OpenStack Community Activity Report
October-December, 2014
Report sponsored by the OpenStack Foundation

Bitergia

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Executive Summary

The 2014 summary of OpenStack Community Activity Report[1] shows increasing activities compared to previous year on every metric. The quantity of code being contributed, the developers involved and people interested in deploying OpenStack kept growing at fast pace in 2014.

In the past editions of the Report, the major source of concern with this fast growth has been quality of the code shipped, like the lead time to merge new patches. This year-end report shows that some indicators seem to be improving: hopefully future reports will confirm these positive trends. The indicators around bugs are still under special scrutiny since they're not changing much. The largest teams (Nova and Neutron, among others) introduced a "bug liaison" in the past months, these changes should lead to improved indicators.

Key findings:

Coders community keeps growing

The mean number of developers active in a given month peaked at 569 people during the third quarter (the highest numer in 2013 was 391). The total number of 'Core' contributors[2] increased during 2014 but not as dramatically: the highest number in 2014 was 191 people, reached in third quarter (in 2013 the highest was 161 in fourth quarter). "Regular" contributors[3] went from a max 245 in 2013 to 369 in 2014.

Lead time to merge code is improving

Mean and median time to merge patches decreased for the first time after growing two years in a row. This is a good sign since many contributors have expressed frustration over lengthy waits. The time to wait for reviewers has decreased two quarters in a row (reviewers are getting faster) while original submitters are still much slower to respond to comments.

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[1]This report is produced quarterly to give Community Managers and OpenStack Foundation's management better insights on development activities and online conversations. The quantitative and qualitative assessment start from tracking actions across all OpenStack git repositories, gerrit code reviews, bug trackers as well as IRC channels, mailing lists and questions/answers.

[2]This is the total count of developers responsible for delivering 80% of OpenStack's code

[3]The count of developers responsible for delivering 95% of OpenStack's code

Ask OpenStack gains popularity while mailing lists have plateaued

With around 10,000 emails sent per quarter during 2014, the mailing lists seem to have reached a plateau while Ask OpenStack keeps gaining in popularity. In 2014 there were regularly over 1,500 questions asked per quarter with a corresponding number of answers given. The most frequently asked questions seem to be around OVS and Neutron. The mailing lists saw conversations about Nova automatic evacuation taking a lot of time. This quarter, we saw changes in Nova and Neutron core reviewers, formation of the API Working Group, a first step to foster a new community of consumers of OpenStack API and more changes in Third-Party Working Group.

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Chapter 1

Overview of the Project

The OpenStack Community Activity Report is produced quarterly to give Community Managers and OpenStack Foundation's management better insights on development activities and online conversations. The quantitative and qualitative assessment start from tracking actions across all OpenStack git repositories, gerrit code reviews, bug trackers as well as IRC channels, mailing lists and questions/answers site Ask OpenStack.

The report looks at activities across the OpenStack community during the fourth quarter of 2014, comparing it to previous eight quarters.[1].

The analysis aims at providing a detailed view of how the OpenStack project is evolving with special focus on each of the OpenStack programs[2]. OpenStack Integrated Releases are delivered at the beginning of the second and fourth quarters of each year and cycles of development activity are visible in the report: the first and third quarters of the year are periods of higher activity while during the second and fourth ones show other recognizable patterns of activity in the OpenStack ecosystem.

A more detailed information about the community activity comparing two periods: 2013 and 2014, shows an increase in all of the analyzed data sources. Special focus on the increments in the question and answers tool[3] and in the IRC channels[4].

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[1]The analyzed data sources are available in appendixB

[2]Each of the projects mentioned are following the analysis of the Programs specified at `http://git.openstack.org/cgit/openstack/governance/tree/reference/programs.yaml`. In addition, the hierarchy of projects and their repositories can be found at the correspondent appendixB
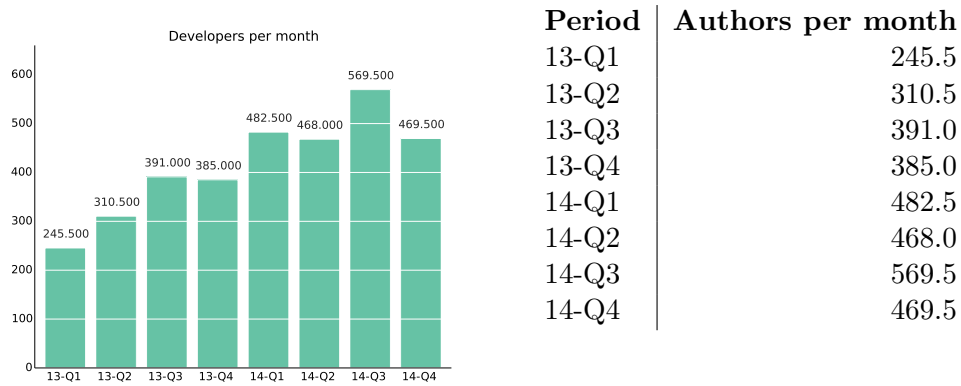
[3]`https://ask.openstack.org`

[4]`http://eavesdrop.openstack.org/irclogs/`

Data source	Activity 365 days	Change (wrt to prev. 365 days)
Gits	53297 commits	38%
Tickets	11911 closed tickets	50%
Mailing Lists	43845 sent emails	37%
Gerrit	57592 submitted reviews	44%
Askbot	5995 posted questions	83%
IRC	1929564 messages	138%

Table 1.1: Activity during the last 365 days and its evolution

Regarding to the community, during the last quarter of 2014 there were 469 developers in mean per month, lower than the third quarter of 2014 (Juno release), but in line with the rest of the year activity and the releases cycle.

Developers per month

Period	Authors per month
13-Q1	245.5
13-Q2	310.5
13-Q3	391.0
13-Q4	385.0
14-Q1	482.5
14-Q2	468.0
14-Q3	569.5
14-Q4	469.5

In addition in order to characterize developers, those are divided into three main sets: core, regular and casual[5].

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[5]Contributing developers are characterized as core, regular and casual depending on their activity in the git repositories. The classification is built by sorting contributors by their total number of commits; we sum the total commits per each individual contributors: the individuals whose commits sum up to 80% of the total number of commits in the quarter are the core contributors in that quarter. The regular contributors are those whose commits sum up to 95% of the total. The others are the casual contributors.
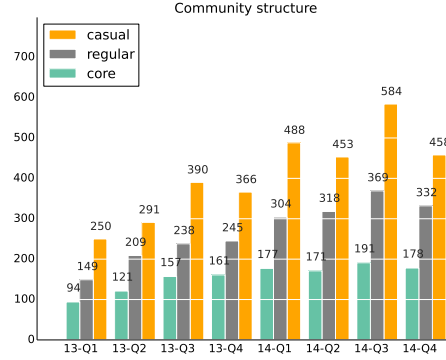
Figure 1.1: Evolution of the last 8 quarters of the core, regular and casual developers (Git activity)

Period	Core	Regular	Occasional
13-Q1	94	149	250
13-Q2	121	209	291
13-Q3	157	238	390
13-Q4	161	245	366
14-Q1	177	304	488
14-Q2	171	318	453
14-Q3	191	369	584
14-Q4	178	332	458

Table 1.2: Characterization of developers by their total contribution to the OpenStack projects

In addition, this report aims to provide some insights about the software development process of the OpenStack community. This report measures efficiency and process of the community based on three metrics. The Review Efficiency Index (REI), the Time to Merge (TTM), and the Backlog Management Index (BMI). REI is measured as the number of closed (merged or abandoned) changesets out of the submitted changesets in a given period. TTM is measured as the time since a review is submitted until this is closed. The BMI is measured as the number of closed tickets out of open tickets in a given period. Typical REI values in the OpenStack Integrated projects is around 0.75, meaning that for 100 opened changesets in a period, the community closed 75. The median TTM is 5.52 days, a decrease from the

previous period.

Integrated project	REI	BMI	TTM
neutron	0.72	0.57	5.83 days
sahara	0.89	0.77	2.1 days
ceilometer	0.81	0.74	3.43 days
horizon	0.62	0.66	3.28 days
heat	0.75	0.72	4.3 days
nova	0.63	0.52	10.81 days
trove	0.73	0.57	10.46 days
swift	0.65	0.5	2.87 days
glance	0.66	0.65	7.65 days
cinder	0.79	0.6	3.74 days
keystone	0.62	0.4	6.35 days

Table 1.3: Closed changesets out of opened changesets (REI), closed ticket out of opened tickets (BMI) and median time to merge in Gerrit (TTM)

Chapter 2

Communication and Support-Related Activities

The OpenStack community uses several channels for communication and support-related activities. Mailing lists were initially the key place for communications, although part of the activity is moving to the questions and answers tool in the Ask OpenStack site.

2.1 Mailing Lists

The following charts show activity in terms of emails sent, people sending emails and people initiating threads per quarter. In addition, two tables are presented with the hot topics in the several analyzed mailing lists. First table shows hot topics ordered by number of total posts in such thread, while the second table shows hot topics ordered by the total number of different participants in the discussions. The two tables are based on the last quarter period of activity.

