# Dirty Clouds Done Dirt Cheap

Matthew Treinish
Open Source Developer Advocate - IBM
mtreinish@kortar.org
`mtreinish` on Freenode

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https://github.com/mtreinish/dirty-clouds-done-dirt-cheap/tree/fossasia-2018

# OpenStack Mission Statement

**The OpenStack Mission:** *to produce a ubiquitous Open Source Cloud Computing platform that is easy to use, simple to implement, interoperable between deployments, **works well at all scales**, and meets the needs of users and operators of both public and private clouds.*

# Scope of the Project

- Pretend to be a sysadmin with no prior OpenStack knowledge
- Try to rely only on install docs and google searches
- $1500 USD Budget
- Build a basic compute cloud
- Install the Ocata release (from April 2017) from tarballs
- No automation or pre-existing install scripts

# Buying Hardware

- ▶ Maximize core count per USD
- ▶ Second priority is amount of RAM per core
- ▶ Machines don't need to be fast (that costs money!)

# The Servers

| Model | PowerEdge R610 |
|---|---|
| Processor | 2x Intel Xeon E5540 |
| Memory Installed | 32GB Total Memory; 8 x 4 GB DDR3 |
| Hard Drives | 2x 146GB 10K SAS Hard Drive |
| RAID Controller | Dell PowerEdge R610 Perc 6i |
| Ethernet | 2x Dual Port Embedded Broadcom NetXtreme II 5709c |
| Return Policy/Warranty | 60 days Money Back Or Exchange |

# $215 Each!!

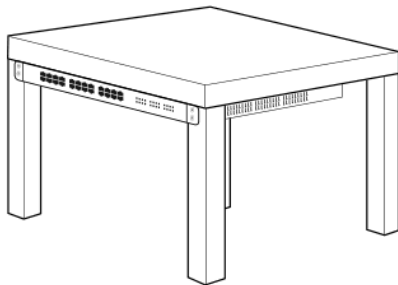# LackRack

- ▶ Use a LACK side table from Ikea
- ▶ 19 inch width between legs
- ▶ Can fit 8U
- ▶ Lots of color choices
- ▶ $9.99 USD

# Quirks with the servers

- ▶ Super stripped down:
  - ▶ No management interface
  - ▶ No redundant power supply
- ▶ 4x8GB of RAM not 8x4GB
- ▶ Memory installed in wrong slots
- ▶ Dead RAID controller battery
- ▶ Came with 15k RPM hard drives not 10k RPM
- ▶ Came pre-installed with Windows Server 2012 (and default password Apple123)
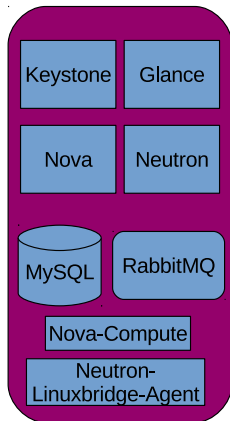
# Figuring Out How To Deploy OpenStack

- ▶ Over 1800 git repositories hosted on: https://git.openstack.org/
- ▶ OpenStack has $> 50$ projects teams: https://governance.openstack.org/tc/reference/projects/index.html
- ▶ Only want the the minimal set of projects to spin up VMs

# Compute Starter Kit

- ▶ Only need 4 projects to get a functional compute cloud
- ▶ Documented at: https://www.openstack.org/software/sample-configs#compute-starter-kit
- ▶ The install guide mostly concerned with these projects



**KEYSTONE**
*an OpenStack Community Project*

**GLANCE**
*an OpenStack Community Project*

**NOVA**
*an OpenStack Community Project*

**NEUTRON**
*an OpenStack Community Project*

# Installing OpenStack



altocumulus01
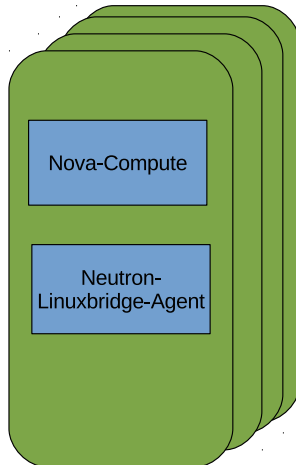
altocumulus{02..05}

# Installing OpenStack Services

1. Download service tarball
2. Create service users
3. Install binary requirements
4. Create service dirs in /etc and /var/lib
5. Copy etc/ from tarball into /etc/$Service
6. pip install the tarball
7. Follow install guide on project configuration and setup

# Setting Up Keystone

- ▶ 2 config options
- ▶ Install guide doesn't have instructions on apache wsgi app setup
- ▶ Google search found: https://docs.openstack.org/developer/keystone/apache-httpd.html
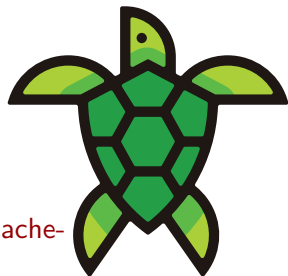


