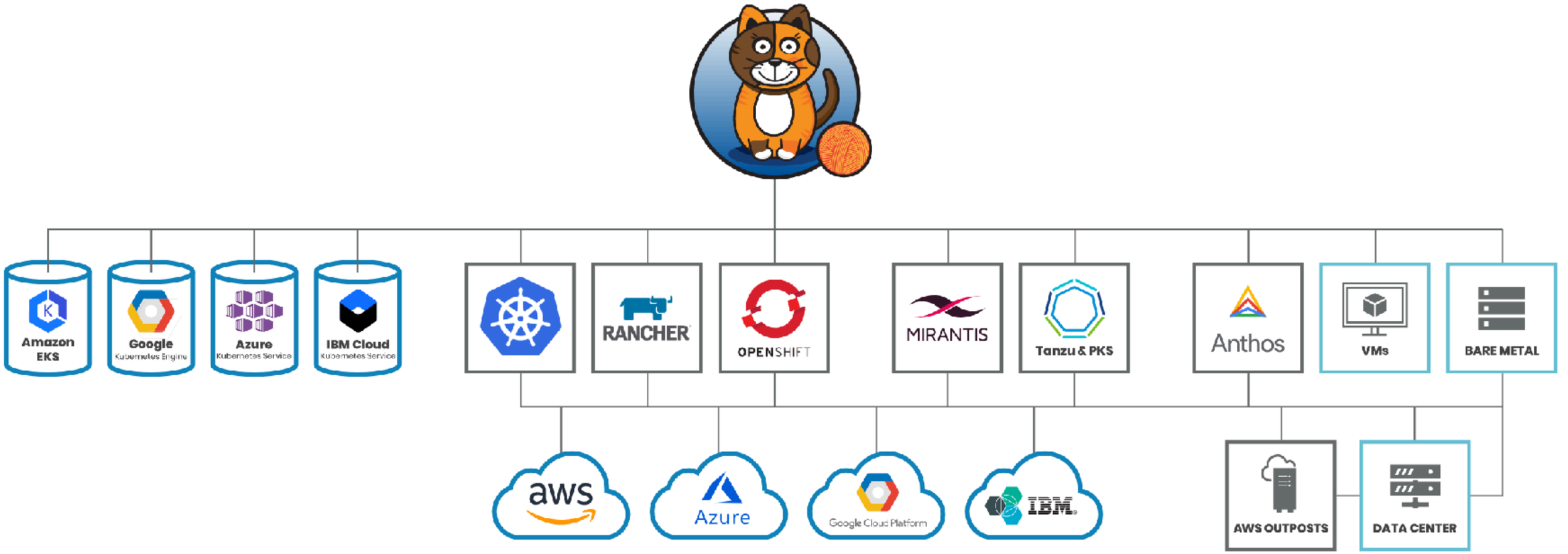
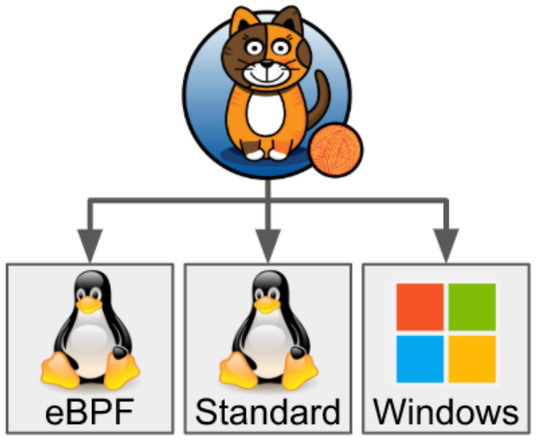
Calico изнутри

Архитектура и возможности

Александров Андрей

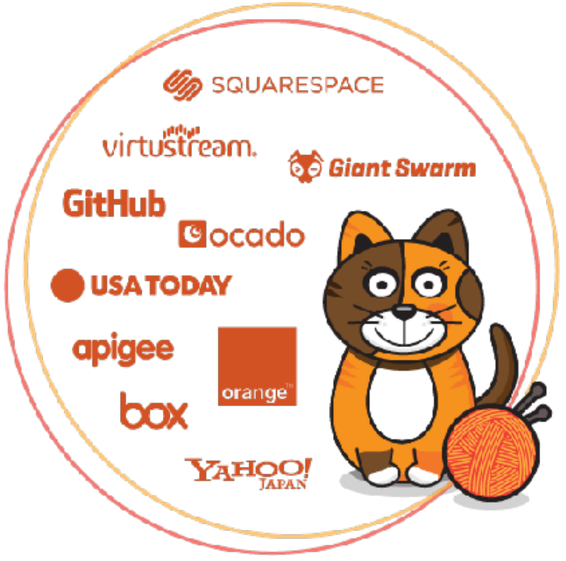
Industry Standard for Kubernetes Network Security





Best Practices

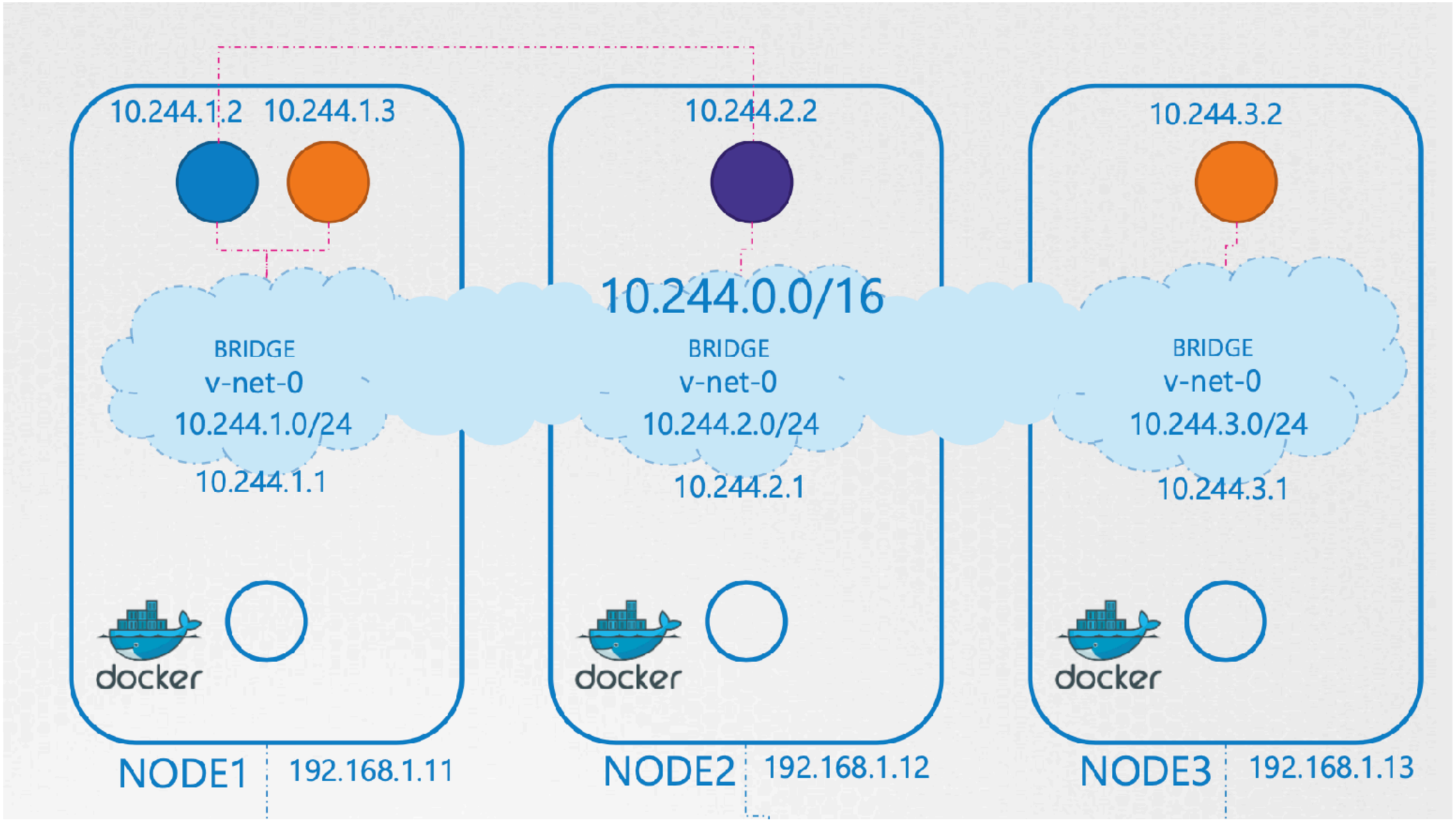
- Adopt zero trust network security model
- Infrastructure as code



