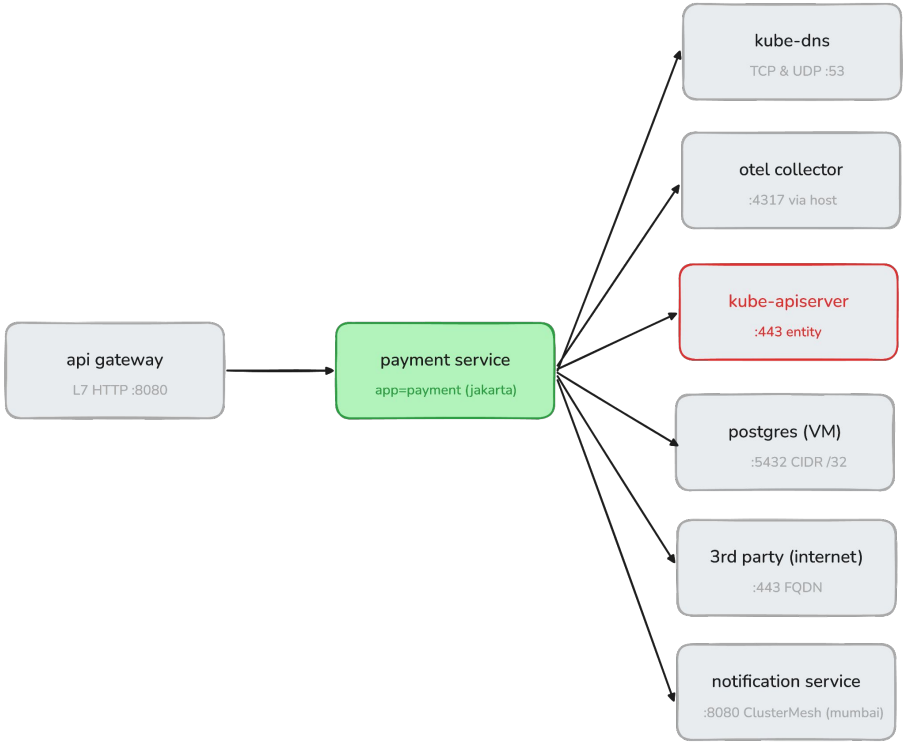

```
....
egress:
  # DNS - REQUIRED, otherwise toFQDNs below can't
resolve
  - toEndpoints:
      - matchLabels:
          io.kubernetes.pod.namespace: kube-system
          k8s-app: kube-dns
    toPorts:
      - ports:
          - port: "53"
            protocol: ANY
        rules:
          dns:
            - matchPattern: "*"
....
```

Cilium Firewall / Network Policy




```
....
egress:
....
  # Node-local OpenTelemetry
collector (DaemonSet)
  - toEntities:
      - host
    toPorts:
      - ports:
          - port: "4317"
            protocol: TCP
....
```

Cilium Firewall / Network Policy




```
....
  # Kubernetes API server
  - toEntities:
      - kube-apiserver
    toPorts:
      - ports:
          - port: "443"
            protocol: TCP
....
```

