

April 2016

# OPENSTACK USER SURVEY

A snapshot of OpenStack users' attitudes and deployments



[openstack.org](http://openstack.org)

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# INTRODUCTION

This is the seventh survey of OpenStack's community and users since April 2013, with a goal of better understanding attitudes, organizational profiles, use cases, and technology choices across the community's various deployment stages and sizes.

This survey report analyzes respondents who completed or updated the survey during a three-week period in February 2016. There are some modifications from prior surveys, in keeping with the evolution of the OpenStack platform and user feedback.

The survey questions and report are guided by the OpenStack User Committee with the support of Foundation staff and an independent data scientist.

This survey represents a snapshot of 1,603 community members and 405 user deployments provided voluntarily. Insights are intended to provide feedback to the broader community and to arm technical leaders and contributors with better data to make decisions regarding the roadmap and feature enhancements.

The User Survey is not a market survey and does not express all OpenStack deployments worldwide.

When reading the report and statistics, remember that the typical respondent is an informed user or someone actively engaged in the OpenStack community.

We have not attempted to normalize the survey data to be more widely representative, since we believe respondents are more representative of decision makers. Not all users answered all survey questions, so the N number (population size) varies by question.

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## Survey Credits

The OpenStack User Committee includes Edgar Magaña, Jonathan Proulx, and Shilla Saebi. Comment analysis and report review provided by the User Committee and the User Survey Team, including Carol Barrett, Kenny Johnston, Piet Kruihof, Yih Leong Sun, and Shamail Tahir. Survey team participation is open to any community member and requires a confidentiality agreement.

Heidi Joy Tretheway from the OpenStack Foundation staff leads creation of the survey and report, with support from Anne Bertucio, Jonathan Bryce, Tom Fifield, Jimmy McArthur, and Lauren Sell.

The OpenStack Foundation partnered with independent data scientist Kelly Valade to analyze and chart the data.

# EXECUTIVE SUMMARY

OpenStack's mature and highly flexible platform has become an innovation engine for companies in all industries, enabling users to operate both legacy systems and cloud-native apps through a single framework.

The purpose of OpenStack's seventh semiannual user survey is to provide a snapshot of cloud deployments, use cases, and user attitudes to help guide future development of the technology.

This survey represents the most responses ever in one cycle, with 1,111 organizations participating—25% more than last cycle.

A significant attribute of survey respondents is their limited crossover with those participating in the last cycle—just 36% of individuals and 39% of deployments also answered the last survey.

The remarkably consistent responses from survey to survey suggests that the user survey has achieved a stable cross-section of the community, enabling us to extrapolate from the data.

Key findings in this survey cycle include the continued trend toward cloud maturity, as a higher share of deployments move into production stage. We also saw strong evidence of deployments upgrading to the two most recent releases of OpenStack at the time of the survey, Kilo and Liberty.

Users are aligning around OpenStack, as its APIs have become the standard for enterprise Infrastructure-as-a-Service (IaaS). This is demonstrated in business drivers: 97% of community members surveyed

“  
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for enterprise  
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said “standardizing on the same open platform and APIs that power a global network of public and private clouds” was one of their top five considerations in choosing OpenStack, while six months ago, only 60% of respondents listed it in their top five.

Container technology continues to be a major interest for the OpenStack community, earning the most interest among emerging technologies. Containers service Magnum was also the OpenStack project in which users indicated greatest interest, suggesting strong potential for future adoption.

Though there were few shakeups in deployment decisions, the use of PaaS and container orchestration tools saw significant changes among the leading technology choices, with Kubernetes surging to the fore.

Analysis of nearly 2,000 verbatim comments about what areas of OpenStack are working well and which

require greater enhancement revealed themes such as consistency, complexity, flexibility, stability, innovation, and documentation—each of which earned both positive and negative comments.

“Being a flexible framework to build on is the most important aspect of the OpenStack platform,” said one user from a global financial institution. “Also, being able to support both traditional and cloud-native workloads is very important because large enterprises don’t have the luxury of dropping their legacy applications and forklifting them into the microservices-type designs from day one. The benefits of the cloud are too great to only allow new workloads onto the platform.”

We include comments that run the gamut—the good, the bad, and the ugly—in this report to paint the most

accurate picture of OpenStack’s progress and where it has to grow.

We also took a closer look at Net Promoter Scores (NPS) by digging into the raw data from the past three cycles to generate an accurate comparison. Our data analysis revealed that users are increasingly pleased with OpenStack, exceeding NPS benchmarks for the software industry in general.

The NPS score from all community members increased over the past three surveys from 20 to 29. NPS scores for end-users with deployments increased from 32 to 41, indicating that those most satisfied with OpenStack are actively using it in their businesses.





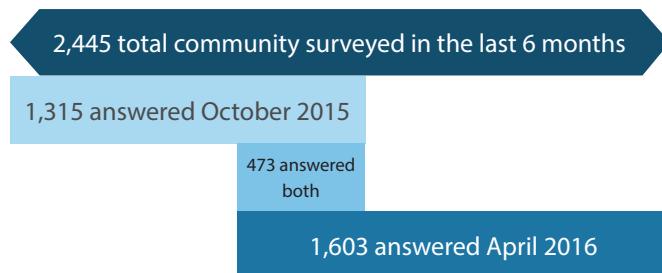
## User survey represents 1,111 organizations, a 25% increase

OpenStack's seventh user survey of the community saw the strongest participation of any survey so far, with 22% more respondents (1603 total survey-takers) who provided insights from 1,111 unique organizations, 25% more than the last survey.

The survey was conducted over three weeks in February 2016 and is intended as a snapshot of the community. Although only 36% of the respondents who answered the September 2015 survey also answered this cycle's survey, survey responses were strikingly similar across all categories.

Even though we saw a 63% change in individual respondents, survey answers reinforce the majority of trends and user preferences established by previous reports.

This consistency suggests the user survey has achieved a critical mass that is representative of the OpenStack community as a whole.



	APRIL 2015	OCT 2015	APRIL 2016
Completed Surveys	1100	1315	1603
Deployments	286	267	405
Multiple Deployments	74	85	88
Most Deployments from a Single Respondent	5	16	11
App Development Surveys*	166	392	446

Figure 1.1

\*April 2015 respondents include those who indicated they "write applications that run on OpenStack."



## What are the OpenStack roles of survey respondents?

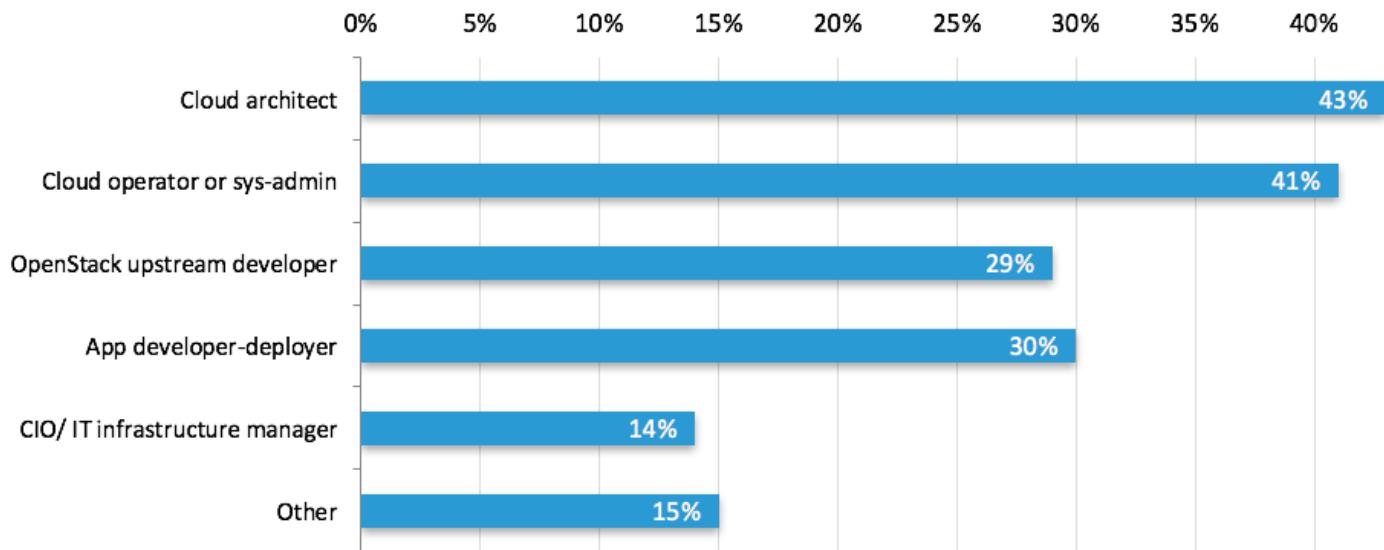


Figure 1.2 n=1530

One of the key changes in this user survey is a finer-grained question about OpenStack community members' roles. With two new options (cloud architect and CIO/IT infrastructure manager were added), nearly half of respondents (47%) indicated they have more than one role in OpenStack.

Surprisingly, one of the new response options—cloud architect—was the most frequent answer (43%).

Additionally, there were 446 application developer responses to this survey, 169% more than a year ago, and 14% more than last cycle.

Among the 15% of respondents who listed "other" as their role, top answers included development/technical contributor, business development, vendor distribution, product manager, marketing, sales, community, training, documentation, and researcher.



## Which industries use OpenStack?

OpenStack has been adopted broadly by companies in virtually every industry, including most notably telecommunications, academic/research, film/media, and finance. In addition to these, government/defense, manufacturing/industrial, retail and ecommerce, energy, consumer goods, travel, automotive, gaming, advertising, and nonprofits are all represented in this user survey.

The most dominant category in the user survey remains information technology. IT took up an even larger slice of the industry pie this year with 68% of responses, compared to 64% last cycle and 54% one year ago.

Among IT industry respondents, application and software development, middleware support, software as a service, security, and software-defined networking were notable segments represented.

Among the 405 deployments recorded in this survey cycle, 59% of deployments were in the IT sector, 14% in academic/research, and 10% in telecommunications.

We also looked at which industries are using OpenStack in production deployments. When broken down this way, most industries have more than half of respondents running OpenStack in production, which is consistent with the overall 65% of deployments recorded in this survey at a production stage.

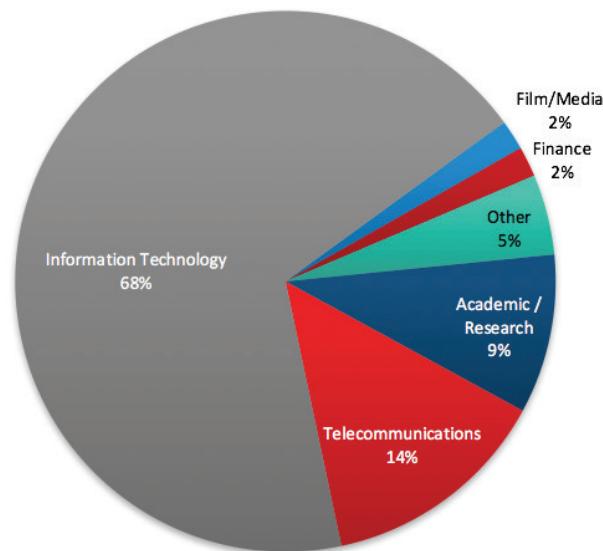


Figure 1.3 n=1402

## Where are OpenStack users located?

OpenStack boasts a thriving global community. Among the 76 countries represented in this survey cycle—the same number as the prior cycle—the United States is the most substantially represented, with 35% of respondents located in the US.

There were slight changes in the share of community responses from various countries, but no statistically significant changes. (Remember, only 36% of survey respondents in this survey answered the prior survey, so the vast majority of respondents are different.)

In terms of changes among strongly represented countries, the United Kingdom is slightly better represented in this survey (from 3% of respondents to 4%),

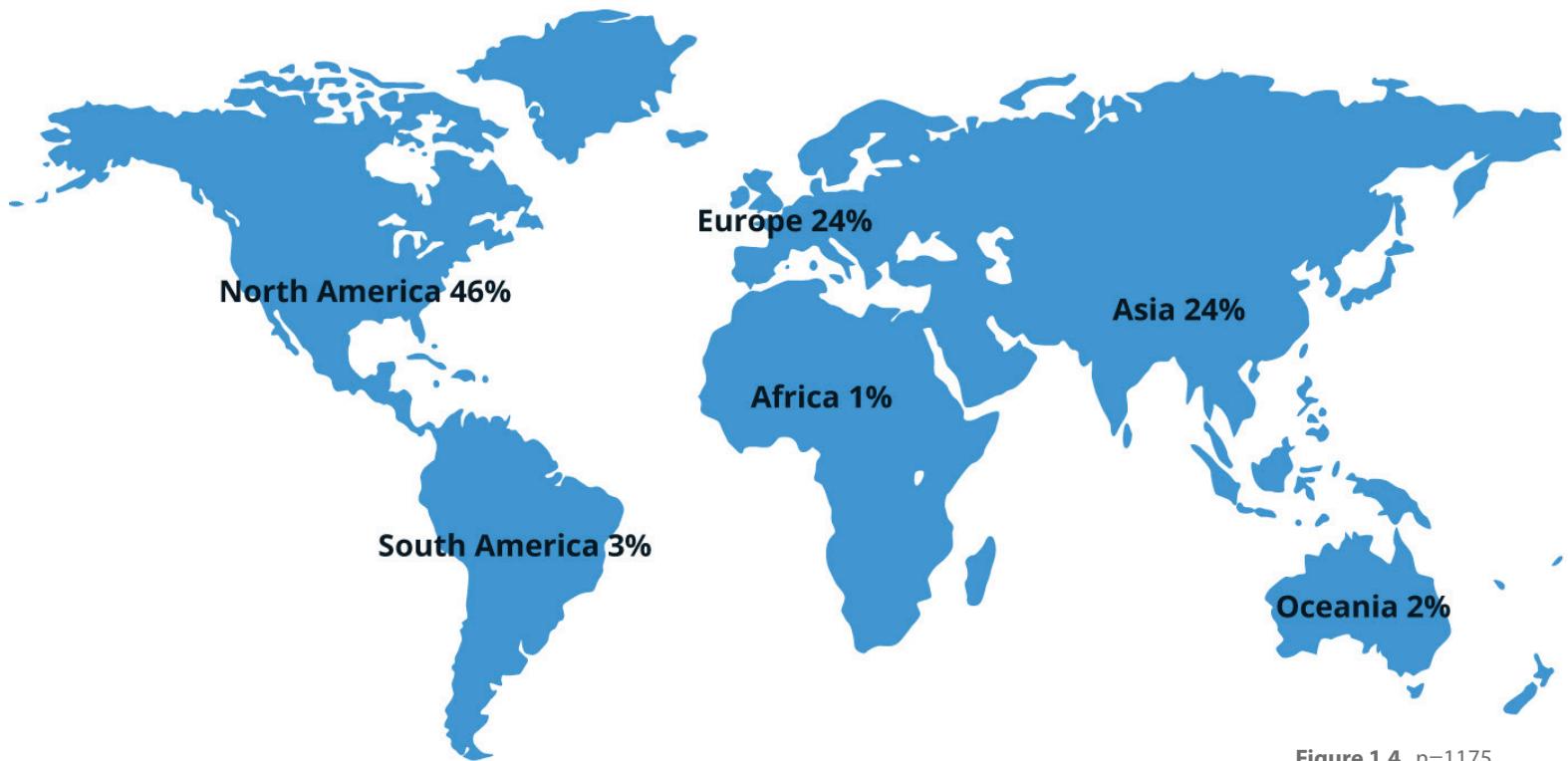


Figure 1.4 n=1175

and both Romania and Australia show up in the list of top 10 countries, each with 2% of the total surveyed.

Countries slightly less represented in this cycle are the US, down 4 points; China, down 3 points to 5%; India, down 3 points to 4%; and France, down 2 points to 2%. Japan and Germany each lost a point as well, leaving them at 5% and 3% of users represented, respectively.

At a continent level, Europe and Asia are now identically weighted, at 24% of respondents each. While this is just a slight uptick of 2 points for Europe, Asia's representation on this survey has varied from 23% a year ago to 28% in the prior survey.

More people from Oceania responded to this survey,

while fewer in South America responded.

It's important to note that the OpenStack user survey is currently only offered in English, which is likely to suppress responses from regions where English is not a first language.

OpenStack community members answered this survey from 536 different cities. Top cities with high concentrations of OpenStack community members included Silicon Valley area cities (10% of respondents), plus Raleigh (USA), London, San Antonio (USA), Tokyo, Seattle, Bangalore, New York, Timisoara (Romania), and Beijing.

Of these cities, Seattle, New York, and Timisoara are new to the list of top cities.

## What size organizations use OpenStack?

OpenStack has proved itself at enterprise scale, with a strong majority of users with 1,000 to 9,999 employees or more. The even distribution of community responses across all sizes suggests that OpenStack is a strong solution for both enterprise and developing companies.

We compared the organizational size in this survey to surveys conducted both six months and one year ago, finding some statistically significant differences:

- The proportion of companies indicating 1,000 to 9,999 employees was significantly higher than one year ago.
- The proportion of companies indicating 10,000 to 99,999 employees was significantly higher than both prior surveys.
- The proportion of companies indicating 100,000 employees or more was significantly higher than one year ago.

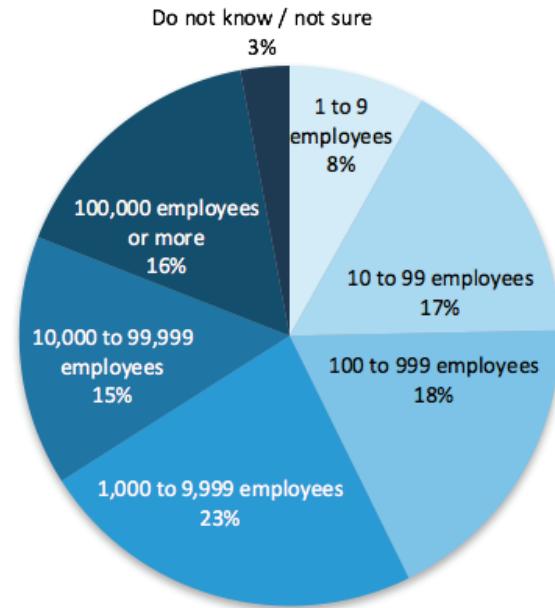


Figure 1.5 n=1402





# USER PERSPECTIVES

## TOP BUSINESS DRIVERS

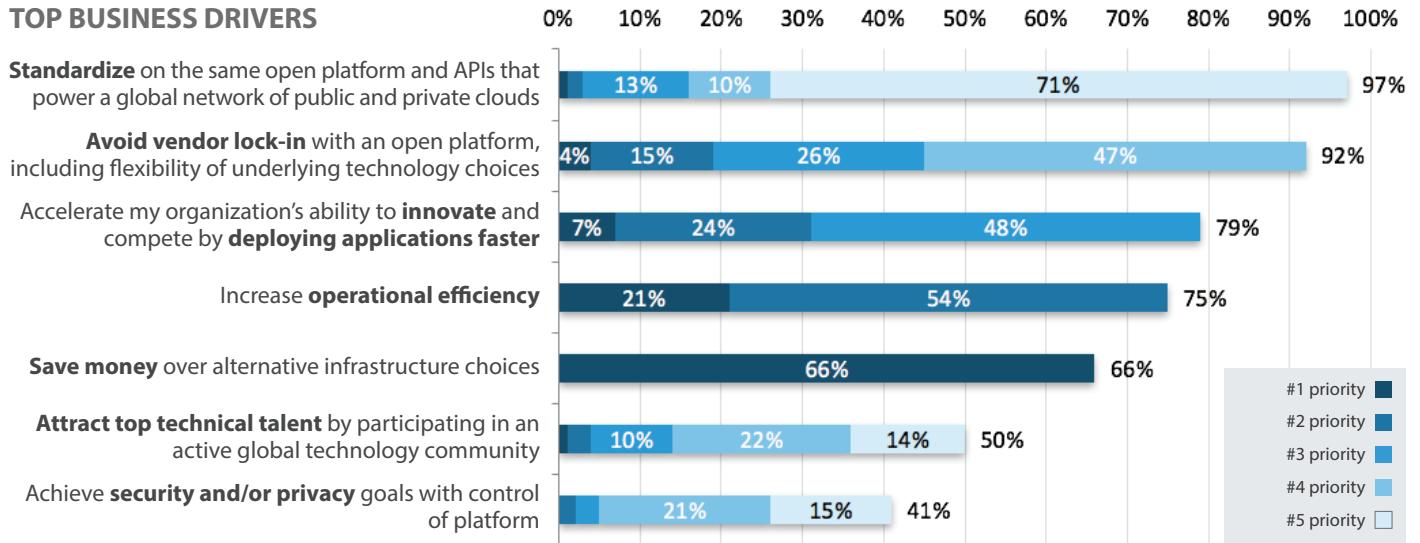


Figure 2.1 n=1183

## Why do organizations choose OpenStack?

Community members were asked to select their top reasons for choosing OpenStack and rank these in terms of priority. The vast majority (66%) still focus first on cost, just one point off last cycle's response.

