OpenStack Compute

Codenamed: Nova

Nova Components

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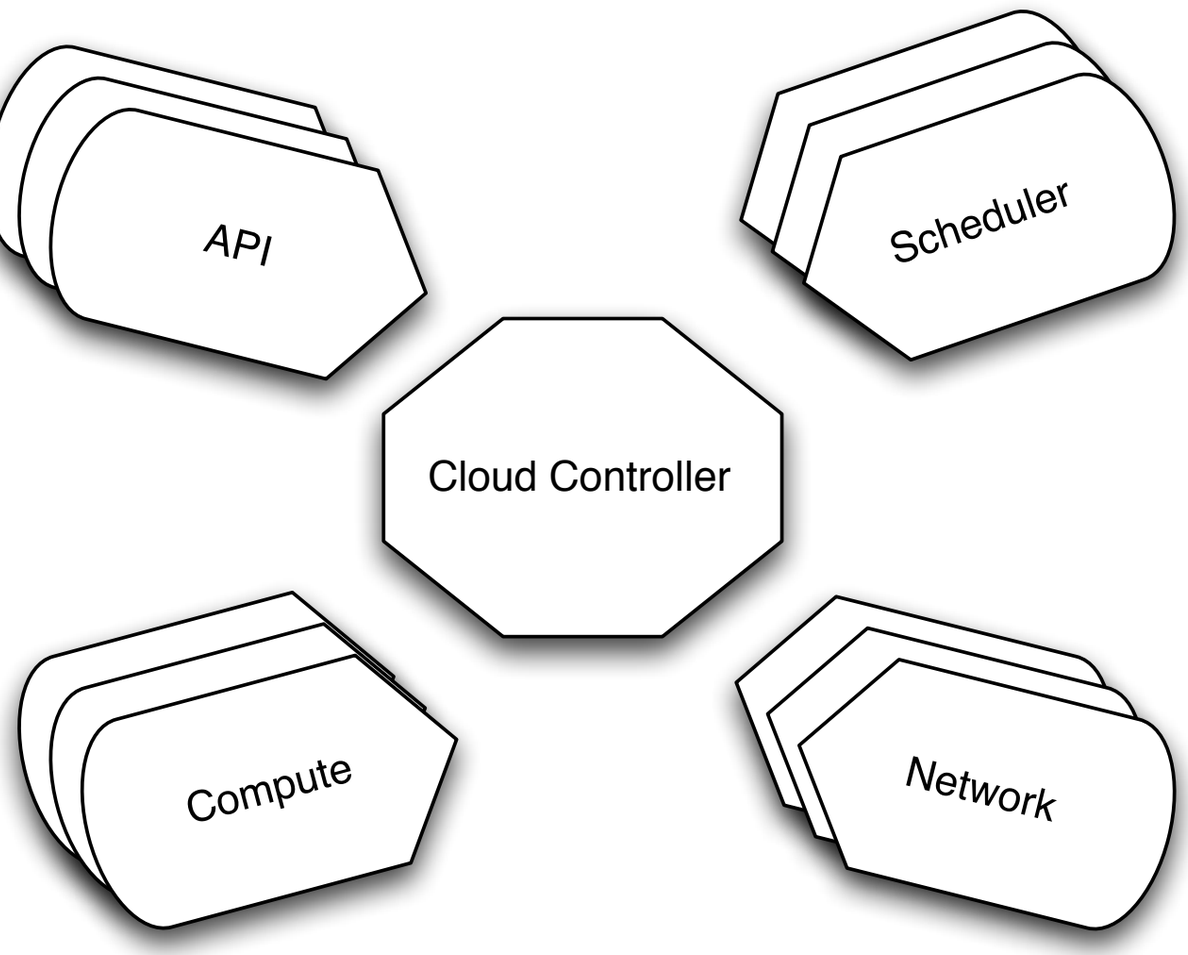
Nova Components



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Nova Components

Request Flow

API

Messaging

Scheduler

Network

Compute

Volume

Objectstore

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Nova API Node

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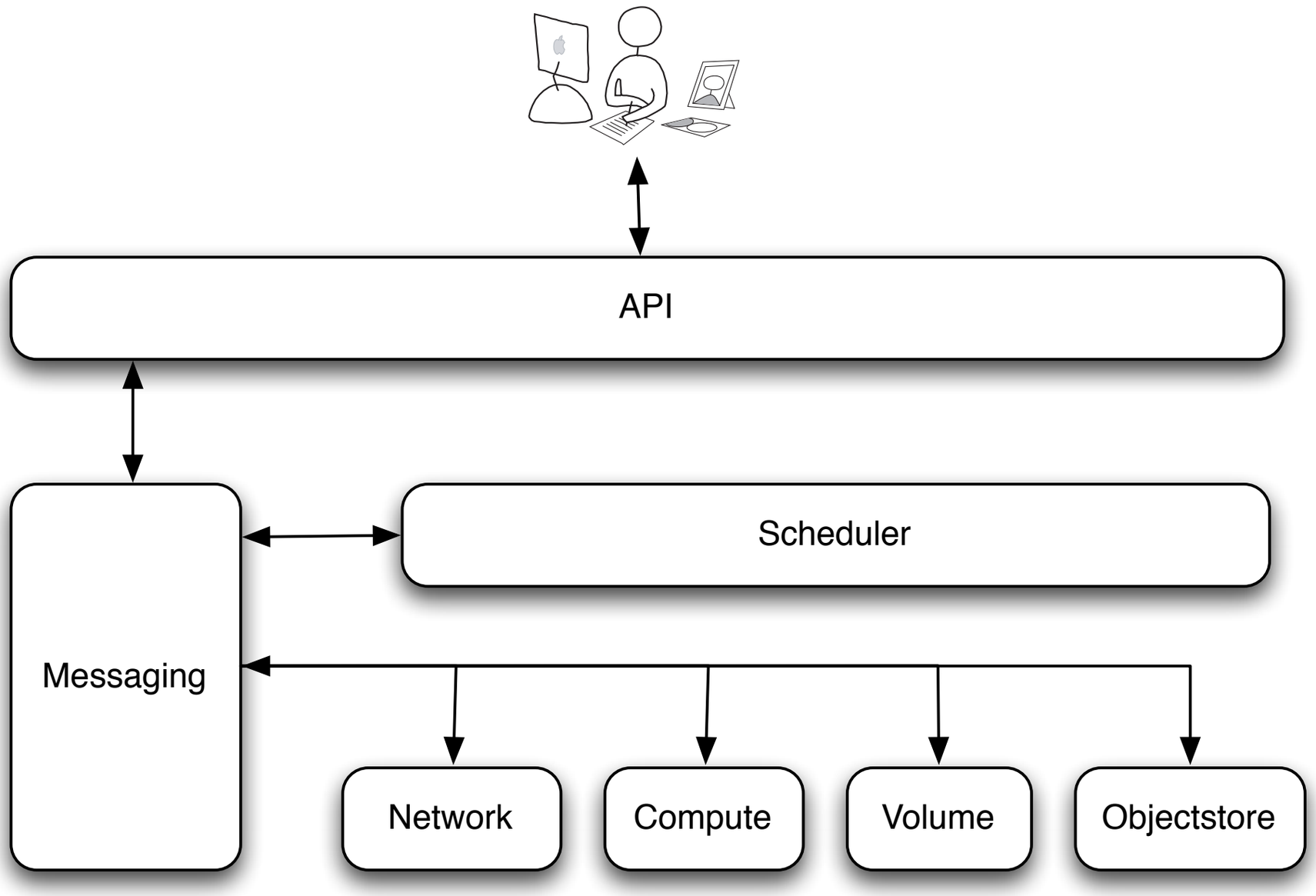
API Node



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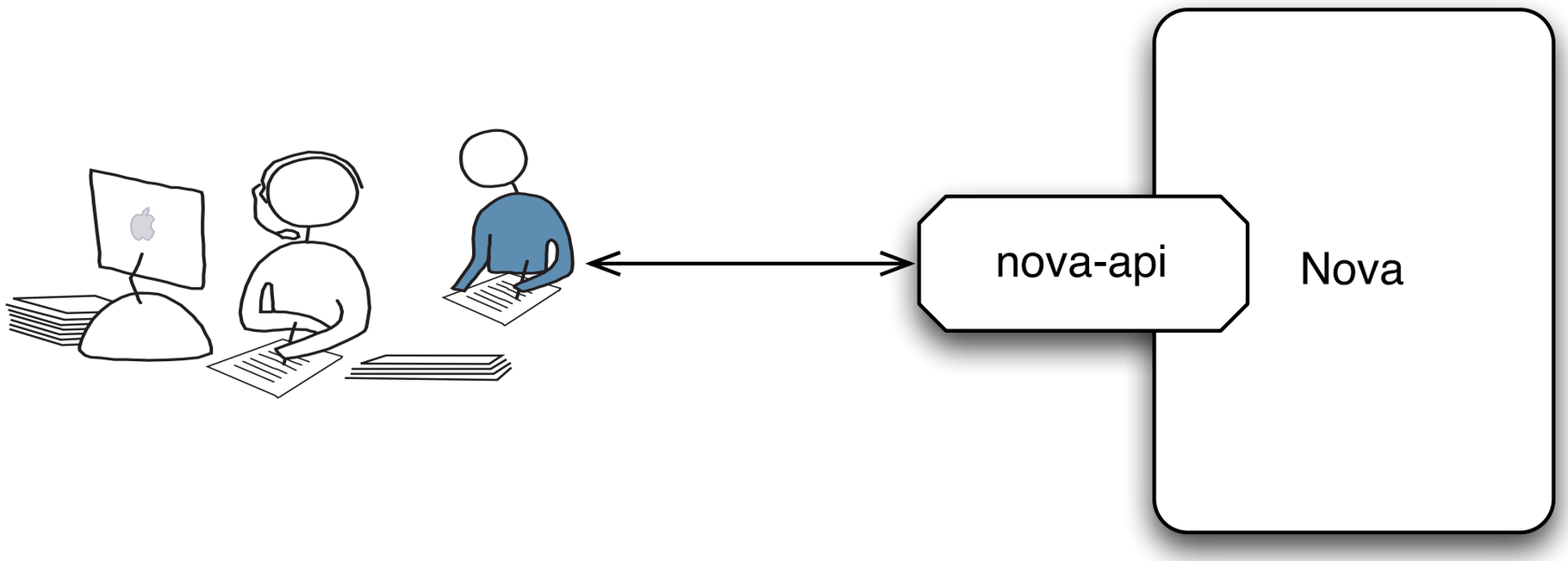
API Node



- An API Node is a machine running the nova-api service
- Serves as the primary gateway to Nova

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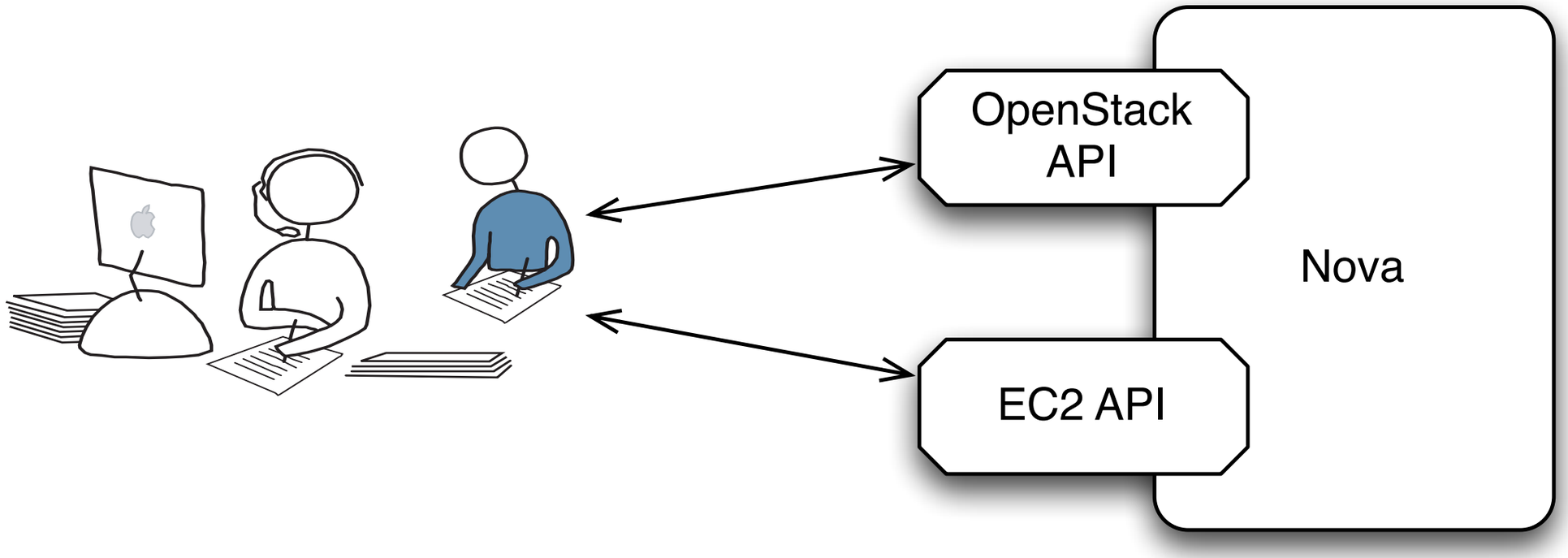
API Node



- Supports the OpenStack API and the EC2 API
- EC2 API is support for backwards compatibility
- The OpenStack API is preferred when possible

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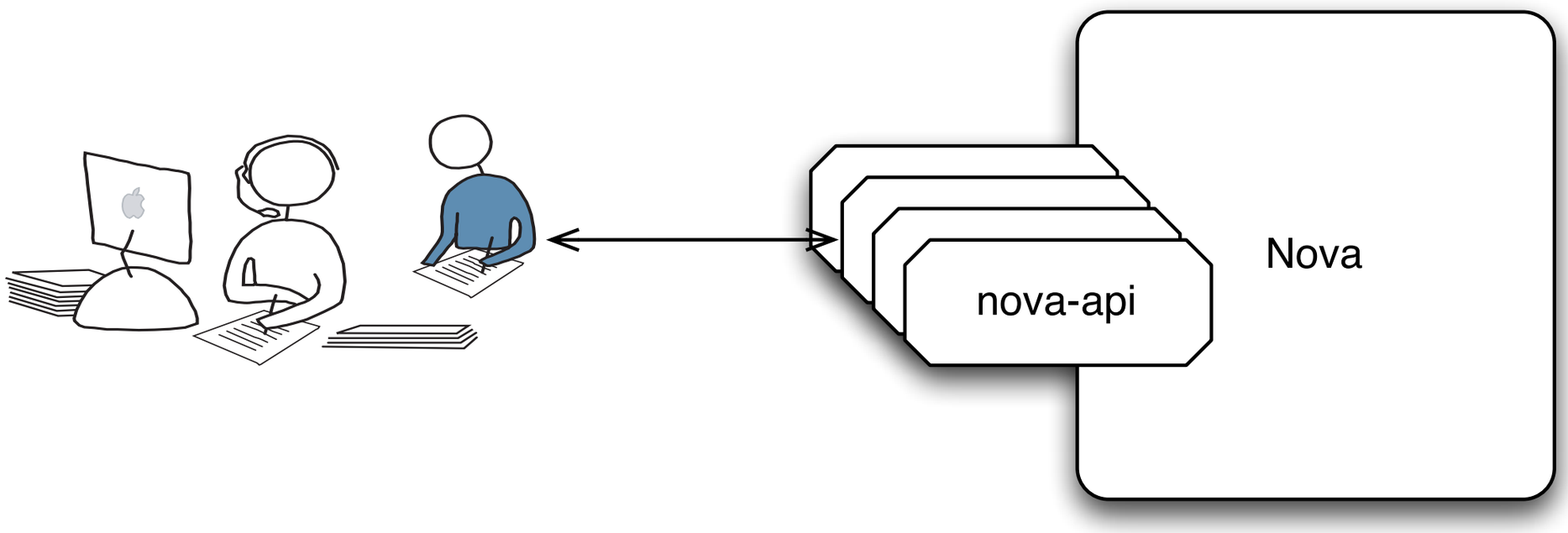
API Node



- A Nova installation has one or more API Nodes

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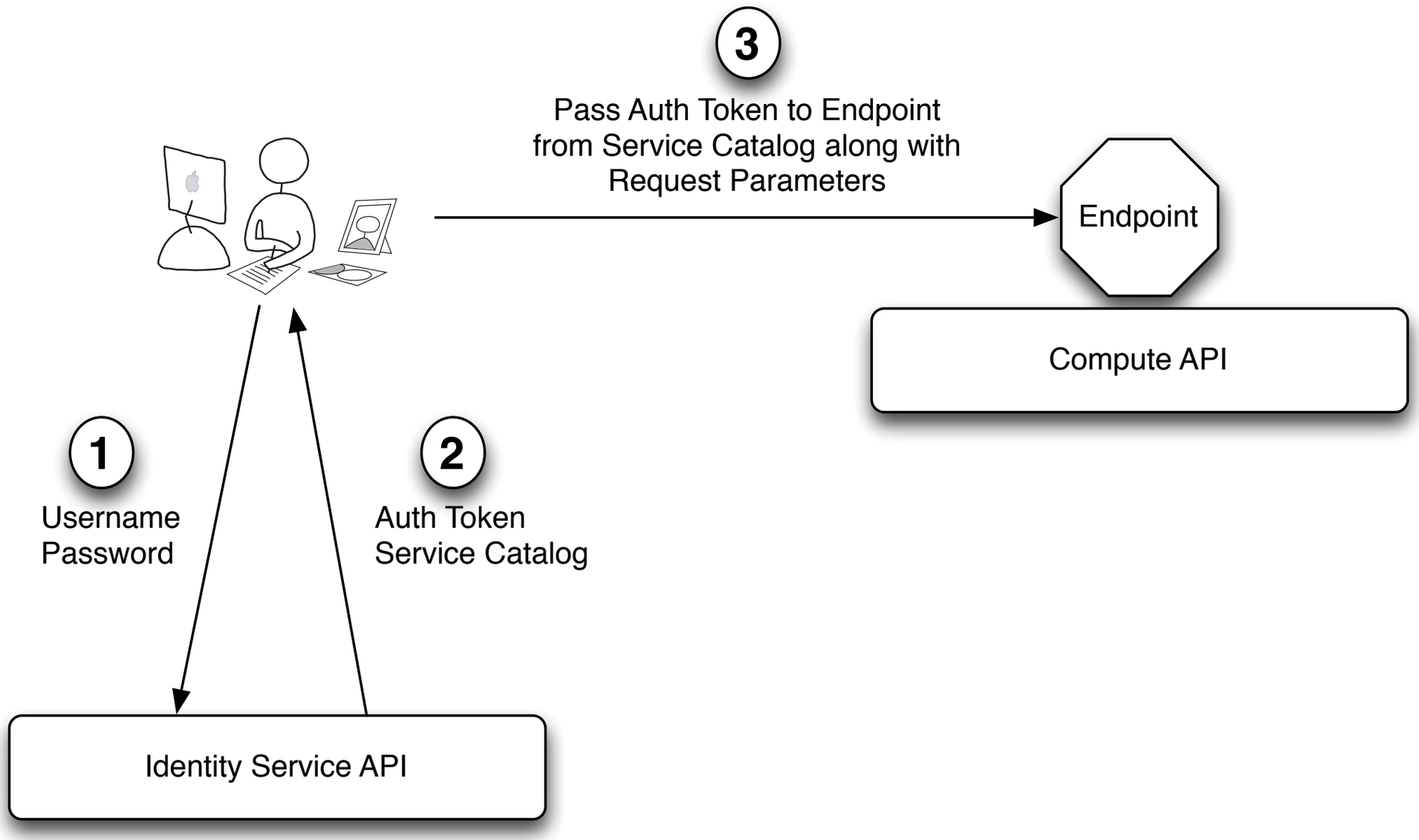
API Flow



