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#KubeCon #CloudNativeCon

Kubernetes SIG Storage Intro & Deep Dive

Xing Yang (VMware by Broadcom) & Jan Šafránek (Red Hat)



Agenda



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- What is SIG Storage
- What we did in 1.35
- What we are working on in 1.36
- Features in design/prototyping
- How to get involved

SIG Storage



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- Co-Chairs: Saad Ali (Google) and Xing Yang (VMware by Broadcom)
- Tech Leads: Michelle Au (Google) and Jan Šafránek (Red Hat)
- #sig-storage slack channel members: 6860+
- #csi slack channel members: 1790+
- #sig-storage-cosi slack channel members: 480+
- #csi-windows slack channel members: 290+
- SIG-Storage zoom meeting attendees: 25
- Unique approvers for SIG-owned packages: 30

What we do



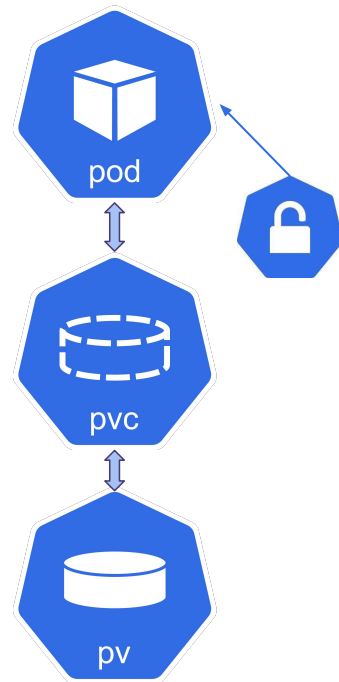
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- Defined in [SIG Storage Charter](#)
 - Persistent Volume Claims and Persistent Volumes
 - Storage Classes and Dynamic Provisioning
 - Kubernetes volume plugins
 - NFS, iSCSI, FC, Local
 - Secret, ConfigMap, DownwardAPI, Projected and EmptyDir Volumes (co-owned with SIG-Node)
 - Container Storage Interface (CSI)
 - CSI sidecars
 - Most CSI drivers are owned by [SIG Cloud Provider](#) or other community
 - Container Object Storage Interface (COSI)
 - Targeting v1alpha2 in 1.36





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What we did in 1.35



What we did in 1.35



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- Beta
 - [SIG-Auth] CSI driver opt-in for service account tokens via secrets field
 - Security improvement for CSI drivers that use Pod service account tokens, like secret-store-csi-driver
 - Passes the token through CSI secrets field in NodePublishVolumeRequest instead of volume context
 - Requires CSI driver update, rollout sequence

```
apiVersion: storage.k8s.io/v1
kind: CSIDriver
metadata:
  name: example-csi-driver
spec:
  # ... existing fields ...
  tokenRequests:
    - audience: "example.com"
      expirationSeconds: 3600
  # New field for opting into secrets
  # delivery; defaults to false
  serviceAccountTokenInSecrets: true
```

What we did in 1.35



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- Beta - Enable by default
 - Mutable Volume Attach Limits
 - Making allocatable property (how many volumes can be used on a node) mutable in CSINode objects
 - Prevent permanent scheduling errors due to mismatch between the reported and actual attachment capacity on nodes.

```
// CSINodeDriver holds information about the
// specification of one CSI driver installed
type CSINodeDriver struct {
    ...
    // +optional
    Allocatable *VolumeNodeResources}

type VolumeNodeResources struct {
    // +optional
    Count *int32
}
```

```
// CSIDriverSpec is the specification of a
// CSIDriver.
type CSIDriverSpec struct {
    ...
    // +optional
    NodeAllocatableUpdatePeriodSeconds *int64
}
```

What we did in 1.35



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- Alpha
 - Mutable PersistentVolume Node Affinity
 - PV Node Affinity limits which nodes can use the volume
 - Volume modification may lead to migration and topology change
 - Drivers have to support non-disruptive topology updates (existing workloads continue to run successfully)

```
required:
  nodeSelectorTerms:
    - matchExpressions:
        - key: topology.kubernetes.io/zone
          operator: In
          values:
            - zone-us-east-1
```



```
required:
  nodeSelectorTerms:
    - matchExpressions:
        - key: topology.kubernetes.io/region
          operator: In
          values:
            - region-us-east
```

