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OpenStack Cinder Tutorial

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Outline

- OpenStack
- Volume
- OpenStack Cinder
- Cinder driver status
- Contributions
- References

OpenStack (1/2)

- An IAAS cloud computing project and open source software under Apache License.

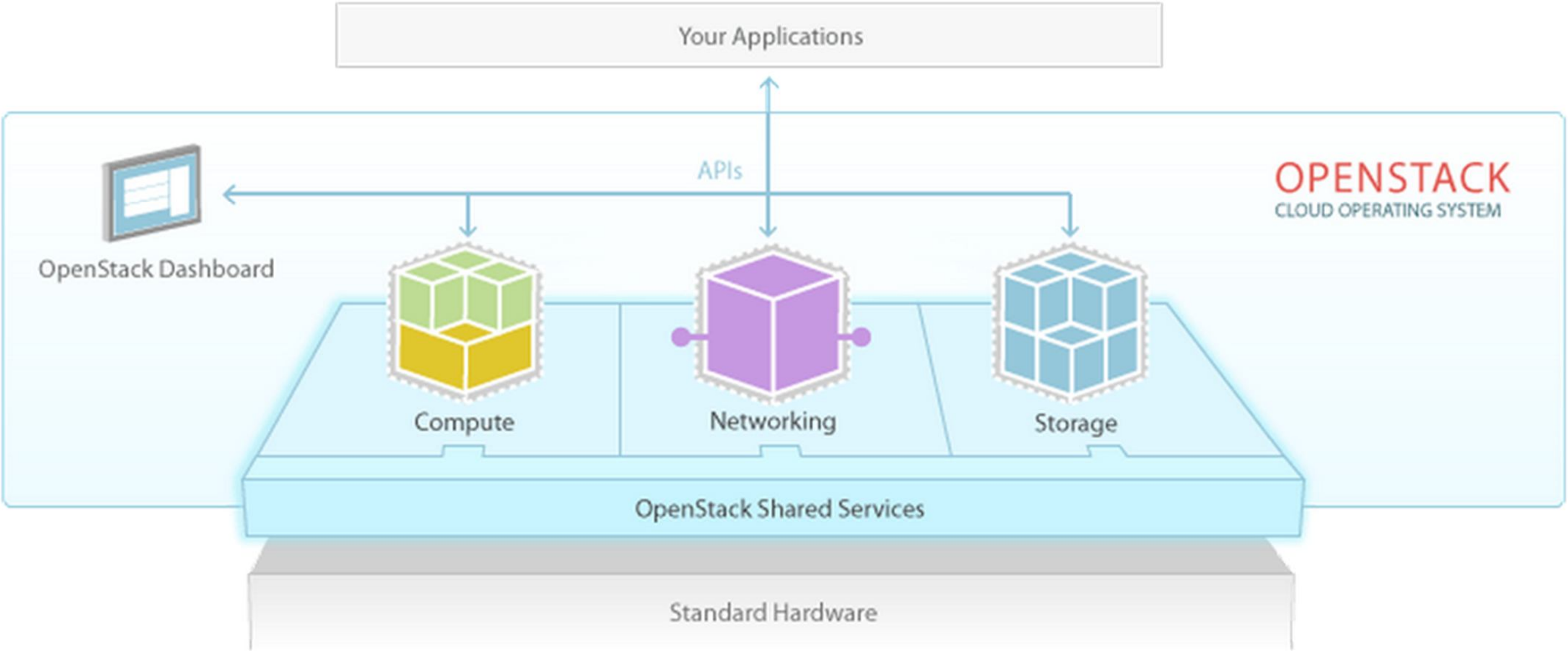
- Rackspace and NASA launched it in Jul. 2010, and OpenStack Foundation managed it since Sep. 2012.
  - ~ 200 companies or organizations have joined the project

- It consists of a series of interrelated project CODEs that control and provide the provision resources through a datacenter.

