Plug IT In 3
Cloud computing

PLUG IT IN OUTLINE

LEARNING OBJECTIVES

1. Describe the evolution of IT infrastructure.
2. Describe the key characteristics and advantages of cloud computing.
3. Identify a use-case scenario for each of the four types of clouds.
4. Explain the operational model of each of the three types of cloud services.
5. Identify the key benefits of cloud computing.
6. Discuss the concerns and risks associated with cloud computing.
7. Explain the role of web services in building a firm's IT applications, providing examples.

Because the overall goal of *Management Information Systems* is for you to be an informed user of information technology, we devote this Plug IT In to a vital and cutting-edge topic: cloud computing. A working knowledge of cloud computing will enhance your appreciation of what technology can and cannot do for a business. In addition, it will enable you to make an immediate contribution by analysing how your organisation manages its information technology assets.

You will be using these computing resources yourself in your career and you will have input into decisions about how your department and organisation can best utilise them. Additionally, cloud computing can be extremely valuable to you if you decide to start your own business.

This Plug IT In defines the cloud as distributed computing services and presents many examples of how the cloud can be used for business purposes. However, the cloud also provides you with personal applications, and this Plug IT In can help you plan for your own use of the cloud. See IT's Personal: 'The Cloud' later in this Plug In.

PI3.1 Introduction

You were introduced to the concept of IT infrastructure in chapter 1. Recall that an organisation's *IT infrastructure* consists of IT components — hardware, software, networks and databases — and IT services — developing information systems, managing security and risk, and managing data. The organisation's IT infrastructure is the foundation for all of the information systems that the organisation uses.

Modern IT infrastructure has evolved through several stages since the early 1950s, when firms first began to apply information technology to business applications. These stages are as follows.

- *Stand-alone mainframes.* Organisations initially used mainframe computers in their engineering and accounting departments. The mainframe was typically housed in a secure area and only MIS personnel had access to it.
- *Mainframe and dumb terminals.* Forcing users to go to wherever the mainframe was located was time-consuming and inefficient. As a result, firms began placing so-called dumb terminals — essentially electronic typewriters with little processing power — in user departments. This arrangement enabled users to input computer programs into the mainframe from their departments, a process called *remote job entry*.
- *Stand-alone personal computers.* In the late 1970s, the first personal computers appeared. The IBM PC's debut in 1981 legitimised the entire personal computer market. Users began bringing personal computers to the workplace to improve their productivity — for example, by using spreadsheet and word processing applications. These computers were not initially supported by the firm's MIS department. However, as the number of personal computers increased dramatically, organisations decided to support personal computers, and they established policies as to which personal computers and software they would support.
- *Local area networks (client/server computing).* When personal computers are networked, individual productivity is substantially increased. For this reason, organisations began to connect personal computers into local area networks (LANs) and then connect these LANs to the mainframe, a type of processing known as *client/server computing*.
- *Enterprise computing.* In the early 1990s, organisations began to use networking standards to integrate different kinds of networks throughout the firm, thereby creating enterprise computing. As the internet became widespread after 1995, organisations began using the TCP/IP networking protocol to integrate different types of networks. All types of hardware were networked, from mainframes to personal computers to smart phones. Software applications and data could now flow seamlessly throughout the enterprise and between and among organisations.
- *Cloud computing and mobile computing.* Today, organisations and individuals can use the power of cloud computing. As you will see in this Plug IT In, cloud computing provides access to a shared pool of computing resources, including computers, storage, applications and services, over a network, typically the internet.

Keep in mind that the computing resources in each stage can be cumulative. For instance, most large firms still use mainframe computers (in addition to all the other types

BEFORE *YOU GO ON . . .*

1 Describe the evolution of the IT infrastructure in organisations.

of computing resources) as large servers to manage operations that involve millions of transactions per day.

Apply the Concept

Background

This section has shown how computer infrastructure has evolved over time. Early computing models were called 'terminal to host' and now a similar model is called 'cloud' or 'distributed computing'. It is helpful to understand how infrastructure models have changed so you can better predict how it may continue to evolve. The rise of mobile computers (smart phones) has driven much computing to servers to lessen the load on the smaller processors.

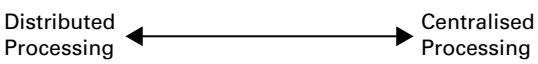
A key factor to distributed computing is the increasing bandwidth that allows for greater amounts of information to be sent over greater distances at greater speed.

Activity

Create two continuums that show the distribution of processing and storage as the models have changed. First, show the location of processing as either distributed (on a central server) or local (on the local machine), then show the location of storage as either distributed or local. As you build these, be sure to discuss the typical bandwidth that was available when these models were used.

Deliverable

Submit your continuum to your tutorial group. It will look something like the following.



PI3.2 What is cloud computing?

Information technology departments have always been tasked to deliver useful IT applications to business users. Today, however, for a variety of reasons, IT departments are facing increased challenges in delivering useful applications. This section begins with a look at problems that traditional IT departments face in delivering useful applications. In that way, when you learn about cloud computing, you will see how cloud computing can help organisations manage the problems that occur in traditional IT departments. You will also see why so many organisations are utilising cloud computing. The section continues with a definition of cloud computing and closes with an examination of the essential characteristics of cloud computing.

Problems facing traditional IT departments

Today, the world is experiencing a digital and mobile transformation, with more information available more quickly from more sources than ever before. As a result, businesspeople need IT-enabled services to help them handle this transformation and envision new opportunities.

Before you take a look at cloud computing, let's look at traditional IT departments in organisations and the problems they face. Today, most companies own IT infrastructure (their software, hardware, networks and data management) and keep them 'on premises' in their data centres, the traditional model of the IT function in organisations.

Traditional IT departments spend huge amounts on IT infrastructure and expert staff to build and maintain complex IT systems. These expenses include software licenses, hardware, and staff training and salaries. Typically, these expenses result in an infrastructure that often is not used to its full capacity. The majority of these expenses are typically applied to maintaining existing IT infrastructure, with the remainder being spent on developing new systems. In addition, companies are being buried in vast amounts of data

(which you learned about in chapter 3). Traditional IT departments are having difficulty capturing, storing, managing and analysing all this data. As a result of these problems, traditional IT infrastructures can actually inhibit an organisation's ability to respond quickly and appropriately to rapidly changing dynamic environments.

Large organisations can afford comprehensive enterprise software and top IT talent. These companies can buy or build software and install these systems in their data centres. They can enable their applications for use on different devices — desktops, laptops, tablets and smart phones — and make them accessible to employees wherever they are. These companies can also make their applications available to people outside the organisation, such as consultants, contractors, suppliers, customers and other business partners. Although large companies have these capabilities, their IT departments are often overtaxed and are not able to accomplish all these functions. Further, smaller organisations usually do not have the resources to accomplish these functions.

As you will see in the next section, cloud computing can help organisations manage the problems that traditional IT departments face. The next section defines cloud computing and discusses cloud computing's essential characteristics.

Definition of cloud computing

Cloud computing is a type of computing that delivers convenient, on-demand, pay-as-you-go access for multiple customers to a shared pool of configurable computing resources (e.g. servers, networks, storage, applications and services) that can be rapidly and easily accessed over the internet. Cloud computing lets customers acquire resources at any time and get rid of them the instant they are no longer needed. The essential *characteristics* of cloud computing are as follows.

Cloud computing provides on-demand self-service. A customer can access needed computing resources automatically.

Cloud computing encompasses the characteristics of grid computing. **Grid computing** applies the unused processing resources of many geographically dispersed computers in a network to form a virtual supercomputer.

- Grid computing enables organisations to utilise their computing resources more efficiently.
- Grid computing provides fault tolerance and redundancy, meaning that there is no single point of failure, so the failure of one computer will not stop an application from executing.
- Grid computing makes it easy to 'scale up' (add computers) to meet the processing demands of complex applications.
- Grid computing makes it easy to 'scale down' (remove computers) if extensive processing is not needed.

Cloud computing encompasses the Characteristics of utility computing. In **utility computing**, a service provider makes computing resources and infrastructure management available to a customer as needed. The provider then charges the customer for specific usage rather than a flat rate. Utility computing enables companies to efficiently meet fluctuating demands for computing power by lowering the cost of owning hardware infrastructure.

Cloud computing utilises broad network access. The cloud provider's computing resources are available over a network, accessed with a web browser, and able to be used with any computing device.

