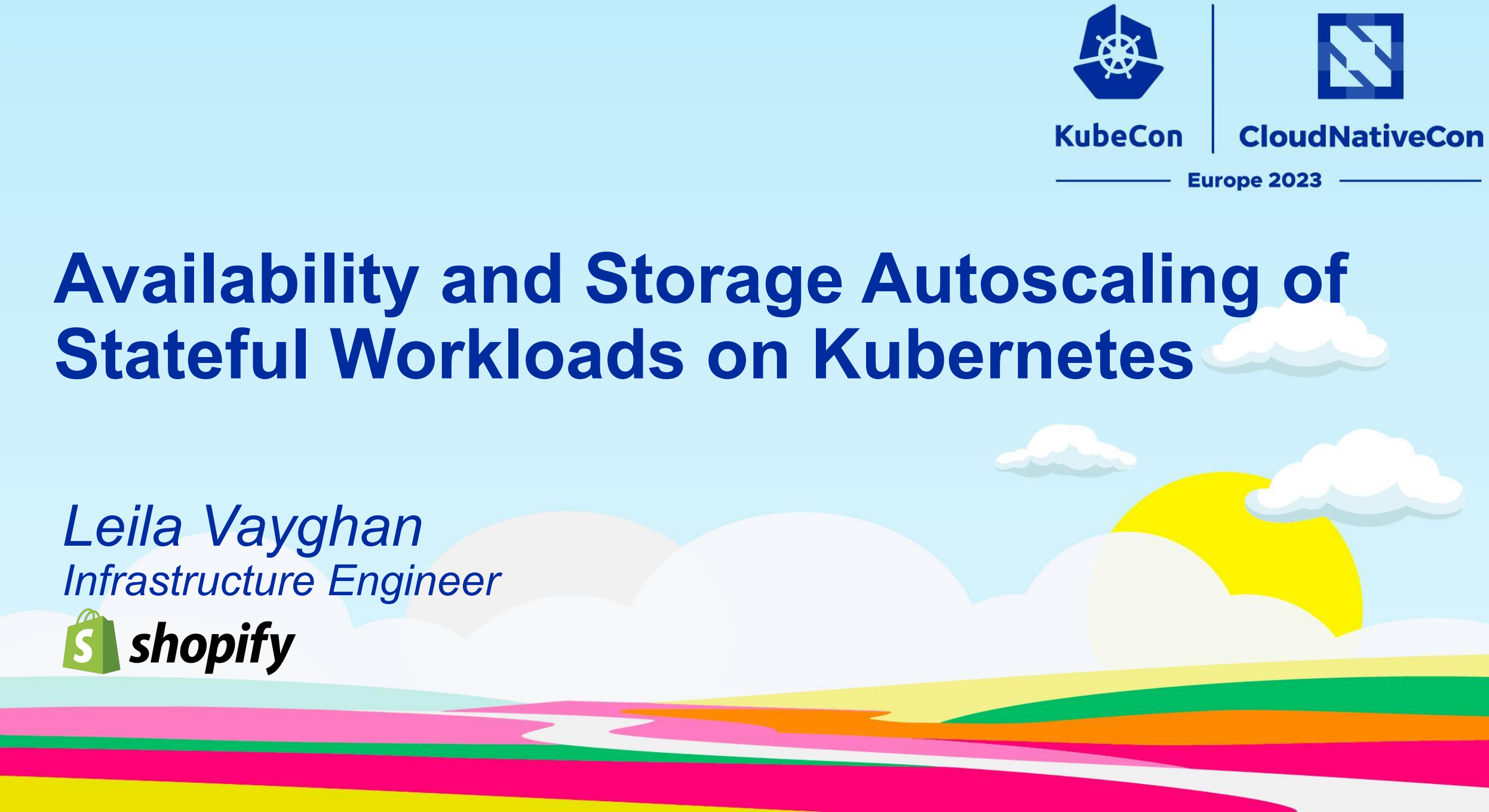

KubeCon
CloudNativeCon
Europe 2023



Availability and Storage Autoscaling of Stateful Workloads on Kubernetes

Leila Vayghan
Infrastructure Engineer
shopify

Agenda

- Stateful services at Shopify
- Availability of stateful services
- Storage autoscaling
  - Storage scale down
  - Storage scale up
  - demo
- Q/A