Respondents also overwhelmingly recognized increase in operational efficiency and accelerating an organization's ability to innovate and compete by deploying applications faster as key drivers.

A different perspective on this data looks at answer frequency without regard to weight. Two factors were clearly important to the vast majority of people.

In this survey, nearly all respondents—97%—said standardizing on the same open platform and APIs that power a global network of public and private clouds was at least one of their top five considerations, while

only 60% listed it in their top five priorities last cycle.

Additionally, avoiding vendor lock-in was important to 92% of respondents, up from 76% in the prior survey. Many respondents indicated additional business drivers beyond the seven specified in our list. Some of these reasons include:

- Market demand for OpenStack compatibility; customer requirements;
- Cloud-native app development;
- Demand from service providers;
- Partnerships with vendors;
- Research and academic use cases;
- Country-specific data governance;
- DevOps-friendly environment; and
- Self-service and open source qualities.

## How likely are users to recommend OpenStack?

We asked the classic Net Promoter Score (NPS) question, “How likely are you to recommend OpenStack to a friend or colleague?”

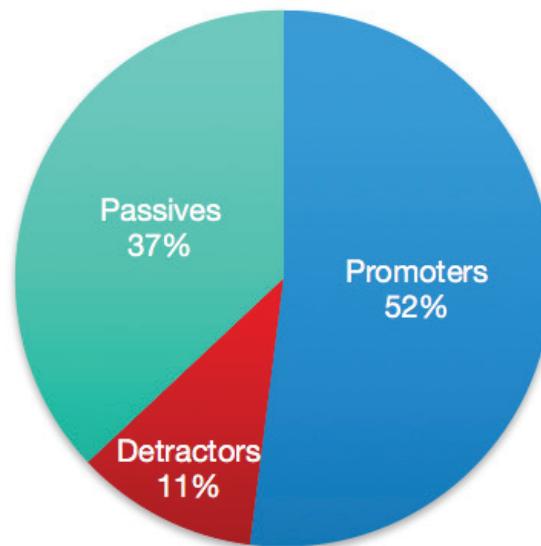
Responses ranged from 0 to 10, with 10 being the highest. Scores of 9 or 10 are “promoters,” scores of 7 or 8 are “passives,” and scores 0 through 6 are “detractors.”

In keeping with the NPS methodology advised by Satmetrix, OpenStack’s score is calculated by taking the percentage of promoters (those rating OpenStack a 9 or 10) and subtracting the percentage of detractors (ratings of 0-6). The result can range from -100 to +100. OpenStack’s Net Promoter Score is 29.

Context is critical when viewing this number. Consider the NPS scores released by Satmetrix in its 2015 US Consumer Study, published in May 2015. Satmetrix surveyed 30,000 respondents in 22 categories. The highest NPS scores were achieved by department/specialty stores (industry average NPS ~57) brokerage/investments (industry average ~45), tablet computers (industry average ~44) and smartphones (industry average ~40).

Software and apps earn typically lower NPS scores (industry average ~19). Satmetrix released a chart detailing NPS high/low scores earned by industry, as well as the 25th, 50th and 75th percentile scores, and the industry average.

In the software and apps category, the scores were approximately: Lowest: -10; 25th percentile: 7; 50th percentile: 22; 75th percentile: 28; Top score: 53.



**Figure 2.2** n=313; NPS = 41

OpenStack’s overall Net Promoter Score of 29, which would place it in the top one-quarter to one-fifth of software companies, is based on 1,183 individual answers.

Nearly half of responding OpenStack community members are promoters of OpenStack (47%), while just 18% are detractors.

There is a clear trend of increasing satisfaction with OpenStack among community members as shown by survey results, with the number of promoters holding steady as the number of detractors declines. It is significant to note that the sample size has more than doubled over the three surveys.

DEPLOYMENTS	APRIL 2015	OCT 2015	APRIL 2016
Responses	243	252	313
Promoters	53%	53%	52%
Passives	26%	29%	37%
Detractors	21%	18%	11%
NPS	<b>32</b>	<b>35</b>	<b>41</b>

Figure 2.3

ALL RESPONSES	APRIL 2015	OCT 2015	APRIL 2016
Responses	517	894	1183
Promoters	47%	47%	47%
Passives	26%	31%	35%
Detractors	27%	22%	18%
NPS	<b>20</b>	<b>25</b>	<b>29</b>

Figure 2.4

## How do NPS scores compare to prior cycle data?

In our prior survey reporting, preliminary results did not properly compare data sets, resulting in an initially reported drop in the NPS score from April 2015 to September 2015. This was in error, because it compared NPS scores from users with deployments from the April 2015 survey (n=270) to NPS scores from community members as a whole from the September 2015 survey (n=894).

Further questions from the user committee in November and December 2015 prompted us to reevaluate the scores by asking a single data scientist to compare the raw data from each of three reports, rather than comparing results produced by different firms.

Now, figure 2.4 shows the clear increase in NPS scores over time among all community members surveyed.

Additionally, we looked at a subset of NPS scores from users with deployments, shown in figures 2.2 and 2.3. Users with deployments tend to rate OpenStack more

highly than OpenStack community members in general, and users with production deployments tend to rate OpenStack most highly of all, with an NPS of 54.

Among users with deployments at any stage, the NPS score has increased 9 points, from 32 a year ago to 41 today.

We looked at NPS scores through a variety of filters (user role, organizational size, geographic location, etc.) in the past survey cycle and found no significant differences.

In this cycle, we tried another method to consider data by weighting organizational scores so that each organization was represented equally by the average score all of their affiliated respondents gave.

Through this filter, the NPS for this cycle improves by two points, while it declines by two points for the prior survey cycle.

## Why do users recommend OpenStack—and why don't they?

In addition to asking how likely respondents are to refer OpenStack to a friend or colleague on a 0-10 scale, we asked a neutral follow-up question: “What was the primary basis for your score?”

Nine themes emerged. On the positive side, community support, avoiding vendor lock-in, consistency, stability, and the importance of open source were key drivers. On the negative side, complexity, difficulty in deployment, inconsistency, and lack of stability were cited. We dug into the comments here:

### GOOD COMMUNITY SUPPORT

- “Huge **community support**, availability of fast response for problems, encouraging developers and new contributors.”
- “Large participation among open source community developers.”
- “Open and **helpful** community, fast innovation, flexibility.”
- “I’ve been involved in the community for almost three years and the **speed and agility** of this technology is unparalleled.”

### COMPLEXITY

- “While I would recommend it to an organization of any size, its **robust feature set** does bring significant complexity, which I feel detracts from the benefits for small- to mid-size deployers.”
- “OpenStack is great to recommend, however there’s a fair amount of **complexity** that needs to be tackled if one wishes to use it.”
- “Main reasons not to rate it higher are the deployment/operations complexity, meaning it doesn’t

just work as easily as [a vendor solution].”

- “Complexity to **deploy and operate.**”
- “There are definitely still maturity and complexity issues with OpenStack.”

### DIFFICULTY TO DEPLOY

- “OpenStack lacks far too many **core components** for anything other than very specialized deployments.”
- “Takes a lot of work to decide on deployment architecture, deploying, and maintaining the software.”
- “**Frequent releases**; keeping up in an operational working deployment model is hard to achieve.”

### AVOIDS VENDOR LOCK-IN

- “In my opinion, vendor lock-in is one of the reasons why **closed platforms are losing the edge** over open platforms.”
- “Avoid vendor lock-in with an open platform and ecosystem, including **flexibility** of an underlying technology choice.”
- “I think deploying and then operating anything more than a toy OpenStack cloud is still difficult without paying for an OpenStack **distribution**, and then it becomes a question of getting into vendor lock-in again.”

### PROJECT (IN)CONSISTENCY

- “Technology is good, but no **synergies** between the sub-projects.”
- “The governance of the OpenStack project seems very **fragmented.**”

- “OpenStack has become a sprawling mess of projects, with quality that is variable/**inconsistent**.”
- “OpenStack has gotten too convoluted and bloated with projects.”

### INCREASE IN STABILITY

- “With Kilo and onward, OpenStack components have matured quite a bit in terms of stability.”
- “As part of our global engineering cloud, we are seeing the **increasing stability, speed, and functionality** of OpenStack.”
- “I think that OpenStack is already **stable enough to be used at mission-critical applications** and has obvious cost advantages.”
- “OpenStack has reached a level of maturity that guarantees stable clouds in a production data center.”

### LACK OF STABILITY

- “OpenStack can address multiple use cases but there are limitations in scale and stability.”
- “While it’s very powerful and flexible, it’s also got a very high barrier to entry/**learning curve**, lacks a true upstream long-term support (LTS), and has some lingering issues (stability of messaging at scale, for example) that need to seriously be taken into consideration before committing.”
- “Stability is difficult to achieve.”
- “There are still some areas in maturity and stability that need to be improved on.”
- “I don’t go higher than this [rating] because Open-



I’ve been involved in the community for almost three years and the speed and agility of this technology is unparalleled.



Stack is extremely hard to manage, not very stable and not very scalable.”

- “I feel difficulties like deployment of OpenStack at a very large level are still not so easy; the product is not very stable, and **migration** of whole infrastructure with a new release of OpenStack is still bit challenging.”

### OPEN SOURCE IS IMPORTANT

- “You can do a lot of **interoperability** with systems.”
- “OpenStack is open source software and has many APIs for comprehensively managing infrastructure.”
- “OpenStack is the best cloud solution on the market because of its open-ness.”
- “I think that as a direction, going with an open platform is always the **best choice in the long run**.”
- “The open source community is large and this large pool of talent is going to bring **innovation more rapidly** than any single organization.”

### What do users like most about OpenStack?

OpenStack's leadership in the evolution of cloud architecture is a critical benefit for users. "OpenStack [is the] defacto standard in open source technologies. It works as a powerful hub to engage with a lot of different types of applications, even for open hardware. It is the heart of standardizing everything around the cloud," one user wrote.

Another added, "It has global visibility as a truly open source movement that all customers/partners/vendors should consider supporting if they want to play a part in next-generation cloud architecture."

We asked users what they liked most about OpenStack besides the fact that it is free and open, and text appearing in quotes in this section are taken verbatim from more than 650 user survey comments.

### COMMUNITY

The most frequent theme emerging from the comments was the value of community and collaboration. Users, upstream developers, app developers, and other contributors love being able to interact with a broad and diverse community, and connect with each other to collaborate and share ideas.

Research users also praised the establishment of an academic/scientific user community.

Another related benefit was the ability to "attract top technical talent by participating in an active, global technology community," said one IT leader, while a developer valued the "chance to work with cutting-edge technologies."



“I enjoy collaborating with a large pool of technical people with different backgrounds. It provides a rich learning environment,” a developer said.

“Working with others who may have slightly different objectives and coming to consensus is very rewarding,” wrote another.

Community breadth and collaboration was frequently cited as a key solution. “There are so many users that you can find someone who already experienced your issue and then can solve it.”

The community was also described as “friendly,” “powerful,” “always willing to help,” “supportive on IRC and mailing lists,” and “great to consult with for problem-solving.”

Many said it was easy to get involved: “I like the opportunity to actively become a part of the community without much red tape. It was very easy to join various forums and groups to stay connected.”

Passion for the community came through in raw comments. “The community is freaking awesome,” wrote one developer. “I like going to OpenStack events to talk to people in a direct, friendly way—not that business-suit [junk] like most of the other events.”

## **FLEXIBILITY**

Flexibility and the ability to customize OpenStack to meet users’ needs was another key theme. “We can combine any kind of virtualization and storage technology into a functional cloud,” said one user. “It’s infinitely flexible, which is fantastic.”

Flexibility manifests itself in OpenStack’s evolving sup-

“There are so many users that you can find someone who already experienced your issue and then can solve it.”

port of new user requirements. “The fact that it is architected in a modular way always means OpenStack can be whatever it needs to be to whomever needs it, i.e., you can pick and choose projects to tailor a deployment to your needs.”

Another user added, “The modular project approach is great as well: each component can continue to improve at its own pace.”

Users appreciate the technology choices that OpenStack enables, allowing them to “provision VMs or bare metal or containers on demand.”

Another user noted it was “capable of handling and extending its services across various hardware and applications; easy to integrate.”

## **INNOVATION**

The ability to innovate and automate within OpenStack is a key benefit. Many users highlighted feature velocity, praising the “innovation around providing enterprise-ready features and capabilities.”

Commenting on OpenStack's continuous innovation, many users also appreciated the "transparency on code/status/releases."

A user noted this key benefit: "the ability to host and leverage the cloud ecosystem including Docker, Kubernetes, and those which are not born yet."

App developers valued "the fact that you can grow your application, and that growth is followed by the [project team leaders] PTLs. Taking into account your advice and your real-life non-devstack experience to push code to enhance the product is priceless."

### **NO VENDOR LOCK-IN**

Users highlighted "nearly universal vendor support" that "gives customers the ability to make decisions without being forced down a specific path."

Noting the value of flexibility and choice of partners for support, a user said "the potential for customizing, tuning, or otherwise deploying the OpenStack services in a way to suit the solution desired outstrips most other platforms currently available. Having [vendor companies] available covers any concerns about vendor support while still allowing choice without lock-in."

Vendor lock-in is not just an issue for users—it's a major concern for companies in the ecosystem.

One wrote, "OpenStack is less risky to develop for than VMWare or other proprietary cloud platforms. Closed systems can change quickly and 'pick a new winner' based on business drivers—even if those decisions don't always help their customers. OpenStack ... has all of its internal debates out in the public [and]



OpenStack's flexibility enables us to construct well-designed distributed architectures without the delays and costs of traditional technologies and processes.



the community behind it is a safer bet. The work we do to build support for OpenStack APIs isn't going to be made irrelevant in a year just because of vendor alliances and the competitive landscape changes between large companies."

Overall, users felt they had more power to affect future development and create complex environments, rather than being beholden to vendors' product development decisions and use restrictions.

"If I require a feature, I could simply build it myself, as I have access to all the underlying components," wrote one user, adding that there are "no black boxes."

### **ECOSYSTEM**

OpenStack offers a large, robust ecosystem including its "huge developer community from a variety of companies" and "the amazing amount of global vendor and community support."

The breadth and maturity of the ecosystem offers the "ability to cooperate with a whole ecosystem of ven-

dors," who can be found at [openstack.org/marketplace](https://openstack.org/marketplace).

Additionally, users highlighted the way that the ecosystem functions to improve the platform. "From the beginning the community has been trying to make choices that support users and operators, even when it complicated development."

One cannot underestimate the value of working with a higher purpose, not just to feed a commercial end. One developer wrote, "It feels like I am working for a good cause when I am working for OpenStack."

## EVOLUTION

"OpenStack is maturing and evolving into a more sophisticated product day by day," a user said, making it "scalable to a fairly extreme degree."

Another noted, "Continuous incorporation of new projects under the OpenStack tent brings much-needed capabilities into the stack."

OpenStack "enables software as code management of not just compute resources, but also storage, and especially network. This flexibility enables us to construct well-designed distributed architectures without the delays and costs of traditional technologies and processes."

Not only is the technology evolving, but users believe OpenStack has also caused an evolution in how companies collaborate. "OpenStack is a nice evolutionary shift forward in terms of vendors coming together in a neutral community space ... [it has] a good upstream project ethos to help keep things moving quickly and with innovation."

Strong governance and infrastructure to support evolving technology was also highlighted by developers.

"As an upstream developer for OpenStack, I am consistently impressed by the review and automated testing systems used for new code submissions. The sheer complexity of the system is amazing to me and that it works ... consistently is awesome. I love the concept of open review and transparent debate, especially since I'm involved with developing security features, so anything I can do to participate in and foster those ideas is a priority for me."

## API-DRIVEN INFRASTRUCTURE

Users called OpenStack "intelligent, trustworthy code to be ran in production." More than a dozen comments specifically called out APIs as a major benefit of OpenStack, including "API-driven access to all components."

Many users praised well-documented APIs, as well as documentation quantity and organization, and the way that a common API functions to reduce duplication or companies creating their own methods. (It's also important to note that many other users took issue with documentation in the following section that highlights areas for improvement.)

"I like that OpenStack has become a service delivery framework for disruptive and innovative technologies. It has provided a standards-based deployment framework for various established and emerging technologies that [makes] delivery as well as consumption of those technologies easy."

## Which areas of OpenStack require further enhancement?

Some of the aspects most often praised about OpenStack were also targeted by users as areas for enhancement.

Leading that list was **documentation**, especially helping users to better find key docs; adding more content; streamlining documentation; and encouraging greater consistency.

“Documentation has also been an issue for us, along with the frequency of version changes,” said one operator. “New projects need better documentation, particularly for operators.”

Overall documentation coverage and internal consistency, quality, and currency were also requested.

“New users do not have the flexibility to spend weeks delving into source code to figure out how to do common tasks, especially in the areas of orchestration. Were it not for ask.openstack.org and the hard work of many bloggers in the community, I would have a significantly more difficult time trying to understand practical uses of OpenStack functionality,” one user said.

This issue was echoed by others, who felt that the installation guide was insufficient to build an OpenStack cluster from start to finish.

Meanwhile, other users recognized the challenges inherent in documentation. “I think the documentation team needs to be given more time before a release to have the documentation completed to a higher standard on release, rather than having to wait four months for completed documentation.”

**Consistency** was another major area of concern. “All projects should strive to use the same standards—in code, libraries used, file formats, and documentation,” one user said. “[We need] consistency between different OpenStack projects and releases.”

Another user called for consistency in operations and documentation: “Additional ‘polish’ in providing an experience for OpenStack as if it were a product, rather than a constellation of disparate services that patch together somehow.”

One user gave the example of Nova and Neutron offering per-project quotas while Glance had a single global quota for image size. “It really boils down to having OpenStack act more like a single initiative, versus a collection of projects.”

Putting a finer point on it, one user said, “Every project has a totally different approach to configuration, which makes it impossible for the newbie to learn what is what before they run up against a brick wall and have to give up.”

Users want to make **deployment** automation easier and faster, with more tools to support this, requesting “a deployment tool that OpenStack distributors can standardize on and which they can enhance via plugins.”

Similarly, a user requested the “ability to upgrade to versions without re-installs—the only way it can scale in enterprise deployments.” And from another: “Bullet-proof deployment methodologies for complex infrastructures.”

“I hear from too many operators that there are simply



too many things to configure to know which one to tweak when things don't work well," one survey respondent wrote.

"I would like more investment in resources for the REST API documentation."

Users called out Ceilometer and Neutron most frequently as projects with significant concerns. For Ceilometer, the issue was scaling. "Five years into the project and it is still difficult to produce the metrics for a bill," one vendor said.

For Neutron, they wanted the networking service to be less complicated to use, with more substantial documentation and better integration with compute functions and PaaS layer integration.

Many users wanted to see greater **maturity** from specific projects, greater clarity on which projects are mature and which are still developing, and more certification and training materials.

"Despite the project being relatively mature, deployment models change dramatically between release. It's close to a full-time job to just to keep up with deprecated features, new APIs, and new tools," wrote one user. "If I take my eye off of the OpenStack developers for a few months, my technical debt balance skyrockets."

The rise of interest in bare metal prompted many users to call for better bare metal management capabilities and "a more flexible way to interconnect components across projects to build workflows that can bundle things together better from an operator perspective. [Also] a better monitoring/logging analytics story and chargeback/showback capabilities."

While some users requested more work on emerging projects, others wanted a greater **focus on core services**. "OpenStack needs to focus on the core products ... and less on the side products. While it is amazing that the OpenStack ecosystem allows others to create these side products, they sometimes serve very little

value and pollute the ecosystem as a whole. But just because I see little value in them doesn't mean others don't."

Users called for improvements such as better API abstraction for compute resources. "There are common instructions that apply to all of these—make these calls common to all. The API should also be aware of its type and allow different calls that are unique to the type."

There were also requests for backwards **API** compatibility and stability, so that "scripts that interact with the API and work today should keep working tomorrow and beyond."

**App development** is seen as a major opportunity for OpenStack development. "This is the next step—to embrace the application development on the top of OpenStack by generating resources such as SDK, documentations, tutorial, and real app examples that developers need to build their cloud-aware apps."

App integration, enhancement, and deployment were also frequently requested. "We are interested in use OpenStack for IoT [Internet of Things] applications. There are many projects, but each project is independent of others. OpenStack [needs] to manage projects toward architectural integration."

Additional themes emerging from the comments included requests for debugging and logging for operators and troubleshooting tools.

Requests for more **communication and cooperation between operators and developers** were frequent. "There's still a bit of a gap between developers and operators. Although that is narrowing, understanding operators' pains in certain areas is key in developing a better product as a whole."

One operator commented, "I know 'making operations easier' is easier said than done. This is for maintenance, upgrades and debugging. It's hard, since it's so distributed, but better error messages (not only stack traces of RPC message timeouts) would already help operation."

