Chapter-4

E-COMMERCE, M-COMMERCE & EMERGING TECHNOLOGIES

Conceptual Additions

1. E-Commerce
2. Components for E-Commerce
3. Architecture of Networked Systems
4. Work-flow Diagram for E-Commerce
5. Risk and Controls
6. Law Governing E-Commerce
7. Digital Payments
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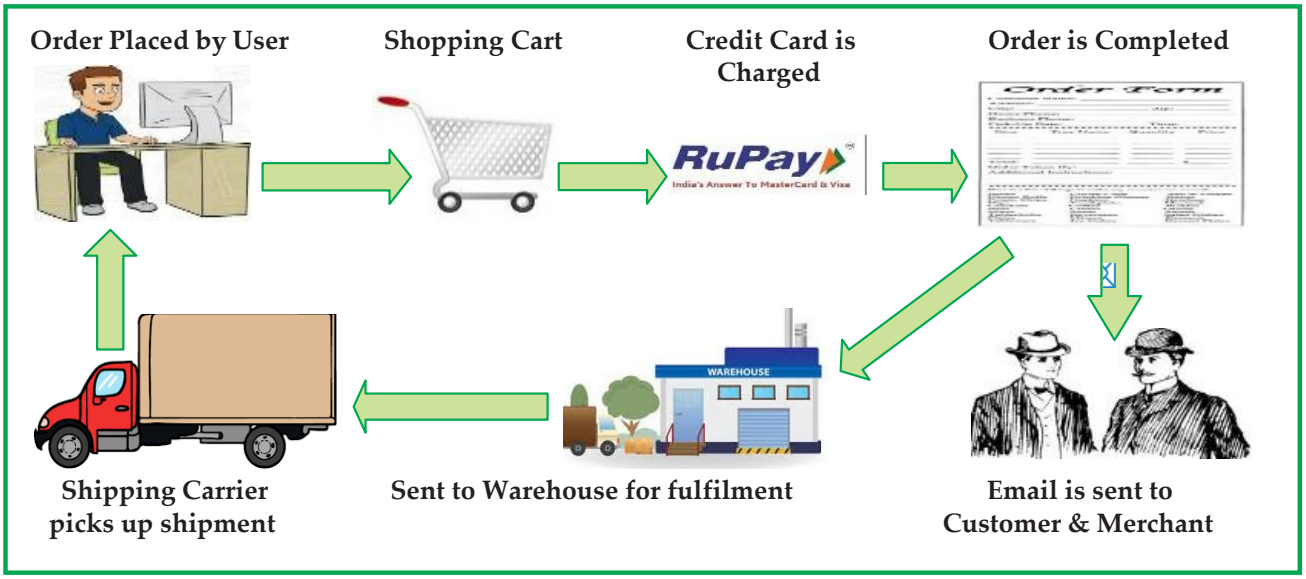
1. E-Commerce

E-Commerce is the process of doing business electronically. It refers to the use of technology to enhance the processing of commercial transactions between a company, its customers and its business partners. It involves the automation of a variety of Business-To-Business (B2B) and Business-To-Consumer (B2C) transactions through reliable and secure connections.

Sale / Purchase of goods / services through electronic mode is e-commerce." This could include the use of technology in the form of Computers, Desktops, Mobile Applications, etc.



1.1 Difference between Traditional and E-Commerce

Base For Comparison	Traditional Commerce	E-Commerce
Definition	Traditional commerce includes all those activities which encourage exchange, in some way or the other of goods / services which are manual and non-electronic.	E-Commerce means carrying out commercial transactions or exchange of information, electronically on the internet.
Transaction Processing	Manual	Electronically
Availability for commercial transactions	For limited time. This time may be defined by law. Like special stores which may run 24 hours, but in general available for limited time.	24×7×365
Nature of purchase	Goods can be inspected physically before purchase.	Goods cannot be inspected physically before purchase.
Customer Interaction	Face-to-face	Screen-to-face
Business Scope	Limited to particular area.	Worldwide reach
Information exchange	No uniform platform for exchange of information.	Provides a uniform platform for information exchange.
Resource focus	Supply side	Demand side
Marketing	One way marketing	One-to-one marketing
Payment	Cash, cheque, credit card, etc.	Credit card, fund transfer, Cash in Delivery, Payment Wallets, UPCI application etc.
Delivery of goods	Instantly	Takes time, but now e-commerce websites have created options of same day delivery, or delivery within 4 hours. This option is restricted to number of cities as of now. AMAZON has already started delivery in United States of America through drones.
Layers of Delivery (Profit Impact)	Increased layers of delivery from manufacturer to customers. -Lower Margin to manufacturers. -Higher price to customer	(i) Increases the profit margin of manufacturers. (ii) Allows manufacturer to give discounts to customers. (iii) Customers get better prices.
Layers of Delivery (Time Impact)	Increased layers of delivery from manufacturer to customers. - Customers get delayed deliveries - Huge inventory need to be maintained by manufacturers.	(i) This helps customers get faster product deliveries. (ii) Manufacturers can have better inventory management. As they will always know what products customers are buying. They shall be able to maintain inventory on Just in Time basis.

1.2 Benefits of E-Business

A. Benefits to Customer / User

- **Convenience**: Every product at the tip of individual's fingertips on internet.
- **Time saving**: No. of operations that can be performed by buyers and sellers increase.
- **Various Options**: There are several options available for customers which are not only being easy to compare but are also provided by different players in the market.
- **Easy to find reviews**: There are often reviews about a particular site or product from the previous customers which provides valuable feedback.
- **Coupon and Deals**: There are discount coupons and reward points available for customers to encourage online transaction.
- **Anytime Access**: Even midnight access to the e commerce platforms is available which brings in customer suitability.

B. Benefits to Business / Sellers

- **Increased Customer Base**: Since the number of people getting online is increasing, which are creating not only new customers but also retaining the old ones.
- **Recurring payments made easy**: Each business has number of operations being homogeneous. Brings in uniformity of scaled operations.
- **Instant Transaction**: The transactions of e commerce are based on real time processes. This has made possible to crack number of deals.
- **Provides a dynamic market**: Since there are several players, providing a dynamic market which enhances quality and business.
- **Reduction in costs**: By electronically accessing on-line databases of bid opportunities, on-line abilities to submit bids, and on-line review of rewards.
- **Efficiency improvement due to**: Reduction in time to complete business transactions, particularly from delivery to payment.
- **Creation of new markets**: This is done through the ability to easily and cheaply reach potential customers.
- **Easier entry into new markets**: This is especially into geographically remote markets, for enterprises regardless of size and location.
- **Better quality of goods**: As standardized specifications and competition have increased and improved variety of goods through expanded markets and the ability to produce customized goods.
- **Elimination of Time Delays**: Faster time to market as business processes are linked thus enabling seamless processing and eliminating time delays.

C. Benefits to Government

- **Instrument to fight corruption**:-In line with Government's vision, e commerce provides a pivotal hand to fight corruption.
- **Reduction in use of ecologically damaging materials** through electronic coordination and the movement of information rather than physical objects.

With the benefits, also come the risks. An organization should be cautious not to leap blindly into e-business, but rather first develop an e-business strategy, and then organize a corporate-wide team to implement that strategy.

1.3 E-Commerce Business Models

A Business Model can be defined as the *organization of* product, service, information-flows, the sources of revenues and benefits for suppliers and customers.

An e-business model is the adaptation of an organization's business model to the internet economy. A Business Model is adopted by an organization as a framework to describe how it makes money on a sustainable basis and grows. E-business models utilize the benefits of electronic communications to achieve the value adding processes.

S.No.	e- Market	Description
1	**e- Shops**	An e-shop is a virtual store front that sells products and services online. Orders are placed and payments made. They are convenient way of effecting direct sales to customers; allow manufacturers to bypass intermediate operators and thereby reduce costs and delivery times.
2	**e-Malls**	The e-mall is defined as the retailing model of a shopping mall, a conglomeration of different shops situated in a convenient location in e-commerce.
3	**e- auctions**	Electronic auctions provide a channel of communication through which the bidding process for products and services can take place between competing buyers.
4	**Portals**	Portals are the channels through which websites are offered as content. The content can be a source of revenue through charging for advertising or access subscription.
5	**Buyer Aggregators**	The Buyer Aggregator brings together large numbers of individual buyers so that they can gain the types of savings that are usually the privilege of large volume buyers. In this, the firm collects the information about goods/service providers, make the providers their partners, and sell their services under its own brand.
6	**Virtual Community**	Virtual Community is a community of customers who share a common interest and use the internet to communicate with each other. Virtual communities benefit from network externalities whereby the more people who join and contribute to the community, the greater the benefits that accrue, but without any additional cost to participants.
7	**e- marketing**	e-marketing is the use of electronic communications technology such as the internet, to achieve marketing objectives. Of course, information on websites also empowers customers and helps them achieve their objectives. For example, they can compare prices of products by rival firms. The internet changes the relationship between buyers and sellers because market information is available to all parties in the transaction
8	**e-procurement**	e-procurement is the management of all procurement activities via electronic means. Business models based on e-procurement seek efficiency in accessing information on suppliers, availability, price, quality and delivery times as well as cost savings by collaborating with partners to pool their buying power and secure best value deals. E-procurement infomediaries specialize in providing up-to-date and real-time information on all aspects of the supply of materials to businesses.
9	**e-distribution**	The e-distribution model helps distributors to achieve efficiency savings by managing large volumes of customers, automating orders, communicating with partners and facilitating value-adding services such as order tracking through each point in the supply chain. An example of a firm specializing in e- distribution is wipro.com (www.wipro.com) who use the internet to provide fully integrated e-business- enabled solutions that help to unify the information flows across all the major distribution processes including sales and marketing automation, customer service, warehouse logistics, purchasing and inventory management, and finance.

