
A Vision for the Data Centre

Are you a Mover, Dreamer or Traditionalist?

Dale Vile, Freeform Dynamics Ltd, December 2012

While the imminent death of on-premise computing as a result of hosted cloud services has been greatly exaggerated, this doesn't mean that the enterprise data centre can remain as it is. Stakeholders want IT to deliver against business requirements more quickly, flexibly, reliably and cost-efficiently than ever before. With advances in technology and best practice continuing to be made in parallel, is it time for a new approach to data centre computing?

Key Points

The majority of organisations see room for improving IT delivery

When 481 participants in a recent study were asked to rate their IT delivery capability in terms of responsiveness, service level management, cost control and business alignment, only a quarter claimed a good level of performance across all areas. Furthermore, a wholesale move to the public cloud was not felt to be the answer. This puts the emphasis squarely on the data centre.

The vision of a flexible, responsive and efficient cloud-based IT infrastructure resonates well

IT and business professionals exhibit a good level of buy-in to a range of advanced data centre attributes and capabilities across strategy and governance, automation and management, hybrid cloud integration, and flexible access. Such capabilities represent the substance of a data centre and IT delivery vision that is cloud-based and has business services as the pivot-point for activity.

While some are moving on the vision, others are just dreaming or focused on the status quo

Analysis of aspiration and activity allows three interesting groups to be identified. The first is made up of those who get the vision and are actively driving towards it (the 'Movers'). We then have those that like the idea of the vision, but don't yet have a firm plan for getting there (the 'Dreamers'). This leaves a third group that doesn't currently see a need for radical change (the 'Traditionalists').

Culture, mind-set and experience separate Movers from Dreamers and Traditionalists

Organisations are much more likely to get and/or to be moving on the vision if they already have a strong culture of business service delivery, investment in shared infrastructure and tight service level management. Indications are that broad and deep experience of infrastructure virtualisation techniques also opens minds to the benefits of more dynamic private/hybrid cloud environments.

Success is dependent on getting the processes, technology and people elements right

A service-centric governance and delivery model provides the foundation for success, enabled by a modern 'cloud platform' (or 'cloud OS'). Another important part of the equation is the creation of teams and processes that cut across traditional server, networking and storage domains.

Early Movers advocate the 'expanding beachhead' approach to get things going

Of the various possible ways of moving forward, 'big bang', 'clean sheet', and 'passive creep' approaches are generally shunned by early Movers. The tactic considered to be most useful is the creation of a modest beachhead to deal with one or two specific requirements, then migrate older applications to it incrementally, expanding the new private/hybrid cloud environment as you go.

The study upon which this report is based was designed, interpreted and reported by Freeform Dynamics, with data gathered from 481 respondents via an online survey hosted on The Register news site. The study was sponsored by Microsoft.



Introduction

The enterprise data centre environment, whether it resides in multiple purpose-built facilities serving the needs of a large corporate, or a more modest computer room in the case of a smaller business, typically has a lot of history associated with it. Over the years, tens, hundreds or even thousands of applications have accumulated, many of which run discretely on their own dedicated 'stack' of platform software. Where virtualisation use is limited, applications even sit on dedicated hardware.

Apart from the obvious overhead and cost of having to manage such a fragmented and disjointed landscape, another consequence of silo-based implementation has been poor utilisation of IT assets. In order to provide each application with enough headroom to grow and handle peaks in demand, over-provisioning of both server and storage capacity has become the norm.

Perhaps the most significant issue with the typical data centre environment of today is lack of flexibility and responsiveness. Whether it is the time it takes to procure and deploy the necessary hardware and platform software, or the delays that result from the frequent hand-off of tasks between separate teams of server, storage, networking, security and application specialists, getting a new solution up and running can take a considerable amount of time. Making changes and troubleshooting problems thereafter can also be very time-consuming as each team deals with its own discrete part of the equation using its own unique set of tools and processes.

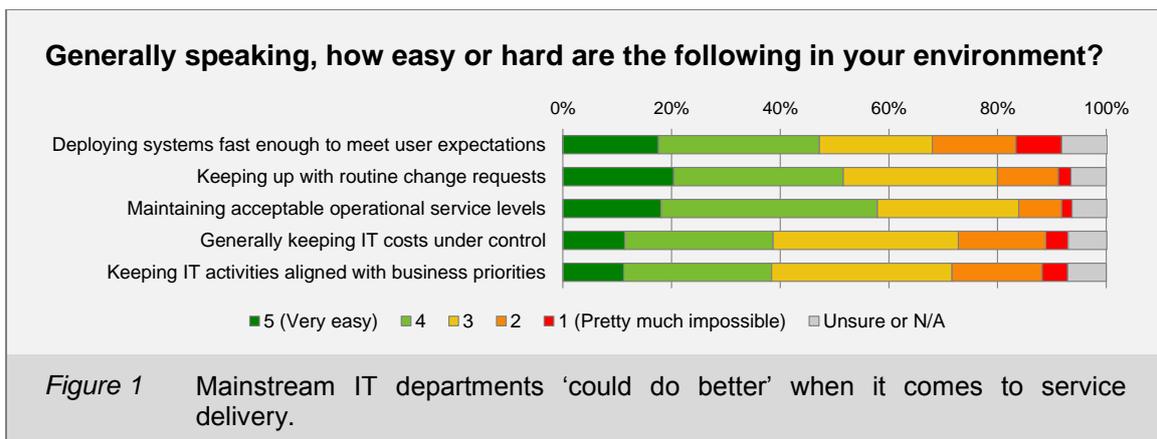
Against the backdrop of continuous business change and evolution¹, such 'friction' in the data centre is not sustainable over the longer term in most organisations.

On the plus side, the last few years have seen the emergence of some very compelling technology and highly effective best practices that can be brought to bear on the problem. These do, however, often require a different way of thinking about the data centre, and even a different way of organising the teams responsible for IT operations. During the remainder of this report, we'll be looking at some of the specifics of this shift and the potential part to be played by emerging technologies and disciplines such as private cloud and unified management.

Along the way, we will be making reference to a research study in which feedback was gathered from 481 IT and business professionals working in a mainstream business environment. More details of the study and sample distribution can be found in Appendix A. In the meantime, let's begin our discussion with a cold hard look at how well IT is delivering today.

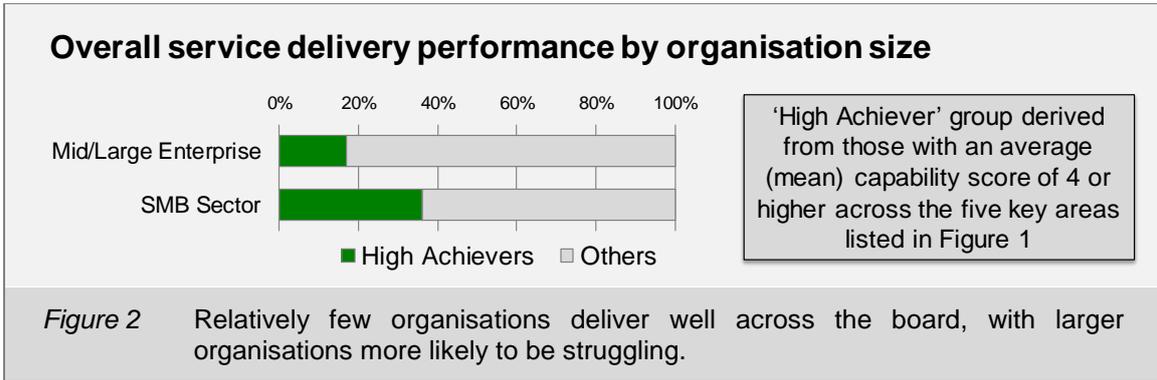
IT performance report card

Considered overall, the group of participants in our study exhibit a mixed report card when it comes to delivering on the things that mean most to business stakeholders (Figure 1).



