

# Auditing Course Material

Part 40 of 61 (Chapters 3901-4000)

## 3. Applications Software

Application software can be divided into two types; Proprietary software and off-the-shelf software, based on their ownership. Let us discuss each of these one by one.

### Proprietary Software

Proprietary software is custom-designed for a specific application and is owned by the company, organization, or individual utilizing it. It is unique and tailored to address specific requirements, often providing a competitive advantage by offering specialized services or solutions not readily available in the market. The company, organization, or individual using proprietary software typically owns the rights to the software and benefits from its unique features.

### Off-the-Shelf Software

Off-the-shelf software or COTS is mass-produced by software vendors to meet common needs across various businesses, organizations, or individuals. It is pre-built and available for purchase or licensing, offering a standardized solution to common problems or requirements. Off-the-shelf software is readily available in the market and can be acquired without the need for extensive customization, making it accessible to a broad user base.

1. Which one of the following is a disadvantage of using proprietary software rather than open source software?

- Proprietary software can only be accessed with a password
- Proprietary software can only be used on proprietary systems
- Proprietary software is usually more expensive
- Proprietary software can only be used with an Internet connection

Check

Question: 1 of 2 questions

## 4. Programming Languages

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A programming language is a formalized set of rules and symbols used to instruct a computer. It serves as a means for humans to communicate with computers by providing a structured way to express algorithms and computations. Programming languages consist of a set of *syntax rules* that define how programs written in the language should be structured and formatted.

Programmers use programming languages to write software, which can include applications, scripts, or systems that enable computers to perform specific tasks. Each programming language has its unique syntax, semantics, and features, catering to different programming paradigms and application domains.

Popular programming languages include Python, Java, C++, JavaScript, Ruby, and many more. These languages vary in their strengths, suitability for specific tasks, and ease of use, allowing programmers to choose the one that best fits their needs and preferences.

### Coding

Coding, also known as *programming*, is the process of designing and building executable computer programs to accomplish a specific task or solve a particular problem. It involves writing a set of instructions, known as code, that a computer can understand and execute.

The process of writing computer instructions in a programming language is known as –

- Folder
- Processing
- File
- Coding

Check

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## 4. Programming Languages

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Programming languages can be classified into different levels based on their proximity to machine code which represents the instructions that a computer's CPU can directly execute. There are three main levels of programming languages: low-level languages, high-level languages, and assembly languages. Let us discuss each level one by one.

- > **Machine languages (low-level languages)**
- > **Assembly languages (symbolic languages)**
- > **Procedure-oriented languages (high-level languages)**

1. What is the difference between mnemonic codes and machine codes?

- There is no difference
- Machine codes are in binary; mnemonic codes are in shorthand English.
- Machine codes are in shorthand English; mnemonic codes are in binary.
- Machine codes are in shorthand English; mnemonic codes are a high-level language

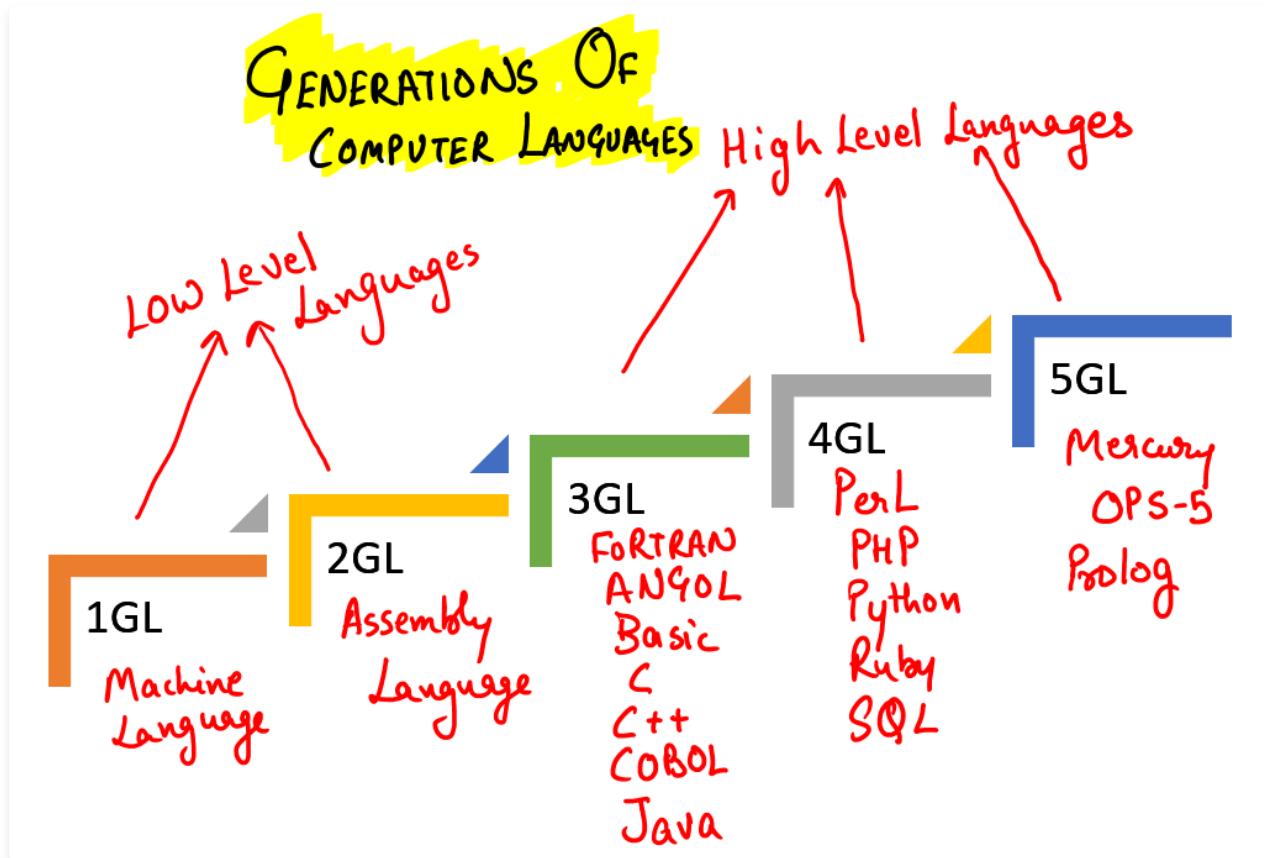
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Question: 1 of 2 questions

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## 4. Programming Languages

Computer languages can be categorized into different generations based on their development and evolution over time. There are typically five generations of programming languages.



- > **1. First-generation languages (1GL)**
- > **2. Second-generation languages (2GL)**
- > **3. Third-generation languages (3GL)**
- > **4. Fourth-generation languages (4GL)**
- > **5. Fifth-generation languages (5GL)**

The progression through generations reflects a shift from low-level, hardware-specific languages to high-level, more abstract languages that prioritize human readability and ease of programming. Each generation has contributed to the evolution of programming, enabling developers to express ideas more intuitively and efficiently.

1. Which of the following is most suitable for being designated as Fourth Generation Language (4GL)?

- ALGOL
- Java
- C
- SQL

Check

Question: 1 of 2 questions

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## 5. Embedded software

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Embedded software refers to computer programs specifically crafted to control machines or devices not traditionally viewed as computers, constituting what is known as *embedded systems*. These systems are often specialized for the particular hardware they operate on, adhering to stringent time and memory constraints. The term 'embedded software' is occasionally used interchangeably with *firmware*.

Bootstrap is often implemented in firmware. The firmware, containing the bootloader, plays a role during the initial stages of system booting by facilitating the loading of the operating system. Bootstrap and firmware work together during the initialization of a computer system.

Manufacturers integrate embedded software into a diverse array of electronic devices, including cars, telephones, modems, robots, appliances, toys, security systems, pacemakers, televisions, set-top boxes, and digital watches. This software plays a pivotal role in governing the functionality and behavior of these devices, contributing to their seamless operation within various contexts.

1. The computer uses a bootstrap. Which of the following shows the part of a computer of which the bootstrap is an example?

- application software
- firmware
- hard disk drive
- IP address

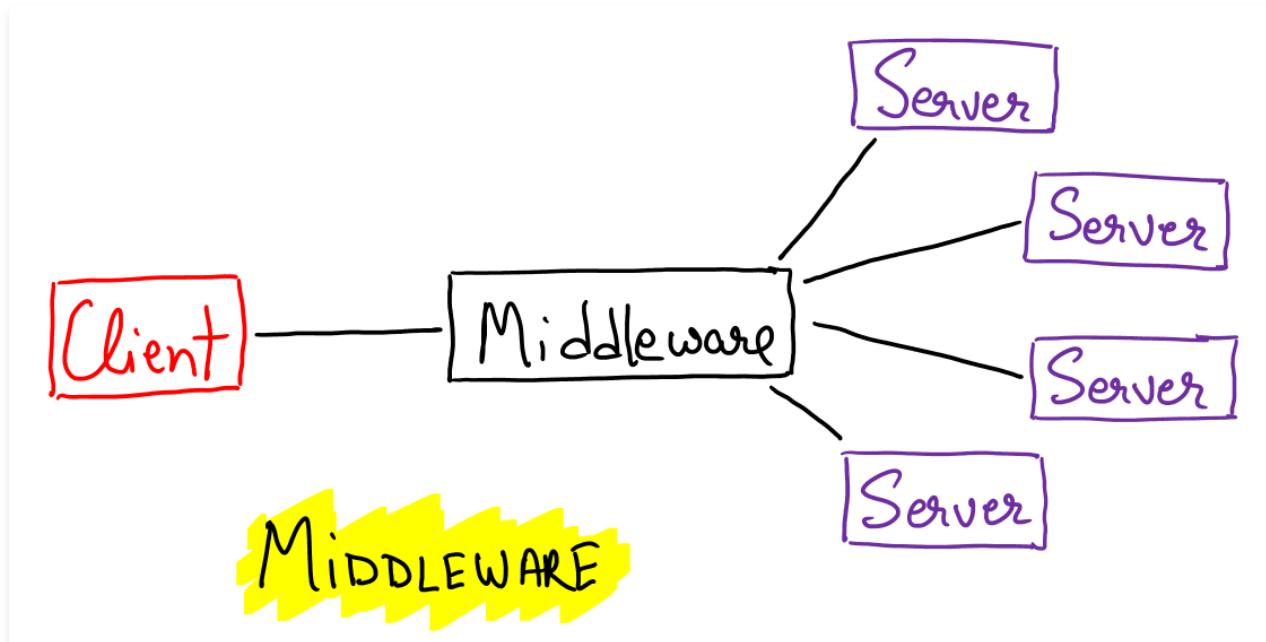
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Question: 1 of 2 questions

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## 6. Middleware and SOA

Middleware serves as software facilitating communication and data exchange between different applications. This integration of disparate applications, known as *Enterprise Application Integration (EAI)*, is particularly useful when companies acquire diverse information systems that need to share data.



Middleware can also act as an interface between the Internet and corporate systems, managing data flow between them. For instance, it can transfer customer requests from a website to a mainframe database and return the results to the customer online.

This approach has evolved into *Service-Oriented Architecture (SOA)*, where discrete software modules provide specific functions as services to other applications, promoting interoperability. Each module in SOA is designed to exchange information seamlessly without manual intervention or changes to the underlying program.

Additionally, an *Application Programming Interface (API)* serves as a set of instructions enabling one software program to access and utilize the services of another program. APIs focus on software-to-software interaction rather than user interfaces, enhancing interoperability and functionality in the software ecosystem.

## 7. Open Systems

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An open system is a type of computing environment that is known for being flexible, interoperable, and accessible. It allows different technologies to work together, can be customized according to user needs, and often has its specifications and source code available to the public.

This openness encourages collaboration, transparency, and community involvement. Open systems follow widely accepted standards, making them compatible and less prone to vendor lock-in. They often have active communities of developers, leading to continuous improvement and cost-effective solutions.

### **Proprietary Software**

Proprietary software is owned by a specific entity, often requiring users to purchase licenses. The source code is confidential, limiting user modifications. Support is typically provided by the company, and customization options may be restricted. Examples include Microsoft Office and Adobe Photoshop.

### **Open Source Software**

Open-source software is collaboratively developed, allowing users to view, modify, and distribute it freely. The source code is openly accessible, fostering transparency and community involvement. Users have high customization and control capabilities, with support often community-driven. Examples include Linux, Apache, Moodle and Mozilla Firefox.

The choice between proprietary and open source depends on factors like cost, flexibility, and community collaboration preferences.

### **Comparing Proprietary software and Open Source software**

Let us compare proprietary software and open-source software.

#### **> 1. Proprietary Software**

#### **> 2. Open-Source Software**

Both types of software have their advantages and limitations. Proprietary software often excels in providing specialized features and dedicated support but at a higher cost, while open-source software emphasizes community collaboration, cost-effectiveness, and flexibility but may require more user involvement for support and customization. The choice between the two depends on specific user needs, resources, and preferences.

Features	Proprietary software	Open-source software
Ownership & Control	Owned and controlled by a single entity	Developed collaboratively, open access to the code
Cost & licensing	Involves licensing fees or subscription models	Typically free, allows modification and redistribution
Features & Support	Tailored features, dedicated customer support	Diverse features, community-driven innovation
Security & Reliability	Controlled by the company, slower fixes	Community-reviewed, quicker response to vulnerabilities
Development model	Closed, limited access to source code	Open, encourages collaborative coding and sharing

## 8. Software Licenses

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A **software license** is a legal agreement between the creator or distributor of software and the end-user. It outlines the terms and conditions under which the software can be used, giving the user specific rights and imposing certain restrictions. The license defines how the software can be installed, accessed, and distributed, and it often includes details about support, warranties, and potential liabilities.

**Software copyright** grants legal protection to the original expression of ideas in software code, preventing unauthorized copying, distribution, or use. Copyright covers the specific code, structure, and organization of a software program, rather than the functional aspects. It does not protect ideas, algorithms, or methods.

### Types of Software licenses

There are different types of software licenses. Let us discuss a few types.

- > **1. Proprietary License**
- > **2. GNU General Public License (GPL)**
- > **3. End User License Agreement (EULA)**

### Software piracy

**Software piracy** involves the unauthorized copying, distribution, or use of software without the proper licenses or permissions from the copyright holder. It is a violation of intellectual property rights and is illegal in many jurisdictions. Software piracy can encompass activities such as distributing cracked or keygen software, using software without a valid license, or making unauthorized copies of software for distribution.

Illegal copying and distribution of software is known as:

Hacking

Software piracy

Software literacy

Cracking

Check

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## 9. Shareware and Freeware

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Software can also be classified based on their distribution among users.

**Shareware** is a type of software that is distributed free on a trial basis, with users expected to pay for it later if they choose to continue using it. It allows users to try the software before purchasing, often with limited features in the trial version.

**Freeware** is distributed at no monetary cost to users. There is no standard definition, and each publisher defines its usage rules. Users can use the software without payment, but rights and restrictions vary.

Software that you can download for free, but have to pay to continue its use after a trial period is called:

public domain software

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freeware

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open-source software

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shareware

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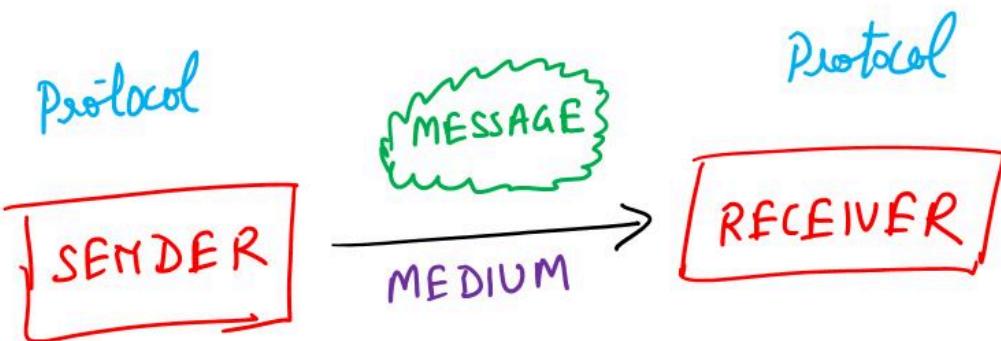
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# 1. Network and Data Communication

A computer network is a group of computers that are interconnected and able to communicate with each other. The purpose of a computer network is to facilitate the sharing of resources such as files, printers, and internet connections, as well as to enable communication between the connected devices.

*Data communication* refers to the process of transferring information from one computer to another. This can be accomplished through a variety of means, including wired and wireless connections. Data communication involves the transmission of a message from a sender to a receiver over a communication medium, such as a network cable or wireless radio waves.



## > Entities in Data Communication

1. Which of the following are the main benefits of networking computers and devices rather than using a number of separate computers?

- A. Devices, such as printers, can be shared, thus reducing costs.
- B. Licences to run software on networks are often far cheaper than buying licenses for an equivalent number of stand-alone computers.
- C. Users cannot share files and data.
- D. Access to reliable data that comes from a central source, such as a file server.

