KubeCon | CloudNativeCon

North America 2017

Cinder for Baremetal Kubernetes Clusters

John Griffith, *NetApp*
Huamin Chen, *Redhat*

Who are these two?

- John Griffith
  - Led the start of the Cinder project back in the day
  - Works on “Cloudy things”, OpenStack, SIG Storage, CSI etc
  - Lead Open Source development and strategy for SolidFire
  - Twitter: @jdg_8, IRC: jgriffith, Slack/Github: j-griffith
- Huamin Chen
  - Wrote many Kubernetes volume plugins back in the day
  - Member of Kubernetes SIG Storage
  - Twitter: @root_fs, Slack/Github: rootfs

What's Cinder

- Block Storage as a Service
- Relatively mature, now around 6 years old
- Provides an abstraction for 70+ block storage backends
- Similar model/philosophy as Amazons EBS
  - with pluggable backends
  - or reference LVM provider
- Implements a standard block service for things like create, attach, snapshot and backup… (the list goes on)
- All drivers are in tree and require CI system
- > 500 community contributors

It’s not just for OpenStack

- Initially was to provide Block Storage for OpenStack
- But always intended to be able to be used by itself
- Can be deployed in Containers as a standalone service
- True standalone (no-auth) or *sorta* standalone w/keystone
- Attach/Detach to bare-metal
- Same backend device maturity and support, just attach to bare-metal and consume in containers
- Cinder’s one of the *simpler* services to deploy and maintain

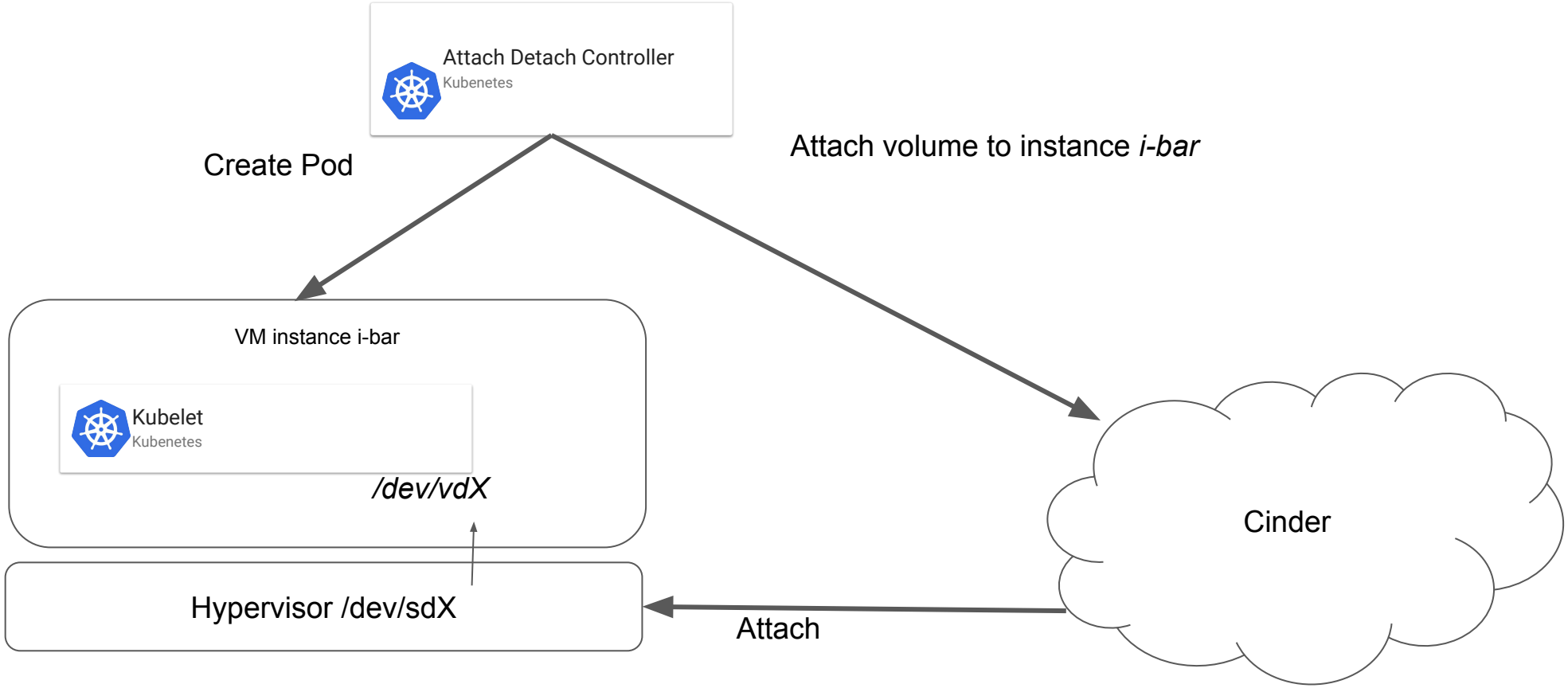
3 step deploy (*BlockBox*)

- *git clone https://github.com/openstack/cinder*
- *cd cinder/contrib/blockbox && Make*
  - Builds images (or build your own, download from dockerhub and skip)
- *docker-compose up*
  - Start all the Cinder services you need in containers
- DONE!
- Ok, Ok.. in reality you'll probably want to adjust/tweak a bit, but that's really all there is to it

