Dirty Clouds Done Dirt Cheap

Matthew Treinish
mtreinish@kortar.org
`mtreinish` on Freenode

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https://github.com/mtreinish/dirty-clouds-done-dirt-cheap
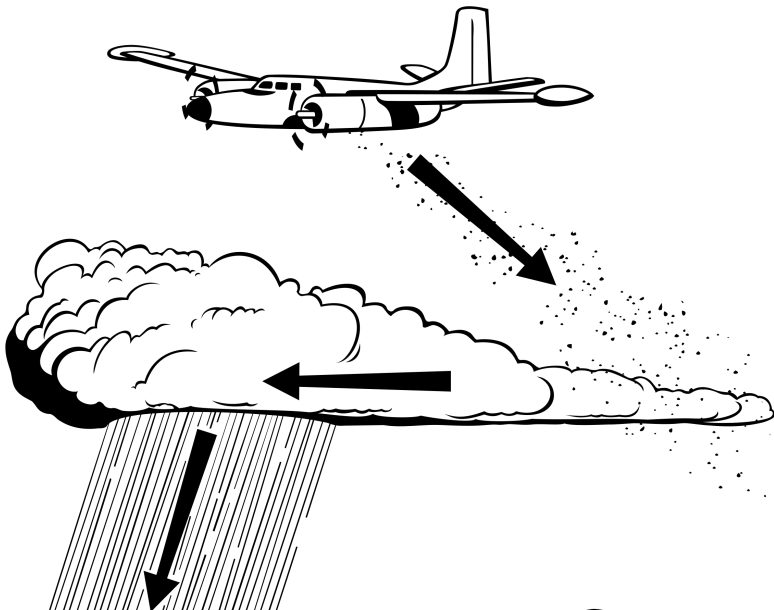
Scope of the Project

- 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:
    - Keystone
    - Glance
    - Nova
    - Neutron
- Install Ocata 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 ll 5709c
Return Policy/Warranty	60 days Money Back Or Exchange

$215 Each!!

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)
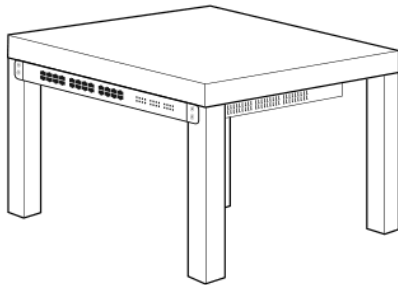- At full fan speed >**70 dB**

Assembling the Cloud

- Need something to hold the servers
- Traditional racks are too much money (even used)

LackRack

https://wiki.eth0.nl/index.php/LackRack

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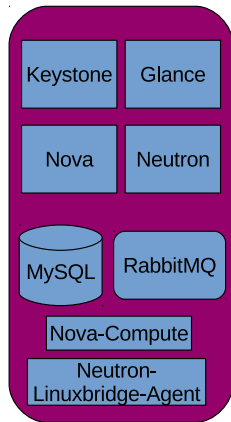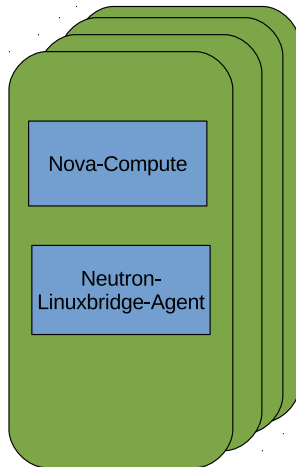- ▶ Lots of color choices
- ▶ $9.99 USD