OpenStack (2/2)

- Adopted a six-month release schedule
  - Grizzly, Apr. 2013
- Primary released on Linux, Ubuntu LTS
- Cloud computing management layer that integrate existing Linux technologies
- Python implementation

Service Architecture


Your Applications
APIs
OPENSTACK
CLOUD OPERATING SYSTEM
OpenStack Dashboard
Compute
Networking
Storage
OpenStack Shared Services
Standard Hardware

OpenStack Code Names

Service	**Code name/Software Project**
Compute	Nova
Image	Glance
Object Storage	Swift
Dashboard	Horizon
Identity	Keystone
Networking	Quantum
Volume	Cinder
…	…

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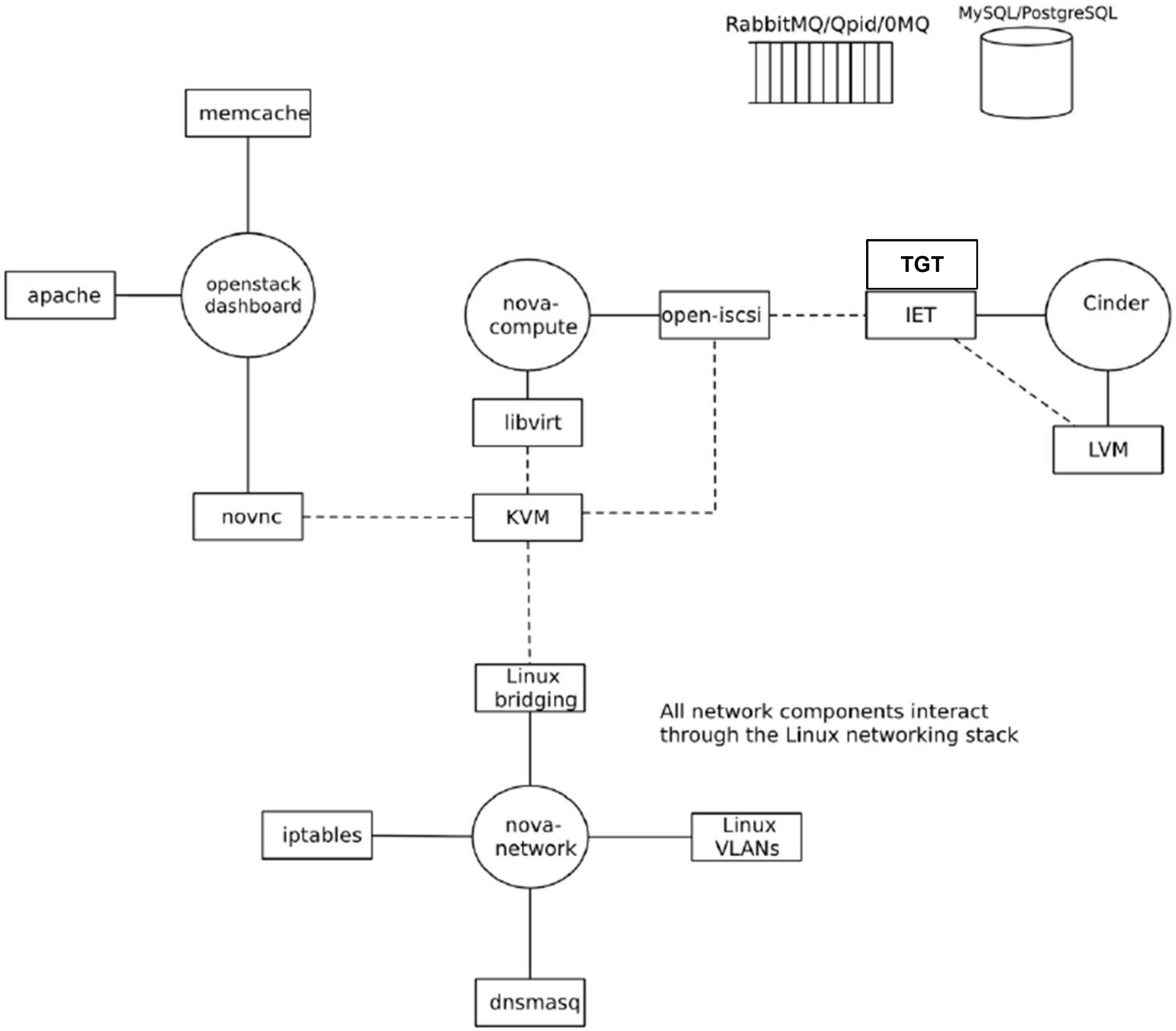
Technology Topologies