Emails sent
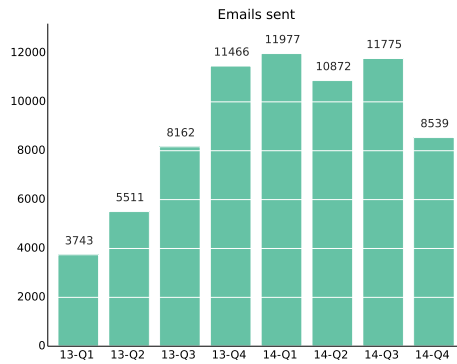
Period	Emails
13-Q1	3743
13-Q2	5511
13-Q3	8162
13-Q4	11466
14-Q1	11977
14-Q2	10872
14-Q3	11775
14-Q4	8539

People sending emails
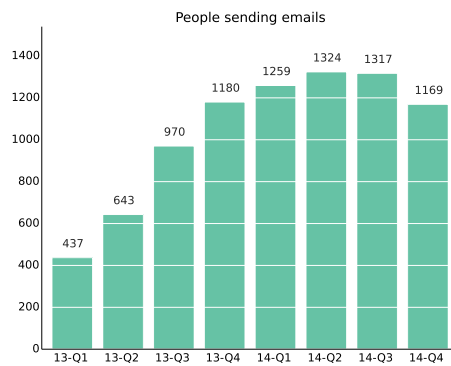
Period	People
13-Q1	437
13-Q2	643
13-Q3	970
13-Q4	1180
14-Q1	1259
14-Q2	1324
14-Q3	1317
14-Q4	1169

People initiating threads
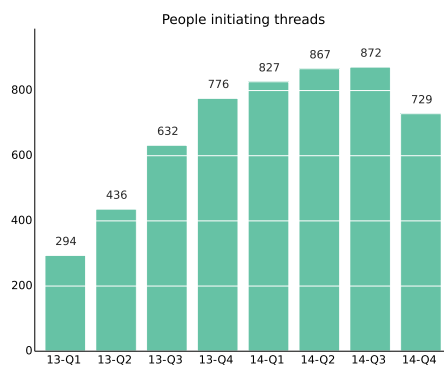
Period	People
13-Q1	294
13-Q2	436
13-Q3	632
13-Q4	776
14-Q1	827
14-Q2	867
14-Q3	872
14-Q4	729

Initial Author and Date	Subject	Number Messages
alawson 2014-10-13	[openstack-dev] [Nova] Automatic evacuate	58
Angus Lees 2014-10-14	[openstack-dev] [kolla] on Dockerfile patterns	49
azemlyanov 2014-11-05	[openstack-dev] [Fuel] fuel master monitoring	41
Doug Hellmann 2014-10-02	[openstack-dev] [all][tc] governance changes for "big tent" model	37
Zane Bitter 2014-11-26	[openstack-dev] [Heat] Convergence proof-of-concept showdown	36
Richard Jones 2014-11-11	[openstack-dev] [Horizon] the future of angularjs development in Horizon	35
Alexis Lee 2014-11-05	[openstack-dev] [Heat] New function: $first_nonnull$	33
Everett Toews 2014-10-08	[openstack-dev] [api] Forming the API Working Group	32
Michael Krotscheck 2014-12-02	[openstack-dev] [Fuel][Nailgun] Web framework	31
Michael Still 2014-12-05	[openstack-dev] [Nova] Spring cleaning nova-core	31

Initial Author and Date	Subject	Diff. People
Anita Kuno 2014-12-04	[openstack-dev] [neutron] Changes to the core team	23
Craig Tracey 2014-11-08	[Openstack-operators] Proposal for an 'Operations' project	17
Sylvain Bauza 2014-10-14	[openstack-dev] [Nova] Automatic evacuate	17
Kevin Benton 2014-12-12	[openstack-dev] [Neutron] Unique-Constraint for name and $tenant_¿dinsecuritygroup$	17
Angus Salkeld 2014-10-17	[openstack-dev] [all] add cyclomatic complexity check to pep8 target	16
vishvananda 2014-12-10	[openstack-dev] [Nova] Spring cleaning nova-core	15
ERROR 2014-11-21	[openstack-dev] [Fuel] fuel master monitoring	15
rbtcollins 2014-11-25	[openstack-dev] [tc][neutron] Proposal to split Neutron into separate repositories	15
nuritv 2014-12-02	[OpenStack-Infra] [openstack-dev] [third-party]Time for Additional Meeting for third-party	14
e.aslan@logicom.com.tr 2014-11-28	[Openstack-operators] Operations project: Packaging	14

2.2 Questions and Answers

The following charts show activity in the Ask OpenStack site. Total number of questions, number of answers, number of comments and people sending

questions are depicted. In addition four tables represent the hot topics activity in the Ask OpenStack site. Those show information about the top visited questions, questions with the highest number of comments, questions with the highest number of different people participating and the tags with the highest number of references.
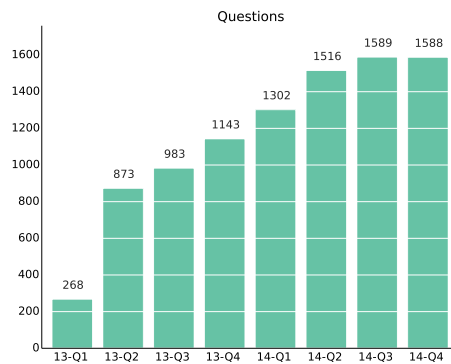
Period	Questions
13-Q1	268
13-Q2	873
13-Q3	983
13-Q4	1143
14-Q1	1302
14-Q2	1516
14-Q3	1589
14-Q4	1588
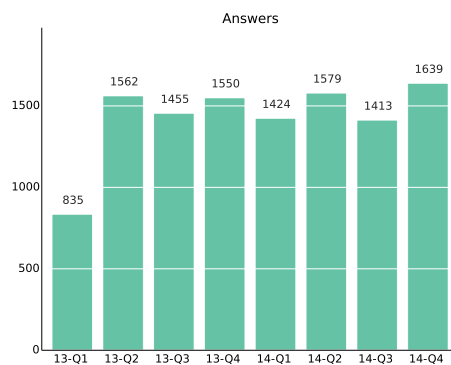
Period	Answers
13-Q1	835
13-Q2	1562
13-Q3	1455
13-Q4	1550
14-Q1	1424
14-Q2	1579
14-Q3	1413
14-Q4	1639

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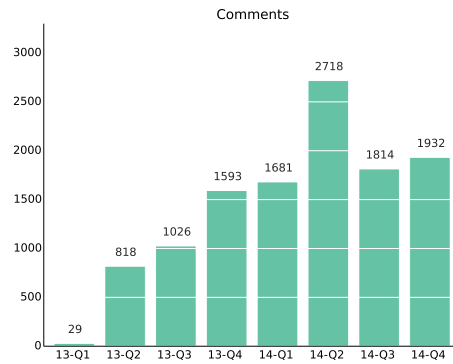
Comments

Period	Comments
13-Q1	29
13-Q2	818
13-Q3	1026
13-Q4	1593
14-Q1	1681
14-Q2	2718
14-Q3	1814
14-Q4	1932

People asking Questions
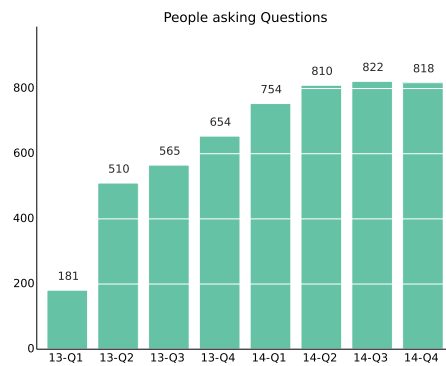
Period	People asking
13-Q1	181
13-Q2	510
13-Q3	565
13-Q4	654
14-Q1	754
14-Q2	810
14-Q3	822
14-Q4	818

- Top visited questions.

Question subject	Visits
nova list error httpconnectionpoolhostcontroller port8774 max+	1027
how to extend the time allowed+	892
mongodbpp error when installing rdo on+	830
authentication failed when setting up two+	700
neutron namespace not getting updated until+	563
rdo installation problem on centos 7+	556
error connectionerror httpconnectionpool- hostopenstack port8774 max retries+	478
rdo deploy openstack error execution of+	420
devstack not starting because of urllib3connectionpool+	402
swift change replication address+	398

- Top questions with more comments.

Question subject	Comments
unable to create a volume in+	5
how to increase the number of+	5
instances dont get an ip address+	5
neutron net create unable to establish+	5
unable to start instances after host+	5
lvmiscsidriver 200 config name lvm driver+	5
neutron server is not running+	5
how to solve openstack instance error+	5
could not find the datastore references+	5
connection timed out when running nova+	5

- Top questions with the highest number of different people participating.