Shopify

Commerce platform

+3 million merchants

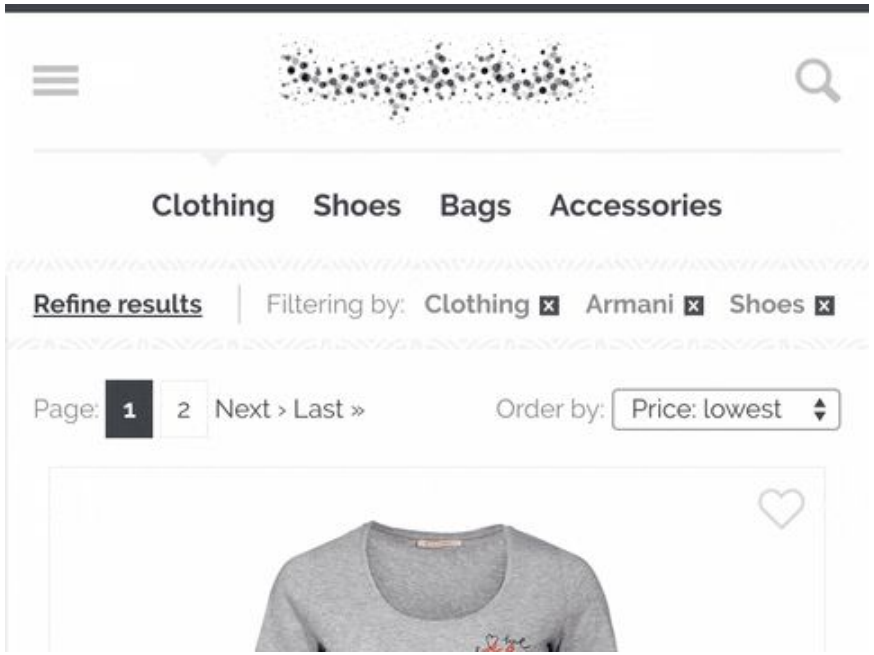
+700 Billion USD in GMV

Shopify

Sold +7 Billion USD in GMV

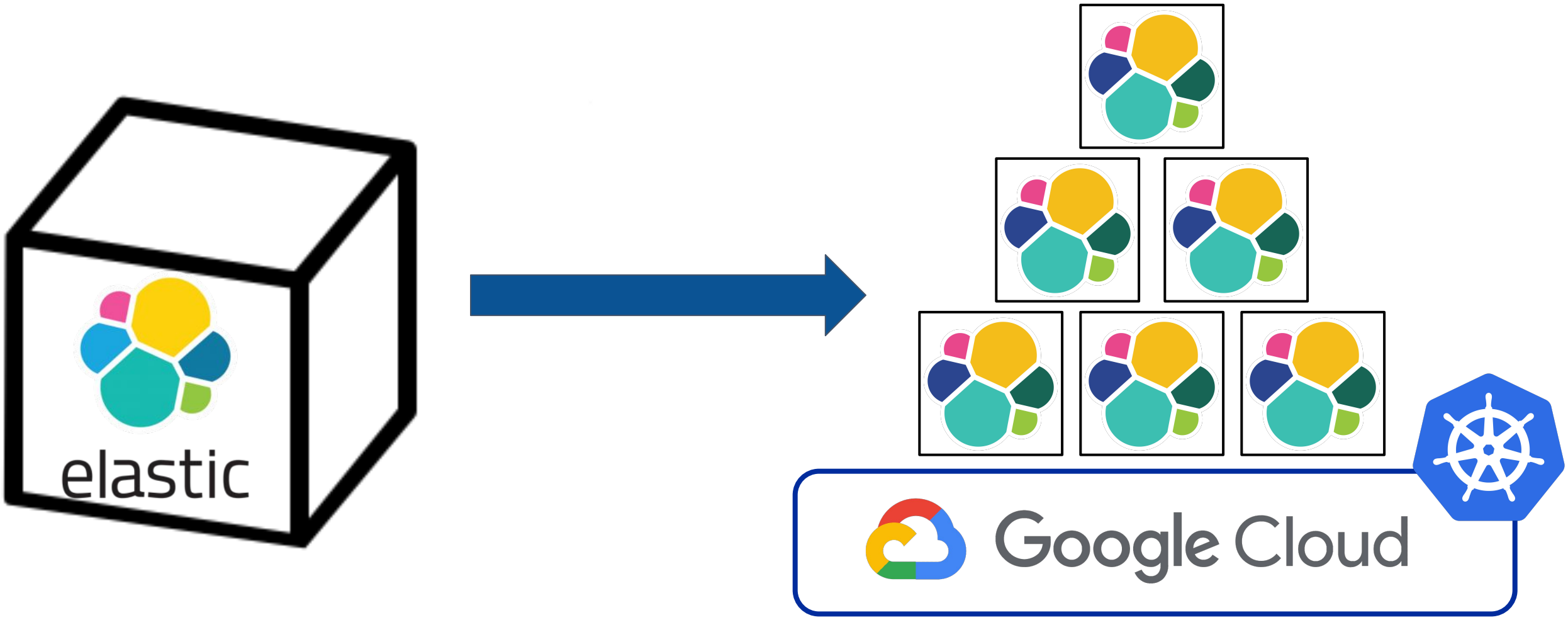
During BFCM 2022

Search at Shopify



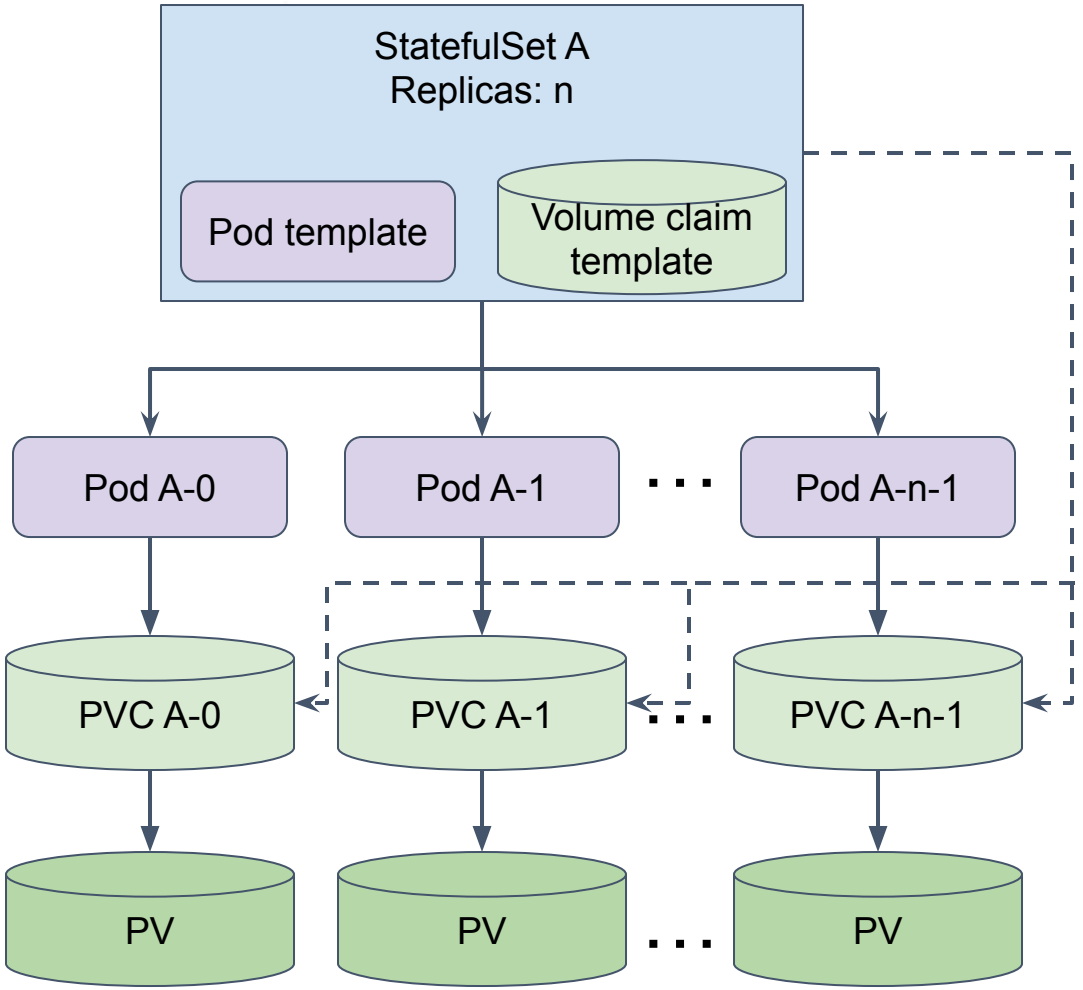
Search Engine

Search at Shopify



Stateful Services

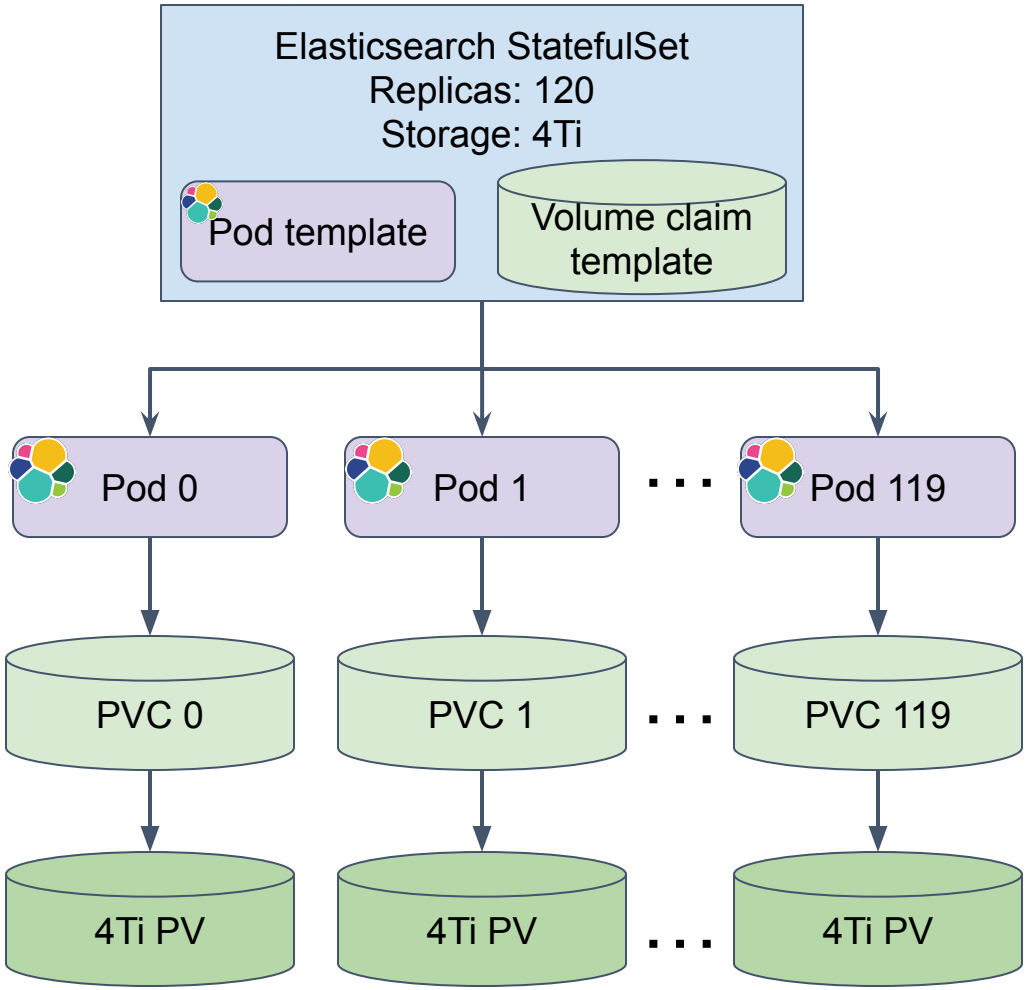
Rely on persistent data and their response depends on history