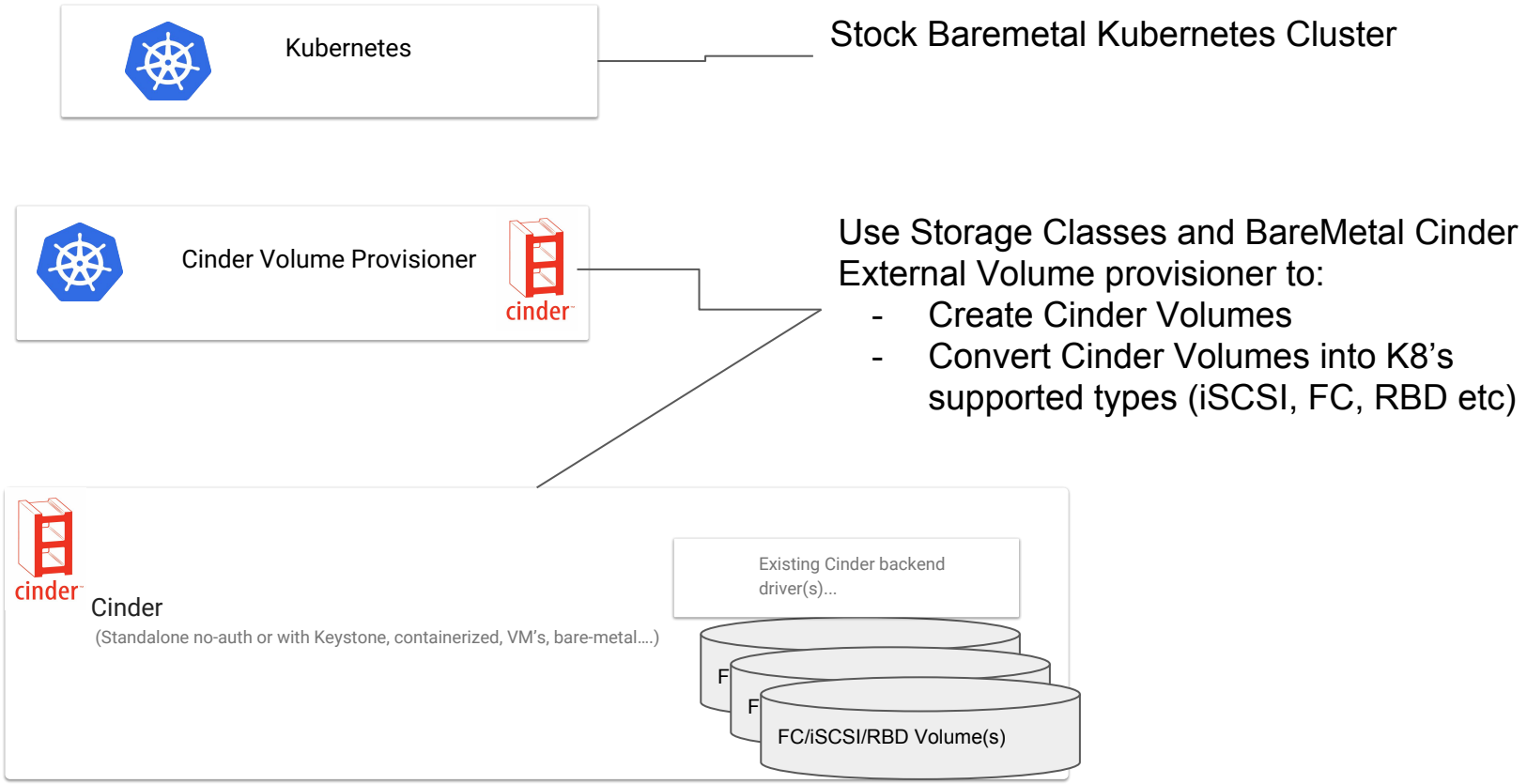
Kubernetes Storage Volumes

- Persistent Volume Sources:
  - Cloud Storage
    - AWS/EBS, Azure File/Disk, GCE PD, Cinder, vSphere
  - Block
    - iSCSI, FC, RBD, Scaleio, StorageOS, Portworx…
  - File Storage:
    - NFS, Gluster, CephFS, Quobyte….
- Features
  - Dynamic provisioning
  - Attach/Detach
  - Resize
  - Snapshot
  - ….

