

Introduction to Cloud Computing Learner's Guide

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Introduction to Cloud Computing Learner's Guide

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APTECH LIMITED

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Edition 1 - 2013



Dear Learner,

We congratulate you on your decision to pursue an Aptech Worldwide course.

Aptech Ltd. designs its courses using a sound instructional design model – from conceptualization to execution, incorporating the following key aspects:

- Scanning the user system and needs assessment

Needs assessment is carried out to find the educational and training needs of the learner

Technology trends are regularly scanned and tracked by core teams at Aptech Ltd. TAG* analyzes these on a monthly basis to understand the emerging technology training needs for the Industry.

An annual Industry Recruitment Profile Survey[#] is conducted during August - October to understand the technologies that Industries would be adapting in the next 2 to 3 years. An analysis of these trends & recruitment needs is then carried out to understand the skill requirements for different roles & career opportunities.

The skill requirements are then mapped with the learner profile (user system) to derive the Learning objectives for the different roles.

- Needs analysis and design of curriculum

The Learning objectives are then analyzed and translated into learning tasks. Each learning task or activity is analyzed in terms of knowledge, skills and attitudes that are required to perform that task. Teachers and domain experts do this jointly. These are then grouped in clusters to form the subjects to be covered by the curriculum.

In addition, the society, the teachers, and the industry expect certain knowledge and skills that are related to abilities such as *learning-to-learn, thinking, adaptability, problem solving, positive attitude etc.* These competencies would cover both cognitive and affective domains.

A precedence diagram for the subjects is drawn where the prerequisites for each subject are graphically illustrated. The number of levels in this diagram is determined by the duration of the course in terms of number of semesters etc. Using the precedence diagram and the time duration for each subject, the curriculum is organized.

- Design & development of instructional materials

The content outlines are developed by including additional topics that are required for the completion of the domain and for the logical development of the competencies identified. Evaluation strategy and scheme is developed for the subject. The topics are arranged/organized in a meaningful sequence.

The detailed instructional material – Training aids, Learner material, reference material, project guidelines, etc.- are then developed. Rigorous quality checks are conducted at every stage.

➤ Strategies for delivery of instruction

Careful consideration is given for the integral development of abilities like thinking, problem solving, learning-to-learn etc. by selecting appropriate instructional strategies (training methodology), instructional activities and instructional materials.

The area of IT is fast changing and nebulous. Hence considerable flexibility is provided in the instructional process by specially including creative activities with group interaction between the students and the trainer. The positive aspects of web based learning –acquiring information, organizing information and acting on the basis of insufficient information are some of the aspects, which are incorporated, in the instructional process.

➤ Assessment of learning

The learning is assessed through different modes – tests, assignments & projects. The assessment system is designed to evaluate the level of knowledge & skills as defined by the learning objectives.

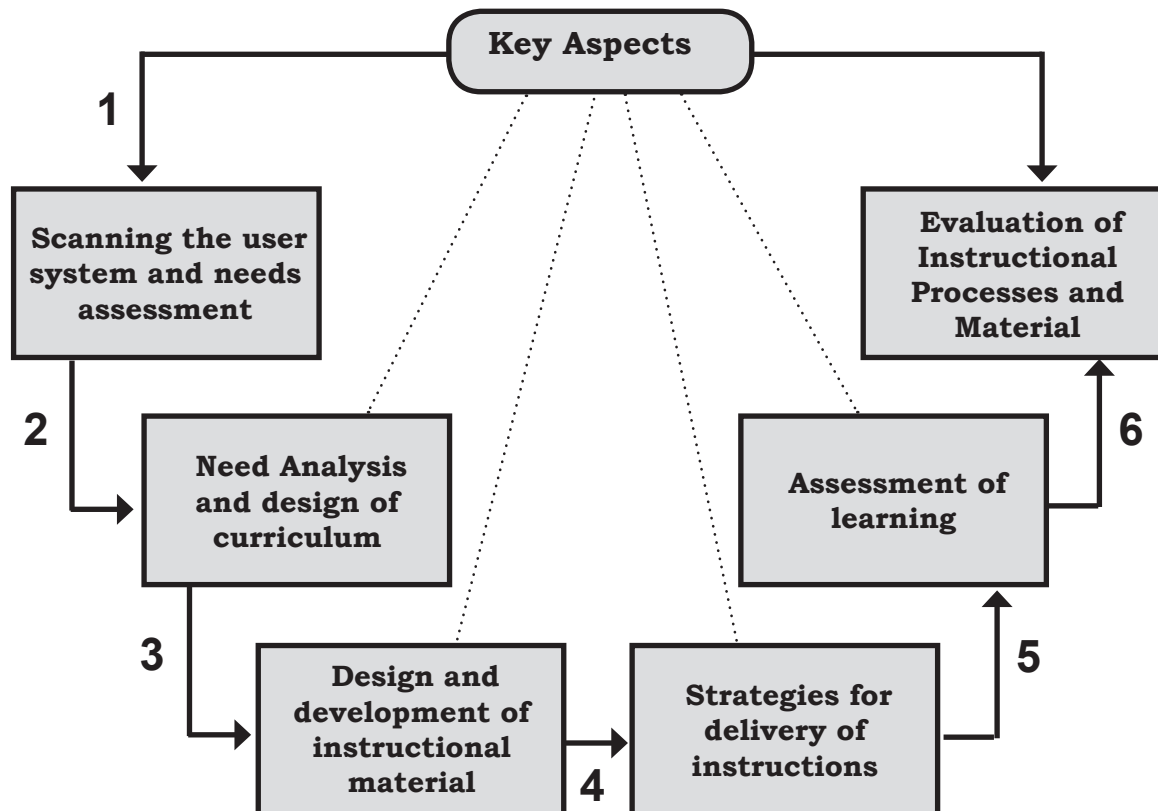
➤ Evaluation of instructional process and instructional materials