Stateful Services

KubeCon CloudNativeCon Europe 2023

One of the Elasticsearch instances powering Shopify search

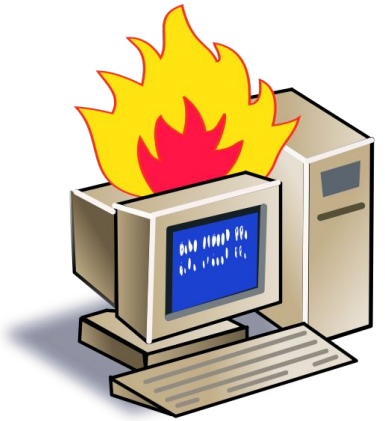


Service Availability

System failures

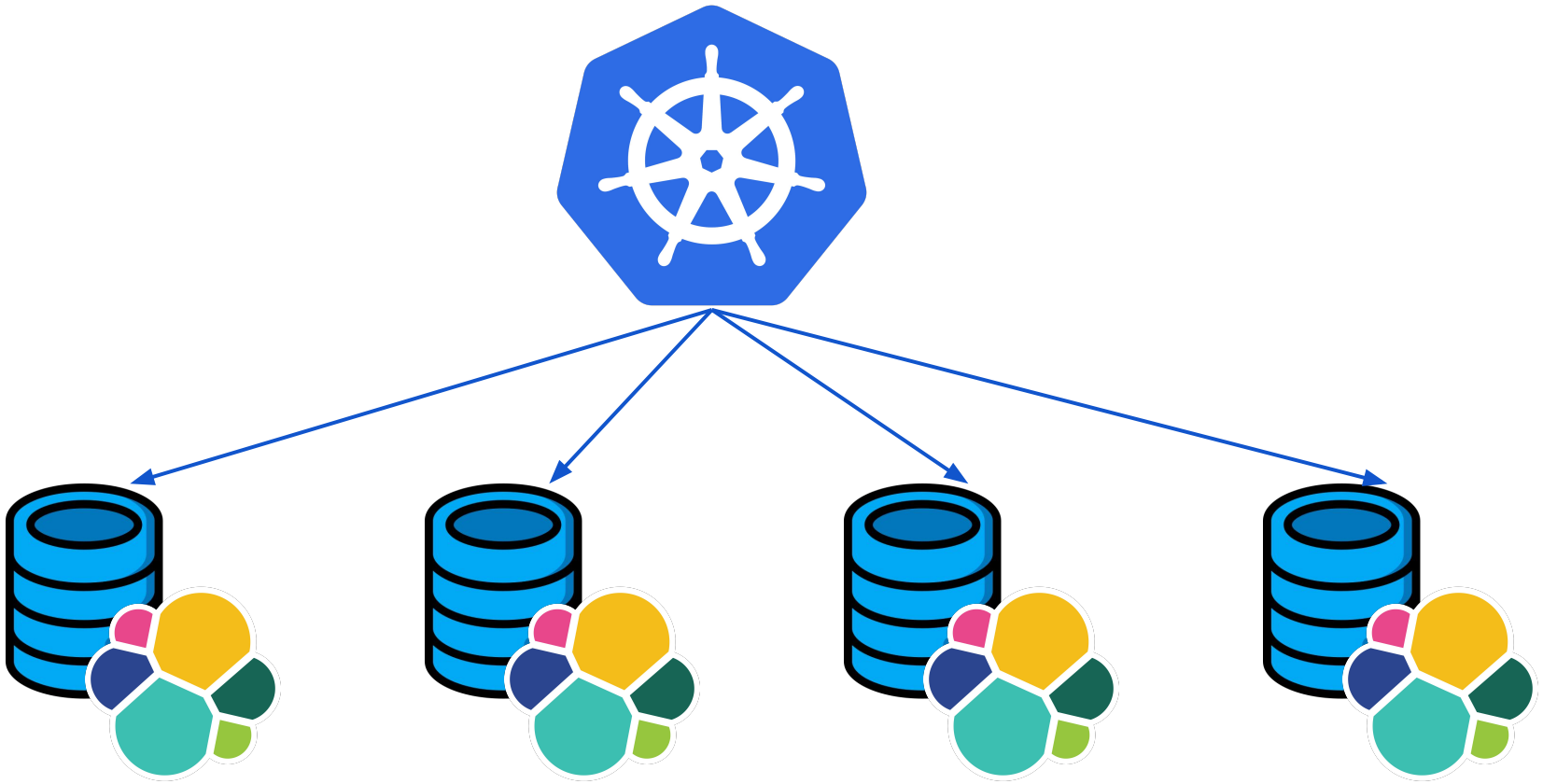
Natural disasters

Lack of storage space



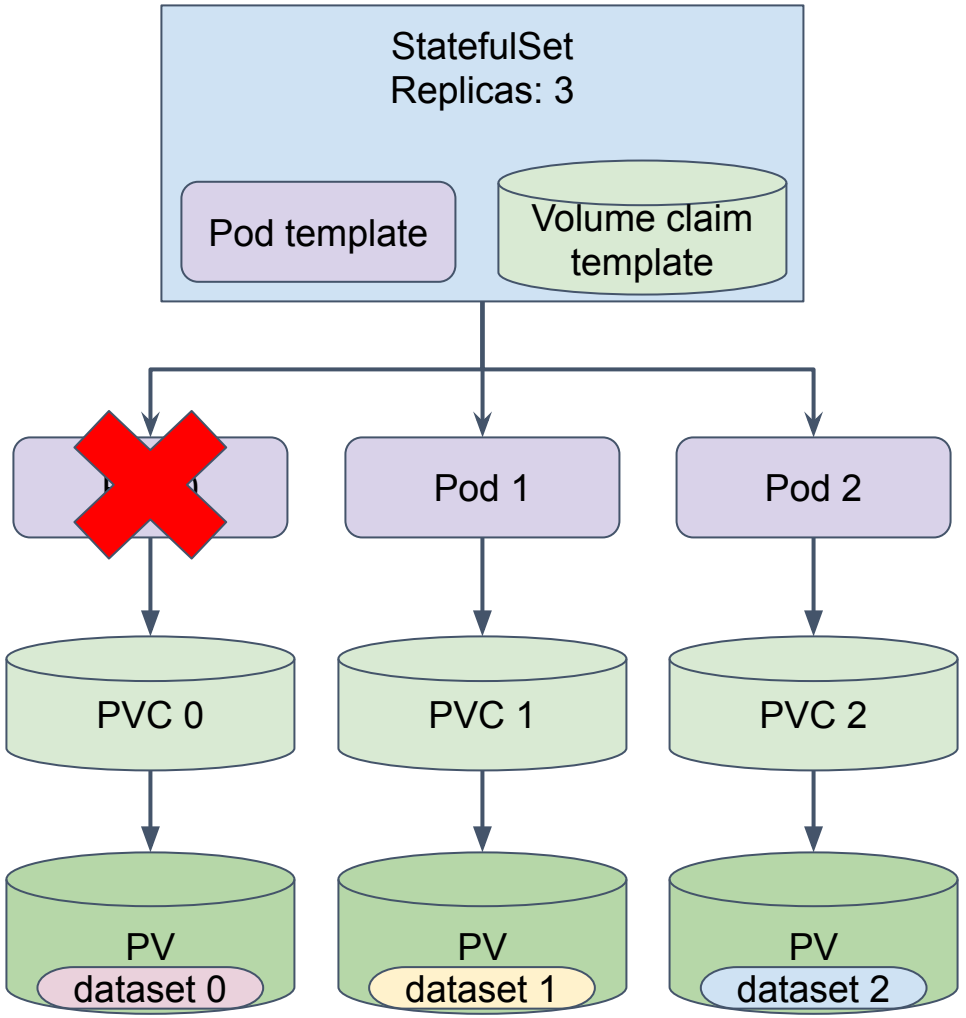
Availability of Stateful Services

Does Kubernetes provide availability for stateful services?

