

Better Testing Through Statistics

Matthew Treinish

mtreinish@kortar.org

mtreinish on Freenode

Masayuki Igawa

masayuki.igawa@gmail.com

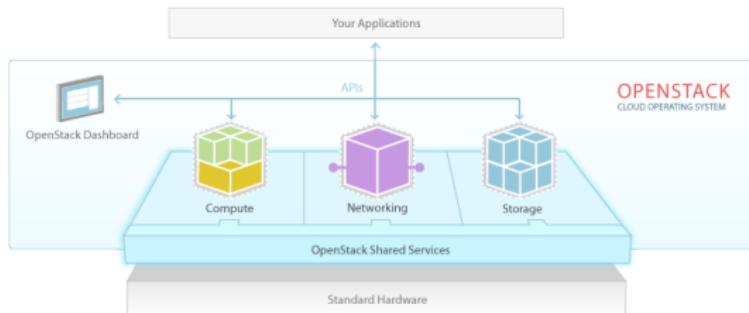
masayukig on Freenode

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”

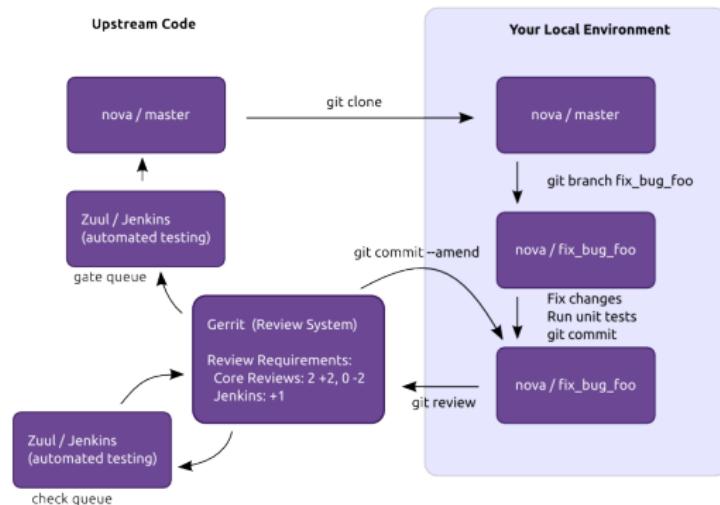
- ▶ An official OpenStack project team
- ▶ Develop, maintain, and initiate tools and plans to ensure the upstream stability and quality of OpenStack, and its release readiness at any point during the release cycle.

Current QA Projects

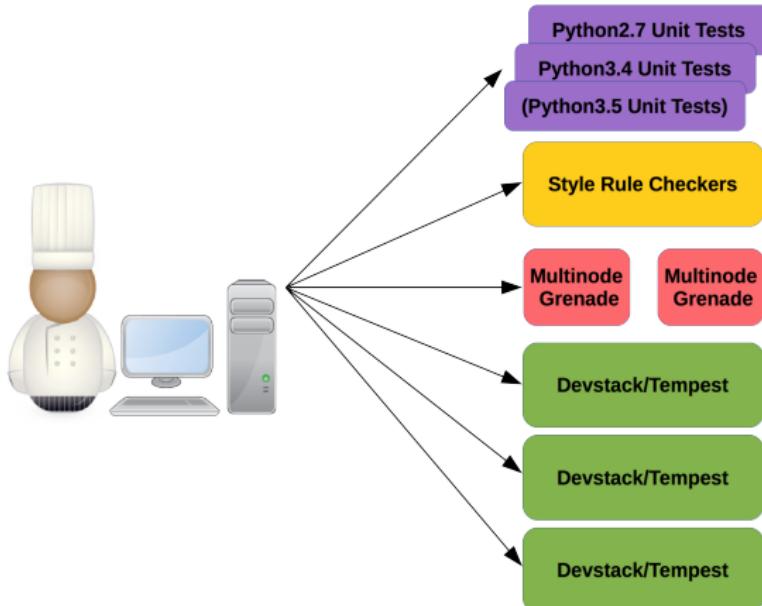
17 repositories (2016/7/8)