A and C only

B, C and D only

A, B, C and D

A, B and D only

Check

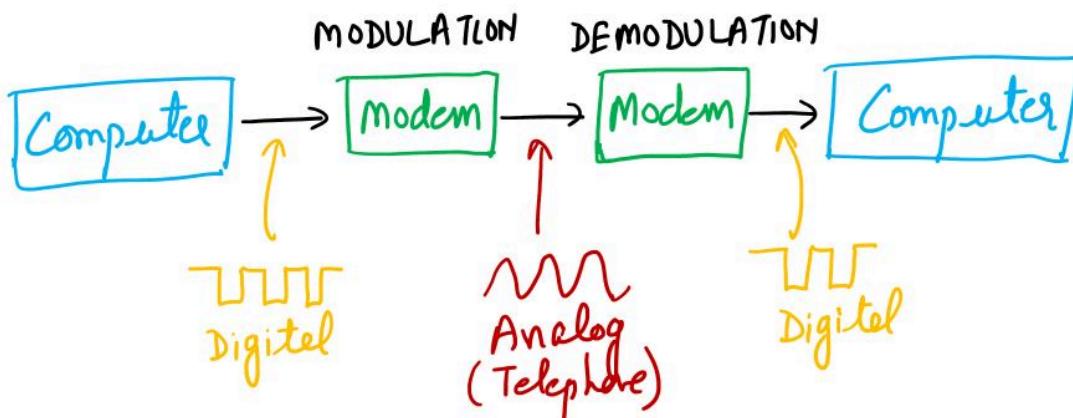
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## 2. Computer Communication

Computer Communication involves the transmission of a message from a sender to a receiver. The physical line or medium over which communication is established is known as the *communications channel*.

### Mode of Communication

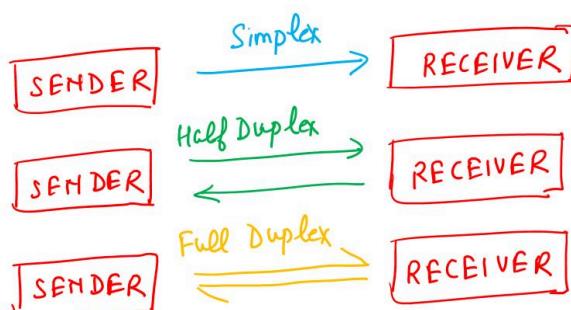
The communication can be carried out using either an analog or a digital signal. *Analog signals* are represented by continuous waveforms and have been traditionally used for voice communication. An example of analog devices are telephones, speakers, and earphones. On the other hand, *digital signals* are represented by binary waveforms consisting of discrete states, 0 and 1. Data in computers are encoded digitally, where 0 corresponds to a low voltage and 1 corresponds to a high voltage.



Computers use digital signals and require a modem to convert these digital signals into analog signals that can be sent over telephone lines, cable lines, or wireless media that use analog signals. *Modem* stands for modulator-demodulator. Without modems, computers could not communicate with one another using analog networks (which include the telephone system and cable networks). This is achieved by altering either the amplitude of the wave formation or the frequency of the wave, known as *amplitude modulation* or *frequency modulation*.

### Types of Communication

Communication modes—simplex, half-duplex, and full-duplex—describe how information flows between sender and receiver(s).



- > Simplex Communication
- > Half-Duplex Communication
- > Full-Duplex Communication

The Internet has become a popular platform for voice transmission and corporate networking. *Voice over IP (VoIP) technology* delivers voice information in digital form using packet switching, avoiding tolls charged by local and long-distance telephone networks. Calls that would ordinarily be transmitted over public telephone networks travel over the corporate network based on the Internet Protocol, or the public internet.

#### **ISDN**

For a long time, the telephone system has been the primary communication infrastructure. It was designed to transmit analog voice data and, therefore, inadequate for other digital needs of data transmission, such as fax or video. The *Integrated Services Digital Network (ISDN)* aims to integrate voice and non-voice services via a fully digital network, which would replace the telephone system step by step. ISDN is a point-to-point Wide Area Network that enables a broad range of services over a single network, including voice, video, and data.

1. Which of the following communication systems would best enable a meeting to take place between people working in different locations?

- VoIP
- Email
- Voicemail
- Text messaging

Check

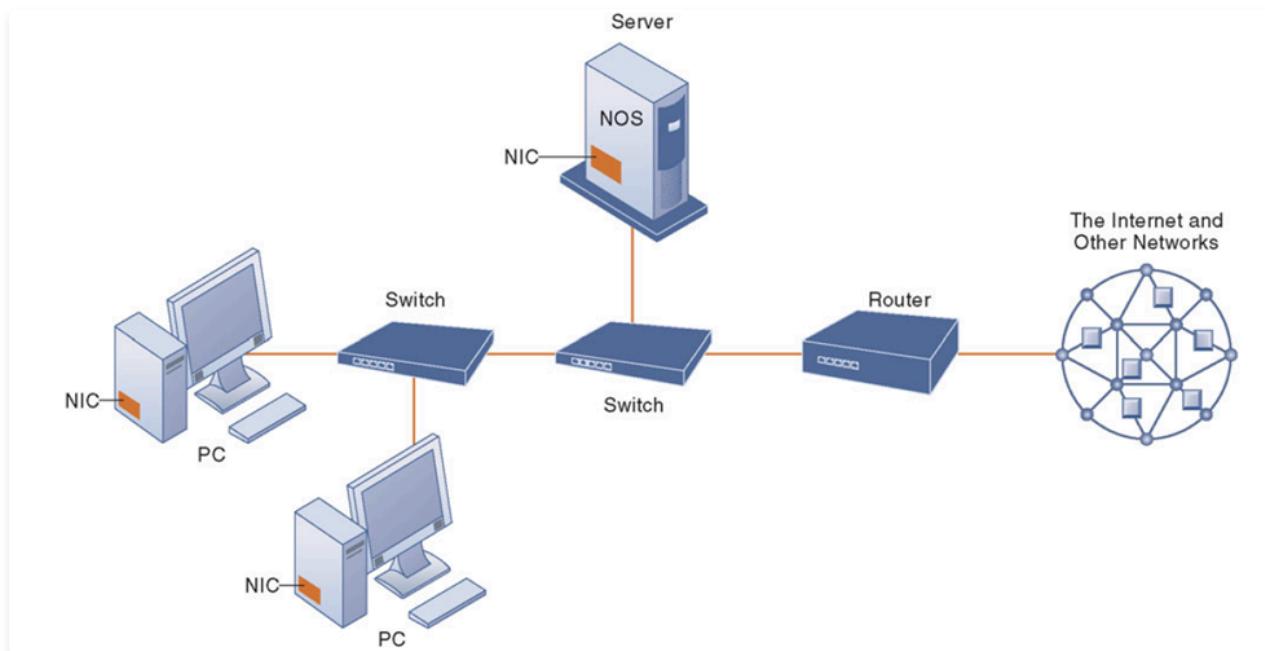
Question: 1 of 5 questions

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### 3. Components of Network

#### Components of Network

Now let us discuss the various components of computer network one-by-one.



- > **1. Network Interface Card (NIC)**
- > **2. Medium**
- > **3. Hub**
- > **4. Switch**
- > **5. Servers**
- > **6. Routers**
- > **7. Repeater**
- > **8. Bridge**
- > **9. Brouter**
- > **10. Gateway**
- > **11. Network Operating System (NOS)**

#### Wireless Access Points (WAP)

A Wireless Access Point (WAP) is a networking device that allows wireless devices to connect to a wired network using Wi-Fi technology. It serves as a bridge between wired and wireless networks, enabling Wi-Fi clients such as laptops, smartphones, tablets, and other devices to connect to a local area network (LAN) without the need for physical cables.

#### Plug-and-Play

Plug-and-Play, sometimes, abbreviated *PnP*, is a phrase used to describe devices that work with a computer system as soon as they are connected. The user does not have to manually install drivers for the device or even tell the computer that a new device has been added. Instead, the computer automatically recognizes the device, loads new drivers for the hardware if needed, and begins to work with the newly connected device. For example, if you connect a Plug-n-Play mouse to the USB port on your computer, it will begin to work within a few seconds of being plugged in.

A *non-plug-n-play* device would require you to go through several steps of installing drivers and setting up the device before it would work.

1. In light of the given statements, choose the correct answer from the options given below

Statement I: WAPs are connected into the wired network at fixed locations.

Statement II: The WAP receives and transmits data between the two wired LANs.

- Both Statement I and Statement II are true
- Both Statement I and Statement II are false
- Statement I is true but Statement II is false
- Statement I is false but Statement II is true

Check

Question: 1 of 4 questions

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## 3. Components of Network

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A MAC address, which stands for *Media Access Control address*, is a unique identifier assigned to network interfaces for communications on a physical network. It is also known as a hardware address or physical address.

MAC addresses are typically assigned to network interface cards (NICs) by the manufacturer. MAC address is 48 bits (6 bytes) long, typically represented in hexadecimal notation. The first half of the address often indicates the manufacturer of the network interface card, while the second half is a unique identifier for the specific device. For example, a MAC address might look like "00:1A:2B:3C:4D:5E."

Every device that connects to a network, such as a computer, smartphone, or network-enabled printer, has a unique MAC address. This address is used at the data link layer of the OSI model to ensure that data is delivered to the correct destination on a local network. Unlike IP addresses, which can change as devices move between networks, a MAC address is generally fixed for the lifetime of the hardware.

In networking, the MAC address is used in protocols like Ethernet to identify devices on the same network segment and facilitate the communication of data between them. When data is sent from one device to another on a local network, the MAC address is used to specify the source and destination of the data at the link layer.

1. The hardware address of a computer network device consists of 48 bits. Which of the following is a valid address in hexadecimal numbers?

- 00E0071944A0
- 0A23B5
- 1E07FG124372
- 398A7E9412110408

Check

Question: 1 of 4 questions

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## 4. Medium of Communication

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*Computer communication* refers to the exchange of data and information between computers or computer systems. This is important for the functioning of networks, the internet, and various applications. Communicating data from one location to another requires a *communication channel*.

Computer communication takes place through two types of channels: *Wired channel* (twisted-pair wire, cable, or fiber-optic cable) and *wireless channel* (microwave, satellite, radio waves, or infrared waves).

Let us discuss these channels one by one.

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## 4. Medium of Communication

A wired communication channel refers to a physical medium or pathway used for the transmission of data and information between devices. It is also known as *cable media* and *guided media*. Wired communication involves the use of tangible, physical connections. Wired communication channels are known for their reliability, stability, and security.

Let us discuss the different types of cables used.

### > 1. Twisted pair cables

### > 2. Coaxial Cables

### > 3. Fiber Optic Cables

Let us discuss the advantages and disadvantages of each type of cable.

Channel	Advantages	Disadvantages
Twisted pair wire	<ul style="list-style-type: none"><li>Inexpensive</li><li>Widely available</li><li>Easy to work with</li></ul>	<ul style="list-style-type: none"><li>Slow (low bandwidth)</li><li>Subject to interference</li><li>Easily tapped (low security)</li></ul>
Coaxial cable	<ul style="list-style-type: none"><li>Higher bandwidth than twisted pair</li><li>less susceptible to electromagnetic interference</li></ul>	<ul style="list-style-type: none"><li>Relatively expensive and inflexible</li><li>Easily tapped (low to medium security)</li><li>somewhat difficult to work with</li></ul>
Fibre optic cable	<ul style="list-style-type: none"><li>Very high bandwidth</li><li>Relatively inexpensive</li><li>Difficult to tap (good security)</li></ul>	Difficult to work with (difficult to splice)

1. With respect to data communication, which of the following statements is true about fibre optic cable?

- Fibre optic cable carries data in pulses of light and is prone to interference
- Fibre optic cables carries data as electronic signals and is not prone to interference
- Fibre optic cable carries data as electronic signals and is prone to interference
- Fibre optic cable carries data in pulses of light and is not prone to interference

Check

Question: 1 of 2 questions

## 4. Medium of Communication

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Wireless communication refers to the transmission of information between devices without the need for physical cables or wires. Wireless communication is also known as *broadcast* or *unguided medium*. In wireless communication, electromagnetic signals, such as radio waves or microwaves, are used to transmit data between devices. This medium is widely used in various technologies, enabling flexible and convenient connectivity.

Wireless communication provides the advantage of mobility and eliminates the need for physical connections, offering flexibility in various applications ranging from personal devices to large-scale networks.

- > **Types of Electromagnetic Waves**
- > **Bluetooth**
- > **Wi-Fi**
- > **WiMAX (Worldwide Interoperability for Microwave Access)**
- > **Wi-Fi Hotspots**
- > **Near Field Communication (NFC)**

1. In the light of the given statements, choose the correct answer from the options given below:

Statement I: Wi-Fi has a shorter range than Bluetooth.

Statement II: Wi-Fi can transmit data at a faster rate than Bluetooth.

- Both Statement I and Statement II are true
- Both Statement I and Statement II are false
- Statement I is true but Statement II is false
- Statement I is false but Statement II is true

Check

Question: 1 of 4 questions

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## 4. Medium of Communication

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The total amount of digital information that can be transmitted through any telecommunications medium is measured in *bits per second (bps)*. One signal change, or *cycle*, is required to transmit one or several bits; therefore, the transmission capacity of each type of telecommunications medium is a function of its frequency. The number of cycles per second that can be sent through that medium is measured in hertz—one hertz is equal to one cycle of the medium.

The range of frequencies that can be accommodated on a particular telecommunications channel is called its *bandwidth*. The bandwidth is the difference between the highest and lowest frequencies that can be accommodated on a single channel. The greater the range of frequencies, the greater the bandwidth and the greater the channel's transmission capacity.

What is the meaning of Bandwidth in Network?

- Transmission capacity of a communication channels
- Connected Computers in the Network
- Class of IP used in Network
- None of Above

Check

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## 4. Medium of Communication

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Broadband denotes high-speed internet connectivity that surpasses the speeds achievable with traditional dial-up services. Its defining feature is a wide bandwidth, enabling the simultaneous transmission of multiple signals and data streams through a singular communication medium. This capability ensures swift and efficient internet access, particularly beneficial for data-intensive activities like streaming video and online gaming.

Various technologies facilitate the delivery of broadband internet. Digital Subscriber Line (DSL), cable modems, fiber optics, satellite, and wireless connections are among the diverse methods employed to provide users with high-speed internet access. DSL utilizes existing telephone lines, cable modems operate over cable television infrastructure, and fiber optics transmit data using light pulses through optical fibers. Additionally, satellite broadband extends internet access to remote areas, while wireless technologies like Wi-Fi and mobile networks offer flexibility and convenience in connectivity.

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## 5. Types of Network

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Networks can vary in size and scope, ranging from local networks within a single building or campus (Local Area Network or LAN) to global networks connecting devices across vast distances (Wide Area Network or WAN).

### Types of Computer Networks

Let us discuss the different types of computer networks.

- > **1. Local Area Network (LAN)**
- > **2. Campus Area Network (CAN)**
- > **3. Metropolitan Area Network (MAN)**
- > **4. Wide Area Network (WAN)**
- > **5. Wireless Local Area Network (WLAN)**
- > **6. Personal Area Network (PAN)**
- > **7. Enterprise Private Network (EPN)**
- > **8. Storage Area Network (SAN)**
- > **9. Virtual Private Network (VPN)**

Type	Geographical area
Local Area Network (LAN)	Up to 500 m; an office or floor of a building
Campus Area Network (CAN)	Up to 1000 m; a college campus or corporate facility
Metropolitan Area Network (MAN)	A city or metropolitan area
Wide Area Network (WAN)	A transcontinental or global area

### Firewalls

Firewalls prevent unauthorized users from accessing private networks. A firewall is a combination of hardware and software that controls the flow of incoming and outgoing network traffic. It is generally placed between the organization's private internal networks and distrusted external networks, such as the Internet, although firewalls can also be used to protect one part of a company's network from the rest of the network. The firewall acts like a gatekeeper who examines each user's credentials before access is granted to a network.

**Packet filtering** is a network security mechanism that involves inspecting and controlling the flow of data packets based on criteria such as source and destination IP addresses, source and destination port numbers, and the protocol used.

Controlling access to a network by analyzing the incoming and outgoing packets is called *packet filtering* or *packet filtering firewall*. Packet filtering is a network security mechanism that involves inspecting and controlling the flow of data packets based on criteria such as source and destination IP addresses, source and destination port numbers, and the protocol used.

1. Which of the following statements are correct?

- A. A WLAN is a wide area network
- B. A hub sends an incoming data packet to the correct device on a network
- C. An IP address is assigned to a device at the manufacturing stage
- D. A network Interface card is needed to allow a device to connect to a network
- E. Routers inspect data packets received over the internet

A and B only

B and E only

D and E only

B, C and D only

Check

Question: 1 of 3 questions

## 5. Types of Network

Network congestion occurs when a computer network experiences a level of traffic that exceeds its capacity, leading to a degradation in the performance and efficiency of data transmission. It is a common issue in both local area networks (LANs) and wide area networks (WANs) where multiple devices share network resources.

Network congestion occurs when there is a significant increase in the number of data packets being transmitted through the network. This increase can result from a surge in user activity, the addition of new devices, or the transfer of large amounts of data.

As congestion builds up, network devices may struggle to handle the incoming traffic, leading to packet loss and increased latency. Packets may be delayed or dropped, negatively impacting the overall performance of applications and communication.

Congestion can result in reduced throughput, meaning that the effective data transfer rate decreases. This can lead to slower file transfers, sluggish internet browsing, and decreased responsiveness in applications.

