V Skills
Skills for a secure future

Certified Cloud Computing Professional Sample Material

V-Skills Certifications

A Government of India
&
Government of NCT Delhi Initiative

V-Skills

Skills for a secure future

1. INTRODUCTION

Let us get flashback of few years back. Suppose you have some important files in a system at home but, you are away from your home. If a file is needed immediately, you would have to return to home for taking that file in a pen-drive or in a CD. But now in this present time the situation is totally different, where you are in one place but can still access the file kept at some other place. This is all because of **CLOUD COMPUTING**.

Cloud Computing is a modern technology which is based on internet. It uses the internet and central remote servers to maintain data and application, or you can say, it uses the computer resources that are delivered as a service over the internet. The Cloud Computing can be called as the next stage in the evolution of internet.

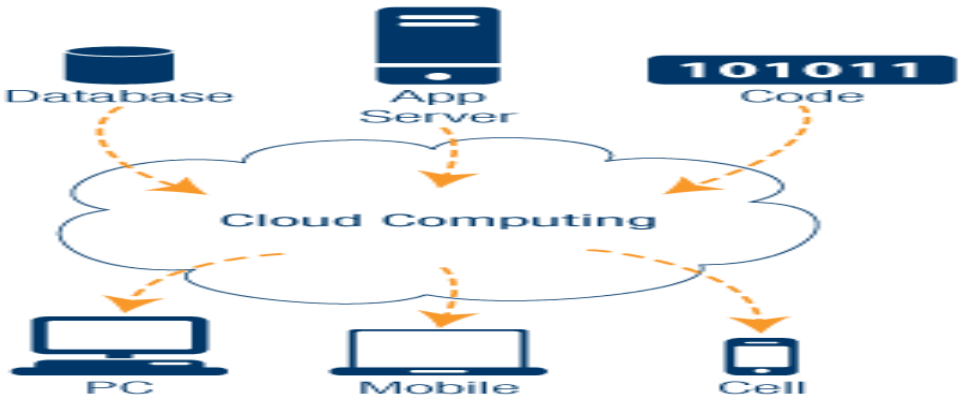

Figure 1: A basic structure of cloud computing

1.1. Evolution of cloud and types

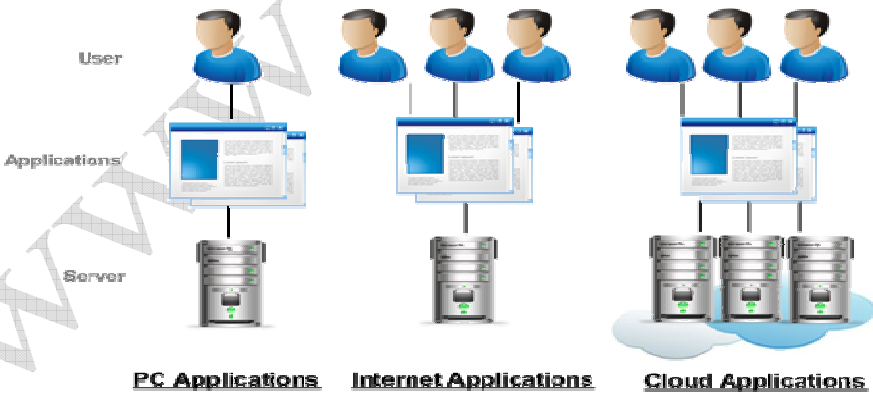

Figure 2: How cloud computing evolved

Have you ever thought of from where the term Cloud Computing or the concept of cloud computing was originated? When this concept started capturing the internet?

J.C.R. Licklider- He is the person who is considered as the genius who brought the concept in front of the world.

If we divide the evolution of cloud computing into eras, then broadly it can be divided into 3 eras, as mentioned below

- ✓ Concept Evolution Era- This era started in around 1960s and was carried on till the last of 20th century. In this time period the central idea and concept of computing as utility computing and grid computing was developed.
- ✓ No Cloud Era- This era started in the end of 20th century and was stretched for about half a decade. In this period, internet as a tool to provide Application/Software as Service got developed.
- ✓ Cloud Computation Era- This is the present era, where the term "Cloud" has a different meaning than what we learnt in the primary classes. Now "Cloud" means storage and accessing of data with access according to the user or the client.

