THE WHITE BOOK OF...

Cloud Adoption

The definitive guide to a
business technology revolution

shaping tomorrow with you

FUJITSU

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Cloud Adoption

Contents

Acknowledgments

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For more information on the steps to cloud computing, go to:
www.fujitsu.com/us

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Preface

Even for an industry hardly averse to talking up the "Next Big Thing", there is a phenomenal amount of hype and hot air surrounding cloud computing. But cloud is real; it is a huge step change in the way IT-based services are delivered, and one that will provide substantial business benefits through reduced capital expenditure and increased business agility.

As ever, any topic with this much hype heightens expectations, thereby creating a challenge for CIOs from our colleagues who are rightly excited by the possibilities for the business but often entirely unsighted on the issues to be managed. The key issue that every CIO must address is **how and where we adopt cloud services so they maximize the benefits to our organizations and customers.**

This Fujitsu *White Book of Cloud Adoption*, produced in consultation with some of the UK's leading CIOs, cuts through the market hype, acronyms and buzzwords to clearly explain the different cloud models on offer. It also provides a mechanism to determine which IT applications and business services to migrate into the cloud, setting out **best practice and practical approaches for cloud adoption**. The aim of all CIOs who contributed was to produce a balanced and succinct guide which could be used with confidence by our peers from all sectors, to enable them to form a realistic understanding of the potential of cloud computing for their organizations.

Cloud computing is here to stay. Its large-scale adoption is inevitable and, for your organization, unavoidable. As IT leaders, we must guard against cloud being viewed as the next big IT fad and ensure that our organizations understand that the inherent flexibility of cloud-based services signals real opportunity to enable business change.

We hope this guide proves useful both as a cloud primer and for ongoing reference as your organization embarks on an extended – and fruitful – cloud journey. So please enjoy it, and tell us what you think.

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1

What
is
Cloud?

In pure business terms, cloud is essentially a flexible, scalable, pay-per-use model for the way IT services are delivered and consumed, typically through short-term contracts. With its pay-as-you-go model, cloud moves many IT costs from capital expenditure to operating expenditure; its "elastic model" means available IT capability can be flexed to mirror changing business demand; and it enables consumers of IT to have much greater transparency over their costs.
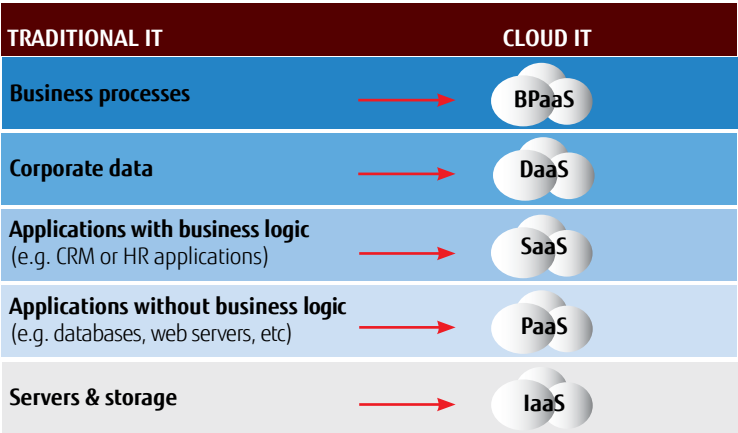
But there are different levels where that model can be applied – and the desired benefits attained:

● **Infrastructure-as-a-Service (IaaS)** Virtual machine services accessed over the network, providing compute and/or storage capabilities

● **Platform-as-a-Service (PaaS)** Platform software services (such as web, application, database servers, enterprise service buses and other middleware, with associated security mechanisms) on which web service-based applications can be built

● **Software-as-a-Service (SaaS)** Applications provided as a service from the cloud, with end-user licences procured or "released" in line with changing demand

● **Data-as-a-Service (DaaS)** Data or information delivered from the cloud either as raw data sets or consumed through an analytics interface

● **Business Process-as-a-Service (BPaaS)** Cloud-delivered business services that are aligned to business processes and associated measurable business outcomes.

Cloud's elastic model means IT capability can be flexed to mirror changing business demand, while turning capital spending on IT into an operating cost

Photograph: Shutterstock

How traditional IT maps onto cloud

TRADITIONAL IT	CLOUD IT
Business processes	BPaaS
Corporate data	DaaS
Applications with business logic (e.g. CRM or HR applications)	SaaS
Applications without business logic (e.g. databases, web servers, etc)	PaaS
Servers & storage	IaaS

The diagram above shows how those cloud services relate to the traditional IT stack. But in the current frenzy of hype, that naming convention has been open to abuse: vendors will often append the "as-a-service" tag to any new network-based product and service, but it doesn't always follow that those will be cloud or even "cloud-ready" – so buyer beware. This confusion is compounded by the same terms being used to define different elements of cloud. For example, DaaS can mean Desktop-as-a-Service as well as Data-as-a-Service (this book uses the latter and makes reference to "virtual desktop infrastructure" – see Cloud Speak, page 57). Data-as-a-Service is further enshrouded in confusion due to some people referencing Content-as-a-Service, which typically refers to media and/or social media related data, such as videos, sound files, blog posts, etc. Data-as-a-Service encompasses unstructured content (i.e. Content-as-a-Service) and structured data.

In the current frenzy of hype, the naming convention for cloud has been open to abuse – so buyer beware

Where is the cloud?
There are also different types of cloud. A **private cloud** service can be accessed only by an organisation's employees and is usually owned and run by the organization, although it could also be internally provided by a third-party supplier or externally provided by a third-party supplier as an IT outsourcing (ITO) service. A **community cloud** is a private cloud for shared use by multiple organizations and can be accessed by their employees and the trusted employees of other organizations. A shared **public cloud** can be accessed by anyone: e.g. the Amazon® Elastic Compute Cloud (EC2) or the Google® App Engine.

It is useful to consider these cloud types as a continuum from traditional IT infrastructure through to public cloud, as highlighted in the table below.

	Traditional infrastructure	Private cloud	Community cloud	Public cloud
Technology model	Customer-owned and dedicated IT delivered on or off customer premise	Customer-owned and dedicated IT run as a pooled resource and sold to customer departments (can be operated also as an ITO in a provider's data center)	Run on a shared platform but for trusted use at an identifiable location	Shared and highly scalable platform with location unspecified
Cost model	Customer-owned IT or provided as an ITO service	Customer-owned IT or provided on ITO-type commercials with scalablity options delivered at an agreed price	Pay-per-use (minimum charge period applies); scalability confined to agreements	Pay-per-use per hour and rapidly scalable to demand

One final possibility for organizations to consider in the longer term is the adoption of several different cloud delivery models. This is generally known as a **hybrid cloud** – most commonly a blend of private cloud and public cloud.

2
What
Cloud
Means
to
Business

Cloud will transform the way IT is delivered. But to understand what that means to the business, the benefits and potential risks of migrating to cloud services need to be carefully considered. There are essentially two types of business benefit that result from operating in the cloud:

Key benefits of cloud

Cloud ensures that applications and data are available to users any time, any place, anywhere

Financial benefits
Cloud brings benefits across a broad range of fiscal areas:

● **Reduced costs** Costs are lower using cloud services compared to bespoke build and maintenance systems
● **Reduced total cost of ownership** Only the capacity required is paid for, with faster resource availability, providing optimum support to the business
● **Reduced capital expenditure** IT is purchased as operational rather than capital expenditure
● **Costs aligned to business demand** Cash flow is improved by spending only when services are required.

Responsiveness benefits
Cloud ensures the organization is more responsive to business requirements through:

● **Instant on** Computing resources and systems are available immediately when needed by the business functions
● **Universal access** Cloud ensures applications and data are available any time, any place, anywhere
● **Agile provisioning** Cloud provides the ability to react to changing business requirements through the rapid delivery of appropriate IT operational resources.

Photograph: Shutterstock

These benefits of operating in the cloud should, however, be weighed up and mitigated against the associated risks. The most common issues can be summed up through the following:

- **Business information security**

- **Data residency and legal jurisdiction**

- **Regulatory compliance**

- **Concerns about vendor lock-in**

- **Interoperability across multiple cloud services and providers.**

(Chapter 3 assesses these risks in more detail.)

The adoption of cloud is therefore not just an IT issue; it is of concern to and impacts all parts of the business. Take for example email: to many organizations moving this to the cloud would be an unacceptably high-risk strategy because of the risk of loss or abuse of sensitive information.

