SMACS (Social, Mobile, Analytics, Cloud, and Security) Technologies for Business

Block

4

CLOUD FOR BUSINESS

Ref. No. SMACS-IFHE – 092022B4

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BLOCK 4: CLOUD FOR BUSINESS

All business entities generate large amounts of data. They also need to work with latest software tools. Cloud allows dynamic memory management, scalable operations, flexibility with applications, easy disaster recovery, collaboration efficiency, and access to tools at low cost. Business executives need to understand the use and advantages of cloud for various business functions.

Cloud for Business is aimed at the use of cloud technology for performing different business functions. It details the architecture and services, use of clouds for social marketing and then integrating various business applications as enterprise systems and deploying on the cloud. There are three units in this block.

Unit 13: Cloud Architectures and Services introduces the reader to cloud features, its functionality, architectures, and service models. It lays emphasis on infrastructure as a service, platform as a service, software as a service, and "anything" as a service. It then discusses cloud business models, commercial clouds, and grid computing.

Business executives need to know about working with these various cloud services to select suitable service based on need, and get results at lower costs.

Unit 14: Enterprise Systems Development Using Cloud Technologies focuses on types of clouds, application design on clouds, architecting big data systems, factors impacting cloud architectures. It covers elastic computing platforms and its features, Hadoop, ERP on the cloud, designing with virtualization, and DevOps.

The business executive needs to be exposed to these aspects for adapting suitable model.

Unit 15: Clouds for Social Marketing describe opportunities and risks in social marketing using clouds, social media marketing, using social data, optimizing email campaigns, types of actionable social data for social marketing, and measuring social marketing results.

Organizations are taking highest advantage of social marketing in the present day scenario to achieve larger connectivity to prospective customers with 100% assurance and at lower costs. Cloud is one such platform which aids the business execuitves in achieving this goal through scalable operations. Hence they need to know of usage of cloud for social maketing.

Unit 13

Cloud Architectures and Services

Structure

"Line-of-business leaders everywhere are bypassing IT departments to get applications from the cloud (also known as software as a service, or SaaS) and paying for them like they would a magazine subscription. And when the service is no longer required, they can cancel that subscription with no equipment left unused in the corner."

- Daryl Plummer, Gartner analyst

13.1   Introduction

By shifting to Cloud based Infrastructure, companies need not make huge capital investment in inhouse IT infrastructure since the cloud provides resources on demand.

We discussed marketing, and business intelligence using analytics in the previous units. This was based on data, information, knowledge, wisdom, business intelligence components, business intelligence architecture, data mining techniques, and customer experience management. All these involve huge investments and many organizations, especially the start-up organizations cannot afford the straight down-payments for resources such as hardware, servers, networks, and storage. Now there is a simple solution to this problem— cloud computing and cloud services. Using cloud services, organizations can pay as per usage of the resources. They do not have to pay for the resources they acquire in

the cloud. They have to pay for their use only. They do not have to pay for the idle resources also. Scaling the applications, ramping up the teams and acquiring infrastructure, platforms, software applications can be easy and cost-effective for the organizations using cloud computing. This avoids huge investments for the organizations. Just as one pays for electricity, water and gas as he or she moves into the new apartment, similarly organizations can subscribe to cloud providers and acquire infrastructure, platforms and software applications from anywhere and connect to the internet. Currently, cloud computing is becoming popular because of the gradual growth of the firms which require digital storage of their data. Therefore, several cloud providers compete with each other to provide, "quality service and huge space for data storage" to companies with many features.

Various companies are advancing with their innovative cloud computing solutions. Microsoft launched cloud solutions like Microsoft Office 365 and Microsoft Dynamics for office related tasks. Salesforce.com is well-known for its on-demand provision of customer relationship management (CRM) applications on a subscription basis using software as a service (SaaS) model. CRM online provides a set of web based tools for small businesses, independent consultants and professionals. IBM provides IBM SmartCloud which is for social business, such as social networking and collaboration that is delivered through SaaS model. VMware offers vCloud Hybrid service as infrastructure as a service (IaaS). vCloud Hybrid service provides two distinct core compute services, dedicated cloud and virtual private. These two services provide a set of resources to compute, storage and network. Amazon Web Services provide infrastructure to several businesses around the globe with high reliability, scalability and cost effectiveness. Rackspace provides an enterprise level hosting services to all sizes of firms across the world.

This unit discusses cloud features and functionality, cloud architecture and cloud deployment models such as public cloud, private cloud, community cloud, and hybrid cloud. It covers all the available Cloud service models such as Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS), Business process-as-a-Service (BaaS) and Anything-as-a-Service (XaaS). Cloud business models, grid computing and Amazon cloud services are also shared for the benefit of the business executive.

The advantages of the cloud include reduced cost of software development, increased productivity because of componentization and reuse, access from anywhere, availability, scalability and portability between different cloud vendors. Virtualization, storage, backup and recovery, and cloud management services are provided by the cloud providers. Organizations such as Amazon, Microsoft, IBM, HP, Apple, Oracle, and Google are competing with one another in the cloud space. Amazon's Web Services (AWS) infrastructure-as-a-service and Microsoft's Azure as platform-as-a-service are currently very popular in the market. Cloud computing is changing business models and product development

models altogether. Now, the non-cloud based products are to be deployed or migrated onto the clouds for effective business purposes.

13.2   Objectives

By the end of this unit, you should be able to:

- Explain cloud computing features and functionality.

- Discuss cloud architectures and deployment models such as public cloud, private cloud, outsourced private cloud, community cloud, and hybrid cloud.

- Discuss the cloud service models such as Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS), Business process-as-a-Service (BaaS) and Anything-as-a-Service (XaaS)

- Explain grid computing and cloud computing.

13.3   Cloud Features and Functionality

Cloud computing is derived from areas such as distributed computing, Web 2.0, Service Oriented Architecture (SOA), high performance computing, grid computing, utility computing, virtualization, and internet. Cloud computing has its own technical, user experience and economic characteristics. Using cloud computing, organizations can have large-scale distributed computing infrastructure without owning it.

Cloud is a logical network of computers, devices, storage, and networks with virtualization, infrastructure providing backup and recovery facilities , platforms, and software to consumers for development purposes on utility or demand basis.

Cloud computing is a service oriented technology that integrates both hardware and software distributed through a network on demand regardless of time and location. Web applications like Web-mail, Flickr, Facebook, YouTube and Google docs are widely used cloud computing services by individuals. The five main features of cloud computing are on-demand self service, broad network access, measured service, resource pooling and rapid elasticity. On demand self-service provides independent supply of IT resources without user interface with the provider. Customers can access computing capabilities as and when they require and this would help them to be in control, get agility in their work. Broad network access feature of cloud allows the delivery of IT resources through the internet using any device. Measured service means the regular control and fulfillment of resource requests in an optimal way through pay per use method. This helps the customer to track their usage and finally help to reduce cost. Cloud computing allows pooling of resources to serve a large number of customers. Resources are dynamically allocated and de-allocated according to demand in cloud environment using multitenancy model. Multitenancy model of cloud permits multiple users to work in a software environment simultaneously, each with their own separate resources, user interface and services. Rapid elasticity feature of cloud computing allows a vigorous scaling up and down of resources

with demand. This means that resource allocation should be elastic, in the way that it should change aptly and rapidly with the demand.

The characteristics of cloud computing include high scalability, security, low cost, availability, reliability, device independence, multi-tenancy, elasticity, location independence, strong fault-tolerance, and sustainability. Other characteristics of cloud computing include the dynamic acquisition of infrastructure, consumption-based billing, self-managed platform, and self-service based usage model.

Features and functionality of clouds are given below:

- Cloud computing is based on TCP/IP networking, which includes massive processors, huge memory, and high speed networks.
- Cloud computing comprises data centers and uses standard protocols for communication between different vendor clouds.
- Clouds are easy to access.
- Cloud is a loosely coupled network. Even if one system fails, other parts of the cloud can function.
- Cloud provides user-friendly virtualization facilities.
- A variety of resources are available over the internet in clouds.
- Pay per use facilities rather than owning the resources are possible in cloud computing.
- Resource optimization can be achieved using cloud computing.
- Different SLAs (Service Level Agreements) are possible between cloud consumers, cloud providers and other cloud stakeholders.
- An application on the cloud can be independent, scalable, economical, and flexible.
- In cloud computing, infrastructure is separated from software or business logic while developing applications.
- Cloud computing also works as a client-server model.
- Return on investment in cloud infrastructure can be achieved quickly.
- In cloud computing, unused resources are released as per the non-usage or idle time.
- Cloud middleware software provides services such as resource accounting, monitoring, management, discovery, virtualization, security, reliability, replication, and mapping.
- Cloud computing allows management of hardware and software by a third party instead of the organization developing the actual software applications or the software product.

Commercially available clouds in the market include Amazon's AWS, Microsoft Azure, Google Apps Engine, and Salesforce CRM.

Example: Cathay Pacific Airways Moves Passenger Revenue Optimization System to Cloud (Amazon Web Services)

Cathay Pacific Airlines was hosting its passenger revenue optimization system on in house servers. The maintenance burden was heavy.

Hardware needed to be upgraded periodically to cater to the growing demand. Also, PRO's standard electronic analytics could not be used by the airline due to lack of infrastructure. The need was for a scalable, high-performance architecture which can reduce the time to add new features while addressing data compliance and cybersecurity.

Management of the system was moved to the cloud. A 20 percent growth was achieved in performance by the airline.

Source: https://aws.amazon.com/solutions/case-studies/cathay-pacific-rds-case-study/?did=cr_card&trk=cr_card, 2020, Accessed on 15th July, 2022

13.4 Cloud Architectures

The backbone architecture of cloud computing is mutitenancy where same software is accessed by several connected users over the internet simultaneously. Cloud service is hosted, provisioned and managed by a cloud provider and each user can customize the service as their preferences and settings. Conversely, same software instance is used to provide to all of these settings without giving access to its source code. For example, SaaS-based service is a common example of multitenant architecture where a single application is accessed by multiple users worldwide.

National Institute of Standards and Technology (NIST), US has given a reference architecture for cloud computing, comprising the stakeholders in cloud computing such as cloud consumers, cloud providers, cloud brokers, cloud auditors, and cloud carriers.

We will define the most used terms below:

- Cloud consumers are the ones who subscribe to cloud services from cloud providers.

- Cloud providers provide cloud computing infrastructure, platforms, and software to the cloud consumers. They can charge a fee from the consumers based on the usage, CPU time and memory used.

- Cloud brokers aggregate the services from different cloud providers and provide services to cloud consumers. The consumers do not have to go to different providers for different purposes.

- Cloud auditors audit the cloud services at both provider and consumer sites with respect to speed, analytics, traffic, bandwidth, quality, reliability, availability, and information security.

- Cloud carriers are like transmission houses in the electric power supply. They enhance or value-add or just transmit the services to cloud consumers.

- Cloud consumers, cloud providers, cloud brokers, cloud auditors, and cloud carriers are stakeholders in the cloud computing industry. They can be individuals or organizations. Cloud deployment models include public cloud, private cloud, community cloud, and hybrid cloud.

13.4.1 Public Cloud

Public cloud is accessible to anybody who subscribes to that cloud. Public clouds provide cloud infrastructure and computing resources over the Internet. Public cloud is provided by a service provider and it is cost effective for small and medium sized businesses (SMBs) to deploy IT solutions. Example of public cloud is Google Apps. Generally, public clouds are accessible over the internet. One can connect to the public cloud using login/password mechanism or some other authentication mechanism. Public cloud owner serves different types of customers at any point in time. Public cloud architecture is shown in Figure 13.1. Examples of public clouds include social networking sites, online photo storage services, and internet email services. Amazon EC2 is also a public cloud.

For some organizations, security is a concern in public clouds because public cloud providers cater to many different customers. Typically they are designed for multi-tenancy and there are firewalls between applications which create a secure environment. While security is built between various users in the cloud if the other customers of this cloud provider include one of the organization's competitors, any leakage in the organization's data can create disasters for the said organization. Thus, having a data center in the public cloud has to be done very judiciously by the organizations.

Figure 13.1: Public Cloud Architecture
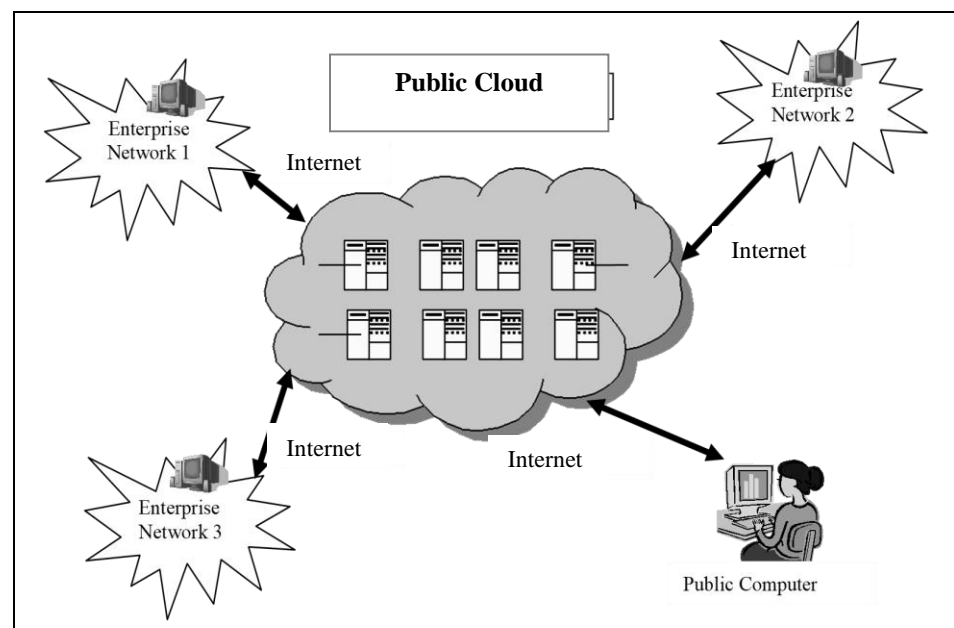
Source: ICFAI Research Center

13.4.2 Private Cloud

The ownership of a private cloud is specific to the organization. All the users or consumers of a private cloud are from that organization itself. Outsiders will not have access to private clouds. It is operated and maintained by the cloud owner itself. Otherwise, organizations can outsource the management of the cloud to a third party. The private cloud architecture is shown in Figure 13.2.

Figure 13.2: Private Cloud Architecture
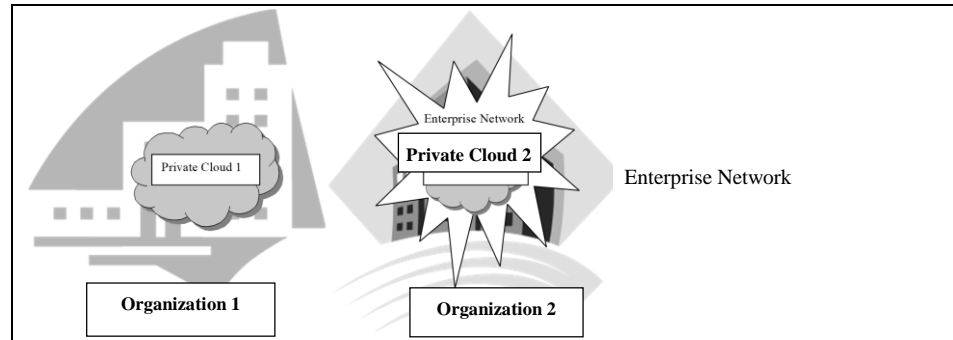
Source: ICFAI Research Center

It is an example of the on-site private cloud. Private cloud can also be part of the organizational enterprise network. Some organizations take/lease the private cloud space in a public cloud. That is, they outsource the need of the private cloud to the public cloud provider and they take a part of public cloud as a private cloud with needed authentication. Generally, large organizations can manage a private cloud in their premises. US government cloud certified by FISMA (Federal Information Security Management Act) is an example of this model. FISMA is US based legislation and protects government information, assets and operations against security threats. This scenario is shown in Figure 13.3.

Figure 13.3: Outsourced Private Cloud Architecture
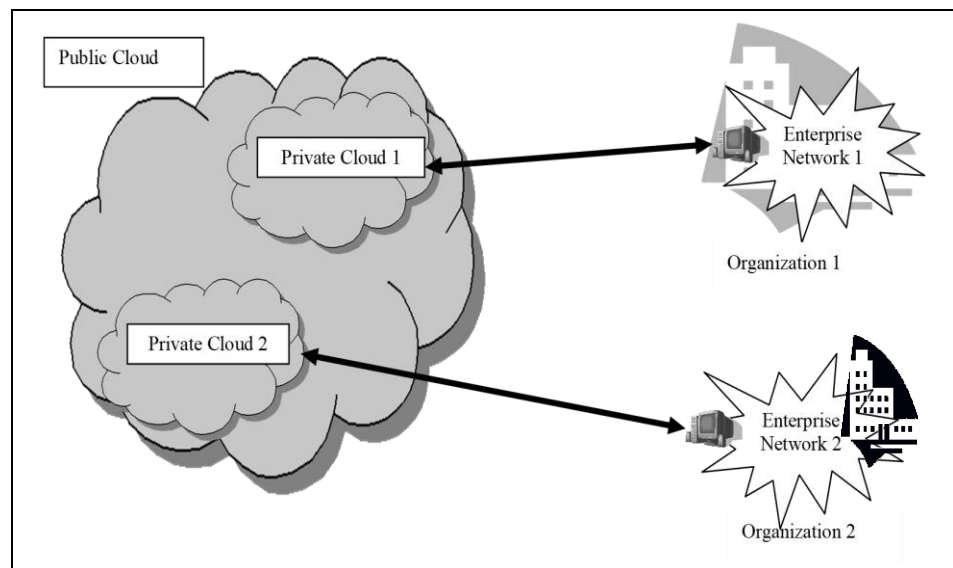
Source: ICFAI Research Center

13.4.3 Community Cloud

Community clouds are formed based on the common purpose of a group of organizations. Only the members of this group have the access to community cloud, and outsiders do not have access to the cloud. The community cloud is owned and operated by that specific group of organizations only. The group may have common interests in mission objectives, data privacy, and security and compliance policies. Figure 13.4 is an example of "community cloud" which connects Organization 1, Organization 2, Organization 3, and Organization 4. A group of organizations can share and control a community cloud having common interests. Terremark's Enterprise cloud platform provides US federal government's community cloud for big data analytics, collaborative applications, high-performance computing, and disaster recovery. Microsoft extended its Government Community Cloud (GCC) offerings to meet the needs of U.S. government agencies for mandatory digital transformations.