Cloud computing pools computing resources. The cloud computing provider's computing resources are available to serve multiple customers, with resources dynamically assigned and reassigned according to customer demand.

Cloud computing often occurs on virtualised servers. Cloud computing providers have placed hundreds or thousands of networked servers inside massive data centres called **server farms** (see figure PI3.1). Recall that a *server* is a computer that supports networks, enabling users to share files, software and other network devices. Server farms require massive amounts of electrical power, air-conditioning, backup generators and security. They also need to be located fairly closely to fibre-optic communications links (see figure PI3.2).

FIGURE PI3.1 A server farm.

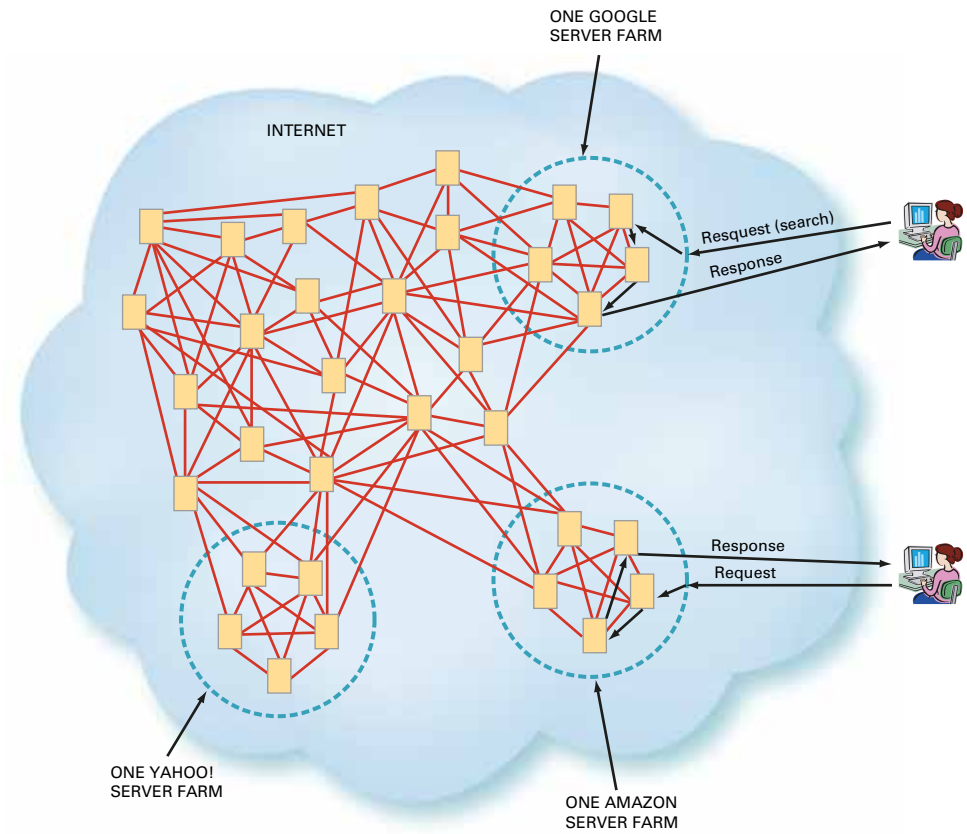


FIGURE PI3.2 Organisational server farms in relation to the internet.

According to Gartner Inc. (**www.gartner.com**), a research firm, typical utilisation rates on servers range from 5 to 10 per cent. That is, most of the time, organisations are using only a small percentage of their total computing capacity. CIOs tolerate this inefficiency to make certain that they can supply enough computing resources to users in case of a spike in demand. To help with this underutilisation problem, companies and cloud computing providers are utilising virtualisation.

Server virtualisation uses software-based partitions to create multiple virtual servers — called *virtual machines* — on a single physical server. Therefore, each server no longer has to be dedicated to a particular task. This arrangement enables multiple

applications to run on a single physical server, with each application running within its own software environment. As a result, virtualisation enables companies to increase server utilisation. In addition, companies see cost savings in two areas. First, they do not have to buy additional servers to meet peak demand and, second, they reduce their utility costs through reduced energy needs.

With cloud computing, setting up and maintaining an IT infrastructure need no longer be a challenge for an organisation. Businesses do not have to scramble to meet the evolving needs of developing applications. With cloud computing, up-front capital expenses and operational costs are reduced, and infrastructure is better utilised and shared from one project to the next. The difficult tasks of procuring, configuring and maintaining hardware and software environments are eased to a large degree by using cloud computing. Cloud computing allows enterprises to get their applications up and running faster, with easier manageability and less maintenance, and enables IT to more rapidly adjust IT resources (such as servers, storage and networking) to meet fluctuating and unpredictable business demand.

Businesses are employing cloud computing for important and innovative work. The next example shows how Amazon has successfully 'moved music into the cloud'.

EXAMPLE

An exciting example of cloud computing innovation in the US is Amazon's move towards online music storage. Amazon's music store has long been in competition with Apple's iTunes. Subsequently, they have looked for a competitive edge, and with the Amazon Cloud Player, as part of their Cloud Drive suite, they may have found it. Using Amazon Cloud Player means that customers can now house their music collection in the cloud, consolidating their tracks from all of their devices in one place for easy access anywhere with an internet connection.[1] This alleviates a number of teething problems associated with having iTunes libraries across various devices. For example, if a user were to buy a music track from iTunes on their home PC, they wouldn't be able to listen to it on their iPod without manually syncing the devices. Also, users with a large library of music would have to prioritise which music they would sync to their iPhone or iPod, due to finite device storage space.

To access their cloud-hosted music library, users simply log in to the Amazon Cloud Player web page (**www.amazon.com/clouddrive**) with their Amazon username and password.[2] Users can also stream any of the tracks from their music library on an Android phone without taking up any hard drive space. The player itself has a simple layout fairly similar to iTunes[3] or Spotify, and can be sorted into playlists, artists, albums and songs. Users can view album art, utilise the standard shuffle and repeat functions, and download tracks to their computer.[4] The Uploader app is perhaps the most important aspect, as it allows users to send the music files already on their computer to their online library so that they are accessible anywhere.[5]

Initially, Amazon offers each user five gigabytes of free space in the cloud, which could host roughly 1200 tracks in MP3 format, depending on individual file sizes. Users can purchase additional space if they choose, at the cost of US$1 per gigabyte per year.[6] Amazon offers an incentive to purchase music from their store, with a free additional 20 GB for the year with your first album purchase. This cost aside, users will have to factor in the cost of internet downloads that they use by streaming their music, and possibly be careful if accessing music via a limited cellular network.

While a limited app version was released in Australia in 2012 — somewhat ironically onto Apple's iPhone and iPod Touch devices — it does not have all of the features of the US Cloud Player. Users cannot purchase music through the app, but can stream or download music stored in their Amazon accounts or play existing music stored on their device.[7]

Amazon faces tough competition with its Cloud Drive, as many other companies offer similar systems. Apple (**www.apple.com/icloud**) and Google (**http://music.google.com**) offer similar services. Also, Rdio (**www.rdio.com**), Audio

Galaxy (www.audiogalaxy.com), Spotify (www.spotify.com) and GrooveShark (www.grooveshark.com) are all streaming services that offer some elements of the Amazon concept for less money.

Streaming services such as these are ideal for anyone looking for a digital collection of music with a vast range of tracks and the ability for users to pick and choose songs when and where they want to. Pandora and Spotify are considered the top music streaming services in the global marketplace. But which service is superior in terms of cost, availability and selection, personalisation and options for businesses?

Both services are free of charge; Pandora's free version is ad-supported and allows customers to listen to up to 40 hours of music per month. Upgrading this service will cost US$3.99 per month. Spotify's free subscription is ad-supported, but only works on PC and laptop computers. Upgrading to the Spotify Unlimited plan will cost customers AU$6.99 per month and offers unlimited PC and laptop playback, free of advertisements. In exchange for AU$11.99 per month, customers can upgrade to Spotify Premium, which lets customers stream music on any and all of their devices, plus save songs, albums and playlists for offline playback (see figure PI3.3).

Pandora's availability and selection service is available in the US, Australia and New Zealand; currently more than 65.6 million active users are part of Pandora.[8] However, Spotify is available in 55 countries and has more than 24 million active users, over 6 million of these paying for their subscription.[9] Using Spotify's service will allow customers to access songs from their iTunes library.