KEYSTONE

*an OpenStack Community Project*

# Python Requirements aren't fun

```
ERROR keystone Traceback (most recent call last):
ERROR keystone     File "/usr/local/bin/keystone-wsgi-admin", line 51, in <module>
ERROR keystone         application = initialize_admin_application()
ERROR keystone     File "/usr/local/lib/python2.7/dist-packages/keystone/server/wsgi.py", line 132, in
    initialize_admin_application
ERROR keystone         config_files=_get_config_files())

...

ERROR keystone     File "/usr/local/lib/python2.7/dist-packages/paste/deploy/loadwsgi.py", line 640, in
    find_egg_entry_point
ERROR keystone         pkg_resources.require(self.spec)
ERROR keystone     File "/usr/lib/python2.7/dist-packages/pkg_resources/__init__.py", line 943, in require
ERROR keystone         needed = self.resolve(parse_requirements(requirements))
ERROR keystone     File "/usr/lib/python2.7/dist-packages/pkg_resources/__init__.py", line 834, in resolve
ERROR keystone         raise VersionConflict(dist, req).with_context(dependent_req)
ERROR keystone ContextualVersionConflict: (requests 2.13.0 (/usr/local/lib/python2.7/dist-packages),
    Requirement.parse('requests!=2.12.2,!=2.13.0,>=2.10.0'), set(['oslo.policy']))
```

# Setting up Glance

- ▶ Straightforward configuration:
  - ▶ Auth
  - ▶ Image Directories
  - ▶ Database



GLANCE

*an OpenStack Community Project*

# Don't forget to create glance store directory

```
[req−8ff7f7d2−a4a5−4558−b5a9−9ecca139675f 20f283024ffd4bf4841a8d33bdb4f385 6
    c3fc6392e0c487e85d57afe5a5ab2b7 − default default] Error in store configuration. Adding images to
    store is disabled.
Traceback (most recent call last):
  File "/usr/local/lib/python2.7/dist−packages/glance/api/v2/image_data.py", line 116, in upload
    image.set_data(data, size)

...

  File "/usr/local/lib/python2.7/dist−packages/glance_store/backend.py", line 426, in
    store_add_to_backend
    verifier=verifier)
  File "/usr/local/lib/python2.7/dist−packages/glance_store/capabilities.py", line 223, in op_checker
    raise op_exec_map[op](**kwargs)
StoreAddDisabled: Configuration for store failed. Adding images to this store is disabled.
```

# Setting up Nova

- ▶ Database migrations are slower, took about 3mins
- ▶ Don't forget the placement API, no docs on apache setup
- ▶ novnc is problematic from source



**NOVA**

*an OpenStack Community Project*

# Requirements still aren't fun

```
ERROR nova Traceback (most recent call last):
ERROR nova   File "/usr/local/bin/nova-api", line 10, in <module>
ERROR nova     sys.exit(main())
ERROR nova   File "/usr/local/lib/python2.7/dist-packages/nova/cmd/api.py", line 59, in main
ERROR nova     server = service.WSGIService(api, use_ssl=should_use_ssl)

...

ERROR nova   File "/usr/local/lib/python2.7/dist-packages/pkg_resources/__init__.py", line 2324, in
    require
ERROR nova     items = working_set.resolve(reqs, env, installer, extras=self.extras)
ERROR nova   File "/usr/local/lib/python2.7/dist-packages/pkg_resources/__init__.py", line 859, in
    resolve
ERROR nova     raise VersionConflict(dist, req).with_context(dependent_req)
ERROR nova ContextualVersionConflict: (pbr 1.10.0 (/usr/local/lib/python2.7/dist-packages), Requirement.
    parse('pbr>=2.0.0'), set(['oslo.i18n', 'oslo.log', 'oslo.context', 'oslo.utils']))
```

# You need a sudoers file

```
ERROR nova Traceback (most recent call last):
ERROR nova   File "/usr/local/bin/nova-api", line 10, in <module>
ERROR nova     sys.exit(main())
ERROR nova   File "/usr/local/lib/python2.7/dist-packages/nova/cmd/api.py", line 59, in main
ERROR nova     server = service.WSGIService(api, use_ssl=should_use_ssl)
ERROR nova   File "/usr/local/lib/python2.7/dist-packages/nova/service.py", line 309, in __init__
ERROR nova     self.manager = self._get_manager()

ERROR nova ...

ERROR nova   File "/usr/local/lib/python2.7/dist-packages/nova/utils.py", line 180, in execute
ERROR nova     return processutils.execute(*cmd, **kwargs)
ERROR nova   File "/usr/local/lib/python2.7/dist-packages/oslo_concurrency/processutils.py", line 400,
    in execute
ERROR nova     cmd=sanitized_cmd)
ERROR nova ProcessExecutionError: Unexpected error while running command.
ERROR nova Command: sudo nova-rootwrap /etc/nova/rootwrap.conf iptables-save -c
ERROR nova Exit code: 1
ERROR nova Stdout: u''
ERROR nova Stderr: u'sudo: no tty present and no askpass program specified\n'
ERROR nova
```