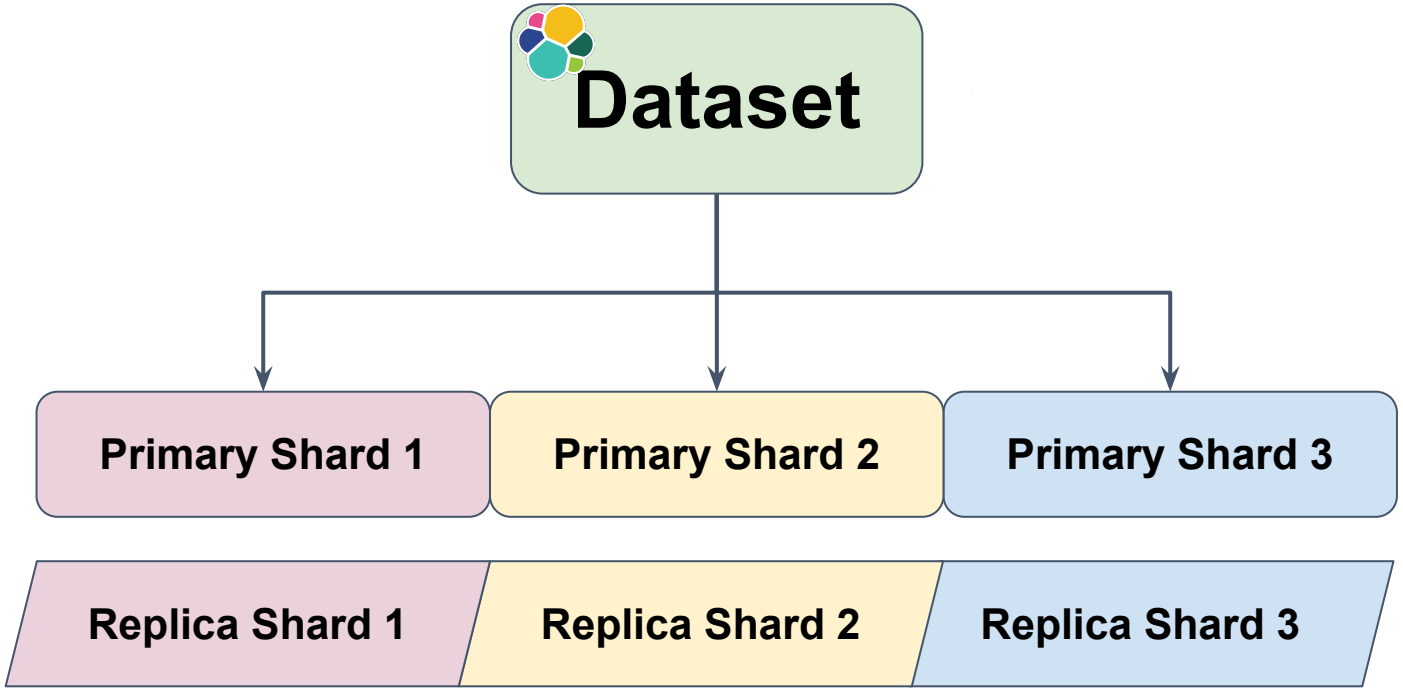


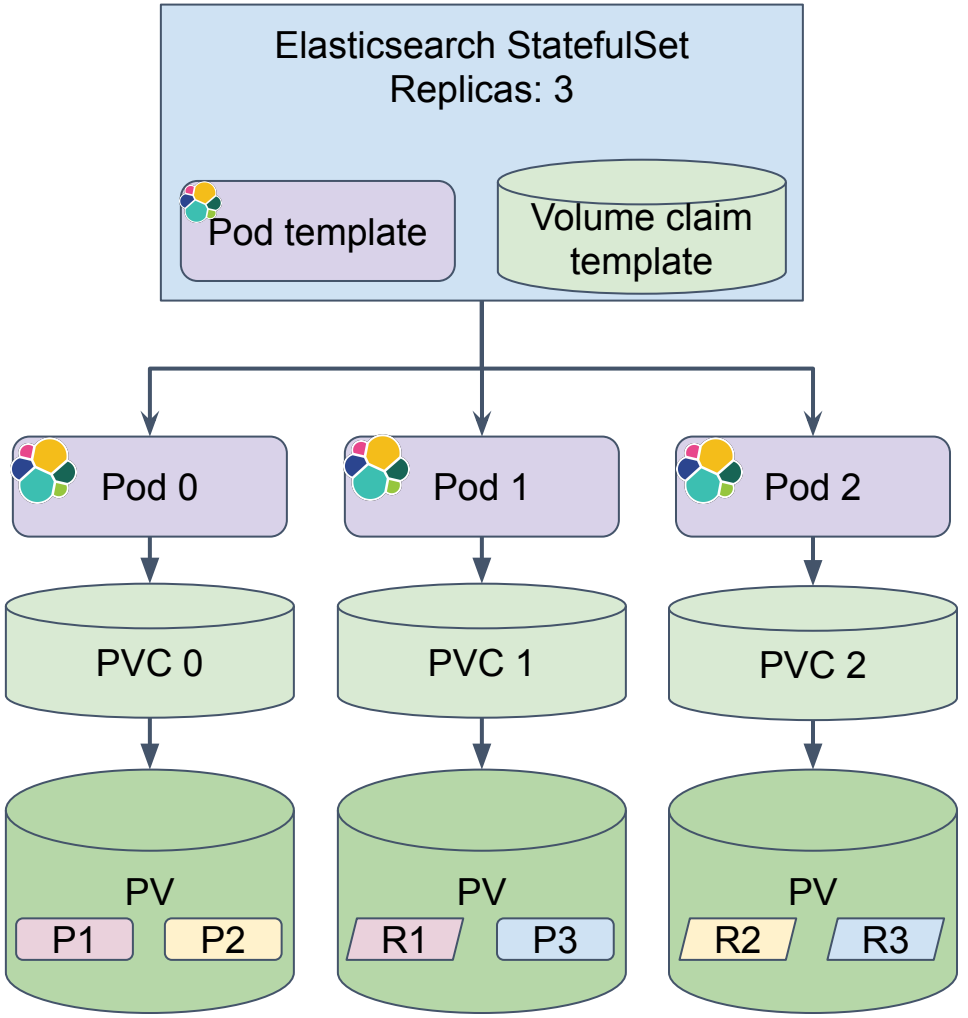
Availability of Stateful Services

Kubernetes does not provide data redundancy



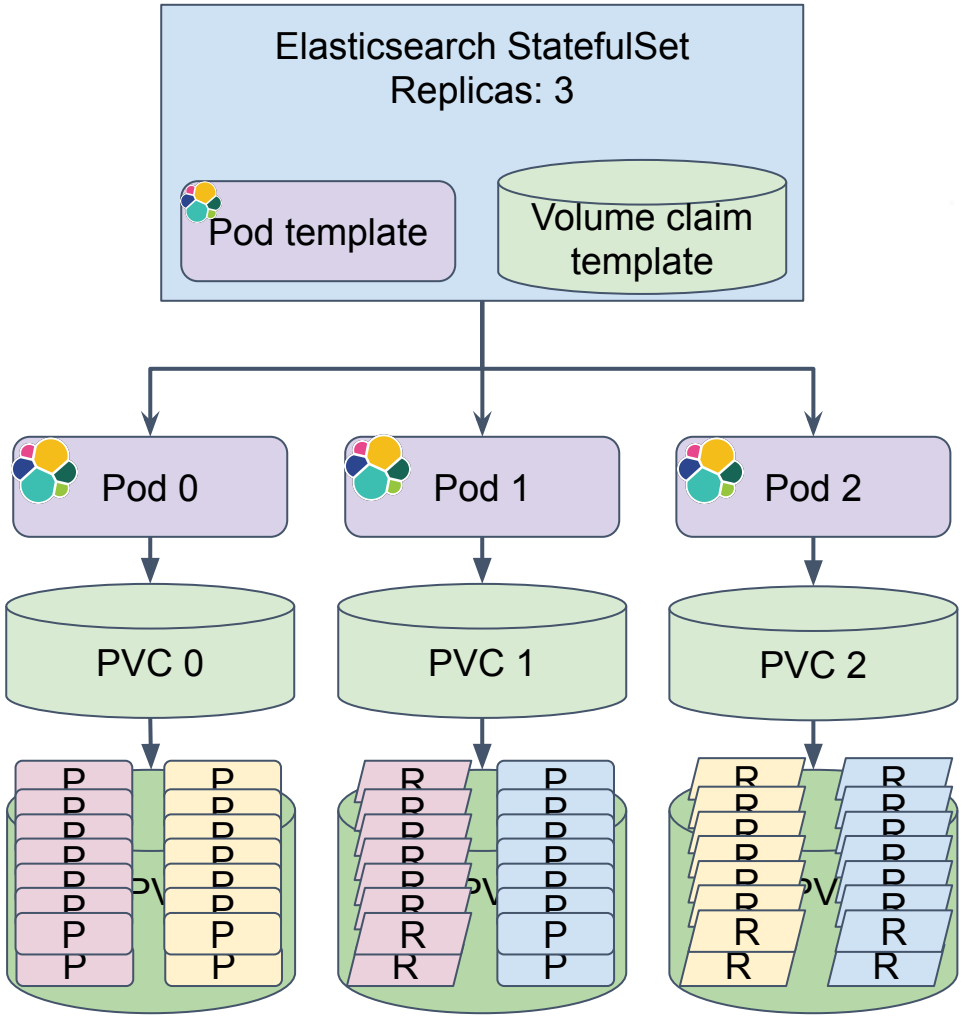
Availability of Stateful Services



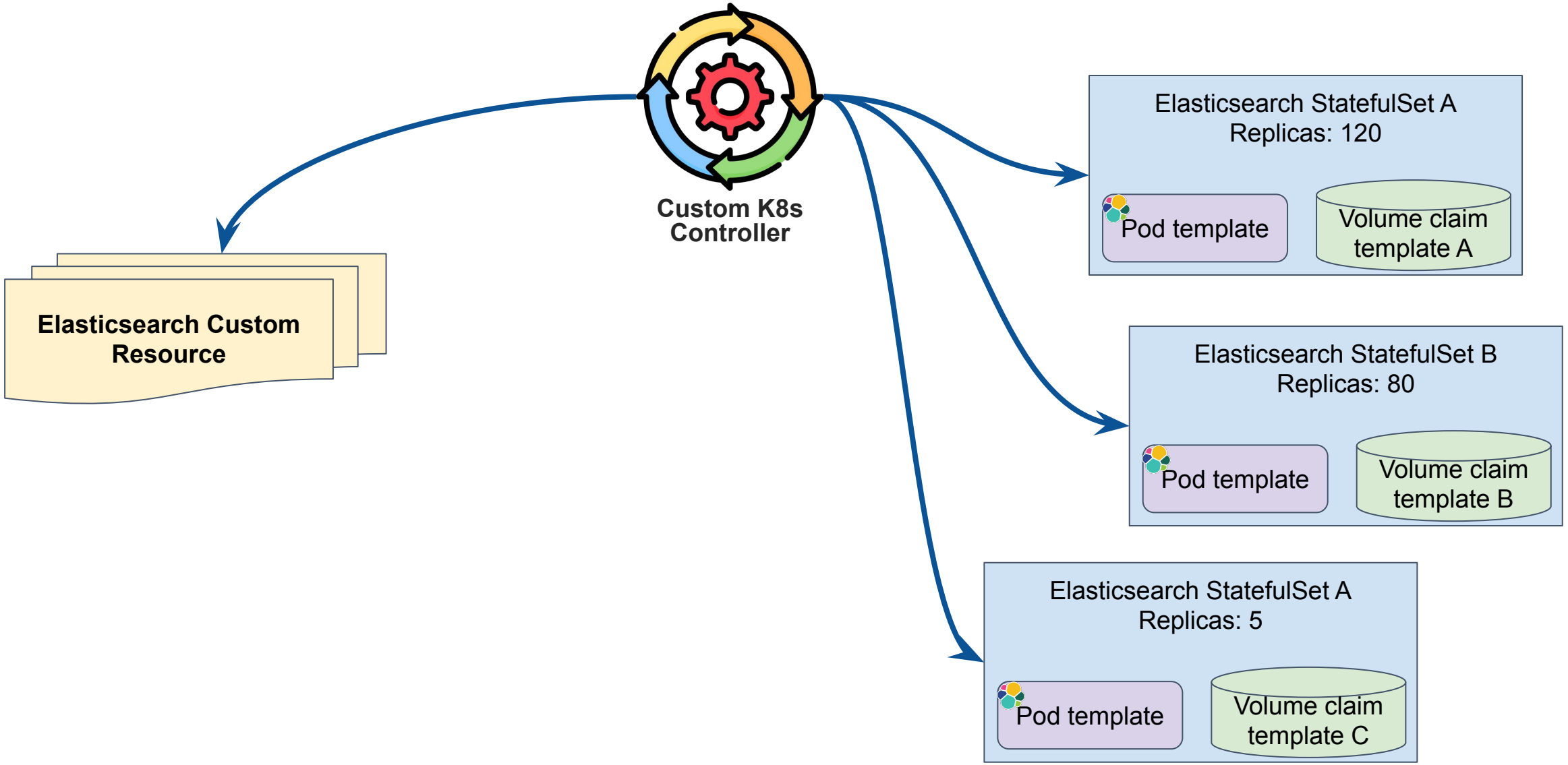


Stateful Services

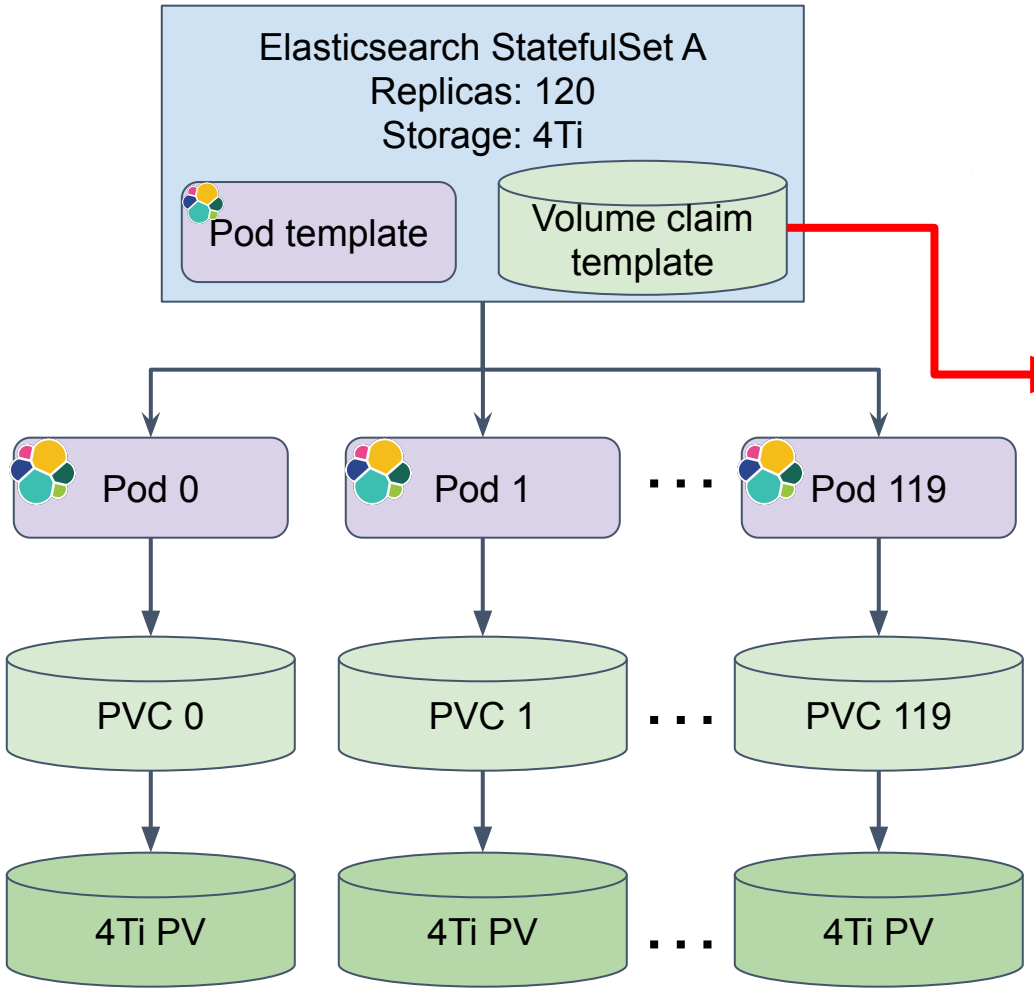
Storage Autoscaling



Storage Autoscaling

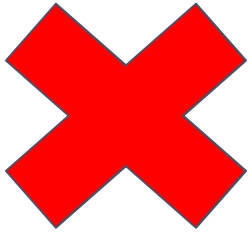


Storage Autoscaling




```yaml
apiVersion: apps/v1
kind: StatefulSet
metadata: …
spec:
  podManagementPolicy: Parallel
  replicas: 120
  selector: …
  serviceName: es-staging--elasticsearch-data
  template: …
  updateStrategy: …
  volumeClaimTemplates:
  - apiVersion: v1
    kind: PersistentVolumeClaim
    metadata:
      name: es-staging--elasticsearch-data
    spec:
      accessModes:
      - ReadWriteOnce
      resources:
        requests:
          storage: 4Ti
      storageClassName: es-pd-ssd
```

