Introduction to the Elastic Cloud on Kubernetes Operator

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2020-11-23

Running the Elastic Stack on Kubernetes?

Elastic Technology

3 solutions

Elastic Enterprise Search   Elastic Observability   Elastic Security

Powered by the Elastic Stack

| Kibana |
| Elasticsearch |
| Beats | Logstash |

Deployed anywhere

Elastic Cloud   **Elastic Cloud Enterprise**   **Elastic Cloud on Kubernetes**

SaaS   Orchestration

elastic

Elastic Cloud on Kubernetes Operator

Challenges of running on Kubernetes

Managing **resources**: StatefulSets, Services, Secrets …

Storage: volume management

Ensuring **consistency** and **availability**

Scaling **up or down** and **configuration changes** **or** **upgrades**

elastic

Elastic Technology

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elastic

Challenges of running on Kubernetes

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Scaling **up or down** and **configuration changes** **or** **upgrades**

elastic

A simple, uniform Elasticsearch cluster

Master, Data, Ingest, ML

Elasticsearch Nodes are not always uniform
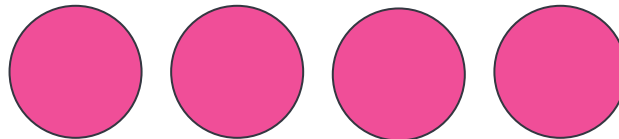
Dedicated Masters

Data, Ingest, ML

elastic

Elasticsearch Nodes are not always uniform

Dedicated Masters

Data

Ingest

ML

elastic

Challenges of running on Kubernetes

Managing **resources**: StatefulSets, Services, Secrets ...

Storage: volume management

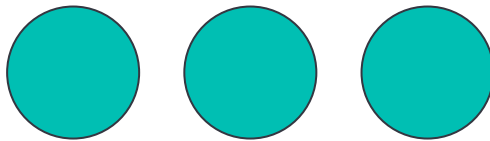Ensuring **consistency** and **availability**
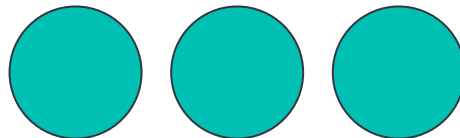
Scaling **up or down** and **configuration changes** **or** **upgrades**

elastic

Operators?

CRDs

K8S
Apiserver

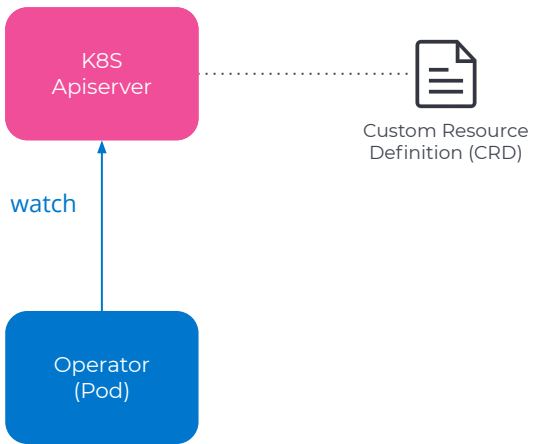Custom Resource
Definition (CRD)

```yaml
apiVersion:
elasticsearch.k8s.elastic.co/v1
kind: Elasticsearch
metadata:
  name: quickstart
spec:
  version: 7.10.0
  nodeSets:
  - name: master-nodes
    count: 3
    config:
      node.master: true
  - name: data-nodes
    count: 2
    config:
      node.data: true
```

Operators?

Reconciliation loop

```
┌─────────────┐
│     K8S     │ ·········  📄
│  Apiserver  │       Custom Resource
└─────────────┘       Definition (CRD)
       ▲
     watch
       │
┌─────────────┐
│  Operator   │
│    (Pod)    │
└─────────────┘
```

New event
A **watched resource** was created/updated/deleted

Operators?