Question subject	People partici- pating
cant create instances status got error+	9
mongodbpp error when installing rdo on+	8
nova list error httpconnectionpoolhostcontroller port8774 max+	7
rdo deploy openstack error execution of+	7
juno error while launching instance+	7
problem with keystone manage db_sync+	6
error in creating instances no valid+	6
whats the difference between flat gre+	6
ceilometer api critical error openstack icehouse+	6
juno glance invalid openstack identity credentials+	6

- Top tags

Tag name	Ocurrences
forum	1588
OpenStack	1588
community	1326
Ask	1321
gerrit	1059
cloud	1002
stackforge	653
iaas	597
branch	356
ovs	344
qemu	110
create	95
neutron	83
unreachable	82
soft-lockup	82

2.3 IRC

Finally, the community of OpenStack uses several IRC channels for asynchronous communication. This section shows information about the total number of messages sent in the community during the last 8 quarters to-

gether with the number of the several people participating in such discussions. In addition, a list with the top participants in the IRC channels is provided.

Messages in IRC channels
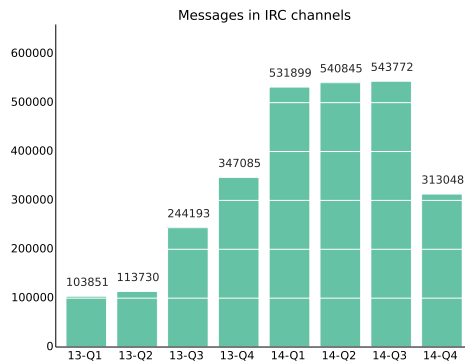
Period	Messages
13-Q1	103851
13-Q2	113730
13-Q3	244193
13-Q4	347085
14-Q1	531899
14-Q2	540845
14-Q3	543772
14-Q4	313048

People in IRC channels
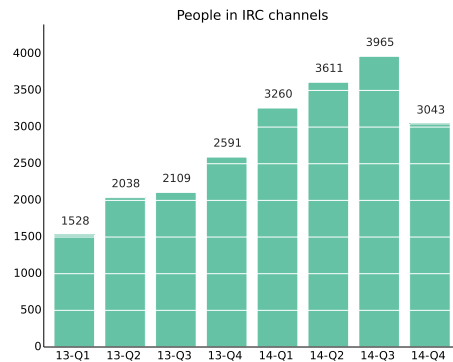
Period	People
13-Q1	1528
13-Q2	2038
13-Q3	2109
13-Q4	2591
14-Q1	3260
14-Q2	3611
14-Q3	3965
14-Q4	3043

IRC id	Messages sent
clarkb	8039
Jeremy Stanley	6674
ayoung	5705
morganfainberg	5598
Anita Kuno	5235
jroll	4060
flaper87	3843
Angus Salkeld	3444
Thierry Carrez	3431
sdake	3408
Devananda	3245
mtreinish	3065
dhellmann	3039
NoBodyCam	2932
Lucas Alvares Gomes	2884

Chapter 3

Details on OpenStack Integrated and Incubated projects

Each breakdown is divided into three sections with information from the last eight quarters:

- activity: centered in the following metrics: commits from git activity, submitted, merge and abandoned reviews from the review system and opened and closed tickets from the issue tracking system.

- community: active core reviewers in gerrit, active authors in git and top ten developers and top ten organizations contributing to the development in the last quarter. of each project.

- process: efficiency closing tickets, efficiency closing changesets, Time to Merge (mean and median), number of patchsets (iterations) per changeset and study on the time waiting for a reviewer or submitter action in the patchset review process.

Details on individual OpenStack programs are provided in separate documents on `git.openstack.org/cgit/openstack-infra/activity-board/tree/reports/2014-q4`.

3.1 Overview of OpenStack Programs

3.2 Activity

Commits in Git, submitted, merged and abandoned reviews in Gerrit and opened and closed issues in Launchpad.

Commits and reviews: OpenStack Software
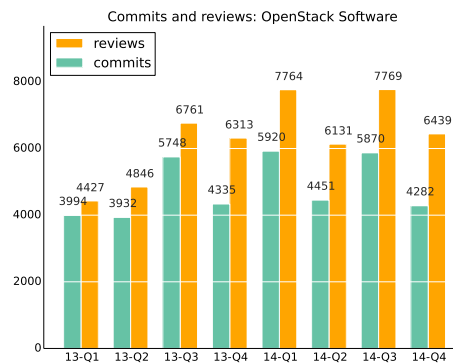
Period	Commits	Reviews
13-Q1	3994	4427
13-Q2	3932	4846
13-Q3	5748	6761
13-Q4	4335	6313
14-Q1	5920	7764
14-Q2	4451	6131
14-Q3	5870	7769
14-Q4	4282	6439

Opened and closed tickets: OpenStack Software
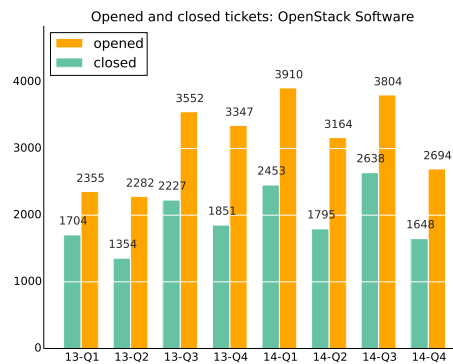
Period	Closed	Opened
13-Q1	1704	2355
13-Q2	1354	2282
13-Q3	2227	3552
13-Q4	1851	3347
14-Q1	2453	3910
14-Q2	1795	3164
14-Q3	2638	3804
14-Q4	1648	2694

Merged and abandoned reviews: OpenStack Software
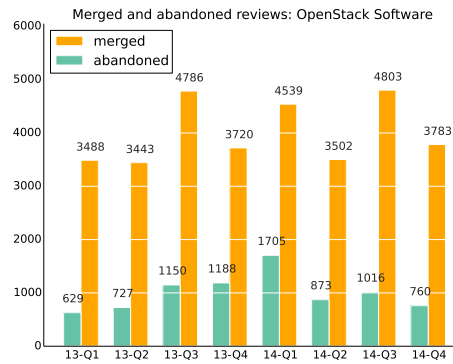
Period	Merged	Abandoned
13-Q1	3488	629
13-Q2	3443	727
13-Q3	4786	1150
13-Q4	3720	1188
14-Q1	4539	1705
14-Q2	3502	873
14-Q3	4803	1016
14-Q4	3783	760

3.3 Community

Active core reviewers in Gerrit, active authors in Git, top authors and organizations in the last quarter

Active Core Reviewers: OpenStack Software
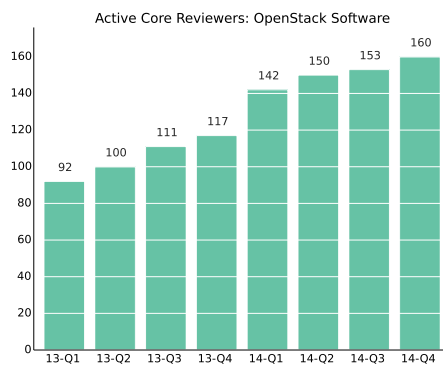
Period	Active Core
13-Q1	92
13-Q2	100
13-Q3	111
13-Q4	117
14-Q1	142
14-Q2	150
14-Q3	153
14-Q4	160

Authors OpenStack Software
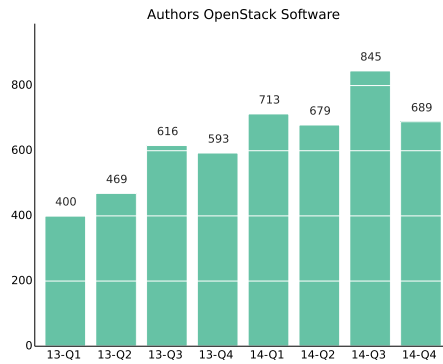
Period	Authors
13-Q1	400
13-Q2	469
13-Q3	616
13-Q4	593
14-Q1	713
14-Q2	679
14-Q3	845
14-Q4	689

Commit (s)	Author
98	Kevin Benton
92	garyk
69	Brant Knudson
67	Russell Bryant
60	Angus Lees
55	Mark McClain
52	Steven Hardy
47	Angus Salkeld
47	Ihar Hrachyshka
46	Daniel P. Berrange

Commit (s)	Organizations
831	Red Hat
634	IBM
474	Mirantis
356	HP
247	Rackspace
133	VMware
118	Huawei
101	NEC
98	Bit Switch Networks
92	Radware