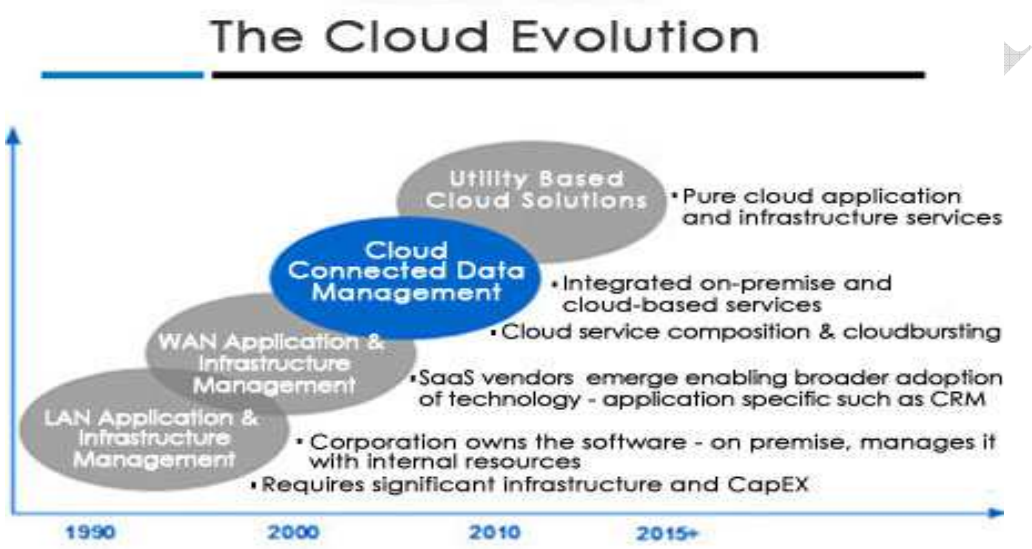

Figure 3: Generation of Cloud

The basic concept of cloud computing was introduced in the 1950s, when large scale mainframe computers were actively used in the industries. These systems were shared via nodes or clients. As huge giant sized mainframes were costly to purchase and maintain, so it was a priority to find a solution which will provide services at low investments. This requirement led to the concept of enabling multi-user access to the data from different nodes and hence saving time, thus saving the time which was used to do work one by one, and this was termed as time-sharing. To prioritize the cost efficiency, many companies and small groups could avail themselves of computing through time-sharing. Also organization like IBM, GE's GEISCO etc. uses time sharing techniques as a commerce issue. The availability of high capacity, low cost computers and storage devices as well as quick adopting of hardware virtualization, service oriented architecture, autonomic, and utility computing resulted in growth of cloud computing.

In the 1960s, John McCarthy opined that "computation may someday be organized as a public utility". Each and every characteristics of cloud computing was (elastic provision, provided as a utility, online, illusion of infinite supply), the comparison to the electricity industry and the use of public, private, government, and community forms, were well mentioned in Douglas Parkhill's book, The Challenge of the Computer Utility. Scientist Herb Grosh postulated the entire world would be operated on dumb terminals powered by about 15 large data centers.

In 1990s, telecommunication companies started using and implementing Virtual Private Networking (VPN), where earlier dedicated or point-to-point data transfer was used. This change

of technology also made a huge cut off to the price of the services and also the bandwidth of networks were used efficiently.

In 2006, Amazon launched its Elastic Compute cloud (EC2) as a commercial web service that allows small companies and individuals to rent computers on which to run their own computer applications. Interesting fact about S3 is that it uses the pricing model of "pay-per-use". This has now become the standard for cloud computing pricing.

1.2. Cloud types

Cloud computing can be divided into three different models: public, hybrid, and private. While the three models have common traits, they also have different key features that make one model a better choice to meet business' IT needs.

The Private Cloud

The Private Cloud is dedicated to private infrastructure. You can consider your personal data centre setup as a Private Cloud IaaS. But unless the cloud infrastructure (virtualization, storage, extreme redundancy, etc.) is present, it is not considered as a cloud, but the basic concept is same. Two examples of private cloud solutions are VMware vCloud and Citrix VDI. It is also called "internal cloud computing," and is the next generation of virtualization.

