

# Better Testing Through Statistics

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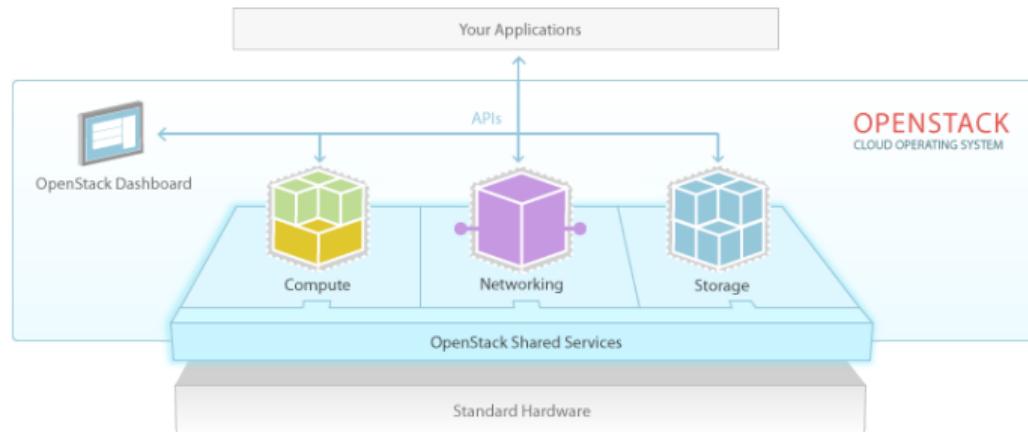
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<https://github.com/masayukig/better-testing-through-statistics>

# What is “the OpenStack”?

- ▶ Open Source Cloud Software: Apache License Version 2.0
- ▶ consists of a lot of projects: **57 projects**
- ▶ released every 6 month: Latest version is called ‘Mitaka’



## What is “the OpenStack QA”

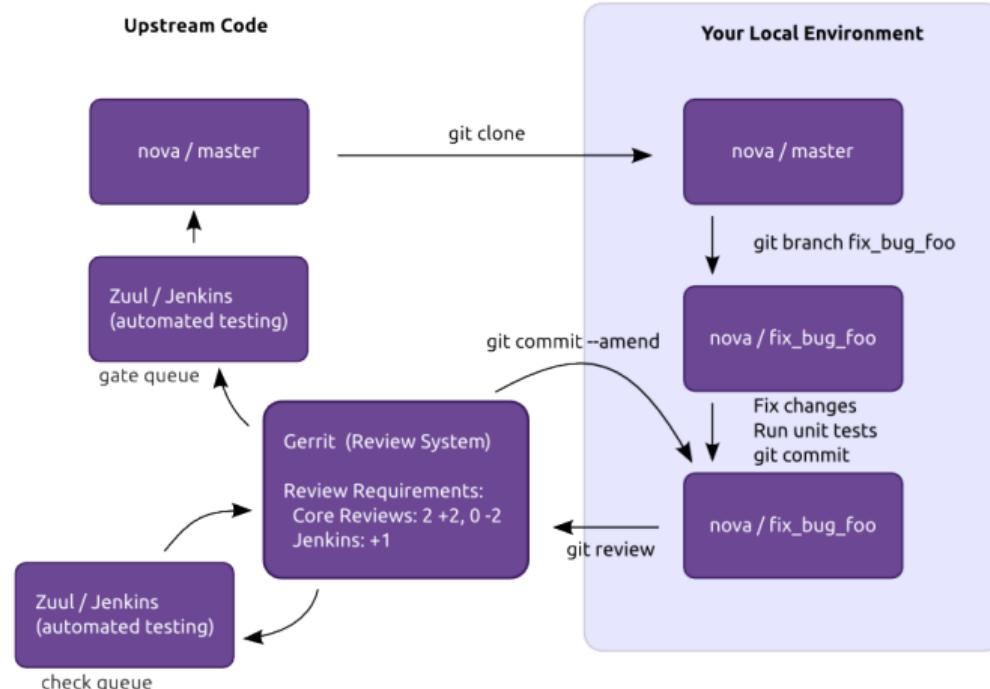
- ▶ An official OpenStack project team
- ▶ Develop, maintain, and initiate tools and plans to ensure the upstream stability and quality of OpenStack, and its release readiness at any point during the release cycle.