Numerous commercial and regulatory considerations must also be evaluated before a cloud solution can be implemented, including the location of corporate data and the repercussions it will have on legal jurisdiction and compliance. The impact on business processes and the ability of the business to react to changing market conditions after a cloud service has been implemented must also be assessed.

The adoption of cloud is not just an IT issue; it is of concern to and impacts all parts of the business

Having considered the benefits and risks of adopting cloud for the business, is there a simple rule of thumb governing what can be put in the cloud and when? Chapter 4 of this guide outlines a framework that allows an IT organization to model what can be moved to the cloud. But, in general, the advice is:

- Critical and confidential data or information needs to be processed and held inside secure private systems; this could be held on a private cloud on customer premises or in a service provider's data centre

- Less critical and confidential data or applications could be held in a shared community cloud where the cloud service is shared with a controlled group of other cloud users

- Public domain, non-critical information that does not place the company at risk can be held outside the organization in the public cloud.

The business benefits of cloud

The table below outlines the business benefits of cloud – which, of course, is what it's all about – and highlights which particular cloud services can provide that benefit (Cloud Speak on page 57 provides definitions for the terminology used below). It is important to note that the magnitude of the benefit will depend on the maturity of an IT department's outsourcing commitments. For example, an organization on its second generation stage of outsourcing is likely to achieve less cost reduction than one on its first generation – or, indeed, one that has never outsourced at all.

Business benefit	IaaS	PaaS	SaaS	DaaS	BPaaS
Overall cost reduction of IT: The same – or better – IT capability is delivered for less money	✓	✓	✓	✓	✓
Pay at the point of use: Business spending on IT shifts from capital expenditure to operational expenditure	✓	✓	✓	✓	✓
Costs are linked to demand: IT costs rise and fall, directly reflecting changing levels of demand, rather being set to meet peak levels	✓	✓	✓	✓	✓
Fast deployment of new applications: Applications are available to the business quicker, allowing IT to be more responsive to new business requirements	✓	✓	✓		✓
Robustness of IT, through better testing: New or upgraded applications and other system components can be exhaustively tested at real-world scale, without threatening live systems or excessive cost		✓		✓	
Consistency of delivery: Processes common to different business units are addressed through consistent, repeatable solutions	✓	✓	✓		✓

Table continues on next page...

Business benefit	IaaS	PaaS	SaaS	DaaS	BPaaS
Scalability: IT resources can be instantly added – or retired – as business demand shifts	✓	✓	✓	✓	✓
Deployment of business functionality: New features can be rolled out across the business, frequently and consistently			✓	✓	✓
Improved business decisions: By providing access to more complete data sets and enforcing consistent business intelligence approaches, users are positioned to make better-informed decisions			✓	✓	✓
Process standardization: Best practice processes and sub-processes are applied and consistently executed across the organization			✓		✓
Setting the stage for BPO: By separating IT from the business service, the functional/people aspect of that service can more readily be outsourced					✓
Try before you buy: Organizations can trial a service, with minimal cost, before having to commit to full-scale adoption	✓	✓	✓	✓	✓
Development of some applications without IT group involvement: The use of business-oriented development tools enables users to create forms, reports, process orchestrations, etc		✓	✓	✓	✓
Multi-channel/platform support: Cloud systems are designed to deliver application functionality/ information to all widely used devices/channels			✓		✓
The wisdom of crowds: With multiple clients on the same cloud service, the larger volume of feedback means greatly enhanced quality and functionality			✓	✓	✓
Problem-free upgrades: Upgrades have minimal impact on the business users and business operations	✓	✓	✓	✓	✓

This table outlines **additional benefits** related to the location of the cloud service.

Additional benefit	Private cloud	Community cloud	Public cloud
Security: Ensuring security of the organization's intellectual property and sensitive data	✓	✓	
Collaboration across organizations: The ability to share data, application logic or services with other trusted organizations		✓	
Choice: Being able to compare multiple vendors, selecting the most appropriate one for the business		✓	✓

CIOs should map their organizations' overall business objectives to the benefits in the two tables. They can then be used as a guide towards the types of cloud services to focus on. Additionally for each application or business service, it is always necessary to create a business case that evaluates and justifies the migration, and then to review it throughout the lifetime of the service.
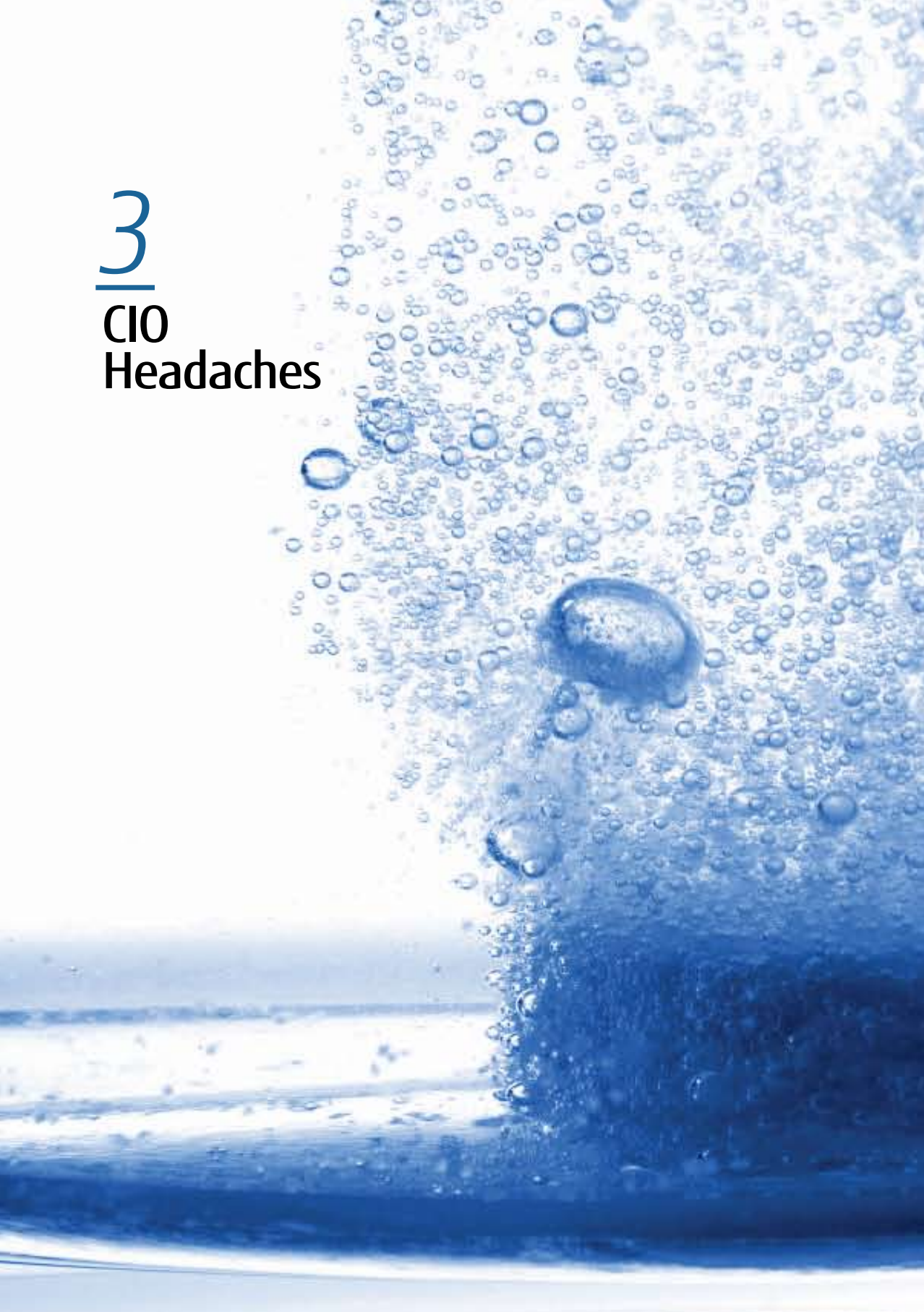
It is also important to note that the achievable benefits vary for each application or business service that is being migrated to the cloud, depending on several factors, including: the size of the service; service efficiency; the location of the cloud; the cloud variant being migrated to; and the nature of the business itself.