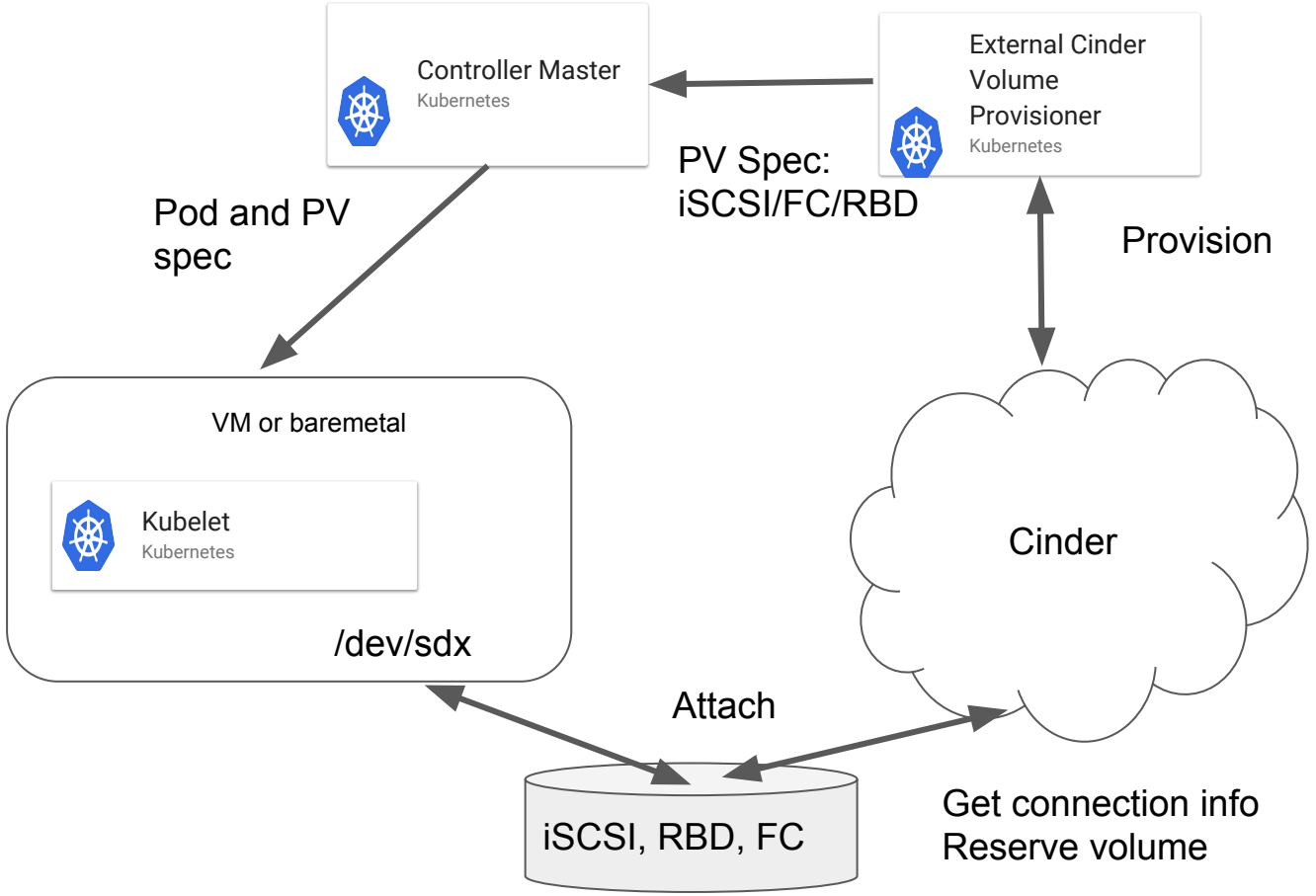
Cloud Storage in Kubernetes (OpenStack)