The Public Cloud

The Public Cloud is dedicated completely to hosted solution. Here no hardware is owed by the user. It is the traditional model that everyone thinks of when they envision cloud computing. Vendors dynamically allocate computing resources (hard drive space, RAM, and processor power) on a per-user basis through web applications. Salesforce.com and ADP are two well-known vendors that offer public cloud computing services.

The Hybrid Cloud

The Hybrid Cloud combines the concept of both Private as well as Public. Most company evolved into this type of cloud from a traditional, private hardware infrastructure to a cloud-based one. Generally, business applications like Exchange Server 2007 or Microsoft Dynamics will interact with a vendor-hosted service. For example, Cisco, offers IronPort Email Security as their hybrid solution and Google, known for hosted solution, offers Postini email archiving.

Mixing of Private Cloud with Public Cloud is the best solution for you and your customer. It intermingle the privacy of a traditional data centre with the hosted cloud infrastructure. It can be said that, companies will transition their data recovery efforts to the Public Cloud while retaining production and operations in-house by a Private Cloud.

Experts and analysts predicted that by the end of 2012, around 20% of businesses will exist completely in the Public Cloud.

www.vskills.in

1.3. Cloud service models

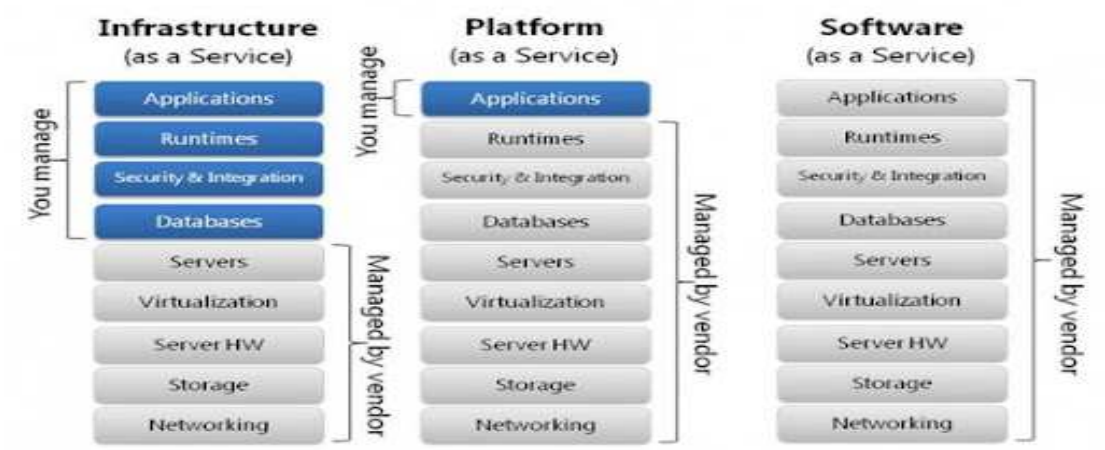

Figure 4: Models of cloud

The basic cloud service models are as follows

- ✓ Infrastructure as a Service (IaaS)
- ✓ Platform as a Service (PaaS)
- ✓ Software as a Service (SaaS)

Infrastructure as a Service (IaaS)

Infrastructure as a Service (IaaS) is that part of cloud computing that allows leasing and managing computing infrastructure for business needs. This consists of virtual machines (VMs) run as guests by a hypervisor, like Xen or KVM with operating system, middleware, network, storage, data and applications.

The vendor also supplies a management interface in which one can interact with the Services. Payment for computing resources in done with respect to number of User's system, time duration (generally per hour), usage of bandwidth (generally in gigabyte), storage(generally in gigabyte) or combination of any.

