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Data Centre Audit 2015

September 2015

£3,995

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1 Executive summary

The enterprise data centre continues to evolve, driven by the ongoing explosion in data volumes, big data, cloud computing and other technologies. Virtualisation of both server – and to a lesser degree storage – continues to dominate the present landscape, but the uptake of cloud services of all kinds is increasing sharply as solutions mature and vendors raise their security game. New technologies, such as software-defined and converged infrastructure, among others, have yet to gain serious ground but are certainly featuring in data centre strategy meetings.

The *Computing Data Centre Audit 2015* summarises and analyses the results of a comprehensive research programme undertaken by *Computing* during July and August 2015. This year's research builds on similar studies conducted in 2013 and 2014 and compares findings to see how technologies such as virtualisation have shaped data centres and how those responsible for strategy are using the cloud and cutting-edge technology to meet present and future demands. The audit looks at how patterns of spending are likely to change as data centres evolve and how the skills required will also develop. We conclude with a discussion of how the lines between different data centre architectures are blurring – and the implications for organisations as a whole.

Highlights of the research include:

- Virtualisation dominates the data centre landscape – many organisations have virtualised just about every workload that they can.

- The pace of virtualisation is expected to slow in the next 12-24 months.

- The use of cloud services in various forms has increased significantly in just 12 months, with hybrid cloud being the most popular model.

- New technologies such as software-defined storage were at very early stages in terms of testing and deployment but were a part of ongoing strategy for approximately one fifth of respondents.

- Flash storage has gained significant ground in the data centre with almost half of respondents using flash or planning to do so.

- The requirement for traditional data centre skills and hardware knowledge is likely to reduce as technology continues to dismantle the barriers between infrastructure and other teams. As DevOps grows, automation and orchestration skills will become key.

- The increasing uptake of cloud services requires greater commercial and organisational skills than traditional data centre management may have required.

- Increases in spending were planned in new technologies, storage and virtualisation and were likely to be triggered by existing infrastructure reaching retirement.

"The uptake of cloud services of all kinds is increasing sharply as solutions mature and vendors raise their security game"

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2 Research overview

The objective of the *Computing Data Centre Audit 2015* research project was to establish how UK business organisations are adapting their data centres to cope with the escalating demands placed on them by changes in expectations of data availability and security.

Key areas of research included:

- The extent of virtualisation in enterprise data centres.
- Whether the use of cloud data centre services and outsourcing has increased.
- The awareness and adoption levels of new technologies such as software-defined and converged infrastructure.
- Whether flash storage had made a significant impact on storage infrastructure.
- How spending patterns on data centre infrastructure were likely to change.
- Skills required for managing the evolving data centre architecture.
- The drivers of change to data centre architecture.
- Impact of changes to EU laws on data protection and privacy.

2.1 Methodology

The research project was conducted in three phases in July and August 2015, using a combination of qualitative and quantitative methods.

Phase 1 – In-depth exploratory interviews with IT decision-makers, data centre managers and infrastructure specialists, many of whom took part in research for the *Computing Data Centre Audit 2014.*

Phase 2 – Nationwide online quantitative study completed by 380 IT decision-makers representing businesses ranging in size from 100 to in excess of 5,000 employees and multiple industries including manufacturing, retail and the public and third sector.

Phase 3 – In order to gain greater insight from quantitative research, several more interviews were conducted with IT decision-makers and specialists.

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3 Data centre strategies

The first step in our 2015 research was to establish exactly what the corporate data centre looks like today. *Computing* asked respondents about their current data centre setup. Figure 1 shows the results and demonstrates just how dominant virtualisation remains in corporate data centre strategy. The benefits of virtualisation over a more traditional data centre have been documented many times over. It is best left to some of our interviewees to set out some of the benefits that their organisations have derived from it.
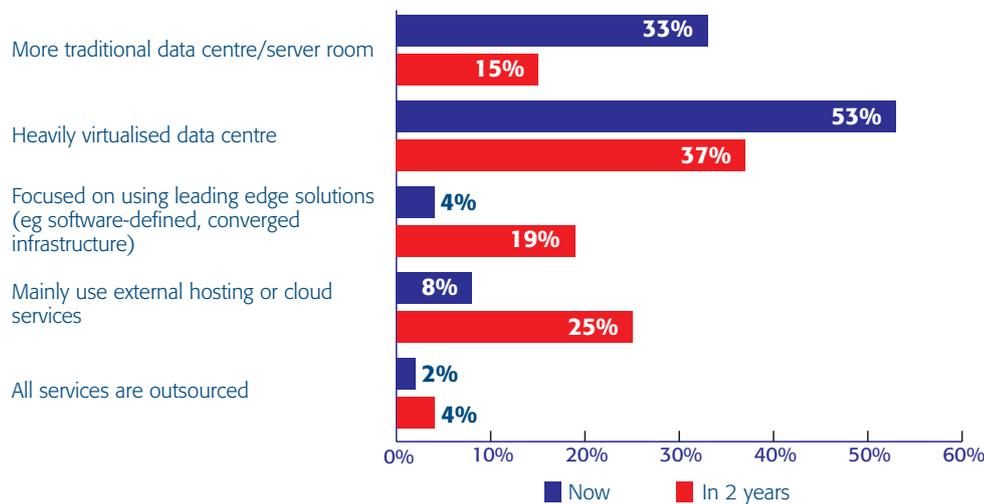
> You're spending a bit less on the hardware with a bit more flexibility in terms of setting up your services and test services. The interface is easier as well…
>
> Head of IT, Finance

> It gives us independence of the workload from the hardware, so you can manage your hardware assets independently from the workloads that sit on top of them. Therefore you can effectively get more dividend quickly…
>
> Infrastructure strategy architect, Large retail

> If I have a large blade setup, I have to make sure that maintenance on the blades software is up to date, with the manufacturer, otherwise I can't go to third parties, I can't get the patching… Service manager, Services

"There will always be a need for the on-premise data centre but a broad consensus seems to be building that the mainstream future for the data centre rests in the cloud"

FIG. 1 Which best describes your current data centre set up? Will this change over the next 2 years?

	Now	In 2 years
More traditional data centre/server room	33%	15%
Heavily virtualised data centre	53%	37%
Focused on using leading edge solutions (eg software-defined, converged infrastructure)	4%	19%
Mainly use external hosting or cloud services	8%	25%
All services are outsourced	2%	4%

In order to establish a better idea of what had informed the data centre strategies of our survey participants, *Computing* asked them to pick up to five issues which had most strongly influenced their strategies. The sheer increase in data volumes was the biggest factor, with 46 per cent giving it a top rating (Fig. 2).

FIG. 2   Which of these issues have had the most impact on your data centre strategy in the last three years?

Issue	%
Increasing data volumes	46%
Cost of data centre technology	37%
Security concerns	36%
Cost of maintenance	32%
Licensing costs	30%
Managed services/colocation	18%
Loss of internal expertise	15%
Energy costs	15%
Mergers, acquisitions, business changes	15%
Legislation and regulations	14%
Shadow IT/self-service by business	13%
Outsourcing	13%
Mobility	11%
Automation	11%
Loss of control by IT department	6%
Customers requiring transparency	6%
Insourcing	5%
Price of land/planning restrictions	4%
None/N/A	4%

▪ Respondents could select multiple answers

> **The whole big data thing and the use of information stored especially from internet usage will put pressure on the data centre…**
> Head of IT, Finance

> **It's the sheer amount of data. We are analysing more and more data to make our business better…** Service manager, Services

Perhaps unsurprisingly, 37 per cent of respondents stated that the cost of data centre technology was one of the largest factors in setting strategy. These costs were also perceived to have increased in tandem with volumes – there was a perception among some of those interviewed that data solution vendors were not playing strictly fair with their licensing costs.