8Ti



Storage Autoscaling

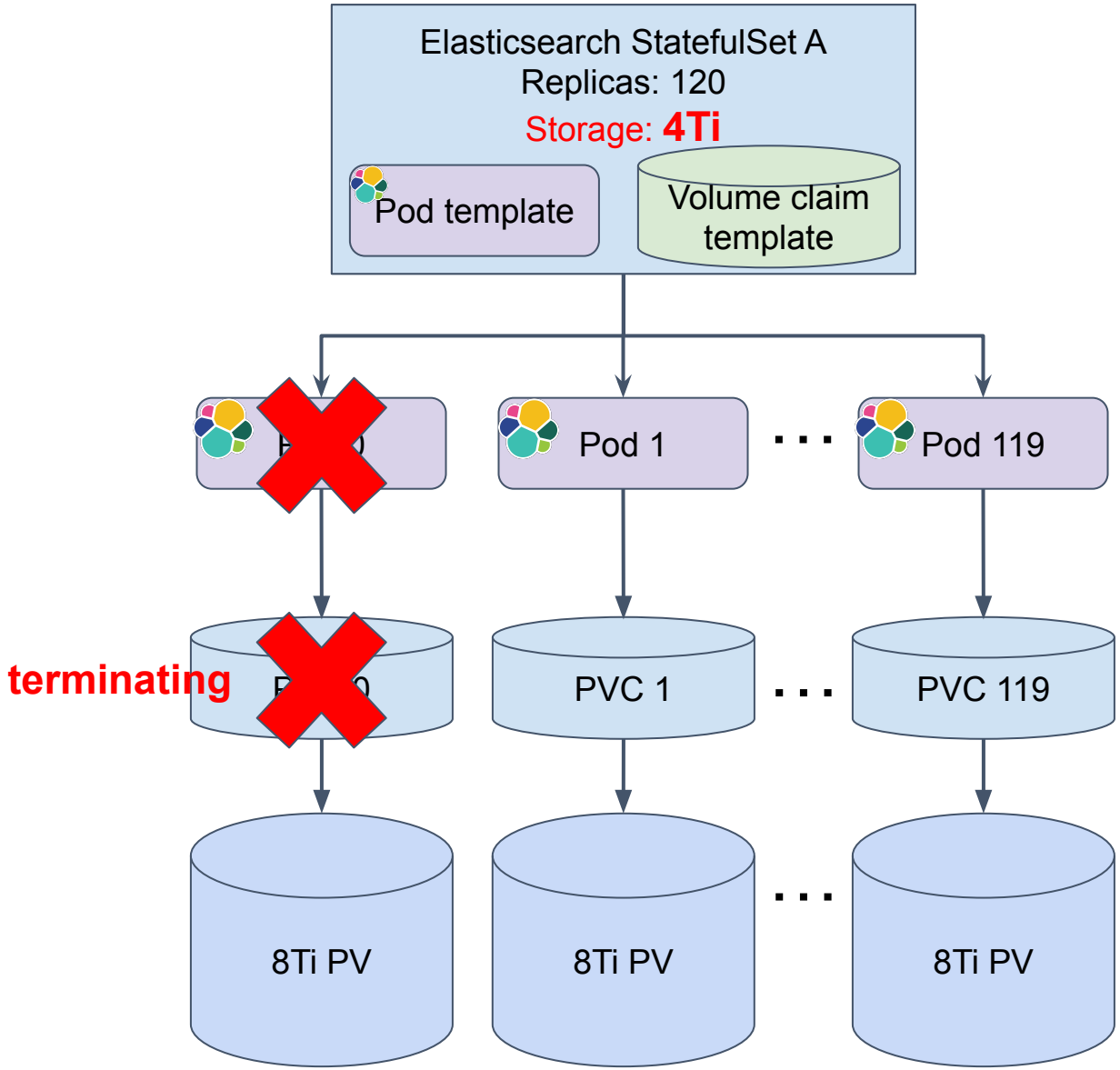
KubeCon CloudNativeCon Europe 2023

-zsh ⌥⌘1

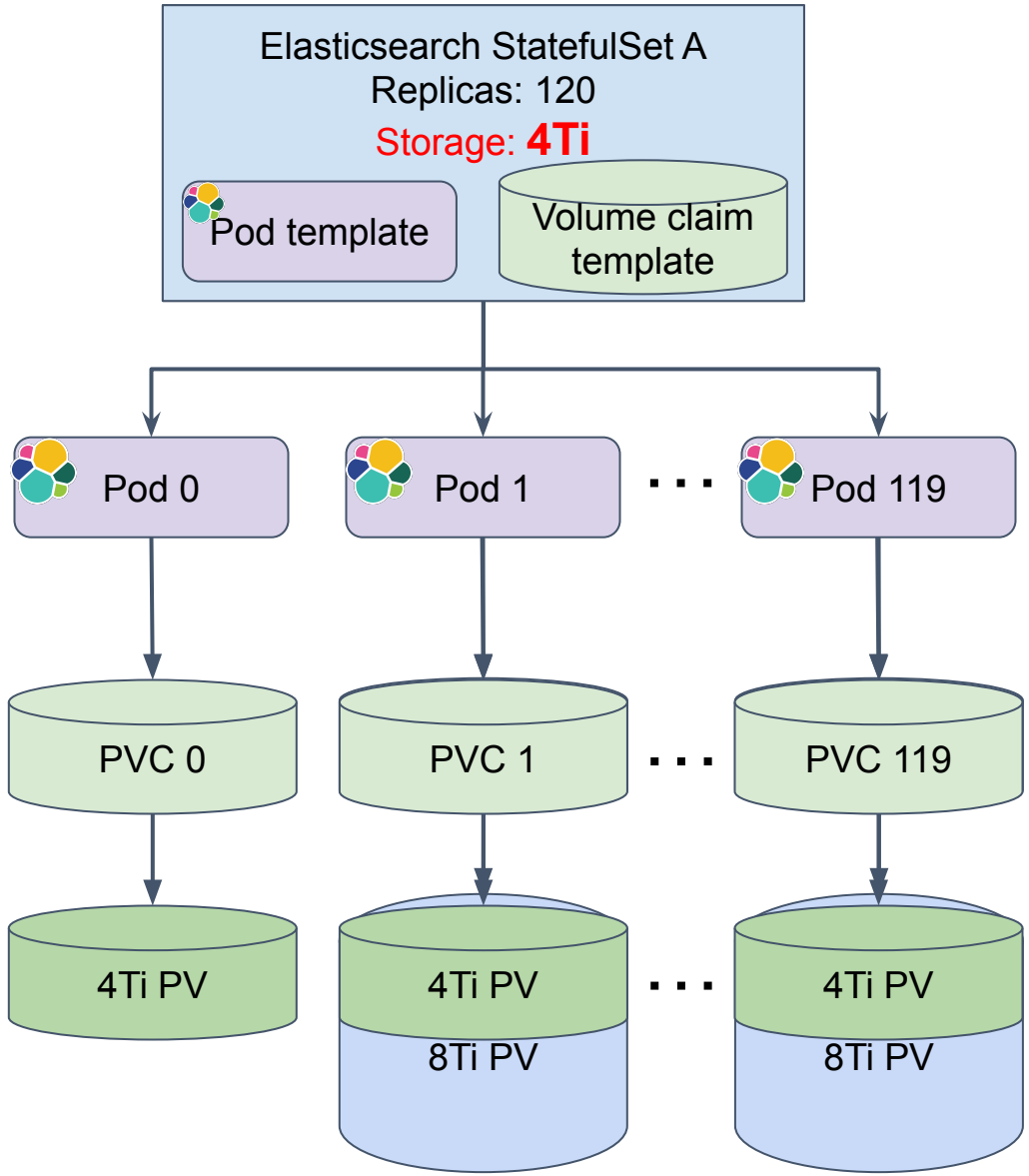
```
# Please edit the object below. Lines beginning with a '#' will be ignored,
# and an empty file will abort the edit. If an error occurs while saving this file will be
# reopened with the relevant failures.
#
# statefulsets.apps "es-staging--elasticsearch-data" was not valid:
# * spec: Forbidden: updates to statefulset spec for fields other than 'replicas', 'template', 'updateStrategy', 'persiste
ntVolumeClaimRetentionPolicy' and 'minReadySeconds' are forbidden
#
apiVersion: apps/v1
kind: StatefulSet
metadata:
  creationTimestamp: "2023-02-21T15:01:24Z"
  generation: 1
  labels:
    client_node: "true"
    component: elasticsearch
    data_node: "true"
    es-major-version: "8"
    es_node: "true"
"/var/folders/nv/4sk3tcc95l5c1525kxw1gjx00000gn/T/kubectl-edit-2309173523.yaml" 426L, 13420B
```