RabbitMQ/Qpid/0MQ
MySQL/PostgreSQL
memcache
apache
openstack dashboard
novnc
nova-compute
libvirt
KVM
open-iscsi
TGT
IET
Cinder
LVM
Linux bridging
All network components interact through the Linux networking stack
iptables
nova-network
Linux VLANs
dnsmasq

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Volume

Physical Disk	Partition	Drive/Volume	Filesystem
Hard Disk 1	Partition 1	/dev/hda1	ext3
	Partition 2	/dev/hda2	xfs
Hard Disk 2	Partition 1	C:	NTFS
	Partition 2	D:	FAT32

A partition, physical drive, is a part of one physical hard drive.

A volume, logical drive, is a single accessible storage area with a single file system.

OpenStack Cinder

- Cinder allows you to give block level storage to your OpenStack Compute instances.
  - Extra block device or boot-from-volume device
  - Storage Access Network (SAN)
  - **Amazon EBS**

- The basic Cinder usage is iSCSI-exposed LVM volumes.
  - Two basic default components
    - **lvm2**
    - **open-iscsi/iscsi-target**

- https://wiki.openstack.org/wiki/CinderMeetings
  - Meets on a weekly basis in #openstack-meeting at 16:00 UTC on Wed.

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Cinder History

- **Grizzly: 2013.1 (Apr. 2013)**
  - **Cinder**

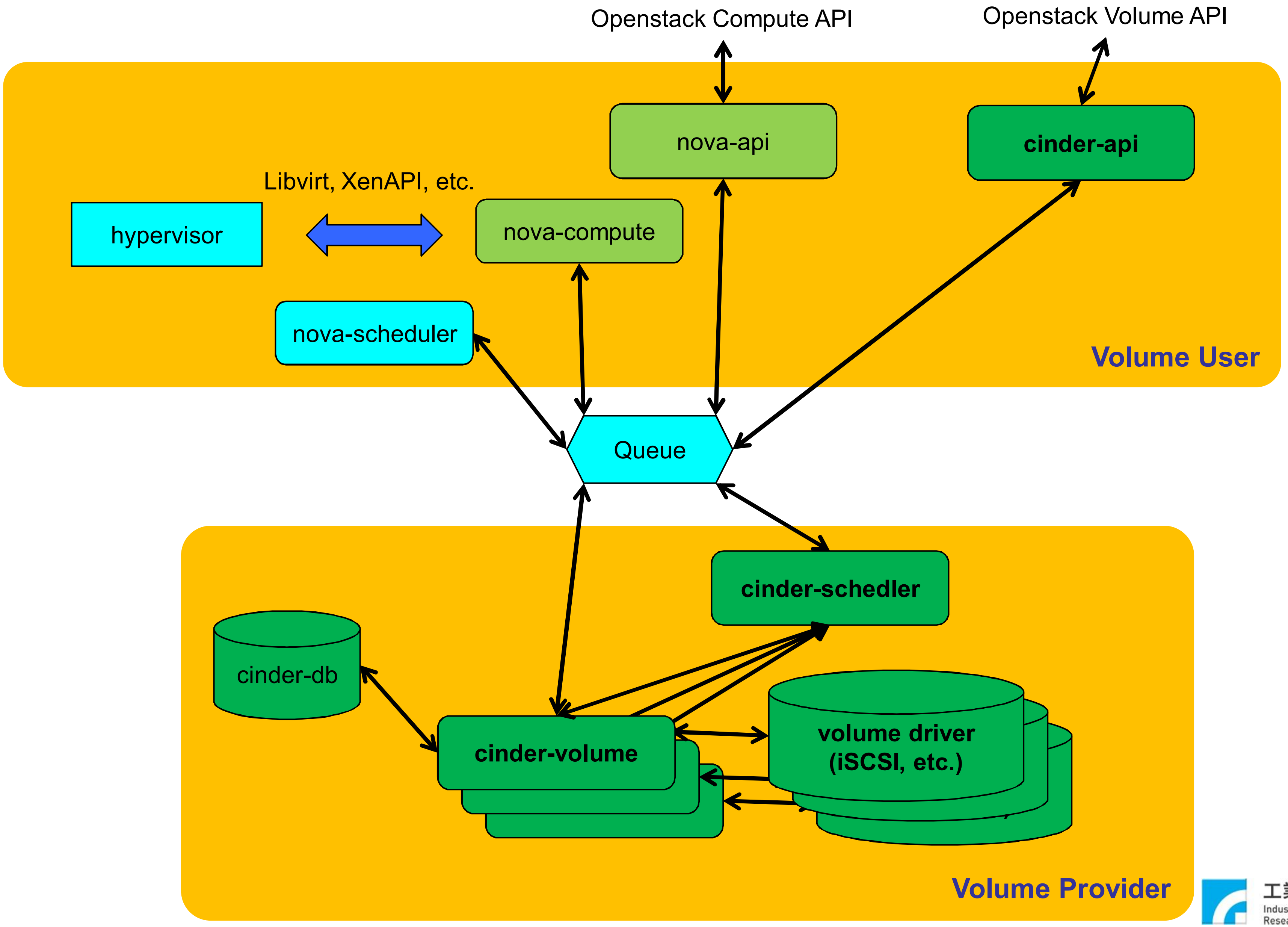
- Folsom: 2012.2 (Oct. 2012)
  - Nova (Compute)
    - Volume
  - Cinder