Network congestion occurs

in case of traffic overloading

when a system terminates

when connection between two nodes terminates

none of the mentioned

Check

## 6. Intranets and Extranets

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Intranets are simply internal company websites that are accessible only by employees. The term **Intranet** refers to the fact that it is an internal network, in contrast to the Internet, which is a public network linking organizations and other external networks. Intranets use the same technologies and techniques as the larger Internet, and they often are simply private access areas in a larger company website.

Similarly, **Extranets** are company websites that are accessible to authorized vendors and suppliers and are often used to coordinate the movement of supplies to the firm's production apparatus. An extranet is a network built using web technologies that link selected resources of the intranet of a company with its customers, suppliers, or other business partners.

Organizations, typically, use multiple computer systems across the firm. Distributed processing divides processing work among two or more computers. This process enables computers in different locations to communicate with one another via *telecommunications links*. A common type of distributed processing is client/server processing. A special type of client/server processing is peer-to-peer processing.

**Client/server computing** links two or more computers in an arrangement in which some machines, called *servers*, provide computing services for user PCs, called *clients*. Usually, an organization performs the bulk of its processing or application/data storage on suitably powerful servers, that can be accessed by less powerful client machines. The client requests applications, data, or processing from the server, which acts on these requests by 'serving' the desired commodity.

Client/server computing leads to the ideas of '*fat*' clients and '*thin*' clients. The fat clients have large storage and processing power and, therefore, can run local programs (such as Microsoft Office) if the network goes down. In contrast, thin clients may have no local storage and only limited processing power. Thus, they must depend on the network to run applications.

**Peer-to-peer (P2P) processing** is a type of client/server distributed processing where each computer acts as both a client and a server. Each computer can access (as assigned for security or integrity purposes) all files on all other computers.

**Value-added networks** are communication networks, supplied and managed by third-party companies, that facilitate electronic data interchange, web services, and transaction delivery by providing extra networking services. A *value-added network (VAN)* is a private network provider (sometimes called a turnkey communications line) that is hired by a company to facilitate *electronic data interchange (EDI)* or provide other network services. Before the arrival of the World Wide Web, some companies hired value-added networks to move data from their company to other companies. With the arrival of the World Wide Web, many companies found it more cost-efficient to move their data over the Internet instead of paying the minimum monthly fees.

1. Which of the following statements about computer networks are TRUE?

- A. An intranet is a public network.
  - B. The Internet is a group of interconnected networks.
  - C. An extranet is an internal network that can be accessed externally by authorized users
- A and B only
  - A and C only
  - B and C only
  - A, B and C

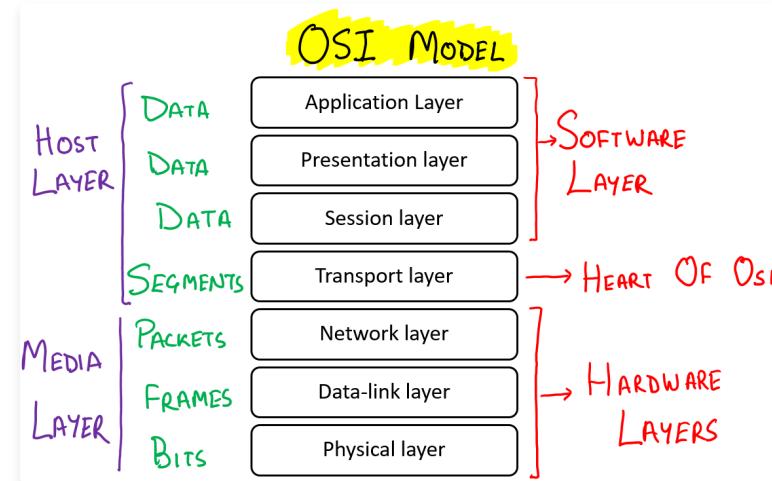
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Question: 1 of 4 questions

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## 7. OSI model

The Open System Interconnection (OSI) Reference Model was developed by the International Standards Organization (ISO). It is an attempt to build a framework of layers, in which various protocols in computer networking fit.



The OSI model is intended to be a reference model for the development of protocols. It views the exchange of information between two devices, operating across a network, from several levels of abstraction. These are known as layers. The seven-layer model is shown in the figure. The various layers correspond to different functions that must be carried out to ensure smooth and cooperative interconnection:

- > 1. Application Layer
- > 2. Presentation Layer
- > 3. Session Layer
- > 4. Transport Layer
- > 5. Network Layer
- > 6. Data Link Layer
- > 7. Physical Layer

Layer number	Layer name	Responsibility	Information form (Data unit)	Device or Protocol
7	Application layer	Helps in identifying the client and synchronizing communication	Data	SMTP
6	Presentation layer	Data from the application layer is extracted and manipulated in the required format for transmission	Data	JPEG, MPEG, GIF
5	Session layer	Establishes connection, and maintenance, ensures authentication, and ensures security	Data	Gateway
4	Transport layer	Take service from the network layer and provide it to the application layer	Segment	Firewall
3	Network layer	Transmission of data from one host to another, located in different networks	Packet	Router
2	Data link layer	Node-to-node delivery of message	Frame	Switch, bridge

1	Physical layer	Established physical connections between devices	Bits	Hub, repeater, modem, cables
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1. Which of the following protocol is/are defined in Transport layer?

- FTP
- TCP
- UDP
- Both B and C

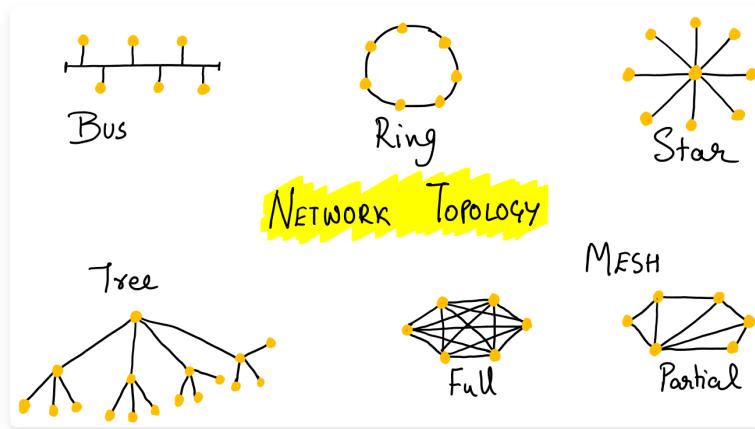
Check

Question: 1 of 4 questions

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## 8. Topology of Network

*Network topology* is the shape or structure of a network, including the arrangement of the communication links and hardware devices on the network. The transmission rates, distances between devices, signal types, and physical interconnection may differ between networks, but they may all have the same topology.



- > **1. Bus Topology**
- > **2. Ring Topology**
- > **3. Star Topology**
- > **4. Tree Topology**
- > **5. Mesh Topology**

1. Match the items given in List – I with the most suitable items in List – II:

List – I

- a. Wireless networking
- b. Network devices
- c. Network models
- d. Network Topology

List – II

- i. Ring
- ii. Infrared
- iii. Network Repeater
- iv. TCP/IP 4 layered protocol

- a-ii, b-i, c-iii, d-iv
- a-iv, b-ii, c-iii, d-i
- a-ii, b-iii, c-iv, d-i
- a-iii, b-iv, c-i, d-ii

Check

Question: 1 of 3 questions

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## 9. Network Protocols

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In a typical telecommunications network, diverse hardware and software components need to work together to transmit information. Different components in a network communicate with each other only by adhering to a common set of rules called protocols. A protocol is a set of rules and procedures governing the transmission of information between two points in a network.

Unfortunately, the Internet does not work with protocols according to the OSI model. Instead, it uses its suite of protocols called **TCP/IP (Transmission Control Protocol/ Internet Protocol)**, named after the two protocols involved. The Internet layer protocol is *IP (Internet Protocol)*; transport is handled by *TCP (Transmission Control Protocol)*.

Transmission Control Protocol/Internet Protocol (TCP/IP) is not part of the OSI reference model, although it roughly corresponds to the network and transport layers. The IP portion of the TCP/IP protocol corresponds roughly to the network layer of the seven-layer OSI model, while the TCP portion corresponds approximately to the transport layer.

In the extended TCP/IP model, the application layer includes protocols such as SMTP (for e-mail), HTTP (for Web pages), FTP (for file transfer), and Telnet (telecommunications network).

- > **1. Simple Mail Transfer Protocol (SMTP)**
- > **2. Hypertext Transfer Protocol (HTTP)**
- > **3. File Transfer Protocol (FTP)**
- > **4. Telecommunication Network (Telnet)**

1. Given below is a typical URL that identifies a web page:

<http://book.com/author/index.html>

The hostname 'book.com' is converted into an IP address by a \_\_\_\_\_ server that has a database of machine names and addresses and is queried for the address.

- SMTP
- FTP
- DNS
- HTTP

Check

Question: 1 of 3 questions

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## 9. Network Protocols

---

*Transport Layer Security (TLS)* is a cryptographic protocol designed to secure communications over a computer network. TLS operates at the transport layer of the Internet Protocol (IP) suite, providing a secure channel between two communicating applications. It is the successor to the earlier Secure Sockets Layer (SSL) protocol.

TLS provides encryption to ensure the confidentiality of data during transmission. It uses cryptographic algorithms to encrypt the data, making it difficult for unauthorized parties to intercept and understand the information.

TLS ensures the integrity of the data being transmitted. It uses cryptographic hash functions to create a digital signature for each data packet, allowing the recipient to verify that the data has not been tampered with during transit.

TLS supports mutual authentication between the communicating parties. This means that both the client and the server can authenticate each other's identities, assuring that the entities involved in the communication are who they claim to be.

TLS employs key exchange mechanisms to establish a secure session key between the client and the server. The session key is used for encrypting and decrypting the data exchanged during the communication session.

The TLS handshake protocol is used at the beginning of a communication session to negotiate encryption algorithms, exchange cryptographic parameters, and establish a shared secret key. The handshake ensures a secure setup before actual data transfer begins.

Drag the correct words to fill in the blanks to complete the paragraph given below that explains how data is sent over the Internet using the Transport Layer Security (TLS) protocol

The browser requests the \_\_\_\_\_ to identify itself by providing its \_\_\_\_\_ . This is sent and a check is performed to see if it is \_\_\_\_\_ . If it is, the \_\_\_\_\_ sends a \_\_\_\_\_ back to the web server and data transmission begins.



Check

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## 10. Distributed Systems

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Grosch's law states that a computer's hardware should exhibit an "economy of scale" which means the difference in performance between two computers is generally the difference in their price, squared. It comes from a quote by computer scientist Herbert Grosch in 1965, he said:

*There is a fundamental rule, which I modestly call Grosch's law, giving added economy only as the square root of the increase in speed — that is, to do a calculation 10 times as cheaply you must do it 100 times as fast.*

It, therefore, made financial sense for an organization to centralize its computer systems to get the most power for its money. Under centralization, an organization that is located on several geographically distant sites would then incur a large communications cost. Terminals at each site are needed to interchange data constantly with the centralized central processing unit.

With the development of much cheaper computing hardware and, in particular, the development of the microchip, Grosch's law has broken down. There are no longer the same economies of scale to be gained by centralization. Local computers can carry out local processing needs, and the need to communicate between different sites in an organization is reduced to those occasions where data held at one location is needed at another. This is called **distributed computing**.

A computer system is said to be distributed, if it consists of hardware located at least two geographically distinct sites, connected electronically by telecommunications, where processing/data storage occurs at more than one site.

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# 1. Background

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The Internet began with a network known as *ARPAnet*, which was developed by the Advanced Research Projects Agency (ARPA) of the USA in 1969.

The Internet consists of computers spread all over the world, connected through wired and wireless transmission media, which contain software codes that allow them to talk to each other. Small businesses and individuals connect to the Internet through **Internet Service Providers (ISP)** such as Airtel or a commercial online service provider such as Dishnet DSL.

The **World Wide Web (WWW)** is a vast repository of data and information connected through hyperlinks. In 1989, CERN (the European Laboratory for Particle Physics in Switzerland) proposed the development of the World Wide Web (now commonly known as the *Web*) to enable high-energy physicists across the world to collaborate through the easy provision and accessibility of information.

In 1989, Sir Tim Berners-Lee, while working at CERN (European Organization for Nuclear Research), proposed the concept of a global hypertext system that would allow information to be easily accessed and shared across different computers. This concept eventually evolved into the World Wide Web.

Thus, the Internet is a global network of networks while the WWW is a collection of information that is accessed via the Internet. Another way to look at this difference is, that, the Internet is infrastructure while the Web is service on top of that infrastructure.

Arrange the following events that influenced the development of the Internet in reverse chronological order (that is most recent to oldest):

DNS implemented

Sputnik I Launched

TCP/IP implemented in ARPANET

ARPA established

WWW Created at CERN

Check

## 2. Evolution of Web

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The terms Web 1.0, Web 2.0, Web 3.0, and Web 5.0 refer to different phases in the evolution of the World Wide Web, each characterized by distinct features, technologies, and user experiences. Let us understand different generations of the web with examples and their distinguishing characteristics.

### > Web 1.0

### > Web 2.0

### > Web 3.0

### > Web 5.0

Web Generation	Description	Key Features
Web 1.0	Democratization of information access	Unidirectional information flow, static text-based content, limited user interaction, emphasis on browsing
Web 2.0	Democratization of content production	User-generated content, two-way communication, multimedia integration, the emergence of social networking platforms
Web 3.0	Democratization of the capacity of action and knowledge	Machine-to-machine interaction, AI and machine learning integration, personalized and intelligent content/services
Web 5.0	Emotional web	Hypothetical integration of VR, AR, advanced AI, seamless fusion of physical and digital worlds

Identify the version of www based upon the description

- a. : Democratization of information access
- b. : Democratization of content production
- c. : Democratization of the capacity of action and knowledge
- d. : Emotional web

Check

---

## 2. Evolution of Web

---

Web 2.0 represents a shift in the World Wide Web from static, one-way communication to a more dynamic, interactive, and collaborative online environment. Several key features define Web 2.0, including the emergence of blogs, social networks, wikis, and tagging. Let us discuss each component.

### > 1. Blogs

### > 2. Social Networks

### > 3. Wikis

### > 4. Tagging

1. Identify the correct internet term as per the provided description

a. : Personal internet journals where a writer enters text about a particular topic or person; anyone can comment on topic.

Social Netw  
Wik  
Tagg  
Blog

b. : Allow interaction of people online. Users can add friends, post messages and update their personal profiles to notify friends about their status.

c. : A type of bookmarking where a user "marks" a webpage or photo using text to describe its contents. Anyone can view the webpages or photos corresponding to these "markers".

d. : Include software that allows users to create and edit web pages using a browser. Anyone is able to create or edit this information.

Check

Question: 1 of 4 questions

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### 3. How Internet Works

---

Each computer attached to the Internet is given an address. This consists of a 32-bit number. Conventionally, this is expressed as a sequence of four decimal numbers, for example, 128.136.18.15. Each number is less than 256.

When you type humanperitus.com in your browser, the browser sends a query over the internet to the **Domain Name Server (DNS)** to find the website of humanperitus.com. The DNS returns the IP address, like 93.184.216.34. It is not easy to remember the IP address. However, a domain name such as humanperitus.com is something people can recognize and remember. DNS maps domain names with IP addresses, enabling humans to use memorable domain names, while computers on the internet can use IP addresses. DNS was developed and implemented by Paul Mockapetris and Jon Postel in 1983.

In the case of an Internet connection, the information that passes between one computer and another is divided into packets, with different packets taking different routes through the network. This process is known as packet switching. To ensure that information proceeds from the transmitter computer to the correct receiver computer, and that the information that is received in different packets is assembled in the correct order at the receiving computer, 2 important standards (protocols) are used.

The **Internet Protocol (IP)** ensures that a packet of data arrives at the correct address (the destination computer) after transfer through the Internet. As the packet passes through the Internet, onward transmission from one network to another is handled by computers known as routers.

Ensuring that these packets arrive at the correct address is the job of the Internet protocol. However, having arrived:

- the information held in the packets needs to be reassembled in the correct order;
- the receiving computer must determine whether the data has been altered in error during transmission; and
- the receiving computer must be able to request the sending computer to resend any packets not received or determined to have been received in an altered state.

All of the information required to do this is inserted into each packet along with the information to be transmitted. The standard protocol that determines how this is done is known as **transmission control protocol (TCP)**. The combination of IP and TCP occurs so regularly that it is known as **TCP/IP**. The Transmission Control Protocol/Internet Protocol (TCP/IP) was implemented in ARPANET in January 1983. Most operating systems contain software to handle these protocols.

1. In the context of computer networking, what protocol is used to turn names such as www.abc.edu, into IP addresses?

- HTTP
- DNS
- SMTP
- SSH

Check

Question: 1 of 2 questions

---

## 4. Internet Protocol

An Internet Protocol address is also known as an *IP address*. It is a numerical label that is assigned to each device connected to a computer network that uses the IP for communication. IP address acts as an identifier for a specific machine on a particular network. The IP address is also called the IP number and internet address.