LACKRACK

Installing the Operating System

- Installed Ubuntu 16.04 LTS server
- Nothing special, stick with base packages

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
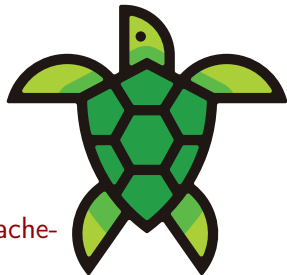
KEYSTONE
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Python Requirements aren't fun

```
2017-03-29 15:27:01.478 26833 ERROR keystone Traceback (most recent call last):
2017-03-29 15:27:01.478 26833 ERROR keystone   File "/usr/local/bin/keystone-wsgi-admin", line
    51, in <module>
2017-03-29 15:27:01.478 26833 ERROR keystone       application = initialize_admin_application()
2017-03-29 15:27:01.478 26833 ERROR keystone   File "/usr/local/lib/python2.7/dist-packages/
    keystone/server/wsgi.py", line 132, in initialize_admin_application
2017-03-29 15:27:01.478 26833 ERROR keystone       config_files=_get_config_files())
...
2017-03-29 15:27:01.478 26833 ERROR keystone   File "/usr/local/lib/python2.7/dist-packages/
    paste/deploy/loadwsgi.py", line 640, in find_egg_entry_point
2017-03-29 15:27:01.478 26833 ERROR keystone       pkg_resources.require(self.spec)
2017-03-29 15:27:01.478 26833 ERROR keystone   File "/usr/lib/python2.7/dist-packages/
    pkg_resources/__init__.py", line 943, in require
2017-03-29 15:27:01.478 26833 ERROR keystone       needed = self.resolve(parse_requirements(
    requirements))
2017-03-29 15:27:01.478 26833 ERROR keystone   File "/usr/lib/python2.7/dist-packages/
    pkg_resources/__init__.py", line 834, in resolve
2017-03-29 15:27:01.478 26833 ERROR keystone       raise VersionConflict(dist, req).with_context
    (dependent_req)
2017-03-29 15:27:01.478 26833 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

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Don't forget to create glance store directory

```
glance-api[29623]: 2017-03-29 16:21:52.038 29647 ERROR glance.api.v2.image_data [req-8ff7f7d2-
    a4a5-4558-b5a9-9ecca139675f 20f283024ffd4bf4841a8d33bdb4f385 6
    c3fc6392e0c487e85d57afe5a5ab2b7 - default default] Error in store configuration. Adding
    images to store is disabled.
glance-api[29623]: 2017-03-29 16:21:52.038 29647 ERROR glance.api.v2.image_data Traceback (
    most recent call last):
glance-api[29623]: 2017-03-29 16:21:52.038 29647 ERROR glance.api.v2.image_data    File "/usr/
    local/lib/python2.7/dist-packages/glance/api/v2/image_data.py", line 116, in upload
glance-api[29623]: 2017-03-29 16:21:52.038 29647 ERROR glance.api.v2.image_data      image.
    set_data(data, size)
...
glance-api[29623]: 2017-03-29 16:21:52.038 29647 ERROR glance.api.v2.image_data    File "/usr/
    local/lib/python2.7/dist-packages/glance_store/backend.py", line 426, in
    store_add_to_backend
glance-api[29623]: 2017-03-29 16:21:52.038 29647 ERROR glance.api.v2.image_data      verifier=
    verifier)
glance-api[29623]: 2017-03-29 16:21:52.038 29647 ERROR glance.api.v2.image_data    File "/usr/
    local/lib/python2.7/dist-packages/glance_store/capabilities.py", line 223, in op_checker
glance-api[29623]: 2017-03-29 16:21:52.038 29647 ERROR glance.api.v2.image_data      raise
    op_exec_map[op](**kwargs)
glance-api[29623]: 2017-03-29 16:21:52.038 29647 ERROR glance.api.v2.image_data
    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

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Requirements still aren't fun

```
nova-api[1155]: 2017-03-29 18:33:11.433 1155 ERROR nova Traceback (most recent call last):
nova-api[1155]: 2017-03-29 18:33:11.433 1155 ERROR nova   File "/usr/local/bin/nova-api", line
    10, in <module>
nova-api[1155]: 2017-03-29 18:33:11.433 1155 ERROR nova     sys.exit(main())
nova-api[1155]: 2017-03-29 18:33:11.433 1155 ERROR nova   File "/usr/local/lib/python2.7/dist-
    packages/nova/cmd/api.py", line 59, in main
nova-api[1155]: 2017-03-29 18:33:11.433 1155 ERROR nova     server = service.WSGIService(api,
    use_ssl=should_use_ssl)
...
nova-api[1155]: 2017-03-29 18:33:11.433 1155 ERROR nova   File "/usr/local/lib/python2.7/dist-
    packages/pkg_resources/__init__.py", line 2324, in require
nova-api[1155]: 2017-03-29 18:33:11.433 1155 ERROR nova     items = working_set.resolve(reqs,
    env, installer, extras=self.extras)
nova-api[1155]: 2017-03-29 18:33:11.433 1155 ERROR nova   File "/usr/local/lib/python2.7/dist-
    packages/pkg_resources/__init__.py", line 859, in resolve
nova-api[1155]: 2017-03-29 18:33:11.433 1155 ERROR nova     raise VersionConflict(dist, req).
    with_context(dependent_req)
nova-api[1155]: 2017-03-29 18:33:11.433 1155 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']))
```

