

# Better Testing Through Statistics

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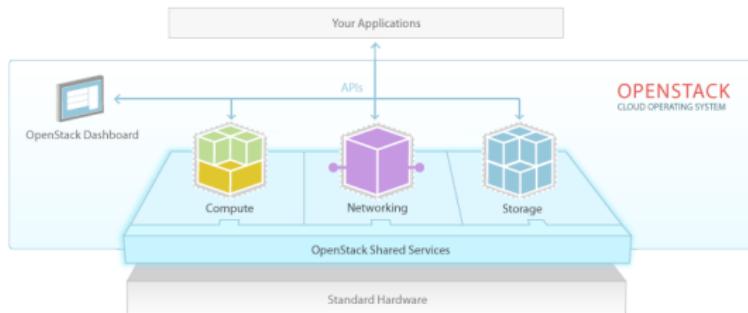
masayukig on Freenode

July 13, 2016

<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”

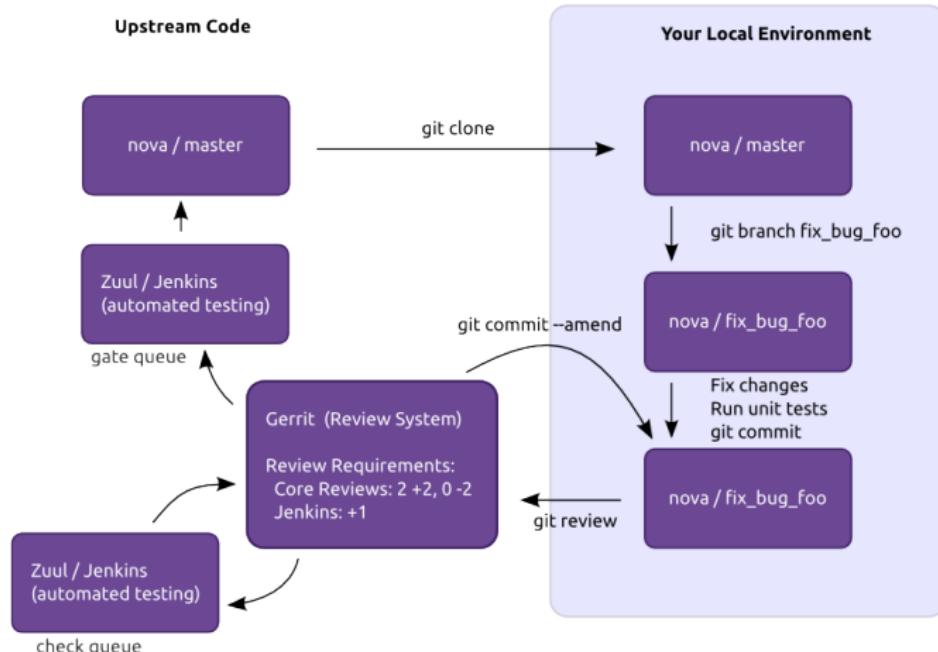
- ▶ An official OpenStack project team
- ▶ Develop, maintain, and initiate tools and plans to ensure the upstream stability and quality of OpenStack, and its release readiness at any point during the release cycle.

# Current QA Projects

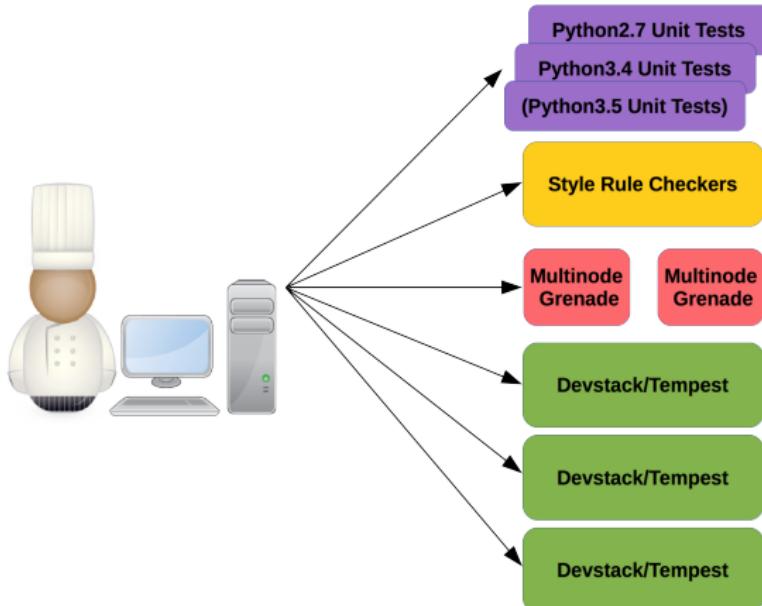
17 repositories (2016/7/8)