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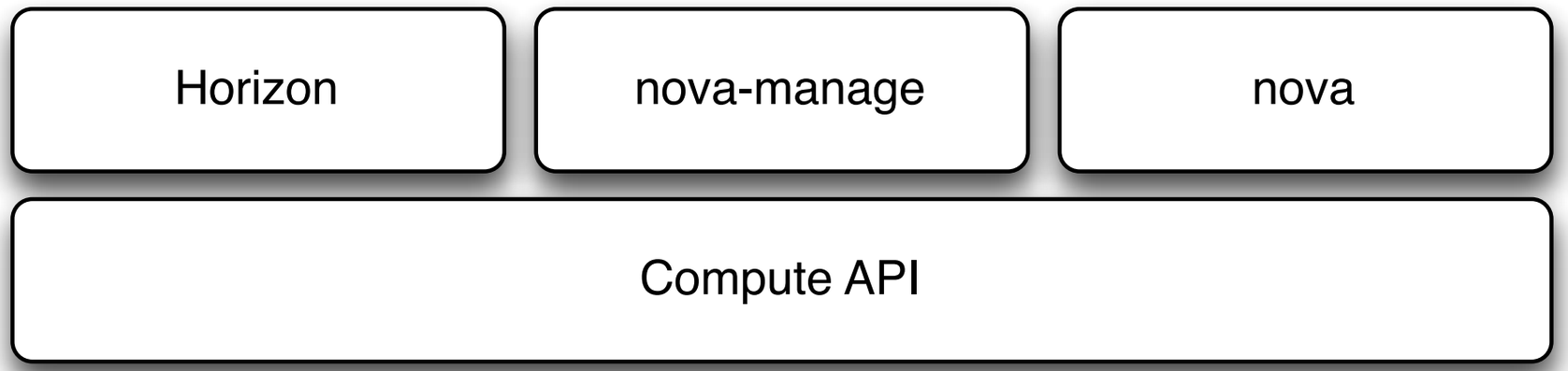
API Examples

curl -d '{"passwordCredentials":{"username": "myuser", "password": "mypassword"}}' -H "Content-type: application/json" http://localhost:5000/v2.0/tokens

curl -H "X-Auth-Token:999888777666" http://localhost:8774/v1.1/1/servers

On Top of the API



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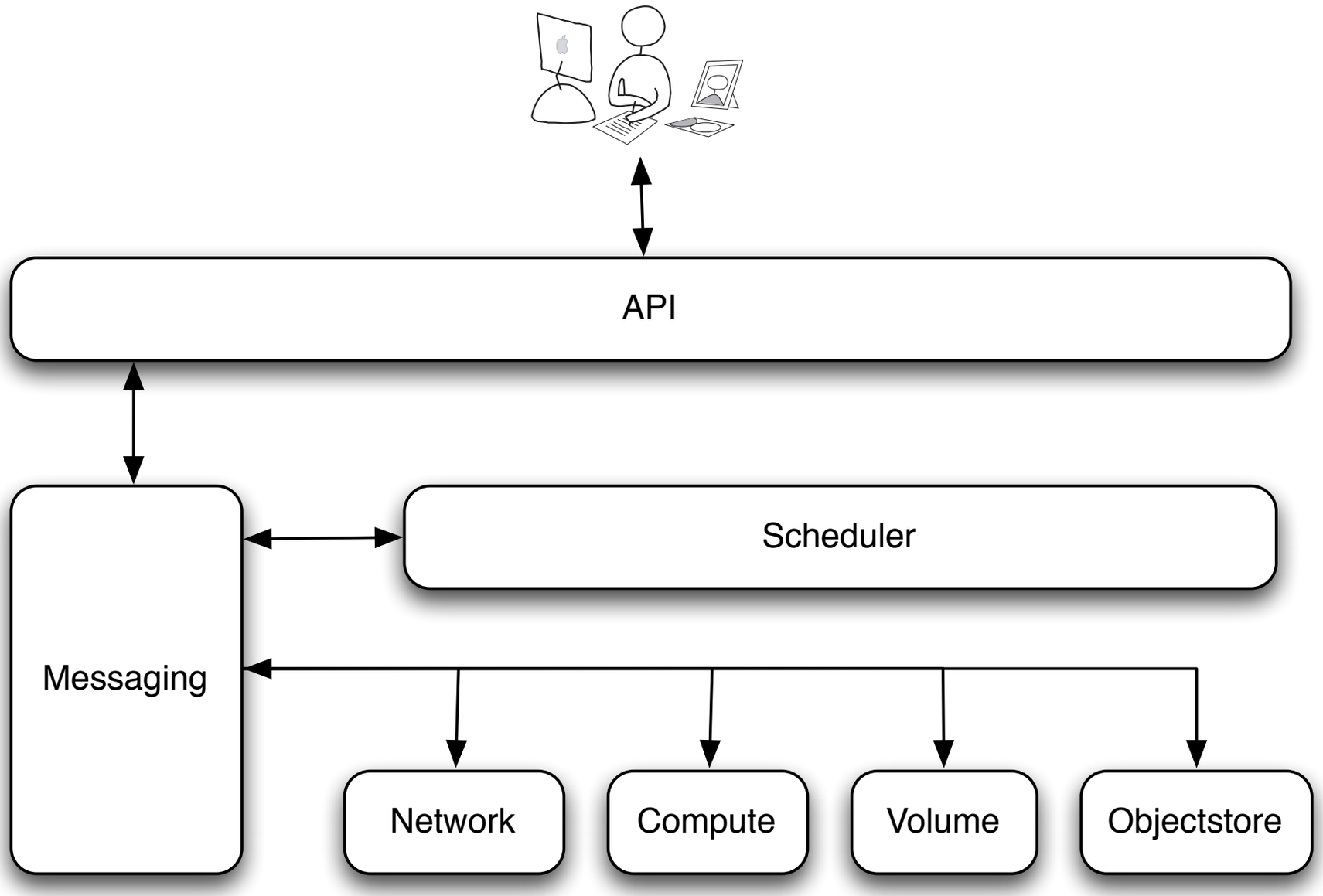
Nova Messaging

Messaging



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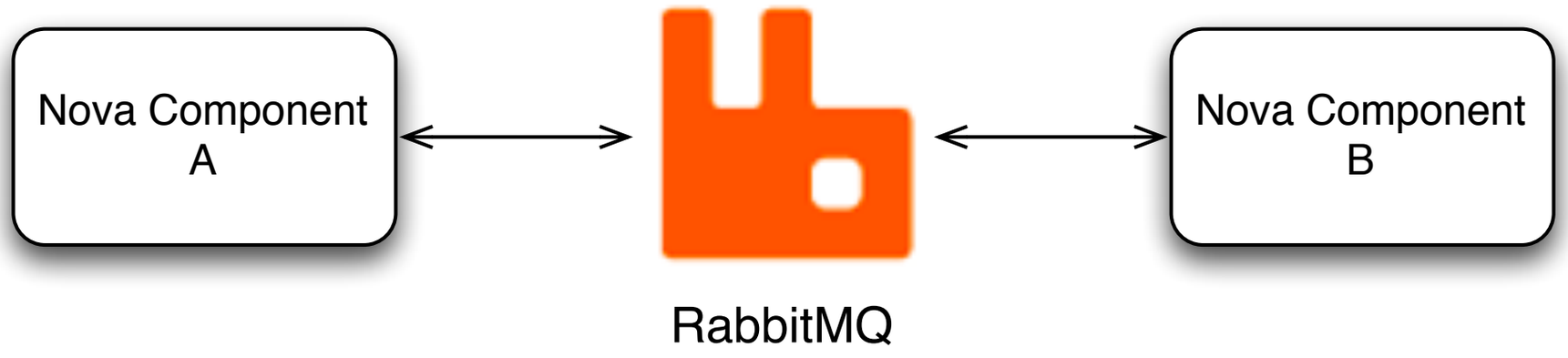
Messaging



- OpenStack uses the RabbitMQ messaging platform
- RabbitMQ sits between any two Nova components
- Allows components to be loosely coupled

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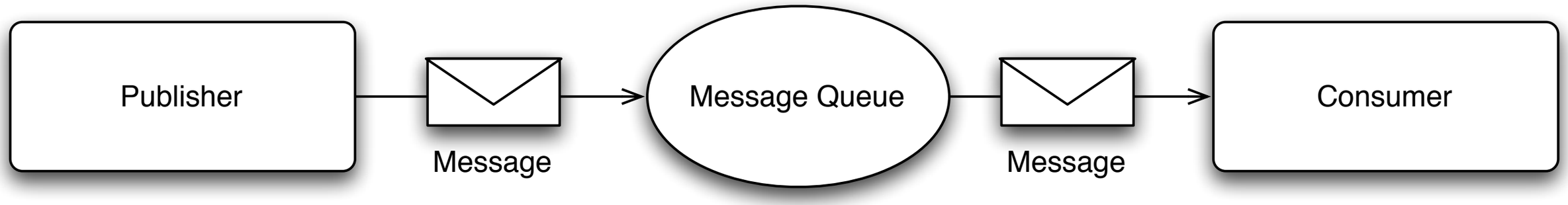
Messaging



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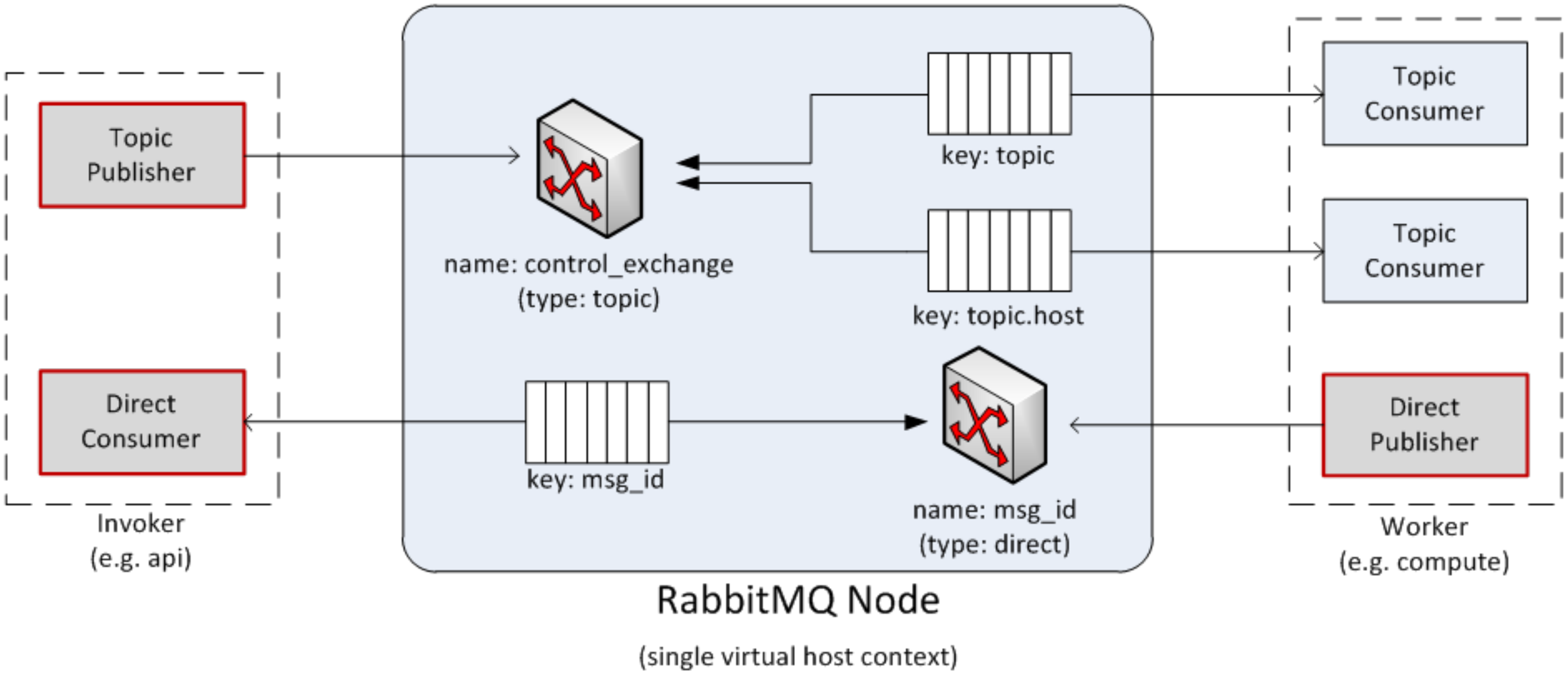
Messaging



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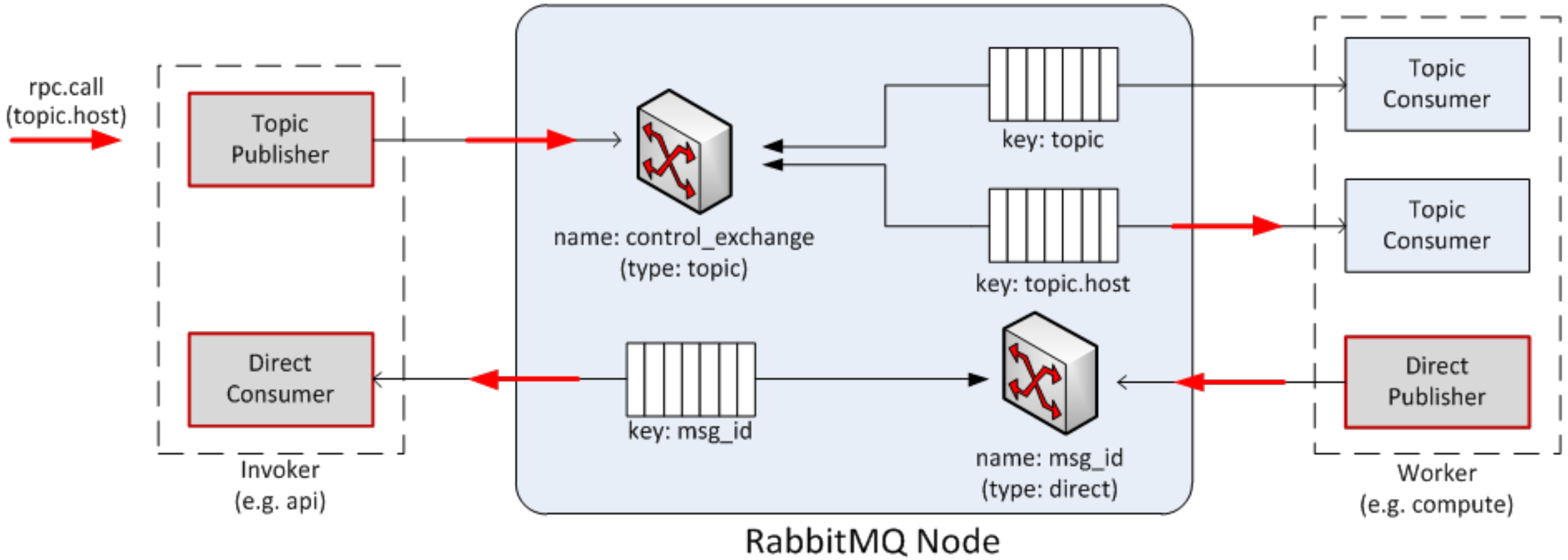
Messaging

rpc.call



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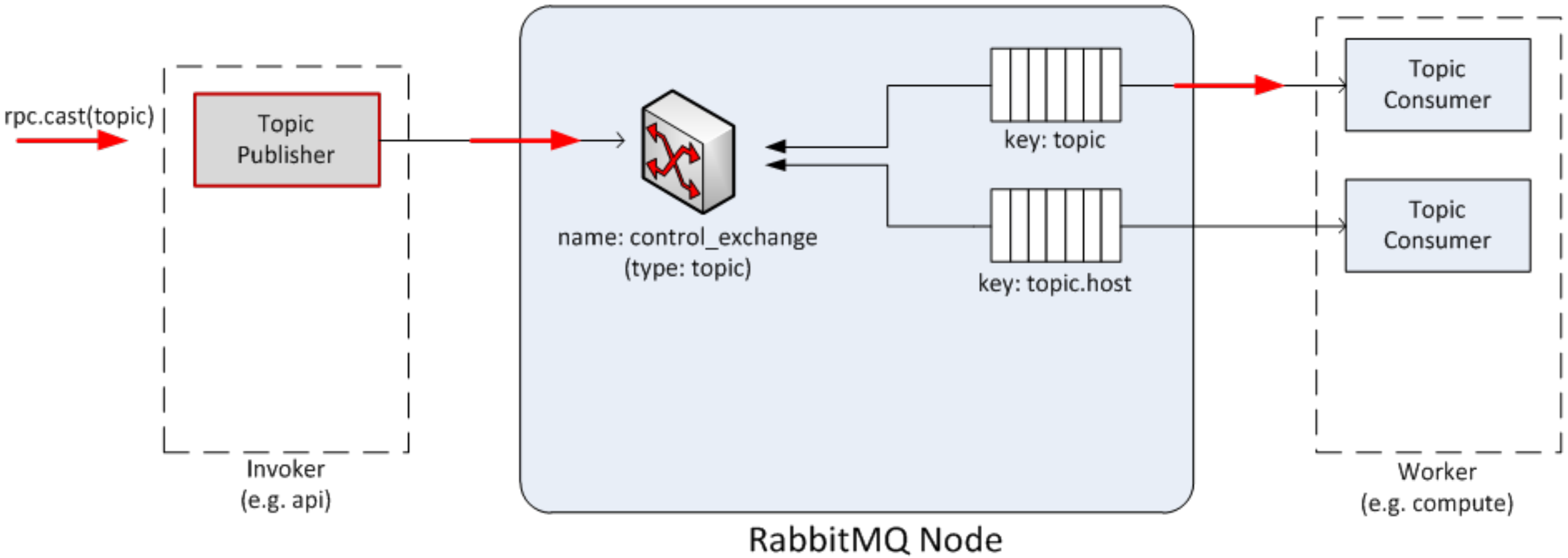
Messaging

rpc.cast



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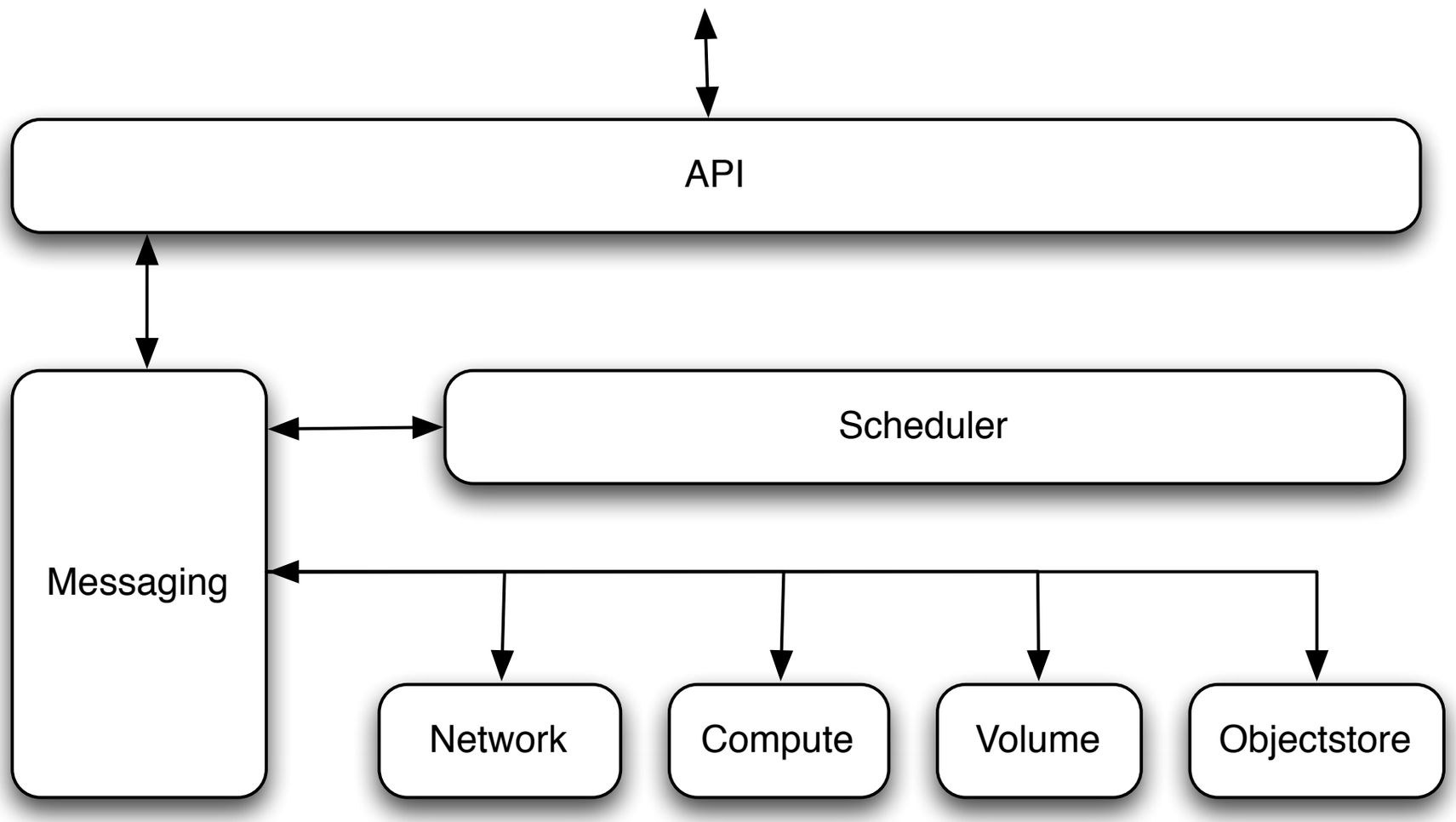
Nova Scheduler