Figure 13.4: Community Cloud Architecture
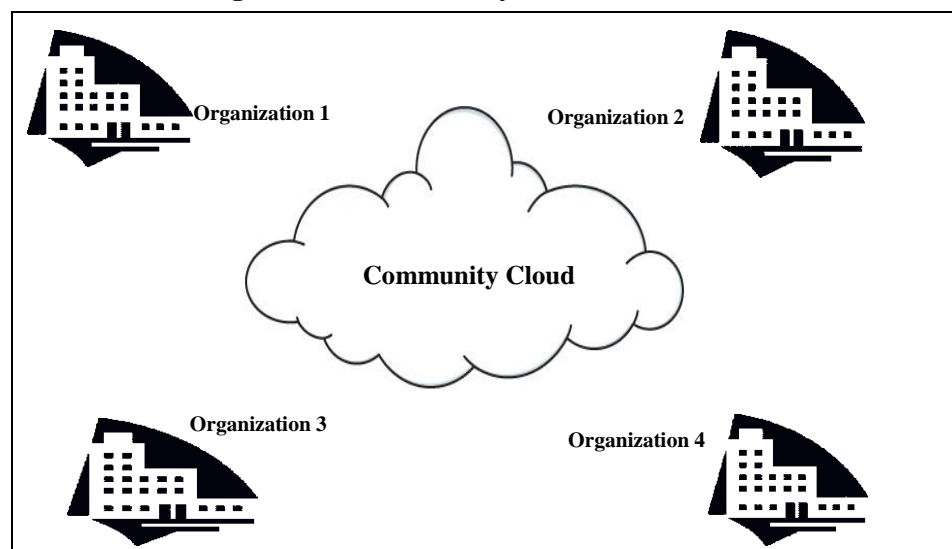
Source: ICFAI Research Center

The cloud users can access the resources from the local cloud in their organization and also the resources from the other organizations using community cloud. Operating and maintaining the community cloud can also be outsourced to a third party organization.

13.4.4 Hybrid Cloud

Hybrid clouds are formed with any combination of private, public and community clouds. It uses a combination of different methods of resource pooling. In Figure 13.5, a hybrid cloud is formed with the combination of a private cloud of Organization 2, Community cloud of Organization 1 and Organization 2, and the Public cloud. These three clouds are interconnected and form a hybrid cloud. The hybrid cloud combines the different deployment forms of cloud. Hybrid cloud

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combines public and private clouds and examples are Eucalyptus, Expedient, Fujitsu Hybrid Cloud Services (FHCS) and HP hybrid cloud management.

Figure 13.5: Hybrid Cloud Architecture
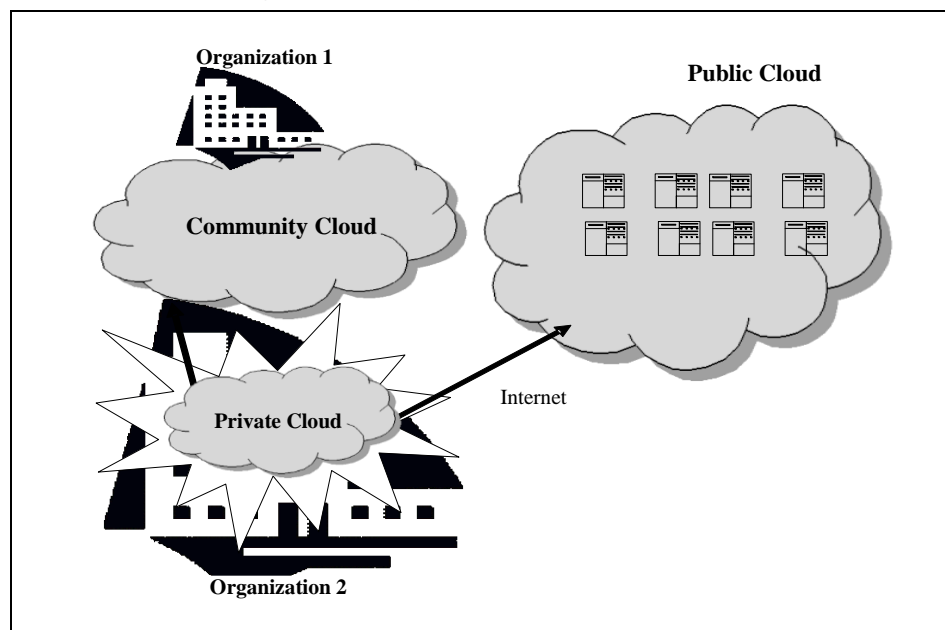
Source: ICFAI Research Center

Example: IBM and AT&T Will Work Together to Help Enterprises Manage their Applications Hosted in Hybrid Cloud Environments

IBM and AT&T joined together to facilitate companies in the management of their applications on the "hybrid cloud". IBM Cloud Satellite and AT&T networks were used for achieving this.

Customers get access to IBM's cloud and security services anywhere by using IBM Cloud Satellite. Along with AT&T's 5G network, customers could access 5G service. Use of 5G technology improved user experiences and generated new revenue streams.

Source: https://www.zdnet.com/article/ibm-forms-5g-network-partnership-with-at-t-to-bolster-its-hybrid-cloud-architecture/, dated October 29, 2020. Accessed on 17/05/2022

Let us do an activity (Activity 13.1) on cloud deployment model for an Indian bank.

Activity 13.1

Cloud Deployment Model for a Bank

The board of one of the small private sector banks in India proposed to go for cloud computing as it reduces software application development costs, application distribution times, processing time, and turnaround time to customers. They also read that there is a risk for customer financial details

using public clouds. However, they would like to achieve operational benefits, reduce the costs and save time for the bank using the cloud computing solution. Suggest a cloud computing solution to the bank management. How can they implement the cloud computing solution in this bank?

Answer:

Check Your Progress - 1

1. Which of the following is not a cloud characteristic?

    a. Scalability

    b. Low cost

    c. Availability

    d. Reliability

    e. Single Node

2. Which of the following is not a stakeholder in cloud computing?

    a. Cloud Provider

    b. Cloud Consumer

    c. Cloud Intruder

    d. Cloud Broker

    e. Cloud Auditor

3. Which of the following is not the possible cloud deployment model?

    a. Public Cloud

    b. Private Cloud

    c. Hybrid Cloud

    d. Community cloud

    e. Native Cloud

4. What can be the constituent clouds within hybrid clouds?

    a. Public and community clouds

    b. Private and community clouds

    c. Private, public and native clouds

    d. Private, public and community clouds

    e. Private and public clouds

5. For which of the following community cloud is meant?

   a. Single company

   b. Group of organizations

   c. General public

   d. Public sector organization

   e. Private company

13.5 Cloud Service Models

Clouds reduce the complexity of owning the resources and cost of acquiring the resources. Cloud computing organizations get freedom from thinking about resources, hardware, software licenses and they can concentrate on programming, innovation and their core competencies in product development.

Cloud service models include Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS), Business process-as-a-Service (BaaS) and Anything-as-a-Service (XaaS) (Figure 13.6).

Figure 13.6: Cloud Service Offerings
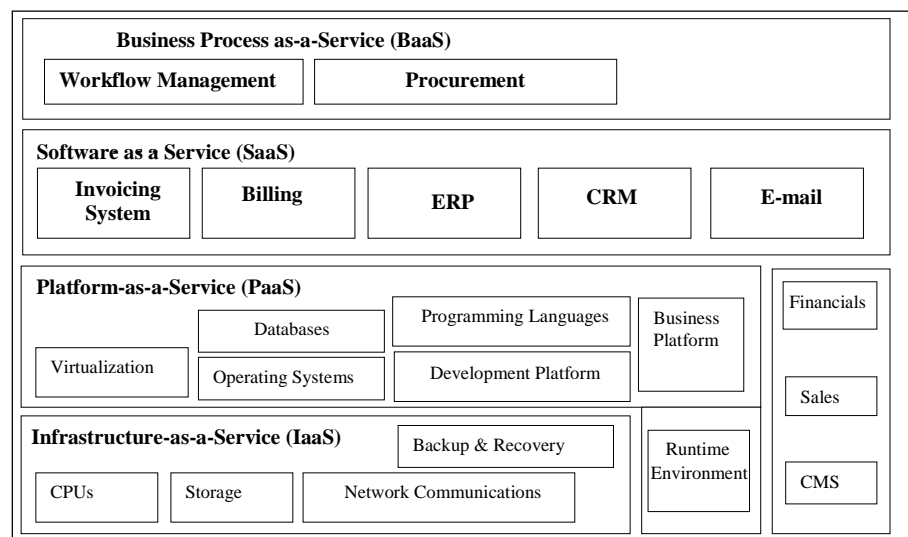
Source: ICFAI Research Center

In Figure 13.6, ERP stands for Enterprise Resource Planning, CRM stands for Customer Relationship Management, CMS stands for Content Management Systems, and CPU stands for Central Processing Unit.

13.5.1 Infrastructure-as-a-Service (IaaS)

In this model, cloud consumers can acquire and use hardware resources, storage and network bandwidth over the cloud. The billing will be based on CPU cycles and used storage space. In this model, the consumer gets the hardware resource or processor as a service and he needs to deploy his development platform and applications on to the cloud for his product development purposes.

The infrastructure services provided by the cloud providers include computing resources, hardware, storage, backup and recovery, platform hosting, and services management. IaaS is also known as Hardware-as-a-Service (HaaS). Infrastructure like hardware, software and devices for storage and network can be accessed with proper authentication.

Amazon Elastic Compute Cloud (EC2), Rackspace cloud servers, Elastic Block Storage (EBS), Simple Storage Service (S3), Joyent and Terremark are IaaS providers.

13.5.2 Platform-as-a-Service (PaaS)

PaaS model offers platforms for operating systems, database storage, middleware and software development and tools. Microsoft Azure Services, Google App Engine platform, Amazon Web Services (AWS), Rackspace cloud sites, Amazon's relational database services, etc. are popular vendors of PaaS. In this model, the consumer gets the hardware resource and development platform as a service from the cloud provider. The consumer further has to develop his or her own applications on the chosen platform in the cloud. The platform services provided by the cloud providers include databases, business intelligence, development platforms, testing tools, application deployment tools, and integration tools.

Example: Microsoft Azure Platform and Google Apps Engine are PaaS providers.

Platforms are of two types. They are development platform and business platform. *Development platforms* allow developers to upload their code, write their code, compile, assemble, and execute their programs. They need not worry about the infrastructure, platform and scalability. Example: Morph Lab and Google App engine. *Business platforms* allow development, deployment and management of tailored or customized business applications on the cloud. Example: Salesforce CRM platform.

13.5.3 Software-as-a-Service (SaaS)

SaaS was a rebirth of ASP as on-demand computing. In SaaS, software applications are kept on a server for hosting over internet for end user usage without installing and updating/upgrading software on the client's machine. It is the most mature and biggest cloud model. Some common examples of SaaS include email applications like Yahoo Mail, Gmail and Hotmail, commercial applications like Word processing, CRM (Customer Relationship Management) and ERP (Enterprise Resource Planning), and social softwares like Google Apps, Facebook, Twitter, Microsoft Office Live and Salesforce.com.

In this model, the cloud consumer straightaway gets the software applications from the cloud provider from their portfolio of applications. The cloud consumer need not develop any applications. He can straightaway start using the applications provided in the cloud. Generally, the software applications which are provided over the cloud by cloud providers include ERP, CRM, billing

applications, sales applications, email, office automation applications, financial applications, document management, content management, social networking applications, and human resources applications. It is targeted at replacing the traditional PC-based software applications. Now, using cloud SaaS services, the desktop PCs need not have software applications; they can be accessed from the cloud.

Examples: Apple's App Store, Amazon's Kindle bookstore, Google Docs and Salesforce CRM.

13.5.4 Business Process–as–a–Service (BPaaS)

Business Process as a Service (BPaaS) is a form of facilitating various business processes for outsourcing (BPO) employing a cloud computing service model. We are familiar that one of the aims of traditional BPO is to probably reduce labor costs. But BPaaS reduces the labor count by utilization of increased automation, which also helps in cutting costs in the process. Many types of outsourcing services are offered via the BPaaS model. Some examples include: HR functions such as payroll and benefits administration, procurement in manufacturing, advertising in marketing, marketing research services etc., and other industry operation processes.

13.5.5 Anything-as-a-Service (XaaS)

In this model, the providers provide infrastructure, platform, software applications, business applications, or any other service to the users over the internet. Anything as a service includes everything as a service over the internet. XaaS also includes providing services such as communications, storage, networking, and monitoring as a service.

For example, everything-as-a-Service, or XaaS, earlier known as software-as-a-service (SaaS), extended itself to add services like storage-as-a-service, desktop-as-a-service, disaster recovery-as-a-service, marketing-as-a-service, and healthcare-as-a-service. Apart from this, infrastructure-as-a-service and platform-as-a-service are also included in it making it a very generic platform to have anything under one umbrella. XaaS is also known by another name as Anything-as-a-Service.

Example: KION Group - A Germany based Warehouse Automation Firm, Lowers Costs and Improves Scalability through Microsoft Azure Cloud

Germany-based KION Group was a leader in warehouse automation. The company owned around six thousand warehouses in about hundred countries. The company migrated its IT applications to Azure with DXC Technologies as a vendor. Around 25 servers were migrated to the cloud every week. The migration led to simplification of operational processes. It also resulted in enhanced reliability.

Source: https://dxc.com/us/en/insights/customer-stories/kion-group-lowers-costs-and-improves-scalability-with-applications-on-microsoft-azure-cloud, 2020. Accessed on 18.05.2022.

Activity 13.2

Cloud Service Model for a Start-up Software Company

A startup software company is into office automation products, developing products and selling to domestic customers. The company currently has 25 developers. They would like to scale it to 200 by the end of the year. The company does not have enough funds for a down payment for hardware and platforms. The known platforms are very expensive. However, they would like to scale quickly at low costs. They want to reduce cycle time and go-to-market time. The developers also would like to work from anywhere using the internet. Suggest the kind of cloud service models suitable for this organization. Also, suggest some of the cloud service providers in this area.

Answer:

13.6   Cloud Business Models

Cloud business model is a model of revenue generation followed by users based on their requirements. It generally focuses on how to measure the resource utilization by the users and its payment model.

Following are some of the business models operating in the cloud computing area:

- Pay-per-use business model is the popular business model in the cloud computing area. As in utility services such as electricity, water and gas, the consumers can pay as per their usage of the CPU time, number of processors, memory consumed, storage taken (gigabytes), bandwidth taken, number of users, and time spent on the cloud. It is also known as utility-based pricing model.

- Subscription-based pricing model is followed by some of the cloud providers. In this model, the user is charged per month fixed subscription charges.

- Leasing IT facilities online is another approach for companies such as IBM, HP, Dell, and EMC.

- Broker-based models reduce the costs to both the cloud providers and the cloud consumers. The consumer does not have to pay different rates to different cloud providers. He can pay flat rates to cloud brokers.

- *Free models:* Some providers whose clouds are in the beta testing stage are even providing access to their clouds freely to attract the customer base and to stabilize their technology by gaining user experience. For example, the free cloud services on the internet include Google Search, Facebook social networking, and Hotmail email services.

- Dynamic pricing models are based on auctions and negotiations. Prices are decided dynamically, based on the usage patterns.

- The traditional hardware and software-based business models evolve into IaaS, PaaS, SaaS, and BaaS business model.

Example: Spanish Logistics Company MRW Migrates to Hybrid Cloud based on Pay Per Use Pricing Model

MRW was a Spain based supplier of logistics services. The company managed around 70 million shipments per year. It signed a contract to migrate its IT systems to hybrid cloud. With this, the company wanted to speed up deliveries and enhance information security. The company also realized cost savings (Pay per use) and flexibility to grow its business.

Source: Spanish Logistics Company MRW Speeds Deliveries with DXC Technology and Nutanix, dated April 27, 2022. Accessed on 17.05.2022

Check Your Progress-2

6. What does PaaS stand for?

    a. Personal Service

    b. Platform-as-a-Service

    c. Passport Service

    d. Peripheral as a Service

    e. Hardware-as-a-Service

7. Which of the following is not a cloud service model?

    a. IaaS

    b. PaaS

    c. SaaS

    d. BaaS

    e. LaaS

8. Which of the following is an example of infrastructure-as-a-service provider?

    a. Amazon Elastic Compute Cloud

    b. Microsoft Azure

    c. Salesforce CRM

    d. Oracle ERP Cloud

    e. Cloud 9

9. For which of the following Salesforce CRM is an example?

    a. IaaS

    b. BaaS

    c. SaaS

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    d.   System Software

    e.   HaaS

10. Cloud consumers can acquire and use hardware resources, storage and network bandwidth over the cloud. What is this service?

    a.   PaaS

    b.   BaaS

    c.   IaaS

    d.   XaS

    e.   SaaS

13.7 Commercial Clouds in the Industry

There are many cloud services commercially available in the market. Among them, the prominent ones are Amazon Elastic Compute Cloud (EC2), Microsoft Azure, Yahoo Hadoop, and Eucalyptus. Ramco Systems has ERP on the cloud. Indian organizations such as TCS (iON), Tata Communications, CtrlS, Orange Scape, Ramco, NetMagic, PK4 Software, and Synage are in cloud computing business.

Amazon Elastic Compute Cloud (Amazon EC2) is a popular and robust infrastructure-as-a-service provider. The users can create an operating system instance called Amazon Machine Image using the web service provided by Amazon EC2 in the cloud. Amazon EC2 supports multiple virtual machine instances. Each virtual machine instance comes with certain processing capabilities and storage capacity. Amazon EC2 supports pay-per-use business model. It can provide virtual machine instances at different geographical locations. It can provide latency optimization, reliability and replication services.

Microsoft Azure provides platform-as-a-service and remote access to clusters. It provides high performance computing, which supports parallel execution of user applications. Azure platform services are used for financial services and scientific applications. Its pricing model is based on the amount of data transferred, usage of storage and the number of transactions that took place.

Apache Hadoop is a group of open-source software utilities that assist in using a network of many computers to solve problems involving enormous amounts of data and computation. It uses MapReduce programming model to provide a software framework for distributed storage and big data processing.

Eucalyptus provides an open source software platform for implementing Infrastructure as a Service (IaaS) in a private or hybrid cloud computing environment. It also pools together existing virtualized infrastructure to create cloud resources for infrastructure as a service, network as a service and storage as a service.

Ramco provides multi-tenanted cloud and mobile-based enterprise software in the area of Human Capital Management (HCM) and Global Payroll, Enterprise Resource Planning (ERP). Ramco also assists aviation industry in providing the enterprise wide cloud based applications for Aircraft maintenance and engineering (M&E), and maintenance, repair and overhaul (MRO) that meets regulatory requirements.

Indian organizations such as TCS (iON), Tata Communications, CtrlS, OrangeScape, Ramco, NetMagic, PK4 Software and Synage are in cloud computing business. Multinational companies (MNCs) like IBM, Microsoft and VMware opened their cloud centers in India and are aggressively developing the cloud applications. Salesforce.com is providing its cloud services to several Indian companies like National Research Development Corporation (NRDC), Bharti, Polaris, SIFY Technology and eBay India. Tata Communications, Computational Research Laboratories (CRL), Zoho are three Indian based cloud providers. Large IT firms, such as Infosys and TCS, have entered the Indian cloud market. Pressmart in Hyderabad provides electronic publishing and digitization solutions to print industry by facilitating transmission of data across various platforms such as social networking websites, mobile, RSS, etc. Another Indian cloud provider Novatium develops cloud based mobile applications for the Indian market.

