

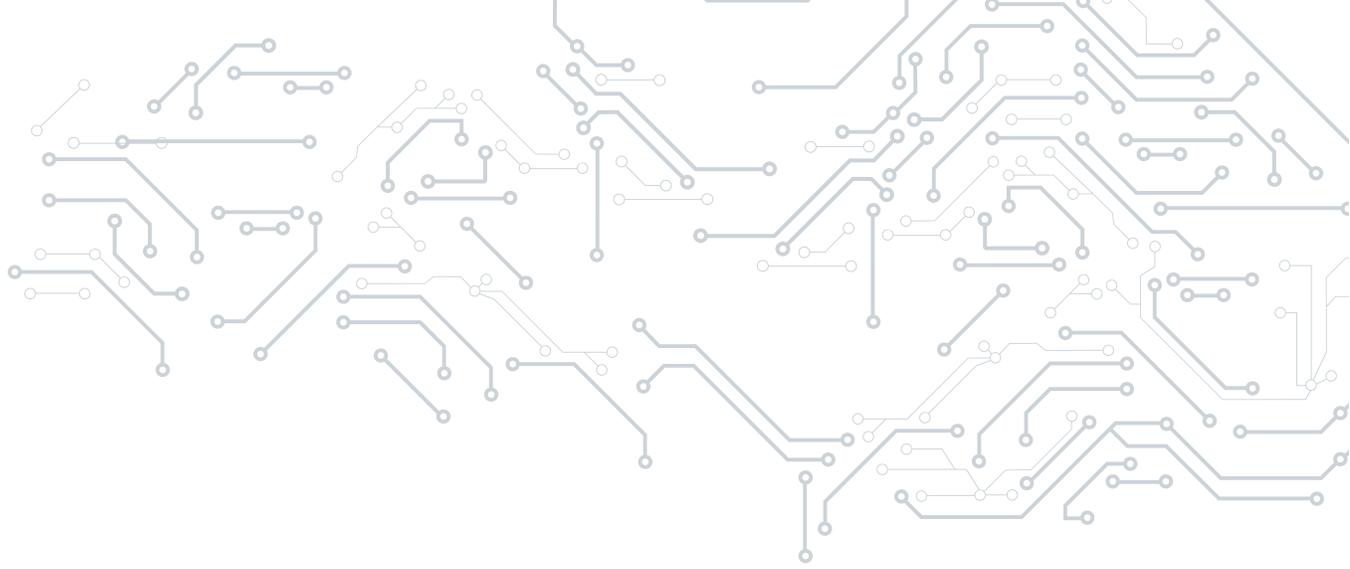


The imperative for hybrid IT: cloud and innovation in the modern era

JUNE 2016

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About this paper

A Black & White paper is a study based on primary research survey data which assesses the market dynamics of a key enterprise technology segment through the lens of the 'on the ground' experience and opinions of real practitioners – what they are doing, and why they are doing it.

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INTRODUCTION

Technology adoption is changing faster than ever, thanks in large part to the influence of cloud and open source on procurement and deployment decisions. Alongside this, in nearly every industry, software-driven startups – such as Uber, Airbnb, Tesla and Zenefits – have emerged to compete with longtime industry behemoths. Enterprises, in many cases, have had trouble keeping up with the agility of nimbler startups. These technological and business shifts are driving a transformation in how enterprise IT shops build and deploy software – using a variety of public and private clouds coupled with DevOps-style approaches to software development and maintenance. Most recently, container technologies built on Docker, especially in the context of microservices, have created a great deal of interest with somewhat less but measureable adoption. However, while startups can start fresh with greenfield implementations, midsized and large businesses typically have a wide variety of existing software and hardware investments that they need to build upon and integrate with. This suggests that perhaps a different approach to the same kind of transition is needed.

This report delves deeper into the what, why and how of these new approaches to IT to understand how IT shops are coping with public and private cloud. We explore their use of tooling and business justifications thereof at different levels of abstraction and opinion, including infrastructure as a service (IaaS), platform as a service (PaaS) and containerization, and the rapidly changing approaches to delivering quality at speed in an increasingly hybrid world. To do so, we surveyed executives and managers with working knowledge and decision-making or influencing authority for cloud services development, with the aim of digging deeply into their usage and motivations. We coupled that with broad-scale data on adoption of technologies from cloud to containers in the enterprise.

KEY FINDINGS

- Respondents are moving to cloud services and to DevOps for three primary reasons, led by service quality.
- Cloud adoption has reached the early mainstream, with a large percentage of workloads expected to move to cloud over the next two years spread across a variety of venues and levels of abstraction.
- Application portability is a vital concern that is driving interest in platforms that can support a variety of public cloud and on-premises infrastructures.

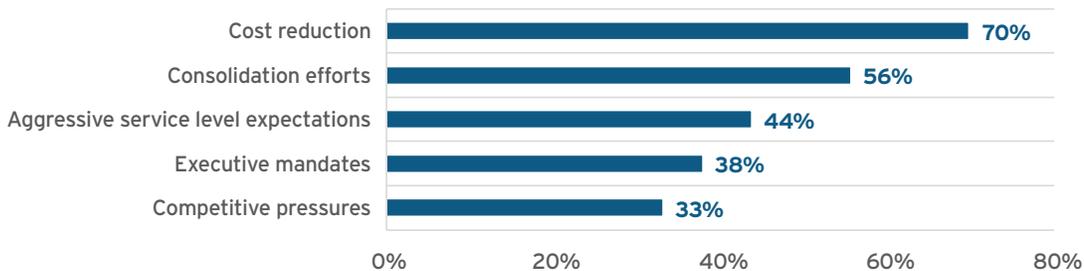
WHY ARE ENTERPRISES MOVING TO THE CLOUD, AND WHAT CHALLENGES DO THEY ENCOUNTER?

We began this research by exploring drivers and blockers for public cloud in particular, as well as cloud services as a whole. In addition, we broke down some of these questions by job role in case differences existed between leadership and practitioners. Finally, considering the importance of managing clouds and the prevalence of multiple clouds being used within a single organization, we asked about cloud management platforms, targeting how and why enterprises rely on them.