Pandora uses its 'music genome project' to provide customers with high quality customised music. Customers have the opportunity to create and customise their own library by entering their favourite artists, with Pandora subsequently creating a personalised radio station featuring similar music. Spotify offers a comparable service with Spotify Radio. When users click on the 'Radio' app, Spotify creates a playlist of music similar to the song currently playing, offering the user exposure to artists who create similar music. Users can then rate the tracks they are streaming with a thumbs up or a thumbs down, allowing Spotify to further hone in on his or her taste in music.[10] While Spotify is limited to personal, non-commercial use, Pandora offers a special service for business owners who want to stream music for their customers, offering access to all of Pandora's tunes and unlimited ad-free music. For $24.95 per month businesses can access all of Pandora's ad-free music, requiring just a DMX media player.

FIGURE PI3.3 Spotify Premium subscribers can access the music streaming service on any number of their devices by downloading the smart phone or tablet app.

In the next section, you learn about the various ways in which customers (individuals and organisations) can utilise cloud computing. These types of cloud computing include public clouds, private clouds, hybrid clouds and vertical clouds.

BEFORE YOU GO ON . . .

1 Define cloud computing.
2 Describe the essential characteristics of cloud computing.

PI3.3 Different types of clouds

There are three major types of cloud computing, representing different types of exclusive and nonexclusive clouds provided to customers or groups of customers. The three types are public clouds, private clouds and hybrid clouds. A fourth type of cloud computing is called vertical clouds.

Public cloud

Public clouds are shared, easily accessible, multicustomer IT infrastructures that are available nonexclusively to any entity in the general public (individuals, groups and/or organisations). Public cloud vendors provide applications, storage and other computing resources as services over the internet. Public cloud services may be free or offered on a pay-per-usage model.

Movirtu provides an example of a public cloud. Sharing mobile phones is a common practice among poor consumers in the developing world. Many customers use their own SIM card and switch it in and out when borrowing a mobile device. This practice can compromise privacy, however, and SIM cards are easy to lose.

Now, millions of impoverished citizens in Africa and Asia will receive mobile phone numbers under a plan developed by the United Nations and a private technology company, Movirtu. Movirtu (**www.movirtu.com**) is a cloud-based phone service that allows people to manage their own mobile network accounts — phone number, voice mail, texting and so on — without ever owning a phone or a SIM card. The Movirtu service is priced with lower income users in mind and the mobile network carriers will get a share of the profits.

Movirtu will supply low-cost mobile phone numbers to participants, who can use any mobile device to log in with their own number to make and receive calls and access information and services. The main beneficiaries will be women in rural communities in South Asia and sub-Saharan Africa, as they are far less likely than men to own their own phones.

Movirtu will bring the technology to 12 or more markets in the selected regions, improving the lives and expanding the earning potential of at least 50 million people. The company selected Madagascar, an island nation off Africa's east coast, as a starting point. The country has an extensive network, but many of its citizens cannot afford to buy a phone. The service became available via a local carrier throughout the island in August 2011.

Private cloud

Private clouds (also known as *internal clouds* or *corporate clouds*) are IT infrastructures that are accessible only by a single entity or by an exclusive group of related entities that share the same purpose and requirements, such as all the business units within a single organisation. With private clouds, IT activities and applications are provided as a service over an intranet within an enterprise. Private clouds are usually private because of the need for system and data security, and for this reason they are behind the corporate firewall.

BEFORE YOU GO ON . . .

1 Define public clouds.
2 Define private clouds.
3 Define hybrid clouds.

Hybrid cloud

Hybrid clouds are composed of public and private clouds that remain unique entities but are bound together, offering the benefits of multiple deployment models. Hybrid clouds deliver services based on security requirements, the mission-critical nature of applications and other company-established policies. For example, customers may need to keep some of their data in a private cloud, for security and privacy reasons, but it may be more economical to keep some other, perhaps less sensitive, data in a public cloud, because the cost of these is generally lower.

Vertical clouds

It is now possible to build cloud infrastructure and applications that are optimised for different business sectors — construction, finance or insurance businesses, for

example — thus offering specialised functions that best support industry needs and specifications. These highly specialised cloud computing solutions are called vertical clouds (see **www.vertical-cloud.com**).

Apply the Concept

Background

This section describes public, private and hybrid clouds. Specifically, it describes a public cloud used in developing countries to help protect the privacy of mobile phone users.

There are many other public cloud examples. Amazon, Apple and Google are some of the bigger names in cloud services for personal use. These provide storage for files and access to music and videos. Google also offers document modification in the cloud. Dropbox is a popular file storage and sharing service. In fact, Dropbox integrates so well with different platforms, it may be the most popular storage service available.

Activity

Visit the Dropbox website (**www.dropbox.com**). You can sign up for a free account that (at the time of writing) is about 2GB. There are many free services that Dropbox offers such as mobile apps, file sharing and photo sharing.

First, you will need to sign up for a free account. Next, create a Word document about the services Dropbox provides and upload this document along with a screenshot of the Dropbox website. Create a folder named 'Plug IT In 3.2' and move the files into the folder. Then share the folder. This should generate a link that will allow you to share the folder with other people by email.

Deliverable

Share the link provided by Dropbox with your tutorial group.

PI3.4 Cloud computing services

Cloud computing providers offer their services according to three service models: infrastructure-as-a-service (IaaS), platform-as-a-service (PaaS) and software-as-a-service (SaaS). These models represent the three types of computing generally required by consumers: infrastructure to run software and store data (IaaS), platforms to develop applications (PaaS) and software applications to process their data (SaaS). Figure PI3.4 shows the differences between on-premises software, infrastructure-as-a-service, platform-as-a-service and software-as-a-service.

ON-PREMISES SOFTWARE	INFRASTRUCTURE-AS-A-SERVICE	PLATFORM-AS-A-SERVICE	SOFTWARE-AS-A-SERVICE
CUSTOMER MANAGES: Applications, Data, Operating system, Servers, Virtualisation, Storage, Networking	CUSTOMER MANAGES: Applications, Data, Operating system VENDOR MANAGES: Servers, Virtualisation, Storage, Networking	CUSTOMER MANAGES: Applications, Data VENDOR MANAGES: Operating system, Servers, Virtualisation, Storage, Networking	VENDOR MANAGES: Applications, Data, Operating system, Servers, Virtualisation, Storage, Networking
Examples	Amazon, IBM, Google, Microsoft, Rackspace	Microsoft Windows Azure, Google App Engine, Force.com	Salesforce.com, Google Apps, Dropbox, Apple iCloud, Box.net

FIGURE PI3.4 Comparison of on-premises software, infrastructure-as-a-service, platform-as-a-service and software-as-a-service.

Note that as you look at the figure from left to right, the customer manages less and less, and the vendor manages more and more.

There are similarities across these three service models. First, customers rent them instead of buying them, shifting IT from a capital expense to an operating expense. Second, vendors are responsible for maintenance, administration, capacity planning, troubleshooting and backups. Finally, it is usually fast and easy to obtain more computing resources (i.e. scale) from the cloud — for example, more storage from an IaaS vendor, the ability to handle more PaaS projects or more seats for users of a SaaS application.

Infrastructure-as-a-service (IaaS)

With the **infrastructure-as-a-service** (IaaS) model, cloud computing providers offer remotely accessible servers, networks and storage capacity. (IaaS is also referred to as *hardware-as-a-service*.) IaaS providers supply computing resources on demand from their large pools of such resources located in their data centres.

IaaS customers are often technology companies with IT expertise. They want access to computing power but do not want to be responsible for installing or maintaining it. Companies use the infrastructure to run software or simply to store data.

To deploy their applications, IaaS users install their operating system and their application software on the cloud computing provider's computers. With IaaS, customers can deploy any software on the infrastructure, including different operating systems, applications or development platforms. The IaaS user is responsible for maintaining their operating system and application software. Cloud providers typically bill IaaS services on a utility computing basis — for example, cost reflects the amount of resources consumed.

As an example, Amazon sells the spare capacity of its vast IT infrastructure to its customers in a cloud environment. These services include its Simple Storage Service (S3) for storing customers' data and its Elastic Compute Cloud (EC2) service for operating their applications. Customers pay for only the amount of storage and computing they use.