- ▶ 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 patchesets enter this pipeline to receive an initial +1 Verified vote from Jenkins.					
Change queue: openstack/neutron					
openstack/neutron 18387423	unknown 3 hr 57 min				
gate-neutron-docs:	SUCCESS				
gate-neutron-pep8:	SUCCESS				
gate-neutron-python3:	FAILURE				
gate-neutron-pybind4:	FAILURE				
gate-tempест-neutron-full:	queued				
gate-granade-neutron:	SUCCESS				
gate-neutron-dns-functional:	SUCCESS				
gate-neutron-dns-failback (non-voting)	SUCCESS				
gate-rally-dnsmq-neutron-revision: (non-voting)	SUCCESS				
gate-tempест-neutron-dnsmq-drv:	SUCCESS				
gate-tempест-neutron-revision-identity v3-only-full-m:	(non-voting)				
gate-tempест-neutron-karibana:	SUCCESS				
gate-neutron-apt:	SUCCESS				
gate-neutron-dns-functional:	SUCCESS				
gate-tempест-neutron-failback: (non-voting)	SUCCESS				
gate-neutron-dns-middleware: (non-voting)	SUCCESS				
gate-tempест-neutron-middleware-4.0: (non-voting)	SUCCESS				
gate-tempест-neutron-middleware-4.0: (non-voting)	SUCCESS				
gate-tempест-neutron-metric_garbage_collector: (non-voting)	SUCCESS				
Change queue: openstack/networking-generic-salt...					
openstack/networking-generic-salt 3088863	unknown 3 hr 56 min				
gate-networking-generic-switch-docs:	SUCCESS				
gate-networking-generic-switch-pep8:	SUCCESS				
gate-networking-generic-switch-pep82:	SUCCESS				
gate-networking-generic-switch-python34:	SUCCESS				
gate-networking-generic-switch-drv-m:	SUCCESS				
Change queue: openstack/neutron					
openstack/neutron 20035612	unknown 3 hr 38 min				
gate-neutron-docs:	SUCCESS				
gate-neutron-pep8:	SUCCESS				
gate-neutron-pybind7:	SUCCESS				
gate-neutron-pybind4:	SUCCESS				
gate-tempест-neutron-full:	queued				
gate-granade-neutron:	SUCCESS				
gate-neutron-dns-functional:	SUCCESS				
gate-tempест-neutron-failback: (non-voting)	SUCCESS				
gate-rally-dnsmq-neutron-revision: (non-voting)	FAILURE				
gate-tempест-neutron-dnsmq-drv:	queued				
gate-tempест-neutron-revision-identity v3-only-full-m:	(non-voting)				
gate-tempест-neutron-karibana:	SUCCESS				
gate-neutron-apt:	SUCCESS				
gate-neutron-dns-functional:	SUCCESS				
gate-tempест-neutron-failback: (non-voting)	SUCCESS				
gate-neutron-dns-middleware: (non-voting)	SUCCESS				
gate-tempест-neutron-middleware-4.0: (non-voting)	SUCCESS				
gate-tempест-neutron-middleware-4.0: (non-voting)	SUCCESS				
gate-tempест-neutron-metric_garbage_collector: (non-voting)	SUCCESS				
Change queue: integrated					