"There are many operations that can be done with the command line clients that cannot be done using the dashboard."

Keystone was called out for changing standards between versions that were not backwards compatible.

Finally, some users took issue with release timing and focus, asking to reduce the release cycle to "just one major release per year to give developers time to build and certify software to hardware."

Another perspective suggested, "Rather than adding one to two [new] components every release, the focus should be on enhancing existing components."

"This would hopefully put focus on a higher-quality stable release and the maintenance cycle of it, plus free up devs to work on features for longer."

## Which emerging technologies interest OpenStack users?

OpenStack adapts and grows with emerging technology, making it an innovation engine for companies as their platforms develop. The proportion of users answering this question increased 34% over last cycle, and several new technologies, including bare metal, hybrid cloud, and hardware accelerators, were added to the list.

Containers remain of greatest interest to survey respondents, at 70% this cycle, six points lower than last cycle. Software-defined networking (SDN) and net-

work functions virtualization (NFV) were second-most intriguing, though seven points off last cycle's 59% of indicated interest.

Other technologies that users noted in the "other" field include:

- Running containers on bare metal;
- Federated identity;
- Self-healing and automated clouds; and
- Single root I/O virtualization (SR-IOV).

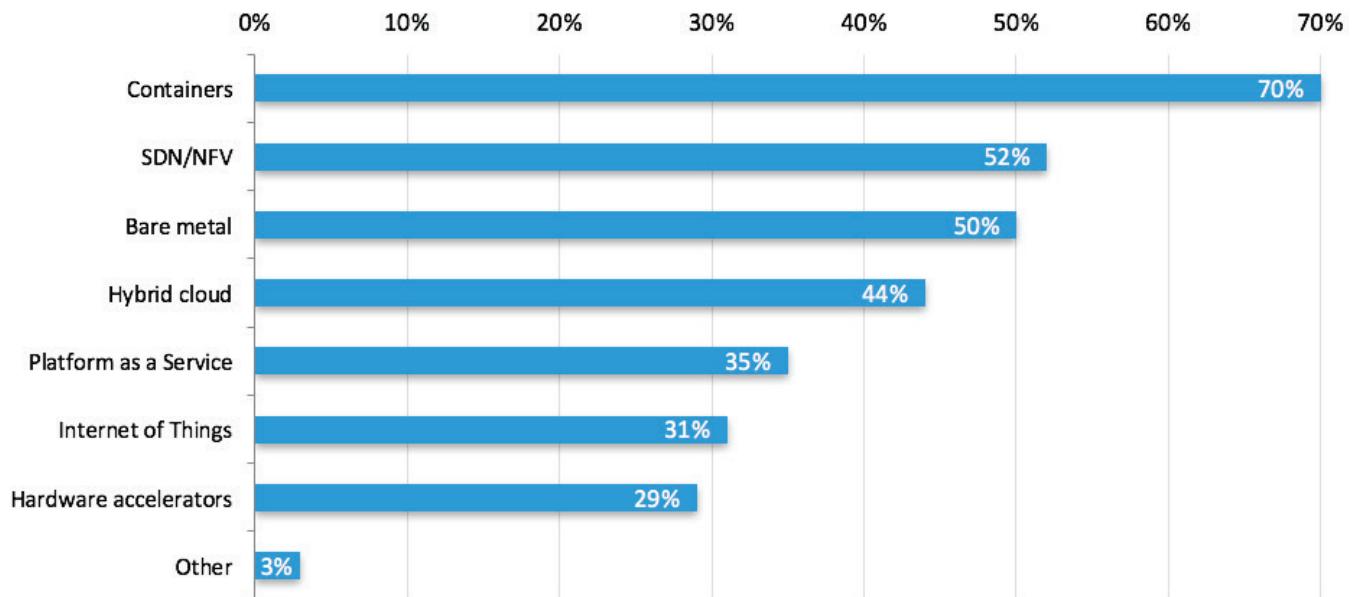


Figure 2.5 n=1131



# APP DEVELOPER PERSPECTIVES

## What toolkits are application developers using with the OpenStack API?

Applications developers' responses have increased markedly from survey to survey, offering insights into their decisions on OpenStack technology. Through survey logic based on the question about user roles, this section of answers was provided exclusively to the app dev community.

Developers said they chiefly use OpenStack clients as their software development toolkit for the OpenStack API, though this top answer is seven points lower than the prior survey cycle, indicating increased use of the more stable SDKs.

However, the proportion of developers who wrote their own toolkit jumped by nearly 50%, 10 points higher and into second place this cycle, surpassing libcloud (Python), which gained seven points, indicating potential difficulties with using SDKs.

FOG edged up one point and jclouds held steady.

Other toolkits noted by 13% of respondents include CURL, GopherCloud (Go SDK), OpenStack4J, Shade, Python SDK, and Terraform.

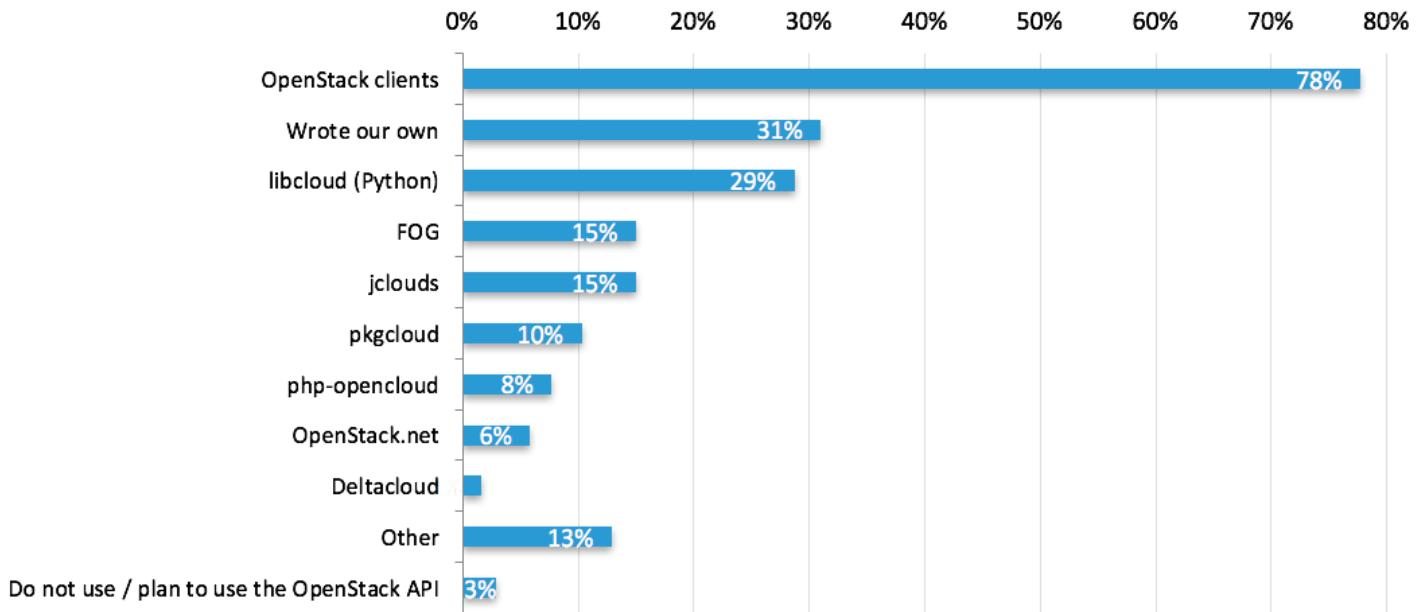


Figure 3.1 n=310

## What improvements to OpenStack would enhance developing applications?

The key themes expressed by the 93 app developers who answered this question included a need for better documentation; a request for tutorials, how-to guides, and knowledge base; debugging tools; improvements to the SDK and API coverage for languages including Python, Go, Java, and Ruby; and consistency between projects and APIs.

“Each project seems to want to do things their own way, rather than seeing themselves as a part of a bigger picture,” one app dev wrote regarding the need for more consistent API use. From another, a request for “unification of command line parameters and switches, making it easy to not wonder whether we should use ‘delete’ or ‘remove’ or something else.”

One commenter asked for OpenStack to accept GitHub pull requests for OpenStack clients. “If I find a bug in

the client and send a patch, ‘use Gerrit’ isn’t a particularly friendly response,” the survey-taker said.

Better documentation was mentioned in 22% of comments in the last cycle, and remained an area of concern with requests including more working examples of code/usage.

“Well-documented APIs with examples would be extremely helpful,” said one app dev. “Many times I end up on GitHub looking through someone else’s code to figure out how to implement a function.”

App developers also asked for better indication of infrastructure status. “For example, when I spin up a VM, it would be nice to know that it stalled because the message queues weren’t coping with the system load,” a commenter wrote.



## With which other clouds do app users interact?

Amazon Web Services remains the most popular choice, increasing 10 points compared to the prior survey. OpenStack private clouds again came second, with two-thirds of app developers interacting with them.

App developers who noted other clouds beyond the five given choices also mentioned DigitalOcean, Joyent, VMware vCloud/Sphere, CloudStack, CloudSigma, IBM Softlayer, and Oracle Cloud.

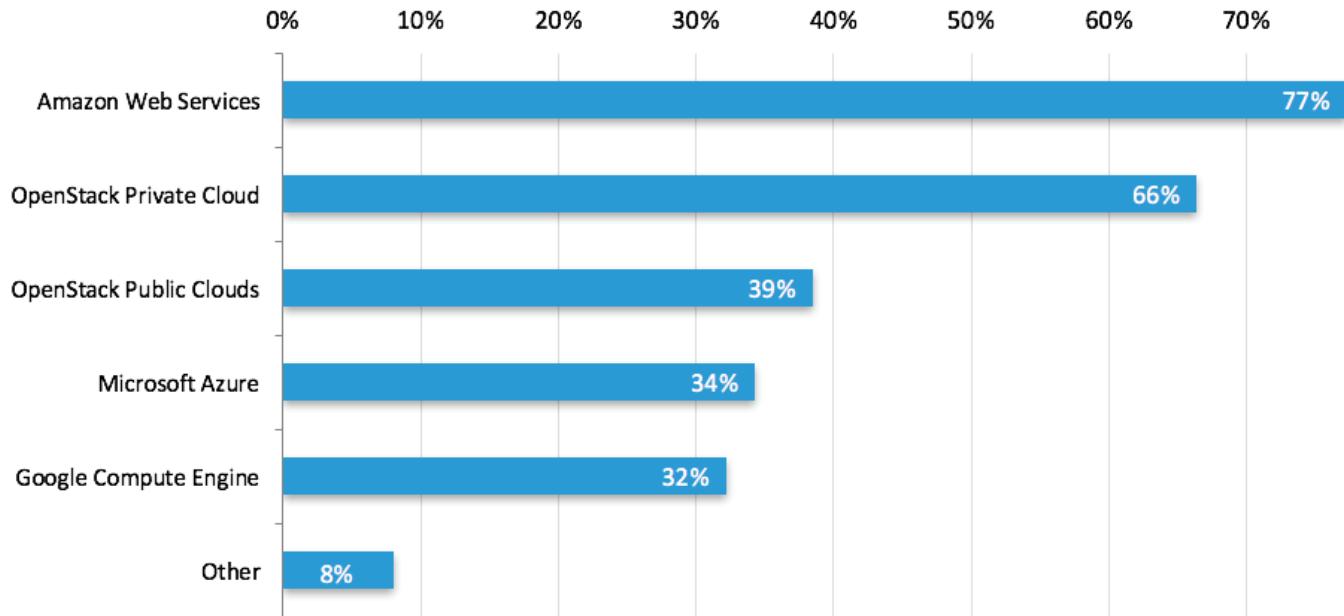


Figure 3.2 n=286

## What stack do app users choose?

Nearly 300 app developers weighed in on this question, with the top three stacks remaining unchanged. WISA and RAILS swapped fourth and fifth place, as RAILS gained 4 points and WISA dropped 9 points.

Among “other” stacks mentioned by a staggering 27% of respondents, these were most often noted:

- Linux, Apache, MySQL, Python (LAMP);
- Linux, Nginx, PostgreSQL, Python (LNPP);
- Tools written by Python, Java, or Go; and
- Multiple stacks.

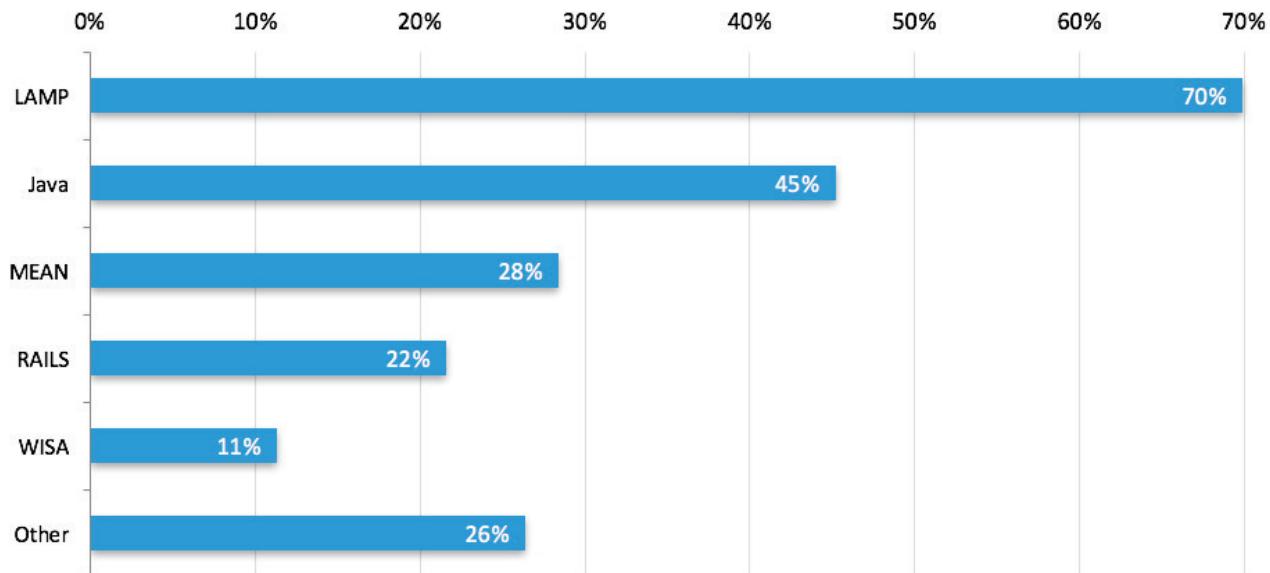


Figure 3.3 n=292



## In what stage are OpenStack deployments?

In this cycle, we see proof of OpenStack's maturity as now nearly two-thirds of clouds are in production or full operational use.

That's a 16-point increase over the survey conducted one year ago, and it represents statistically significant growth and development. Likewise, the proportion of cloud deployments in the test stage has significantly declined.

Remember, just 39% of deployments answered both this survey and the prior survey, so we're looking at a substantially different cross-section of the community in this survey cycle, yet the results continue to trend consistently upward toward full operational use.

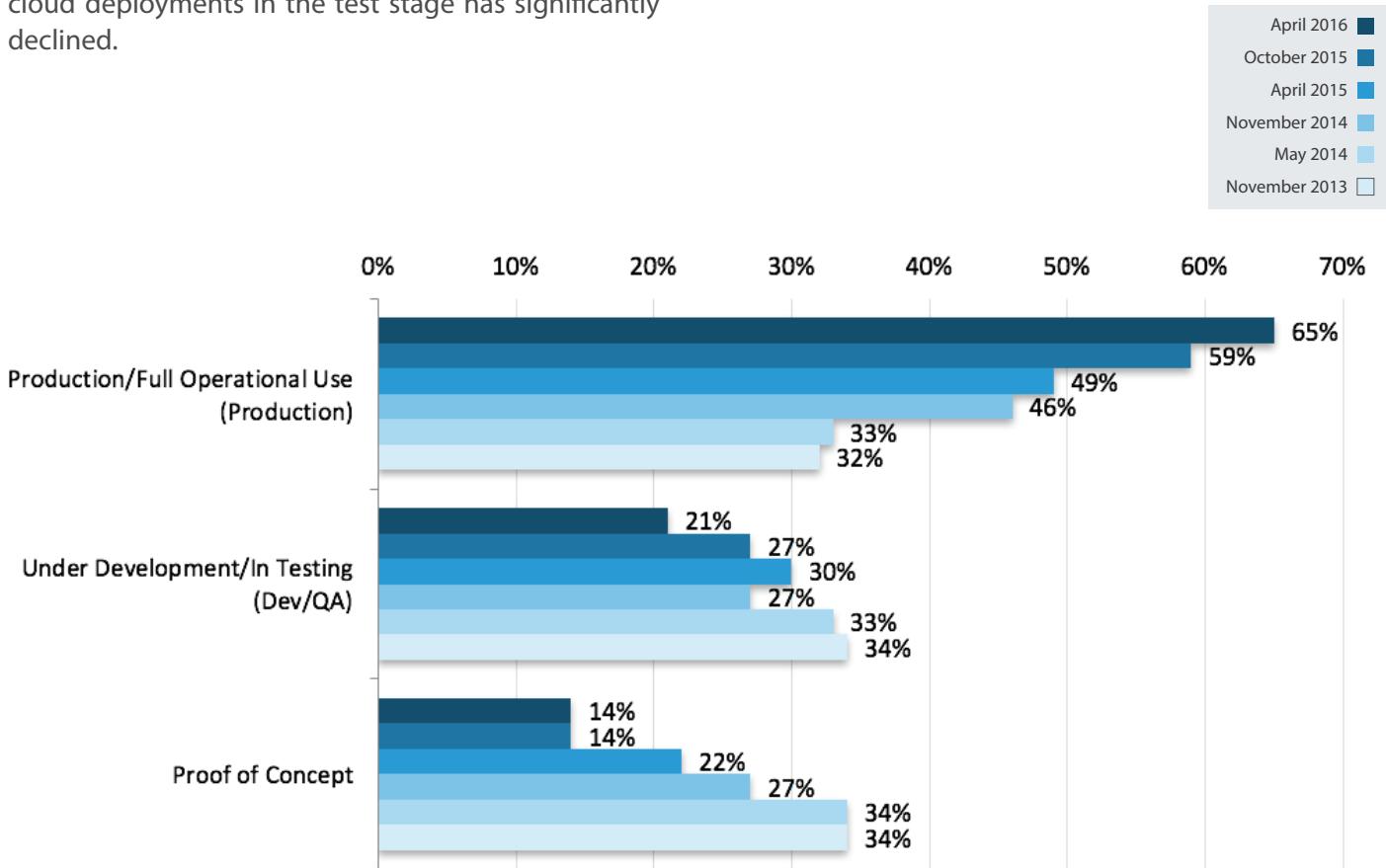


Figure 4.1 n=318 for April 2016

## What types of clouds are running OpenStack?

Nearly two-thirds of deployments are on-premise private clouds, a 3-point increase over last year, and more than half of these are in production. The number of public clouds reported fell from 19% to 16% of total deployments, though virtually all of these are in full production.