> …Although storage costs have come down in some respects, enterprise storage is still very expensive. When you are looking at fast SAN systems you are paying a significant premium. So as the data increases, so does the cost, which impacts on DR as you need to have a replica of everything… IT security manager, Legal
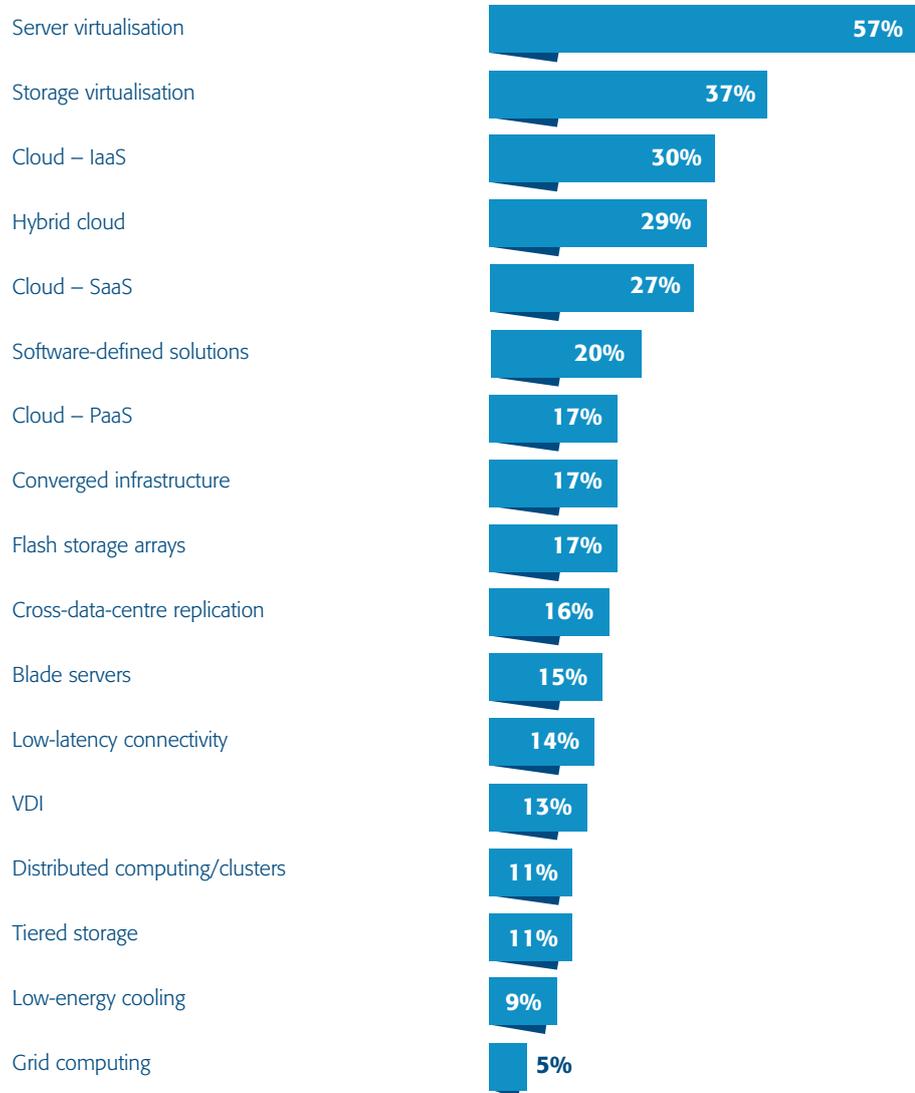
> Licensing costs: licensing has become more complex. Vendors have made it more difficult to understand what you're paying for and you sometimes end up paying for something you don't need… IT security manager, Legal

When it comes to the actual technological trends that have influenced strategy, figure 3 illustrates that there was one, clear winner. Fifty-seven per cent stated that server virtualisation was the trend most strongly influencing their decision making.

> There has been a massive adoption of virtualisation; it's very focused on the server side and at the back of that is orchestration and automation. The DevOps stuff has been changing the way that server provisioning and automation has happened, but it's been more on system admin than on application delivery… Strategic consultant, Finance

> Virtualisation of the servers themselves has become better and cheaper… Head of IT, Finance

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FIG. 3 What have been the most consequential technological trends regarding the data centre in the last three years?

Trend	Percentage
Server virtualisation	57%
Storage virtualisation	37%
Cloud – IaaS	30%
Hybrid cloud	29%
Cloud – SaaS	27%
Software-defined solutions	20%
Cloud – PaaS	17%
Converged infrastructure	17%
Flash storage arrays	17%
Cross-data-centre replication	16%
Blade servers	15%
Low-latency connectivity	14%
VDI	13%
Distributed computing/clusters	11%
Tiered storage	11%
Low-energy cooling	9%
Grid computing	5%

▪ Respondents could select multiple answers

Whatever the benefits of virtualisation, it must be noted that 33 per cent of survey respondents still described their data centres as "traditional" (Fig. 1) – taken to mean virtualised only to a limited extent – although only 15 per cent expected this to be their strategy in the years ahead. This core of traditional data centres persists for several reasons – and most of these can be filed under "control and compliance".

> **It's total control and 100 per cent secure. You're compliant. If you're in banking you sometimes have no choice…** Head of IT, Finance

> **The planning cycle; it allows good capacity planning…** Infrastructure strategy architect, Large retail

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Our survey indicates that the number of businesses using leading-edge technologies such as software-defined solutions or converged infrastructure will grow – four per cent of our respondents presently place themselves in this category, whereas 19 per cent state that their focus will be on this in the following two years. Software-defined solutions were named by 19 per cent as an influential technological trend for them and 17 per cent named converged infrastructure thus.

The benefits that the software-defined data centre (SDDC) in particular can bring are a degree of agility that is simply impossible with even a conventionally virtualised environment. Taken to its logical conclusion, SDDC could enable the provisioning of data centres to deliver network, server and storage with a few clicks with a pay-by-use service model.

> **The principle benefits we would see around software-defined networking would be micro segmentation of the internal network, so a security benefit…** Infrastructure strategy architect, Large retail

> **There's less vendor lock-in as it puts a layer of abstraction into the control plane. That was in a propriety solution from a vendor before. By abstracting that out you can then change the vendor solution to anything…** Strategy consultant, Finance

A critical component of data centre strategy is, of course, the cloud. Most of the respondents stated that the cloud had been a technology trend meaningful to them – IaaS (30 per cent), hybrid cloud (29 per cent), SaaS (27 per cent) and PaaS (17 per cent) all featured in the responses. While only eight per cent of our survey respondents were presently using external hosting or cloud services to supply the majority of their data centre services, 25 per cent believed this would be the picture in two years' time (see Fig. 1).

Moving data centre services, or indeed any workload, into the cloud has a huge impact on an organistion – second only in terms of strategy to the type of leading-edge solutions already discussed. Some of our interviewees set out the benefits that they were reaping from their adoption of cloud services.

> **You're not paying for excess, you have the ability to scale, you are always on the latest versions…** Enterprise architect, Entertainment

> **You're saving on the hardware and on the maintenance and personnel costs…** Head of IT, Finance
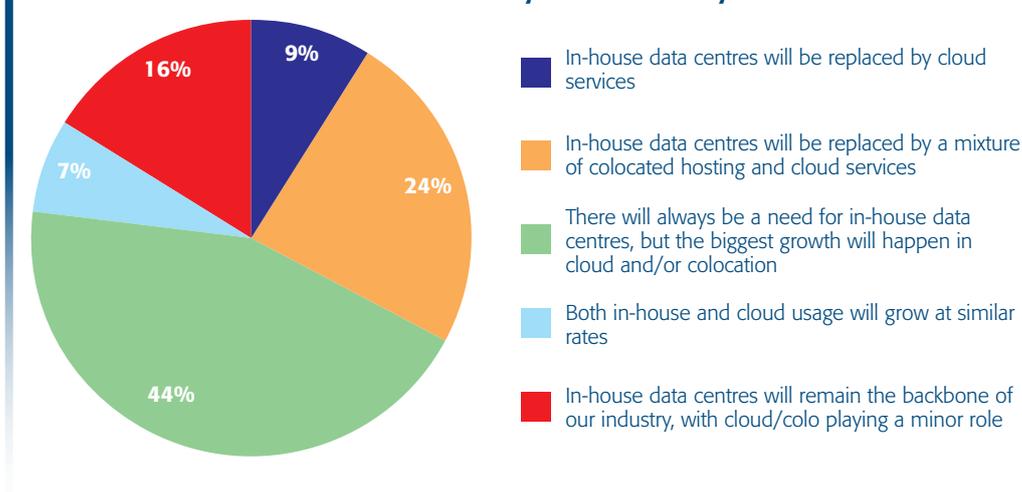
Participants in our data centre research have been well aware of the benefits of outsourcing and the cloud since we began conducting research in 2013. However, the fact that only eight per cent stated that it forms the core of their current strategy does rather suggest that the transition to the cloud has been slow and reluctant. Again, some of our interviewees detailed their concerns.

