SUPPLYCHAIN SECURITYCON

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THE LINUX FOUNDATION OPEN SOURCE SUMMIT NORTH AMERICA

April 10th, 2023

Securing Kubernetes manifests with Sigstore Cosign, what are your options?

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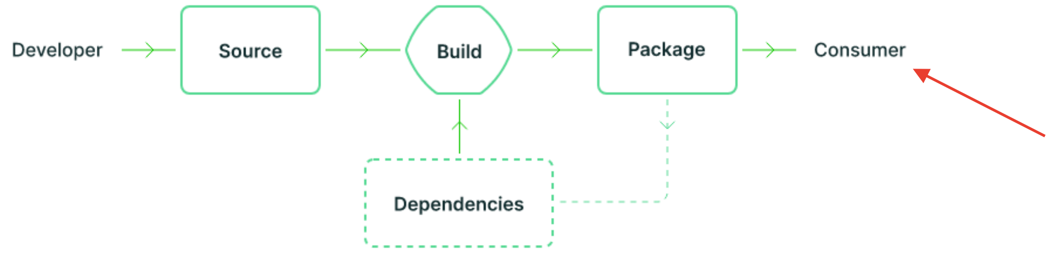
Agenda

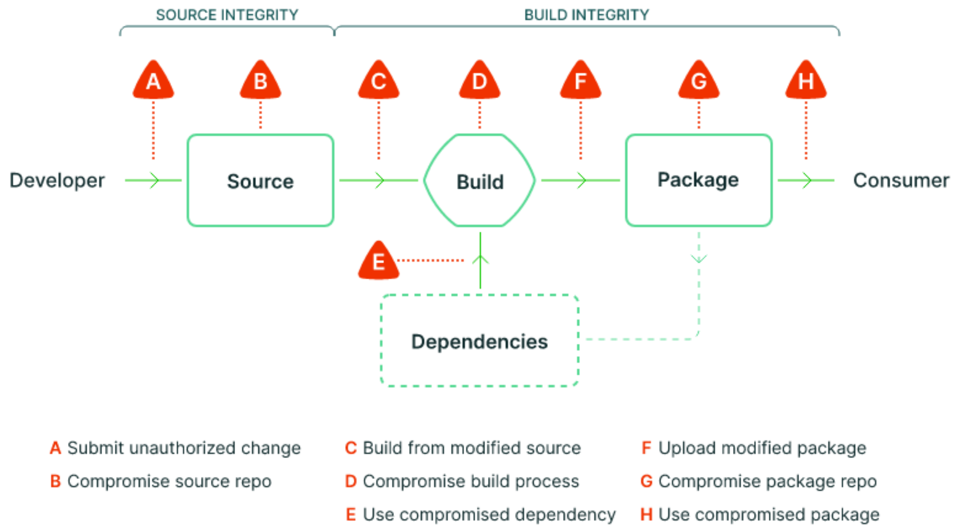
1. **Cosign** for Container images
2. **Kyverno** for Kubernetes manifests
3. **Flux** for Helm charts
4. **Flux** for OCI images

Zero Trust with Software Supply Chain - slsa.dev

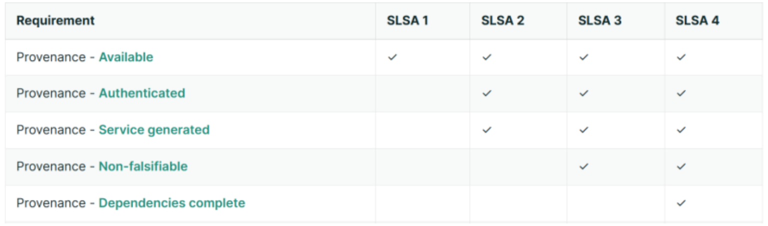


You use an artifact from the right place, but it's not what the owner intended:

- ○ Compromised account
- ○ Compromised build process
- ○ Compromised package repository

