Track Overview: Containers

Mark Carlson
Kioxia
Co-chair SNIA Technical Council
Leveraging Modern Networks to Deliver Faster Storage to Database Workloads in Kubernetes

Amarjit Singh
Kioxia America
StatefulSet Workloads in Kubernetes

- Mostly used for Databases
- Require Permanent Storage
- Permanent Storage provided by Persistent Volumes
- Performance and Flexibility of Statefulset PVs
- Reattach same storage volume when Pod reschedules on new node
Provisioning a Volume (Kubernetes)

Kubernetes Master
- Kube-APIServer
- Kube-Controller Manager
- Kube-scheduler

Provisioner Service

Kubelet
- POD

Storage Node

Provisioning Process:
1. K8s Scheduler schedules a pod
2. PVC requests a PV from Storage Class
3. SC points to Volume Provisioner
4. Provisioner creates a volume
5. CSI Node driver connects volume to worker node
6. Volume is attached to Pod
DYNAMIC STORAGE PROVISIONING IN KUBERNETES

Divya Vijayakumar, Arun Kandasamy
MSys Technologies, LLC
Concept of Dynamic Provisioning

- Dynamic Provisioning of Volume allows storage volumes to be created on demand.

- Previously, cluster management was a manual process by contacting storage provider to create new storage volumes. Subsequently, Persistent Volume objects were created to represent them in Kubernetes.

- Dynamic Provisioning eliminated the need for cluster managers to pre-provision storage. Instead, it automatically provisions storage when requested by users.

- Persistent Volume types are implemented as plugins. Kubernetes currently supports many plugins like: AWSElasticBlockStore, AzureDisk, CSI, FlexVolume, NFS, Cinder, Glusterfs, etc.
SC-PV-PVC Relationship

1. Kubernetes statefulset (to create pods)
   Consists of user requirement for Volume as a PVC template

2. Contacts the Storage Class (Provided by CSI)

3. Creates PV

4. Allocates PVC and binds to PV

5. Pod uses this Storage as its data store

Storage Created
Why We Opted for CSI

- Owing to the drawback from other methods, we opted for external storage provided via CSI driver.

- When provisioning volume for a huge framework with vast amount of data and complexity that needs to be orchestrated using Kubernetes, CSI driver appears as the best approach to manage the data store.

- Storage provisioned via CSI drivers was external to the host and was easy to incorporate into the Kubernetes manifest file.

- This was like creating any other resource on K8s - like pod, service or volume, and linking it to the storage array present elsewhere.
SPDK-CSI: Bring SPDK to Kubernetes Storage

Yibo Cai
arm
What is SPDK

**SPDK ARCHITECTURE**

**Block Storage Protocols**
- Networking: NVMe-oF (RDMA, TCP, FC), iSCSI
- Virtualization: vhost-scsi, vhost-blk

**File Storage Services**
- Filesystems: BlobFS

**Block Storage Services**
- Partitioning: Logical Volumes, GPT
- Caching: OCF
- Host FTL: Open Channel
- Pooling: RAID-0
- Transforms: Crypto, Compression

**Block Storage Providers**
- NVMe, io_uring, Linux AIO, virtio, iSCSI, Ceph RBD

**Drivers**
- NVMe (PCIe, RDMA, TCP), virtio (scsi, blk)
Dynamic Volume Provisioning

**Pod**
- kind: Pod
- spec:
  - volumes:
    - name: spdk-volume
      persistentVolumeClaim:
        claimName: my-pvc

**PVC**
- kind: PersistentVolumeClaim
- metadata:
  - name: my-pvc
- spec:
  - resources:
    - requests:
      storage: 1Gi
  - storageClassName: my-sc

**Storage Class**
- kind: StorageClass
- metadata:
  - name: my-sc
- provisioner: my-csi-driver

**CSI Node Driver**

**CSI Controller Driver**
- kind: PersistentVolume
- API Server
- Mount volume to Node
- Provision volume

**Kubernetes Cluster**
- Storage Provider

**SPDK**
- Alibaba Cloud
- Google Cloud Storage
Maximize your SDC 2020 Experience

- Participate in our online chat for this track at <TBD>
- Check out the Birds of a Feather (BoF) sessions
- Please be sure you rate each session you watch – you’ll see a box under the video
- For additional details see the *Introduction to Virtual SDC* video ([https://www.snia.org/SDCintro](https://www.snia.org/SDCintro))
- *Enjoy the SDC 2020 virtual event!*