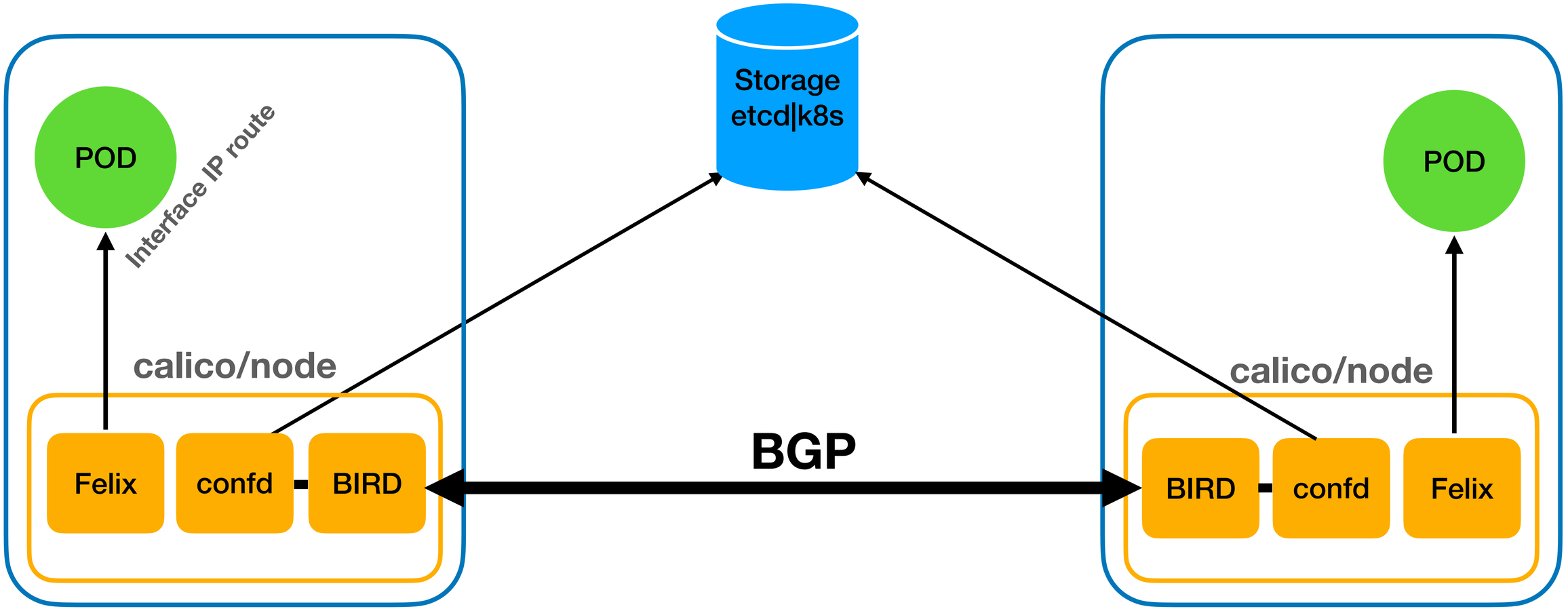
Kubernetes Network Model

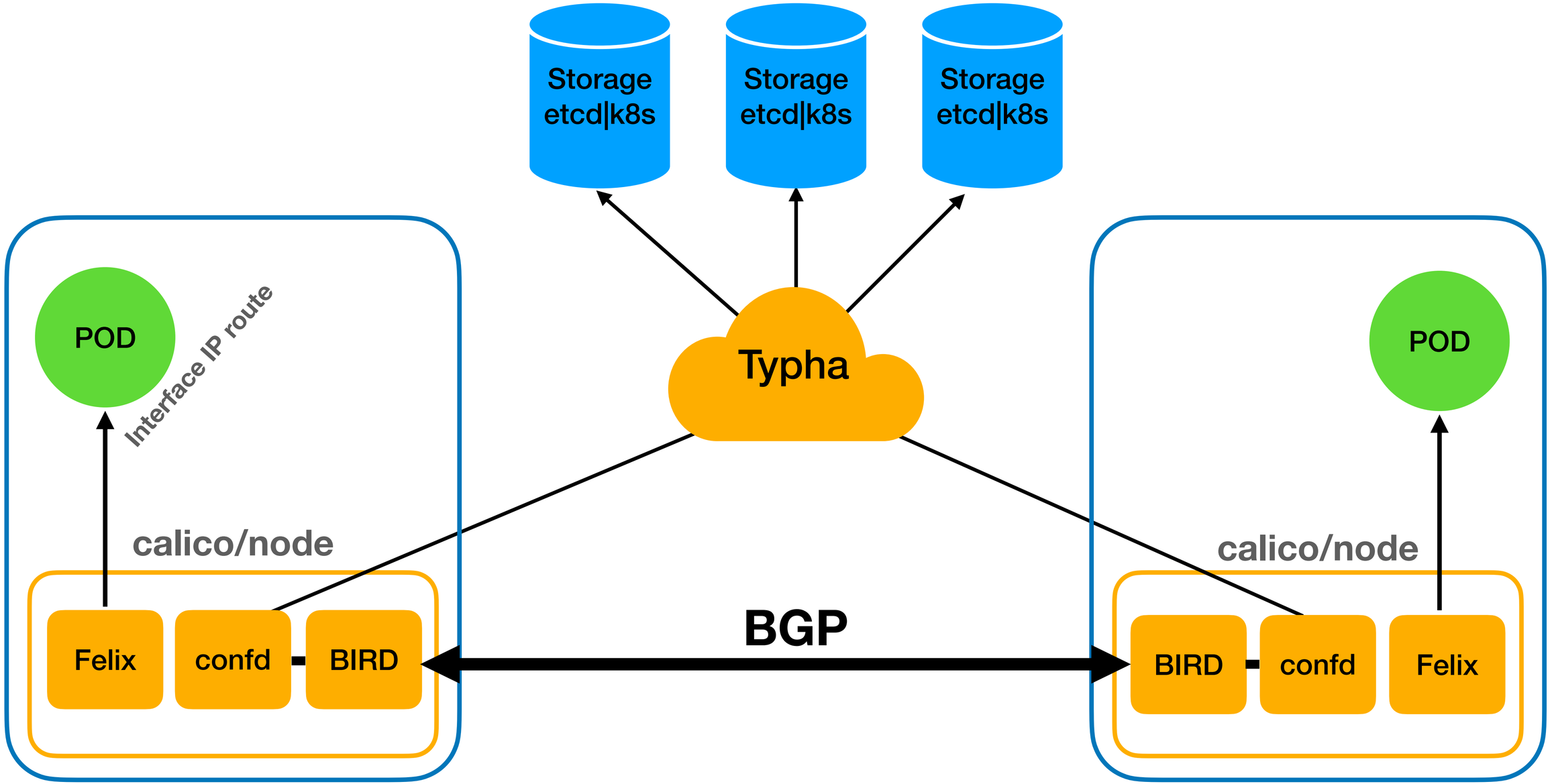
- Every pod gets its own IP address
- Containers within a pod share the pod IP address and can communicate freely with each other
- Pods can communicate with all other pods in the cluster using pod IP addresses (without NAT)