- ▶ 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-revision:	SUCCESS				
gate-neutron-dns-functional:	SUCCESS				
gate-neutron-dns-failback (non-voting)	SUCCESS				
gate-rally-dnsmq-revision: (non-voting)	SUCCESS				
gate-tempест-neutron-dnsmq-drv:	SUCCESS				
gate-tempест-neutron-revision-identity v3-only-full-m:	(non-voting)				
gate-tempест-neutron-revision-kneebe:	SUCCESS				
gate-tempест-neutron-revision-pgfull: (non-voting)	SUCCESS				
gate-tempест-neutron-revision-pgfail: (non-voting)	SUCCESS				
gate-granade-neutron-dns-malformed:	(non-voting)				
gate-tempест-neutron-dns-malformed: (non-voting)	SUCCESS				
gate-tempест-neutron-dns-malformed-v3: (non-voting)	SUCCESS				
gate-tempест-neutron-dns-monic-pg1-mr: (non-voting)	SUCCESS				
Change queue: openstack/networking-generic-salt...					
openstack/networking-generic-salt 3088863	unknown 3 hr 50 min				
gate-networking-generic-switch-docs:	queued				
gate-networking-generic-switch-pep8:	SUCCESS				
gate-networking-generic-switch-pep82:	SUCCESS				
gate-networking-generic-switch-pybind4:	SUCCESS				
gate-networking-generic-switch-drv:	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-revision:	SUCCESS				
gate-neutron-dns-functional:	SUCCESS				
gate-neutron-dns-failback: (non-voting)	SUCCESS				
gate-rally-dnsmq-revision: (non-voting)	queued				
gate-tempест-neutron-dnsmq-drv:	SUCCESS				
gate-tempест-neutron-revision-identity v3-only-full-m:	(non-voting)				
gate-tempест-neutron-revision-kneebe:	SUCCESS				
gate-tempест-neutron-revision-pgfull: (non-voting)	SUCCESS				
gate-neutron-haasv2-dns-realm:	SUCCESS				
gate-granade-neutron-dns-malformed: (non-voting)	SUCCESS				
gate-tempест-neutron-dns-malformed: (non-voting)	SUCCESS				
gate-tempест-neutron-dns-malformed-v3: (non-voting)	SUCCESS				
gate-tempест-neutron-dns-monic-pg1-mr: (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-db:	SUCCESS				
gate-neva-python34-db:	SUCCESS				
gate-neva-requirements:	SUCCESS				
gate-tempест-dnsmq-full:	queued				
gate-tempест-dnsmq-revision:	SUCCESS				
gate-granade-dnsmq:	SUCCESS				
gate-neva-relevantes:	SUCCESS				
gate-neva-tox-db-functional:	SUCCESS				
gate-granade-dnsmq-multimode:	SUCCESS				
gate-tempест-dnsmq-calls:	SUCCESS				
gate-tempест-dnsmq-full-devstack-plugin-ceph:	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 0 min				
publish-infra-docs-index:	queued				
publish-spec-site:	queued				
Change queue: openstack/infra-project-config					
openstack/infra-project-config 970706	unknown 4 hr 59 min				
publish-infra-docs-index:	queued				
publish-spec-site:	queued				
Change queue: openstack/networking-vsphere					
openstack/networking-vsphere 195965	unknown 4 hr 55 min				
networking-vsphere-branch-tarball:	queued				
networking-vsphere-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 409776	unknown 4 hr 51 min				
hook-stackalytics-rbd:	SUCCESS				
stackalytics-branch-tarball:	queued				
Change queue: openstack/stackalytics					
openstack/stackalytics aef237	unknown 4 hr 51 min				
hook-stackalytics-rbd:	SUCCESS				
stackalytics-branch-tarball:	queued				
Change queue: openstack/governance					
openstack/governance 416124a	unknown 4 hr 2 min				
static-governance-publish:	queued				
Change queue: openstack/glance-store					
openstack/glance-store 2166519	unknown 3 hr 54 min				
glance_store-branch-tarball:	queued				
glance_store-docs:	queued				
glance_store-relevantes:	queued				
glance_store-upstream-translation-update:	SUCCESS				

