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Cloud_Native
Rejekts
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Kyverno Chronicles:

A DevSecOps Tale

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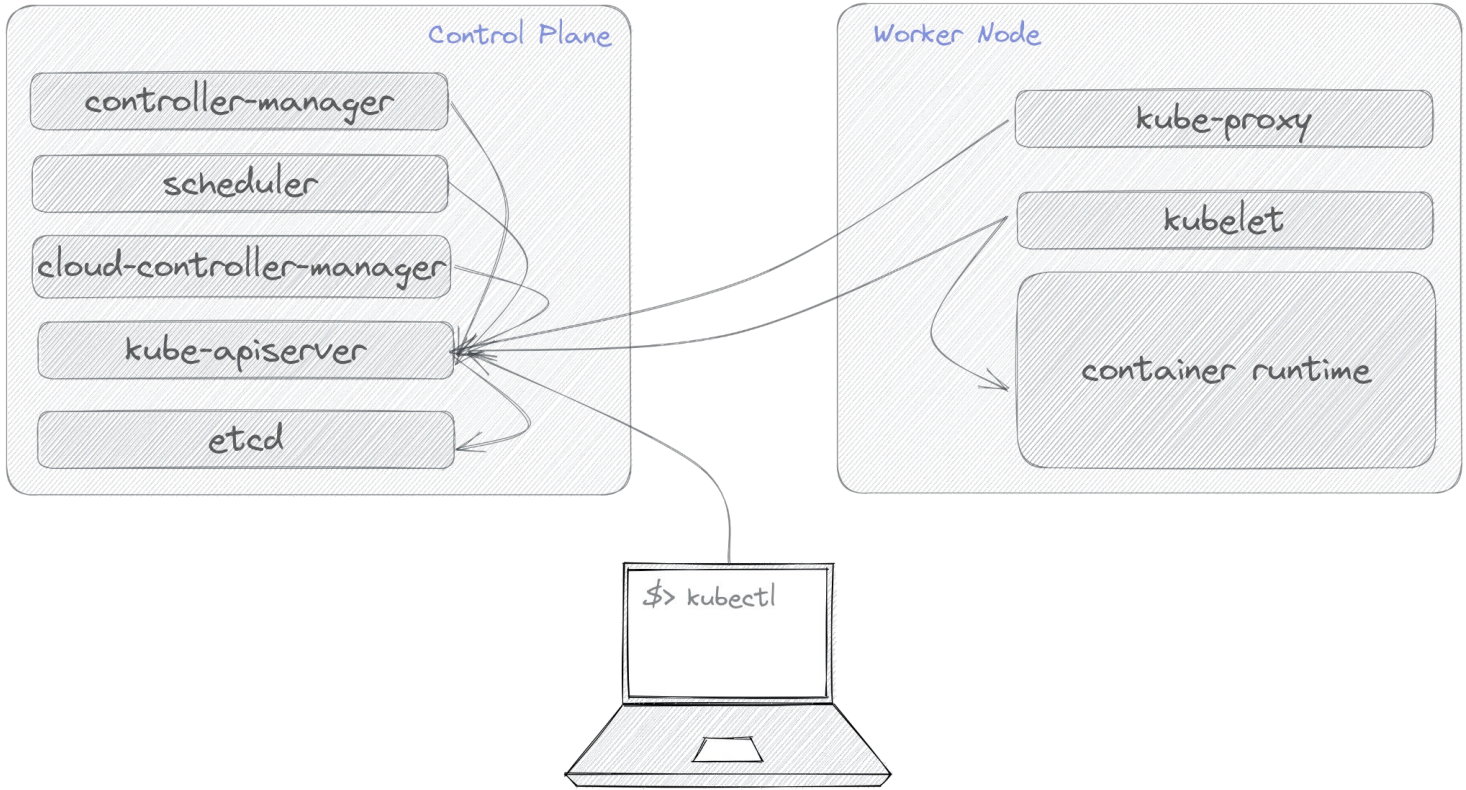
Kubernetes Architecture