First, we asked about the primary drivers for moving workloads to public cloud specifically. Respondents claimed the key drivers were reducing cost and complexity, which maps to what we see more broadly: the more technical cloud benefits such as potential for improvements in scalability and availability are seen as less important overall than financial and internal overhead benefits such as management and portfolio complexity. Notably, respondents that mentioned competitive pressures were in the minority, although we expect to see that number gradually rise as more companies become increasingly software-driven to compete with startups in their respective markets.

Figure 1: Primary drivers for workloads moving to public cloud.

Source: 451 Research, 2016



However, public cloud is not alone – we need to also consider private cloud in looking at goals for migration to cloud in general. We asked respondents to this survey what their main goals were in moving their business into cloud services as a whole, and three primary reasons emerged as very important or critical influences:

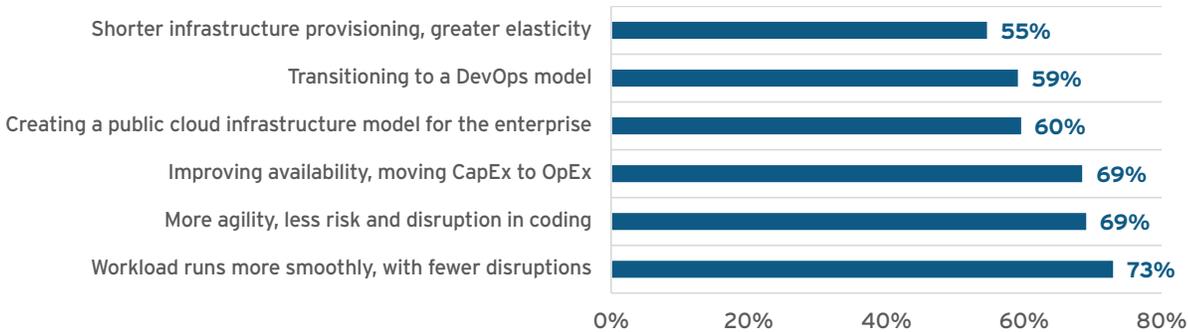
1. **The workload runs more smoothly, with fewer disruptions** (73.1%). This was the most important goal, although it was closely trailed by the following two goals across a total spread of just 18 points. As the top goal, it pertains to providing high levels of service quality, a demand that IT regularly receives from the business.
2. **More agility, less risk and disruption in coding** (69.2%). Nearly equivalent was the desire to improve software development through increasing development speed while simultaneously decreasing risk. We see this being enabled by a variety of new approaches to architecture and release engineering, including continuous delivery, microservices and rolling deployments.
3. **Improving availability, moving capex to opex** (68.7%). Close behind was a group of criteria that fall under the umbrella of IT resource optimization. In particular, the driving force of shifting capex budget to opex is pushing many enterprises to the public cloud (or hosted private) and to subscription- or metering-based purchasing models, in contrast to investing millions of dollars up front to build out a new datacenter.

Lower down on the list, while still considered quite important, were creating a public cloud model for the enterprise (59.7%), transitioning to a DevOps model with agile development including continuous integration and delivery (59.2%), and providing shorter infrastructure provisioning times with greater elasticity (54.7%). It is worth noting that each of these issues is considered very important or critical by a majority of respondents, which shows that IT departments are dealing with a large number of priorities that pull them in many different directions. That said, providing a good experience for their customers with the ability to move fast but with stability leads the list.

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Figure 2: Key overarching goals driving the business into cloud services as a whole. Shown is the percentage of respondents who ranked each goal as a very important or critical influence.

Source: 451 Research, 2016



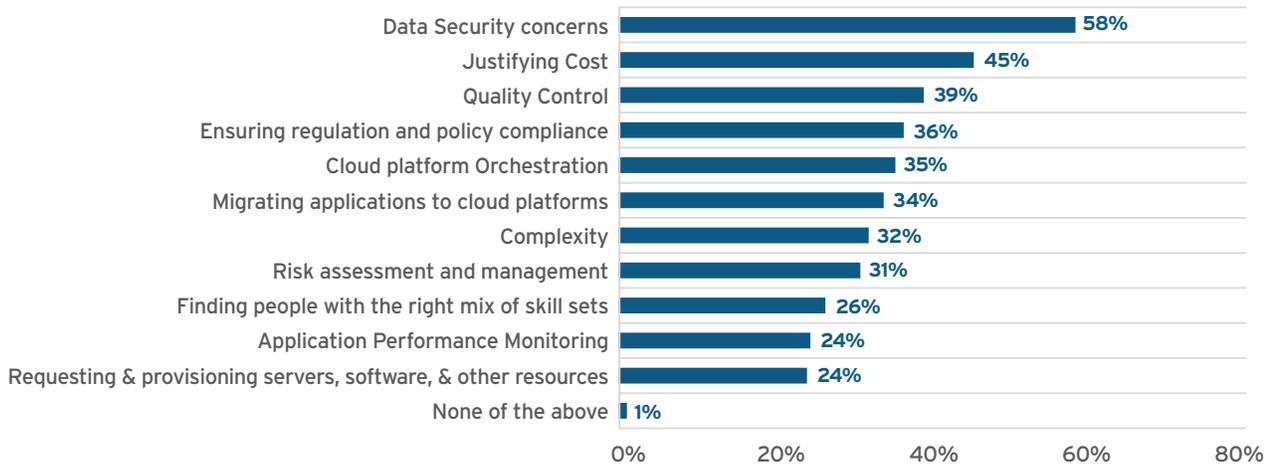
We also investigated which audiences were driving each of these overarching goals to see whether each role may have a clear sense of priorities, but they're becoming mixed together from a big-picture view. IT operations tended to be the primary driver for all of the top goals, with its priorities starting with optimization (#3 overall), followed by quality (#1 overall) and then agility (#2 overall). **This suggests that IT operations personnel may feel significant budget pressure to do more with less, which could be impacting their ability to move forward with new investments in quality or agility.** In fact, no other roles besides IT operations placed resource optimization as their top priority. Quality had the most interest from business operations, lines of business and DevOps groups, while agility was heavily driven by software development, followed by lines of business, DevOps groups and finance.