Looking behind this data, it is evident that most organisations do OK in at least one or two of the areas shown, but relatively few deliver well across the board. If we average the 1-5 scores shown in Figure 1, for example, only 27% of the respondents overall can boast an average performance

rating of 4 or higher. Furthermore, mid/large enterprises with a workforce of 250 plus employees find it harder to achieve high performance than SMBs with fewer than 250 employees (Figure 2).

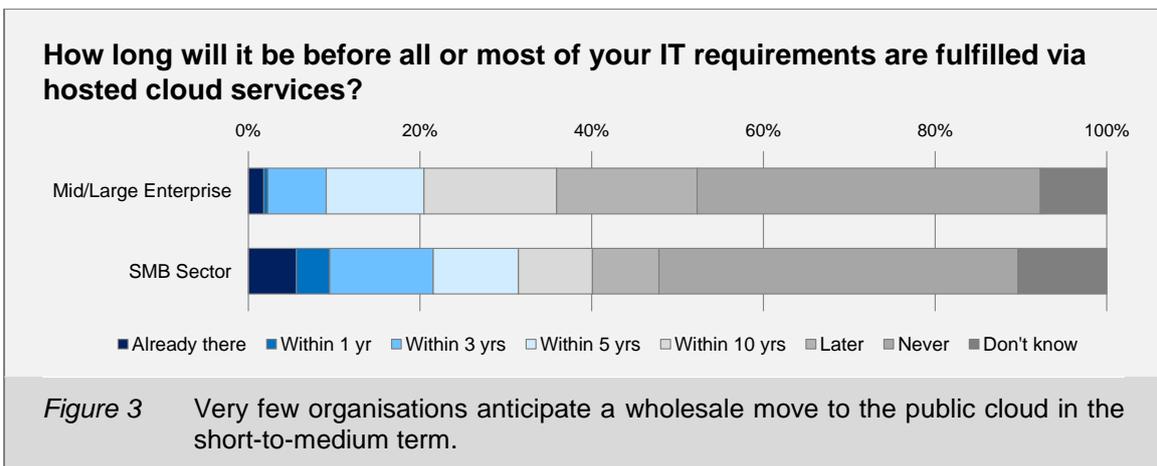


Complexity and scale clearly play a role in the difference we see here, but it is still notable that smaller organisations are often falling short on the things that matter the most to business stakeholders.

‘Public Cloud’ to the rescue?

The fact that most mainstream organisations have trouble with at least some aspects of IT delivery is often used as an argument for switching to hosted cloud services. Whether it’s cost control, responsiveness, flexibility or service level management, advocates of the ‘public cloud’ approach highlight that cloud service providers can often do better than in-house IT departments because they enjoy economies of scale and can afford to invest in the best technology, facilities, practices and skills.

Previous research² has shown, however, that public cloud services are generally regarded more as a tactical convenience to deal with specific discrete requirements than as a target for wholesale migration of IT capability. This also came through in our latest study, particularly in relation to Mid/Large Enterprises. While many are keeping an open mind for the longer haul, few see all or even most of their IT being delivered via the public cloud in the short-to-medium term (Figure 3).



The truth is that early experiences with cloud-based services have highlighted the dangers of creating yet more fragmentation. The notion of a single provider being able to meet all of your infrastructure, platform and application needs is unrealistic, so the number of service provider arrangements quickly escalates as you scale up your activity in this area. Given that standards and conventions for dealing with cloud service interoperability and migration are still in their infancy, you can easily end up getting locked into a disjointed and constraining set of service silos.

Having said this, the publicity surrounding cloud services has reached the ears of many business executives, and the promise of cost-effective delivery, rapid access to new capability, and inherent connectivity to support mobile and remote working is changing expectations. The result is that internal IT departments are going to be increasingly judged by similar criteria as time goes on.

Coming back to the main theme of the report, this is another reason why the status quo in relation to the data centre and associated delivery processes is going to be unsustainable over the longer term.

The 40,000 ft vision

Generic visioning is always a risky thing to do, not least because IT vendors frequently present us with contrived visions that just happen to have what they are trying to sell us at the centre of everything. Visions are also often dismissed as the output of idealism, which can be a particular problem in the complex world of enterprise IT. However, painting a picture of how the perfect world might look is sometimes useful for moving your thinking on beyond the detailed clutter and constraints of today's real world, often allowing you to look at problems in a totally different way.

So let's take a stab at a vision for the data centre (we can sanity check it later):

- The data centre of the future will be the hub for IT service delivery.
- On-premise (or co-located) resources will largely be organised into virtualised pools to facilitate rapid provisioning, dynamic resource management, and optimum use of IT assets, which will in turn maximise responsiveness, flexibility and cost-efficiency.
- A holistic approach to architecture and operations will mean that servers, storage, networking and other aspects of the data centre are managed coherently with a clear focus on business services and service quality.
- Access and communications flexibility will be implicit, allowing optimised integration with external instruments, systems and feeds, together with secure user connectivity from any type of device, whether owned by the employee or the business.
- External cloud services will be consumed where it makes sense, but everything will be orchestrated, monitored and managed via platform software, tools, processes and policies under the control of the organisation's IT department.
- Where appropriate, it will be possible to migrate workloads easily between public clouds and the data centre, and applications will be able to work safely and efficiently in 'hybrid' mode and/or will be able to 'burst' across boundaries to deal with spikes in demand.
- A 'source agnostic' culture and governance model will exist in which the only things that matter are the service delivered to the business, how well it works, and how much it costs, with the delivery mechanics being a secondary concern.
- Costs will be reported back or charged back to the business based on activity or consumption.

We have phrased the above using language that assumes the presence of an in-house IT department, so need to appreciate that the vision may be different if IT has been mostly or completely outsourced. It will also be obvious that such a high level definition of capability and attributes translates to a lot of detail at the next level down, particularly when you start to consider the practicalities of actually delivering on the vision with decades of data centre legacy in place.