Storage Scale Down

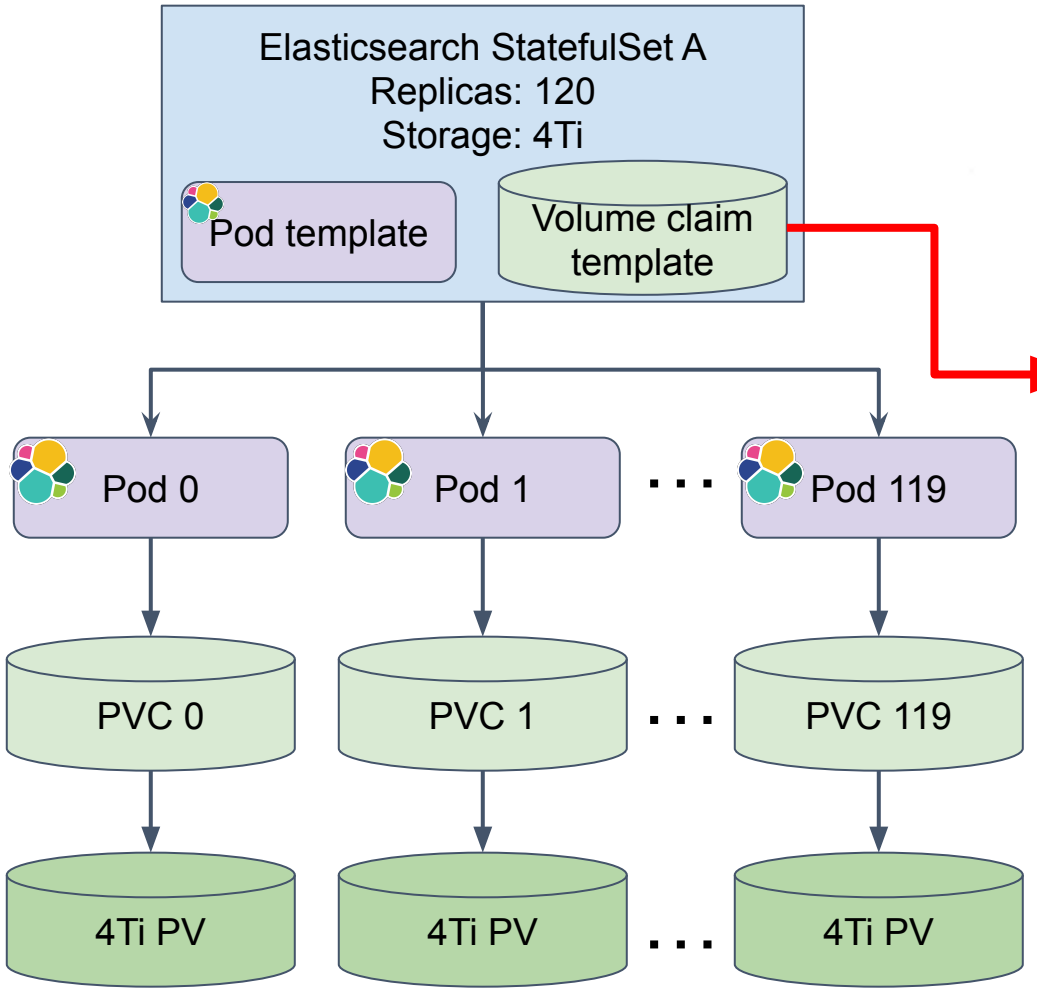
```
kubectl delete statefulset some-statefulset --cascade=false
```



Storage Scale Down



Storage Scale Up

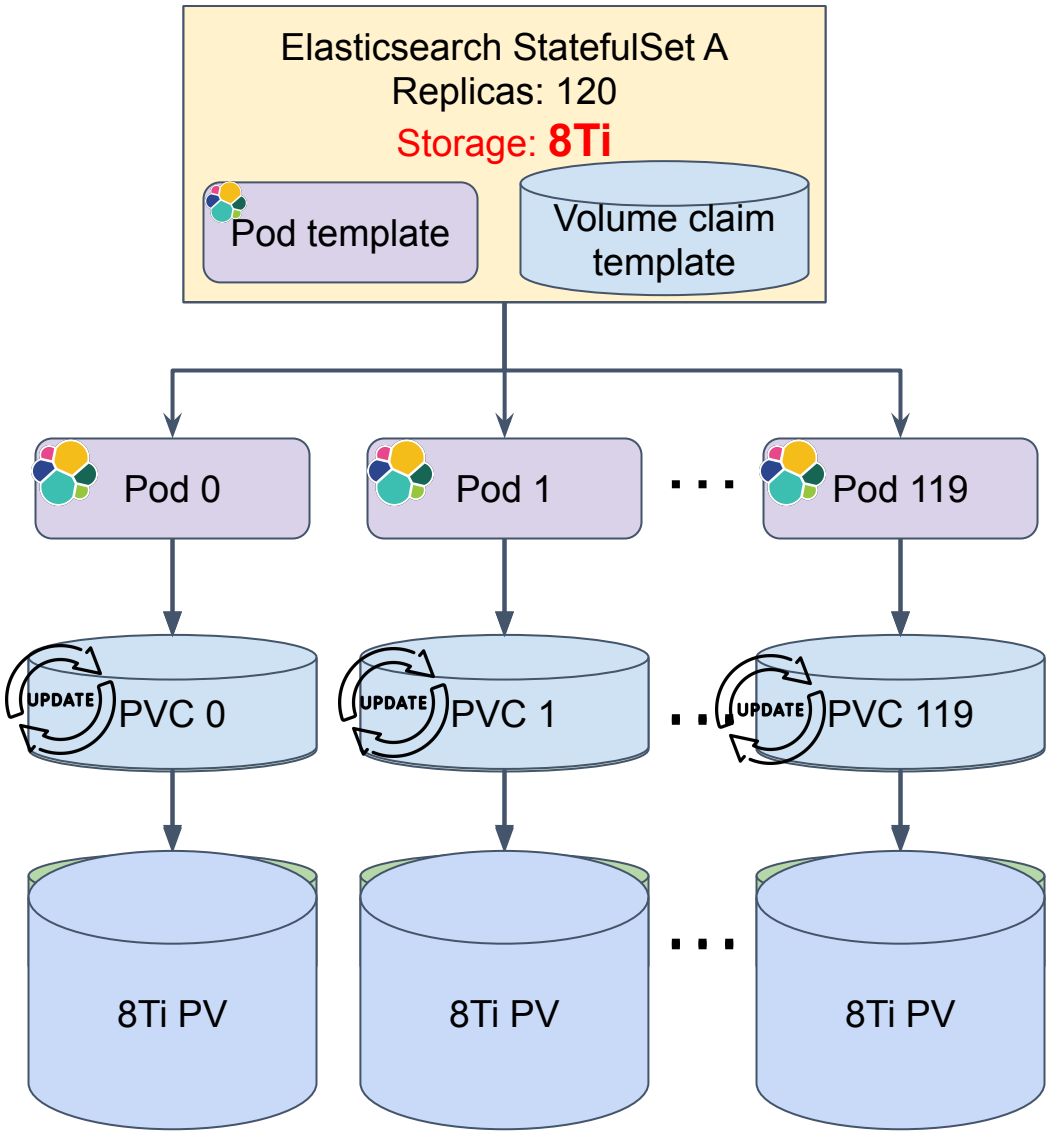



```yaml
apiVersion: apps/v1
kind: StatefulSet
metadata: …
spec:
  podManagementPolicy: Parallel
  replicas: 120
  selector: …
  serviceName: es-staging--elasticsearch-data
  template: …
  updateStrategy: …
  volumeClaimTemplates:
  - apiVersion: v1
    kind: PersistentVolumeClaim
    metadata:
      name: es-staging--elasticsearch-data
    spec:
      accessModes:
      - ReadWriteOnce
      resources:
        requests:
          storage: 4Ti
      storageClassName: es-pd-ssd
```

```yaml
allowVolumeExpansion: true
apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
  labels: …
  name: es-pd-ssd
parameters:
  type: pd-ssd
provisioner: kubernetes.io/gce-pd
reclaimPolicy: Delete
volumeBindingMode: Immediate
```