High Level component view

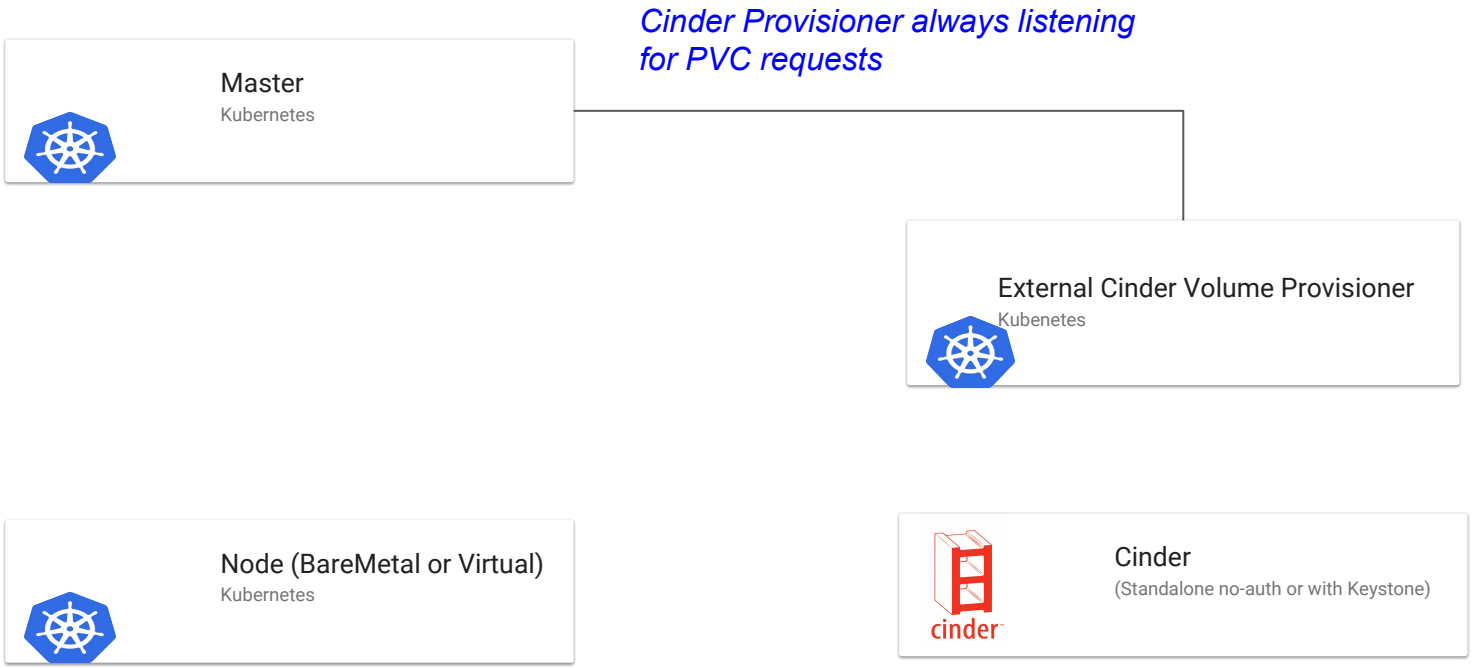


External provisioner process flow



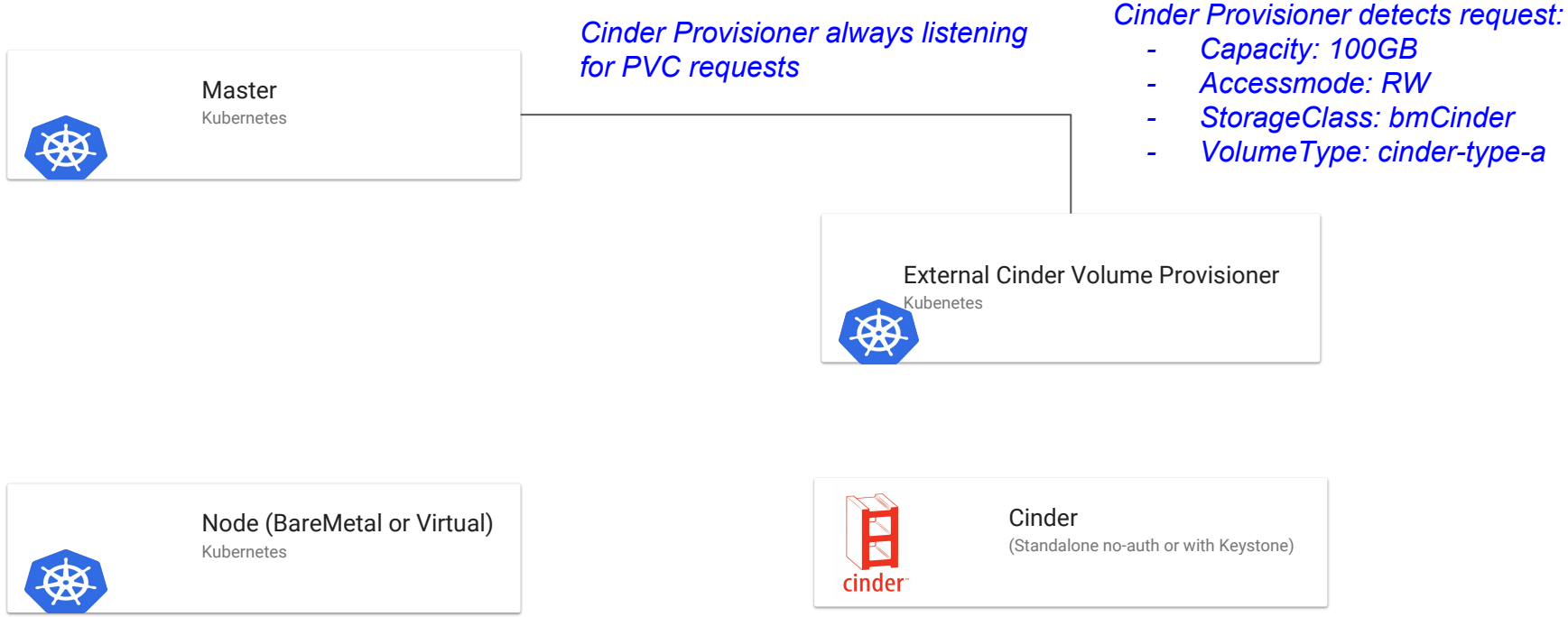
Example process/flow

External provisioner “listening” for PVC requests