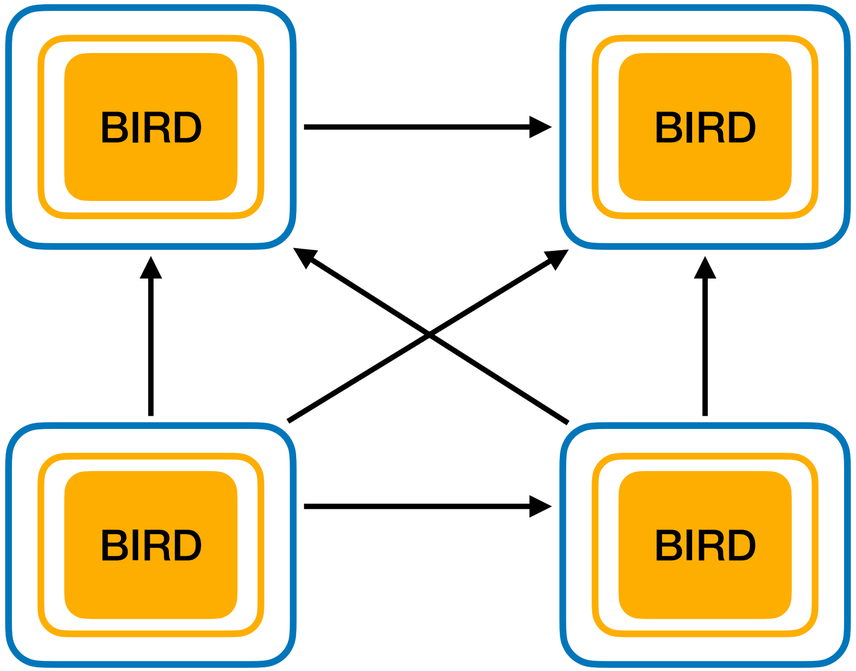
Kubernetes Network Model



Calico Architecture




Storage
etcd|k8s
Storage
etcd|k8s
Storage
etcd|k8s
Typha
POD
Interface IP route
calico/node
Felix
confd
BIRD
BGP
POD
calico/node
BIRD
confd
Felix


BIRD
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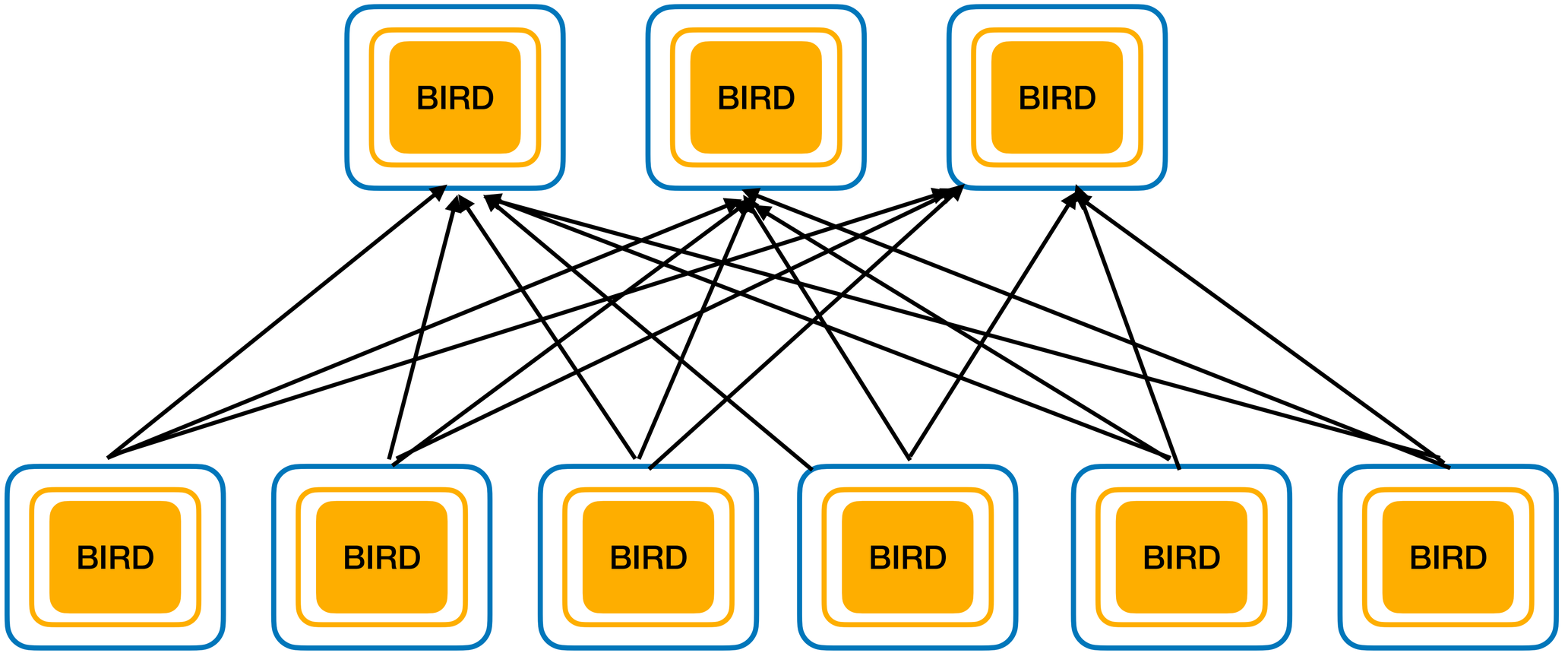
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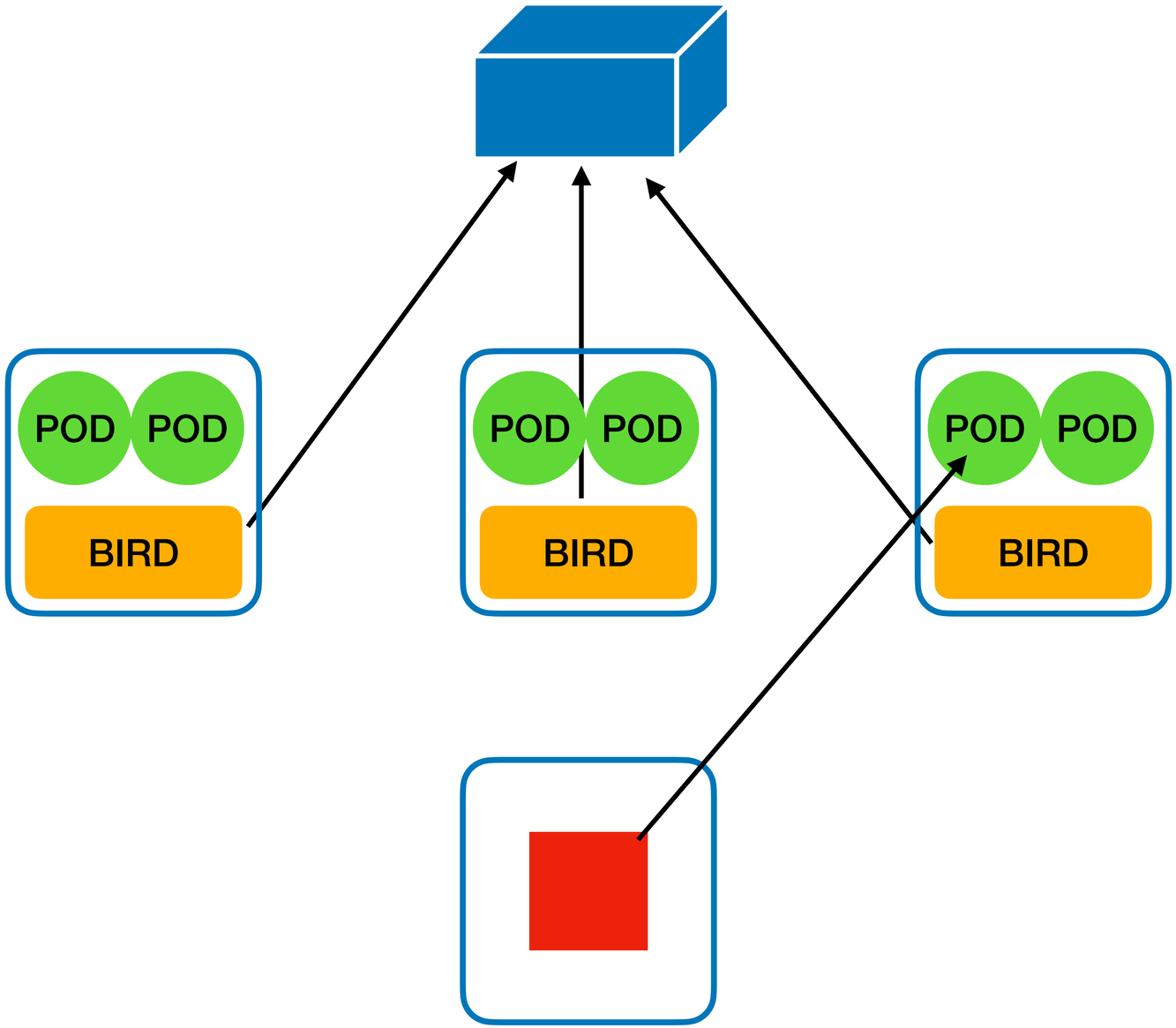
POD
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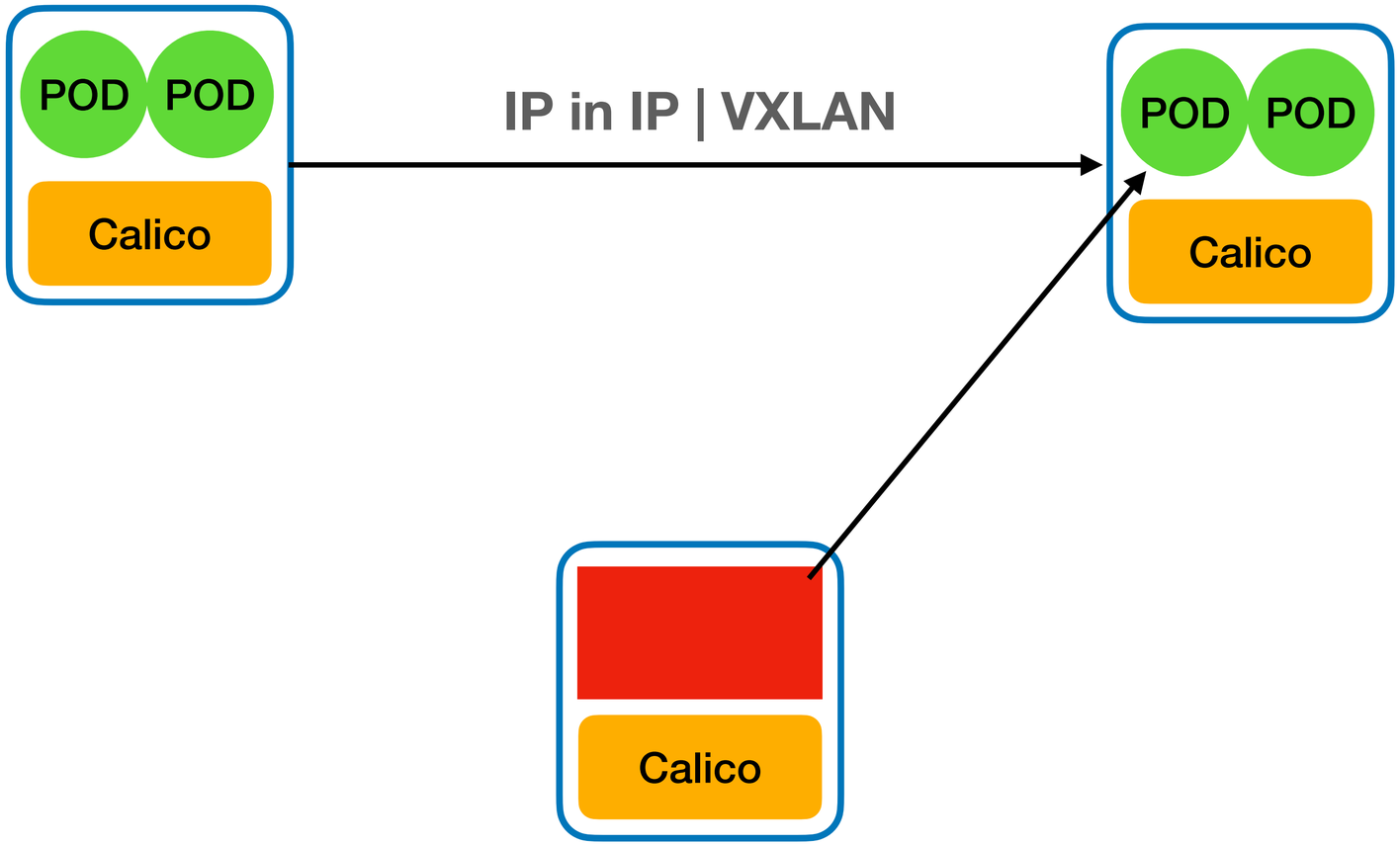
Overlay Network