Platform-as-a-service (PaaS)

In the **platform-as-a-service** (PaaS) model, customers rent servers, operating systems, storage, databases, software development technologies (such as Java and .NET), and network capacity over the internet. The PaaS model allows the customer to run existing applications or develop and test new applications.

PaaS offers customers several advantages, which include the following.

- Application developers can develop and run their software solutions on a cloud platform without the cost and complexity of buying and managing the underlying hardware and software layers.
- Underlying computing and storage resources scale automatically to match application demand.
- Operating system features can be upgraded frequently.
- Geographically distributed development teams can work together on software development projects.
- PaaS services can come from diverse sources anywhere in the world.
- Initial and ongoing costs can be reduced by the use of infrastructure services from a single vendor rather than maintaining multiple hardware facilities that often perform duplicate functions or suffer from incompatibility problems.
- Infraworx (**www.infraworx.com**) is a private company based in Sydney, Australia which specialises in cloud storage and infrastructure solutions. Infraworx PaaS (platform-as-a-service) offers a computing platform solution as a service. It facilitates deployment of applications without buying and managing the underlying hardware and software. This platform will let developers write and design certain types of applications that can run in the cloud, or even use this service via the cloud.

Software-as-a-service (SaaS)

With the **software-as-a-service (SaaS)** delivery model, cloud computing vendors provide software that is specific to their customers' requirements. The SaaS model is the

largest and it provides a very wide range of software applications. The pricing model for SaaS applications is typically a monthly or yearly flat fee per user.

These applications reside in the cloud instead of on a user's hard drive or in a data centre. The host manages the software and the infrastructure that runs this software and that stores data. The customers do not control the software, beyond the usual configuration settings, or the infrastructure, beyond changing the resources they use, such as the amount of disk space required for their data. This process eliminates the need to install and run the application on the cloud user's own computers simplifying maintenance and support.

What makes a SaaS application different from other applications is its ability to scale (i.e. access increased computing resources). This process means that applications can run on as many servers as necessary to meet changing demands. This process is transparent to the cloud computing user.

To reduce the risk of an infrastructure outage, SaaS providers regularly backup all data, across all customers. However, customers can also back up their own data on their own storage hardware.

For example, Flextronics (**www.flextronics.com**) is using SaaS from Workday for some of its human resources management function. Flextronics is the Singapore-based manufacturer of such electronics as Research in Motion's BlackBerry handsets and Microsoft's motion-sensing Kinect add-on for the Xbox 360 gaming console. The chief information officer of Flextronics knew he was taking risks as he handed over the human resources computing tasks for his 200 000-employee company to Workday (**www.workday.com**), an outside provider. What would happen, for example, if Workday lost sensitive employee data?

Workday handled Flextronics's human resources processes from tracking employee compensation and benefits to hiring for open positions. By outsourcing to Workday rather than handling HR computing in-house with on-premises IT infrastructure, Flextronics was able to save $100 million in three years and employee information remained secure. These expense reductions were critically important at Flextronics, which has an operating margin of only 2.9 per cent.

A subset of the SaaS model is the *desktop-as-a-service* (DaaS) model. In the DaaS model, a SaaS provider hosts a desktop personal computer software environment, including productivity and collaboration software–spreadsheets, word processing programs and so on such as Google Apps, Microsoft 365 and other products. The DaaS model means that only a thin client can access all the required software. The DaaS model can be financially advantageous for the consumer. Also, it simplifies deployment and administration of the PC environment. DaaS is also known as a *cloud desktop* or *desktop in the cloud*.

BEFORE *YOU GO ON . . .*

1. What is infrastructure-as-a-service?
2. What is platform-as-a-service?
3. What is software-as-a-service?

IT'S PERSONAL: 'THE CLOUD'

This Plug IT In defines the cloud as distributed computing services and presents many examples of how the cloud can be used for both personal and business purposes. This IT's Personal is intended to help you differentiate between the business and personal applications of the cloud and help you plan for your own use of the cloud.

First, you need to understand that there is no single 'cloud' but that almost all businesses call their internet-based services 'cloud services'. Basically, anything you do over the internet that you used to do on a local computer is a form of cloud computing. When you store files on Dropbox, create a document with Google Docs, use iCloud to store purchases or sync documents, or use OnLive on your tablet, you are using cloud-based services intended for personal use.

Infrastructure-as-a-service is an important application of the cloud for personal purposes. Dropbox is one of the most prominent companies in this area. In the past, users had to carry around a USB drive, CD, external hard drive or (way back in the day) floppy discs to store their personal information. At the time of writing, a free Dropbox account offers 2 GB of online storage. Not only does this offer you a place to store your files (eliminating the need for personal infrastructure of removable storage), but it provides synchronisation across computers and access from mobile devices.

Virtualisation is gaining ground. If you have an iPad you should look up the app called 'OnLive' and give it a test run. It allows you to log into a virtual computer that is running Windows 7. Here, your iPad is simply providing the input/output and the server is 'serving up' a virtual

operating system. It is very likely that one day your home computer will be virtual as well.

Software-as-a-service has been a popular option for quite some time. Google Docs have offered internet-based word processing, spreadsheet, presentation, forms and drawing tools for quite some time. Recently, Microsoft has moved into the game with their Microsoft Office 365 product. Basically, each of these services allows you to use a computer program without having to install it on your computer or mobile device. You simply access the entire program (and your saved files) over the internet.

Google recently combined a couple of these cloud services with Google Drive, a service that offers the same services as Dropbox with the addition of their online Google Docs editing and sharing of files. This also crosses over with software-as-a-service because of the added benefit of Google Docs. It is very likely that one day Google will try again with its Chrome Notebook, which would merge virtualisation, infrastructure and software into one cloud-based service. When this happens, all you will need as a consumer is an internet-connected device and you will be able to store, access, edit and share your files from the cloud. You will also be able to choose apps to run on your 'virtual machine' much the way that today you go through a vendor-approved store to purchase applications for your mobile devices.

So what is the point? Cloud-based services are here to stay. The rise of ubiquitous internet access has brought a new world of possibilities. As you move into your future, you need to pay close attention to privacy statements and internet security. Because your files, apps and editing capability will no longer be stored on a local machine, they are only as safe as the company you have trusted them with makes them. Be sure you choose wisely!

Apply the Concept

Background

Software-as-a-service (SaaS) is growing at a very rapid pace. More and more applications are being made available where companies just subscribe to the service rather than purchasing, installing and maintaining the software. This makes it easier on the purchasing company because it does not have to manage updates, patches and so on. They are all just rolled out by the host/providing company.

Activity

Search some industry examples of SaaS. Choose one and learn all you can about it. Research some companies that offer software for purchase that performs the same function. For example, if you choose to read about 'Payroll' SaaS, you may also research ADP's Payroll solutions to compare.

Deliverable

Prepare a brief summary of your comparison of the SaaS solution you chose and the one that is installed and run locally. Is there any reason you would pick one over the other?

PI3.5 Cloud computing benefits

Cloud computing offers benefits for individuals and groups. It allows companies to increase the scale and power of their IT and the speed at which it can be deployed and accessed. It eliminates administrative headaches and works across locations, devices and organisational boundaries.

Cloud computing has changed both business and everyday life — from consumers who use it to access their favourite music to companies that harness its powerful resources. When utilised effectively, cloud computing capabilities offer numerous opportunities to businesses to drive innovation. Organisations are exploiting cloud computing to transform both product and service development and strengthen customer relationships.

Organisations of all sizes, across geographies and in virtually every industry are using cloud computing as a way to reduce the complexity and costs associated with traditional IT approaches. Nearly half of the respondents in a recent CIO Economic Impact

survey indicated that they evaluate cloud computing options first — over traditional IT approaches — before making any new IT investments.

In Australia, there has been a shift to move to 'cloud first' policy, which is similar in the US and Britain. This policy encourages businesses and customers to design and implement cloud computing in their work, not only for the private sector but for public and government levels as well. Australian cloud computing companies currently offer an array of services and assistance to their clients, but privacy and data security are still a crucial part of their strategy and business.

Adopting cloud computing in businesses will lead to mobility, versatile compatibility, a 'pay for what you need' mentality and increased individuality. However, cloud computing can bring some disadvantages, arising from having less control, inadequate space and more potential for security and confidentiality breaches.

Organisations are not only relying on cloud computing to enhance internal efficiencies, but also to target more strategic business capabilities. IBM predicts that the global cloud computing market will grow 22 per cent annually to US$241 billion by 2020.