Cloud application areas in science include molecular simulations, earthquake modeling, nano-science, bioinformatics, weather modeling, remote sensing, image processing, signal processing, security, and surveillance. Cloud application areas in government include managing health records, traffic control, urban planning, land documents management, satellite imagery education, and agricultural information. Other cloud application areas include e-governance, e-learning, e-commerce, e-banking, e-health, e-environment, and e-education. In India, C-DAC is also involved in cloud and grid computing. IIT Delhi, IIT Mumbai, and IISc Bangalore have the cloud computing facilities for research purposes.

Example: South Africa based Discovery Group Boosts Global Growth with Amazon Cloud

Discovery Group was a South Africa financial and insurance company. The company was not just interested in selling policies but also worked towards improvement in the health conditions of its customers. The company had a set a targets of motivating around hundred million people globally to be 20 percent more active. For this, the company felt the need for a flexible and cost-effective IT infrastructure. The group went for Amazon Web Services (AWS) with an intention of reducing set up costs for infrastructure. The proposed infrastructure offered enhanced scalability on demand.

Source: Discovery Group Case Study (amazon.com), 2021. Accessed on 17.05.2022

13.8   Grid Computing

Grid computing is derived from the word 'power grid' of electrical engineering. It is because of the characteristics of grids such as simplicity, reliability, and pervasiveness. Grid computing connects geographically distributed high performing clusters, data sources and data storage facilities from different organizations. Grid implementations include SUN "NI" Grid, IBM's grid solution known as "grid and grow" and Oracle grid, which offers features such as adding dynamic capacity to the computing power.

Characteristics of grid computing include decentralized resource control, reliability, throughput, latency, and standardization through standard protocols and interfaces. Grids work for specific projects and do not allow flexibility or changes in computations. Grids require middleware over the standard protocols for communication between different computing resources and devices. Example: middleware in grid environment includes Globus Toolkit 4, gLite and Unicore. One of the standards followed in grid architecture is OGSA (Open Grid Services Architecture).

Table 13.1 defines grid computing and describes the differences between grid computing and cloud computing.

Table 13.1: Differences between Grid Computing and Cloud Computing

Grid Computing	Cloud Computing
Involves sharing of distributed and heterogeneous computing resources specific to user requirements. It is used where geographically distributed collaborative work is required.	It is a general purpose network of computing resources, storage, networks with virtualization facilities accessible over the internet.
Widely used in scientific and research community.	Widely used in industry and commercial purposes.
Used in e-commerce and e-science.	Widely used in e-commerce and e-learning.
Loose coupling, security, virtualization, and fault-tolerance are partially achieved in grid computing.	Loose coupling, virtualization, fault-tolerance, service orientation, and ease of use are completely achieved in cloud computing. Information Security is still a concern and emerging area in the cloud computing discipline.
Grid computing is based on High Performance Computing (HPC) and uses Service-Oriented Architecture (SOA).	Cloud computing uses HPC, utility computing, autonomous computing, and achieves parallelism.

Grid Computing	Cloud Computing
Data centers are not widely used in grid computing because of its concentration on scientific computing.	Data centers are widely used in cloud computing because of its concentration on commercial business purposes.
It is supported by governments, academia and research organizations.	It is supported by the industry and big multinational corporations.
Users are to be skilled enough to use grid computing. It is relatively hard to use.	User experience is better in cloud computing than in grid computing. It is easy to use.
Uses TCP/IP protocol.	Uses HTTP (Hyper Text Transfer Protocol) and TCP/IP protocols.
It supports batch processing.	It supports interactive systems.
It depends on grid middleware.	It depends on standard web-based protocols.
Its business model is based on *sharing*.	Its business model is based on utility-based pricing.
It supports decentralized data centers.	It supports centralized data center.
Switching costs from one grid to other grid is less because of standardization.	Switching costs from one cloud to other cloud is more because of incompatibilities.

Source: ICFAI Research Center

The application development is different in both the grid and the cloud. In grids, an executable is prepared on the local machine and then transferred to a remote machine in the grid. An entirely different approach is followed for application development in the cloud. In clouds, the user can integrate the existing functionality on the cloud available as SaaS services and achieve the required new functionality.

Please do an activity (Activity 13.3) on grid computing.

Activity 13.3

Grid Computing for Weather Forecasting

The Indian meteorological department would like to provide latest and fastest weather details to the public. They have many locations across coastal regions of the country. They would like to use high-performance computing, decentralized data centers, and standard protocols. Also, they do not want to give access of their systems to the general public. The solution they are looking

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for should support scientific computing and should provide reliable results. Suggest a solution for this project. Between cloud computing and grid computing, which one would you suggest to them? Justify your answer.

Answer:

Check Your Progress-3

11. Which of the following is an example of ERP on cloud?

    a. Microsoft Azure

    b. Ramco Systems ERP

    c. Amazon Web Services

    d. Unix OS

    e. Citrix Solutions

12. Which of the following is/are commercially available clouds in the market?

    a. Amazon Elastic Compute Cloud

    b. Microsoft Azure

    c. TCS iON

    d. Amazon Elastic Compute Cloud, Microsoft Azure, TCS iON

    e. Citrix Solutions

13. Which of the following is supported by Grid computing?

    a. Centralized data center

    b. Decentralized data centers

    c. No data center at all

    d. Zero networked servers

    e. Co-located data

14. What does HPC stand for?

    a. High Pressure

    b. Higher Printed Circuits

    c. High Performance Computing

    d. High Processing Cloud

    e. Hewlett Packard Computing

15. What does OGSA stand for?

    a. Open Grid Services Architecture

    b. Open Gate Services

    c. Omega Systems Architecture

    d. Open Global Services Architecture

    e. Open Grid Server Architecture

13.9   Summary

- Cloud computing can be used in universities, educational institutions, e-governance, agriculture, start-ups businesses, meteorology, business organizations, financial institutions, and entertainment. Business organizations need not worry about IT infrastructure and development environments.

- Cloud service models include Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS), Business process-as-a-Service (BaaS) and Anything-as-a-Service (XaaS).

- Grid computing is derived from the word 'power grid' of electrical engineering. It is because of the characteristics of grids such as simplicity, reliability, and pervasiveness.

- Grid computing connects geographically distributed high performing clusters, data sources and data storage facilities from different organizations.

- Cloud Business Model is a model of revenue generation followed by users based on their requirements and focuses on how to measure the resource utilization by the users and its payment model.

- Cloud deployment models: There are several cloud deployment models such as Private Clouds, Public Clouds, Hybrid Clouds, and Community Clouds. In a private cloud, the required hardware is privately managed while in a public cloud environment both software and hardware services are used on payment basis in a shared manner. Similarly, in a community cloud environment, pools of organizations are involved that are interested in using services from a cloud. Hybrid could is a combination of above cloud models.

13.10   Glossary

Cluster: It is a collection of loosely coupled or tightly coupled network of computers which appears as a single system. The nodes in the cluster can be connected through higher power LAN (Local Area Network). Each node in the cluster may have its own operating system. The performance of a cluster is more than its individual nodes performance. They are used to achieve high performance computing. The sequences in which technological developments have happened are distributed systems, clusters, grid computing, and cloud computing.

Pay-per-use Model: In this cloud pricing model, users are supposed to pay only for the services and hardware used for a specific duration. As the resources acquired changes dynamically by the users, the price charged keeps changing as per the usage of resources.

Salesforce: It is a suite of CRM software applications available over cloud as Software-as-a-service (SaaS) model from Oracle Corporation. Users can just subscribe (payment based) to the applications over the cloud and start using them.

SOA: SOA stands for Service Oriented Architecture. It is designing the software systems using a services-based approach. Multiple applications make use of general purpose services provided over the internet. SOA can be implemented using web services.

TCP/IP: TCP/IP is Transmission Control Protocol/Internet Protocol. It is connection- oriented protocol used in network communications. Entire internet communication is based on this protocol. It is a transport layer protocol in OSI (Open Systems Interconnection) framework. There are many protocols developed on top of it.

Virtualization: Using virtualization, consumers can have a feel of the actual resources, capabilities, and usage in a shared environment. That is, using virtualization software such as VMW, the consumers can have multiple operating systems such as Windows, Unix and Linux on the same machine/CPU. The consumer feels as if he has many computers with different operating systems with him.

13.11 Self-Assessment Test

1. What are the features and functionality of a cloud? Support your answer with suitable examples.

2. Explain the community cloud. What are the advantages of having a community cloud instead of having just a private cloud?

3. What kinds of applications are provided by cloud providers under SaaS (Software-as-a-Service) model?

4. How is pay-per-use business model different from the subscription-based business model?

5. Define grid computing. Distinguish between grid computing and cloud computing.

13.12 Suggested Readings / Reference Material

1. Rodney Heisterberg and Alakh Verma (April 2022). "Creating Business Agility: How Convergence of Cloud, Social, Mobile, Video and Big Data Enables Competitive Advantage," Narrated by Stephen Graybill.

2. Jonathan S Walker (2021). Social Media Marketing For Beginners - How To Make Money Online: Guaranteed Strategies To Monetizing, Mastering, & Dominating Any Platform For Your Brand, JW Choices.

3. Barry Connolly (2020). Digital Trust: Social Media Strategies to Increase Trust and Engage Customers, Bloomsbury Business.

4. Seema Gupta (6 August 2020). Digital Marketing McGraw Hill; Second edition.

5. Tracy L. Tuten, Michael R (15 June 2020). Solomon et al, Social Media Marketing, SAGE Publications Pvt. Ltd; Third edition.

6. Paul Martin Thomas Erickson (2019). Social Media: Usage and Impact, Global Vision Publishing House, 2 edition.

7. Steve Randazzo (2019). Brand Experiences: Building Connections in a Digitally Cluttered World, Paipen publishing.

13.13   Answers to Check Your Progress Questions

1. **(e)   Single Node**

    Cloud characteristics include scalability, low cost, availability, and reliability. A Cloud can have multiple nodes.

2. **(c)   Cloud Intruder**

    Cloud intruder is not a stakeholder in cloud computing. Cloud providers, cloud consumers, cloud auditors, and cloud brokers are stakeholders in the cloud computing area.

3. **(e)   Native Cloud**

    Cloud deployment models include public cloud, private cloud, community cloud, and hybrid cloud.

4. **(d)**   Hybrid clouds are formed with any combination of private, public and community clouds. It uses a combination of different methods of resource pooling. A hybrid cloud is formed with the combination of a private cloud of the organization 2, Community cloud of the organization 1 and organization 2, and the Public cloud.

5. **(b)   Group of organizations**

    The community cloud is meant for a group of organizations.

6. **(b)   Platform-as-a-Service**

    PaaS stands for Platform-as-a-Service.

7. **(e)   LaaS**

    IaaS, PaaS , BaaS and SaaS are cloud service models.

8. **(a)   Amazon Elastic Compute Cloud**

    Amazon Elastic Compute Cloud provides infrastructure-as-a-service.

9. **(c) SaaS**

    Salesforce CRM is an example of SaaS (Software-as-a-Service) provider.

10. **(c) IaaS**

    In this model, cloud consumers can acquire and use hardware resources, storage and network bandwidth over the cloud. The billing will be based on CPU cycles and used storage space.

11. **(b) Ramco Systems ERP**

    Ramco Systems ERP is an example of ERP on the cloud.

12. **(d) Amazon Elastic Compute Cloud, Microsoft Azure and TCS iON**

    Amazon Elastic Compute Cloud, Microsoft Azure and TCS iON are commercially available cloud computing solutions in the market.

13. **(b) Decentralized data centers**

    Grid computing supports decentralized data centers.

14. **(c) High Performance Computing**

    HPC stands for High Performance Computing.

15. **(a) Open Grid Services Architecture**

    OGSA stands for Open Grid Services Architecture.

Unit 14

Enterprise Systems Development Using Cloud Technologies

Structure

"Cloud computing is empowering; companies leveraging cloud will be able to innovate cheaper and faster."

- Jamal Mazhar, Founder and CEO, Kaavo

14.1   Introduction

A move to the cloud can save money, and frees up IT teams of enterprises from managing day-to-day tasks so that they can focus on improving operations and bettering the business.

In the previous unit, cloud features and functionality, cloud architectures, cloud service models, cloud business models, representative clouds in the industry, and grid computing are discussed. Cloud in the computer terminology is an 'extended

environment' which can be used for "providing", "developing", "hosting", and "virtualization" of software. Cloud can be used for both software and infrastructure services. Currently, enterprise systems such as ERP and CRM systems are also being developed over cloud frameworks.

The business executive needs to be exposed to these aspects for adapting suitable model.

This unit provides details on types of the cloud environment, various deployment models and architectures used for cloud services. Different types of clouds, cloud applications design, elastic computing platform, and architecting big data systems will be discussed in the unit. The unit also explains architecting with Hadoop, ERP on a cloud, designing with virtualization, DevOps, factors impacting cloud architectures, cloud entrepreneurship, and some of the business models.

14.2   Objectives

By the end of this unit, you should be able to:

- Explain cloud applications design
- Define elastic cloud computing platforms
- Describe architecting big data systems using cloud architectures
- Define architecting with Hadoop
- Explain ERP on Cloud
- Discuss the factors impacting cloud architectures

14.3   Different Types of Clouds

The operation of the cloud depends on the various services provided by the cloud operating agencies to its subscribers.

Some of the services provided by cloud operators include:

- Providing software: Cloud environment provides software for end-user usage. This type of service available in the cloud environment is called "Software-as-a-Service". It is also called SaaS.
- Developing software: Cloud is available as a platform or a complete environment to develop/modify software applications. This type of service available in the cloud environment is called "Platform-as-a-Service", also called PaaS.
- Hosting software as an infrastructure: Cloud environment is available as an infrastructure platform to host software and it is called "Infrastructure-as-a-Service", also called IaaS.
- Virtual Desktop as an Infrastructure: DaaS (Desktop-as-a-Service) is a service provided by the cloud service provider to host the virtual desktop infrastructure.

There is a continuous demand for cloud models as business drivers are changing and organizations are thriving towards efficiency, agility and other capabilities around the growth.

14.3.1 Cloud Services

To recapitulate, though there are several cloud-based services, the main types are:

- *SaaS:* It is also called on-demand software such as Gmail accessed by end-users via web client-like browsers. SaaS has become a common effective model for pay and use as there are no IT support costs in this model. In this model, applications are hosted by a service provider and made available to users over the internet or other networks.

- *PaaS:* In PaaS, computing or development environment is available as a service. So, users can develop applications using tools and libraries in the platform environment. Hence, the cost of buying software or license cost and complexity will be reduced. Along with PaaS, most of the cloud providers are offering integration as a service where integration services to various applications using APIs or XML-based mechanism for integration purpose. Examples of a platform are the operating system, server-side scripting, database, server software, virtualization, support, storage, and network access, etc.

- *IaaS:* In infrastructure-as-a-service, hardware such as servers, networking, computing, and storage are provided as a service.

14.3.2 Cloud Types

There are several cloud deployment models such as private clouds, public clouds, hybrid clouds, and community clouds. In a private cloud, the required hardware is privately managed while in a public cloud environment both software and hardware services are used on payment basis in a shared manner. Similarly, in a community cloud environment, pools of organizations are involved that are interested in using services from a cloud.

Example: Uber's Subscription as a Service Program for Transit is Growing

Uber created a cloud based service (software as a service) which can be used by the organizations which are in the transportation industry. The well proven Uber system was used by the licensees without investing on hardware or software. Uber was going to offer this software service to transport organizations in Denver, Cecil County, and Porterville. All three agencies used Uber's management software to manage its fleet of public transport vehicles. These agencies will be paying a subscription fee for the usage.

Contd....

> The companies used the Uber service to provide on-call passenger rides using their own vehicles. The companies saved time, money in developing and maintaining such systems on their own.

Source: https://www.theverge.com/2021/4/14/22382505/uber-public-transportation-saas-software-cities, dated April 14, 2021. Accessed on 18/05/2022

14.4 Cloud Applications Design

Cloud computing benefits are maximized when we design applications to adopt a cloud computing platform. With cloud computing, applications are designed differently, built differently, hosted differently, run differently, and finally consumed differently. So, all these cloud-based actions require different application designs to get the best results.

It is a known fact that multi-layered architecture applications played a significant role in the last two decades. Now, with the advent of cloud, we need to adopt a new design pattern to gain through the shift from traditional applications design to cloud-based application design.

In the traditional three-layered architecture, typically, presentation layer provides the user interface, middle tier handles user requests from the presentation layer and implements business logic, and data tier provides data storage for applications. Each layer's components are run on single or multiple servers, based on the type of complexity of the applications. To increase the operational efficiency, load balancing is applied between layers. At this stage, it becomes important to understand how multi-layered applications are designed in the cloud environment.

Virtual environments: Let us first consider virtual environments. In virtual environments, applications are deployed to virtual machines rather than physical hardware. Virtualization ensures that resources are used effectively and efficiently using the automation techniques. Although for an application, a virtualized environment is the same as physical environment, the virtualized environment provides more efficiency because new components are built easily and efficiently. This is made possible because cloud computing environment enables the creation and configuration of components on demand. This behavior of dynamic scale out/in is possible through virtualized load balancers and virtual IPs (Internet Protocol Addresses). The interesting point is that each layer of the application can be scaled out independently as each one is hosted on a separate instance of the server.

Before we discuss about application design of cloud applications, let us look at a few principles of cloud-based applications.

a. Location independent: Applications work in dynamic nature rather than with hard-coded dependencies.

b. Elastic scalability: Applications respond to demand levels, scale out and scale in as required by the business.

c. Service (with SOA): Create run-time discoverability for APIs and services as applications consume and expose APIs/services at runtime.

d. Abstractness: Applications need not understand the complexity of the underlying systems and infrastructure as everything else is abstracted from the consumption point of view.

e. Resilient to failure: In a large-scale environment, applications are prone to certain types of failures that can disrupt the operations such as failure of hardware, network, etc. So applications need to be architected in such a way that they are resilient to such failures.

f. Latency: Cloud applications are deployed in a common environment and need to handle loads of other applications. To handle this challenge, applications need to be designed to handle latency such as network congestion, I/O bandwidth and denial of service, etc.

g. Multi-tenancy: Multi-tenancy is the ability of an application to be shared across several users using different channels of communication like browser, mobile, kiosk, and tool. This will provide cost benefits to the application as it is a single instance that is being accessed by multiple users in different modes of communication. Interestingly, multi-tenancy can occur at an infrastructure level, platform level, or at an application level.

The significance of cloud applications design is in resolving recurring problems of adopting cloud technology such as availability, data management, design and implementation, messaging, management and monitoring, performance and scalability, resiliency and security.