# Current QA Projects

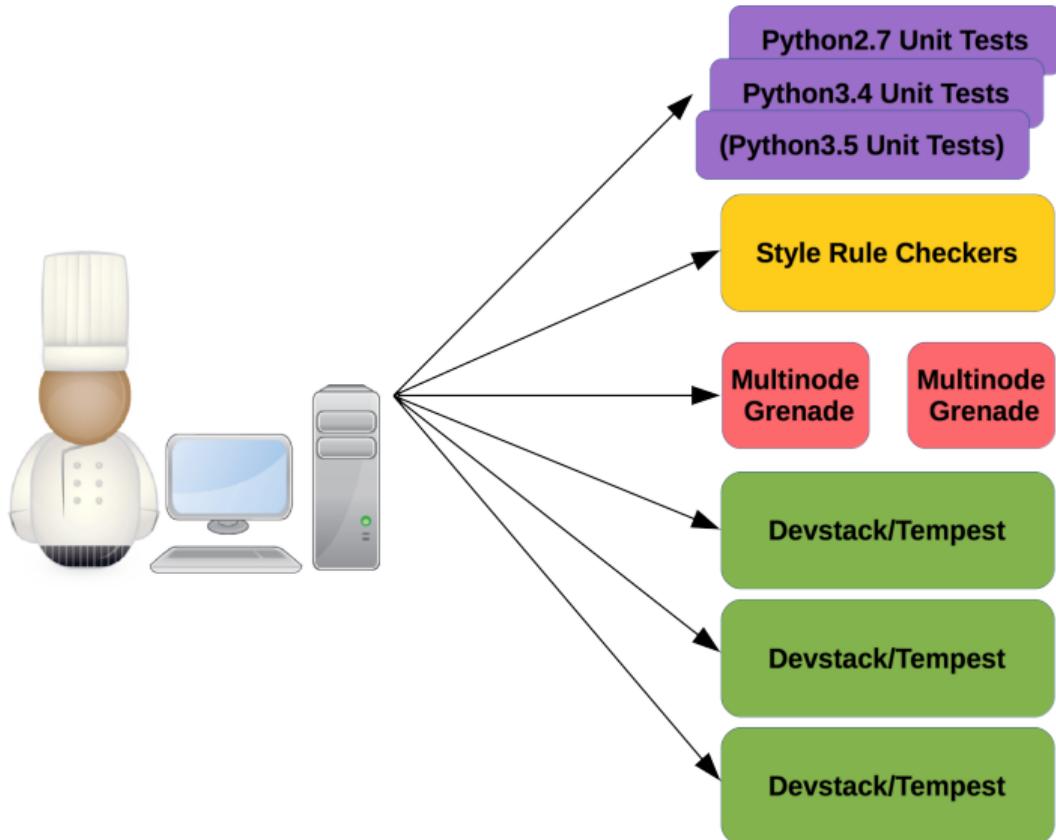
17 repositories (2016/7/8)

- ▶ devstack
- ▶ devstack-plugin-cookiecutter
- ▶ devstack-plugin-ceph
- ▶ devstack-vagrant
- ▶ grenade
- ▶ tempest
- ▶ tempest-lib
- ▶ tempest-plugin-cookiecutter
- ▶ bashate
- ▶ stackviz
- ▶ hacking
- ▶ eslint-config-openstack
- ▶ os-testr
- ▶ os-performance-tools
- ▶ openstack-health dashboard
- ▶ karma-subunit-reporter

# What is “the OpenStack Gate”?



# What Happens when you push a change?



**check**

(268)

**gate**

(26)

**post**

(79)

Newly uploaded patchsets enter this pipeline to receive an initial +1-1 Verified vote from Jenkins.

Changes that have been approved by core developers are enqueued in order in this pipeline, and if they pass tests in Jenkins, will be merged.

This pipeline runs jobs that operate after each change is merged.

Change queue: [openstack/neutron](#)

<a href="#">openstack/neutron</a>	181574,23	unknown	3 hr 57 min
gate-neutron-docs:	SUCCESS		
gate-neutron-pep8:	SUCCESS		
gate-neutron-python27:	FAILURE		
gate-neutron-python34:	FAILURE		
gate-tempест-dsvm-neutron-full:	queued		
gate-grenade-dsvm-neutron:	SUCCESS		
gate-neutron-dsvm-api:	SUCCESS		
gate-neutron-dsvm-functional:	SUCCESS		
gate-neutron-dsvm-fullstack: (non-voting)	SUCCESS		
gate-rally-dsvm-neutron-neutron: (non-voting)	SUCCESS		
gate-tempест-dsvm-neutron-dvr:	SUCCESS		
gate-tempест-dsvm-neutron-identity-v3-only-full-rv: (non-voting)	SUCCESS		
gate-tempест-dsvm-neutron-linuxbridge:	SUCCESS		
gate-tempест-dsvm-neutron-pg-full: (non-voting)	SUCCESS		
gate-neutron-lbaasv2-dsvm-minimal:	SUCCESS		
gate-grenade-dsvm-neutron-multinode: (non-voting)	SUCCESS		
gate-grenade-dsvm-neutron-dvr-multinode: (non-voting)	SUCCESS		
gate-tempест-dsvm-neutron-multinode-full: (non-voting)	SUCCESS		
gate-tempест-dsvm-neutron-dvr-multinode-full: (non-voting)	SUCCESS		
gate-tempест-dsvm-ironic-pxe_ipa-rv: (non-voting)	SUCCESS		

Change queue: [openstack/networking-generic-swift](#)

<a href="#">openstack/networking-generic-switch</a>	308884,3	unknown	3 hr 52 min
gate-networking-generic-switch-docs:	queued		
gate-networking-generic-switch-pep8:	SUCCESS		
gate-networking-generic-switch-python27:	SUCCESS		
gate-networking-generic-switch-python34:	SUCCESS		
gate-networking-generic-switch-dsvm:	SUCCESS		