Nova Components

Request Flow



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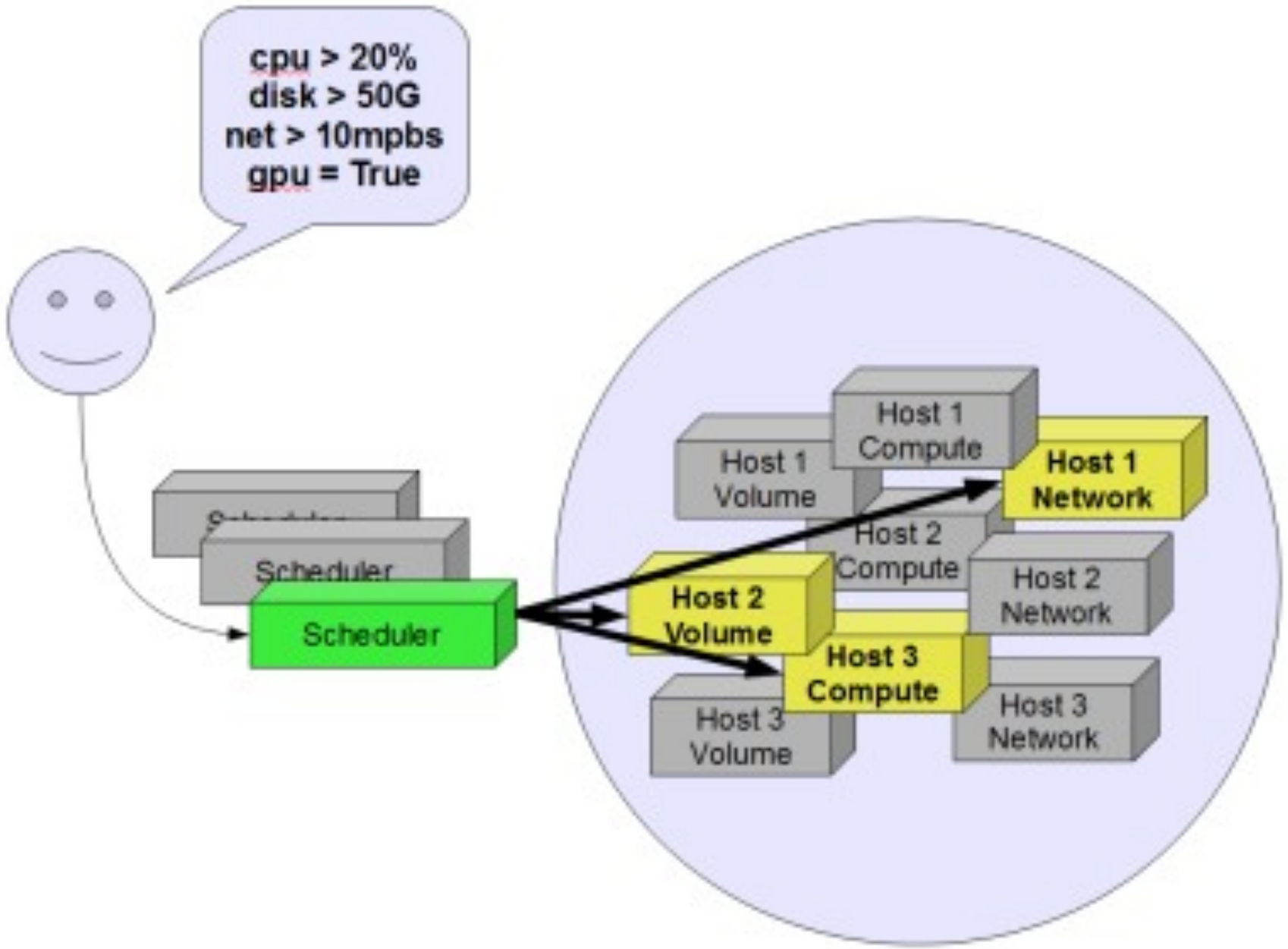
Scheduler



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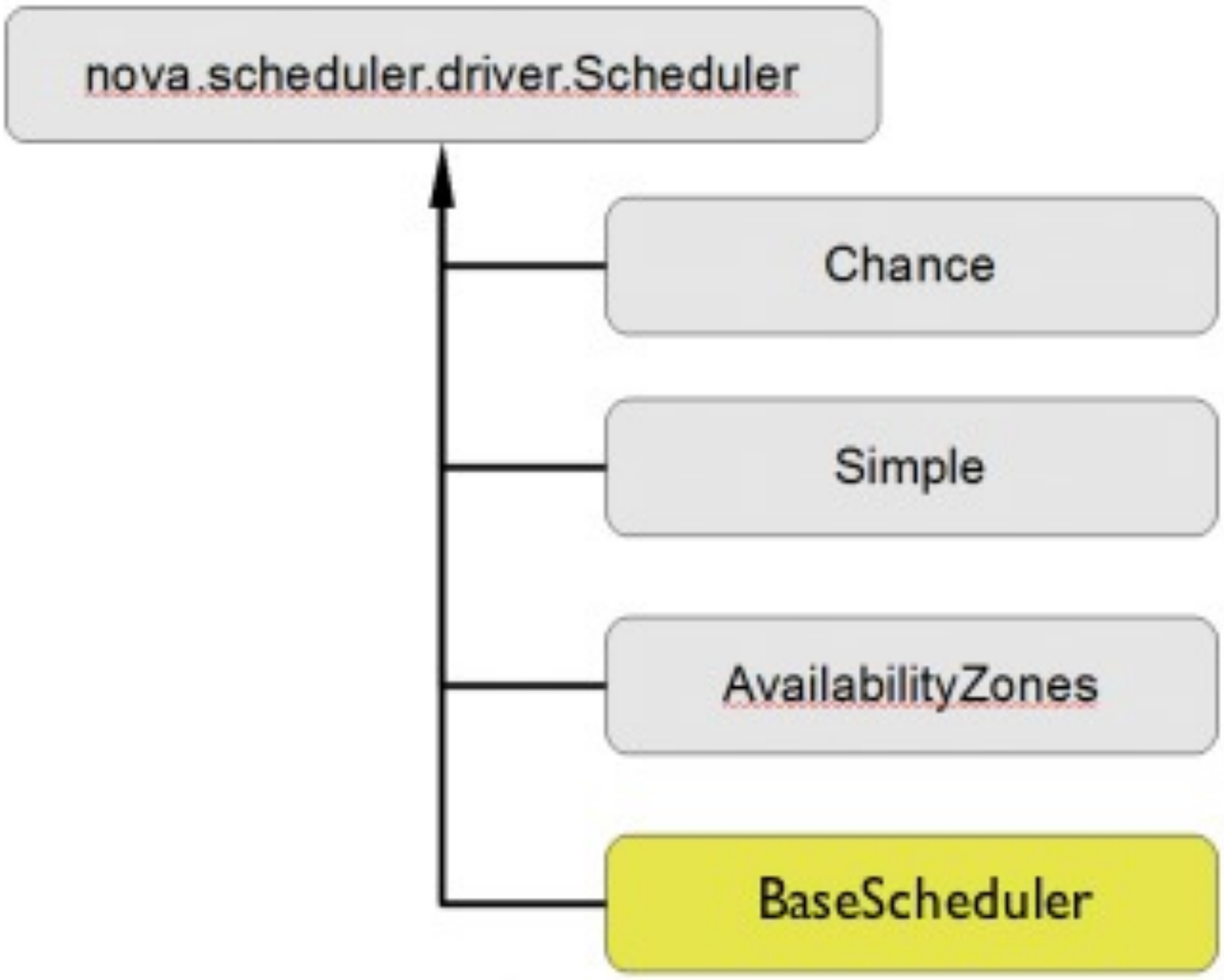
Scheduler



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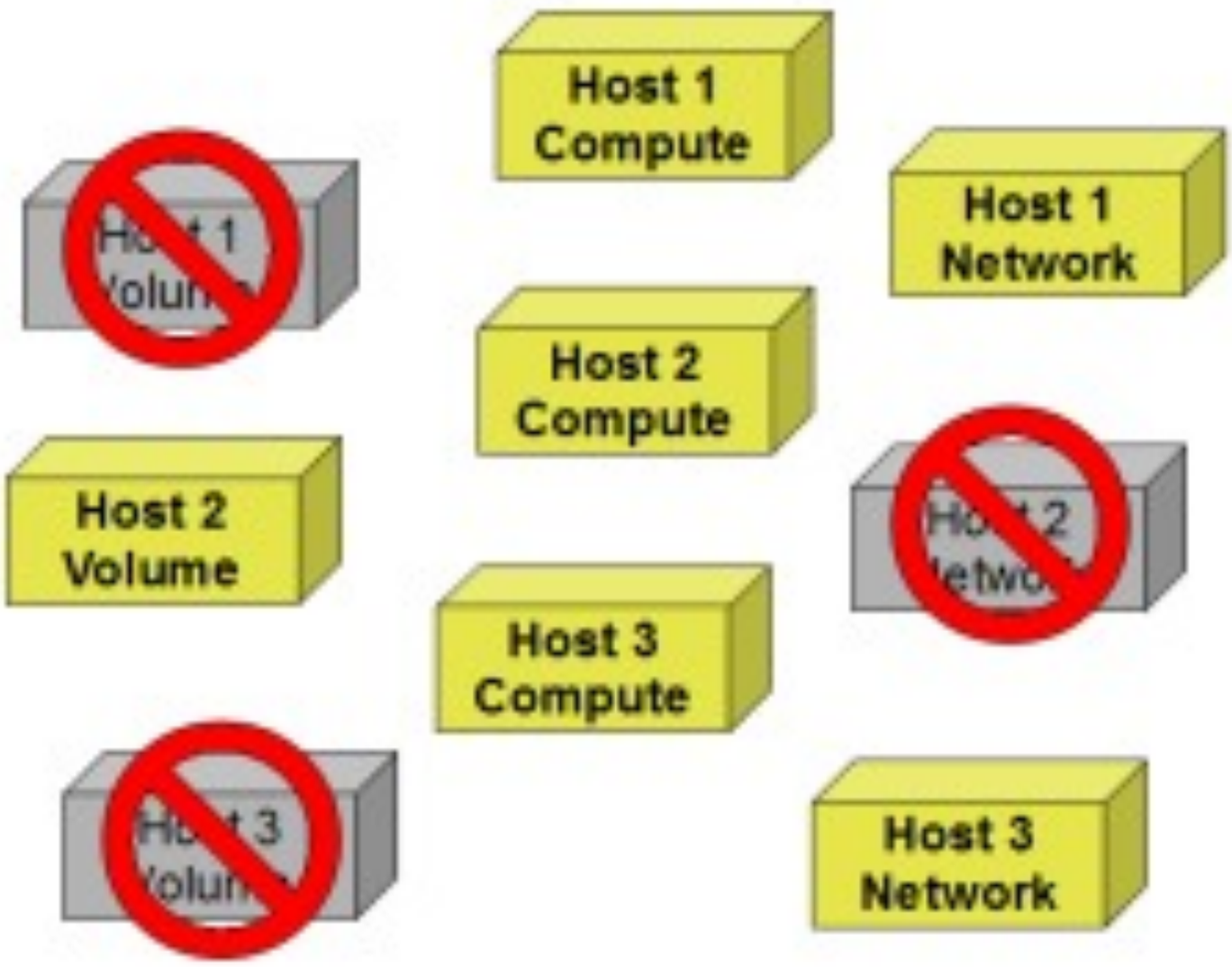
Filtering



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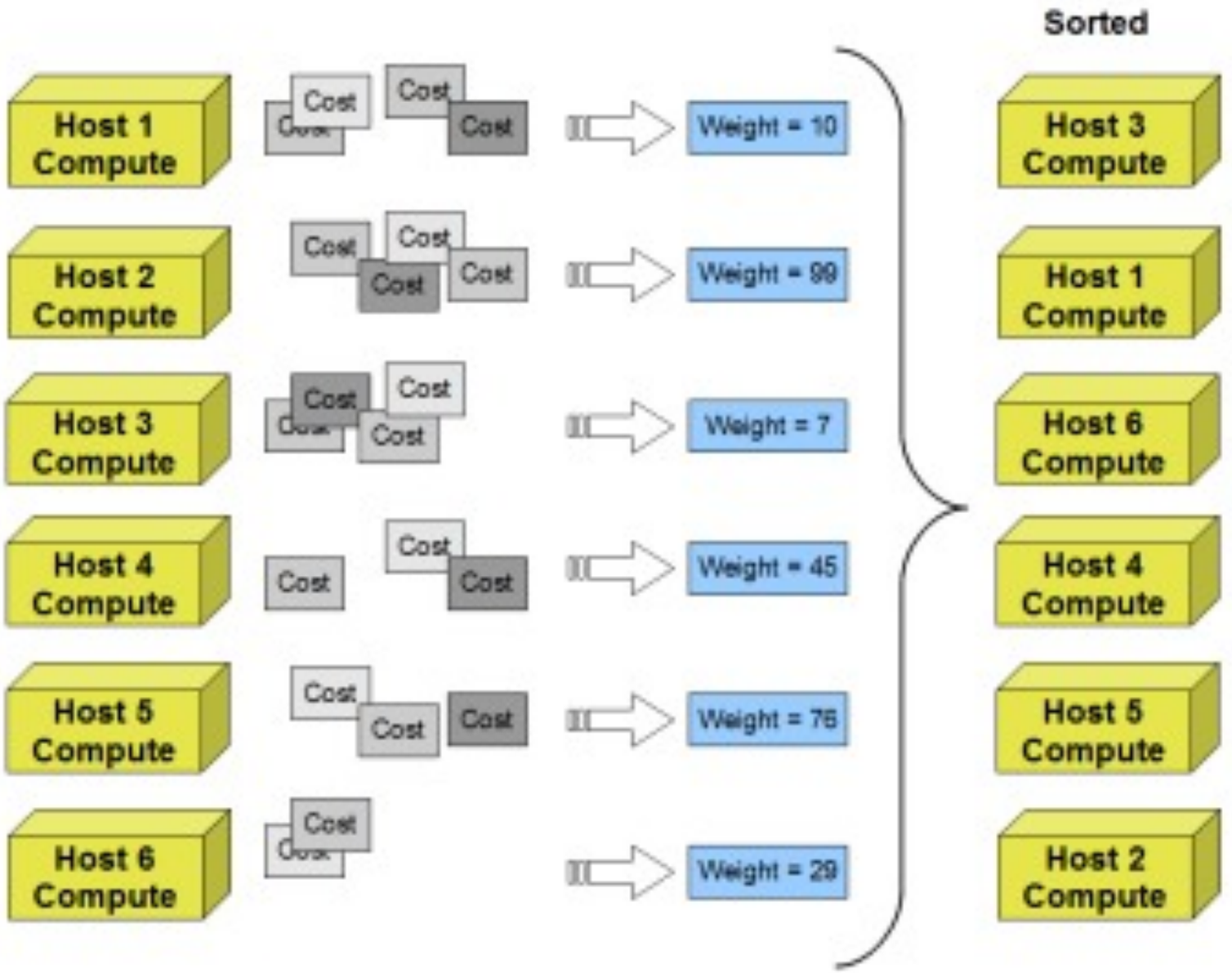
Cost & Weights



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Nova Zones

Where OpenStack is Headed

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Zones

- A Nova deployment is called a Zone
- A Zone allows you to partition your deployments into logical groups for load balancing and instance distribution

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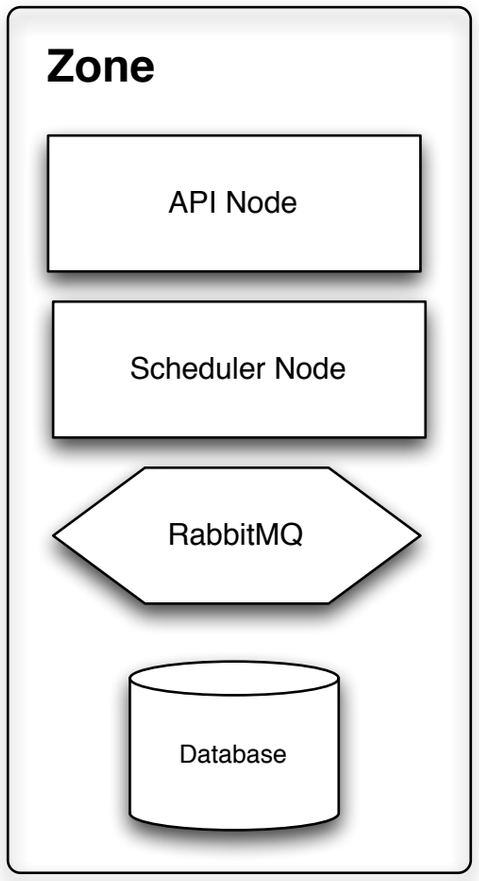
Zones