3

CIO
Headaches

Although moving to the cloud is not without its difficulties, with careful management these can be mitigated. What's more, the upsides can often far outweigh the headaches.

A recent survey of 100 CIOs and IT managers by Vanson Bourne, commissioned by Fujitsu, shows strong success rates for their early cloud projects. The executives report that, on average, they have experienced **24% cost savings** on their projects, with some achieving as much as **40%**. Of those that reported savings, **71% said cloud services met or exceeded their expectations**. Only 3% stated that they had seen no cost saving when moving to a cloud service.

This research indicates that, contrary to many industry warnings, early adopters of cloud have had a mostly positive experience – **more than two-thirds said they would recommend cloud services to a peer**. The research also shows that organizations have invested in private cloud ownership (73%), but to get the twin benefits of pay-as-you-go flexibility and zero operational risk, some organizations are using shared community clouds (30%).

However, the research also highlights areas of concern. And while these do represent major headaches for CIOs, they should not necessarily be considered as show-stoppers for their organization's move to cloud. Market solutions exist to help customers navigate the cloud and make the right choices at the right time to fulfil their objectives.

Early adopters have seen average cost savings of

24%

in their cloud computing projects

Photograph: Shutterstock

Top 10 barriers to cloud adoption
...and how to address them

1) Where and how should we use different cloud service providers?
There are many different types of cloud model, and whether you opt to
implement the full array from private through to public cloud, or choose to
selectively deploy cloud-based infrastructure, applications or business processes,
you will be faced with the conundrum of where to apply cloud in order to gain
the maximum benefit.

Approach: Consider all options and ensure the risk is evaluated (some
providers have dedicated professional cloud specialists who use their expertise
to determine which cloud services are suitable for achieving the best returns).
Transformation roadmaps are available to help with navigation to appropriate
cloud service providers and are designed to fit operational circumstances and
objectives. They also provide additional information on return on investment
for the organization's business approval processes.

**2) How do we integrate all of our cloud service providers, ensuring
continuity of service?**
Moving services to the cloud could mean contracting with many disparate
suppliers. Ensuring that the boundaries between service provisions have no gaps
is a major concern.

Approach: Adapt the service governance mechanism to cater for the cloud.
Create a map of contracts that identifies where the gaps and connections are
between services. When procuring a cloud service of a given type compare not
only the contracts of potential suppliers but the contracts with existing providers
to determine and mitigate any holes or risks. Ensure that your enterprise
architecture team identifies and resolves gaps in service. (Turn to Chapters 5
and 6 for further information on the impact of cloud on the service
management organization and the enterprise architecture function).

3) How do we ensure moving to the cloud makes commercial sense?
Comparing the costs and benefits of a cloud service against a traditional service
can be difficult because the two cost models are fundamentally different.

Approach: There are two parts of the equation to address here: cost and benefits. When considering the former, an effective approach is to create two cost models for the new service – one for the cloud provision and one for the traditional approach, calculating the costs over a three-year period. Include all costs (for example exit costs, which are often forgotten) and compare the total cost of ownership (TCO). But it's crucial to remember that TCO is not everything with cloud: moving to cloud brings other benefits, such as agility and scalability, that may outweigh any additional costs and should be factored into the analysis.

4) Will we face a lack of cloud engineering and commercial skills?
Currently, there are limited cloud skills within the IT marketplace. Many existing IT staff find it hard to favour a cloud approach over a more traditional approach.

Approach: Focus on your core architecture team first, and develop it through recruitment or training to embrace and adopt cloud. You can then use this team as mentors. It makes sense to align one of the commercial team with potential cloud contracts, and get the architecture team to mentor and work with that individual to develop suitable deals. Revamp your IT leaders' skills to cater for cloud, while developing the expertise of specific commercial decision-makers.

5) How do we avoid being locked in to a particular supplier/vendor?
Vendor lock-in is a big concern, especially at the Software-as-a-Service (SaaS) level.

Approach: Ensure you have an exit strategy defined prior to signing on the dotted line. Also ensure that the contractual arrangements cater for novation, whether early or not. Take special care regarding data extraction, as large amounts of data could take a long time to repatriate, causing potential service interruptions.

6) How do we engage and manage suppliers?
In a cloud environment, where vendors are "hidden" behind the internet, how do we engage with – and successfully manage – them?

Approach: Due to the remoteness of the vendor in a public cloud scenario, the responsibility for managing the cloud estate falls to the service management function, which has to work closely with the enterprise architecture team to ensure there is suitable coverage and support for each business service.

TCO is not everything with cloud. The move brings other benefits such as business agility

Traditional outsourcing or service management companies are starting to provide "broker" services to fulfil this function on behalf of cloud users.

7) Will our business information be secure in the cloud?
If your organization's data is shared insecurely with an external supplier, rather than within your own internal systems, there is the danger of data loss and the risk of unauthorized access.

Approach: Be clear on what data could be migrated to the cloud and stored externally within a community or public cloud, and what data should be retained within a private or trusted cloud environment. The key is knowing what data you are allowing into the cloud and which type of cloud is suitable for that data. Sensitive data, for example, should only be stored and processed at specified data centers in a private or appropriate community cloud that is fully auditable. And, of course, data stored in any kind of cloud model needs to be securely backed up – this can be managed in-house or through a provider.

8) Where will our data be stored and what risk does that pose?
With public cloud computing an organization may not know where its data is being physically stored – it may not even be in the same country. This can be a problem when the organization is subject to data protection and governance laws and policies that require it to retain control over this.

Approach: Select a cloud partner able to provision data from identifiable and given locations. In the case of a private or community cloud, individual data centers can be assured. Some cloud providers can also ensure that customer data is not exported out of the country of origin, thereby ensuring that the legal jurisdiction governing the data is the same as that applied to data on premise.

9) Will cloud be reliable and fast enough for live business systems?
Once an organization's data is in a cloud, there is a potential risk of latency and difficulty in extracting that information.

Approach: Take steps to ensure you select a cloud service provider that delivers both the response times and the continuous availability that business users need – as well as the efficiency and flexibility benefits of cloud. Some cloud service providers will contract on performance SLAs, taking on this responsibility for you.

10) Our people don't have the time or knowledge to <u>move us to cloud.</u>
Who will set up our cloud? And can we trust them?
There are four areas to consider here:

i) In today's tough and challenging economic times, some service providers will simply not survive.

Approach: While this is unlikely to happen to the strong brands, it is a potential area of risk. Therefore, organizations should thoroughly assess vendor robustness.

ii) In many instances, organizations simply don't have the skillset to competently make the move to cloud-based services on their own.

Approach: IT departments and organizations can focus on their primary business objectives while a cloud provider manages the transition to cloud services, integrating and establishing the systems as a seamless part of the IT estate. Providers ensure effective transition to a fully working system, so customers can benefit from the cloud cost-savings and speed without the problems of establishing clouds themselves.

iii) How will we manage all the individual cloud services and providers? And how will our cloud be managed?

Approach: To ensure that cloud services continue to operate as an effective part of the IT service to business users, a cloud service "broker" would manage the day-to-day system management and ongoing supplier management of the individual cloud service providers. This would enhance cost-effectiveness as well as ensuring IT service levels deliver increasing value for money to customers.

iv) A provider may simply fail to deliver the required service.

Approach: In both (ii) and (iii) an organization should verify vendor viability through the proven and trusted methods adopted in choosing any outsourcer or managed service provider. Steps should also be taken to secure the protection of business data and application intellectual property rights (IPR).

4

Adoption
Approaches

There is no one-size-fits-all approach to adopting cloud computing and this section outlines the different "architectural patterns" that organizations should consider. It explains how an organization can choose the most suitable option for any specific application or service.

The starting point is to assess each application across key factors, such as: the suitability for cloud deployment; whether the requirement is for a migration to cloud or a new build; integration; and security and data issues. These need to be identified before applying the most appropriate architectural pattern.

Another consideration to take into account is the maturity of the organization's IT governance model. For a greater chance of success, it is vital that wider business functions such as legal, commercial and marketing are represented on the governance boards, where all business implications and risks will be highlighted.

It is vital that wider business functions such as legal, commercial and marketing are represented on cloud governance boards, where all business implications will be highlighted

Architectural and cloud patterns

Architectural patterns are a good way of adopting standard approaches to similar tasks. Once an appropriate pattern is selected it is applied to the target component and sets the context for the more detailed design, which then takes into consideration the implementation aspects of the component.