Benefit 1: making individuals more productive

Cloud computing can enable companies to ensure that their employees have access to all the information they need no matter where they are, what device they are using or whom they are working with.

Cloud computing provides a way for organisations to 'hide' some of the complexity of their operations from end users, which can help attract a broader range of consumers. Because complexity is hidden from the end user, a company can expand its product and service sophistication without needing to increase the level of user knowledge to utilise or maintain the product or service.

For example, global contractor Balfour Beatty (**www.balfourbeatty.com**) is using cloud computing to allow its employees access to the information they needed to do their jobs. The company's design and construction professionals spend much of their time on job sites overseas, where they needed instant and reliable access to cost estimates, photos, blueprints and other large files. For ten years, Balfour had been managing uploads and downloads of all these documents with an internal FTP (file transfer protocol) server maintained by its IT department, which was difficult to use and constantly running out of capacity.

Therefore, Balfour turned to Box (**www.box.com**), a provider of cloud-based content management and file sharing. Balfour employees can now access resources stored on Box via a web browser located on computers, tablets and smart phones.

Although the firm had implemented Box to allow easier access to its information, it quickly realised that Box had other advantages as well. With the old system, the IT department had to sign up each new user and create a unique folder for him or her. If a user wanted to invite a collaborator into that folder, the request also had to be routed through IT. With the cloud-based solution, users could administer their own accounts and digital properties, saving valuable time. Overall, the Box cloud-based solution significantly improved productivity at Balfour.

Benefit 2: facilitating collaboration

Cloud computing enables groups and communities to work together in ways that were previously not possible. Cloud computing facilitates external collaboration with business partners and customers, which can lead to improvements in productivity and increased innovation. Cloud-based platforms can bring together disparate groups of people who can collaborate and share resources, information and processes.

For example, to improve knowledge capture and sharing among its 90 000 employees, CSC (**www.csc.com**) is using Jive's cloud-based collaboration software. CSC's first step was an experiment to see if people would be receptive to working with the software. Jive was made available to all employees, an approach that would have been prohibitively expensive if CSC had needed to buy all the hardware and software licenses itself. For

example, people could use Jive to pose a question to the entire company, visit and contribute to digital forums like 'Where have we done this before?' and 'Excel power tips' and set up new communities as needed.

During the initial 20-week experiment, more than 25 000 people registered for the new cloud-based resource, called C3. They created more than 2100 groups and logged as many as 150 000 activities per month. Those results persuaded CSC to make C3 permanent. The company chief information officer noted that the results had been 'stunning'. He said that C3 is now the standard for how CSC collaborates.

Benefit 3: mining insights from data

Analytics is one of the most popular cloud computing applications. Companies today gather massive amounts of data, and cloud providers are providing the hardware and software algorithms to help businesses perform sophisticated analyses of this data.

For example, restaurant owners can use Aloha Restaurant Guard, a cloud-based service from Radiant Systems, to reduce shrinkage. Shrinkage is a serious problem in the food service industry, and can range from accidental spillage of food or drink onto the floor (see figure PI3.5) to a bartender giving away free drinks or employee theft. It is also a difficult problem to solve, because it is difficult for restaurant owners to monitor servers and bartenders closely in their busy work environments.

Enter Radiant Systems (**www.radiantsystems.com**), a company that supplies the Aloha point-of-sale system to thousands of restaurants and keeps their data. Radiant realised that the huge amounts of transaction data that it kept for each customer could be analysed for suspicious patterns, such as a volume of large tips far above average for bartenders on a Friday night. When this pattern occurs, it is likely that the bartender is not charging people for drinks in hopes of getting a big tip.

Using data from all of its customers, Radiant developed a set of algorithms to detect many types of shrinkage and bundled them into a product called Aloha Restaurant Guard (ARG). ARG generates a weekly set of reports on suspicious activity by site and by employee. These reports are sent to restaurant owners and managers, who use them to take corrective action. The results can be surprising and dramatic. According to Radiant, one casual dining restaurant saw a profit increase of $20 000 to $40 000 per year after

FIGURE PI3.5 Shrinkage, such as the beer that is overflowing from the pictured schooner, is a serious problem in the food service industry, but one that cloud-based applications such as the Aloha Restaurant Guard can help to solve.

using ARG to detect employee theft. The restaurant owner did not have to buy or install any new software, hire IT people or alter his IT infrastructure in any way.

Benefit 4: reduce costs

Cloud computing can help an organisation reduce fixed IT costs by enabling a shift from capital expenses to operational expenses. IT capital expenses — which typically include enterprise software licenses, servers and networking equipment, and other costs — tend to be more expensive than routine IT operating expenses. With cloud computing applications, there is no need to buy hardware, build and install software or pay dedicated software licensing fees. By adopting cloud computing services, an organisation can shift costs from capital to operational — or from fixed to variable. The organisation pays only for the computing resources it needs, only when it needs them. This pay-for-use model provides greater flexibility and eliminates the need for significant capital expenditures.

Consider Etsy (**www.etsy.com**), an online marketplace for handmade goods. In addition to bringing buyers and sellers together, Etsy provides recommendations for customers. The company rents hundreds of Amazon servers every night to cost-effectively analyse data from the 1 billion monthly views of its website. When Etsy's engineers come to work in the morning, they have a wealth of data showing what types of clothes, furniture and jewellery appeal to what types of people. Etsy has used this information to create product recommendation systems that let people rank their interest in a series of products. Etsy then creates a list of products that they might like. Consumers can also grant Etsy permission to search through their Facebook accounts and find products that their friends might like as gifts. The cost flexibility afforded by cloud computing provides Etsy access to tools and computing power that have, in the past, been affordable only for larger retailers.

Benefit 5: expand scope of business operations

Cloud computing allows organisations to use the amount of computing resources they need, without any limitations. Therefore, companies utilising cloud computing are able to increase the scope of their business operations.

Consider Netflix (**www.netflix.com**), a US-based internet subscription service for movies and television shows. Because the company streams many movies and shows on demand, it faces large surges of capacity at peak times. As Netflix began to outgrow its data centre capabilities (on-premises IT), the company decided to move its website and streaming service from a traditional data centre implementation to a cloud computing environment. This move allowed Netflix to manage peak demands more efficiently, providing a better customer experience. As a result, Netflix was able to grow and expand its customer base without having to build and support the larger data centre that they would have needed to meet company requirements.

Benefit 6: respond quickly to market changes

The ability to respond to rapidly changing customer needs quickly is a critically important strategic goal for organisations. Therefore, companies are continuously seeking ways to improve their agility in adjusting to market demands. Cloud computing enables businesses to adjust business processes, products and services rapidly to meet the changing needs of the market. Furthermore, cloud computing facilitates prompt prototyping and innovation, and speeds time to market for new products.

For example, ActiveVideo (**www.activevideo.com**) recognised cloud computing's potential to enhance their market adaptability when they created CloudTV, a cloud-based platform that unifies all forms of content — web, television, mobile, social, video-on-demand and so on — onto any video screen. Content and applications from web content creators, television networks, advertisers and other media entities can be quickly developed for CloudTV using standard web tools. CloudTV leverages content stored and processed in the cloud to significantly expand the reach and availability of web-based

user experiences, and allow operators to deploy a consistent user interface quickly across diverse set top boxes and connected devices. The CloudTV approach of placing the intelligence in the network, rather than in the device, enables content creators, service providers and consumer electronics manufacturers to create new television experiences for their viewers.

Benefit 7: customise products and services

Because of its expanded computing power and capacity, cloud computing can store massive amounts of information about user preferences, which can then serve to enable customisation of a service or a product. This context-driven variability allows businesses to offer personal experiences to users by having the service or production adapt to subtle changes in user-defined context. As a result, the company's customers are more likely to enjoy their personally customised experience and are more likely to become return customers.

A good example of a product that has effectively made use of cloud computing's user preference storage is Siri, the Apple iPhone 4S cloud-based natural language 'intelligent assistant' (see figure PI3.6). Siri allows users to send messages, schedule meetings, place phone calls, locate restaurants and much more. And while other phones have some voice recognition features, Siri effectively 'learns your voice'. Siri uses artificial intelligence and a growing base of knowledge about the user, including his or her location and frequent contacts, to understand not only what users say, but what they mean. Siri leverages cloud computing to enable individualised, context-relevant customer experiences.

FIGURE PI3.6 Apple's intelligent assistant, Siri, is a prime example of user preference storage innovation made possible by cloud computing.