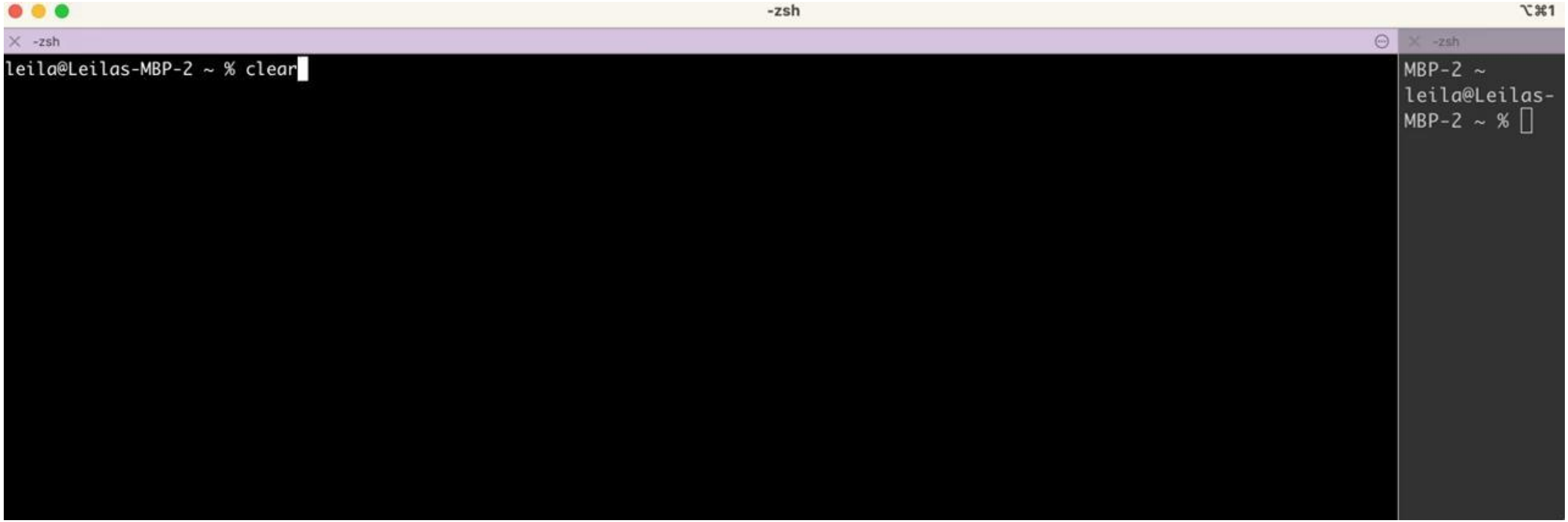
Storage Scale Up

```
kubectl delete statefulset some-statefulset --cascade=false
```

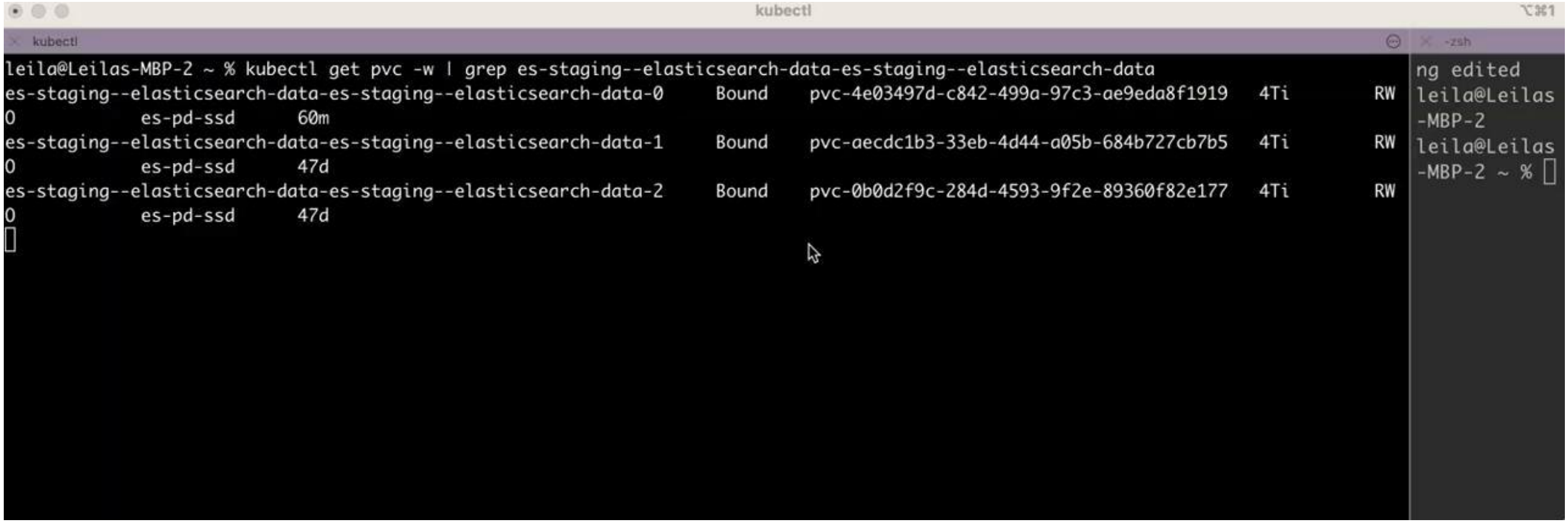


Storage Scale Up Demo

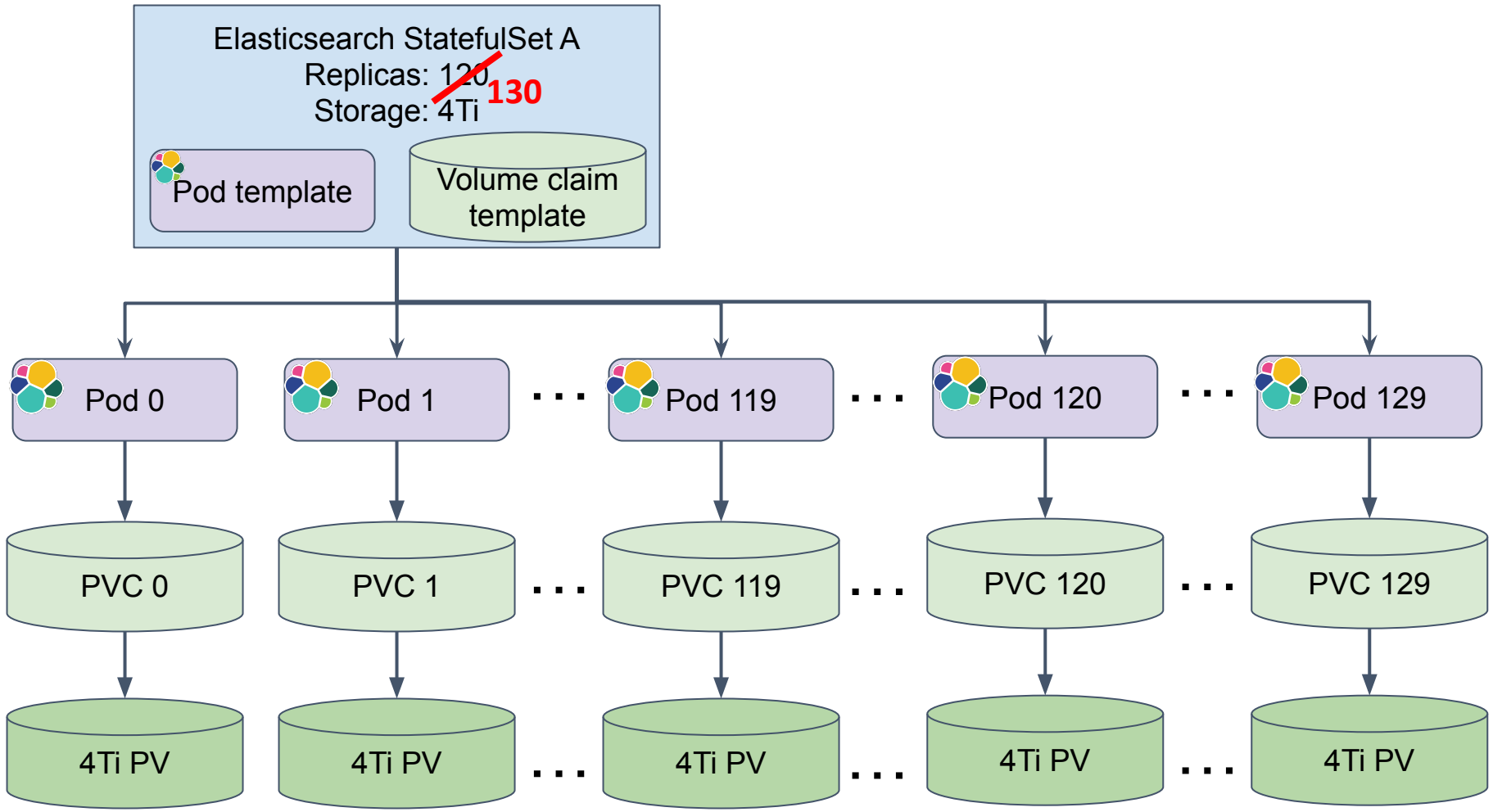
KubeCon CloudNativeCon Europe 2023



Storage Scale Up Demo



Storage Scale Out



Summary

- Kubernetes does not automatically provide availability and fault tolerance for stateful services
- Storage autoscaling can be automated by using custom controllers
- Scaling down storage is not a trivial task and Kubernetes does not support it
- Scaling up storage is more straightforward and Kubernetes has a feature that allows for volume expansion

Q/A

Please scan the QR Code above
to leave feedback on this session