For cloud, the following patterns apply:

All-in cloud
This is where every aspect of the application resides within the cloud environment or is provided as a Software-as-a-Service (SaaS) application.

On-premise plus in-cloud
Part of the application resides in the cloud and part of the application is on the organization's own premises. This could be a horizontal split, i.e. the database and its contents reside in-house and the business/presentation application logic resides in the cloud; or a vertical split, where different modules reside in either location. This is a good pattern to use to maintain business-critical data or functionality in your own data center.

Presentation veneer
A new front-end is developed in the cloud to "represent" one or more legacy business applications in a more user-friendly format, typically aligned to the target business processes. For example, this pattern could be used to create a new variant of the organisation's website.

Timeline splitting (development, testing, production)
The above patterns may also apply but the cloud environment would be used for either development or testing prior to all or part of the business application being deployed on-premise. The benefits of this approach are speed of development and scalability of the testing and development environment.

Once an appropriate pattern is selected it is then applied to the target component and sets the context for more detailed design

Business migration

This is related more to the business users than the technology, but can have an impact on the organization's approach to cloud as far as some specific applications are concerned. A prerequisite for this pattern is for a business application to exist as a SaaS application on the internet. In this pattern, users and data are moved onto an existing SaaS business application, with little or no configuration/customization to the application. This potentially means that users will have to undertake a significant amount of learning to master the new application and existing business processes may have to be adapted to suit.

Service-oriented architecture (SOA)

This is already a recognized architectural pattern, using web services to access business logic and/or data. An application that is already built to an SOA pattern is typically easier to migrate to the cloud in whole or in part. As part of the organisation's governance a portfolio of business services should be maintained.

Data split

The data within the database is logically and physically divided into critical and non-critical. The non-critical data is then placed in the cloud and critical data is maintained on-premise. This pattern needs to be used with caution as it typically requires significant redevelopment of the application to allow it to access both data repositories. This approach can also be applied to other forms of data, such as email.

CIOs should also note that, for all of these cloud architectural patterns, non-functional requirements such as security, performance, data residency, etc, are critical and should be given due consideration when selecting the appropriate patterns.

A smart approach is to catalog "solution" patterns for each type of business demand (e.g. product release, website and event management). These should be tied into the organization's overall IT governance mechanisms.

The maturing cloud

As the cloud market evolves and matures, several key areas of concern will be addressed. This trend can already be seen in the area of Infrastructure-as-a-Service (IaaS) where secure trusted clouds have emerged as an alternative to open public clouds.

The IT function should monitor and, as appropriate, collaborate in the evolution of the following:

● **Interoperability standards** The creation of generic standards for managing services distributed across multiple cloud service providers

The IT function should monitor – and collaborate in – the evolution of interoperability standards across multiple clouds

● **Tools for managing multiple providers** For example, ensuring the organization has the capability to monitor and react holistically to changes in business services that span multiple cloud service providers

● **Common data exchange standards** For moving data between service providers

● **Common interface standards** At software, data and business process levels for invoking business logic.

The consumerisation of IT

There are several other IT trends that could impact an organization's cloud strategy. These trends have a close relationship with the evolution of the internet (and therefore the cloud) and, while they have already been proven
in the consumer world, they have not yet been fully adopted in a business context. They can be summarized as follows:

Social media replacing email With the arrival of "Generation Y" in the workplace, demand for collaboration technologies that provide Facebook®-like features is growing rapidly. The rise of these technologies will drive down the use of others, such as email. So when migrating messaging and collaboration to the cloud, CIOs need to consider the impact of these social media technologies.

"DIY" IT The trend for users to connect their own laptops to the organization's network is following a similar pattern to the move from the company car to car allowances. Under such a scheme, employees are given a budget to buy a device, such as a laptop, and are responsible for managing it. For this to work, an organisation's business applications would need to be web-enabled and have robust access control mechanisms and security in place (covering authorization, authentication and virus protection). From a cloud perspective, this trend would reinforce the move to web-based applications.

Application stores Successfully pioneered by Apple® with its App Store, the concept of having a marketplace for proven and tested applications is being seriously considered by many organizations. This is particularly true for organizations that have deployed corporate iPhones® and iPads®, with many looking to create company-specific, internal applications designed to drive productivity among their employees. Typically these applications are light and access back-end data stores via web services, making them ideal for inclusion in a cloud, multi-channel environment.

Mobile (multi-platform) support This trend parallels the app store trend. Employees and clients are increasingly demanding access to the same information or business logic via multiple devices. This needs to be taken
into consideration if moving that business application into the cloud.

Key considerations for CIOs

When moving applications or business services to the cloud, there are some major issues that all CIOs should consider carefully before acting:

1) What is the motivation for cloud?
Organizations need to understand why they are moving to cloud, as knowing the aim will help to guide crucial adoption decisions. Is the overall objective:
● Cost saving
● Fast deployment of business systems
● Providing the business with additional functionality and benefit
● The ability to quickly track business demand increases and decreases?

2) Start with data assessment
When evaluating an application or business service for migration into the cloud, start by assessing the data to see which data types can be migrated. How secure does the data need to be? Which data records can be migrated? For example, certain types of email such as finance-related ones may be secure and need to be on an internal system, while others, such as customer website registrations, might not need to be secure and can be placed in the cloud.

3) Prioritise applications
Focus on the applications that provide the maximum benefit for the minimum cost/risk. Measure the business criticality, business risk, functionality of the services and impact on data sovereignty, regulation and compliance. (See page 36 for the Fujitsu Cloud Assessment Model, which can be used to compare all applications within an organization's portfolio in order to help CIOs prioritize which applications to migrate to the cloud and in which order.)

4) Functional and non-functional requirements
When moving to a SaaS product, ensure that the functional requirements of the business are still met (or exceeded). Do not assume that the SaaS variant of any application provides the same functionality or fits into existing business processes. This will be easier if the organization doesn't currently use a similar application (but even then the evaluation is needed).

Additionally, there will be further functional requirements to consider, such as application integration and master data management. Moving to a SaaS application also has a significant impact on customers' expectations from a

It is essential to compare like-for-like cloud service providers for each application. Be aware that SLAs may be set at different levels

non-functional perspective, i.e. the amount of down-time for maintenance, availability hours, performance, data protection, etc.

5) SOA culture

One of the key enabling technologies for any form of cloud strategy is SOA. An organization that has a mature SOA culture (i.e. service catalogues, service introduction governance, an overall strategy for moving to SOA that is/has been implemented) will find it much easier to move more of its applications to the cloud. An organization without an existing SOA culture will take a little longer to gain all of the benefits of cloud across its whole application portfolio.

6) Consumption models

Each type of cloud service and each provider will have a different consumption model for how you procure and use the service. Some of the basic models, for IaaS for example, will involve a number of resources (typically virtual processing units) that are rented on an hourly metered basis. Some SaaS services are offered on a per-user, per-month basis. These consumption models need to be considered carefully from two perspectives:

● **Frequency of change** As processing units are procured and used on demand, they also need to be retired when they are no longer needed. If this isn't done, organizations will be paying for redundant units and end up with runaway costs. Managing this is a key responsibility of the service management function.

● **Volume** Especially with SaaS services, and sometimes in others, there is a tipping point where the cost of the service being procured on a per-user, per-month basis can exceed the cost of deploying the same or a similar application either in-house, or running on a Platform-as-a-Service (PaaS) or IaaS service. The service management function should monitor the economics of using a cloud service compared to direct ownership.

7) Data residency and legal jurisdiction

Although it may not be common knowledge among other business functions, most CIOs and their information managers know that business information stored outside its country of origin is subject to the commercial laws of the country in which it is held – and not the country in which it was created. Most organizations therefore decide to keep their data in the country of origin to ensure that the local country law still applies. The USA's Patriot Act is a concern for private enterprises and government departments: it states that data

managed by a US corporation can be accessed by the US government, regardless of where it is located. Organizations should check which legal jurisdiction will be invoked by their cloud provider and which court will be used for any service disputes. Obviously, disputes handled under a different jurisdiction and in a foreign court will always have added complexities and costs.