openstack/integrated 3072931	0 min 1 hr 10 min				
gate-neva-docs:	SUCCESS				
gate-neva-pep8:	SUCCESS				
gate-neva-python27-dv:	SUCCESS				
gate-neva-python34-dv:	SUCCESS				
gate-neva-requirements:	SUCCESS				
gate-tempест-dnsmq-full:	queued				
gate-tempест-dnsmq-pep8-full:	SUCCESS				
gate-tempест-dnsmq-neutron-full:	SUCCESS				
gate-granade-dnsmq:	SUCCESS				
gate-neva-releases:	SUCCESS				
gate-neva-tox-dv-functional:	SUCCESS				
gate-granade-dnsmq-middleware:	SUCCESS				
gate-tempест-dnsmq-drv-middleware: (non-voting)	SUCCESS				
gate-tempест-dnsmq-drv-middleware-4.0: (non-voting)	SUCCESS				
gate-tempест-dnsmq-metric_garbage_collector: (non-voting)	SUCCESS				
gate-tempест-dnsmq-full-devstack-plugin-peph:	SUCCESS				
Change queue: openstack/infra-project-concurrency					
openstack/infra-project-concurrency 342695	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					
openstack/infra-project-config 980010	unknown 5 hr 10 min				
publish-infra-docs-index:	queued				
publish-spec-site:	queued				
Change queue: openstack/infra-project-config					
openstack/infra-project-config infra0001	unknown 4 hr 59 min				
publish-infra-docs-index:	queued				
publish-spec-site:	queued				
Change queue: openstack/networking-ovsphere					
openstack/networking-ovsphere 199f69	unknown 4 hr 55 min				
networking-ovsphere-branch-tarball:	queued				
networking-ovsphere-docs:	queued				
Change queue: openstack/infra/project-config					
openstack/infra/project-config d70708	unknown 4 hr 54 min				
publish-infra-docs-index:	queued				
publish-spec-site:	queued				
Change queue: openstack/infra/project-config					
openstack/infra/project-config e63637	unknown 4 hr 52 min				
publish-infra-docs-index:	queued				
publish-spec-site:	queued				
Change queue: openstack/stackalytics					
openstack/stackalytics 400776	unknown 4 hr 17 min				
hook-stackalytics-rbd:	SUCCESS				
stackalytics-branch-tarball:	queued				
Change queue: openstack/stackalytics					
openstack/stackalytics aef237	unknown 4 hr 17 min				
hook-stackalytics-rbd:	SUCCESS				
stackalytics-branch-tarball:	queued				
Change queue: openstack/governance					
openstack/governance 4f6124a	unknown 4 hr 2 min				
static/governance-publish:	queued				
Change queue: openstack/glance-store					
openstack/glance-store 2f6e619	unknown 3 hr 54 min				
glance_store_branch-tarball:	queued				
glance_store-docs:	queued				
glance_store-releases:	queued				
glance_store-upstream-translation-update:	SUCCESS				