What we did in 1.35



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- Alpha
 - [SIG-Autoscaling] Integrate CSI volume attach limits with cluster auto scaler
 - Fix cluster-autoscaler to consider volume attach limits
 - Scale-from-zero
 - Scale nodegroups with existing nodes
 - Also, only schedule pods to nodes where CSI driver is installed, if cluster admin opt-in via CSIDriver object.

```
// CSIDriverSpec is the specification of a
// CSIDriver.
type CSIDriverSpec struct {
    ...
    // +optional
    // Defaults: false
    PreventPodPlacementWithoutDriver *bool
}
```



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What we are working on in 1.36 and beyond



What we are working on in 1.36



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- Target GA
 - [SIG-Auth] CSI driver opt-in for service account tokens via secrets field
 - Mutable Volume Attach Limits
- Staying in Alpha
 - [SIG-Autoscaling] Integrate CSI volume node limits with auto scaler
 - Mutable PersistentVolume Node Affinity

What we are working on in 1.36



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- Target GA
 - VolumeGroupSnapshot
 - New Kubernetes APIs to take a snapshot of multiple volumes together:
 - VolumeGroupSnapshot
 - VolumeGroupSnapshotContent
 - VolumeGroupSnapshotClass
 - CSI spec changes
 - New Group Controller Service
 - New gRPC interfaces for create/delete/get volume group snapshot
 - Introduced in 1.27
 - v1beta1 in 1.32; v1beta2 in 1.34
 - <https://kubernetes.io/blog/2025/09/16/kubernetes-v1-34-volume-group-snaps-hot-beta-2/>

VolumeGroupSnapshot



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```
apiVersion: groupsnapshot.storage.k8s.io/v1beta2
kind: VolumeGroupSnapshot
metadata:
  name: mygroupsnap
  namespace: default
spec:
  source:
    selector:
      matchLabels:
        app.kubernetes.io/name: mongo
  volumeGroupSnapshotClassName: my-groupclass
```

VolumeGroupSnapshot



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```
apiVersion: groupsnapshot.storage.k8s.io/v1beta2
kind: VolumeGroupSnapshot
metadata:
  name: mygroupsnap
  namespace: default
spec:
  source:
    selector:
      matchLabels:
        app.kubernetes.io/name: mongo
    volumeGroupSnapshotClassName: my-groupclass
status:
  readyToUse: true
```

VolumeGroupSnapshot



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```
apiVersion: groupsnapshot.storage.k8s.io/v1beta2
kind: VolumeGroupSnapshot
metadata:
  name: mygroupsnap
  namespace: default
spec:
  source:
    selector:
      matchLabels:
        app.kubernetes.io/name: mongo
    volumeGroupSnapshotClassName: my-groupclass
status:
  readyToUse: true
```