# Don't forget to create state directories

```
ERROR nova Traceback (most recent call last):
ERROR nova   File "/usr/local/bin/nova-api", line 10, in <module>
ERROR nova     sys.exit(main())
ERROR nova   File "/usr/local/lib/python2.7/dist-packages/nova/cmd/api.py", line 59, in main
ERROR nova     server = service.WSGIService(api, use_ssl=should_use_ssl)
ERROR nova   File "/usr/local/lib/python2.7/dist-packages/nova/service.py", line 311, in __init__
ERROR nova     self.app = self.loader.load_app(name)
ERROR nova   File "/usr/local/lib/python2.7/dist-packages/nova/wsgi.py", line 497, in load_app

 ...

ERROR nova   File "/usr/local/lib/python2.7/dist-packages/nova/api/openstack/compute/cloudpipe.py", line
      55, in setup
ERROR nova     fileutils.ensure_tree(CONF.crypto.keys_path)
ERROR nova   File "/usr/local/lib/python2.7/dist-packages/oslo_utils/fileutils.py", line 40, in
     ensure_tree
ERROR nova     os.makedirs(path, mode)
ERROR nova   File "/usr/lib/python2.7/os.py", line 157, in makedirs
ERROR nova     mkdir(name, mode)
ERROR nova OSError: [Errno 13] Permission denied: '/usr/local/lib/python2.7/dist-packages/keys'
```

# Networking Configuration



Linux Bridge - Provider Networks
Overview
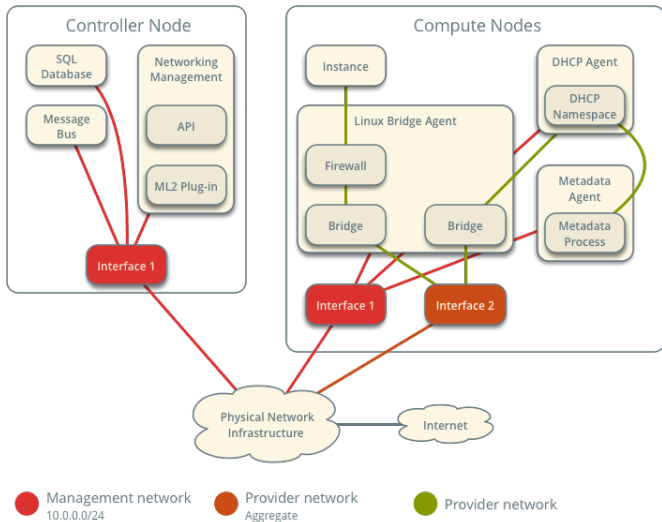
# Setting Up Neutron

- ▶ Too many configuration files
- ▶ Blindly copying pasting from install guide
- ▶ Rootwrap and sudo configuration are not documented
- ▶ First time I had to look at packages and/or devstack