Following the drivers behind cloud adoption, we next looked into the challenges that are holding organizations back from moving more workloads to cloud environments. We first asked respondents about their overall concerns and followed up by asking about the two most important ones. Security remains the dominant overall concern in moving to cloud, followed by cost, quality assurance (QA), and governance, risk and compliance (GRC), and then by more technical concerns including orchestration, migration and complexity. When we asked respondents to rank the top two concerns, security was emphasized even further, with 42% including it, compared to only 24% and 23% for cost and GRC, respectively. QA dropped down to nearly the bottom of the list as a top concern, clarifying its role as a common lower-priority concern.

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Figure 3: Most vexing challenges in moving to cloud technologies

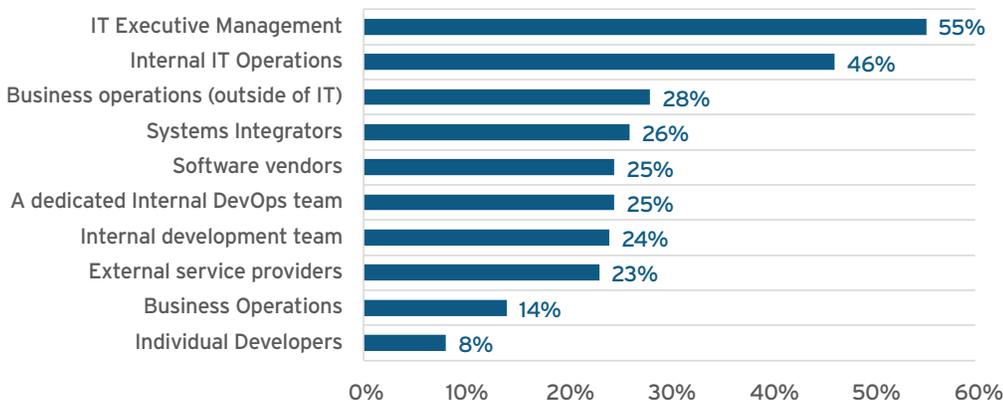
Source: 451 Research, 2016



Although key challenges such as security, cost and GRC seem to be largely external, IT shops are, interestingly, looking to internal resources to deal with them – namely IT executive management (heard from 55% of respondents) and internal IT operations (46%). External options such as systems integrators, software vendors and service providers appear far lower, at 26%, 25% and 23%, respectively, while internal DevOps and development teams are also seen as less realistic ways to address challenges with cloud adoption. We discovered some minor surprises when we reframed the question from who respondents thought should help to who they thought could help – IT ops (46%) swapped spots with management (41%) to become best-positioned, while service providers moved up to the third position at 22% (while still much less likely to be called upon than internal resources).

Figure 4: Who IT decision-makers think should help solve challenges with moving to cloud technologies.

Source: 451 Research, 2016

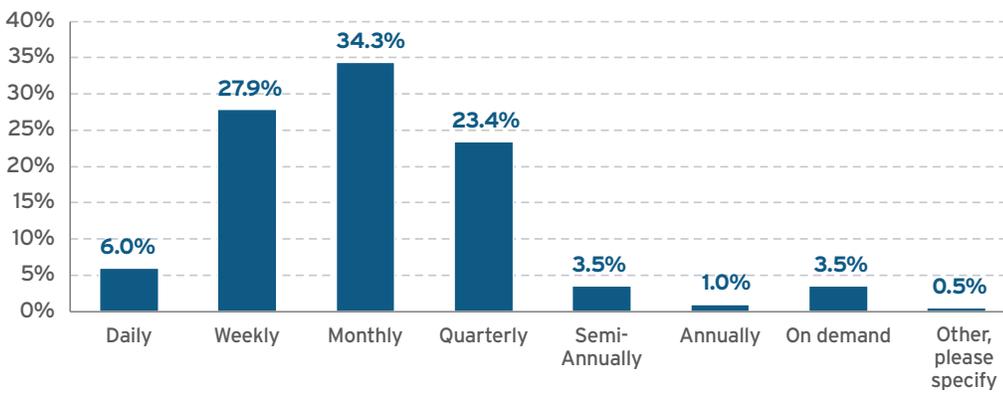


DELIVERING QUALITY AT SPEED

Because one of the key benefits of cloud is generally perceived to be agility – and this is borne out by the priorities of our survey respondents – we investigated release demands and DevOps practices in terms of infrastructure automation and development automation. To begin this, we asked about current release practices and found that the most common release pace was monthly (34%), with weekly and quarterly following at 28% and 23%, respectively. After that, there was a large trail-off in both directions. On the slow end, semiannual or annual releases came only from 4.5% of respondents combined. Opposing that, we found daily releases occurring at 6% of our respondents. For the seven respondents who said they deployed on demand, the maximum frequency was scattered across the entire range from annually to daily.

Figure 5: How often respondents deploy software applications to production.

Source: 451 Research, 2016



We were curious whether it was the underlying software infrastructure being changed or the application itself, so we asked respondents to discriminate between those two (not shown).

What we found was that the most common rate of change to the infrastructure was monthly (33%), with weekly and quarterly at 22% and 27%. Daily changes occurred at 7%, with truly continuous deployment (changes multiple times per day) happening at 2.5% of respondents. With applications, however, the most common rate was still monthly (38%), but the distribution shifted toward a more rapid pace, with weekly at 33% and quarterly down to 13%.

Daily changes occurred at 9.5% of respondents, and multiple updates per day happened at 3.5%. This is notably a more common pace at the application layer than the infrastructure layer. We did not see identical responses to the prior question that aggregated application and infrastructure layers; however, it is directionally very similar with a significant bias toward moving faster as companies grow closer to their differentiating value (the application).

