Cloud & Infrastructure Review 2016
Cloud first, cloud only or cloud never

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1 Executive summary

The Computing Cloud & Infrastructure Review is the fourth such report published by Computing on the subject of infrastructure and data centres, but the first to focus primarily on the growth of the market for cloud. The meteoric rate of growth in the use of cloud services, along with the sheer number of services which now depend upon it, mean that cloud has moved from being used selectively for only non-critical applications and workloads to being a mainstream proposition for organisations of all sizes.

The review summarises the results of a comprehensive research programme undertaken by Computing during the third quarter 2016. The review discusses present data centre strategies and those in the planning, the prevalence of cloud-first strategies and the overlap between public, private and hybrid cloud strategies. The obstacles to further cloud adoption are analysed in detail along with the metrics that organisations are using to determine whether their cloud and wider infrastructure strategies are working. The review also takes in the importance of non-internet connectivity to the cloud and whether the declining price of flash technology is having any impact on cloud strategies.

Along with our quantitative research, the review contains some unique insights from high-ranking IT decision makers into the scale of growth.

Key highlights from the research include:

- Seventy-seven per cent of those surveyed were using cloud services to some extent. A further 10 per cent were trialling them.
- Three quarters of survey respondents expected their use of cloud services to increase in the next year.
- The proportion of respondents expecting to focus their data centre strategies mainly on external hosting or cloud infrastructure is expected to triple in the next three years.
- SaaS was still the most popular way for organisations to kick off their cloud strategies – 67 per cent of respondents had subscribed to at least one SaaS.
- IaaS and PaaS were less popular now but were expected to show the strongest growth in the next three years.
- Large players dominate the cloud vendor rankings – even more so for businesses who have already invested heavily in cloud technology.
- Twenty per cent were pursuing a “cloud-first” strategy. By 2019, 40 per cent expected to be doing so.
- The most popular cloud strategy was still a hybrid infrastructure of customer owned and cloud.
- There was little consensus over the meaning of the terms public, private and hybrid cloud and lines of demarcation between these models were becoming less distinct.

“The meteoric rate of growth in the use of cloud services, along with the sheer number of services that now depend upon it, mean that cloud has moved from being used selectively for only non-critical applications and workloads to being a mainstream proposition for organisations of all sizes”
Security remained the most frequently raised objection to public cloud although the perception of public cloud security has improved enormously.

Cost was a significant barrier to the cloud and yet cost savings and reduced capital expenditure were the two most popular ways of measuring the success of cloud strategies.

Resilience and uptime were also key metrics which had increased the importance of non-internet connectivity to the cloud and between clouds.

Flash technology was increasingly used in data centres as it became cheaper with hybrid arrays still the most popular approach.

2 Research overview

The key objective of this review was to understand the degree to which the cloud has grown in importance to data centre and infrastructure strategy. Where appropriate, findings are compared with research published in 2013, 2014 and 2015 to establish just how infrastructure, data centres and connectivity to the world at large have evolved – and how it is likely to evolve further.

Key areas of research included:

- Present data centre strategy, how it has evolved and how cloud services are being utilised
- Infrastructure strategies for the next three years and in particular the extent to which organisations expect to utilise cloud services
- The prevalence of “cloud-first” strategies
- The understanding of the terms public, private and hybrid cloud
- Barriers to greater adoption of cloud services including security, cost and flexibility
- Metrics for success of cloud strategies
- The importance of non-internet connectivity
- The extent to which the declining price of flash technology is influencing data centre strategy

2.1 Methodology

The research project was conducted in four phases, using a combination of qualitative and quantitative methods.

Phase 1 – In-depth interviews with IT and business decision makers from industries including financial services, utilities and leisure.

Phase 2 – Focus group discussion comprised of senior technical employees from organisations all at differing positions with regards to their use of cloud services. Industries represented include media, healthcare, charity and local government.
Phase 3 – A nationwide, online quantitative study completed by more than 250 IT decision makers representing organisations ranging in size from a minimum of 100 employees to enterprises comprising many thousands. Numerous industries were represented including banking and finance, technology, retail, utilities, business services and public sector.

Phase 4 – In order to verify the quantitative results and gain further insights, several interviews were conducted with key thought leaders and companies with varying policies on cloud infrastructure.

3 Data centre strategy today

Our first objective was to establish exactly how many respondents were using cloud services. Fifty four per cent of survey respondents said they use cloud services “to a lesser extent”, while 23 per cent answered “to a greater extent” (Fig. 1). A further 10 per cent were trialling cloud services and 13 per cent were not using cloud in any way.

Computing then asked about respondents’ current data centre set up. Answers were compared to those given to the same question 12 months ago (Fig. 2). As is clear, there has only been a slight shift in data centre strategy, if at all. The popularity of the traditional, on-premise data centre has declined slightly, with corresponding small increases in the proportions using predominantly external hosting or cloud services or outsourcing in entirety, but the change is not significant.

“Our research into data centres and infrastructure since 2013 has pointed to virtualisation levelling off, a finding supported by this year’s results”
While virtualisation remains the most popular data centre strategy, our research into data centres and infrastructure since 2013 has pointed to virtualisation levelling off, a finding supported by this year’s results. In last year’s research we found that “many organisations, having virtualised all that they feasibly can, are now assessing virtualisation as part of a broader strategy encompassing newer technologies such as software-defined data centre (SDDC) and the use of public, private and hybrid clouds”. Participants in our qualitative research concur.

What elements of cloud infrastructure had been adopted? Software-as-a-Service was the most popular route, with 67 per cent of respondents subscribing to at least one such service. Our interviewees and focus group panelists explained how SaaS has been working for them.