- Essex: 2012.1 (Apr. 2012)
  - Nova (Compute)
    - Volume
  - …

Cinder Services

- cinder-api
  - Authenticates and routes requests throughout the block storage system.
- cinder-scheduler
  - Scheduling/routing volume create requests to the appropriate volume service.
- cinder-volume
  - Managing block storage devices, specifically the back-end devices themselves.

Cinder Interaction


Openstack Compute API
Openstack Volume API
nova-api
cinder-api
Libvirt, XenAPI, etc.
hypervisor
nova-compute
nova-scheduler
Volume User
Queue
cinder-schedler
cinder-db
cinder-volume
volume driver
(iSCSI, etc.)
Volume Provider

Cinder Internal

- Cinder deployment
- Volume operations
- Volume stack
  - LVM/iSCSI
- Implementation
- Driver Status

Cinder Deployment

- Ubuntu 12.10
- Package
  - `# apt-get install cinder-api cinder-scheduler cinder-volume open-iscsi python-cinderclient tgt`
- Configuration file:
  - /etc/cinder/api-paste.init, /etc/cinder/cinder.conf, /etc/nova/nova.conf, /etc/nova/nova-compute.conf
- Create storage space: (iSCSI-exposed LVM)
  - LVM partition with VG name = ‘cinder-volumes’
- Services
  - `sudo service cinder-volume restart`
  - `sudo service cinder-api restart`
  - `sudo service cinder-scheduler restart`

Volume Operations

- Create/Delete volume
- Create volume from snapshot
- Clone volume
- Create volume from image
- Copy image to volume
- Create/Delete snapshot