> **Moving to the cloud has a significant impact as it affects your costs, it affect your IT's organisational structure, it affects your development and delivery. It has the greatest impact across the business…** Enterprise architect, Entertainment

> **There are still jurisdictional, data protection and compliance issues…** IT security manager, Legal

There will always be a need for the on-premise data centre but a broad consensus seems to be building that the mainstream future for the data centre rests in the cloud. *Computing* asked: "Which of the following best sums up your opinion of the future data centres in your industry sector?" Forty-four per cent replied that "there will always be a need for in-house data centres, but the biggest growth will happen in cloud and/or colocation". A further 24 per cent agreed that "in-house data centres will be replaced by a mixture of colocated hosting and cloud services". As many as nine per cent of respondents believed that in-house data centres would be replaced entirely by the cloud, and 16 per cent thought that while in-house data centres would remain the backbone of their particular industry the cloud and colocation services could still play a minor role (Fig. 4).

FIG. 4 Which of the following best sums up your opinion of the future of data centres in your industry sector?

- **In-house data centres will be replaced by cloud services**
- **In-house data centres will be replaced by a mixture of colocated hosting and cloud services**
- **There will always be a need for in-house data centres, but the biggest growth will happen in cloud and/or colocation**
- **Both in-house and cloud usage will grow at similar rates**
- **In-house data centres will remain the backbone of our industry, with cloud/colo playing a minor role**

4 Peak virtualisation?

Fifty-three per cent of respondents described their data centres as "heavily virtualised" (see Fig. 1). In contrast, only 33 per cent of respondents still had a more traditional data centre/server room and eight per cent were using primarily externally hosted or cloud services with a further two per cent having outsourced all services.

Our interviewees explained concisely why virtualisation remains such a strong focus.

"While virtualisation technologies dominate the data centre of today, our research suggests that the growth in virtualisation may have peaked"

> **We are 95 per cent virtualised mainly due to costs and efficiency in terms of cost, as you need fewer people to manage a large estate…**
> IT security manager, Legal

> **We are 86 per cent virtualised, which is apparently above the curve. It was driven by the lack of physical space and better utilisation of resources…** Technical solutions infrastructure architect, Museum

While virtualisation technologies dominate the data centre of today, our research suggests that the growth in virtualisation may have peaked. When asked to describe their data centre strategies for the next two years, the proportion of our survey respondents focusing on virtualisation drops from 53 per cent to 37 per cent. The proportion focusing on external hosting, cloud services or complete outsourcing of all services increases from 10 per cent to 29 per cent. Those planning to focus on leading-edge solutions such as software-defined, jumps from four per cent to 19 per cent (see Fig. 1).

It would be rash to predict the death of virtualisation based on these results alone, but comparison of the answers to this question with those from research undertaken in 2013 and 2014 would suggest that the transition to in-house virtualisation has peaked – or is at least slowing considerably. In 2013, the proportion of respondents who had virtualised between 61 and 100 per cent of their servers stood at 37 per cent. In 2014 the equivalent proportion was 61 per cent – phenomenal growth in just 12 months. This year the number stands at 58 per cent.

There are two explanations for this finding. The first is simple – the growth in virtualisation really has peaked, in part due to the greater use of the cloud and newer technologies, but mainly because organisations have simply virtualised as much as they possibly can. Some applications and services are not good candidates for virtualisation.

> **The things that we haven't virtualised are things that are very had to virtualise. It might be specific legacy systems. Things like Open VMS are not candidates for virtualisation**… Head of technical architecture, Health

> **It's hitting critical mass; organisations have come as far as they can. Some services and applications don't lend themselves very well to virtualisation, such as indexing engines**… IT security manager, Legal

The other, more likely, conclusion that can be drawn from our research is that this is simply the initial stage of virtualisation drawing to a close. Enterprises are now focusing on the nuts and bolts of integration and adding value to their existing virtualised environment.

> **You can now take this virtual infrastructure and put it out there combining it with other things; you are then value-adding to what you've got. You are joining things up in a much better way with identity and access management integration between the different items out there. You can have different products with just one sign on for all of that and make it seamless**… Technical solutions infrastructure architect, Museum

> **People have now virtualised as much as they can and it's stabilised. Now they are looking for ways to minimise the costs overhead-wise and infrastructure-wise. They're also trying to take what they've virtualised and get the most from it**… Technical solutions infrastructure architect, Museum

Converged infrastructure, whereby compute, network and storage are no longer separate components but delivered as a service controlled from a single "pane of glass", is the ultimate extension of virtualisation, as is SDDC. It is likely that many organisations, having virtualised all that they feasibly can, are now assessing virtualisation as part of a broader strategy encompassing these technologies and the use of public, private and hybrid clouds.

4.1 Storage virtualisation

In late 2013, many research participants expected to have approximately 60 per cent of their storage virtualised by the same time in 2016. Furthermore, storage virtualisation came only second to server virtualisation in our list of influential technologies with 37 per cent naming it as a significant trend.

However, our research this year indicates that much of this growth will have to occur in 2016 if the expectations of 2013 are to become reality. There has been a tiny amount of growth in storage virtualisation among our survey respondents – the largest area of growth is in the proportion virtualising between one and 20 per cent of their storage, which has grown from 10 to 14 per cent this year. Despite the slow pace of growth over the last year several of our interviewees expected this situation to change as solutions matured.

> It's easier to migrate, you can get your storage balanced easier. It's been a big bonus. I am frustrated by our non-virtualised storage as it's fixed and contained with limited options. Migrating all the data across was so prohibitive and complex compared with how we were able to do it with virtualised storage… Technical solutions infrastructure architect, Museum

> It's getting easier to do and we've had some quick wins… Head of technical architecture, Health

> This will change because the solutions are maturing. Not just the storage solutions, but the orchestration solutions that consume those storage solutions… Strategic consultant, Finance

Again, it is likely that storage virtualisation, like server virtualisation, is being considered as part of a far bigger picture.
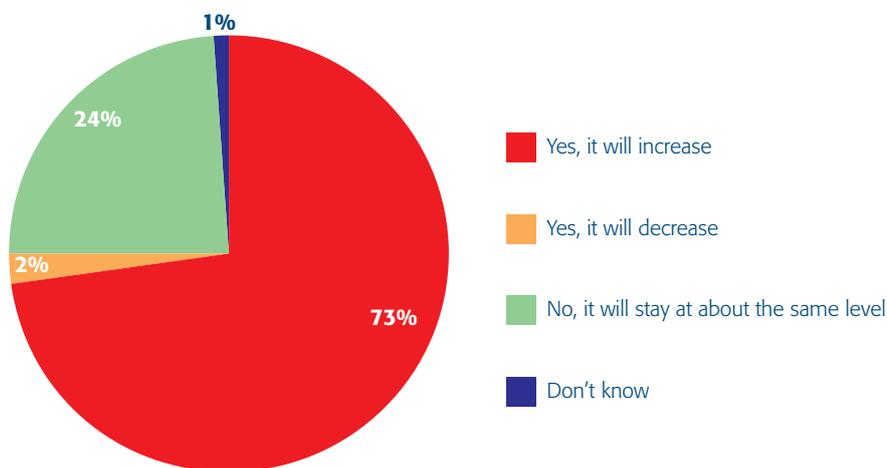
5 The cloud

Although only 10 per cent of survey respondents were either "mainly" using external hosting or cloud services or had outsourced the lot (see Fig. 1), many more were using the cloud more selectively – a continuation of the pattern *Computing* has seen consistently since 2013. In 2013, 41 per cent of respondents had experience of using cloud services and by 2014 the number had risen to 48 per cent. This year, the proportion has increased to 60 per cent of those questioned, which is quite a jump in comparison to previous years (Fig. 5).

FIG. 5 Do you have experience of outsourcing to cloud services?

2013	2014	2015
Yes: 41%	Yes: 48%	Yes: 60%

Furthermore, 73 per cent of respondents expected their use of cloud services to increase in the next 12 months, with 24 per cent expecting it to remain as it currently stood. Only two per cent expected their use of the cloud to decrease (Fig. 6).

FIG. 6 Do you expect your use of cloud services to change over the next 12 months?

- Yes, it will increase
- Yes, it will decrease
- No, it will stay at about the same level
- Don't know

"Use of the cloud in some way, shape or form is on the way to becoming the norm. Indeed, in some organisations it has become the standard model"

These findings, along with the views of our interviewees, indicate that use of the cloud in some way, shape or form is on the way to becoming the norm. Indeed, in some organisations it has become the standard model.