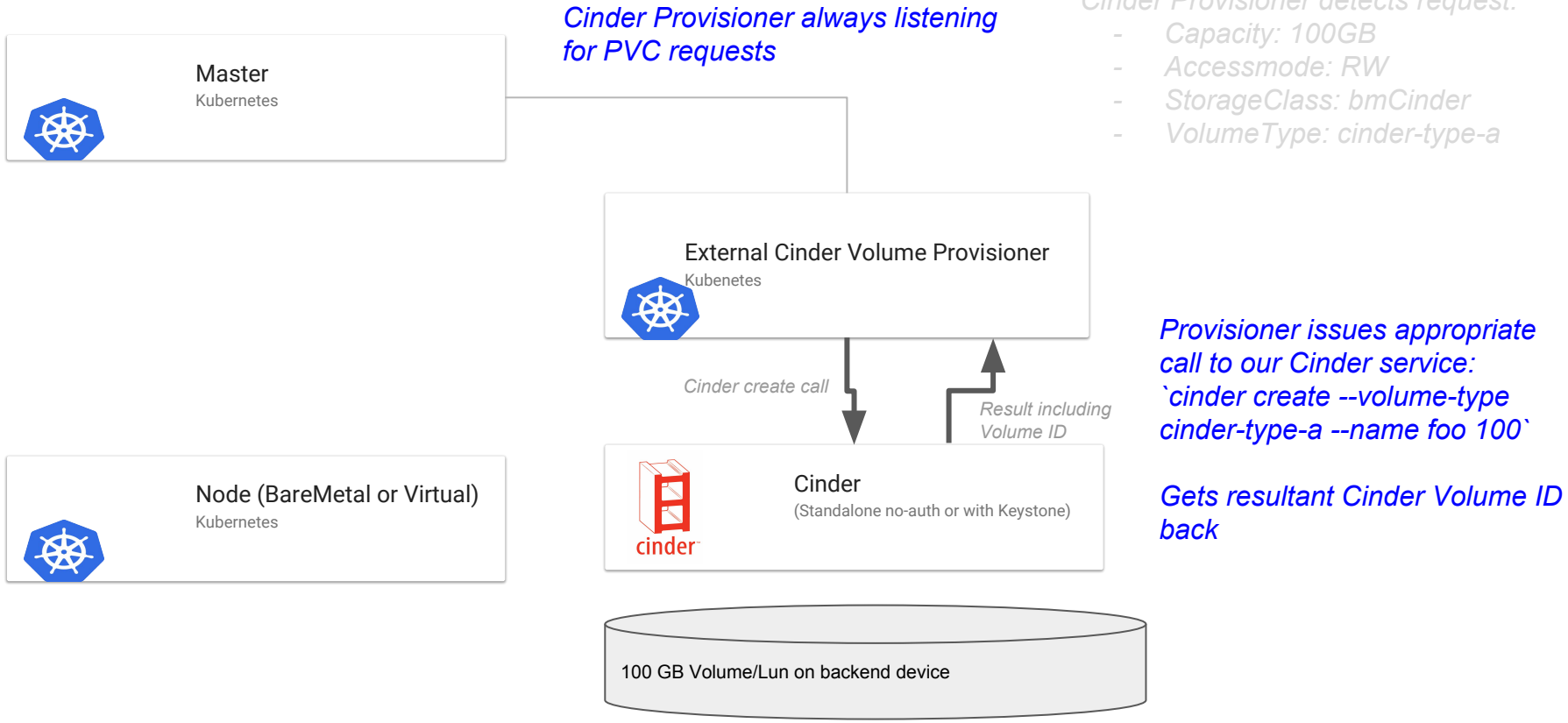
Example process/flow

PVC Request via Kubernetes



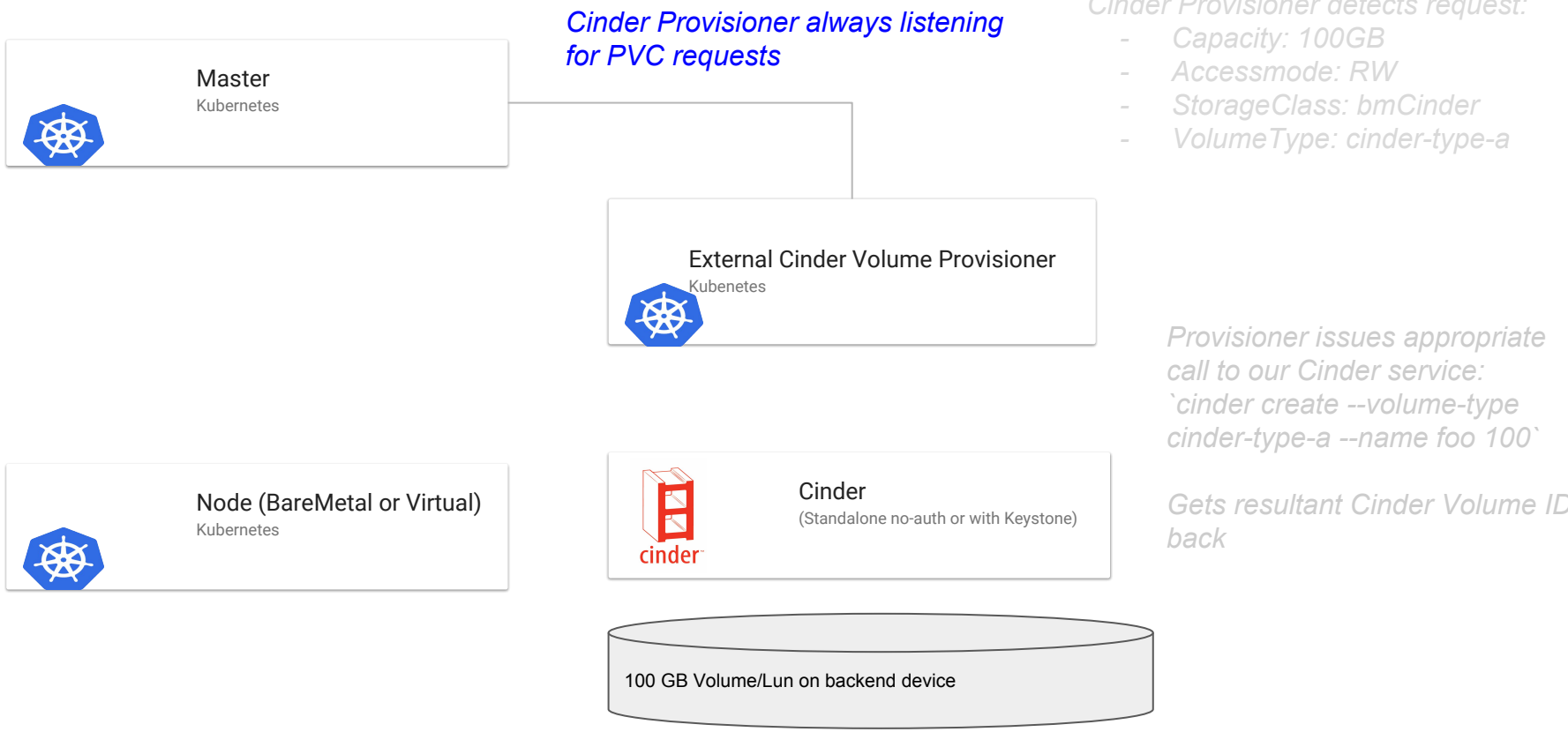
Example process/flow

Volume Creation



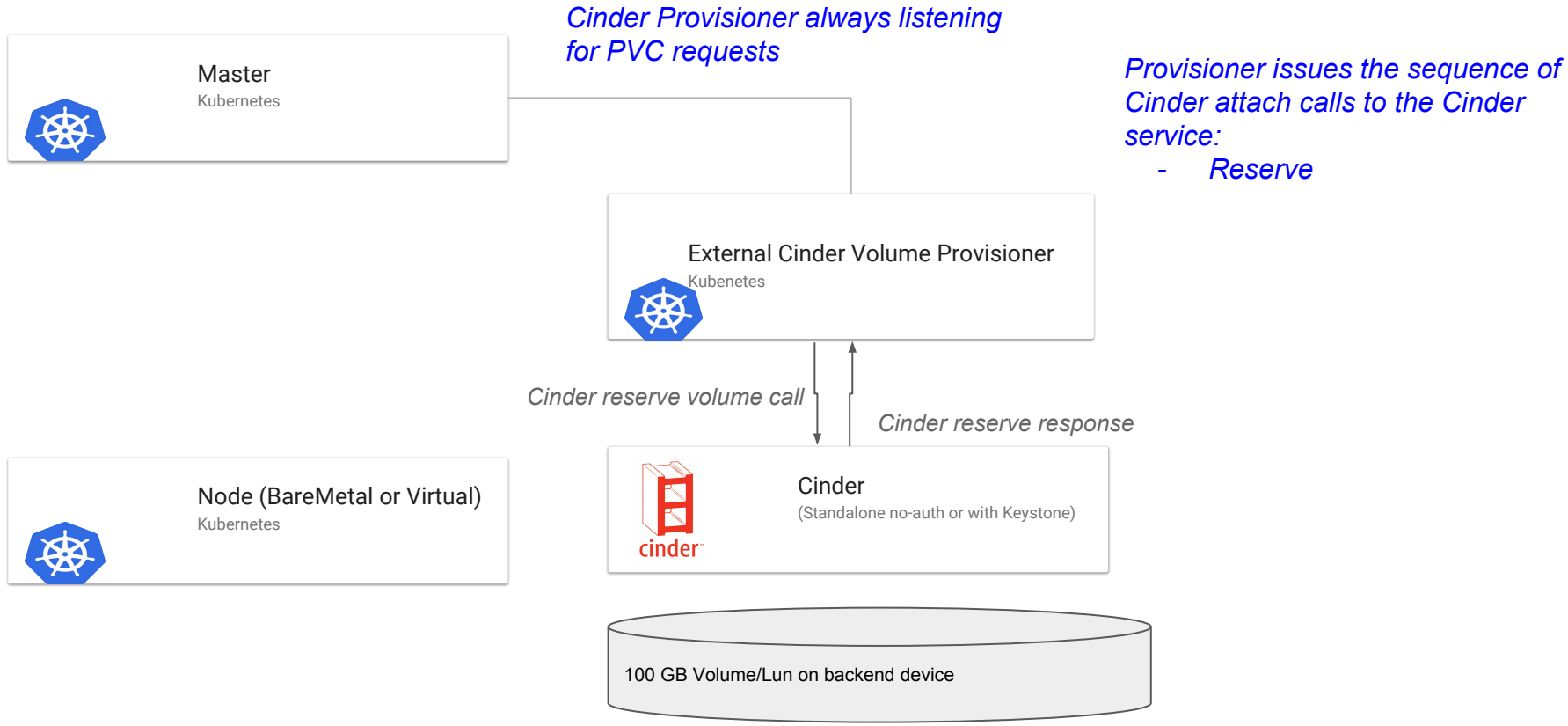
Example process/flow