### Internet Protocol version 4 (IPv4)

	IPv4 (1981)	IPv6 (1994)
Address Scheme	32 bit	128 bit
Number of Addresses	$2^{32}$	$2^{128}$
Format	Decimal	Hexadecimal
Configuration	Manual	Auto
Example	12.244.233.165	2001:0db8:0000:0000:ff00:0042:7879

IPv4 was the first version of IP. It was deployed for production in the ARPANET in 1983. Today it is the most widely used IP version. It is used to identify devices on a network using an addressing system. The IPv4 uses a 32-bit address scheme allowing to store addresses which is more than 4 billion addresses.

IPv4 is a numeric address, and its binary bits are separated by a dot (.)

The example is given below

12.244.233.165

There are 12 Header Fields and the length of the header field is 20. It has checksum fields.

The classes of IPv4 addresses are traditionally divided into five classes: A, B, C, D, and E. These classes are defined based on the range of the first octet in the IP address and are associated with different address spaces and network sizes.

Class	Class range	Network
A	1.0.0.0 to 126.0.0.0	Large Networks
B	128.0.0.0 to 191.255.0.0	Medium to large Networks
C	192.0.0.0 to 223.255.255.0	Small Networks
D	224.0.0.0 to 239.255.255.255	Reserved for Multicasting networks
E	240.0.0.0 to 255.255.255.255	Reserved for research, reserved and Experimental networks

### Internet Protocol version 6 (IPv6)

IPv6 is the most recent version of the Internet Protocol. Internet Engineer Taskforce initiated it in early 1994. The design and development of that suite is now called IPv6. This new IP address version is being deployed to fulfill the need for more Internet addresses. It was aimed to resolve issues which are associated with IPv4. With 128-bit address space, it allows 340 undecillion unique address space. IPv6 is also called *IPng (Internet Protocol next generation)*.

IPv6 is an alphanumeric address whose binary bits are separated by a colon (:). It also contains hexadecimal characters.

The example is given below

2001:0db8:0000:0000:ff00:0042:7879

There are 8 Header Fields and the length of the header field is 40. IPv6 allows storing an unlimited number of IP Addresses. It does not have checksum fields.

1. In light of the given statements, choose the correct answer from the options given below

Statement I: In computer networking, the purpose of changing the IP addressing scheme between IPv4 and IPv6 for more IP addresses.

Statement II: A web cookie is stored on the server machine.

- Both Statement I and Statement II are true
- Both Statement I and Statement II are false
- Statement I is true but Statement II is false
- Statement I is false but Statement II is true

 Check

Question: 1 of 4 questions

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## 4. Internet Protocol

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An IP (Internet Protocol) packet is a fundamental unit of data in the Internet Protocol suite. IP packets are the building blocks of communication over the Internet and are used to transmit data between devices in a network. These packets contain both the data being transmitted and the information needed to route the data from the source to the destination.

Let us discuss some key components of IP packets.

### 1. Header

The header is the metadata section at the beginning of the IP packet. It contains crucial information for routing and delivering the packet. Key fields in the IP header include:

- *Version*: Indicates whether the packet is using IPv4 or IPv6.
- *Header Length*: Specifies the length of the header in 32-bit words.
- *Type of Service (ToS)*: Provides information about the priority and characteristics of the packet.
- *Total Length*: Specifies the total length of the packet (header + data).
- *Identification, Flags, Fragmentation Offset*: Used in packet fragmentation and reassembly.
- *Time to Live (TTL)*: Limits the lifespan of the packet, preventing it from circulating indefinitely.
- *Protocol*: Identifies the higher-layer protocol (e.g., TCP, UDP) that will process the data in the packet.
- *Header Checksum*: A checksum for error checking in the header.

### 2. Data

The data section follows the header and contains the actual payload being transmitted. The size of the data can vary, and it may include segments of a larger message or file.

### 3. Trailer

In IPv4, a trailer called the *Frame Check Sequence (FCS)* is used for error checking at the link layer. In IPv6, error checking is typically handled by the link layer, and a trailer is not used.

### 4. Source and Destination IP Addresses

The IP packet includes the source and destination IP addresses, allowing routers to forward the packet along the appropriate path to reach its destination.

Each IP packet must contain:

- Only Source address
- Only Destination address
- Source and Destination address
- Source or Destination address

Check

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## 5. World Wide Web

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The World Wide Web (WWW), often referred to as the *Web*, is an information system that allows users to access and share resources on the Internet. It's a collection of interconnected documents and resources linked by hyperlinks and URLs (Uniform Resource Locators).

### Key components of the World Wide Web

Let us discuss a few key components of the World Wide Web.

- > **1. Web Pages**
- > **2. Hyperlinks**
- > **3. URLs (Uniform Resource Locators)**
- > **4. Web Browsers**
- > **5. Web Servers**
- > **6. Internet**

1. Which of the following statements is/are correct?

- (a) WWW is a network of networks that first started with four computer nodes  
(b) WWW is a service that runs on the Internet

a only

b only

both a and b

neither a nor b

Check

Question: 1 of 2 questions

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## 6. Web Page

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A web page is a digital document accessible via the internet, comprising text, multimedia, and interactive elements like hyperlinks. It's displayed within web browsers and serves as a fundamental unit of information presentation on the World Wide Web.

The foundation of web pages lies in their electronic storage on the web, enriched by embedded hypertext links. These links enable readers to effortlessly navigate by clicking, seamlessly transitioning to another web page, even possibly to a different website. Integral to this structure is the application of **Hypertext Markup Language (HTML)**, a specialized language that orchestrates the layout and connectivity of web pages.

HTML, as a page description language, dictates the placement of text, graphics, videos, and sound within a web document. While it boasts ease of learning and usage, its inflexibility as a single facet of **Standardized General Markup Language (SGML)** constrains its adaptability. SGML, a meta-language, extends far beyond HTML, offering the potential to create an array of document types, ranging from clinical records to musical notation and ancient manuscript transcriptions.

The inherent power of SGML renders it complex to wield, leading to the emergence of **Extensible Markup Language (XML)** as a streamlined subset. XML diversifies document definition beyond HTML's scope, maintaining a syntax that's more graspable than full-fledged SGML. Notably, unlike HTML, XML doesn't confine itself to a predetermined tag set.

Complementing HTML's role, **Cascading Style Sheets (CSS)** delineate the visual presentation of web page content. By defining the technical aspects of appearance once within a separate CSS file or HTML section, CSS streamlines the design process, imparting global characteristics to diverse page elements and their layout.

Acting as the interface between users and web content, a *browser* serves as a software platform installed on a client's computer. It facilitates the display of web page content stored on a remote server, such as HTML documents. To achieve this, browsers leverage the Hypertext Transfer Protocol (HTTP) for seamless data retrieval from the internet.

Notable examples of browsers include Google Chrome, Firefox Mozilla, Netscape Navigator, and Microsoft's Internet Explorer.

1. In HTML, tags consist of keywords enclosed within

- flower bracket
- angular bracket
- parentheses
- square

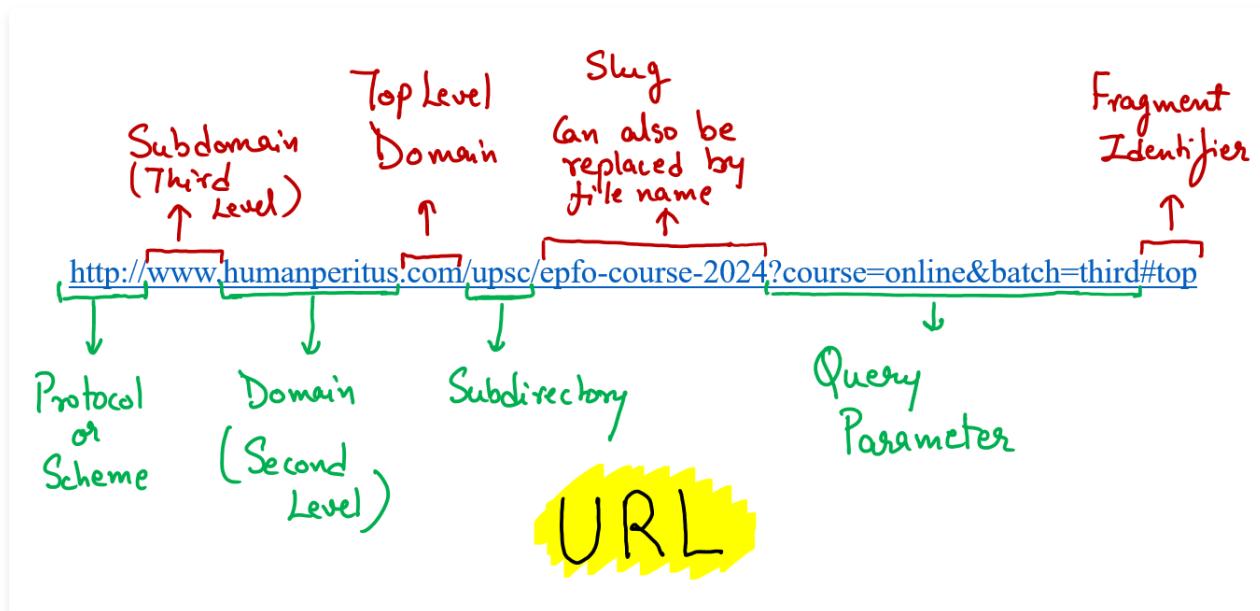
Check

Question: 1 of 3 questions

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## 7. Uniform Resource Locator

As explained earlier, each computer attached to the Internet has an address. The *Uniform Resource Locator* (URL; note that some people call this the *Universal Resource Locator*) identifies the location of a resource on the web (type of resource, site, and position or path to the resource at the site). It is useful to think of the URL as the web page address.



Two examples are given below:

<http://www.humanperitus.com/upsc/epfo-course-2024?course=online&batch=third#top>

[http://www.humanperitus.com/upsc/new\\_course.html?course=online&batch=third#top](http://www.humanperitus.com/upsc/new_course.html?course=online&batch=third#top)

Let us discuss parts of the URL one by one.

- > **1. Protocol or Scheme**
- > **2. Subdomain (Third Level)**
- > **3. Domain (Second Level)**
- > **4. Top-Level Domain (TLD)**
- > **5. Subfolder (Subdirectory)**
- > **6. Slug**
- > **7. File Name**
- > **8. Query Parameters**
- > **9. Fragment Identifier**

1. Consider the URL:

<http://example.org/index.html>.

Which of the following are contained in the URL?

- A. Brower name
- B. File name
- C. Host name
- D. Email address
- E. Protocol

A, B, C

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A, C, E

---

B, C, E

---

C, D, E

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Check

Question: 1 of 3 questions

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## 8. e-Business and e-Commerce

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**Electronic business**, or *e-business* refers to the use of digital technology and the Internet to execute the major business processes in an enterprise. It includes activities for the internal management of the firm, interaction with customers, and coordination with suppliers and other business partners. e-Business systems integrate and support enterprise-wide business processes and the business functions of marketing, manufacturing, human resource management, accounting, and finance.

**Electronic commerce**, or *e-Commerce* is the part of e-business that deals with the buying and selling of goods and services over the Internet. It also encompasses activities supporting those market transactions, such as advertising, marketing, customer support, security, delivery, and payment.

e-Business is a broader concept than e-commerce. In addition to the buying and selling of goods and services, e-business refers to collaborating with business partners and performing electronic transactions within an organization. e-Business systems describe how information systems integrate and support enterprise-wide business processes and the business functions of marketing, manufacturing, human resource management, accounting, and finance.

The technologies associated with e-business have brought changes, not only in private enterprises but also in the public sector. Governments on all levels are using Internet technology to deliver information and services to citizens, employees, and businesses with which they work. e-Government refers to the application of the internet and networking technologies to digitally enable government and public sector agencies' relationships with citizens, businesses, and other arms of government.

e-Commerce can take several forms depending on the degree of digitization involved. The *degree of digitization* is the extent to which commerce has been transformed from physical to digital. In other words, the product can be either physical or digital, and the delivery agent can be either physical or digital.

In traditional commerce, both dimensions are physical. Purely physical organizations are referred to as *brick-and-mortar organizations*. In contrast, in pure e-commerce, all dimensions are digital. Companies engaged only in e-commerce are considered *virtual* (also called *pure-play organizations*).

All other combinations that include a mix of digital and physical dimensions are considered *partial e-commerce*. The *clicks-and-mortar organizations* conduct some e-commerce activities, yet their primary business is carried out in the physical world. A common alternative name to the term clicks-and-mortar is clicks-and-bricks.

- > **Types of e-Commerce**
- > **Mechanisms of e-Commerce**

1. Drag the examples of the website addresses in front of the types of websites mentioned below:

a. e-Commerce:

www.lin  
www.an  
www.t  
www.l

b. Building up social media:

c. News:

d. Search engine:

Check

Question: 1 of 4 questions

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## 8. e-Business and e-Commerce

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e-Commerce has transformed the way businesses operate and how consumers access goods and services. Let us discuss the advantages and disadvantages associated with e-commerce.

> **Advantages of e-commerce**

> **Disadvantages of e-commerce**

The dimension of e-commerce that enables commerce across national boundaries is called \_\_\_\_\_.

- interactivity
- global reach
- richness
- ubiquity

Check

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## 1. Introduction

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With the widespread expansion and utilization of digital information, much of which is confidential, there has been a corresponding increase in incidents of information theft, including cyber-attacks perpetrated by hackers. This trend is evident in both government and private sectors, emphasizing the imperative to safeguard information from data breaches through a variety of tools and techniques.

**Authentication** involves verifying one's own identity, while **Authorization** entails granting access to the system. In simpler terms, authentication is the process of confirming who you are, whereas authorization is the process of confirming what you have access to.

**Two-factor Authentication (2FA)**, also known as *two-step verification* or *dual-factor authentication*, is a security protocol wherein the user provides two distinct authentication factors to verify their identity. This serves to enhance the protection of both the user's credentials and the resources they can access.

Two-factor authentication offers a higher level of assurance compared to authentication methods reliant on **Single-factor Authentication (SFA)**, where the user typically provides only one factor, such as a password or passcode. In two-factor authentication, users are required to provide a password along with a second factor, usually either a security token or a biometric factor like a fingerprint or facial scan.

Verification of a login name and password is known as

- Configuration
- Accessibility
- Authentication
- Logging in

Check

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## 2. Malware

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Malware encompasses various types of software, including viruses, spyware, adware, worms, Trojans, ransomware, and more. Its purpose is to inflict harm on a specific computer or induce a level of operational disturbance.

Now, let's delve into each type individually.

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## 2. Malware

---

A computer virus is a malicious software program that attaches itself to other software programs or data files, aiming to execute without user knowledge or permission. The majority of computer viruses carry a *payload*, which can range from relatively harmless instructions, such as displaying a message or image, to highly destructive actions like destroying programs or data, clogging computer memory, reformatting a computer's hard drive, or causing improper program execution. Viruses commonly spread when individuals take actions such as sending an email attachment or copying an infected file. The term Virus stands for *Vital Information Resource Under Siege*.

### Types of Virus

Let us discuss various types of computer viruses:

- > **1. Resident Virus**
- > **2. Macro Virus**
- > **3. Boot Virus**
- > **4. Polymorphic Virus**
- > **5. Metamorphic Virus**
- > **6. File Virus**
- > **7. Stealth Virus**
- > **8. Companion Virus**
- > **9. Cavity Virus**
- > **10. Multipartite Virus**

### Antivirus Software

Antivirus software is designed to scan computer systems and drives for the presence of computer viruses, often eliminating them from infected areas. However, its effectiveness is primarily against viruses known when the software was written. Continuous updates are crucial for antivirus software to remain effective.

Products are available for various devices, including mobile, handheld, servers, workstations, and desktop PCs, with examples like Quickheal, McAfee, Norton, Symantec, and Kaspersky.

1. Which of the following statements about Anti-virus software are correct?

- A. Problem files/programs are quarantined and can be automatically removed
- B. Check all files before being loaded or run
- C. Use a database to identify potential risks
- D. Used for data authenticity

B, C and D only

A, B and C only

A, C and D only

A, B and D only

Check

Question: 1 of 2 questions

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## 2. Malware

---

A worm belongs to the category of malicious programs that exploit vulnerabilities in operating systems to propagate itself. In terms of design, worms share similarities with viruses and are often considered a subclass of them.

However, a key distinction exists between viruses and worms: viruses necessitate an active host program or an already-infected system to run, cause harm, and infect other executable files. Conversely, worms are standalone malicious programs with the capability to self-replicate.

Worms exhibit various types based on their methods of spread, including *email worms*, *internet worms*, *network worms*, and *multi-vector worms*. Each type employs distinct strategies for propagation, making them a versatile and potent threat in the realm of cybersecurity.

Which of the following best describes a computer worm?

- Malware that does not replicate itself but spreads through social engineering
- Malware that replicated by attaching itself to a word processing document
- Malware that replicates by attaching itself to an executable programme
- Malware that replicate itself as standalone software

Check

---

## 2. Malware

---

Computer Trojans, or *Trojan Horses*, derive their name from the mythological Trojan horse due to their analogous operational strategy. A Trojan horse is a seemingly innocuous program that conceals malicious code within its structure. Victims are typically deceived into opening it, as it appears to be useful software originating from a legitimate source, such as an update for the software currently installed on their computers.

