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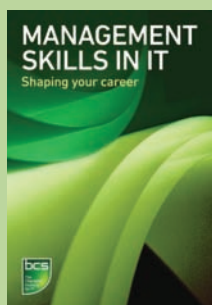
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**SECTION 1:
WHAT IS THE CLOUD?**

1 WHAT IS CLOUD COMPUTING?

An extract from a chapter in *A Manager's Guide to IT Law* by Stuart Smith, a solicitor in the Information Technology Team of Bond Pearce.

Cloud computing is best described as 'a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources [...] that can be rapidly provisioned and released with minimal management effort or service provider interaction'. National Institute of Standards and Technology (NIST).

Cloud computing consists of three different types of service provision. In each case the services are hosted remotely and accessed over a network (usually the internet) through a customer's web browser, rather than being installed locally on a customer's computer. Firstly, SaaS (software as a service) refers to the provision of software applications in the cloud. Secondly, PaaS (platform as a service) refers to the provision of services that enable customers to deploy, in the cloud, applications created using programming languages and tools supported by the supplier. Thirdly, IaaS (infrastructure as a service) refers to services providing computer processing power, storage space and network capacity, which enable customers to run arbitrary software (including operating systems and applications) in the cloud. These three elements are together referred to as the cloud computing 'stack'. This article concentrates on the issues surrounding the provision of SaaS.

The supply of IT services in the cloud has been enabled both by the evolution of sophisticated data centres and widespread access to improved bandwidth. These technical advances mean that services may be hosted on machines across a wide range of locations but, from the customer's perspective, they simply originate in the 'cloud'.

The cloud model enables customers to access, from any computer connected to the internet (whether a desktop PC or a mobile device), a multitude of IT services rather than being limited to using locally installed software and being dependent on the storage capacity of their local computer network.

This model of IT service provision is one that is growing exponentially. It is estimated that one third of all revenue generated in the software market today relates to the delivery of cloud computing services, and that the value of the UK cloud computing market could reach around £10.5 billion in 2014, up from £6 billion in 2010.

THE SERVICES IN THE CLOUD

The multitude of IT services available in the cloud include familiar web-based email services such as Windows® Live Hotmail® (Microsoft®), Yahoo!® Mail, Gmail® (Google), and the search engine facilities Google, Bing™ (Microsoft®), Yahoo!® and AltaVista®. They also include the social networking services of Facebook, Twitter, Friends Reunited, Bebo, Flickr®, YouTube, MySpace and LinkedIn®, which provide chat, instant messaging and file sharing services. But there are a growing number of other services available. Two examples from different ends of the spectrum are Zynga®, which provides online gaming services, and Wikileaks, which publishes and comments on leaked documents alleging government and corporate misconduct. These services are often provided free of charge to the user.

There are also a range of paid-for business-orientated IT services. These are provided by suppliers including Google, Microsoft®, Amazon, Salesforce.com® and Tempora. They offer a suite of services to assist with business management. Google offers Google Docs for word processing, Business Gmail for emails, Google Calendar for diary management and Google Sites for website management, and it even offers different editions of its applications for different sectors (education, governmental and 'not for profit'). Microsoft® offers Windows® Azure that allows users to build and host applications on Microsoft® servers (PaaS).

Amazon Web Services (AWS) offers its Elastic Compute Cloud (Amazon EC2), enabling customers to rent space on Amazon's own computers from which they can run their own applications. Tempora provides a time recording and profitability analysis system for creative agencies and professional service firms, and Salesforce.com® provides customer relationship management solutions.

THE EVOLUTION OF CLOUD COMPUTING

Long before the term cloud computing was coined, software suppliers were providing services to their customers from remote servers via internet-enabled computers. This was called Application Service Provision (ASP) and was the original platform of IT service delivery to emerge from the convergence of computing and communications in the mid-1990s. However, the ASP model ultimately was an experiment that failed. Firstly, it involved more complicated initial installation and configuration (at the customer end) than is involved with today's on-demand cloud services. Secondly, it originated as a means of providing software on a one-to-one basis rather than on the one-to-many (multi-tenant) basis of cloud computing, where one supplier has many customers. Consequently, ASP lacked the huge advantage that cloud computing enjoys of being very scalable.