> Cloud has become the de facto approach unless there is a very good reason not to use it. I don't think people will be building physical data centres, but there may be compliance, performance or specific business requirements to have physical hardware that will never go away… Enterprise architect, Entertainment

> We don't deploy any new physical hardware any more. Whenever we want to commission something new it needs to be SaaS or on some form of cloud platform. Our last option is to deploy virtual machines on our own estate and we would never deploy physical tin any more… Head of technical architecture, Health

Figure 7 provides some indication of how enterprises are using the cloud. The most popular approach is a hybrid cloud. This was the approach chosen by 46 per cent. A further 20 per cent had built a private cloud and 17 per cent were using the public cloud. However, a significant 17 per cent were still making little or no use of the cloud in their data centres.

FIG. 7 Which of the following best describes your use of cloud computing?

Public cloud services (eg Salesforce.com, Dropbox)	17%
Private cloud services (bespoke cloud for organisation's own use)	20%
Hybrid cloud (some functions in public cloud, others in private cloud or other in-house system)	46%
None yet – we currently make no or very little use of the cloud	17%

The popularity of the hybrid cloud model with our research participants is no surprise. For several years now, enterprises when considering the advantages of public and private cloud infrastructure have often chosen both. This enables the leveraging of the advantages of both types of infrastructure. Public cloud can potentially deliver significant capital and management cost reductions but the private cloud can provide a degree of security and compliance that the multi-tenant architecture of the public cloud has, so far, failed to bestow. More heavily regulated industries need to be absolutely sure of where their data resides and hybrid architecture offers this possibility. Applications and workloads can be delivered on the most appropriate platform and the hybrid model offers the enticing possibility of being able to burst into the public cloud if the computing power of private infrastructure is insufficient to handle demand and do so on a pay-per-use basis. A hybrid infrastructure is also not as reliant in internet availability as the public cloud, so risks arising from outages and latency are reduced.

" We are moving to cloud, but more our own cloud, because of security; we are very tentative in going "proper" cloud. Hybrid is for the best of both worlds… Data centre manager, News media

" At the moment we are all in-house, but we will be putting bits out to a hybrid cloud type of thing, depending on what would be the best fit; for security reasons some of it has to stay in-house. It will be a real bespoke mix… Service manager, Services

However, a hybrid cloud architecture is not entirely without its challenges. In our digital, data-driven existence, the hybrid cloud is only optimised when data is truly portable between clouds, and issues frequently arise with interoperability, visbility and control of multiple platforms.

Building a private cloud was the next most popular approach. This approach can be costly – and it takes time to build – but virtualisation offers a degree of scalability that, while it cannot match that of the public cloud, may be quite sufficient for the enterprise in question. Private cloud tends to be the choice of organisations for which security and compliance are their lifeblood. Their use of the public cloud will always be limited, as the following interviewee explains.

> ❝ In the financial sector, you see public cloud as being public data which is out in the public domain already. Software as a service is where hybrid cloud comes in, but private cloud addresses a number of concerns: it gives you the ownership of the data, it allows you to move to a more cloud-centric approach for application delivery as an incremental step to learn how to do things differently… Strategic consultant, Finance

The popularity of the private cloud model is demonstrated further by the fact that the largest proportion of respondents (28 per cent) gave private cloud as their response to the question "Where do you see the fastest growth in cloud services deployed by organisations like yours?". By comparison, hybrid cloud polled 24 per cent, public cloud SaaS 22 per cent, public cloud IaaS nine per cent and public cloud PaaS five per cent.

Data governance is not the only factor hampering greater use of the public cloud. Connectivity and compatibility between cloud service providers as well as the challenges inherent in customising applications and those oft-occurring concerns about vendor lock-in, contractual issues, service levels and other factors all act as a brake on the rush to the cloud.

That said, the public cloud has been an incredible enabler and driver of change. The case for application development in the cloud is very strong – development and testing environments can, theoretically, be whistled up in minutes rather than losing precious time waiting for the provisioning and deployment of tin in an on-premise data centre. The cloud has enabled the rise of DevOps – developers get the infrastructure they need when they need it and infrastructure managers are freed from having to deal with the consequences of experimental code. Applications can also be scaled quickly and collaboration between developers, designers, security teams and so on is potentially enhanced.

> ❝ Cloud is not just about storage, it's about how you develop applications differently, so you can be more agile…
> Strategy consultant, Finance

> ❝ Cloud is a big enabler as you are turning infrastructure into code. If I have to stand up an environment in a physical data centre, I need to know how fast the software is going to run, I need to know the scale, I have then got to cost it up, I've got to get it implemented and that is before I can do anything… With a cloud environment, I don't care what the initial scaling is, as I have the ability to scale it up at a later date. I can create an environment purely through code, so if I am setting up virtual networking, VMs or platform services, I just create a script to do that…
> Enterprise architect, Entertainment

6 The cutting-edge data centre

In order to try to paint a picture of how the enterprise data centre is likely to look a few years down the line, *Computing* tested a number of new solutions for awareness and the advantages that these technologies may confer.

Figure 8 illustrates clearly that these solutions are filed in the majority of organisations as "futures". Indeed, awareness and deployment has not moved on much since last year (see Fig. 8b). Software-defined storage (SDS) polled highest for awareness and actual testing and deployment although only six per cent of respondents had actually deployed. Despite these low figures, our interviewees believed that SDS had considerable potential.

> With our block-based storage, we have software-defined storage on top of it; now we can move through the software-defined environment onto different block storage, which is difficult to do at block level. We've now got flexibility to grow/shrink at speed… The con is that I don't feel it is a fully enough developed product yet. It is still command-line driven and you need a third-party support company… The next iteration that is coming out this year is very much more GUI-based. That is the big thing that is coming up with software-defined storage is GUI. I am really looking forward to that, as I hate doing things with command lines – it's old hat now. GUI makes products far easier to use… Technical solutions infrastructure architect, Museum

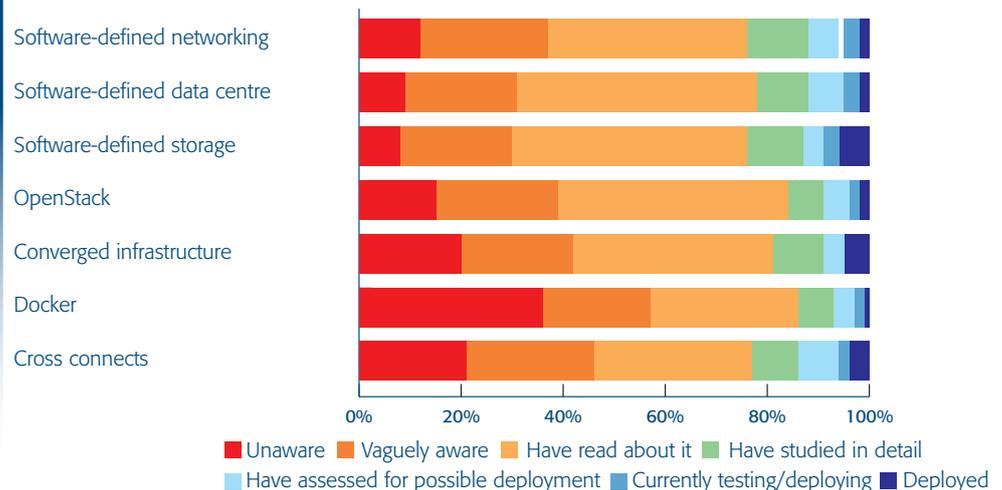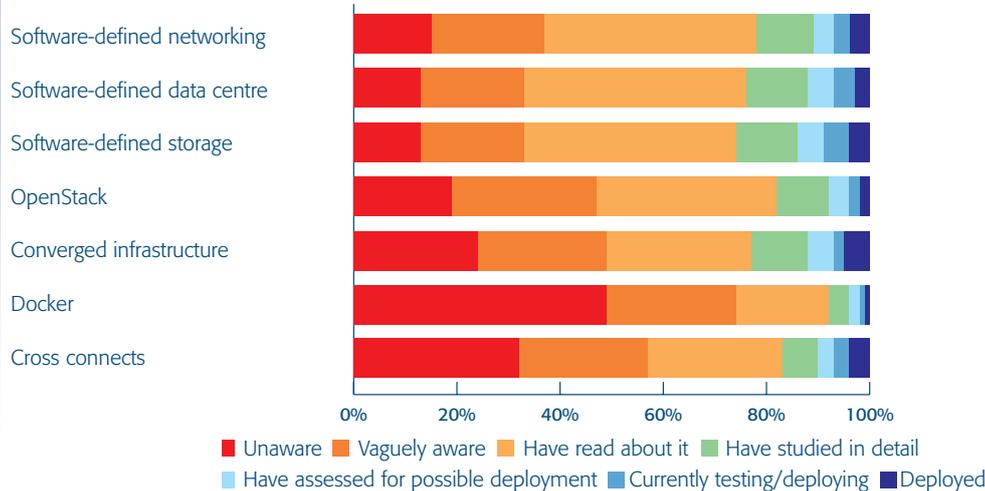## FIG. 8a How aware are you of the following data centre solutions?