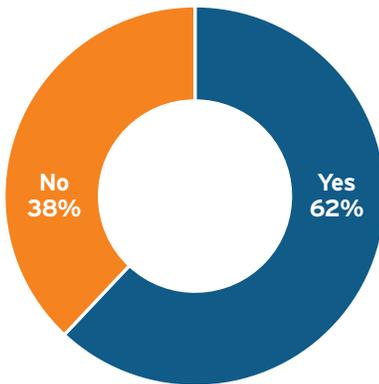
This low number of companies making daily releases, within a cloud-leaning group of respondents, illustrates clearly that although the DevOps community spends a great deal of time talking about things like continuous delivery, such practices are rare in the wild –outside of that particular bubble. Daily releases at 5-10% of respondents indicates that those companies have developed a mature and automated set of processes to support moving at that pace, with a small number of manual approvals in place. The presence of multiple releases per day at an even smaller minority shows how challenging it is to implement continuous deployment successfully.

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However, most respondents still feel pressure to move faster. We asked respondents whether their companies struggle with increased demand for shorter release cycles, with the business expecting weekly, daily or even hourly releases. A full 62% said they encounter this struggle, which is consistent with previous surveys that put this at 60-65%. In comparing this to the question about current release pace, we found that contrary to what one might expect, the companies already moving relatively quickly feel the most pressure to continue stepping on the gas pedal. Those releasing monthly to daily already feel the brunt of this pressure, while the minority at quarterly or slower prices are much less likely to encounter this struggle, with about 45% of them concurring (not shown).

Figure 6: Whether companies struggle with increased demands for shorter release cycles.

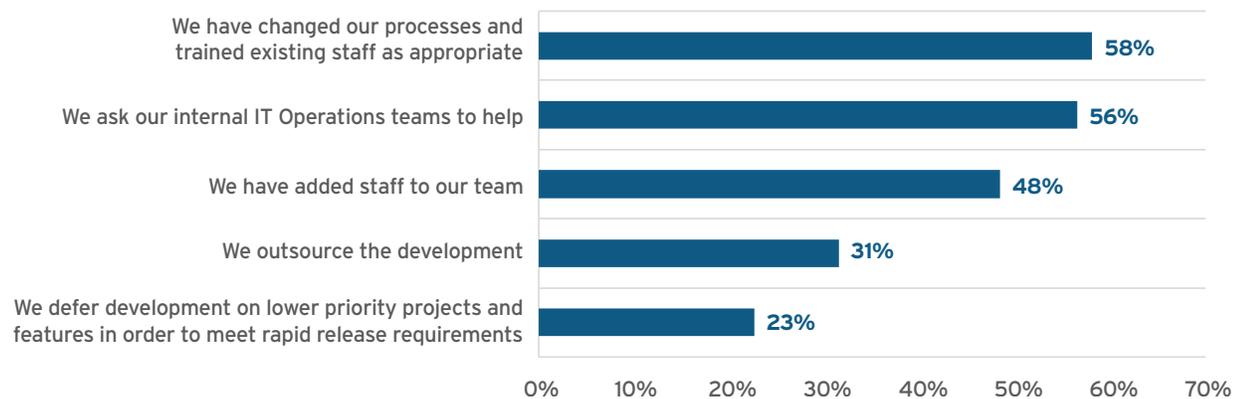
Source: 451 Research, 2016



To address this need for speed, businesses tend to take an inward-facing route again, much like when trying to make the move to cloud technologies. When we asked how companies dealt with these demands for shorter release cycles, they (encouragingly) did not jump for the fallacy of adding more staff, whether by hiring or outsourcing, along the lines of the famous project management book, *The Mythical Man-Month*. Instead, they looked first to change processes and train existing staff (58%) or ask internal IT operations teams to help (56%).

Figure 7: How businesses address demands for shorter release cycles.

Source: 451 Research, 2016



The approaches we see that can aid in moving to a faster release pace are agile software development coupled with DevOps, and using techniques such as continuous integration and delivery to get to a daily or hourly release clip. For the purposes of this report, we will assume readers are generally familiar with agile-development concepts, including the use of sprints that typically run a couple of weeks to more consistently produce working

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software. DevOps, on the other hand, is a more complex and nuanced term. We describe it briefly as a combination of three pillars:

- Cultural changes to promote collaboration and empathy, such as eliminating organizational silos and providing improved tooling for collaboration, such as real-time chat, with a focus on knowledge sharing and building empathy.
- Automation of the server infrastructure, as well as the application pipeline, to enable scalability and reproducibility.
- Measurements that can cope with highly automated elastic environments and that include organizational metrics.

In our large-scale enterprise panel, Voice of the Enterprise, 65% of IT decision-makers said their organization had adopted agile development, while 40% said their organization had adopted DevOps. Because DevOps is a more nuanced term, it is difficult to say much about a company's status when it says it has adopted DevOps, but we may conclude from the much lower proportion of those releasing multiple times per day that it may be necessary, but is not sufficient to guarantee that fast release pace. This is consistent with a crosstab of DevOps adoption compared to release pace (not shown), with those at quarterly or slower releases much more likely to be in the early stages of DevOps adoption.

Figure 8: Current agile adoption (n = 670).

Source: 451 Research, Voice of the Enterprise: Software-Defined Infrastructure, Q4 2015

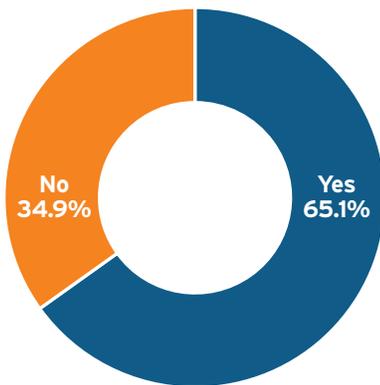
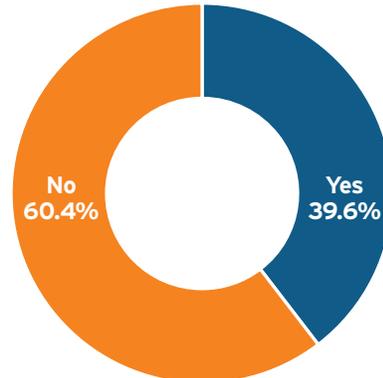


Figure 9: Current DevOps adoption (n = 568).