The Size of the Gate

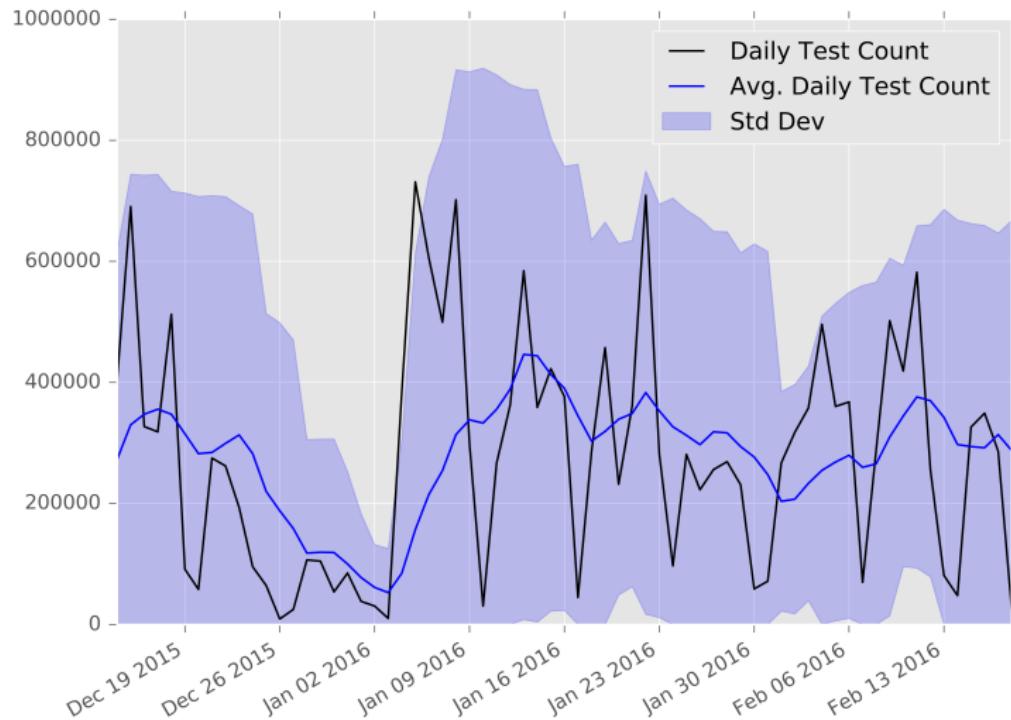
One Proposed Change Generates:

- ▶ 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:

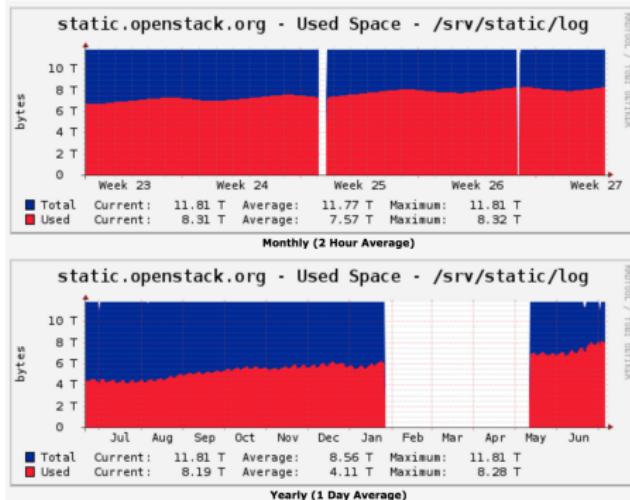
- ▶ ~12,500 jobs run in check and gate daily
- ▶ ~0.01% individual tempest test failure rate
- ▶ ~.77% tempest run failure rate