Minimum Requirements for a Zone

- API Node
- Scheduler Node
- RabbitMQ
- Database

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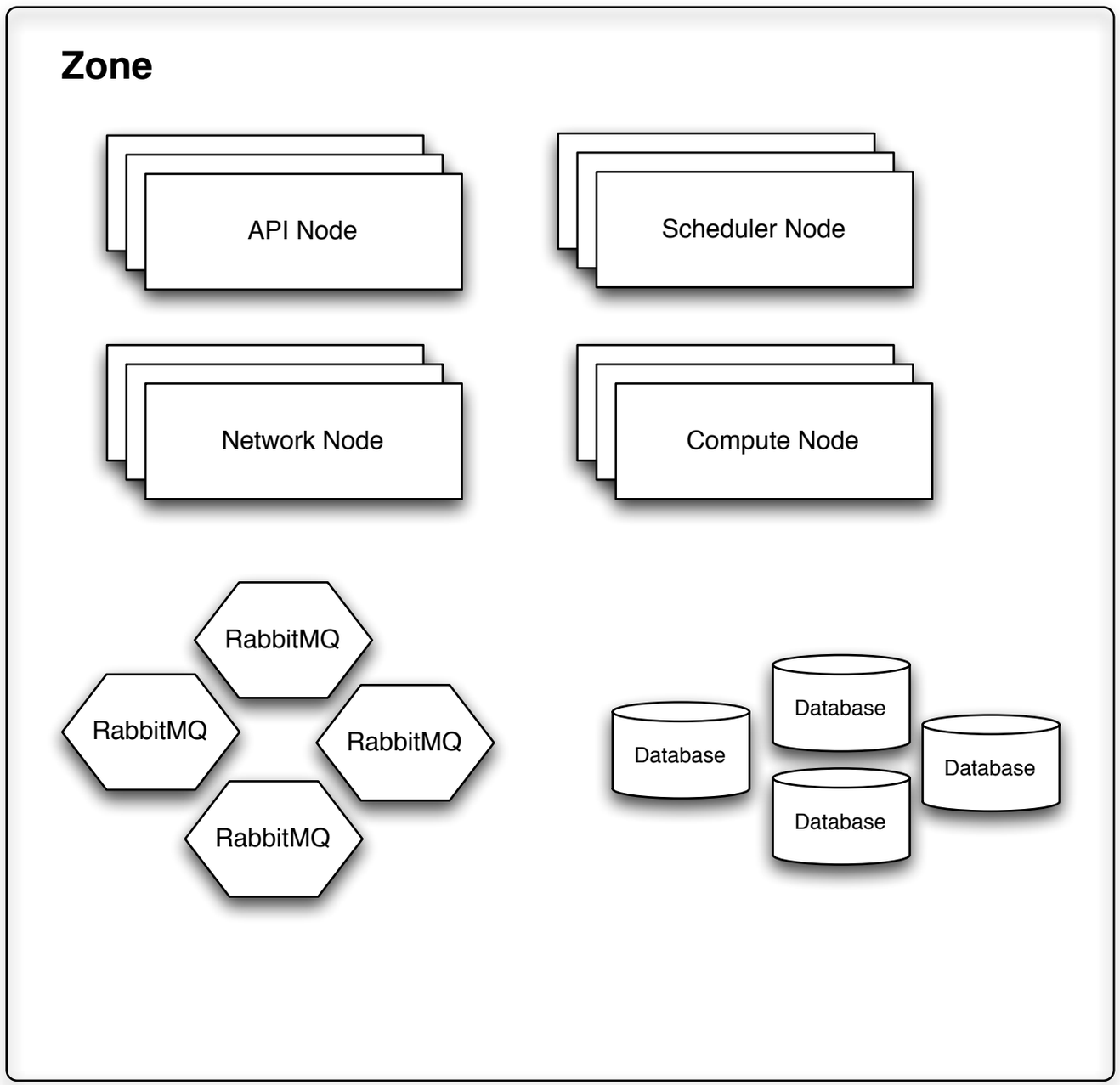
Zones



A Complex Zone May Have

- Multiple API Nodes
- Multiple Scheduler Nodes
- Multiple Network Nodes
- Multiple Compute Nodes
- A RabbitMQ Cluster
- A Database Cluster

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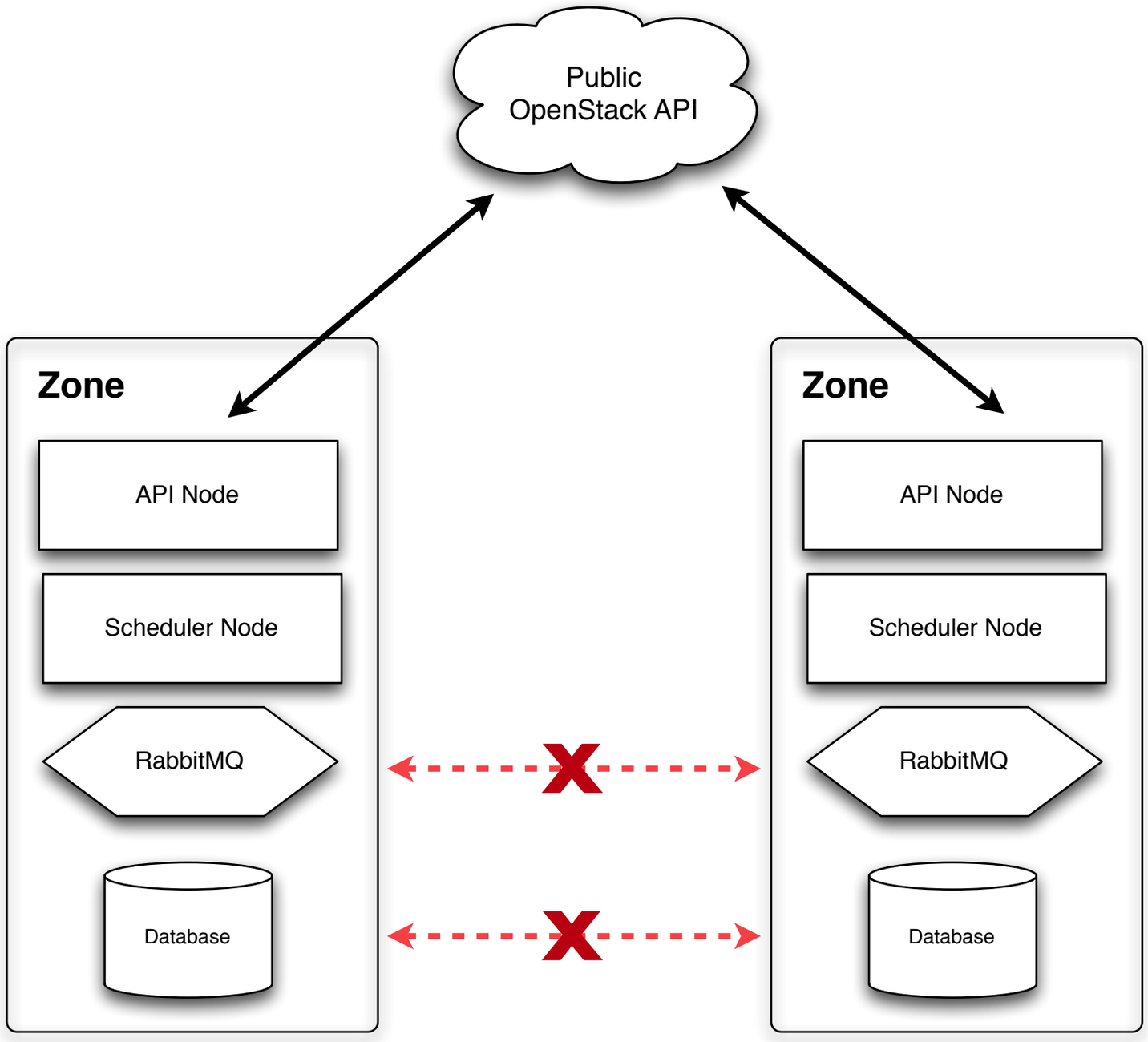
Zones Share Nothing



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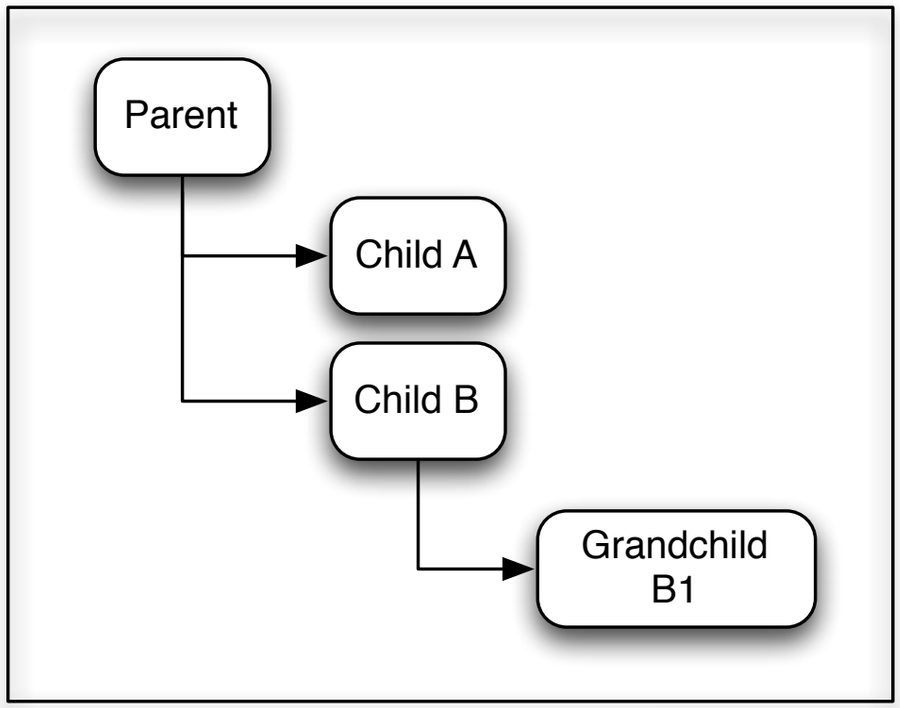
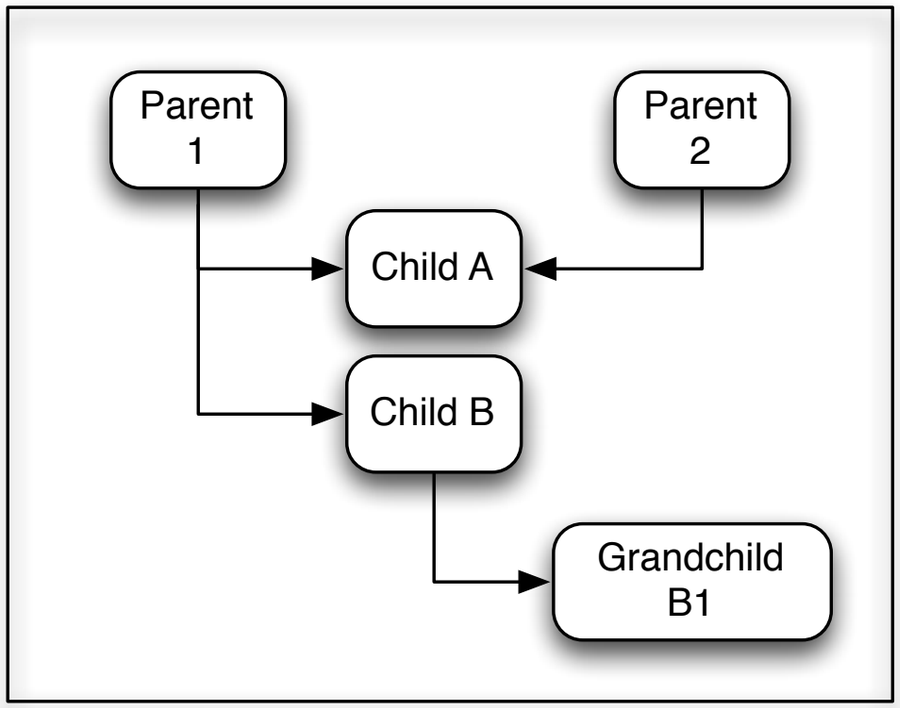
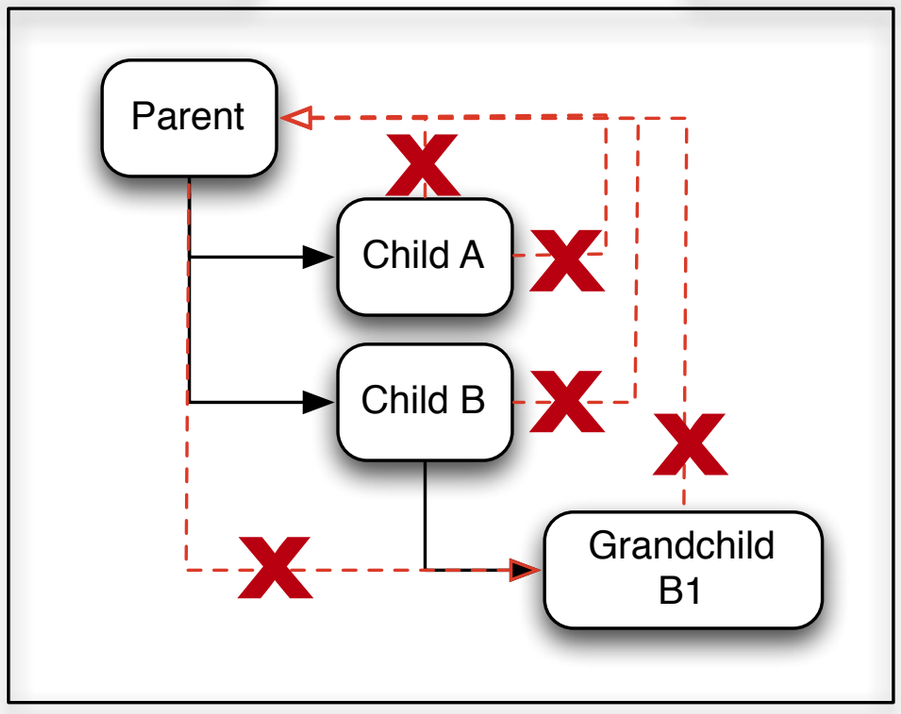
Zone Nesting







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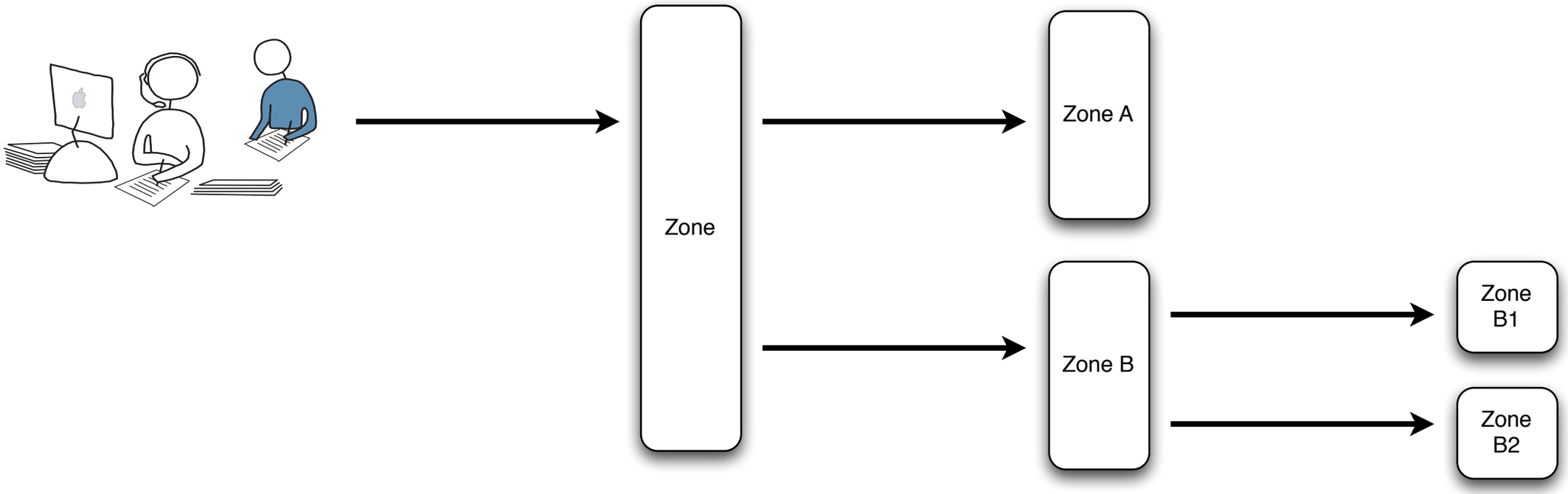
Request Processing



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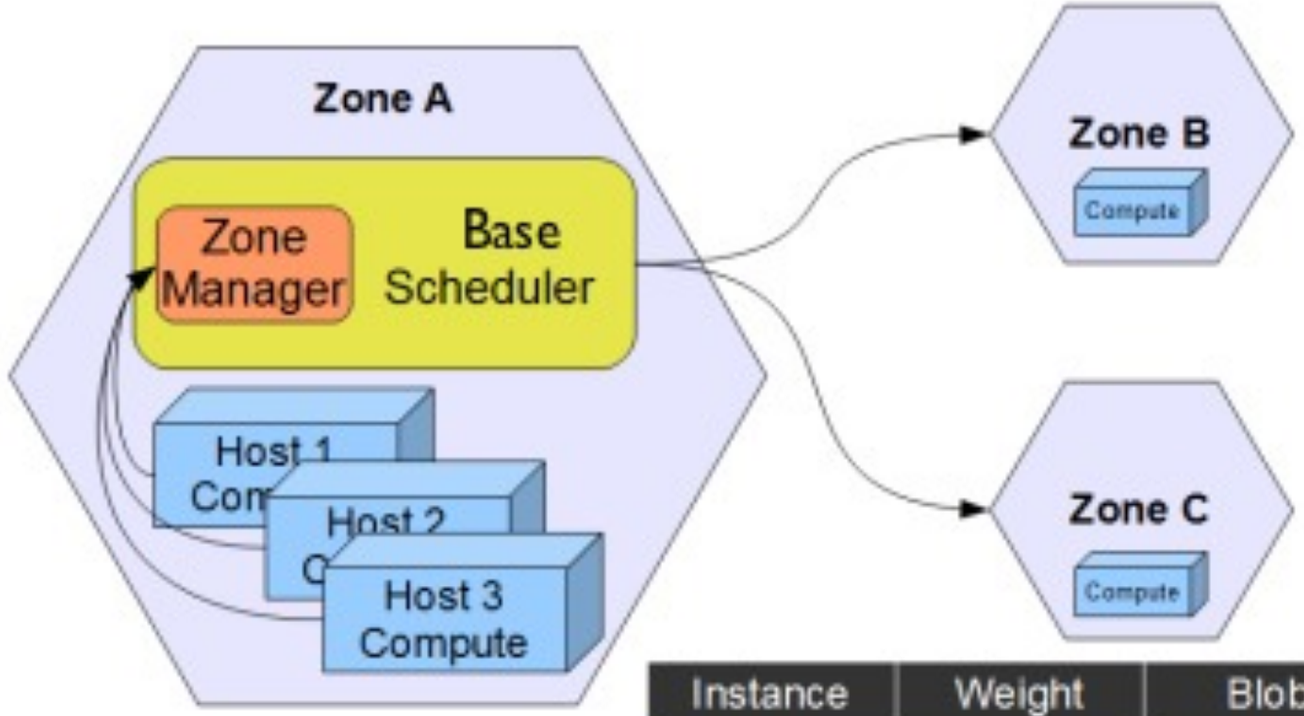
Cost & Weights

nova.compute.api.create_all_at_once()

Quantity=2
cpu > 20%
disk > 50G
net > 10mpbs
gpu = True

Instance	Weight	Blob
1	23	f7b383c1...
2	78	cab6297...



Instance	Weight	Host
1	8	MyHost27
2	19	MyHost38

Instance	Weight	Blob
1	15	3ab34d7...
2	56	2746abd...