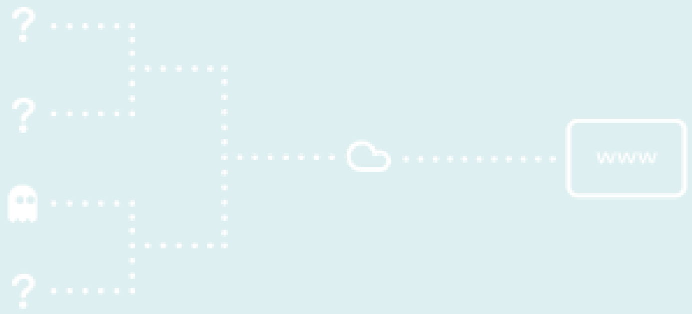


SOURCE INTEGRITY
BUILD INTEGRITY
A
B
C
D
F
G
H
Developer
Source
Build
Package
Consumer
E
Dependencies
A Submit unauthorized change
B Compromise source repo
C Build from modified source
D Compromise build process
E Use compromised dependency
F Upload modified package
G Compromise package repo
H Use compromised package



Requirement	SLSA 1	SLSA 2	SLSA 3	SLSA 4
Provenance - Available	✓	✓	✓	✓
Provenance - Authenticated		✓	✓	✓
Provenance - Service generated		✓	✓	✓
Provenance - Non-falsifiable			✓	✓
Provenance - Dependencies complete				✓

Sigstore

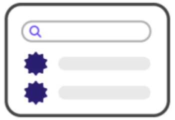


sigstore was started to improve supply chain technology for anyone using open source projects. It's for open source maintainers, by open source maintainers.

And it's a direct response to today's challenges, a work in progress for a future where the integrity of what we build and use is up to standard.

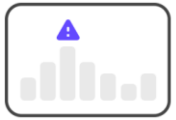
Sign code

Easy authentication and smart cryptography work in the background. Just push your code.



Verify signatures

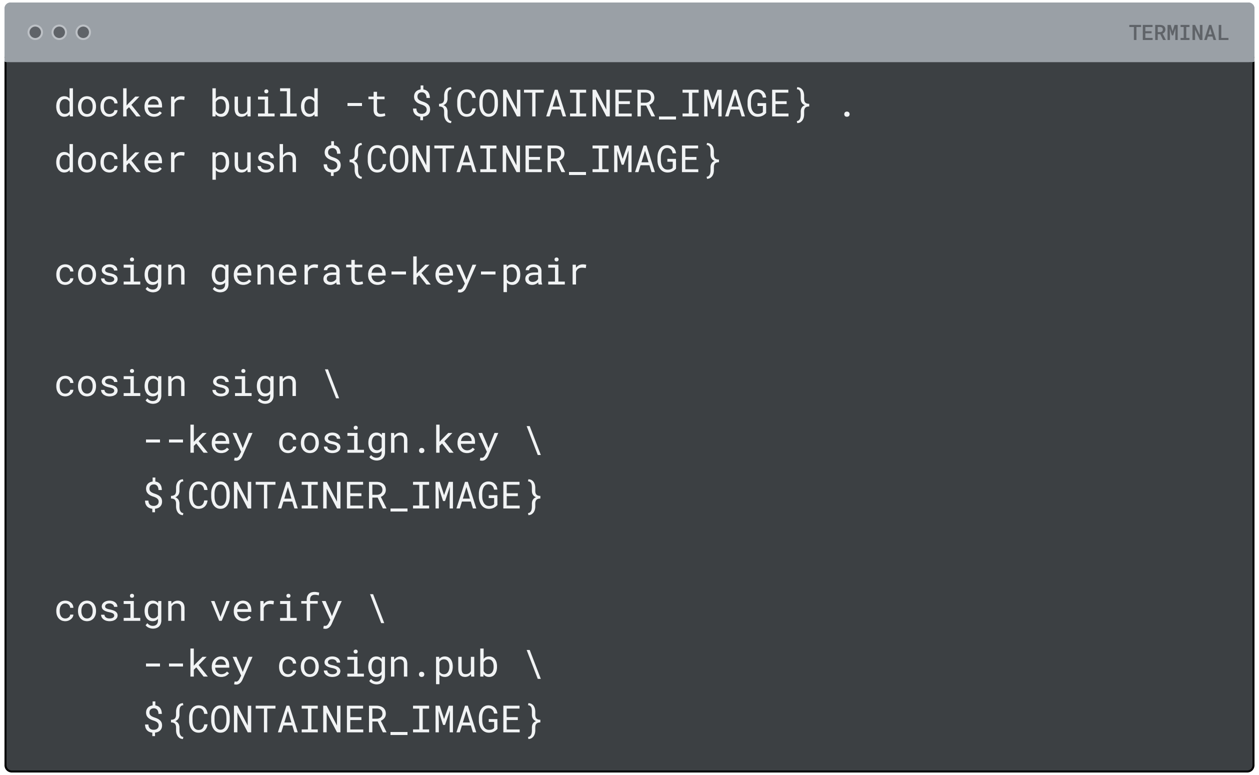
A transparency log stores data like who created something and how, so you know it hasn't been changed.