The harmful payload of the program may be crafted to empower hackers to undertake various malicious activities, including but not limited to destroying hard drives, corrupting files, remote control of the computer, launching attacks against other computers, stealing passwords, or spying on users by recording keystrokes and transmitting them to a server operated by a third party.

One common consequence of a Trojan horse is the creation of a *backdoor* on the infected computer, allowing attackers to maintain future access to the system and compromise confidential or private information.

Trojan horses can be delivered through diverse means, such as email attachments, downloads from websites, or infection via removable media devices like DVDs or USB memory sticks.

A specific subtype of the Trojan horse is the **logic bomb**, which triggers its execution based on a predefined event. For instance, logic bombs may activate in response to a change in a particular file, the entry of a specific series of keystrokes, or at a designated time or date. This dynamic makes Trojan horses and logic bombs versatile tools for cyber attackers seeking to infiltrate and compromise computer systems.

1. A destructive computer program that masquerades as a useful application is called

- Virus
- Worm
- Trojan
- Firmware

Check

Question: 1 of 3 questions

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## 2. Malware

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Spyware refers to software that covertly monitors and gathers information about a specific user, computer, or organization without the user's awareness.

Various types of spyware exist, including system monitors, Trojans (such as keyloggers, banker Trojans, and info-stealers), adware, and tracking cookies.

> **Keyloggers**

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> **Creepware**

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> **Tracking cookies**

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> **Riskware**

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**Anti-spyware software**

Anti-spyware software plays a crucial role in safeguarding against these threats. Designed to detect and remove spyware, this software scans computer systems for known spyware programs, identifies their presence, and offers options to eliminate or quarantine them. Its purpose is to protect user privacy, prevent unauthorized access to personal information, and ensure the security of computer systems.

Notable examples of anti-spyware software include Malwarebytes, Spybot-Search & Destroy, Ad-Aware Free Antivirus+, SUPERAntiSpyware, Windows Defender, Bitdefender Antivirus, Emsisoft Anti-Malware, and Norton 360.

These tools are essential for maintaining a secure and private digital environment by actively countering the presence of spyware and related threats.

1. A keylogger is an example of:

- Trojan
  - Spyware
  - Worm
  - Logic Bomb
- 

Check

Question: 1 of 3 questions

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## 2. Malware

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Adware, short for *advertising-supported software*, is a type of software that delivers advertisements to users, usually in the form of banners or *pop-up windows*. It is often bundled with freeware or shareware applications as a means of generating revenue for the developers. While some adware operates legitimately by displaying ads as a way to support free software, there are instances where adware becomes intrusive or even malicious.

One common characteristic of adware is its ability to track and analyze user behavior. By monitoring the user's internet habits, adware can create a profile of the individual's interests and preferences. This information is then used to deliver targeted advertisements, making the ad content more relevant to the user. While this customization might be seen as a way to enhance the user experience, it also raises concerns about privacy and data security.

Users often encounter adware when downloading and installing free software from the internet. Developers of free applications may include adware as a way to offset the costs of development and distribution. However, users should exercise caution and carefully read the terms of service and installation agreements to be aware of any bundled adware. In some cases, adware may go beyond displaying ads and collect sensitive information without the user's consent, leading to privacy issues.

To counter the potential negative impact of adware, users can employ anti-adware tools or ad blockers. These tools help identify and block unwanted advertisements, providing users with more control over their online experience and mitigating potential privacy risks associated with certain adware practices.

### Popup windows

Pop-up windows are a common feature on many websites, serving various purposes from advertising products or services to providing additional details or notifications. While they can be effective in conveying information, users often find them intrusive, especially when they appear without prior warning or user initiation.

Extra browser window of commercials that open automatically on browsing web pages is called:

- Spam
- Virus
- Phishing
- Pop-up

Check

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## 2. Malware

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The pay-per-click model is a common method used in online advertising where advertisers pay a fee each time their ad is clicked. This model is designed to drive traffic to the advertiser's website, potentially leading to increased sales or engagement.

*Click fraud* occurs when individuals or automated programs manipulate the pay-per-click system by generating fake clicks on ads. This activity is not motivated by genuine interest in the advertised product or service but rather seeks to exploit the payment structure of online advertising.

Click fraud can have significant financial implications for advertisers. They may end up paying for clicks that do not contribute to genuine user interest or potential business transactions. This undermines the effectiveness of the advertising campaign and can lead to wasted advertising budgets.

Google, being a major player in online advertising, has implemented measures to combat click fraud. The company utilizes sophisticated algorithms and machine learning to identify and filter out invalid clicks.

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## 2. Malware

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Ransomware is a type of malicious software that restricts your ability to use your computer or access your data until specific demands are met, often involving paying a ransom or complying with instructions such as sending photos to the attacker.

Infection typically occurs when users open email attachments containing the malware or are enticed to visit compromised websites through deceptive emails or pop-up windows.

Additionally, ransomware can spread through removable USB drives or web messenger platforms, where the malicious payload may be disguised as an image.

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## 2. Malware

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Scareware, alternatively labeled as *Rogue Security Software or Misleading Software*, constitutes a category of malware encompassing both Ransomware and Fake Antivirus software. This deceptive software manipulates users by falsely suggesting a computer infection and then proposes paid solutions to purportedly address the fabricated issue.

Essentially, scareware preys on users' fears of malware infections, coercing them into purchasing unnecessary and fraudulent security services. This manipulative tactic poses a significant threat to individuals and organizations, exploiting cybersecurity concerns for financial gain.

A virus hoax is an untrue virus warning, email. When you receive a virus hoax such as the one below, what is the appropriate action?

Subject: Warning!

A new Virus has been detected in your computer. Format your hard disk and re-install all software's immediately.

- Ignore this email
- Format your hard disk and re-install all software immediately
- Reply to the sender
- Forward this email to your friends

Check

---

## 2. Malware

---

Spam refers to unwanted or unsolicited messages, often sent over the internet, typically via email. These messages are usually sent in bulk to a large number of recipients and often contain advertisements, promotional content, or links to websites.

The primary purpose of spam is to reach as many people as possible, with the hope of promoting products, services, or other content.

Spam can also be found in other forms of digital communication, such as instant messaging, social media, and comments on websites. The term can also extend to irrelevant or inappropriate messages that clutter communication channels and negatively impact user experience.

Various measures, including spam filters and regulations, are employed to mitigate the impact of spam and reduce its prevalence.

An unsolicited e-mail message sent to many recipients at once is a

Inbox

Spam

Virus

Attack

Check

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### 3. Network Attacks

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A network attack is usually defined as an intrusion on the network infrastructure, that will first analyze the environment and collect information to exploit the existing open ports or vulnerabilities. This may include unauthorized access to organization resources.

*Identity theft* is the theft of personal information, which is then used without the owner's permission. Often, stolen personal identification information, such as a person's name, PAN number, mobile number, Aadhaar number, or credit card number, is used to commit fraud or other crimes. Thieves may use a consumer's credit card number to charge items to that person's account, use the identification information to apply for a new credit card or a loan in a consumer's name or use a consumer's name and Aadhaar number to receive government benefits. Thieves also often sell personal identification information on the black market.

#### Types of Network Attacks

Let us discuss various types of network attacks.

- > **1. Direct access attack**
- > **2. Back door attack**
- > **3. Social engineering**
- > **4. Phishing attack**
- > **5. Watering hole attack**
- > **6. Evil twins**
- > **7. Pharming**
- > **8. Port scanning**
- > **9. Cracking**
- > **10. Sniffer**
- > **11. Search engine poisoning**
- > **12. Denial-of-service (DoS) & Distributed Denial-of-service (DDoS) attacks**
- > **13. Session hijacking attack**
- > **14. SQL injection attacks**
- > **15. Bluetooth-related attacks**

#### CAPTCHA

A CAPTCHA is a type of challenge-response test used in computing to determine whether or not the user is human. CAPTCHA (*Completely Automated Public Turing Test to Tell Computers and Humans Apart*) software generates and grades tests that humans can pass but the most sophisticated computer programs cannot. For example, humans can read distorted text, but simple computer programs cannot.

1. In light of the given statements, choose the correct answer from the options given below

Statement I: 'Spam' is an attempt to acquire sensitive information for malicious reasons, by masquerading as a true entity.

Statement II: 'Phishing' is a type of unsolicited bulk email of identical messages sent to numerous recipients.

Both Statement I and Statement II are true

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Both Statement I and Statement II are false

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Statement I is true but Statement II is false

---

Statement I is false but Statement II is true

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Check

Question: 1 of 6 questions

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## 4. Famous Malwares

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Let us see a few examples of the most famous malware.

Malware	Year of Discovery	Type of Malware
Creeper	1971	Virus
Morris	1988	Worm
Melissa	1999	Virus
ILOVEYOU	2000	Virus
Slammer	2003	Worm
MyDoom	2004	Worm
Zeus	2007	Trojan
DarkHotel	2007	Spyware
Conficker	2008	Worm
Stuxnet	2010	Worm
NotPetya	2013	Ransomware
CryptoLocker	2013	Ransomware
Emotet	2014	Trojan
Mirai	2016	DDoS attack
Triada	2016	Trojan
Olympic Vision	2016	Keyloggers
WannaCry	2017	Ransomware
Fireball	2017	Adware
RYUK	2018	Ransomware
Maze	2019	Ransomware

The terms Maze, Petya and Wannacry mentioned in the news over the last few years are related to

- Mobile Apps
- Crypto-Currency
- Cyber Attacks
- Virtual Reality

Check

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## 5. Encryption

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*Encryption* is the process of transforming plain text or data into cipher text that cannot be read by anyone other than the sender and the intended receiver. Data are encrypted by using a secret numerical code, called an encryption key, that transforms plain data into cipher text. The message must be decrypted by the receiver.

Two methods for encrypting network traffic on the Web are SSL and HTTPS. *Secure Sockets Layer (SSL)* and its successor *Transport Layer Security (TLS)* enable client and server computers to manage encryption and decryption activities as they communicate with each other during a secure web session.

*Secure Hypertext Transfer Protocol (HTTPS)* is another protocol used for encrypting data flowing over the Internet, but it is limited to individual messages, whereas SSL and TLS are designed to establish a secure connection between two computers.

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- > **Methods of Encryption**

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- > **Digital certificates**

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- > **Process of Encryption**

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1. In India, the term "Public Key Infrastructure" is used in the context of

- Digital security infrastructure
  - Food security infrastructure
  - Health care and education infrastructure
  - Telecommunication and transportation infrastructure
- 

Check

Question: 1 of 3 questions

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## 6. Cyber Security in India

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Currently, the *Information Technology Act, 2000* is the primary law for dealing with cybercrime and digital commerce in the country. The Act was first formulated in 2000, and then was revised in 2008 and came into force a year later. The Information Technology (Amendment) Bill, 2008 amended several sections that were related to digital data, electronic devices, and cybercrimes.

In the *Information Technology Amendment Act, 2008*, cybersecurity is exercised under sections 43 (data protection), 66 (hacking), 66A (measures against sending offensive messages), 66B (punishment for illegally possessing stolen computer resources or communication devices), 67 (protection against unauthorized access to data), 69 (cyberterrorism), 70 (securing access or attempting to secure access to a protected system) and 72 (privacy and confidentiality) among others.

The Section 66A of the Information Technology Act, 2000 was struck down by the Supreme Court in 2015.

The government approved a '*Framework for Enhancing Security in Cyberspace*' for cyber security in Indian cyberspace, with the National Security Council Secretariat (NSCS) as the nodal agency. National Technical Research Organisation (NTRO) has been designated as the nodal agency for taking all measures for the protection of national critical infrastructure and to handle cyber security incidents in critical sectors.

Further, the *Indian Computer Emergency Response Team (CERT-In)* is designated as the national agency for incident response including analysis, forecast, and alerts on cyber security breaches. It is under MeitY (Ministry of Electronics and Information Technology), Government of India.

The *Cyber and Information Security (C&IS) Division* under the Ministry of Home Affairs, deals with matters related to cyber security, cyber-crime, National Information Security Policy & Guidelines (NISPG), and implementation of NISPG, NATGRID, etc. It is implementing the '*Cyber Crime Prevention against Women & Children*' Scheme intending to handle issues of cybercrime against women and children.

*National Cyber Security Policy (2013)* provides for developing effective public-private partnerships and collaborative engagements through technical and operational cooperation and contribution to enhancing the security of cyberspace.

> **Global Cybersecurity Index (GCI)**

> **International Computer Security Day (ICSD)**

> **ISO/IEC 27001**

1. The IT (Amendment) Act, 2008 aimed at strengthening the law to combat cybercrime, came into force in India on

- 27 - October - 2009
- 27 - October - 2008
- 17 - October - 2009
- 17 - October – 2008

Check

Question: 1 of 5 questions

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# 1. Introduction

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In our everyday life, we use numbers in base 10 (using digits 0 to 9). The Computers use base 2 (using digits 0 to 1, or binary base). Similarly, the numbers can be written in any base.

These numbers, 0 and 1 in binary base, are known as bits in computer terminology. *Nibble* is a combination of 4 bits, *Byte* is 8 bits and *Word* is 16 bits.

Number of Bits	Common Name
1	Bit
4	Nibble
8	Byte
16	Word
32	Double Word
64	Quad Word

A 16-bit register can store  $2^{16}$  different values (equal to 65336). The signed range of integer values that can be stored in 16 bits is  $-32,768$  ( $-1 \times 2^{15}$ ) through  $32,767$  ( $2^{15} - 1$ ); the unsigned range is 0 through 65,535 ( $2^{16} - 1$ ).

Similarly, we can calculate the values stored by 2, 4, 8, and 32 bits. An 8-bit register can store  $2^8$  different values (equal to 256).

## American Standard Code for Information Interexchange (ASCII)

The *American Standard Code for Information Interexchange* (ASCII) is a standard that assigns letters, numbers, and other characters in the 256 slots available in the 8-bit code. The ASCII decimal number is created from binary, which is the language of all computers. The ASCII table is divided into 3 different sections:

1. *Non-printable*, system codes between 0 and 31;
2. *Lower ASCII*, between 32 and 127; and
3. *Higher ASCII*, between 128 and 255.

Computer uses which number system to store data and perform calculations?

- Decimal
- Octal
- Binary
- Hexadecimal

Check

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## 2. Types of Bases

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### Decimal Numeral System (Base 10)

Decimal numbers use digits from 0 to 9. These are the regular numbers that we use.

$$2538_{10} = 2 \times 10^3 + 5 \times 10^2 + 3 \times 10^1 + 8 \times 10^0$$

### Binary Numeral System (Base 2)

Binary numbers use only 0 and 1 digits.

$$10101_2 = 1 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 = 16 + 4 + 1 = 21$$

$$10111_2 = 1 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 = 16 + 4 + 2 + 1 = 23$$

### Octal Numeral System (Base 8)

Octal numbers use digits from 0 to 7.

$$27_8 = 2 \times 8^1 + 7 \times 8^0 = 16 + 7 = 23$$

$$4307_8 = 4 \times 8^3 + 3 \times 8^2 + 0 \times 8^1 + 7 \times 8^0 = 2247$$

### Hexadecimal Numeral System (Base 16)

Hexadecimal numbers use digits from 0 to 9 and A to F.

$$28_{16} = 2 \times 16^1 + 8 \times 16^0 = 40$$

$$2F_{16} = 2 \times 16^1 + 15 \times 16^0 = 47$$

$$BC12_{16} = 11 \times 16^3 + 12 \times 16^2 + 1 \times 16^1 + 2 \times 16^0 = 48146$$

### Binary Coded Decimal (BCD)

Binary Coded Decimal (BCD) is a system of writing numerals that assign a four-digit binary code to each digit 0 through 9 in a decimal (base-10) numeral. The four-bit BCD code for any particular single base-10 digit is its representation in binary notation, as follows: 0 = 0000, 1 = 0001, 2 = 0010.

A-F system is used in which of the following number systems?

Binary

Octal

Decimal

Hexa-Decimal

Check

### 3. Convert Decimal to Binary

---

The method of converting *Decimal to Binary* number equivalents is to write down the decimal number and continually divide by 2 to give a result and a remainder of either a "1" or a "0" until the final result equals zero.

Let us Convert 35 into Binary.

- Step 1:  $35/2$ , Quotient = 17 Remainder = 1 (*Least Significant Bit*)
- Step 2:  $17/2$ , Quotient = 8 Remainder = 1
- Step 3:  $8/2$ , Quotient = 4 Remainder = 0
- Step 4:  $4/2$ , Quotient = 2 Remainder = 0
- Step 5:  $2/2$ , Quotient = 1 Remainder = 0
- Step 6:  $1/2$ , Quotient = 0 Remainder = 1 (*Most Significant Bit*)

The Remainders, but in *reverse order*, will give you the Binary code. Start writing reminders from the last step, toward the first step.