Even virtualising services on-premise is something we just don’t do anymore. If we need a new service we just use Azure because it’s easier. It’s sort of set and forget; just click a button and it builds you a server. Five minutes later you come back, and you can start transacting or working on it… Head of technology, NGO

Saturation is a good characterisation of what is going on. For years there was a race to take your data centre and virtualise it, compress it as much as possible, minimise the footprint and take cost out. At this stage, people have got to the end of the virtualisation journey and are looking forward to what’s next, which is probably migration of some of those workloads from virtualisation onto a public or private cloud… CTO, Managed cloud services

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Infrastructure- and Platform-as-a-Service were significantly less widely used with 41 per cent and 33 per cent respectively having adopted them. However, for those using cloud “to a greater extent”, 69 per cent were using IaaS and 53 per cent PaaS.

They’re very easy and quick to set up; you’re up and running much quicker… Head of IT services, Financial services

For the organisation I work for, running SaaS makes a lot of sense because we vary in size; when we take on a new site, we know exactly what it’s going to cost… Head of IT, Local government

We are now adopting more cloud SaaS because it is easier just to consume these products and we’re starting to move more services into Office 365 from a mobility standpoint… Head of IT, Museum

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A huge 75 per cent of respondents expected their use of cloud services to increase in the next 12 months

4 Data centre strategy tomorrow

So if data centres today are heavily virtualised with companies adopting some degree of SaaS, and slightly lesser take up of IaaS and PaaS, what are our respondents’ plans for the years ahead? As Figure 3 shows, overall we see the proportions favouring an internal data centre declining and the numbers focusing on external hosting and cloud services picking up.

The impact of IaaS means less upfront costs and less need for skilled personnel… IT director, Entertainment

It’s mostly AWS with some Azure. It’s largely microservice-based architectures, high volumes, maybe 15,000 transactions a second, that sort of thing. We’re capturing lots of user data, so players, followers, favourites, that sort of stuff. And then we’re using that to generate recommendations, notifications and doing big data analytics for targeted communications… Development lead, Media

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FIG. 3 Which best describes your current situation/future data centre strategy over the next two years?

<table>
<thead>
<tr>
<th>Current Situation/Future Data Centre Strategy</th>
<th>Now</th>
<th>In 2 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>More traditional data centre</td>
<td>30%</td>
<td>12%</td>
</tr>
<tr>
<td>Heavily virtualised data centre</td>
<td>52%</td>
<td>39%</td>
</tr>
<tr>
<td>Focused on using leading edge solutions (eg software-defined, converged infrastructure)</td>
<td>4%</td>
<td>15%</td>
</tr>
<tr>
<td>Mainly use external hosting or cloud services</td>
<td>10%</td>
<td>32%</td>
</tr>
<tr>
<td>All services are outsourced</td>
<td>3%</td>
<td>4%</td>
</tr>
</tbody>
</table>
The proportion focusing on leading-edge solutions also increases significantly. It will be interesting to see how this plays out because Computing has been asking how aware respondents are of cutting-edge data centre technologies such as software-defined, OpenStack and converged infrastructure since 2014 and the proportions of respondents actually at the testing and deployment stages has hovered around the three to five per cent mark year-on-year. We recorded a slight increase in deployment for SDDC this year but there is still a lot of uncertainty about what these technologies are – and a degree of cynicism that they may be simply a rebranding of the concept of virtualisation.

Software-defined could be part of a private or hybrid cloud strategy – or an extension of it. For those presently favouring the cloud “to a lesser degree”, 34 per cent were planning to focus on cloud services. For those presently using cloud “to a greater degree” (see Fig. 1) this proportion rises to 48 per cent. The latter group is also more likely to favour cutting-edge solutions with 20 per cent planning to focus here as opposed to 15 per cent overall.

Projected spending patterns remain broadly the same as last year, although cloud is expected to soak up more of the IT budget. Spending on traditional in-house data centres was the main focus for 31 per cent of respondents, and services such as colocation were the primary recipient for 19 per cent. However, spending on cloud services has risen from 22 per cent when we asked the question last year to 29 per cent (Fig. 4).
Because of the nature of cloud services expenditure and the fact that it comes from operational or departmental expenditure, questions about budgets from year to year can actually mask much bigger variations in strategy over the same time. Computing also asked: “Do you expect your use of cloud services to change over the next 12 months?” A huge 75 per cent of respondents expected it to increase. Only two per cent expected a decrease. Surprisingly, a greater proportion of those already using the cloud “to a greater extent” expected their use to increase even more. No less than 93 per cent of these respondents expected to use more cloud services (Fig. 5).

Again, the overall figures give little indication of the variation between different services. The proportion expecting to be using SaaS seems to have peaked. However, the proportions expecting greater take-up of IaaS and PaaS increase from 41 per cent to 50 per cent and 33 per cent to 45 per cent, respectively (Fig. 6).
The slowing growth of SaaS was, at first glance, a surprising finding. Of our users currently utilising the cloud “to a greater extent”, 82 per cent have adopted SaaS. However, only 73 per cent expect this to be the case in three years’ time. Is this indicative of saturation? One of interviewees quoted below stated their belief that SaaS has peaked. Certainly, it has been the dominant model of cloud computing for nigh on a decade but the expectations of our survey respondents are actually broadly in line with the predictions of analysts.¹

While analysts expect SaaS to remain the dominant model, they predict faster growth rates for IaaS and PaaS as these services continue to mature. IaaS is expected to grow faster than any other segment of the cloud services market.² Nonetheless, spending on SaaS is still expected to grow – just not as fast as it has been of late.