For example, "Circuit Breaker" is one design pattern which can be used to eliminate timeout delays due to network or VM instance failures. Another example is "Request Queuing", which involves an application server enquiring and directing incoming client requests to one or more queues for processing. Computer nodes will handle the requests and thereby process. So, the queue will act as a buffer between requests and processing services. In this way, heavy service requests are handled without any failures (fault tolerance) and endpoint load on heavily requested APIs is reduced.

Example: Boeing Shifts Focus to Cloud Unleashing Additional Opportunities

Boeing was hosting most of its applications on-premises servers. A team of its own IT engineers and some engineers from external vendors were busy managing the servers and applications. Many of these legacy systems were getting outdated and require a major effort to maintain.

> The company decided to move the applications to the cloud. This move enabled Boeing to remove constraints on infrastructure and make the processes simpler. The move also enabled Boeing to offer easier and more secure access to its data bases. Now, Boeing's developers concentrated on developing applications quicker and also identified new applications for different business units.
>
> The company engineers were redesigning the applications to be hosted on the web.

Source: https://siliconangle.com/2022/04/06/boeing-heads-cloud-aws-microsoft-azure-google-cloud/ (Apr 2022). Accessed on 18/05/2022

Check Your Progress - 1

1. What does SaaS in cloud computing stand for?
   a. Infrastructure-as-a-Service
   b. Software-as-a-Service
   c. Platform-as-a-Service
   d. Payment-as-a-Service
   e. Hardware-as-a-Service

2. Which of the following is not one among the cloud services?
   a. SaaS
   b. PaaS
   c. TaaS
   d. IaaS
   e. SaaS and PaaS

3. Which of the following is not a component of cloud architecture?
   a. Client Platforms
   b. Server Platforms
   c. Cloud-Based Services
   d. Retail Services
   e. Networks

4. Which of the following is a cloud deployment model which has characteristics of both private and public cloud?
   a. Private Clouds
   b. Public Clouds
   c. Hybrid Clouds
   d. Community Clouds
   e. Open Source Clouds

14.5 Elastic Computing Platforms (ECP)

The Elastic Computing Platform (ECP) has frequently been illustrated as the world's first real IaaS platform. It is first made available in 2005 and named as ECP v1 (Version 1) and v2 (Version 2). These product generations were deployed tens of thousands of times around the globe. ECP Version 3 is a full featured cloud computing platform for service providers. ECP was designed to meet the most of IT demands as well as remaining easy to administer and use.

Cloud-based elasticity is the application's ability to automatically adjust the infrastructure resources used by it to suit changing workloads and priorities. At the same time, the application is available and performs accordingly in a context-aware environment.

Elastic computing is a cloud computing concept in which computing resources can be dynamically scaled based on the requirement by the service provider. These resources include e-processing power, storage, bandwidth, etc.

Cloud computing is about provisioning computing resources on-demand, which can be easily scaled during run-time without affecting operations. For example, a larger provider of online video could set up a system so that the number of web servers online are scaled during peak viewing hours.

14.5.1 Features of ECP Platforms

Some of key features of ECP platform are detailed below:

Authorize Simplicity

ECP was designed to authorize by providing a spontaneous self servic interface. ECP enables the easy deployment of hosted cloud applications. It also significantly surmounts complex IT business problems without the need of cloud experts or system engineers.

Integrated Cloud Infrastructure (as a service)

Corresponding (Application Program Interface) API of ECP provides a complete unified infrastructure as a service (IaaS). ECP enables a particular point of contact that includes entire infrastructure from networking to storage to hypervisors.

Assist in Making Money

ECP was intended to help service providers to get better revenue opportunities and easily create new cloud business services for making profit. Cloud service providers can oversubscribe their own existing in house IT environments allocating for a variety of pricing & costing schemes. ECP can be executed using any number of economic and business models that can integrate usage quality-of-service tiers. It has the ability to provide supplementary physical resources dynamically, which is called just in time hardware procurement.

Unrestricted Global Scalability

ECP architecture supports very large cloud platforms, spanning multiple datacenters in unrelated geographies around the globe. This allows the companies to provide the service to the customers anywhere and at anytime.

Application Centric Model

ECP provides all the essential tools to install intricate cloud applications, without the need for complicated tools. ECP helps the firm to develop a platform that focuses on the infrastructure, not on the management.

Sturdy and Secure Multitenant Platform

ECP provides multi-level access controls to each customer and allows them to access and manage their own resources. Network separation between multiple customers running workloads on the cloud guarantees privacy, while facilitating the provider to configure an unrestricted number of private VLANs for each customer with built-in firewalls. ECP provides a hard quota system that protects the cloud against exploitation or misuse.

Trusted, Secure and Verified

High Assurance Edition of ECP comes with a unique set of high-security capabilities to meet the needs of customers who have the need of a higher level of security.

Elastic Provisioning and Orchestration

Provisioning rules engine of ECP is proficient in determining the best possible location of each virtual application component. ECP ensures that an application node is deployed to an optimal physical and virtual location. In addition, ECP is capable of changing an offline virtual machine (VM) image. This helps in pre-configuring storage, networking, cluster state, etc. for quick deployments, including offsite and maintenance relocations.

Affluent Assimilation with Existing Infrastructure

Affluent customer-facing API provided by ECP, enables users to automate the management of their cloud infrastructure, for example, incorporation with external SLA management or user experience management systems. It also offers a controlling back-office facing administrative API, enabling simple assimilation with provisioning and billing systems of the provider and support automation of all administrative tasks. ECP is also well-suited with many admired cloud providers API's offering a real multi-cloud experience.

Technology Agnostic

ECP holds up a variety of the most common hypervisors including Xen, KVM and VMware as well as a highly fault tolerant and distributed Extensible Messaging and Presence Protocol (XMPP) with built in fail over capabilities.

Various ECP Platforms

OpenECP: OpenECP initially was an open source Elastic Computing Platform owned by EnomalyInc. This was later converted into a paid service in 2009. It is a web-based management platform for Linux-based supervision tools like KVM and Xen which can be used to create "public" and "private" cloud computing environments. Some of the Open ECP features are given below:

- It supports Qemu tool used for hardware virtualization.

- Open VZ is an operating system-level virtualization technology based on the Linux operating system. It allows a physical server to run multiple operating system instances, called containers, Virtual Private Servers (VPSs), or Virtual Environments (VEs).

- It facilitates Dashboard with metering.

- It has Multiple Open ECP server support.

- It provides automated virtual machine deployment.

Amazon EC2: Amazon EC2 is basically an offering of infrastructure as a service (IaaS) from Amazon cloud computing portfolio. Amazon EC2 uses Linux, and it provides storage facilities. Amazon EC2 provides two types of storage facilities such as instance storage and elastic block storage. Instance storage is non-persistent storage; as soon as the instance goes, the storage disappears, whereas elastic block storage is network-based persistent storage. Instance storage appears as 3 portions of virtual block storage.

Amazon EC2 is a scalable computing capacity under Amazon Web services. Amazon EC2 provides virtual computing environments (known as instances), various CPUs, storage, memory, and network capacities known as instance types. It also provides a firewall useful to specify protocols, source IPs and port numbers. It provides security groups, Windows Instances, static IP addresses for dynamic cloud computing, and secure login facilities using key pairs. It also provides operating systems and maintains metadata about the resources in the cloud environment.

Microsoft Azure: Microsoft Azure is a cloud-based PaaS (Platform-as-a-Service) offering from Microsoft. It provides Windows Azure operating system and other platform-oriented resources such as memory and networking. Windows Azure provides cloud computing the ability to quickly and easily expand and contract computing resources based on demand. For example, Microsoft's Social Experience Platform (SXP) is a web-based service that monitors and manages community and conversations for microsoft.com sites along with Cloud Power website. When the Cloud Power site traffic increases, SXP traffic also increases. In April 2006, there was heavy traffic in SXP due to Ads, SXP team decided to

double their Windows Azure computing capacity from 3 to 6 servers on their web-tier to handle the load.

Tata Consultancy Services (TCS) Enterprise Cloud: Enterprise Cloud Platform (ECP) provided by TCS distributes a numerous flexible cloud infrastructure alternatives to enterprises that are moving rapidly along with the digital maturity curve. The platform comes with vigorous SDx capabilities, and is integrated with OpenStack software to make automation at all levels. It supports dynamic cloud services with greater cloud portability without the issue of vendor lock-in. It is characterized by an open architecture, an enriched PaaS layer, and container services based on Docker, Kubernetes and Cloud Foundry technologies. Furthermore, it is built on an open source stack like Spark, Mesos, Akka, Cassandra, Kafka (SMACK). It is capable of meeting varied big data analytics, Internet of Things (IOT), and streaming data workload requirements.

Example: Gifore Technology uses Amazon EC2 Web Services (EC2) for its Digital Transformation

Gifore Technology was a China based agriculture machinery company. It was deploying innovative digital technologies to grow its business. The company put in place industry-standard operational management system while fostering a unique corporate culture. The company had 200 plus own stores and nearly 3,000 services across China. The company created a robust web based service platform for its products.

The company migrated its IT systems to Amazon Cloud by subscribing to the elastic computing services provided by Amazon Elastic Compute Cloud (Amazon EC2). The company replaced its expensive on-premises data centres by a suitable computing instance from the cloud. This deployment of instances was done in few minutes. The IT team had done a number of comparisons and migration tests and finally succeeded in migrating to the cloud. The company asked for resources or surrendered the resources at the click of a button to cater to fluctuating demands of the business. This lead to huge savings in both capital and operational costs.

Source: https://www.amazonaws.cn/en/customer-stories/retail/gifore/ Accessed on 18/05/2022

14.6 Architecting Big Data Systems

Big data is not just large volumes of data. Big data is one which cannot be processed using traditional tools. So, how do you process large volumes of data which is a wealth of information? Without processing, data remains data and no information is extracted and is of no use. Big data is characterized by volume, variety, veracity and velocity. It is important to understand how these characters impact big data processing. Variety is indicative of non-uniformity or varying

data from structured to unstructured formats. Velocity is the speed at which data is processed. It is like asynchronous transactions to synchronized transactions. Data veracity is the uncertain or imprecise data. And finally, the volume is moving from terabytes to zetabytes.

Big data architecture applications are essential for a lot of factors such as management of data for risk reports, decision making and intelligence factoring. The real value of big data is for the purpose of patterns in analytics, indicators for decisions and ability to respond in providing higher intelligence.

Two important trends in big data are:

- Data analytics is transitioning from batch to real-time as real-time supports predictive analytics.

- Exceptional cloud delivery models will enable IT to evaluate the best approach to add big data analytics to their internal services, customer services, use a cloud services provider, or build a hybrid cloud that protects certain sensitive data in a private cloud.

Using cloud infrastructure for big data analytics is significant because of:

- Cost-effective infrastructure

- Several cloud delivery models help managing big data

- Cloud services provide data services to extract value from big data

- Enabling cloud technologies on big data will provide cost-effective solutions for analytics and other activities which do not require active-active type transactions.

Example: Chipotle Deploys Microsoft Dynamics 365 - Converting More Guests into Loyalty-program Members

Chipotle, the American fast food chain, acquired customer data from many sources which included point of sale, online etc. The company had a loyalty program with more than 17 million members.

Chipotle Chose Microsoft Dynamics 365 Customer Insights to understand customer preferences better especially from members of loyalty program. Customer Insights also ensured interoperability with other tools in Chipotle's technology stack.

Chipotle also was able to grow its customer base by over 30% by converting more guests into loyalty program members.

The company built an architecture to manage the big data from multiple channels and by using appropriate analytical tools. The company got actionable insights directly translating into revenues and profits.

Source: https://customers.microsoft.com/en-us/story/849868-chipotle-retailers-dynamics-365, dated January 11, 2021. Accessed on 18/05/2022

Activity 14.1

UID System on Cloud

The Indian Aadhaar Card system provides a Unique ID to each citizen. This is developed by UIDAI (Unique Identification Authority of India). Based on the volume, velocity and variety, the data can be categorized as huge/big data. To make this big data available across the country using cloud architecture, what considerations are important with respect to architecture? Please suggest.

Answer:

Check Your Progress - 2

5. Which type of networking is not used in cloud?

    a. Internet

    b. Intranet

    c. Inter-cloud

    d. Intra-cloud

    e. Extranet

6. Identify all the activities an exceptional cloud delivery model adds to big data analytics in a private cloud.

    a. External services, customer services, use a cloud services provider, or build a hybrid cloud to protect sensitive data

    b. Internal services, customer services, or build a hybrid cloud to protect sensitive data

    c. Internal services, customer services, use a cloud services provider, to protect sensitive data

    d. Internal services, use a cloud services provider, or build a hybrid cloud to protect sensitive data

    e. Internal services, customer services, use a cloud services provider, or build a hybrid cloud to protect sensitive data

7. Which of the following is a principle of cloud application design?

   a. Elastic Scalability

   b. Centralized

   c. SAP

   d. Location-aware

   e. Explicit

8. Which of the following is not a characteristic of big data?

   a. Volume

   b. Velocity

   c. Volatility

   d. Variety

   e. Veracity

14.7 Architecting with Hadoop

Hadoop is an open source distributed processing framework from Apache that allows computation of large datasets, computation by splitting the dataset into manageable chunks. It spreads across a fleet of commodity hardware servers and manages the overall process by launching jobs, processing the job, no matter where the data is physically located and, in the end, aggregating the job output into a final result.

It is experienced that the entire volume of data is not processed always and obviously the focus needs to be on the existing peaks. That is exactly where cloud environment, will help to process these large data sets, with cost optimization. Cloud environment with Hadoop provides high-volume data processing capabilities.

Hadoop is a batch processing and distributed file system for running MapReduce jobs. It is designed to store data in local storage across a network of commodity machines. This allows the same PCs to run virtual machines in a data center. MapReduce consists of two programs. Map takes items like a string from a csv file and run an operation over every line in the file and split it into a list of fields. These become (key->value) pairs. Reduce groups these (key->value) pairs and concatenate them into one string as key->sum.

Reduce can work on associative operation. The associate property of Hadoop will tell how many times to replication data. Hadoop adopts a master-slave architecture. The basic idea of its design is to convey the computing to the data. It stores data files that are bulky to fit on one server across multiple servers. Map and Reduce operations further divide those and lets each server in the node to do the computing. Hence each node acts as a computer in Hadoop architecture and not just a disk drive with no computing capabilities.

There are three important components of Hadoop (Figure 14.1).

Figure 14.1: Hadoop Architecture
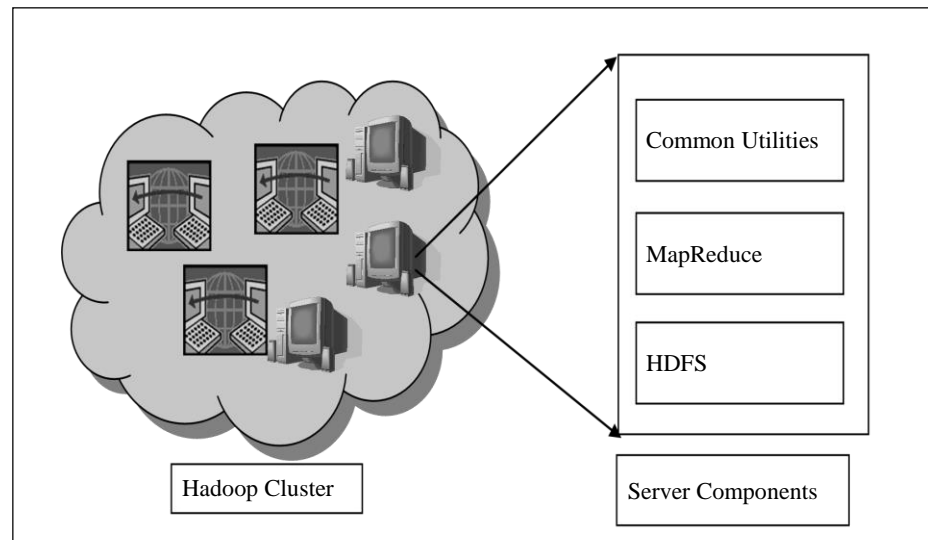
Source: ICFAI Research Center

One of them is HDFS (Hadoop Distributed File System) which provides a file system that sits on top of Hadoop node's native file system and can span and replicate data across the nodes in the cluster. Typically, a file system can scale from a single node to thousands of nodes and provide resiliency and performance for large datasets.

The second component is MapReduce, which is a processing framework that enables large-scale analytics across distributed and unstructured data. Hadoop breaks down the analytics jobs into smaller activities that are then executed by MapReduce on individual nodes as close as possible to the data being analyzed.

The third component is common utilities which tie both HDFS and MapReduce together. These Java-based API jar components consist of lots of utility libraries.

Hadoop's distributed and parallel processing model has a significant effect on how the data center infrastructure is architected to support a Hadoop system. The typical Hadoop architecture consists of a minimum 1,000 nodes of a cluster. The primary requirement for the individual node hardware is to balance four resource parameters – compute, network, storage and memory with cost. Typically, Hadoop architecture is used for searching, log processing, recommendation systems, analytics, video and image analysis, and data retention.

14.8   ERP on Cloud

At the beginning of this unit, we have detailed about Software-as-a-Service which is nothing but hosting software application on cloud and allowing any user (with security permissions) access to the network (intranet/internet). It is like anytime,

anywhere option for software. Traditional ERP applications are typically large applications hosted on-premise. So there is a limited flexibility. However, with the modularization of ERP, software as per business needs is designed to address the inflexibility of existing ERP application by allowing businesses to choose the deployment option that fits their specific needs.

Cloud ERP is Software as a Service (SaaS) that permits users to get access to Enterprise Resource Planning (ERP) software over the internet. Cloud ERP allows companies to reduce upfront costs, because computing resources are leased by vendor of Cloud ERP on monthly basis. Hence, there is no need to purchase the software outright and maintained on premises. Cloud ERP also provides companies access to their business-critical applications any time from any location.

The cloud is particularly valuable to small and medium-size businesses (SMBs) because it provides access to full-function applications at a reasonable price without a substantial upfront expenditure for hardware and software. Using the right cloud provider, a company can rapidly scale their business productivity software as their business grows or a new company is added.

Cloud ERP has been proven to reduce costs in many ways because it:

i. Avoids upfront costs for all computing infrastructure such as hardware and data servers

ii. Reduces IT support services because IT support is provided by the data center

iii. Eliminates paying upfront for application software licenses in favor of a monthly fee

iv. Minimizes the cost of maintaining and supporting those applications since the cloud vendor handles the updates and upgrades

The most significant benefits of Cloud ERP go beyond cost-savings and include:

a. Payment required only for the computing resources needed

b. Consumption based billing or a fixed monthly rate required and hence, companies can utilize their cash on other business initiatives

c. Cloud ERP applications can be utilized faster since installation of hardware and software on servers or local devices is not required

d. The capability to regulate the amount of cloud service as a computing or storage needs of the company can fluctuate

e. Having the benefit of data back up and disaster recovery plan that are provided by cloud provider

f. Circumventing attacks on the server of the company because the data is not stored locally, but in the cloud

Right to use the system from anywhere makes it easy for a company to develop geographically since the internet is everywhere and there is no need to implement hardware and software at remote locations.

