

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



December 30, 2014

AUTHOR Daniel Izquierdo Cortázar
Chief Data Officer
dizquierdo@bitergia.com

AUTHOR Stefano Maffulli
OpenStack Community Manager
stefano@openstack.org

We would like to thank the effort of the following people their effort to provide feedback and validation process.

Finally, this report would not exist without the effort of the people involved in the development of the OpenStack Activity Board, Grimoire toolset and the feedback of the people in the development mailing list of the OpenStack Foundation.

Executive Summary

Contents

1	Overview of the Project	4
1.1	General Activity	4
1.2	Development and Conversations	5
1.3	Efficiency	6
2	Per Project break down	8
2.1	Overall OpenStack Programs	9
2.2	Activity	9
2.3	Community	10
2.4	Process	11
2.4.1	OpenStack Integrated Programs	14
2.5	Activity	14
2.6	Community	15
2.7	Process	16
2.7.1	Incubated	19
2.8	Activity	19
2.9	Community	20
2.10	Process	21
3	General Activity and Community Evolution	24
3.1	Git Community Structure	24
3.2	Mailing Lists	25
3.3	Questions and Answers	29
3.4	IRC	32
A	Metrics Definitions	34
B	Source Code and Data Sources	37

Chapter 1

Overview of the Project

1.1 General Activity

A more detailed information about the community activity ...

Data source	Activity 365 days	Change (wrt to prev. 365 days)
Gits	53008 commits	37%
Tickets	11864 closed tickets	49%
Mailing Lists	43752 sent emails	36%
Gerrit	57458 submitted reviews	44%
Askbot	5967 posted questions	82%
IRC	1927648 messages	138%

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

Focusing on the development activity,

Integrated Project	Commits
neutron	691
sahara	174
ceilometer	166
horizon	288
heat	376
nova	784
trove	67
swift	85
glance	138
cinder	316
keystone	199

Table 1.2: Last quarter integrated projects number of commits

1.2 Development and Conversations

Regarding to the community, developers are divided into three main sets, core, regular and occasional¹.

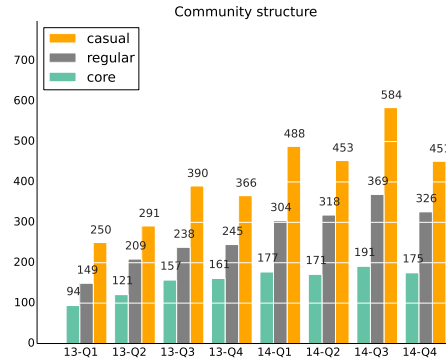


Figure 1.1: Evolution of the last 8 quarters of the core, regular and occasional developers (Git activity)

¹Contributing developers are characterized as core, regular and occasional 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 occasional contributors.

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	175	326	451

Table 1.3: Characterization of developers by their total contribution to the OpenStack projects

The mean number of developers per month

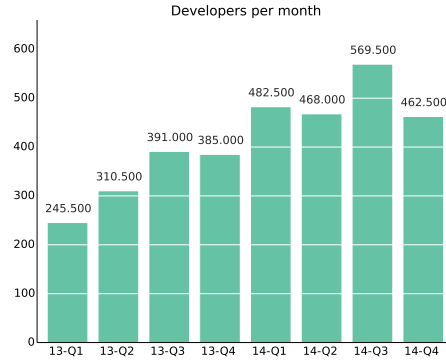


Figure 1.2: Number of developers per month in mean for each quarter

1.3 Efficiency

Two metrics have been identified to measure efficiency: the review efficiency index (REI) and the Time to Merge. REI is measured as the number of closed (merged or abandoned) changesets out of the submitted changesets in a given period. Time to Merge is measured as the time since a review is submitted until this is closed. Typical BMI values in the OpenStack Integrated projects rounds a 0.75, what indicates that for 100 opened changesets in a period, the community closes 75. Besides, the median Time to Merge is of 7.82, having an increase from the previous period.

Integrated project	REI	TTM	BMI
neutron	0.71	5.16	0.56 days
sahara	0.9	2.1	0.79 days
ceilometer	0.82	3.37	0.74 days
horizon	0.63	3.27	0.66 days
heat	0.75	4.33	0.73 days
nova	0.63	10.8	0.53 days
trove	0.73	10.46	0.58 days
swift	0.66	2.87	0.5 days
glance	0.67	7.69	0.66 days
cinder	0.8	3.58	0.61 days
keystone	0.62	6.2	0.41 days

Table 1.4: Closed changesets out of opened changesets and median Time to Merge in Gerrit

Chapter 2

Per Project break down

This chapter aims at providing a detailed report on the activity of the OpenStack Foundation projects. This is mainly focused on the activity per project as defined, stressing the point on the 'integrated' projects.

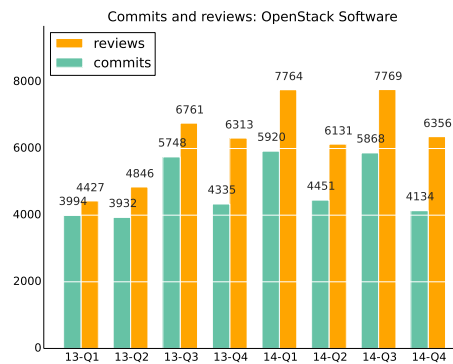
Each of the projects is divided into three sections and provides information from the last eight quarters.:

- 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 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.