Change queue: [openstack/neutron](#)

<a href="#">openstack/neutron</a>	280595,12	unknown	3 hr 38 min
gate-neutron-docs:	SUCCESS		
gate-neutron-pep8:	SUCCESS		
gate-neutron-python27:	SUCCESS		
gate-neutron-python34:	SUCCESS		
gate-tempест-dsvm-neutron-full:	SUCCESS		
gate-grenade-dsvm-neutron:	SUCCESS		
gate-neutron-dsvm-api:	SUCCESS		
gate-neutron-dsvm-functional:	SUCCESS		
gate-neutron-dsvm-fullstack: (non-voting)	FAILURE		
gate-rally-dsvm-neutron-neutron: (non-voting)	queued		
gate-tempест-dsvm-neutron-dvr:	SUCCESS		
gate-tempест-dsvm-neutron-identity-v3-only-full-rv: (non-voting)	SUCCESS		
gate-tempест-dsvm-neutron-linuxbridge:	SUCCESS		
gate-tempест-dsvm-neutron-pg-full (non-voting)	SUCCESS		

Change queue: [integrated](#)

<a href="#">openstack/khovva</a>	307269,1	0 min	1 hr 10 min
gate-nova-docs:	SUCCESS		
gate-nova-pep8:	SUCCESS		
gate-nova-python27-db:	FAILURE		
gate-nova-python34-db:	FAILURE		
gate-nova-requirements:	SUCCESS		
gate-tempест-dsvm-full:	SUCCESS		
gate-tempест-dsvm-postgres-full:	SUCCESS		
gate-tempест-dsvm-neutron-full:	SUCCESS		
gate-grenade-dsvm:	SUCCESS		
gate-nova-releasenotes:	SUCCESS		
gate-nova-tox-db-functional:	SUCCESS		
gate-grenade-dsvm-multinode:	SUCCESS		
gate-tempест-dsvm-cells:	SUCCESS		
gate-tempест-dsvm-full-devstack-plugin-ceph:	SUCCESS		

<a href="#">openstack/khovva</a>	304730,1	0 min	1 hr 10 min
gate-nova-docs:	SUCCESS		
gate-nova-pep8:	SUCCESS		
gate-nova-python27-db:	SUCCESS		
gate-nova-python34-db:	SUCCESS		
gate-tempест-dsvm-full:	SUCCESS		
gate-tempест-dsvm-postgres-full:	SUCCESS		
gate-tempест-dsvm-neutron-full:	SUCCESS		
gate-grenade-dsvm:	SUCCESS		
gate-nova-releasenotes:	SUCCESS		
gate-nova-tox-db-functional:	SUCCESS		
gate-grenade-dsvm-multinode:	SUCCESS		
gate-tempест-dsvm-cells:	SUCCESS		
gate-tempест-dsvm-full-devstack-plugin-ceph:	SUCCESS		

<a href="#">openstack/khovva</a>	303995,1	0 min	1 hr 5 min
gate-nova-docs:	SUCCESS		
gate-nova-pep8:	SUCCESS		
gate-nova-python27-db:	SUCCESS		
gate-nova-python34-db:	SUCCESS		
gate-tempест-dsvm-full:	SUCCESS		
gate-tempест-dsvm-postgres-full:	SUCCESS		
gate-tempест-dsvm-neutron-full:	SUCCESS		
gate-grenade-dsvm:	SUCCESS		
gate-nova-releasenotes:	SUCCESS		
gate-nova-tox-db-functional:	SUCCESS		
gate-grenade-dsvm-multinode:	SUCCESS		
gate-tempест-dsvm-cells:	SUCCESS		
gate-tempест-dsvm-full-devstack-plugin-ceph:	SUCCESS		

<a href="#">openstack/dev/devstack</a>	308791,1	0 min	1 hr 5 min
gate-devstack-docs:	SUCCESS		
gate-devstack-pep8:	SUCCESS		

Change queue: [openstack/osl.concurrency](#)

<a href="#">openstack/osl.concurrency</a>	342ef03	unknown	5 hr 2 min
oslo.concurrency-branch-tarball:	SUCCESS		
oslo.concurrency-docs:	queued		
oslo.concurrency-upstream-translation-update:	SUCCESS		
oslo.concurrency-coverage:	queued		

Change queue: [openstack-infra/project-config](#)

<a href="#">openstack-infra/project-config</a>	08001cc	unknown	5 hr 0 min
publish-infra-docs-index:	queued		
publish-specs-site:	queued		

Change queue: [openstack-infra/project-config](#)

<a href="#">openstack-infra/project-config</a>	bdf07b6c	unknown	4 hr 56 min
publish-infra-docs-index:	queued		
publish-specs-site:	queued		

Change queue: [openstack/networking-vsphere](#)

<a href="#">openstack/networking-vsphere</a>	1931febe	unknown	4 hr 55 min
networking-vsphere-branch-tarball:	queued		

Change queue: [openstack-infra/project-config](#)