Reconciliation loop

```
        K8S                    [document]
      Apiserver          Custom Resource
                         Definition (CRD)

   watch    create
            update
            delete

      Operator
       (Pod)
```

New event
A **watched resource** was created/updated/deleted

Reconcile!
Get resource spec
Create/update **expected** resources

Reconciliation loop
In Elastic Cloud on Kubernetes

```
apiVersion:
elasticsearch.k8s.elastic.co/v1
kind: Elasticsearch
metadata:
  name: quickstart
spec:
  version: 7.10.0
  nodeSets:
  - name: master-nodes
    count: 3
    config:
      node.master: true
  - name: data-nodes
    count: 2
    config:
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```
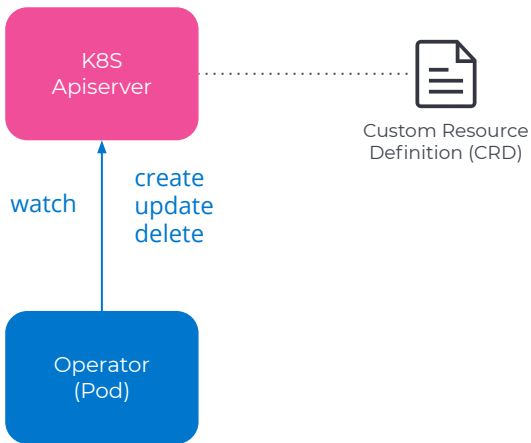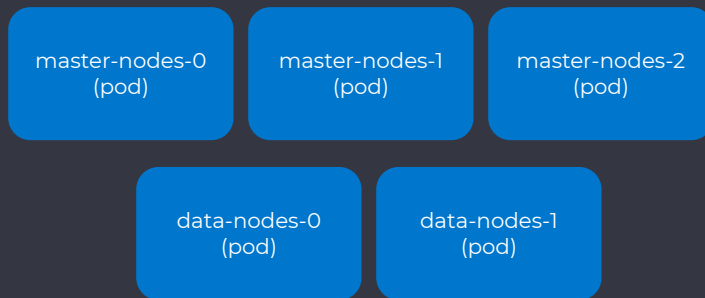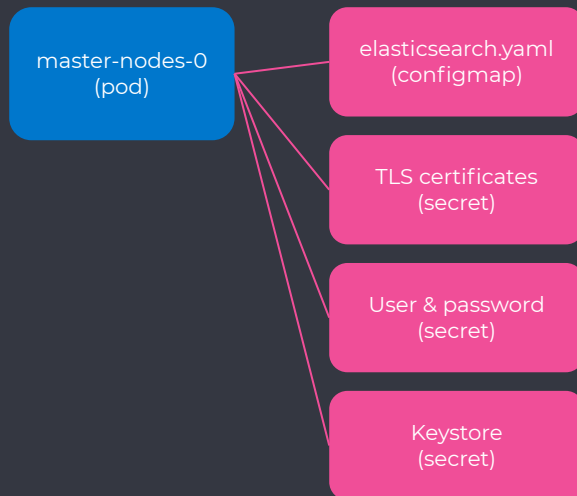
Create/update Elasticsearch Pods...

| master-nodes-0 (pod) | master-nodes-1 (pod) | master-nodes-2 (pod) |

| data-nodes-0 (pod) | data-nodes-1 (pod) |

elastic

Reconciliation loop
In Elastic Cloud on Kubernetes

```yaml
apiVersion:
elasticsearch.k8s.elastic.co/v1
kind: Elasticsearch
metadata:
  name: quickstart
spec:
  version: 7.10.0
  nodeSets:
  - name: master-nodes
    count: 3
    config:
      node.master: true
  - name: data-nodes
    count: 2
    config:
      node.data: true
```

...and much more

master-nodes-0
(pod)

elasticsearch.yaml
(configmap)

TLS certificates
(secret)

User & password
(secret)

Keystore
(secret)

elastic

Reconciliation loop
In Elastic Cloud on Kubernetes