The emergence of software as a service (SaaS) in around 2001 signified the beginning of software delivery based on multi-tenant architecture involving network-based access to software managed from a central location and removing the need for customers to install patches or upgrades.

The term SaaS is useful because it highlights the principal difference between the internet-based model of software provision and the more orthodox licence and

installation-based model. The latter involves a customer being granted a licence to use a software package, while the former involves the provision of a web-based service under a contract for services. There are considerable differences between a software licence and a contract for services.

CLOUD FORMATIONS

The cloud environment is subdivided into public, private, hybrid and community clouds.

- **Public clouds** are those in which services are available to the public at large over the internet in the manner already described in this chapter.
- A **private cloud** is essentially a private network used by one customer for whom data security and privacy is usually the primary concern. The downside of this type of cloud is that the customer will have to bear the significant cost of setting up and then maintaining the network alone.
- **Hybrid cloud** environments are often used where a customer has requirements for a mix of dedicated server and cloud hosting, for example if some of the data that is being stored is of a very sensitive nature. In such circumstances the organisation may choose to store some data on its dedicated server and less sensitive data in the cloud. Another common reason for using hybrid clouds is where an organisation needs more processing power than is available in-house and obtains the extra requirement in the cloud. This is referred to as 'cloud bursting'. Additionally, hybrid cloud environments are often found in situations where a customer is moving from an entirely private to an entirely public cloud setup.
- **Community clouds** usually exist where a limited number of customers with similar IT requirements share an infrastructure provided by a single supplier. The costs of the services are spread between the customers so this model is better, from an economic point of view, than a single tenant arrangement. Although the cost savings are likely to be greater in a public cloud environment, community cloud users generally benefit from greater security and privacy, which may be important for policy reasons.

SILVER LININGS AND THUNDER CLOUDS

The main benefits and drawbacks of cloud computing are as follows.

Advantages

Access to resources

The greatest advantage of cloud computing is the access it provides to the processing power of multiple remote computers. This enables customers to take advantage of greater computation speed and larger storage capacity than most organisations can provide on their premises and at a fraction of the cost.

Mobility

Customers can access the services from almost any location in the world because the services are web-based (and because of the advent of mobile devices). This can enable employees to access important business tools while they are on the move. For example, the employee can fill in a Tempora online timesheet whilst on a train, providing the rest of the business with access to that data in real time.

Easily scalable

Both the monthly subscription and 'pay as you use' charging models make it easy for the amount of service being provided to be increased or decreased. Should a customer want to increase the number of 'seats' included in its subscription to Tempora or the amount of megabytes of storage space rented from AWS, this can be done easily. The supplier simply provides access to additional users or increases the storage space available in exchange for higher monthly payments by the customer. The scalability of the cloud computing model makes it especially attractive to growing organisations with varying levels of demand for computer resources (e.g. where an organisation's website receives higher volumes of visitors at certain times of year).

Data security and storage capacity

Data security is of particular importance as lapses in procedure can cause severe financial and reputational damage. For the majority of organisations, the data security and data storage capacity offered by data centres is far superior to that which can be afforded in-house. This is because they specialise in the secure storage of data.

Cost savings

Most business-orientated cloud computing services are paid for and the payment model is usually a rental arrangement based on monthly subscription charges (per user or 'seat') or a 'pay as you use' system. This means that there is no large upfront payment as there would be with the purchase of a licence in the orthodox software licence model. Although there may be an initial setup or configuration fee, this is usually very low by comparison.

The monthly subscription charges will also usually include support and maintenance fees, which would be significantly higher in the orthodox software licence model. Also, customers do not need to invest in secure servers because hosting is provided by third-party data centres and is included in the subscription charge.

The 'pay as you use' system is of particular benefit to an organisation with peaks and troughs in its demand for computing resources. It is cheaper than paying for exclusive use of enough resources to meet peak demand when it is not required, as is the case where all computation is carried out by an organisation in-house.