The e-business models relating to e-business markets can be summarized as given below:

Models	Definition	e-business markets	Examples
Business-to-Consumer (B2C)	Generally, this supports the activities within the customer chain in that it focuses on sell-side activities.	e-shops, e-malls, e-auctions, buyer aggregators, portals etc.	www.cisco.com www.amazon.com
Business-to-Business (B2B)	This supports the supply chain of organizations that involves repeat commerce between a company and its suppliers or other partners.	e-auctions, e-procurement, e-distribution, portals, e-marketing etc.	www.emall. com
Consumer- to-Consumer (C2C)	This supports the community plan surrounding the organization and can be seen as a commercial extension of community activities.	e-auctions, virtual communities etc.	www.eBay.com

2. Components for E-Commerce

a. **User**: This may be individual / organization or anybody using the e-commerce platforms. As e-commerce, has made procurement easy and simple, just on a click of button e-commerce vendors needs to ensure that their products are not delivered to wrong users.

b. **E-commerce Vendors**: This is the organization providing the user, goods/ services asked for. For example: www.amazon.in. E-commerce vendors further needs to ensure following for better, effective and efficient transaction.

- **Suppliers and Supply Chain Management**: These being another important component of the whole operations. For effectiveness, they need to ensure that-
  - They have enough and the right goods supplies.
  - They are financially and operational safe.
  - The order to deliver time is very short.
- **Warehouse operations**: When a product is bought, it is delivered from the warehouse of e-commerce vendor. This place is where online retailers pick products from the shelf, pack them as per pre-decided standards and prepare those products to be delivered. These operations have become very critical to the success of the whole e-commerce business. Many e-commerce companies are investing huge amounts of money in automating the whole warehouses.
- **Shipping and returns**: Shipping is supplementary and complementary to whole warehouse operations. Fast returns have become Unique Selling Preposition (USP) for many e-commerce vendors, so these vendors need very effective and efficient return processing.
- **E - Commerce catalogue and product display**: Proper display of all products being sold by vendor including product details, technical specifications, makes for a better sales conversion ratio.
- **Marketing and loyalty programs**: Loyalty programs establish a long-term relationship with customer. Example- In airline industry, customer can get good discount based on loyalty points accumulated. The same concept is being used by e-commerce vendors to ensure customer loyalty.
- **Showroom and offline purchase**: Few e-commerce vendors over period have realized that their products can be sold fast if customers are able to feel / touch / see those products. Thus have opened outlets for customer experience of their products.
- **Different Ordering Methods**: These are the way customer can place his/her order, say Cash on Delivery is today's most preferred method.

- **Guarantees**: Guarantees generates a security in customer's mind that in case of any problem, their product will be taken care of, or money shall be safely returned back.
- **Privacy Policy**: Customers are very concerned about the information that they are sharing. E - Commerce vendors need to clearly explain them what the vendor plan to do with the various information that is collected from its customers. The Information Technology Act, 2000 (as amended 2008) specifically states that security of such data shall be the responsibility of e-commerce vendor.
- **Security**: Represents the security policy adopted by the e-commerce vendors. Vendor website needs to state that online data used to transact is safe that vendors is using appropriate security including security systems like SSL (Secure Socket Layer). This guarantees that the data provided by customer will not fall into the hand of a malicious hacker while transferring from his / her computer to the web server.

c. Technology Infrastructure:

- **Computers, Servers and Database**

- These are the backbone for the success of the venture. Big e-commerce organizations invest huge amounts in creating these systems. They store the data / program used to run the whole operation of the organization.
- As cloud computing is increasingly being used, many small / mid-sized e-commerce originations have started using shared infrastructures.

- **Mobile Apps**

  Just as with the personal computer, mobile devices also have operating systems and application software. They have become a dominant form of computing, with many more smartphones being sold than personal computers. This means that organizations will have to get smart about developing software on mobile devices in order to stay relevant. Each app takes several thousand dollars to create, so this is not a trivial decision for many companies. One option many companies have is to create a website that is mobile-friendly and relatively less costly than a mobile app.

- **Digital Library**:

  A Digital Library is a special library with a focused collection of digital objects that can include text, visual material, audio material, stored as electronic media formats along with means for organizing, storing, and retrieving the files and media contained in the library collection. The digital content may be stored locally, or accessed remotely via computer networks. An electronic library is a type of information retrieval system.

- **Data Interchange**:

  Data Interchange is an electronic communication of data. For ensuring the correctness of data interchange between multiple players in e-commerce, business specific protocols are being used. There are defined standards to ensure seamless / exact communication in e-commerce.

d. Internet/Network:

This is the key to success of e-commerce transactions.

- Internet connectivity is important for any e-commerce transactions to go through. Net connectivity in present days can be through traditional as well as new technology.
- The faster net connectivity leads to better e-commerce.
- The success of e-commerce trade depends upon the internet capability of organization. At a global level, it is linked to the countries capability to create a high speed network.

e. **Web portal**: This shall provide the interface through which an individual / organization shall perform e-commerce transactions.
   - Web Portal is the application through which user interacts with the e-commerce vendor. The front end through which user interacts for an e-commerce transaction.
   - The simplicity and clarity of content on web portal is directly linked to customer experience of buying a product online. E-commerce vendors put a lot of money and effort in this aspect.

f. **Payment Gateway**: The payment mode through which customers shall make payments. Payment gateway represents the way e-commerce / m-commerce vendors collects their payments. Presently numerous methods of payments by buyers to sellers are being used, including Credit / Debit Card Payments, Online bank payments, Vendors own payment wallet, Third Party Payment wallets, like SBI YONO or PAYTM, Cash on Delivery (COD) and Unified Payments Interface (UPI).

3. Architecture of Networked Systems

Architecture is a term to define the style of design and method of construction, used generally for buildings and other physical structures. In e-commerce, it denotes the way network architectures are build. E-commerce runs through network-connected systems. Networked systems can have two types of architecture namely: Two tier and Three tier.

A. Two Tier Client Server

In a Two-tier network, client (user) sends request to Server and the Server responds to the request by fetching the data from it. The Two-tier architecture is divided into two tiers- **Presentation Tier and Database Tier**

(i) **Presentation Tier (Client Application/Client Tier):** This is the interface that allows user to interact with the e-commerce / m-commerce vendor. User can login to an e-commerce vendor through this tier. This application also connects to database tier and displays the various products / prices to customers.

(ii) **Database Tier (Data Tier)**: The product data / price data / customer data and other related data are kept here. User has no access to data / information at this level but he/she can see all data / information stored here through application tier.

The Advantages of Two-Tier Systems are as follows:

- The system performance is higher because business logic and database are physically close.
- Since processing is shared between the client and server, more users could interact with system.
- By having simple structure, it is easy to setup and maintain entire system smoothly.

The Disadvantages of Two-Tier Systems are as follows:

- Performance deteriorates if number of users' increases.
- There is restricted flexibility and choice of DBMS, since data language used in server is proprietary to each vendor.

B. Three Tier Client Server

Three - Tier architecture is a software design pattern and well-established software architecture. Its three tiers are the **Presentation Tier, Application Tier and Data Tier**.

In Three Tier Architecture three layers like Client, Server and Database are involved. In this, the Client sends a request to Server, where the Server sends the request to Database for data, based on that request the Database sends back the data to Server and from Server the data is forwarded to Client. The three-tier architecture is as follows:

(i) **Presentation Tier**: Occupies the top level and displays information related to services available on a website. This tier communicates with other tiers by sending results to the browser and other tiers in the network.

(ii) **Application Tier**: Also, called the Middle Tier, Business Logic or Logic Tier; this tier is pulled from the presentation tier. It controls application functionality by performing detailed processing. In computer software, business logic or domain logic is the part of the program that encodes the real-world business rules that determine how data can be created, displayed, stored, and changed.

(iii) **Database Tier**: This tier houses the database servers where information is stored and retrieved. Data in this tier is kept independent of application servers or business logic. The data access layer should provide an Application Programming Interface (API) to the application tier that exposes methods of managing the stored data without exposing or creating dependencies on the data storage mechanisms. Avoiding dependencies on the storage mechanisms allows for updates or changes without the application tier clients being affected by or even aware of the change.