```
apiVersion:
elasticsearch.k8s.elastic.co/v1
kind: Elasticsearch
metadata:
  name: quickstart
spec:
  version: 7.7.0
  nodeSets:
  - name: master-nodes
    count: 3
    config:
      node.master: true
  - name: data-nodes
    count: 2
    config:
      node.data: true
```
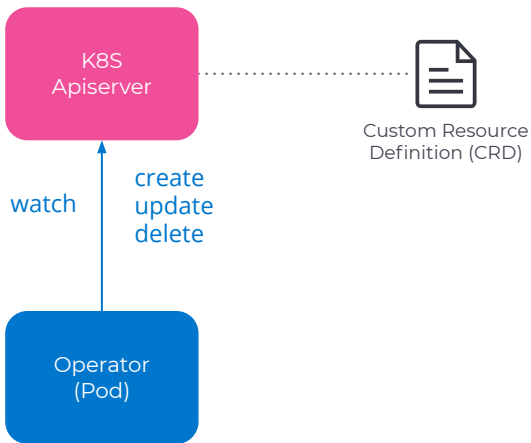
...and much much more
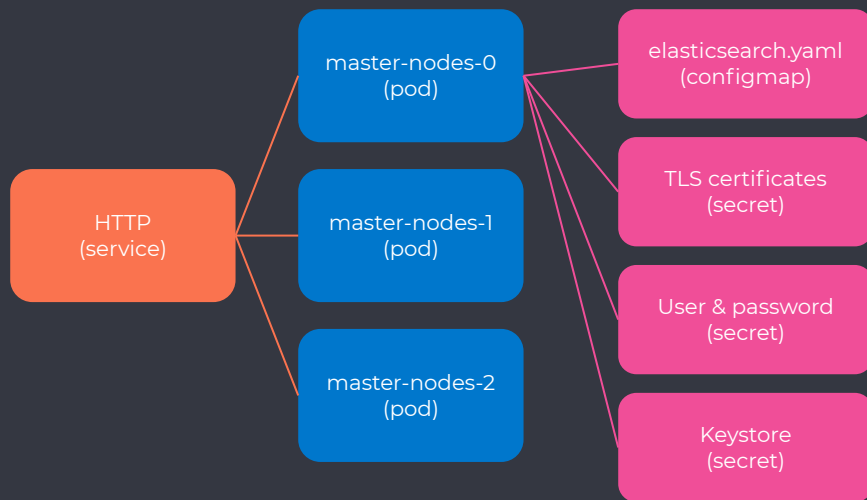
Operators?

Reconciliation loop

K8S Apiserver

Custom Resource Definition (CRD)

watch

create
update
delete

Operator
(Pod)

New event

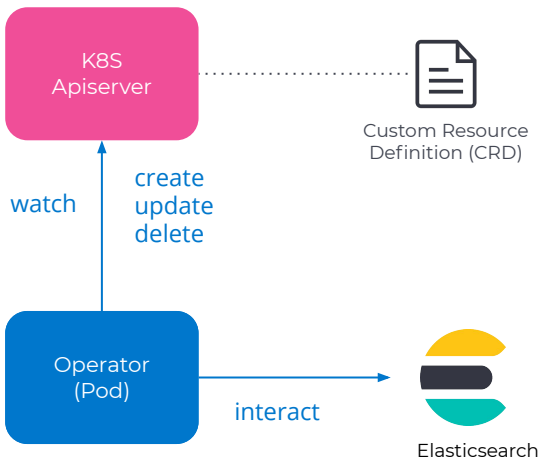A **watched resource** was created/updated/deleted

Reconcile!

Get resource spec

Create/update **expected** resources

- HTTP service
- TLS certificates (secret)
- Users (secret)
- Keystore (secret)
- ES configuration (configmap)
- ES Nodes StatefulSets (Pod + PersistentVolume)

Operators?

Reconciliation loop

K8S
Apiserver

Custom Resource
Definition (CRD)

watch

create
update
delete

Operator
(Pod)

interact

Elasticsearch

New event

A **watched resource** was created/updated/deleted

Reconcile!

Get resource spec

Create/update **expected** resources

- HTTP service
- TLS certificates (secret)
- Users (secret)
- Keystore (secret)
- ES configuration (configmap)
- ES Nodes StatefulSets (Pod + PersistentVolume)

Interact with the **Elasticsearch API**

- Change cluster settings
- Migrate data
- Prepare for rolling upgrade

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```yaml
apiVersion: elasticsearch.k8s.elastic.co/v1beta1
kind: Elasticsearch
metadata:
  name: elasticsearch-sample
spec:
  version: 7.10.0
  nodeSets:
  - name: default
    count: 1
    podTemplate:
      metadata:
        labels: {"foo": "bar"}
      spec:
        affinity:
          nodeAffinity:
            requiredDuringSchedulingIgnoredDuringExecution:
              nodeSelectorTerms:
              - matchExpressions:
                - key: environment
                  operator: In
                  values: ["e2e", "production"]
        containers:
        - name: elasticsearch
          env:
          - name: ES_JAVA_OPTS
            value: "-Xms2g -Xmx4g"
```