Cilium Firewall / Network Policy

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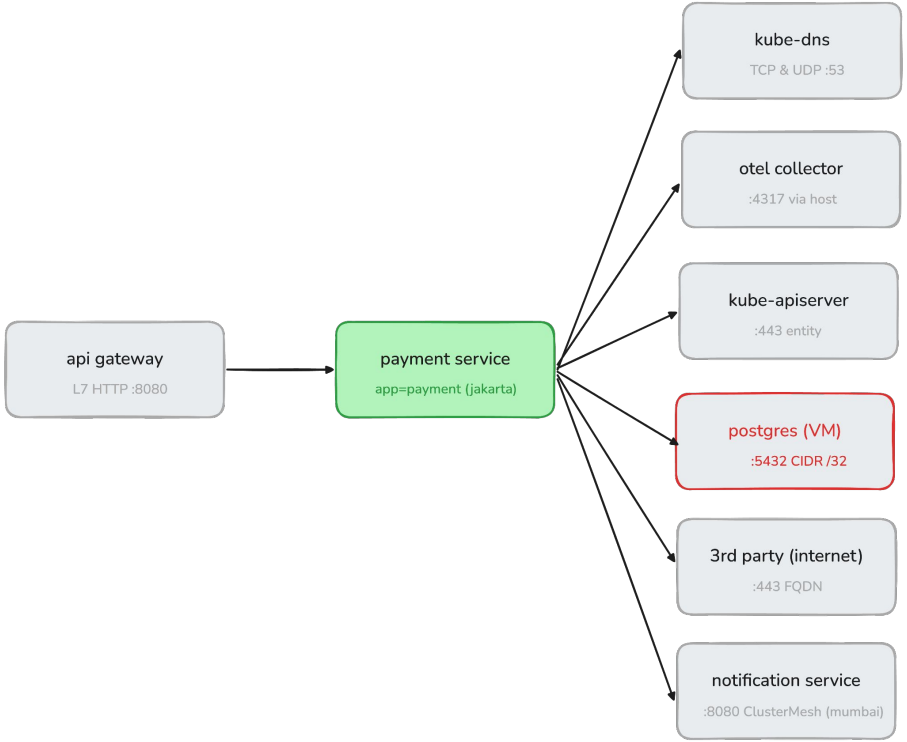
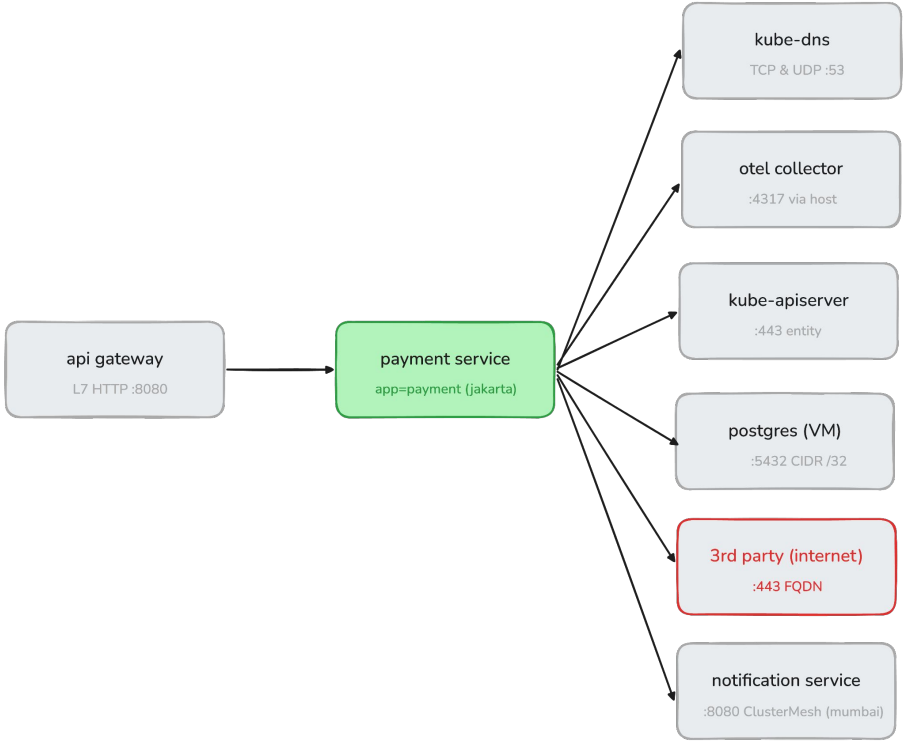


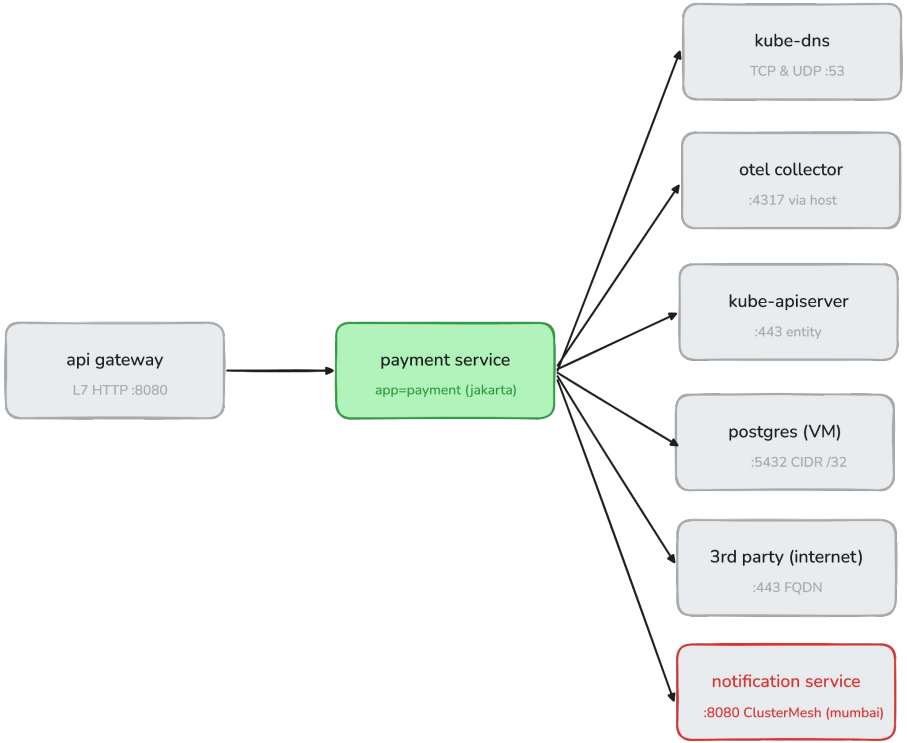

```
....
  # CIDR postgres (VM / managed service)
  - toCIDRSet:
      - cidr: 10.123.123.10/32
      - cidr: 10.123.123.20/32
    toPorts:
      - ports:
          - port: "5432"
            protocol: TCP
....
```