The instructional process is backed by an elaborate monitoring system to evaluate - on-time delivery, understanding of a subject module, ability of the instructor to impart learning. As an integral part of this process, we request you to kindly send us your feedback in the reply pre-paid form appended at the end of each module.

*TAG – Technology & Academics Group comprises of members from Aptech Ltd., professors from reputed Academic Institutions, Senior Managers from Industry, Technical gurus from Software Majors & representatives from regulatory organizations/forums.

Technology heads of Aptech Ltd. meet on a monthly basis to share and evaluate the technology trends. The group interfaces with the representatives of the TAG thrice a year to review and validate the technology and academic directions and endeavors of Aptech Ltd.

Aptech New Products Design Model





**“Knowing is not enough,
we must apply;
Willing is not enough,
we must do”**

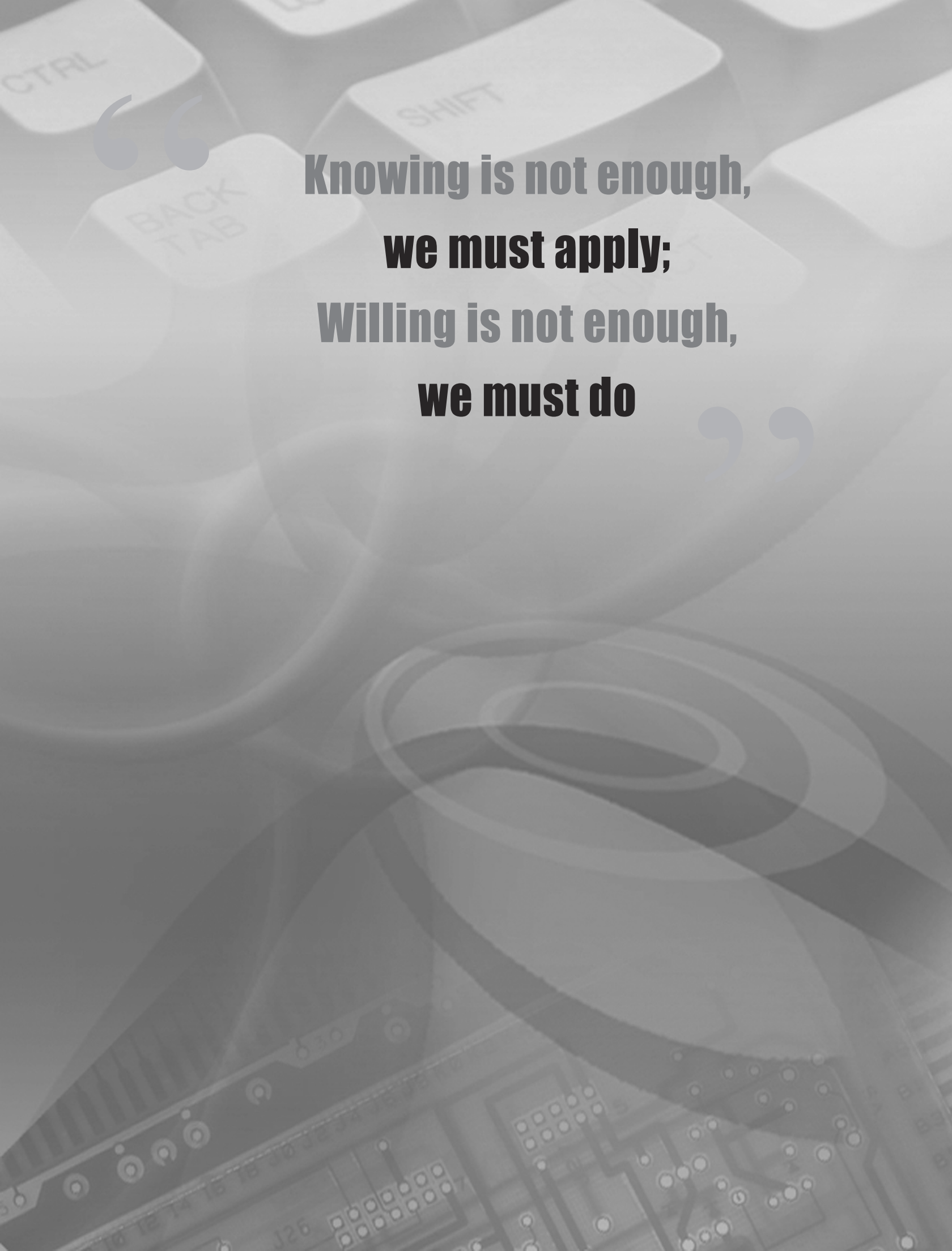
Preface

The book, **Introduction to Cloud Computing**, introduces cloud computing, which is an emerging technology trend in today's computing world. It involves the delivery of software, platforms, and infrastructure as services through the Internet or networks.

This book is the result of a concentrated effort of the Design Team, which is continuously striving to bring you the best and the latest in Information Technology. The process of design has been a part of the ISO 9001 certification for Aptech-IT Division, Education Support Services. As part of Aptech's quality drive, this team does intensive research and curriculum enrichment to keep it in line with industry trends.

We will be glad to receive your suggestions.

Design Team

The background is a grayscale, high-contrast image of a computer keyboard and a circuit board. The keyboard keys are visible in the upper half, with labels like 'CTRL', 'SHIFT', and 'BACK TAB' partially legible. The lower half shows a detailed view of a circuit board with various components, including a large circular component and numerous smaller electronic parts. The overall aesthetic is technical and modern.

**“Knowing is not enough,
we must apply;