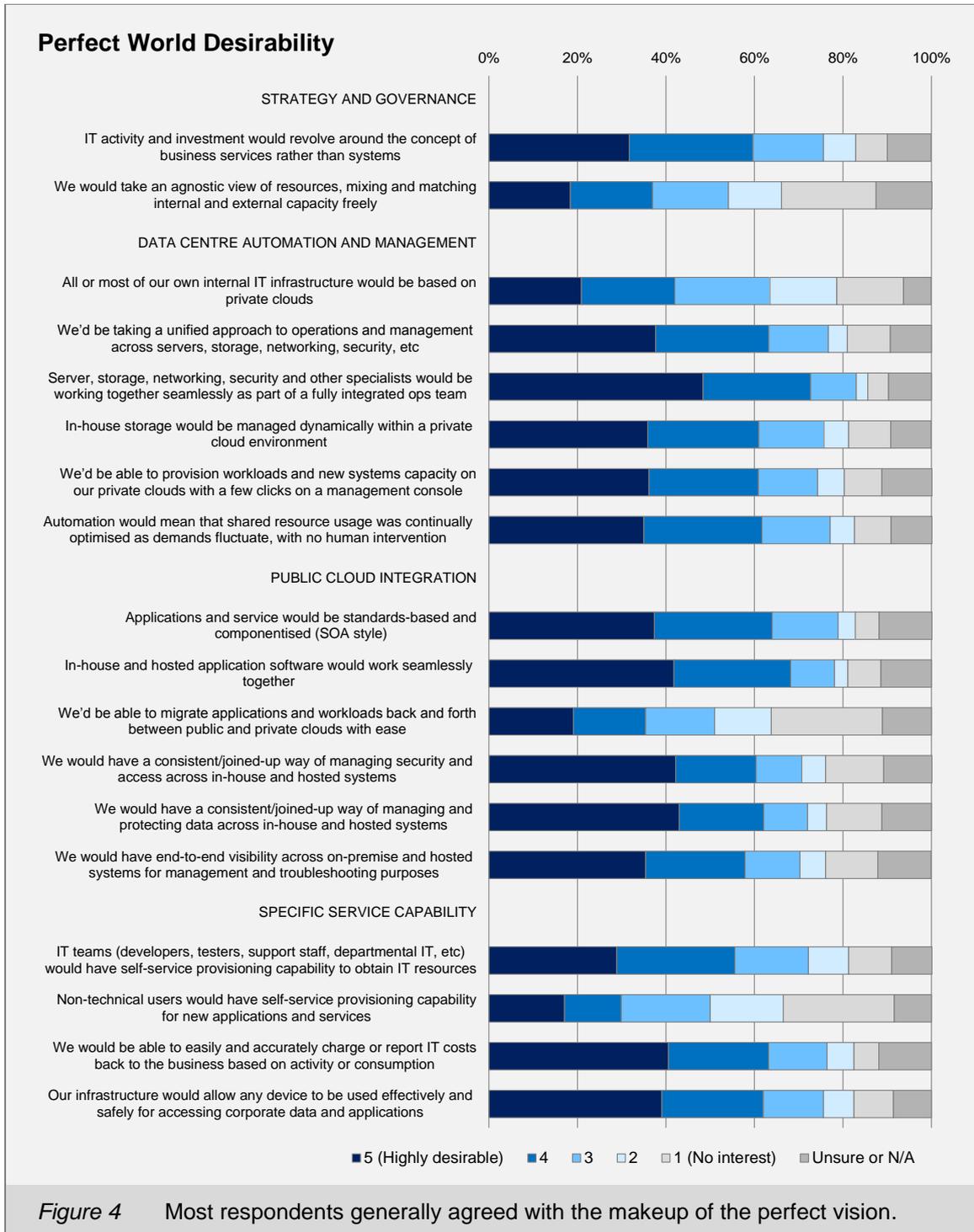
Nevertheless, this gives us a framework to work within when setting direction and plotting a course for the future, assuming, of course, that those working in mainstream businesses acknowledge this kind of vision as being legitimate.

This is something we tested in the research.

Testing the vision

Building on the above, respondents in our study were presented with a list of more specific capabilities and attributes associated with the data centre and IT service delivery, and asked how desirable each item was considered to be in the context of the perfect IT vision. When answering the questions, the instructions were not to get too bogged down in real-world constraints.

With a small number of exceptions, there was a good level of agreement among our respondents on the components that go to make up our proposed vision (Figure 4).



The items on the above chart are pretty self-explanatory, so we won't go through them all. It is, however, worth considering the ones upon which there is less agreement, such as these:

We would take an agnostic view of resources, mixing and matching internal and external capacity freely

We'd be able to migrate applications and workloads back and forth between public and private clouds with ease

The lower level of interest in these two is consistent with many still having a very firm idea of what should run in the public cloud versus what should be kept in-house; this group of respondents likes to maintain clear demarcation between the two environments – the 'horses for courses' mind-set. However, where public cloud services are used, there is a good level of agreement that they need to be integrated with the overall IT delivery framework from a security, information management and troubleshooting perspective, with in-house and hosted applications working together seamlessly where appropriate.

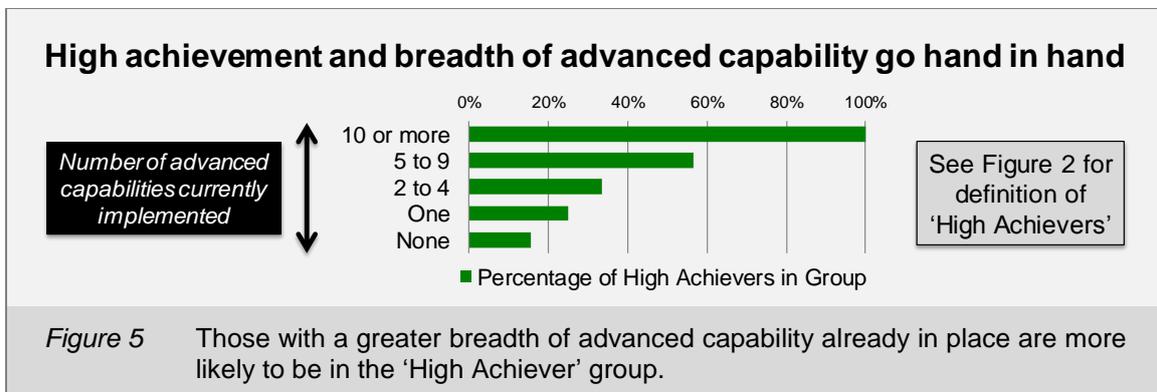
With regard to wholesale migration of internal infrastructure to private cloud, the lower level buy-in here is likely to be down to two factors. Firstly, a general feeling that traditional infrastructure and alternative architectures (e.g. mainframe, HPC clusters, big data clusters, dedicated application landscapes, and so on) have a role to play alongside generic 'mixed workload' private clouds, and secondly a lack of understanding in some peoples' minds of what, exactly, a private cloud is. Some of the capabilities for which a higher level of interest is shown, for example, are in many cases going to be delivered via private clouds (rapid provisioning, flexible resource management, etc).

The last area of relative disinterest is associated with end user self-service, which is something we have picked up strongly in previous research studies³. The fear here undoubtedly stems from past experience. Whether it's cycles on HPC/analytics environments, mailbox space, file storage or the ability to generate team-sites in SharePoint, the result is often a lot of mismanagement and wasted capacity as users grab resources but seldom want to relinquish or recycle them when they are no longer needed.

Of course IT professionals are far from perfect in this respect, but at least they appreciate the concept of finite resources and the need to manage utilisation. It's therefore encouraging to see the value of self-service within IT (developers, testers, support staff, etc) acknowledged by many.