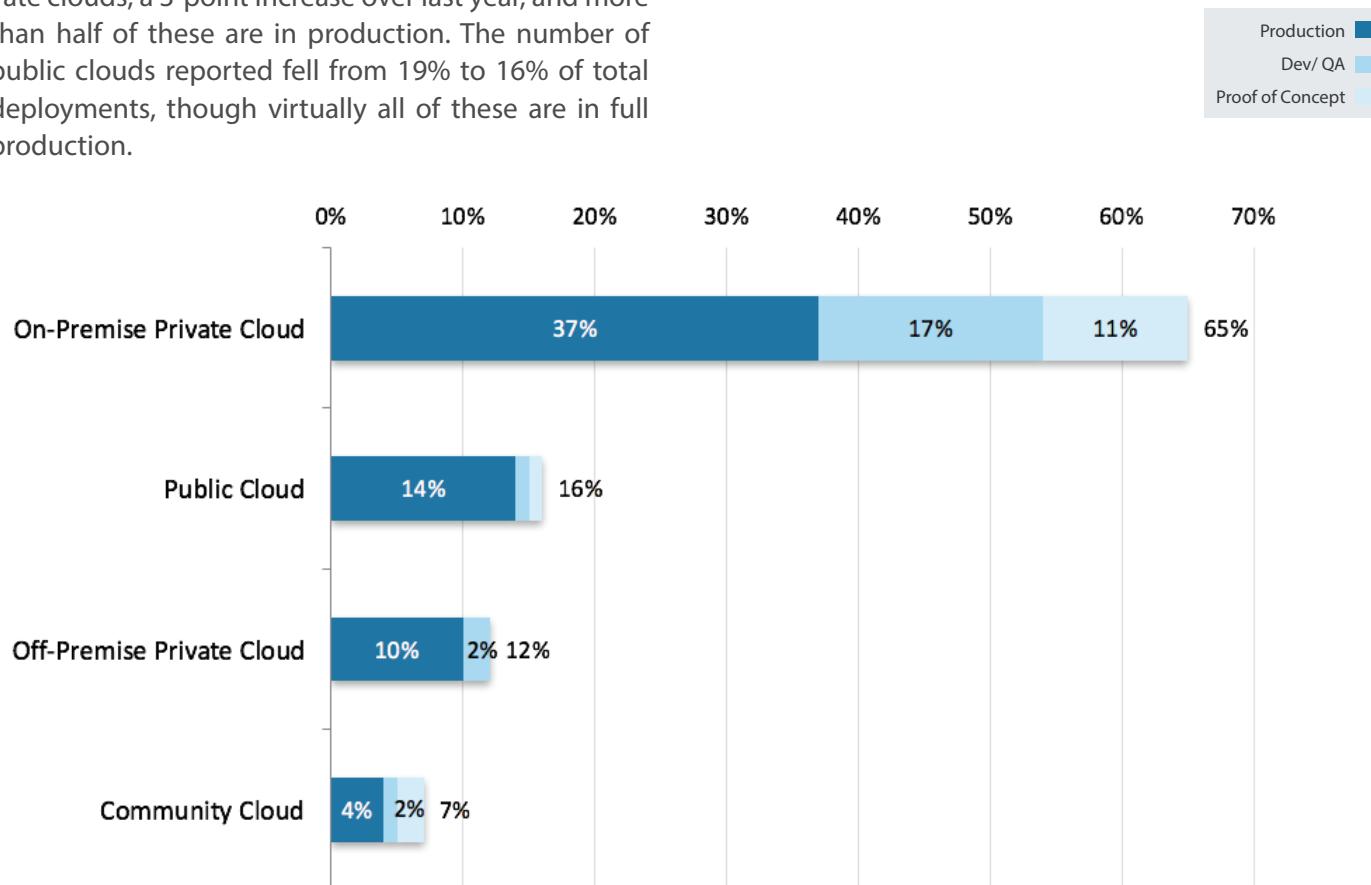


Figure 4.2 n=318



## Which releases are deployments using?

When this survey was conducted, OpenStack's 13th software release, Mitaka, was two months away from its April 7, 2016 release, and Liberty had been released four months prior, on Oct. 15, 2015.

Whereas last year the proportion of users running the three most recent releases were spread fairly evenly across Icehouse (last cycle: 33%), Juno (36%), and Kilo (35%), in this cycle there was a strong push to adopt a newer release. Now, 94% of deployments are using the two most recent releases of OpenStack.

The total number of responses adds to greater than 100% because some deployments indicated more than one release, which is facilitated by the upgrade functionality in some projects.

Additionally, we segmented this data to focus on production deployments only, which represent 65% of the total reported deployments. This chart shifts a few points back toward older releases, but still remains concentrated on Kilo and Liberty.

ALL DEPLOYMENTS, BY RELEASE

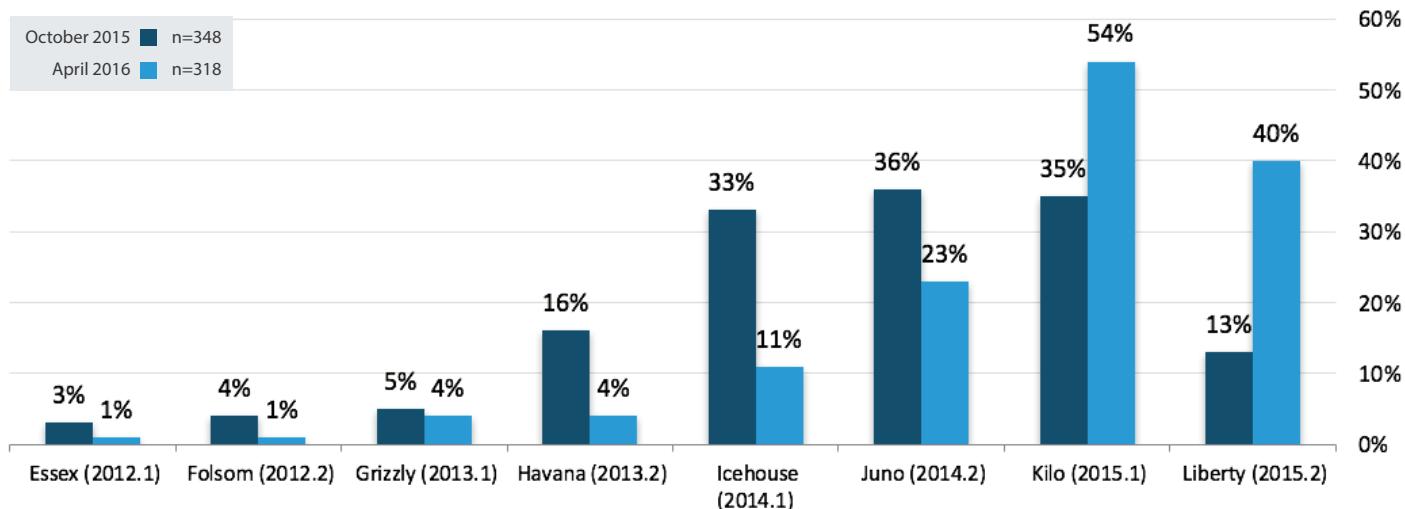


Figure 4.3

PRODUCTION DEPLOYMENTS, BY RELEASE

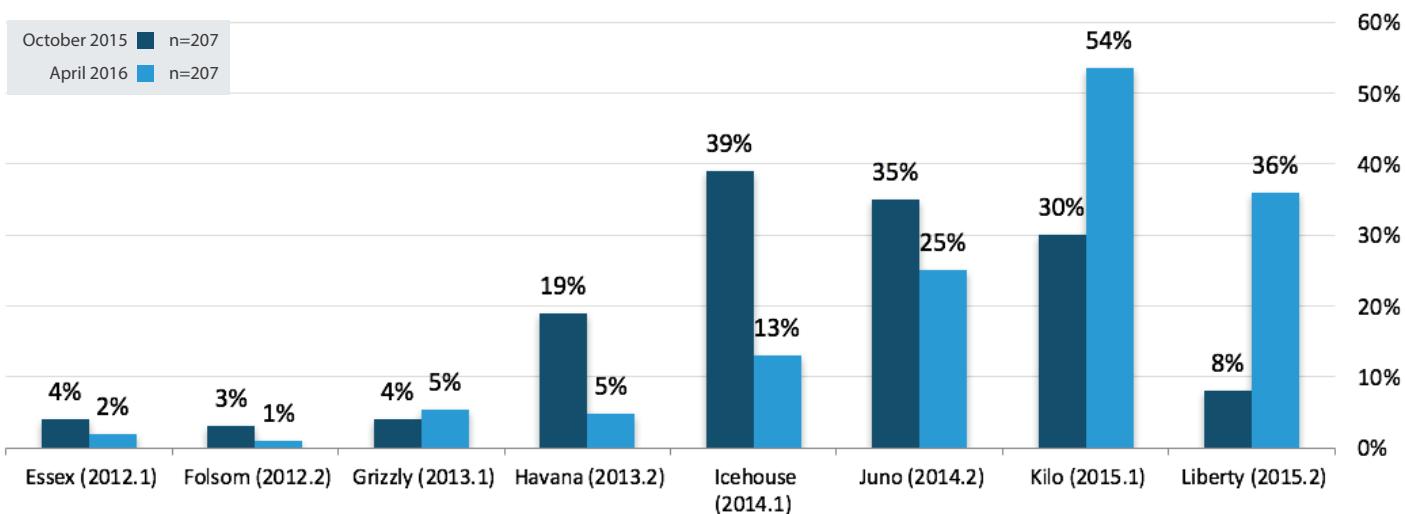


Figure 4.4

## How are releases being adopted by production deployments?

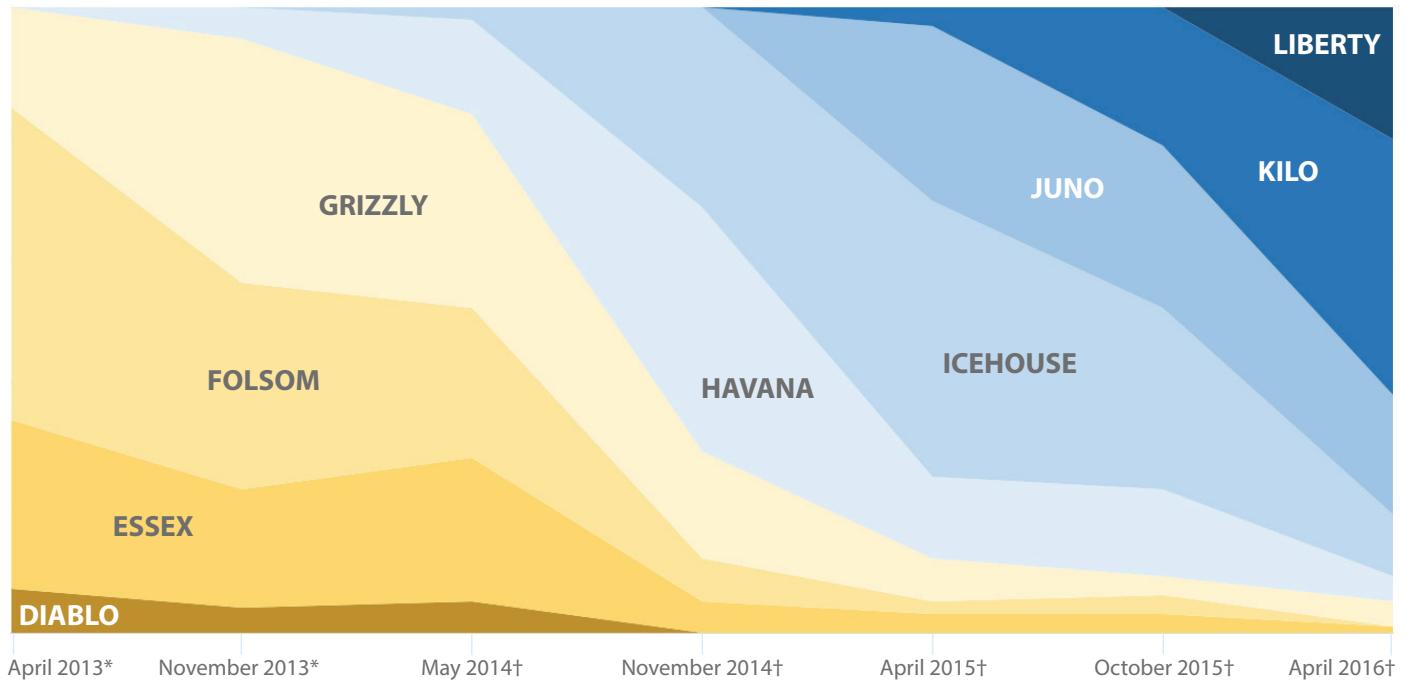


Figure 4.5 n=207 for April 2016

\*April 2013 and November 2013 figures include all deployments  
 † May 2014 – April 2016 figures represent production deployments only



We used data from the previous chart [figure 4.4, production deployments, by release] combined with historical data on release adoption to create this area chart depicting current OpenStack release adoption.

This chart again demonstrates the strong adoption of Kilo and shift toward the most recent versions of OpenStack software.

## Which projects do OpenStack deployments use?

In addition to asking about a cloud's overall deployment stage—production/full operational use, QA/testing, or proof of concept—we asked about how individual projects are being used and their level of readiness.

New survey logic in this cycle ensured that an individual project could only be designated “in production” if the respondent's cloud was also marked “in production.”

Among 290 deployments answering this question, the majority of the top six adopted projects (Keystone, Nova, Horizon, Glance, Neutron and Cinder) are in production.

In the last survey, the top six projects were in testing or production for between 78% and 85% of deployments. In this survey, adoption soared to between 83% and 97%, with five projects at 90% adoption or higher.

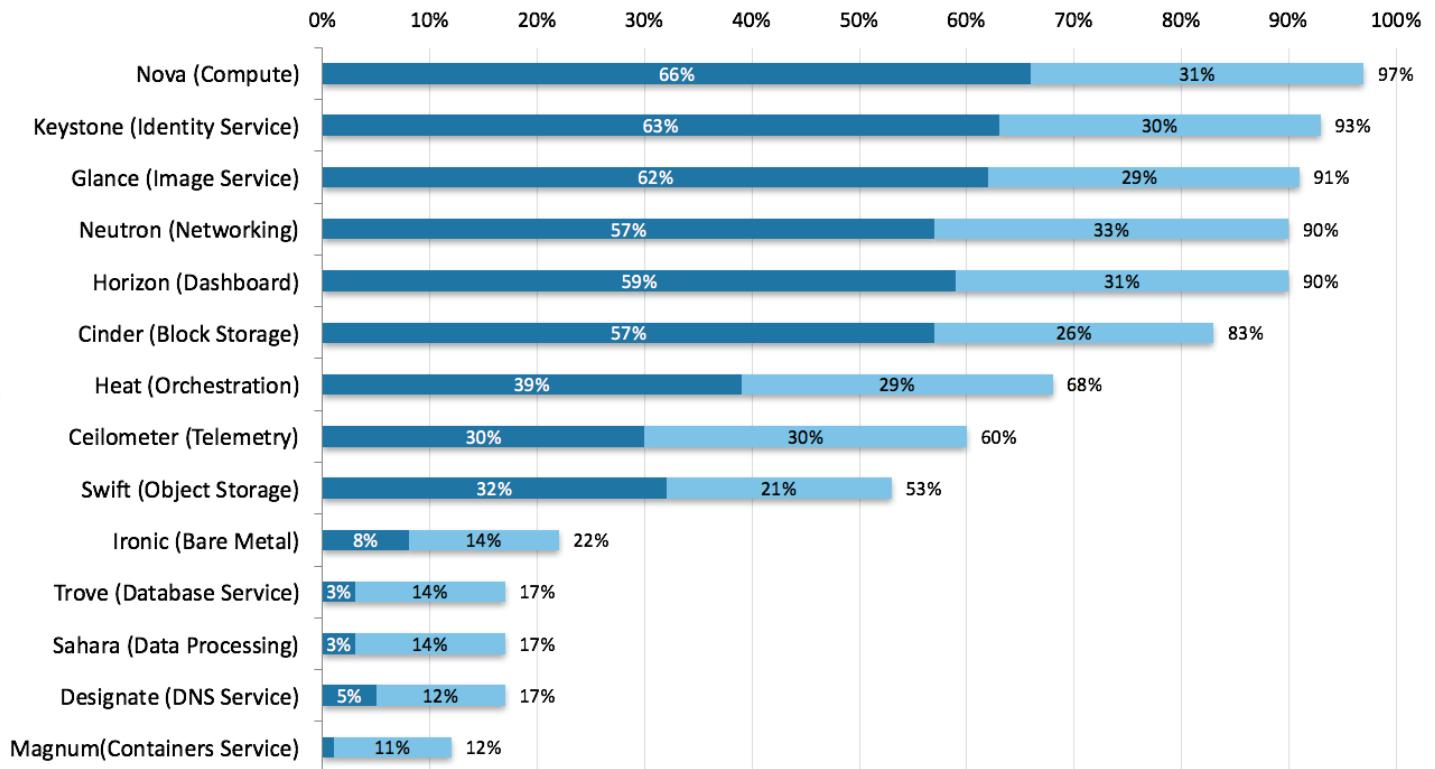


Figure 4.6 n=290

Production ■  
Testing ■

## Which emerging projects do OpenStack deployments use?

A new survey design gave greater exposure to OpenStack's emerging projects by showing a grid of all of these projects to users registering a deployment, rather than requiring that the users first add them to a grid and then indicate their use or interest.

As a result, answers cannot precisely be compared to last cycle answers, yet they reveal significant use or testing of the projects.

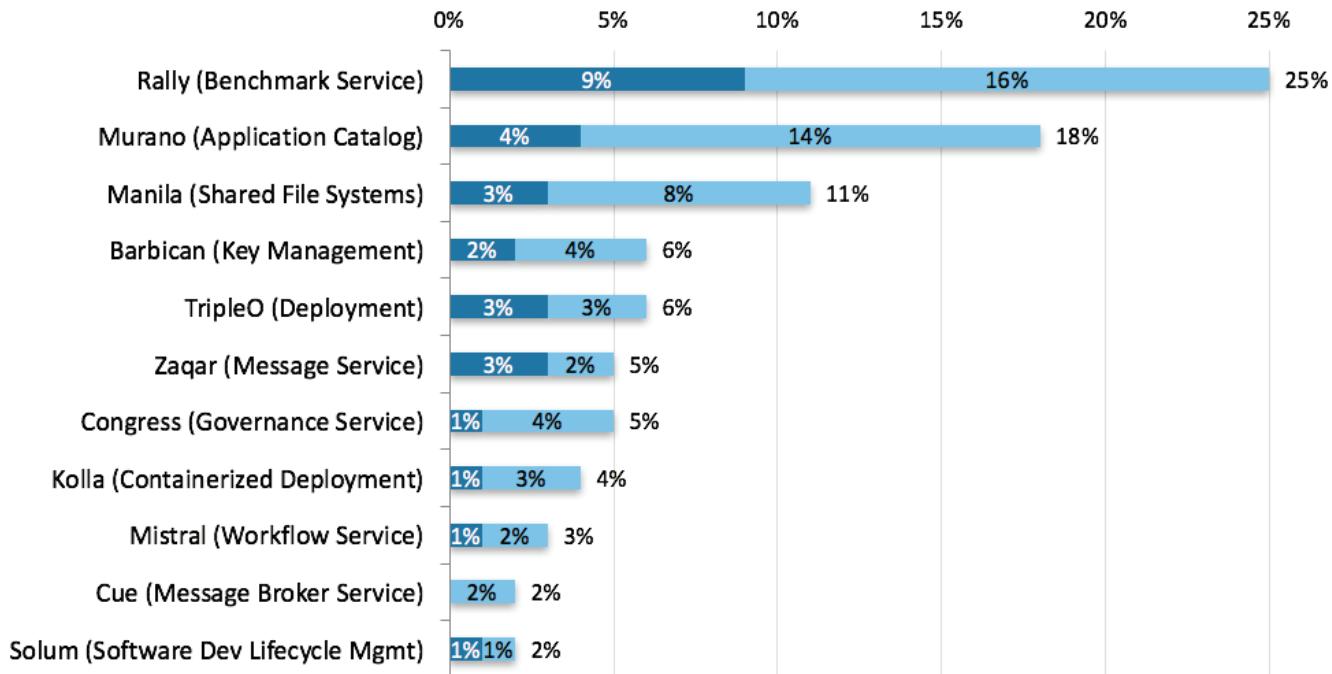


Figure 4.7 n=290

Production ■  
Testing ■

## Which projects are OpenStack users most interested in?

So, what does the future of OpenStack look like? Due to the change in survey design, many more users indicated interest in emerging OpenStack projects, especially in containers service Magnum, DNS service Designate, and the shared file system Manila.

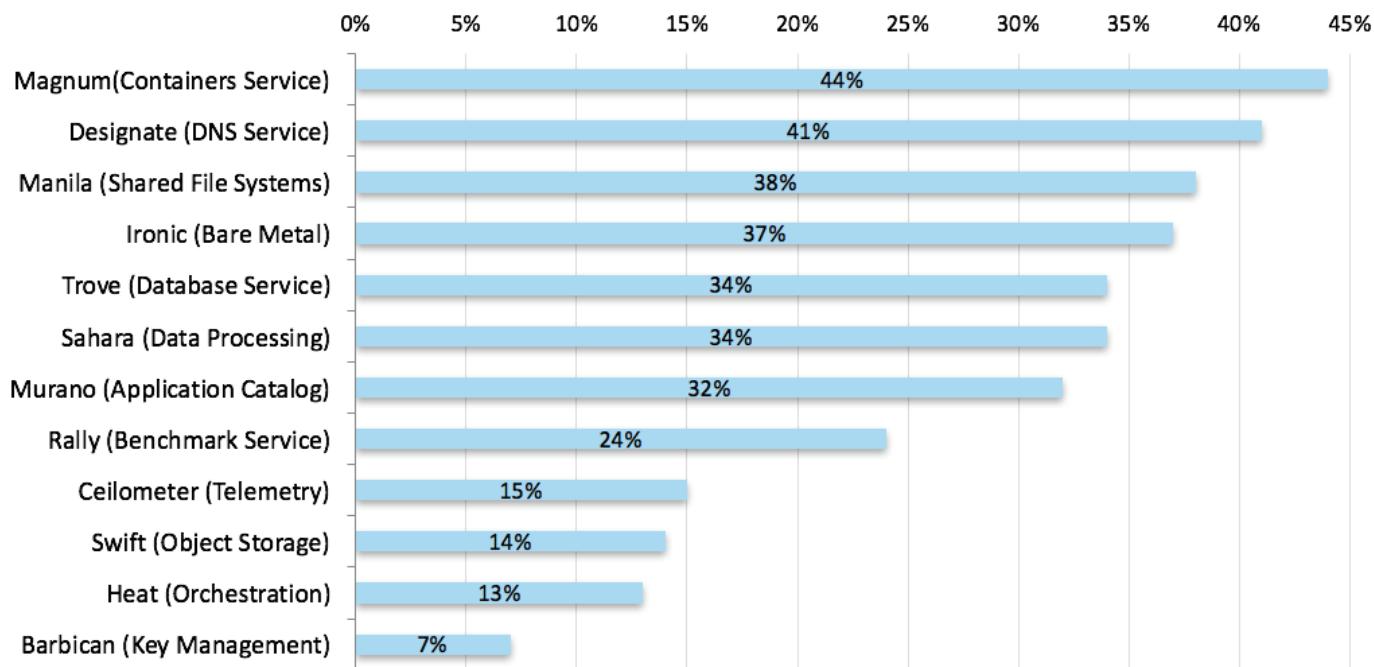


Figure 4.8 n=290

## How many projects does an OpenStack deployment use?

In this cycle, we wanted to know not only the adoption rate per project, but also how many projects a typical cloud has adopted. We looked only at clouds in production or Dev/QA stage (excluding those at proof of concept stage).