In the meantime, PaaS is popular with the increasing number of firms developing their own software and IaaS is undergoing changes with the arrival of the “serverless” architecture.

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¹ [https://www.idc.com/getdoc.jsp?containerId=prUS40960516](https://www.idc.com/getdoc.jsp?containerId=prUS40960516)
5 Cloud-first and cloud-only

The rate of adoption of cloud services by the enterprise has increased in part because of conscious decisions being made to pursue a “cloud-first” strategy. Cloud-first was actually pioneered by the public sector in order to reduce costs – first in the US and later in the UK. The UK government announced a cloud-first policy for public sector IT in May 2013, and now numerous workshops and seminars are taking place on the development of cloud-first strategies within the enterprise.

As Figure 7 shows, the last three years have been crucial in convincing a critical mass of organisations to finally begin to move to the cloud, despite cloud services having been around in one form or another since the start of the century. Three years ago just over two thirds of those polled had not utilised the cloud at all. However, three years later 63 per cent had at least partial cloud adoption, and the upward trajectory of cloud services continues into the three years ahead.

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What was your cloud strategy three years ago, what is it today, and what do you predict in three years’ time?

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Only a pioneering four per cent of our respondents favoured a cloud-first strategy in 2013. Fast forward three years and that number has grown to 20 per cent. More than twice this number of respondents expect cloud-first to be their default position in 2019.

“It’s actually my first port of call now, to see if there’s a cloud solution to this requirement or have I got something in-house that I can move to the cloud. It’s simply easier not to have your own team. Maintenance and procedures, back-up, storage and licensing and all that good stuff is commodity. Core systems, which often are specialist, they have to stay in-house…” Head of IT, Healthcare

“New projects, you look at the cloud first before anything internal, not just because hardware for internal use or hosting it internally is expensive, but because it is more convenient…” But if an application runs on legacy infrastructure, let it run for the course of its life as it is too expensive to retrofit… Director, cloud and infrastructure services, Technology

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Cloud has the potential to confer huge gains for businesses by allowing them to take advantage of the economies of scale of both compute and storage that the cloud can offer and removing the need to house, maintain and manage their own infrastructure. It can also be a fundamental component of digital strategy and a key strategy to improve agility, which is essential for organisations to fully realise digital aspirations. As masses of newly connected devices come online with the arrival of the IoT, and as data volumes and the need for real-time processing continue to grow the role of cloud computing can only increase further.

Fifty-two per cent of respondents told us that their cloud strategies were part of a wider digital transformation strategy. A cloud-first position certainly makes sense when it comes to new projects but our findings suggest that for the moment (and indeed for the next three years) the hybrid approach will remain the most popular in the real world. Our focus group panelists and interviewees quoted below give us an indication why cloud-first remains an aspiration rather than an achievable reality for the majority of organisations.

“We are more partial cloud. From a security and data protection perspective, we still need to maintain ownership. We use cloud for more specific cases or SaaS…” Head of IT services, Financial services

“If I’m either building something new or if I’m going through a hardware refresh or a cycle of software upgrades, I am going to attempt to put it in the cloud with a fallback strategy if the cloud doesn’t work. I might fall back to something like a private cloud or a virtualisation environment, and if that doesn’t work I fall back to a traditional physical server…” CTO, Managed cloud services

“We’ll always look at the cloud option before making a decision but we don’t always find a realistic one available…” Head of IT, Local government

At the far end of the spectrum we have cloud-only, dispensing with on-premise infrastructure altogether. Some of our panelists believed that cloud-only was just for smaller organisations, and that larger ones will struggle to turn the tanker round.

“A cloud-first strategy makes an organisation more agile and able to deal with peaks and troughs. Cloud-only is just for small start-ups…” IT director, Entertainment

“It’s typically a company that is not already invested in a data centre. They don’t have an existing IT infrastructure, they don’t own the equipment. They are at the stage where they want to be nimble and agile and they don’t necessarily want to spend on the capital required to build a data centre or even invest in a colocation environment. It’s typically small start-ups; it could also be a department, segment or off-shoot of a company where the IT spend is shifting from IT to these other departments…” CTO, Managed cloud services
But back to cloud-first. The public sector is, arguably, the biggest supertanker of all. Perhaps this is why, in 2015, a full two years after cloud-first had been mandated for public sector, more than half of Whitehall staff were still not happy using G-Cloud for IT. Forty-three per cent of civil servants were still printing out documents and physically mailing them to each other instead of using cloud collaboration services. A caricatured picture of a civil servant clinging to the outdated practices they know and trust is easy to mock, but the survey indicates just how long a hybrid or bimodal infrastructure is likely to persist – and suggests why it has taken so long for a cloud-first mentality to be established.

6 Public, private or hybrid?

Whenever cloud infrastructure is discussed, the words public, private and hybrid cloud are used. These terms have always been confusing, the result of opportunistic marketing, and may be even more so now as new “as a service” offerings become available. People have different understandings of each term and new concepts such as multi-cloud and serverless need to be included in the cloud lexicon.

The term “private cloud” is also sometimes used to describe highly virtualised environments which may or may not be a genuine cloud. Research found in 2013 that a high proportion of what IT teams described as “private clouds” weren’t actually clouds at all. Participants in our qualitative research illustrated the lack of agreement on the language of the cloud.

“A high proportion of what IT teams described as ‘private clouds’ weren’t actually clouds at all…”

Is hybrid a mixture of public and private cloud utilisation or simply a mix of on-premise data centres and being able to “burst” into the cloud during periods of peak demand? Also, is multi-cloud considered part of a hybrid cloud environment or is it a concept in its own right?