Если все открыто, мы в опасности!

- k8s API / etcd
- Попав в один контейнер, атакуют все остальные
- Скомпрометировав один хост, атакуем все что хотим

Zero Trust Network Model

- Все соединения подчиняются политикам
- Все ожидаемые соединения явно разрешены
- Скомпроментированные хосты не могут обойти примененные политики
- Идентификация эндпоинта устанавливается по IP/port и криптографии(SSL)
- Шифрование траффика

Calicoctl

$ calicoctl node status

Calico process is running.

IPv4 BGP status

```
+--------------+-------------------+-------+------------+-------------+
| PEER ADDRESS |     PEER TYPE     | STATE |   SINCE    |    INFO     |
+--------------+-------------------+-------+------------+-------------+
| 10.234.3.104 | node-to-node mesh | up    | 2020-08-27 | Established |
| 10.234.3.103 | node-to-node mesh | up    | 2020-08-27 | Established |
| 10.234.2.228 | node-to-node mesh | up    | 2020-08-27 | Established |
+--------------+-------------------+-------+------------+-------------+
```

$ calicoctl apply -f file.yml

$ calicoctl get --help

* bgpConfiguration
* bgpPeer
* felixConfiguration
* globalNetworkPolicy
* globalNetworkSet
* hostEndpoint
* ipPool
* kubeControllersConfiguration
* networkPolicy
* networkSet
* node
* profile
* workloadEndpoint

Network Policy

- Применяются к любым эндпоинтам: pods/containers, VMs, and/or to host interfaces
- Контролирует входящий/исходящий трафик
- Работает по критериям:
  - port, port-range
  - HTTP-attributes(istio)
  - IP/CIDR
  - **selector!**
  - **namespace!**
  - **serviceaccount!**

Allow Ingress in Production from a pod with labels

```
apiVersion: projectcalico.org/v3
kind: NetworkPolicy
metadata:
  name: allow-tcp-6379
  namespace: production
spec:
  selector: type == ‘db'
  ingress:
  - action: Allow
    protocol: TCP
    source:
      selector: type == 'app'
    destination:
      ports:
        - 6379
```

Allow Ingress in Production from another NS

```
apiVersion: projectcalico.org/v3
kind: NetworkPolicy
metadata:
  name: allow-tcp-6379
  namespace: production
spec:
  selector: type == 'db'
  ingress:
  - action: Allow
    protocol: TCP
    source:
      selector: type == 'app'
      namespaceSelector: services == ‘backend'
    destination:
      ports:
      - 6379
```

Host endpoint

```
- apiVersion: projectcalico.org/v3
  kind: HostEndpoint
  metadata:
    name: <name of endpoint>
    labels:
      role: webserver
      environment: production
  spec:
    interfaceName: eth0
    node: <node name or hostname>
    profiles: [<list of profile IDs>]
    expectedIPs: ["10.0.0.1"]
```