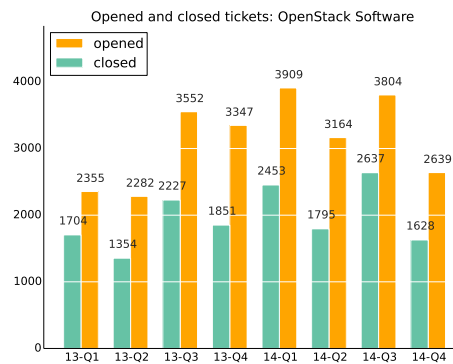
2.1 Overall OpenStack Programs

2.2 Activity

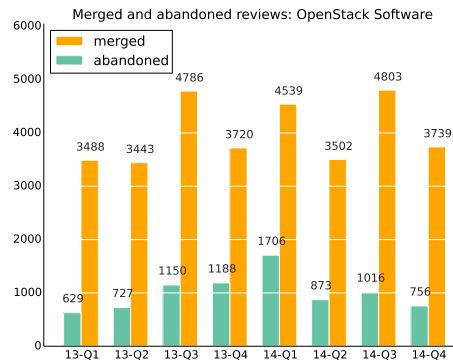
Commits in Git, submitted, merged and abandoned reviews in Gerrit and opened and closed issues in Launchpad.



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	5868	7769
14-Q4	4134	6356



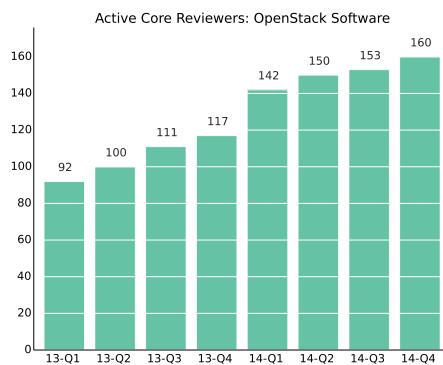
Period	Closed	Opened
13-Q1	1704	2355
13-Q2	1354	2282
13-Q3	2227	3552
13-Q4	1851	3347
14-Q1	2453	3909
14-Q2	1795	3164
14-Q3	2637	3804
14-Q4	1628	2639



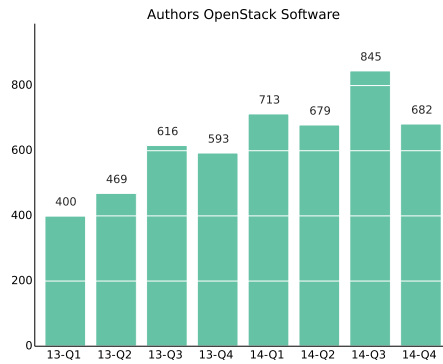
Period	Merged	Abandoned
13-Q1	3488	629
13-Q2	3443	727
13-Q3	4786	1150
13-Q4	3720	1188
14-Q1	4539	1706
14-Q2	3502	873
14-Q3	4803	1016
14-Q4	3739	756

2.3 Community

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



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



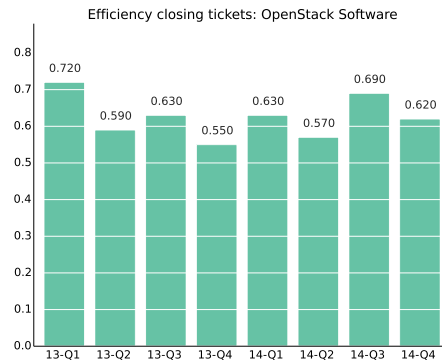
Period	Authors
13-Q1	400
13-Q2	469
13-Q3	616
13-Q4	593
14-Q1	713
14-Q2	679
14-Q3	845
14-Q4	682

Commit (s)	Author
96	Kevin Benton
90	garyk
67	Russell Bryant
64	Brant Knudson
57	Angus Lees
55	Mark McClain
52	Steven Hardy
47	Angus Salkeld
47	Ihar Hrachyshka
41	Flavio Percoco

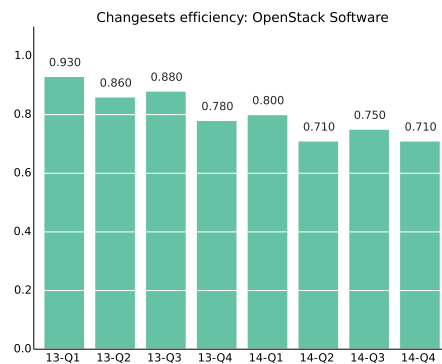
Commit (s)	Organizations
808	Red Hat
617	IBM
453	Mirantis
345	HP
237	Rackspace
129	VMware
112	Huawei
96	Bit Switch Networks
96	NEC
90	Radware

2.4 Process

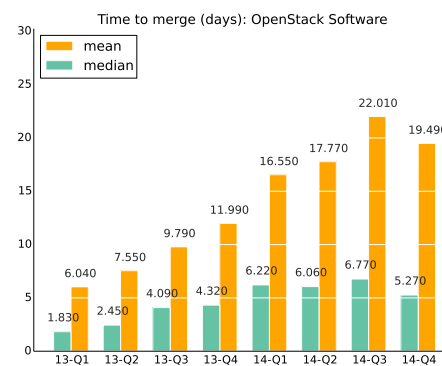
Efficiency closing changesets and tickets, time to review (mean and median), number of patchsets (iterations) per changeset and study on the time waiting for a reviewer or submitter action in the patchset review process.