3.4   Process

Efficiency closing changesets and tickets, time to review (mean and median), number of patchests (iterations) per changeset and study on the time waiting for a reviewer or submitter action in the patchset review process.
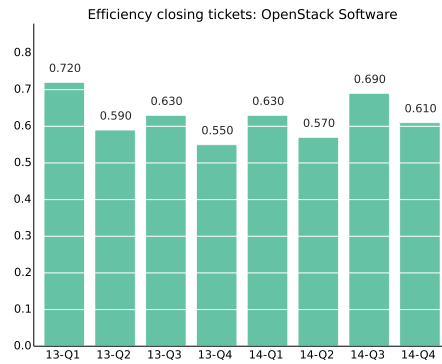
Period	Closed/Opened
13-Q1	0.72
13-Q2	0.59
13-Q3	0.63
13-Q4	0.55
14-Q1	0.63
14-Q2	0.57
14-Q3	0.69
14-Q4	0.61
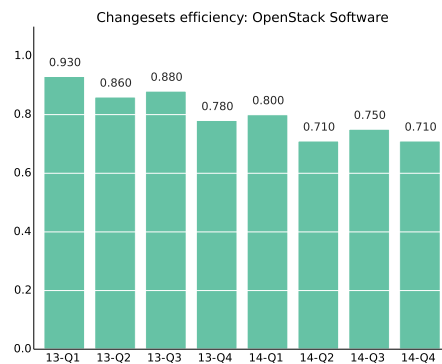
Period	(Aband. and Merg.)/Subm.
13-Q1	0.93
13-Q2	0.86
13-Q3	0.88
13-Q4	0.78
14-Q1	0.8
14-Q2	0.71
14-Q3	0.75
14-Q4	0.71
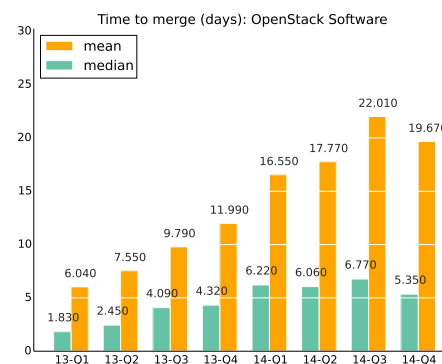
Period	Median	Mean
13-Q1	1.83	6.04
13-Q2	2.45	7.55
13-Q3	4.09	9.79
13-Q4	4.32	11.99
14-Q1	6.22	16.55
14-Q2	6.06	17.77
14-Q3	6.77	22.01
14-Q4	5.35	19.67

Patchsets per Changeset: OpenStack Software
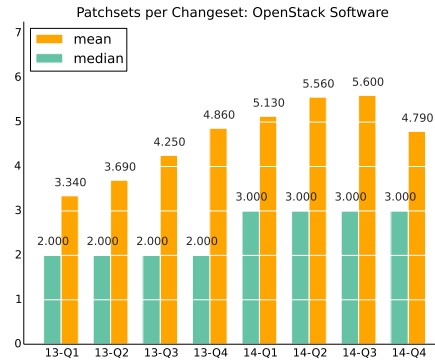
Period	Median	Mean
13-Q1	2.0	3.34
13-Q2	2.0	3.69
13-Q3	2.0	4.25
13-Q4	2.0	4.86
14-Q1	3.0	5.13
14-Q2	3.0	5.56
14-Q3	3.0	5.6
14-Q4	3.0	4.79

Time waiting for the reviewer: OpenStack Software
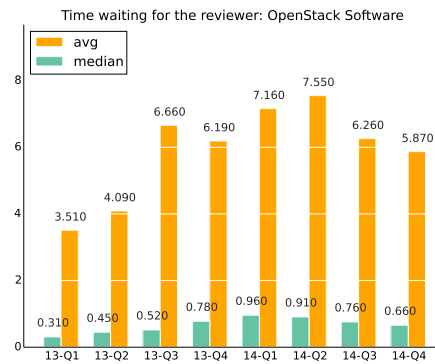
Period	Median	Mean
13-Q1	0.31	3.51
13-Q2	0.45	4.09
13-Q3	0.52	6.66
13-Q4	0.78	6.19
14-Q1	0.96	7.16
14-Q2	0.91	7.55
14-Q3	0.76	6.26
14-Q4	0.66	5.87

Time waiting for the submitter: OpenStack Software
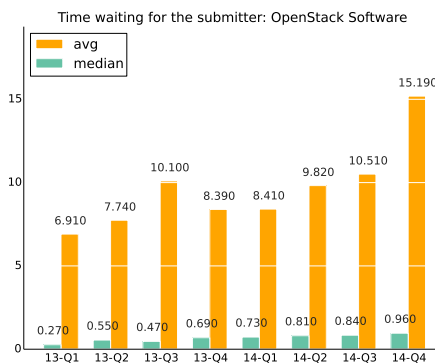
Period	Median	Mean
13-Q1	0.27	6.91
13-Q2	0.55	7.74
13-Q3	0.47	10.1
13-Q4	0.69	8.39
14-Q1	0.73	8.41
14-Q2	0.81	9.82
14-Q3	0.84	10.51
14-Q4	0.96	15.19

3.4.1   OpenStack Integrated Programs

3.5   Activity

Commits in Git, submitted, merged and abandoned reviews in Gerrit and opened and closed issues in Launchpad.

Commits and reviews: integrated
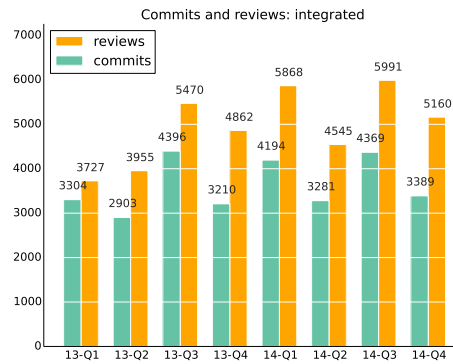
Period	Commits	Reviews
13-Q1	3304	3727
13-Q2	2903	3955
13-Q3	4396	5470
13-Q4	3210	4862
14-Q1	4194	5868
14-Q2	3281	4545
14-Q3	4369	5991
14-Q4	3389	5160

Opened and closed tickets: integrated
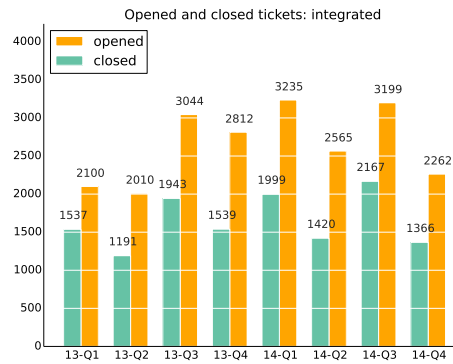
Period	Closed	Opened
13-Q1	1537	2100
13-Q2	1191	2010
13-Q3	1943	3044
13-Q4	1539	2812
14-Q1	1999	3235
14-Q2	1420	2565
14-Q3	2167	3199
14-Q4	1366	2262

Merged and abandoned reviews: integrated
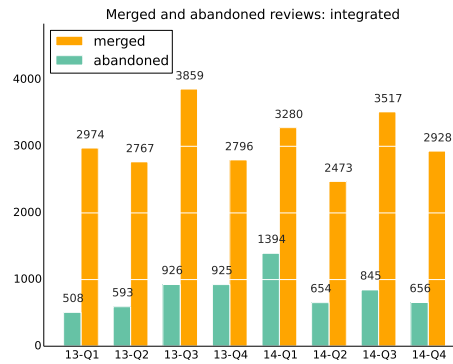
Period	Merged	Abandoned
13-Q1	2974	508
13-Q2	2767	593
13-Q3	3859	926
13-Q4	2796	925
14-Q1	3280	1394
14-Q2	2473	654
14-Q3	3517	845
14-Q4	2928	656

3.6 Community

Active core reviewers in Gerrit, active authors in Git, top authors and organizations in the last quarter

Active Core Reviewers: integrated
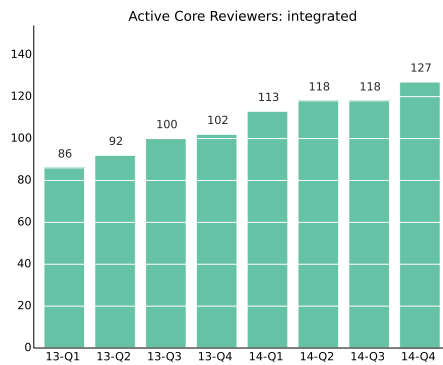
Period	Active Core
13-Q1	86
13-Q2	92
13-Q3	100
13-Q4	102
14-Q1	113
14-Q2	118
14-Q3	118
14-Q4	127

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Authors integrated
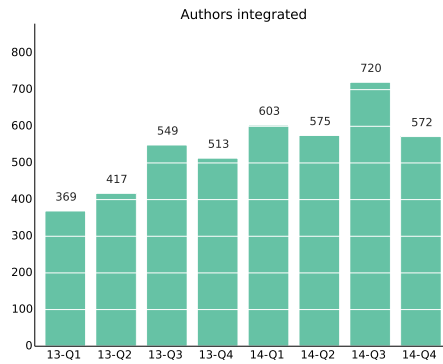
Period	Authors
13-Q1	369
13-Q2	417
13-Q3	549
13-Q4	513
14-Q1	603
14-Q2	575
14-Q3	720
14-Q4	572

Commit (s)	Author
98	Kevin Benton
92	garyk
66	Russell Bryant
60	Angus Lees
55	Mark McClain
49	Brant Knudson
47	Steven Hardy
46	Daniel P. Berrange
46	Ihar Hrachyshka
44	Angus Salkeld

Commit (s)	Organizations
650	Red Hat
592	IBM
333	Mirantis
247	HP
172	Rackspace
131	VMware
105	Huawei
98	Bit Switch Networks
92	Radware
91	NEC

3.7 Process

Efficiency closing changesets and tickets, time to review (mean and median), number of patchests (iterations) per changeset and study on the time waiting for a reviewer or submitter action in the patchset review process.