A further sanity check

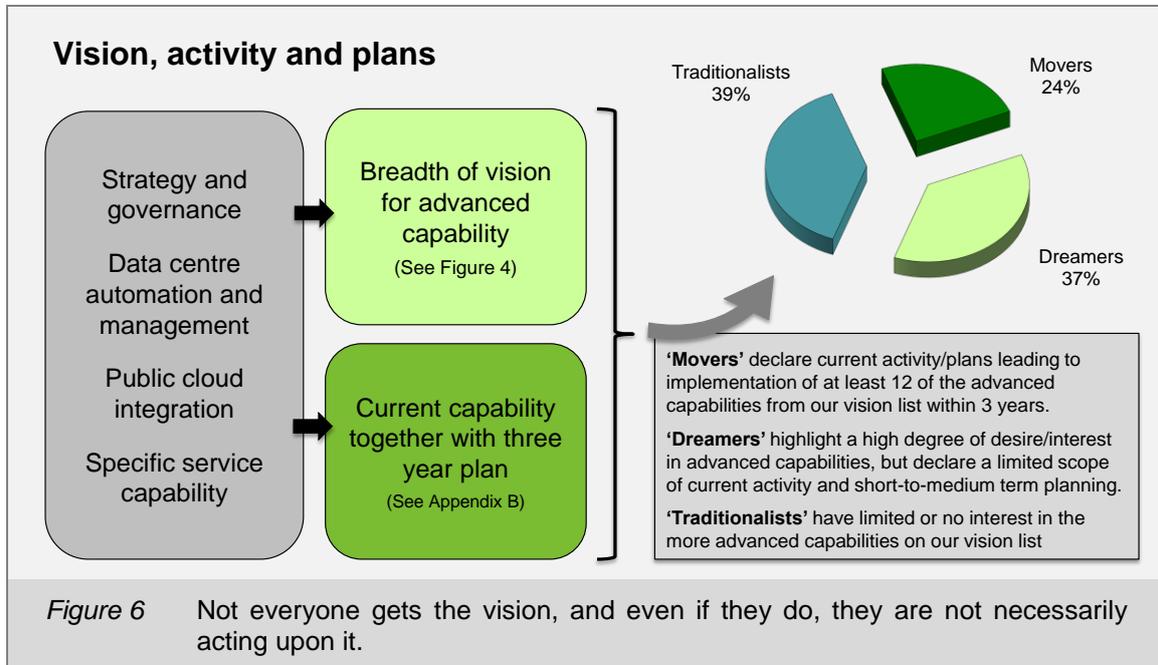
Beyond the data presented in Figure 4, we carried out a more empirical sanity check as part of our analysis to make sure our proposed vision aligned with the delivery of incremental value. In a later survey question (Appendix B), we looked at current activity and plans, so we were able to identify the breadth of advanced capability already in place. Reassuringly, we found a strong correlation between this and the likelihood of the respondent being in the 'High Achiever' group (Figure 5).



This correlation provides us with a degree of confidence that the vision we have outlined is likely to drive tangible business outcomes. But who is bought in and how are they progressing towards it?

Movers, Dreamers and Traditionalists

Taking our analysis one step further, we are able to identify three interesting groups. The first is made up of those who get the vision and are actively driving towards it (the 'Movers'). We then have those that like the idea of the vision, but don't yet have a firm plan for getting there (the 'Dreamers'). The third group is comprised of the remainder, who at this stage don't see the vision we have outlined as particularly relevant or attractive (the 'Traditionalists'). Organisation size is not a big factor, and all three groups are reasonably well represented in our survey sample (Figure 6).

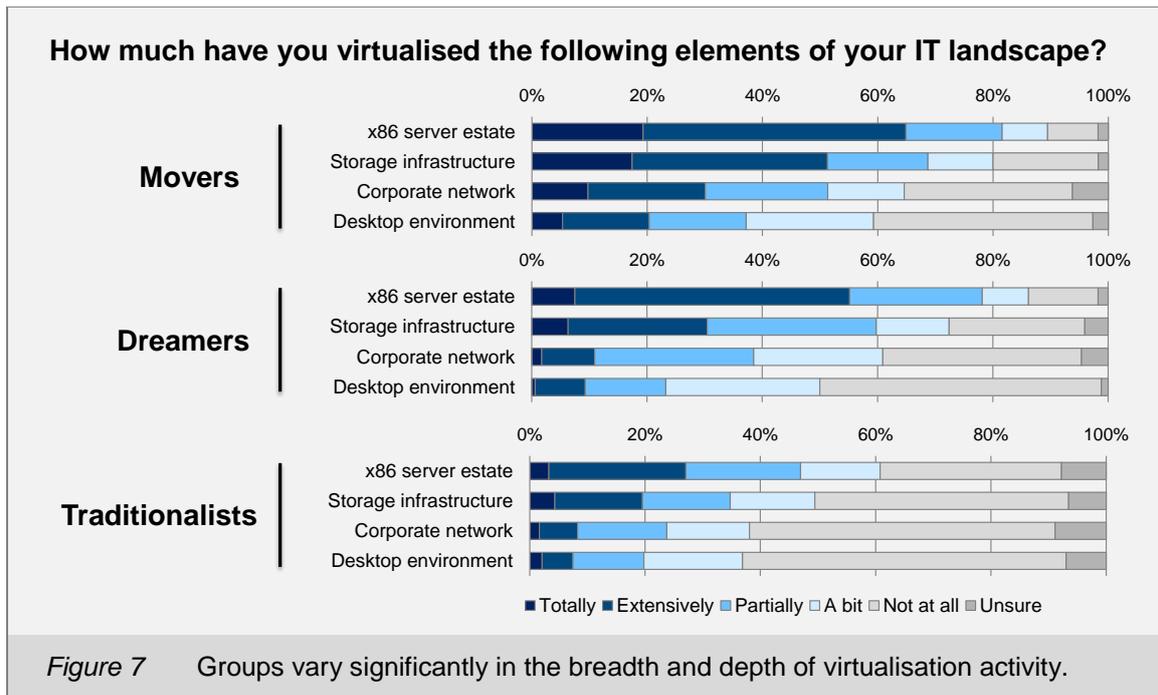


We should point out at this stage that the online survey methodology used in this research, which is based on respondents 'self-selecting' into the study, is likely to have led to a bias in the sample towards those with more of an interest in or commitment to advanced data centre capability. It's therefore important not to take the absolute percentages shown as a reflection of activity in the mainstream business community as a whole. Movers, and possibly Dreamers, will undoubtedly be over-represented, and the proportion of Traditionalists will appear lower than in the real world.

This doesn't, however, prevent us from gaining some interesting and useful insights by looking at the differences between these groups. When we do this, for example, we find that respondents are significantly more likely to be in the Mover group if the following are true:

- The organisation has a strong culture of business service delivery
- A strategy and/or plan for data centre modernisation is in place
- The value of shared infrastructure investment is appreciated
- A strong focus exists on maintenance of operational service levels
- Significant use has been made of hosted/cloud services
- Infrastructure virtualisation has been broadly implemented

On this last point, both the breadth and depth of virtualisation activity matter. When we compare the groups, while the difference between Movers and Dreamers is not that great in relation to server virtualisation, Dreamers are significantly further behind when it comes to virtualisation of the storage, networking and desktop infrastructure (Figure 7).



We can also see from this chart that Traditionalists are behind the virtualisation curve in all infrastructure categories.