**NEUTRON**

*an OpenStack Community Project*

# Any guesses what this means

```
ERROR neutron.plugins.ml2.drivers.agent._common_agent [req-8c98874d-5436-4912-9db5-f675bfe4df5e - - - -
     -] Error in agent loop. Devices info: {'current': set(['tap0ab3c3ba-09']), 'timestamps': {'
     tap0ab3c3ba-09': 9}, 'removed': set([]), 'added': set(['tap0ab3c3ba-09']), 'updated': set([])}
ERROR neutron.plugins.ml2.drivers.agent._common_agent Traceback (most recent call last):
ERROR neutron.plugins.ml2.drivers.agent._common_agent   File "/usr/local/lib/python2.7/dist-packages/
     neutron/plugins/ml2/drivers/agent/_common_agent.py", line 453, in daemon_loop
ERROR neutron.plugins.ml2.drivers.agent._common_agent     sync = self.process_network_devices(
     device_info)
ERROR neutron.plugins.ml2.drivers.agent._common_agent   File "/usr/local/lib/python2.7/dist-packages/
     osprofiler/profiler.py", line 153, in wrapper
ERROR neutron.plugins.ml2.drivers.agent._common_agent     return f(*args, **kwargs)
ERROR neutron.plugins.ml2.drivers.agent._common_agent   File "/usr/local/lib/python2.7/dist-packages/
     neutron/plugins/ml2/drivers/agent/_common_agent.py", line 203, in process_network_devices

...

ERROR neutron.plugins.ml2.drivers.agent._common_agent     execute_rootwrap_daemon(cmd, process_input,
     addl_env))
ERROR neutron.plugins.ml2.drivers.agent._common_agent   File "<string>", line 2, in run_one_command
ERROR neutron.plugins.ml2.drivers.agent._common_agent   File "/usr/lib/python2.7/multiprocessing/
     managers.py", line 774, in _callmethod
ERROR neutron.plugins.ml2.drivers.agent._common_agent     raise convert_to_error(kind, result)
ERROR neutron.plugins.ml2.drivers.agent._common_agent RemoteError:
ERROR neutron.plugins.ml2.drivers.agent._common_agent
     _____
ERROR neutron.plugins.ml2.drivers.agent._common_agent Unserializable message: ('#ERROR', ValueError('I/O
     operation on closed file',))
ERROR neutron.plugins.ml2.drivers.agent._common_agent
     _____
```
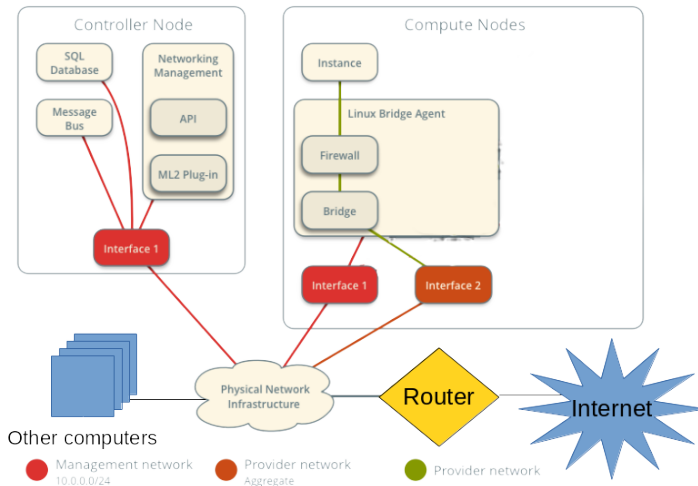
# DHCP Fun



Linux Bridge - Provider Networks
Overview

# Blank Images

```
DEBUG glance_store._drivers.filesystem [req−3163a1a7−4ca9−47e8
    −9444−cd8b865055fb 20f283024ffd4bf4841a8d33bdb4f385 6
    c3fc6392e0c487e85d57afe5a5ab2b7 − default default] Wrote 0
    bytes to /var/lib/glance/images/e6735636−43d9−4fb0−a302−
    f3710386b689 with checksum d41d8cd98f00b204e9800998ecf8427e add
    /usr/local/lib/python2.7/dist−packages/glance_store/_drivers/
    filesystem.py:706
```

# Where's my metadata?

- Without DHCP neutron can't set routes to metadata service at *169.254.169.254*
- Need to get IP address into the guest to start networking
- Using Nova's ConfigDrive works except most versions of cloud-init don't set static IP from config drives
- Set *force_config_drive* option to true
- Need to create custom images with Glean instead of cloud-init

# Installation Pain Points

- Python Packaging:
  - Binary Dependencies
  - etc files (and any data files)
  - No dependency solver, always use upper constraints
- Debugging OpenStack requires a high level of competence

# Making OpenStack Better for Small Deployments

- Honestly, it's not that bad
- >=90% of the issues were because of using tarballs
- Networking and neutron is too confusing
- Work on improving logging and error reporting

# What to do with your budget cloud?

# OpenStack Development

- Lots of capacity for running devstack or virtual clouds
- A really good platform to develop and test OpenStack applications
- For example I found 4 tempest bugs testing it on the cloud

# Cloud Native Compute Workloads

- ▶ Good for running embarrasingly parallel workloads
- ▶ Each invidiual machine is slow, but a fair amount of parallel capacity.
- ▶ My example use case: https://github.com/mtreinish/handbrakecloud

# Why you don't want to do this

- 5x 1U Servers in your bedroom closet is not pleasant
- The power bill (at peak draw it's about 1.35kW for the rack)
- Don't get to spend $1,328.37 on a weekend vacation

# Where to get more information

- openstack-dev ML  openstack-dev@lists.openstack.org
- Ocata install guides  https://docs.openstack.org/project-install-guide/ocata/
- Ocata network guides  https://docs.openstack.org/ocata/networking-guide/
- Blog post about the project:  https://blog.kortar.org/?p=380
- These slides:
  https://github.com/mtreinish/dirty-clouds-done-dirt-cheap/tree/fossasia-2018