For example, NetSuite is a business management software solution that performs enterprise resource planning (ERP) and customer relationship management (CRM) functions. It is a parallel package intended for a broad range of industries. The NetSuite Financials system can incorporate with companies' back-office, sales and service processes.

NetSuite Financials comprises applications for financial accounting, financial reporting and analytics, payment management, order and billing management, supply chain management and inventory management. The system undergoes automatic upgrades and comes with various customization options.

SAP Business ByDesign is a software as a service (SaaS) based enterprise resource planning (ERP) system. The software is intended to supply all the main needs of a business and offers applications for customer relationship management (CRM), financial management, project management, supply chain management, supplier relationship management, human resources, executive management dashboards, and compliance. SAP Business's ByDesign provides a concurrent firm wide view of financial condition of the firm and modernizes core accounting process to handle cash and liquidity. The software allows users to manage accounts for multiple operating units, currencies, and reporting standards. It's cash flow management module utilizes customer and supplier transaction data to get enhanced visibility into firm's cash position.

SAP Business ByDesign handles all of the hosting, maintenance and upgradation of the system. The software supports start-up businesses as they develop into midsize enterprises. The industries such as manufacturing, wholesale distribution, project and commercial services use this software solution.

Most of the ERP packages are large and complex and typically hosted on on-premise servers.

However, in the recent past, most of the software vendors have rolled out smaller versions of these ERP packages and these versions are flexible to host in a Cloud-on-Demand.

Some of the other benefits of hosting ERP on Cloud are:

1. Dynamic provision will help users use ERP on required scalability.

2. Many forms of cloud computing exist as requirements will vary based on the size and capability of the organization.

3. Many cloud computing choices are based on business needs such as security protocols, disaster-recovery capabilities, etc.

Two important models to choose between are SaaS ERP and Host ERP. In SaaS ERP, a user pays based on usage and for hosted ERP, a user buys the license to host it on provided environments such as AT&T. Each model has benefits, risks and advantages based on the type of model adopted.

Example: Fedex Uses Oracle ERP Cloud Solution to Revolutionise their Supply Chain

FedEx management wanted to reduce the complexity in their database system and so decided to move to Oracle Cloud. Through Oracle ERP Cloud, SCM, and PaaS, the company drastically modernized its supply chain. This led to speedier processes and mobile access to 10,000 workers. With real-time data and intelligence, the company took better decisions.

Source: https://questoraclecommunity.org/learn/blogs/success-stories-from-companies-using-oracle-cloud/, dated 11.06.2020. Accessed on 18/05/2022

Activity 14.2

Traditional ERP Vs. ERP on Cloud

Find out the differences between ERP stand-alone version and ERP on the cloud. What can be the differences between traditional SAP and other ERP on the cloud? What are the additional benefits for organizations and users with ERP on a cloud? (Note: Use the internet for research purpose.)

Answer:

14.9   Designing with Virtualization

Virtualization is basically creating resources as virtual objects and virtualization can be a hardware platform, operating systems or computer networks. In fact, virtualization is one of the first and widely-used concepts among all cloud computing technologies because this technique helps in the cost-effective utilization of computing resources such as memory, networks, storage, desktop or laptop or server hardware, operating systems, and applications. It provides a layer of abstraction between physical resources and virtual resources and this abstraction layer is managed by tools like hypervisor (see Figure 14.2). Hypervisor will help in managing the pool of resources by the administrator.

Figure 14.2: Virtualization
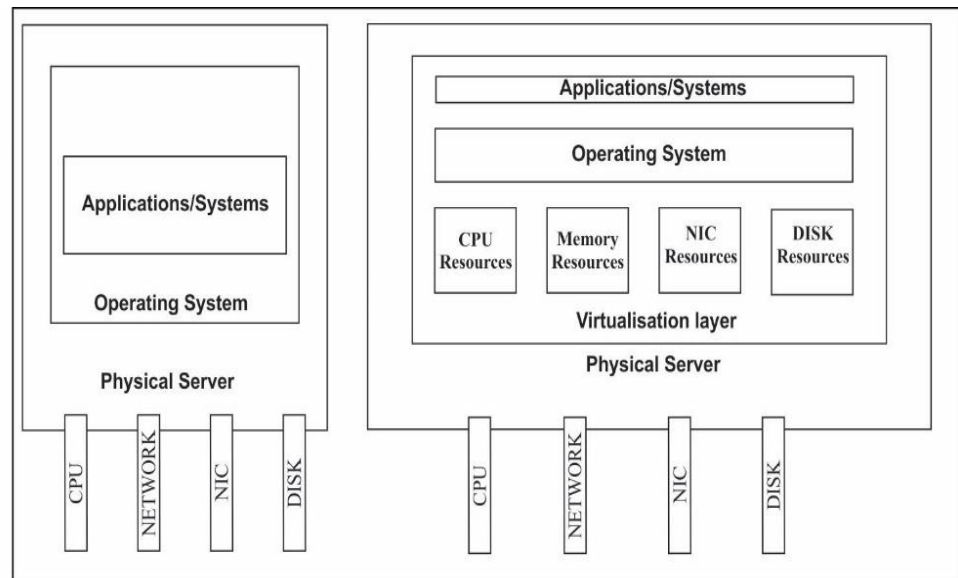
Source: ICFAI Research Center

There are several types of virtualization. Among them, operating system virtualization is the most common one. Some of the effects of virtualization are:

- Transition from single OS image per machine to hardware independent OS and applications

- Decoupled environment of software and hardware

- From dedicated and non-flexible resources, flexible scale out/in of resources

- From under-utilized resources to most-effectively utilized resources

- From a single operating system to multiple operating systems on one physical server

Virtualization can be broadly classified into three categories: Operating Systems Virtualization, Storage Systems Virtualization, and Applications Systems Virtualization.

i) **Operating Systems Virtualization:** Also called 'virtual machines', Operating Systems Virtualization is one of the most prevalent virtualization techniques in the IT Industry and provides the full implementation of a standard operating system. For example, Windows 2000 and Red Hat Enterprise Linux running simultaneously on the same physical hardware.

As the term virtualization refers to something virtual and not real, virtualization is creating virtual components in the information technology. While virtualization is applicable to many components of IT such as servers, switches, storage, networking, applications, and client-end machines, the most important is server virtualization.

Before the age of server virtualization, servers were used based on particular purpose/deployment and each server was effectively used for that particular purpose or deployment only. Over a period of time, this practice lost efficiency as each of these servers is optimized for one particular purpose/application and there is no flexibility in using the same server for different purposes simultaneously. Also, managing each dedicated physical server is resource-expensive. Considering all these factors, server virtualization has emerged as a cost-effective and flexible solution.

What is server virtualization? It is a software abstraction layer called hypervisor (native and hosted types) that sits on a physical server and allows creating multiple operating systems and applications on the same physical server. Server virtualization is more effective when one can enhance the server capacity in multiples and use the same server for multiple operating systems and applications. There are several players in the market for server virtualization like VMware, CISCO, Dell, etc. Each of these players provides stateless offloads, multiple framework support, multiple queue support, storage and network offload, etc.

ii) **Storage Virtualization:** It is another type of virtualization which has a lot of significance. It can be block virtualization or file virtualization. Block virtualization is typically distributed storage network but appears as a single source of storage. This distributed storage is categorized into SAN and NAS. SAN is Storage Area Network and NAS is Network Attached Storage. Block virtualizations can be implemented using RAID or iSCSI forms. The second storage virtualization called file virtualization helps in storing data in files and file structure is used for the same.

iii) **Application Virtualization:** It is the third most important type of virtualization where application binaries and files are on a virtualized environment storage and the CPU and RAM of the client machine is used only for accessing the application. In this case, management of application and application logic is controlled by virtualized server apart from binaries.

Apart from these three types of popular virtualizations, there are several other types of virtualizations such as application server virtualization (this is different from application virtualization), management virtualization, hardware virtualization, and service virtualization.

For example, TotalCloud is a virtualization platform with interactive and immersive cloud monitoring features. Developers and cloud engineers can use this solution real-time to visualize their Amazon Web Services (AWS) infrastructure, costs, and resources. This solution is intended to help teams to increase visibility over the cloud to improve their efficiency and productivity by contextually managing data in a virtual environment. Users can easily monitor their services perform with this vigorous capability.

> **Example: University of Pisa Gains Greater Flexibility and Value from its IT Infrastructure**
>
> University of Pisa had Dell Technologies High Performance Computing & Artificial Intelligence centre on its campus. The centre focused on VMware the virtualization technology. The University was focussed on virtualizing IT resources with a view to improve resource utilization and enable easier deployment and management of infrastructure for system administrators and end users. The University had two virtualization systems, one based on VMware software, and one based on Microsoft software.

Source: https://www.delltechnologies.com/asset/en-us/products/ready-solutions/customer-stories-case-studies/dell-pisa-vmware-case-study.pdf, 2020. Accessed on 18/05/2022

14.10 DevOps

DevOps is the combination of cultural philosophies, practices and tools that increase an organization's ability to deliver applications and services at high velocity: evolving and improving products at a faster pace than organizations using traditional software development and infrastructure management processes. This speed enables organizations to serve their customers better and compete more effectively in the market. With cloud environment providing dynamic elastable opportunity, it is gaining prominence in the organizations.

The use of DevOps in an organization is rising these days as it lays stress on the improvement of collaboration between development and operations that benefits the organization. The need for DevOps lies in the fact that it is a mechanism to identify system and application gaps that have impacted major areas like financial services, including large banks, trading firms, and the trading exchanges. DevOps is a software development method that integrates collaboration between the software developer and other information systems' operations. It aims to help organizations produce software product and services to improve operational performance.

DevOps means that developers and operators are working together jointly to make sure that the end product is reliable. In addition, ensure to see that as many potential issues are covered as amicably possible. DevOps can be considered as a set of values and principles. It can consist of tools, methods and practices those are instrumental in implementing the joint approach.

The tight alignment between "Dev" and "Ops" (and QA – in the mid - responsibility of the operations team) can be regarded as an extension to Agile. This encourages close collaboration of all stakeholders throughout the development. The basic values that drive the DevOps approach are considered similar to Agile's principles.

With DevOps, they share the goal of delivering a dependable piece of software that perfectly fits the requirements of the user; with the Agile terminology, we could simply call this "working software".

The benefits offered by employing the DevOps approach throughout the software development lifecycle include:

- More frequent releases/deployment (faster time-to-market)

- Lower chance of product failure, once deployed (stability)

- Faster time-to-recovery after unexpected events

- Increased efficiency through automation

- Maintainability (and scalability) of Ops processes.

DevOps project management together with the agile approach helps to achieve the business goal and produces a quality product in a shorter span of time. Development and operation teams are coming together and working in an agile approach helps in achieving a quick delivery to the customer and reducing the latency time. Major benefits in Agile and DevOps project management include better customer satisfaction, faster deliverables and continuous feedback with increased collaboration between development and operations team.

Example: HSBC is Changing the Way Typical Banking Works with Cloud-native Technology & DevOps

HSBC chose a DevOps to enable its 23,000 developers to meet the growing demands of its customers for newer digital banking services. HSBC used DevOps (CloudBees platform) for the standardisation and automation of the bank's end-to-end software delivery system. It hastened up the process of securely developing and delivering new digital products and services to its customers.

Source: https://www.computerweekly.com/news/252508925/HSBC-standardises-on-DevOps-platform, dated 2nd November, 2021. Accessed on 18/05/2022

14.11 Factors Impacting Cloud Architectures

Cloud can be used for both software and infrastructure. It can be the "software" we access through the web or private network for software applications, and "infrastructure" when we provision the server on demand. Cloud client platforms consist of computer software and hardware that rely on cloud architecture and cloud services. Simply put, they act as gateways to cloud applications. Some of the examples of cloud clients are desktops, laptops, tablets, smart phones, etc. Cloud clients can be web clients or application clients. Web clients are web browsers, mobile browsers or any web-based medium.

The following factors impact cloud architectures in current-day organizations.

- Cost is one of the important factors

- Availability and uptime of cloud

- Comparing in-house systems with cloud-based systems

- Issues in service level agreements with cloud service provider

- Disruption of cloud-based services

- Organizational change management

- Application complexity

- Infrastructure, networks

- Mobility, level of usage

- Skills and competencies of programmers and designers

- Number of users

- Information sharing and information security issues

- Variety of technologies

- Organizational structure, size and priorities

- Business continuity planning

- Disaster recovery and backup plans

- Capacity and scalability of applications and users

- Environmental factors

- Time available for application design and development

- Migration of legacy data and applications

Example: A Glitch in Amazon Cloud Forced Unavailability of World Wide Web for Around 7 Hours

Many online services were hosted on AWS's cloud. So when AWS collapsed, it affected a host of websites and apps, including Netflix, the Amazon website, Prime Video, IMDB, etc.

The outage was a result of a large increase in connection activity. The network was flooded. This resulted in delays and latency between the internal AWS networks, which in turn affected customer apps. This led to slower sites and site shutdowns globally for about 7 hours.

So when something happens on a cloud, all the tenants are affected. This is one of the disadvantages of using the cloud services.

Source: https://techgenix.com/7-biggest-cloud-outages-services-2021/, dated February 11, 2022. Accessed on 18/05/2022

14.12   Cloud Entrepreneurship and Business Models

Discussed here are the opportunities for cloud entrepreneurship and allied business models.

14.12.1 Cloud Entrepreneurship

Cloud entrepreneurship is the business of cloud, following various business models. When large organizations adopt new technology, the opportunities for entrepreneurs are endless depending upon how it is utilized. The advent of the internet in mid-1990 brought thousands of new entrepreneurial success parables with it. Some of these early internet employing entrepreneurs created applications and services for the web, while others leveraged the same applications and services to enter new markets. The internet also allowed e-commerce boom in the late 1990s and cloud computing created opportunities for the next generation of technopreneurs (that is, technical entrepreneurs) around 2010 and beyond.

The growth rate of cloud computing and cloud services is marked to be more than five times the growth rate of traditional, on-premise IT delivery business. With significant interest from industry, cloud computing has become rich with opportunities for IT entrepreneurs. Many start-up companies are leading the cloud craze by providing management services and application development for cloud computing. Others are building internal cloud computing infrastructure for large organizations. Some others are concentrating on finding solutions for security concerns associated with cloud computing. Thus, in the current scenario, the opportunities are immense for the cloud entrepreneurs.

Another group of entrepreneurs finds cloud computing as an opportunity to add high-end computing power and storage to their toolkits. For example, new social gaming sites are taking advantage of cloud computing (both Zygna and PlayFish are using cloud computing from RightScale). Computationally, intensive operations have been traditionally cost-prohibitive for young start-ups. However, cloud computing lowers the barrier to entry-level and provides start-up companies with access to enterprise-class servers and systems without excessive up-front costs associated with traditional hardware and software licenses. The RightScale is currently offering companies the opportunity to try the cloud computing management for free.

Even for non-computationally-intensive start-up businesses, cloud computing and cloud services have their sufficient niche. The economic goals of start-ups are often more geared toward short-term survival rather than long-term financial efficiency.

With cloud computing, it is assessed that electricity costs, real estate expenses to domestic hardware, and IT administrator fees can be largely eliminated. Moreover, the economic benefit extends beyond the direct cost of capital equipment. That is, clouds allow companies to become more agile with respect to changes in IT infrastructure.

Although there are many benefits of cloud computing, there are few liabilities too. It is natural that entrepreneurs may be concerned with the fallout (unexpected problem with cloud hosting): if a cloud goes down, a company could, in essence, be shut down. But, fortunately, this outcome is typically addressed by having backup cloud servicing centers.

One needs to realize that, like most web-based innovations, cloud computing cannot be a universal solution to all computing problems—some companies prefer having local servers and file sharing. That said, many large, well-established companies are moving towards cloud computing.

Though entrepreneurs in small start-ups may not be able to reap the full scope of benefits available to larger companies, cloud computing provides a viable path towards cost-savings through the adoption of minimal resources.

14.12.2 Cloud Business Models

Cloud computing is not so much about technology as it is about the new business models that this technology enables. The question then is: how do these business models look? One of the most inspiring ways of looking at business models is through the so-called "Business Model Canvas".

Business Model Canvas

The Business Model Canvas is a practical artificial design tool to help people understand, analyze, share, discuss and improve the business model. The impact of cloud business model on business is in many ways such as it helps in interactions with partners and customers, positioning in the value chain, product and services innovation, improve internal resources and processes, channels, revenue and costs structures. It establishes enormous opportunities for externalization and standardization of services with a variety of costs structures, when companies have internal IT systems.

The business model canvas (perspective) is a visual template for developing and discussing business models.

The business model canvas has nine basic building blocks and specific relations between those building blocks. The rest of this unit describes each of them and gives a brief example of how they apply to a cloud provider proposition. The main cloud provider example used in this unit is Amazon Web Services (AWS), in particular, EC2 (Elastic Compute Cloud) which is virtual machines on demand. This is an Infrastructure-as-a-Service offering. The power of the business model canvas approach will become clear if we see how it can distinguish between various cloud service offerings and traditional IT.