The Advantages of Three-Tier Systems:

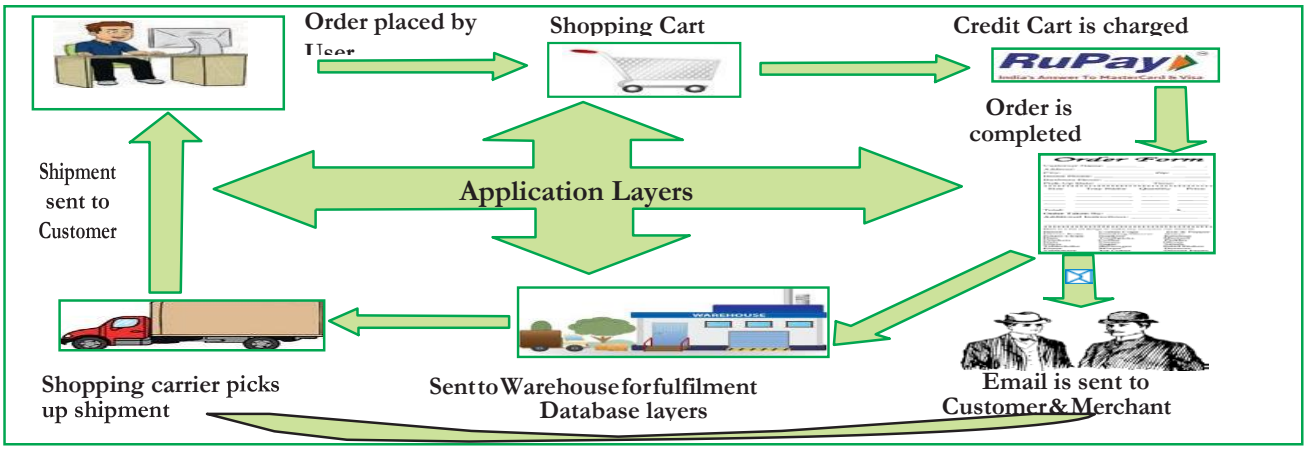
- Clear separation of user-interface-control and data presentation from application-logic: Through this separation more clients can have access to a wide variety of server applications.
- Dynamic load balancing: If bottlenecks in terms of performance occur, the server process can be moved to other servers at runtime.
- Change management: It is easy and faster to exchange a component on the server than to furnish numerous PCs with new program versions.

The Disadvantages of Three-Tier Systems:

- It creates an increased need for network traffic management, server load balancing, and fault tolerance.
- Current tools are relatively immature and are more complex.
- Maintenance tools are currently inadequate for maintaining server libraries.

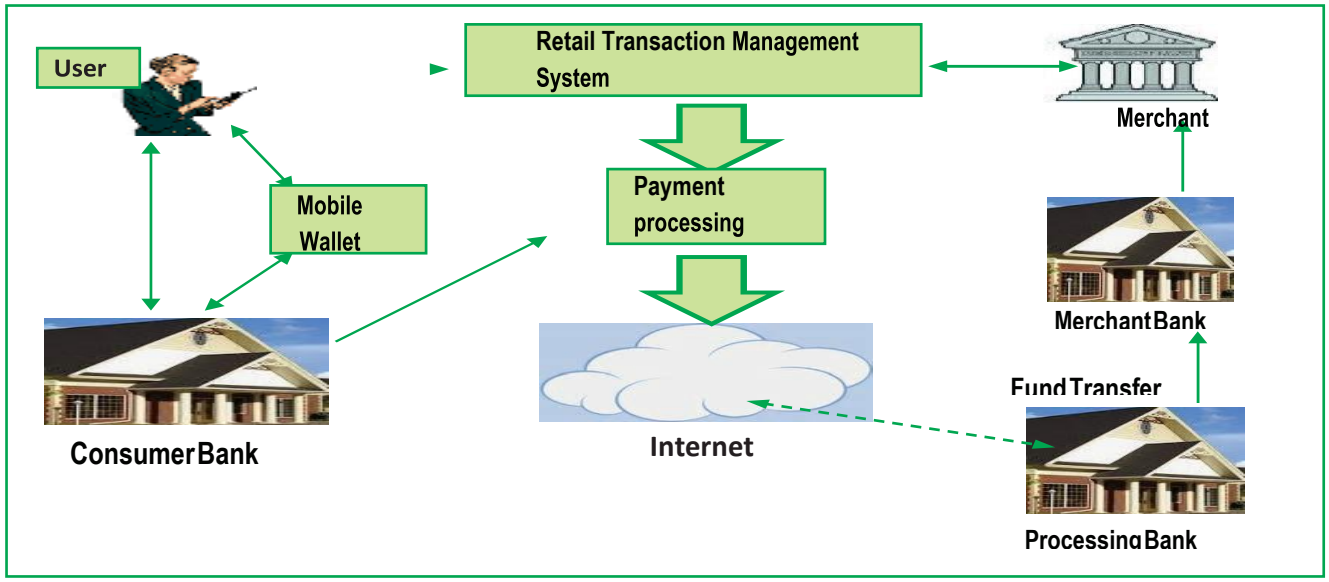
In two-tier architecture, application performance will be degraded upon increasing the users and it is cost in-effective whereas three-tier architecture provides High performance, lightweight persistent objects, flexibility, maintainability. Apart from the usual advantages of modular software with well-defined interfaces, the three-tier architecture is intended to allow any of the three tiers to be upgraded or replaced independently in response to changes in requirements or technology. All e-commerce applications follow the three-tier network architecture.

3.1 E-Commerce Architecture Vide Internet



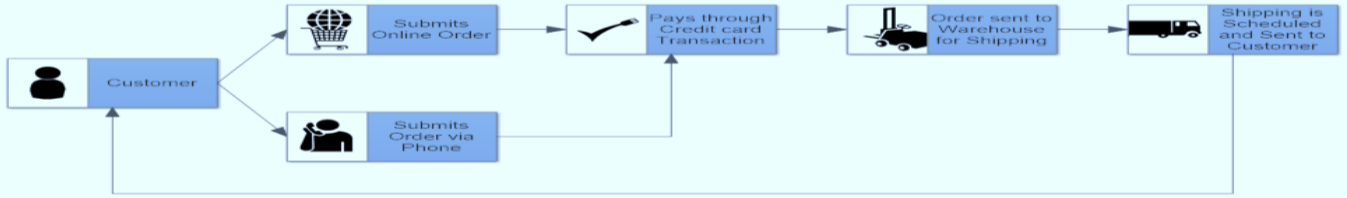
S. No.	Layer	Includes	Purpose
1	**Client / User Interface**	Web Server, Web Browser and Internet. For example: where user buys a mobile phone from an e-commerce merchant it includes - - User - Web Browser - Web Server	This layer helps the e-commerce customer connect to e-commerce merchant.
2	**Application Layer**	Application Server and Back End Server. For example - In the same example, it includes - E-merchant - Reseller - Logistics partner	Through these applications customer logs to merchant systems. This layer allows customer to check the products available on merchant's website.
3	**Database Layer**	The information store house, where all data relating to products, price it kept.	This layer is accessible to user through application layer.

3.2 E-Commerce Architecture Vide Mobile Apps



S. No.	Layer	Includes	Purpose
1	Client / User Interface	Mobile Web Browser and Internet. For example: where user buys a mobile phone from e-commerce merchant it includes, - Mobile APP (Application) - User	This layer helps the e-commerce customer connect to e-commerce merchant.
2	Application Layer	Application Server and back end server. For example: In the same example, it includes - E-merchant - Reseller - Logistics partner - Payment Gateway	Through these application's customer logs to merchant systems. This layer allows customer to check the products available on merchant's website.
3	Database Layer	The information store house, where all data relating to products, price it kept.	This layer is accessible to user through application layer.

4. Work Flow Diagram for E-Commerce



S. No.	Step	Activities
1	Customers login	Few e-commerce merchants may allow same transactions to be done through phone, but the basic information flow is e-mode.
2	Product/Service Selection	Customer selects products / services from available options.
3	Customer Places Order	Order is placed for selected product / service by customer. This step leads to next important activity PAYMENT GATEWAY.
4	Payment Gateway	Here customer makes a selection of the payment method. Merchant gets the update from payment gateway about payment realization from customer. In case of COD, vendor may do an additional check to validate customer.
5	Dispatch and Shipping Process	This process may be executed at two different ends. First if product/ service inventory is managed by e-commerce vendor, then dispatch shall be initiated at merchant warehouse. Second, many e-commerce merchants allow third party vendors to sale through merchant websites. For example: FLIPKART states that it has more than 1 lac registered third party vendors on its website.
6	Delivery Tracking	Another key element denoting success of e-commerce business is timely delivery. Merchants keep a track of this. All merchants have provided their delivery shippers with hand held devices, where the product/ service delivery to customers are immediately updated.
7	COD tracking	In case products are sold on COD payment mode, merchants need to have additional check on matching delivery with payments.
Numerous services are of the nature which does not have a separate delivery need, for example booking a train ticket through irctc.co.in. In this case, there is no separate delivery of service; tickets booking updates are generated as soon as payments are received by irctc.co.in payment gateways.		