Additionally, the chart below reflects only projects in production or testing phase, excluding instances where the respondent simply indicated interest in the project.

We hypothesized that OpenStack's core services plus a few additional projects were likely to be in use, and

among deployments in production, 77% are using between five and nine projects in production or test phase. However, we were surprised to learn that the average number of projects in use among all production or QA deployments was 11.

The average number of projects that clouds are using in test phase is five, with 57% of deployments testing one to four projects, and 25% of deployments indicating that they are testing 15 or more projects.

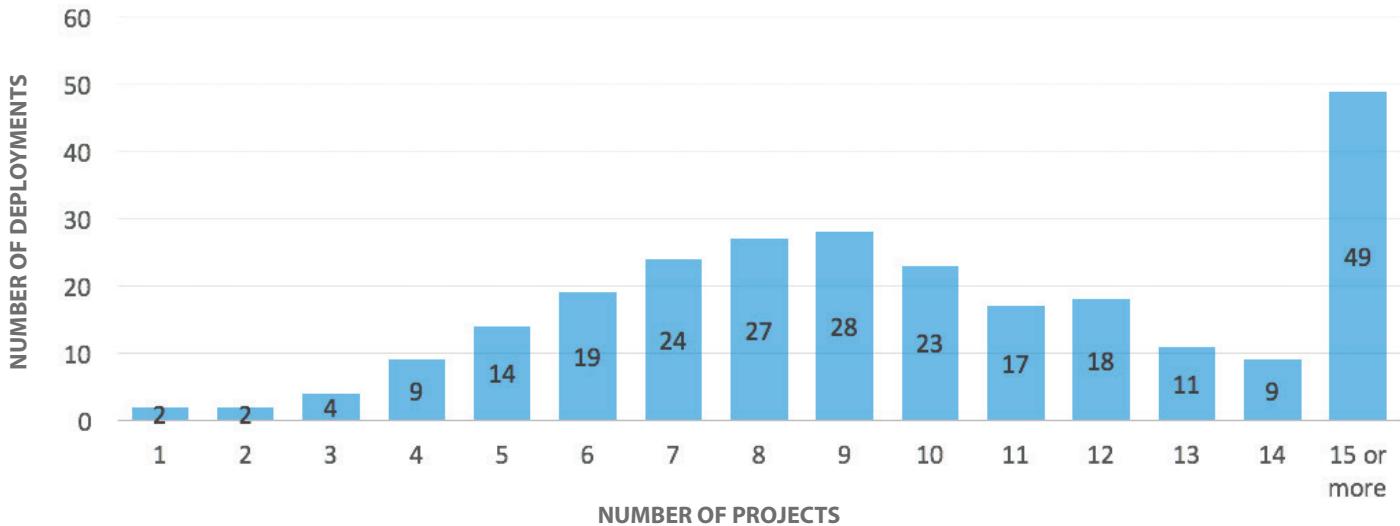


Figure 4.9 n=256

## Which workloads and frameworks are running on OpenStack?

We segmented this data based on the deployment stage, with production deployments again in dark blue.

Software development and testing remains the top use case, edging two points higher in this survey, with infrastructure services also gaining a point and web services and e-commerce holding steady. A greater share of each of these workloads are in production.

Network functions virtualization (NFV) surged up the list this cycle, from ninth to fourth place, an increase of eight points.

Among the 4% of users who indicated other workloads, virtual desktop infrastructure (VDI), voice, training, and data science were noted.

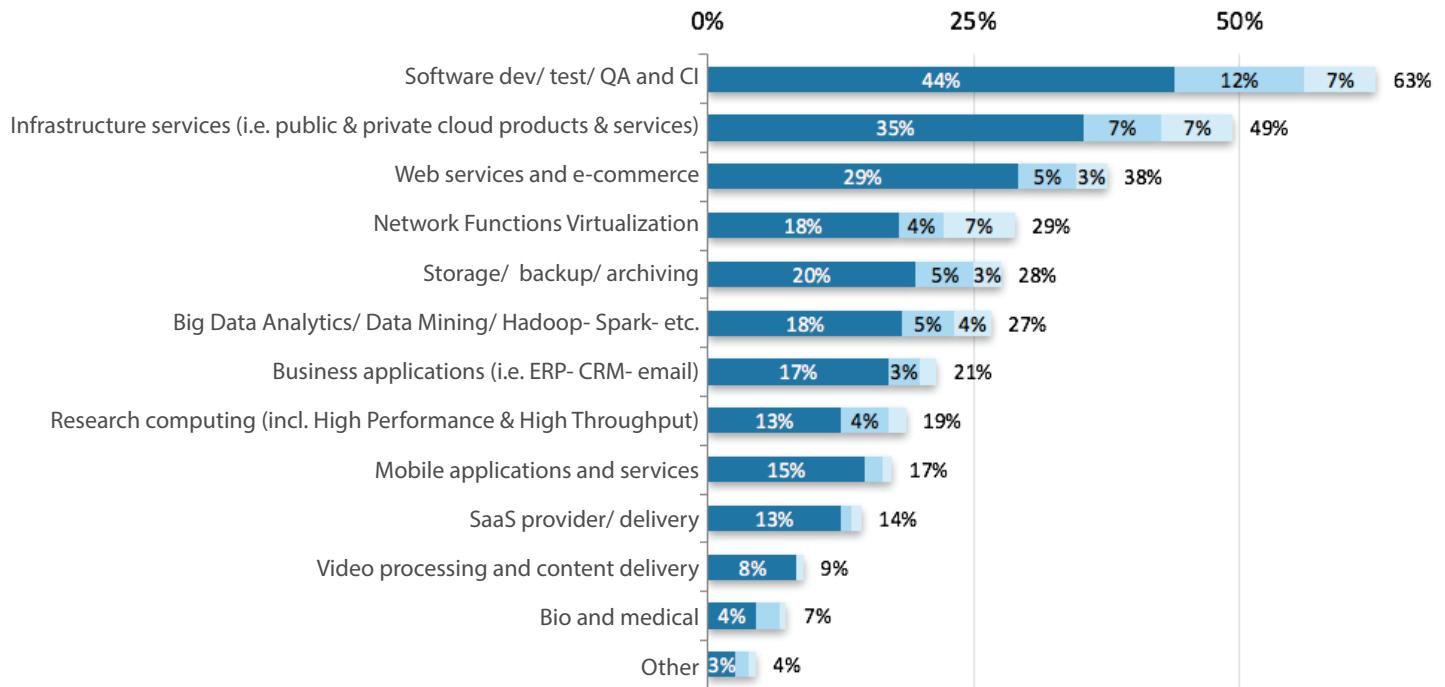
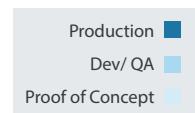


Figure 4.10 n=312





# DEPLOYMENT DECISIONS

## What packages are OpenStack deployments using?

There is strong consistency from the last survey to this survey in terms of the packages OpenStack deployments are using, with a six-point decrease in both packages the user has modified and packages the user has built.

However, self-built or self-modified packages were also higher one year ago compared to the last survey cycle, indicating no clear trend.

Vendor distributions increased two points, which is not statistically significant.

We asked users why they modified or built their own packages. Most deployers indicated that they were making or modifying packages to deal with missing features or bug fixes, with a lesser number working around packaging bugs or the speed with which packages are updated.

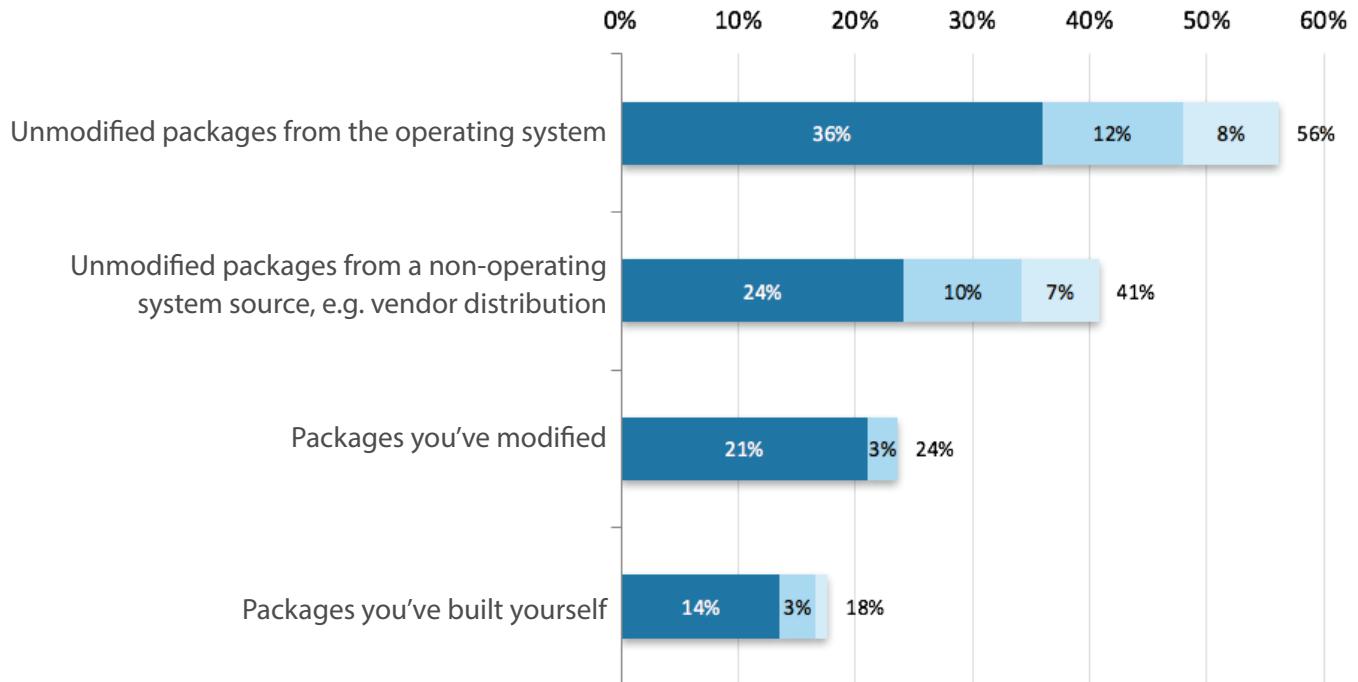


Figure 5.1 n=302

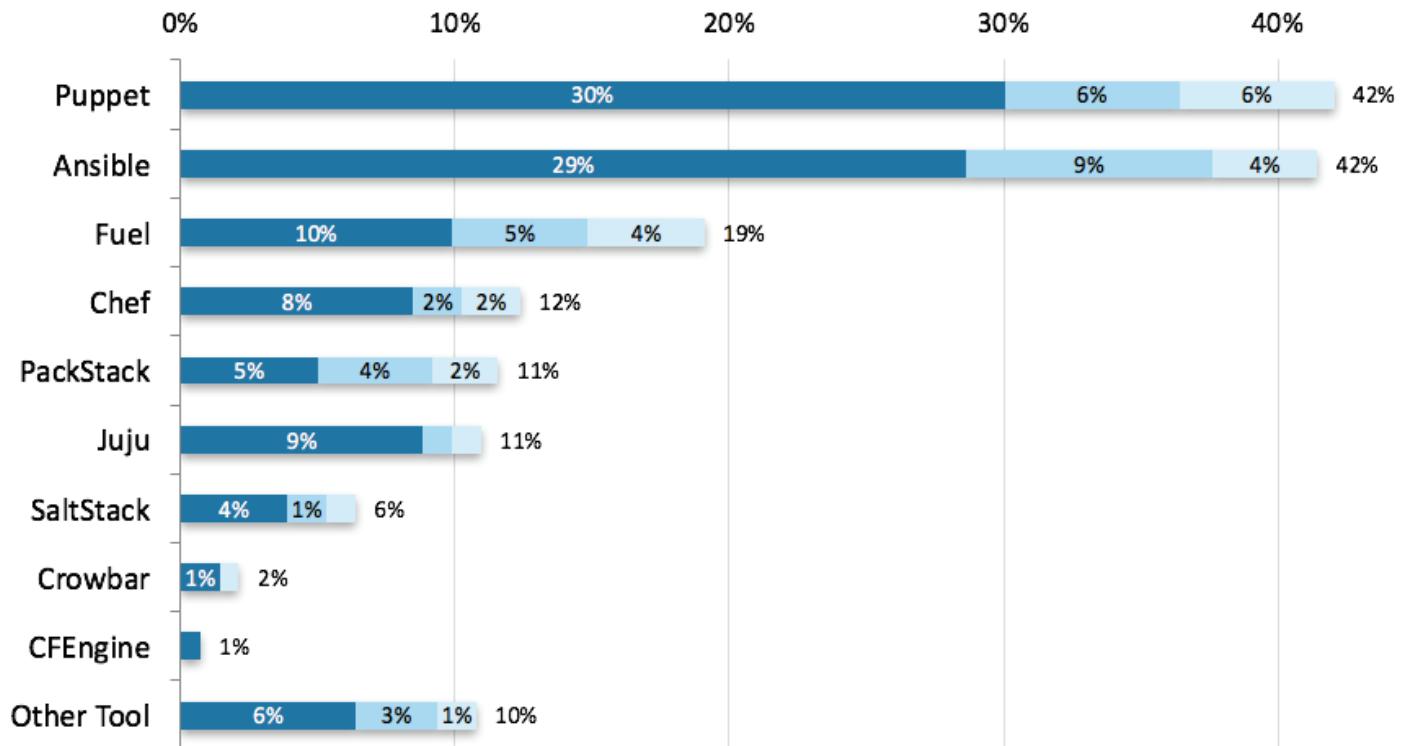


## What tools are used to deploy/configure OpenStack clusters?

Unlike last cycle, when Puppet had a 14-point lead over Ansible, the two are now neck and neck in popularity for tools used to deploy or configure OpenStack clusters.

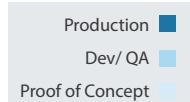
Fuel also jumped from fifth place to third, ahead of Chef and PackStack. SaltStack declined by 5 points.

From the “other” category, we saw several instances of RDO Director (TripleO), OpenStack Ansible (OSA), Cobbler for bare metal installation, Foreman (which appeared on the list last year), Kolla, Ursula, Bifrost, home grown/custom, and none used (appliance noted instead).



**Figure 5.2** n=283

Percentages are rounded to the nearest whole number; bar length shows fractions.



## What container and PaaS tools are used to manage OpenStack applications?

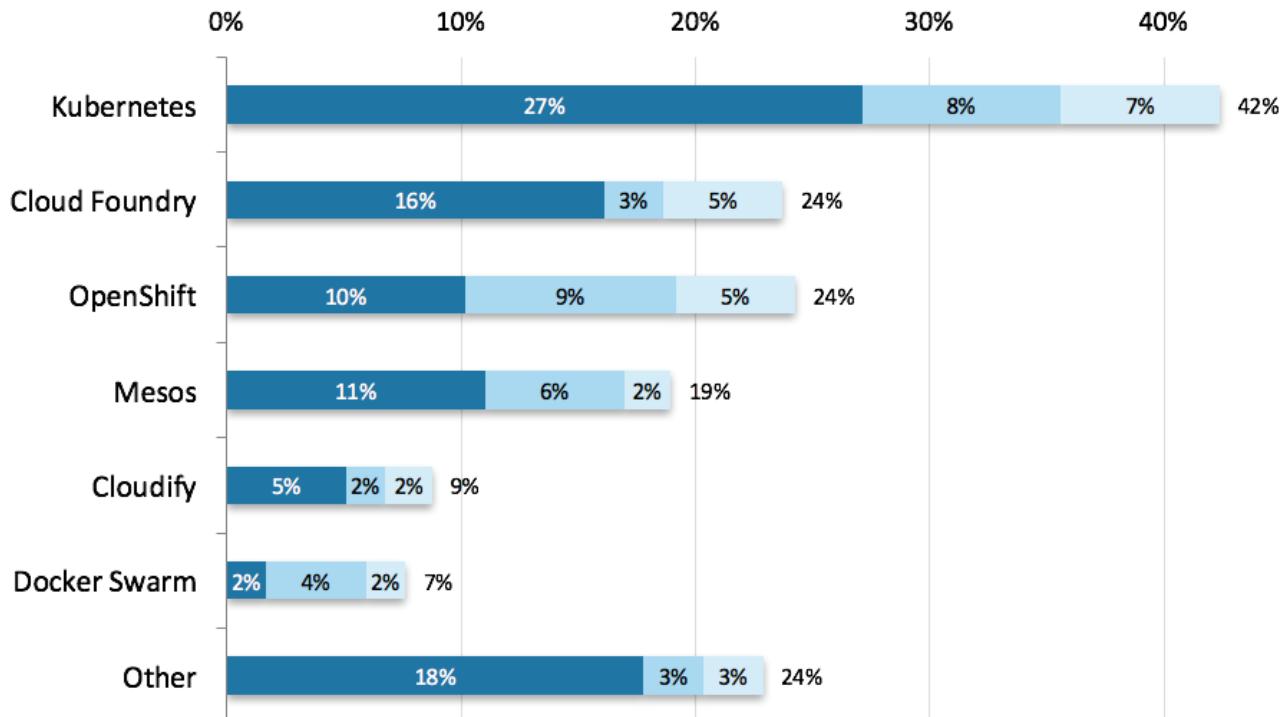
Kubernetes surged ahead of CloudFoundry in this cycle, increasing 8 points to be the top Platform-as-a-Service (PaaS) tool, while CloudFoundry lost 11 points.

Docker Swarm dropped off from 23% to just 7%, and OpenShift, while stable in terms of market share, continues to have the lowest proportion of production deployments.

The significant volatility in this category, compared to other categories where vendors or tools changed only

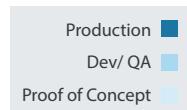
a few points from cycle to cycle, is in part due to the relatively small sample size (just 82 deployments answered this question last cycle; 118 this cycle, a 31% increase in total responses).

But the share of responses indicating other PaaS tools remains between one-fourth and one-fifth of deployments, with OneOps, Stackato, Scalr, and Docker most commonly used, as well as self-built or none used.



**Figure 5.3** n=118

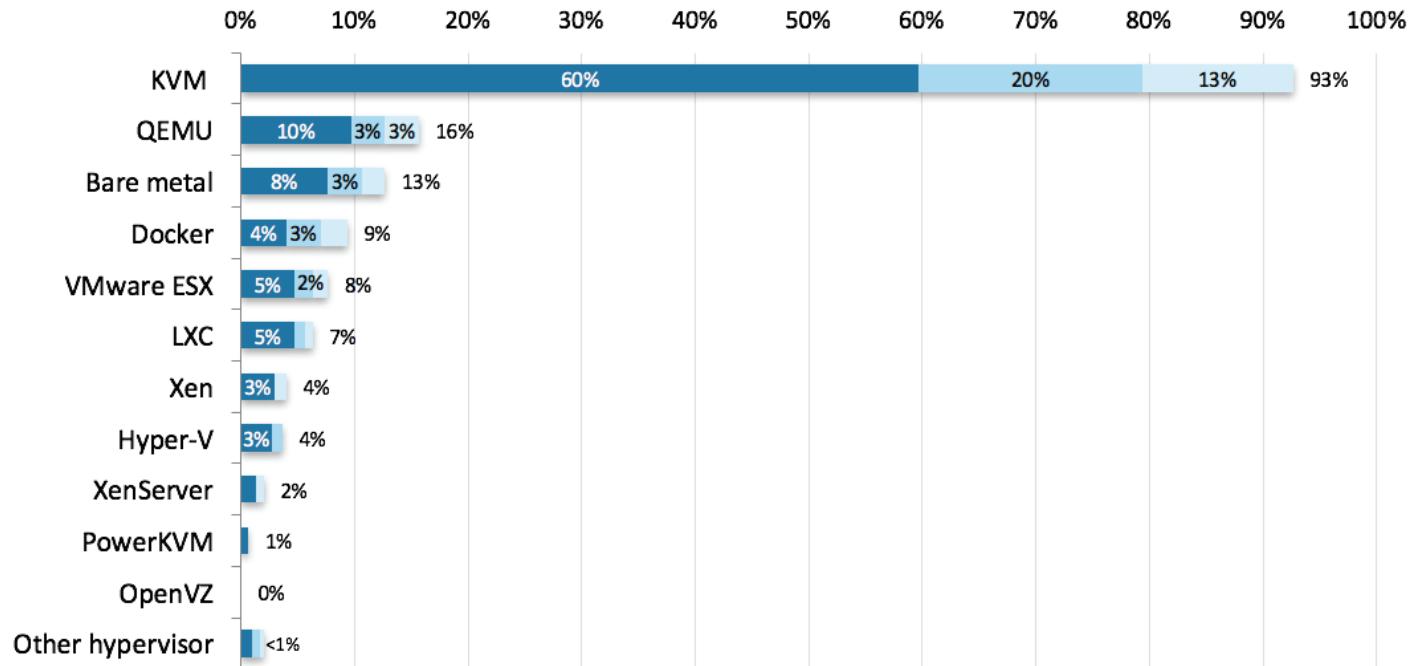
Percentages are rounded to the nearest whole number; bar length shows fractions.