Host endpoint

```
apiVersion: projectcalico.org/v3
kind: GlobalNetworkPolicy
metadata:
  name: k8s-worker
spec:
  selector: "role == 'k8s-worker'"
  order: 0
  ingress:
  - action: Allow
    protocol: TCP
    source:
      nets:
      - "<your management CIDR>"
    destination:
      ports: [22, 10250]
```

```
egress:
  - action: Allow
    protocol: TCP
    destination:
      nets:
      - "<your etcd IP>/32"
      ports: [2379]
  - action: Allow
    protocol: UDP
    destination:
      ports: [53, 67]
```

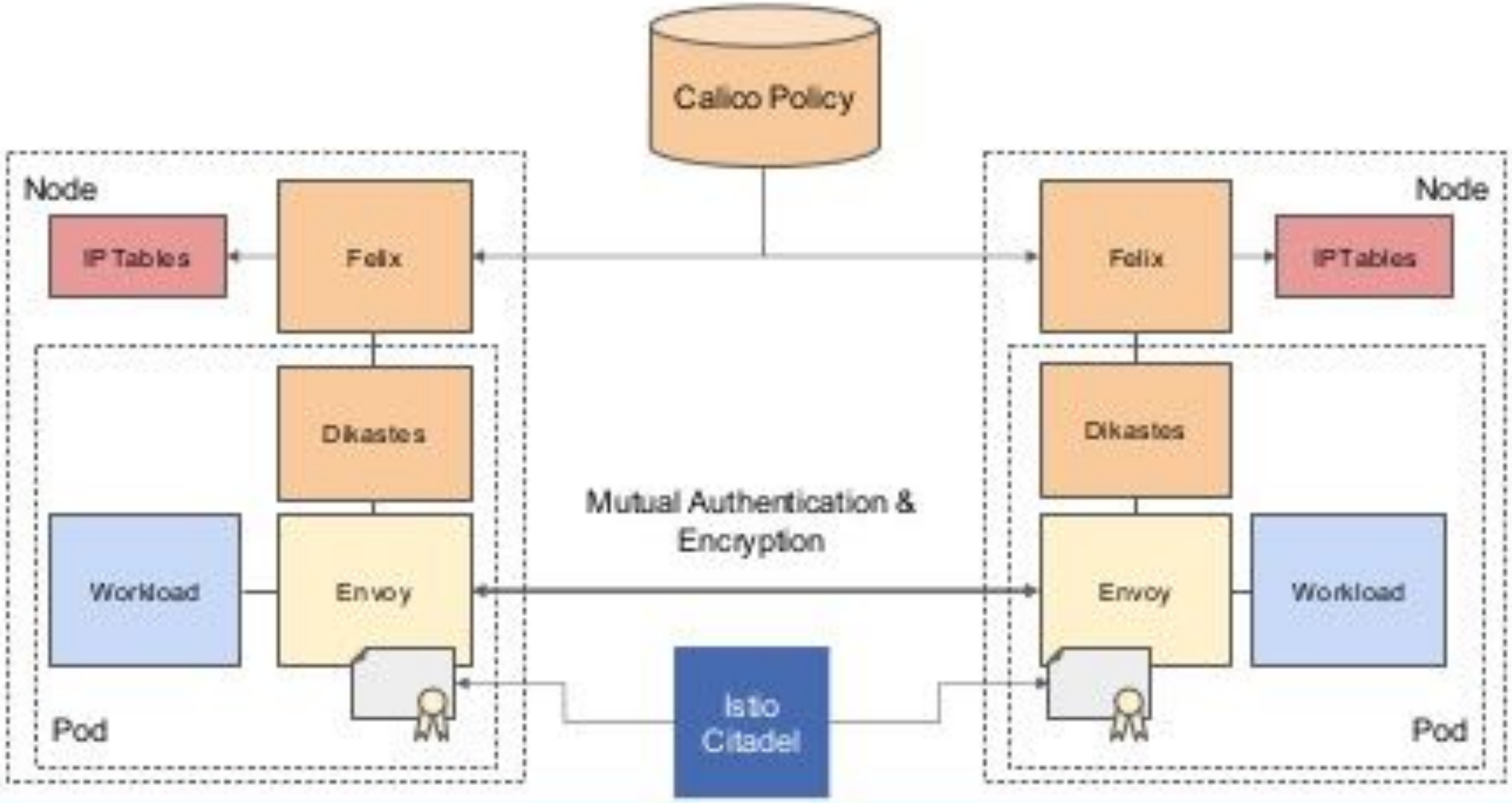
Защита от дурака!

22	TCP	Inbound	SSH access
53	UDP	Outbound	DNS queries
67	UDP	Outbound	DHCP access
68	UDP	Inbound	DHCP access
179	TCP	Inbound & Outbound	BGP access (Calico networking)
2379	TCP	Inbound & Outbound	etcd access
2380	TCP	Inbound & Outbound	etcd access
6443	TCP	Inbound & Outbound	Kubernetes API server access
6666	TCP	Inbound & Outbound	etcd self-hosted service access
6667	TCP	Inbound & Outbound	etcd self-hosted service access

Но защиту можно отключить :)

```
apiVersion: projectcalico.org/v3
kind: FelixConfiguration
metadata:
  name: default
spec:
  ipv6Support: false
  ipipMTU: 1400
  failsafeInboundHostPorts:
    -
    -
  failsafeOutboundHostPorts:
    -
    -
```

Zero Trust Network Model



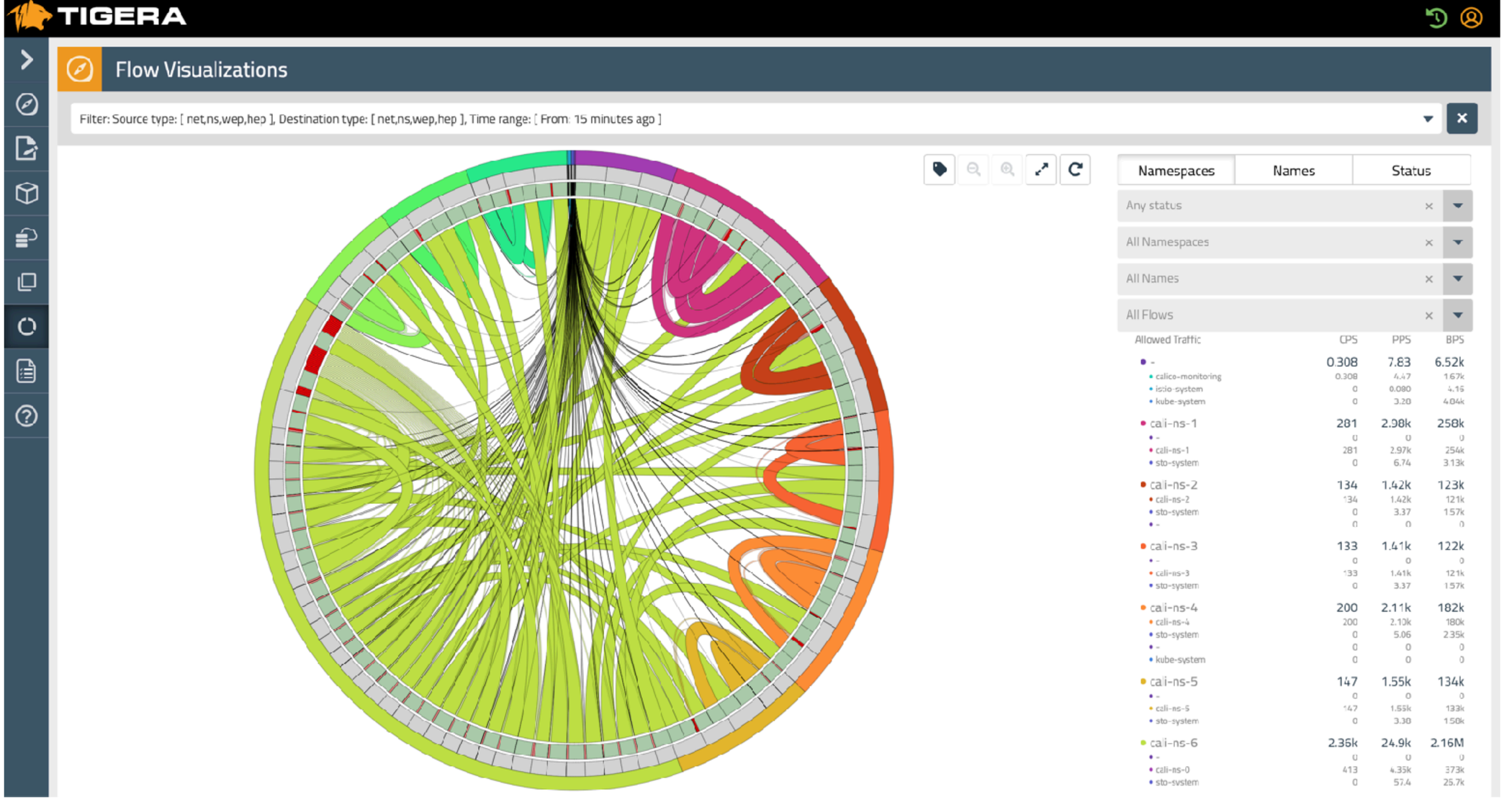
Zero Trust Network Model

```
$ calicoctl patch felixconfiguration default
        --type='merge' -p ‘{"spec":
            {“wireguardEnabled":true}}'
```

```
...
  status:
    ..
    wireguardPublicKey: jlkVyQYooZYzI2wFfNhSZez5e
    ...
```