2015

Legend: Unaware, Vaguely aware, Have read about it, Have studied in detail, Have assessed for possible deployment, Currently testing/deploying, Deployed

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FIG. 8b How aware are you of the following data centre solutions?

2014

Horizontal stacked bar chart showing awareness levels for each data centre solution:
- Software-defined networking
- Software-defined data centre
- Software-defined storage
- OpenStack
- Converged infrastructure
- Docker
- Cross connects

X-axis: 0%, 20%, 40%, 60%, 80%, 100%

Legend:
- Unaware
- Vaguely aware
- Have read about it
- Have studied in detail
- Have assessed for possible deployment
- Currently testing/deploying
- Deployed

> **The principle benefits we would see around software-defined networking would be micro segmentation of the internal network, so a security benefit…** Infrastructure strategy architect, Large retail

> **Less vendor lock-in as it puts a layer of abstraction into the control plane. Before that was in a propriety solution from a vendor. By abstracting that out you can then change the vendor solution to anything…** Strategy consultant, Finance

There are considerable obstacles on the way to the wider implementation of many of these technologies, particularly software-defined and converged infrastructure, and they all relate to the fact that this is a radical change. They effectively represent the end of traditional vendor-specific physical infrastructure and as such require some profound changes in the culture of IT departments and the wider business. The required skill sets of the individuals involved will also change significantly – an issue that is discussed in greater detail in Section 7.

It is not just skills and the wider cultural environment hampering the complete abstraction of the data centre from hardware. The relative lack of maturity of the model – particularly software-defined networking – is also a key factor.

> **There's no driving motivation towards it. It's been hyped, but no one has really adopted it yet. In our virtual environment, we are still on standalone switches; we haven't gone to distributed switches yet. That is a move we would have to make first, before looking at software-defined networking…** Technical solutions infrastructure architect, Museum

Certainly, among our survey sample there had been virtually no increase in the uptake of software-defined solutions in the last 12 months. This would suggest that widespread transition to these models is still likely some years away, although the fact that such a relatively large proportion of our respondents stated that it would form the core of their strategy moving forward suggests that it might be closer than the eight to 10 years that some industry figures expect.

Other technologies such as Docker, while not polling well in terms of current awareness and deployment levels, were creating a buzz among some of our interviewees.
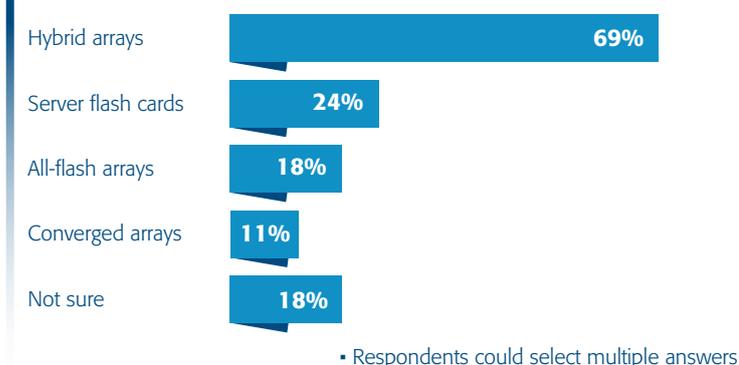
> **Containerisation such as Docker will become quite key as it enables you to create a piece of code in a runtime environment that you can move from cloud to cloud and take advantage of all the features of cloud, but not being tied in to any particular supplier**… Enterprise architect, Entertainment

> **Docker is application virtualisation, rather than machine virtualisation. You take all the components you need for your application and you put that into a container and you can then deploy that container wherever you need to. We are using that in DevOps at the moment for rolling things out from our dev into our ops environment**… Technical solutions infrastructure architect, Museum

6.1 Flash storage

Flash (solid-state) storage has secured itself a significant presence in the enterprise data centre. Forty-five per cent of our survey respondents were already using flash products in their data centres or were planning to do so. Figure 9 shows the types of flash storage being implemented or considered.

FIG. 9 What type of flash storage are you considering/ have you implemented?

Type	Percentage
Hybrid arrays	69%
Server flash cards	24%
All-flash arrays	18%
Converged arrays	11%
Not sure	18%

▪ Respondents could select multiple answers

Although solid-state storage has dropped in price – up to 75 per cent in the last 18 months – flash was still perceived as expensive so the most popular approach was a hybrid array.

> **We are in favour of it. We have an increasing amount of flash in our current arrays. It helps reduce power and provides a more consistent and better performance…**
> Infrastructure strategy architect, Large retail

> **As the price comes down and as the technology improves, people will adopt that. It is quite expensive at the moment. In terms of reliability, as there are no moving parts, the solid state will improve and become more economically viable and therefore replace the older style servers…**
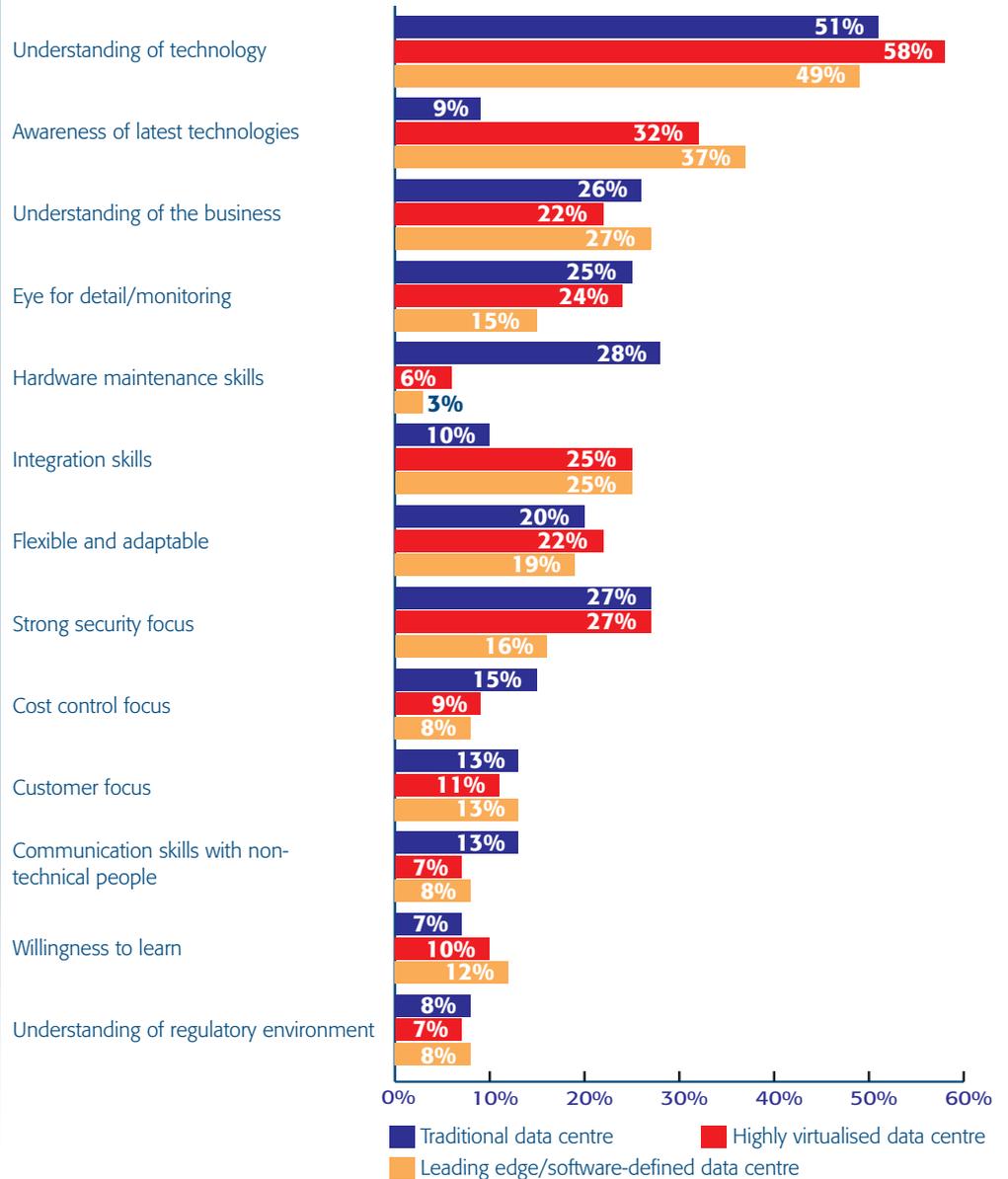> Head of IT, Finance