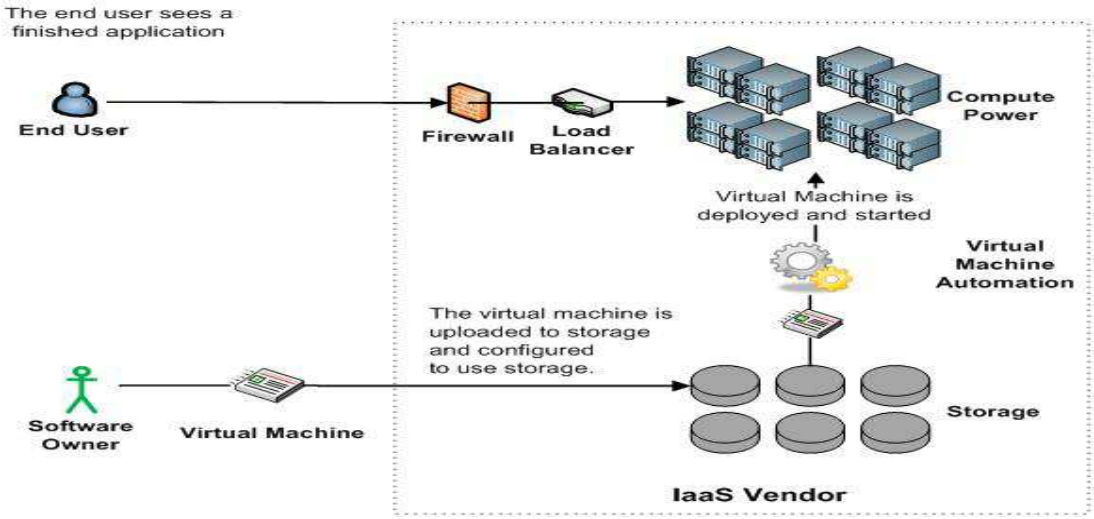

Figure 5: IaaS model

IaaS cloud providers and vendors provide the physical hardware that they own and manage in the backhand, supply on demand from large pools in data centers. Examples of IaaS include: Amazon CloudFormation (and underlying services such as Amazon EC2), Rackspace Cloud, Terremark and Google Compute Engine. User installs operating system images on the machines as well as needed application software. The end user is responsible for patching and maintaining the operating systems and application software.

Platform as a Service (PaaS)

Platform as a Service are development platforms for which the development tool itself is hosted in the cloud and accessed through a browser. With PaaS, developer can build web applications without installing any tools on their computer and then deploy those applications without any specialized systems administration skills. PaaS service providers deliver a computing platform with operating system, programming execution environment, database, and web server. The computer and storage resources scale automatically to match application demand in PaaS.

The alternative to PaaS is to develop web applications using desktop development tools like Eclipse, and then manually deploy those applications to a cloud hosting provider. PaaS requires the following elements as a minimum requirement

- ✓ Browser-based development studio - If you have to install something on your computer to develop applications.
- ✓ Seamless deployment to hosted runtime environment - Ideally, a developer should be able to deploy a PaaS application with one click.
- ✓ Management and monitoring tools - While cloud-based solutions are very cost effective, but are tricky to manage and scale without good tools. Hence, monitoring tools to monitor cloud application are needed.
- ✓ Pay as you go billing - Avoiding upfront costs has made PaaS popular as payment is based on actual usage of resources.

PaaS platforms also have functional differences from traditional development platforms. These include

- ✓ Multi-tenant development tool: traditional development tools are single user - a cloud-based studio must support multiple users, each with multiple active projects.
- ✓ Multi-tenant deployment architecture: scalability is often not a concern of the initial development effort and is left instead for the administrators to deal with when the project deploys. In PaaS, scalability of the application and data tiers must be built-in (e.g., load balancing, failover need to be basic elements of the dev platform itself).
- ✓ Integrated management: traditional development solution usually does not concern themselves with runtime monitoring, but in PaaS, the monitoring ability needs to be integrated into the development platform.
- ✓ Integrated billing: PaaS offerings require mechanisms for billing based on usage that are unique to the SaaS world.

The benefits of PaaS depend upon the people who can develop, maintain and deploy web applications. Building web applications requires expert developer with three, highly specialized skill sets

- ✓ Back end server development (e.g., Java/J2EE)
- ✓ Front end client development (e.g., Javascript/Dojo)

www.vskills.in

- ✓ Web site administration.