Waiting for new PVC or Attach request



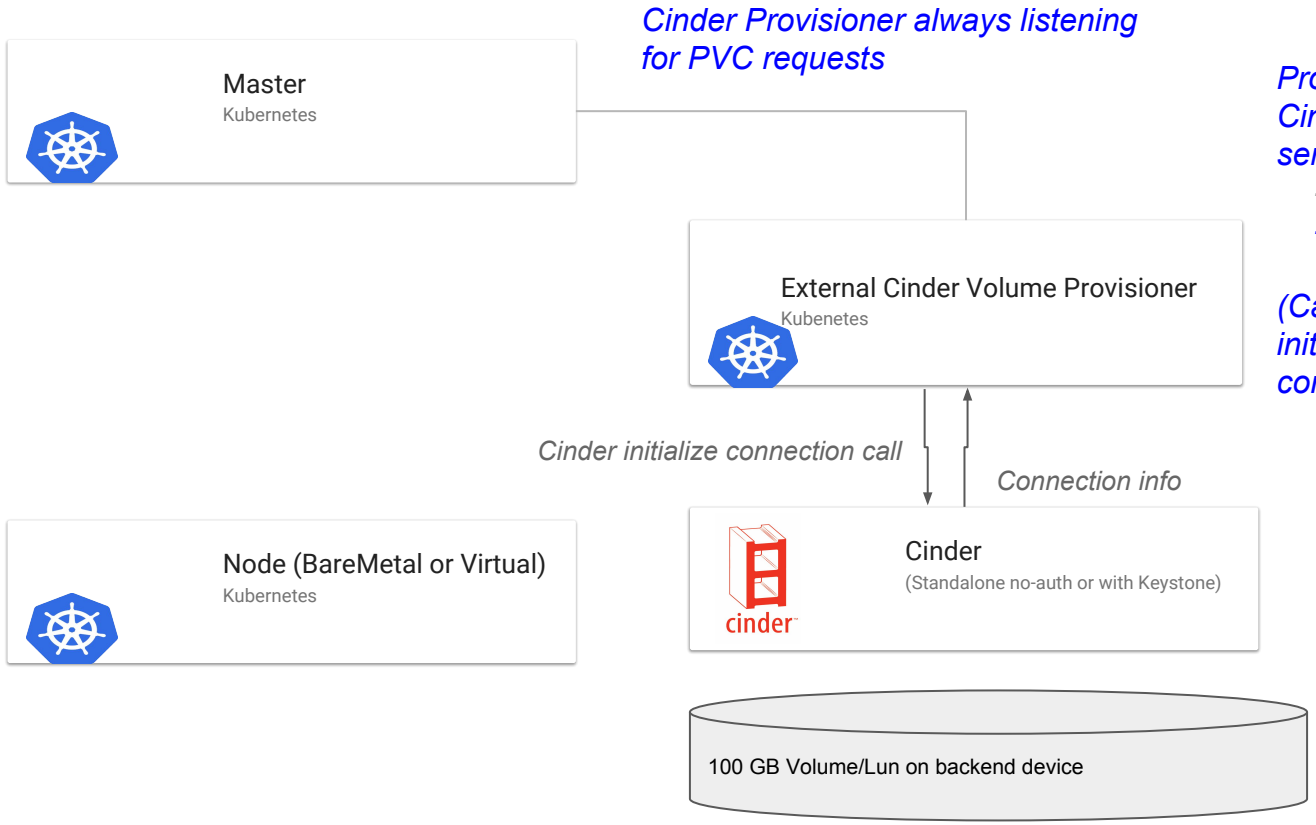
Provisioning detail

Provisioning our Volume to a POD (1 of 4)



Provisioning detail

Provisioning our Volume to a POD (2 of 4)