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

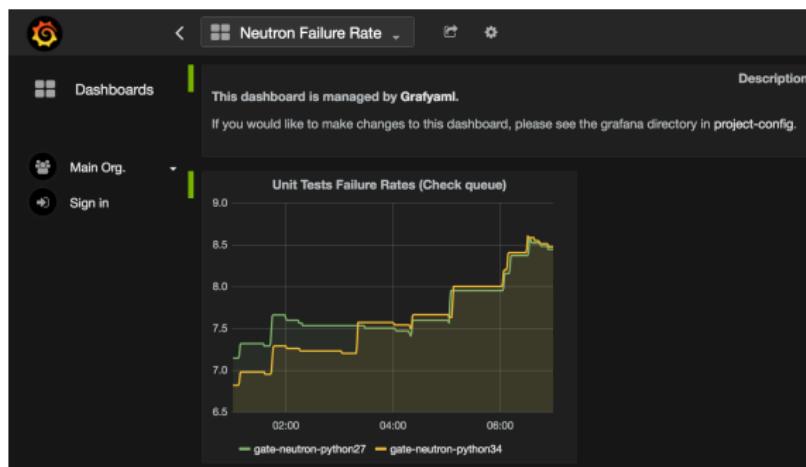
Graphite

- ▶ <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
 - ▶



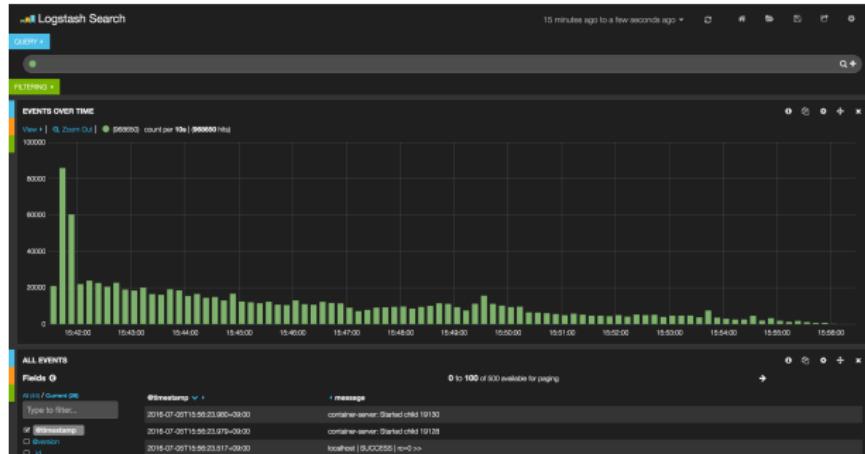
Grafana

- ▶ <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



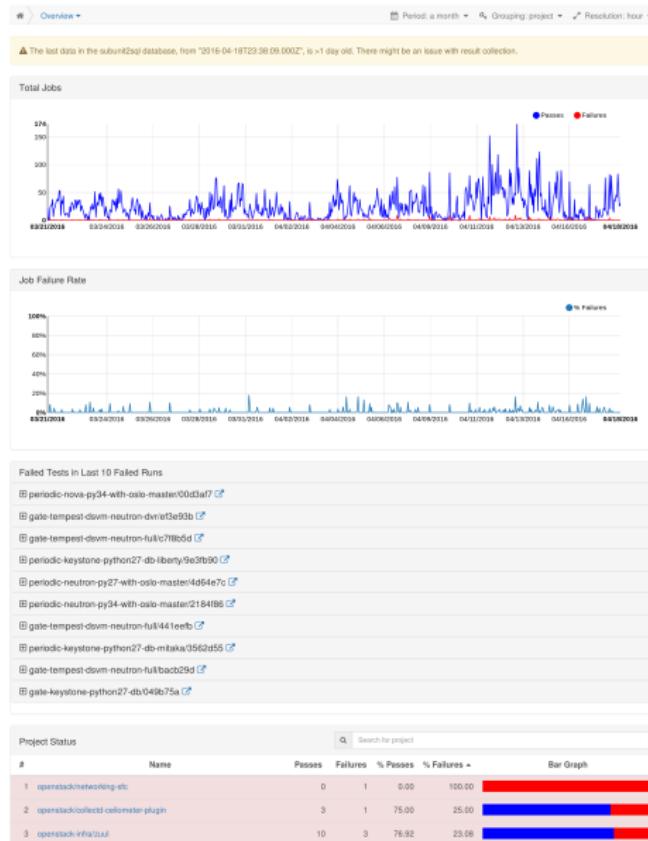
ELK

- ▶ 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

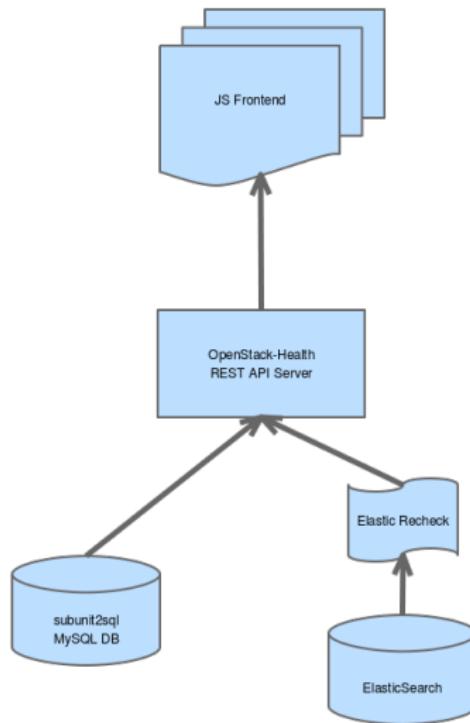