# The Size of the Gate

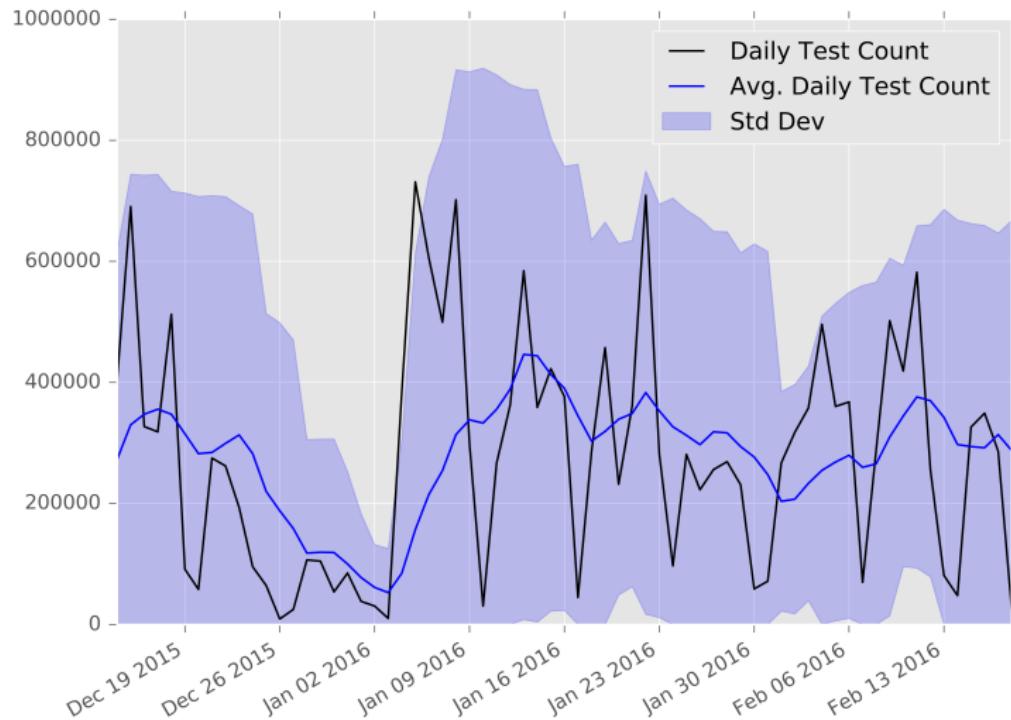
## One Proposed Change Generates:

- ▶ 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:

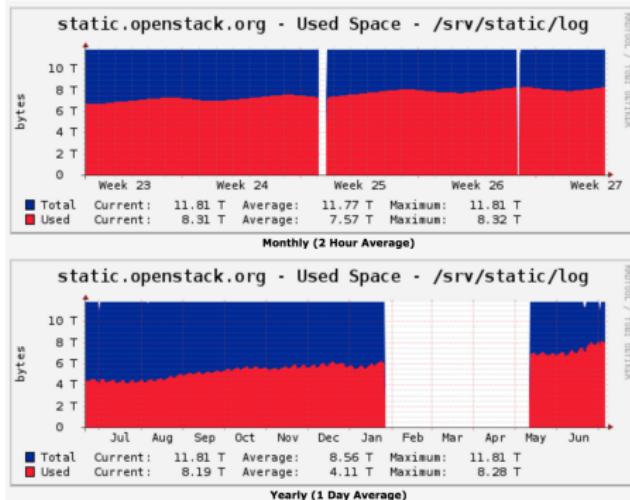
- ▶ ~12,500 jobs run in check and gate daily
- ▶ ~0.01% individual tempest test failure rate
- ▶ ~.77% tempest run failure rate

# 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



## Problems/Issues when Running in the Gate

- ▶ Works fine for looking at results 1 at a time
- ▶ Difficult to find a non-deterministic failures
- ▶ Difficult to find performance regressions
- ▶ Finding out how often something passes or fails is impossible