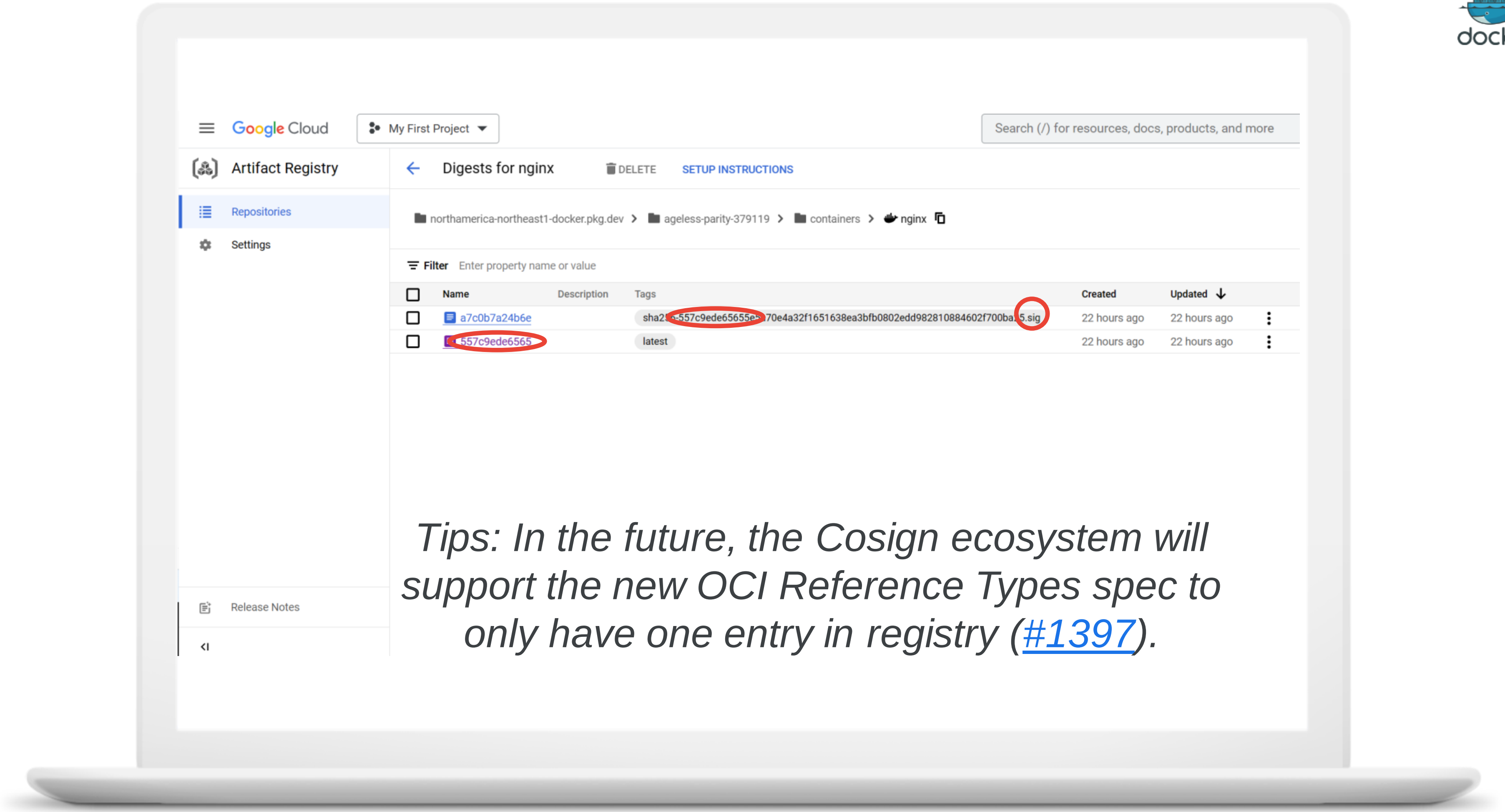
Monitor activity

Logged data is readily auditable, for future monitors and integrations to build into your security workflow.

1. **Cosign** for Container images


TERMINAL

```
docker build -t ${CONTAINER_IMAGE} .
docker push ${CONTAINER_IMAGE}

cosign generate-key-pair

cosign sign \
    --key cosign.key \
    ${CONTAINER_IMAGE}

cosign verify \
    --key cosign.pub \
    ${CONTAINER_IMAGE}
```


Google Cloud | My First Project | Search (/) for resources, docs, products, and more

Artifact Registry

Repositories

Settings

Release Notes