- Attach/Detach volume

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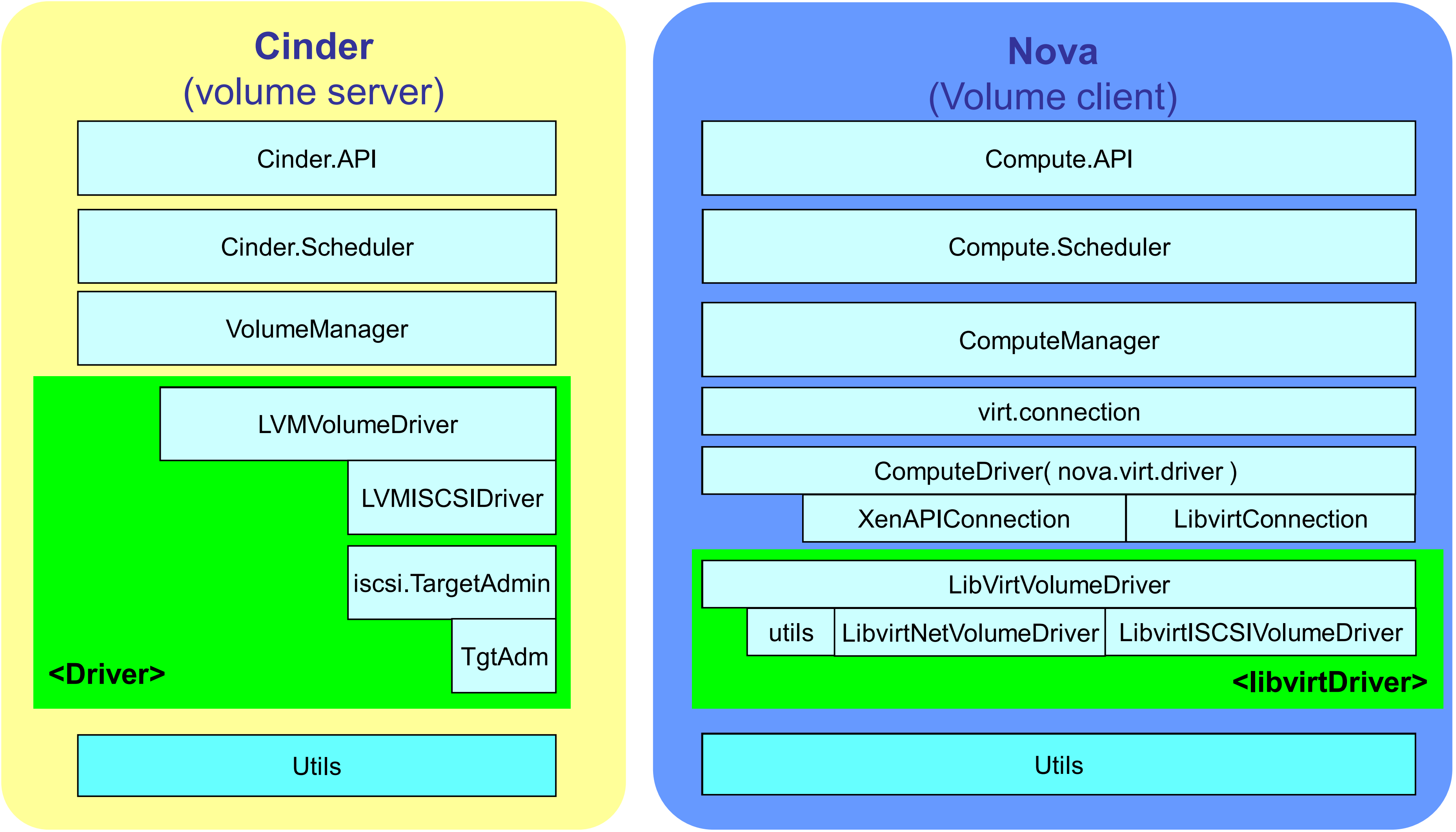
Usage by Example

```
# cinder create --display_name test 1
# cinder list
+--------------------------------------+-----------+--------------+------+-------------+--------------------------------------+
|                  ID                  |   Status  | Display Name | Size | Volume Type |             Attached to              |
+--------------------------------------+-----------+--------------+------+-------------+--------------------------------------+
| 81c8c61c-4889-423e-a9f4-05663b1e4b48 | available |     test     |  1   |     None    |                                      |
+--------------------------------------+-----------+--------------+------+-------------+--------------------------------------+
# nova volume-attach vm1 81c8c61c-4889-423e-a9f4-05663b1e4b48 /dev/vdb

# nova volume-detach vm1 81c8c61c-4889-423e-a9f4-05663b1e4b48

# cinder delete 81c8c61c-4889-423e-a9f4-05663b1e4b48
```