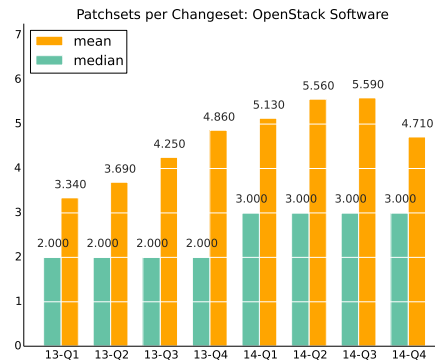
Period	Closed/Opened
13-Q1	0.72
13-Q2	0.59
13-Q3	0.63
13-Q4	0.55
14-Q1	0.63
14-Q2	0.57
14-Q3	0.69
14-Q4	0.62



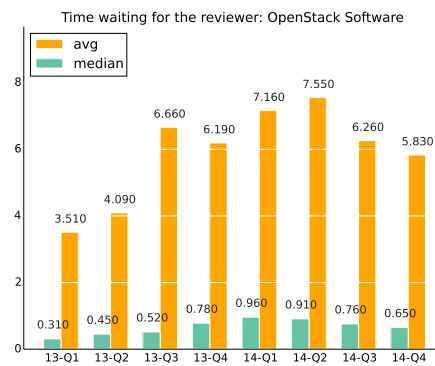
Period	Closed/Opened
13-Q1	0.93
13-Q2	0.86
13-Q3	0.88
13-Q4	0.78
14-Q1	0.8
14-Q2	0.71
14-Q3	0.75
14-Q4	0.71



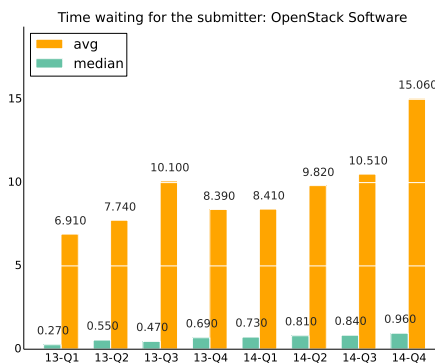
Period	Median	Mean
13-Q1	1.83	6.04
13-Q2	2.45	7.55
13-Q3	4.09	9.79
13-Q4	4.32	11.99
14-Q1	6.22	16.55
14-Q2	6.06	17.77
14-Q3	6.77	22.01
14-Q4	5.27	19.49



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	5.59
14-Q4	3.0	4.71



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	0.65	5.83

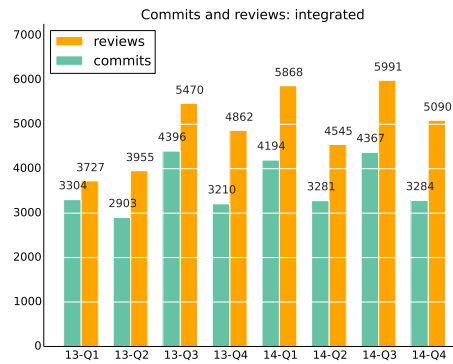


Period	Median	Mean
13-Q1	0.27	6.91
13-Q2	0.55	7.74
13-Q3	0.47	10.1
13-Q4	0.69	8.39
14-Q1	0.73	8.41
14-Q2	0.81	9.82
14-Q3	0.84	10.51
14-Q4	0.96	15.06

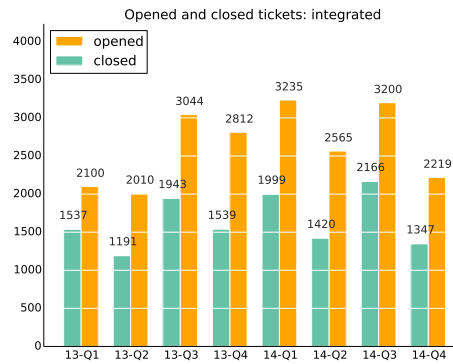
2.4.1 OpenStack Integrated Programs

2.5 Activity

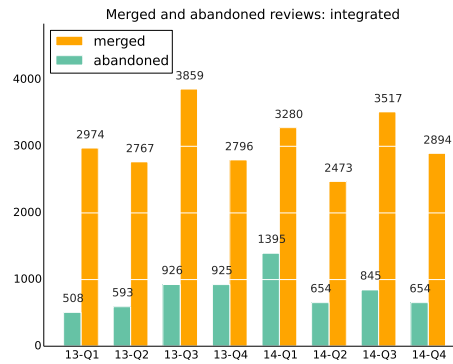
Commits in Git, submitted, merged and abandoned reviews in Gerrit and opened and closed issues in Launchpad.



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	4367	5991
14-Q4	3284	5090



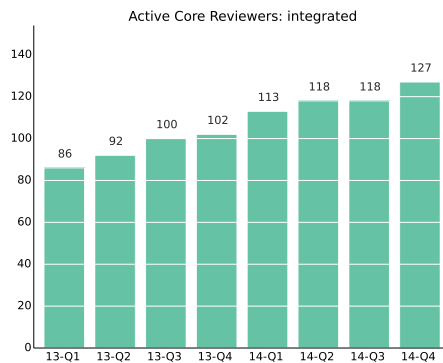
Period	Closed	Opened
13-Q1	1537	2100
13-Q2	1191	2010
13-Q3	1943	3044
13-Q4	1539	2812
14-Q1	1999	3235
14-Q2	1420	2565
14-Q3	2166	3200
14-Q4	1347	2219



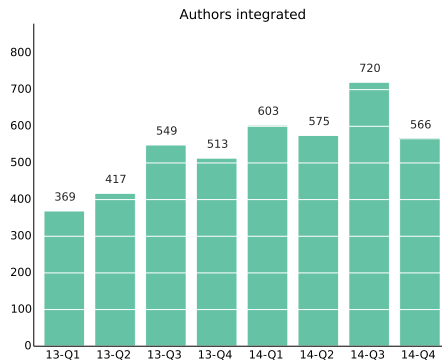
Period	Merged	Abandoned
13-Q1	2974	508
13-Q2	2767	593
13-Q3	3859	926
13-Q4	2796	925
14-Q1	3280	1395
14-Q2	2473	654
14-Q3	3517	845
14-Q4	2894	654