<a href="#">openstack-infra/project-config</a>	d7f08ff6	unknown	4 hr 54 min
publish-infra-docs-index:	queued		
publish-specs-site:	queued		

Change queue: [openstack-stackalytics](#)

<a href="#">openstack-stackalytics</a>	40f07b8	unknown	4 hr 7 min
hook-stackalyticics-rtd:	SUCCESS		
stackalytics-branch-tarball:	queued		
<a href="#">openstack-stackalytics</a>	a5e5a37	unknown	4 hr 7 min
hook-stackalyticics-rtd:	SUCCESS		
stackalytics-branch-tarball:	queued		

Change queue: [openstack/governance](#)

# The Size of the Gate

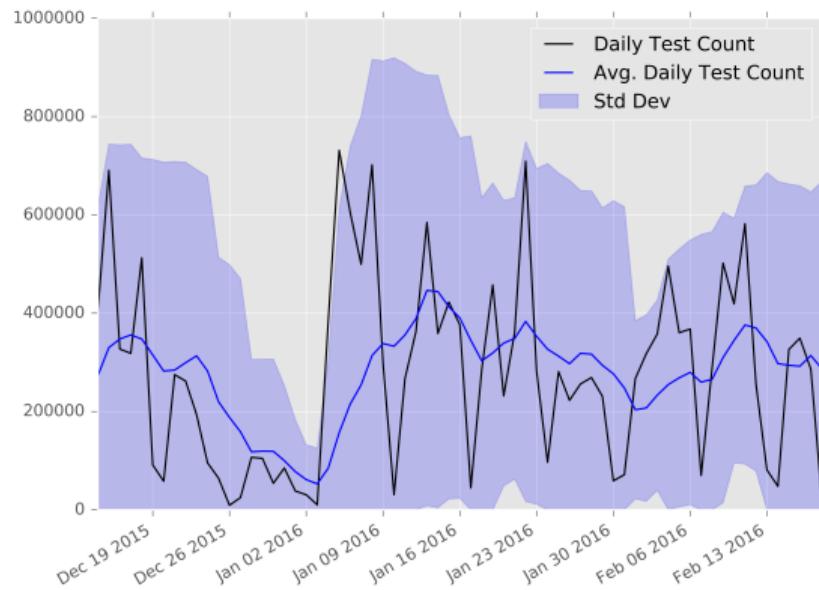
## One Proposed Change Generates:

- ▶ 5–25 Devstacks
- ▶ ~10,000 integration tests (roughly 1.5k per devstack)
- ▶ ~151 2nd level guests created in each devstack cloud
- ▶ ~1 GB of logs uncompressed for each run

## In aggregate:

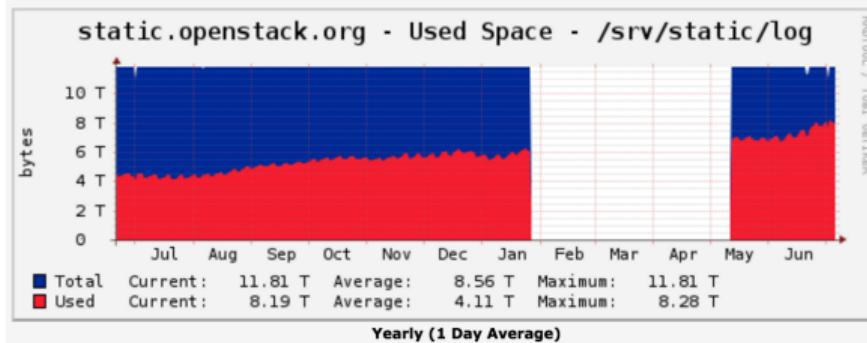
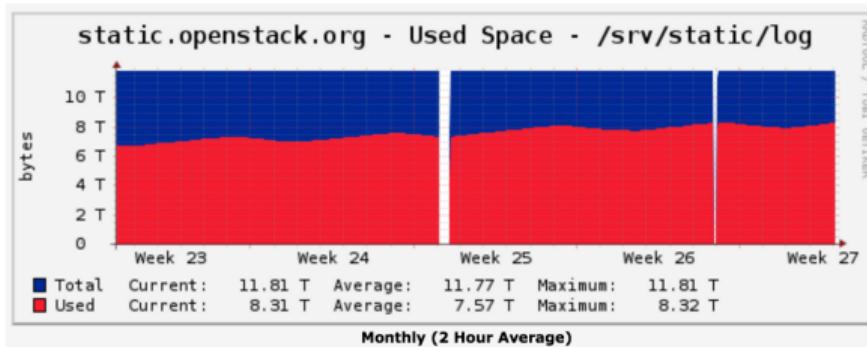
- ▶ ~12,500 jobs run in check and gate daily
- ▶ ~0.01% individual tempest test failure rate
- ▶ ~.77% tempest run failure rate

## Number of Tempest Tests per Day in the Gate Queue:



# Log Server

- ▶ Log Server: <http://logs.openstack.org/>
- ▶ Archive of all artifacts from all jobs for ~4 months
- ▶ ~8 TB of data compressed