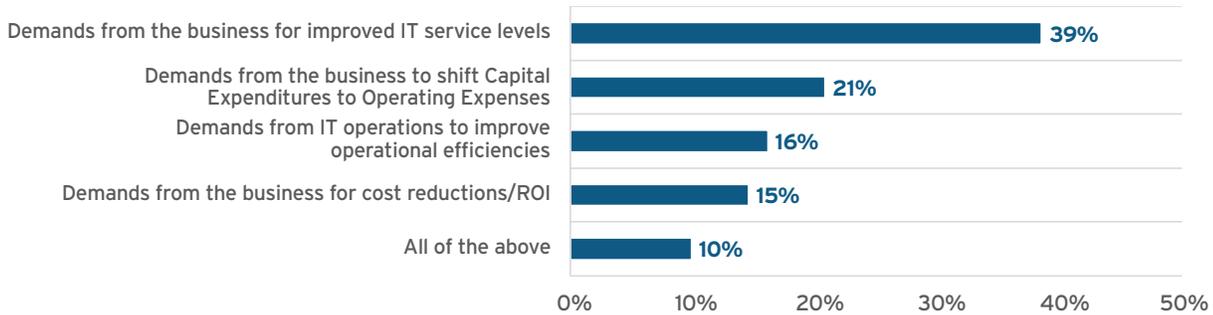
Source: 451 Research, Voice of the Enterprise: Software-Defined Infrastructure, Q4 2015



When we asked respondents about their reasons for moving to DevOps, their responses mapped well to the overall reasons for migrating to cloud services. Service quality came first (39%), trailed by financial concerns (21%) and resource optimization. In a way, this is encouraging because it indicates that IT is increasingly driven by the business as a whole. Because IT has traditionally been perceived as a department that's about cost optimization and keeping the lights on, this business-supported shift to DevOps, as well as to cloud, points to a positive future for IT.

Figure 10: DevOps transformations are driven primarily by business demands.

Source: 451 Research, 2016



This overlap between the reasons our respondents moved to DevOps and cloud services supports their synergistic nature. Although it is possible to adopt DevOps outside of cloud environments, just as it is possible to manually maintain virtual machines in a cloud, coupling automation with cloud environments that can support that automation to provide extreme scalability and resilience maximizes the benefits of each approach and enables IT to meet business demands for improved service levels and delivery speed. To reach this point, teams should focus on adopting cloud, enabling infrastructure automation, and providing automated application-delivery pipelines.

THE SURPRISING STATE OF CLOUD ADOPTION AND USAGE

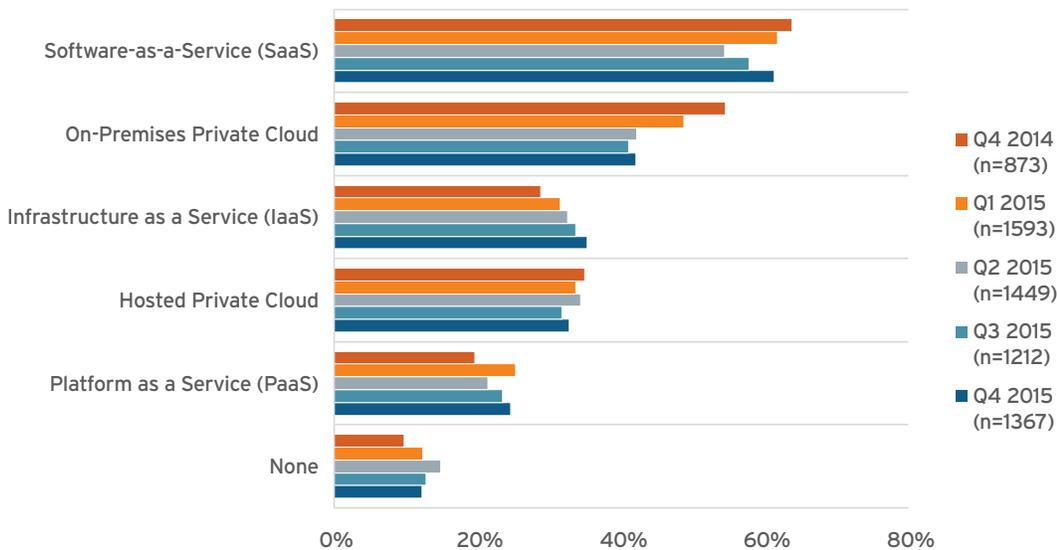
To meet the business drivers addressed in the previous section, cloud adoption as a whole continues to grow increasingly dominant. Today, nearly 90% of enterprises overall use at least one form of cloud. In a large-scale survey of IT decision-makers that has topped 1,500 respondents, we consistently see broad adoption of a wide variety of cloud types, both public and private, and ranging from SaaS through PaaS to IaaS. This indicates that enterprises often use multiple flavors of cloud. Exactly which flavor and when depends on the workload and a combination of other concerns, particularly those around security, regulation/compliance and data sovereignty in the public-private case.

More specifically, in terms of cloud platforms rather than SaaS cloud applications, we see on-premises private cloud as the dominant form with usage by about 45% of respondents on average, trailed by IaaS and hosted private cloud (almost neck and neck at 30%). PaaS comes along at the trailing edge – 20-25% of IT decision-makers say their companies use a PaaS. However, the overall total across cloud flavors sums to roughly 200%, which shows that the ‘typical’ enterprise uses two types of cloud.

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Figure 11: Current cloud computing services usage.

Source: 451 Research, Voice of the Enterprise: Cloud, Q4 2015

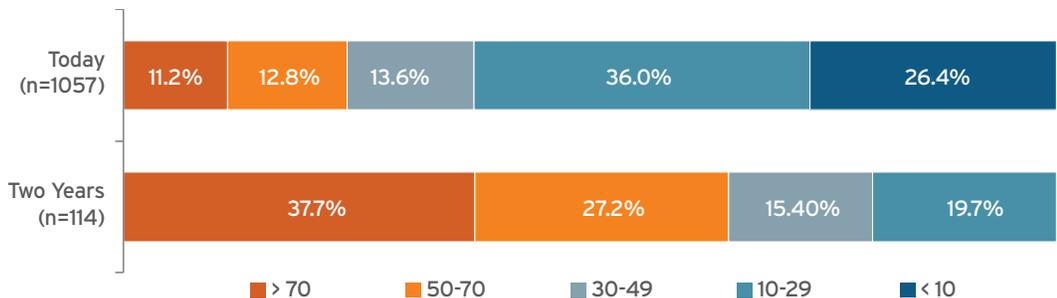


Although nearly all companies are using it, the percentage of their workloads running in the cloud could still remain small. In other words, they could be just dipping their toes into the water with cloud rather than truly relying upon it at scale or for business-critical applications. This turns out to be the case; **most enterprises are placing 10-29% of applications in the public cloud today, although great change is expected within two years.** That leaves the majority of today's workloads in non-cloud, traditional infrastructure – in fact, only one out of four enterprises today has more than half of its workloads in a cloud of any sort, and only about one in 10 has more than 70% of its workloads in a cloud. This makes the dominance of traditional infrastructure very clear, although the situation is changing quickly.