## Which OpenStack Compute (Nova) hypervisors are in use?

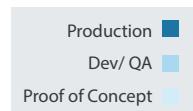
Kernel-based Virtual Machine (KVM) provides the vast majority of Nova hypervisor support, with 95% of deployments in the last cycle indicating its use, and just 2 points less this round.

Use of ESXi and LXC declined somewhat, and other hypervisors noted to be in use were PowerVM, z/VM, Solaris Kernel Zones, and LXI.



**Figure 5.4** n=300

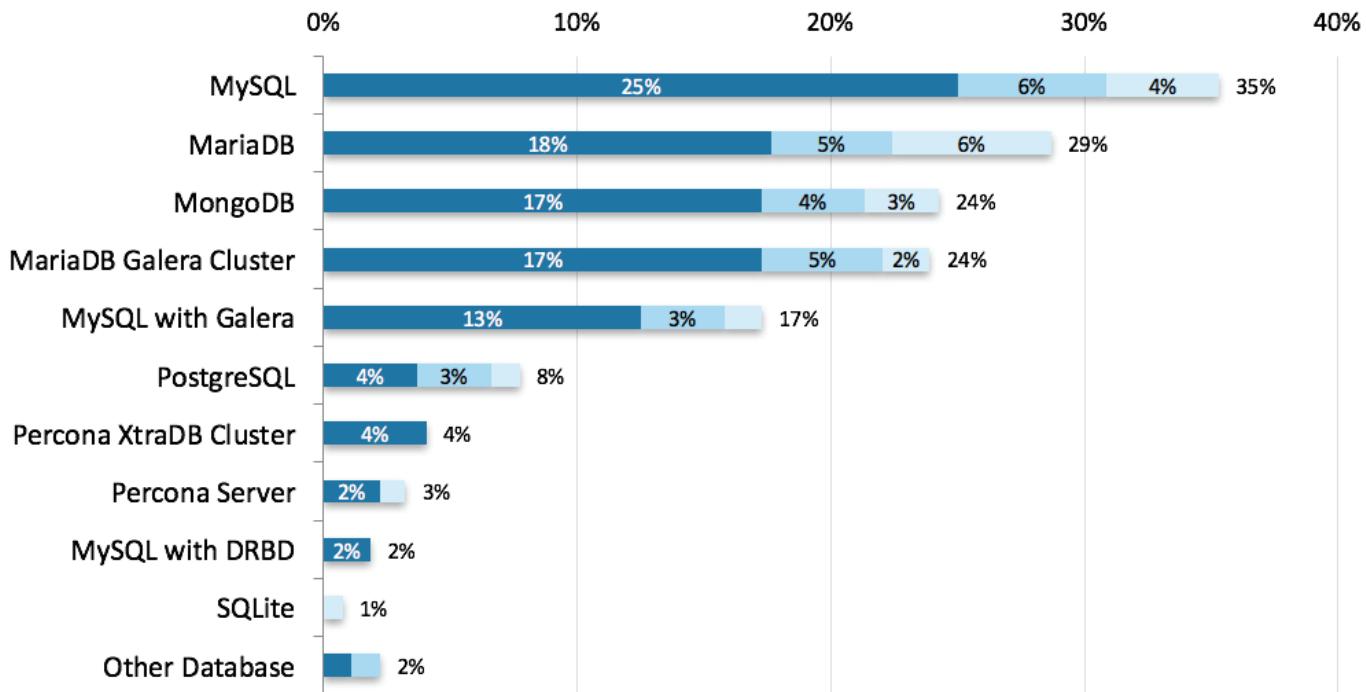
Percentages are rounded to the nearest whole number; bar length shows fractions.



## Which databases are used for OpenStack components?

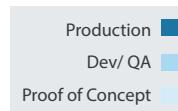
A few changes of note compared to the prior cycle are MariaDB up 6 points, becoming the second most popular choice, and MongoDB up 3 points and now on par with MariaDB Galera Cluster, which lost 1 point

and dropped from second place to fourth. Users noted DB2, ZooKeeper, and HBase among other databases used.



**Figure 5.5** n=272

Percentages are rounded to the nearest whole number; bar length shows fractions.



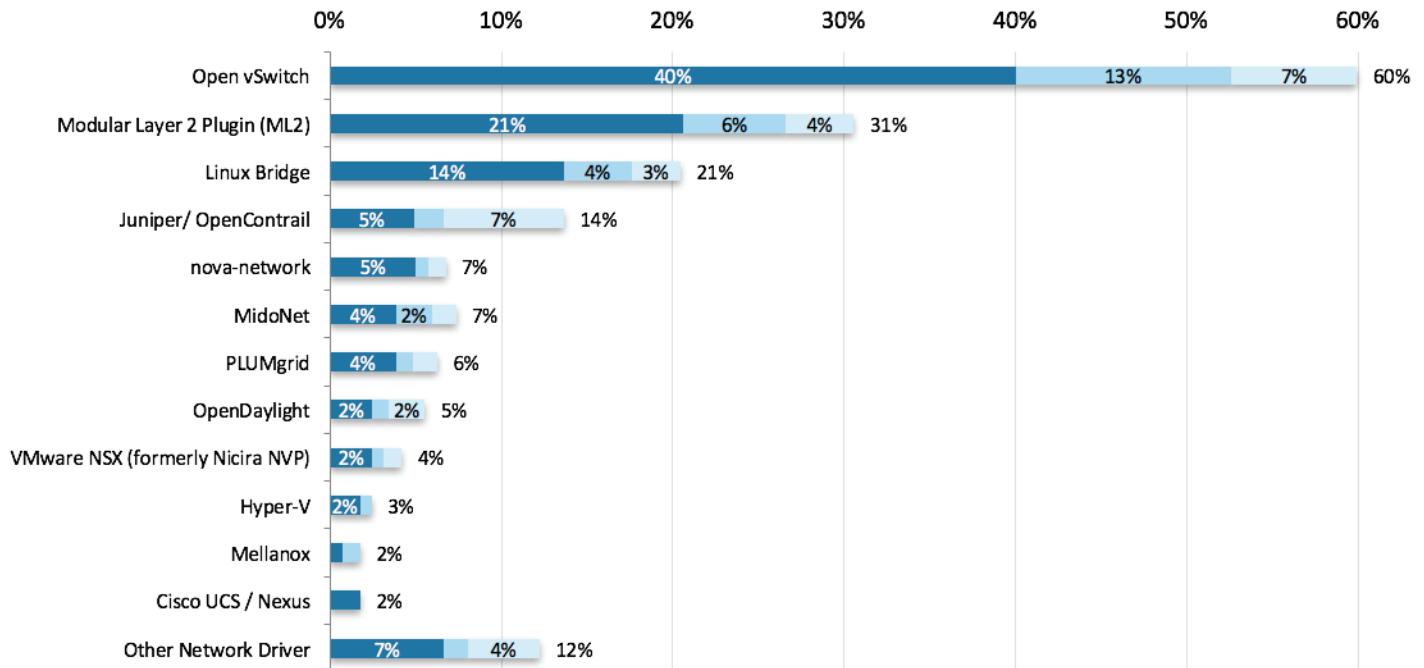
## Which OpenStack Network (Neutron) drivers are in use?

Among leading Neutron drivers, Open vSwitch remained relatively constant at just 2 points lower than last cycle and nearly double the next most common choice, Modular Layer 2 Plugin (ML2).

Significant change is demonstrated in the data segmentation, revealing the proportion of deployments in production. There is massive growth across nearly

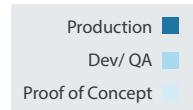
every driver category in terms of maturity, from proof of concept to testing to production.

For example, in the last cycle, 13% of those who use Open vSwitch as a Neutron driver were operating in production stage. In this cycle, more than 68% of those using Open vSwitch are in production. This is a massive shift in maturity, specifically for the Neutron project.



**Figure 5.6** n=286

Percentages are rounded to the nearest whole number; bar length shows fractions.

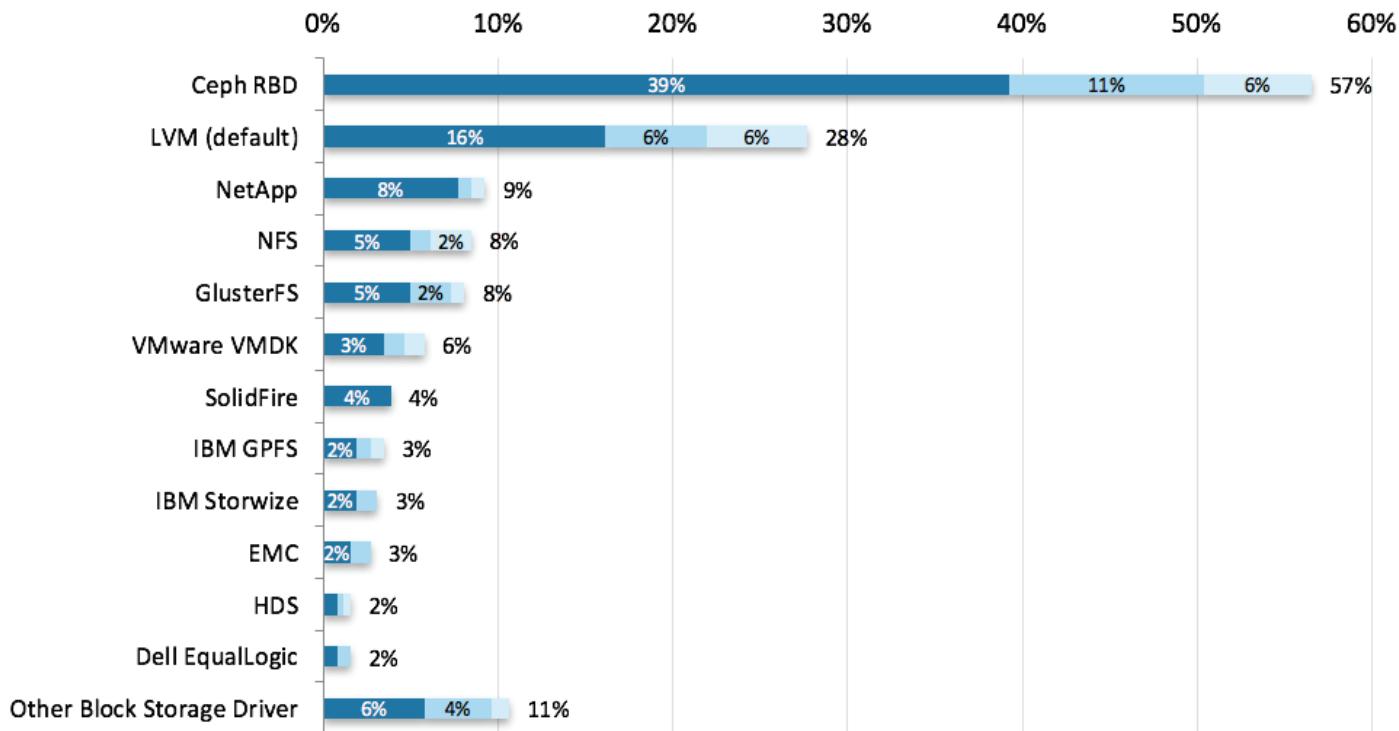


## Which OpenStack Block Storage (Cinder) drivers are in use?

Ceph RBD continues to dominate Cinder drivers, though its share declined 5 points while second-place LVM (default) increased 6 points.

NetApp lost 3 points, EMC and NFS lost 2, and Gluster FS and Dell EqualLogic were down 1.

The portion of users indicating other storage drivers rose markedly from 7% to 11%, with users writing in DRDB, Dell Storage Center, ZFS, Fujitsu Ethernus, HPE MSA, and Quobyte.



**Figure 5.7** n=260

Percentages are rounded to the nearest whole number; bar length shows fractions.



## Which Neutron and Cinder drivers are used by clouds with 1,000+ cores?

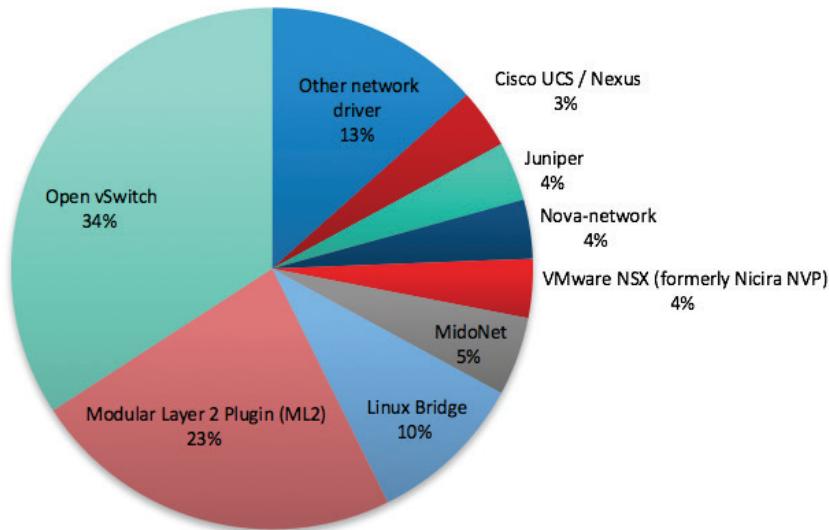


Figure 5.6.1 n=44

### NEUTRON DRIVERS

We drilled down in the data on networking drivers to find out which drivers are used by production clouds with more than 1,000 cores.

There are 44 responses meeting this criteria (one more than last cycle), so this should be considered directional data only and not necessarily representative. Open vSwitch and ML2 both take larger slices of the pie compared to last cycle, up 8 points and 4 points, respectively.

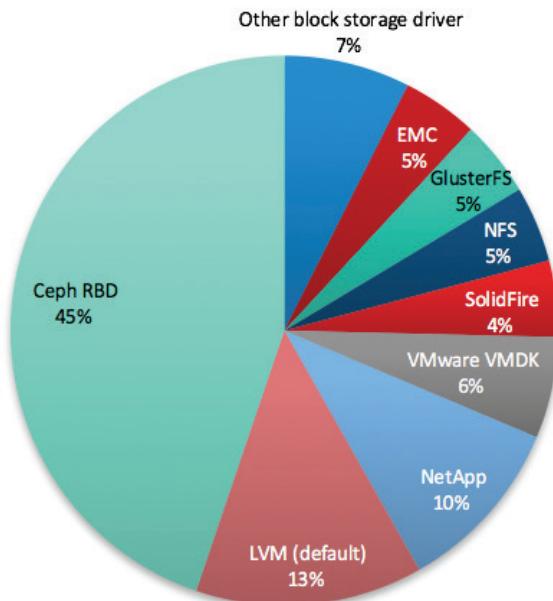


Figure 5.7.1 n=47

### CINDER DRIVERS

We also looked at the largest production clouds (more than 1,000 cores) to find out which Cinder drivers they select.

Though the sample size is small and results should be treated as directional, of the 47 clouds meeting this criteria and answering this question (five more than in the prior cycle), Ceph RBD increased its share of the pie by 8 points, LVM was up by 1 point, and NetApp shrunk 2 points.

## Which OpenStack Identity Service (Keystone) drivers are in use?

Rankings for this question didn't change one bit, though SQL gained 7 points, AD's share shrunk 6 points, and LDAP remained constant. Across the board, a larger proportion of production deployments

are represented. Other Keystone drivers mentioned in comments are Shibboleth, FreeIPA, SAML, Atlassian Crowd Plugin, and SUSE LDAP.

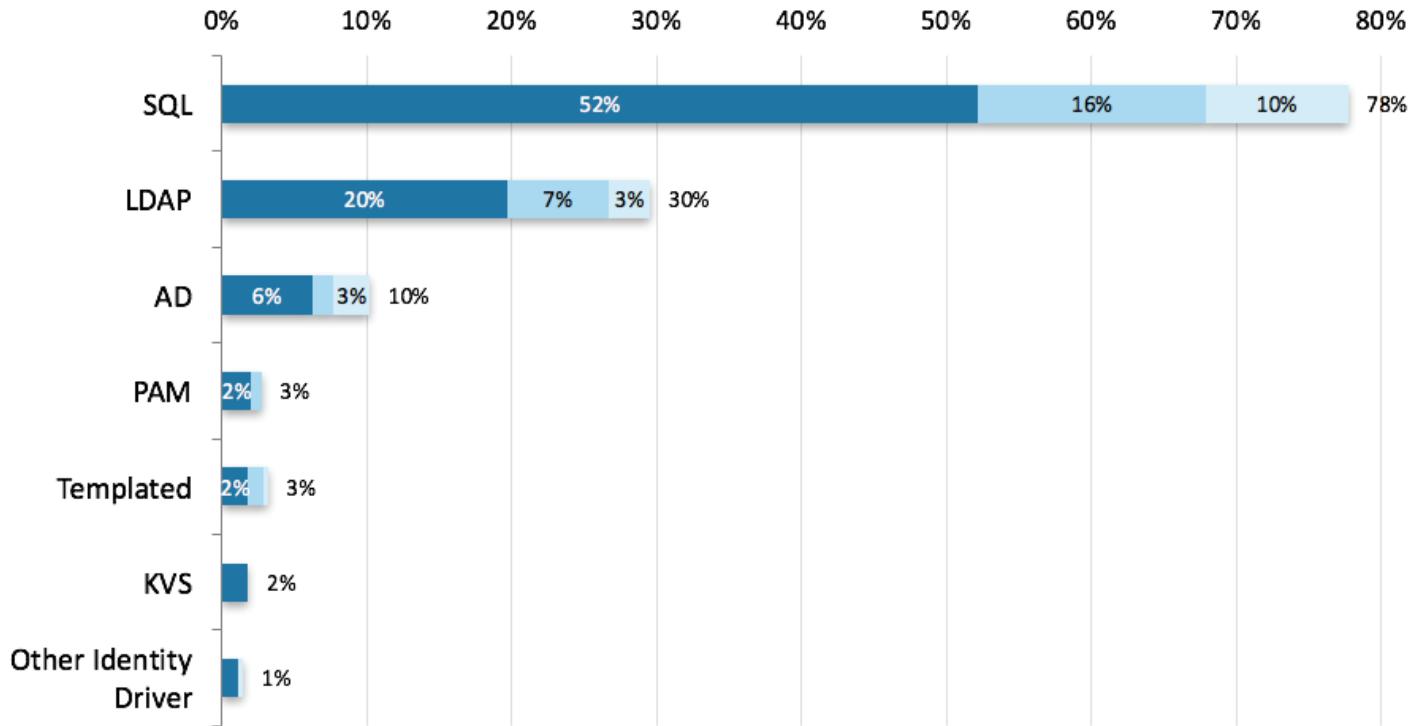
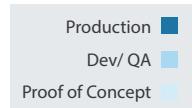


Figure 5.8 n=274

Percentages are rounded to the nearest whole number; bar length shows fractions.



## Which operating systems are running OpenStack deployments?

Ubuntu Server continues to provide the operating system for the majority of OpenStack deployments, and was indicated by 45% more deployments than in the last survey.

Red Hat also grew by 8 points, while CentOS remained steady. Other operating systems included Solaris, HP hLinux, and Gentoo.

Going one level deeper, we found that among OpenStack deployments with more than 1,000 users, of which there were a nonrepresentative set of 48 responses, a smaller proportion use the Ubuntu Server, while the percentage using Red Hat Enterprise Linux increased from just 6% of the limited sample last survey.