Apply the Concept

Background

This section has outlined the benefits that are driving many organisations to use cloud computing. Productivity, cost reduction, collaboration, more robust data mining, flexibility and scope expansion are just the beginning. Cloud computing is a powerful tool that is changing the way we do business today.

Activity

Search the web for a company that offers cloud computing services of some kind. Then look for customer testimonials. Read them and see if these customers indicate the same benefits that we have discussed in this Plug IT In.

Deliverable

Write a paragraph about the company you have learned about, what that company does with cloud computing and which benefits parallel what you have read about in this Plug IT In.

Submit your work to your tutorial group.

BEFORE *YOU GO ON . . .*

1 Describe several benefits that cloud computing can offer organisations. Provide a specific example of each benefit you discuss.

PI3.6 Concerns and risks with cloud computing

Even though Gartner predicts that cloud computing will grow at an annual rate of 19 per cent through to the year 2015, cloud computing will still account for less than 5 per cent of total worldwide IT spending that year. Why is this percentage so low? The reason is that there are serious concerns with cloud computing. These concerns fall into the areas of legacy IT systems, cost, reliability, security and regulations.

Concern 1: legacy IT systems

Historically, organisational IT systems have accumulated a diversity of hardware, operating systems and applications (together called 'legacy spaghetti'). These systems are not easily transferable to the cloud because they must first be untangled and simplified. Furthermore, many IT professionals have vested interests in various legacy systems and are unwilling to allow them to be exchanged for cloud computing.

Concern 2: cost

There are widespread debates over the comparative cost of cloud computing. A McKinsey case study involving an anonymous client concluded that putting the client's entire data centre in the cloud would increase costs by 144 per cent. On the other hand, a recent Microsoft report concluded that it would be cheaper for all organisations to move to cloud computing.

Whatever the truth, this focus on cost is irrelevant for two reasons. First, most companies do not spend massive amounts of money on information technologies. Gartner estimates that for S&P (Standard & Poor's) 500 companies, all IT-related costs account for less than 5 per cent of revenue on average. Therefore, even large percentage-wise changes in the IT budget will not make an overall budget difference to most firms.

Secondly, over time, the economics of building and operating an IT infrastructure will favour cloud computing. Cloud providers purchase massive amounts of technology infrastructure (e.g. hardware and bandwidth), because they can obtain better prices by buying in bulk. Because they also buy technology all the time, they can take continual advantage of computing cost declines predicted by Moore's Law.

Concern 3: reliability

Many sceptics state that cloud computing is not as reliable as a well-managed, on-premises IT infrastructure. The cloud's reliability was called into question in April 2011, when large parts of Amazon's Web Services infrastructure went down for as long as three days (see example below). This outage was a major blow to many companies that used the service. Although the outage was serious, it affected only one of Amazon's US data centres. Amazon had also explicitly advised its customers to design their IT architectures to withstand a service interruption. Other cloud companies have learned from Amazon's experience and are all improving the redundancy and reliability of their offerings.

EXAMPLE

Amazon Web Services (AWS, **http://aws.amazon.com**), the Amazon cloud, is designed with backups to the backups' backups to prevent hosted websites and applications from failing. Despite all of these safety measures, however, in 2011 Amazon's cloud crashed, taking with it Reddit (**www.reddit.com**), Quora (**www.quora.com**), FourSquare (**www.foursquare.com**), ProPublica (**www.propublica.org**), parts of the *New York Times* (**www.nytimes.com**) and about 70 other websites. The massive outage raised questions about the reliability of Amazon Web Services and of the cloud itself.

Thousands of companies use Amazon Web Services (AWS) to run their websites through a service called Elastic Compute Cloud (EC2). Rather than hosting their sites on their own servers, these customers essentially rent some of Amazon's unused server capacity. EC2 is hosted in five regions: Virginia and California in the US, Ireland, Tokyo and Singapore. Within each region are multiple 'availability zones', and within each availability zone are multiple 'locations' or data centres.

Amazon assured its customers that its method of linking together many different data centres would protect its customers from isolated failures. It promised to keep customers' sites up and running 99.95 per cent of the year, or it would reduce their monthly bills by 10 per cent. Based on these claims, customers could be down a maximum of just 4.4 hours in a year. In fact, during the outage, some customers' websites were down for days.

The crash occurred at Amazon's Virginia data centre, located in one of the company's East Coast availability zones. Amazon claimed that a 'networking event' caused a domino effect across other availability zones in that region, which in turn caused many of its storage volumes to create backups of themselves. That process filled up Amazon's available storage capacity and prevented some websites from accessing their data. Amazon did not reveal what the 'networking event' was.

Websites like Quora and Reddit were able to come back online in 'read-only' mode, but users were not able to post new content for many hours. Many experts blamed Amazon's customers themselves, asserting that their websites should have spread their processing out among multiple geographical regions to take full advantage of Amazon's backup systems. In fact, sites like Reddit were simply following the instructions that Amazon provided in its service agreement. The agreement states that hosting in a single region should be sufficient. Furthermore, some smaller companies were not able to afford the resources needed to duplicate their infrastructure in data centres all over the world.

Sources: Compiled from C Brooks (2011), 'A crack in the cloud: why the Amazon outage caught so many by surprise', *SearchCloudComputing*, 27 April, www.searchcloudcomputing.com; D Goldman (2011), 'Why Amazon's cloud Titanic went down', *CNN Money*, 22 April, www.money.cnn.com; J Brodkin (2011), 'Amazon EC2 outage calls 'availability zones' into question', *Network World*, 21 April, www.networkworld.com; Amazon Web Services website, http://aws.amazon.com.

Concern 4: privacy

Privacy advocates have criticised cloud computing for the ease with which cloud computing providers control, and thus lawfully or unlawfully monitor, the communication and data stored between the user and the host company. In a famous example of privacy violation in the US, the secret NSA program, working with telecommunications providers AT&T and Verizon, used cloud computing to record over 10 million phone calls between US citizens. Instances such as these raise concerns among privacy advocates.

Using a cloud computing provider complicates data privacy because of the extent to which cloud processing and cloud storage are used to implement cloud services. The point is that customer data may not remain on the same system or in the same data centre. This situation can lead to legal concerns over jurisdiction.

There have been efforts to integrate the legal environment. For example, the US-EU Safe Harbor is a streamlined process for US companies to comply with the European Union directive on the protection of personal data. However, providers such as Amazon still cater to major markets (typically the United States and the European Union) by deploying local infrastructure and allowing customers to select 'availability zones'. Cloud computing poses privacy concerns because the service provider may access the data that is on the cloud at any point in time. They could accidentally or deliberately alter or even delete some information.

Concern 5: security

The security of cloud computing is frequently questioned. The effectiveness and efficiency of traditional security mechanisms are being reconsidered as the characteristics of cloud computing can differ widely from those of traditional IT architectures. Security issues include sensitive data access, data segregation (among customers), privacy, error exploitation, recovery, accountability, malicious insiders and account control.

The relative security of cloud computing services is a contentious issue that may be delaying its adoption. Security issues are due in large part to the private and public sectors' unease surrounding the external management of security-based services. It is the very nature of cloud computing-based services, private or public, that promote external management of provided services. This situation provides great incentive to cloud computing service providers to prioritise building and maintaining strong security services.

Another security issue is controlling who is able to do and see what (see our discussion of least privilege in chapter 7). Many organisations exercise least privilege controls effectively with their on-premises IT infrastructures. Some cloud computing environments, in contrast, cannot exercise least privilege controls effectively. This problem occurs because cloud computing environments were originally designed for individuals or groups, not for hierarchical organisations in which some people have both the right and the responsibility to exercise control over others. Cloud computing vendors are working to incorporate administrative, least-privilege functionality into their products, and many have already done so.

Security experts note that the best approach for excellent security is to constantly monitor the threat landscape; buy or build the best technologies to protect devices and networks; and hire and retain top digital security specialists. Cloud computing vendors are better able to do these things than all but the very largest and most security-conscious organisations.

Concern 6: the regulatory and legal environment

There are numerous legal and regulatory barriers to cloud computing, and many have to do with data access and transport. For example, the European Union prohibits consumers' data from being transferred to non-member countries without prior consent and approval. Companies outside the EU can overcome this restriction by demonstrating that they provide a 'safe harbour' for data. Some countries, such as Germany, have even more restrictive data export laws, and it is not yet clear (at the time of writing) if

the safe harbour process will satisfy them. Cloud computing vendors are aware of these regulations and laws and are working to modify their offerings so that they can assure customers and regulators that data entrusted to them is secure enough to meet all applicable regulations and laws.