Cilium Firewall / Network Policy




```
....
  # FQDN 3rd party via internet
  - toFQDNs:
      - matchName: "api.abc123.com"
      - matchPattern: "*.cncf.io"
    toPorts:
      - ports:
          - port: "443"
            protocol: TCP
....
```

Cilium Firewall / Network Policy




```
....
egress:
....
  # Cross-cluster via ClusterMesh
  - toEndpoints:
      - matchLabels:
          io.cilium.k8s.policy.cluster: mumbai
          io.kubernetes.pod.namespace: notif
          app: notif
    toPorts:
      - ports:
          - port: "8080"
            protocol: TCP
....
```

Cilium Encryption

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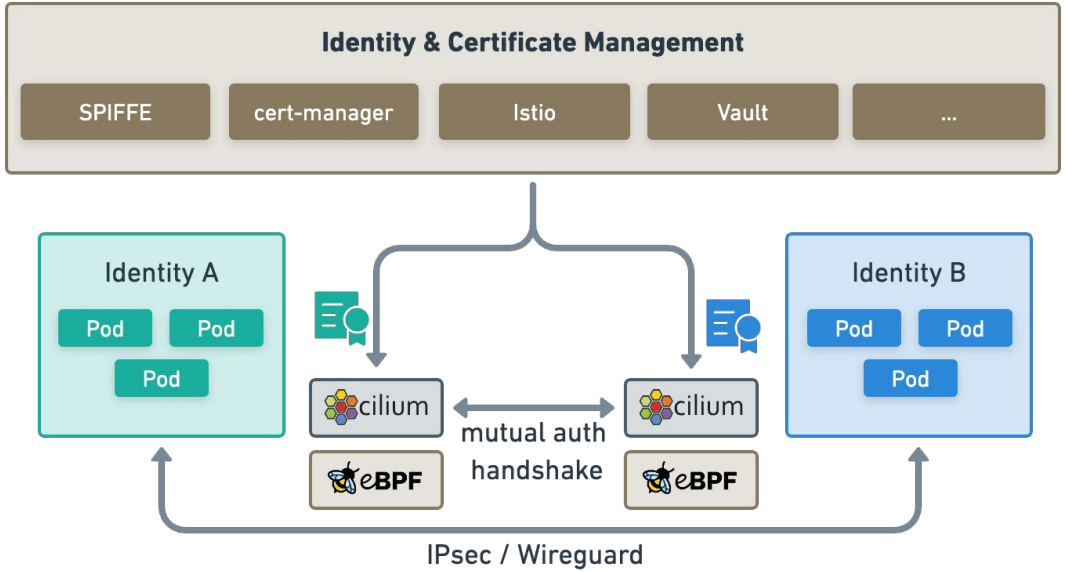
Encrypt the wire AND the workload. Transparent transport + identity-based mTLS.




```yaml
ingress:
  - fromEndpoints:
      - matchLabels:
          App: service-a
    authentication:
      mode: "required"
    toPorts:
      - ports:
          - port: "8080"
            protocol: TCP
```

Use both: WireGuard / IPsec for the wire, mTLS for workload identity proof.