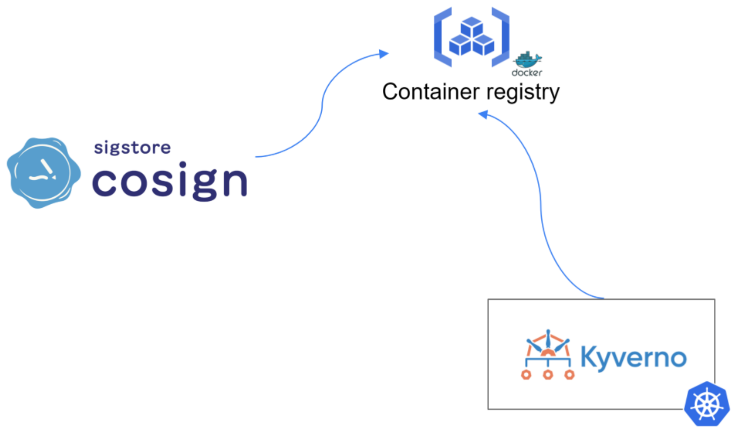
Digests for nginx | DELETE | SETUP INSTRUCTIONS

northamerica-northeast1-docker.pkg.dev > ageless-parity-379119 > containers > nginx

Filter Enter property name or value

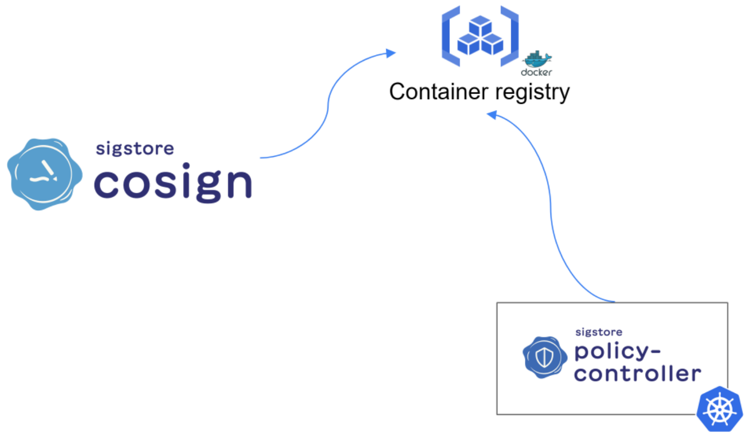
Name	Description	Tags	Created	Updated
a7c0b7a24b6e		sha256-557c9ede65655e5a70e4a32f1651638ea3bfb0802edd982810884602f700ba25.sig	22 hours ago	22 hours ago
557c9ede6565		latest	22 hours ago	22 hours ago

Tips: In the future, the Cosign ecosystem will support the new OCI Reference Types spec to only have one entry in registry ([#1397](#)).