In 2013, the Australian Communications and Media Authority (ACMA) released their national cloud computing strategy. This strategy indicated that as a priority, Australian businesses and consumers should be able to create and use world-class cloud computing services to enhance job performance and productivity across the digital economy.[11] This strategy identified the following three goals.

1 The Australian government will be a leader in cloud services use to enhance efficiency via IT investment, and transport better services and support among the public sector.
2 The government will encourage small businesses, not-for-profit organisations and consumers to use cloud computing services with confidence.
3 Australia will have an exciting cloud sector supported by a skilled and experienced IT workforce to create and adopt cloud services in the competitive market to support growth and innovation. Furthermore, Australia will have cloud computing awareness among businesses and consumers to allow them to use and implement cloud computing services in their work to support growth, foster innovation and meet market needs locally and globally.

BEFORE *YOU GO ON . . .*

1 Describe the privacy and security risks associated with cloud computing.
2 Describe the risks of cloud computing involved with adhering to regulatory guidelines.

PI3.7 Web services and service-oriented architecture

As you have seen so far in this Plug IT In, cloud computing can deliver a variety of functionality to users in the form of services. (Think infrastructure-as-a-service, platform-as-a-service, and software-as-a-service.) Therefore, in this section you will learn about web services and service-oriented architecture.

Web services are applications delivered over the internet (the cloud) that MIS professionals can select and combine through almost any device, from personal computers to mobile phones. By using a set of shared standards, or protocols, these applications permit different systems to 'talk' with one another — that is, to share data and services — without requiring human beings to translate the conversations. Web services have great potential because they can be used in a variety of environments: over the internet, on an intranet inside a corporate firewall or even on an extranet set up by business partners. Web services perform a wide variety of tasks, from automating business processes to integrating components of an enterprise wide system to streamlining online buying and selling.

Web services provide numerous benefits for organisations, including the following.

- The organisation can utilise the existing internet infrastructure without having to implement any new technologies.
- Organisational personnel can access remote or local data without having to understand the complexities of this process.
- The organisation can create new applications quickly and easily.

The collection of web services that are used to build a firm's IT applications constitutes a **service-oriented architecture**. Business processes are accomplished by executing a series of these services. The web services can be reused across an organisation in other applications. For example, a web service that checks a consumer's credit could be used with a service that processes a mortgage application or a credit card application.

Web services are based on four key protocols: XML, SOAP, WSDL and UDDI.

Extensible markup language (XML) is a computer language that makes it easier to exchange data among a variety of applications and to validate and interpret these data (see figure PI3.7b). XML is a more powerful and flexible markup language than **hypertext markup language (HTML)**.

HTML is a page-description language for specifying how text, graphics, video and sound are placed on a web page document (see figure PI3.7a). HTML was originally designed to create and link static documents composed largely of text. Today, however, the web is much more social and interactive, and many web pages have multimedia elements, such as images, audio and video. Third-party plug-in applications such as Flash, Silverlight

(a) html

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" http://www.wiley.com/college/gisslen/0470179961/video/
video111
<html xmlns="http://www.wiley.com/college/rainer/0470179061/video/video111.html><head>
<meta http-equiv="content-Type" content="text/html; charset=ISO-8859-1">
<title>CSS Text Wrapper</title>
<link type="text/css" rel="stylesheet" href="css/stylesheet.css">
</head><body id="examples">

<div id="container">
        <div class="wrapper">
                <div class="ex">
                        <script type="text/javascript">shapewrapp
er("15","7.5,141,145|22.5,89,89|37.5,68,69|52.5,46,50|67.5,3
height: 15px; width: 39px;"></div><div style="float: left; clear: left; height: 15px; width: 27px;"></div><div style="float:
15px; width: 4px;"></div><div style="float: left; clear: left; height: 15px; width: 6px;"></div><div style="float:
right; cle
width: 43px;"></div><div style="float: left; clear: left; height: 15px; width: 57px;"></div><div style="float: right; clear:
                        <span style="font-size: 13px;" class=c">
```

(b) XML