## 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

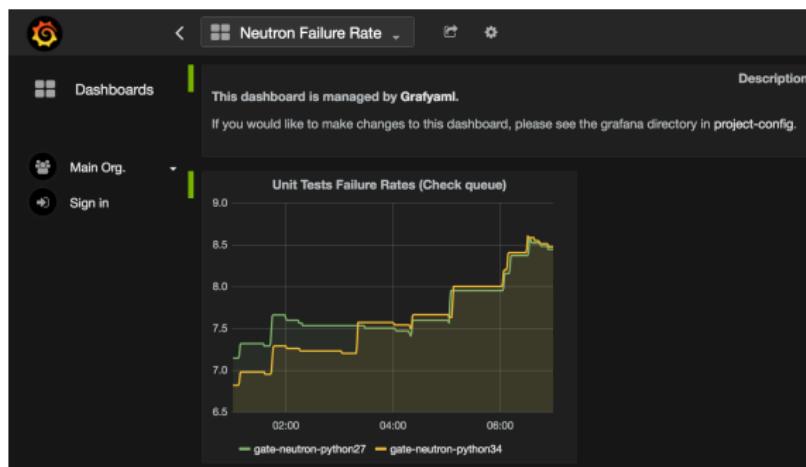
# Graphite

- ▶ <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
- ▶



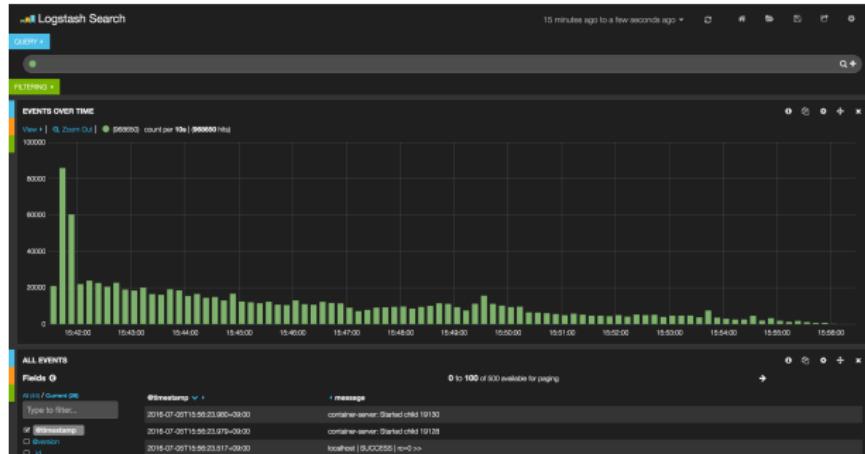
# Grafana

- ▶ <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



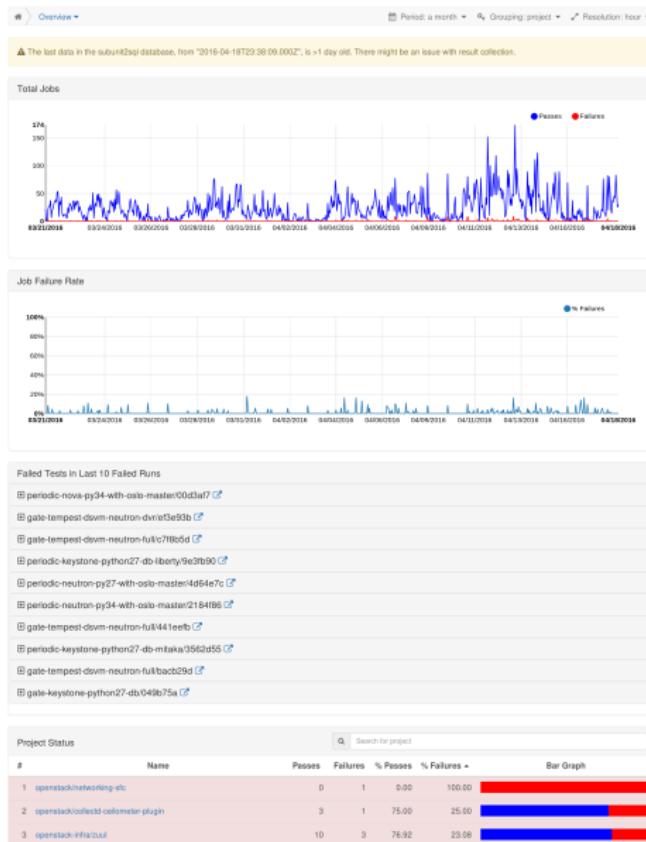
# ELK

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



# Using OpenStack Health

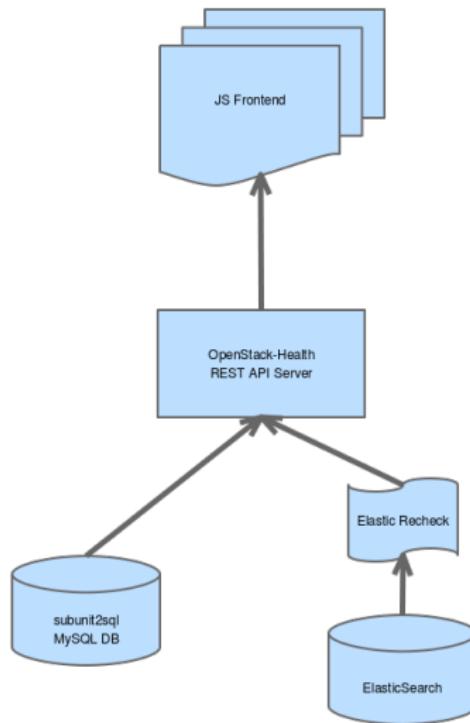
OpenStack Health is a dashboard for visualizing test results of OpenStack CI jobs.



## 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

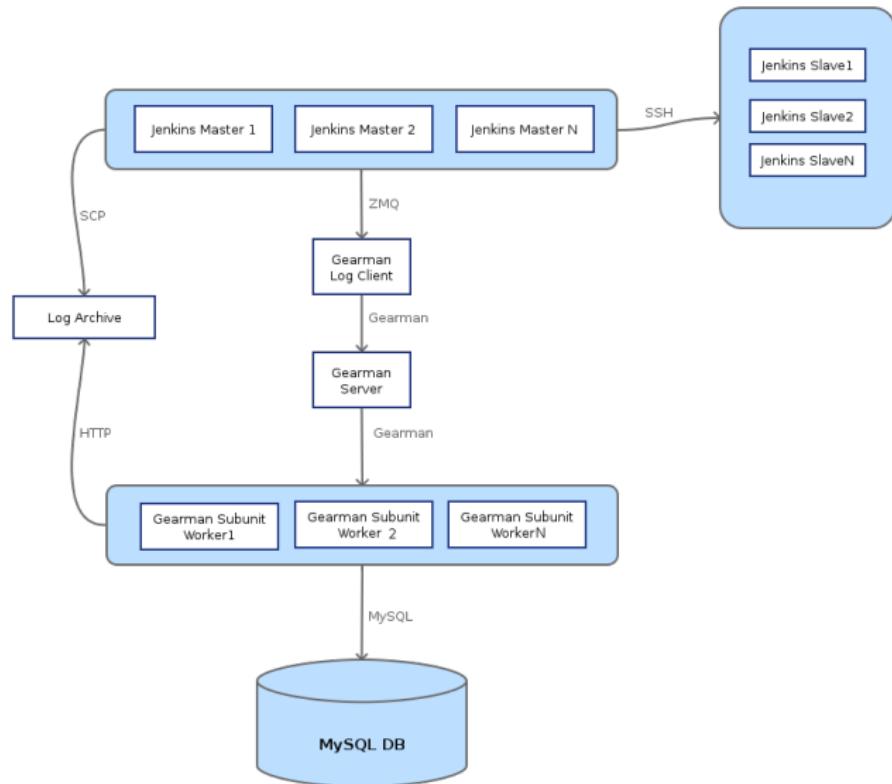
# OpenStack-Health Architecture



## subunit2sql

- ▶ Designed to store test results data in a sql database
- ▶ Provides a DB schema and a python API for interacting with the database
- ▶ CLI utilities for storing and retrieving results in the DB as subunit v2
- ▶ A public database of everything with subunit output run in OpenStack-Infra
- ▶ Used to store the results from test runs for 6 months

# subunit2sql in OpenStack Infrastructure



# Elastic Recheck

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

All Pipelines Gate Pipeline Uncategorized

The elastic-recheck project uses Elasticsearch to classify and track OpenStack gate failures. Documentation can be found [here](#). You can also learn more by reading this post on the Elasticsearch blog: [OpenStack elastic-recheck: powered by the elk stack](#)

Data Last Updated: Tue Jul 12 2016 13:00:01 GMT+0900 (JST)

Last Elastic Search Index Update: Tue Jul 12 2016 12:59:20 GMT+0900 (JST)