cluster-policy.yaml

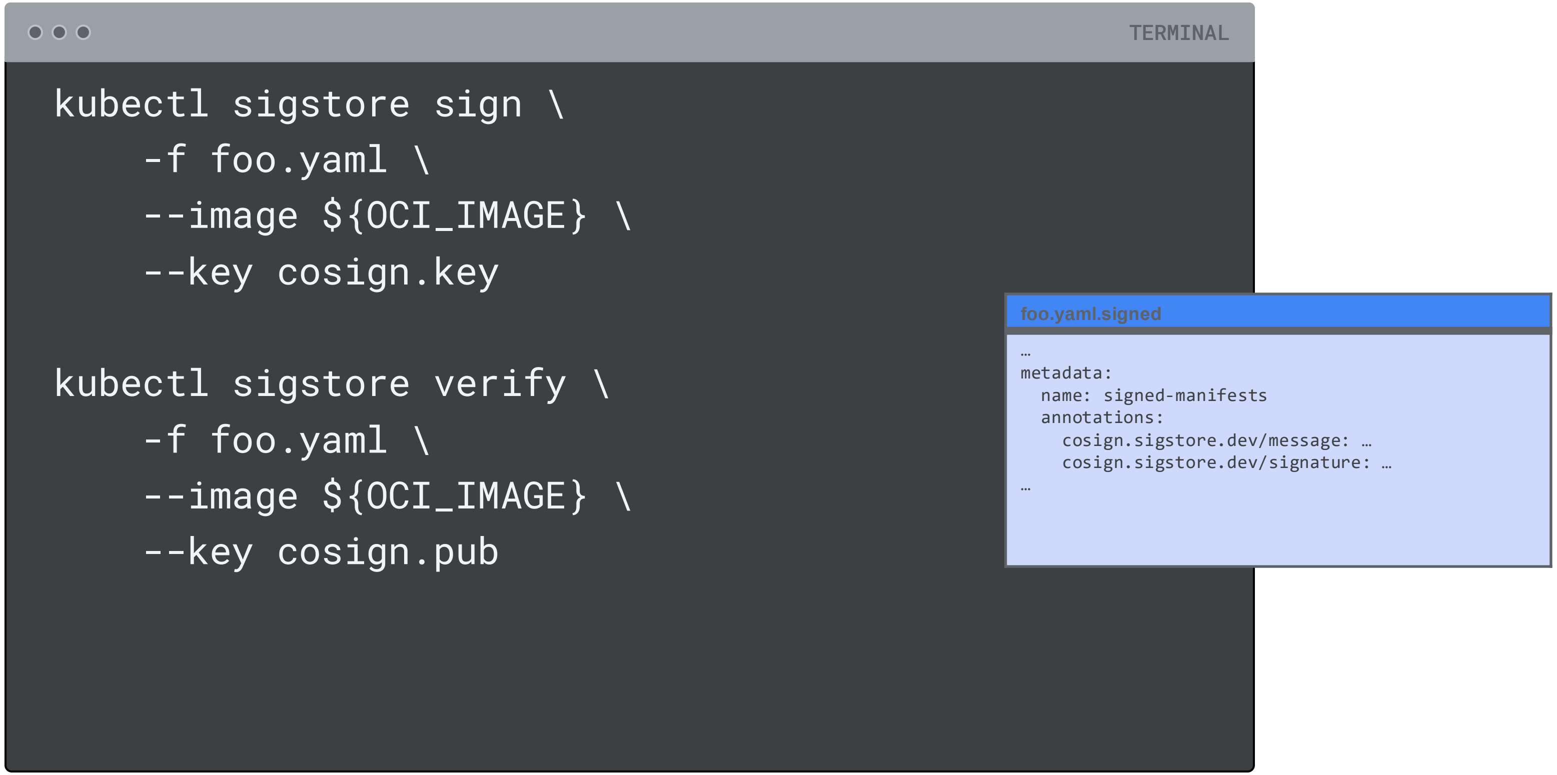
```yaml
apiVersion: kyverno.io/v1
kind: ClusterPolicy
metadata:
  name: private-signed-images-cp
spec:
  validationFailureAction: Enforce
  background: true
  rules:
  - name: private-signed-images
    match:
      any:
      - resources:
          kinds:
          - Pod
    verifyImages:
      - imageReferences:
        - "*"
        attestors:
        - count: 1
          entries:
          - keys:
              secret:
                name: cosign-pub
```



cluster-image-policy.yaml

```yaml
apiVersion: policy.sigstore.dev/v1alpha1
kind: ClusterImagePolicy
metadata:
  name: private-signed-images-cip
spec:
  images:
  - glob: "**"
  authorities:
  - key:
      secret:
        name: cosign-pub
```