2 http://blogs.forrester.com/james_staten/13-02-25-why_your_enterprise_private_cloud_is_failing
Perhaps the easiest way to define different types of cloud services is to go back to basics and distinguish between them according to levels of control and ownership – particularly of security.

Hybrid cloud is a blending of public cloud with other form factors such as virtualisation or dedicated servers, anything which is not public cloud…

CTO, Managed cloud services

There is now another term called ‘multi-cloud’. That’s the idea that you are using more than one public cloud and you are trying to make your applications run in all these different environments. You might have the marketing department use Amazon, while the core IT department might be using Azure, where a bank might be using a private cloud on-premise for components on their applications, while others may be using Salesforce…

CTO, Managed cloud services

A lot of people use the term incorrectly. Hybrid is when you have a legacy or internal infrastructure and you either want to test the water in the cloud or you have specific applications that lend themselves to work very well in a cloud-type infrastructure. That is hybrid and you would have an orchestration tool to allow you to either provision services internally or in the cloud depending on the workload that is required, but in a very controlled way. All the control is still within your organisation, but you allow certain features to run in a public cloud…

Director, cloud and infrastructure services, Technology

Those terms kind of need to be turned into a different model – who owns it, who manages it, who services it…

Head of IT, Healthcare

If it’s a private cloud I have control and I own the licences. If it’s a public cloud in Microsoft terms, I don’t have the licences and that’s how I see the difference…

Head of infrastructure, Charity

Security and performance are the two critical things, because if you are on a shared platform, you have no idea who you are sharing with and what their seasonal loads may be, which might have an impact on that piece of hardware that could impact on you…

Director, cloud and infrastructure services, Technology

It’s really down to how much control you relinquish at the security layer and that is what makes something private…

Director, cloud and infrastructure services, Technology
7 Barriers to cloud

Despite the considerable advantages that cloud computing can bring to an organisation, there remain a number of real-world factors preventing its wider adoption. Computing asked respondents who were making little or no use of cloud about these barriers. Their concerns are shown in Figure 8 and top of the list is, of course, security.

7.1 Security

Security, and related issues of data protection and compliance, have long been the biggest sticking point for cloud, and this state of affairs remains to this day. Arguably, data is safer with a cloud provider than in many in-house data centres, but cloud vendors still have a mountain to climb to convince organisations of this. Security was a concern even for those who had adopted the cloud “to a greater extent” – as many as 20 per cent of these respondents still had concerns.

However, in a follow-up question respondents were asked to rate the security of their data in the public cloud on a scale of one to seven. Cloud service providers can draw some comfort from the fact that overall, our respondents considered their data to be reasonably secure. Sixty-three per cent of respondents ranked security at a five, six or seven. Only 17 per cent of respondents ranked their security from a one to three. Those who had already adopted the cloud to a large degree had fewer concerns with no less than 91 per cent giving a rating of five, six or seven. Interestingly, of those who had only adopted cloud services to a lesser degree, 68 per cent gave a security rating in excess of five which indicates that it is not security concerns holding back further cloud adoption by this particular group.

Certainly, the perception of cloud security has improved enormously in the last two to three years – a finding borne out by Computing research into security as a whole. Providers have gone out of their way to offer greater transparency of security practices and data encryption has been more widely adopted – both of these offer comfort to organisations wanting to leverage the scale of the cloud without the associated risks.

* Respondents could select multiple answers.
In theory, cloud providers should be able to provide layers of security that would be impossible to replicate in an on-premise environment.

However, not everybody is convinced.

It is not knowing who has access to your data, not just people accessing the public cloud but people who work for these organisations. We have very rigorous security checks for the staff in our company, even more so for people in the IT department, but what guarantees are there that in these organisations people aren’t accessing your vulnerable clients’ data?

Head of infrastructure, Charity

Some companies are having a hard time with security on-premise and getting the security resources they need. Cloud providers may sometimes be able to provide security in a more sophisticated manner than companies can do themselves… CTO, Managed cloud services

It is was compliance, then security, or the other way round. But it is changing. Security has got better and the compliance will make life easier… Head of IT, Local government

I have a lot more confidence in Amazon and Microsoft keeping my data safe than I would in 99.9 per cent of operations staff in normal companies… Development lead, Media

I think it’s getting much better, the perception as well. The major cloud vendors are putting so much effort into securing customer environments… Director, cloud and infrastructure services, Technology

It has clarified a whole bunch of things that were very muddy before and it is laying down new guidelines in a much more clear and concise and doable way… Head of policy and procedures, Charity

Our survey respondents expected the GDPR to have a reasonable impact on their organisations in the next two years. When asked to rate the scale of impact, the average rating was four out of seven. Those respondents using the cloud more extensively expected a greater impact, with 26 per cent rating it at a six or seven as opposed to 17 per cent doing so overall. Some of our panelists considered the GDPR quite beneficial because of the clarity it brings to data protection matters rather than the patchwork of regulations and law presently in place.

It is concerns such as the one expressed above that have held back cloud adoption to a considerable degree and for a long time. At the heart of the matter is the question of whether it is the responsibility of the cloud service provider or of the customer to ensure data security. This question has finally been answered by the impending EU General Data Protection Regulation (GDPR) – and the answer is both. The GDPR will stipulate that any organisation processing data has a legal obligation to secure it.

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It has clarified a whole bunch of things that were very muddy before and it is laying down new guidelines in a much more clear and concise and doable way… Head of policy and procedures, Charity

Our survey respondents expected the GDPR to have a reasonable impact on their organisations in the next two years. When asked to rate the scale of impact, the average rating was four out of seven. Those respondents using the cloud more extensively expected a greater impact, with 26 per cent rating it at a six or seven as opposed to 17 per cent doing so overall. Some of our panelists considered the GDPR quite beneficial because of the clarity it brings to data protection matters rather than the patchwork of regulations and law presently in place.