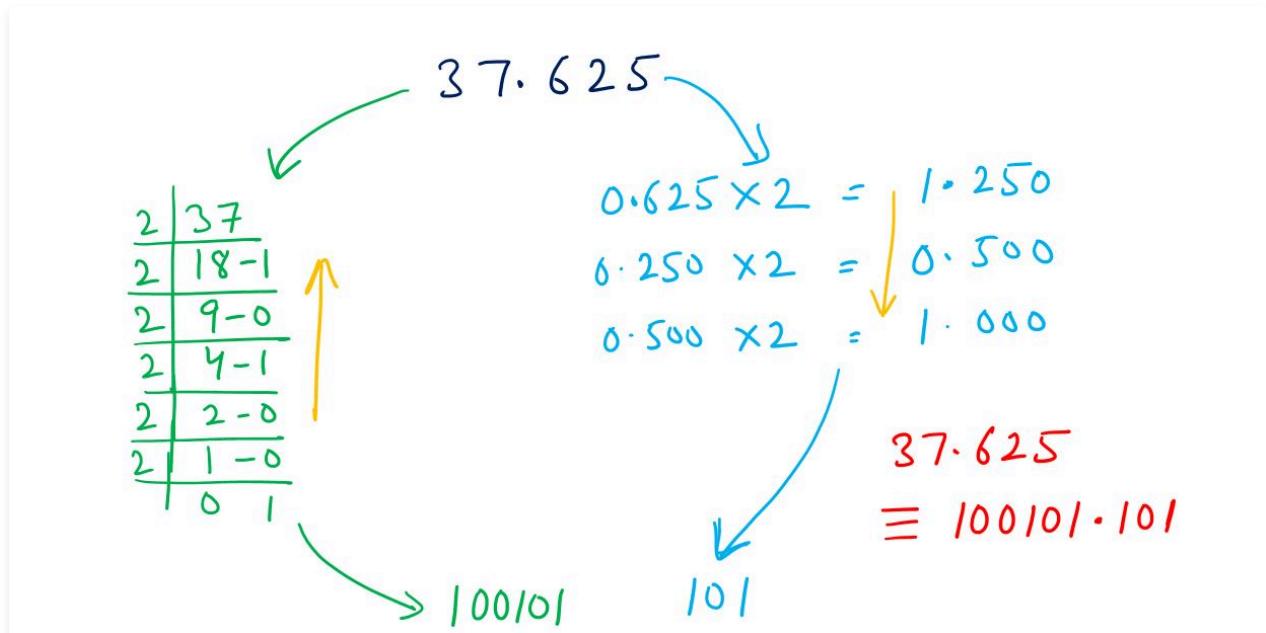
In this example, first we write 1 (remainder of Step 6), then we write 0 (remainder of Step 5), then we write 0 (remainder of Step 5), then we write 0 (remainder of Step 4), then we write 1 (remainder of Step 2), then we write 1 (remainder of Step 1).

Finally, we have 100011, which is the Binary equivalent of 35.

---

## 4. Convert Decimal Fraction to Binary

Let us now Convert 37.625 from Decimal to base 2 (Binary)



You first need to look at the integer part and convert it to base 2. The integer part of 37.625 is 37.

- Step 1:  $37/2$ , Quotient = 18 Remainder = 1 (Least Significant Bit)
- Step 2:  $18/2$ , Quotient = 9 Remainder = 0
- Step 3:  $9/2$ , Quotient = 4 Remainder = 1
- Step 4:  $4/2$ , Quotient = 2 Remainder = 0
- Step 5:  $2/2$ , Quotient = 1 Remainder = 0
- Step 6:  $1/2$ , Quotient = 0 Remainder = 1 (Most Significant Bit)

The Remainders, but in reverse order, will give you the binary code. Start writing reminders from the last step, toward the first step.

Which means 37 (Decimal) = 100101 (Binary). We are now done with the integer part.

Now, let us convert the fraction part (.625)

Begin with the decimal fraction, and multiply by 2. The whole number part of the result is the first binary digit to the right of the point. Because  $0.625 \times 2 = 1.25$ , the first binary digit to the right of the point is a 1. So far, we have  $0.625 = .1???$  (base 2).

*Step 2:* Next, we disregard the whole number part of the previous result (the 1 in this case) and multiply by 2 once again. The whole number part, of this new result, is the second binary digit to the right of the point. We will continue this process until we get a zero as our decimal part or until we recognize an infinite repeating pattern. Because  $.25 \times 2 = 0.50$ , the second binary digit to the right of the point is a 0.

So far, we have  $.625 = .10???$  (base 2).

*Step 3:* Disregarding the whole number part of the previous result (this result was .50, so there is no whole number part to disregard in this case), we multiply by 2 once again. The whole number part of the result is now the next binary digit to the right of the point.

Because  $.50 \times 2 = 1.00$ , the third binary digit to the right of the point is a 1.

So, now we have  $.625 = .101???$  (base 2).

*Step 4:* In fact, we do not need a Step 4. We are finished in Step 3 because we had 0 as the fractional part of our result there.

Hence the representation of  $.625 = .101$  (base 2)

Thus, the Binary equivalent of 37.625 is 100101.101

1. In the light of the given statements, choose the correct answer from the options given below:

Statement I: ASCII, a character-encoding scheme, is an acronym for American Standard Code for Intelligent Information Processing.

Statement II :  $(37.25)_{10} = (100101.01)_2$

- Both Statement I and Statement II are true
- Both Statement I and Statement II are false
- Statement I is true but Statement II is false
- Statement I is false but Statement II is true

 Check

Question: 1 of 2 questions

---

## 5. Convert Binary to Decimal

---

Let's take an example for  $n = 1100110$ . We want to convert it from Binary to Decimal.

We will take right most digits and multiply them by  $2^0$

$$0 \times 2^0 = 0$$

Then, we will take the next left digit and multiply it by  $2^1$

$$1 \times 2^1 = 2$$

Then, we will take the next left digit and multiply it by  $2^2$

$$1 \times 2^2 = 4$$

Then, we will take the next left digit and multiply it by  $2^3$

$$0 \times 2^3 = 0$$

Then, we will take the next left digit and multiply it by  $2^4$

$$0 \times 2^4 = 0$$

Then, we will take the next left digit and multiply it by  $2^5$

$$1 \times 2^5 = 32$$

Then, we will take the next left digit and multiply it by  $2^6$

$$1 \times 2^6 = 64$$

We add all of them to get a decimal representation of the binary number

$$\Rightarrow 1100110_2 = 0 + 2 + 4 + 0 + 0 + 32 + 64 = 102$$

In light of the given statements, choose the correct answer from the options given below:

Statement I: The binary equivalent of decimal number  $(19)_{10}$  is  $(10101)_2$

Statement II:  $(1011)_2 + (110)_2 = (10101)_2$

Both Statement I and II are true

Both Statement I and II are false

Statement I is true but II is false

Statement I is false but II is true

Check

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## 6. Convert Binary Fraction to Decimal

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Let's take an example for  $n = 110.101$ . We want to convert it from Binary to Decimal.

*Step 1:* Convert the integral part of binary to decimal equivalent

Multiply each digit separately from left side of radix point till the first digit by  $2^0, 2^1, 2^2, \dots$  respectively.

Add all the result coming from step 1.

Step 1: Conversion of 110 to decimal

$$\Rightarrow 110_2 = (1 \times 2^2) + (1 \times 2^1) + (0 \times 2^0)$$

$$\Rightarrow 110_2 = 4 + 2 + 0$$

$$\Rightarrow 110_2 = 6$$

So, the equivalent decimal of binary integral is 6.

*Step 2:* Convert the fractional part of binary to decimal equivalent

Divide each digit from the right side of the radix point till the end by  $2^1, 2^2, 2^3, \dots$  respectively.

Add all the results coming from step 1.

Step 2: Conversion of .0101 to decimal

$$\Rightarrow 0.101_2 = (1 \times 1/2) + (0 \times 1/2^2) + (1 \times 1/2^3)$$

$$\Rightarrow 0.101_2 = 1 \times 0.5 + 0 \times 0.25 + 1 \times 0.125$$

$$\Rightarrow 0.101_2 = 0.625$$

So equivalent decimal of binary fractional is 0.625

*Step 3:* Add both integral and fractional parts of the decimal number.

Step 3: Add the result of steps 1 and 2.

$$\Rightarrow 6 + 0.625 = 6.625$$

1. In light of the given statements, choose the correct answer from the options given below:

Statement I:  $(43.25)_{10} = (101011.01)_2$

Statement II:  $(1110.111)_2 = (14.625)_{10}$

- Both Statement I and Statement II are true
- Both Statement I and Statement II are false
- Statement I is true but Statement II is false
- Statement I is false but Statement II is true

Check

Question: 1 of 2 questions

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## 7. Hexadecimal System

---

The one main disadvantage of binary numbers is that the binary equivalent of a large decimal number can be quite long, which makes it difficult to both read and write without producing errors especially when working with 16 or 32-bit numbers. One common way of overcoming this problem is to arrange the binary numbers into groups of four, as Hexadecimal Numbers, starting with the least significant digit on the right-hand side. This Hexadecimal or simply "Hex" numbering system uses the Base-of-16 system. Hence, it uses 16 (sixteen) different digits with a combination of numbers from 0 to 9, and the capital letters A to F, to represent its binary or decimal equivalent.

Hexadecimal Numbers are a more complex system, than using just binary or decimal, and is mainly used when dealing with computers and memory address locations. By dividing a binary number up into groups of 4 bits, each group or set of 4 digits can now have a possible value of between "0000" (0) and "1111" ( $1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 = 15$ ) giving a total of 16 different number combinations from 0 to 15. Don't forget that "0" is also a valid digit.

A four-bit group of digits is called a *nibble*, and as four-bits are also required to produce a hexadecimal number, a hex digit can also be thought of as a nibble, or half-a-byte.

The decimal system still uses the numbers 0 to 9 but for the numbers from 10 to 15, capital alphabets A to F are used. The relationship between binary and hexadecimal is shown below:

Using the original binary number from above,  $1101\ 0101\ 1100\ 1111_2$ , this can now be converted into an equivalent hexadecimal number of D5CF<sub>16</sub> which is much easier to read, and understand, than a long row of 1's and 0's that we had before. Similarly, converting Hex-based numbers back into binary is simply the reverse operation.

Then, the main characteristic of a *Hexadecimal Numbering System* is, that, there are 16 distinct counting digits from 0 to F with each digit having a weight, or value of 16, starting from the least significant bit (LSB). To distinguish Hexadecimal numbers from Decimal numbers, a prefix of either a "#", (Hash) or a "\$" (Dollar sign) is used, before the actual Hexadecimal value, #D5CF or \$D5CF.

### Convert 23524 from Decimal to Hexadecimal

The following process is used to convert a decimal number into a hexadecimal number. Keep dividing the number by 16, and keep noting reminders till you get Quotient = 0.

Let us Convert 23524 (decimal) into Hexadecimal:

Step 1:  $23524/16$ , Quotient = 1470 Remainder = 4 (*Least Significant Bit*)

Step 2:  $1470/16$ , Quotient = 91 Remainder = 14

Step 3:  $91/16$ , Quotient = 5 Remainder = 11

Step 4:  $5/16$ , Quotient = 0 Remainder = 5 (*Most Significant Bit*)

The remainders, but in reverse order, will give you the hexadecimal code. Start writing reminders from the last step, toward the first step.

In this example, first, we write 5 (reminder of Step 4), then we write 11 (reminder of Step 3), then we write 14 (reminder of Step 2), then we write 4 (reminder of Step 1).

Thus we have 5 11 14 4

But in Hexadecimal Code 10 = A, 11 = B, 12 = C, 13 = D, 14 = E, 15 = F

So, the answer is 5 B E 4

Decimal	4-bit Binary	Hexadecimal
0	0000	0
1	0001	1
2	0010	2
3	0011	3
4	0100	4

5	0101	5
6	0110	6
7	0111	7
8	1000	8
9	1001	9
10	1010	A
11	1011	B
12	1100	C
13	1101	D
14	1110	E
15	1111	F
16	0001 0000	10 (1+0)
17	0001 0001	11 (1+1)

1. In light of the given statements, choose the correct answer from the options given below:

Statement I:  $(4A2F)_{16} = (18991)_{10}$

Statement II:  $(6940)_{10} = (1B1C)_{16}$

- Both Statement I and Statement II are true
- Both Statement I and Statement II are false
- Statement I is true but Statement II is false
- Statement I is false but Statement II is true

Check

Question: 1 of 5 questions

---

## 8. Negative Numbers

---

There are 3 methods of representing negative numbers in binary system.

*Unsigned Binary Number* is the number with a magnitude of either 0 or greater than 0.

### Method 1: Signed Magnitude Method

In this method, we use left most place to store sign (called *sign bit*). In this method, we put value as 0 at left most place, if it is a positive number. We put value as 1 at left most place, if it is negative number.

Consider that we use 4-bit representation.

Now "Plus 3" will be stored as 0011 (4 places to store).

And "Minus 3" will be stored as 1011.

Consider that we use 8-bit representation.

"Plus 37" will be stored as 00100101

"Minus 37" will be stored as 10100101

### Method 2: 1's Complement

Suppose, we have to convert "Minus 19" into Binary.

Since -19 will require more than 4 places, we write this as an 8-bit representation.

So, "Plus 19" is written as 00010011

Then, we flip all digits (we change 0 into 1 and we change 1 into 0)

Thus, the flipped version of "plus 19" is 11101100

This flipped version is called *1's complement*.

Note, that 1's complement of Zero has two different representations. +0 is represented as 0000, while -0 is represented as 1111.

### Method 3: 2's Complement

Now, we add 1 to this flipped version, as obtained above.

Adding 1 to 11101100, we get 11101101.

After adding 1 to the flipped version, we get *2's complement*.

Let us convert Minus 19 into Binary using 2's complement method

The process to convert a negative decimal into binary is given below:

1. Convert the decimal number into binary, ignoring the negative sign.
2. Thus, the binary of 19 is 10011
3. Now, make this binary a stack of 4's. 0001|0011 (we added three Zeroes to the left to make two groups of 4 digits each).
4. Now, reverse sign of all digits. The reversed number is 11101100

Now add 1 to this number. We get 11101101. This is a binary of -19 (Minus 19).

1. 1's complement of 1011101 is \_\_\_\_\_.

- 0101110
- 1001101
- 0100010
- 1100101

Check

Question: 1 of 5 questions

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## 1. e-Governance

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Electronic governance or *e-governance* can be defined as the usage of Information and Communication Technology (ICT), by the government to provide, and facilitate government services, exchange of information, communication transactions, and integration of various stand-alone systems, and services. In other words, it is the use of technology to perform government activities and achieve the objectives of governance.

Through e-governance, government services are made available to citizens and businesses in a convenient, efficient, and transparent manner. Examples of e-governance include the Digital India initiative, GSTN project, Aadhar portal, online payment of taxes, digital land management systems, online application for competitive exams, and conduction of online exams, etc.

> **Types of e-Governance**

> **Objectives of ICT in Governance**

### Digital divide

Digital divide is a term that refers to the gap between demographics and regions, that have access to modern information and communications technology, and those that don't or have restricted access. This technology can include the telephone, television, personal computers and the Internet.

1. In the light of the given statements, choose the correct answer from the options below:

Assertion A: e-Governance is regarded as the ICT-enabled system in achieving good governance

Reason R: Empathy is one of the desirable characteristics of e-Governance.

- Both A and R are true and R is the correct explanation of A
- Both A and R are true but R is not the correct explanation of A
- A is true but R is false
- A is false but R is true

Check

Question: 1 of 5 questions

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## 2. NeGP

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The *National e-Governance Plan (NeGP)* is the most significant initiative taken in India during the last decade, to mainstream ICT in governance, at both central and state levels. The original vision of NeGP was to "Make all Government services accessible to the common man in his locality through common service delivery outlets and ensure efficiency, transparency and reliability of such services at affordable costs to realize the basic needs of the common man".

The plan, consisting originally of 27 Mission Mode Projects (MMPs) and 8 Components, was approved in May 2006. Subsequently, in July 2011, 4 new MMPs on Health, Education, Public Distribution System (PDS) and Posts were added. The respective ministries and departments in the Government of India were responsible for the overall formulation, financial approvals, and implementation of the MMPs.

The NeGP consists of 8 components. The 3 main core components consist of the State Wide Area Networks (SWANs), State Data Centres (SDCs), and Common Service Centres (CSCs). The other 5 components comprise standards, awareness and communication, capacity building, assessment, and research and development.

### **Mission Mode Projects (MMPs)**

The 31 MMPs under the NeGP consist of 11 central, 7 integrated, and 13 state projects. The 11 central MMPs are as follows:

- > **Banking**
- > **Insurance**
- > **MCA 21**
- > **Income Tax**
- > **Central Excise**
- > **National ID/UID**
- > **Passports**
- > **Immigration and Visa**
- > **Pensions**
- > **e-Office**
- > **Posts**

1. Which domain does MCA 21 e-governance project focus upon?

- Immigration
- Passport
- Corporate affairs
- Pension

Check

Question: 1 of 2 questions

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### 3. Digital India

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The National e-Governance Action Plan (NeGP) is now subsumed under Digital India (which came into being in 2015).

- > **Vision areas of Digital India**
- > **Pillars of Digital India**
- > **e-Kranti**

Which of the following statements is/are correct regarding e-governance?

- (a) Decreasing transparency is an ICT enabled advantage of e-Governance.
- (b) e-Governance is related to the implementation of ICT in the government processes and functions.
- (c) Common Service Centres (CSCs) help in providing and using e-Governance related services.