OpenStack Health is a dashboard for visualizing test results of OpenStack CI jobs.



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

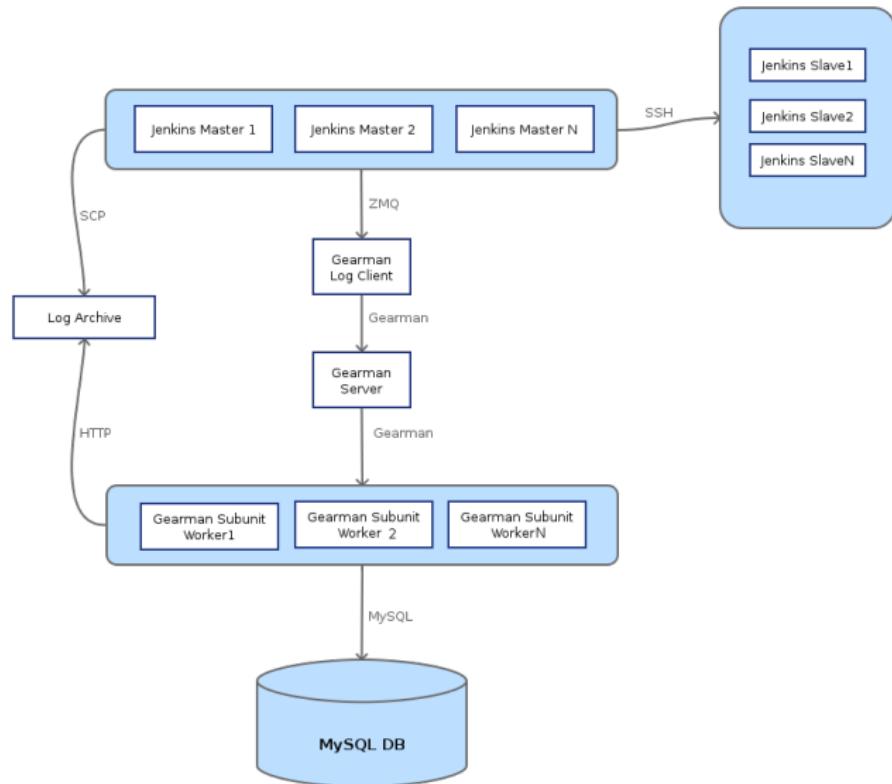
OpenStack-Health Architecture



subunit2sql

- ▶ Designed to store test results data in a sql database
- ▶ Provides a DB schema and a python API for interacting with the database
- ▶ 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)