It is concerns such as the one expressed above that have held back cloud adoption to a considerable degree and for a long time. At the heart of the matter is the question of whether it is the responsibility of the cloud service provider or of the customer to ensure data security. This question has finally been answered by the impending EU General Data Protection Regulation (GDPR) – and the answer is both. The GDPR will stipulate that any organisation processing data has a legal obligation to secure it.
Our panelists did not expect Brexit to allow British companies to somehow circumvent the new regulations, and rightly so. If any data that you store or process pertains to EU citizens the security of that data is your responsibility – regardless of whether you are an EU member or not. The increasing focus on security by providers of hosted and cloud services is evidence of the potential impact of the GDPR. It is quite possible that this increased focus is the reason that organisations, after years of stalling, have finally started to get on board with cloud infrastructure in the way that early proponents predicted.

7.2 Price
The second biggest factor holding back organisations from moving infrastructure to the cloud was the cost. This should raise alarm bells with cloud vendors because reduced cost has been one of the central reasons given for moving to the cloud, so something is going wrong somewhere.

Establishing the true total cost of ownership (TCO) of infrastructure and cloud alternatives is fiendishly tricky. Vendors provide their own tools but prospects are understandably suspicious about their methods. A one-size-fits-all tool will never provide accurate results because each organisation will benefit in different ways from cloud services. What you actually do as an organisation will affect the cost/benefit analysis. The value of the agility that the cloud can provide is nigh on impossible to calculate – as are the attendant costs of the potential risk of failure to comply with data privacy and security regulations. These calculations go way beyond the straight Opex/Capex trade off that many cloud vendors use as a sales hook.

When it came to the ongoing costs of cloud services, there was some disparity between the results of our quantitative and qualitative research. Our survey respondents believed that they had a fair understanding of costs. When asked how aware they considered themselves on the actual costs of using cloud services on a scale of one to seven, 65 per cent of respondents rated themselves a five, six or seven.

However, the feeling among our interviewees was that it is challenging to establish the true cost of cloud services in comparison to the alternatives. While vendors were considered reasonably transparent in terms of the basic cost of services, there was a feeling that additions to the basic service could increase the final cost to a surprising degree.

"It's a bit like your gas bill. You’re vaguely aware how much it costs but you’re not totally aware of how much you’re using, nor can you calculate it. The Microsoft back-up regime does a block back-up so even when you delete data, your back-up size increases because it stores all the changes that those deletions have made. So the back-up size is going up and up and up and it's impossible to see – and it's charged to the total storage. It's very hard to calculate. I know how much it will cost per terabyte but I don’t know how many terabytes I’m going to end up with at the end of the month..." — Head of IT, Museum

“Establishing the true TCO of infrastructure and cloud alternatives is fiendishly tricky. Vendors provide their own tools but prospects are understandably cynical about their methods”
These factors make it very difficult to calculate the true cost of cloud services. Some of our panelists suggested that while the dashboards provided by some cloud service providers showing consumption and costs were useful, they needed to improve to be able to impart a greater level of awareness for the customer. Some vendors were clearly doing better than others when it came to helping their customers get the best value out of their service.

**7.3 Flexibility and choice of partner**

Another obstacle faced by organisations considering cloud was who to partner with and the flexibility of vendors. Recent research by *Computing* on the technology purchasing process found considerable dissatisfaction among buyers with large, multiple year contracts – which are just the type of contract that the providers of cloud services tend to like.

A request for a break clause has traditionally been accompanied by an uplift on the overall cost of the contract. From the vendors’ commercial point of view it doesn’t seem unreasonable. However, a big part of the attraction of cloud services is the flexibility to scale up. But does this flexibility work the other way too? Our research struggled to answer this question because only nine per cent of our survey respondents using cloud had actually switched cloud providers or moved data. In theory, if an SLA is breached, customers should be free to move, but the reality may be somewhat different.
Increasing competition in the cloud services market means that vendors may have to raise their game – both in terms of more flexible and innovative contracts and the ease of data movement. On the other hand some see the aggressive price war between four big players (Microsoft, Amazon, Google and IBM) in the public-cloud space as a worrying sign that smaller vendors will be driven out of the market.

7.4 Getting staff trained

In-house IT professionals have always needed qualifications and accreditations in ITIL, Cisco, Oracle, Microsoft, VMware – whatever the proprietary technologies they work with. As the issues outlined above indicate, moving to cloud is likely to be challenging, but the variety of different scenarios mean that cloud qualifications and accreditations are less widely recognised at present.

Running workloads in the cloud can be just as complex as doing so in-house, particularly if a hybrid cloud model is adopted. Platform-, Infrastructure- and Software-as-a-Service are all different beasts, requiring a range of skillsets. In addition, many enterprises mix and match their cloud providers, and applications and support layers running on different clouds such as Microsoft Azure, AWS and Google Cloud work in different ways and may not be inter-compatible. Then there are the overarching business considerations of managing SLAs, IT security, data governance, data migration, data protection and cost management to consider.

The answers to a question posed in Computing’s latest research regarding training were revealing. The more experience the respondents had with cloud, the more they felt that training was a good idea.

Among the whole survey sample, 38 per cent said they would consider formal training in cloud services. Among those who use cloud to a greater or lesser extent that number rose to 41 per cent, while among the advanced users it was 47 per cent.