Empower users
But provide good defaults

optional podTemplate

elastic

```yaml
apiVersion: elasticsearch.k8s.elastic.co/v1
kind: Elasticsearch
metadata:
  name: elasticsearch-sample
spec:
  version: 7.10.0
  nodeSets:
  - name: master-nodes
    count: 3
    config:
      node.master: true
      node.data: false
  - name: data-nodes
    count: 3
    config:
      node.master: false
      node.data: true
    volumeClaimTemplates:
    - metadata:
        name: elasticsearch-data
      spec:
        resource:
          requests:
            storage: 100Gi
        storageClassName: <name>
                          (gce-pd)
                          (aws-ebs)
                          (local-storage)
                          (your-own)
```
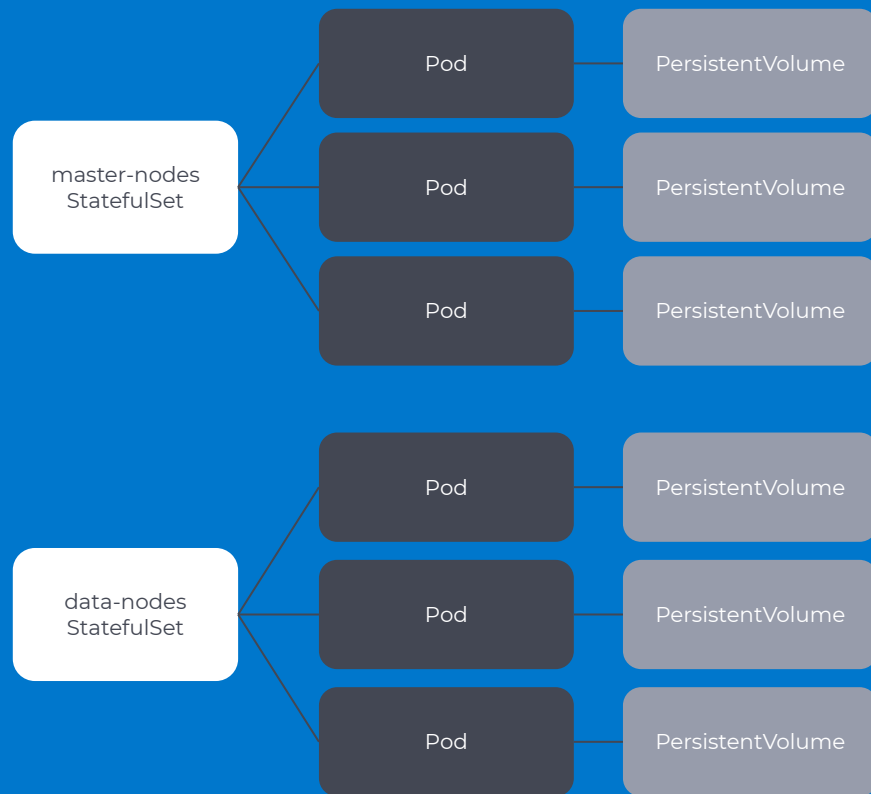
Elastic Operator

Elastic Cloud on Kubernetes

Deploy
Elasticsearch, Kibana, APM Server, Beats and Enterprise Search

On Kubernetes
Vanilla, OpenShift, GKE, EKS, AKS, etc.