2.6 Community

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



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



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	566

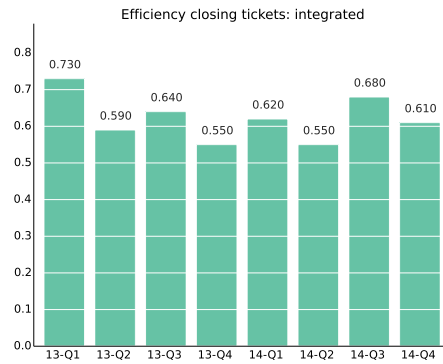
Commit (s)	Author
96	Kevin Benton
90	garyk
66	Russell Bryant
57	Angus Lees
55	Mark McClain
47	Steven Hardy
46	Ihar Hrachyshka
45	Brant Knudson
44	Angus Salkeld
39	Daniel P. Berrange

Commit (s)	Organizations
630	Red Hat
577	IBM
321	Mirantis
240	HP
165	Rackspace
128	VMware
99	Huawei
96	Bit Switch Networks
90	Radware
87	NEC

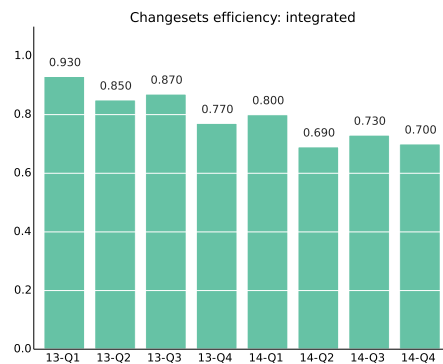
2.7 Process

Efficiency closing changesets and tickets, time to review (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.

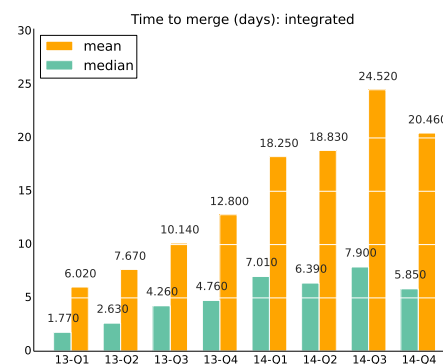
2.7. PROCESS



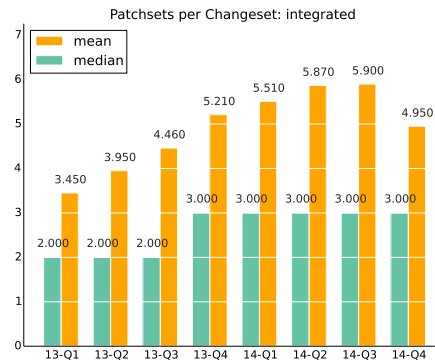
Period	Closed/Opened
13-Q1	0.73
13-Q2	0.59
13-Q3	0.64
13-Q4	0.55
14-Q1	0.62
14-Q2	0.55
14-Q3	0.68
14-Q4	0.61



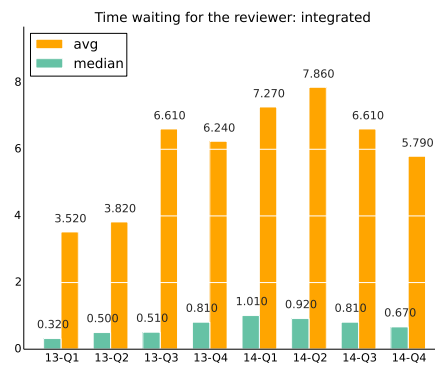
Period	Closed/Opened
13-Q1	0.93
13-Q2	0.85
13-Q3	0.87
13-Q4	0.77
14-Q1	0.8
14-Q2	0.69
14-Q3	0.73
14-Q4	0.7



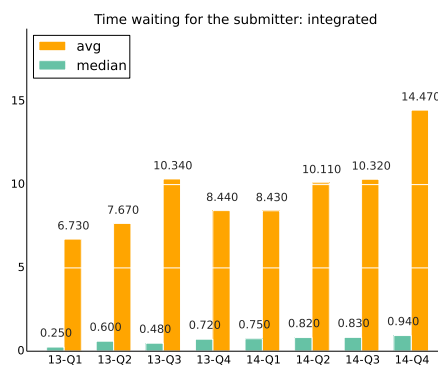
Period	Median	Mean
13-Q1	1.77	6.02
13-Q2	2.63	7.67
13-Q3	4.26	10.14
13-Q4	4.76	12.8
14-Q1	7.01	18.25
14-Q2	6.39	18.83
14-Q3	7.9	24.52
14-Q4	5.85	20.46



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	5.87
14-Q3	3.0	5.9
14-Q4	3.0	4.95



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	0.67	5.79

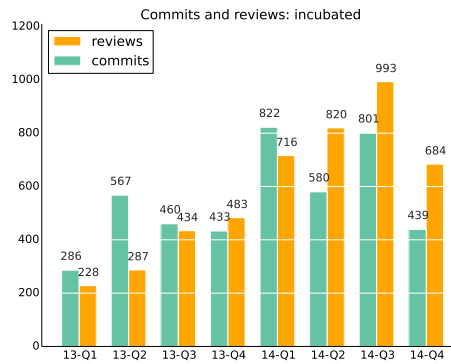


Period	Median	Mean
13-Q1	0.25	6.73
13-Q2	0.6	7.67
13-Q3	0.48	10.34
13-Q4	0.72	8.44
14-Q1	0.75	8.43
14-Q2	0.82	10.11
14-Q3	0.83	10.32
14-Q4	0.94	14.47