Don't forget your sudoers file

```
nova-api[905]: 2017-03-29 18:29:47.844 905 ERROR nova Traceback (most recent call last):
nova-api[905]: 2017-03-29 18:29:47.844 905 ERROR nova   File "/usr/local/bin/nova-api", line
    10, in <module>
nova-api[905]: 2017-03-29 18:29:47.844 905 ERROR nova     sys.exit(main())
nova-api[905]: 2017-03-29 18:29:47.844 905 ERROR nova   File "/usr/local/lib/python2.7/dist-
    packages/nova/cmd/api.py", line 59, in main
nova-api[905]: 2017-03-29 18:29:47.844 905 ERROR nova     server = service.WSGIService(api,
    use_ssl=should_use_ssl)
nova-api[905]: 2017-03-29 18:29:47.844 905 ERROR nova   File "/usr/local/lib/python2.7/dist-
    packages/nova/service.py", line 309, in __init__
nova-api[905]: 2017-03-29 18:29:47.844 905 ERROR nova     self.manager = self._get_manager()
...
nova-api[905]: 2017-03-29 18:29:47.844 905 ERROR nova   File "/usr/local/lib/python2.7/dist-
    packages/nova/utils.py", line 180, in execute
nova-api[905]: 2017-03-29 18:29:47.844 905 ERROR nova     return processutils.execute(*cmd, **
    kwargs)
nova-api[905]: 2017-03-29 18:29:47.844 905 ERROR nova   File "/usr/local/lib/python2.7/dist-
    packages/oslo_concurrency/processutils.py", line 400, in execute
nova-api[905]: 2017-03-29 18:29:47.844 905 ERROR nova     cmd=sanitized_cmd)
nova-api[905]: 2017-03-29 18:29:47.844 905 ERROR nova ProcessExecutionError: Unexpected error
    while running command.
nova-api[905]: 2017-03-29 18:29:47.844 905 ERROR nova Command: sudo nova-rootwrap /etc/nova/
    rootwrap.conf iptables-save -c
nova-api[905]: 2017-03-29 18:29:47.844 905 ERROR nova Exit code: 1
nova-api[905]: 2017-03-29 18:29:47.844 905 ERROR nova Stdout: u''
nova-api[905]: 2017-03-29 18:29:47.844 905 ERROR nova Stderr: u'sudo: no tty present and no
    askpass program specified\n'
nova-api[905]: 2017-03-29 18:29:47.844 905 ERROR nova
```