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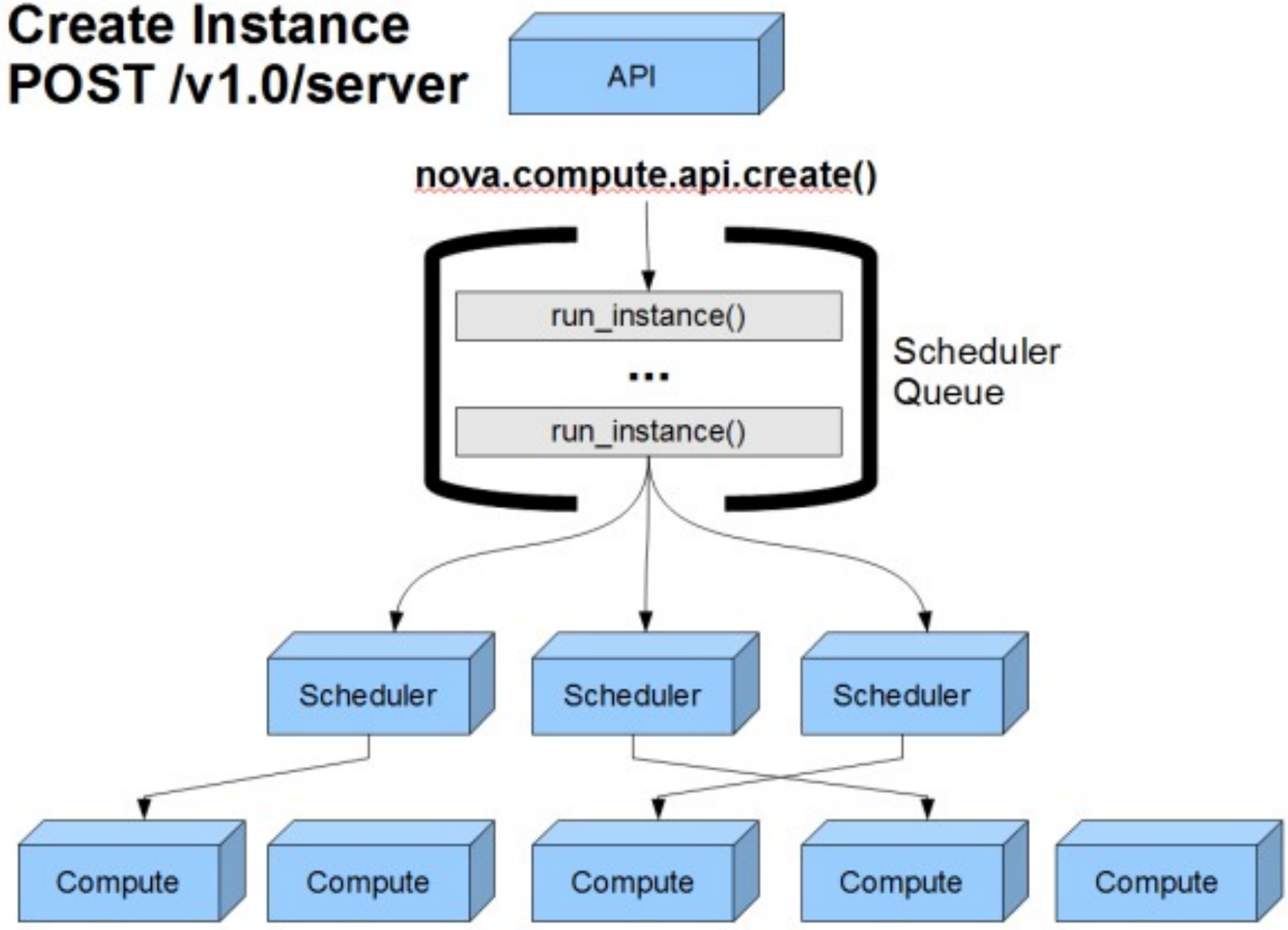
Scheduler

Create Instance
POST /v1.0/server



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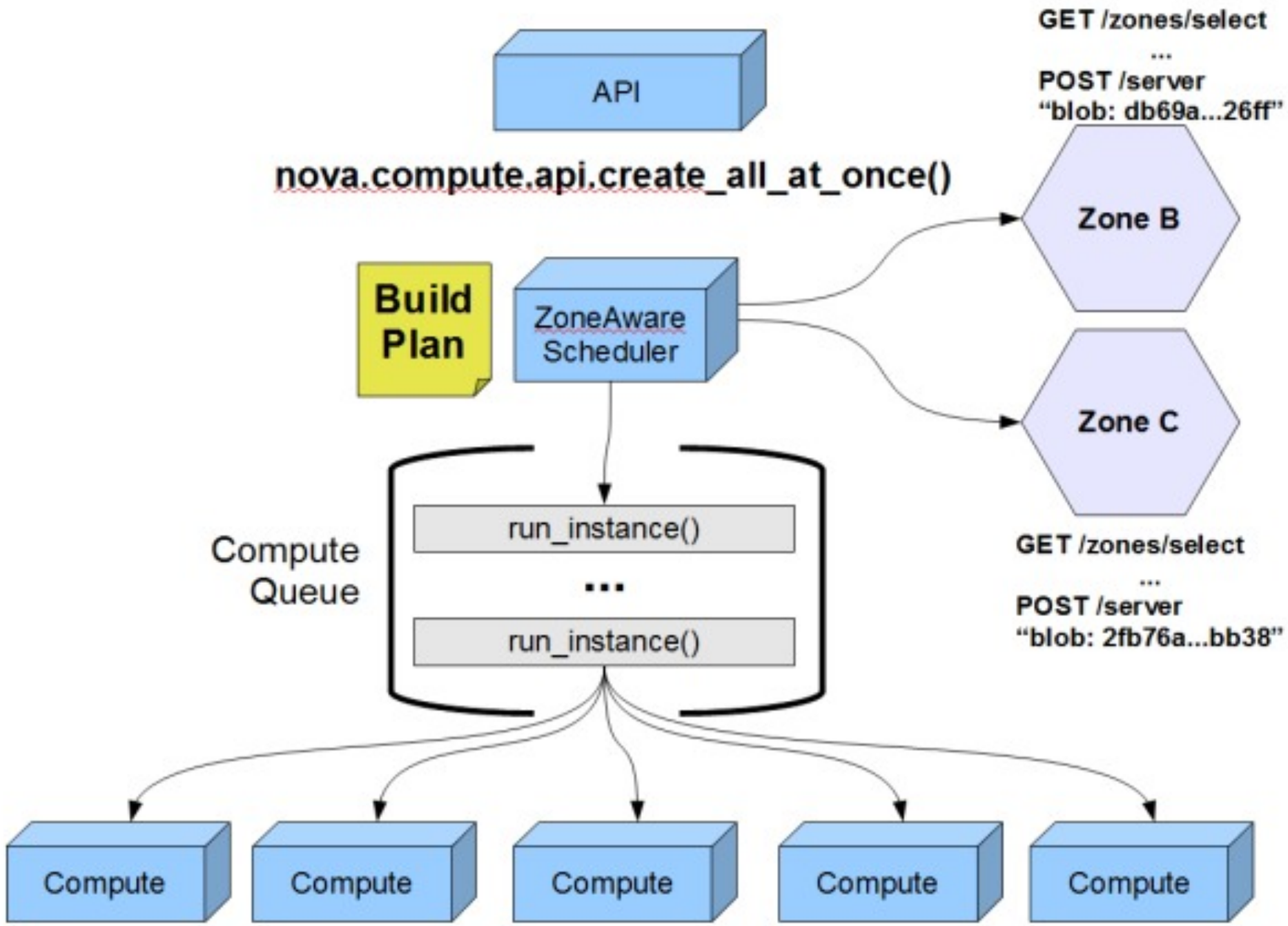
All At Once



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Zone Capabilities

General Capabilities

- `key=value;value;value, key=value;value;value`
- `hypervisor=xenserver;kvm,os=linux;windows`
- *`--zone_capabilities`* flag

Dynamic Capabilities

- Derived from *`nova.manager.SchedulerDependentManager`*
- set these capabilities by calling the *`update_service_capabilities()`* method on their *`Manager`* base class

Nova Network Node

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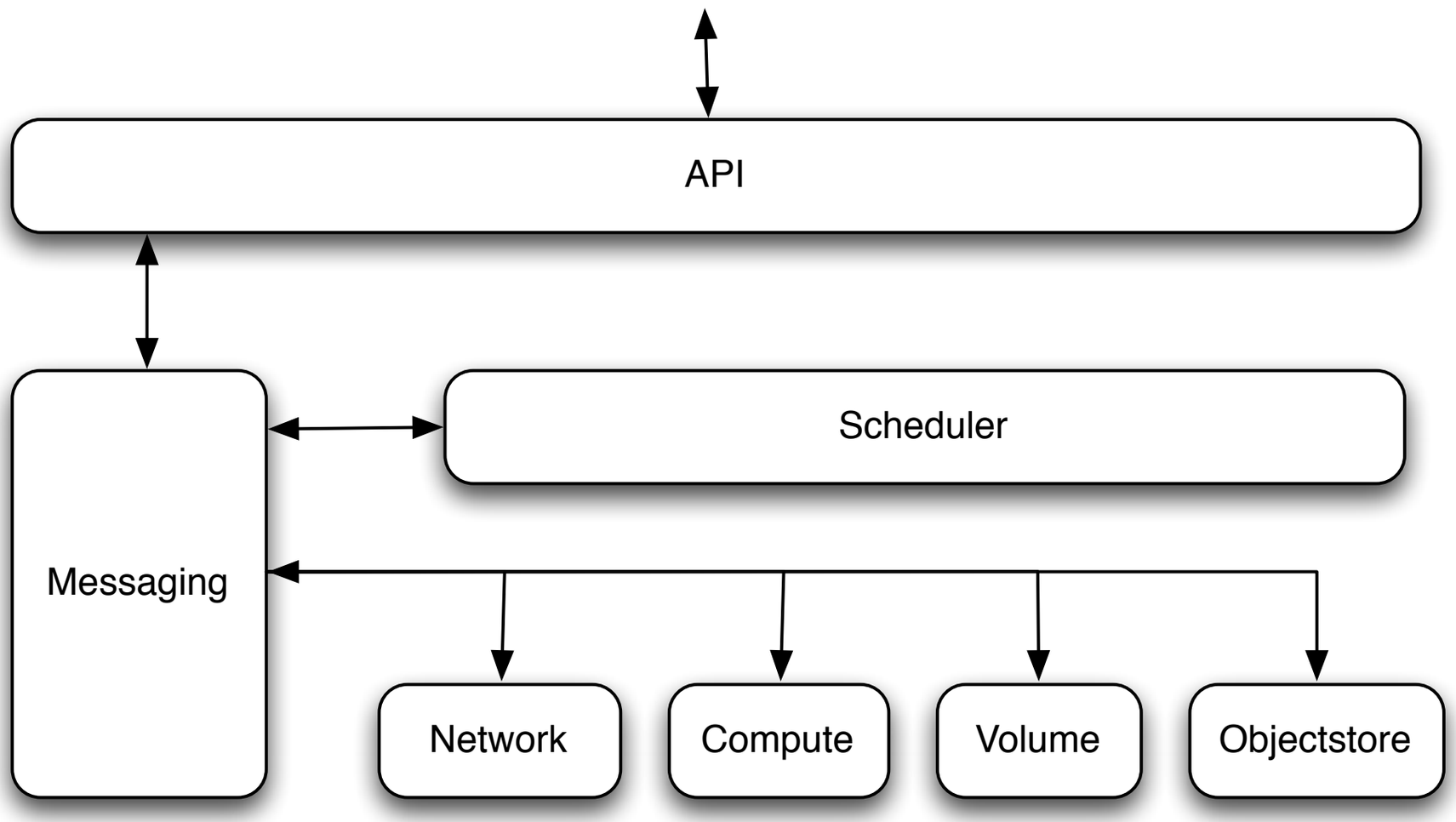
Nova Network

Request Flow



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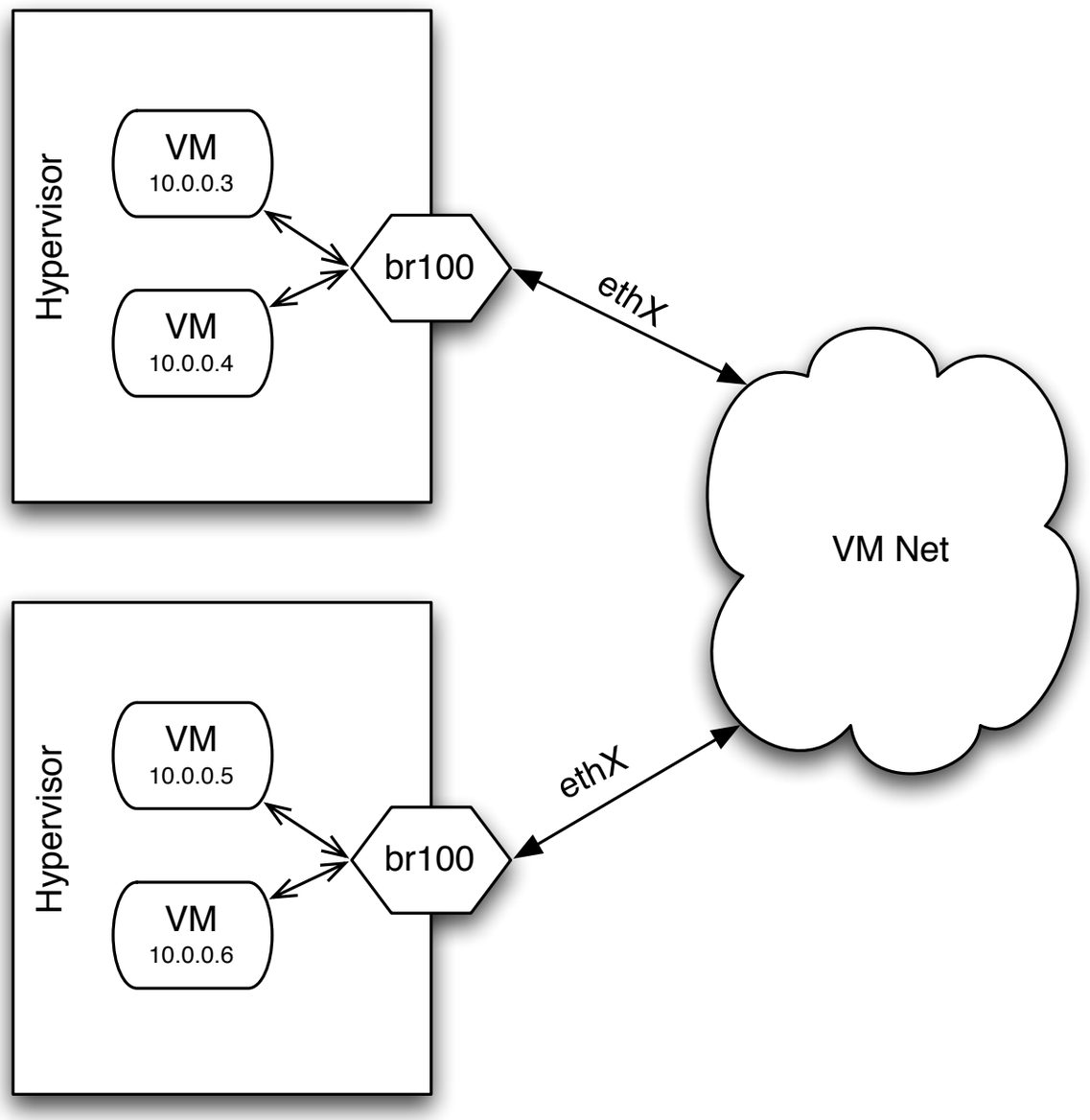
Nova Network

Flat Manager



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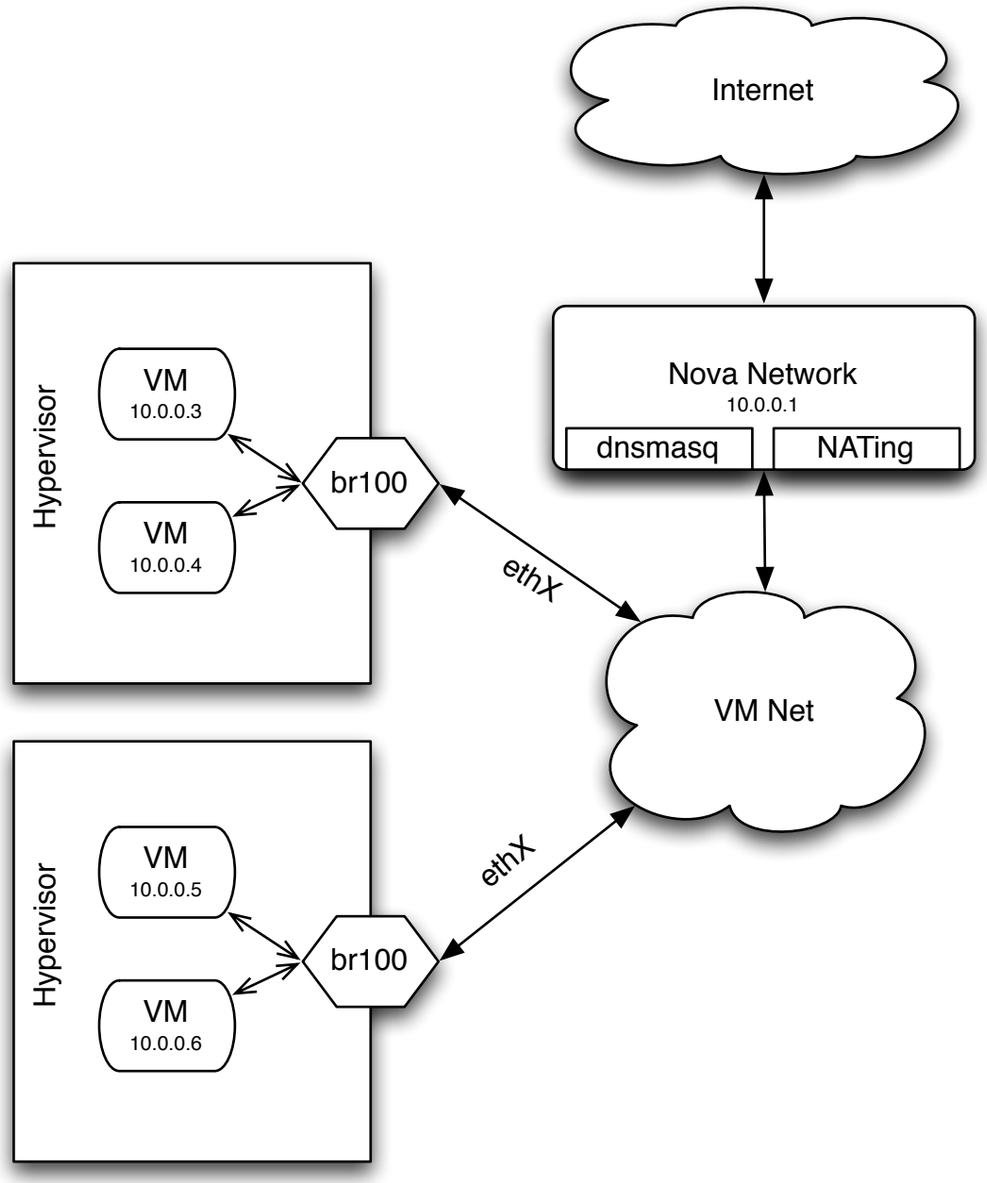
Nova Network