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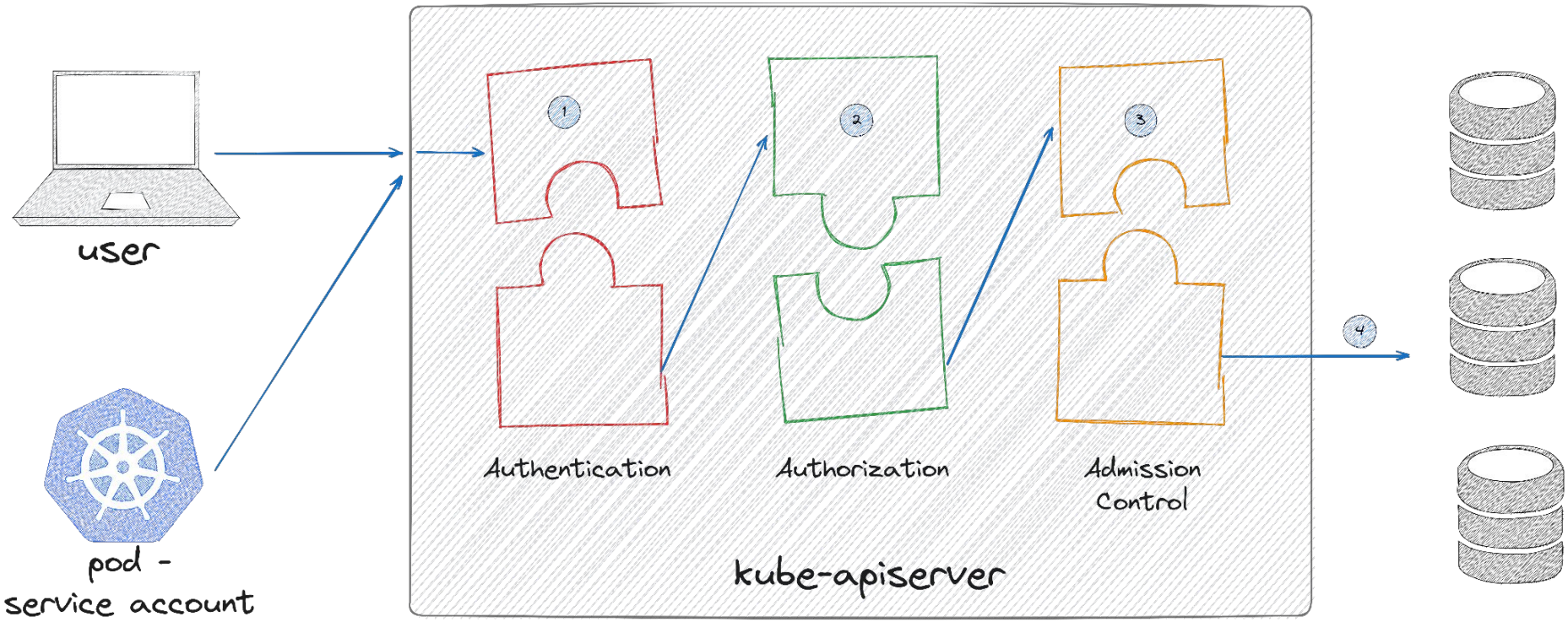
Kubernetes API Access Control



Admission Controllers

Compiled-in

- DefaultStorageClass
- LimitRanger
- DefaultStorageClass
- ...

Dymamic

- Validating Admission Webhook
- Mutating Admission Webhook

What is Kyverno?

Greek for “Govern”

Policies as Kubernetes resources,
(no new language to learn)

Validate, mutate, generate, or
cleanup (remove) any resource

Verify container images for
software supply chain security

What is Kyverno?