Don't forget to create state directories

```
Mar 29 17:46:28 altocumulus01 nova-api[32263]: 2017-03-29 17:46:28.176 32263 ERROR nova
    Traceback (most recent call last):
Mar 29 17:46:28 altocumulus01 nova-api[32263]: 2017-03-29 17:46:28.176 32263 ERROR nova    File
    "/usr/local/bin/nova-api", line 10, in <module>
Mar 29 17:46:28 altocumulus01 nova-api[32263]: 2017-03-29 17:46:28.176 32263 ERROR nova
    sys.exit(main())
Mar 29 17:46:28 altocumulus01 nova-api[32263]: 2017-03-29 17:46:28.176 32263 ERROR nova    File
    "/usr/local/lib/python2.7/dist-packages/nova/cmd/api.py", line 59, in main
Mar 29 17:46:28 altocumulus01 nova-api[32263]: 2017-03-29 17:46:28.176 32263 ERROR nova
    server = service.WSGIService(api, use_ssl=should_use_ssl)
Mar 29 17:46:28 altocumulus01 nova-api[32263]: 2017-03-29 17:46:28.176 32263 ERROR nova    File
    "/usr/local/lib/python2.7/dist-packages/nova/service.py", line 311, in __init__
Mar 29 17:46:28 altocumulus01 nova-api[32263]: 2017-03-29 17:46:28.176 32263 ERROR nova
    self.app = self.loader.load_app(name)
Mar 29 17:46:28 altocumulus01 nova-api[32263]: 2017-03-29 17:46:28.176 32263 ERROR nova    File
    "/usr/local/lib/python2.7/dist-packages/nova/wsgi.py", line 497, in load_app
...
Mar 29 17:46:28 altocumulus01 nova-api[32263]: 2017-03-29 17:46:28.176 32263 ERROR nova    File
    "/usr/local/lib/python2.7/dist-packages/nova/api/openstack/compute/cloudpipe.py", line
    55, in setup
Mar 29 17:46:28 altocumulus01 nova-api[32263]: 2017-03-29 17:46:28.176 32263 ERROR nova
    fileutils.ensure_tree(CONF.crypto.keys_path)
Mar 29 17:46:28 altocumulus01 nova-api[32263]: 2017-03-29 17:46:28.176 32263 ERROR nova    File
    "/usr/local/lib/python2.7/dist-packages/oslo_utils/fileutils.py", line 40, in
    ensure_tree
Mar 29 17:46:28 altocumulus01 nova-api[32263]: 2017-03-29 17:46:28.176 32263 ERROR nova       os
    .makedirs(path, mode)
Mar 29 17:46:28 altocumulus01 nova-api[32263]: 2017-03-29 17:46:28.176 32263 ERROR nova    File
    "/usr/lib/python2.7/os.py", line 157, in makedirs
Mar 29 17:46:28 altocumulus01 nova-api[32263]: 2017-03-29 17:46:28.176 32263 ERROR nova
    mkdir(name, mode)
Mar 29 17:46:28 altocumulus01 nova-api[32263]: 2017-03-29 17:46:28.176 32263 ERROR nova
    OSError: [Errno 13] Permission denied: '/usr/local/lib/python2.7/dist-packages/keys'
```

Networking Configuration

Linux Bridge - Provider Networks
Overview
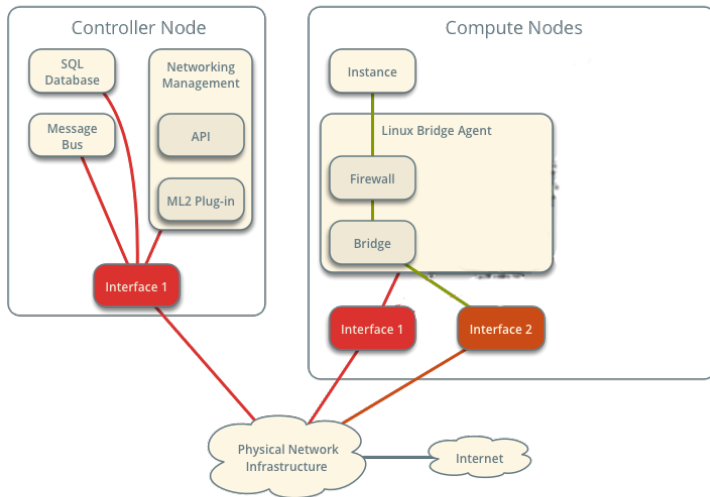
Setting Up Neutron

- ▶ 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

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Setting up Compute Nodes

- Same basic formula
- Rinse and repeat 4 times
- Don't forget to run nova discover_hosts after bring it up

What to do with your budget cloud?

OpenStack Development

- Lots of capacity for running devstack
- A really good platform to develop and test OpenStack applications
-

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

Virtualized Home Infrastructure

- Gives you the flexability
- Also enables HA migration to public cloud

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 I used tarballs
- Networking is still very confusing
- Work on improving logging and error reporting

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 1.1kW 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/