> **It is very expensive, but it does offer enhanced productivity. We're at the hybrid stage. Some applications just don't require that level of state…** IT security manager, Legal

7 Data centre skill sets

One of the goals of this year's research was to examine the skills required for successfully managing each type of data centre and to see how this has influenced strategy. The results of this research indicate that one factor that has enabled the growth of virtualisation is that the skill sets required are not so very different from those required for managing a traditional data centre. When asked, "What are the most important skill sets or attributes required for managing a data centre?", the only real differences in answers between traditional and virtualised data centres was a decrease in the importance of hardware maintenance skills (which moved from second place in the priority list with 28 per cent naming it as important in the traditional data centre to just six per cent doing so in a virtualised environment) and an increase in the importance of awareness of the latest technologies (Fig. 10).

"The ability to manage service partners and oversee contractual obligations being delivered – and seeking redress if they are not – requires organisational and managerial abilities not required to such a degree in traditional on-premise data centres"

FIG. 10 What are the most important skill sets or attributes required for managing an in-house data centre?

Skill/Attribute	Traditional data centre	Highly virtualised data centre	Leading edge/software-defined data centre
Understanding of technology	51%	58%	49%
Awareness of latest technologies	9%	32%	37%
Understanding of the business	26%	22%	27%
Eye for detail/monitoring	25%	24%	15%
Hardware maintenance skills	28%	6%	3%
Integration skills	10%	25%	25%
Flexible and adaptable	20%	22%	19%
Strong security focus	27%	27%	16%
Cost control focus	15%	9%	8%
Customer focus	13%	11%	13%
Communication skills with non-technical people	13%	7%	8%
Willingness to learn	7%	10%	12%
Understanding of regulatory environment	8%	7%	8%

■ Traditional data centre   ■ Highly virtualised data centre
■ Leading edge/software-defined data centre

▪ Respondents could select multiple answers

> " You go from dealing with bits of tin, to dealing with orchestration of environment setups…
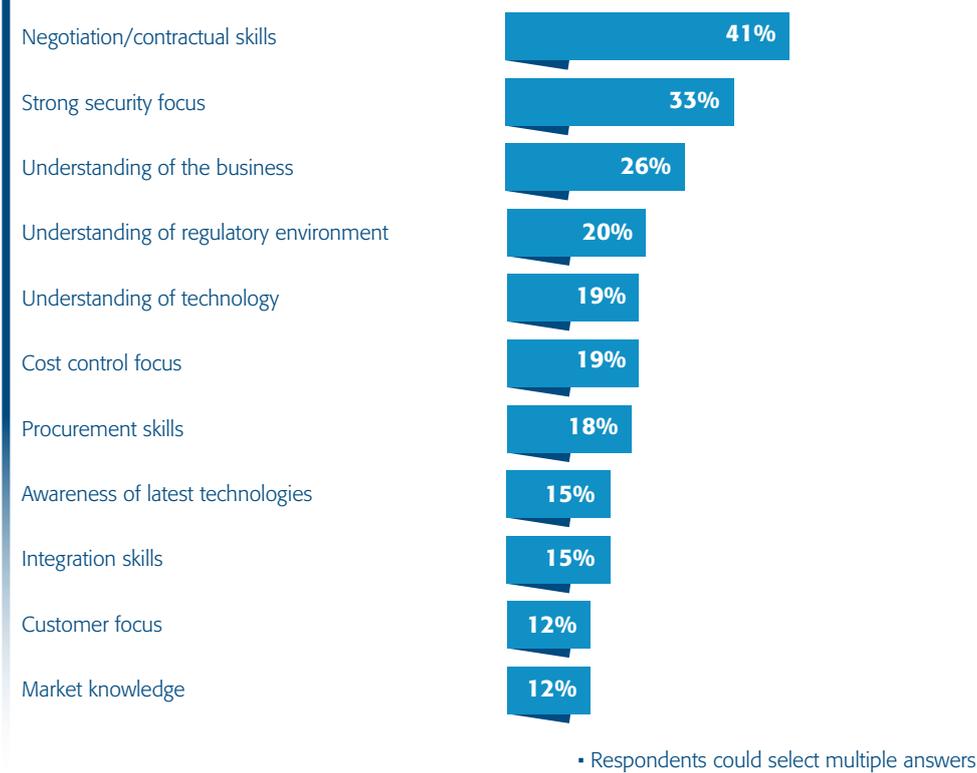> Enterprise architect, Entertainment

> " Knowledge of the virtualisation software itself, the back-up thereof, and the day-to-day monitoring of the software. You need to make sure that the software is doing exactly what it should be doing… Head of IT, Finance

computing research

One of our interviewees also raised the requirement for an increased focus on financial management in the virtualised environment.

> **It requires a strong commitment to standardisation. You need to be a better finance manager because you've broken the association with the specific piece of equipment, so you need to be better at software licensing and rules. You need to understand financial planning…**
>
> Infrastructure strategy architect, Large retail

The types of skills required to work with outsourced data centres and cloud data centre services change again. Top of the list came negotiation/contractual skills. The ability to manage service partners and oversee contractual obligations being delivered – and seeking redress if they are not – requires organisation and managerial abilities not required to such a degree in traditional on-premise data centres (Fig. 11).

FIG. 11 What are the most important skill sets or attributes required for managing outsourced data centre services and cloud?

Skill	%
Negotiation/contractual skills	41%
Strong security focus	33%
Understanding of the business	26%
Understanding of regulatory environment	20%
Understanding of technology	19%
Cost control focus	19%
Procurement skills	18%
Awareness of latest technologies	15%
Integration skills	15%
Customer focus	12%
Market knowledge	12%

• Respondents could select multiple answers

> **The focus is heavily on supplier relationship and monitoring to make sure that it's doing exactly what it should be doing in an efficient way…**
>
> Head of IT, Finance

> **You need the skills to be able to move workloads tactically to make sure that commercially there aren't lock-ins that you can't escape from when your planned usage differs from your contracted usage…** Infrastructure strategy architect, Large retail

Having a strong security focus was rated more highly for cloud solutions than any other type.

> **You don't have that end-to-end view of what you're in charge of, so you need full control of what you're in charge of…** Strategy consultant, Finance

> **Because you lose a certain amount of control, you might argue that your security should be a bit tighter…** Enterprise architect, Entertainment

Survey respondents and interviewees alike agreed that in a leading-edge, software-defined data centre an understanding of the business became significantly more important. In these data centres the need for employees whose skills are limited to infrastructure reduces and the application developers become more of a driving force. The rise of DevOps (the bringing together of developer and operations roles and the use of automation to speed up the delivery of software) has been happening in tandem with the rise in software-defined. For example, storage infrastructure can be implemented in code rather than by provisioning a physical device. Some traditional data centre skills will still be required but these may well be found in DevOps teams. Instead of hardware specialists, what is required is the knowledge of automation and orchestration.

> **We used to have a traditional operational team looking after our data centres. We still needed those skills when we virtualised it, but now they haven't got the right skills for Azure or new solutions…** Head of technical architecture, Health

> **You need to be way up on the understanding of how your workloads are operating and inter-operating with the overlap of development and organisational skills…** Infrastructure strategy architect, Large retail

The leading-edge data centre needs employees who can understand what it is truly capable of.