Inspect image metadata

Synchronize configurations across Namespaces

Test policies and validate resources using the Kyverno CLI, in your CI/CD pipeline, before applying to your cluster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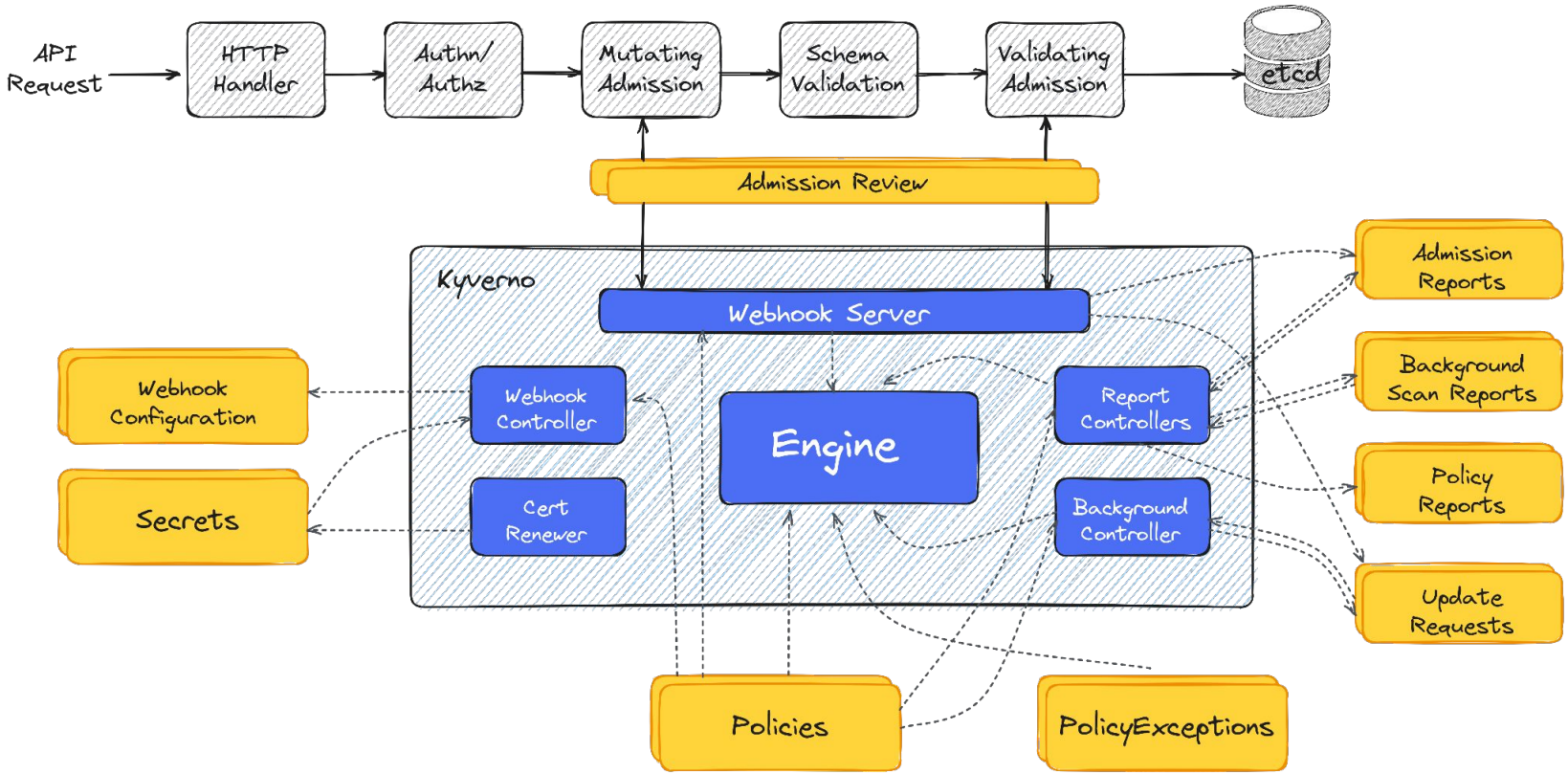
Deployed Kyverno and policies!

High Level Architecture

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Is this High Available?

⚠ Attention!

Make sure you deploy Kyverno with the high available (multiple replicas) option on the helm chart, otherwise your api-server will not work when kyverno is down.

failurePolicy

Defines the API server behavior if the webhook fails to respond. Allowed values are “Ignore” or “Fail”.