## Problem/Issue

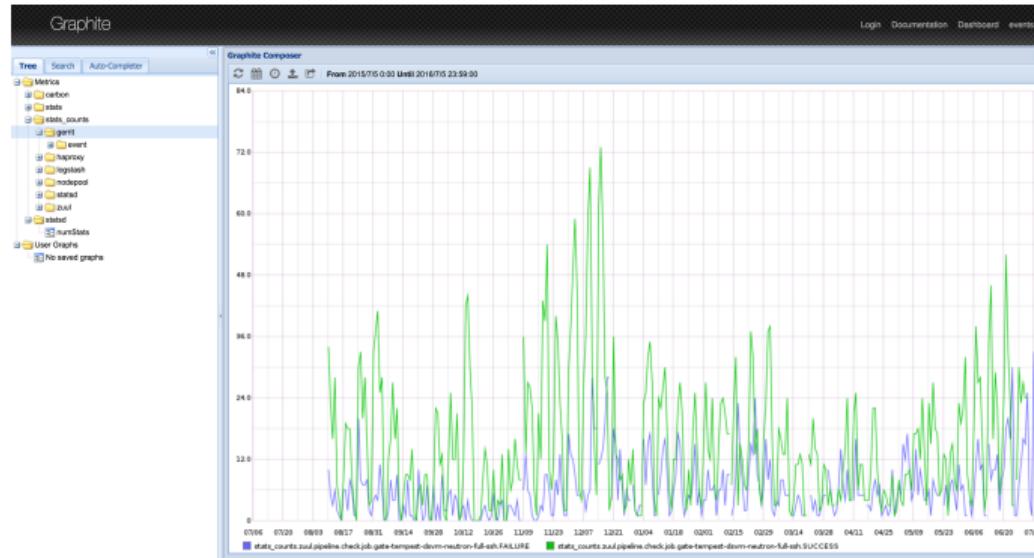
- ▶ It's difficult to find a problem from the large amount of log
- ▶ It's difficult to find performance regression/improvement
- ▶

## General Approach

- ▶ Look at things on the larger scale
- ▶ Use statistics and data mining to find
- ▶ Make the data from test runs open and accessible to
- ▶ Ensure there are APIs for accessing everything

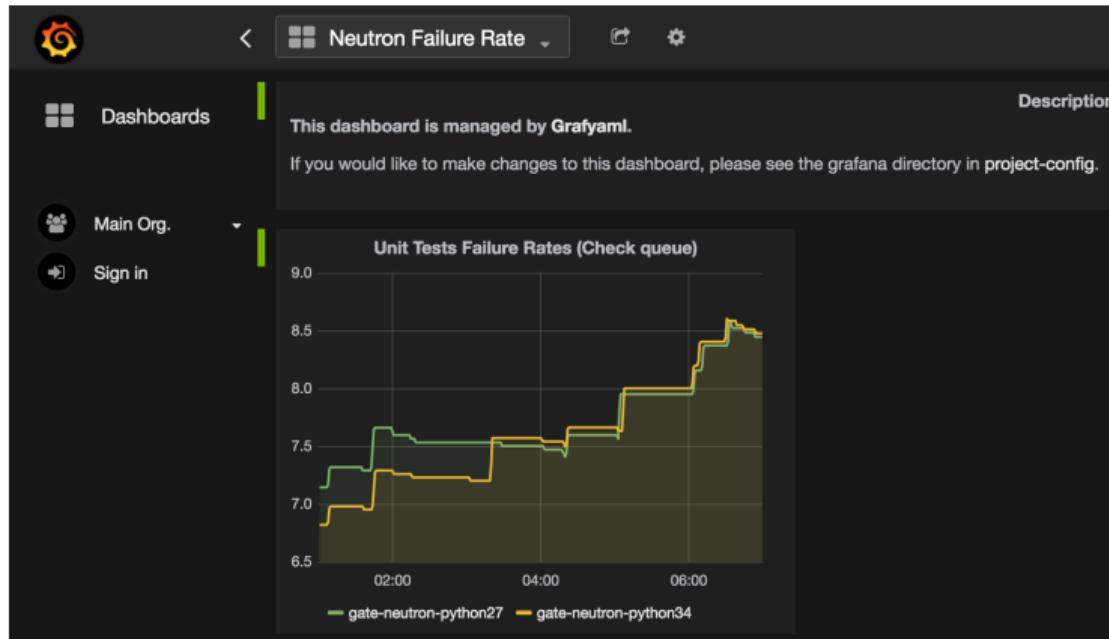
# Graphite

- ▶ <http://graphite.openstack.org/>
- ▶ Infra services report to graphite
- ▶ Include job results
- ▶ Limited to job level data
- ▶ Time based, can't be linked to an individual job
- ▶