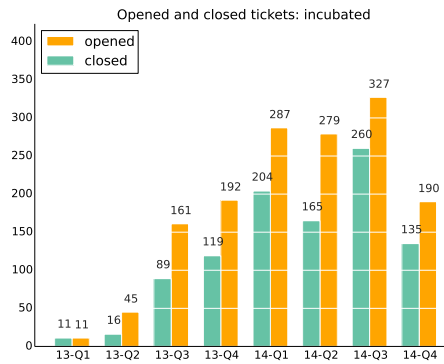
2.7.1 Incubated

2.8 Activity

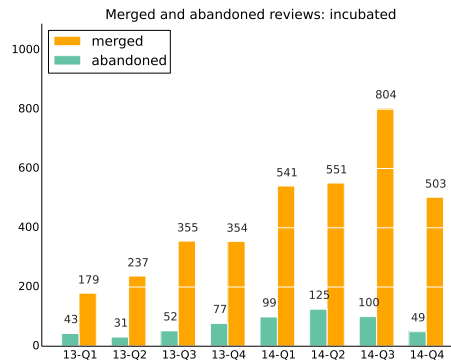
Commits in Git, submitted, merged and abandoned reviews in Gerrit and opened and closed issues in Launchpad.



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	439	684



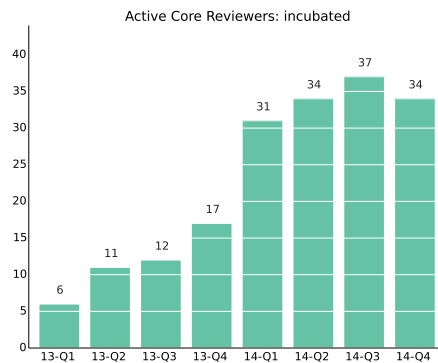
Period	Closed	Opened
13-Q1	11	11
13-Q2	16	45
13-Q3	89	161
13-Q4	119	192
14-Q1	204	287
14-Q2	165	279
14-Q3	260	327
14-Q4	135	190



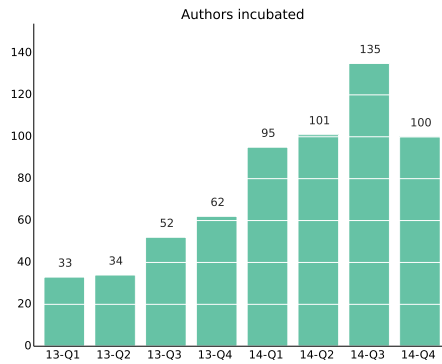
Period	Merged	Abandoned
13-Q1	179	43
13-Q2	237	31
13-Q3	355	52
13-Q4	354	77
14-Q1	541	99
14-Q2	551	125
14-Q3	804	100
14-Q4	503	49

2.9 Community

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



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



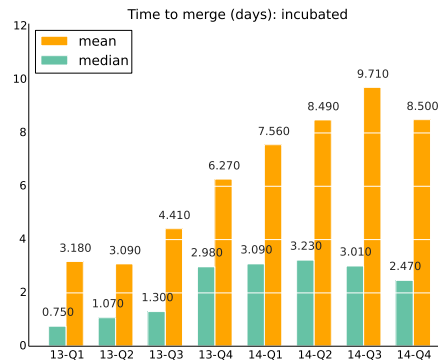
Period	Authors
13-Q1	33
13-Q2	34
13-Q3	52
13-Q4	62
14-Q1	95
14-Q2	101
14-Q3	135
14-Q4	100

Commit (s)	Author
32	Kiall Mac Innes
27	Valeriy Ponomaryov
26	Flavio Percoco
19	Andreas Jaeger
17	Jim Rollenhagen
17	Lucas Alvares Gomes
16	Lei Zhang
13	Vladyslav Drok
12	John Vrbanac
11	Thomas Dinkjian

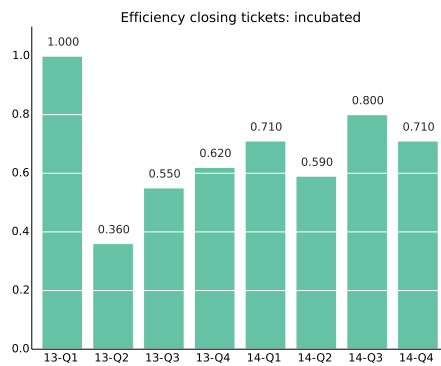
Commit (s)	Organizations
68	HP
68	Mirantis
65	Rackspace
32	Red Hat
19	SUSE
14	OpenStack Foundation
10	Yahoo!
9	Ericsson
9	JPBerlin
8	eBay

2.10 Process

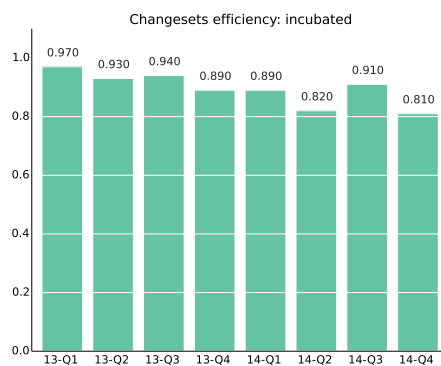
Efficiency closing changesets and tickets, time to review (mean and median), number of patchsets (iterations) per changeset and study on the time waiting for a reviewer or submitter action in the patchset review process.