5. Risks and Controls

A. Risk

Risk is possibility of loss. The same may be result of intentional or un-intentional action by individuals. Risks associated with e-commerce transactions are high compared to general internet activities. These include the following:

a. Privacy and Security
b. Quality issues
c. Delay in goods and Hidden Costs
d. Needs Access to internet and lack of personal touch
e. Security and credit card issues
f. Infrastructure
g. Problem of anonymity
h. Repudiation of contract
i. Lack of authenticity of transactions
j. Data Loss or theft or duplication
k. Attack from hackers
l. Denial of Service
m. Problem of piracy

B. Case Studies

Case 1: Return of Mobile with defective parts

- He used to buy new mobile online from India's largest m-commerce vendor.
- Return them with complaint that mobile purchased is defective.
- He used to replace the new mobiles internal components with defective components.
- He kept on doing this for two years before being caught. What control lapse leads to above fraud?
- Entities poor policy documentation regarding accepting mobile returns as defective.
- Within the organization there must have been a person putting a red mark when the same person was returning mobiles as defective. This reflects poor audit mechanism.

Case 2: Purchase fake/inferior products online.

- Certain websites allow anybody to sell products, which create a market for fake and illegal products. It is important to check the history of the seller and read all the details to ensure the product is the brand name product you originally intended to buy. A good rule of thumb is that if it's too good to be true, it may be fake. Designer headphones, purses, and watches will always cost around retail price online.

C. Control

Internal control, as defined in accounting and auditing, is a process for assuring achievement of an organization's objectives in operational effectiveness and efficiency, reliable financial reporting, and compliance with laws, regulations and policies.

For example:

- Company may have a policy to force employees to change passwords every 30 days.
- A CA firm may not allow office staff to access to social sites during office hours.

In an e-business environment, controls are necessary for all persons in the chain, including-

a. **Users**: This is important to ensure that the genuine user is using the e-commerce platform. There is risk if user accounts are hacked and hackers buy products/ services.
b. **Sellers / Buyers**: These people need to proper framework in place to insure success of business. Many e-commerce businesses have lost huge amount of money as they did not have proper controls put in place.

c. **Government**: Governments across the world and in India have few critical concerns vis-à-vis electronic transactions, namely:
   i. Tax accounting of all products / services sold.
   ii. All products/services sold are legal. There have been instances where narcotics drugs have found to be sold and bought through electronic means.
d. **Network Service Providers**: They need to ensure availability and security of network. Any downtime of network can be disastrous for business.
e. **Technology Service Providers**: These include all other service provider other than network service provider, for example, cloud computing back-ends, applications back-ends and like. They are also prone to risk of availability and security.
f. **Logistics Service Providers**: Success or failure of any e-commerce / m-commerce venture finally lies here. Logistics service providers are the ones who are finally responsible for timely product deliveries.
g. **Payment Gateways**: E-commerce vendors' business shall run only when their payment gateways are efficient, effective and foolproof.

Any lack of exercising controls by anyone can bring the risk to whole chain. Each participant needs to put in place policies, practices and procedures in place to protect from e-commerce / m-commerce related risks. These will include the following:

1. Educating the participant about the nature of risks
2. Communication of organizational policies to its customers
3. Ensure Compliance with Industry Body Standards
4. Protect your e-Commerce business from intrusions

There could be cyber security risks with Direct as well as Indirect impact:

A Direct Financial Impact could be if the Application at the Company's Retailers which contains financial information has weak password resulting in harm to the integrity of data.

An Indirect Operational Impact could be if the sensitive customer information in the form of Bank Account Numbers, Recipes of Patented products, etc. could be breached which would result in legal and regulatory actions on the Company on account of breach of confidential information.

Following are the procedures to be considered for the assets whether owned or not by the Company and also where the Company is utilizing services from another service provider like the Server maintenance and security is outsourced to an outsourced service provider:

a. The Entity should have a IT Security Policy circulated to all Employees detailing the procedures to be adhered to when accessing IT systems/resources like password security, restricted use of internet, etc.
b. Periodical review of access rights to all IT resources to ensure that the access to the users is commensurate with their functional roles and responsibilities.
c. Adequate approvals exist before the access is granted to any IT resources.
d. Timely employee awareness campaigns focusing on methods of intrusion which can be stopped based on individual actions.
e. Use of firewalls by the Company to allow internet activity in accordance with the rules.
f. Any baseline security configurations established by the Company under any security standards which are periodically reviewed.
g. All remote access logins are configured for two factor authentication using of username, password, pin, token, etc.

h. Any vulnerability scans or penetration testing performed by the Company and any findings noted.
i. Are the backups scheduled properly and timely checked by restoration of data?

6. Laws Governing E-Commerce

All e-commerce transactions are commercial business transactions. All these transactions are covered under multiple laws, including commercial laws. Following commercial laws are applicable to e-commerce and m-commerce transactions.

Income Tax Act, 1961: Income Tax Act, has detailed provisions regarding taxation of income in India. In respect of e-commerce / m-commerce transactions, the issue of deciding place of origin transaction for tax purpose is critical.

Companies Act, 2013: The law defines all regulatory aspects for companies in India. Most of the merchants in e-commerce business are companies, both private and public.

Foreign Trade (Development and Regulation) Act, 1992: An Act to provide for the development and regulation of foreign trade by facilitating imports into, augmenting exports from, India and for matters connected therewith or incidental thereto. Amazon has recently allowed Indian citizens to purchase from its global stores. All these shall be regulated through above law.

The Factories Act, 1948: Act to regulate working conditions of workers. The act extends to place of storage as well as transportation.

The Custom Act, 1962: The act that defines import / export of goods / services from India and provides for levy of appropriate customs duty. India being a signatory to General Agreement on Trade and Tariff (GATT) under World Trade Organisation, cannot levy any custom duty that GATT non-compliant. This one law is subject to debate across the world. For example: An Indian company downloads software being sold by a foreign company whether the same shall be chargeable to duty of import.

The Goods and Services Tax Act, 2017 (GST): This Act requires each applicable business, including e-commerce/ m-commerce, to upload each sales and purchase invoice on one central IT infrastructure, mandating reconciliations of transactions between business, triggering of tax credits on payments of GST, facilitating filling of e-returns, etc.

Indian Contract Act, 1872: The act defines constituents of a valid contract. In case of e-commerce / m-commerce business it becomes important to define these constituents.

The Competition Act, 2002: Law to regulate practices that may have adverse effect on competition in India. Competition Commission has been vigilant to ensure that e-commerce / m-commerce merchants do not engage in predatory practices.

Foreign Exchange Management Act (FEMA 1999): The law to regulate foreign direct investments, flow of foreign exchange in India. With a view to promote foreign investment, FDI up to 100% under the automatic route is permitted in companies engaged in e-commerce provided that such companies would engage in Business to Business (B2B) e-commerce. Foreign investment in Business to Customer (B2C) e-commerce activities has been opened in a calibrated manner and an entity is permitted to undertake retail trading through e-commerce under the following circumstances:

(i) A manufacturer is permitted to sell its products manufactured in India through e-commerce retail.
(ii) A single brand retail trading entity operating through brick and mortar stores is permitted to undertake retail trading through e-commerce.
(iii) An Indian manufacturer is permitted to sell its own single brand products through e-commerce retail. Indian manufacturer would be the investee company, which is the owner of the Indian brand and which manufactures in India, in terms of value, at least 70% of its products in house.

Consumer Protection Act, 1986: The law to protect consumer rights has been source of most of litigations for transaction done through e-commerce and m-commerce.

Special Laws governing E-Commerce

E-commerce are covered under few other laws as these transactions are done electronically.

I. Information Technology Act, 2000

The law is applicable to all online transactions in India, and provides for penalties, prosecution for non-compliances. The important issues dealt in by the law includes:

a. Legality of products / services being offered online.
b. Data Protection
c. Protecting Your Customer's Privacy Online
d. Online Advertising Compliance
e. Compliance with Information Technology Act, provisions.

II. Reserve Bank of India, 1932

Reserve Bank of India (RBI), from time to time frames guidelines to be followed by e-commerce / m-commerce merchants allowing online payments through various modes. The merchant needs to comply with these guidelines. For example:

a. The conversion of all Credit / Debit cards to be made chip based.
b. PIN for all transactions done on point of sale machines through debit / credit cards.
c. The compliance with capital adequacy norms for payment wallets like SBI BUDDY/ PAYTM etc.

7. Digital Payments

Digital Payment is a way of payment which is made through digital modes. In digital payments, payer and payee both use digital modes to send and receive money. It is also called electronic payment.

New digital payment platforms such as UPI and IMPS are becoming increasingly popular. A high level of adaptability is a must for banking sector in this highly digital and tech-savvy age, where banking transactions can happen even on a mobile or tablet with a few clicks.

7.1 Different Types of Digital Payments

I. New Methods of Digital Payment

(i) **UPI Apps**: Unified Payment Interface is a system that powers multiple bank accounts, several banking services features like fund transfer, and merchant payments in a single mobile application. UPI or unified payment interface is a payment mode which is used to make fund transfers through the mobile app. User must register for mobile banking to use UPI apps and has to create a UPI ID. Examples: BHIM, PhonePe app.

(ii) **Immediate Payment Service (IMPS)**: It is an instant interbank electronic fund transfer service through mobile phones. It is also being extended through other channels such as ATM, Internet Banking, etc.

(iii) **Mobile Apps**: BHIM (Bharat Interface for Money) is a Mobile App developed by National Payments Corporation of India (NPCI) based on UPI. It facilitates e-payments directly through banks and supports all Indian banks which use that platform. It is built on the Immediate Payment Service infrastructure and allows the user to instantly transfer money between the bank accounts of any two parties.