Examples of PaaS include

- ✓ App Engine from Google: based on Python and Django
- ✓ Force.com from SalesForce: based on the SalesForce SaaS infrastructure and Apex language
- ✓ Bungee Connect: visual development studio based on Java
- ✓ Long Jump: based on Java/Eclipse
- ✓ Wave Maker: visual development studio based on Java and hosted on Amazon EC2

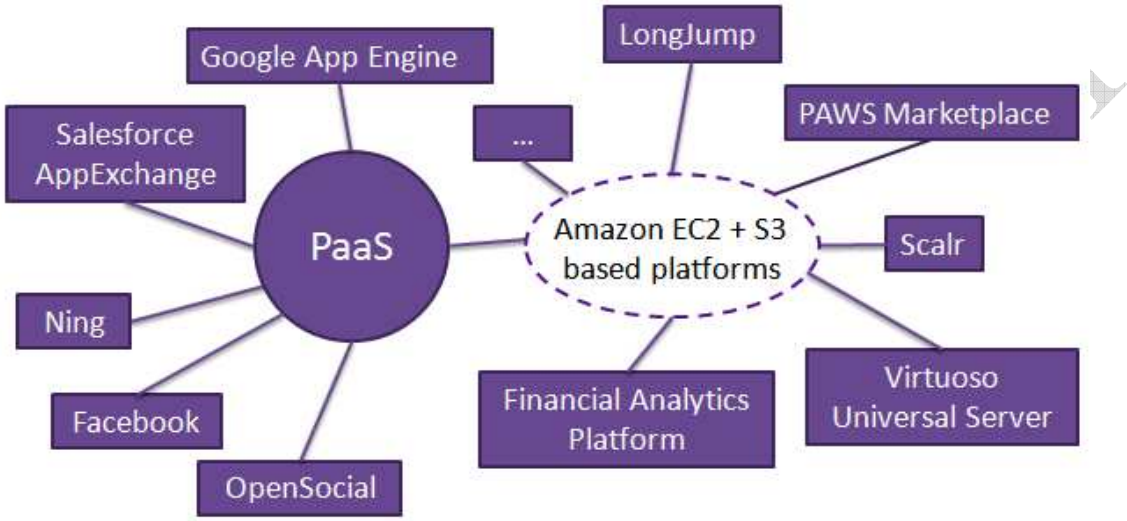

Figure 6: PaaS model

Software as a Service

Software as a Service (SaaS), works as a software supplier. It is a software supplying model where software and data are hosted on the cloud. SaaS is accessed by users via web browser.

SaaS in the present technical industry have become a common delivery model for many business applications, including accounting, collaboration, customer relationship management (CRM), management information systems (MIS), enterprise resource planning (ERP), invoicing, human resource management (HRM), content management (CM) and service desk management. One of the biggest selling points for these companies is the potential to reduce IT support costs by outsourcing hardware and software maintenance and support to the SaaS provider.

Centralized hosting of business applications dates back to the 1960s. Starting in that decade, IBM and other mainframe providers conducted a service bureau business often referred to as time sharing or utility computing. Such services included offering computing power and database storage to banks and other large organizations from their worldwide data centers.

Software as a service essentially extends the idea of the ASP (Application Service Provider) model. The term Software as a Service (SaaS), however, is commonly used in more specific settings

- ✓ As of 2012 Software as a Service vendors typically develop and manage their own software instead of managing and hosting third-party independent software vendors' software

- ✓ SaaS solutions rely predominantly on the web and only require an internet browser to use against requirement of installing software on users' personal computers by application service providers.
- ✓ Whereas the software architecture used by most initial application service providers mandated maintaining a separate instance of the application for each business, as of 2012 SaaS solutions normally utilize a multi-tenant architecture, in which the application serves multiple businesses and users, and partitions its data accordingly.

Unlike the traditional software which is sold as a perpetual license with an upfront cost in the market, SaaS provides price applications using a subscription fee, mostly a monthly or yearly fee. The initial setup cost for SaaS is typically lower than the equivalent commonly used software. SaaS vendors typically price their applications on the basis of usage parameters.

In SaaS model, a free service is made available with limited functionality, and fees are charged for enhanced functionality. Some other SaaS applications are completely free to users, with revenue being derived from alternate sources such as advertising.

With SaaS model, a single version of the application, with a single configuration, is used for all customers. In some cases, a second version of the application is set up to enable a select group of customers with access to pre-release versions of the applications for testing purposes. This is advantage with traditional software, where multiple physical copies of the software, each potentially of a different version, with a potentially different configuration, and oftentimes customized, are installed across various customer sites.

SaaS applications support application customization, i.e., users can set their own configuration that satisfies their functionality and appearance. Each user can have their own settings for the configuration options.