`kubectl` plugin for signing Kubernetes manifests



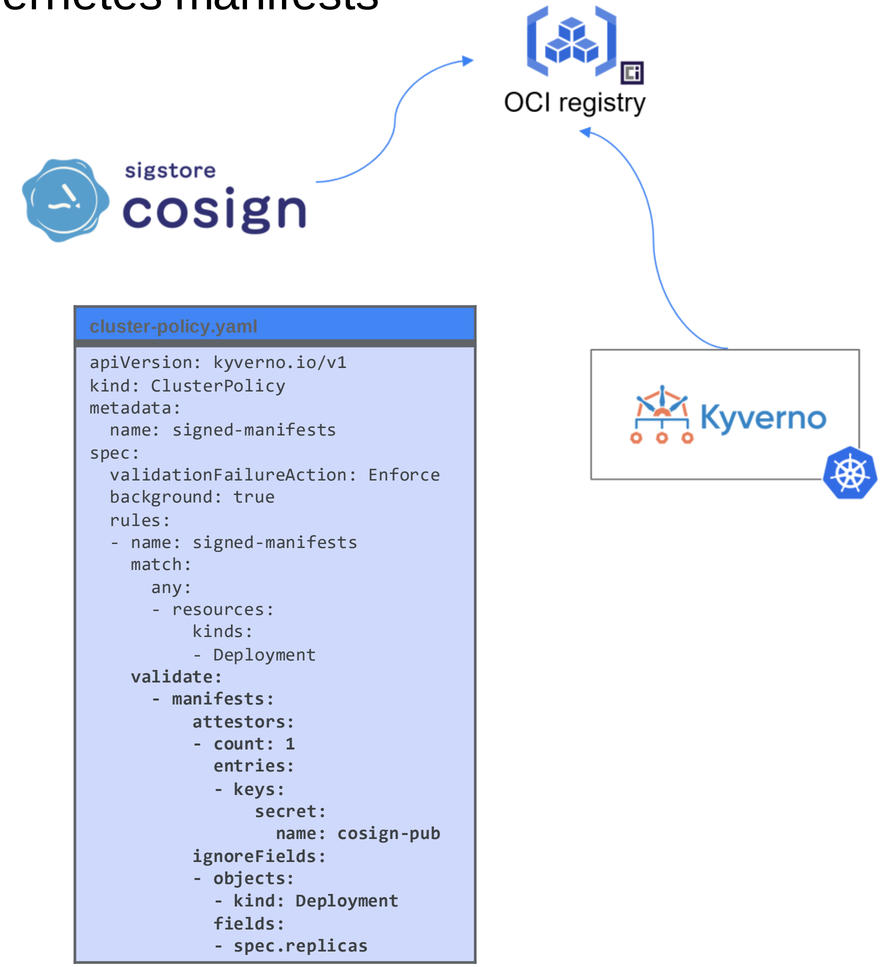
```
kubectl sigstore sign \
    -f foo.yaml \
    --image ${OCI_IMAGE} \
    --key cosign.key

kubectl sigstore verify \
    -f foo.yaml \
    --image ${OCI_IMAGE} \
    --key cosign.pub
```

foo.yaml.signed

```
…
metadata:
  name: signed-manifests
  annotations:
    cosign.sigstore.dev/message: …
    cosign.sigstore.dev/signature: …
…
```

[sigstore/k8s-manifest-sigstore: kubectl plugin for signing Kubernetes manifest]