(iv) **Mobile Wallets**: It is defined as virtual wallets that stores payment card information on a mobile device. Mobile Wallets provide a convenient way for a user to make-in-store payments and can be used that merchants listed with the mobile wallet service providers. Examples: PayTm, Freecharge, Buddy, Mobikwik etc.

(v) **Aadhar Enabled Payment Service (AEPS)**: Customer needs only his or her Aadhaar number to pay to any merchant. AEPS allows bank to bank transactions. It means the money you pay will be deducted from your account and credited to the payee's account directly.

(vi) **Unstructure Supplementary Service Data(USSD):** A revolutionary idea, where to make payments through mobiles there is neither need for internet nor any smart phone. User does not need to have a smartphone or internet connection to use USSD banking. It can use this service for many financial and non-financial operations such as checking balance, sending money, changing Mobile Banking PIN and getting MMID.

II. Traditional Methods of Digital Payment

(i) **Cards**: Cards are provided by banks to their account holders. These have been the most used digital payment modes till now. Various types of cards are as follows:

a. Credit Cards: A small plastic card issued by a bank, or issuer etc., allowing the holder to purchase goods or services on credit. In this mode of payment, the buyer's cash flow is not immediately impacted. User of the card makes payment to card issuer at end of billing cycle which is generally a monthly cycle.

b. Debits Cards: A small plastic card issued by a bank. Allowing the holder to purchase goods or services on credit. In this mode of payment, the buyer's cash flow is immediately affected that as soon as payment is authorized buyers account is debited.

(ii) **Net Banking**: In this mode, the customers log to the bank account and makes payments. All large banks allow net banking facilities to their customers.

7.1.1 Advantages of Digital Payments

(i) Easy and convenient
(ii) Pay or send money from anywhere
(iii) Discounts from taxes
(iv) Written record gets maintained

7.1.2 Drawbacks of Digital Payments

(i) Difficult for a Non-technical person
(ii) The risk of data and money theft
(iii) Overspending: One keeps limited cash in his/her physical wallet and hence thinks twice before buying anything. But if digital payment modes are used, one has an access to all his/her money that can result in overspending.

8. Computing Technologies

8.1 Virtualization

8.1.1 Concept of Virtualization

The core concept of Virtualization lies in Partitioning, which divides a single physical server into multiple logical servers. Once the physical server is divided, each logical server can run an operating system and applications independently. For example - Partitioning of a hard drive is considered virtualization because one drive is partitioned in a way to create two separate hard drives.

8.1.2 Common Types of Virtualization

- **Hardware Virtualization**: Hardware Virtualization or Platform Virtualization refers to the creation of a virtual machine that acts like a real computer with an operating system. Software executed on these virtual machines is separated from the underlying hardware resources. For example, a computer that is running Microsoft Windows may host a virtual machine that looks like a computer with the Linux operating system; based software that can be run on the virtual machine.
  The basic idea of Hardware virtualization is to consolidate many small physical servers into one large physical server so that the processor can be used more effectively. The software that creates a virtual machine on the host hardware is called a hypervisor or **Virtual Machine Manager**.

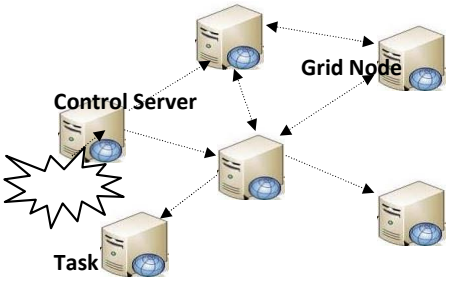
- **Network Virtualization**: Network Virtualization is a method of combining the available resources in a network by splitting up the available bandwidth into channels, each of which is independent from the others, and each of which can be assigned (or reassigned) to a particular server or device in real time. This allows a large physical network to be provisioned into multiple smaller logical networks and conversely allows multiple physical LANs to be combined into a larger logical network. This behaviour allows administrators to improve network traffic control. Network virtualization involves platform virtualization, often combined with resource virtualization.

- **Storage Virtualization**: Storage Virtualization is the apparent pooling of data from multiple storage devices, even different types of storage devices, into a single device that is centrally managed. It helps the storage administrator perform the tasks of backup and recovery more easily. Administrators can implement virtualization with software or by using hardware and software hybrid appliances. The servers connected to the storage system aren't aware of where the data really is.

8.2 Grid Computing

The computing resources in most of the organizations are underutilized but are necessary for certain operations. The idea of Grid computing is to make use of such non-utilized computing power by the needy organizations, and thereby the Return on Investment on computing investments can be increased.

Grid Computing is a computer network in which each computer's resources are shared with every other computer in the system. It is a distributed architecture of large numbers of computers connected to solve a complex problem. In the grid computing model, servers or personal computers run independent tasks and are loosely linked by the Internet or low-speed networks.



8.2.1 Benefits of Grid Computing

a. **Making use of Underutilized Resources**: Grid computing can be used to aggregate the unused storages into a much larger virtual data store, possibly configured to achieve improved performance and reliability over that of any single machine.

b. **Resource Balancing**: An unexpected peak can be routed to relatively idle machines in the grid; and if the grid is already fully utilized, the lowest priority work being performed on the grid can be temporarily suspended and performed again later to make room for the higher priority work.

c. **Parallel CPU Capacity**: The potential for usage of parallel CPU capacity is one of the most common visions and attractive features of a grid. A CPU- intensive grid application can be thought of as many smaller sub-jobs, each executing on a different machine in the grid. A perfectly scalable application will, for example, finish in one tenth of the time if it uses ten number of processors

d. **Access to additional resources**: In addition to CPU and storage resources, a grid can provide access to other resources as well. For example, if a user needs to increase their total bandwidth to the Internet to implement a data mining search engine, the work can be split among grid machines that have independent connections to the Internet. In this way, total searching capability is multiplied, since each machine has a separate connection to the Internet.

e. **Reliability**: High-end conventional computing systems use expensive hardware to increase reliability. The machines also use duplicate processors in such a way that when they fail, one can be replaced without turning the other off. Power supplies and cooling systems are duplicated. All of this builds a reliable system, but at a great cost, due to the duplication of expensive components.

f. **Management**: When maintenance is required, grid work can be rerouted to other machines without crippling the projects involved.

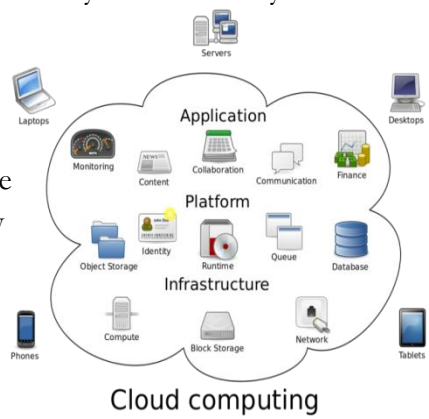
8.2.2 Grid Computing Security

- **Single Sign-on**: A user should authenticate once and then should be able to acquire resources, use them, and to communicate internally without any further authentication.
- **Protection of Credentials**: User passwords, private keys, etc. should be protected.
- **Interoperability with local security solutions**: Access to local resources should have local security policy at a local level.
- **Exportability**: The code should be exportable i.e. they cannot use a large amount of encryption at a time. There should be a minimum communication at a time.
- **Support for multiple implementations**: There should be a security policy which should provide security to multiple sources based on public and private key cryptography.

8.3 Cloud Computing

Simply put, cloud computing is the delivery of computing services-servers, storage, databases, networking, software, analytics, intelligence and more-over the Internet ("the cloud") to offer faster innovation, flexible resources and economies of scale. You typically pay only for cloud services you use, helping lower your operating costs, run your infrastructure more efficiently and scale as your business needs change.

With Cloud Computing, users can access database resources via the Internet from anywhere, for as long as they need, without worrying about any maintenance or management of actual resources. The location of physical resources and devices being accessed are typically not known to the end user. It also provides facilities for users to develop, deploy, and manage their applications 'on the cloud'.



Cloud computing

8.3.1 Characteristics of Cloud Computing

Some of the key-characteristics of cloud computing are:

- **Elasticity and Scalability**: Cloud computing gives us the ability to expand and reduce resources according to the specific service requirement. For example, we may need a large number of server resources for the duration of a specific task. We can then release these server resources after we complete our task.
- **Pay-per-Use**: We pay for cloud services only when we use them, either for the short term (for example, for CPU time) or for a longer duration (for ex., for cloud-based storage or vault services).
- **On-demand**: Because we invoke cloud services only when we need them, they are not permanent parts of the IT infrastructure. With cloud services there is no need to have dedicated resources, as is the case with internal services.
- **Resiliency**: The resiliency (capacity to recover quickly from difficulties) of a cloud service offering can completely isolate the failure of server and storage resources from cloud users. Work is migrated to a different physical resource in the cloud with or without user awareness and intervention.
- **Multi Tenancy**: Public cloud service providers often can host the cloud services for multiple users within the same infrastructure. Server and storage isolation may be physical or virtual depending upon the specific user requirements.
- **Workload Movement**: Cloud-computing providers can migrate workloads across servers both inside the data center and across data centers.