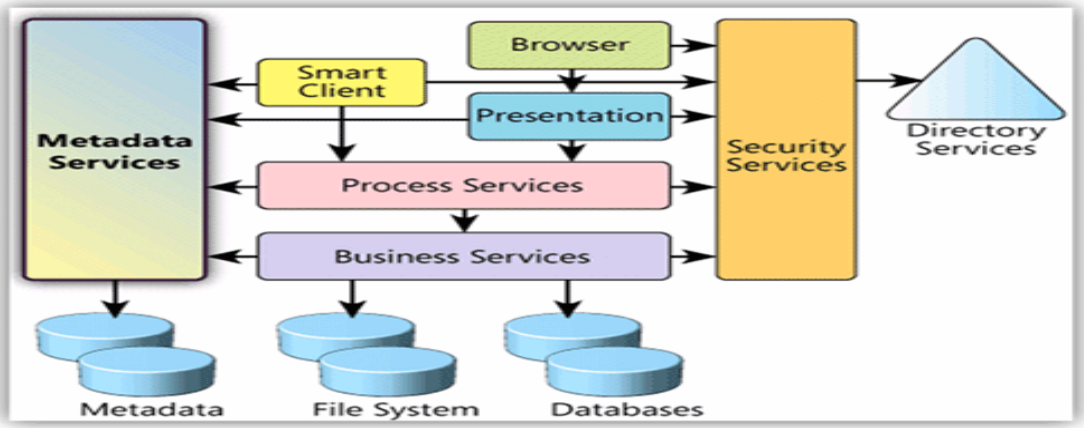

Figure 7: SaaS model

1.4. Cloud Characteristics

The salient characteristics of cloud computing based on the definitions provided by the National Institute of Standards and Terminology (NIST) are outlined below

- ✓ Cost Efficiency: Cost efficiency is the top characteristic of cloud computing model. To purchase the same amount of physical equipments and to maintain them, costs a lot that than bulk pricing from a cloud vender. IaaS is a hardware outsourcing, where users neither

purchase/own the hardware, nor maintain those. User uses the hardware but its maintenance is service provider's issue. As the traditional data centre infrastructure management is expensive due to payout for the hardware, maintenance, management and the business services that required all of this expense in the first place. The number of full-time employees (FTEs) not required for managing any hardware shows a significant savings. Since the virtual infrastructure comes with online management tools for creating new servers, installing operating systems, presenting storage and configuring network hence, fewer FTEs are needed to handle the job.

- ✓ On-demand self-service: A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service's provider.
- ✓ Broad network access: Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, laptops, and PDAs).
- ✓ Resource pooling: The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. Examples of resources include storage, processing, memory, network bandwidth, and virtual machines.
- ✓ Device and location independence enable users to access systems using a web browser regardless of their location or what device they are using. There is a sense of location-independence in that the customer generally has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction (e.g., country, state, or data centre).
- ✓ Rapid elasticity: Capabilities can be rapidly and elastically provisioned, in some cases automatically, to quickly scale out and rapidly released to quickly scale in. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be purchased in any quantity at any time.
- ✓ Measured service: Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts). Resource usage can be managed, controlled, and reported providing transparency for both the provider and consumer of the utilized service.
- ✓ Application programming interface (API) accessibility to software that enables machines to interact with cloud software in the same way the user interface facilitates interaction between humans and computers. Cloud computing systems typically use REST-based APIs (Representational State Transfer).

www.vskills.in

Self Assessment Questions

Q.1 What does the term REST refers to?
A. Representational Station Transfer
B. Representational State Transfer
C. Representational State Transmission
D. Representative State Transfer

Q.2 Which cloud type is known to use personal data center for cloud applications?
A. Private
B. Public
C. Hybrid
D. None

Q.3 Which of the following cloud models uses web?
A. IaaS
B. PaaS
C. SaaS
D. All of the above

Q.4 Which type of cloud is offered by Sales force?
A. Public
B. Private
C. Hybrid
D. None

Q.5 What does the term API stands for?
A. Application programming interface
B. Application program interface
C. Application protocol interface
D. Application provisioning interface

Answers: 1-B, 2-A,3-D,4-A,5-A

www.vskills.in