Cilium Audit & Observability

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Hubble shows every flow, every drop, every L7 verb. Captured from eBPF, in the kernel.

```
$ hubble observe --namespace banking --verdict DROPPED

Jun 14 09:12:03  DROP  pay-svc → ledger-db:5432  TCP  policy-denied
Jun 14 09:12:04  DROP  web-fe → 198.51.100.7:80  TCP  policy-denied
Jun 14 09:12:06  DROP  fraud-svc → ledger-db:5432  TCP  no L7 match
Jun 14 09:12:08  DROP  dev-pod → ledger-db:5432  TCP  identity not
allowed
```

What the audit team gets

Forensic replay

Every dropped packet, source, destination, and reason — for any incident window.

Continuous evidence

Export to Prometheus, OpenTelemetry, or SIEM. Same data for SRE and audit.

Live service map

Hubble UI renders the live graph — invaluable for scope-of-PCI reviews.

Cilium Runtime Security

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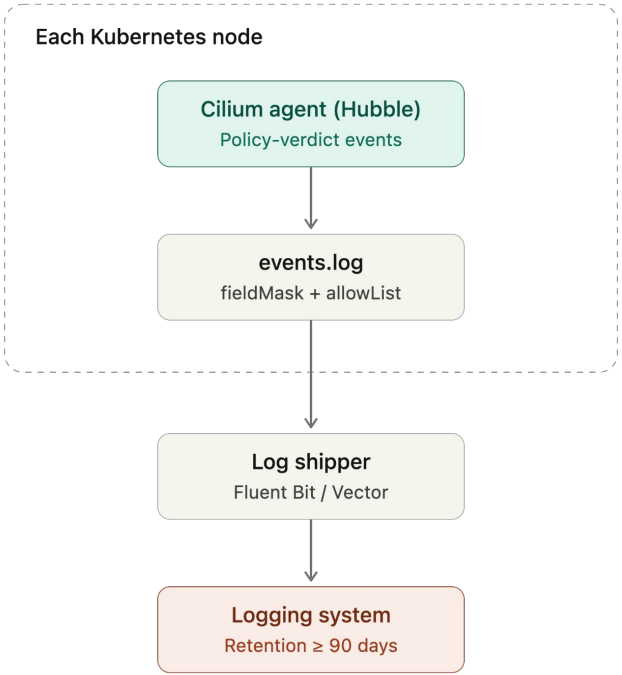
*Network policy stops bad packets. **Tetragon** stops bad behavior inside the pod itself.*

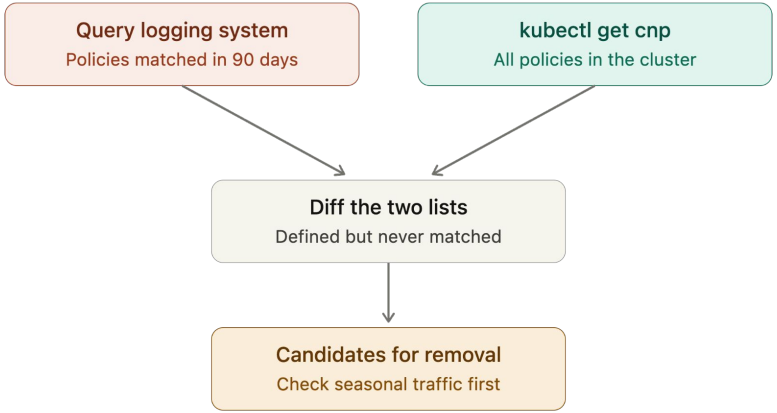
Observe and enforce, in the kernel

- **Process execution**
  Detect every exec — shell, curl, kubectl in prod pods.
- **File integrity**
  Alert on read or write of secrets paths and keystores.
- **Syscall tracing**
  Capture ptrace, raw sockets, capability use.
- **Process-aware network**
  Attribute every flow to a specific binary and PID.
- **Inline enforcement**
  SIGKILL or override syscalls when a policy matches.

```
$ tetra getevents -o compact

[exec]  payment-7d9  bash -c "..."
  parent: kubectl exec  user: root

[file]  ledger-pg  open() /etc/ssl/pg.key
  binary: cat   policy: secret-files   BLOCK

[net]   web-3kf2  connect 185.220.101.42:443
  binary: /tmp/.x   policy: tor-exit   SIGKILL

[cap]   dev-pod  ptrace(PEEKTEXT) pid=1421
  binary: gdb   policy: ptrace-deny
```