Additionally, cloud services reduce the need for an organisation to maintain in-house expertise in their own technological infrastructure, which reduces IT costs.

Finally, cloud computing services do not represent a capital expenditure, so customers lose less if they switch suppliers.

Maintenance and support

The supplier will usually offer ongoing support services. However, remote hosting of the services makes the process of maintaining and supporting the services less intrusive for the customer. The supplier can handle backups, updates and upgrades automatically and remotely without visiting a customer's site. This will generally mean that maintenance and support can be carried out more quickly. In addition, customers are able to piggy-back on their suppliers' upgrades in computing resources and are not locked into using infrastructure purchased at great cost 10 years previously.

Environmentally friendly

It has been suggested that data centres are a 'green' alternative to in-house computing and this is a hotly debated topic. This is because servers in very large data centres typically run at around 80 per cent capacity, while an in-house server might run at five per cent capacity, to allow for peaks in resource demand; and a server running at five per cent capacity uses only slightly less energy per hour than one running at 80 per cent, while doing 16 times less computation. Nevertheless, it is probable that the existence of cheap and more easily accessible cloud computing architectures has increased the overall demand for computation, outstripping the energy-efficiency gains that have been made in data centres. One option is to choose a supplier that uses a data centre that makes use of solar technology or wind cooling, or a data centre that is based in an area where local electricity comes from a renewable energy resource.

Free trials

Some suppliers offer the opportunity to trial their product for a period without charge. This is made easier by the supplier's ability to terminate access at the end of the period and provides them with the opportunity to 'hook' the customer. This business model is sometimes referred to as a 'freemium'.

Disadvantages**Internet reliability**

Clearly where IT services are provided over the internet, lack of internet access or slow connections will hinder access to those services. Where those services are business-critical this can be a major problem. However, as internet access improves, this should be a diminishing concern. Also, it should be remembered that there is no guarantee of uninterrupted service even with locally hosted software applications or data storage, which can be rendered inoperable by defects or bugs.

Dependence on the supplier

With cloud computing the customer is dependent on the supplier for day-to-day access to the IT services rather than just for support and maintenance. If the supplier is in financial trouble, is reliant on an unstable subcontractor or is involved in litigation, its ability to provide the services may be affected. These issues could leave the customer without access to business-critical systems.

However, dependence on a supplier is a common concept for most organisations and the usual risk assessment can be carried out to mitigate that risk. Due diligence checks on the supplier may disclose whether it is, for example, in financial trouble and references can be sought from existing or past customers to establish whether

the supplier has a history of reliability. The customer can always seek to include certain measures in the contract to provide protection from the risks mentioned. Ultimately, if in too much doubt, the customer may need to choose an alternative supplier.

As part of supplier selection, the customer should consider what steps will be required to switch suppliers if this proves necessary. For example, what termination notice periods apply, how the customer's data will be retrieved from the supplier-controlled servers (including in what format) and what level of migration assistance is available from the supplier. Furthermore, it is prudent to establish what level of interruption to operations would be caused by switching suppliers; in other words, identifying how long it would take to get up and running with an alternative supplier.

Some cloud computing suppliers also provide IT services in the orthodox licence model. Where this is the case, it may be possible to agree that failure of the cloud computing service would trigger an orthodox licence of the software to be hosted on the premises by the customer.

Finally, there are also data protection and security concerns associated with cloud computing and these are discussed in more depth in Section 5, Security in the cloud.

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Published by British Informatics Society Limited (BISL), a wholly owned subsidiary of BCS, The Chartered Institute for IT, First Floor, Block D, North Star House, North Star Avenue, Swindon, SN2 1FA, UK.
www.bcs.org

PDF ISBN: 978-1-78017-130-2
ePub ISBN: 978-1-78017-131-9
Kindle ISBN: 978-1-78017-132-6

British Cataloguing in Publication Data.
A CIP catalogue record for this book is available at the British Library.

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Typeset by Lapid Digital Services, Chennai, India.