Willing is not enough,
we must do”**

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Session - 1

Introduction to Cloud Computing

Welcome to the session, **Introduction to Cloud Computing**. Cloud computing is an emerging technology trend in today's computing world. It involves the delivery of software, platforms, and infrastructure as services through the Internet or networks.

The session covers the various aspects of cloud computing, such as advantages and characteristics, cloud delivery models, and types of clouds. Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS) are explored briefly.

In this Session, you will learn to:

- ➔ Describe the evolution of cloud computing.
- ➔ Explain the advantages of cloud computing.
- ➔ State the characteristics of cloud computing.
- ➔ Describe the cloud delivery models.
- ➔ Define and describe SaaS, PaaS, and IaaS.
- ➔ Describe the cloud deployment models.

1.1 Evolution of Cloud Computing

Cloud computing is an approach enabling convenient and on-demand access through the Internet to resources such as networks, servers, storage, applications, and services.

Figure 1.1 depicts this concept.



Figure 1.1: Cloud Computing

Cloud computing evolved from a concept called virtualization. Virtualization is the process of creating a virtual version of an Operating System (OS), a server, or network resources. Using virtualization, you can host multiple OSes at the same time on a single machine.

A traditional application server may have just 5-10% utilization, whereas virtualized servers can reach 50-80% utilization. By hosting more virtualized instances on fewer physical servers, you can lower costs for hardware acquisition, maintenance, energy, and cooling system usage.

Although virtualization offers many benefits, it was not enough because companies began to have many new needs such as on-demand scalability, zero capital expenditure, usage of software as a service, and so forth. Moreover, managing large numbers of virtual machines posed problems. Added to this were the issues of disaster management and data recovery.

This is when cloud computing began to emerge.

Figure 1.2 shows this.