Simple integration
kubectl & usual k8s tooling
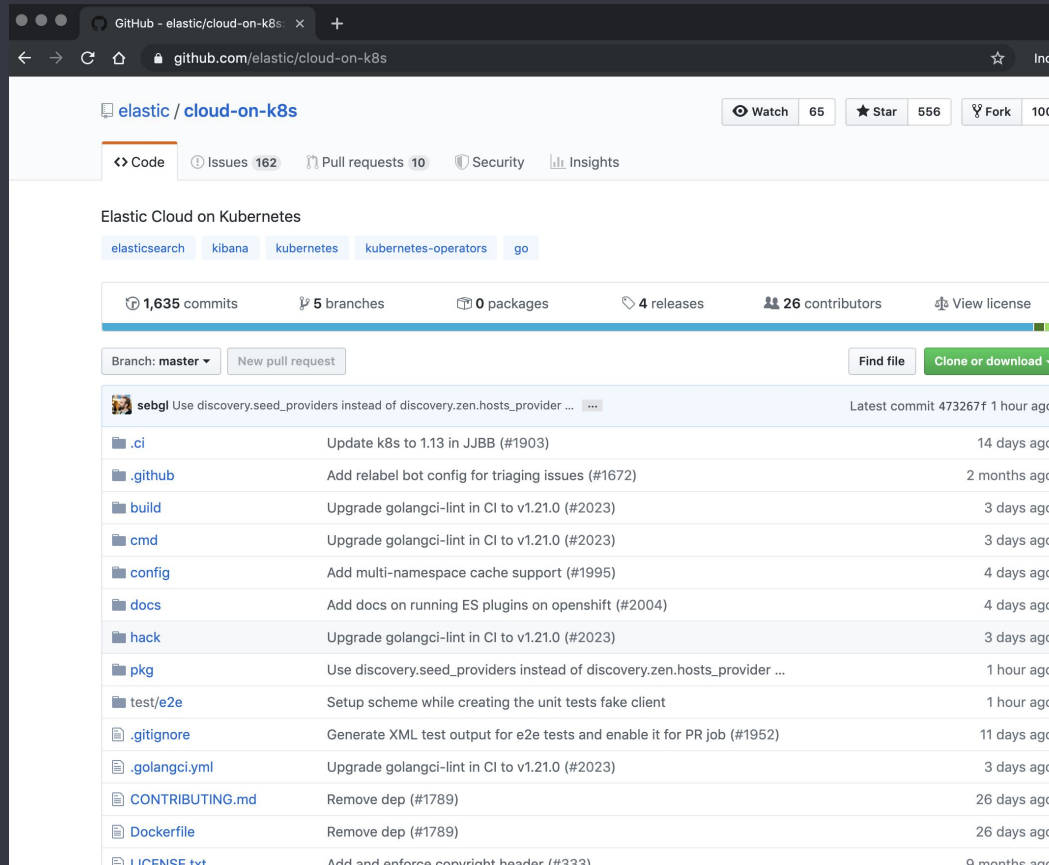
Advanced topologies
Hot/warm/cold, dedicated masters

Smooth operations
Scale up/down, rolling upgrade, version upgrade

Elastic Cloud on Kubernetes Operator
1.3.0 just released!

1.3.0

- Red Hat OpenShift Certified Operator

- Volume expansion support

- Helm chart for the operator

- IPv6 support

elastic

Demo

elastic

Docs and Quickstart https://www.elastic.co/guide/en/cloud-on-k8s

Code https://github.com/elastic/cloud-on-k8s

Sebastien Guilloux on our experience writing an operator
https://www.youtube.com/watch?v=wMqzAOp15wo