8.3.2 Advantages of Cloud Computing

- **Achieve economies of scale**: Volume output or productivity can be increased even with fewer systems and thereby reduce the cost per unit of a project or product.
- **Reduce spending on technology infrastructure**: Data and information can be accessed with minimal upfront spending in a pay-as-you-go approach.
- **Globalize the workforce**: People worldwide can access the cloud with Internet.
- **Reduce capital costs**: Saves huge money on hardware, software, or licensing fee.
- **Pervasive accessibility**: Data and applications can be accesses anytime, anywhere.
- **Less personnel training is needed**: It takes fewer people to do more work on a cloud, with a minimal learning curve on hardware and software issues.

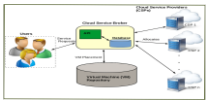
- **Minimize maintenance and licensing software**: As there is no too much of non-premise computing resources, maintenance becomes simple and updates and renewals of software systems rely on the cloud vendor or provider.
- **Improved flexibility**: It is possible to make fast changes in our work environment without serious issues at stake.

8.3.3 Drawbacks of Cloud Computing

- If Internet connection is lost, the link to the cloud and thereby to the data and applications is lost.
- Security is a major concern as entire working with data and applications depend on other cloud vendors or providers.
- Although Cloud computing supports scalability (i.e., quickly scaling up and down computing resources depending on the need), it does not permit the control on these resources as these are not owned by the user or customer.
- Depending on the cloud vendor, customers may have to face restrictions on the availability of applications, operating systems and infrastructure options.
- Interoperability (ability of two or more applications that are required to support a business need to work together by sharing data and other business-related resources) is an issue wherein all the applications may not reside with a single cloud vendor and two vendors may have applications that do not cooperate with each other.

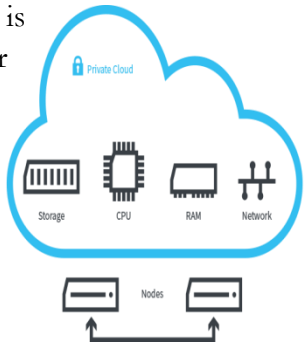
8.3.4 Cloud Computing Environment

The Cloud Computing environment can consist of multiple types of clouds based on their deployment and usage. Such typical Cloud computing environments, catering to special requirements, are briefly described as follows:



8.3.4.1 Private Cloud

This cloud computing environment resides within the boundaries of an organization and is used exclusively for the organization's benefits. These are also called Internal Clouds or Corporate Clouds. Private Clouds can either be private to the organization and managed by the single organization **(On- Premise Private Cloud)** or can be managed by third party **(Outsourced Private Cloud)**. They are built primarily by IT departments within enterprises, who seek to optimize utilization of infrastructure resources within the enterprise by provisioning the infrastructure with applications using the concepts of grid and virtualization.



Characteristics of Private Cloud

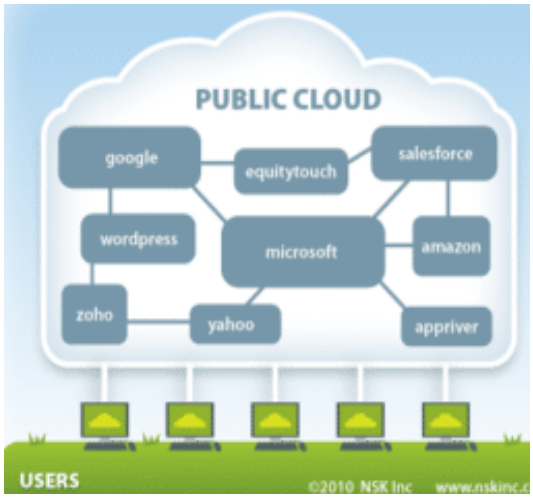
- **Secure**: The private cloud is secure as it is deployed and managed by the organization itself, and hence there is least chance of data being leaked out of the cloud.
- **Central Control**: As usually the private cloud is managed by the organization itself, there is no need for the organization to rely on anybody and it is controlled by the organization itself.
- **Weak Service Level Agreements** (SLAs): SLAs play a very important role in any cloud service deployment model as they are defined as agreements between the user and the service provider in private cloud. In private cloud, either Formal SLAs do not exist or are weak as it is between the organization and user of the same organization.

Advantages of Private Cloud

- It improves average server utilization; allow usage of low-cost servers and hardware while providing higher efficiencies; thus, reducing the costs that a greater number of servers would otherwise entail.
- It provides a high level of security and privacy to the user.
- It is small and controlled and maintained by the organization.

Moreover, one major limitation of Private Cloud is that IT teams in the organization may have to invest in buying, building and managing the clouds independently. Budget is a constraint in private clouds and they also have loose SLAs.

8.3.4.2 Public Cloud



The public cloud is the cloud infrastructure that is provisioned for open use by the general public. It may be owned, managed, and operated by a business, academic, or government organizations, or some combination of them. Typically, public clouds are administrated by third parties or vendors over the Internet, and the services are offered on pay-per-use basis. These are also called Provider Clouds. Public cloud consists of users from all over the world wherein a user can simply purchase resources on an hourly basis and work with the resources which are available in the cloud provider's premises.

Characteristics of Public Cloud

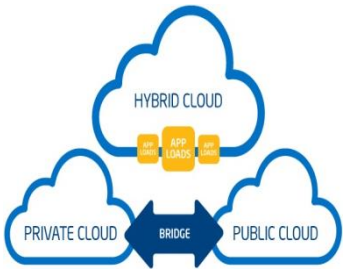
- **Highly Scalable**: The resources in the public cloud are large in number and the service providers make sure that all requests are granted.
- **Affordable**: The cloud is offered to the public on a pay-as-you-go basis; hence the user has to pay only for what he is using.
- **Less Secure**: Since it is offered by a third party and they have full control over the cloud, the public cloud is less secure out of all the other deployment models.
- **Highly Available**: It is highly available because anybody from any part of the world can access the public cloud with proper permission, and this is not possible in other models as geographical or other access restrictions might be there.
- **Stringent SLAs**: As the service provider's business reputation and customer strength are totally dependent on the cloud services, they follow the SLAs strictly.

Advantages of Public Cloud

- It is widely used in the development, deployment and management of enterprise applications, at affordable costs.
- It allows the organizations to deliver highly scalable and reliable applications rapidly and at more affordable costs.
- No need for establishing infrastructure for setting up and maintaining the cloud.
- Strict SLAs are followed.
- There is no limit for the number of users.

Moreover, one of the limitations of Public cloud is security assurance and thereby building trust among the clients is far from desired but slowly liable to happen. Further, privacy and organizational autonomy are not possible.

8.3.4.3 Hybrid Cloud



This is a combination of both at least one private (internal) and at least one public (external) cloud computing environments. The usual method of using the hybrid cloud is to have a private cloud initially, and then for additional resources, the public cloud is used. The hybrid cloud can be regarded as *a private cloud extended to the public cloud* and aims at utilizing the power of the public cloud by retaining the properties of the private cloud. It is typically offered in either of two ways. A vendor has a private cloud and forms a partnership with a public cloud provider or a public cloud provider forms a partnership/franchise with a vendor with private cloud platforms.

Characteristics of Hybrid Cloud

- **Scalable**: The hybrid cloud has the property of public cloud with a private cloud environment and as the public cloud is scalable; the hybrid cloud with the help of its public counterpart is also scalable.
- **Partially Secure**: The private cloud is considered as secured and public cloud has high risk of security breach. The hybrid cloud thus cannot be fully termed as secure but as partially secure.
- **Stringent SLAs**: Overall the SLAs are more stringent than the private cloud and might be as per the public cloud service providers.
- **Complex Cloud Management**: Cloud management is complex as it involves more than one type of deployment models and also the number of users is high.

The Advantages of Hybrid Cloud

- It is highly scalable and gives the power of both private and public clouds.
- It provides better security than the public cloud.

The limitation of Hybrid Cloud is that the security features are not as good as the private cloud and complex to manage.

8.3.4.4 Community Cloud

The community cloud is the cloud infrastructure that is provisioned for exclusive use by a specific community of consumers from organizations that have shared concerns. It may be owned, managed, and operated by one or more of the organizations in the community, a third party and it may exist on or off premises. This model is suitable for organizations that cannot afford a private cloud and cannot rely on the public cloud either.

Characteristics of Community Cloud

- **Collaborative and Distributive Maintenance**: In this, no single company has full control over the whole cloud. Better cooperation provides better results.
- **Partially Secure**: This refers to the property of the community cloud where few organizations share the cloud, so there is a possibility that the data can be leaked from one organization to another, though it is safe from the external world.
- **Cost Effective**: As the complete cloud if being shared by several organizations, not only the responsibility gets shared; the community cloud becomes cost effective too.

Community Cloud Advantages of Community Cloud

- It allows establishing a low-cost private cloud.
- It allows collaborative work on the cloud.
- It allows sharing of responsibilities among the organizations.
- It has better security than the public cloud.

8.3.5 Cloud Computing Service Models

The National Institute of Standards and Technology defines three basic service models -

A. Infrastructure as a Service (IaaS)

IaaS, a hardware-level service, provides computing resources such as processing power, memory, storage, and networks for cloud users to run their application on-demand. This allows users to maximize the utilization of computing capacities without having to own and manage their own resources. The IT architects need not maintain the physical servers as it is maintained by the service providers.