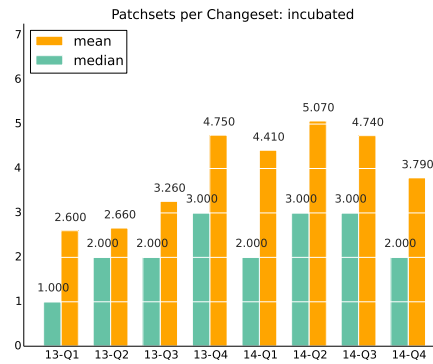
Period	Median	Mean
13-Q1	0.75	3.18
13-Q2	1.07	3.09
13-Q3	1.3	4.41
13-Q4	2.98	6.27
14-Q1	3.09	7.56
14-Q2	3.23	8.49
14-Q3	3.01	9.71
14-Q4	2.47	8.5



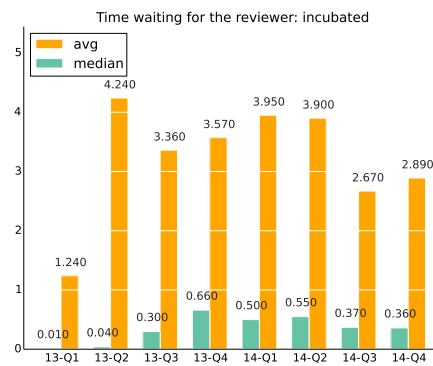
Period	Closed/Opened
13-Q1	1.0
13-Q2	0.36
13-Q3	0.55
13-Q4	0.62
14-Q1	0.71
14-Q2	0.59
14-Q3	0.8
14-Q4	0.71



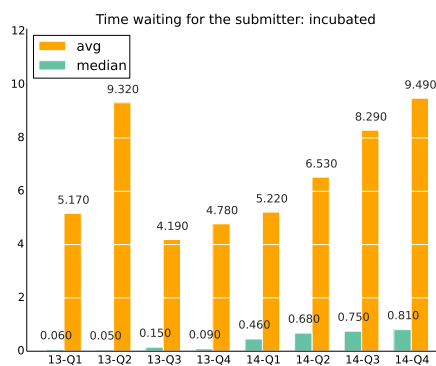
Period	Closed/Opened
13-Q1	0.97
13-Q2	0.93
13-Q3	0.94
13-Q4	0.89
14-Q1	0.89
14-Q2	0.82
14-Q3	0.91
14-Q4	0.81



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	3.79



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	2.89

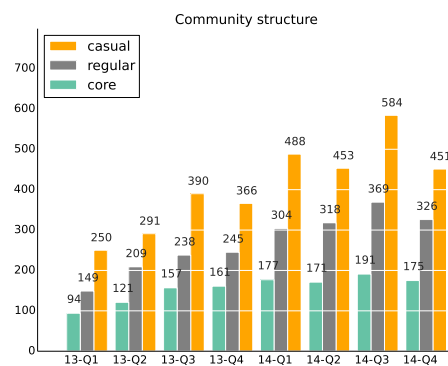


Period	Median	Mean
13-Q1	0.06	5.17
13-Q2	0.05	9.32
13-Q3	0.15	4.19
13-Q4	0.09	4.78
14-Q1	0.46	5.22
14-Q2	0.68	6.53
14-Q3	0.75	8.29
14-Q4	0.81	9.49

Chapter 3

General Activity and Community Evolution

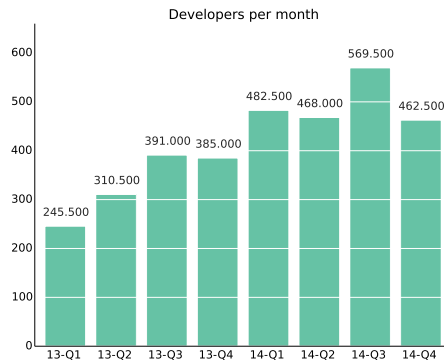
3.1 Git Community Structure



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	175	326	451

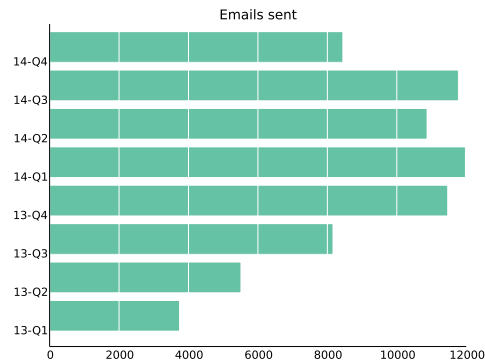
Developers per Month

3.2. MAILING LISTS

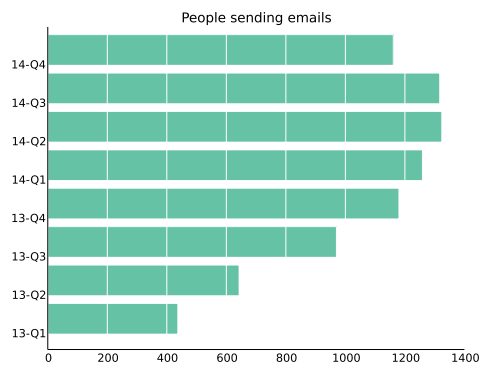


Period	Authors per month
13-Q1	245.5
13-Q2	310.5
13-Q3	391.0
13-Q4	385.0
14-Q1	482.5
14-Q2	468.0
14-Q3	569.5
14-Q4	462.5

3.2 Mailing Lists

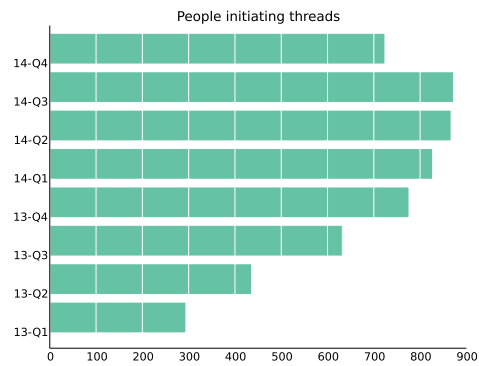


Period	Emails
13-Q1	3743
13-Q2	5511
13-Q3	8162
13-Q4	11466
14-Q1	11977
14-Q2	10872
14-Q3	11775
14-Q4	8446