```
<feature numbered="no" xml:id="c08-fea-0001">
    <titleGroup>
        <title type="featureName">OPENING CASE</title>
        <title type="main">Tiger Tans and Gifts</title>
    </titleGroup>
    <section xml:id="c08-sec-0002">
        <p>
            <blockFixed onlyChannels="print" type="graphic">
                <mediaResource alt="p0310" copyright="John Wiley &amp;amp; Sons, Inc." eRights="yes"
                    href="urn:x-wiley:9781118443590:media:rainer9781118443590c08:p0310" pRights="yes"/>
            </blockFixed>
            Lisa Keiling owns & tanning salon in Wedowee, Alabama, that does very well from January to May....
        </p>
    </section>
</feature>
```

FIGURE PI3.7 a) Screenshot of an HTML wrapper. This wrapper gives instructions on how to open a video associated with this book. b) Example of XML tagging done on chapter 8 of this book.

and Java have been required to integrate these rich media into web pages. However, these add-ons require additional programming and require a great deal of computer processing.

The next evolution of HTML, called **HTML5**, solves this problem by making it possible to embed images, audio and video directly into a document without the add-ons. HTML5 also makes it easier for web pages to function across different display devices, including mobile devices as well as desktops. HTML5 also supports the storage of data offline for apps that run over the web. Web pages will execute more quickly and look like smart phone apps.

HTML5 is used in a number of internet platforms, including Apple's Safari browsers, Google Chrome and Firefox browsers. Google's Gmail and Google Reader also use HTML5. Websites listed as 'iPad ready' are using HTML5 extensively. Examples of such sites include CNN, *The New York Times* and CBS.

Whereas HTML is limited to describing how data should be presented in the form of web pages, XML can perform presentation, communication and storage of data. For example, in XML a number is not simply a number. The XML tag specifies whether the number represents a price, a date or a postcode. Consider this example of XML, which identifies the contact information for Jane Smith.

<contact-info>
<name>Jane Smith</name>
<company>Telstra </company></contact-info>
<postcode> 4000 </postcode>

Simple object access protocol (*SOAP*) is a set of rules that define how messages can be exchanged among different network systems and applications through the use of XML. These rules establish a common protocol that allows different web services to interoperate. For example, Visual Basic clients can use SOAP to access a Java server. SOAP runs on all hardware and software systems.

The *web services description language* (*WSDL*) is used to create the XML document that describes the tasks performed by the various web services. Tools such as VisualStudio.net automate the process of accessing the WSDL, reading it and coding the application to reference the specific web service.

Universal description, discovery and integration (*UDDI*) allows MIS professionals to search for needed web services by creating public or private searchable directories of these services. In other words, UDDI is the registry of descriptions of web services.

Examples of web services abound. The next example shows how Yelp uses Amazon Web Services successfully.

BEFORE *YOU GO ON . . .*

1. Describe the function of web services.
2. Describe the function of service-oriented architectures.

EXAMPLE

Yelp was founded in 2004 with the main goal of helping people connect with great local businesses. The Yelp community is best known for sharing in-depth reviews and insights on all types of local businesses. Yelp has gone from being based in one city only (San Francisco), to becoming an international phenomenon spanning 8 countries and nearly 50 cities. Yelp now has almost 50 million unique visitors to its site. In total, 'yelpers' have posted more than 14 million reviews.

Yelp has established a loyal consumer following, due in large part to the fact that the company is vigilant in protecting the user from suspect content. Yelp uses an automated review filter to identify suspicious content and minimise exposure to the consumer.

The site also features a wide range of other features that help people discover new businesses (lists, special offers and events) and communicate with each other. Additionally, business owners and managers are able to set up free accounts to post special offers, upload photos and message customers.

The company has also focused on developing mobile apps and has been voted into the iTunes Apps Hall of Fame. Yelp apps are also available for Android, Blackberry and Windows 7 devices.

Local search advertising makes up the majority of Yelp's revenue stream. The search ads are coloured light orange and clearly labelled 'Sponsored Results'. Paying advertisers are not allowed to change or reorder their reviews.

Yelp originally depended upon giant RAIDs (redundant arrays of independent disks, a type of enterprise storage) to store their customer posts, along with a single local instance of Hadoop (a type of database; see chapter 3's Closing Case 1). Because they were running out of hard drive space and capacity, Yelp decided to use Amazon Web Services. They implemented Amazon Simple Storage Service (Amazon S3) and Amazon Elastic MapReduce. They were then able to replace their RAID storage technology with Amazon S3 and immediately transfer all Hadoop jobs to Amazon Elastic MapReduce.

Yelp uses Amazon S3 to store daily logs and photos, generating around 100GB of posts per day. The company also uses Amazon Elastic MapReduce to process customer posts. Each day, Yelp runs approximately 200 Elastic MapReduce jobs, processing 3 terabytes of data. Features powered by Amazon Elastic MapReduce include:

- people who viewed this also viewed
- review highlights
- auto complete as users type on search
- search spelling suggestions
- top searches
- advertisements.

Using Amazon Elastic MapReduce, Yelp was able to save US$55 000 in upfront hardware costs and was able to get up and running in a matter of days. However, the opportunity cost is most important to Yelp. The company says that with AWS, its developers can now do things they could not do before, and focus their energies on other challenges.

Sources: C Babcock (2012), 'Cloud Success Stories', *InformationWeek*, 6 February, www.informationweek.com; N Hemsoth (2011), 'Elastic MapReduce Lead Traces Big Data Clouds', *datanami*, 4 November, www.datanami.com; 'AWS Case Study: Yelp', *Amazon Web Services website*, http://aws.amazon.com; Yelp website, www.yelp.com.

Apply the Concept

Background

Apple has never allowed Adobe Flash to run on its iPhones, iPads or iPods. For a while, this was a controversial point and opened the door for some competition to create 'flash-ready' mobile devices. HTML5 technology has now quietened the critics somewhat..

HTML5 is the next version of code that is the basis for coding and displaying web pages. The big improvement of HTML5 over HTML4 is that it has the ability to display video and other graphics without using 'plug-ins' like Adobe Flash. This allows video to play faster without the need for the periodic updates.

Activity

Search online for the letter written by the late Steve Jobs (former Apple CEO) discussing the reasons why his company did not allow Flash to run on their mobile devices.

Do you remember what Henry Ford (founder of Ford Motor Company) said? 'If I had asked people what they wanted, they would have said faster horses.' Think about the state of technology and why it is important to understand where things will be in five years rather than just using the technology that is available today. Preparation and planning are paramount in IT.

Deliverable

Develop your own list of five reasons why it is important to have a solid understanding of the direction of technology and where it will be in five years.

WHAT'S IN IT FOR ME?

FOR ALL BUSINESS MAJORS

As with hardware (Plug IT In 2), the design of enterprise IT architectures has profound impacts for businesspeople. Personal and organisational success can depend on an understanding of cloud computing and a commitment to knowing the opportunities and challenges they will bring.

At the organisational level, cloud computing has the potential to make the organisation function more efficiently and effectively, while still saving the organisation money. Web services and SOA make the organisation more flexible when deploying new IT applications.

At the individual level, you might very well be utilising cloud computing yourself if you decide to start your own business. Remember that cloud computing provides start-up companies with world-class IT capabilities at a very low cost.

SUMMARY

1 Describe the evolution of IT infrastructure.

The IT infrastructure in organisations has evolved through these stages:

- the stand-alone mainframe
- mainframe and dumb terminals
- stand-alone personal computers
- local area networks (client/server computing)
- enterprise computing
- cloud computing and mobile computing.

2 Describe the key characteristics and advantages of cloud computing.

Cloud computing is a type of computing that delivers convenient, on-demand, pay-as-you-go access for multiple customers to a shared pool of configurable computing resources (e.g. servers, networks, storage, applications and services) that can be rapidly and easily accessed over the internet. The essential *characteristics* of cloud computing include the following.

- > Cloud computing provides on-demand self-service.
- > Cloud computing includes the characteristics of grid computing.
- > Cloud computing includes the characteristics of utility computing.
- > Cloud computing utilises broad network access.
- > Cloud computing pools computing resources.
- > Cloud computing typically occurs on virtualised servers.

3 Identify a use-case scenario for each of the four types of clouds.

Public clouds are shared, easily accessible, multi-customer IT infrastructures that are available non-exclusively to any entity in the public (individuals, groups and/or organisations). *Private clouds* (also known as *internal clouds* or *corporate clouds*) are IT infrastructures that are accessible only by a single entity, or by an exclusive group of related entities that share the same purpose and requirements, such as all the business units within a single organisation. *Hybrid clouds* are composed of public and private clouds that remain unique entities but are bound together, offering the benefits of multiple deployment models. *Vertical clouds* serve specific industries.

4 Explain the operational model of each of the three types of cloud services.

With the *infrastructure-as-a-service* (IaaS) model, cloud computing providers offer remotely accessible servers, networks and storage capacity. In the *platform-as-a-service* (PaaS) model, customers rent servers, operating systems, storage, databases, software development technologies such as Java and .NET, and network capacity over the internet. With the *software-as-a-service* (SaaS) delivery model, cloud computing vendors provide software that is specific to their customers' requirements.

5 Identify the key benefits of cloud computing.

The benefits of cloud computing include making individuals more productive; facilitating collaboration; mining insights from data; developing and hosting applications; cost flexibility; business scalability; improved utilisation of hardware; market adaptability; and product and service customisation.

6 Discuss the concerns and risks associated with cloud computing.

Cloud computing does raise concerns and have risks, which include legacy spaghetti, cost, reliability, privacy, security, and the regulatory and legal environment.

7 Explain the role of web services in building a firm's IT applications, providing examples.

Web services are applications delivered over the internet that MIS professionals can select and combine through almost any device, from personal computers to mobile phones. A *service-oriented architecture* makes it possible to for MIS professionals to construct business applications using web services.

>>> GLOSSARY

Cloud computing A technology in which tasks are performed by computers physically removed from the user and accessed over a network, in particular the internet.

Extensible markup language (XML) A computer language that makes it easier to exchange data among a variety of applications and to validate and interpret these data.

Grid computing A technology that applies the unused processing resources of many geographically dispersed computers in a network to form a virtual supercomputer.

HTML5 A page-description language that makes it possible to embed images, audio and video directly into a document without add-ons. Also makes it easier for web pages to function across different display devices, including mobile devices as well as desktops. Supports the storage of data offline.

Hybrid clouds Clouds composed of public and private clouds that remain unique entities but are bound together, offering the benefits of multiple deployment models.

hypertext markup language (HTML) A page-description language for specifying how text, graphics, video and sound are placed on a web page document.

infrastructure-as-a-service (IaaS) model Cloud computing providers offer remotely accessible servers, networks and storage capacity.

platform-as-a-service (PaaS) model Customers rent servers, operating systems, storage, databases, software development technologies such as Java and .NET, and network capacity over the internet.

Private clouds (also known as *internal clouds or corporate clouds*) IT infrastructures that are accessible only by a single entity or by an exclusive group of related entities that share the same purpose and

requirements, such as all the business units within a single organisation.

Public clouds Shared, easily accessible, multicustomer IT infrastructures that are available nonexclusively to any entity in the general public (individuals, groups and/or organisations).

server farms Massive data centres, which may contain hundreds of thousands of networked computer servers.

Server virtualisation A technology that uses software-based partitions to create multiple virtual servers (called *virtual machines*) on a single physical server.

service-oriented architecture An IT architecture that makes it possible to construct business applications using web services.

software-as-a-service (SaaS) delivery model Cloud computing vendors provide software that is specific to their customers' requirements.

utility computing A technology whereby a service provider makes computing resources and infrastructure management available to a customer as needed.

Web services Applications delivered over the internet that IT developers can select and combine through almost any device, from personal computers to mobile phones.

>>> DISCUSSION QUESTIONS

1. What is the value of server farms and virtualisation to any large organisation?
2. If you were the chief information officer (CIO) of a firm, how would you explain the workings, benefits and limitations of cloud computing?
3. What is the value of cloud computing to a small organisation?
4. What is the value of cloud computing to an entrepreneur who is starting a business?

>>> PROBLEM-SOLVING ACTIVITIES

1. Investigate the status of cloud computing by researching the offerings of the following leading vendors. Note any inhibitors to cloud computing.
   - Dell
   - Oracle
   - IBM
   - Amazon
   - Microsoft
   - Google.

>>> ENDNOTES

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