Flat DHCP Manager



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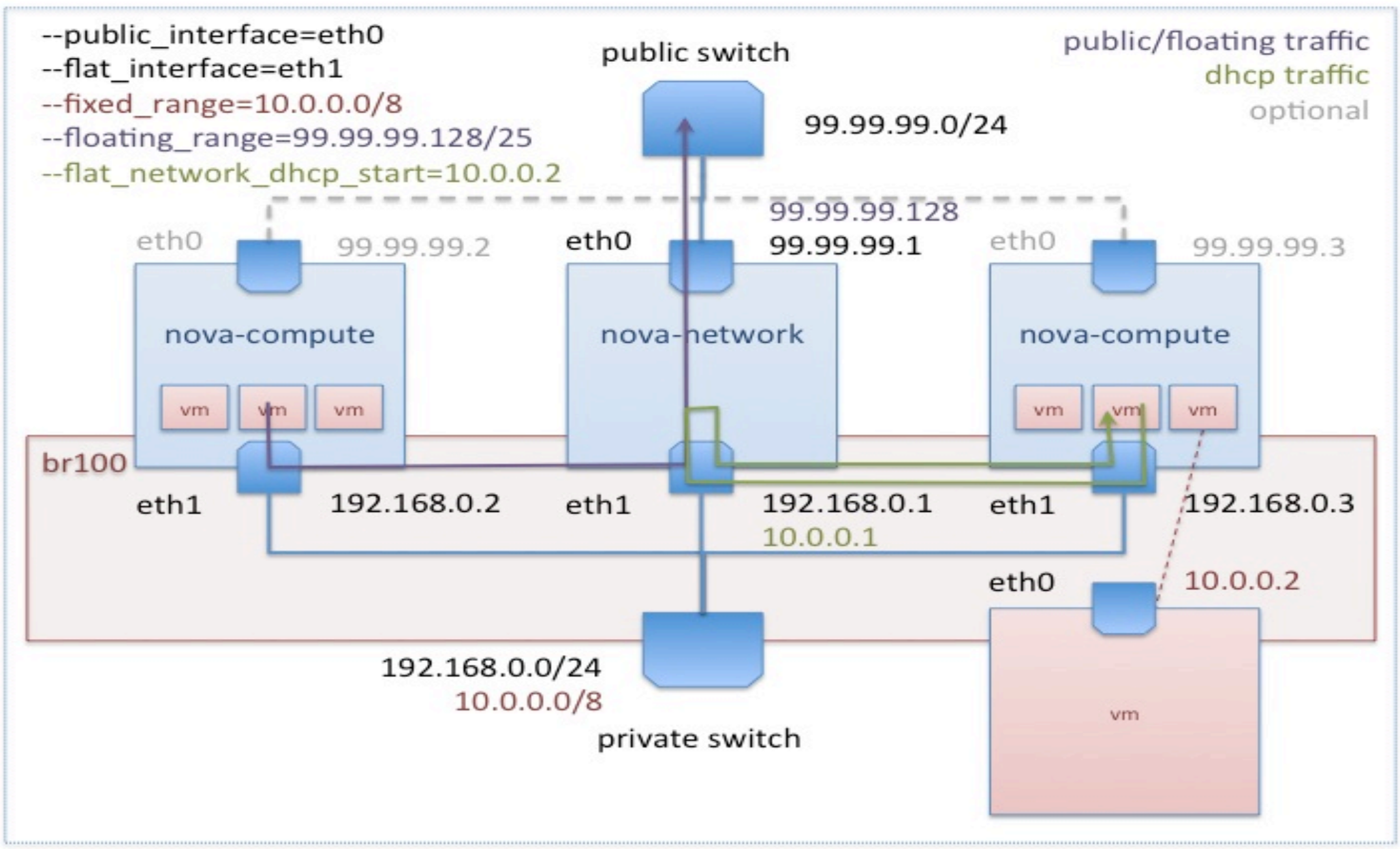
Nova Network

Flat DHCP Manager



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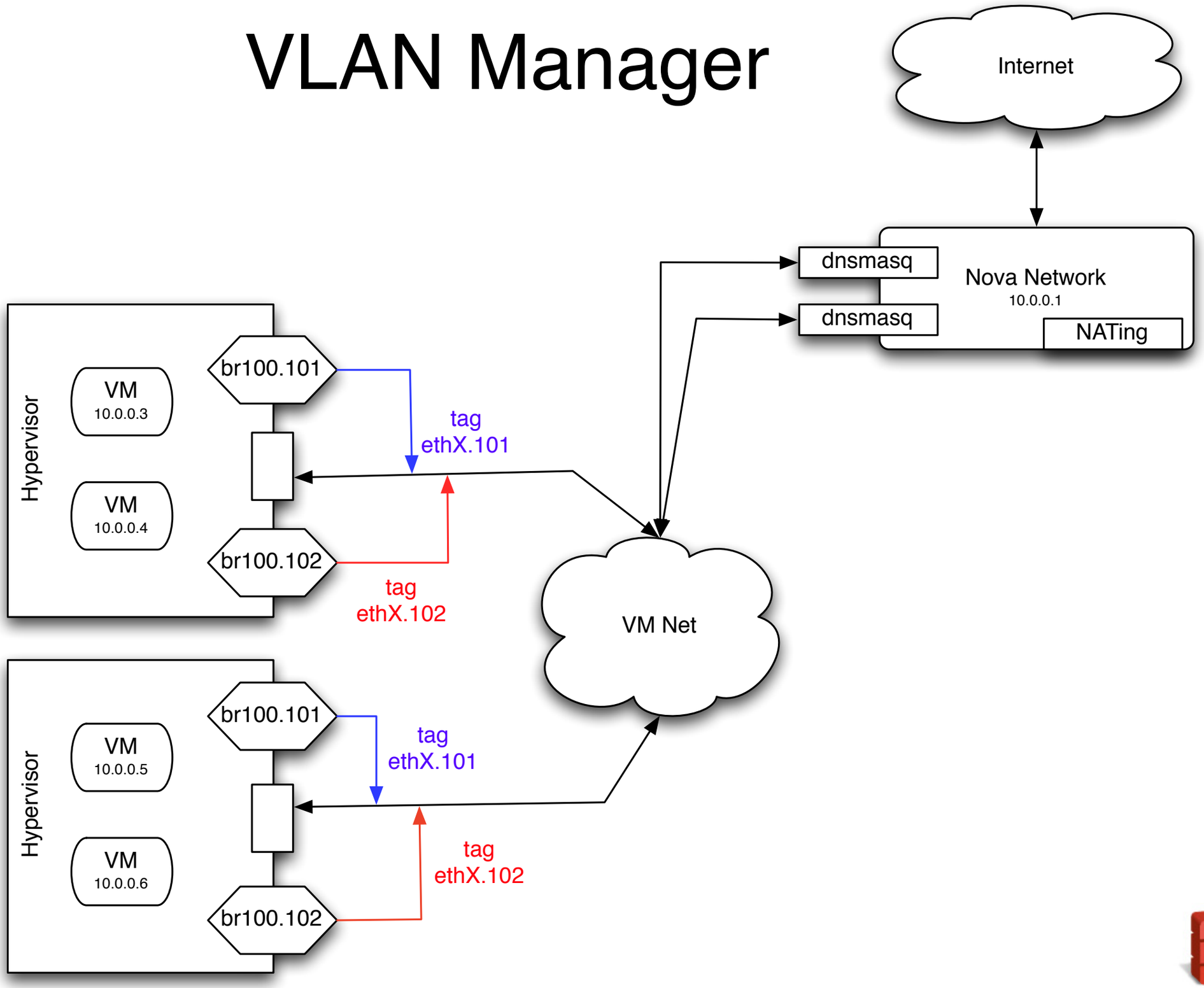
Nova Network

VLAN Manager



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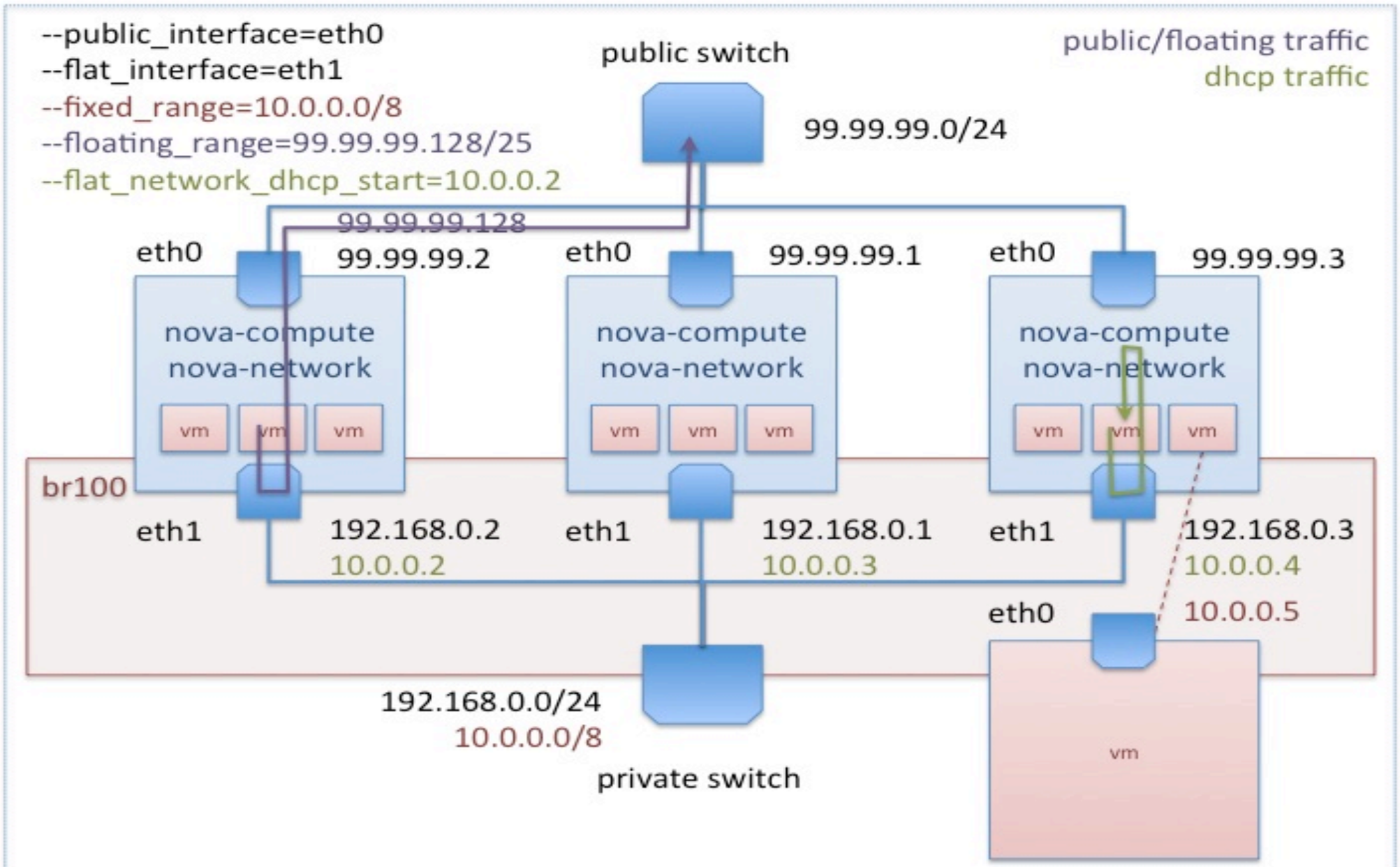
Nova Network

High Availability Manager



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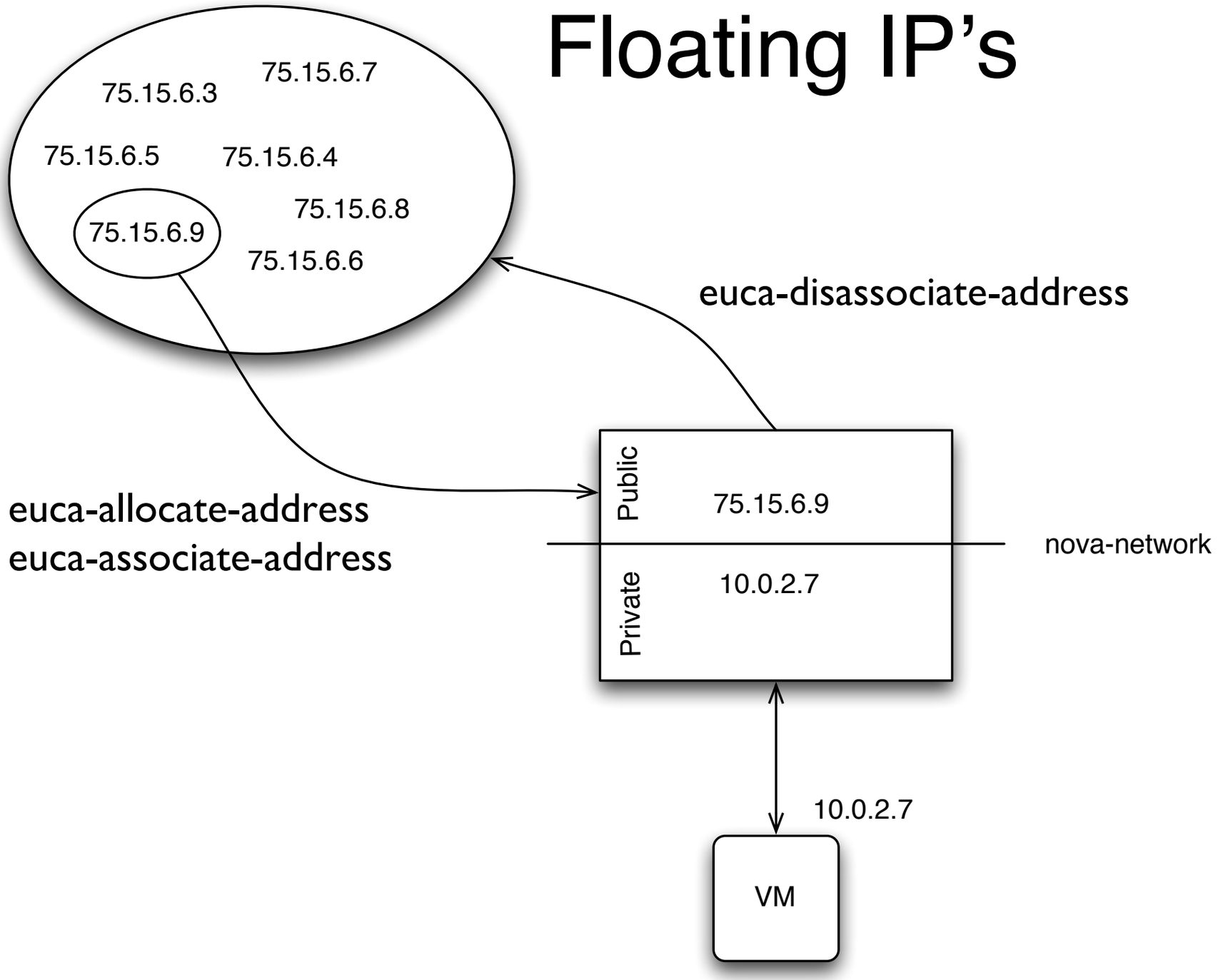
Nova Network

Floating IP's



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Nova Network

Floating IP's

nova-manage floating create --ip_range=10.0.2.0/24

euca-allocate-address

euca-associate-address -i i-00000007 10.0.2.3

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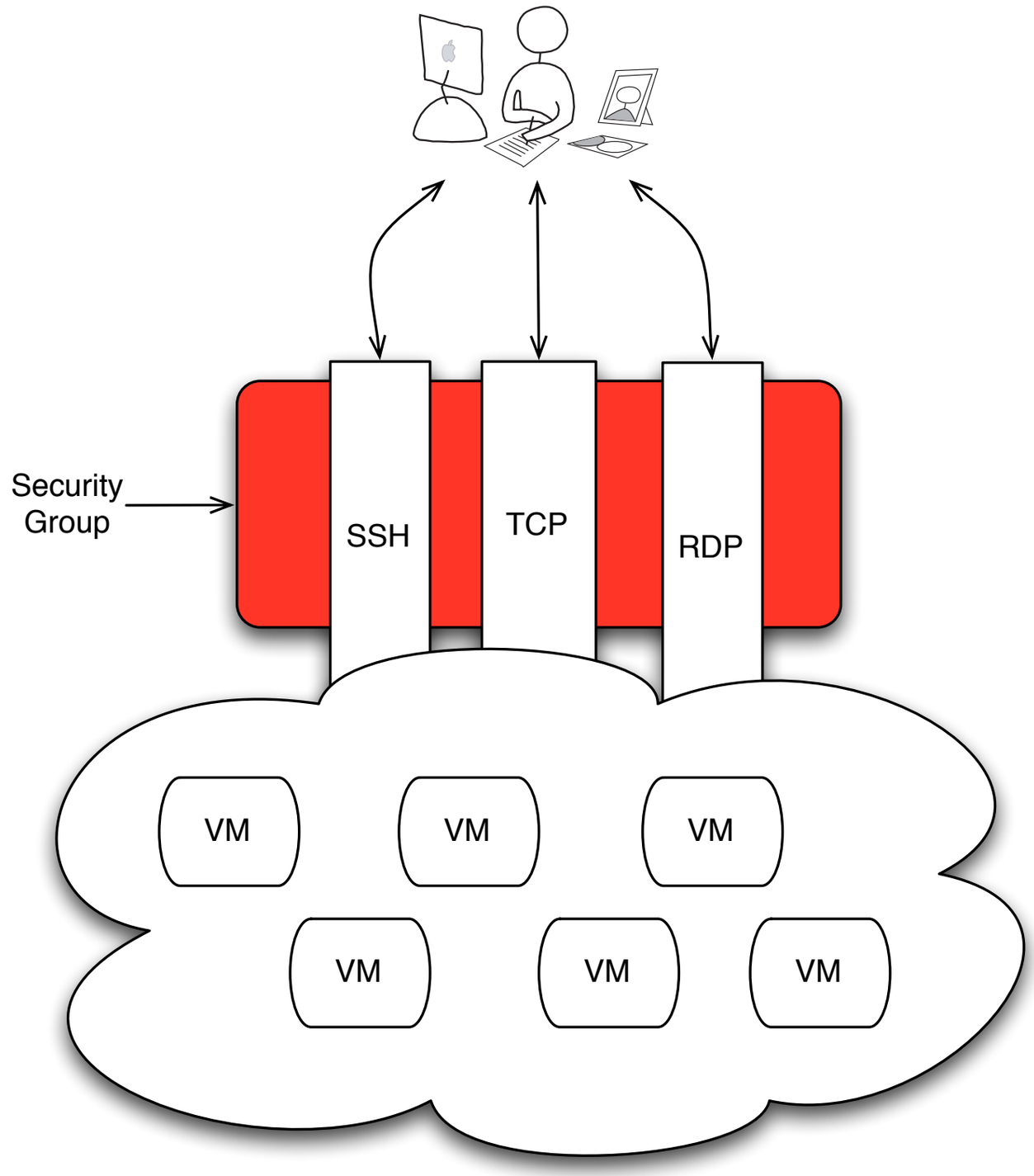
Nova Network

Security Groups



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Nova Network

Security Groups

- Create a new security group
  - euca-add-group –d “my servers” myservers
  - Add rules to the security group
    - ssh
      - euca-authorize –P tcp –s 192.168.1.1 –p 22 myservers
    - Ping
      - euca-authorize –P icmp –s 192.168.1.1 –t -1:1 myservers
- Boot an instance into the security group
  - nova boot –flavor 3 –image 3 –ipgroup myservers <name>