8) SaaS application maturity

Currently cloud application maturity is extremely variable from one application to the next. Many software applications exposed to consumers from the cloud are traditional software products that have had rudimentary security and access controls added and been published as a SaaS application. CIOs should be wary of such applications. They may, for example, address functional requirements and have basic security (which may or may not be applicable to your own security requirements), but may still store all of the data within a single repository, may not be resilient to denial-of-service attacks, or may not be easily configurable. A smart move is to determine whether the product was built from the ground up specifically for the cloud, or whether it is a converted application.

9) Data exchange and application interfaces

When it comes to data exchange and interoperability standards – which are vital for operating-related services across multiple cloud providers at different levels within the cloud services stack – the whole SaaS market is still very immature. And that extends to the actual process of extracting data. For example, a SaaS app may have an application programming interface (API) for extracting your data, allowing you to move it to another vendor, but you might have so much data stored in the SaaS applications data store that it is impossible to extract it without interrupting the service (see point 15, below).

When engaging with a cloud vendor, ensure the business case includes activities and costs that cover the end of the contract, novation and data-extraction. In the early stages of engagement, ensure your enterprise architecture team can identify what long-lasting data elements are being stored in the cloud service and how, when extracted, these can be transformed to an appropriate data structure for your organization. As well as a portfolio of business services, a catalog of application interfaces (typically web services) should also be maintained, facilitating an optimized reuse model when orchestrating business processes.

When migrating an application to the cloud, the API needs to be considered carefully. For example if a PaaS is being used, then it just needs to support the

Determine whether a SaaS product was built specifically for the cloud, or whether it is an existing app that has been converted

When engaging
with a cloud vendor,
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cover the end
of the contract,
novation and
data-extraction

API transportation mechanism, e.g. WebServices, REST, HTTP. However, migrating to a SaaS model needs more consideration because the SaaS service will, in all probability, have its own API for data interchange.

10) Development lifecycle impact
The development lifecycle of an application will be impacted when moving it to the cloud, mainly at the deployment stage. If the application is split to segregate the data from the application within the cloud, then this will impact the development lifecycle even more, as each element will need to be deployed separately. This could impact operations, even if only for a short time.

11) Performance
When moving to a distributed IT landscape with some functionality in the cloud, where there is integration between these cloud applications and on-premise applications, performance needs careful consideration. A potential increase in processing power may be necessary to ensure service delivery. Management must decide whether the new level of performance (and availability, see below) is appropriate, even though it could be lower than before. CIOs also need to ensure that their local and wide area networks are enabled for cloud and will support the associated increase in bandwidth and network traffic.

12) Availability
In a similar way to performance, availability will need careful assessment because an application that is all in the cloud, or distributed across the cloud and on-premise, will have different availability characteristics to the legacy, on-premise application.

13) Service integration
When moving an application to the cloud, continuity of service and service management must be considered. It's important to acknowledge that the service management role will evolve into a service integration role (see Chapter 5 for more on this). An alternative to the in-house service management function providing this capability is the use of an outsourcing organization, such as Fujitsu, to provide this function.

14) Volume
If demand for new applications or websites from the business is high, there is a good argument for creating a common, repeatable solution pattern that is

If demand for new apps or websites is high, there is a good argument for creating a common solution pattern based on the cloud

based on the cloud. This is especially the case if the applications or sites are transient – for example, marketing sites for new promotions.

15) Data migration

Moving data into or out of a SaaS application may require considerable transformation and load effort. This is especially the case if the data needs to be distributed across multiple tables/objects within the cloud application.

16) Service and transaction state

Maintaining the continuity of in-flight transactions at the point of transition into the cloud will need consideration. This will also be the case at the point of exit, of course.

17) Compare apples with apples

Once a strategy has been decided and it's time to go out to the market, it is essential to compare like-for-like cloud service providers for each application. While headline services, such as cost per server, might be the same or better, certain conditions within the smallprint may be excluded or SLAs may be set at different levels.

18) Decommissioning redundant systems

After migrating data and functionality from a system into the cloud, ensure that the legacy system is decommissioned after the cloud service is fully operational, to achieve all the targeted cost savings and prevent business users from migrating back.

Starting on page 36, the Fujitsu Cloud Assessment Model can help you to prioritize which applications to migrate to the cloud, and in which order...

When deciding which to the cloud, focus provide the ~~maximum~~ minimum cost and/or business criticality, services, business sovereignty, regulation,

applications to move on the ones that <u>benefit</u> for the <u>risk</u>. Measure the functionality of the risk and impact on data and compliance.

The Cloud Assessment Model

To assist in the assessment of which applications to move to the cloud, the prioritization of which ones to move first, and which target cloud services should be considered, Fujitsu has developed an assessment model. This allows CIOs to plot their application portfolio on a four-dimensional graph (see right).
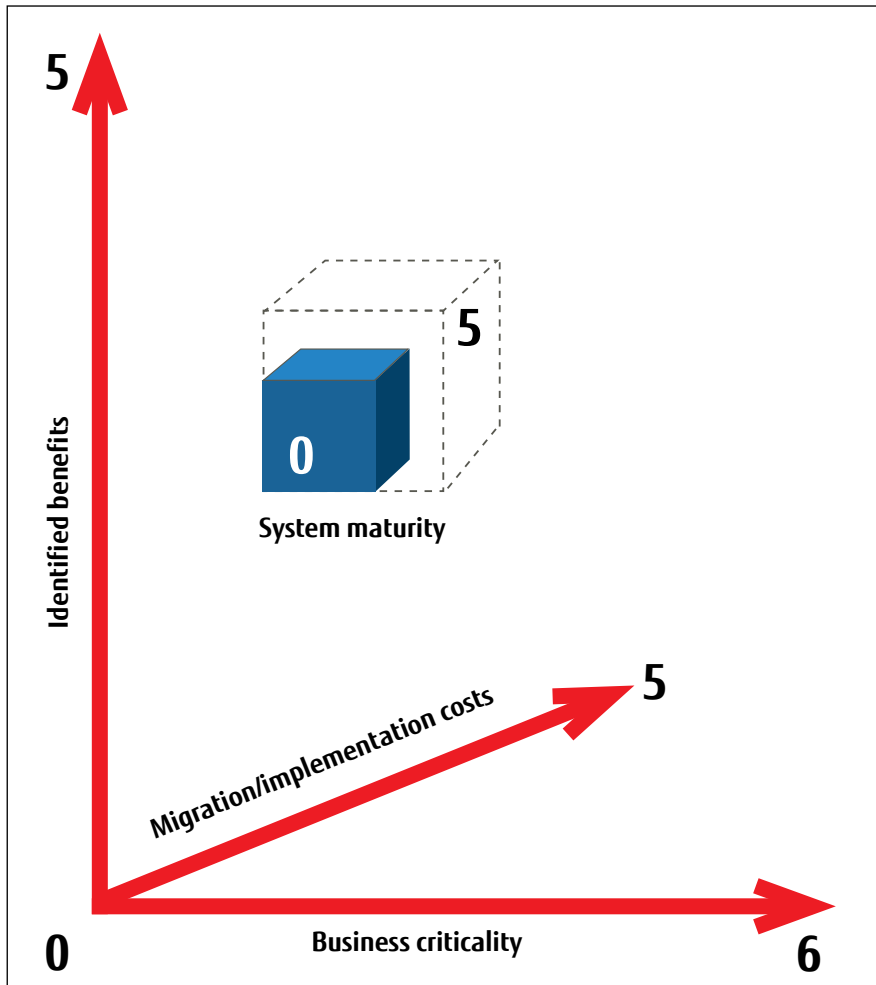
These scales are only indicators, and a more detailed assessment will be needed once the field is narrowed down. If you find that the scales are slightly different to your organisation's needs, then adjust the criteria accordingly.

Although risk is not explicit in the model, it is implied: systems in the top-right corner are likely to be less risky to migrate to the cloud, while providing the most benefit. Bottom-left systems exhibit a tendency towards minimal benefit with increased cost and risk.

A full migration assessment – including a detailed look at tangible and intangible benefits, cost and risk – should be undertaken for all candidate systems.

The tables on the following pages elaborate on the measurement criteria for each of the axes in the Assessment Model.

5

Identified benefits

5

0

System maturity

Migration/implementation costs

5

0 Business criticality 6

Business criticality

This is a measure of how important the business logic or information within the system is to the organization. Typically this revolves around sensitive customer data, or sensitive data/algorithmic intellectual property. For example, for a car manufacturer, the personal details of celebrity car owners may be business critical, but the time of an appointment for a test drive is less critical. Equally, financial reporting information would typically fall into the "critical" category.