> **You need to understand what the business needs to take advantage of what is coming out…** Technical solutions infrastructure architect, Museum

> **Market awareness, future proofing things and knowledge of the features of the solution…** Head of IT, Finance
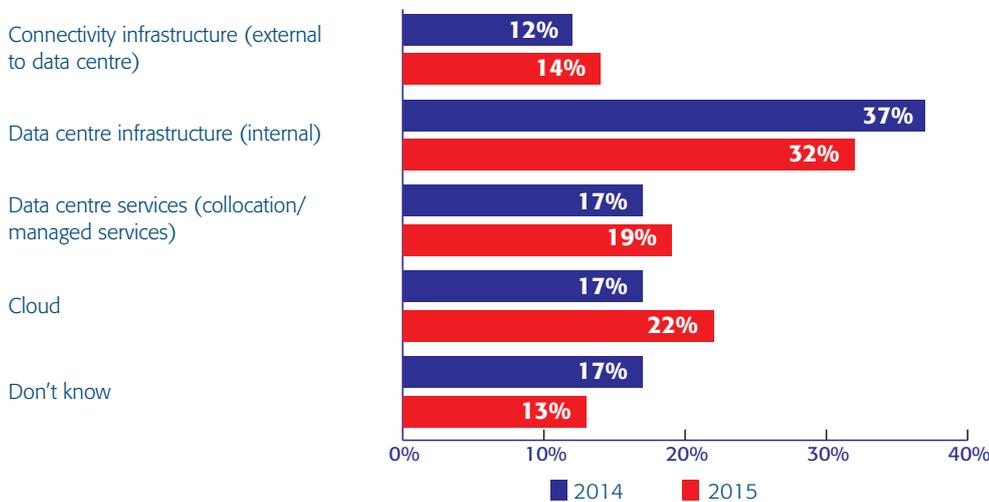
8 Higher or lower?

Computing asked: "Do you expect your spending on data centre technology and equipment to increase, decrease or remain constant over the next 12 months?" Forty per cent predicted an increase in spending with 18 per cent expecting reduced expenditure. The largest proportion of respondents – 42 per cent – expected no change.

So, how is the budget being allocated? Figure 12 shows a breakdown of expenditure and also compares it to last years' survey.

FIG. 12 Please specify the main area of spend in the next 12 months

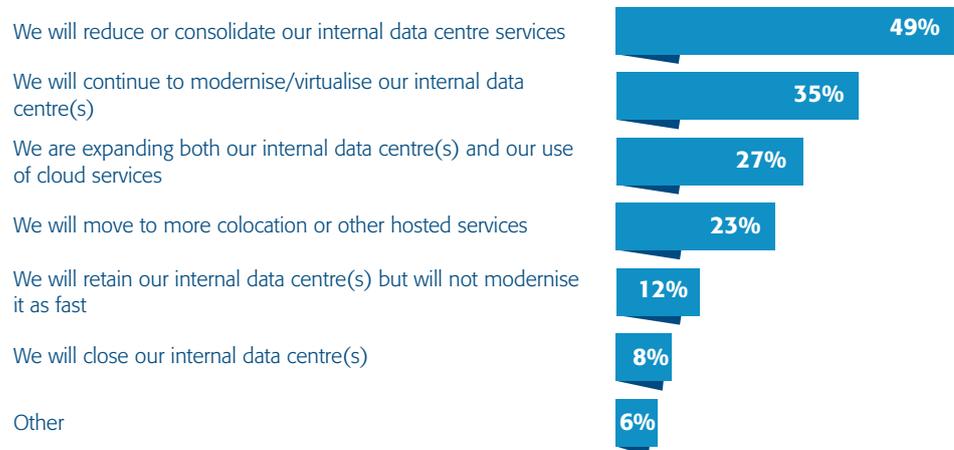|	2014	2015
Connectivity infrastructure (external to data centre)	12%	14%
Data centre infrastructure (internal)	37%	32%
Data centre services (collocation/managed services)	17%	19%
Cloud	17%	22%
Don't know	17%	13%

As was also the case in 2014, our survey this year shows the internal data centre to be the biggest source of expenditure. However, internal data centre infrastructure accounts for a proportionally smaller segment of spending at 32 per cent than it did in 2014 when it accounted for 37 per cent of spending. Data centre services such as colocation are the main area of expenditure for 19 per cent this year, compared with 17 percent in 2014. However, the biggest increase is shown in the number of respondents saying that cloud will be the biggest item of expenditure. Last year this accounted for 17 per cent of respondents, and this year the equivalent finding is 22 per cent. This represents a significant shift in a relatively short time frame, and is consistent with other survey findings about the increasing popularity of cloud solutions.

> It's a massive thing. I write the application, I want a server, I can just go and get it. No one from infrastructure needs to know anything about it... Strategy consultant, Finance

The increase in spending on cloud services will, of course, have an impact on the internal data centre. Forty-nine per cent of those who indicated that cloud expenditure would be increasing said "we will reduce or consolidate our internal data centre services". However, 35 per cent stated that "we will continue to modernise/virtualise our internal data centres" and 27 per cent said "we are expanding both our internal data centres and our use of cloud services". Only eight per cent were planning to close their internal data centre (Fig. 13).

FIG. 13 Since you believe your use of cloud services will increase, how will that affect plans for your internal data centre?

We will reduce or consolidate our internal data centre services	49%
We will continue to modernise/virtualise our internal data centre(s)	35%
We are expanding both our internal data centre(s) and our use of cloud services	27%
We will move to more colocation or other hosted services	23%
We will retain our internal data centre(s) but will not modernise it as fast	12%
We will close our internal data centre(s)	8%
Other	6%

▪ Only answered by respondents reporting a planned increase in cloud spending; respondents could select multiple answers

This impact on the "traditional" data centre infrastructure was also reflected in the responses to questions asking where our survey respondents believed the increases and decreases in their spending were likely to come from. Of those expecting spending to increase, 30 per cent thought the main allocation would be to new technologies such as software-defined solutions, converged infrastructure or specialised appliances. Eighteen per cent were allocating increased spend to storage and 14 per cent to virtualisation.

Respondents expecting to decrease their expenditure revealed that spending on servers will be the most heavily cut area (mentioned by 27 per cent), with data centre equipment such as cabling, racking systems, cabinet following at 18 per cent. Moreover, 18 per cent of those facing spending reductions expected to close data centres, while similar numbers said they would move services out to colocation providers or would consolidate data centres in larger facilities.

However, while cloud lay behind many of these cuts, some investment will be needed in supporting the migration of some services to cloud, as one interviewee pointed out.

> People are spending massive amounts of data infrastructure to support cloud. They are not buying traditional data centre infrastructure… Strategy consultant, Finance
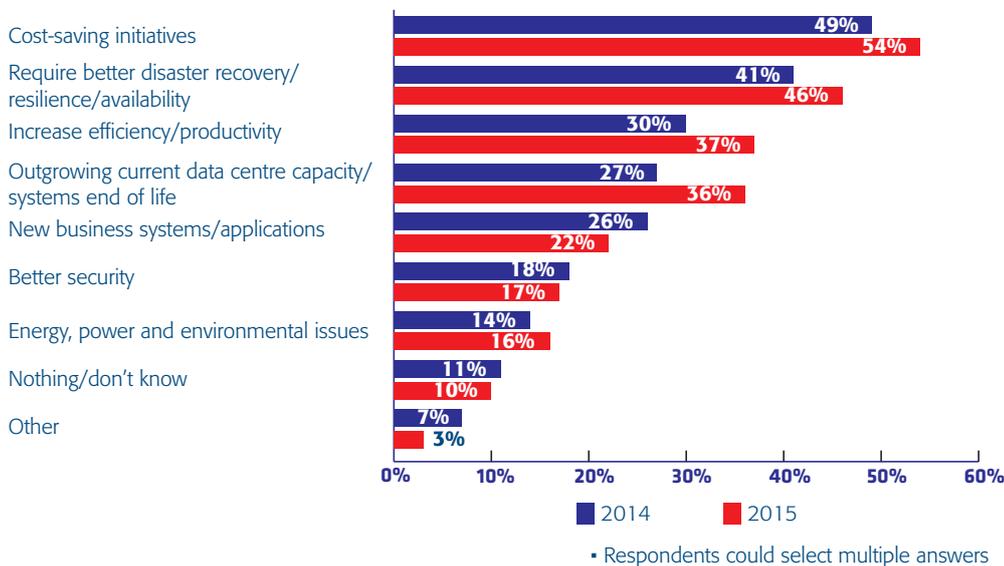
Private cloud solutions could also still be deemed as data centre infrastructure. The spending patterns of our respondents illustrate the biggest trend arising from this year's research – that the delineations between the on-premise data centre and the alternatives are blurring more with every year that passes.