Examples: Amazon Web Services (AWS), Google Compute Engine, OpenStack

Characteristics of IaaS

- **Web access to the resources**: The IaaS model enables the IT users to access infrastructure resources over the Internet.
- **Centralized Management**: The resources distributed across different parts are controlled from any management console that ensures effective resource management.
- **Elasticity and Dynamic Scaling**: Depending on the load, the usage of resources can be increased or decreased according to the requirements.
- **Shared infrastructure**: IaaS follows a one-to-many delivery model and allows multiple users to share the same physical infrastructure and thus ensure high resource utilization.
- **Metered Services**: IaaS allows the IT users to rent the computing resources instead of buying it. The users will be charged based on the amount of usage.

Instance	Description
Network as a Service (NaaS)	• Provides users with needed data communication capacity to accommodate peak data usage. • It is an ability given to the end-users to access virtual network services on a per-per-use. • NaaS providers operate using three common service models: Virtual Private Network (VPN), Bandwidth on Demand (BoD) and Mobile Virtual Network (MVN).
Storage as a Service (STaaS)	• Provides storage infrastructure on a subscription basis to store the data. • STaaS allows the end users to access the files at any time from any place. • STaaS provider provides the virtual storage that is pre-occupied from any cloud data center.
Database as a Service (DBaaS)	• Provides users with seamless mechanisms to create, store, and access databases at a host site. • It is an ability given to the end users to access the database service without the need to install and maintain it on the pay-per-use basis. • The end users can access the database services through any Application Programming Interfaces (APIs) or Web User Interfaces provided by the service provider.
Backend as a Service (BaaS)	• Provides web and mobile app developers a way to connect their applications to backend cloud storage with added services such as user management, push notifications, social network services integration using custom software development kits
Desktop as a Service (DTaaS)	• Provides ability to the end users to use desktop virtualization without buying and managing their own infrastructure. • It is a pay-per-use cloud service delivery model in which the service provider manages the back-end responsibilities of data storage, backup, security and upgrades. • The end-users are responsible for managing their own desktop images, applications, and security. These are simple to deploy, highly secure and produce better experience on all devices.

B. Platform as a Service (PaaS)

PaaS provides the users the ability to develop and deploy an application on the development platform provided by the service provider. In traditional application development, the application will be developed locally and will be hosted in the central location. In stand-alone application development, the application will

be developed by traditional development platforms result in licensing - based software, whereas PaaS changes the application development from local machine to online.

Examples: Google AppEngine, Windows Azure Compute

Typical PaaS providers may provide programming languages, application frameworks, databases, and testing tools apart from some build tools, deployment tools and software load balancers as a service in some cases.

C. Software as a Service (SaaS)

SaaS provides ability to the end users to access an application over the Internet that is hosted and managed by the service provider. Thus, the end users are exempted from managing or controlling an application the development platform, and the underlying infrastructure. SaaS changes the way the software is delivered to the customers. SaaS provides users to access large variety of applications over internets that are hosted on service provider's infrastructure.

Example: One can make his own word document in Google docs online, he can edit a photo online on pixlr.com so he need not install the photo editing software on his system - thus Google is provisioning software as a service.

Instances of SaaS

Instance	Description
Testing as a Service (TaaS)	• Provides users with software testing capabilities such as generation of test data, generation of test cases, execution of test cases and test result evaluation on a pay-per-use basis.
API as a Service(APIaaS)	• Allows users to explore functionality of Web services such as Google Maps, Payroll processing, and credit card processing services etc.
Email as a Service (EaaS)	• Provides users with an integrated system of emailing, office automation, records management, migration, and integration services with archiving, spam blocking, malware protection, and compliance features.

8.4 Mobile Computing

Mobile Computing refers to the technology that allows transmission of data via a computer without having to be connected to a fixed physical link. Mobile voice communication is widely established throughout the world and has had a very rapid increase in the number of subscribers to the various cellular networks over the last few years. An extension of this technology is the ability to send and receive data across these cellular networks. This is the fundamental principle of mobile computing. Mobile data communication has become a very important and rapidly evolving technology as it allows users to transmit data from remote locations. This proves to be the solution of the biggest problem of business people on move.

Components of Mobile Computing

- **Mobile Communication**: This refers to the infrastructure put in place to ensure that seamless and reliable communication goes on.
- **Mobile Hardware**: Mobile Hardware includes mobile devices or device components that receive or access the service of mobility. They would range from Portable laptops, Smart Phones, Tablet PCs that use an established network to operate on
- **Mobile Software**: Mobile Software is the actual program that runs on the mobile hardware and deals with the characteristics and requirements of mobile applications. It is the operating system of that appliance and is the essential component that makes the mobile device operates.

Benefits of Mobile Computing

- In general, Mobile Computing enhances operational efficiency, and improves management effectiveness.
- It enables mobile sales personnel to update work order status in real-time, facilitating excellent communication.
- It facilitates access to corporate services and information at any time, from anywhere.
- It provides remote access to the corporate Knowledge base at the job location.
- It enables to improve management effectiveness by enhancing information quality, information flow, and ability to control a mobile workforce.

Limitations of Mobile Computing

- **Insufficient Bandwidth**: Mobile Internet access is generally slower than direct cable connections. These networks are usually available within range of commercial cell phone towers. Higher speed wireless LANs are inexpensive but have very limited range.
- **Security Standards**: When working mobile, one is dependent on public networks, requiring careful use of Virtual Private Network (VPN).
- **Power consumption**: When a power outlet or portable generator is not available, mobile computers must rely entirely on battery power.
- **Transmission interferences**: Weather, terrain, and range from the nearest signal point can all interfere with signal reception. Reception in tunnels, rural areas is often poor.
- **Potential health hazards**: People who use mobile devices while driving are often distracted from driving are thus assumed more likely to be involved in traffic accidents. Cell phones may interfere with sensitive medical devices. There are allegations that cell phone signals may cause health problems.
- **Human interface with device**: Screens and keyboards tend to be small, which may make them hard to use.

8.5 Green Computing

Green Computing or Green IT refers to the study and practice of environmentally sustainable computing or IT. In other words, it is the study and practice of establishing/ using computers and IT resources in a more efficient and environmentally friendly and responsible way. Computers consume a lot of natural resources, from the raw materials needed to manufacture them, the power used to run them, and the problems of disposing them at the end of their life cycle. The objective of Green computing is to reduce the use of hazardous materials, maximize energy efficiency during the product's lifetime, and promote the recyclability or biodegradability of defunct products and factory waste.

Green Computing Best Practices

Government regulation is only part of an overall green computing philosophy. The work habits of computer users and businesses can be modified to minimize adverse impact on the global environment. Some of such steps for Green IT include the following:

- Develop a sustainable Green Computing plan
  Encourage the IT community for using the best practices and encourage them to consider green computing practices and guidelines.
- Recycle
  Dispose e-waste according to central, state and local regulations.
- Make environmentally sound purchase decisions
  Purchase of computers, notebooks and monitors based on environmental attributes;
- Reduce Paper Consumption
  Reduce paper consumption by use of e-mail and electronic archiving.
- Conserve Energy
  Use Liquid Crystal Display (LCD) monitors rather than Cathode Ray Tube (CRT).

8.6 Bring Your Own Device (BYOD)

BYOD refers to business policy that allows employees to use their preferred computing devices, like smart phones and laptops for business purposes. It means employees are welcome to use personal devices to connect to the corporate network to access information and application. The BYOD policy has rendered the workspaces flexible, empowering employees to be mobile and giving them the right to work beyond their required hours. Though it has led to an increase in employees' satisfaction but also reduced IT desktop costs for organizations as employees are willing to buy, maintain and update devices in return for a one-time investment cost to be paid by the organization.

Advantages of BYOD

- **Happy Employees**: Employees love to use their own devices when at work. This also reduces the number of devices an employee has to carry.
- **Lower IT budgets**: Could involve financial savings to the organization since employees would be using the devices they already possess.
- **IT reduces support requirement**: IT department does not have to provide end user support and maintenance, resulting in cost savings.
- **Increased employee efficiency**: The efficiency of employees is more when the employee works on his/her own device. In an organization provided devices, employees have to learn and there is a learning curve involved in it.

Emerging BYOD Threats

As outlined in the Gartner survey, a BYOD program that allows access to corporate network, emails, client data etc. is one of the top security concerns for enterprises. Overall, these risks can be classified into four areas as outlined below:

- **Network Risks**: When company-owned devices are used by all employees within an organization, the organization's IT team has complete visibility of the devices connected to the network. This helps to analyze traffic and data exchanged over the Internet. As BYOD permits employees to carry their own devices, the IT team is unaware about the number of devices being connected to the network.

For example, if a virus hits the network and all the devices connected to the network need be scanned, it is probable that some of the devices would miss out on this routine scan operation.