The more heavily one uses cloud, the more valuable training is likely to be, of course, but the way that the number rises with experience shows that whatever else it might be, the ideal of cloud as utility computing, to be consumed like electricity or water, is as far away as ever. Specialist skills are still needed.
“Survey respondents who were using the cloud to the greatest degree were less motivated by cost savings than they were by the increased flexibility that the cloud offered them.”

8 Signs of success

*Computing* asked survey respondents to choose up to five metrics that they would use to measure the success of a cloud strategy. The results are shown in Figure 9 and show that the main impetus for getting out of the infrastructure game is cost. The most popular metrics – cost savings and less capital expenditure – are strongly related. Many other metrics are also ultimately related to cost savings – increased resilience and uptime, simpler licensing and fewer staff for example.

FIG. 9 What are the main metrics you would use to measure success of a cloud strategy?

<table>
<thead>
<tr>
<th>Metric</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost savings</td>
<td>44%</td>
</tr>
<tr>
<td>Less capital expenditure</td>
<td>36%</td>
</tr>
<tr>
<td>Increased flexibility</td>
<td>34%</td>
</tr>
<tr>
<td>Increased resilience</td>
<td>34%</td>
</tr>
<tr>
<td>Faster disaster recovery</td>
<td>32%</td>
</tr>
<tr>
<td>Ease of administration</td>
<td>29%</td>
</tr>
<tr>
<td>Ease of access/availability</td>
<td>29%</td>
</tr>
<tr>
<td>Speed of deployment of new applications</td>
<td>26%</td>
</tr>
<tr>
<td>Increased uptime</td>
<td>23%</td>
</tr>
<tr>
<td>Access to new solutions/technology</td>
<td>21%</td>
</tr>
<tr>
<td>Increase in capacity</td>
<td>18%</td>
</tr>
<tr>
<td>Simplifying licence management</td>
<td>15%</td>
</tr>
<tr>
<td>More efficient workflow</td>
<td>15%</td>
</tr>
<tr>
<td>Risk and compliance improvement</td>
<td>14%</td>
</tr>
<tr>
<td>Less staff to manage</td>
<td>12%</td>
</tr>
<tr>
<td>Increase of compute power</td>
<td>12%</td>
</tr>
<tr>
<td>Speed and rate of change</td>
<td>12%</td>
</tr>
<tr>
<td>Increase in productive collaboration</td>
<td>10%</td>
</tr>
<tr>
<td>Increase in utilisation/more users</td>
<td>9%</td>
</tr>
<tr>
<td>Ease of transfer</td>
<td>7%</td>
</tr>
<tr>
<td>Less issues overtime</td>
<td>7%</td>
</tr>
</tbody>
</table>

* Respondents could select multiple answers.
A particularly interesting finding was that the survey respondents who were using the cloud to the greatest degree were less motivated by cost savings than they were by the increased flexibility that the cloud offered them. As we mentioned in Section 7.2, the potential commercial benefits in the form of a reduced time to market that the agility enabled by the cloud offers are almost incalculable. Those already plugged into the almost infinite compute power and scalability of the cloud are quite possibly realising this. Some of our interviewees and panelists also focused on competitive advantage rather than cost reduction.

These findings, along with those in Section 7.2, should be food for thought for cloud service vendors. While a reduction in costs is not the primary motivator of every organisation looking at cloud services, our survey suggests that it is very, very important. Uncertainty about cost – and the complexity and opacity of the pricing models that vendors have in place – is serving to prevent some businesses that otherwise would do moving infrastructure to the cloud. It is also preventing some of those who already have some cloud infrastructure actually realising the full value of their investment.
9 The connectivity conundrum

In addition to reducing costs, some of the key metrics for success in cloud service deployment set out in the previous section were resilience and uptime. This may mean that the “best effort” of internet connectivity to the cloud may just not be good enough. The security of the public internet is also still the single biggest concern that people have about placing elements of their infrastructure into the cloud. Both of these issues can potentially be resolved by non-internet connectivity to the cloud – a dedicated private connection of some sort. However, whatever mode of private connectivity is chosen, it will invariably add a degree of complication and therefore cost into the service. How important was non-internet connectivity to the cloud for those surveyed?

The majority of respondents to this question ranked its importance somewhere between a five and a seven, although it must be pointed out that in excess of one third of respondents told us that they did not know (their answers are not included in Figure 10). The more infrastructure and mission-critical applications that an organisation places in the cloud, the more likely a dedicated connection becomes.

However, the potential costs of non-internet connectivity can cause some sharp intakes of breath.

“Once you go for non-internet connectivity, your costs escalate quite dramatically. Today you can get a secure connection via the internet if you use the right technologies. We chose internet for connectivity between sites and not just for the cloud because Cisco and others out there are putting a lot of effort in securing connections across the internet…” Director, cloud and infrastructure services, Technology

“If you were outsourcing all of your infrastructure and you had high speed latency-sensitive applications then, you’d want a dedicated pipe…” Head of IT, Healthcare

If you are looking to put some of your back office applications in the cloud, then you would really want to extend your network into the cloud as if it were another node on your corporate network. Private connectivity seems a natural way to make that extension rather than trying to use the internet to do it…” CTO, Managed cloud services

FIG. 10  How important is non-internet network connectivity to cloud services?

6% 7% 10% 10% 24% 17% 26%

1 2 3 4 5 6 7

Not important Very important
The question of connectivity may also be holding back cloud adoption in other ways. Although connectivity was not a frequently mentioned barrier to cloud services among those surveyed, some of our qualitative research participants mentioned BT as being an obstacle to cloud adoption. BT Infinity might be offering speeds of 52Mbps – so long as you don’t live in the countryside. This is not just a consumer issue. Cloud collaboration tools, for example, only work to their full extent if they are available to workers wherever they happen to be.