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	1161

3.2. MAILING LISTS

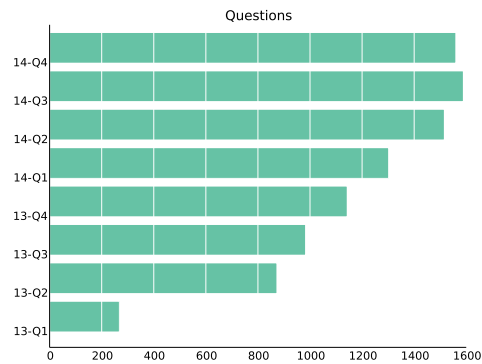


Period	People
13-Q1	294
13-Q2	436
13-Q3	632
13-Q4	776
14-Q1	827
14-Q2	867
14-Q3	872
14-Q4	724

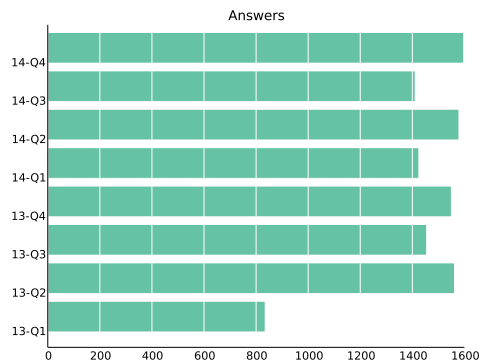
Initial Author and Date	Subject	Number Messages
alawson 2014-10-13	[openstack-dev] [Nova] Auto- matic evacuate	58
Angus Lees 2014-10-14	[openstack-dev] [kolla] on Dockerfile patterns	49
azemlyanov 2014-11-05	[openstack-dev] [Fuel] fuel master monitoring	41
Doug Hellmann 2014-10-02	[openstack-dev] [all][tc] gover- nance changes for "big tent" model	37
Zane Bitter 2014-11-26	[openstack-dev] [Heat] Con- vergence proof-of-concept showdown	36
Richard Jones 2014-11-11	[openstack-dev] [Horizon] the future of angularjs develop- ment in Horizon	35
Alexis Lee 2014-11-05	[openstack-dev] [Heat] New function: first _n onnull	33
Everett Toews 2014-10-08	[openstack-dev] [api] Forming the API Working Group	32
Michael Still 2014-12-05	[openstack-dev] [Nova] Spring cleaning nova-core	31
Sean Dague 2014-12-09	[openstack-dev] [hacking] pro- posed rules drop for 1.0	30

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; <i>dinsecuritygroup</i>	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 clean- ing nova-core	15
ERROR 2014-11-21	[openstack-dev] [Fuel] fuel master monitoring	15
rbtcollins 2014-11-25	[openstack-dev] [tc][neutron] Pro- posal to split Neutron into separate repositories	15
nuritu 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

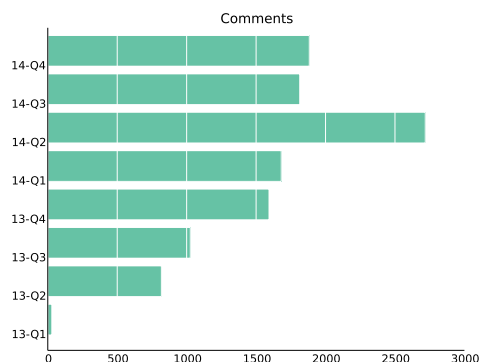
3.3 Questions and Answers



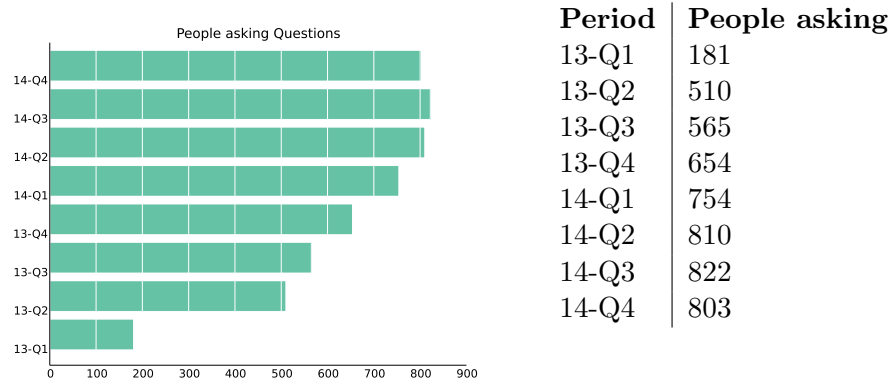
Period	Questions
13-Q1	268
13-Q2	873
13-Q3	983
13-Q4	1143
14-Q1	1302
14-Q2	1516
14-Q3	1589
14-Q4	1560



Period	Answers
13-Q1	835
13-Q2	1562
13-Q3	1455
13-Q4	1550
14-Q1	1425
14-Q2	1579
14-Q3	1411
14-Q4	1597



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	1883



- 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-	478
hostopenstack port8774 max retries+	420
rdo deploy openstack error execution of+	420
devstack not starting because of	402
urllib3connectionpool+	375
what are the supported tenant network+	375

- Top questions with more comments.

Question subject	Comments
ssh_key_pair in hot template+	5
cant remove router spanning tree+	5
systemctl status neutron serverservice is not+	5
cannot attach volume to instance+	5
calling http1692541692542009 04 04meta datainstance id+	5
need help setting up neutron networking+	5
ceilometer api critical error openstack icehouse+	5
vms not getting ip through dhcp+	5
unable to start instances after host+	5
ssh public key cant be injected+	5

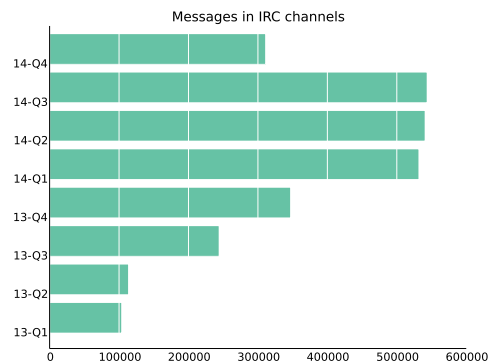
- Top questions with the highest number of different people participating.