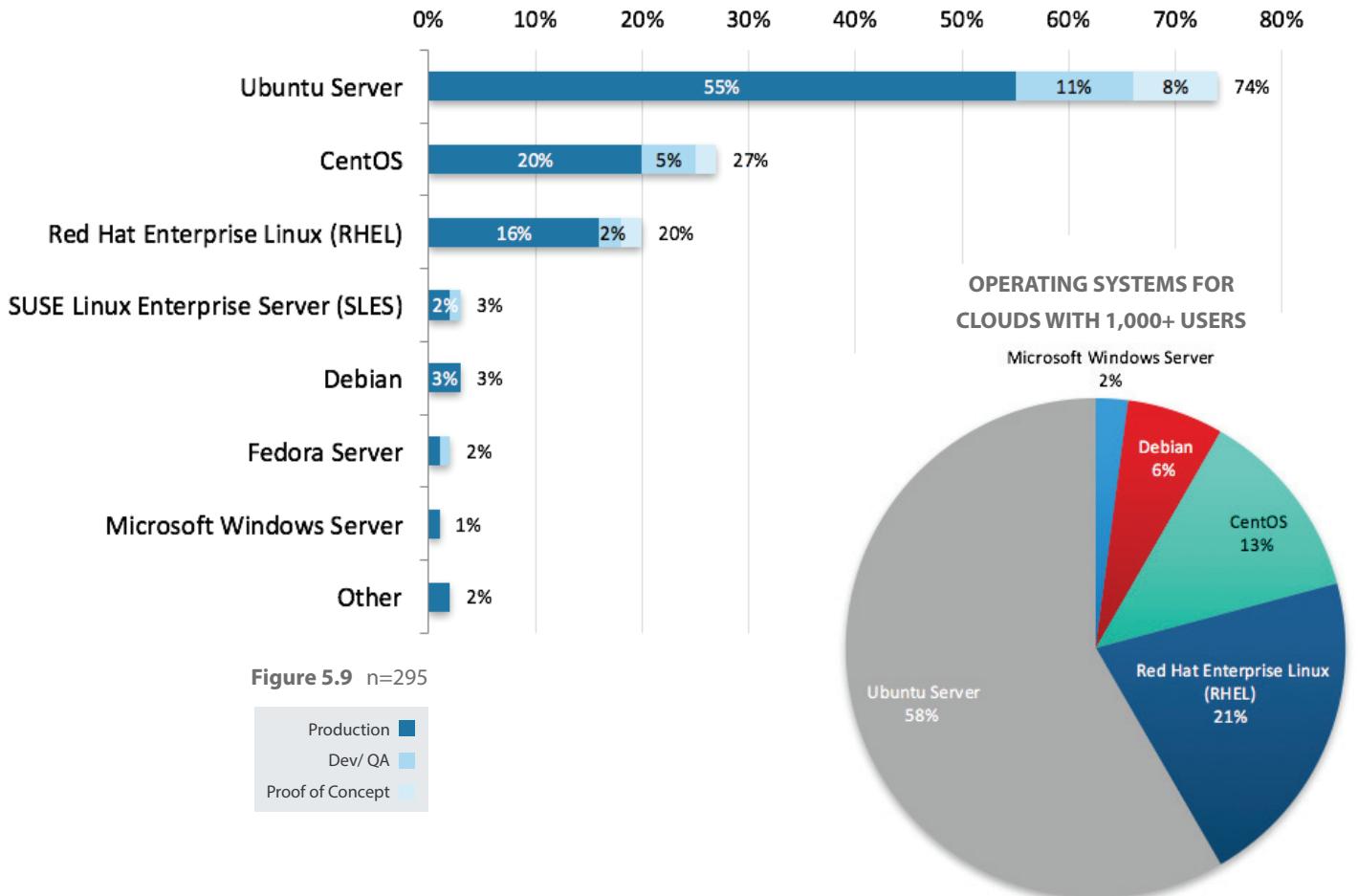
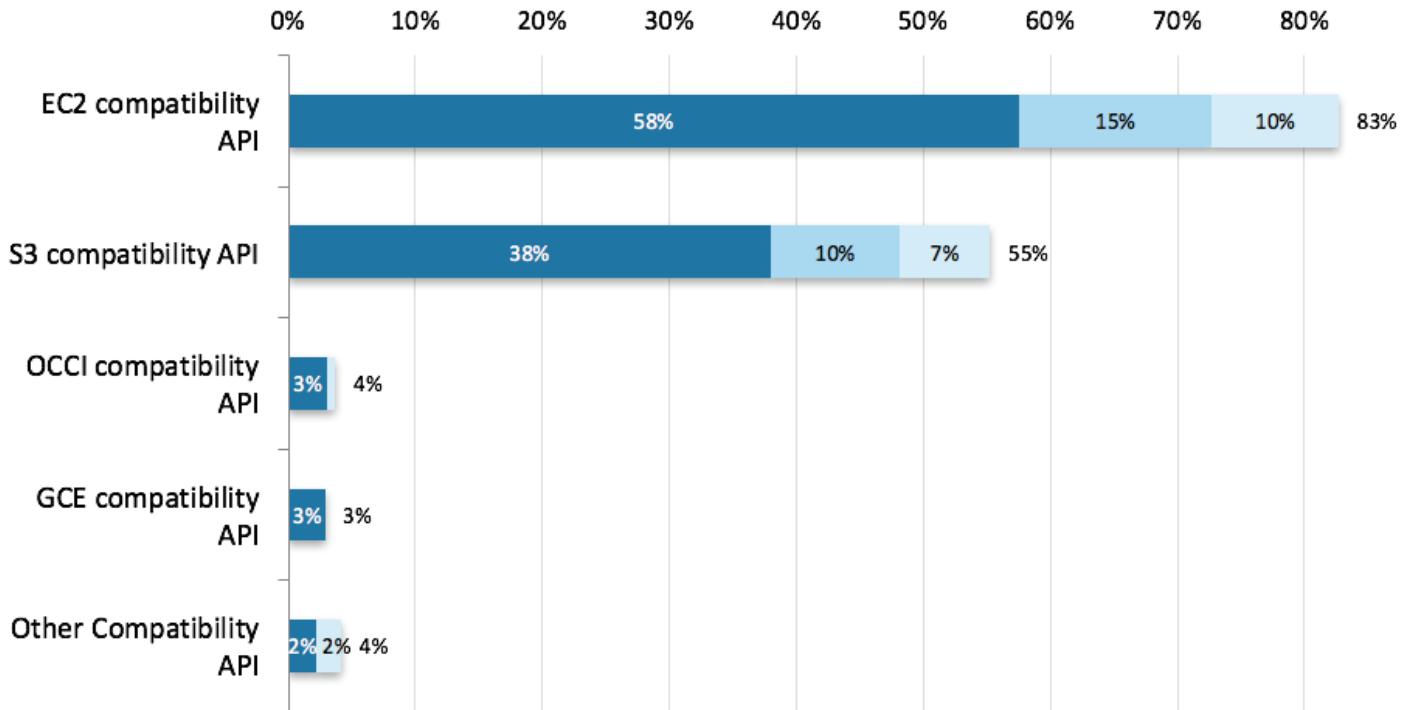


Figure 5.9.1 n=48

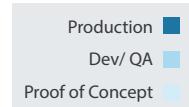
## Among clouds that support compatibility APIs, which APIs are supported?

While the leaders remain unchanged, EC2 gained 6 points, S3 and OCCl lost 4 points, and GCE lost 2. One other compatibility API noted was the cloud data management interface (CDMI).



**Figure 5.10** n=139

Percentages are rounded to the nearest whole number; bar length shows fractions.





# CLOUD SIZE

Throughout this section, we focused on data from deployments in production or testing, excluding those deployments in early proof of concept stage, to get a more realistic view of cloud size.

## How many users do OpenStack clouds support?

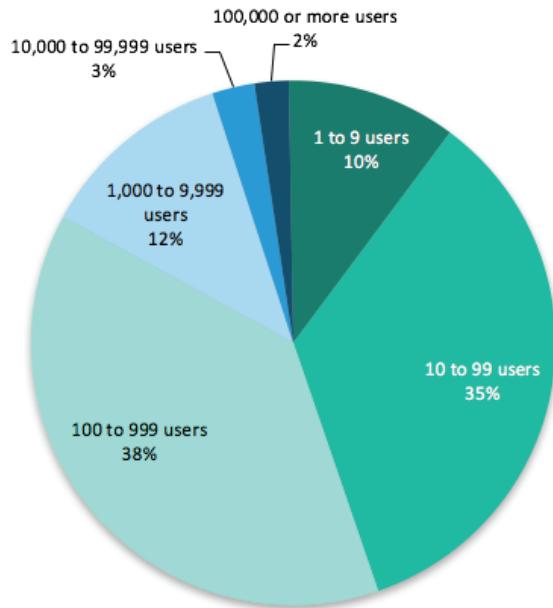


Figure 6.1 n=190

## How many physical compute nodes do OpenStack clouds have?

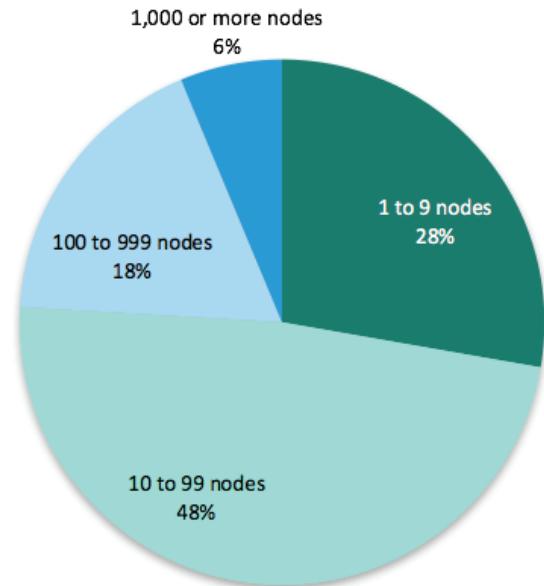


Figure 6.2 n=191

### How many processor cores in an OpenStack cloud?

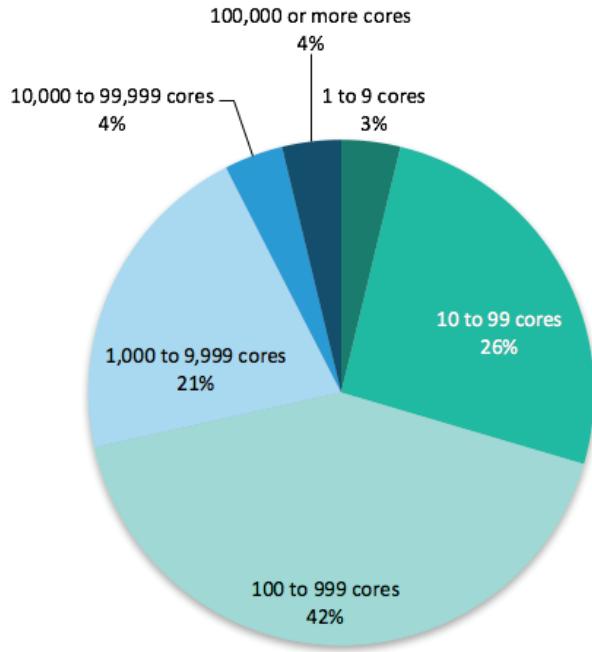


Figure 6.3 n=186

### How many instances in an OpenStack deployment?

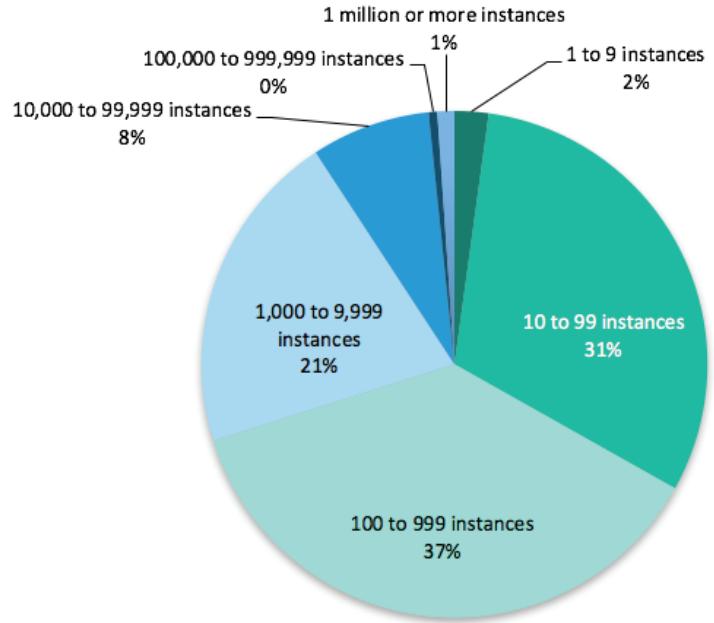


Figure 6.4 n=183



### How many usable IPs?

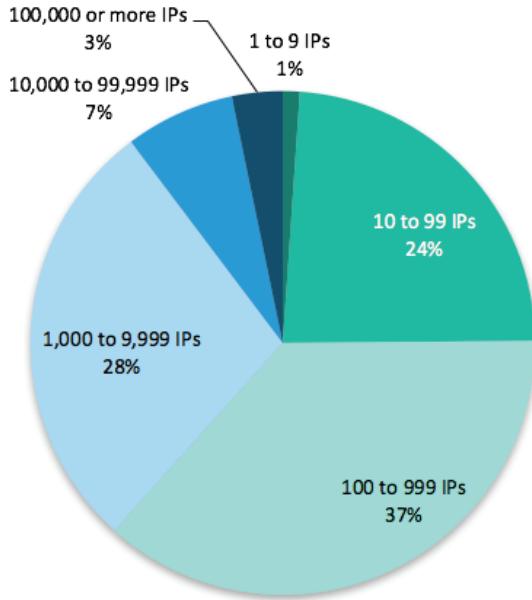


Figure 6.5 n=185

### What is the size of the deployment's Cinder block storage?

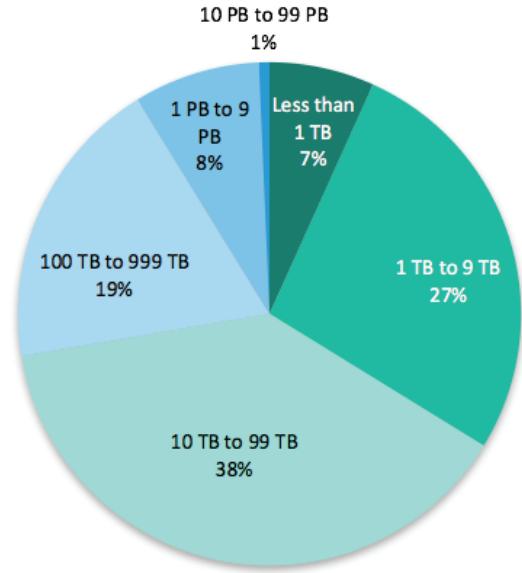


Figure 6.6 n=148



Figure 6.6 n=188

### How much Swift object storage is provisioned in a deployment?

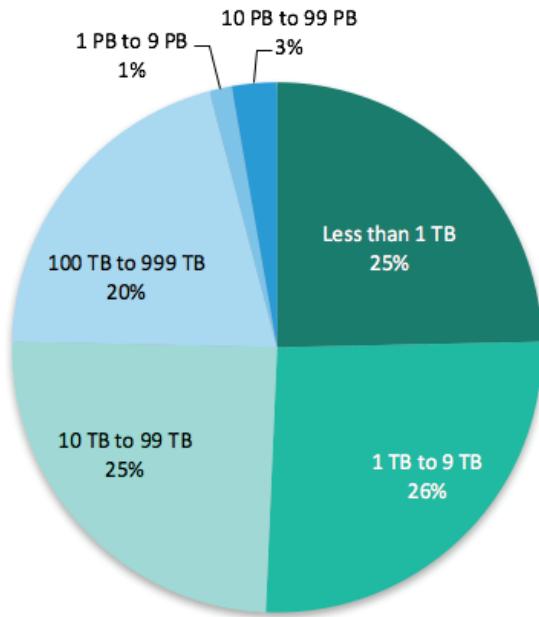


Figure 6.7 n=73

### How many Swift objects are stored in a deployment?

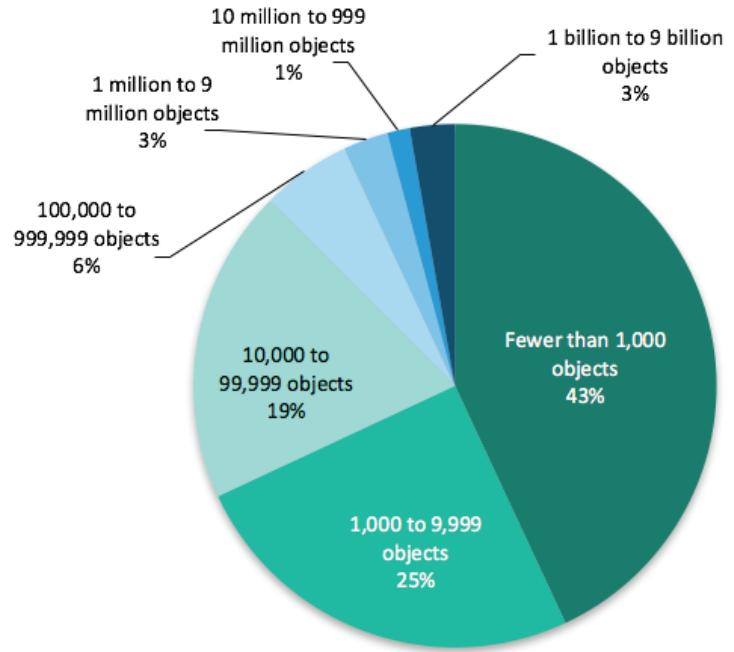


Figure 6.8 n=72

## How many Nova cells are used?

This is the first survey in which this question is asked. While nearly half of respondents indicated using just one cell, 13 users indicated use of between 10 and 40 cells, and a few indicated more than 100 cells in use.

One user commented, "We don't use Nova cells. We did research on it, but noticed a massive change happening with V2 API which is getting released only in Mitaka. So we are waiting for that to try out cells."

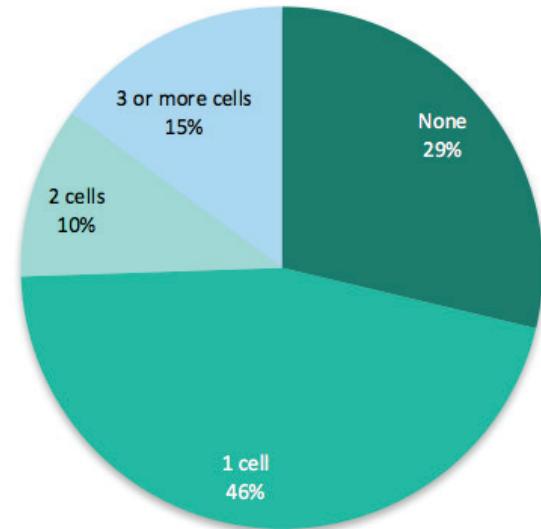


Figure 6.9 n=94





# CURRENT ISSUES

This portion of the User Survey report is conducted at the request of Project Team Leaders (PTLs), who had an opportunity to submit their own question for consideration.

Survey logic prompted survey-takers for a response to this question only when they indicated in the deployments section that they were using a given project.