2. **Kyverno** for Kubernetes manifests



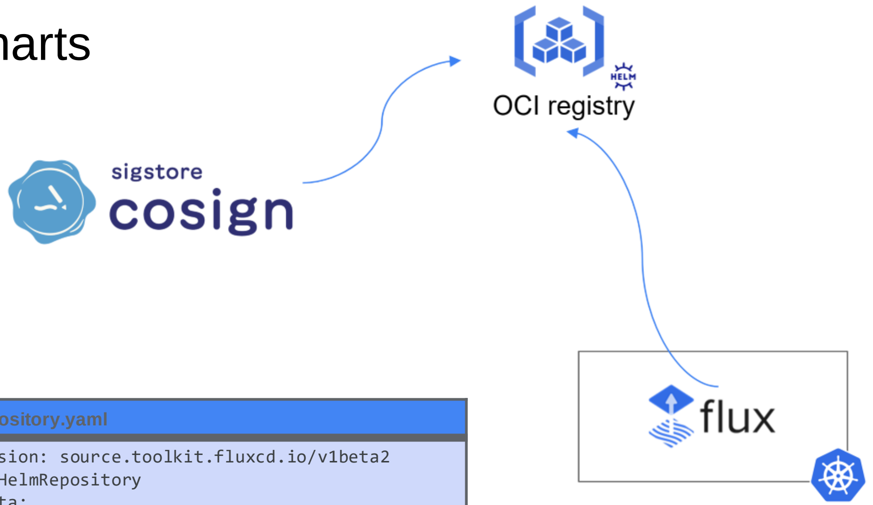
```yaml
apiVersion: kyverno.io/v1
kind: ClusterPolicy
metadata:
  name: signed-manifests
spec:
  validationFailureAction: Enforce
  background: true
  rules:
  - name: signed-manifests
    match:
      any:
      - resources:
          kinds:
          - Deployment
    validate:
      - manifests:
          attestors:
          - count: 1
            entries:
            - keys:
                secret:
                  name: cosign-pub
          ignoreFields:
          - objects:
            - kind: Deployment
            fields:
            - spec.replicas
```

Cosign for signing Helm charts

```
TERMINAL

helm package ${HELM_CHART_NAME}   # --sign (#10644)
helm push oci://${HELM_CHART_IMAGE}

cosign generate-key-pair

cosign sign \
    --key cosign.key \
    ${HELM_CHART_IMAGE}

cosign verify \
    --key cosign.pub \
    ${HELM_CHART_IMAGE}
```