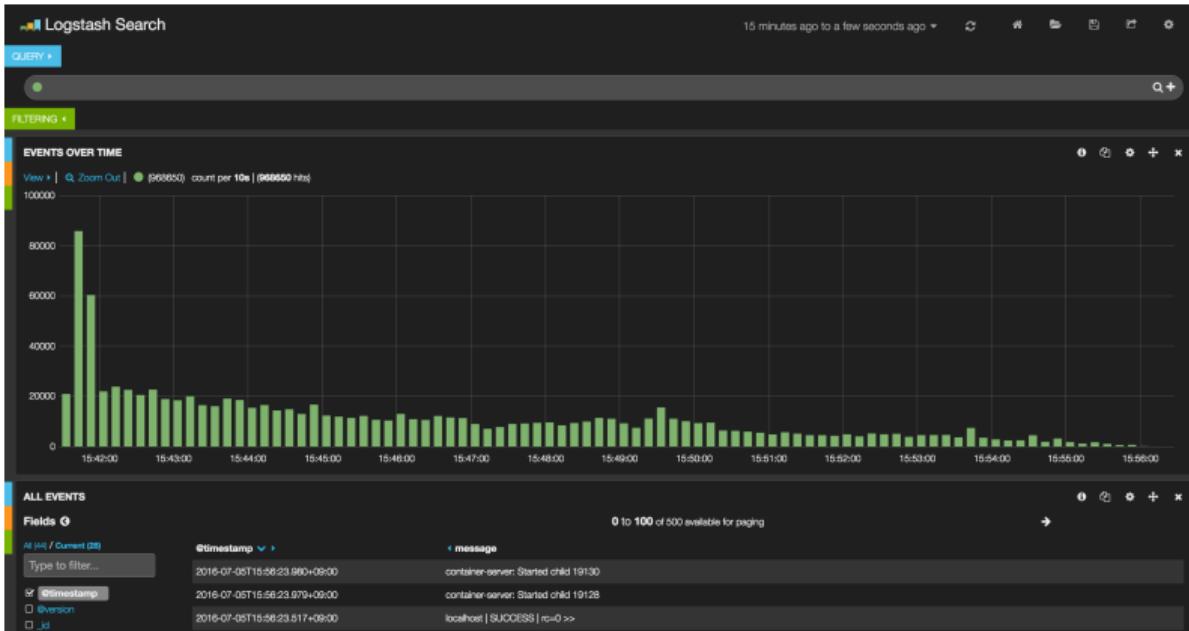
# Grafana

- ▶ <http://grafana.openstack.org/>
- ▶ Provides a layer on top of graphite to easily make useful visualizations
- ▶ Adds a number of dashboards
- ▶ Some projects using this to track job failure rates



# ELK

- ▶ Elasticsearch, Logstash, Kibana
- ▶ <http://logstash.openstack.org>
- ▶ Provides a search engine on top of are job artifacts
- ▶ Limited to 10 days of results



# Elastic Recheck

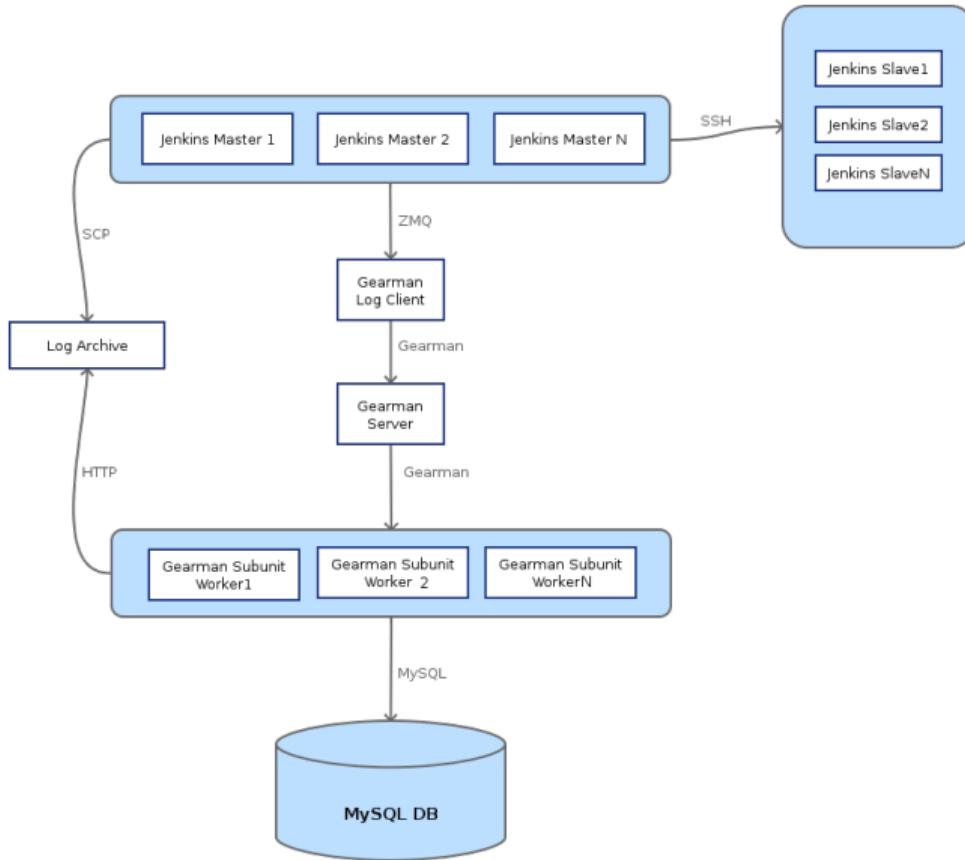
- ▶ Designed to answer the question “Have you seen this recently?”
- ▶ <http://status.openstack.org/elastic-recheck/>
- ▶