Efficiency closing tickets: integrated
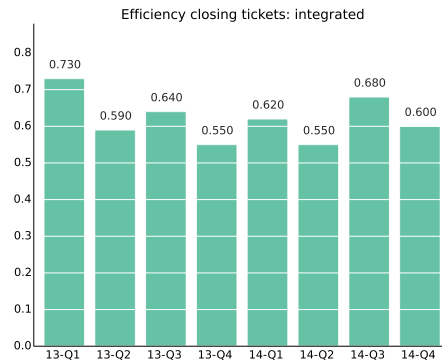
Period	Closed/Opened
13-Q1	0.73
13-Q2	0.59
13-Q3	0.64
13-Q4	0.55
14-Q1	0.62
14-Q2	0.55
14-Q3	0.68
14-Q4	0.6

Changesets efficiency: integrated
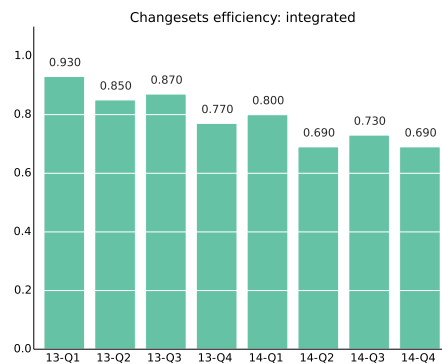
Period	(Aband. and Merg.)/Subm.
13-Q1	0.93
13-Q2	0.85
13-Q3	0.87
13-Q4	0.77
14-Q1	0.8
14-Q2	0.69
14-Q3	0.73
14-Q4	0.69

Time to merge (days): integrated
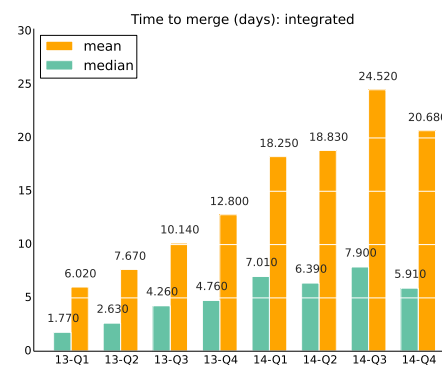
Period	Median	Mean
13-Q1	1.77	6.02
13-Q2	2.63	7.67
13-Q3	4.26	10.14
13-Q4	4.76	12.8
14-Q1	7.01	18.25
14-Q2	6.39	18.83
14-Q3	7.9	24.52
14-Q4	5.91	20.68

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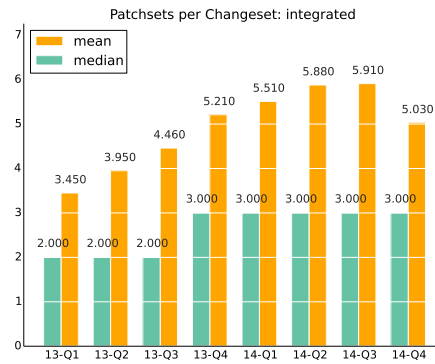
Period	Median	Mean
13-Q1	2.0	3.45
13-Q2	2.0	3.95
13-Q3	2.0	4.46
13-Q4	3.0	5.21
14-Q1	3.0	5.51
14-Q2	3.0	5.88
14-Q3	3.0	5.91
14-Q4	3.0	5.03
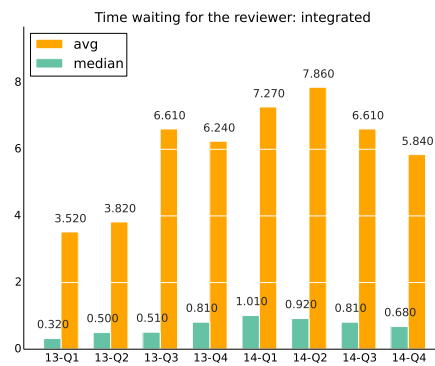
Period	Median	Mean
13-Q1	0.32	3.52
13-Q2	0.5	3.82
13-Q3	0.51	6.61
13-Q4	0.81	6.24
14-Q1	1.01	7.27
14-Q2	0.92	7.86
14-Q3	0.81	6.61
14-Q4	0.68	5.84
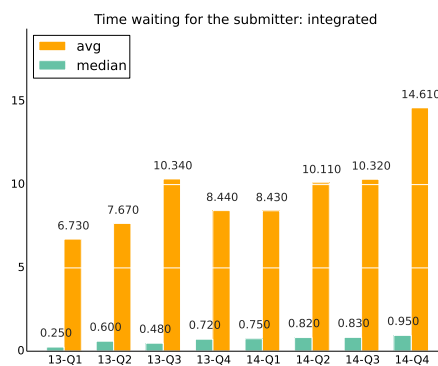
Period	Median	Mean
13-Q1	0.25	6.73
13-Q2	0.6	7.67
13-Q3	0.48	10.34
13-Q4	0.72	8.44
14-Q1	0.75	8.43
14-Q2	0.82	10.11
14-Q3	0.83	10.32
14-Q4	0.95	14.61

3.7.1 OpenStack Incubated Programs

3.8 Activity

Commits in Git, submitted, merged and abandoned reviews in Gerrit and opened and closed issues in Launchpad.

Commits and reviews: incubated
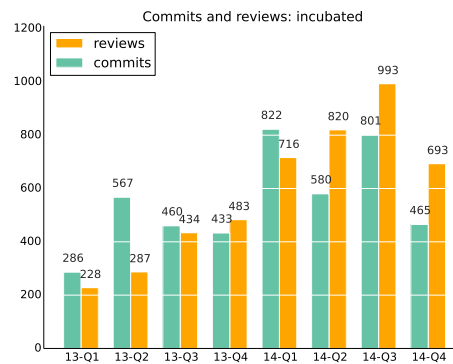
Period	Commits	Reviews
13-Q1	286	228
13-Q2	567	287
13-Q3	460	434
13-Q4	433	483
14-Q1	822	716
14-Q2	580	820
14-Q3	801	993
14-Q4	465	693

Opened and closed tickets: incubated
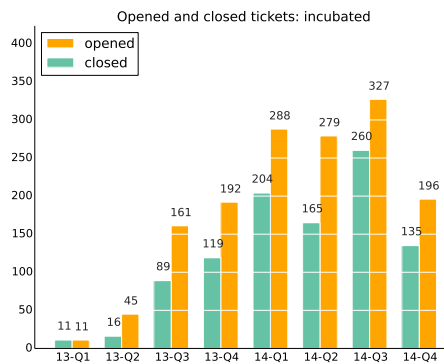
Period	Closed	Opened
13-Q1	11	11
13-Q2	16	45
13-Q3	89	161
13-Q4	119	192
14-Q1	204	288
14-Q2	165	279
14-Q3	260	327
14-Q4	135	196

Merged and abandoned reviews: incubated
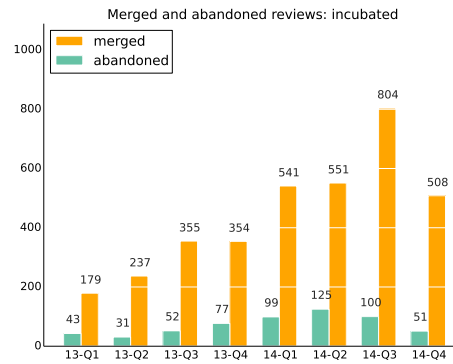
Period	Merged	Abandoned
13-Q1	179	43
13-Q2	237	31
13-Q3	355	52
13-Q4	354	77
14-Q1	541	99
14-Q2	551	125
14-Q3	804	100
14-Q4	508	51

3.9 Community

Active core reviewers in Gerrit, active authors in Git, top authors and organizations in the last quarter

Active Core Reviewers: incubated
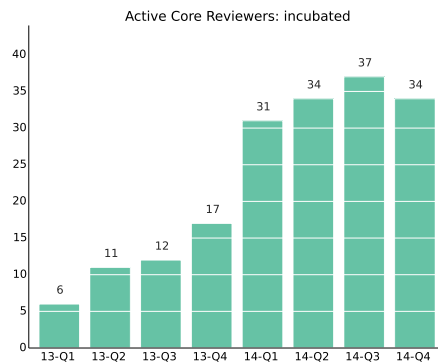
Period	Active Core
13-Q1	6
13-Q2	11
13-Q3	12
13-Q4	17
14-Q1	31
14-Q2	34
14-Q3	37
14-Q4	34

Authors incubated
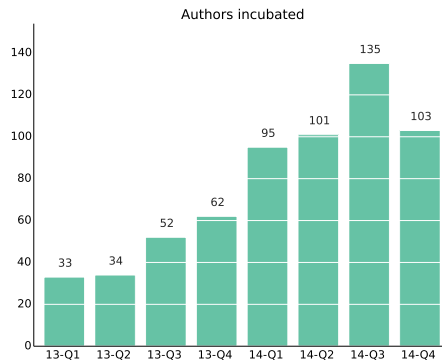
Period	Authors
13-Q1	33
13-Q2	34
13-Q3	52
13-Q4	62
14-Q1	95
14-Q2	101
14-Q3	135
14-Q4	103

Commit (s)	Author	Commit (s)	Organizations
33	Valeriy Ponomaryov	76	Mirantis
32	Kiall Mac Innes	68	HP
26	Flavio Percoco	67	Rackspace
19	Andreas Jaeger	32	Red Hat
19	Jim Rollenhagen	19	SUSE
18	Lucas Alvares Gomes	14	OpenStack Foundation
17	Lei Zhang	12	Ericsson
14	Vladyslav Drok	12	JPBerlin
12	John Vrbanac	10	Yahoo!
12	Juan Antonio Osorio Robles8		eBay

3.10   Process

Efficiency closing changesets and tickets, time to review (mean and median),
number of patchests (iterations) per changeset and study on the time waiting
for a reviewer or submitter action in the patchset review process.