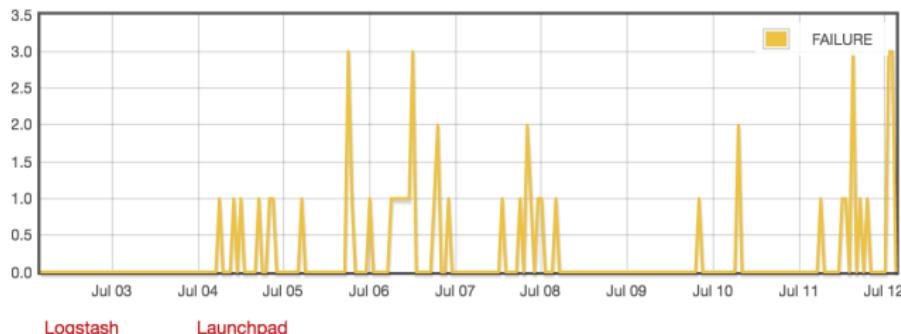
Delay in Elastic Search: Up to date

Cluster Health: green

## Bug 1539271 - Libvirt live block migration stalls

14 fails in 24 hrs / 50 fails in 10 days

Projects: (nova - Confirmed)



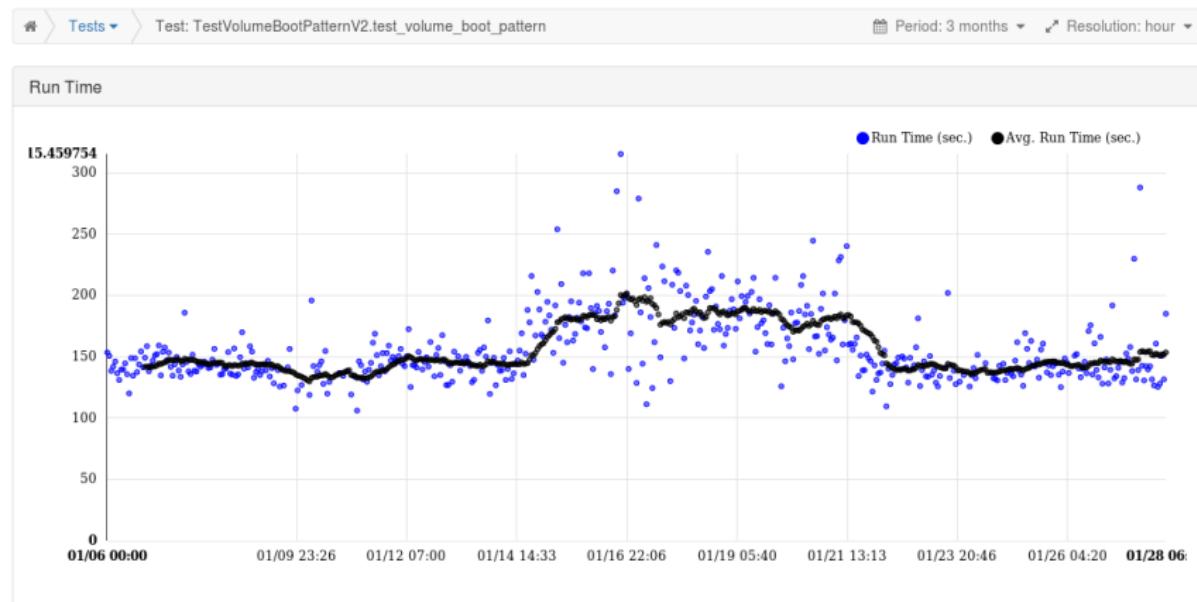
# Data Driven Decision Making

- ▶ 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
- ▶ Identify relational trends in the data

### TestVolumeBootPatternV2.test\_volume\_boot\_pattern



## Issues

- ▶ Too many varied data sources each with unique limitations
- ▶ Only Gate and Periodic Job data (subunit2sql)
- ▶ No views for infra failure (subunit2sql)
- ▶ Limited contribution in this space

## Future work

- ▶ Integrate all the things in openstack-health
- ▶ Use the data to optimize our test runner scheduler
- ▶ Enable automation around failure detection