What's almost certainly going on here is virtualisation activity opening minds to alternative ways of doing things, particularly where mature deployments are in place that tend to have a greater focus on management (e.g. workload provisioning and migration). This is not the first time we have seen this phenomenon. Previous research⁴ has demonstrated quite clearly that extensive experience with infrastructure virtualisation tends to create an interest in automation, which in turn encourages private cloud adoption.

Of course apart from the enlightenment factor, those that have validated or ported a significant proportion of their application portfolio to run in a virtual environment will have a clear head start when moving to a more sophisticated 'cloud Platform' or 'cloud OS'.

This brings us on to the practicalities of next generation data centre creation.

Creating the right operating environment

A number of elements need to fall into place in order to deliver the advanced capabilities outlined in our next generation data centre vision.

Service-centric governance and delivery

Starting at the top, one of the most important enablers of the next generation data centre is a service-centric approach to governance. The idea is to create a delivery model in which the business service is the pivot-point for all IT related activity.

In many cases, this will require a shift in mind-set. It's about thinking in terms of delivering an email service, for example, rather than operating an email system. The same principle can be applied across all application areas such as CRM and ERP, and even horizontal capability such as unified communications and collaboration.

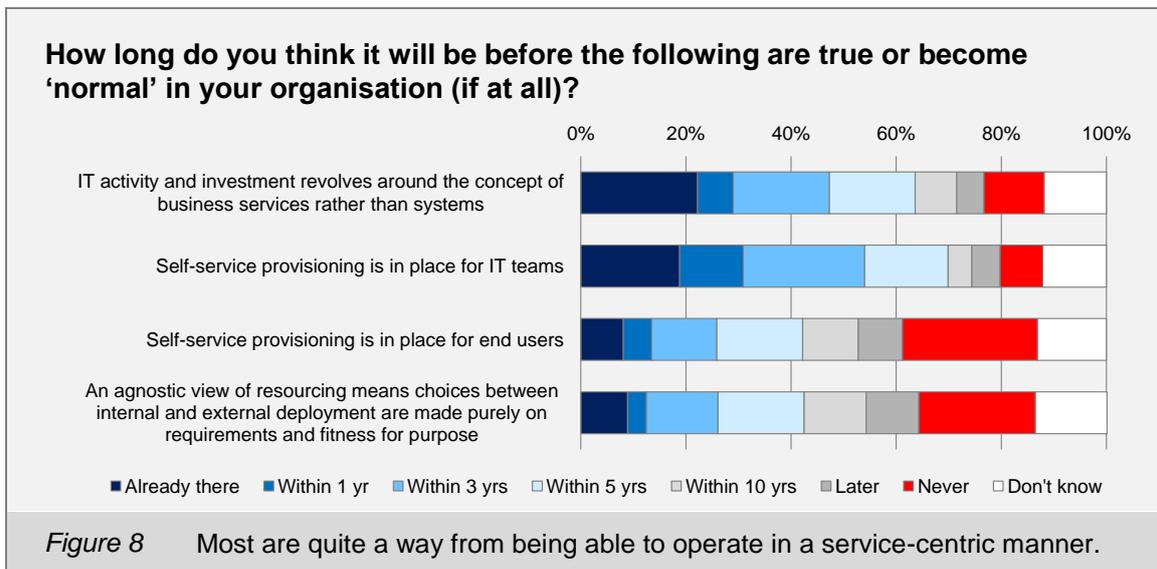
A key concept here is the 'service catalogue', which captures a definition of services delivered by IT (or at least, in the beginning, the more critical ones), along with pertinent attributes in areas such as performance, availability, recovery, security and other criteria that need to be met as part of the service delivery process. Service catalogues, which are often built into management suites and

service desk solutions, can also form the foundation for a self-service deployment model if they are hooked up to an automated provisioning capability.

In order to facilitate a dialogue with business stakeholders for prioritisation, investment appraisal, delivery planning and ongoing review purposes, it may be useful to look at Service Portfolio Management solutions. These are closely related to Project Portfolio Management (PPM) tools, but designed to track a service throughout its lifetime (not just during the development and implementation phase).

One of the other objectives of the service-centric approach is to allow an agnostic view of sourcing to be taken. The idea here is to focus on what needs to be delivered in terms of business capability, and all other things being equal, not get hung up about whether the requirement is fulfilled in-house or via an external cloud service.

Right now, most of the respondents, even in our very progressive sample, are quite a way from being able to take a genuinely service-centric approach to delivery (Figure 8).



Given that the shift from systems to services is mostly a cultural one, closing the gaps we see is not going to be easy for some. Once in place, however, everything becomes easier and more meaningful, from discussions with business stakeholders, through planning and prioritisation, to delivery and support.

Cloud platforms/operating systems

An important enabler in the mix is the 'cloud platform'. This is a layer of software which some vendors refer to as a 'cloud operating system' because it does a similar job to a traditional OS, but at the level of clusters or pools of servers and other resources, rather than individual machines.

The cloud platform (which usually manifests itself as a suite of platform software and management tools) is the key to enabling many of the capabilities we have defined as part of our data centre vision. Some of the main requirements it fulfils include:

Hardware abstraction: Not just compute, also networking and storage. The job of the cloud platform is to virtualise pretty much all aspects of the underlying hardware infrastructure (including server clusters, storage pools and redundant/parallel network equipment) to maximise flexibility and utilisation (invisibly to the application). Of course performance and scalability are implicit in this, so platforms are designed with dynamic optimisation in mind.

Dynamic workload management: Whether it's initial provisioning, subsequent scaling-up or scaling-down of resource allocation to deal with fluctuating demands, or migration of workloads

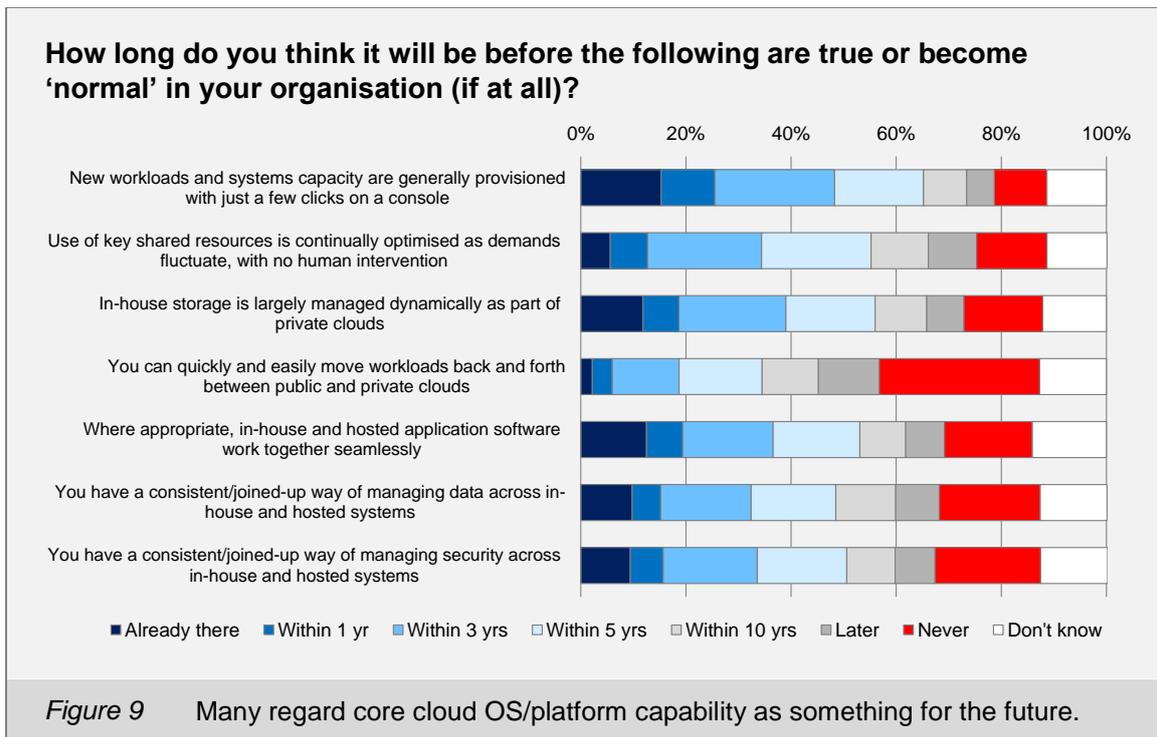
to deal with constraints, bottlenecks and failures, an important aspect of the cloud platform is to make sure applications always have the mix of resources needed to meet service requirements. The process is generally known as 'orchestration', and templates or 'patterns' are used to define how it takes place in the context of a given application or service.