- a, b, and c
- b and c only
- a and c only
- a and b only

Check

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## 4. Major Initiatives

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Some of the other prominent initiatives are listed below:

- > **MyGov**
- > **DigiLocker**
- > **e-Hospital-Online Registration Framework (ORF)**
- > **National Scholarships Portal (NSP)**
- > **DARPAN**
- > **PRAGATI (Pro-Active Governance and Timely Implementation)**
- > **Common Services Centres 2.0 (CSC 2.0)**
- > **Jeevan Pramaan**
- > **SWAYAM**

Which of the following statements is/are correct about e-Pragati?

1. 'e-Pragati' is a comprehensive framework for implementing e-governance and provides e-services to citizens of Karnataka.
2. It is developed in association with Infosys.

- Only 1
- Only 2
- Both 1 and 2
- Neither 1 nor 2

Check

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## 5. Data Governance

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*Data governance (DG)* is the overall management of the availability, usability, integrity, and security of data used in an enterprise. A sound data governance program includes a governing body or council, a defined set of procedures, and a plan to execute those procedures.

Businesses benefit from data governance because it ensures data is consistent and trustworthy. This is critical as more organizations rely on data to make business decisions, optimize operations, create new products and services, and improve profitability.

The initial step in implementing a data governance framework involves defining the owners or custodians of the data assets in the enterprise. This role is called data stewardship.

Processes must, then, be defined to effectively cover how the data will be stored, archived, backed up, and protected from mishaps, theft, or attacks. A set of standards and procedures must be developed that defines how the data is to be used by authorized personnel. Moreover, a set of controls and audit procedures must be put into place that ensures ongoing compliance with internal data policies and external government regulations, and that guarantees data is used consistently across multiple enterprise applications.

Once an overarching strategy is defined and data owners and custodians are identified, data governance teams are often formed to implement policies and procedures for handling data. These teams can comprise business managers, data managers, and staff, as well as, end users familiar with relevant data domains within the organization.

**Data quality** is the driving force behind most data governance activities. Accuracy, completeness, and consistency across data sources are the crucial hallmarks of successful initiatives.

**Data scrubbing**, also known as *data cleansing*, is a common element in the data quality initiative, as it identifies, correlates and removes duplicated instances of the same data points. Data scrubbing accounts for the various ways in which, for example, the same customer or product, may be described. Data editors, data mining tools, data differencing utilities, data linking tools, as well as version control, workflow and project management systems are included among software types that help organizations attain better data quality.

Data governance touches on nearly every aspect of data management, but one area of data management, very closely associated with data governance processes is Master Data Management (MDM). This is a discipline that establishes a master reference to ensure consistent use of data across large organizations.

Data governance is a particularly important component of mergers and acquisitions, business process management, legacy modernization, financial and regulatory compliance, credit risk management, analytics, business intelligence applications, data warehouses, and data lakes.

As data use expands and new technologies emerge, data governance will gain wider application. Numerous high-profile data breaches have made data security a more central part of data governance efforts. Calls for data privacy have also led to the inclusion of data protection and data privacy audits as part of data governance programs.

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## 5. Data Governance

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The *General Data Protection Regulation (EU) (GDPR)* is a regulation in EU law on data protection and privacy for all individuals within the European Union (EU) and the European Economic Area (EEA). It was enforced in May 2018. Some of the key privacy and data protection requirements of the GDPR include:

1. Requiring the consent of subjects for data processing;
2. Anonymizing collected data to protect privacy;
3. Providing data breach notifications;
4. Safely handling the transfer of data across borders; and
5. Requiring certain companies to appoint a data protection officer to oversee GDPR compliance.

Simply put, the GDPR mandates a baseline set of standards for companies that handle EU citizens' data to better safeguard the processing and movement of citizen's personal data.

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## 5. Data Governance

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*Data protection* refers to policies and procedures seeking to minimize intrusion into the privacy of an individual caused by the collection and usage of their data.

In India, the usage of personal data or information of citizens is regulated by the *Information Technology (Reasonable Security Practices and Procedures and Sensitive Personal Data or Information) Rules, 2011*, under Section 43A of the Information Technology Act, 2000. The Rules define the personal information of an individual as any information which may be used to identify them. They hold the body corporate (who is using the data) liable for compensating the individual, in case of any negligence in maintaining security standards while dealing with the data.

Over the years, rapid technological advances have led to large volumes of data being generated through various activities, and the increasing reliance of businesses on data-driven decision-making. Large-scale collection and usage of data by the government for the provision of State benefits have also been enabled.

One example of this is the biometric identification and verification system of Aadhaar, that enables the government to ensure targeted delivery of State benefits, such as LPG subsidies.

In 2012, a petition was filed in the Supreme Court, challenging the constitutional validity of Aadhaar on the grounds that it violated an individual's right to privacy. Following this, in August 2017, a nine-judge bench of the Supreme Court declared privacy as a fundamental right of Indian citizens. The Court ruled that the right to privacy is protected by the Constitution as an intrinsic part of the right to life and personal liberty under Article 21. The Court also observed that 'informational privacy', or the privacy of personal data and facts, is an essential facet of the right to privacy.

A Committee of Experts was set up under the Chairmanship of Justice B. N. Srikrishna in July 2017 to examine various issues related to data protection in India.

The *Personal Data Protection Bill, 2019* was introduced in Lok Sabha by the Minister of Electronics and Information Technology on December 11, 2019. The Bill was later withdrawn.

### **Digital Personal Data Protection Bill, 2023**

The Digital Personal Data Protection Bill, 2023 became an Act in August 2023, after it was passed by both houses of parliament and assented to by the President of India.

The Act provides for the processing of digital personal data in a manner that recognizes both the rights of the individuals to protect their data and the need to process such personal data for lawful purposes. The Act protects digital personal data (that is, the data by which a person may be identified) by providing for the following:

1. The obligations of Data Fiduciaries (that is, persons, companies, and government entities who process data) for data processing (that is, collection, storage, or any other operation on personal data);
2. The rights and duties of Data Principals (that is, the person to whom the data relates); and
3. Financial penalties for breach of rights, duties and obligations.

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#### **> Seven Principles of the Bill**

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#### **> Rights awarded to individuals**

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Which of the following statements is/are correct?

- A. Digital governance has been legalized by the IT Act (2000) in India.
- B. IT Act is a watershed in conceptualizing administrative reforms in India.
- C. Digital governance is a boon in curbing bureaucratic red-tapism.

B and C

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B only

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A and C

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A, B and C

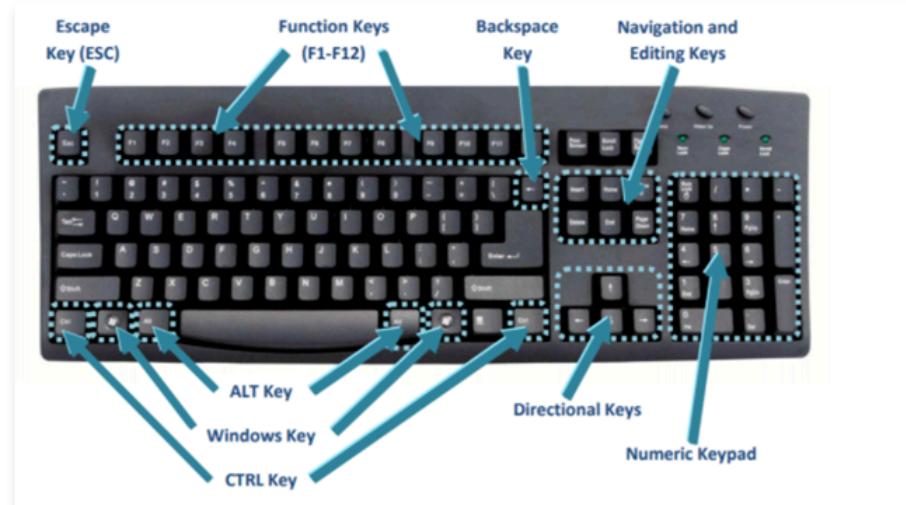
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Check

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# 1. Computer Keyboards

A keyboard's primary function is to act as an input device. Using a keyboard, a person can type a document, use keystroke shortcuts, access menus, play games, and perform a variety of other tasks. Keyboards can have different keys depending on the manufacturer, the operating system they're designed for, and whether they are attached to a desktop computer or part of a laptop. But, some standard keys remain the same for all the keyboards.



Some Standard keys on a Keyboard are:

- > 1. Alt key
- > 2. Arrow key
- > 3. Backspace
- > 4. Caps lock
- > 5. Character set
- > 6. Command key
- > 7. Control key
- > 8. Delete key
- > 9. Enter key
- > 10. Escape
- > 11. Function key
- > 12. Num Lock
- > 13. Return key
- > 14. Shift
- > 15. Space bar
- > 16. Tab key

1. In a keyboard, left-right-up-down set of keys facilitates which among the following functions?

- Deleting data
- Page scrolling
- Launching start menu
- Initiating search and help

Check

Question: 1 of 2 questions

## 2. Computer shortcut keys

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Let us look at a few important shortcuts

1. Alt + F-- File menu options in the current program.
2. F1-- Universal help (for any sort of program).
3. Ctrl + A --Selects all text.
4. Ctrl + X --Cuts the selected item.
5. Ctrl + C --Copy the selected item.
6. Ctrl + V--Paste the selected item.
7. Ctrl + Home--Go to the beginning of the document.
8. Ctrl + End -- Go to the end of a document.
9. Alt + Tab -- Switch between open applications.
10. Alt + Print Screen -- Create screenshots for the current program.
11. Ctrl + Alt + Del -- Reboot/Windows task manager.
12. Ctrl + Esc -- Bring up the start menu.
13. Alt + Esc -- Switch between applications on the taskbar.
14. F2 -- Rename the selected icon.
15. F3 -- Start finding from the desktop.
16. F4 -- Open the drive selection when browsing.
17. F5 -- Refresh contents.
18. Alt + F4 -- Close current open program.
19. Ctrl + F4 -- Close the window in the program.
20. Ctrl + Plus Key-- Automatically adjust the widths of all columns in Windows Explorer.
21. Shift + Del -- Delete programs/files permanently.

1. F2 key use to change the \_\_\_\_\_ of file/folder.

- Colour
- Size
- Name
- Style

Check

Question: 1 of 2 questions

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### 3. Word shortcut keys

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Let us discuss a few shortcut keys which are used in MS Word.

1. Ctrl + A -- Select all contents of the page.
2. Ctrl + B -- Bold highlighted selection.
3. Ctrl + C -- Copy selected text.
4. Ctrl + X -- Cut selected text.
5. Ctrl + N -- Open a new/blank document.
6. Ctrl + P -- Open the print window.
7. Ctrl + F -- Open the find box.
8. Ctrl + I -- Italicize highlighted selection.
9. Ctrl + K -- Insert link.
10. Ctrl + U -- Underline highlighted selection.
11. Ctrl + V -- Paste.
12. Ctrl + Y -- Redo the last action performed.
13. Ctrl + Z -- Undo the last action.
14. Ctrl + G -- Find and replace options.
15. Ctrl + H -- Find and replace options.
16. Ctrl + J -- Justify paragraph alignment.
17. Ctrl + L -- Align selected text or line to the left.
18. Ctrl + Q -- Align the selected paragraph to the left.
19. Ctrl + E -- Align selected text or line to the center.
20. Ctrl + R -- Align selected text or line to the right.
21. Ctrl + M -- Indent the paragraph.
22. Ctrl + T -- Hanging indent.
23. Ctrl + D -- Font options.
24. Ctrl + Shift + F -- Change the font.
25. F1 -- Open help.
26. F4 -- Repeat the last action performed
27. F7 -- Spell check selected text and/or document.
28. Shift + F7 -- Activate the thesaurus.
29. F12 -- Save as.
30. Ctrl + S -- Save.
31. Ctrl + W -- Close document.

1. Which of the following is a short-cut to “Undo Typing”?

- Ctrl+Y
- Ctrl+Z
- Ctrl+S
- Ctrl+P

Check

Question: 1 of 4 questions

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## 4. Excel shortcut keys

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Let us now look at a few examples of the shortcuts that are used in MS Excel.

1. F2 -- Edit the selected cell.
2. F5 -- Go to a specific cell.
3. F7 -- Spell check selected text and/or document.
4. F11 -- Create chart
5. Alt + Shift + F1 -- Insert a new worksheet.
6. Shift + F3 -- Open the Excel formula window.
7. Shift + F5 -- Bring up the search box
8. Ctrl + A -- Select all contents of a worksheet.
9. Ctrl + B -- Bold highlighted selection.
10. Ctrl + I -- Italicize highlighted selection.
11. Ctrl + C -- Copy selected text.
12. Ctrl + V -- Paste
13. Ctrl + F -- Open find and replace options.
14. Ctrl + G -- Open go-to options.
15. Ctrl + H -- Open find and replace options.
16. Ctrl + U -- Underline highlighted selection.
17. Ctrl + Y -- Underline selected text.
18. Ctrl + 5 -- Strikethrough highlighted selection.
19. Ctrl + O -- Open options.
20. Ctrl + N -- Open a new document.
21. Ctrl + P -- Open print dialog box.
22. Ctrl + S -- Save.
23. Ctrl + Z -- Undo the last action.
24. Ctrl + F9 -- Minimize the current window.
25. Ctrl + F10 -- Maximize the currently selected window.
26. Ctrl + F6 -- Switch between open workbooks/windows.
27. Ctrl + Page up & Page Down -- Move between Excel worksheets in the same document.
28. Ctrl + Tab -- Move between two or more open Excel files
29. Ctrl + W -- Close document.

1. What is the short cut key for Print a Document?

- Alt + P
- Ctrl + P
- Shift + P
- Ctrl + Alt + P

Check

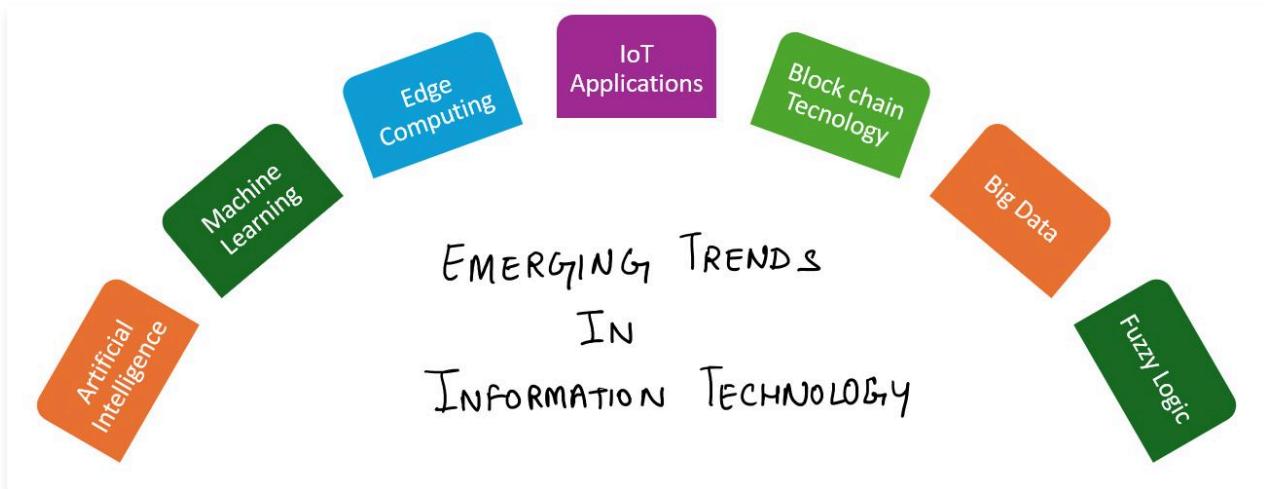
Question: 1 of 5 questions

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## 1. Introduction

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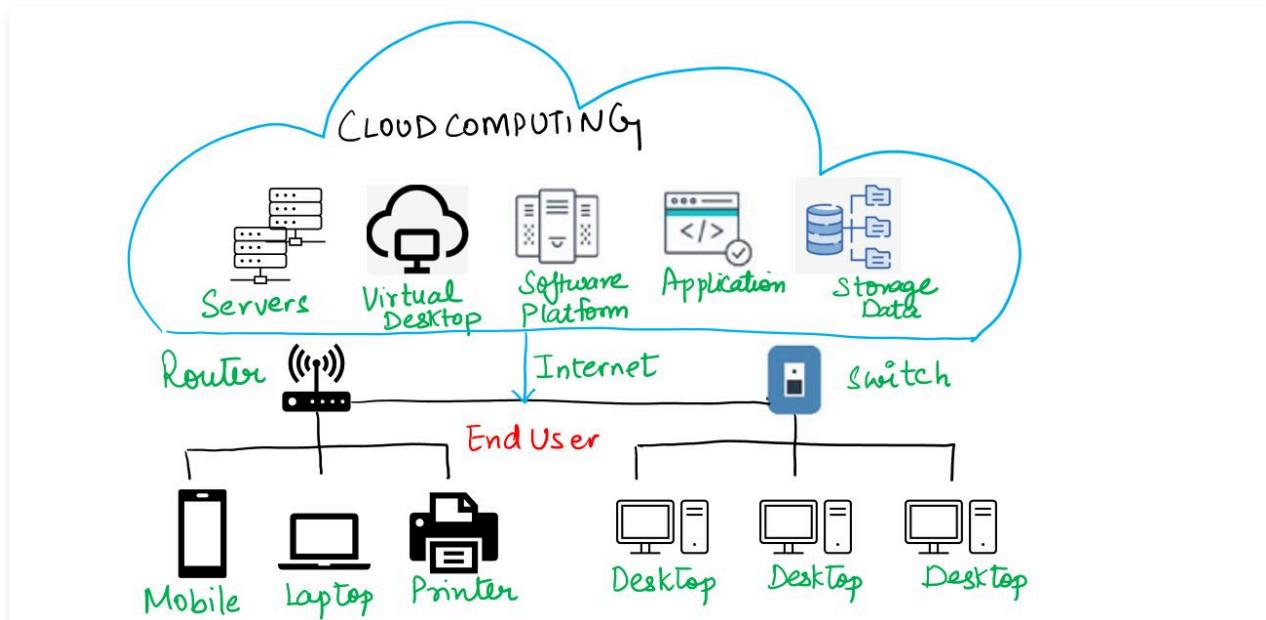
Emerging trends in information technology are continually reshaping the digital landscape. Artificial intelligence (AI) and machine learning (ML) are driving automation and predictive analytics, while edge computing is revolutionizing real-time data processing.