The nine elements of AWS EC2 business model canvas are:

i)   *Customer segments (CS):* In the Business Model Canvas, "Customer Segments" are the groups of customers that the company ultimately serves,

i.e., the ones that consume and pay for the services. In the AWS case, basically anybody with a credit card has a choice to spin up a virtual machine; it looks like Amazon is primarily targeting software developers and (startup) SaaS providers as its main customers. Historically, Amazon development teams were the first customers. External customers were added as an afterthought.

ii) *Value Propositions (VP):* Value propositions reflect the customer's problems and needs. This is the crucial element that pinpoints why a customer would ultimately be willing to pay for the product or service. The value proposition of cloud computing centers around five essential characteristics. For example, in the AWS EC2 case, the critical component of the customer value proposition is the rapid self-service provisioning of virtual machines with pay per use billing. For each individual customer, this translates into different business advantages. An example is reduced capital expenditure and reduced risk of over-investing or under-provisioning.

iii) *Channels (CH):* Value propositions are delivered to customers through communications, distribution and sales channels. It is often assumed that cloud computing relies solely on self-service direct sales, but the reality is much more diverse. SaaS providers, in particular, are developing extensive partner programs. AWS primarily employs a self-service direct model, where the delivery is through APIs (Application Program Interfaces). AWS also provides a web user interface to those APIs. Observably, the said interface used to log in required functionality behind the main AWS services, but these days most new features are announced on the API and the Web UI simultaneously. The model is enhanced by a premium support.

iv) *Customer Relationships (CR):* Customer relations are established and maintained with each specific customer segment. AWS maintains significant relationships with its defined customer segments through planned conferences. The 2013 reinvent developer conference attracted 9,000 visitors. Additionally, there are vibrant online communities. Finally, though details are scarce, we can assume that AWS does extensive analytics on the activities customers engage in using the platform.

v) *Revenue Streams (RS):* Revenue streams are defined as the result of value propositions which are successfully offered to customers. The structure of revenue streams can be seen as the area where cloud computing differs from established IT service models, as they are specific usage-based rather than asset-based. AWS basically charges hourly fees per virtual machine. The 'bigger' the virtual machine, the higher the hourly rate.

vi) *Key Resources (KR):* Key resources are none other than the assets and resources required to offer and deliver the previously mentioned elements (e.g. value proposition, customer relationships). AWS owns massive amounts of hardware, estimated at 1 million servers or more. That is housed

in dozens of data-centers worldwide. But there is more; the service can only be delivered through advanced and unique fulfillment software and processes. Amazon must have invested substantially in that also.

vii) *Key Activities (KA):* At AWS, the key activity, delivery, is highly automated. But looking at the scale of AWS, occasional oversight and resource planning is still an identified serious effort. Optimizing assets versus utilization is essential in the IaaS business model. Through economies of scale, AWS is able to spend a lot of effort on these activities.

viii) *Key Partnerships (KP):* Some activities are outsourced, and some resources are acquired outside the enterprise. AWS has to buy immense amounts of hardware, and equally need to use a lot of (open source) software. Building of data centers is also likely to be outsourced.

ix) *Cost Structure (CS):* A larger number of traditional IT service models have the revenue streams tightly coupled to the cost structure. The cloud computing innovation is also about decoupling these. At AWS the significant cost elements are in assets. These are servers and data centers; in customer services such as electrical power and telecommunications; and in people for developing and managing the systems.

14.12.3 Cloud Sales Models

Cloud sales model is not different from the cloud business model. However, the sales model differs in its operational characteristics.

Some best practices for cloud selling include:

1. Learn to Sell to New Buyers
2. Focus on Different Stakeholder Needs
3. Drive Buyer Consensus
4. Align on a Buyer-Centric Sales Process
5. Communicate Value Without overpromising

Normally, the sales model adopted depends largely on the negotiation of the selling organization and the client's organization or client who fixes up the sales terms by negotiation between them and follows the terms throughout as fixed at the beginning.

The sales can be made by taking hard cash, which is usually not possible in the big buying or it can be made by accepting a certain token amount in the initial stage as a down-payment. The slabs then follow as determined by negotiation between the selling and buying organizations.

A valid sales process is to receive a certain amount as an initial down-payment and divide the rest of the amount into an affordable number of slabs that may be paid every month till it ends. This system is largely adopted in most part of the world, being one of the most convenient systems of making sales.

Sometimes, the discounted sales are made to suit the client's need and desire. Normally, such sales are valid where the client is supposed to be the potential client who may give more business to the selling organization in the near future too.

As environmental, economic conditions change and businesses need to meet newer challenges, selling models also had to evolve. With new skills came new sales models. With new models came new kinds of training. Below are the 12 models which are generally used by sales trainers now even in cloud sales environment..

i) *Personal Preparation Models:* These focus on the salesperson's personality.

1. *5-P Sales Model:* This basic model was defined as "Product Pushing through Personality, Persistence and Price". This was the land of the "born salesman". These people had an engaging personality and tenacious persistence. With a suggested low price and playing a very simple numbers game, they could really make sales. Even today, people wake up in the morning and decide to go into selling with few or no skills. For them, mental conditioning is a must.

2. *Mental Conditioning Sales Model:* It is a universal fact that professionals in sales need to hear the word "no" more often than people in other occupations do in an entire lifetime. When salespeople lose their excitement and enthusiasm for what they sell, their prospects respond likewise. Significant advancements have been made from the short-lived motivation sessions.

3. *Relationship Sales Model:* This model was established on building a relationship by identifying and calling on the same prospect repeatedly over an extended period of time. The salesperson and the buyer get to know each other better on both professional and personal levels. The core of this model can be identified as the ability to cross boundaries, but never to violate them.

4. *Personality Styles Sales Model:* The importance of relationships in selling fostered the use of psychological assessment instruments to identify key personality characteristics. Depending on the recognition that different customer/consumer personality types prefer their own particular style of interaction, this model provides structure to the interaction and relationship-building components of selling.

ii) *Presentation-based Models:* These models focus on using the presentation portion of the sales interaction to do the actual selling.

1. *Closing Sales Model:* Starting from and introduced in the 1950s, major emphasis was placed on presentation skills, sales trial closing and overcoming objections, then going for the final major closing sequence.

In its pure form, this model was and still is today, most commonly used in high-pressure sales.

2. *Problem-Solving Sales Model:* From the early1960s, sales professionals were trained to ask open-closed-ended questions to probe further for problems. Once discovered, solutions were then presented. In today's highly competitive markets, this model has a tendency to elicit the "price" objection.

3. *Value-Added Sales Model:* This model gained ground in the late 1960s as a counteract measure of the tendency of the Problem-Solving Model to elicit a price objection. When the price objection is anticipated, incentives are "added on" to the basic product/service as a means to make up the difference in customer perceived value versus price.

4. *Consultative Sales Model:* This model got introduced in the early 1970s. The focus was to determine how the sales professional could lower the customer's operating costs and/or increase the customer's ability to generate revenues. This model requires that you have an extensive track record and strong proof of results. Subsequently, it had limited application identified for new companies, new ideas and new products or new services.

iii) *Applications Models:* Fully developed primarily during the 1980s in response to special selling situations, application models are more strategic in nature and assume that the salesperson already knows how to sell.

1. *Partnering Sales Model:* The partnering model is not a "legal" partnership. Rather, it is a part of the "Total Quality Management" process many US companies are now pursuing. Partnering is usually done at the highest levels within the seller's and the customer's organizations. To successfully partner, the salesperson must understand the needs of the "customer's customers". Collectively, the seller and customer build and exchange business plans related to the product/service.

2. *Team Selling Model:* Although it has been around for many years, only now it has become popular with sales organizations. This process involves a number of people at various levels interacting with a similar group at the same level at the prospect company. The sales professional is primarily engaged in a communications-coordinating "quarterback" role. Specific roles, defined boundaries, documented authorities, procedures, and proper communications are necessary for this model.

3. *Complex Sales Model:* This model involves long lead times and big-ticket items, coupled with multiple decision makers, both internal and external to the client company, i.e., banks, citizens groups, etc.

iv) *Value Selling Matrix Models:* It can be easily understood that in a value selling process, the real selling is done during the interview phase of the sales interaction, rather than the traditional presentation phase.

Value Selling Model: This relatively new model introduced in the late 1980s, was developed as the result of reduced product/service differentiation, competitor-induced increased pressure on price, new products and services that have no previous track records, as well as organizations staffed with people who no longer have the time to listen to sales presentations.

Value selling is designed to prevent the price objection by establishing the value of the solution using the prospect's data. The criteria-driven version of this model uses an "irrefutable logic stream" so that proof of performance is not necessary and sets the seller's unique selling points as criteria to select a supplier in order to rule out the competition.

14.12.4 Cloud Partnerships

Cloud partnerships offer cloud computing consulting services for developing, migrating, and managing cloud applications and infrastructures. Cloud partner is designed to provide clients with the right space and context to think and then execute a far more coherent solution. Many consultant firms help both the large and medium-sized enterprises with alternative solutions from those being sold by the last generation of technology manufacturers.

By first understanding the business outcomes, then finding and applying the right technology solution, so that it really works, is the single-minded mission of many consultants.

By focusing on what the business actually needs and only then acting as an agnostic provider of third-party technology offerings, consultants are able to introduce enterprise customers to solutions they would otherwise never find .

Technology is definitely proven and identified as successful if it supports the business outcome. Usually, organizations work exclusively with technology providers that have mature, enterprise-class products and solutions that deliver quantifiable results. The net result is drastically reduced cost, reduced development time, increased revenues, improved productivity, and increased time-to-market the product.

A partnership was announced between Dell Technologies, VMware, and Microsoft Technologies in April 2019, in which authorization was given to the customers of Microsoft Azure to use VMware's virtualization software to handle their IT operations on Azure cloud. Dell owns a majority stake in this partnership. The intention of this cloud partnership is to develop a "hybrid cloud" that performs as a common operating platform for the users where they can effortlessly run and manage the applications across the VMware environment and Microsoft Azure.

This collaboration also provides an additional layer of security. VMware customers will be permitted to install all their applications on Azure cloud. Customers will not face any problem of making any significant changes to their architecture. Other benefit of this partnership is that, it reduces the extra coding efforts required to coordinate VMware applications with multiple services. The customers of VMware can take advantage of Azure's scalability, security, and faster performances to innovate and update applications by means of integration with a broad range of Azure services such as Azure (Artificial Intelligence) AI, Azure Active Directory and Internet of Things (IoT)-enabling innovative experiences.

14.12.5 Cloud Business Management Tools

Business management tools are basically business management software with a specific purpose. There are a number of such tools available by paying for it and even free of cost. However, the tools for which the payment is made are more reliable than the free tools since the paid tools can be replaced or even serviced by the selling party who is responsible for such things.

Business management tools, those offered by cloud, help the organization to manage all types of cloud activities, like resource deployment, use tracking, data integration, and even disaster recovery. These also provide administrative control over the infrastructure, platforms, applications, and data that together create a cloud.

Some of the paid tools available in the market include:

i) *WORKetc:* CRM, projects, billing, help desk, and more in the one web-based small business management solution.

ii) *Windward System five:* Find ways to making it easy to track transactions in the store, starting from sales, allied stock movements, statutory taxes and measured gross profit, barcodes, and label printing.

iii) *Planner Dale:* A record management system & planning tool that allows for managing contacts, events, rosters, expense claims, and help desk.

iv) *Monday.com:* It is a team collaboration and cloud management application. It provides a solo handy hub for all projects so that business team can make important decisions as one. This platform helps restructure workflow and enhance productivity. It also provides a lot of training materials for complete newbies.

v) *CloudFuze:* It is another complete cloud management platform. It allows individuals and business users to easily manage any file using any device. It also provides a vigorous cloud migration solution that allows users to securely and speedily access, share, and migrate any volume of data.

vi) *vCommander:* It is a complete hybrid cloud management software assembled by Embotics for corporate IT groups, enterprises, and SMEs. It is

a powerful, complete platform that helps users decrease cloud infrastructure costs while increasing provisioning times by the use of automation, integration, and an end-user self-service portal.

vii) *Abiquo:* It is a hybrid cloud software meant to help companies and IT professionals in properly handling their commercial cloud service. Users can easily integrate Abiquo to their back-office systems, billing platforms, and workflows from a single unified platform.

viii) *Ormuco Stack:* It is a multi-cloud management platform that assists businesses to provide private and public cloud services. Users can easily combine a host of services, including machine learning, AI, workload automation, and cloud orchestration use this solution.

Example: The Cloud Start-up Slack Offers a Collaboration Tool to Enhance Networking

Slack was a start-up providing a cloud-based team collaboration tool to enhance networking among collaborators in a team. Due to increasing demand for remote working, Slack gained popularity among the workforces and proved to be a good competition for major players like Microsoft Teams. The start-up had over 2,000 apps and a robust API. This facilitated collaborations and lead to smoother workflow. It offered secure, enterprise level connectivity on the cloud that allows you to connect other tools seamlessly.

The cloud provided an opportunity for a start-up to fill a need in the cloud space especially in view of the growing remote working due to the pandemic.

Source: https://www.analyticsinsight.net/top-10-cloud-startups-to-watch-out-for-in-2021/, dated March 23, 2021. Accessed on 18/05/2022

Check Your Progress-3

9. Which of the following is not a personal preparation model for salesman?

   a. 5P Sales model

   b. Mental conditioning sales model

   c. 4P model

   d. Relationship sales model

   e. Personality styles sales model

10. What does HDFS in cloud computing stand for?

   a. Hadoop Distributed File System

   b. Hadoop Data File System

   c. Hadoop Data Format Symbols

   d. Hadoop Disk Filter System

   e. Hadoop Drive Filter System

11. Virtualization in cloud helps in effective utilization of which of the following resources?

    a. Storage

    b. Memory

    c. Networks

    d. Operating systems

    e. Storage, memory, networks, and operating systems

12. What does Storage, memory, networks, and operating systems SAN in cloud stand for?

    a. Storage Area Network

    b. Stack Area Net

    c. Stack Area Node

    d. Storage Alarm Node

    e. Small Area Network

13. For which of the following teams DevOps encourages cooperation?

    a. Developers and Operations teams

    b. Company and Operations team

    c. Management and Partners

    d. Customers and Sales team

    e. Operations team and Suppliers

14. Which of the following is used by Cloud business models?

    a. Business model canvas

    b. Painting canvas

    c. Data model canvas

    d. People model canvas

    e. Repeated canvas

15. Which of the following is not a cloud sales model?

    a. 5-P sales model

    b. Problem solving sales model

    c. Closing sales model

    d. Work selling model

    e. Value selling model

14.13 Summary

- Cloud computing has given facilities to work from anywhere and anytime. The location of the resources is transparent to the user. Cloud architectures have changed the way we design, develop and deploy the software applications traditionally. There are several cloud models such as private clouds, public clouds, hybrid clouds, and community clouds.

- Big data is one which cannot be processed using traditional tools. Big data is characterized by volume, variety and velocity. Big data helps in the management of data for risk reports, decision making and intelligence factoring. The real value of big data is for the purpose of patterns in analytics, indicators for decisions and the ability to respond in providing higher intelligence.

- Hadoop is an open source distributed processing framework from Apache that allows computation of large datasets (about 6MB), computation by splitting the dataset into manageable chunks.

- Virtualization is basically creating resources as virtual objects and virtualization can be a hardware platform, operating systems or computer networks. In fact, virtualization is one of the first and widely-used concepts among all cloud computing technologies, because this technique helps in the cost-effective utilization of computing resources such as memory, networks, storage, desktop or laptop or server hardware, operating systems, and applications.

14.14 Glossary

ERP: Enterprise Resource Planning is an integrated suite of solutions for organizational internal and external business processes. It consists of the functionality such as human resources, accounting, inventory control, process control, project management, etc. ORACLE ERP, SAP, PeopleSoft are examples of ERP products.

Hadoop: Apache Hadoop is an open source framework for processing big data. Using Hadoop, one can analyze the structured, semi-structured and unstructured data.

Hypervisor: It is software used for virtualization that provides virtual partitioning, which runs on hardware.

Operating Systems Virtualization: Also called 'virtual machines', Operating Systems Virtualization is one of the most prevalent virtualization techniques in the IT industry and provides the full implementation of a standard operating system.

SAN: It is Storage Area Network. It is a high speed network of storage devices. It also connects to the servers. HP has SAN products. Amazon EC2 cloud platform uses SAN.

14.15 Self-Assessment Test

1. What are the different services provided by clouds? Explain each one of them.

2. Briefly explain the different components of the cloud architecture.

3. Distinguish between different cloud deployment models.

4. What are the design considerations while designing cloud-based applications?

5. Explain virtualization in clouds by drawing a block diagram.

6. Write a short note on DevOps concept with the help of a suitable example.

14.16 Suggested Readings/Reference Material

1. Rodney Heisterberg and Alakh Verma (April 2022). "Creating Business Agility: How Convergence of Cloud, Social, Mobile, Video and Big Data Enables Competitive Advantage," Narrated by Stephen Graybill.

2. Jonathan S Walker (2021). Social Media Marketing For Beginners - How To Make Money Online: Guaranteed Strategies To Monetizing, Mastering, & Dominating Any Platform For Your Brand, JW Choices.

3. Barry Connolly (2020). Digital Trust: Social Media Strategies to Increase Trust and Engage Customers, Bloomsbury Business.

4. Seema Gupta (6 August 2020). Digital Marketing McGraw Hill; Second edition.

5. Tracy L. Tuten, Michael R (15 June 2020). Solomon et al, Social Media Marketing, SAGE Publications Pvt. Ltd; Third edition.

6. Paul Martin Thomas Erickson (2019). Social Media: Usage and Impact, Global Vision Publishing House, 2 edition.

7. Steve Randazzo (2019). Brand Experiences: Building Connections in a Digitally Cluttered World, Paipen publishing.

14.17 Answers to Check Your Progress Questions

1. **(b) Software-as-a-Service**

   SaaS stands for Software-as-a-Service in cloud computing terminology.

2. **(c) TaaS**

   TaaS is not a cloud service. SaaS, PaaS and IaaS are cloud services.

3. **(d) Retail Services**

   Retail services is not a component of the cloud architecture. Cloud architecture consists of client platforms, server platforms, networks, cloud services, etc.

4. (c) Hybrid Cloud

Hybrid Cloud deployment model has characteristics of both private and public cloud.

5. (e) Extranet

Extranet type of networking is not used in clouds.

6. (e) Internal services, customer services, use a cloud services provider, or build a hybrid cloud to protect sensitive data

Exceptional cloud delivery models will enable IT to evaluate the best approach to add big data analytics to their internal services, customer services, use a cloud services provider, or build a hybrid cloud that protects certain sensitive data in a private cloud.

7. (a) Elastic Scalability

Cloud application design principles include location independence, elastic scalability, abstractness, and designing using service-oriented architectures.

8. (c) Volatility

Big data characteristics include volume, velocity and variety. Volatility is not a characteristic of big data.

9. (c) 4P model

This is a famous marketing related model not salesman related.

10. (a) Hadoop Distributed File System

HDFS stands for Hadoop Distributed File System.

11. (e) Storage, memory, networks, and operating systems

Virtualization in the clouds makes efficient use of storage, memory, networks, and operating systems.

12. (a) Storage Area Network

SAN in clouds stands for Storage Area Network.

13. (a) Developers and Operations teams

In DevOps, development and operation teams work together using an agile approach which helps in achieving high customer satisfaction.

14. (a) Business model canvas

Cloud business model makes use of a business model canvas for designing various aspects of cloud business.

15. (d) Work selling model

Work selling model is not one among the cloud sales models described.

Unit 15

Clouds for Social Marketing

Structure

"A large social-media presence is important because it's one of the last ways to conduct cost-effective marketing. Everything else involves buying eyeballs and ears. Social media enables a small business to earn eyeballs and ears."

- Guy Kawasaki, Chief Evangelist, Canva

15.1   Introduction

Every organization is taking highest advantage of social marketing using the cloud in the present-day scenario to achieve larger connectivity to prospective customers with 100% assurance and at lower costs.

The previous unit, Enterprise Systems Development Using Cloud Technologies, covered different types of clouds, cloud architectures, big data, ERP on the cloud, Hadoop and factors impacting cloud architectures. Nowadays, millions of people are connected through the internet on social networking sites. It has become an online gathering of platform for friends and family members, use of email, connecting to fellow researchers, connecting to peers in the field, a great search engine for knowledge articles, and idea sharing. Social networking sites are becoming a destination for e-commerce and marketing. Modern social marketing is based on the cloud environment. The cloud computing services are provided through the public cloud, private cloud, and hybrid cloud environment.