CALICO ENTERPRISE

- Hierarchical network policy
- Egress access controls (DNS policies, egress gateways)
- Network visualization and troubleshooting
- Network policy recommendations
- Network policy preview and staging
- Compliance controls and reporting
- Intrusion detection (suspicious activity, anomaly detection)
- Multi-cluster management with multi-cloud federation



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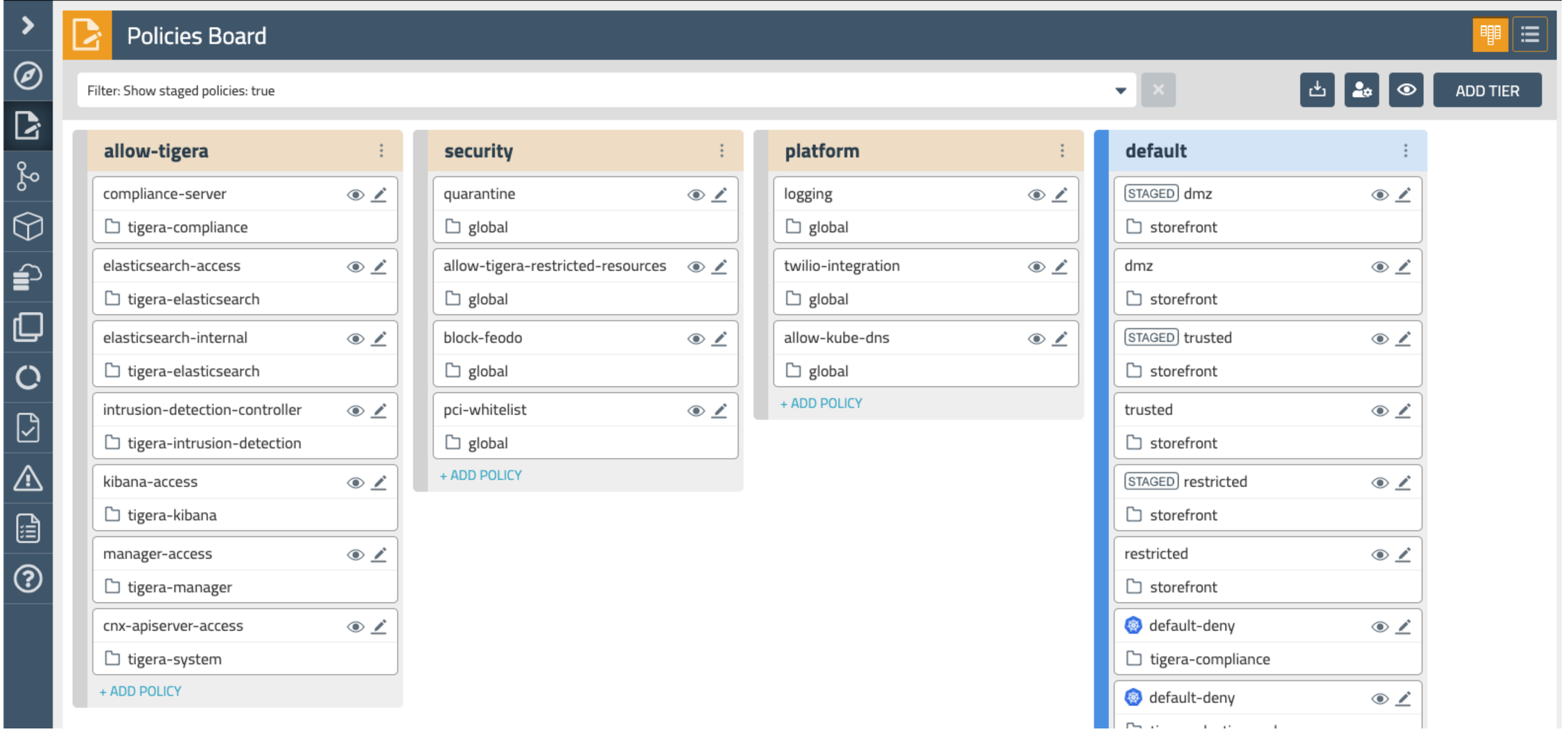

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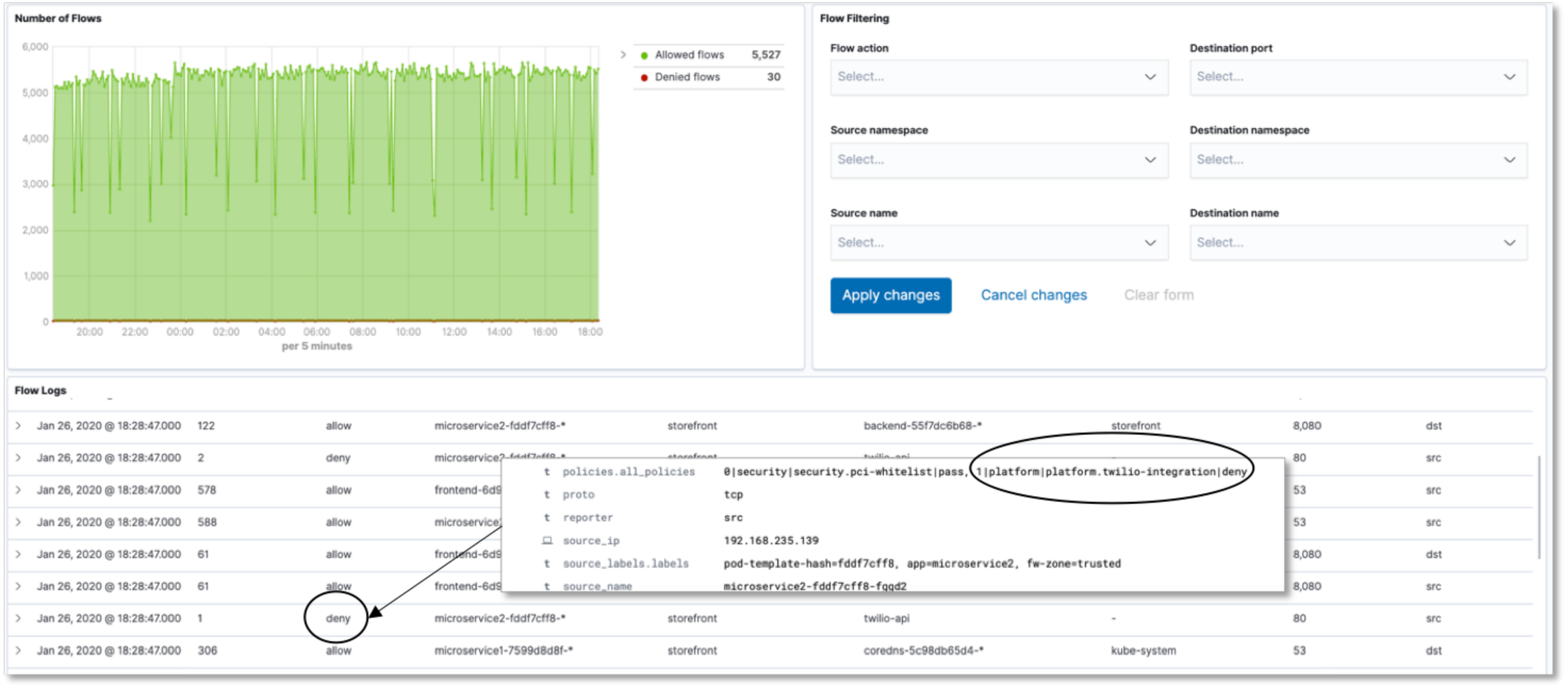