Evaluate Policy

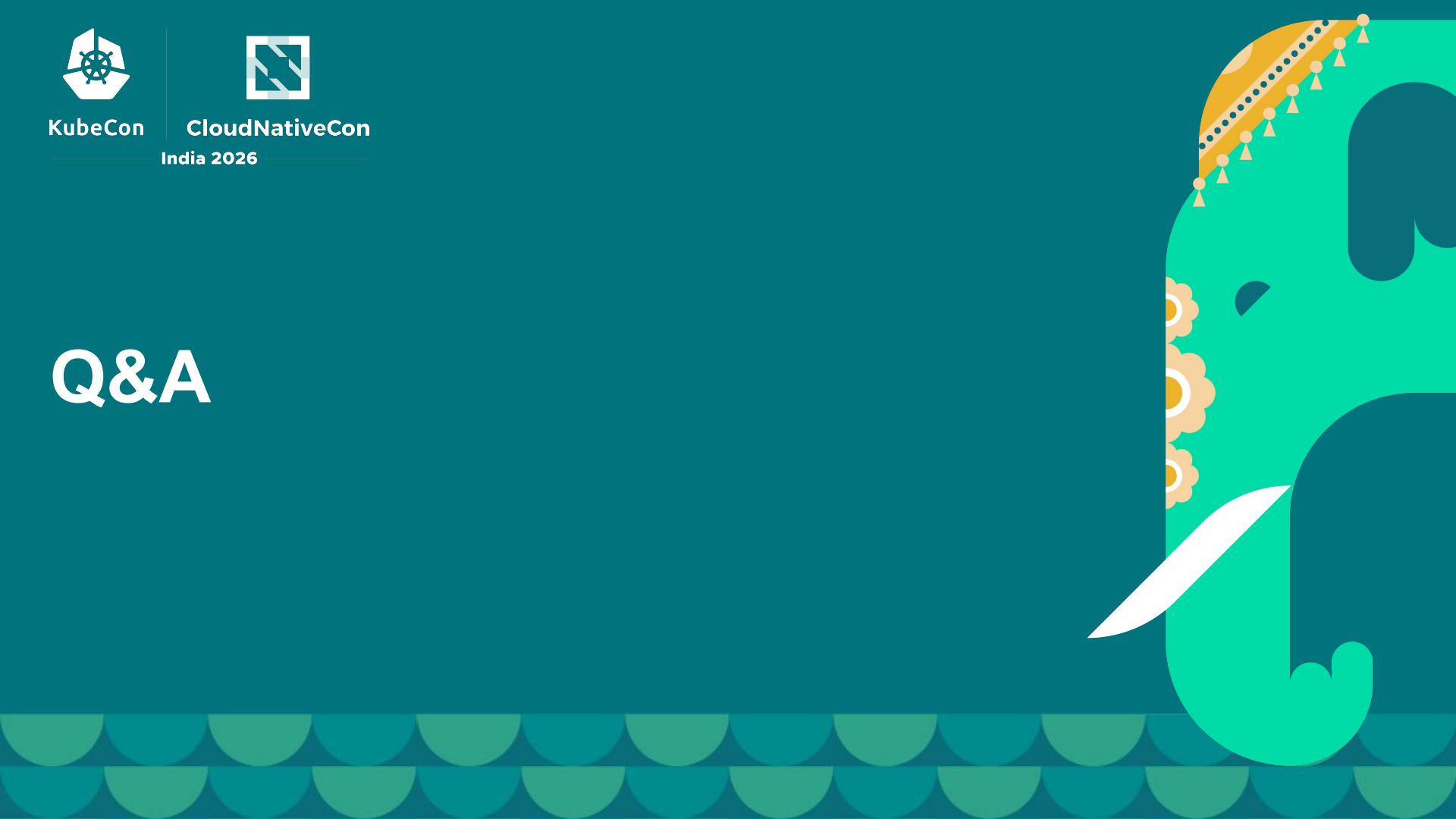




Key Takeaways

Zero Trust is a practice, not a product. Cilium gives you the pieces.

1. **Identity, not IP**
   K8s labels become identity. Policy travels with the workload.
2. **Policy at every layer**
   Identity, FQDN, DNS, and L7 one CRD, one control plane.
3. **Encrypt wire AND workload**
   WireGuard / IPsec for transport; mTLS for mutual identity proof.
4. **Observability is evidence**
   Hubble flow logs serve both the SRE and the auditor.
5. **Runtime closes the loop**
   Tetragon catches what bypasses the network in real time.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