Within two years, these numbers will begin to look different. About two-thirds of enterprises intend to place at least half of their applications in a cloud somewhere, be it public or private. This is in contrast to only one-fourth today, a dramatic shift in gravity biased toward shifting applications to a cloud environment.

Figure 12: Workloads in cloud environments today and in two years.

Source: 451 Research, Voice of the Enterprise: Cloud, Q4 2015 (n=1057).



Now that we have addressed overall adoption of public and private cloud, as well as a layer-specific comparison of infrastructures and platforms, we investigated the cloud management layer and how enterprises are using it. In this context, cloud management means the software that sits atop the hypervisor with feature sets that may include some or all of: self-service infrastructure provisioning, resource balancing, performance management, up-

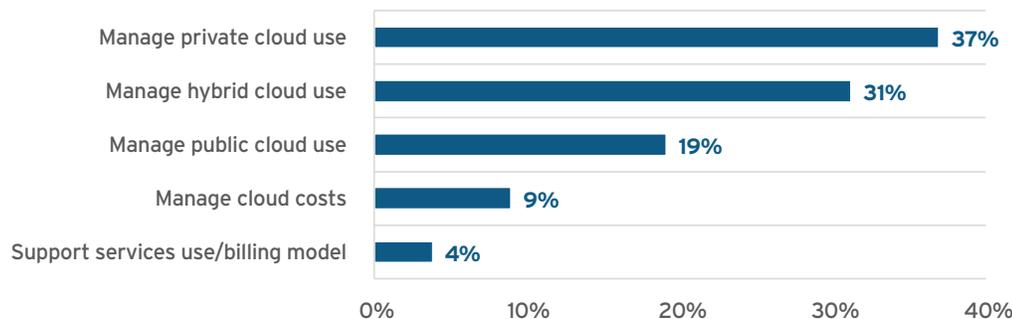
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time management, workflow orchestration, consumption management and cloud brokerage. We asked respondents to provide more details about the main purpose for adopting cloud management as it pertains to cloud type (public/private/hybrid), as well as cost and billing benefits.

We found that management of usage was far more important to them than management of cloud costs or supporting the usage/billing models. In-line with overall public versus private cloud adoption, the main purpose for cloud management was heavily biased toward private settings. But interestingly, managing hybrid cloud use came out a relatively close second to private management (31% vs. 37% of respondents putting it as their main purpose, respectively). This underlies the growing importance of multi-cloud approaches to enterprises – and while a single application may not be natively multi-cloud, the enterprise as a whole needs to manage all of them and likely prefers a unified tool for doing so.

Figure 13: Most respondents use cloud management for private cloud, but increasingly it's deployed for hybrid use cases.

Source: 451 Research, 2016



THE MODERN CLOUD ENVIRONMENT

Now that we have a better sense of adoption, drivers and challenges for cloud at the infrastructure and platform layers, the demand for hybrid management platforms, and the business requirements for faster-paced releases that can be supported by DevOps approaches, we tackled the question of what sorts of technology stacks can support all of these desires and requirements. In this section, we cover the IaaS-PaaS spectrum, the rise of Docker and containers and where that fits into cloud, and the interest in multi-cloud use, hybrid and otherwise, across a variety of execution venues to find the best one for each workload.

First, we asked respondents more about what they want from their IaaS and PaaS environments in terms of overlap between the two. This took place through two separate questions, one aimed from the platform down and another from the infrastructure up. We saw that 78% of respondents wanted the capability to manage the underlying IaaS from the PaaS, while conversely, 67% of them wanted native PaaS integration from their IaaS. In both cases, a clear majority would like stronger support for integration and management that crosses the boundaries from infrastructure to platform. More broadly, an ongoing industry trend has been a fading of these boundaries altogether as more enterprises build against the infrastructure layer with the addition of some higher-level services such as databases and identity, or build against a platform but desire additional transparency and flexibility in the stack.

Figure 14: Interest in managing underlying IaaS from the PaaS.

Source: 451 Research, 2016

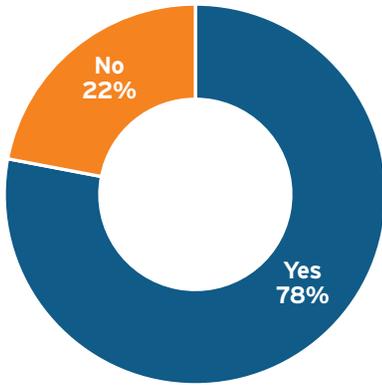
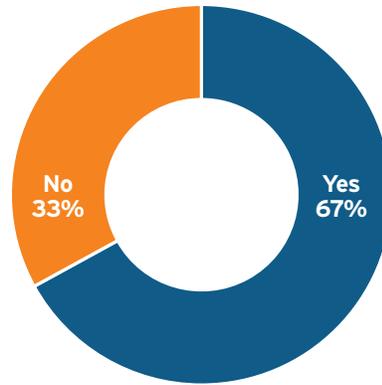


Figure 15: Interest in native PaaS integration from IaaS.