9 Drivers of change

Computing asked: "What are the main triggers/drivers leading you to consider new data centre or outsourcing solutions?" As is usually the case, "cost-saving initiatives" topped the poll, increasing its importance from 49 per cent of respondents in 2014 to 54 per cent this year (Fig. 14).

FIG. 14 What are the main triggers/drivers leading you to consider new data centre or outsourcing solutions?

Driver	2014	2015
Cost-saving initiatives	49%	54%
Require better disaster recovery/resilience/availability	41%	46%
Increase efficiency/productivity	30%	37%
Outgrowing current data centre capacity/systems end of life	27%	36%
New business systems/applications	26%	22%
Better security	18%	17%
Energy, power and environmental issues	14%	16%
Nothing/don't know	11%	10%
Other	7%	3%

• Respondents could select multiple answers

The importance attached to resilience and disaster recovery had also increased from 41 per cent to 46 per cent.

> It's all about cost savings and agility… Strategic consultant, Finance

> From our perspective, it's more to provide access to our services more easily. To enable that we need quite a lot of storage that is fast with fast disaster recovery… IT security manager, Legal

"Our findings indicate that as existing data centre infrastructure comes of age, we will see spending on cutting-edge technology continue to accelerate"

An improvement in efficiency and/or productivity was also a key factor for 37 per cent of respondents, an increase from 30 per cent last year. In fourth position in the list of reasons for change was "outgrowing current data centre capacity". This factor was given by 27 per cent of respondents last year but 36 per cent this year.

The increase in importance attached to outgrowing capacity may well account for the proposed increase in spending on new technology. As existing infrastructure reaches end-of-life there is little benefit in replacing it with like-for-like technology.

> There's been a lot of innovation in the new technologies to support digital and mobile and a lot of that is moving into traditional enterprise applications… Strategy consultant, Finance

> Our intranet is on a physical box, we need to replace it, we will virtualise it. That physical one will go away. That has happened to many systems…
> Technical solutions infrastructure architect, Museum

As existing data centre infrastructure comes of age, we will see spending on cutting-edge technology continue to accelerate.

9.1 Rules and regulations

Cost savings, resilience and productivity may be the most significant triggers of change in the data centre but change must be implemented with knowledge of the regulatory burden – and the understanding that this burden will only increase. It is interesting to note that when asked about the skills required to manage data centres of various types, our survey respondents accorded a far higher significance to regulatory knowledge for those managing cloud and/or outsourced data centres than on-premise varieties, whether they be traditional, heavily virtualised or cutting edge (see Figs. 10 and 11).

Knowledge of the existing data protection picture involves an understanding of the patchwork of laws and directives enforced at country level in Europe and the mix of federal and state laws and industry specific regulations in the US. The upside is that the picture will become a good deal more simple in the EU as the current EU Data Protection Directive becomes the first EU Data Protection Regulation, due to be on the statute books by 2017. The down side is that penalties will become more severe and more difficult to avoid.

> There's EU regulation on data privacy. If you leak customer data then it will cost you five per cent of your global turnover in fines if you lose any private data. Software-defined solutions help keep applications in their own pot, so there isn't any cross-fertilisation… Strategy consultant, Finance

> EU regulations will have a significant impact in terms of affording the right attention to personal identifiable information and the penalties; however, how it will work in practice remains to be seen. They will probably make an example of someone to show it has teeth, the penalties will be significant… IT security manager, Legal

This is not the only piece of legislation with which any organisation storing, processing and transferring data should be familiar. The Data Protection Act and EU Safe Harbor also figure highly – particularly among the more heavily regulated industries such as finance and healthcare. EU Safe Harbor in particular has been under the spotlight since the Snowden revelations of 2013 and is in the process of being renegotiated and possibly replaced with another "umbrella" agreement covering the personal data of EU citizens. Despite the lack of confidence in it, Safe Harbor has had a huge impact on cloud services and colocated data centre service providers because in order to win business, the service providers must be able to prove that data will stay within EU boundaries. Various service providers have scrambled to provision new data centres within the EU for just this reason.

> It's all about protecting customer data and encryption. It's also pinning down where data is stored, if it's in Europe, America or another jurisdiction. Some may need to pin data to a particular location…
>
> Enterprise architect, Entertainment

As if these regulations and legislation were not sufficiently difficult to ensure compliance with, many organisations also choose to comply with ISO 9001/27001/27108 or similar and many others face UK industry specific standards such as the Payment Card Industry Data Security Standard (PCI-DSS).

It is probably fair to say that the issue of compliance is higher up the business agenda than ever before.

10 Conclusions

The *Computing Data Centre Audit 2015* shows the degree to which the enterprise data centre has transformed within a relatively short period of time – and gives us a strong indication of what we can expect it to look like several years down the line. The drivers of this transformation have been the staggering increase in data volumes as well as the costs associated with these volumes.

The technical trend which has had the greatest impact on the data centre to date has been virtualisation – over half of our research participants described their data centre strategy as "heavily virtualised". Approximately one-third of respondents still described their data centres as "traditional" – taken to mean not highly virtualised with some applications and data stored on "bare metal" – and about half of that number expected this to be their ongoing strategy.

Nonetheless, there are signs that virtualisation is approaching saturation – at least in its present form. The proportion of our survey respondents stating that virtualisation will be key to strategy in the future shows a sharp decrease from that focusing on it today. In terms of existing architecture, many organisations have simply virtualised as much as they possibly can.

"The delineation between virtualised/ outsourced/ cloud data centres will continue to blur as a new approach takes hold"

As cutting-edge technologies begin to penetrate and the long-running computing paradigm of separate vendor-specific server, storage and networking devices begins to break down, the model changes completely. Converged infrastructure delivered via appliances and the software-defined model in which the underlying hardware becomes commodified takes virtualisation and the use of the cloud to a whole new level. The delineation between virtualised/outsourced/cloud data centres will continue to blur as a new approach takes hold.

The biggest single change in the results of this years' research compared with previous years is the use of the cloud. The use of cloud services in various forms has jumped from 48 per cent of respondents to 60 per cent stating that they had some experience with cloud services. All this year's findings point to the use of the cloud to deliver at least some aspect of data centre services becoming the norm. The maturing of cloud platforms is acting as a huge impetus for and enabler of change in IT infrastructures. DevOps has developed in parallel with the process and the agility, scalability and collaborative potential of the cloud is dismantling the traditional barriers between application development and infrastructure.

The move to a more abstracted infrastructure is still fairly far down the line for the majority of our respondents. Technologies such as software-defined storage, networking, OpenStack and converged infrastructure polled fairly poorly for both awareness and actual testing and deployment. Software-defined storage had been deployed more than any other leading-edge technology yet only six per cent of respondents were there. None of these technologies can be considered even slightly mature as yet, and when they are considered in the light of the cultural upheaval that they entail it is easy to see why they will take time to gain ground in the corporate data centre. The theoretical abstraction of hardware from the data centre will involve massive organisational change and changes in the skills required.

Above all, in the data centre of the future an understanding of the business itself becomes even more important as the need for employees whose skills are limited to infrastructure reduces and the application developers become more of a driving force. The requirement for traditional operational skills and hardware knowledge is likely to reduce as DevOps grows. Knowledge of automation and orchestration will become key. The increasing uptake of cloud services is also changing the skills required for data centre management with commercial skills moving up the priority list to enable the negotiations and service delivery partner management required.

Another promising technology featuring strongly in this year's research was Flash storage. Flash has quietly made significant inroads into the enterprise data centre – 45 per cent of our research participants were either already using flash products in their data centres or were planning to do so, with the hybrid array being the most cost-effective and popular approach.

While some are consolidating and even ditching their in-house data centre facilities, the majority expected investment in their in-house infrastructure to increase. However, 22 per cent expected the main area of spend to be on cloud, as opposed to 17 per cent last year. This can be viewed as further evidence of the sharp increase in popularity of cloud services. Increases in spending were also planned in new technologies, storage and virtualisation – likely to be triggered by existing infrastructure reaching retirement.

Those responsible for data centre strategy have some difficult decisions ahead of them as the old model becomes redundant and new technologies mature. The possibilities for the enterprise of convergence and software-defined in particular are endless but the organisational and cultural changes involved will take time and must take place within an increasingly stringent legal and regulatory framework. It will be a slow transition but our research indicates that it is certainly underway.

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