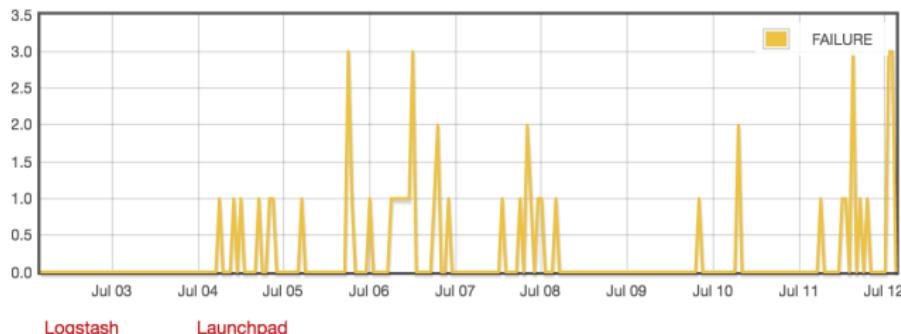
Delay in Elastic Search: Up to date

Cluster Health: green

Bug 1539271 - Libvirt live block migration stalls

14 fails in 24 hrs / 50 fails in 10 days

Projects: (nova - Confirmed)



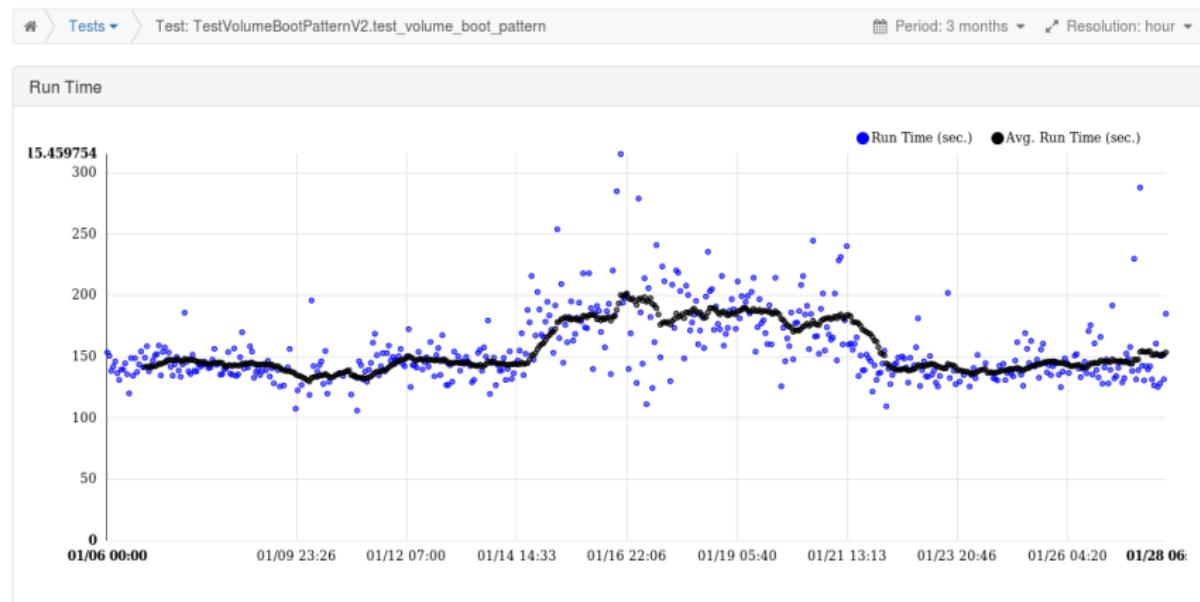
Data Driven Decision Making

- ▶ 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)
- ▶ 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
- ▶ #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/>