```
apiVersion: snapshot.storage.k8s.io/v1
kind: VolumeSnapshot
metadata:
  name: snapshot-40c5e6...
spec:
  source:
    persistentVolumeClaimName: mongo-1
status:
  volumeGroupSnapshotName: mygroupsnap
```

What we are working on in 1.36



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- Target GA
 - SELinux Relabeling with Mount Options for non-RWOP volumes.
 - Speeds up container startup by mounting volumes with the correct SELinux label
 - Behavior change!
 - Today:
 - A privileged + unprivileged pods can simultaneously access a volume
 - 1.37-ish:
 - **A privileged + unprivileged pods can't simultaneously access the same volume**

SELinux Relabeling



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- 1.36:
 - All “safe” feature gates are GA:
 - SELinuxMountReadWriteOncePod - for volumes can’t conflict
 - SELinuxChangePolicy - as a pro-active opt-out
 - KCM + kubelet emits events + metrics
 - Rework your Pods
 - Opt-out using Pod
 - `spec.securityContext.seLinuxChangePolicy`
- 1.37:
 - SELinuxMount is GA 🤖

What we are working on in 1.36



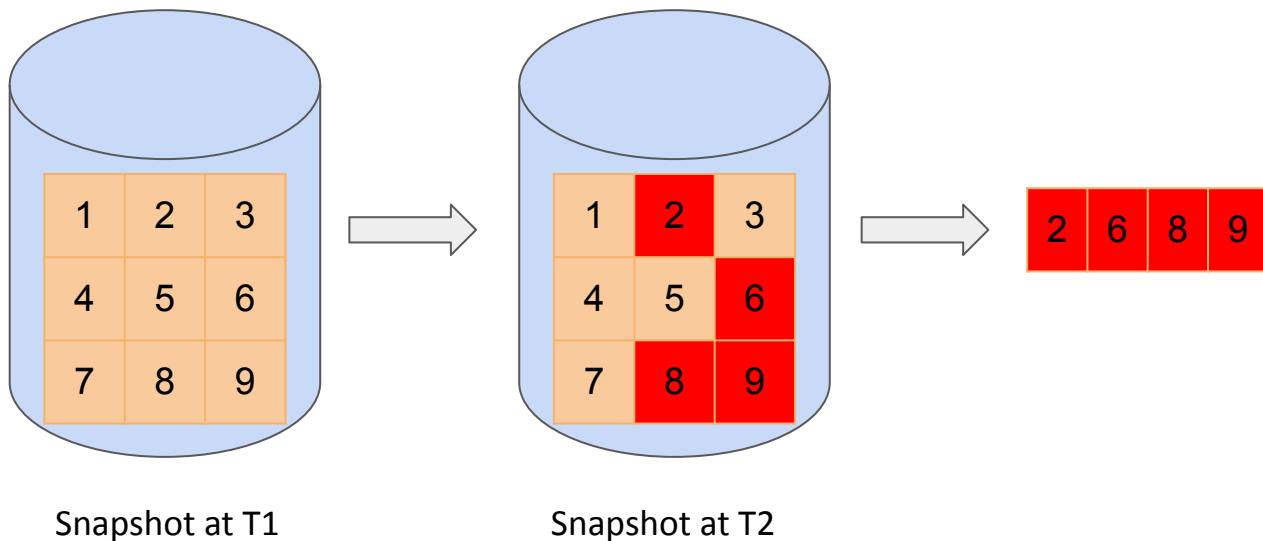
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- Target Beta
 - Changed block tracking (CBT)



What we are working on in 1.36



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- Target Beta
 - Changed block tracking (CBT)
 - Introduces a new sidecar for snapshot metadata service:
 - <https://github.com/kubernetes-csi/external-snapshot-metadata>
 - Exposes secure gRPC service to which backup vendors can connect to for retrieving snapshot metadata of allocated and changed blocks to support Incremental volume backup

What we are working on in 1.36



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- Target Beta

- Remove GitRepo in-tree Plugin
- Deprecated for a long time and unmaintained
- Security concerns: gitRepo volume types can be exploited to gain remote code execution as root on the nodes (CVE-2024-10220)
- Alternatives: initContainers, git-sync
- 1.36: The in-tree gitRepo volume plugin is disabled & locked
 - Feature gate `GitRepoVolumeDriver`.
- 1.39: Remove the gitRepo driver code.

What we are working on in 1.36



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- Staying in Alpha - moving to [v1alpha2](#)
 - Container Object Storage Interface [COSI](#)
 - Adds Read/Write access mode
 - Adds multiple bucket support to BucketAccess
 - Sidecar/controller architecture redesign to improve version skew and reduced RBACs.

What we are working on in 1.36



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- Target Alpha
 - Report last used time on a PVC
 - Report when a PVC was last used in PVC status

```
kind: PersistentVolumeClaim
spec:
  ...
status:
  conditions:
    - lastTransitionTime: "2026-03-21T05:12:05Z"
      message: No pods are currently referencing this PVC
      reason: NoPodsUsingPVC
      status: "True"
      type: Unused
```

Features in Design/Prototyping



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- [SIG-Apps] Support Volume Expansion through StatefulSet
- Combining CSI sidecars into a single component
 - Reduce sidecar overhead and reduce CSI driver maintenance complexity
- Volume Health
 - Currently in alpha
 - Add API reporting and fine-grained signals (statuses, timestamps)



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How to get involved



How to get involved



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- Start at the SIG Storage page:
 - <https://github.com/kubernetes/community/tree/master/sig-storage>
- Attend [our meetings](#):
 - [Bi-weekly meeting](#): 9am PT / 6pm CET every second Thursday.
 - Sub-project meetings: [COSI](#), [CSI](#), [Data protection](#)
- Mailing List:
 - sig-storage@kubernetes.io
- Slack channel:
 - #sig-storage
 - #csi
 - #sig-storage-cosi

Resources



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- [SIG Storage page](#)
- [Storage concepts](#)
- [CSI driver docs](#)
- [CSI spec](#)
- [CSI sample driver hostpath deployment example](#)
- [SIG Storage annual report](#)



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Thank You





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