LVM/iSCSI Volume Stack



Cinder
(volume server)

Cinder.API

Cinder.Scheduler

VolumeManager

LVMVolumeDriver

LVMISCSIDriver

iscsi.TargetAdmin

TgtAdm

<Driver>

Utils

Nova
(Volume client)

Compute.API

Compute.Scheduler

ComputeManager

virt.connection

ComputeDriver(nova.virt.driver)

XenAPIConnection

LibvirtConnection

LibVirtVolumeDriver

utils

LibvirtNetVolumeDriver

LibvirtISCSIVolumeDriver

<libvirtDriver>

Utils

Implementation(1/2)

- Create volume
  - User: **POST** http://volume1.server.itri:8776/v1/{tenant_id}/volumes

  - Cinder-API: **CALL** cinder.volume.API().create()
  - Cinder.volume.API: **RPC CAST** cinder.scheduler()

  - Cinder.scheduler: **SCHEDULE** volume host
  - Cinder.scheduler: **RPC CAST** cinder.volume.create_volume()

  - Cinder.volume.manager: **CALL** cinder.volume.driver.create_volume()
  - Cinder.volume.manager: **CALL** cinder.volume.driver.create_export()

Implementation(2/2)

- Attach volume
  - User: **POST** http://novacompute1.itri:8774/v2/{tenant_id}/servers/{vm_uuid}/os--volume_attachments

  - Nova-API: **CAST** Nova.compute.API.attach_volume()
  - Nova.compute.api(): **RPC CAST** NOVA.compute.manager.attach_volume()

  - Nova.compute.manager. attach_volume: **RPC CALL** cinder.volume.initialize_connection()
  - Nova.compute.manager.attach_volume: **RPC CALL** virt volume driver attach_volume()
    - E.g. libvirt.driver.attach_volume() → volume_driver.connect_volume()
  - Nova.compute.manager.attach_volume: **RPC CALL** cinder.volume.attach()

Cinder Driver Status

- SAN
  - LVM based IET or TGT
  - SAN ISCSI
  - EMC SMI-S
  - HP 3PAR/LeftHand
  - Huawei
  - IBM StorwizeSVC/XIV
  - NetApp iSCSI
  - Nextenta NexentarStor
  - Windows
  - SolidFire
  - Coraid
  - Solaris
  - Sheepdog
  - Zadara
  - …

- NFS
  - GlusterFS
  - NetApp NFS
  - XenAPI
  - Coraid
  - Scality SOFS
  - …

- Object
  - Ceph RBD

https://wiki.openstack.org/wiki/CinderSupportMatrix

Contributions (1/2)

- Add Cinder driver and Nova virt driver to promote your storage solution.

- Add Cinder scheduler to enhance different cinder drivers

Contributions (2/2)

- Cinder driver
  - create_volume()
  - create_export()
  - delete_volume()
  - delete_export()
  - ensure_export()
  - initialize_connection()
  - terminate_connection()
  - create_volume_from_snapshot()
  - create_snapshot()
  - delete_snapshot()
  - copy_image_to_volume()
  - copy_volume_to_image()
  - clone_image()

- Nova driver
  - attach_volume() / *connect_volume()*
  - detach_volume() / *disconnect_volume()*

- Cinder scheduler
  - schedule_create_volume()

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Conclusions

- OpenStack Cinder defines a set of common methods to model block storage solutions for virtual machine

- Storage providers can easily integrate storage solution into Cinder for customer usage

- Storage customer can easily adopt different storage product via Cinder

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Q&A

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References

- https://wiki.openstack.org/wiki/Cinder
- http://docs.openstack.org/trunk/openstack-compute/admin/content/
- https://launchpad.net/openstack
  - https://launchpad.net/nova
  - https://launchpad.net/cinder