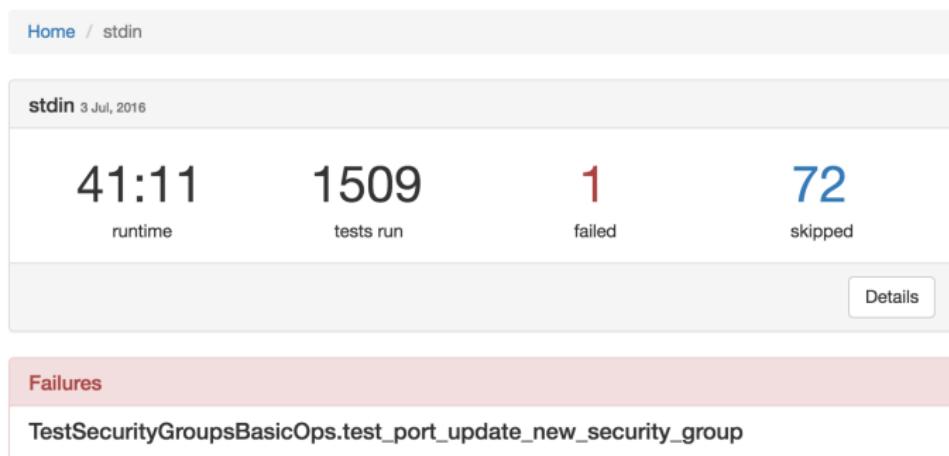
Questions?

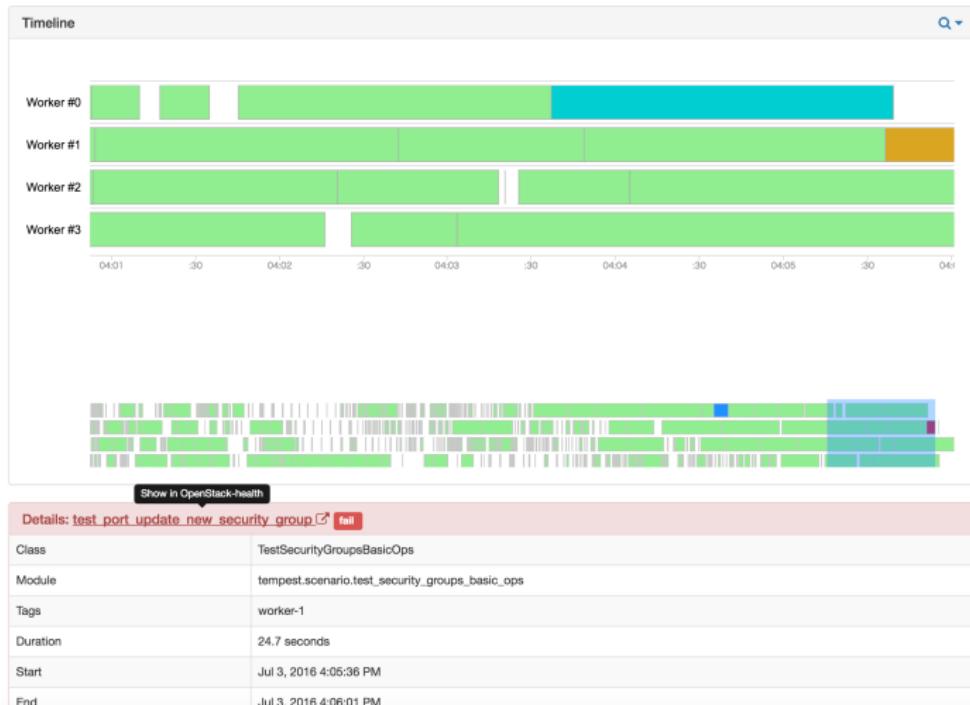
Appendix: StackViz

Visualization tool of individual CI build results

- ▶ git.openstack.org/cgit/openstack/stackviz

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