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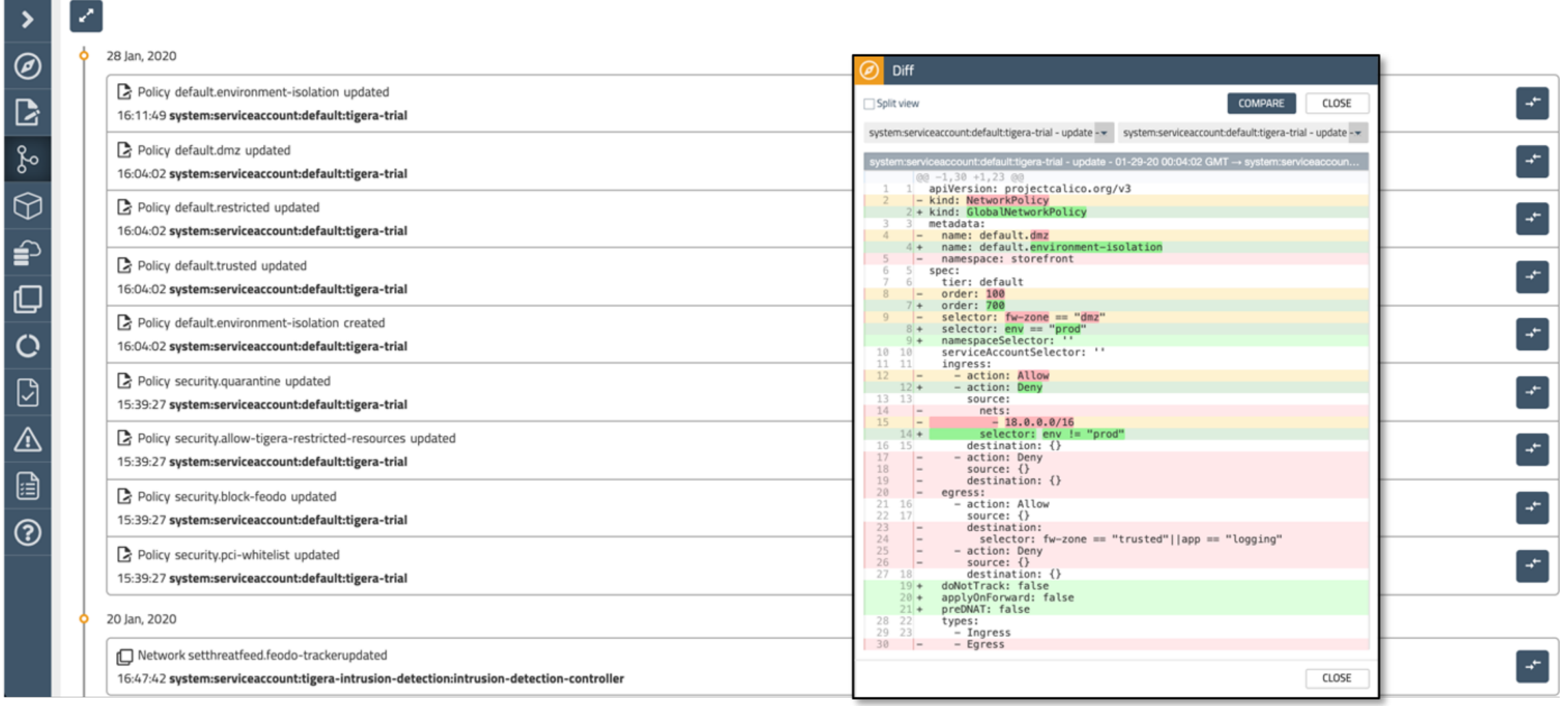

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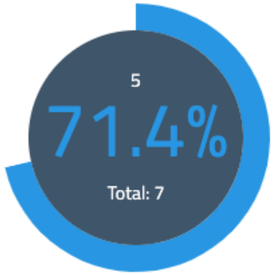
Compliance Reports

Filter: none

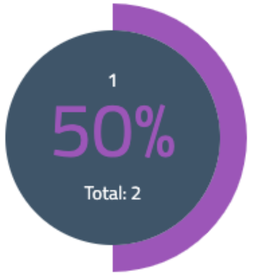
	Name	Type	Date Range	Created On
▶	daily-cis-results	cis-benchmark	01-26-20 00:00:00 GMT - 01-27-20 00:00:00 GMT	01-27-20 00:30:09 GMT
▼	daily-storefront-inventory	inventory	01-26-20 00:00:00 GMT - 01-27-20 00:00:00 GMT	01-27-20 00:30:09 GMT

Inscope vs Protected

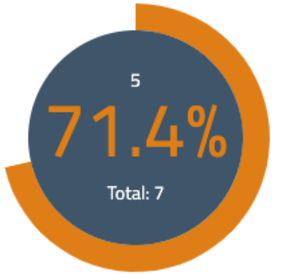
Protected Ingress Endpoints: 5



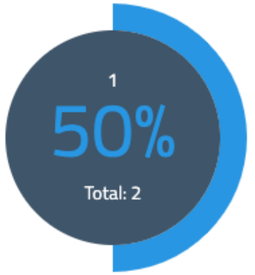
Protected Ingress Namespaces: 1



Protected Egress Endpoints: 5



Protected Egress Namespaces: 1



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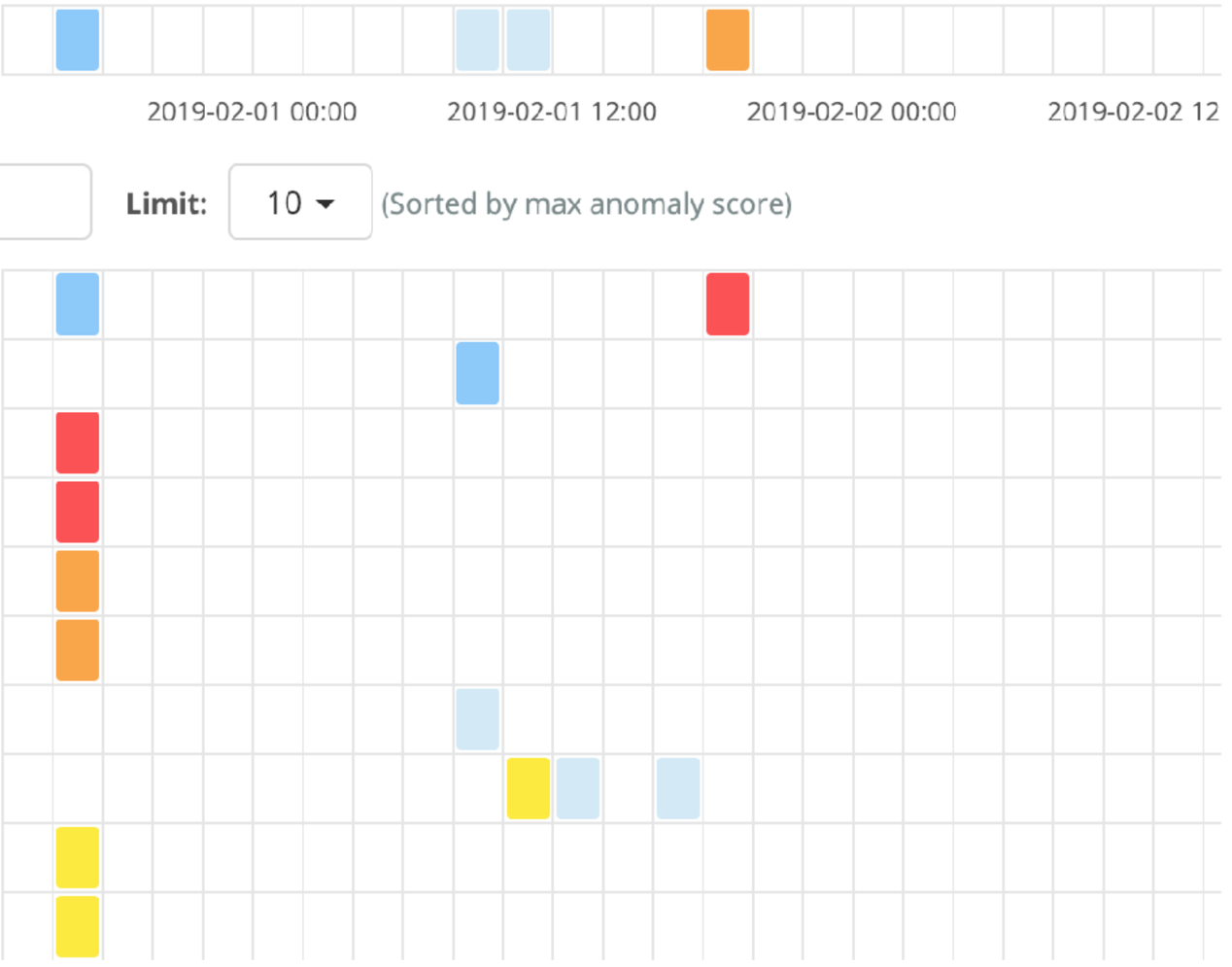
Top Influencers