In-flight management: When resources are pooled and utilised as a single virtual entity, the last thing you need is to have to shut everything down and restart it to deal with routine activities such as patch management and adding, removing or replacing hardware. The cloud platform will therefore allow all such operations to be carried out in-flight, with no interruption of service.

Integration of external resources: The concept of 'hybrid cloud', in which public and private cloud resources are used in harmony, is gaining acceptance as a mechanism to optimise service delivery costs and flexibility. The cloud platform can be made aware of external resources, and can notionally integrate them into the resource pool to deal with migration, bursting and failover models that cross data centre and service provider boundaries.

Holistic operational visibility: The advantage of having a single operating environment that governs the use of all available resources and supports a broad portfolio of applications and services is enhanced monitoring and visibility across the entire landscape. This can be exploited for ongoing service management, troubleshooting when issues arise, and even activity based reporting or charge back accounting.

This is just a taste of what solutions in this space can offer, and although scalability to support thousands of services, vast storage pools, and huge aggregate network bandwidth is offered, cloud platforms/OSs can generally also be deployed on a more modest scale. This is something to bear in mind if you are one of those who see advanced private/hybrid cloud capability as being something for the distant future (Figure 9).



It should be pointed out that at the time of writing, there is an ongoing debate and a degree of confusion in the industry surrounding 'integrated stacks' and how they sit with the cloud OS concept. The idea behind such solutions is to bring together compute, networking and often storage equipment, and pre-integrate them into a single physical unit, complete with cloud OS-style platform software and management tools. Units can then be bolted together to achieve scalability.

The upside of this approach is rapid time to deployment and performance benefits that arise from components having been put together optimally by the vendor. The downside is the risk of lock-in if it proves difficult or impossible to break out of the pre-integrated configuration to drive interoperability or allow component substitution as requirements change down the line.

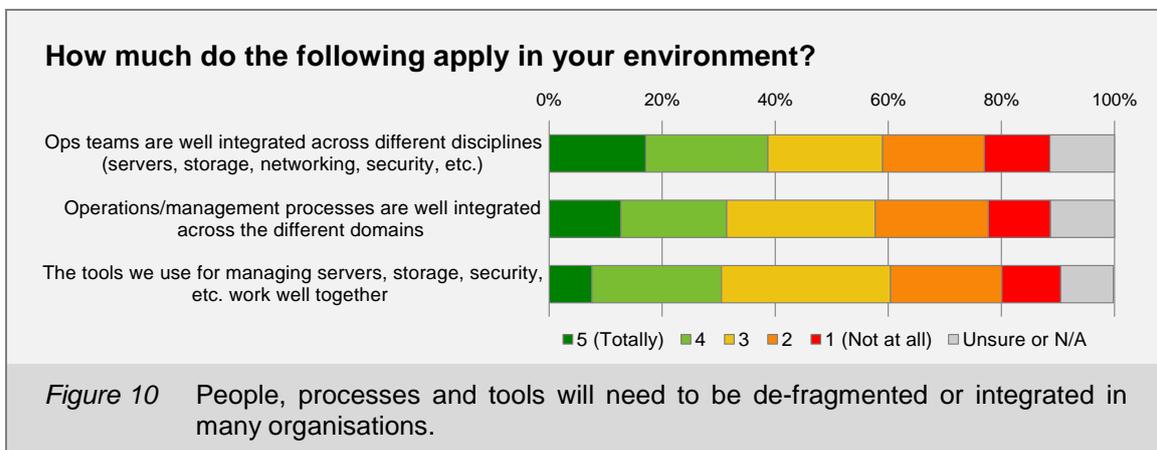
Cloud OS purists argue that it is better to focus on hardware independent platform software that allows complete freedom to evolve the physical infrastructure layer without constraint, and point out that 'plug-ins' are generally available to deal with all popular specialist equipment optimally anyway.

There is no right or wrong here; you simply need to figure out what's most important to you and do your due diligence.

The right team structure and processes

From the discussion so far, it will be evident that one of the fundamental principles upon which the data centre of the future will be based is what's starting to be called 'unified infrastructure', i.e. looking at compute, storage and networking as an integrated whole. This in turn leads to the concept of 'unified management' and there are three angles to this – people, process and tools.

Right now, many organisations, particularly larger ones, are pretty fragmented in the way they operate (Figure 10).



It would be nice to say that the tools and process dimension will be taken care of implicitly as cloud OS/platform solutions are brought on board together with associated best practices. It may, however, be the case that parts of the existing infrastructure will be used to underpin the initial private/hybrid cloud environment, particularly around networking and storage, and these will already be operated under one or more management regimes.

Thinking through how the new will coexist with the old may therefore be necessary, especially if there is a need for end-to-end service monitoring and troubleshooting capability.

Regarding teams, smaller organisations in which everyone in IT does a bit of everything anyway will find it relatively straightforward to adapt to the unified management approach – in fact they probably already operate in a holistic manner. A total reorganisation to bring server, storage and networking specialists together in a larger IT department, however, can be a pretty daunting notion, so let's look at some relevant migration tactics.