Ofcom concluded earlier this year that BT must both open up its network and reform Openreach to better serve both businesses and consumers. If this happens, it removes another yet another obstacle to the transition of more infrastructure to the cloud.

“We may rethink our cloud-first option after BT’s debacle in the last week [refers to a prolonged outage in July 2016]. We couldn’t get access to some of our services. Some of the services we put out in the cloud because we wanted the resilience. We lost Sunday night…” Head of IT, Healthcare

“The only thing that’s holding back more cloud is BT. I work in an organisation that’s diverse across the whole country. We’ve actually just changed our networking to Virgin because BT could not provide services into remote areas. The difference between BT and the others is that all the other providers will traverse anybody else’s network except BT, so BT is the biggest stumbling block in going to cloud. If you are somebody in a little village somewhere and all you can get is ADSL, you can’t use cloud services, there just isn’t the bandwidth…” Head of Infrastructure, Charity
10 Impact of flash

Flash storage technology is far from new. Solid state drives have been around for some time but have only recently begun to drop significantly in price in comparison to HDD. *Computing* wanted to establish the degree to which flash has penetrated data centres and the impact it may have on cloud strategies. Thirty five per cent of respondents said they are currently deploying flash products – as opposed to 28 per cent in 2015. The proportion of respondents planning to do so remained the same at 17 per cent.

The increase in the proportion using flash in just one year is significant. Figure 11 provides an indication of how organisations are using flash. Hybrid arrays are popular for some very good reasons. While the cost of flash has dropped considerably, there remains a price gap at the high capacity end of the market. Hybrid arrays can be a useful way to process IOPs-intensive workloads for business-critical applications while utilising the still-cheaper HDDs for bulk data storage.

However, the biggest rise is seen in the deployment of top-end all-flash arrays. Once a luxury item found only in very large data centric organisations, the price drops have made them much more affordable and a genuine option when the time comes for a storage refresh. Converged arrays, too have seen a significant boost in their adoption.

Flash is certainly highly attractive technology for businesses that, perhaps for regulatory reasons, have no plans to rush headlong into cloud.

*If you look at large corporations, large banks where they can’t move to the cloud because of data protection and the value of their data, flash storage is a great opportunity because of its performance. Flash storage is really changing the way that data is presented to applications…*

*Director, cloud and infrastructure services, Technology*
Will the drop in flash prices induce organisations to retain their own infrastructure when they may otherwise have put at least some of it into the cloud? The short answer is a little but not to a great extent – which demonstrates again that the cost/benefit analysis of moving to the cloud is far more complicated than immediate Capex/Opex calculations. When asked, “Is the drop in price of flash storage or of other new data centre technologies changing your view of the usefulness of cloud computing?”, 42 per cent said yes. Of those who have utilised cloud services for their infrastructure to a greater extent, the proportion answer yes was slightly less at 40 per cent. This headline question might lead one to conclude that use of flash in internal data centres could do some damage to cloud services.

However, when those saying that cheap flash might change their cloud strategy were probed further, 52 per cent said they planned to retain the same ratio of cloud to on-premise, 28 per cent said they were less likely to move workloads to the public cloud and 17 per cent said that they might bring some workloads back to an on-premise or hybrid environment.

Flash and the cloud are not, of course, mutually exclusive. A possible scenario in several years’ time might well be flash/cloud hybrid architectures with application data being served by flash and less frequently accessed data going to the cloud. Furthermore, the falling prices of flash is as advantageous to cloud vendors building as it is to end users building their own infrastructure. Cloud vendors are also offering flash-enhanced infrastructure and are likely to be doing so in increasing numbers over the coming months and years.

I think people are just going to want flash in the cloud as a means to make their cloud better… CTO, Managed cloud services

11 Conclusion

The Cloud & Infrastructure Review 2016 is the fourth review published by Computing on the subject of infrastructure and data centres, but the first to be a cloud-focused publication. The change was prompted by research by Computing into a number of aspects of infrastructure establishing that the cloud has finally made the jump to the mainstream rather than being utilised highly selectively by a majority of organisations for non-critical workloads and storage.

Seventy-seven per cent of those surveyed were using cloud services to some extent. A further 10 per cent were trialling them. Three-quarters of survey respondents also expected their use of cloud services to increase in the next year. There is yet more evidence that the drive to virtualise data centres to make them more space, energy and cost efficient has peaked. Over the next three years more data and applications will find themselves hosted out of house; the proportion expecting to use mainly external hosting or cloud services moves from 10 per cent today to 32 per cent whereas the proportion focusing on a traditional in-house setup plummets from 30 per cent to 12 per cent.

“It has taken over a decade of promise, but the cloud has finally made an enormous leap in the minds of those deciding where the future of their infrastructure lies”
An increasing number of respondents also expect to focus on cutting-edge technologies such as SDDC. These technologies have gained little traction in the several years since Computing began researching this topic in depth but they have the potential to become part of hybrid cloud strategies in the years ahead.

SaaS was still the most popular way for organisations to kick off their cloud strategies – 67 per cent of respondents had subscribed to at least one SaaS. IaaS and PaaS, although less popular now, were expected to show the strongest growth in the next three years. This finding is in line with analyst predictions for SaaS to remain the most popular model of cloud computing but for IaaS and PaaS to grow more sharply until 2019.