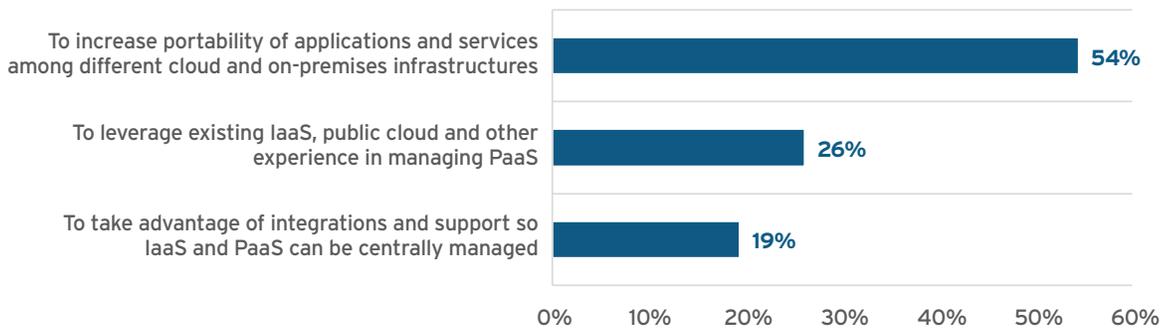
Source: 451 Research, 2016



When we asked for the primary reason why IaaS-PaaS integration is critical, one rose well above the others; an overwhelming 54% of respondents said the reason was to increase portability across different infrastructure, both cloud and on-premises – compared to 26% and 19% for the other two options. The application-level concerns about portability were dominant compared to being able to leverage existing IaaS experience in managing PaaS or using integrations to centrally manage IaaS and PaaS. This indicates that enterprises are interested in going with a higher-level offering to increase portability across a variety of lower-level infrastructure as demand for hybrid and multi-cloud environments continues to grow.

Figure 16: The primary reason why IaaS-PaaS is critical.

Source: 451 Research, 2016



Alongside this ever-blending IaaS-PaaS spectrum, Docker and containers have emerged as a key new technology to help package and deploy applications both within a single container and across an orchestrated cluster. Since the open sourcing of Docker in early 2013, it took a while for enterprise adoption to grow despite shockingly large developer interest. However, we began tracking enterprise uptake for containers in early 2015 and saw it double over the course of six months, going from 6.3% of IT decision-makers saying their organizations had a containerized application in production to 14.1% by Q3 2015.

While this is still low on an absolute level, nearly one-third of IT decision-makers had containers at least in a pilot phase by then, and we expect that number to continue growing. Why? **Enterprises have begun adopting containers – much like cloud – to increase their agility and decrease their time to market.** They also see containers helping them to improve their service uptime and reliability, as well as decrease maintenance over-

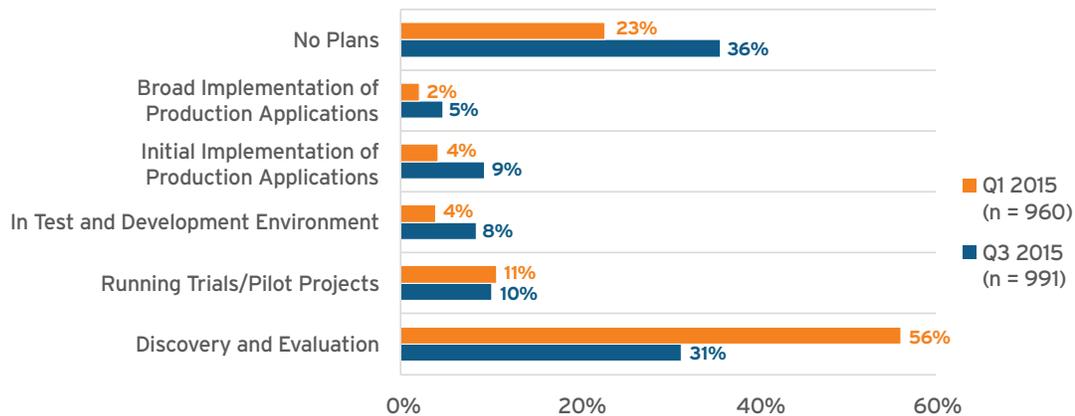
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head – again, qualities that put containers on par with cloud in terms of the perceived benefits. Containers and cloud go hand in hand to enable both the business and technological benefits to span the entire application and infrastructure stack.

As container adoption has grown, so has the realization that containers alone do not compose a complete application. Applications require networking, data and orchestration to function, so the benefits of a platform-centric approach become apparent to help simplify that complexity. Containers are a good tool to help translate between the infrastructure and platform layers and aid in the portability desires that we observed in the previous question.

Figure 17: Container usage is increasing quickly.

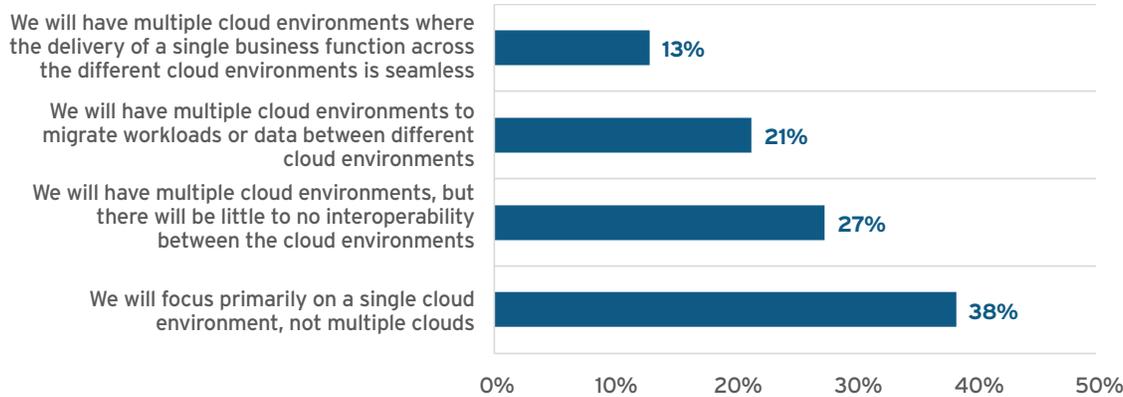
Source: 451 Research, Voice of the Enterprise: Cloud



Finally, we move from the technological level to look more deeply at multi-cloud plans and how they impact service delivery. In the Voice of the Enterprise survey, we found that roughly one-third of enterprises explicitly plan to support multiple clouds, whether to have true multi-cloud applications or to support workload or data migration across cloud environments. Another 27% said they would have multiple clouds but didn't plan on interoperability. However, even in that case, it's likely that they would prefer unified management rather than adding yet another tool, which is typically not a favored option due to the additional support burden each tool brings along with it. And for the 38% who said they intend to focus on a single cloud, we expect it's likely that they will take advantage of both infrastructure- and platform-level services within that cloud to build and deploy applications. **Overall, most enterprises will need to support many venues and layers of cloud, and as we showed earlier with cloud management, they will often look for a hybrid-supporting management platform to do so.**

Figure 18: Plans regarding future cloud environments. The future is significantly multi-cloud, but not necessarily hybrid cloud. Still need tools to manage all of them (n = 777) .