## 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/>

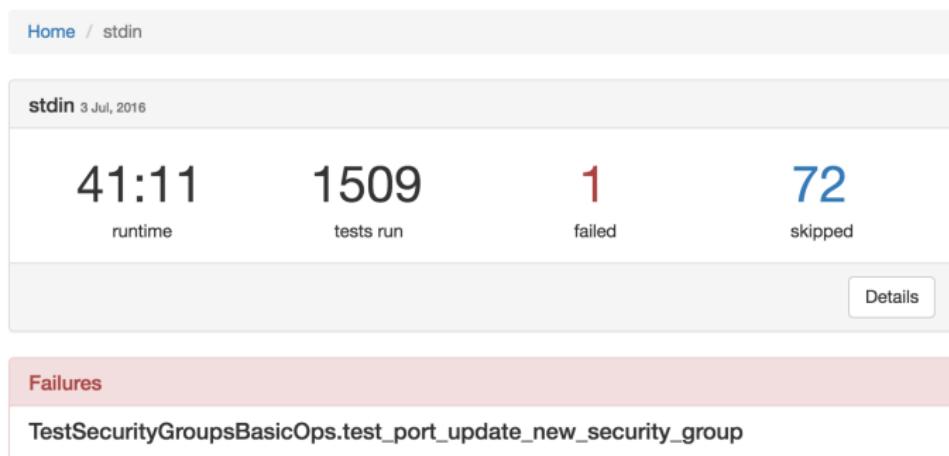
# Questions?

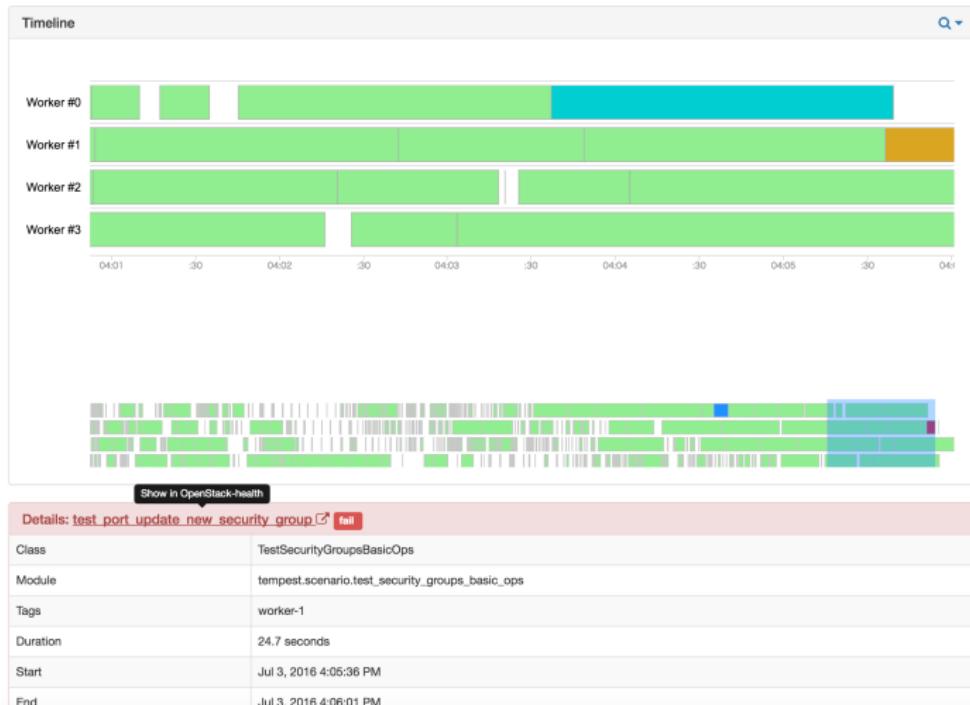
# Appendix: StackViz

Visualization tool of individual CI build results

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

## Datasets





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

Summary    traceback    pythonlogging

Q ▾

```
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