Small but perfectly formed initial steps

In order to keep the implementation of a new data centre environment manageable, the most popular approach among early Movers is to start off by building a discrete, but fully integrated, private/hybrid cloud setup. The trick is to fund this off the back of one or more target services that require either new platform capability or re-platforming as part of an upgrade or overhaul. Once the new environment has been bedded in, older applications can then be migrated to it incrementally,

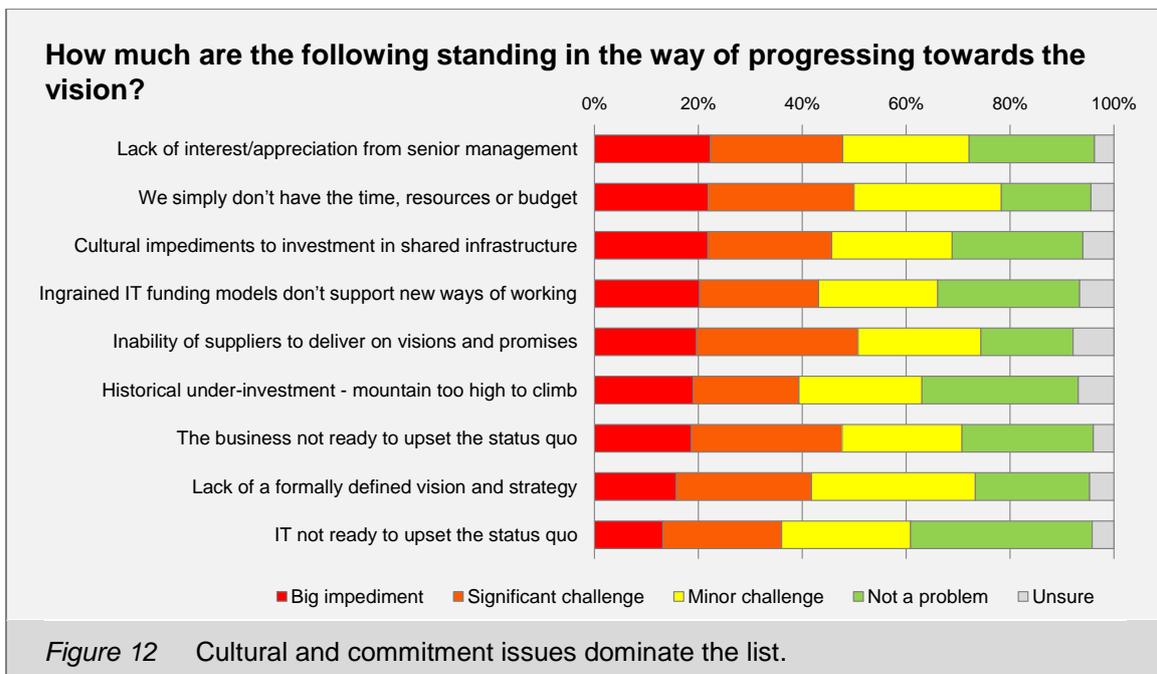
with more hardware resources being added to the pool as growth occurs. It's not the only way of moving forward – the 'big bang', 'clean sheet' and 'passive creep' approaches are options too – but around 60% of those in our Movers category favour the creation of an 'expanding beachhead' (Figure 11).



Coming back to the question of people, the approach we have been discussing has the advantage that in a larger environment, you can pull together some of your best server, storage and networking specialists to design, build and run the initial environment.

Challenges to be prepared for

The most commonly encountered challenges are to do with culture, organisational inertia and the perennial issue of gaining the interest and commitment of senior management, though some are concerned that suppliers are not able to deliver on their visions and promises (Figure 12).



Many of these challenges can be overcome by investing the time to get up to speed and then starting to socialise the vision and benefits with key stakeholders in line with the discussion in this report. The trick is to focus on business services, and to paint a picture of a world in which IT is much more flexible, efficient and responsive than it is today. A lot of executives respond well to the notion of getting IT off the critical path to business change.

One of the thornier problems that many will need to work through is budgeting and accounting. In most organisations, decades of investing in silo-based systems, with the budget, capital cost and associated depreciation allocated to individual departments and cost centres, means the concept of investing in shared IT assets is unfamiliar and uncomfortable. Funding an initial deployment off the back of a new application or service requirement is fine to get going, but in order to scale the new approach to IT delivery, governance and accounting models will need to be adjusted.

On the topic of supplier readiness, cloud platform/OS technology has matured significantly over the last couple of years. However, beware of standards and interoperability issues, and be sure to quiz IT vendors on the feasibility of smaller configurations; many are keen to talk about how their solutions can scale up, but don't dwell on whether they can scale down. Having said this, be wary of low-cost entry-level configurations that have a hard limit on scalability. These aren't necessarily a bad idea, but you need to be aware if significant step changes in licensing will kick in at certain points so you don't get caught out.

Final thoughts

There is no stopping the march of technology or the ever evolving business agenda. Against the backdrop of these dynamics, the status quo when it comes to the data centre environment and the approach to IT delivery is not going to be sustainable for much longer in many organisations.

One option, of course, is to let new technologies and techniques creep into your world on a passive, ad hoc basis, but IT professionals know in their hearts that unplanned evolution is seldom a good idea, even though they often allow it to happen. Another possible course of action is to make continuous tactical improvements to what's in place already, but the problem with that is you never end up shaking the constraints of legacy and the consequences of historical decisions.

This is why the results of the research presented in this report are so encouraging. It would appear that many in the IT and business community have a positive reaction to the vision we have painted, with a good level of agreement on all but a few of the specifics. The challenge, though, is figuring out how best to get from A to B, particularly as point A often represents a complex, fragmented and disjointed existing IT infrastructure, and point B can look like an unachievable ideal.

The best way around this is to think in terms of creating one or more oases of order and harmony based on the latest cloud platform technology, and expanding the footprint from there. This is certainly how most early Movers are doing it. Our advice would also be to not get too hung up on creating a single homogenous environment across the entire data centre – that might work for a big service provider, and in a small scale business environment, but it's really not a sensible goal for a larger enterprise in the short to medium term. Indeed you may even end up with more than one cloud-style pool of resources as you acquire a mix of platforms and integrated systems from your key vendor partners. There is nothing wrong with this, provided you are making decisions consciously and objectively, and don't let efforts become too fragmented.

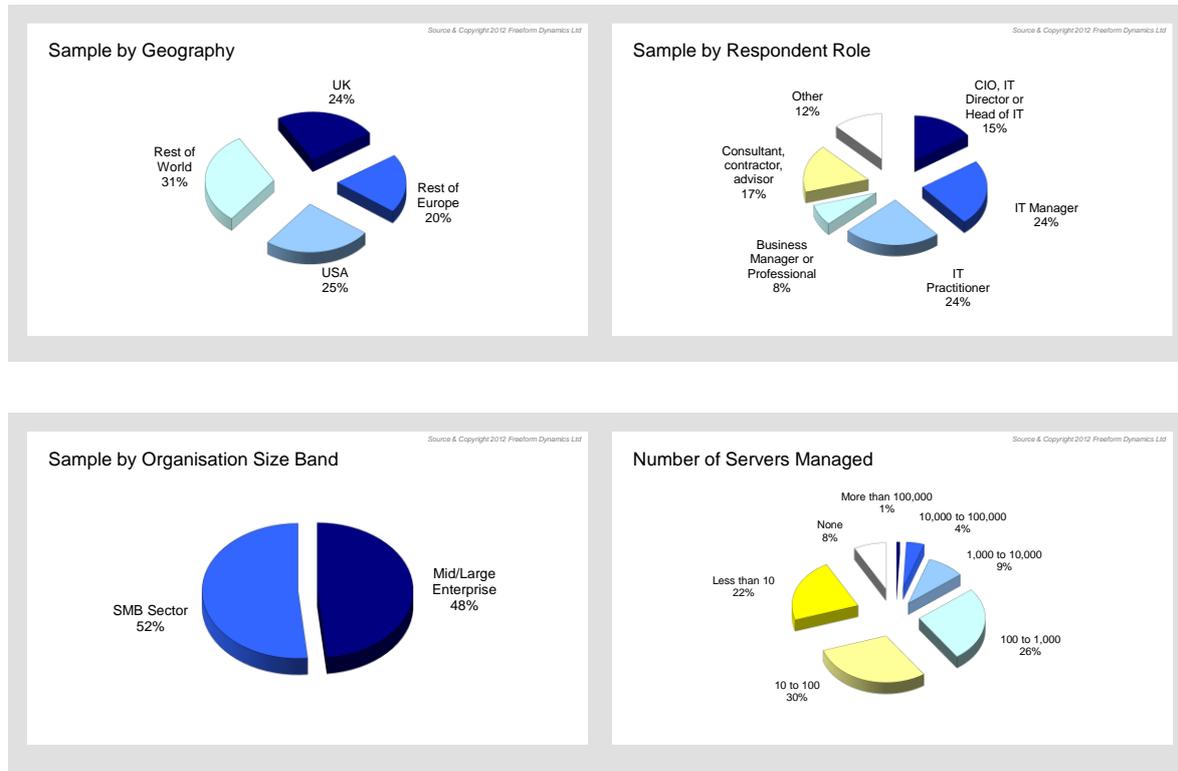
In the meantime, we hope this report has helped to clarify your thoughts on how modern cloud platforms can allow you to benefit from the best of both worlds – flexible and efficient data centre computing, and the ever increasing range of innovative public cloud services on offer.