The cloud vendors of choice for our research participants are shown in Figure 12. Large players dominate the rankings. Those already utilising the public cloud to a high degree are even more likely to favour large, established partners. The top ranking of Microsoft can probably be attributed to the runaway success of Office 365, which, according to recent research, has approximately double the market share of its nearest competitor. Nevertheless, Amazon’s AWS is thought to be several times larger than Microsoft Azure, so the relative positions of the top two vendors might come as something of a surprise. Our focus group panelists gave us their thoughts.

Microsoft is doing a lot in terms of marketing and introducing people to the cloud. There are existing relationships along licensing and software, so you’re probably getting some licences for Azure being bundled into your annual subscriptions. Amazon has not historically been an enterprise software company; it doesn’t have relationships like Microsoft does. Google is in even worse shape from that perspective…

The challenge facing the smaller public cloud vendors is clear.

The challenge is that unless it’s based on one of the big providers like an Amazon, Google or a Microsoft, their technologies are not advancing at the same pace; they have to retrofit and are not doing it on the same scale as the big providers, so they can’t keep pace and they are not going to be able to compete on pricing either…

---

FIG. 12 Which cloud vendors (SaaS, IaaS or PaaS) do you use or are you considering?

<table>
<thead>
<tr>
<th>Vendor</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microsoft</td>
<td>68%</td>
</tr>
<tr>
<td>Amazon</td>
<td>43%</td>
</tr>
<tr>
<td>Google</td>
<td>33%</td>
</tr>
<tr>
<td>Salesforce</td>
<td>21%</td>
</tr>
<tr>
<td>IBM</td>
<td>18%</td>
</tr>
<tr>
<td>Rackspace</td>
<td>14%</td>
</tr>
<tr>
<td>Oracle</td>
<td>11%</td>
</tr>
<tr>
<td>OpenStack</td>
<td>11%</td>
</tr>
<tr>
<td>SAP</td>
<td>8%</td>
</tr>
<tr>
<td>Cloudfoundry</td>
<td>2%</td>
</tr>
<tr>
<td>None/don’t know</td>
<td>13%</td>
</tr>
<tr>
<td>Other</td>
<td>10%</td>
</tr>
</tbody>
</table>

It is difficult to overstate the momentum of the move to the cloud. Three years ago, more than two thirds of the representatives we spoke to were not using the cloud at all. In 2016, 63 per cent had at least partial cloud adoption. Twenty per cent are now pursuing a “cloud-first” strategy and by 2019 40 per cent expect to be doing so. The attitude to the cloud among our audience has changed from reluctant acceptance – and in many cases active avoidance – to one of more enthusiastic adoption. This has much to do with digital aspirations.

The scale of the compute power offered up by the cloud confers the level of agility that digital business requires. Making decisions on the back of historical data is no longer good enough and the cloud allows organisations to spin up the tools in minutes to turn unending quantities of unstructured data into decisions to put them at the forefront of the digital marketplace. Cloud-first was initially rolled out as a strategy for money-saving reasons but it has the potential to be so much more.

But “potential” is the file in which cloud-first, and even more so cloud-only, is likely to stay for many established organisations who have invested heavily in their infrastructure over many years. The most popular cloud strategy was still a hybrid infrastructure of customer owned and cloud, although we found a degree of confusion and disagreement over the meaning of the oft used public, private and hybrid cloud terminology.
The demarcation lines between the different models are becoming less distinct but a crucial differentiator is over the amount of control over security. Security remains the most frequently raised objection to public cloud. While the perception of public cloud security has improved enormously in the last two years, a degree of wariness persists. The EU GDPR has clarified expectations of cloud service providers and their customers in this area and the issue of security in the public cloud is expected to diminish for all except very heavily regulated industries, although for many firms a great deal of work will be required to comply.

Cost is also still a significant barrier to the cloud. The extravagant claims of cloud vendors about the savings involved in shifting from a Capex to Opex-based model have been toned down but establishing the true TCO of infrastructure and cloud alternatives remains challenging because a number of costs and benefits are borderline intangible. There was also a feeling among those we spoke to that cloud vendors could help themselves by being a little more transparent with not just basic costs but with ongoing ones. It is easy to run up unexpectedly large bills.

Concerns also existed about vendor lock-in and the difficulty of safely moving data between different providers. Cost savings and reduced capital expenditure were the two most popular ways of measuring the success of cloud strategies, although those already using the cloud to a significant degree were less motivated by cost savings than respondents overall. These findings indicate that the complexity of some pricing models is acting as a barrier to cloud service adoptions and also preventing existing customers gaining real value for money.

Other important metrics for success in cloud service deployment were resilience and uptime, leading some of our respondents to consider non-internet connectivity to the cloud – or indeed between clouds. The more mission-critical applications that an organisation places in the cloud, the more attractive a dedicated connection becomes.

Our survey also recorded an increase in the proportion of respondents using flash-based storage technology in their data centres – an increase highly likely to have been facilitated by aggressive pricing from flash vendors. Hybrid arrays were still the most popular approach as organisations utilise existing HDD infrastructure for infrequently accessed data and server flash for high IOPs workloads, but all-flash arrays and speed-boosting server cards were on the rise, as was converged storage infrastructure. The plummeting price of flash is leading a minority of respondents to reconsider their use of public cloud. A flash/cloud hybrid architecture is a tantalising proposition for organisations that will always be limited in their use of public cloud.
It has taken over a decade of promise, but the cloud has finally made an enormous leap in the minds of those deciding where the future of their infrastructure lies. The transition will proceed slowly and very few organisations are going to outsource their whole infrastructure anytime soon. However, as start-ups avoid having to buy any infrastructure at all, and the digital strategies of existing organisations begin to mature, the move to cloud will pick up pace for the compute and storage of all but the most business-critical data. Cloud infrastructure is finally part of the mainstream.

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