	BUSINESS CRITICALITY SCALE	
1	Customer systems or systems with corporate IP	Systems that contain business intellectual property information (e.g. the design of a product, software code), sensitive customer information or corporate financial data.
2	Messaging & collaboration systems	Systems used for communication, e.g. email, instant messenger, social networking tools, collaboration environments, etc.
3	Presentation layer	The applications that present/aggregate/orchestrate functions and information to users, such as intranet, internet and extranet sites. Would also include mobile devices and other channels.
4	Corporate systems	Internal systems that provide supporting functions, e.g. employee benefits management systems.
5	Development & test environments	Temporary environments used for developing and/or testing new applications. Often aligned to IT projects.
6	Ancillary systems	Systems used for providing additional simple functionality, outside the core systems, e.g. market analyst sites, news sites, etc.

Most critical

Least critical

Identified benefits

This is a rough indication of the type and size of benefits an organization can expect to receive by moving this system to the cloud. A CIO should use this in line with the objectives of the business. (Note that the term "significant" should be used within the context of the organization, i.e. one person's "significant" can often be another person's annoyance.)

No benefits

IDENTIFIED BENEFITS SCALE		
1	No identified benefits	Migrating this system to the cloud provides either no benefit, or negative benefits.
2	IT cost savings	The only benefit of moving the system to the cloud is the reduction in IT costs.
3	Increased IT flexibility and responsiveness	Migrating the system to the cloud means that the IT department can be more responsive to associated change requests and flexible to the provision of new/different business requirements.
4	Additional business benefit	Moving the system to the cloud provides additional benefit above IT cost savings and/or IT flexibility. E.g. increased revenue, customer acquisition or brand enhancement.
5	Significant additional business benefit	Moving the system to the cloud provides significant additional benefit (or multiple additional benefits) above IT cost savings and/or flexibility. E.g. increased revenue, customer acquisition or brand enhancement.

Most benefits

Migration and implementation costs

This gives an indication of the cost to migrate applications to the cloud. (As for the Identified Benefits scale, the term "significant" should be used in context within your own organization.)

MIGRATION & IMPLEMENTATION		
1	Data segregation, application redevelopment and migration costs	The application needs to be split between the cloud and the premises, involving significant development and risk.
2	Significant application redevelopment and migration costs	The application needs modification for it to run in the target environment as well as data migration/ transformation.
3	Application redevelopment and migration costs	The application needs modification for it to run in the target environment.
4	Significant application migration costs	Costs associated with the migration of the system to the cloud are small, typically limited to moving the application and data across.
5	Minimal application migration costs	Costs associated with the migration of the system to the cloud are small, and are typically limited to moving the application across.

System maturity

This scale gives an indication of the complexity associated with making the system cloud-ready. When used in conjunction with the migration and implementation scale, it gives a good indication of the risk that can be attributed to migrating the system in question.

SYSTEM MATURITY		
1	Legacy system with proprietary API	Systems are old and hosted on old platforms, with APIs etc specific to the product.
2	Web service API	The system has a generic web services API that is easy to integrate to.
3	Tokenized security integrated into API	The users' security credentials are passed into the system via the messages being sent across the API.
4	System presented through portals	The system's API is extensive and can be easily reused in many ways by portal technologies.
5	System participates in web service orchestration	The system can co-operate automatically within a wider business process.

Oldest (left axis, top)
Newest (left axis, bottom)

This assessment model allows an organization to test its cloud strategy for robustness. Assessing each application against all of these scales will highlight which ones to prioritize for moving to the cloud and which ones never to move. This is only a guide, of course, and each application will require further detailed assessment at the design/implementation level, accompanied by a full business case for migration.

5

The Changing Role of the Service Management Organization

Moving to a cloud-based IT landscape will have a very large impact on the service management organization responsible for managing IT services – probably more than initially expected. Here are some important considerations to help manage this:

Service consistency

In an IT landscape that exploits the cloud to different degrees, the service management organization will need to pay close attention to ensuring continuity of the service level agreements (SLAs) throughout the initial transition to cloud and any subsequent moves. Moving to a cloud environment means accepting the SLAs and contractual terms of the provider, as opposed to stating them as initial requirements. This is a shift that impacts the initial assessment at the point of provider selection, making that process more complex. Additionally, it might be more beneficial to the organization to accept more relaxed SLAs than currently exist for a given service, without negatively impacting service delivery or continuity. Performing a market comparison in this environment is inherently more difficult and needs strong consideration.

Governance

All governance processes and policies will need to be reviewed in light of a move to cloud computing, to ensure they cater for the concept and do not inhibit the inherent benefits of cloud (speed to market being the main one). Existing processes, principles, etc should be modified to ensure they work for both cloud and non-cloud delivered services. However, it is inadvisable to create new processes solely for cloud.

Service brokering

The service management organization's role will have to factor in the need for the brokering of service provision across multiple services, and service providers, ensuring a consistent delivery of service with no gaps or overlaps. The service broker role also needs to establish how it is going to deal with monitoring the market for better service provision and switching vendors, almost dynamically, to maximize benefit.

The service broker needs to establish how it is going to deal with monitoring the market for better service provision and switching vendors to maximize benefit

Photograph: Photolibrary

43

Matching demand

The service management organization's role will need to involve the additional responsibility of "throttling" the usage of specific cloud platforms, especially Infrastructure-as-a-Service (IaaS) and Platform-as-a-Service (PaaS). It must have processes in place to address this, otherwise it will end up collecting vast amounts of unnecessary servers, storage systems, etc.

Managing application segregation

When application components are separated across multiple clouds or on-premise providers, the service management organization has a harder job of ensuring the business SLAs are met. It needs to work with the enterprise architecture team to ensure the appropriate interface standards are defined and adopted to support its business needs. For example, an interface that has financial transactions flowing through it needs to be more resilient than an SMS text message interface.

Service integration

The role of service integration becomes critical in an IT landscape that has adopted cloud, as services at many different levels are being delivered by many providers. The service management organization must have an effective function that brokers between all providers, ultimately ensuring that the business services are delivered effectively. To make this work, organizations need to mesh services together while maintaining the discipline that allows for a "plug and play" approach.

Service integration is the key to transforming the component service from being disjointed and IT-focused into being business-relevant, enabling and seamless. Companies can try to do this integration themselves – or, better still, they can entrust the role and risk to a third-party service integrator. This brings focus and market leverage, and allows the organization's IT function to concentrate its stretched resources on the needs of the business.

Whether operating with IaaS or with the complexities of a networked society requiring Business Process-as-a-Service (BPaaS), successful implementation of the service integration model will result in seamless, business-relevant, high-performing services, a high degree of flexibility to support ever-changing business needs and a significant strengthening of the bond between IT and business.

The service management organization must "throttle" the usage of specific cloud platforms otherwise it will collect vast amounts of unnecessary servers, storage systems, etc

Service integration is the key to transforming the component service from being disjointed and IT-focused into being business-relevant, enabling and seamless. Using a third-party integrator brings focus and market leverage

6

The
Changing
Role
of the
Enterprise
Architecture
Team

One of the most important roles in the introduction of cloud computing will be that of the enterprise architecture (EA) team. These people will need to lead the implementation of any cloud strategy and also deal with a lot of its implications. In a cloud environment, for instance, standards become much more important and the organization's data and applications become more loosely integrated across zones of differing security levels.

Articulating the benefits to the business
The EA team will need to lead and clearly articulate the benefits of migrating an application to the cloud – or developing a new application in the cloud – to all of the key stakeholders of that application. This is especially true for the instances where moving to the cloud, such as migrating from a legacy customer relationship management (CRM) application onto a cloud-based Software-as-a-Service (SaaS) CRM application, brings additional business benefits through the introduction of new functionality available in the new application. In the SaaS arena this will be managed by the EA team working with the business to help align business processes to these new applications.

Identification of migration candidates
Identifying the cloud migration candidates and selecting the most appropriate architectural model for each one will be the responsibility of the EA team. It will have to do this continually, with the strategic horizon shrinking from five or ten years to two to three years. This will make the EA role much more dynamic and increase the pressure on the team to show value quickly.

The importance of standards
When evaluating cloud migration, the EA team will need to ensure compliance with – and assess the impact of – appropriate standards, which typically will be related to application interfaces. In the early days of the journey, the team may need to accelerate its efforts in this area to ensure the appropriate standards are in place and that the governance processes for applications against those standards are rigorous.