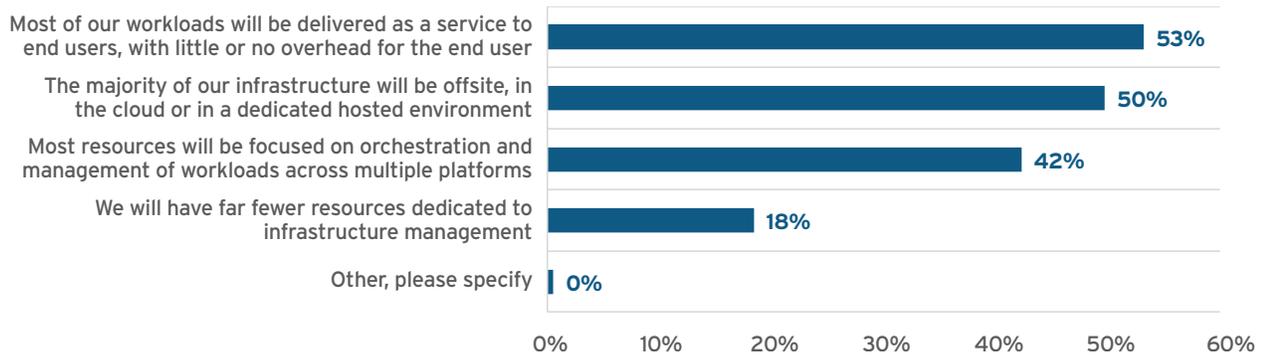
Source: 451 Research, Voice of the Enterprise: Cloud, Q3 2015



In this survey, we aimed to dig deeper into exactly how those responsible for cloud services planned to deliver them. In two years, the majority (53%) plan to provide most of their internal or external users with ‘as a service’ workloads, while an even 50% said they expect the majority of their underlying infrastructure to live off-site either in a public cloud or a hosted environment. **A notably large 42% said they expect most of the resources to focus on managing and orchestrating workloads across multiple platforms. Importantly, only 18% thought they would have fewer resources dedicated to infrastructure management, so this increased drive toward ‘as a service’ delivery and outsourced infrastructure does not at all seem to imply that the need for IT staffing will disappear.**

Figure 19: How services will be delivered in the future?

Source: 451 Research, 2016



CONCLUSIONS

KEY REASONS TO MOVE TO CLOUD SERVICES ARE TO PROVIDE HIGH LEVELS OF SERVICE QUALITY, ENABLE HIGHER AGILITY AND LOWER RISK IN DEVELOPMENT, AS WELL AS FINANCIAL CONSIDERATIONS SUCH AS SHIFTING CAPEX TO OPEX. Security remains the dominant overall concern in moving to cloud, followed by cost, quality assurance, and governance, risk and compliance, followed by more technical concerns including orchestration, migration and complexity.

Most respondents said they have limited agility today and are looking to the cloud, along with approaches such as agile development and DevOps, to improve it. The typical release pace is monthly, with weekly and quarterly also common. Fewer than 10% said they are able to release multiple times per day, showing the rarity of continuous deployment. A full 62% of respondents struggle with increased demand for shorter release cycles driven by the business, and interestingly, faster-moving companies feel the most pressure to continue accelerating while those at a quarterly or slower pace don't experience nearly as much pressure.

We consistently see broad adoption of a wide variety of cloud types, both public and private, and ranging from SaaS through PaaS to IaaS. In fact, individual enterprises often use multiple flavors of cloud. Cloud workloads remain limited today, but this is expected to change. Within two years, these numbers will begin to look different; most enterprises intend to place at least half of their applications in a cloud somewhere, in contrast to only 25% of them doing so today. This multi-cloud future is driving what enterprises want out of cloud management as well – managing hybrid cloud leads public cloud and ranks a close second to private cloud. This underlies the growing importance of multi-cloud approaches to enterprises, and while a single application may not be natively multi-cloud, the enterprise as a whole needs to manage all applications and will likely prefer a unified tool for doing so.

Cloud environments are becoming increasingly blurry in terms of their distinction between infrastructure and platform layers, and respondents have a clear desire to continue this trend. A clear majority want integration and management that crosses the boundary from infrastructure to platform. Most respondents look for this to increase portability across a variety of infrastructures. As this spectrum has become a trifecta with the addition of containers, the respondents have seen a significant increase in enterprise traction over the past year, which makes the ability to manage and orchestrate them key for cloud platforms.

As IT becomes increasingly flexible across cloud layer and execution venues, we find enterprises preparing for this multi-cloud, multi-layered world to provide a high-quality experience to their internal and external users that they could deliver quickly and reliably. To do so, they look to provide cloud capabilities across infrastructure and platform layers, adopt agile development and DevOps, and automate their infrastructure and application delivery pipelines, requirements for coping with business demands for high-quality, fast-moving services.

APPENDIX

This survey was conducted in the first quarter of 2016 with 201 US-based respondents. Companies varied by size, from 1,000 to 5,000+ employees, and were biased toward the larger enterprises. The verticals represented varied as well, although 16% identified being in 'computer products, services, support, manufacturing or distribution.' We screened for IT decision-makers for cloud services to provide deeper insight into the decision-making processes for cloud and for DevOps and pulled in data from our large-scale Voice of the Enterprise survey to provide broader market context.