<b>Jenkins</b>	Patch Set 9: Verified-1 Build failed (check pipeline). For information on how to proceed, see <a href="http://docs.openstack.org/in">http://docs.openstack.org/in</a>
<b>Elastic Recheck</b>	<p>Patch Set 9:</p> <p>I noticed jenkins failed, I think you hit bug(s):</p> <ul style="list-style-type: none"><li>• gate-grenade-dsvm-multinode: <a href="https://bugs.launchpad.net/bugs/1298006">https://bugs.launchpad.net/bugs/1298006</a> <a href="https://bugs.launchpad.net/bugs/1282876">https://bugs.launchpad.net/bugs/1282876</a></li><li>• gate-grenade-dsvm: unrecognized error</li><li>• gate-tempest-dsvm-cells: unrecognized error</li><li>• gate-tempest-dsvm-full-devstack-plugin-ceph: unrecognized error</li><li>• gate-tempest-dsvm-full: unrecognized error</li><li>• gate-tempest-dsvm-neutron-full: unrecognized error</li><li>• gate-tempest-dsvm-postgres-full: unrecognized error</li></ul> <p>Some of the tests failed in a way that we did not understand. Please help us classify these issues so that they can be part of Elastic Recheck <a href="http://status.openstack.org/elastic-recheck/">http://status.openstack.org/elastic-recheck/</a></p> <p>For more details on this and other bugs, please see <a href="http://status.openstack.org/elastic-recheck/">http://status.openstack.org/elastic-recheck/</a></p>

## subunit2sql

- ▶ Designed to store test results data in a sql database
- ▶ Provides a DB schema and a python API for interacting with the database
- ▶ Used to store the results from test runs for 6 months
- ▶

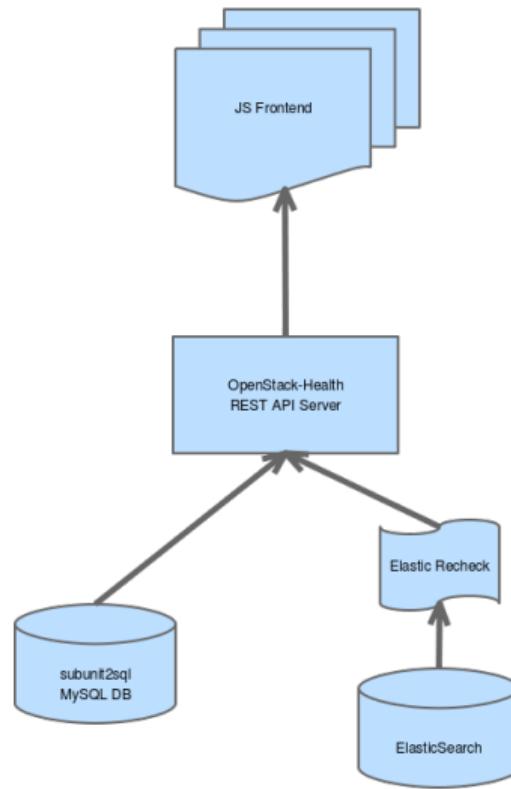
# subunit2sql in OpenStack Infrastructure



## openstack-health

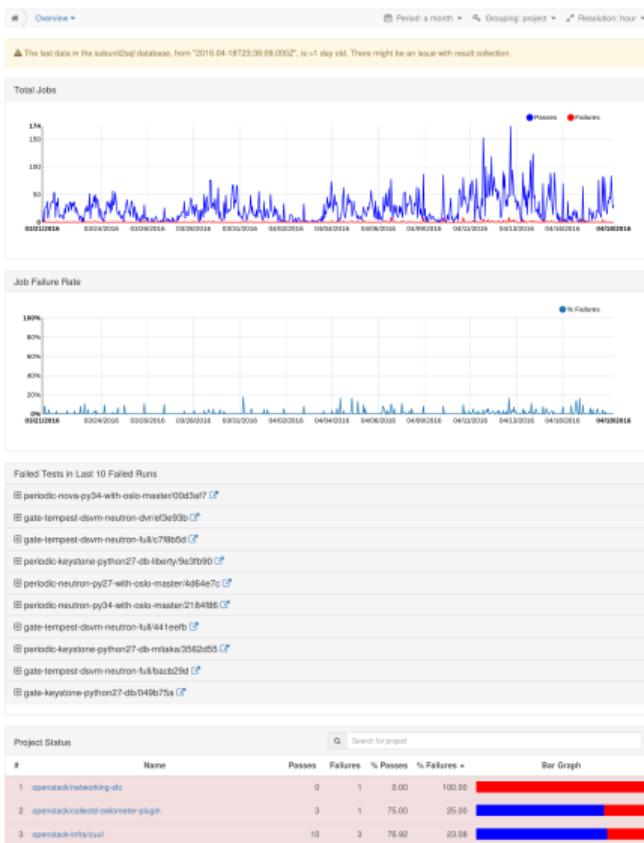
- ▶ <http://status.openstack.org/openstack-health/#/>
- ▶ Designed to be a single point of access for all the data about the gate
- ▶ Currently can leverage subunit2sql and elastic-recheck

# OpenStack-Health Architecture



# Using OpenStack Health

OpenStack Health is a dashboard for visualizing test results of OpenStack CI jobs.