Bitergia

Time to merge (days): incubated
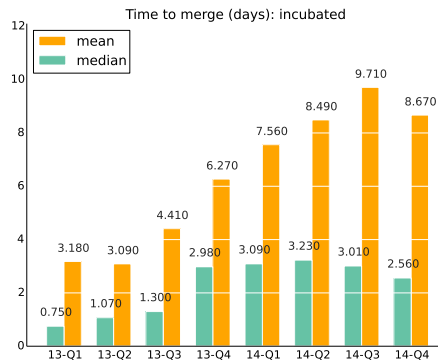
Period	Median	Mean
13-Q1	0.75	3.18
13-Q2	1.07	3.09
13-Q3	1.3	4.41
13-Q4	2.98	6.27
14-Q1	3.09	7.56
14-Q2	3.23	8.49
14-Q3	3.01	9.71
14-Q4	2.56	8.67

Efficiency closing tickets: incubated
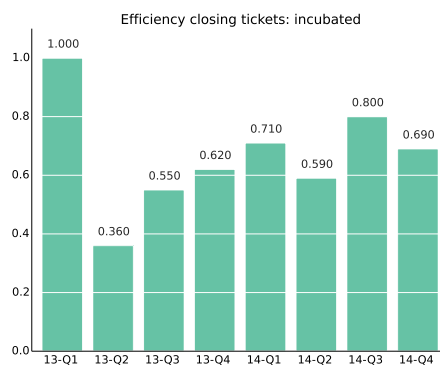
Period	Closed/Opened
13-Q1	1.0
13-Q2	0.36
13-Q3	0.55
13-Q4	0.62
14-Q1	0.71
14-Q2	0.59
14-Q3	0.8
14-Q4	0.69

Changesets efficiency: incubated
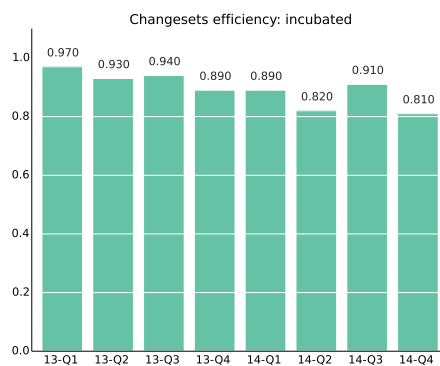
Period	(Aband. and Merg.)/Subm.
13-Q1	0.97
13-Q2	0.93
13-Q3	0.94
13-Q4	0.89
14-Q1	0.89
14-Q2	0.82
14-Q3	0.91
14-Q4	0.81

Patchsets per Changeset: incubated
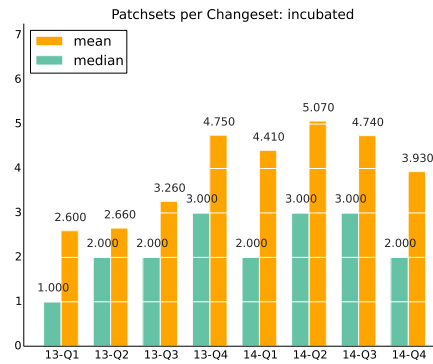
Period	Median	Mean
13-Q1	1.0	2.6
13-Q2	2.0	2.66
13-Q3	2.0	3.26
13-Q4	3.0	4.75
14-Q1	2.0	4.41
14-Q2	3.0	5.07
14-Q3	3.0	4.74
14-Q4	2.0	3.93

Time waiting for the reviewer: incubated
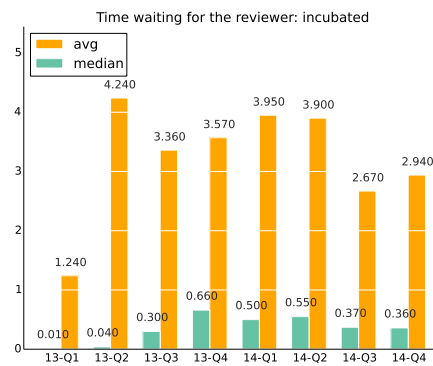
Period	Median	Mean
13-Q1	0.01	1.24
13-Q2	0.04	4.24
13-Q3	0.3	3.36
13-Q4	0.66	3.57
14-Q1	0.5	3.95
14-Q2	0.55	3.9
14-Q3	0.37	2.67
14-Q4	0.36	2.94

Time waiting for the submitter: incubated
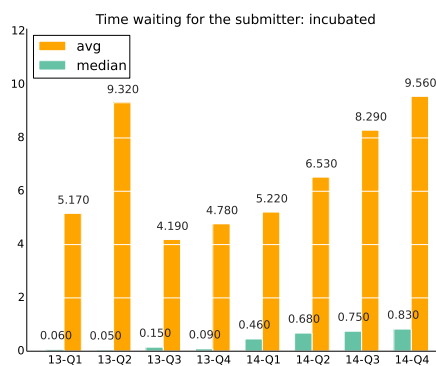
Period	Median	Mean
13-Q1	0.06	5.17
13-Q2	0.05	9.32
13-Q3	0.15	4.19
13-Q4	0.09	4.78
14-Q1	0.46	5.22
14-Q2	0.68	6.53
14-Q3	0.75	8.29
14-Q4	0.83	9.56

Appendix A

Metrics Definitions

Metrics measured in each OpenStack program:

- Commit: this is defined as the action(s) that performes a change in the source code. Bots, merges and other type of automatic activity is removed from the records. In addition, when aggregating several git repositories, this metric only counts unique revisions (unique hashes found in the git repositories). Finally, all branches are aggregated to the analysis.

- Submitted changeset: a changeset is the process of peer reviewing source code changes. A commit is not merged to the master code of a given project till this is approved for at least one core reviewer of such project. A submitted changeset is defined as any changeset submitted to the Gerrit system. However, given the limitations of the current version of the tool, with at least 5,900 changesets detected as having an erroneous creation date, this metric counts the first patchset upload action.

- Merged and abandoned changsets: a merge is defined as the patchset that was finally submitted to the source code. An abandoned changeset is a potential merge that was finally dismissed by developers as being part of the source code. This status is found in the status of the final patchset. However, although a patchset can be merged or abandoned, this action can be reverted. If a patchset presents several of these changes in the same period of time, only one of them is counted (the very last one). On the other hand, if those changes take place in different periods of analysis, both status would be counted.

- Open and closed ticket: a ticket in Launchpad is counted as closed if the status of such ticket is defined as 'Fix Released'. The rest of the tickets are counted as opened tickets.

- Active Core Reviewer: a core reviewer has the possibility to use +2 or -2 actions when reviewing the code. However, if there are developers that for some period do not use those actions, those can not be measured as core reviewer. Thus, this metric provides information about 'active' core reviewers. This can be also defined as those developers that actively have used the +2 or -2 review action. This metric is also filtered by branch of activity, only using 'master'. This helps to detect actual core reviewers in each of the projects.

- Authors: a developer is defined as author if she is the owner of the patchset sent for reviewing and this is merged into the source code. As previously indicated, automatic commits such bot's are removed from this analysis.

- Efficiency closing issues: this metric is a derivation of the Backlog Management Index (BMI) that measures the number of closed tickets out of the opened tickets in a period of time. Values under 1.0 indicates that the number of closing issues is lower than the number of opened issues arriving. On the contrary, higher charts would indicate better maintenance effort by the community.

- Efficiency closing changesets: this metric is a derivation of the Backlog Management Index as it is named as Review efficiency index (REI). As similarly used in the BMI index, this metrics measures the number of closed changesets (merged or abandoned) out of the total number of new changesets.

- Time to Merge: this time consists of the time between the first upload of the first patchset (as defined as a submitted changeset) till the last patchset of the changeset is merged into the code and this is indicated in the comments side of the Gerrit tool. This metric is provided in number of days.

- Patchsets per changeset: this metric calculates the total number of iterations in a changeset till this is abandoned or merged.

- Time waiting for the reviewer or the submitter: a changeset is waiting for a reviewer action if a new patchset upload or a new changset arrives

to the system. On the other hand, a submitter action is required when a specific negative verification or reviewing action takes place (Verified -1/-2 or Code-Review -1/-2). In addition, when a Code-Review +2 action takes place, it is assumed that the changset is closing and no more times are registered either for the reviewer or the submitter. For this analysis, those patchsets flagged as work in progress are ignored.

Metrics measured in the general overview:

- Community structure, core, regular and casual developers: developers are ordered in descendant order by the number of commits authored for a given period. Core developers are defined as the list of developers that reach 80% of the total commits. Regular is the set of developers that are between that 80% and 95% of the commits. Casual developers are found in the rest of the 5%. Bots are ignored in this list of developers.

- Developer per month: average of developers per month ignoring bots.