## What kinds of data are you planning to store on object storage in the next 12 months?

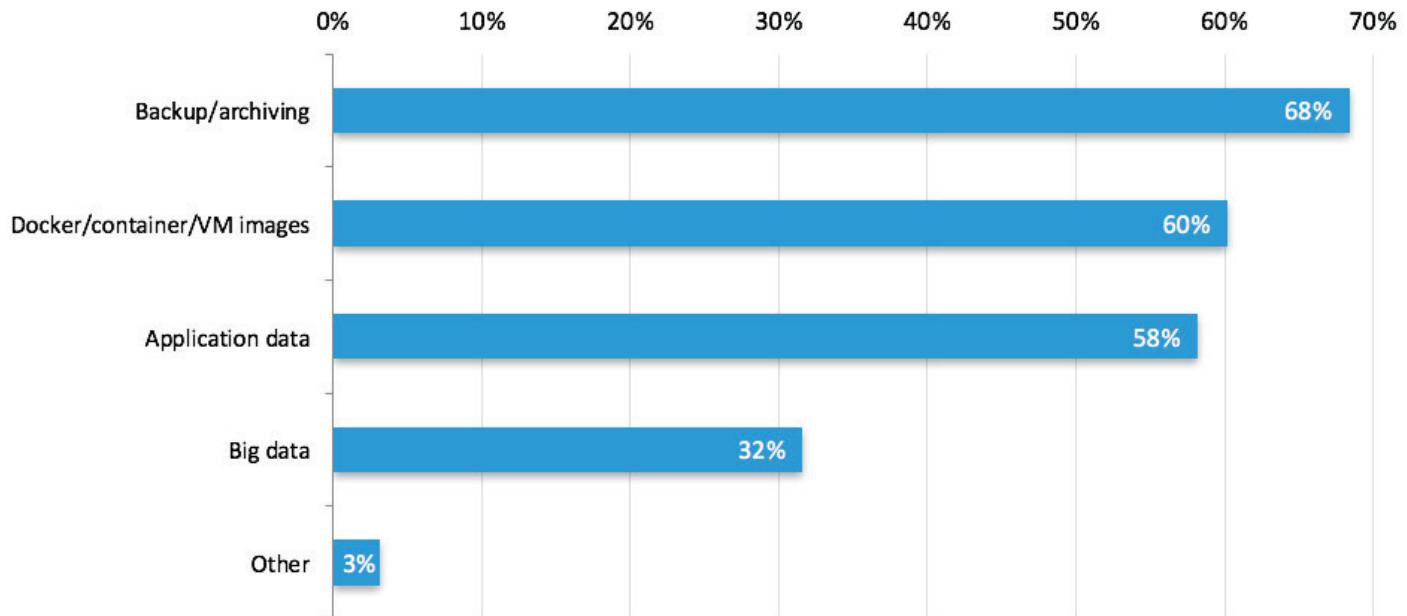
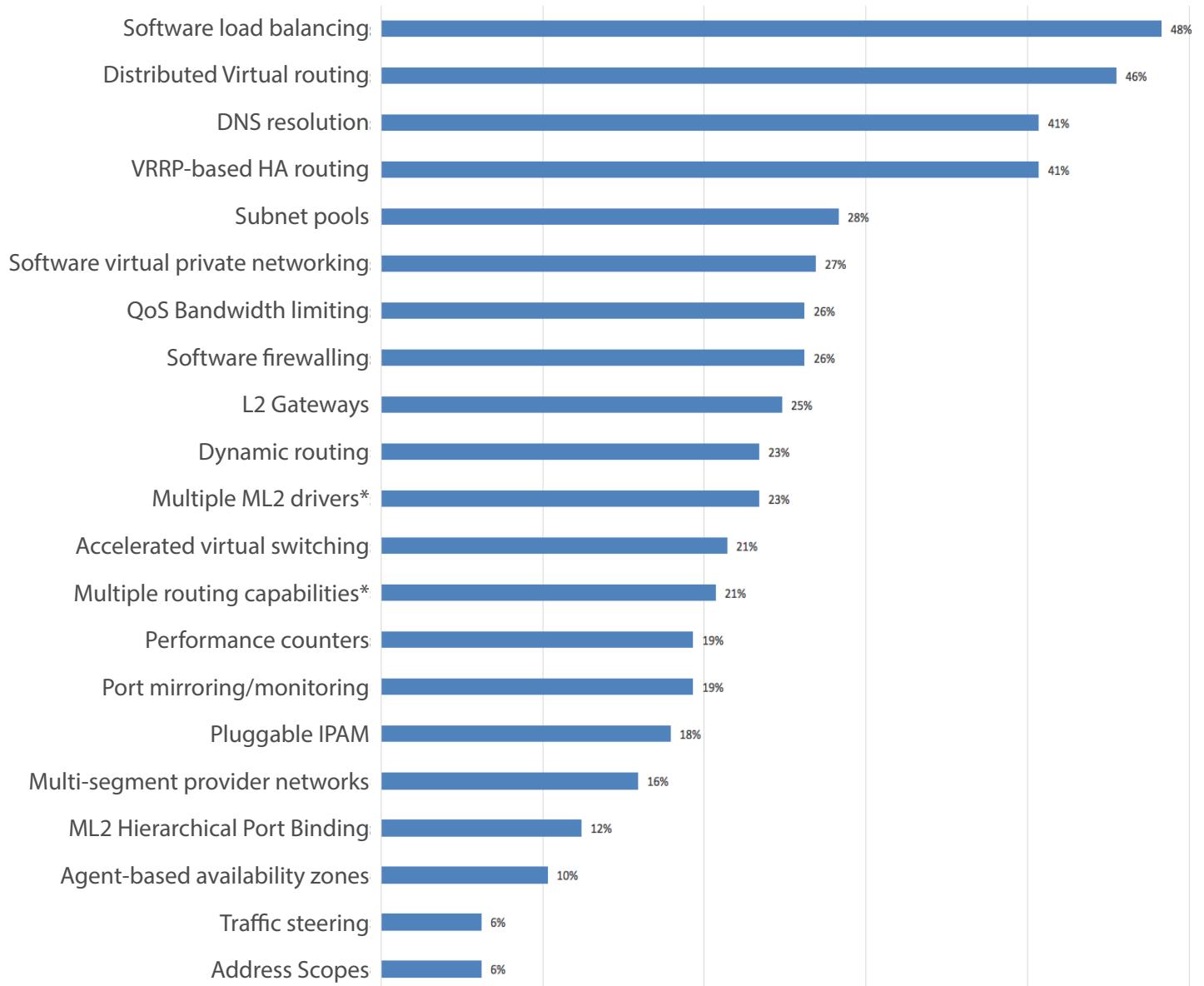


Figure 7.1 n=98

## Which Neutron features are actively used, interested in, or planned for use?



**Figure 7.2** n=145  
\*in the same deployment

Percentages are rounded to the nearest whole number; bar length shows fractions.

## Which DNS Servers would users like support for in Designate?

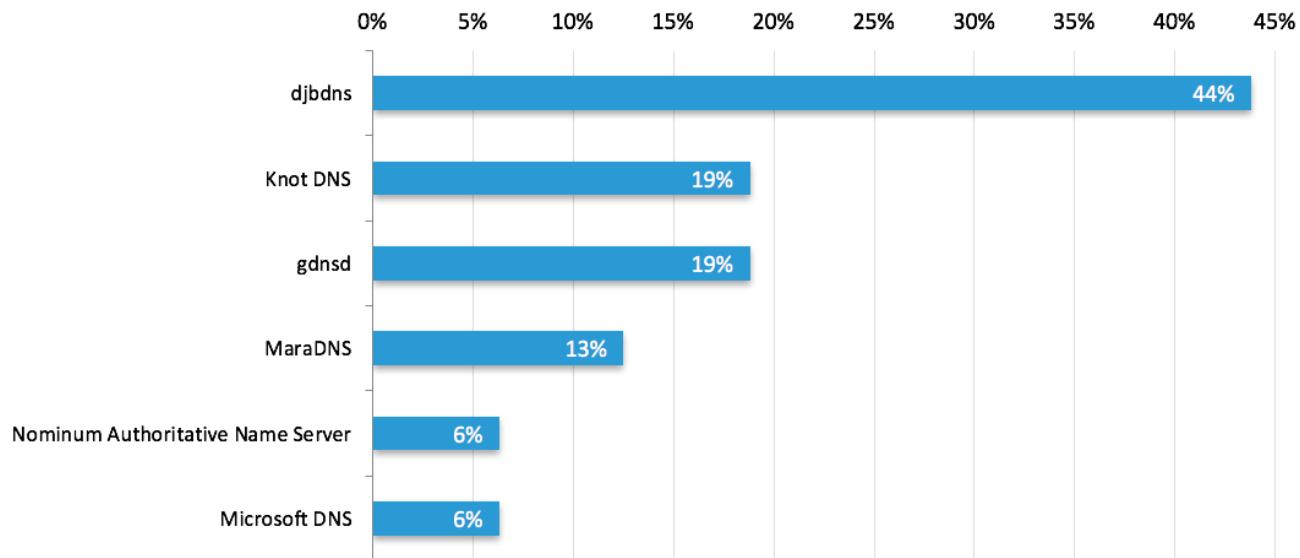


Figure 7.3 n=16, results are directional only

## Which Storage solutions are in use with Sahara or Hadoop deployments?

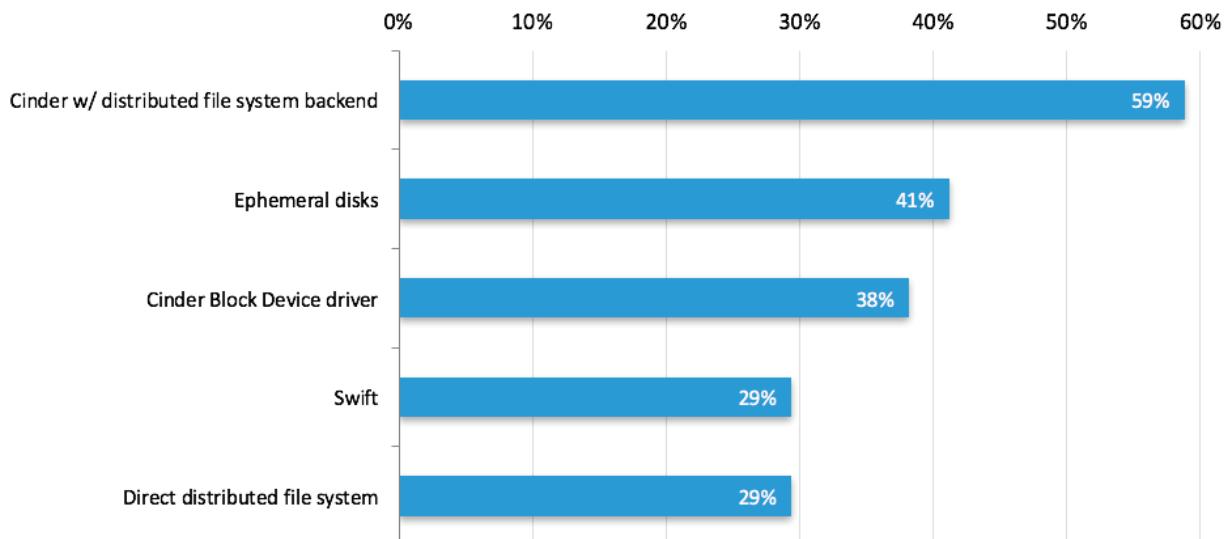


Figure 7.4 n=34, results are directional only

## Which OpenStack Shared File System (Manila) drivers are in use?

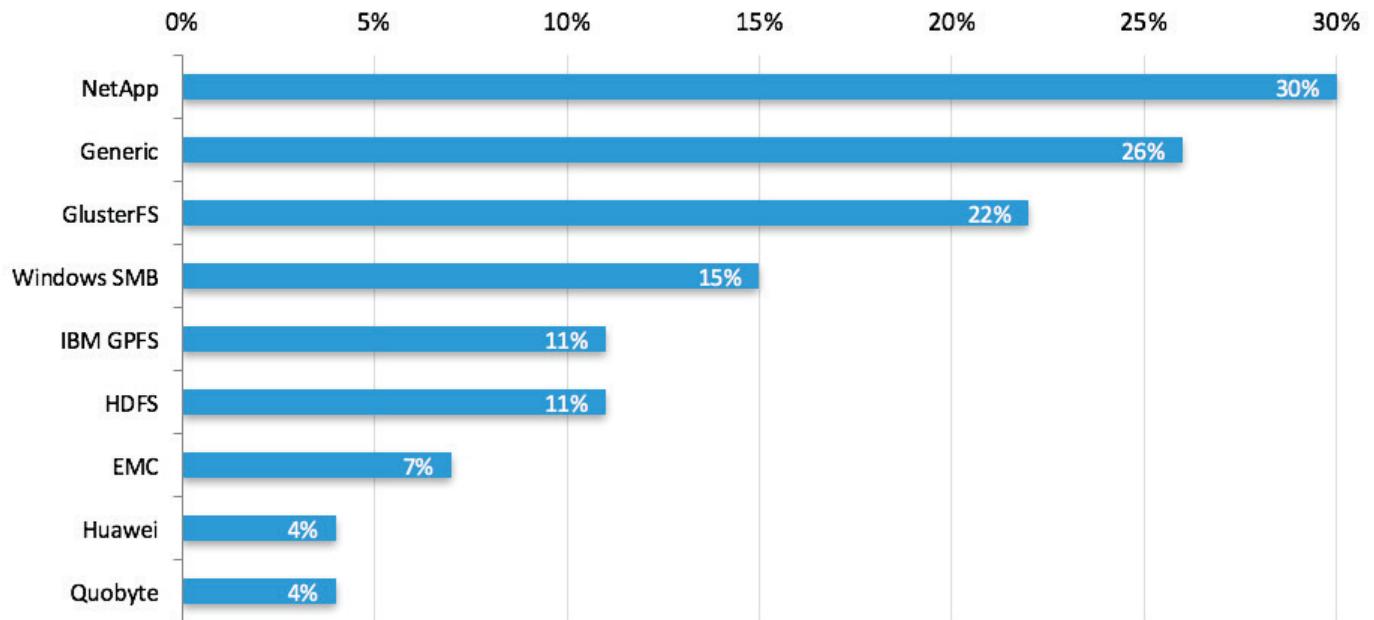


Figure 7.5 n=27, results are directional only

## How often do users refer to documentation for OpenStack?

OpenStack's documentation at [docs.openstack.org](https://docs.openstack.org) continues to be a well-used resource, with more than one in five users checking it daily and two-thirds using it at least weekly.

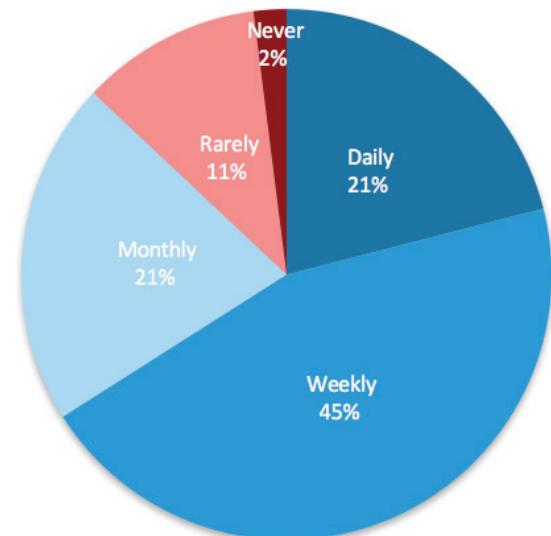


Figure 7.5 n=1161

## Which of the following features in RefStack are important to you?

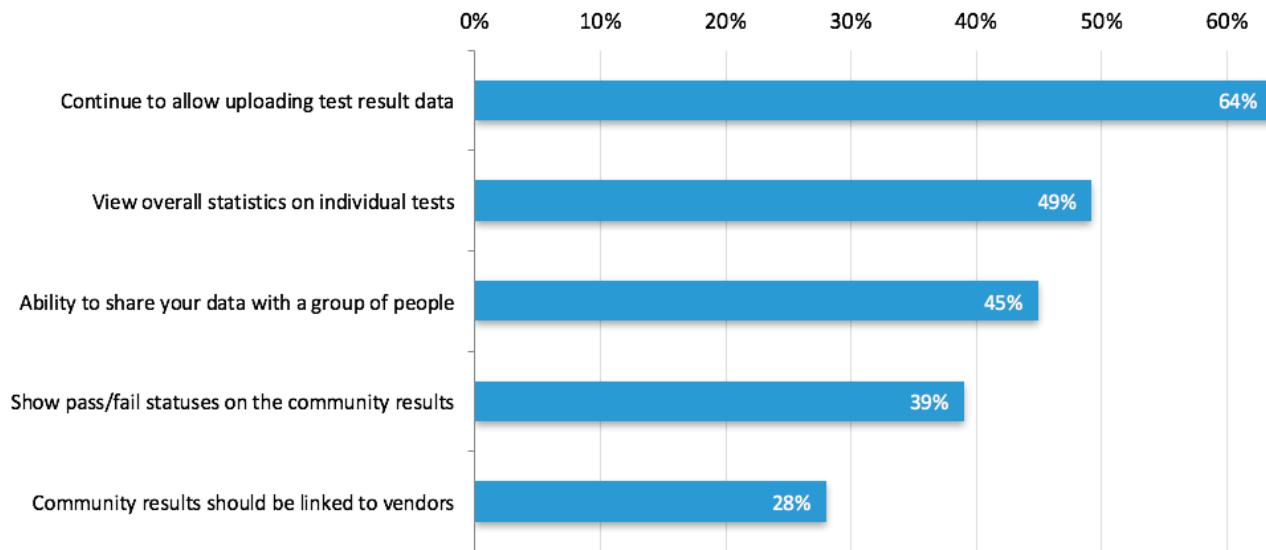


Figure 7.6 n=118

OpenStack users are a generous community with their feedback, with 95 individuals with deployments—23% of all deployments—indicating they are interested in helping interoperability testing efforts by checking their cloud capabilities with RefStack.

Additionally, 124 individuals volunteered to participate in User Experience testing with the UX committee.



## METHODOLOGY

For the second survey in a row, the User Committee and OpenStack Foundation partnered with an external independent data scientist to help analyze and report the data. This cycle's survey changed few questions compared to the prior survey to maximize our ability to compare results.

We added new options to the question about interest in emerging technologies, and to the question about user roles. We also revised survey logic so that only users with clouds in production could indicate that a specific project was also in production (it would be impossible to run X project in production when the cloud itself was in PoC stage). As a result, not all results can be compared exactly to previous cycles' answers.

This is the third survey with isolated data outputs, meaning that the first four surveys' results (two surveys each in 2013 and 2014) were mixed, but since the April 2015 survey, each survey's data is isolated to allow for comparisons and, eventually, trend analysis.

In this report, we primarily looked at trends from answers submitted:

- Jan. 21 – Feb. 29, 2016: survey 2016-01 (Mitaka cycle); denoted as the April 2016 survey
- Sept. 14 – Oct. 5, 2015: survey 2015-02 (Liberty cycle); denoted as the October 2015 survey, and
- March 9 – April 16, 2015: survey 2015-01 (Kilo cycle); denoted as the April 2015 survey.

As in the last two surveys, survey logic showed some users certain questions, based on their responses to prior questions. For example, if a deployment is using Swift, we asked additional questions about Swift.

This helped us keep the survey as short as possible, and generally improves the quality of results by limiting the response size to just those who have a valid answer.

In addition to quantitative data, we gathered a substantial amount of qualitative data from open-ended questions. The user committee and survey analysis volunteers from the committee, bound by a confidentiality agreement, selected representative comments to add more insights to numerical results.

All comments are checked to ensure anonymity and relevant responses are forwarded to project team leaders (PTLs).



## Changes to the user survey in this cycle, compared to last cycle

For user roles, two new roles were added to the “select-all” options: cloud architect and CIO/ IT infrastructure manager.

In the emerging technologies question, existing answers from the last survey (containers, Internet of Things, and Platform-as-a-Service) were kept, network functions virtualization was expanded to read “SDN/ NFV” and these additional options were added: hybrid cloud, hardware accelerators and bare metal.

In the question about cloud deployment stage, “production” was amended to read “production or full operational use” to help users select the appropriate stage.

The project matrix of most commonly deployed projects was expanded to include Rally, Manila, Magnum, and Murano, due to their popularity indicated in the last user survey cycle.

Conditional logic was added to the project matrix to eliminate impossible choices, e.g. if a cloud was not in production, a user could not indicate that a specific project was in production.

The question functionality for other, less-frequently adopted OpenStack projects changed dramatically. In the last cycle, a user had to select the project to add it to his or her deployment, then indicate production, testing, or interested. In this cycle, all possible projects for feedback were listed in a simple matrix, resulting in much higher levels of indicated interest across projects (in the last cycle, no project received more than 11% interest; in this cycle, some projects had four times that amount).

This change was made to improve the user-friendliness of the matrix and we anticipate using this matrix style in future surveys.

The question about which OpenStack release was being used was collapsed to exclude unreleased versions in the last survey analysis (those indicating “Liberty,” who answered the survey three weeks prior to its release, were collapsed into the “trunk” answer). In this cycle, Liberty was the most current release option, as the survey was conducted nearly two months prior to Mitaka’s release.

In the question about which Neutron drivers are in use, OpenContrail was added as an option.

In the question about the size and number of Swift objects being stored, survey logic excluded answers from those who did not indicate they are running Swift.

The question, “Approximately how many Nova cells do you use?” is new in this cycle.

Project Team Leaders (PTLs) were offered an opportunity to submit one question regarding their project to the user survey, in either a select-one, select-all, or short answer field format. PTLs from Cinder, Designate, Keystone, Manila, Neutron, RefStack, Sahara, Swift, and Trove submitted questions.

Questions supplied by the PTLs changed substantially compared to the prior survey, and therefore cannot be compared to a prior cycle’s data set.

The last survey’s questions about Nova, Ironic, and Ceilometer were not updated by the PTL for this cycle, so they were excluded.

## Errata

Anyone who filled out a deployment in the September 2015 survey cycle had much of their deployment information pre-populated, however, if they had not filled out the user survey since April 2015, they had to re-enter their information.

Since nearly two-thirds of respondents indicated they were in the IT industry, we attempted to provide a new, finer-grained question with conditional logic asking about their IT industry segment. However, due to a database error, these responses were not captured. This question will be deployed in the next survey cycle.

Last year's survey mistakenly selected Zimbabwe as the default country location of an organization, resulting in a few more users in Africa than is accurate. This question was changed to default to a "select one" prompt.

One user indicated the largest possible answer to every cloud size question, including seemingly impossible answers that were several orders of magnitude greater than the next-highest answer. On further investigation, these were deemed invalid answers and the user's cloud size responses were excluded from charted data.



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