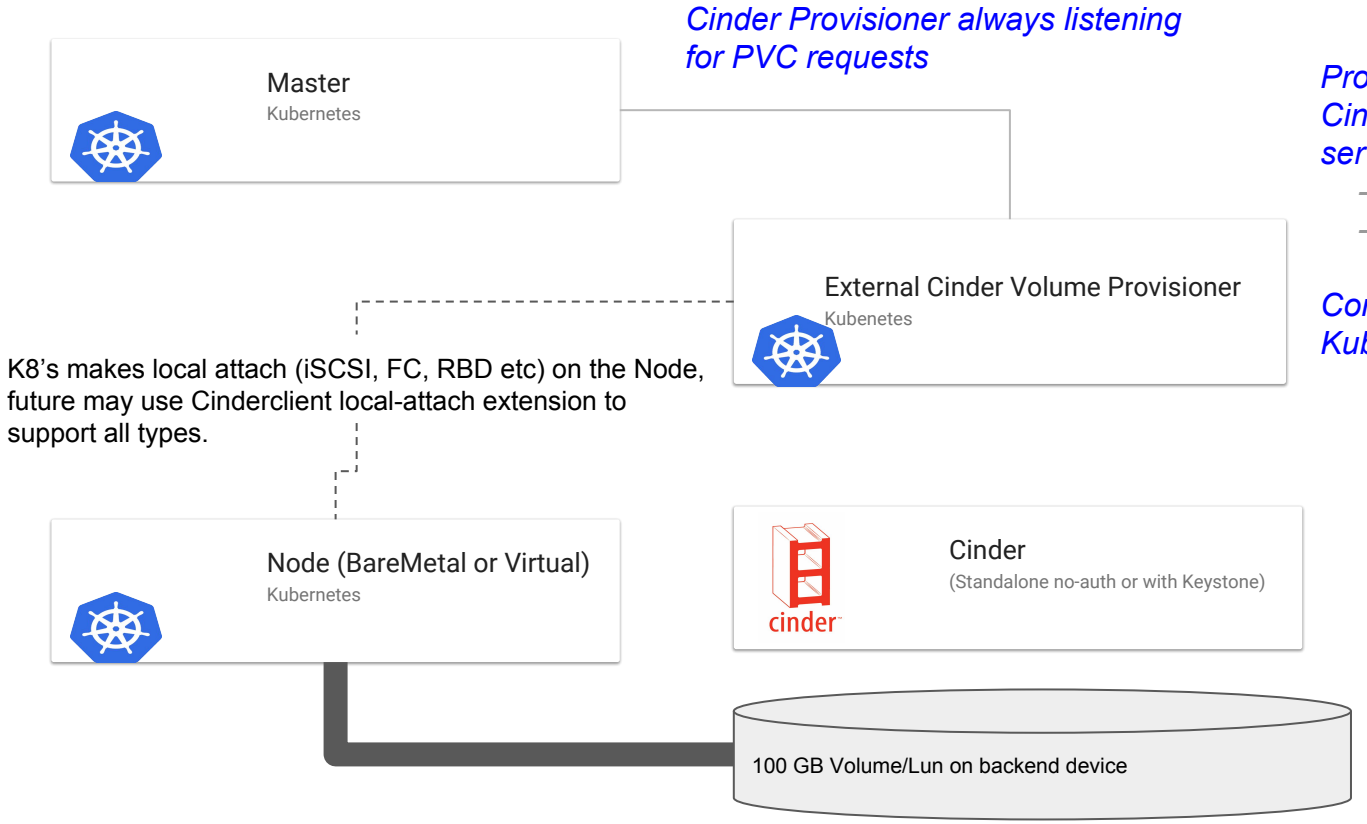
Provisioner issues the sequence of Cinder attach calls to the Cinder service:

- *Reserve*
- *Initialize Connection*

(Called with Kubernetes Node initiator info etc and builds a connetor object)