- Emails sent: number of emails sent by people to the several mailing lists. Bots are not registered.

- People sending emails: number of people sending those emails ignoring bots.

- People initiating threads: a thread is defined as a list of emails that has the same root. There may exist threads of one email.

- Top threads: this list provides the longest threads in terms of number of emails that have a common root email.

- Questions, answers and comments in Askbot.

- People asking questions in Askbot: number of people sending a new question.

- Top visited questions.

- Top tags: each of the questions has a list of associated tags. The top tags are those with the highest number of repetitions aggregating all of the questions.

- Messages and people in IRC: this analysis ignores as a message those entries in the IRC channels that provide information about people entering or leaving the system.

Appendix B

Source Code and Data Sources

The data source used to provide the data of this analysis can be found at the GrimoireLib library. Specifically the openstack_report.py file[1].

With respect to the list of analyzed repositories per project, the following table lists all of them. There are three data sources: git activity (scm), tickets activity (its) and review activity (scr). This information is based on the information listed in the yaml organizational file[2] provided by the OpenStack Foundation.

Program	Data source	Repository
barbican	its	https://bugs.launchpad.net/barbican
barbican	scm	git://git.openstack.org/openstack/barbican
barbican	scm	git://git.openstack.org/openstack/castellan
barbican	scm	git://git.openstack.org/openstack/kite
barbican	scr	review.openstack.org_openstack/barbican
barbican	scr	review.openstack.org_openstack/castellan
barbican	scr	review.openstack.org_openstack/kite
ceilometer	its	https://bugs.launchpad.net/ceilometer
ceilometer	scm	https://github.com/openstack/ceilometer.git
ceilometer	scr	review.openstack.org_openstack/ceilometer
cinder	its	https://bugs.launchpad.net/cinder

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[1]`https://github.com/VizGrimoire/GrimoireLib/blob/master/vizGrimoireJS/openstack_report.py`. Commit identified with the hash *60230d0fe8b4628e091736f902a9e230506a6297*

[2]`http://git.openstack.org/cgit/openstack/governance/tree/reference/programs.yaml`

cinder	scm	https://github.com/openstack/cinder.git
cinder	scr	review.openstack.org_openstack/cinder
clients	its	https://bugs.launchpad.net/python-ceilometerclient
clients	its	https://bugs.launchpad.net/python-cinderclient
clients	its	https://bugs.launchpad.net/python-designateclient
clients	its	https://bugs.launchpad.net/python-glanceclient
clients	its	https://bugs.launchpad.net/python-heatclient
clients	its	https://bugs.launchpad.net/python-keystoneclient
clients	its	https://bugs.launchpad.net/python-neutronclient
clients	its	https://bugs.launchpad.net/python-novaclient
clients	its	https://bugs.launchpad.net/python-saharaclient
clients	its	https://bugs.launchpad.net/python-swiftclient
clients	its	https://bugs.launchpad.net/python-zaqarclient
clients	scm	git://git.openstack.org/openstack-dev/heat-cfnclient
clients	scm	git://git.openstack.org/openstack/python-kiteclient
clients	scm	git://git.openstack.org/openstack/python-saharaclient
clients	scm	git://git.openstack.org/openstack/python-zaqarclient
clients	scm	https://github.com/openstack/python-ceilometerclient.git
clients	scm	https://github.com/openstack/python-cinderclient.git
clients	scm	https://github.com/openstack/python-glanceclient.git
clients	scm	https://github.com/openstack/python-heatclient.git
clients	scm	https://github.com/openstack/python-ironicclient.git
clients	scm	https://github.com/openstack/python-keystoneclient.git
clients	scm	https://github.com/openstack/python-neutronclient.git
clients	scm	https://github.com/openstack/python-novaclient.git
clients	scm	https://github.com/openstack/python-swiftclient.git
clients	scm	https://github.com/openstack/python-troveclient.git
clients	scr	review.openstack.org_openstack/python-ceilometerclient
clients	scr	review.openstack.org_openstack/python-cinderclient
clients	scr	review.openstack.org_openstack/python-glanceclient
clients	scr	review.openstack.org_openstack/python-heatclient
clients	scr	review.openstack.org_openstack/python-ironicclient
clients	scr	review.openstack.org_openstack/python-keystoneclient
clients	scr	review.openstack.org_openstack/python-kiteclient
clients	scr	review.openstack.org_openstack/python-neutronclient
clients	scr	review.openstack.org_openstack/python-novaclient
clients	scr	review.openstack.org_openstack/python-saharaclient
clients	scr	review.openstack.org_openstack/python-swiftclient
clients	scr	review.openstack.org_openstack/python-troveclient
clients	scr	review.openstack.org_openstack/python-zaqarclient

clients	scr	review.openstack.org_stackforge/python-designateclient
Common Libraries	its	https://bugs.launchpad.net/hacking
Common Libraries	its	https://bugs.launchpad.net/oslo.messaging
Common Libraries	its	https://bugs.launchpad.net/pbr
Common Libraries	its	https://bugs.launchpad.net/taskflow
Common Libraries	scm	git://git.openstack.org/openstack-dev/oslo-cookiecutter
Common Libraries	scm	git://git.openstack.org/openstack/oslo.concurrency
Common Libraries	scm	git://git.openstack.org/openstack/oslo.context
Common Libraries	scm	git://git.openstack.org/openstack/oslo.db
Common Libraries	scm	git://git.openstack.org/openstack/oslo.i18n
Common Libraries	scm	git://git.openstack.org/openstack/oslo.rootwrap
Common Libraries	scm	git://git.openstack.org/openstack/oslo.vmware
Common Libraries	scm	git://git.openstack.org/openstack/oslosphinx
Common Libraries	scm	git://git.openstack.org/openstack/pycadf
Common Libraries	scm	git://git.openstack.org/openstack/stevedore
Common Libraries	scm	git://git.openstack.org/openstack/taskflow
Common Libraries	scm	git://git.openstack.org/openstack/tooz
Common Libraries	scm	https://github.com/openstack/oslo-incubator.git
Common Libraries	scm	https://github.com/openstack/oslo.config.git
Common Libraries	scm	https://github.com/openstack/oslo.messaging.git
Common Libraries	scm	https://github.com/openstack/oslo.version.git
Common Libraries	scr	review.openstack.org_openstack-dev/hacking
Common Libraries	scr	review.openstack.org_openstack-dev/pbr
Common Libraries	scr	review.openstack.org_openstack/oslo-incubator
Common Libraries	scr	review.openstack.org_openstack/oslo.concurrency
Common Libraries	scr	review.openstack.org_openstack/oslo.config
Common Libraries	scr	review.openstack.org_openstack/oslo.context
Common Libraries	scr	review.openstack.org_openstack/oslo.db
Common Libraries	scr	review.openstack.org_openstack/oslo.i18n
Common Libraries	scr	review.openstack.org_openstack/tooz
Deployment	its	https://bugs.launchpad.net/python-tuskarclient
Deployment	its	https://bugs.launchpad.net/tuskar
Deployment	scm	git://git.openstack.org/openstack/os-apply-config
Deployment	scm	git://git.openstack.org/openstack/os-cloud-config
Deployment	scm	git://git.openstack.org/openstack/os-collect-config
Deployment	scm	git://git.openstack.org/openstack/os-refresh-config
Deployment	scm	git://git.openstack.org/openstack/python-tuskarclient
Deployment	scm	git://git.openstack.org/openstack/tripleo-puppet-elements
Deployment	scm	git://git.openstack.org/openstack/tuskar
Deployment	scm	https://github.com/openstack/tripleo-heat-templates.git

Deployment	scm	https://github.com/openstack/tripleo-image-elements.git
Deployment	scm	https://github.com/openstack/tripleo-incubator.git
Deployment	scr	review.openstack.org_openstack/diskimage-builder
Deployment	scr	review.openstack.org_openstack/os-apply-config
Deployment	scr	review.openstack.org_openstack/os-cloud-config
Deployment	scr	review.openstack.org_openstack/os-collect-config
Deployment	scr	review.openstack.org_openstack/os-refresh-config
Deployment	scr	review.openstack.org_openstack/python-tuskarclient
Deployment	scr	review.openstack.org_openstack/tripleo-heat-templates
Deployment	scr	review.openstack.org_openstack/tripleo-image-elements
Deployment	scr	review.openstack.org_openstack/tripleo-incubator
Deployment	scr	review.openstack.org_openstack/tripleo-puppet-elements
Deployment	scr	review.openstack.org_openstack/tuskar
designate	its	https://bugs.launchpad.net/designate
designate	scm	git://git.openstack.org/openstack/designate
designate	scr	review.openstack.org_openstack/designate
Documentation	its	https://bugs.launchpad.net/openstack-api-site
Documentation	its	https://bugs.launchpad.net/openstack-manuals
Documentation	scm	git://git.openstack.org/openstack/ha-guide
Documentation	scm	git://git.openstack.org/openstack/openstack-doc-tools
Documentation	scm	git://git.openstack.org/openstack/operations-guide
Documentation	scm	git://git.openstack.org/openstack/security-doc
Documentation	scm	git://git.openstack.org/openstack/training-guides
Documentation	scm	https://github.com/openstack/api-site.git
Documentation	scm	https://github.com/openstack/compute-api.git
Documentation	scm	https://github.com/openstack/identity-api.git
Documentation	scm	https://github.com/openstack/image-api.git
Documentation	scm	https://github.com/openstack/netconn-api.git
Documentation	scm	https://github.com/openstack/object-api.git
Documentation	scm	https://github.com/openstack/openstack-manuals.git
Documentation	scm	https://github.com/openstack/volume-api.git
Documentation	scr	review.openstack.org_openstack/api-site
Documentation	scr	review.openstack.org_openstack/compute-api
Documentation	scr	review.openstack.org_openstack/ha-guide
Documentation	scr	review.openstack.org_openstack/identity-api
Documentation	scr	review.openstack.org_openstack/image-api
Documentation	scr	review.openstack.org_openstack/netconn-api
Documentation	scr	review.openstack.org_openstack/object-api
Documentation	scr	review.openstack.org_openstack/openstack-doc-tools
Documentation	scr	review.openstack.org_openstack/openstack-manuals