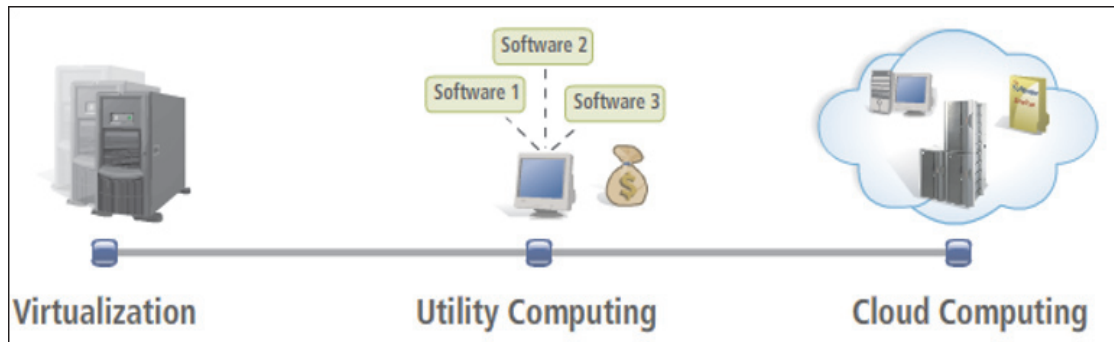


Figure 1.2: Evolution of Cloud Computing

Today, there are several cloud applications available for consumers such as GMail and others. Figure 1.3 depicts an example.

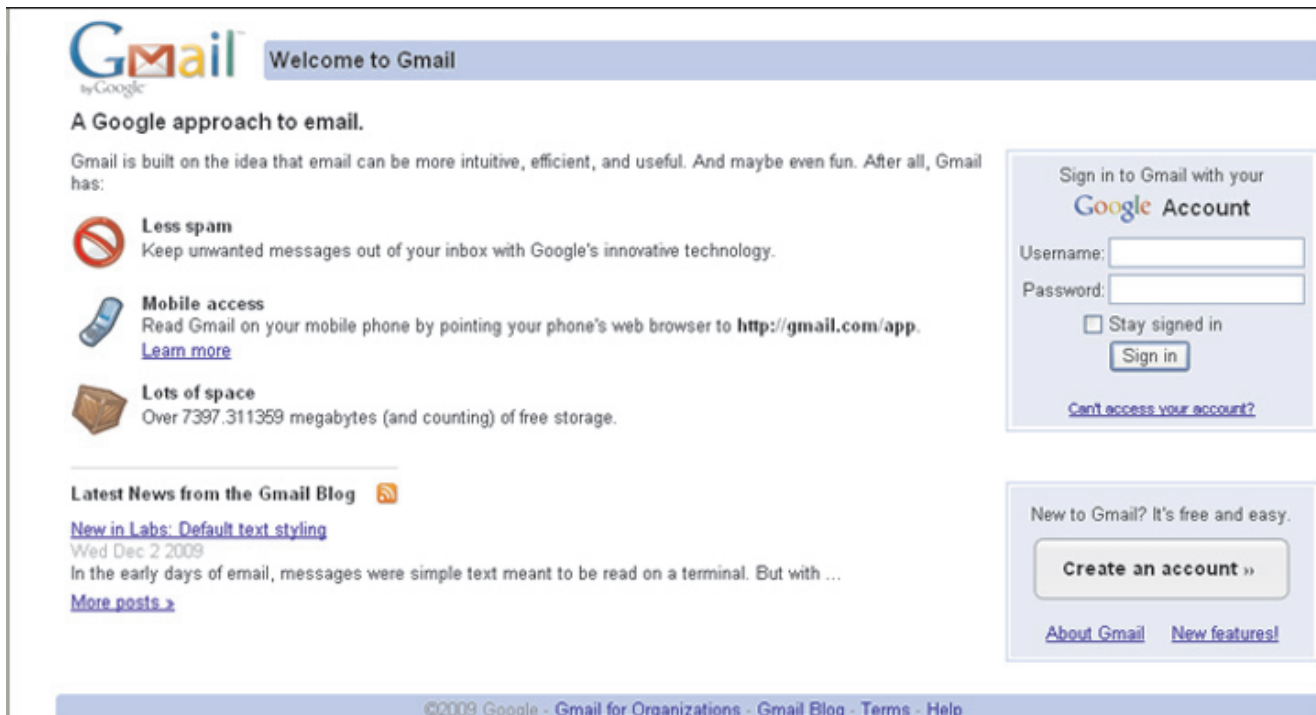


Figure 1.3: Example of Cloud Computing In Real World

1.2 Cloud Desktop OS

A cloud Operating System or cloud OS, is an Internet based OS that can be accessed anytime from any desktop. With a cloud based OS, you don't have to worry about hard disk space on your machine as the data will be stored on the cloud. Google Chrome and EyeOS are examples of such Internet based operating systems.