Every organization is taking highest advantage of social marketing in the present day scenario to achieve larger connectivity to prospective customers with 100% assurance and at lower costs. Cloud is one such platform which aids the business execuitves in achieving this goal through scalable operations. Hence they need to know of usage of cloud for social maketing.

Cloud for social marketing is becoming a hotcake these days. Here, in this unit, we discuss the various opportunities and risks in social marketing using clouds, social software, validating various social data for social marketing, and measuring social marketing results.

15.2 Objectives

By the end of this unit, you should be able to:

- Explain opportunities and risks in social marketing using clouds

- Define social software and Web 2.0

- Discuss social media marketing

- Analyze social data for social marketing

- Define segmentation for social marketing

15.3 Opportunities and Risks in Social Marketing Using Clouds

Facebook founder Mark Zuckerberg opined that the "social norm" of privacy was "evolving":

"People have really gotten comfortable not only sharing more information and different kinds, but more openly and with more people. That social norm is just something that has evolved over time."

US Attorney-General George Brandis said:

"There is an entirely different attitude to privacy among young people than there was perhaps a generation ago."

Social media can be a threat to an organization's security because what details the employees are sharing on social media is important. According to the World Economic Forum Global Risks Report (2013), spreading false information using social media is the major emerging risk they have identified.

However, social media over cloud brings potential power to the organization. For example, British Telecom used social media extensively, using its platforms for customer interaction. The results include improved customer satisfaction, clear return on investment with an increased reputation for customer turnaround services. British Telecom has used its own technologies to maintain social media.

Presently, social networking and cloud computing are being used collectively in a number of ways. Cloud-based application provides authentication and user

management services with the help of social networks. The majority of organizations are using cloud computing to carry out most of their functions through social media. Organizations face challenges related to sharing sensitive information in social cloud systems. Any cloud environment has top most business concerns related to security, availability, and privacy. Cloud is supposed to be a double-edged sword from the security standpoint. Cloud has criticism about its privacy and security related to illicit access and utilization of information for ill motives and other malevolent reasons. The usefulness of cloud computing in the social network is highly admirable, there is still a flaw in terms of its performance because the policies and practices that are related with its privacy and security remain fragile.

Infringements of privacy in cloud social system are of different types from image hacking, to profile hacking then later on to the risky malware attacks. The three major privacy issues related to social networks are cyber bullying, profile hacking, and identity theft. Identity theft entails leaking of relevant data such as photos phrases or the use of one's digital identity. Individuals gain access to information by means of actions with the use of phishing scams, such as alteration of addresses, receiving the financial services or formation of new accounts using the identification of the victims. False documents are created on this platform and employ it for malevolent gains.

Social networks assist in improving internet usage by storing intense multimedia content in cloud storage systems. The most popular content on social media are videos and photographs, which basically occupy the maximum space. They have the capability to slow down servers and applications with all of their resource demands. Salesforce and Amazon currently provide various services including Customer Relationship Management (CRM) and Enterprise Resource Planning (ERP). These applications are delivered through cloud servers by cloud vendors thus, users can use the flexibility and scalability of the system without purchasing separate software or hardware.

Social networks are currently also using clouds for various other tasks apart from data storage. For example, for big data analytics. One of the advantages of using cloud systems is that users can easily get huge amount of structured and unstructured data. Social networking site like Facebook provides much-improved analytics, especially for its business users via cloud.

Cloud computing reduces the cost of data backup and recovery in case of a disaster.. It is particularly helpful for social networks as these sites store user's personal data and hence cannot afford to lose even one part of it. The chances of using powerful computing resources on demand by means of the web are considered as a possible factor for the growth of the world economy and it also transforms the way business is done.

To cite another instance, Investec, an investment bank, used a technology to measure customer sentiment about the bank in social media. Investec uses this information for marketing purposes. Figure 15.1 describes the life cycle of social media marketing using clouds. +

Figure 15.1: Social Marketing Using Clouds
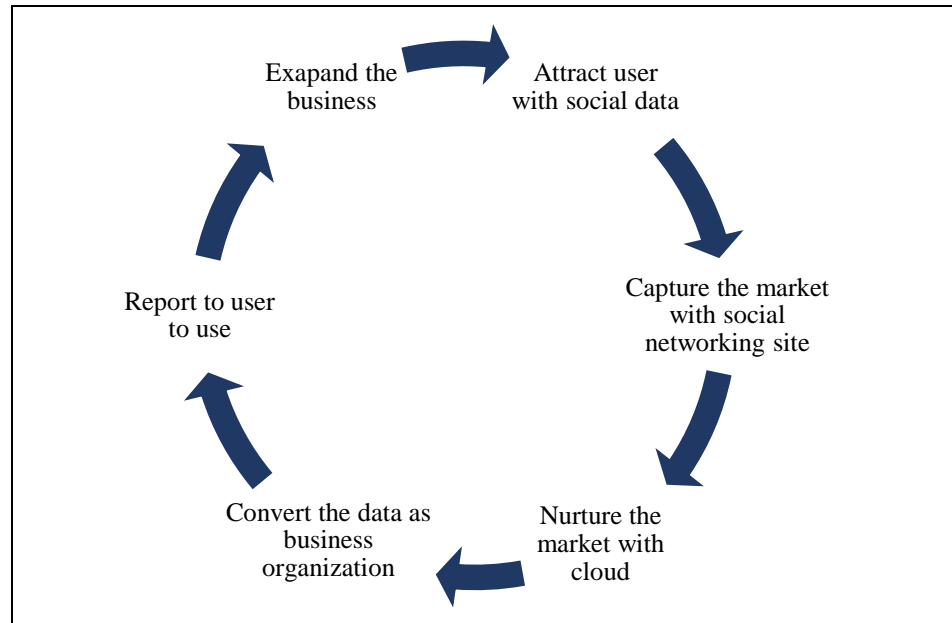
Source: ICFAI Research Center

Following are the some of the opportunities in social marketing using clouds:

i. Marketing material cost reduction: Companies can reduce their cost in advertisements.

ii. Marketing distribution cost reduction: Online marketers do not have to pay to mail their catalogs or newsletters. Digital formats offer fast and cheap ways to communicate with customers.

iii. Increased customization: The web has opened all kinds of new interactive mediums for advertisers to place marketing in advertisements. This helps to focus, relevant and effective advertising.

iv. Increased efficiency: Cloud marketing significantly reduces the time gap between planning and implementing an ad campaign.

Following are the some of the risks in social marketing using clouds:

i) We can only work better where there is always high-speed network connectivity. This creates a new dependency on a business.

ii) We have to sync up and always keep key data in cloud backup in emergency recovery. We have to focus and prioritize our data for sync up, instead of taking the entire data.

Example: ADP, a Leader in Human Capital Management, Uses Social Selling to Optimize Lead Flow and Save Staff Time

ADP is a leader in Human Resource Management. The company maintains strong relationships with its 600,000 plus customers. The company uses Adobe Marketing Cloud to accomplish this. ADP engages its customers in discussing its brand. The company also identifies and addresses customer service issues. ADP is able to distribute information to multiple social networks with a standard message about its brand. Marketing Cloud is deployed to locate sales leads from social media. ADP continuously scans social media platforms for topics of interest. The company provides the potential leads with relevant information to nudge them to buy its services. Leads data flows directly into Sales Cloud from social media. With Marketing Cloud, ADP sends leads information to sales teams to enhance their pipeline. ADP has fully exploited opportunities in social marketing using cloud to increase sales and lower its marketing costs.


Source: https://www.salesforce.com/customer-success-stories/adp, 2022, Accessed on 19/05/2022

15.4 Social Software and Web 2.0

Web 2.0 was made popular by Tim O'Reilly who wrote an article on the seven values of Web 2.0. To many people, web 2.0 is a web where users can collaborate, meet and share content on social platforms by means of tagged items, activity streams, social networking functionality etc. MySpace, del.icio.us, Digg, Flickr, Upcoming.org, Technorati, orkut, 43 Things, and the Wikipedia are various examples of web 2.0 that work with collaboration.

The internet has been used to assist communication not only between computers but also between people, since its inception. Bulletin boards and usenet mailing lists enabled people to connect with each other and allowed communities to form, often around topics of concerns. The social networks created by means of these technologies were not clearly confirmed, but were entirely described by the communications of the people involved. Technologies such as IRC (Internet Relay Chat), instant messaging, web forums, blogging, social networking services have continued the movement of using the internet and web to construct communities.

Social software is a certain class of information system that supports the creation of virtual communities. It manages the online communities for companies in performing certain tasks. Social software provides different services for community members to support activities such as to find members with similar interests, find information on interesting subjects, discussing common problems, or for storing of private or publicly accessible documents (Figure 15.2).

Figure 15.2: Social Sharing on Social Networks
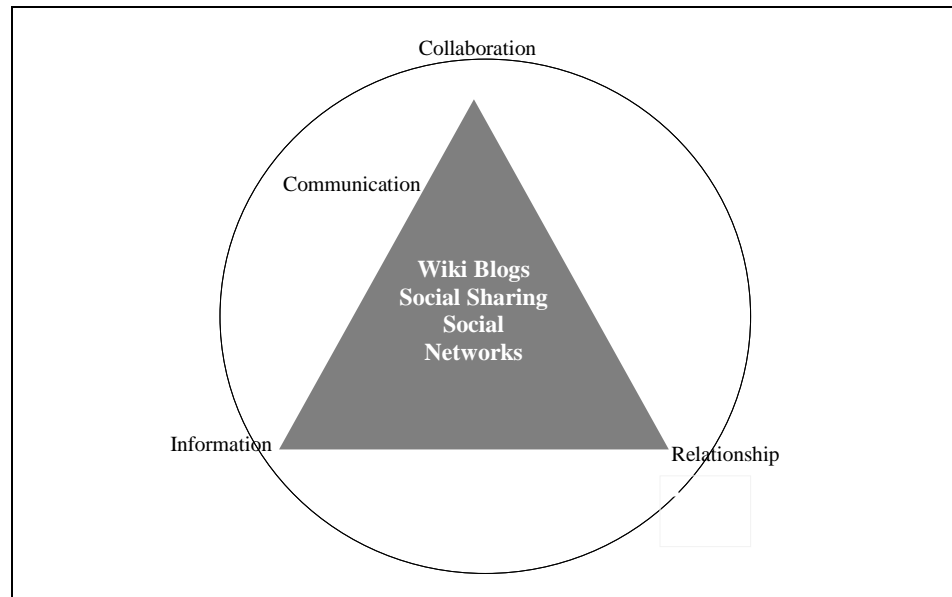
Source: ICFAI Research Center

The following are the communication tools used in social software:

a. *Internet Messaging:* Instant messaging (IM) technology is a type of online chat that offers real-time text transmission over the internet.

b. *Text chat:* Online chat may refer to any kind of communication over the Internet that offers a real-time transmission of text messages from sender to receiver.

c. *Internet forums:* An internet forum, or message board, is an online discussion site where people can hold conversations in the form of posted messages

d. *Blogs (weblogs):* A regularly updated website or web page, typically run by an individual or small group that is written in an informal or conversational style.

Web 2.0 consists of a number of new technologies making the web browser user interfaces more user-friendly and it also reduces traffic load on the internet. The basic HTTP-protocol that is used to fetch HTML pages from servers to clients is stateless. This means if a user enters any phrase on a web page and sends this data to the server, the server sends in response the new page of the HTML related to the typed in the search phrase, and the client software has no knowledge about what the user has entered.

In Web 1.0 we can access the content that is created by someone else. But in Web 2.0 we can design our own content on the website. Web 2.0: The second stage of development of the internet, characterized especially by the change from static web pages to dynamic or user-generated content and the growth of social media.

15.5   Definition of Social Media Marketing

Social media marketing (SMM) is a kind of internet marketing that makes use of social networking websites as a marketing tool. The objective of SMM is to create content that users can share with their social network to assist a firm to enhance brand exposure and expand customer reach.

Social media optimization (SMO) is one of the key components of SMM. SMO is a strategy for identifying new and exclusive visitors to a website. SMO can be done by two ways: adding social media links to content, like Really Simple Syndication (RSS) feeds and partaking buttons or encouraging activity through social media by updating statuses or tweets, or blog posts.

A firm can get straight feedback from potential customers with the help of SMM making the firm customer centric. Customers are getting the opportunity to ask questions or voice complaints and believe they are not being ignored with the help of interactive parts of social media. SMM became more popular with the improved reputation of websites such as Facebook, Twitter, LinkedIn Myspace, and YouTube. Federal Trade Commission (FTC) simplified its rules to include SMM. These rules are related to unfair or deceptive advertising. If a firm or its advertising agency offers a blogger or other online community with free products or other incentives to produce positive buzz for a product, the online comments will be treated officially as approvals. Both the firm and blogger will be held accountable for certifying that the incentives are noticeably and clearly revealed, and that the posts of the blogger include no deceptive or uncorroborated assertions and/or else complies with the FTC's rules relating to unwarranted or misleading advertising.

Social Media Marketing consists of programs which require an effort to create content that attracts and encourages readers to share it across their social network. Social networking sites act by word of mouth. They allow followers to "re-tweet" or "repost" the comments made by others about a product being promoted.

Following are a few techniques used in social media marketing:

1. *Blog creation:* Blogs are created by individuals or organizations. These web pages are updated regularly, sometimes even daily. Blogs use conversational language rather than a formal language. For example, Microsoft Corporation uses blogs to interact with developers and customers across the world over the internet.

2. *Social networking:* Social networking is possible through dedicated websites or applications. Likeminded individuals use these websites to interact and network. For example, Proctor & Gamble uses social networking sites such as Facebook to interact socially and build its customer base.

3. *Social bookmarking:* Social bookmarking is an online service which allows to add, edit and share bookmarks of web pages. Search engine optimization uses these bookmarks for efficient search operations over the internet. For example, pinterest.com, reddit.com, delicious.com are examples of social bookmarking sites.

4. *Podcasting:* It is a social, commercial application which an organization can share, give details, and spread about its product. Usually, organizations have products to explain their product features over the social media. For example, HDFC ERGO podcast is about general insurance product marketing.

5. *Viral video marketing:* As of 2022, 92% of the marketers believed that video has maximum impact on their marketing campaigns.[1] According to Ericson Mobility Report 2020, mobile video consumption is increasing every year. In 2020, videos accounted for 63% of mobile traffic. For example, Dove's video campaign "Dove Campaign for Real Beauty", which was started in 2004, has attracted many women across the world towards their products and could make them buy their product.

Example: Dove, the Soap Brand, ran a Video Campaign on Social Media to Fight Against Unrealistic Beauty Standards Set by Young Girls

Dove, the soap brand, ran a social media video campaign "Reverse selfie" to fight against unrealistic beauty standards set to themselves by young girls. A 13-year-old girl who posted an edited picture of herself, based on a false notion of beauty, was featured in the video. The video played back and showed the original picture as a contrast.

The campaign was very impactful with Facebook getting 7.5 lakh views and Instagram 0.87 lakhs. This was the power of social media marketing. This impactful message enhanced the image of the brand few notches higher and that made a lot of business sense to the brand.

Source: https://www.sookio.com/blog/dove-reverse-selfie-the-anatomy-of-a-campaign-dpwyrh (1st Sep, 2021). Accessed on 19/05/2022

Activity 15.1

Social Media Marketing

Ranbaxy, an Indian pharmaceutical company, has come up with a device for hearing impaired persons. The chief of marketing expressed that to reduce the costs and since on-stage presentations could not reach the hearing impaired effectively, they decided to go for social media marketing for the product. As a social media expert, advise the chief of marketing how they can go about

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[1] https://blog.hubspot.com/marketing/state-of-video-marketing-new-data, May 6th 2022 (accessed on July 11th 2022)

social media marketing so that they can reduce costs and also reach a wider audience. What platforms and technologies will you be using?

Answer:

Check Your Progress - 1

1. What does SaaS stand for?

   a. Software-as-a-Storage

   b. Software-as-a-Service

   c. Software-as-a-Script

   d. Software-as-a-Source

   e. System Software

2. Under which broad area of social activity will Blog creation, Social networking, Social media marketing, podcasting come?

   a. Digital marketing

   b. Content management

   c. Social book marking

   d. Social media marketing

   e. Social relationships

3. Which of the following is/are leading communication tool/s for social media marketing?

   a. Internet Messaging

   b. Text Chat

   c. Blogs

   d. Internet Messaging, Blogs, Text Chat, & Wiki

   e. Newspaper

4. In which of the following, Podcasting technique is used?

   a. Software services

   b. Enterprise project management

   c. Social media marketing

   d. Financial accounting

   e. Product development

5. What does IaaS stand for in the context of cloud computing?

    a. Income-as-a-Software

    b. Infrastructure-as-a-Service

    c. Inquiry-as-a-Software

    d. Indian Audits and Accounts Service

    e. Internet-as-a-Service

15.6 Social Data for Social Marketing

Social data is information that users of social media share in public, which comprises metadata such as the location of the user, language spoken, biographical data, and/or shared links. Social data is important to makers seeking for customer insights that may enhance sales, information about a political campaign that may win votes. Social data can be accumulated from comments, shares, URL clicks, hashtags, likes, mentions, analysis of the overall following base etc.

Social data is defined as the information that social media users publicly share. This includes metadata: user's location, language spoken, biographical data and/or shared links. Social data includes tweets from Twitter, posts on Facebook, pins on Pinterest, posts on Tumblr, and check-ins on Foursquare and Yelp. Facebook for Business and Twitter Ads are two programs that help advertisers use social data to market to targeted users. Social data is useful and valuable to marketers looking for customer insights that may increase sales or in the case of a political campaign, to win votes.

Social data is simple and it can be used to send messages to potential customers. It can be used in all stages of the customer lifecycle. Social data is available to marketers through publicly available social media websites over the internet. Social data provides insight into the details of a whole new level of social marketing.

Following are a few social data used in social marketing:

1. Details of influencers and high-performing content marketing strategies from content management sites

2. Spot and visualize emerging trends and threats to business across social media

3. Details of the most engaged audience

4. Real-time opportunities and threats in social marketing

5. Details of what is working for your competitors

6. Segmenting the social contacts based on where they are supporting in business sales.

Social data (Association analysis) can be used in following ways for social marketing purposes:

i) Target potential customers by following the events people go to.

ii) Target social media/content marketing based on people's likes and dislikes gathered using social media sites.

iii) Filter the customers based on their demographic and behavioral attributes exhibited over the social media sites.

iv) Marketers can target e-mails with matched social data of customers.

v) Marketers can target their campaign to multiple social segments based on social data classification.

vi) Organizations can segment customers based on sales cycle using social data.

vii) Marketers can integrate social data with their organizational CRM systems. Using big data analytics over the CRM data and social data, useful insights can be derived for organizational marketing purposes.