REFERENCES AND FURTHER READING		
Ref	Title	
1	Defining the Business Change Agenda	These reports are available for download from the Freeform Dynamics website: www.freeformdynamics.com
2	Cloud Computing Checkpoint	
3	Private Cloud in Context	
4	From Virtualisation to Private Cloud	

Appendix A: Study sample

Feedback was gathered via an online questionnaire published on The Register news and information site (www.theregister.com). In total, 638 respondents participated in the study, of which 157 declared themselves as suppliers of IT products or services. These were removed from the sample (and will be reported at a later date), leaving the 481 respondents from mainstream 'user' organisations that were used as the basis for the analysis presented in this report.

The sample distribution was as follows:



A note on methodology

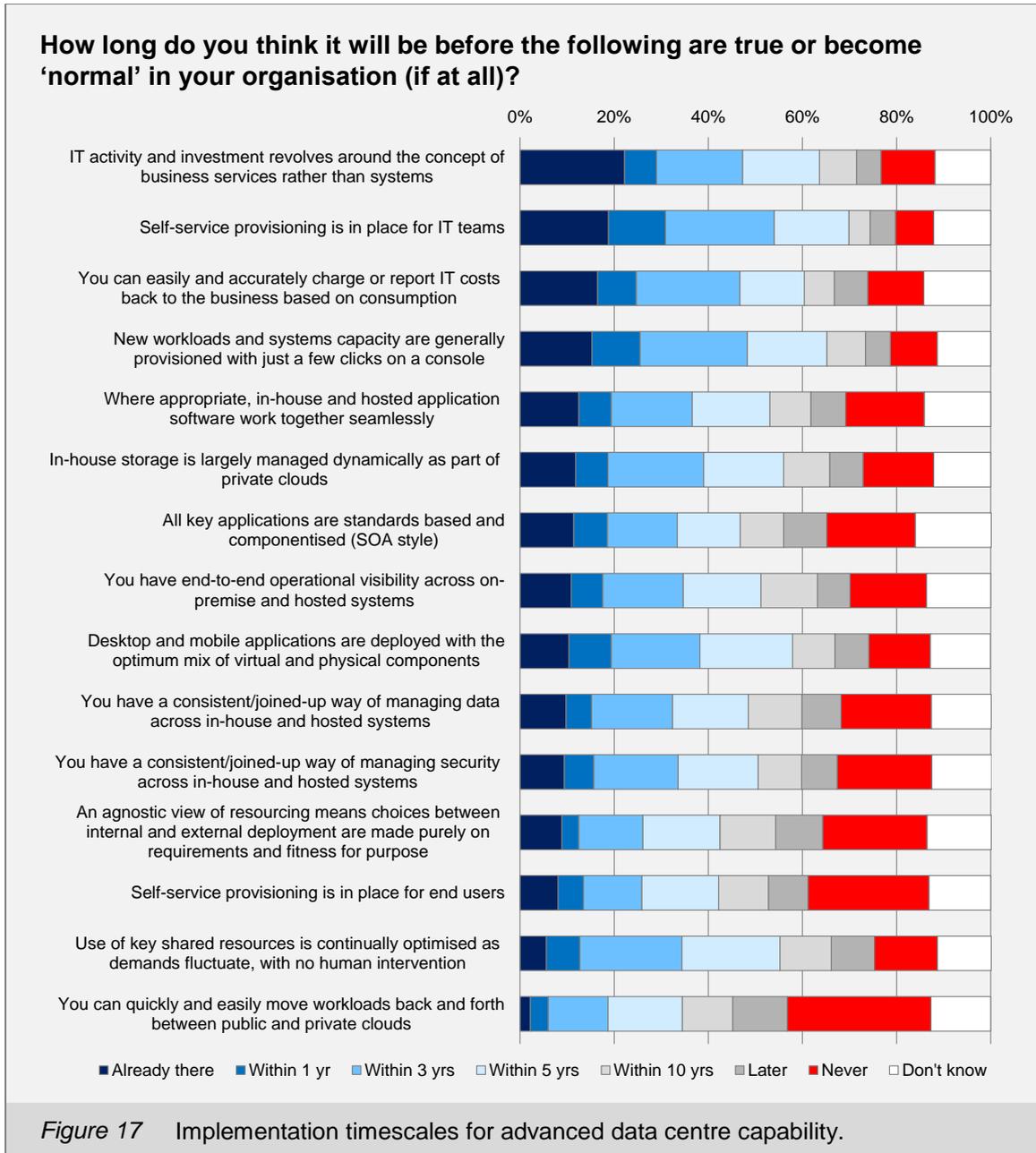
The web survey approach used in this study is subject to the 'self-selection' principle, which basically means that people with a greater knowledge of or interest in the topic are more likely to have responded.

Such self-selection does not undermine the analysis we have presented in this report. It does, however, mean that it would be inappropriate to regard any of the statistics we have used as a representation of the mainstream business and IT community as a whole.

The study was completed in December 2012, and we would like to take this opportunity to thank all of those who took the time to participate. Your help is very much appreciated.

Appendix B: Activity and Plans for Advanced Capability

Relatively few organisations, even in this progressive sample, have a broad range of advanced data centre capabilities in place (Figure 17).



As a general rule, it is safest to assume that plans relating to activity more than 3 years out are largely speculative, hence we have focused our analysis on current activity and short-to-medium term intentions over the coming 36 months.

About Freeform Dynamics



Freeform Dynamics is a research and analysis firm. We track and report on the business impact of developments in the IT and communications sectors.

As part of this, we use an innovative research methodology to gather feedback directly from those involved in IT strategy, planning, procurement and implementation. Our output is therefore grounded in real-world practicality for use by mainstream IT professionals.

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About Microsoft



Founded in 1975, Microsoft (Nasdaq "MSFT") is the worldwide leader in software, services and solutions that help people and businesses realise their full potential.

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