1.3 Advantages

Companies often cannot predict whether their customer base is going to grow or shrink. If they map their infrastructure to a large potential customer base but the growth does not reach that level, then the huge infrastructure is a waste. On the other hand, if companies underestimate their growth and plan for a small infrastructure, they could lose potential customers. What is required in such scenarios is the capability to scale the infrastructure up or down depending on the demand of the hour. This capability is called elasticity and is one of the biggest advantages of cloud computing.

Another key advantage of cloud computing is that of failover capabilities. Failover is a mechanism in which tasks from a primary system are automatically offloaded to a secondary standby system during system failure or pre-planned downtime.

Figure 1.4 depicts an example of failover.



Figure 1.4: FailOver

There are several other advantages. With cloud computing, enterprises may use minimal infrastructure locally, thus saving on power and hardware costs.

Backup becomes easier with cloud computing. Figure 1.5 shows an example.

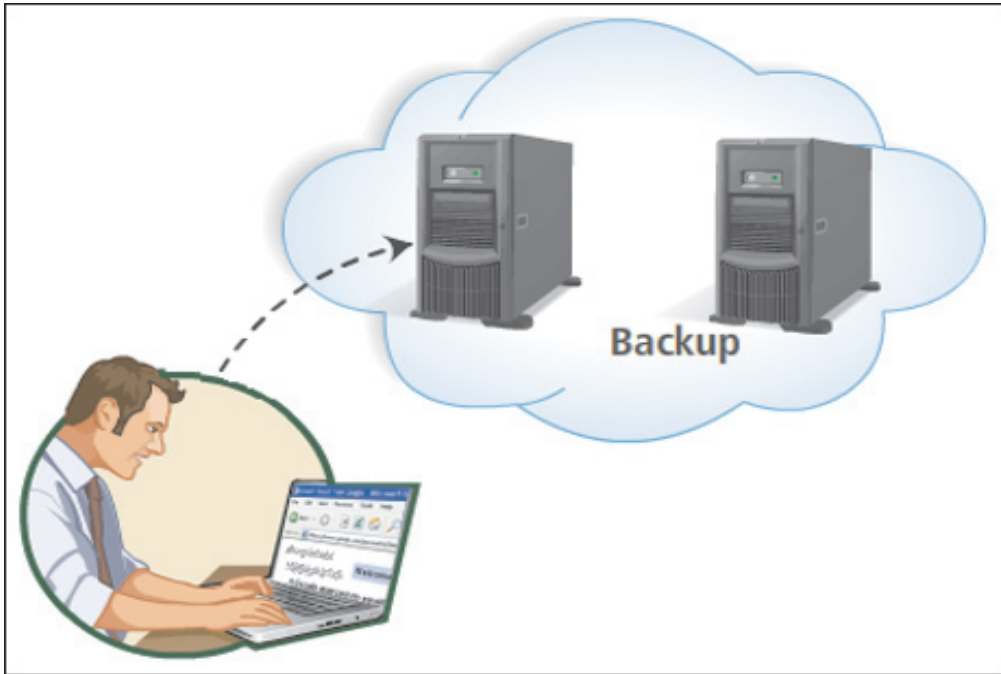


Figure 1.5: Backup

Also, as the carbon footprints left behind on the planet is reduced because of less number of individual machines at the local end, environmental damage is also reduced. Local software licenses would not be required as cloud services are Web-based, thus reducing costs.

1.4 Characteristics

Some fundamental characteristics commonly offered by cloud computing systems are as follows:

- ➔ **User Centric:** When a user is connected to a cloud, the data, application, and services offered by the cloud are available to the user. The user can not only use but also share them with others and collaborate on shared applications.
- ➔ **Task Centric:** Instead of just focusing on the application and its capabilities, the focus has shifted to what a user needs and how it can be done by the application.
- ➔ **Powerful:** Multiple resources together create a vast pool of computing power.
- ➔ **Programmable:** Computing power and data are now distributed across the cloud. Hence, even if one computer hosting a module becomes nonfunctional, its task can be automatically moved to another computer in the cloud.

Amazon, Salesforce, Microsoft, and Google are the foremost vendors of cloud computing solutions today.

Amazon offers many cloud computing products as part of Amazon Web Services.

The Amazon Elastic Compute Cloud, also known as EC2, enables you to create virtual computers or instances in the Amazon Cloud. Figure 1.6 depicts the EC2 feature.