The enterprise architecture team will need to lead and clearly articulate the benefits of cloud to all of the key stakeholders

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Managing the hybrid cloud model

In a hybrid cloud model – where an application is distributed across the cloud and an organization's own premises – the EA team will need to manage the situation carefully to ensure performance SLAs are met as well as making sure the application's architecture still meets all of the other key non-functional requirements, such as resilience.

Development processes

Once it has identified a candidate for migration, the EA team will need to work closely with the application development team to ensure the application's development lifecycle takes into account the new, cloud-based architecture. This is especially the case when migrating the test and validation function, across the company as a whole, to the cloud.

The team will need to manage a hybrid cloud model carefully to ensure performance SLAs are met

Once the EA team has demonstrated the success of a given application that has been migrated to or developed in the cloud, it will need to continually evaluate the situation to ensure this remains the case, as well as identifying new opportunities as the cloud market evolves. Having moved an application into the cloud so that it is running on Platform-as-a-Service (PaaS), for example, a new SaaS version of the application may be released by a vendor that delivers even more benefits.

Once the enterprise architecture team has demonstrated the success of a given application that has been migrated to or developed in the cloud, it will need to <u>continually evaluate</u> the situation to ensure this remains the case.

7

The
Future
of
Cloud

The cloud market is maturing rapidly. And as the market matures, so will IT departments' adoption of cloud. This can be seen by an organization's propensity to **move up the cloud stack** from one cloud service to another, from Infrastructure-as-a-Service (IaaS) towards Business Process-as-a-Service (BPaaS) – although it is possible to enter at any level.

While the **greatest value** in cloud services is found at the BPaaS level, organizations at the lower end of the stack should be wary of jumping straight there, as chaos can ensue. This should only be attempted by organizations that already have **mature governance mechanisms** (e.g. service principles, a patterns catalog, business services portfolio management, a services catalog and business representatives on architecture governance boards). The roles of the enterprise architecture and service management organization must also **evolve** to address these demands on the IT organization.

To maximize the benefits of migrating to cloud, CIOs and the IT organization should define, document and deliver their cloud landscape as **business services** that clearly encapsulate a **business process** with true **business outcomes**.

Customers will derive further value as their cloud adoption precipitates a natural **disaggregation of business processes**. For example, different initiatives may result in aspects of HR, CRM and ERP being delivered by separate cloud vendors. Interoperability standards will ensure processes from competing vendors will co-exist, allowing customers to pick and mix services to suit their business needs and budget. Any organization adopting cloud services must **continually evaluate** whether its current service provider is still the best option.

Photograph: Shutterstock

CIOs should define, document and deliver their cloud landscape as business services that clearly encapsulate a business process

Beyond Business Process-as-a-Service

By moving to BPaaS, organizations will create a consumption environment for encapsulated business processes and activities used in the day-to-day running of the business.

Fujitsu predicts that in the future organizations will operate at **the next level of process and business optimization** by leasing from an open marketplace multiple end-to-end processes and sub-processes that are pre-integrated, or inherently able to be integrated, into a full business model.

For example, an owner of an estate agent, accessing a service broker's hub, could select the "Organization-as-a-Service" option and **buy all the processes** for an estate agent (property promotion, property viewing scheduling, HR, payroll and so on) – pre-integrated to provide all that the company needs. They could even choose one particular service provider as their preferred supplier, and receive new modules that extend the scope of the business as these become available, say, for rent-to-buy or foreign property.

Typically, such consumers of services will subscribe to multiple brokered business services at a price and quality determined by business value. Providers will supply individual and/or integrated processes as a subscription service, i.e. using a pay-per-transaction model.

In effect, organizations will be able to consume entire business process sets to fulfil all of their business needs, adopting specialist or niche service providers to create **a cohesive suite of integrated services**. For example: in a "networked society", an agricultural cloud that senses environmental and human activity would provide production knowledge and data analysis throughout the whole supply chain – from the farmer, supplier and buyer through to the consumer.
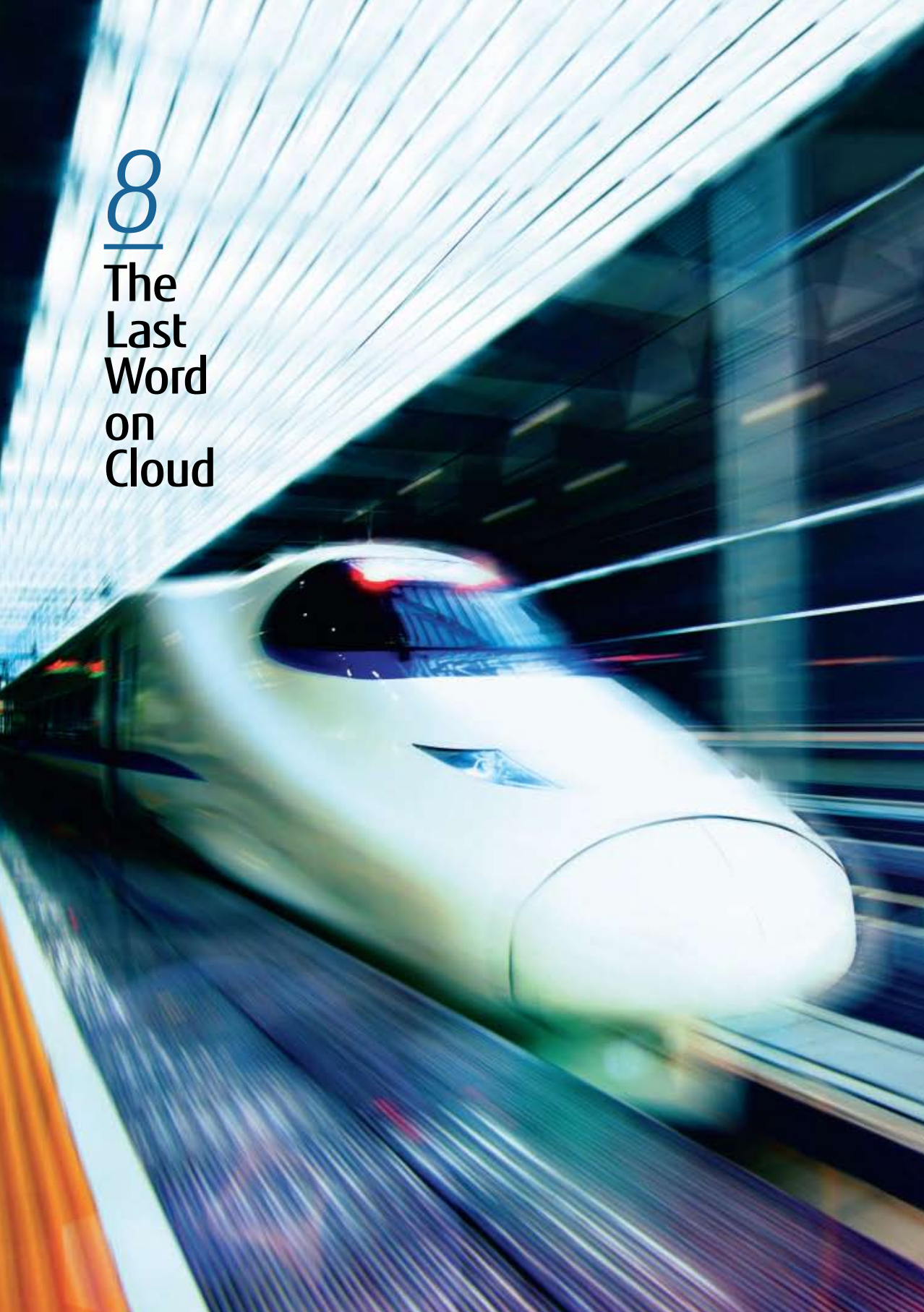
The speed at which service providers are "switched" in or out of customer environments will be much quicker and **service brokers will operate like a trading team** rather than a service management team, driving the provision of business process marketplaces instead of simple application stores.

In the future, organizations will lease end-to-end processes and sub-processes from an open marketplace. They will subscribe to brokered business services, integrated by service suppliers, at a price and quality determined by business value

8
The Last Word on Cloud

Cloud is here to stay. It is immature, but maturing fast. There are clearly benefits to cloud adoption, but the journey is complex and long, with implications for both the IT organization and the wider business.