Some Policies

```yaml
apiVersion: kyverno.io/v1
kind: ClusterPolicy
metadata:
  name: disallow-privileged-containers
spec:
  validationFailureAction: audit
  background: true
  rules:
    - name: privileged-containers
      match:
        any:
        - resources:
            kinds:
              - Pod
      validate:
        message: >-
          Privileged mode is disallowed. The fields spec.containers[*].securityContext.privileged
          and spec.initContainers[*].securityContext.privileged must be unset or set to `false`.
        pattern:
          spec:
            =(ephemeralContainers):
              - =(securityContext):
                  =(privileged): "false"
            =(initContainers):
              - =(securityContext):
                  =(privileged): "false"
            containers:
              - =(securityContext):
                  =(privileged): "false"
```

```yaml
apiVersion: kyverno.io/v1
kind: ClusterPolicy
metadata:
  name: block-stale-images
spec:
  validationFailureAction: audit
  rules:
    - name: block-stale-images
      match:
        any:
        - resources:
            kinds:
            - Pod
      validate:
        message: "Images built more than 6 months ago are prohibited."
        foreach:
        - list: "request.object.spec.containers"
          context:
          - name: imageData
            imageRegistry:
              reference: "{{ element.image }}"
          deny:
            conditions:
              all:
                - key: "{{ time_since('', '{{ imageData.configData.created }}', '') }}"
                  operator: GreaterThan
                  value: 4380h
```

```yaml
apiVersion: kyverno.io/v1
kind: ClusterPolicy
metadata:
  name: reduce-cpu-requests
  annotations:
    policies.kyverno.io/title: Reduce the CPU limits and requests by 10%
spec:
  rules:
  - name: set-cpu-limit-request
    match:
      any:
      - resources:
          kinds:
          - Pod
    exclude:
      any:
      - resources:
          kinds:
          - Pod
          selector:
            matchExpressions:
            - key: prow.k8s.io/job
              operator: In
              values:
              - periodic-cluster-api-provider-vsphere-test-integration-release
              - ci-kubernetes-integration-1-27
    mutate:
      foreach:
      - list: request.object.spec.containers
        patchStrategicMerge:
          spec:
            containers:
            - (name): "{{element.name}}"
              resources:
                limits:
                  cpu: "{{ multiply(divide('{{element.resources.limits.cpu || element.resources.requests.cpu}}', `10`), `9`) }}"
                requests:
                  cpu: "{{ multiply(divide('{{element.resources.requests.cpu || element.resources.limits.cpu}}', `10`), `9`) }}"
```

```yaml
apiVersion: kyverno.io/v1
kind: ClusterPolicy
metadata:
  name: add-networkpolicy
  annotations:
    policies.kyverno.io/description: >-
      By default, Kubernetes allows communications across all Pods within a cluster. The NetworkPolicy resource and a CNI plug-in that supports
      NetworkPolicy must be used to restrict communications. A default NetworkPolicy should be configured for each Namespace to
      default deny all ingress and egress traffic to the Pods in the Namespace. Application teams can then configure additional NetworkPolicy
      resources to allow desired traffic to application Pods from select sources. This policy will create a new NetworkPolicy resource
      named `default-deny` which will deny all traffic anytime a new Namespace is created.
spec:
  rules:
  - name: default-deny
    match:
      any:
      - resources:
          kinds:
          - Namespace
    generate:
      apiVersion: networking.k8s.io/v1
      kind: NetworkPolicy
      name: default-deny
      namespace: "{{request.object.metadata.name}}"
      synchronize: true
      data:
        spec:
          # select all pods in the namespace
          podSelector: {}
          # deny all traffic
          policyTypes:
          - Ingress
          - Egress
```

```yaml
apiVersion: kyverno.io/v1
kind: ClusterPolicy
metadata:
  name: add-networkpolicy-dns
  annotations:
    policies.kyverno.io/description: >-
      By default, Kubernetes allows communications across all Pods within a cluster. The NetworkPolicy resource and a CNI plug-in that supports
      NetworkPolicy must be used to restrict communications. A default NetworkPolicy should be configured for each Namespace to default deny all
      ingress and egress traffic to the Pods in the Namespace. Application teams can then configure additional NetworkPolicy resources to allow
      desired traffic to application Pods from select sources. This policy will create a new NetworkPolicy resource named `default-deny` which will
      deny all traffic anytime a new Namespace is created.
spec:
  rules:
  - name: add-netpol-dns
    match:
      any:
      - resources:
          kinds:
          - Namespace
    generate:
      apiVersion: networking.k8s.io/v1
      kind: NetworkPolicy
      name: allow-dns
      namespace: "{{request.object.metadata.name}}"
      synchronize: false
      data:
        spec:
          podSelector:
            matchLabels: {}
          policyTypes:
          - Egress
          egress:
          - to:
            - namespaceSelector:
                matchLabels:
                  name: kube-system
            ports:
            - protocol: UDP
              port: 53
```

```yaml
apiVersion: kyverno.io/v1
kind: ClusterPolicy
metadata:
  name: disallow-default-namespace
  annotations:
    policies.kyverno.io/description: >-
      Kubernetes Namespaces are an optional feature that provide a way to segment and isolate cluster resources across multiple applications and
      users. As a best practice, workloads should be isolated with Namespaces. Namespaces should be required and the default (empty) Namespace
      should not be used. This policy validates that Pods specify a Namespace name other than `default`. Rule auto-generation is disabled here
      due to Pod controllers need to specify the `namespace` field under the top-level `metadata` object and not at the Pod template level.
spec:
  validationFailureAction: audit
  background: true
  rules:
  - name: validate-namespace
    match:
      any:
      - resources:
          kinds:
          - Pod
    validate:
      message: "Using 'default' namespace is not allowed."
      pattern:
        metadata:
          namespace: "!default"
  - name: validate-podcontroller-namespace
    match:
      any:
      - resources:
          kinds:
          - DaemonSet
          - Deployment
          - Job
          - StatefulSet
    validate:
      message: "Using 'default' namespace is not allowed for pod controllers."
      pattern:
        metadata:
          namespace: "!default"
```


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For more: https://kyverno.io/policies/

What about ...

Kubernetes Documentation / Reference / API Access Control / Validating Admission Policy

Validating Admission Policy

ⓘ **FEATURE STATE:** Kubernetes v1.30 [stable]

This page provides an overview of Validating Admission Policy.

What is Validating Admission Policy?

Validating admission policies offer a declarative, in-process alternative to validating admission webhooks.

Validating admission policies use the Common Expression Language (CEL) to declare the validation rules of a policy. Validation admission policies are highly configurable, enabling policy authors to define policies that can be parameterized and scoped to resources as needed by cluster administrators.

https://kubernetes.io/docs/reference/access-authn-authz/validating-admission-policy/

https://kyverno.io/blog/2024/02/26/generating-kubernetes-validatingadmissionpolicies-from-kyverno-policies/


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DEMO
https://killercoda.com/koksay/course/kyverno

Thanks!

Do you have any questions?

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