Figure 1.6: Amazon Elastic Compute Cloud

1.5 Cloud Delivery Models

There are three delivery models (also called layers in a cloud stack) that deliver software, application platforms, and infrastructure respectively:

- ➔ **SaaS:** End users or consumers can make use of applications that are available as services on demand. The consumer does not have any control over the hardware, software, or operating system being used.
- ➔ **PaaS:** In PaaS, a hosting environment or platform is provided to the consumer using which applications can be deployed to the cloud. The consumer can control the platform to an extent but does not have any control over the hardware, software, or operating system being used.
- ➔ **IaaS:** Using IaaS, the consumer can rent computing power, storage, networks, and other computing resources. The consumer can control the hardware, software, or operating system being used.

In all the three models, the pricing structure is on a pay-as-you-use basis.

1.6 SaaS

SaaS is a delivery model that provides access to software and its functionality as a Web service through the Internet on demand.

Traditionally, organizations follow a standard approach to work with documents, data, or to develop business applications. They acquire licensed software, purchase the necessary operating system,

hardware and other resources, and then install the software. From time to time, the licensed software (and hardware) may require maintenance and upgradation. All these activities consume time, money, and effort in the long run.

This led to the emergence of SaaS, a software delivery model in which applications hosted by a vendor are available to end users through the Internet.

The fees for SaaS applications or services are subscription based monthly fees, a pay-as-you-use model, which costs much lesser than actual licenses.

Google Docs and Gmail are some of the most well-known examples of SaaS.

1.7 PaaS

PaaS is a delivery model that provides a platform as a service through the Internet or a network, enabling developers to deploy their applications on the cloud.

A PaaS vendor provides a platform as a service through the Internet or a network. PaaS enables customer-created applications to be deployed on the cloud. It offers on-demand elasticity, scaling the platform or runtime environment up or down as required.

PaaS is also called as cloudware because it moves resources from desktop PCs to the Internet cloud.

1.8 IaaS

IaaS is a delivery model that provides processing capabilities, storage, and networking components through the Internet.

An IaaS vendor provides you the infrastructure you need for developing your applications, such as network, processing capabilities, and data storage. This infrastructure is elastic and available on-demand.

With the IaaS model, a customer could be anyone who needs a development environment, hardware and network resources for creating software.

1.9 Cloud Deployment Models

The cloud deployment model determines how the cloud computing environment will be deployed.

There are two cloud deployment models:

➔ Private Cloud:

In this deployment model, the cloud infrastructure is private to an organization. A private cloud may be hosted and managed by an organization inside an organization's firewall or may even be off the premises.

In a private cloud, data and processes are managed at data centers within the organization without the restrictions of network bandwidth and security exposures. This improves security and reliability because the access to the infrastructure is restricted.

→ Public Cloud:

In this deployment model, the cloud services are available on a pay-and-use basis to all Internet users or to a large organization. These services are provided by third party service providers or vendors through the Internet.

Public clouds provide a flexible and cost effective way to deploy solutions. The cost of infrastructure and deployment of applications is distributed among all users, providing each user the benefit of “pay-as-you-go” model. Each user pays only for his/her usage of computing resources that are provided by the vendor.

Knowledge Check 1

- Which of the following statements about SaaS, PaaS, and IaaS are true?

(A)	SaaS is also called as cloudware because it moves resources from desktop PCs to the Internet cloud.
(B)	Cloud computing is the convergence of three major trends: Virtualization, Utility Computing, and SaaS.
(C)	Amazon EC2 is an example of IaaS.
(D)	An IaaS vendor provides only a platform as a service through the Internet or a network.

- Which of the following statements are true about cloud deployment models, delivery models, and Amazon EC2?

(A)	Amazon Elastic Block Store (EBS) offers temporary storage for Amazon EC2 instances.
(B)	Instances can be placed in multiple locations with the help of Amazon EC2.
(C)	In a PaaS model, the consumer can control the platform to an extent but does not have any control over the hardware, software or operating system being used.
(D)	In a private cloud, data is managed in the organization without the restrictions of network bandwidth and security exposures.

Knowledge Check 1 Answers

1.	(B), (C)
2.	(B), (C)



Summary

- ➔ Cloud Computing enables on-demand access through Internet or a network to computing capabilities and resources.
- ➔ SaaS, PaaS, and IaaS are three models to deliver cloud services, application platforms, or infrastructure.
- ➔ There are two cloud deployment models namely private and public.