Fujitsu analysis shows:

● Despite the hype, cloud is making serious inroads into enterprise IT. However, there is a lot of confusion about what cloud really means – the tendency to label everything "as a Service" (whether it really is or not) is a classic example of this

● Cloud has a certain set of characteristics, e.g. a pay-as-you-go model, with a taxonomy standardizing around two dimensions: business value (IaaS, PaaS, SaaS, DaaS, BPaaS); and the level of sharing (private, community, public)

● The main focus to date has been on cost reduction as the primary win when adopting cloud computing. There are, however, many additional business benefits to cloud – ranging from IT agility and responsiveness to new revenue opportunities

● CIOs' concerns about cloud are mainly in the areas of service interoperability, data security, residency and contracting

● Several architectural patterns can be applied to an application or business service for easier and more efficient migration to the cloud

● The roles of service management and enterprise architecture are impacted significantly by the move to cloud

● Cloud adoption will be evident across the spectrum of IT-enabled business services and will provide new levels of business efficiency

● The cloud journey will go even further – to "Organization-as-a-Service", where business services that meet all of an organization's needs are procured as a group.

Despite the challenges that the adoption of cloud computing may present, it is important never to lose sight of the many real opportunities that are there for the taking. With a carefully considered approach, genuine business benefits can be achieved in every organization.
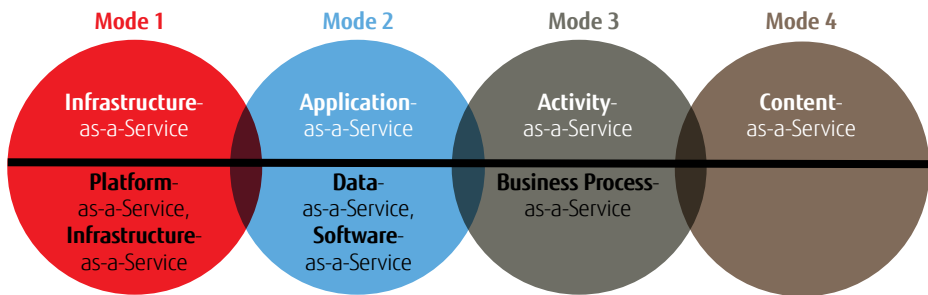
The main focus to date has been on cost reduction when adopting cloud computing. There are, however, many additional business benefits

Fujitsu in the cloud

At Fujitsu, we recognise that cloud is a means to an end – that end being the creation of business value. IT industry players must be serious about this – and not simply pursue cloud as a technology fad – since the ramifications will be felt across the whole of the sector and its customers. As a major global player,

Fujitsu is committed to delivering that value, and is investing heavily to create an evolving environment for cloud services that will benefit all IT consumers.

Cloud computing is therefore a key focus of Fujitsu's strategy and vision of the future. **Fujitsu president, Masami Yamamoto**, sums it up as follows: Through our strengths in leading technologies and networking, supplemented with partner capability, we have a vertically integrated end-to-end portfolio. This enables us to be the trusted cloud provider to the networked society.

Mode 1	Mode 2	Mode 3	Mode 4
Infrastructure-as-a-Service	**Application**-as-a-Service	**Activity**-as-a-Service	**Content**-as-a-Service
Platform-as-a-Service, **Infrastructure**-as-a-Service	**Data**-as-a-Service, **Software**-as-a-Service	**Business Process**-as-a-Service	

The Fujitsu cloud model defines four cloud consumption modes. In Mode 1, consumers seek to reduce their internal infrastructure estate and its operational and capital costs. Mode 2 provides the ability to move the application portfolio onto one or many of the infrastructure providers seen at Mode 1. Mode 3 offers the ability to select and subscribe to IT resources and business processes that match the workflow of the business. In Mode 4, consumers move to the next stage of process and business optimization by leasing both end-to-end processes and sub-processes from an open marketplace and subscribe to brokered business services integrated by service suppliers. We believe this model will underpin the choices an organization has to make to develop its business and operational strategy over the next five years.

This book has examined the various cloud platform options, highlighted best practice approaches to cloud adoption, and defined an assessment framework to help prioritize applications for cloud adoption. We hope it serves as a valuable guide as you and your management colleagues together seek to maximize the business benefits of the move to cloud.

Cloud computing is a key focus of Fujitsu's strategy and vision of the future

For more detailed information on the Fujitsu cloud strategy and how we can further assist your organization, please contact us at:
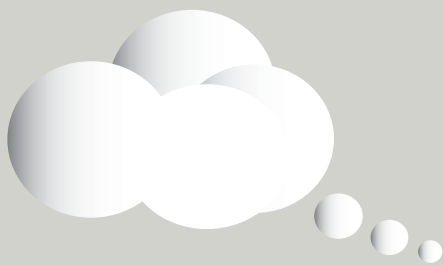*AskFujitsu@us.fujitsu.com*

Cloud Speak

In your journey to cloud, these are some of the key terms you are likely to come across. These definitions will also help in your discussions with other stakeholders in your cloud adoption program:

Application integration
Interfaces/converters enabling applications from different sources to interact.

Application programming interface (API)
An interface from which users can operate a cloud platform using their own programs and tools.

Architectural patterns
A design model that documents how a solution to a design problem can be achieved and repeated.

Azure®
The Micorsoft® Azure is a cloud services platform that enables the benefits   of cloud computing delivered in a familiar Windows operating system environment.

Business Process-as-a-Service (BPaaS)
Cloud-delivered business services that are aligned to business processes and associated measurable business outcomes.

Cloud application
An application that is never installed on a local computer and instead is only accessed in the cloud.

Cloud-oriented architecture (COA)
An architecture for IT infrastructure and software applications that is optimized for use in cloud computing environments.

Cloud provider
A service provider that makes a cloud computing environment – such as public cloud – available to others.

Cloud service broker
A third-party IT services partner who handles the day-to-day ongoing supplier management of an organisation's array of cloud service providers.

Community cloud
A private cloud for shared use by multiple organizations.

Data-as-a-Service (DaaS)
Data or information delivered from the cloud either as raw data sets or consumed through an analytics interface.

Desktop-as-a-Service
See Virtual desktop infrastructure.

Enterprise architecture
The definition for the structure of an enterprise (including its supporting technology) that maps out different business entities and the relationships between them.

Fujitsu cloud services
Services which provide a fully flexible model for IT infrastructure, platforms and applications, allowing companies to match technology systems and costs directly to changing business needs.

Fujitsu trusted cloud
A hybrid platform which combines the ease of use of public cloud with the confidence and security of private cloud. Services are hosted in Fujitsu data centers at a defined location with secure private connections to the network.

Hybrid cloud

The delivery of an IT landscape or business service from multiple, integrated cloud service providers.

Identity and access management (IAM)

Identifies and manages the data used in a system to authenticate users and grant or deny access rights to data and system resources.

Infrastructure-as-a-Service (IaaS)

Virtual systems services accessed over the network, providing compute and/or storage capabilities (a superset of Platform-as-a-Service).

Messaging-as-a-Service (MaaS)

Email and other communication tools delivered as a cloud service (typically over the internet).

Novation

The substitution of an existing contract with a new one through mutual agreement between the involved parties.

Organization-as-a-Service (OaaS)

A **set** of business services that meet all of an organization's needs, procured as a group and delivered using cloud infrastructure.

Platform-as-a-Service (PaaS)

A base of software services (web, application, database servers, enterprise service buses and other middleware) on which web service-based applications are built.

Private cloud

A cloud service commissioned and owned by an organization and delivered either by internal or third-party teams, or hosted externally by a provider as an IT outsourcing service.

Public cloud

A cloud service hosted on a common infrastructure, shared by different users or enterprises, with the location of applications and data typically unspecified.

Service-oriented architecture (SOA)

A software design approach resulting in functionally independent, interoperable services that can be reused in multiple applications.

Software-as-a-Service (SaaS)

Applications functionality provided as an on-demand service from cloud infrastructure.

Virtual desktop infrastructure

The provision of software to a PC or other device from a remote server. Also know as server-based computing. This is different to cloud in that it does not exploit all of the internet technologies, e.g. HTML and web browsers.

Web services

Application programming interfaces or web APIs that are accessed via the Hypertext Transfer Protocol (HTTP) and executed on a remote system hosting the requested services.

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