Let us understand what actionable social data is and how to put this to use in social marketing applications.

Social media is a means of communication and sharing attractive pictures. Users of social media investigate the platforms to locate and communicate with brands, give their feedback and share their views about the products. Thus, social media platforms have altered into an influential marketing tool. These platforms have become the foundation for many businesses and their functions.

Stats hold the advantageous role of social media for the marketing needs of business and its increasing influence:

- Social network dissemination across the world has got higher radically since 2014 and is likely to reach 73% of the world's population by 2021.

- It is reported that 7 of 10 people in the U.S. (or 77% of the country's population) have at least one social media profile.

- Overall social media population globally combinedly reach to 3.4 billion active social media users.

- Approximately 90% of social media users argue that they can reach to different brands or retailers by means of social media platforms.

15.6.1 Different Types of Actionable Social Data for Social Marketing

Actionable social data is a measurement of social marketing. It provides trends, opportunity, threats, and customer satisfaction for a business.

Social media analytics measure the impact of social media on business. It is a growing business discipline that helps the firm in understanding industry-driven and brand-driven discussions in online communities, including social networks.

It also influences conversations related to business performance such as conversations driven by industry experts, competitors, prospects, customers and social marketing teams.

The author of Social Media Metrics, Jim Sterne, defines social media analytics as the study of social media metrics that help drive business strategy. Social data analytics comprises web analytics, engagement, and revenue generated from social platforms. Conversely, actionable social analytics focus on specific engagement metrics that are directly attached to lead generation, sales and brand promotion for marketing and sales effectiveness.

The following are the different types of actionable social data:

1. Web activity: It provides user behavior on the website which includes parameters like time spent on the web page and what content is being shared on social network.

2. Email interaction: It refers to action performed by the user on the email received and that includes opening a message, clicking a link and unsubscribing.

3. Purchase history: It describes the user's past purchases which can be used for predicting future spending patterns.

4. Profile information: It includes any personal data the user agrees to share on the web such as location, marital status, and friends.

15.6.2 Optimizing Email Campaigns Using Social Data

Email marketing optimization is the procedure of improving any aspect of email marketing. That aspect could be related to service providers, original decisions, targeting, and even strategy, among others. It is a set of measures firms employ to boost the conversion rate and build long-term relationships with their audience.

Segmenting the audience is the first step in optimizing email campaigns using social data. Clustering techniques are used to segment the customer base for targeted marketing. It essentially helps in grouping the readers according to specific criteria, such as interests, site actions and backgrounds. By dividing the audience into groups, we set the stage to begin sending tailored emails that our readers will actually care about. Accurate and comprehensive data is required for any consistent marketing strategy. We have to include social sharing links in all of our emails and not be afraid to give our readers options. Everyone has his/her own favorite social network, including links for Facebook, Twitter, LinkedIn, Pinterest, and Google+. We can also include an email forward link, which is another great way to encourage our readers to share the content to help generate new leads and opportunity. Integrating with Geo-spatial and temporal cues leads to much deeper insight into customer behavior. Location-based sequence of events are additional cues.

Relevancy is the key to build lifelong relationships with audience. Relevancy is the ways or means of putting contents for email marketing. These ways are as follows:

- *Use personalization*: Initiate by using subscribers' names in the subject lines and content. Use variables that are automatically produced after users apply for a subscription form by SendPulse.

- *Segment your audience* : Segregate subscribers into groups having similar features, like age, gender, or location. Using those segments, emails can send to those subscribers with dynamic contents such as changing images, phrases, call-to-actions. Behavioral segmentation can be used to understand the common patterns in user behavior.

- *Use automation:* Automation helps in creating email workflows, greeting new subscribers with welcome emails, and sending discarded cart emails. It also helps the firms in upselling and cross-selling more goods to customers and re-engage inactive subscribers.

- *Create fascinating subject lines:* Ensure the subject line should be stunning and reveals the email content. Spammy words should not be used like "buy", "money", "best", etc. For preheader text, same rules should be applied. This supports the idea of subject line.

- *Offer appropriate products:* Modify promotions of the product to exact subscribers at the correct time. Target marketing can be used to communicate with the right audience. Special offers in emails can be provided by making use of celebrations like holidays, birthdays, anniversaries.

- *Design emails easy to distinguish:* Attach to the reversed pyramid email design. Make use of images that explain products in the best way. Pursue email design best practices to make emails seem more professional.

Example: Tokyo Smart City Studio used GPS to Track Trends in Human Behaviour

Tokyo Smart City Studio used GPS to track fast changing trends in human behaviour. The studio was used by the Georgia Tech designers to change the way we plan cities.

Advanced analytics deployed on a massive pool of data enabled designers to visualize the way citizens chose to use a space. The designers took decisions on real behaviour instead of behaviour models or citizen surveys.

The team was using social data for social marketing.

Source: https://news.gatech.edu/news/2022/04/05/georgia-tech-plans-tokyo-redesign-using-social-data-including-tweets, dated April 5, 2022. Accessed on 19/05/2022

15.7   Segmentation for Social Marketing

Segmentation is a process of dividing people into similar subgroups based on defined criteria such as product usage, demographics, psychographics, communication, behavior, and media use. Homogeneous groups may be derived by clustering techniques and the "defined criteria" is actually mined.

There are 'Creators' or 'E-Influencers' – active bloggers who are highly influential in social marketing. They are 10% of social network users who generate 90% of the content. These people could be classified as a new market segment. There are a few negative influencers, known as 'detractors' who give brands a bad sign and their words are contagious like no others. Segmentation strategies are increasing in importance in social marketing. The social media marketing team requires training in these concepts and working hand in hand with customers' insights or market segmentation teams. In all the methods of social marketing also, it is necessary that the business goals are met for the organization (see Figure 15.3).

Figure 15.3: Business Goals of an Organization
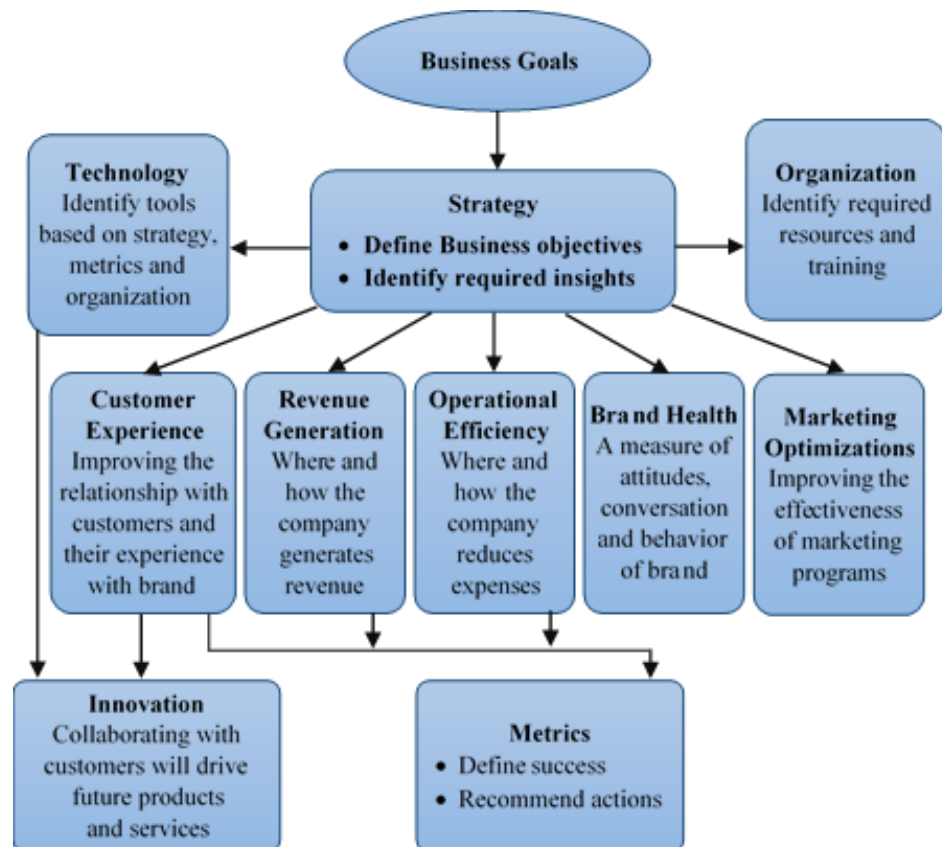
Source: ICFAI Research Center

Social media segmentation is the process of breaking down audience demographics within and between different social media platforms. It provides

an understanding of the different groups of people using a variety of social media platforms. It helps in analyzing the channels required to take up to reach those groups.

Some social media platforms, like Facebook, Instagram, provide segmentation tools that allow users to focus their messaging on particular age groups, industries, locations, etc. Conversely, not every social media platform has that tool in place. There are few ways to reach the different segments of the audience across social media platforms effectively, such as:

- Multiple accounts for different aspects of business can be created to reach different audiences within each social media platform.

- Proprietary grouping option of each social media platforms can be used (i.e. LinkedIn groups, Twitter lists, etc.) to target for messaging.

- Check the posts which get the most engagement and from which segments of social media audience by testing out timing messages for different points in the day.

- Apart from regular demographic segmentation, segmentation must be done based on new versus established leads, brand ambassadors versus silent customers, etc.

15.8   Measuring Social Marketing Results

The measurement of social marketing results is important for business performance analysis. Social media measurement is a monitoring mechanism for information on social media channels about a company or organization, usually tracking of various social media platforms such as blogs, news sites, micro-blogs such as Twitter video/photo sharing websites, forums, and user-generated content in general as a way to determine the volume and sentiment of online discussion about a brand or topic.

Social media monitoring allows companies to get insights into a brand's visibility on social media, helps to measure the impact of campaigns, identifies opportunities for engagement, assesses competitor activity, and be alerted to an impending crisis. It can also provide valuable information about emerging trends and understand what consumers and clients think about specific brands or products. This is the work of different groups which includes people like market researchers, PR staff, marketing teams, different agencies, and sales teams. Several different service providers in this area have created tools to facilitate the monitoring of a variety of social media platforms ranging from blogging to internet forums. This allows companies to track what consumers are talking about their brands. Companies can then react to these insights and interact with consumers through social media platforms. These are quite useful for transport, tourism activities. Graph techniques are used to mine relationships between entities and use it for targeted marketing and recommendations.

Ongoing analytics and campaign-focused metrics are the two types of social media measurement. Ongoing analytics monitors and tracks activity over time. These are essential for keeping up with the overall pulse of general conversation about brand and company. Campaign-focused metrics is also called event analytics. It includes clear beginning and end. It helps in understanding the influence of targeted marketing proposals and will differ from campaign to campaign, depending on business goals for each. A successful social media measurement program includes both ongoing and campaign-specific measurements.

15.8.1 Metrics in Social Marketing

The most important and general metrics to consider are engagement, share of voice, referrals, impressions and reach, conversions and response rate and time. These metrics jointly provide a 360º view of social media performance.

Reach: It measures the number of eyes or people exposed to the contents of social media presence. It does not constantly paint the full picture and it is a critical metric to monitor.

Engagement: It measures the number of people interacting with the content on social media platform. It comes with several forms like comments, shares, likes, clicks, and saves.

Referrals, *or referral traffic:* It measures the number of visitors that come to a particular website from social media. A referral visit is clicking a link in a social media post and that directs people to the particular website. Social media referrals are a major source of website traffic for many businesses.

Click-through-rate or CTR: It follows the number of people click ad or content on social media platform. Clicking on ad or content directs the user to a page on a particular website where additional content lives.

Bounce rate: It measures the number of splits that occur on the website after landing on the page. This occurs due to a number of reasons, like accidental clicks. Bounce rate is high in the case of traffic coming to website from social media platform. This indicates that website is not providing the users what they are expecting.

Conversions: These are related to an individual business model. A conversion might be a direct website purchase, for example, people subscribe to newsletter, download gated content, or register for local event. These are the business goals that are finally trying to accomplish, the goals that lift up the bottom line of the firm.

The most powerful and fundamental internet-based measurement is website statistics or Google Analytics. However, a number of other internet tools exist for measuring Pay-Per-Click (PPC), Search Engine Optimization (SEO), email metrics, news placements, and keyword mentions. Social media monitoring is

possible through all the top platforms (YouTube, Facebook, Twitter, and LinkedIn).

With the alignment of the business goals for social marketing activities, the following elements emerge as the focus of social marketing :

a. Brand health: Check how people are talking about service, products and customer experience. Businesses need to be aware of their customers' perceptions.

b. Marketing optimization: It determines what types of people search the site and from what sites they are coming to our site. Some of the things to be optimized are campaigns, content channels, timing, and influencers.

c. Revenue generation: It determines leads and conversions to generate revenue.

d. Customer experience: Social media has a direct relationship with the customer experience that translates into improved brand health, increased revenue and cost saving.

e. Innovation: It determines how well the business listens to the customers for their insights into products and service improvements.

Please do an activity on social marketing using social data (Activity 15.2).

Activity 15.2

Social Marketing Using Social Data

Bodyfit manufactures and sells physical exercise devices. You are hired for Bodyfit to introduce a new physical exercise device for people who are suffering from pain in the wrist. How will you collect the social data, analyze causes and segment for social marketing this device?

Answer:

<u>**Check Your Progress - 2**</u>

6. Which of the following is actionable social data for social marketing?

  a. Listening

  b. Reading

  c. Web Activity

  d. Migration

  e. Reports

7. Which of the following is not one of the focus areas of social marketing?

   a. Brand health

   b. Market optimization

   c. Revenue generation

   d. Customer experience

   e. Quality

8. Which of the following is an example of measurement for Social Marketing Result?

   a. Brand Health

   b. Health Check

   c. Artists and Creative Endeavors

   d. Advertisements

   e. Number of Hits

9. What does SEO stand for?

   a. Subject Expert Optimization

   b. Super Expert Objectives

   c. Search Engine Optimization

   d. Subject Expert Operations

   e. Subject Expert Orientation

10. For which of the following Twitter is an example?

    a. Social Search Engine

    b. Social Networking

    c. Social Service

    d. Business Intelligence Tool

    e. Community Service

15.9 Summary

- Social Marketing in the cloud is an emerging technology. It increases the efficiency of marketing by reducing the time between planning and implementing an ad campaign. The importance of social media marketing in the cloud is highlighted in the Unit.

- The various opportunities and risks in social marketing using clouds, Social software, validating various social data for social marketing, and measuring social marketing results are discussed in this Unit.

- Social marketing using clouds have multifold benefits such as – marketing material cost reduction, marketing distribution cost reduction, increased customization, increased efficiency, etc.

- However, the flip side of the story is that we become dependent on the cloud since it provides high working speed, and we need to always decide to sync up the cloud backups instead of pushing the entire data into the backup.

- Some of the challenges are related to unstructured data, integration of multiple domains and related ontologies, and high dimensional, high velocity data flow.

- Further, identifying the same entity across different networks is also a challenge.

15.10   Glossary

Cloud Computing: Cloud computing services are provided through Public Cloud, Private Cloud, and Hybrid Cloud environment. There are 3 broad Cloud Service Categories: a) Software-as-a-Service (SaaS), b) Platform-as-a-Service (PaaS), and c) Infrastructure-as-a-Service (IaaS).

Segmentation for Social Marketing: Segmentation is a process of dividing people into similar subgroups based on defined criteria such as product usage, demographics, psychographics, communication, behavior, and media use.

Social Media Marketing: Social media marketing consists of programs which require an effort to create such content that can attract readers and encourage them to share it across their social network.

Social software: Social software is a certain class of information systems that support the creation of virtual communities. It monitors the online communities of people while they are performing certain tasks.

Web 2.0: Web 2.0 consists of a number of new technologies making the web browser user interfaces more user-friendly and it also reduces the traffic load on the internet. The basic HTTP-protocol that is used to fetch HTML pages from servers to clients is stateless. This means if a user enters anything on a web page and sends this data to the server, and the server sends in response a new page to the client, then the client software has no knowledge about what the user has entered.

15.11   Self-Assessment Test

1. What is cloud computing?

2. Explain Social software and Web 2.0.

3. Write a note on optimizing email campaigns.

4. What are the different types of actionable social data for social marketing?

5. What do you understand by segmentation for social marketing?

6. Explain the assessment of social marketing results.

15.12   Suggested Readings / Reference Material

1. Rodney Heisterberg and Alakh Verma (April 2022). "Creating Business Agility: How Convergence of Cloud, Social, Mobile, Video and Big Data Enables Competitive Advantage," Narrated by Stephen Graybill.

2. Jonathan S Walker (2021). Social Media Marketing For Beginners - How To Make Money Online: Guaranteed Strategies To Monetizing, Mastering, & Dominating Any Platform For Your Brand, JW Choices.

3. Barry Connolly (2020). Digital Trust: Social Media Strategies to Increase Trust and Engage Customers, Bloomsbury Business.

4. Seema Gupta (6 August 2020). Digital Marketing McGraw Hill; Second edition.

5. Tracy L. Tuten, Michael R (15 June 2020). Solomon et al, Social Media Marketing, SAGE Publications Pvt. Ltd; Third edition.

6. Paul Martin Thomas Erickson (2019). Social Media: Usage and Impact, Global Vision Publishing House, 2 edition.

7. Steve Randazzo (2019). Brand Experiences: Building Connections in a Digitally Cluttered World, Paipen publishing.

15.13   Answers to Check Your Progress Questions

1. (b)   Software-as-a-Service

> SaaS stands for Software as a Service in cloud computing terminology.

2. (d)   Social media marketing

> Blog creation, Social networking, Social book marking, Podcasting and Viral video marketing are elements of social media marketing.

3. (d)   Internet Messaging, Text chat, Blogs and Wiki

> Internet messaging, text chat, blogs and wiki are the leading communication tools for Social software.

4. (c)   Social media marketing

> Podcasting is a technique used in Social Media Marketing.

5. (b)   Infrastructure-as-a-Service

> IaaS stands for Infrastructure-as-a-Service in the cloud computing area.

6. (c)   Web Activity

> Web activity is actionable social data for social marketing.

7. (e)   Quality

> Brand health, Market optimization, Revenue generation, Customer experience and Innovation are the focus areas of social marketing.

8. **(a) Brand Health**

   Brand Health is an example of measurement of social marketing result.

9. **(c) Search Engine Optimization**

   SEO stands for Search Engine Optimization.

10. **(b) Social Networking**

    Twitter is defined as Social Networking.

SMACS (Social, Mobile, Analytics, Cloud, and Security) Technologies for Business

Course Structure

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Unit 7	Mobile Apps for Business Organizations
Unit 8	Mobile Business Process Management
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Unit 9	Decision Making Using Big Data
Unit 10	Handling Unstructured Data
Unit 11	Data Analytics for Top Management Decision Making
Unit 12	Business and Marketing Intelligence Using Analytics
Block 4: Cloud for Business	
Unit 13	Cloud Architectures and Services
Unit 14	Enterprise Systems Development Using Cloud Technologies
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