Provisioning detail

Provisioning our Volume to a POD (3 of 4)



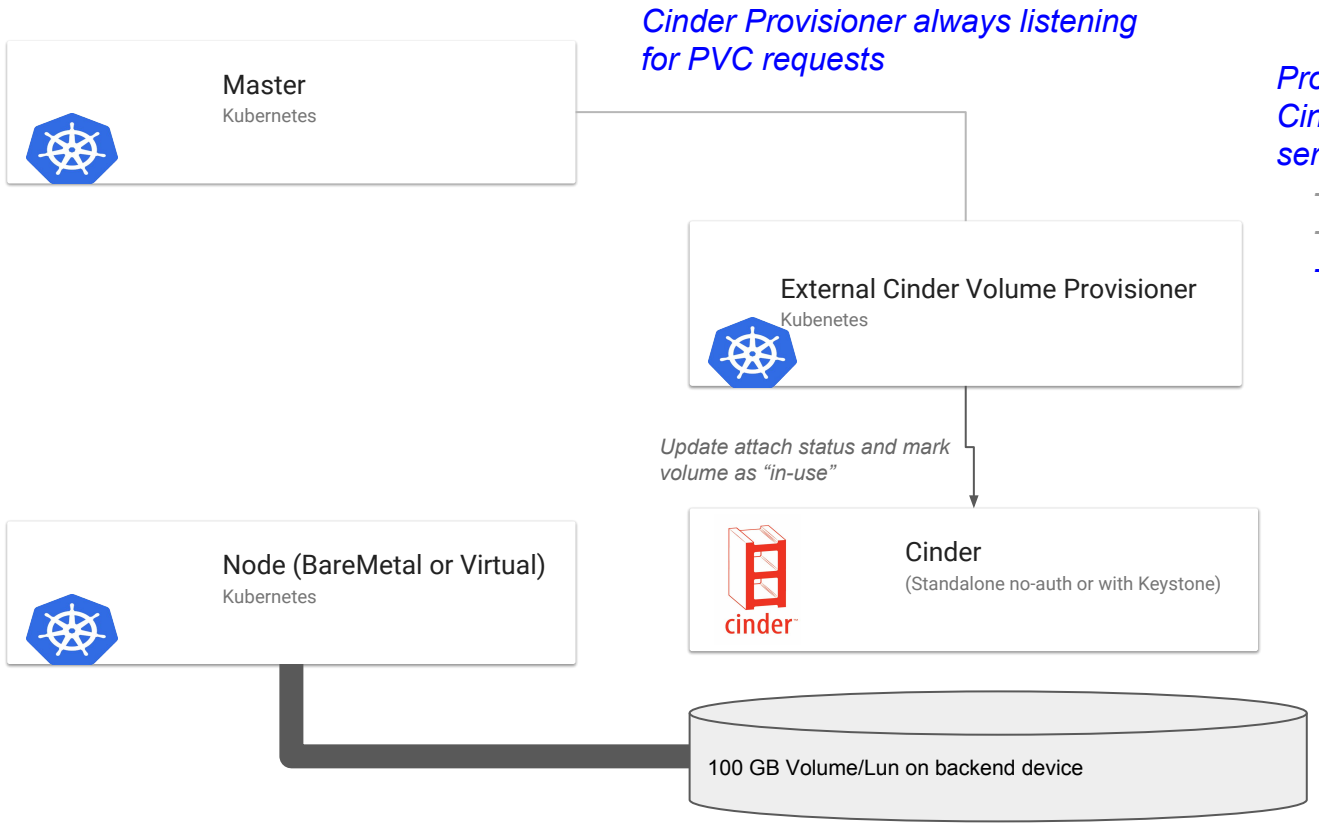
Provisioner issues the sequence of Cinder attach calls to the Cinder service:

- *Reserve*
- *Initialize Connection*

Connection is made on the Kubernetes Node….

Provisioning detail

Provisioning our Volume to a POD (4 of 4)



Provisioner issues the sequence of Cinder attach calls to the Cinder service:

- *Reserve*
- *Initialize Connection*
- *Attach completion*

Current Status

- Merged into Kubernetes-Incubator/external-storage
  - https://github.com/kubernetes-incubator/external-storage
- Supports iSCSI and RBD
  - iSCSI is predominant Cinder data transport (49 out of 71)
- FC and NFS are likely next
  - Might be able to leverage the existing cinder extensions here?
  - Use tcmu-runner for NFS?

Kubernetes Storage Feature Integration

Kubernetes Storage Features	Links	Benefits
Volume Snapshot	https://github.com/kubernetes-incubator/external-storage/tree/master/snapshot	Use Cinder snapshot out of the box
Volume Resize	https://kubernetes.io/docs/concepts/storage/persistent-volumes/#expanding-persistent-volumes-claims	Use Cinder volume extend out of the box
Future features (replication, etc)	N/A	Cinder replication, etc

What's next?

- Container Storage Interface (CSI) Integration
  - Provisioner
    - https://github.com/kubernetes-csi/external-provisioner
    - Implements CSI CO CreateVolume/DeleteVolume API
  - Attacher
    - https://github.com/kubernetes-csi/external-attacher
    - Implements CSI CO Publish/Unpublish Volume
  - Driver
    - https://github.com/kubernetes-csi/drivers
    - Will implement CSI SP API and call Cinder Volume and Attachment API to work with Provisioner and Attacher

Additional CSI thoughts

- Number of ways to do this
- Shim layer on top of Cinder to make it “talk CSI”
- Maybe Cinder version that at some point accepts CSI drivers and protocol?