Nova Compute Node

Nova Compute Node

Request Flow

API

Messaging

Scheduler

Network

Compute

Volume

Objectstore

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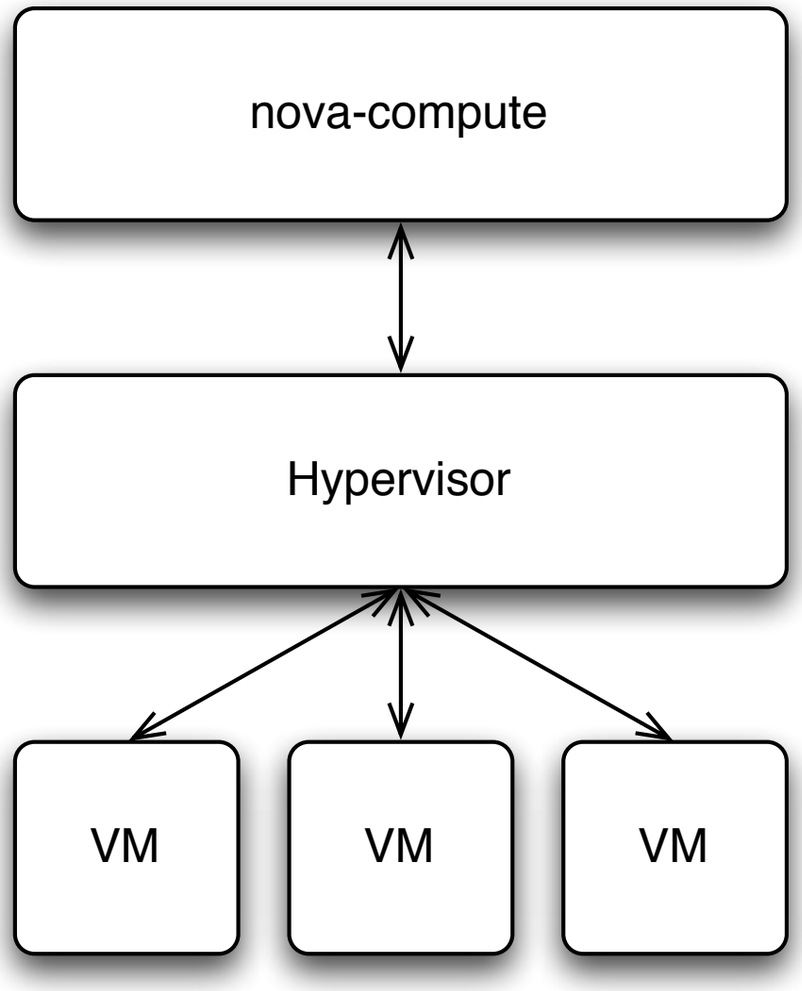
Nova Compute Node



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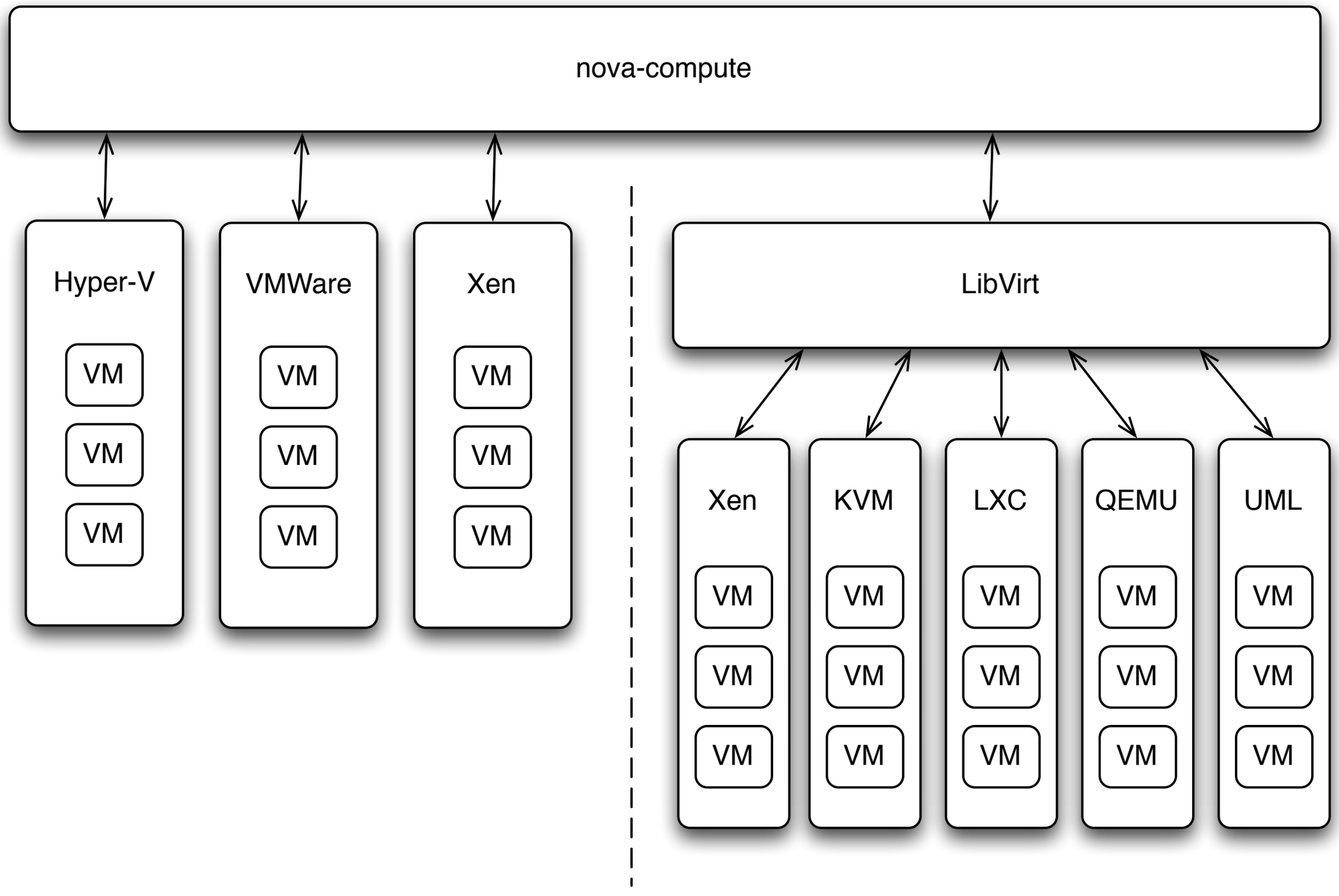
Nova Compute Node



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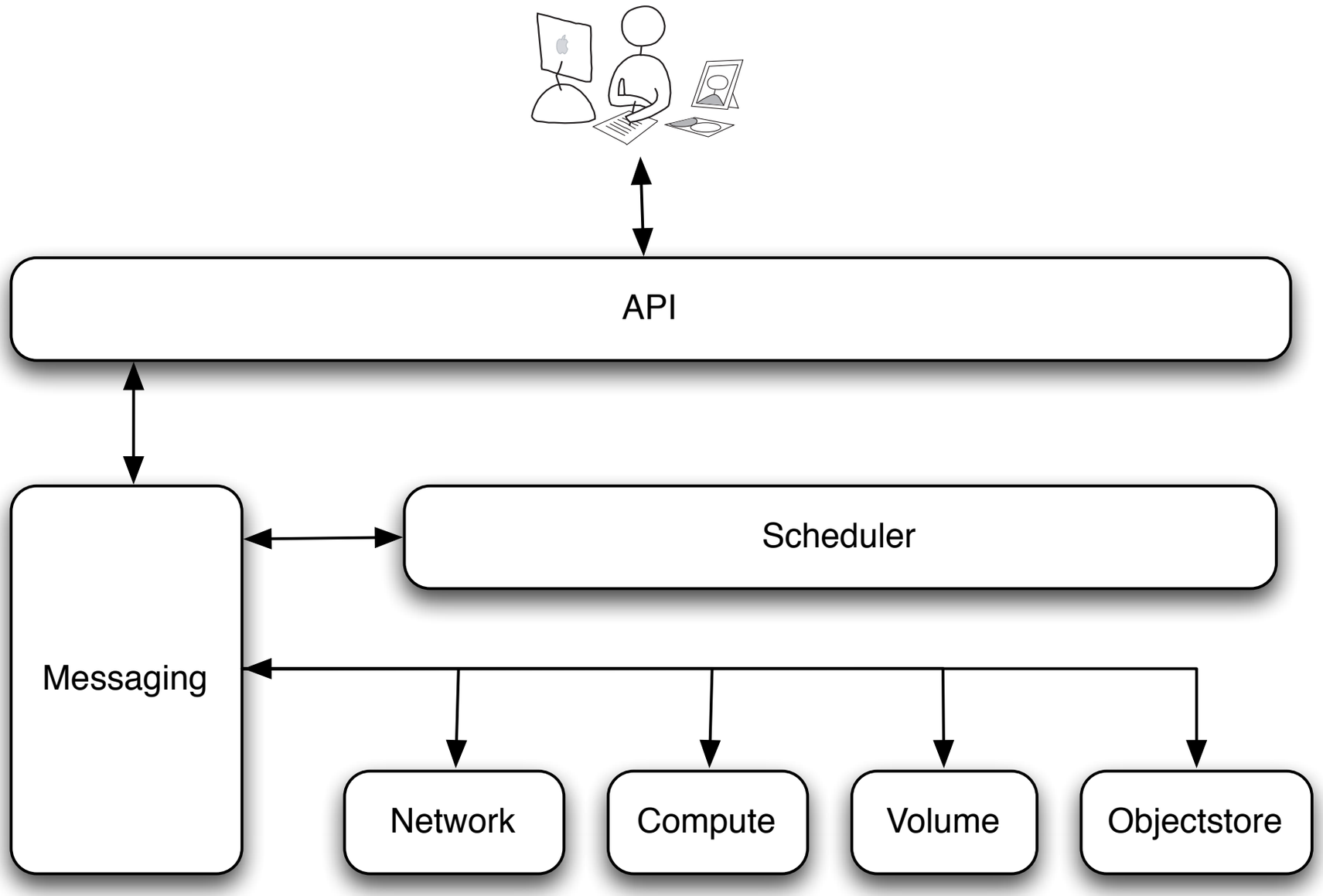
Nova Objectstore

Nova Objectstore



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Nova Volumes

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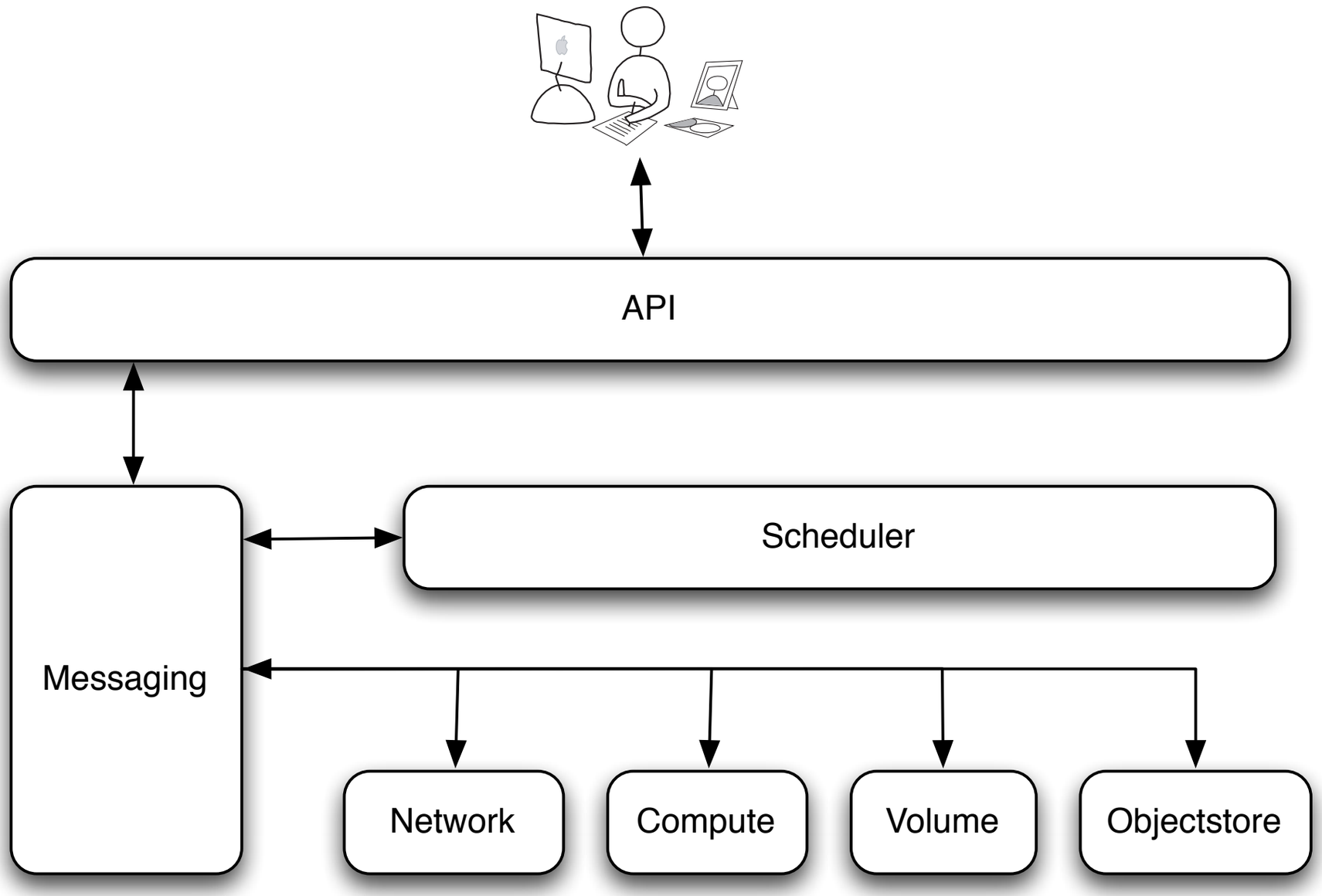
Nova Volumes



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Nova Configuration

Nova Configuration

- Flag File @ /etc/nova/nova.conf
- All Configuration options: **nova-manage config list**

Exercise 0

Accessing the Classroom Cloud

Accessing the Classroom Cloud

- Divide into Teams
- Training Lab WiFi Network
  - SSID: openstack
  - Password: openstack
- Lab Nodes
  - 192.168.2.<your team number> (example: 192.168.2.11)
  - username: nova
  - password: nova
- Shared nodes = one operator at a time
- Resist temptation
  - please don't hack the nodes belonging to other teams
  - try to stay with us and not jump ahead too far

Accessing the Exercises

- Exercises will be available at:

http://192.168.2.1/training/nova/

Exercise 1

Nova All In One Installation

The Nova Filesystem

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The Nova Filesystem

/etc/nova/
- api-paste.ini
- nova-compute.conf
- nova.conf

/var/log/nova/
- nova-api.log
- nova-compute.log
- nova-dhcpbridge.log
- nova-manage.log
- nova-network.log
- nova-objectstore.log
- nova-scheduler.log

/var/lib/nova/
- buckets
- CA
- extensions
- images
- instances
- keys
- networks
- nova.sqlite
- tmp

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The Nova Filesystem

```
/var/lib/nova/CA/
├── cacert.pem
├── certs
├── crl
├── crl.pem
├── index.txt
├── index.txt.attr
├── index.txt.old
├── INTER
├── newcerts
│   └── 10.pem
├── openssl.cnf
├── private
│   └── cakey.pem
├── reqs
├── serial
└── serial.old
```

```
/var/lib/nova/extensions/
├── admin -> /usr/share/pyshared/openstackx/admin
├── admin.py
├── api -> /usr/share/pyshared/openstackx/api
├── auth -> /usr/share/pyshared/openstackx/auth
├── compute -> /usr/share/pyshared/openstackx/compute
├── extras -> /usr/share/pyshared/openstackx/extras
└── __init__.py
```


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The Nova Filesystem

/var/lib/nova/instances/
- _base
- instance-00000005
- instance-00000007

/var/lib/nova/instances/_base
- 00000001
- 00000002
- 1b6453892473a467d07372d45eb05abc2031647a
- 77de68daecd823babbb58edb1c8e14d7106e83bb
- 77de68daecd823babbb58edb1c8e14d7106e83bb_sm
- local_40

/var/lib/nova/instances/instance-00000005/
- console.log
- disk
- disk.local
- kernel
- libvirt.xml
- ramdisk

/var/lib/nova/instances/instance-00000007/
- console.log
- disk
- disk.local
- libvirt.xml

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Nova Troubleshooting

Nova Troubleshooting

- /var/log/nova/nova-*.log
- ps -aux | grep nova
- virsh
- brctl
- rabbitmqctl
- sqlite3, mysql, psql
- euca-get-console-output

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Nova CLI

Nova CLI

nova

actions	Retrieve server actions.
add-fixed-ip	Add new IP address to network.
boot	Boot a new server.
delete	Immediately shut down and delete a server.
diagnostics	Retrieve server diagnostics.
flavor-list	Print a list of available 'flavors' (sizes of servers).
image-create	Create a new image by taking a snapshot of a running server.
image-delete	Delete an image.
image-list	Print a list of available images to boot from.
list	List active servers.
migrate	Migrate a server.
pause	Pause a server.
reboot	Reboot a server.
rebuild	Shutdown, re-image, and re-boot a server.
remove-fixed-ip	Remove an IP address from a server.
rename	Rename a server.
rescue	Rescue a server.

Nova CLI

nova

resize	Resize a server.
resize-confirm	Confirm a previous resize.
resize-revert	Revert a previous resize (and return to the previous VM).
resume	Resume a server.
root-password	Change the root password for a server.
show	Show details about the given server.
suspend	Suspend a server.
unpause	Unpause a server.
unrescue	Unrescue a server.
zone	Show or edit a child zone. No zone arg for this zone.
zone-add	Add a new child zone.
zone-boot	Boot a new server, potentially across Zones.
zone-delete	Delete a zone.
zone-info	Get this zones name and capabilities.
zone-list	List the children of a zone.
help	Display help about this program or one of its subcommands.

Nova CLI

nova-manage

account	network
agent	project
config	role
db	service
drive	shell
fixed	user
flavor	version
floating	vm
host	volume
instance_type	vpn
image	vsa

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Nova API

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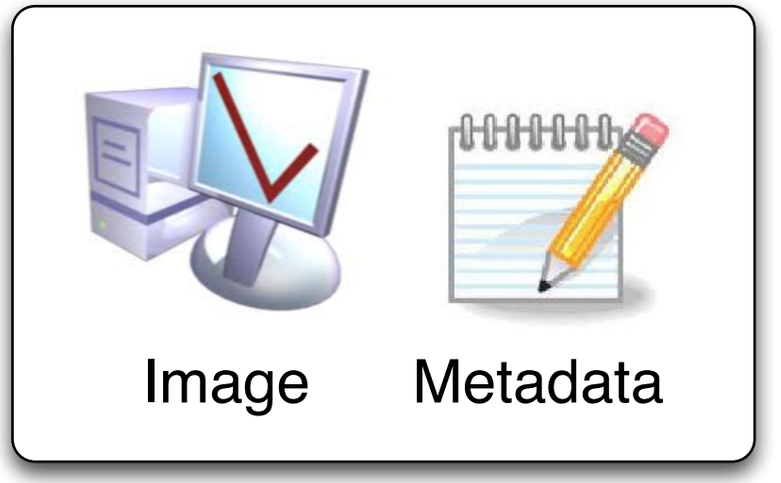
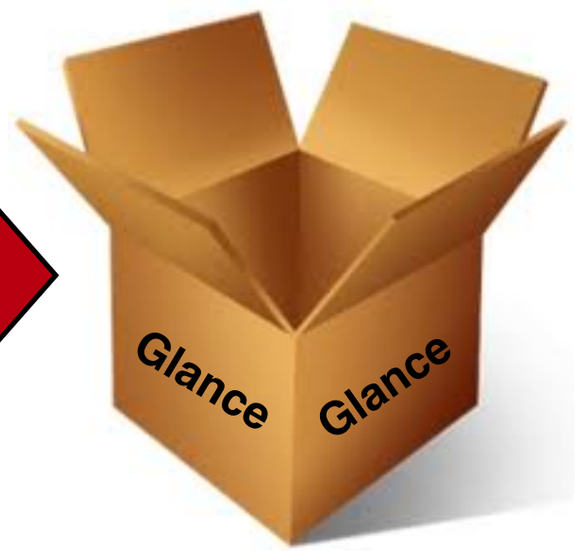
OpenStack Image Service

Codenamed: Glance

Glance

Original





im-age
n.