Documentation	scr	review.openstack.org_openstack/operations-guide
Documentation	scr	review.openstack.org_openstack/security-doc
Documentation	scr	review.openstack.org_openstack/training-guides
Documentation	scr	review.openstack.org_openstack/volume-api
glance	its	https://bugs.launchpad.net/glance
glance	scm	git://git.openstack.org/openstack/glance_store
glance	scm	https://github.com/openstack/glance.git
glance	scr	review.openstack.org_openstack/glance
glance	scr	review.openstack.org_openstack/glance_store
heat	its	https://bugs.launchpad.net/heat
heat	scm	git://git.openstack.org/openstack/heat-translator
heat	scm	https://github.com/openstack/heat.git
heat	scr	review.openstack.org_openstack/heat
heat	scr	review.openstack.org_openstack/heat-translator
horizon	its	https://bugs.launchpad.net/horizon
horizon	scm	https://github.com/openstack/horizon.git
horizon	scr	review.openstack.org_openstack/horizon
Infrastructure	its	https://bugs.launchpad.net/openstack-ci
Infrastructure	scm	git://git.openstack.org/openstack-dev/openstack-nose
Infrastructure	scm	git://git.openstack.org/openstack-infra/activity-board
Infrastructure	scm	git://git.openstack.org/openstack-infra/elastic-recheck
Infrastructure	scm	git://git.openstack.org/openstack-infra/groups
Infrastructure	scm	git://git.openstack.org/openstack-infra/irc-meetings
Infrastructure	scm	git://git.openstack.org/openstack-infra/nodepool
Infrastructure	scm	git://git.openstack.org/openstack-infra/odsreg
Infrastructure	scm	git://git.openstack.org/openstack-infra/os-loganalyze
Infrastructure	scm	git://git.openstack.org/openstack-infra/project-config
Infrastructure	scm	git://git.openstack.org/openstack-infra/storyboard
Infrastructure	scm	git://git.openstack.org/openstack-infra/storyboard-webclient
Infrastructure	scm	git://git.openstack.org/openstack-infra/subunit2sql
Infrastructure	scm	git://git.openstack.org/openstack-infra/tripleo-ci
Infrastructure	scm	git://git.openstack.org/openstack-infra/zuul-packaging
Infrastructure	scm	https://github.com/openstack-infra/askbot-theme.git
Infrastructure	scm	https://github.com/openstack-infra/config.git
Infrastructure	scm	https://github.com/openstack-infra/devstack-gate.git
Infrastructure	scm	https://github.com/openstack-infra/gear.git
Infrastructure	scm	https://github.com/openstack-infra/gearman-plugin.git
Infrastructure	scm	https://github.com/openstack-infra/gerritbot.git
Infrastructure	scm	https://github.com/openstack-infra/gerritlib.git

Infrastructure	scm	https://github.com/openstack-infra/git-review.git
Infrastructure	scm	https://github.com/openstack-infra/jeepyb.git
Infrastructure	scm	https://github.com/openstack-infra/jenkins-job-builder.git
Infrastructure	scm	https://github.com/openstack-infra/nose-html-output.git
Infrastructure	scm	https://github.com/openstack-infra/releasestatus.git
Infrastructure	scm	https://github.com/openstack-infra/reviewday.git
Infrastructure	scm	https://github.com/openstack-infra/statusbot.git
Infrastructure	scm	https://github.com/openstack-infra/zmq-event-publisher.git
Infrastructure	scm	https://github.com/openstack-infra/zuul.git
Infrastructure	scm	https://github.com/openstack/openstack-planet.git
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Infrastructure	scr	review.openstack.org_openstack-infra/config
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Infrastructure	scr	review.openstack.org_openstack-infra/puppet-apparmor
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Infrastructure	scr	review.openstack.org_openstack-infra/reviewday
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Infrastructure	scr	review.openstack.org_openstack-infra/subunit2sql
Infrastructure	scr	review.openstack.org_openstack-infra/zmq-event-publisher

Infrastructure	scr	review.openstack.org_openstack-infra/zuul
Infrastructure	scr	review.openstack.org_openstack/openstack-planet
ironic	its	https://bugs.launchpad.net/ironic
ironic	scm	git://git.openstack.org/openstack/ironic-python-agent
ironic	scm	https://github.com/openstack/ironic.git
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ironic	scr	review.openstack.org_openstack/ironic-python-agent
keystone	its	https://bugs.launchpad.net/keystone
keystone	scm	git://git.openstack.org/openstack/keystonemiddleware
keystone	scm	git://git.openstack.org/openstack/keystonemiddleware
keystone	scm	git://git.openstack.org/openstack/python-keystoneclient-federation
keystone	scm	git://git.openstack.org/openstack/python-keystoneclient-kerberos
keystone	scm	https://github.com/openstack/keystone.git
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keystone	scr	review.openstack.org_openstack/python-keystoneclient-kerberos
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neutron	its	https://bugs.launchpad.net/neutron
neutron	scm	git://git.openstack.org/openstack/neutron-fwaas
neutron	scm	git://git.openstack.org/openstack/neutron-lbaas
neutron	scm	git://git.openstack.org/openstack/neutron-vpnaas
neutron	scm	https://github.com/openstack/neutron.git
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neutron	scr	review.openstack.org_openstack/neutron-lbaas
neutron	scr	review.openstack.org_openstack/neutron-vpnaas
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nova	scm	https://github.com/openstack/nova.git
nova	scr	review.openstack.org_openstack/nova
others	its	https://bugs.launchpad.net/django-openstack-auth
others	its	https://bugs.launchpad.net/heat-cfntools
others	its	https://bugs.launchpad.net/heat-templates
others	its	https://bugs.launchpad.net/swift-bench

others	its	https://bugs.launchpad.net/tuskar-ui
others	scm	git://git.openstack.org/openstack/django_openstack_auth
others	scm	git://git.openstack.org/openstack/heat-cfntools
others	scm	git://git.openstack.org/openstack/sahara-dashboard
others	scm	git://git.openstack.org/openstack/sahara-extra
others	scm	git://git.openstack.org/openstack/sahara-image-elements
others	scm	git://git.openstack.org/openstack/swift-bench
others	scm	git://git.openstack.org/openstack/trove-integration
others	scm	git://git.openstack.org/openstack/tuskar-ui
others	scr	review.openstack.org_openstack/heat-cfntools
others	scr	review.openstack.org_openstack/heat-templates
others	scr	review.openstack.org_openstack/sahara-dashboard
others	scr	review.openstack.org_openstack/sahara-extra
others	scr	review.openstack.org_openstack/sahara-image-elements
others	scr	review.openstack.org_openstack/trove-integration
Quality Assurance	its	https://bugs.launchpad.net/devstack
Quality Assurance	its	https://bugs.launchpad.net/tempest
Quality Assurance	scm	git://git.openstack.org/openstack-dev/devstack
Quality Assurance	scm	git://git.openstack.org/openstack-dev/grenade
Quality Assurance	scm	git://git.openstack.org/openstack/tempest-lib
Quality Assurance	scm	https://github.com/openstack/tempest.git
Quality Assurance	scr	review.openstack.org_openstack-dev/devstack
Quality Assurance	scr	review.openstack.org_openstack-dev/grenade
Quality Assurance	scr	review.openstack.org_openstack/tempest
Quality Assurance	scr	review.openstack.org_openstack/tempest-lib
Release cycle management	scm	git://git.openstack.org/openstack-infra/release-tools
Release cycle management	scm	git://git.openstack.org/openstack/requirements
Release cycle management	scr	review.openstack.org_openstack/requirements
sahara	its	https://bugs.launchpad.net/sahara
sahara	scm	git://git.openstack.org/openstack/sahara
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swift	its	https://bugs.launchpad.net/swift
swift	scm	https://github.com/openstack/swift.git
swift	scr	review.openstack.org_openstack/swift
trove	its	https://bugs.launchpad.net/trove
trove	scm	https://github.com/openstack/trove.git
trove	scr	review.openstack.org_openstack/trove

zaqar	its	https://bugs.launchpad.net/zaqar
zaqar	scm	git://git.openstack.org/openstack/zaqar
zaqar	scr	review.openstack.org_openstack/zaqar