- **Device Risks**: A lost or stolen device can result in an enormous financial and reputational embarrassment to an organization as the device may hold sensitive corporate information. Data lost from stolen or lost devices ranks as the top security threats as per the rankings released by Cloud Security Alliance.
- **Application Risks**: A related report revealed that a majority of employees' phones and smart devices that were connected to the corporate network weren't protected by security software. Organizations are not clear in deciding that 'who is responsible for device security – the organization or the user'.
- **Implementation Risks**: The effective implementation of the BYOD program should not only cover the technical issues mentioned above but also mandate the development of a robust implementation policy.

8.7 Web 3.0

The term Web 3.0, also known as the **Semantic Web**, describes sites wherein the computers will be generating raw data on their own without direct user interaction. Computer scientists and Internet experts believe that this new paradigm in web interaction will further make people's online lives easier and more intuitive as smarter applications such as better search functions give users exactly what they are looking for, since it will be akin to an artificial intelligence which understands context rather than simply comparing keywords.

Example: If someone is preparing for a vacation and needs to search for cheap flights and accommodations as well as meals, they must look through a lot of information on the web comparing different selections and the search might take hours. But Web 3.0 search engines or assistants will be able to pull all of this information and present it to user in a very intelligent way, even making highly accurate and favorable suggestions based on the user's profile

Components of Web 3.0

Semantic Web: This provides the web user a common framework that could be used to share and reuse the data across various applications, and enterprises. This allows the data and information to be readily intercepted by machines, so that the machines are able to take contextual decision on their own by finding, combining and acting upon relevant information.

Web Services: It is a software system that supports computer-to-computer interaction over the Internet. For example - the popular photo-sharing website Flickr provides a web service that could be utilized by the developers to interact with Flickr in order to search for images.

8.8 Internet of Things (IoT)

Definition: The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. For example:

(i) **Washing machines** with Wi-Fi networking capabilities can connect themselves to home Wi-Fi. Once these machines are so connected, they can be controlled through machine manufacturer mobile APP from anywhere in the world.

(ii) Advertisement for **water purifier** informs that, the water purifier is Wi-Fi enabled. When the purifying agents deplete in the machine, it informs the service agents of the company.

(iii) As a research study, individuals have got themselves implanted with **electronic chips in** their **bodies**. This chip allows him / her to connect to home / office Wi-Fi. Once connected person can enter home / office and perform designated function. This chip becomes individual's authentication token.

(iv) **Wearable**: Just like smart homes, wearable remain another important potential IoT application like Apple smart watch.

(v) **Smart City**: Smart cities, like its name suggests, is a big innovation and spans a wide variety of use cases, from water distribution and traffic management to waste management and environmental monitoring.

(vi) **Smart Grids**: Smart grids are another area of IoT technology that stands out. A smart grid basically promises to extract information on the behaviors of consumers and electricity suppliers in an automated fashion to improve the efficiency, economics, and reliability of electricity distribution.

(vii) **Industrial Internet of things**: One way to think of the Industrial Internet is by looking at connected machines and devices in industries such as power generation, oil, gas, etc. for monitoring and improving control efficiency. With an IoT enabled system, factory equipment that contains embedded sensors communicate data about different parameters, such as pressure, temperature, of the machine. The IoT system can also process workflow and change equipment settings to optimize performance.

(viii) **Connected Car**: Connected car technology is a vast and network of multiple sensors, antennas, embedded software, and technologies that assist in communication to navigate in our complex world.

(ix) **Connected Health (Digital Health/Telemedicine)**: IoT has various applications in healthcare, which are from remote monitoring equipment to advance and smart sensors to equipment integration. It has the potential to improve how physicians deliver care and keep patients safe and healthy.

(x) **Smart Retail**: Retailers have started adopting IoT solutions and using IoT embedded systems across several applications that improve store operations, increasing purchases, reducing theft, enabling inventory management, and enhancing the consumer's shopping experience.

(xi) **Smart Supply Chain**: Supply chains have already been getting smarter for a couple of years. Offering solutions to problems like tracking of goods while they are on the road or in transit or helping suppliers exchange inventory information are some of the popular offerings.

Risks

- Risk to Product manufacturer
  - Manufacturers may be out of business in few years if IOT becomes a necessary product feature.
  - Data storage and analytics: The manufacturers will to ensure the huge data generated from IOT devices is kept secured.
- Risk to user of these products
  - Security: This is the greatest risk due to IOT. As home devices / office equipment's are connected to network they shall be hit by all network related risks, including hacking, virus attacks, stealing confidential data etc.
  - Privacy, autonomy and control: There is a huge risk that individuals may lose control over their personal life. Their personal life can be hacked and made public. The other major concern is who has the ownership of this personal data.

    For example: A person daily eats a burger at 12.00 in night and takes bottle of chilled cold drink with it. He uses his mobile to operate the griller and refrigerator. The griller and refrigerator are both sold by say XYZ ltd. This data is available on XYZ database.

- Intentional obsolescence of devices: This may happen due to -
  - Companies which want to bring a new product may force users to dump the old products. This they can do by disabling the operating software of old product.
  - A manufacturer is bought out by another manufacturer. The buyer does not support old products sold.
- Technology Risk
  - Platform fragmentation and lack of technical standards are situations where the variety of IoT devices, in terms of both hardware variations and differences in the software running on them, makes the task of developing applications tough.
- Environmental Risk due to Technology
  - These studies are being done to see the impact on house air quality, due to use of heavy earth metals in devices.

8.9 Artificial Intelligence (AI)

Definition: Intelligence, as defined in Chambers dictionary; "The ability to use memory, knowledge, experience, understanding, reasoning, imagination and judgement to solve problems and adapt to new situations". The ability described above when exhibited by machines is called as Artificial intelligence (AI). It is intelligence exhibited by machines.

For example:

- This technology is being used in autonomous vehicles, the google car.
- Apple online assistant Siri is supposed to use it.

Applications

- Autonomous vehicles (such as drones and self-driving cars);
- Medical diagnosis, predicting the chances of an individual getting ill by a disease;
- Proving mathematical theorems;
- Search engines (such as Google search);
- Online assistants (such as Siri);

Risks

1. AI relies heavily of data it gets. Incorrect data can lead to incorrect conclusions.
2. AI (robots) carries a security threats. Countries are discussing to have a KILL button in all AI capable machines. This is important otherwise someday machine may start controlling humans
3. AI in long term may kill human skills of thinking the unthinkable. All data shall be processed in a structured manner, where machines shall provide solution based on their learning over a period of time.

Controls

The set of controls in AI will be extremely complex because of the nature of processing of information and must be dealt with based on the nature of the AI tool and the purpose, etc.

8.10 Machine Learning

Definition: Machine Learning is a type of Artificial Intelligence (AI) that provides computers with the ability to learn without being explicitly programmed. Machine learning focuses on the development of computer programs that can change when exposed to new data. The process of machine learning is similar to that of data mining.

For example:

- Machine learning has been used for image, video, and text recognition, as well as serving as the power behind recommendation engines.

Applications

Virtually all applications that were in AI are there for Machine learning also, so that some value is added.

Risk

Machine learning being an application based on AI, the nature of risk to it remain similar to those posed by AI systems.

9. Case Studies

I. Category: Flipkart started as e-commerce and has now moved to m-commerce space.

Back in 2007, when Flipkart was launched, Indian e-commerce industry was taking its beginner steps. The company is registered in Singapore, but their headquarters are in the city of Bangalore, India. The promoters are Binny Bansal and Sachin Bansal. They left their jobs in Amazon to start their own business. One can easily call that a risky move. Flipkart began selling books to begin with. It soon expanded and began offering a wide variety of goods. Innovating right from the start, Flipkart has been home to few of the striking features of Indian e-commerce. Flipkart success in the first few years of its existence. Flipkart raised funds through venture capital funding. As the company grew in stature, more funding arrived.

Flipkart addressed to major issues in online purchasing in India. Indians love to pay after checking the products so Flipkart was the first to implement the popular 'Cash On Delivery' facility, which every online shopping website in India offers as an option today. Second major issue Flipkart addressed was timely delivery. It was more of a cultural revolution to ensure the whole supply chain was revamped and sensitized to issue of timely delivery.

II. Category: JUGNOO started as a m-commerce company.

Jugnoo is an auto-rickshaw aggregator, focused on doubling the driver's efficiency and earnings, and providing affordable transportation to the masses on a tap. There are around 5 million auto-rickshaws in our country, whereas the utilization is only 30%. It started operation in October 2014 from Chandigarh.

Despite being one of the most popular and economical modes of public transportation in India, auto-rickshaws have remained highly underutilized due to inefficiencies prevalent in the conventional hailing procedure such as availability and fares. Jugnoo was started with a vision to overcome these roadblocks by bringing structure into this space, aggregating auto-rickshaws via technology, thereby, enabling optimum utilization of resources.

III. Category: OYO started as a m-commerce company.

OYO MEANS "ON YOUR OWN". OYO Rooms was nothing but an idea to create India's largest chain of efficient, young, standardized rooms with an intention to build the coolest chain of no add-on rooms which might not have Spa, Gym etc. like the star hotels but will live upto the basic standards & high expectations for prices like never before. They have few basic amenities including, clean rooms, clean linen, AC, clean bathroom, free wifi, free breakfast. OYO rooms does nothing out of the box but provides travellers the coolest yet cheapest efficient, young, standardized rooms with no add-ons attached to it!