Helm supply chain security · Issue #10644 - helm package --sign

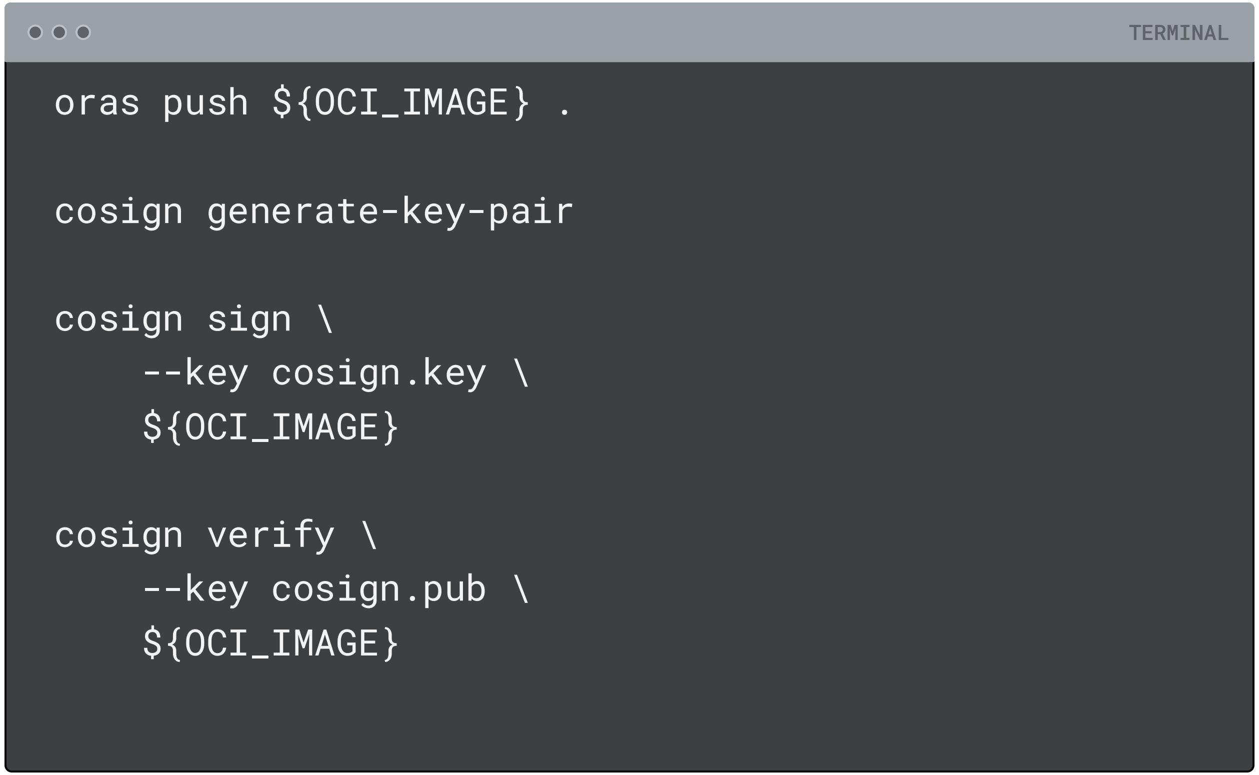
3. **Flux** for Helm charts



oci-repository.yaml

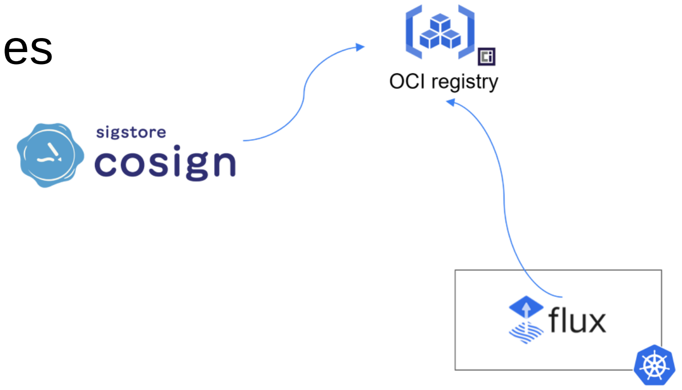
```
apiVersion: source.toolkit.fluxcd.io/v1beta2
kind: HelmRepository
metadata:
  name: my-helm-registry
spec:
  type: oci
  interval: 5m
  provider: gcp
  url: oci://${HELM_REPO}
---
apiVersion: source.toolkit.fluxcd.io/v1beta2
kind: HelmChart
metadata:
  name: my-helm-chart
spec:
  verify:
    provider: cosign
    secretRef:
      name: cosign-pub
```

Cosign for signing OCI images



```
oras push ${OCI_IMAGE} .

cosign generate-key-pair

cosign sign \
    --key cosign.key \
    ${OCI_IMAGE}

cosign verify \
    --key cosign.pub \
    ${OCI_IMAGE}
```

4. **Flux** for OCI images



oci-repository.yaml

```
apiVersion: source.toolkit.fluxcd.io/v1beta2
kind: OCIRepository
metadata:
  name: my-oci-image
spec:
  interval: 5m
  url: oci://${OCI_IMAGE}
  ref:
    semver: "*"
  verify:
    provider: cosign
    secretRef:
      name: cosign-pub
```

That’s a wrap!

We demonstrated how to verify the Cosign signature of your Kubernetes manifests.

3 options were illustrated:

1. **Kyverno** for Kubernetes manifests
2. **Flux** for Helm charts
3. **Flux** for OCI images

Resources

- My first experience with Kyverno
- Cosign and Policy-controller with GKE, Artifact Registry and KMS
  - Associated talk
- Build and Deploy Cloud Native (OCI) Artifacts, the GitOps Way
- Securing Kubernetes Manifests with Sigstore and Kyverno

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