Question subject	People participating
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
error in creating instances+	7
whats the difference between flat gre+	6
ceilometer api critical error openstack icehouse+	6
juno glance invalid openstack identity credentials+	6
how do i extend a subnet+	6

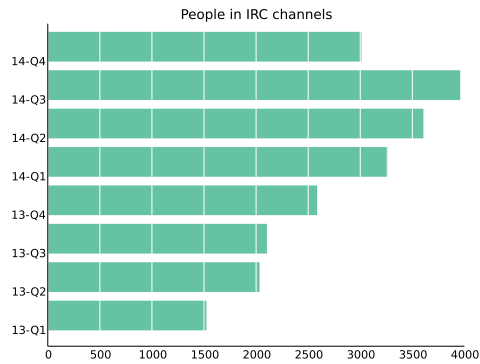
- Top tags

Tag name	Ocurrences
OpenStack	1560
forum	1560
Ask	1321
community	1292
gerrit	1051
cloud	973
stackforge	653
iaas	575
branch	358
ovs	322
qemu	108
create	94
soft-lockup	83
unreachable	81
neutron	81

3.4 IRC



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	311132



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	3017

IRC id

Messages sent

clarkb	8025
Jeremy Stanley	6644
ayoung	5705
morganfainberg	5598
Anita Kuno	5235
jroll	3966
flaper87	3843
Thierry Carrez	3431
Angus Salkeld	3414
sdake	3376
Devananda	3243
mtreinish	3065
dhellmann	3039
NoBodyCam	2930
Lucas Alvares Gomes	2884

Appendix A

Metrics Definitions

Metrics depicted in each OpenStack program:

- Commit: this is defined as the action(s) that performs a change in the source code. Bots, merges and other type of automatic activity is removed from the records. Besides, when aggregating several Gits, 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. Besides, this metric is 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 depicted 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` file¹.

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 file² 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

¹https://github.com/VizGrimoire/GrimoireLib/blob/master/vizGrimoireJS/openstack_report.py.
In order to download the exact version used for this analysis with the hash `xxxx`

²[urlhttp://git.openstack.org/cgit/openstack/governance/tree/reference/programs.yaml](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/oslo.sphinx
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
Infrastructure	scr	review.openstack.org_openstack-dev/openstack-nose
Infrastructure	scr	review.openstack.org_openstack-infra/askbot-theme
Infrastructure	scr	review.openstack.org_openstack-infra/config
Infrastructure	scr	review.openstack.org_openstack-infra/devstack-gate
Infrastructure	scr	review.openstack.org_openstack-infra/gear
Infrastructure	scr	review.openstack.org_openstack-infra/gearman-plugin
Infrastructure	scr	review.openstack.org_openstack-infra/gerrit
Infrastructure	scr	review.openstack.org_openstack-infra/gerritbot
Infrastructure	scr	review.openstack.org_openstack-infra/gerritlib
Infrastructure	scr	review.openstack.org_openstack-infra/git-review
Infrastructure	scr	review.openstack.org_openstack-infra/gitdm
Infrastructure	scr	review.openstack.org_openstack-infra/irc-meetings
Infrastructure	scr	review.openstack.org_openstack-infra/jeepyb
Infrastructure	scr	review.openstack.org_openstack-infra/jenkins-job-builder
Infrastructure	scr	review.openstack.org_openstack-infra/lodgeit
Infrastructure	scr	review.openstack.org_openstack-infra/meetbot
Infrastructure	scr	review.openstack.org_openstack-infra/nose-html-output
Infrastructure	scr	review.openstack.org_openstack-infra/odsreg
Infrastructure	scr	review.openstack.org_openstack-infra/project-config
Infrastructure	scr	review.openstack.org_openstack-infra/publications
Infrastructure	scr	review.openstack.org_openstack-infra/puppet-apparmor
Infrastructure	scr	review.openstack.org_openstack-infra/puppet-dashboard
Infrastructure	scr	review.openstack.org_openstack-infra/puppet-vcsrepo
Infrastructure	scr	review.openstack.org_openstack-infra/pypi-mirror
Infrastructure	scr	review.openstack.org_openstack-infra/releasestatus
Infrastructure	scr	review.openstack.org_openstack-infra/reviewday
Infrastructure	scr	review.openstack.org_openstack-infra/statusbot
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
ironic	scr	review.openstack.org_openstack/ironic
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
keystone	scr	review.openstack.org_openstack/keystone
keystone	scr	review.openstack.org_openstack/keystonemiddleware
keystone	scr	review.openstack.org_openstack/python-keystoneclient-federation
keystone	scr	review.openstack.org_openstack/python-keystoneclient-kerberos
manila	its	https://bugs.launchpad.net/manila
manila	scm	git://git.openstack.org/openstack/manila
manila	scr	review.openstack.org_openstack/manila
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
neutron	scr	review.openstack.org_openstack/neutron
neutron	scr	review.openstack.org_openstack/neutron-fwaas
neutron	scr	review.openstack.org_openstack/neutron-lbaas
neutron	scr	review.openstack.org_openstack/neutron-vpnaas
nova	its	https://bugs.launchpad.net/nova
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-cfnutils
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
sahara	scr	review.openstack.org_openstack/sahara
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