# Data Driven Decision Making

- ▶ Determine when it's time to skip a test
- ▶ Identify tests that are actually catching bugs
- ▶ Determine if failures are isolated to region, config, etc.
- ▶

## Finding trends amongst the noise

- ▶ Catch performance regressions
- ▶

## Issues

- ▶ Too many varied data sources each with unique limitations
- ▶ Only Gate and Periodic Job data (subunit2sql)
- ▶ No views for infra failure (subunit2sql)
- ▶ It'd difficult to get contribution from employees of companies

## Future work

- ▶ Integrate all the things in openstack-health
- ▶ Use the data to optimize our test runner scheduler
- ▶ (Auto cause of failure detection with machine learning or something:)

## Where to get more information

- ▶ openstack-dev ML [openstack-dev@lists.openstack.org](mailto:openstack-dev@lists.openstack.org)
- ▶ #openstack-qa on Freenode
- ▶ <http://git.openstack.org/cgit/openstack/openstack-health/>
- ▶ <http://git.openstack.org/cgit/openstack-infra/subunit2sql>
- ▶ <http://git.openstack.org/cgit/openstack-infra/elastic-recheck/>

Questions?

## Appendix: StackViz

Visualization tool of individual CI build results

► [git.openstack.org/cgit/openstack/stackviz](http://git.openstack.org/cgit/openstack/stackviz)

### Datasets

[Home](#) / stdin

stdin 3 Jul, 2016

41:11

runtime

1509

tests run

1

failed

72

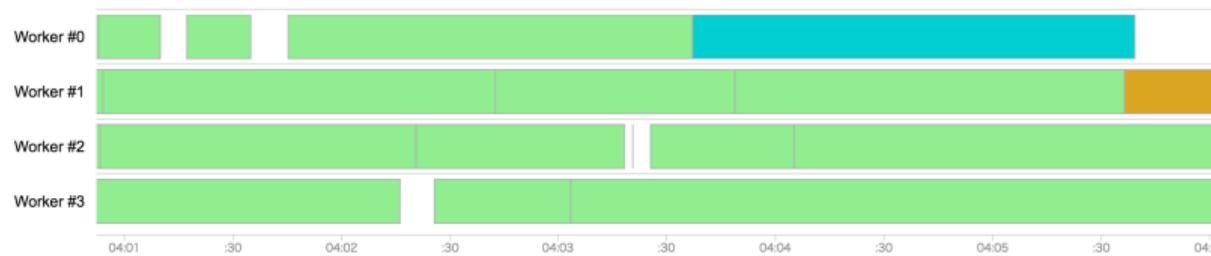
skipped

Details

#### Failures

TestSecurityGroupsBasicOps.test\_port\_update\_new\_security\_group

## Timeline

[Show in OpenStack-health](#)

Details: [test\\_port\\_update\\_new\\_security\\_group](#) fail

Class	TestSecurityGroupsBasicOps
Module	tempest.scenario.test_security_groups_basic_ops
Tags	worker-1
Duration	24.7 seconds
Start	Jul 3, 2016 4:05:36 PM
End	Jul 3, 2016 4:06:01 PM

## TestSecurityGroupsBasicOps.test\_port\_update\_new\_security\_group

Q ▾

Summary

traceback

pythonlogging

```
Traceback (most recent call last):
  File "tempest/scenario/test_security_groups_basic_ops.py", line 188, in setUp
    self._deploy_tenant(self.primary_tenant)
  File "tempest/scenario/test_security_groups_basic_ops.py", line 352, in _deploy_tenant
    self._set_access_point(tenant)
  File "tempest/scenario/test_security_groups_basic_ops.py", line 320, in _set_access_point
    self._assign_floating_ips(tenant, server)
  File "tempest/scenario/test_security_groups_basic_ops.py", line 326, in _assign_floating_ips
    client=tenant.manager.floating_ips_client)
  File "tempest/scenario/manager.py", line 868, in create_floating_ip
    port_id, ip4 = self._get_server_port_id_and_ip4(thing)
  File "tempest/scenario/manager.py", line 847, in _get_server_port_id_and_ip4
    "No IPv4 addresses found in: %s" % ports)
  File "/opt/stack/new/tempest/.tox/tempest/local/lib/python2.7/site-packages/unittest2/case.py", line 845, in assertNotEqual
    raise self.failureException(msg)
AssertionError: 0 == 0 : No IPv4 addresses found in: [{u'extra_dhcp_opts': [], u'admin_state_up': True, u'mac_address': u'fa:16:3e:ee:7f:bc'}
```

Timeline