1. A reproduction of the form of a person or object, especially a sculptured likeness.
2. One that closely or exactly resembles another; a double:

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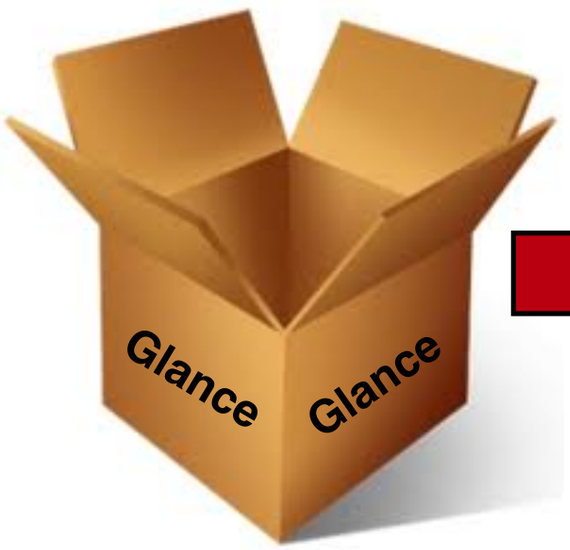
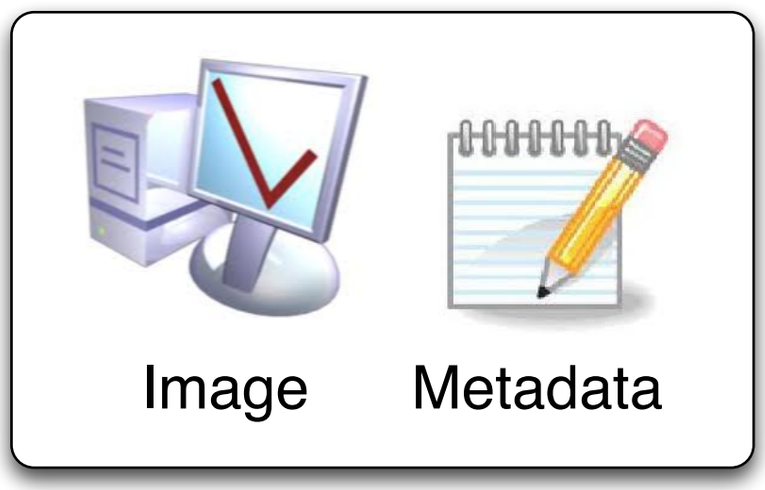
Glance





New Instance

im-age
n.
1. A reproduction of the form of a person or object, especially a sculptured likeness.
2. One that closely or exactly resembles another; a double:

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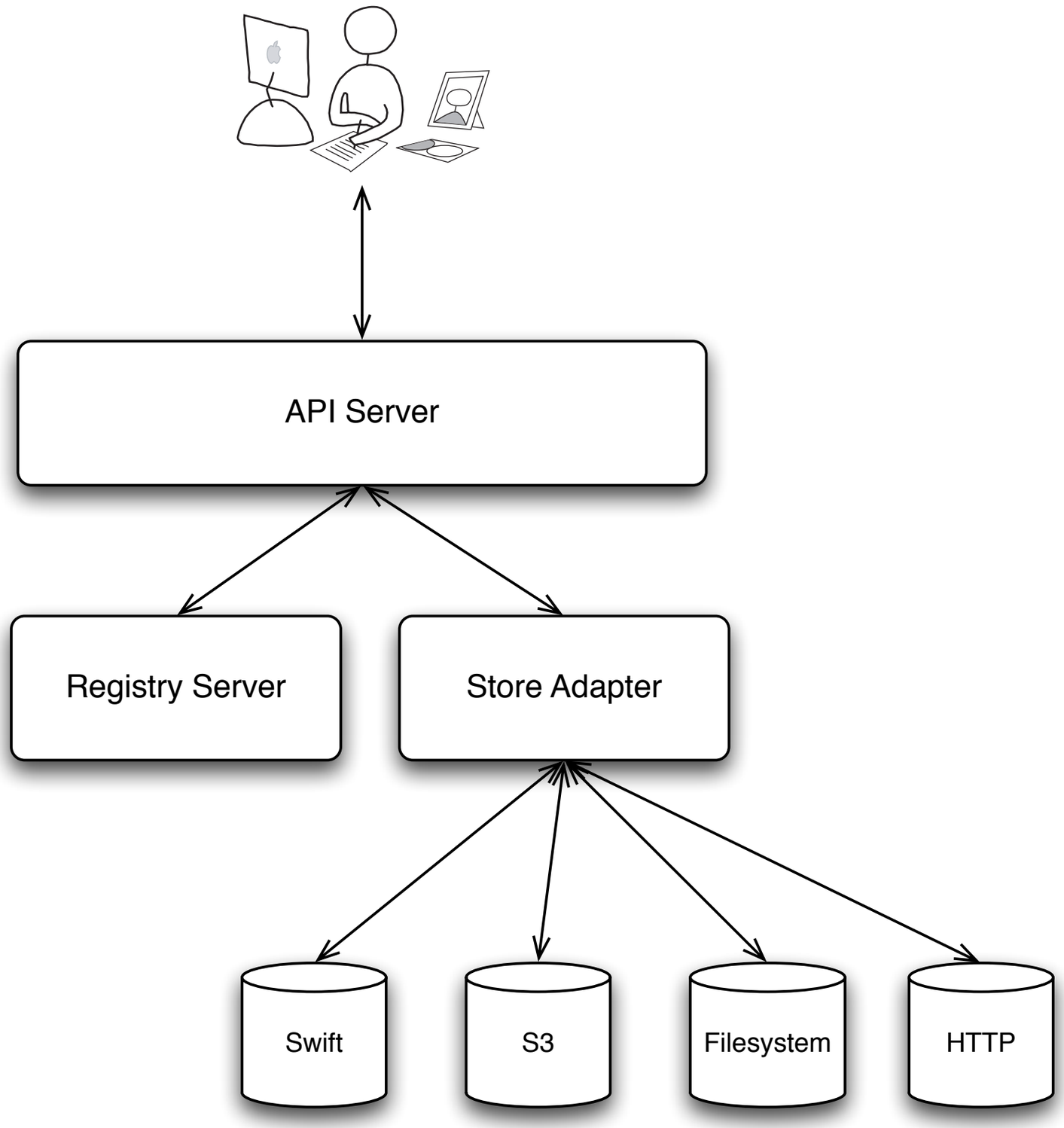

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Glance

Image Identifiers

Images are uniquely identified by way of a URI that matches the following signature:

```
<Glance Server Location>/images/<ID>
```

The resource location of the Glance service

The image's identifier that is unique to that Glance server

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Glance

Image Registry API

http://<glance server location>:9292/v1

```
GET     /images          Return brief information about public images
GET     /images/detail   Return detailed information about public images
HEAD    /images/<ID>     Return metadata about an image in HTTP headers
POST    /images          Register metadata about a new image
PUT     /images/<ID>     Update metadata about an existing image
DELETE  /images/<ID>     Remove an image's metadata from the registry
```

Image registries are any web service that adheres to the Glance REST-like API for image metadata.

Glance
REST API

curl -G http://192.168.2.17:9292/v1/
curl -G http://192.168.2.17:9292/v1/images?disk_format=ami
curl -G http://192.168.2.17:9292/v1/images/detail
curl -I http://192.168.2.17:9292/v1/images/3 (May want to Pipe this)

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Filtering Image Lists

`name=NAME`	Filters images having a `name` attribute matching `NAME`.
`container_format=FORMAT`	Filters images having a `container_format` attribute matching `FORMAT`
`disk_format=FORMAT`	Filters images having a `disk_format` attribute matching `FORMAT`
`status=STATUS`	Filters images having a `status` attribute matching `STATUS`
`size_min=BYTES`	Filters images having a `size` attribute greater than or equal to `BYTES`
`size_max=BYTES`	Filters images having a `size` attribute less than or equal to `BYTES`
`sort_key=KEY`	Results will be ordered by the specified image attribute `KEY`. Accepted values include `id`, `name`, `status`, `disk_format`, `container_format`, `size`, `created_at` (default) and `updated_at`.
`sort_dir=DIR`	Results will be sorted in the direction `DIR`. Accepted values are `asc` for ascending or `desc` (default) for descending.

Glance

POST /images

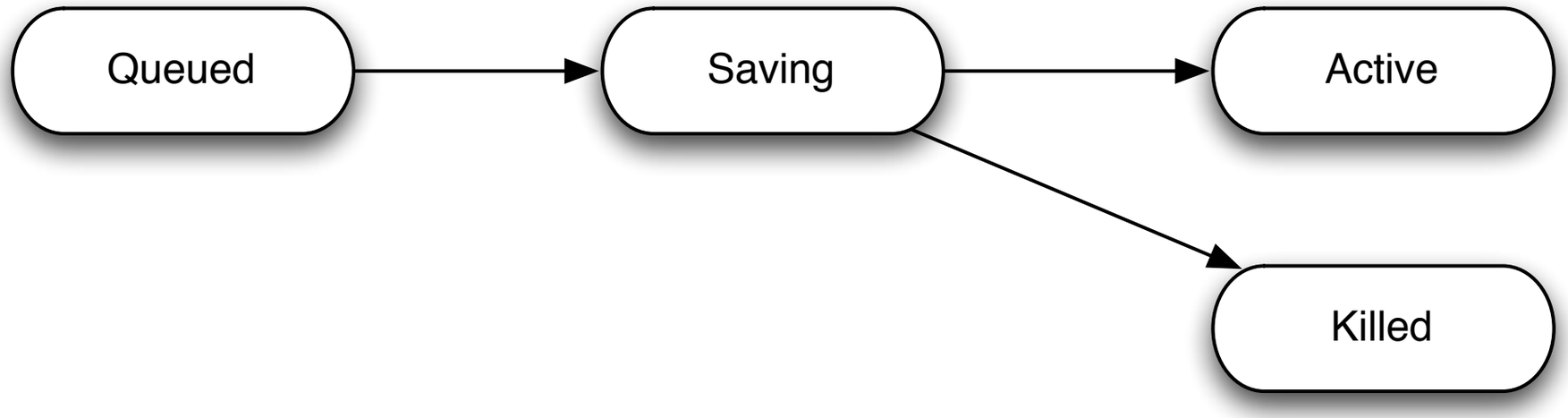
```
{'image':
  {'id': <ID>|None,
   'name': <NAME>,
   'status': <STATUS>,
   'disk_format': <DISK_FORMAT>,
   'container_format': <CONTAINER_FORMAT>,
   'properties': [ ... ]
  }
}
```

- `status` must be non-empty, and must be one of **active**, **saving**, **queued**, or **killed**
- `disk_format` must be non-empty, and must be one of **ari**, **aki**, **ami**, **raw**, **iso**, **vhd**, **vdi**, **qcow2**, or **vmdk**
- `container_format` must be non-empty, and must be on of **ari**, **aki**, **ami**, **bare**, or **ovf**
- If `disk_format` *or* `container_format` is **ari**, **aki**, **ami**, then *both* `disk_format` and `container_format` must be the same.

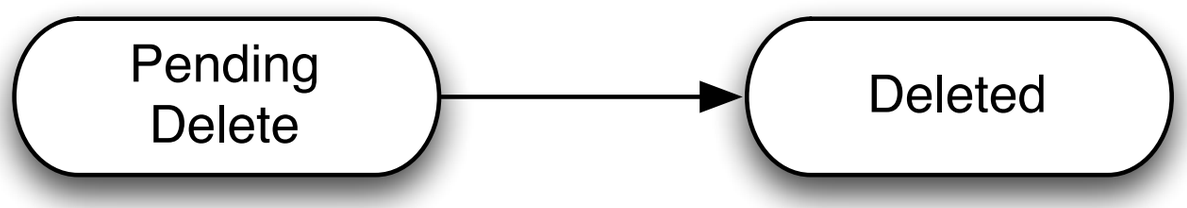
Glance

Image Statuses

Adding Images



Removing Images



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Glance

Disk Formats

raw	This is an unstructured disk image format
vhd	This is the VHD disk format, a common disk format used by virtual machine monitors from VMWare, Xen, Microsoft, VirtualBox, and others
vmdk	Another common disk format supported by many common virtual machine monitors
vdi	A disk format supported by VirtualBox virtual machine monitor and the QEMU emulator
iso	An archive format for the data contents of an optical disc (e.g. CDROM)
qcow2	A disk format supported by the QEMU emulator that can expand dynamically and supports Copy on Write
aki	This indicates what is stored in Glance is an Amazon kernel image
ari	This indicates what is stored in Glance is an Amazon ramdisk image
ami	This indicates what is stored in Glance is an Amazon machine image

Exercise 2

Glance Installation & Image Loading

Exercise 2

Glance Installation

sudo apt-get install -y --force-yes glance

Glance

Glance Configuration

glance-api.conf
glance-registry.conf

glance-prefetcher.conf
glance-pruner.conf
glance-reaper.conf
glance-scrubber.conf

Exercise 3

Boot Instance

OpenStack Identity Service

Codenamed: Keystone

Keystone Concepts

User

Role

Credentials

Endpoint

Authentication

Service

Tenant

Token

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Keystone Concepts

User

Person

System

Service

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Keystone Concepts

Credentials

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Keystone Concepts

Authentication

openstack™

Keystone Concepts

Token

openstack™

Keystone Concepts

Tenant

openstack™

Keystone Concepts

Service

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Keystone Concepts

Endpoint

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Keystone Concepts

Role

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Keystone

Populating Auth Data

Add Tenants

- keystone-manage tenant add MyTenant
- keystone-manage tenant list

Add Users

- keystone-manage user add myuser mypassword MyTenant
- keystone-manage user list

Add Roles

- keystone-manage role add Admin
- keystone-manage role add Member

Grant Roles

- keystone-manage role grant Admin myuser MyTenant
- keystone-manage role grant Member myuser MyTenant
- keystone-manage role list MyTenant

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Keystone

Populating Auth Admin Data

Keystone Service Admin

- keystone-manage role add KeystoneServiceAdmin

Endpoint Templates

- keystone-manage endpointTemplates add ZoneOne swift http://swift.publicinternets.com/v1/AUTH_%tenant_id% http://swift.admin-nets.local:8080/ http://127.0.0.1:8080/v1/AUTH_%tenant_id% 1 0

Add Tokens

- keystone-manage token add 999888777666 myadmin MyTenant 2015-02-05T00:00

Add Services

- keystone-manage service add swift

Add Credentials

- keystone-manage credentials add admin EC2 admin:admin mypassword MyTenant

Exercise 4

Keystone Installation & Setup

OpenStack Dashboard

The OpenStack Web Interface

Exercise 5
Dashboard Installation

Demo

A Dashboard Walkthrough

Packages for Labs

deb http://ops.rcb.me/packages maverick diablo-d5

Resources

- http://www.openstack.org
- https://launchpad.net/openstack
- https://github.com/openstack
- https://github.com/cloudbuilders
- http://www.referencearchitecture.org/
- http://devstack.org/
- http://programmerthoughts.com/
- http://www.unchainyourbrain.com
- http://www.tlohg.com

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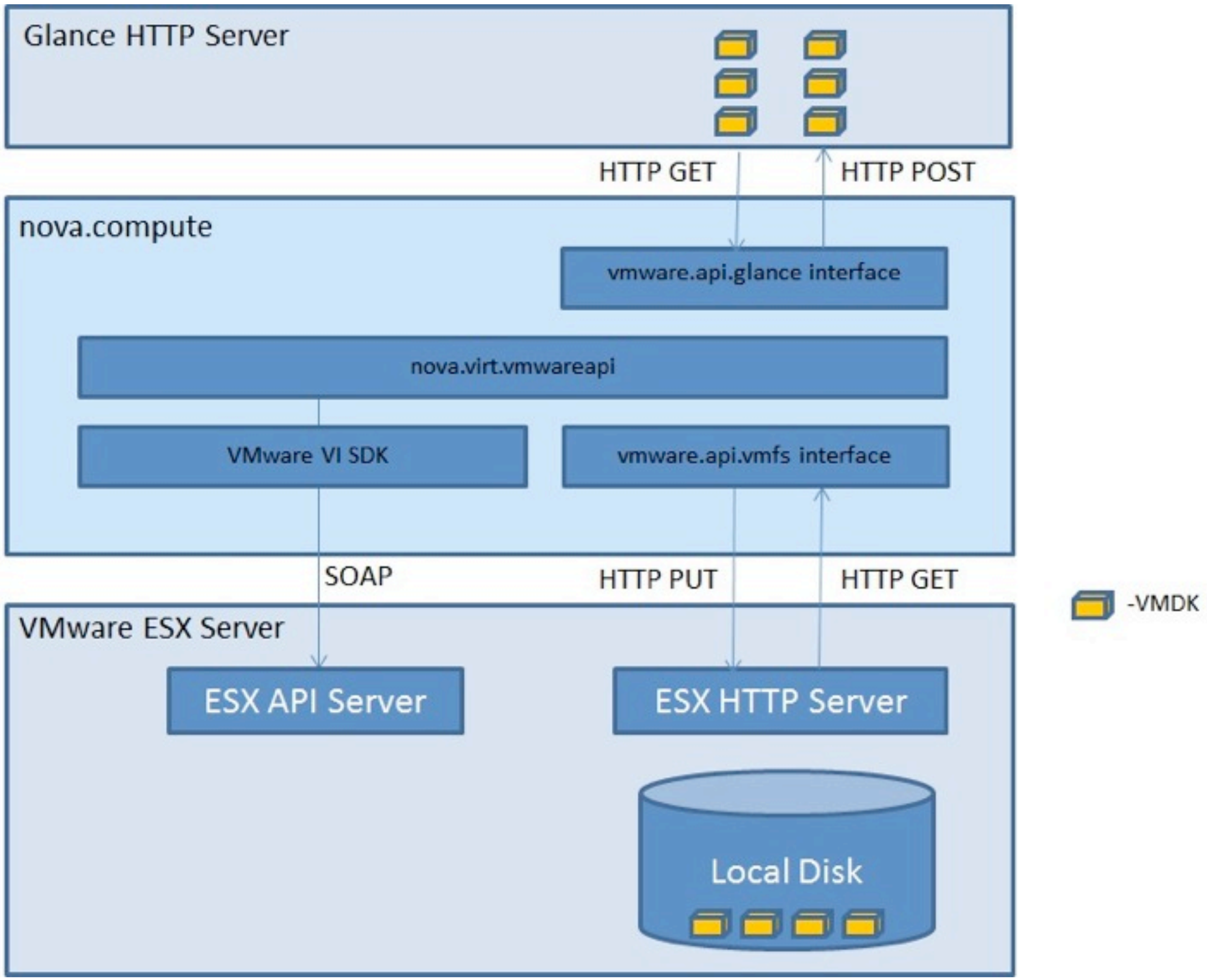
Appendix

Nova & VMWare



http://nova.openstack.org/vmwareapi_readme.html

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