dest_name

-	98	110
alertmanager-calico-node-alert...	93	139
server9-cali-ns-9-6b5656bb79-...	76	143
server9-cali-ns-9-6b5656bb79-r...	75	132
server9-cali-ns-9-6b5656bb79-...	69	130
server9-cali-ns-9-6b5656bb79-g...	65	106
alertmanager-calico-node-alert...	54	56
server9-cali-ns-9-6b5656bb79-k...	29	32
server19-cali-ns-9-f7bbb96cf-7l...		

Anomaly timeline



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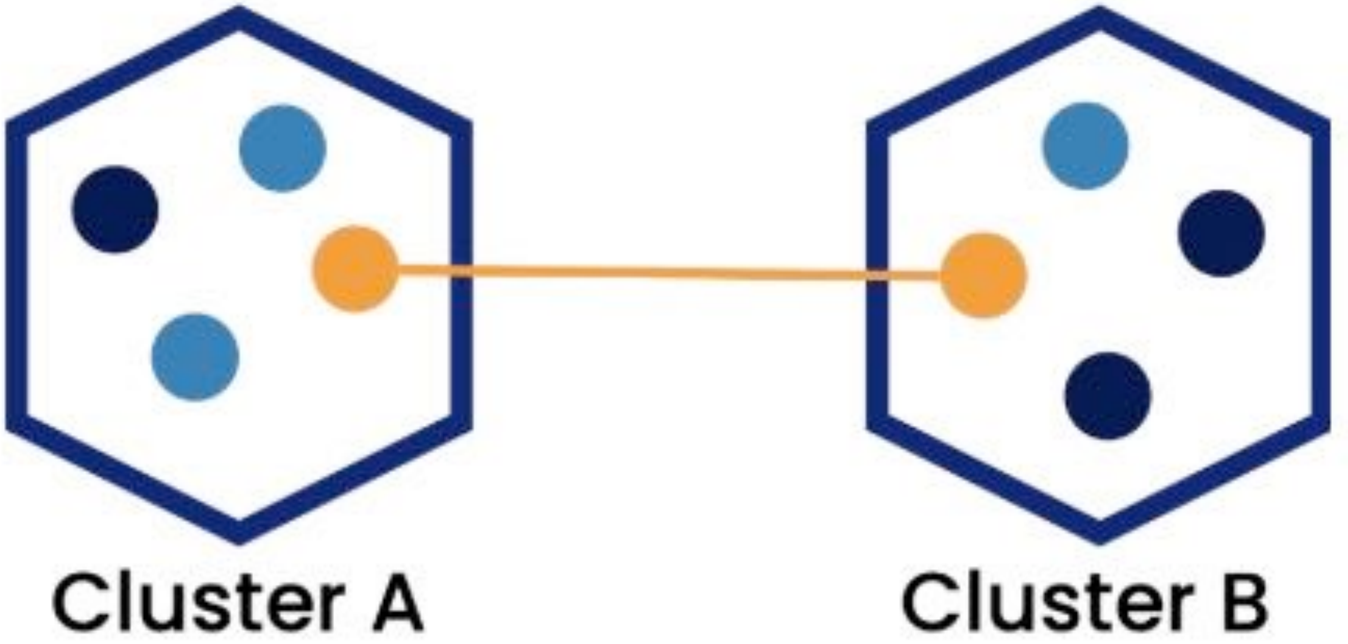

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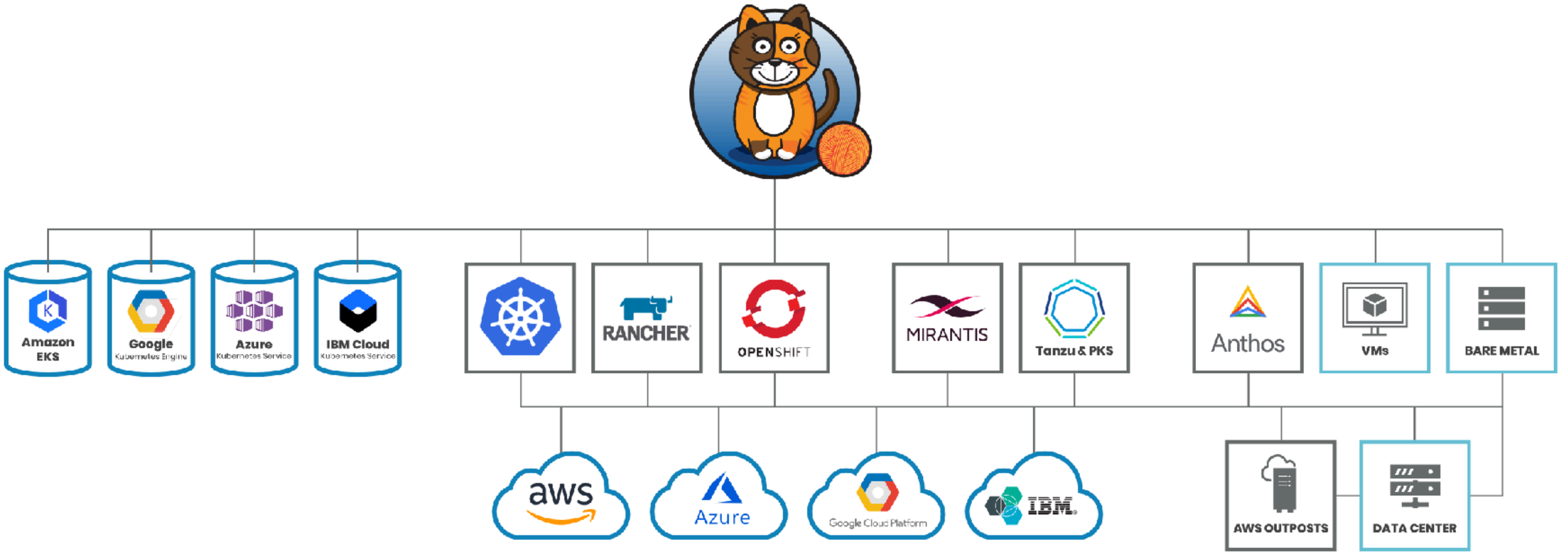
Industry Standard for Kubernetes Network Security



TG: @aladmit

TG channel: @aladmit_world