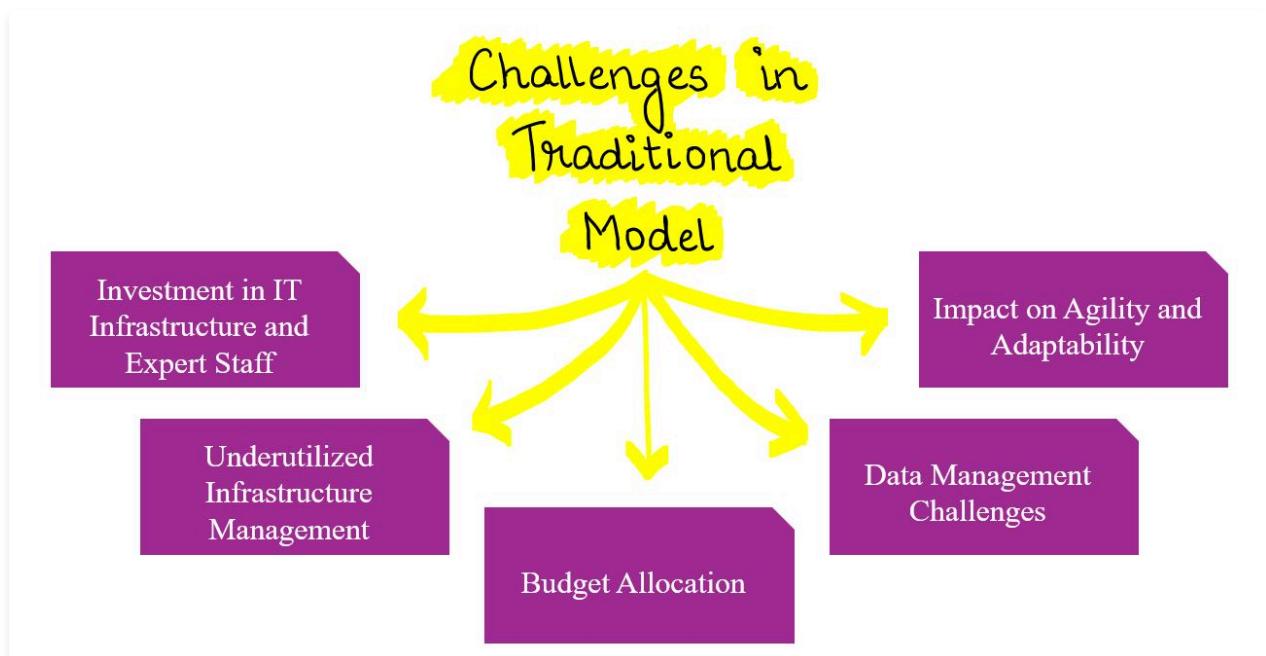
The deployment of 5G technology promises faster internet speeds and lower latency, fueling the growth of IoT applications and immersive experiences like augmented reality (AR) and virtual reality (VR). Cybersecurity remains paramount as threats evolve, prompting the adoption of advanced solutions such as AI-driven cybersecurity and zero-trust architecture. Additionally, blockchain technology finds applications beyond cryptocurrencies, offering transparency and security in supply chain management and digital identity verification. Quantum computing holds promise for solving complex problems, while digital transformation initiatives leverage cloud computing, big data analytics, and robotic process automation (RPA) to drive innovation and enhance customer experiences across industries. These trends underscore the dynamic nature of information technology, driving forward progress and transformation in diverse domains.

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## 2. Cloud Computing



To appreciate the transformation effects of cloud computing, we first need to understand traditional IT departments in organizations and the problems they face. Till sometime back, most companies owned their IT infrastructure (software, hardware, networks, and data management) and maintained them "on-premise" in their data centers. On-premise software, is the traditional model of the IT function in organizations.



Some of the challenges in the traditional model are:

- They spend huge amounts on IT infrastructure and expert staffs to build and maintain complex IT systems. These expenses include software licenses, hardware, and staff training and salaries.
- They must manage an infrastructure that often is not used to its full capacity.
- They spend the majority of their budgets on maintaining existing IT infrastructure, with the remainder being spent on developing new systems.
- They have difficulty capturing, storing, managing, and analyzing all this data.
- They can actually inhibit an organization's ability to respond quickly and appropriately to rapidly changing dynamic environments.

**Cloud Computing** is a model for delivering information technology services in which resources are retrieved from the internet through web-based tools and applications, rather than a direct connection to an owned server. Cloud computing is a type of

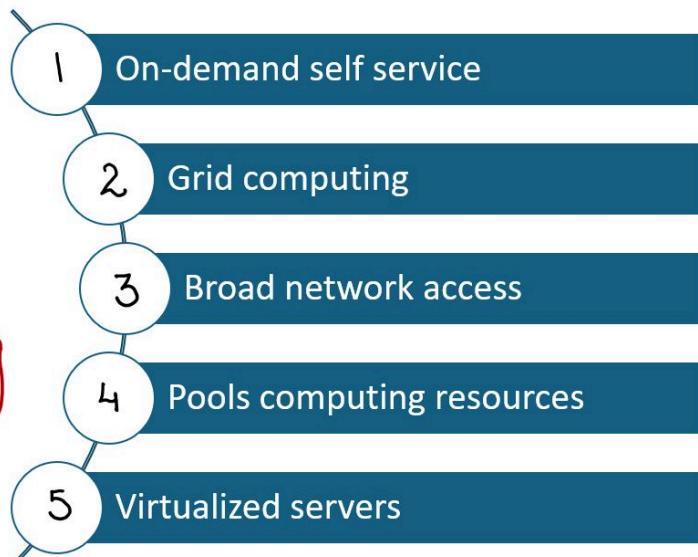
computing that delivers convenient, on-demand, pay-as-you-go access for multiple customers to a shared pool of configurable computing resources (e.g., servers, networks, storage, applications, and services) that can be rapidly and easily accessed over the internet.

In other words, Cloud computing refers to the delivery of computing services over the internet, providing access to a shared pool of resources, including computing power, storage, and applications, on a pay-as-you-go basis. Instead of owning and maintaining physical hardware and infrastructure, organizations can leverage cloud providers' infrastructure to run their applications, store data, and perform computing tasks.

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## 2. Cloud Computing

Characteristics  
of  
Cloud Computing



The essential characteristics of cloud computing include the following:

- **Cloud computing provides on-demand self-service**
  - A customer can access needed computing resources automatically.
- **Cloud computing includes the characteristics of grid computing**
  - Grid computing pools various hardware and software components to create a single IT environment with shared resources. Grid computing shares the processing resources of many geographically dispersed computers across a network.
  - Grid computing enables organizations to utilize their computing resources more efficiently.
  - Grid computing provides fault tolerance and redundancy, meaning that there is no single point of failure, so the failure of one computer will not stop an application from executing.
  - Grid computing makes it easy to scale up—that is, to access increased computing resources—to meet the processing demands of complex applications.
  - Grid computing makes it easy to scale down (remove computers) if extensive processing is not needed.
- **Cloud computing includes the characteristics of utility computing**
  - In utility computing, a service provider makes computing resources and infrastructure management available to a customer as needed. The provider then charges the customer for its specific usage rather than a flat rate.
  - Utility computing enables companies to efficiently meet fluctuating demands for computing power by lowering the costs of owning the hardware infrastructure.
- **Cloud computing utilizes broad network access**
  - The cloud provider's computing resources are available over a network, accessed with a web browser, and they are configured so they can be used with any computing device.
- **Cloud computing pools computing resources**
  - The provider's computing resources are available to serve multiple customers. These resources are dynamically assigned and reassigned according to customer demand.
- **Cloud computing typically occurs on virtualized servers**
  - Server virtualization uses software-based partitions to create multiple virtual servers- called "*virtual machines*"-on a single physical server.
  - The major benefit of this system is that each server no longer has to be dedicated to a particular task. Instead, multiple applications can run on a single physical server, with each application running within its own software environment. As a result, virtualization enables companies to increase server utilization.
  - In addition, companies realize cost savings in two areas. Firstly, they do not have to buy additional servers to meet peak demand. Secondly, they reduce their utility costs because they are using less energy.

## 2. Cloud Computing

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There are 3 major types of cloud computing that companies provide to customers: public clouds, private clouds, and hybrid clouds.



### Public clouds

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

### Private clouds

Private clouds (also known as internal clouds or corporate clouds) are IT infrastructures that can be accessed only by a single entity or by an exclusive group of related entities that share the same purpose and requirements, such as all of the business units within a single organization. Private clouds provide IT activities and applications as a service over an intranet within an enterprise. Enterprises adopt private clouds to ensure system and data security. For this reason, these systems are implemented behind the corporate firewall.

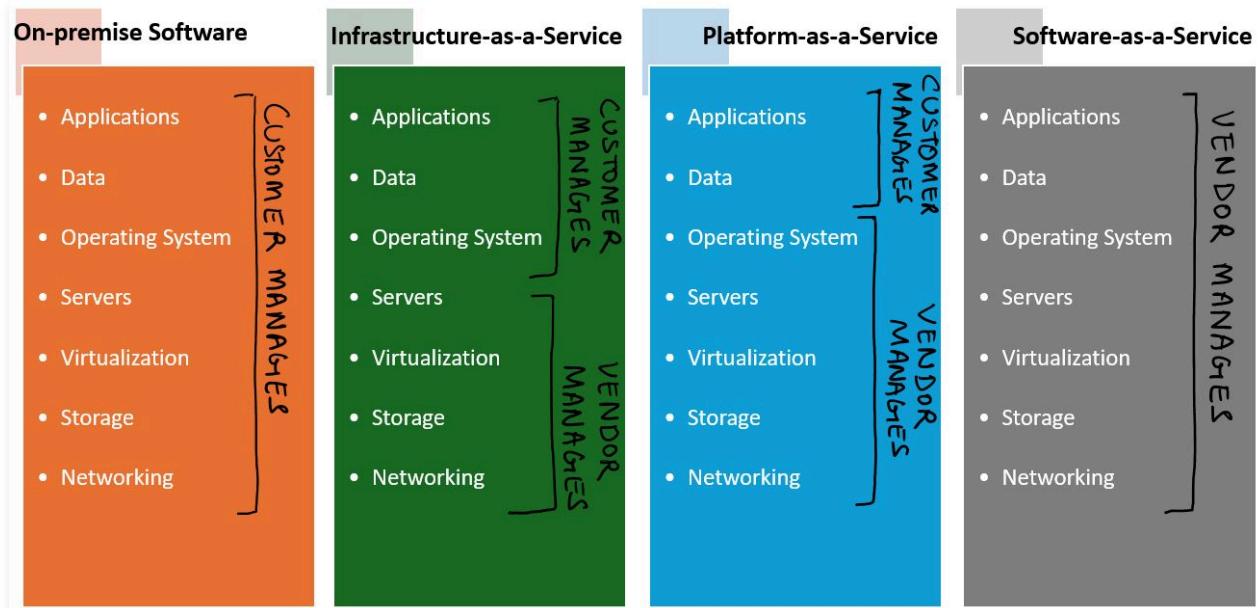
### Hybrid clouds

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

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## 2. Cloud Computing

Cloud computing services are based on 3 models: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), and Software-as-a-Service (SaaS). These models represent the 3 types of computing generally required by consumers: infrastructure to run software and store data (IaaS), platforms to develop applications (PaaS), and software applications to process their data (SaaS).



### Infrastructure as a Service (IaaS)

With the Infrastructure-as-a-Service (IaaS) model, cloud computing providers offer remotely accessible servers, networks, and storage capacity. They supply these resources on demand from their large pools of such resources, which are located in their data centers.

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

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

The examples of IaaS are deployments of Microsoft Azure and Amazon Web Services (AWS).

### Platform as a Service (PaaS)

In the Platform-as-a-Service (PaaS) model, customers rent servers, operating systems, storage, a database, software development technologies such as Java and .NET, and network capacity over the Internet. The PaaS model allows the customer to run existing applications and to develop and test new applications.

PaaS offers customers several advantages, which include the following:

- Application developers can develop and run their software solutions on a cloud platform without the cost and complexity of buying and managing the underlying hardware and software layers.
- Underlying computing and storage resources automatically scale to match application demand.
- Operating system features can be upgraded frequently.
- Geographically distributed development teams can work together on software development projects.
- PaaS services can be provided by diverse sources located throughout the world.
- Initial and ongoing costs can be reduced by the use of infrastructure services from a single vendor rather than maintaining multiple hardware facilities that often perform duplicate functions or suffer from incompatibility problems.

The examples of PaaS are Salesforce, Google App Engine (GAE).

### Software as a Service (SaaS)

With the Software-as-a-Service (SaaS) delivery model, cloud computing vendors provide software that is specific to their customers' requirements. SaaS is the most widely utilized service model, and it provides a broad range of software applications. SaaS providers typically charge their customers a monthly or yearly subscription fee.

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

What differentiates SaaS applications from other applications is its ability to scale. As a result, applications can run on as many servers as is necessary to meet changing demands. This process is transparent to the user.

To reduce the risk of an infrastructure outage, SaaS providers regularly back up all of their customers' data. In addition, customers can also back up their data on their storage hardware.

The examples of SaaS are Google G-Suite, Dropbox, Cisco Webex, Microsoft 365 etc.

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## 2. Cloud Computing

Flexible Access to Information

Enhanced Collaboration and Resource Sharing

Advanced Analytics Capabilities

Cost Efficiency and Financial Flexibility

Scalability and Resource Optimization

Agility and Innovation

Personalized Customer Experiences

Benefits of Cloud Computing

The advantages of cloud computing are listed below:

- Cloud computing can **enable companies to provide their employees with access to all the information** they need, no matter where they are, what device they are using, or whom they are working with. A company can expand its product and service sophistication without requiring its users to substantially increase their knowledge in order to utilize or maintain the product or service.
- Cloud based platforms can **bring together disparate groups of people who can collaborate and share** resources, information, and processes. For example, it enhances a company's ability to collaborate with its partners and customers, a process that can lead to greater productivity and increased innovation.
- **Analytics** is one of the most popular cloud computing applications. Companies today gather massive amounts of data, and cloud providers are providing hardware and software algorithms to help businesses perform sophisticated analyses of these data.
- Cloud computing can **help an organization reduce fixed IT costs** by enabling them to shift from capital expenses to operational expenses—or from fixed to variable. IT capital expenses—which typically include enterprise software licenses, servers and networking equipment, and other costs—tend to be more expensive than routine IT operating expenses. Cloud computing applications eliminate the need to purchase hardware, build and install software, and pay software licensing fees. The organization pays only for the computing resources it needs, and only when it needs them. This pay-for-use model provides greater flexibility, and it eliminates the need for significant capital expenditures.
- Cloud computing **allows organizations to use the amount of computing resources they need**. Therefore, companies utilizing cloud computing are able to increase the scope of their business operations.
- Cloud computing **enables businesses to rapidly adjust their processes, products, and services** to meet the changing needs of the market. Furthermore, cloud computing facilitates rapid prototyping and innovation, and it speeds up time to market for new products.
- Because of its expanded computing power and capacity, cloud computing can **store massive amounts of information** about user preferences. Companies can then utilize this information to customize their products and services.

## 2. Cloud Computing

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There are also some concerns and risks with the cloud computing. Let us discuss them:

- Historically, organizational IT systems have accumulated a diversity of hardware, operating systems, and applications. When bundled together, these systems are called "legacy spaghetti." These systems cannot easily be transferred to the cloud because they must first be untangled and simplified.
  - Many skeptics contend that cloud computing is not as reliable as a well-managed, on premise IT infrastructure.
  - Privacy advocates have criticized cloud computing for posing a major threat to privacy because the providers control, and thus lawfully or unlawfully monitor the data and communication stored between the user and the host company.
  - Critics also question how secure cloud computing really is. Because the characteristics of cloud computing can differ widely from those of traditional IT architectures, providers need to reconsider the effectiveness and efficiency of traditional security mechanisms. Security issues include access to sensitive data, data segregation (among customers), privacy, error exploitation, recovery, accountability, malicious insiders, and account control.
  - There are numerous legal and regulatory barriers to cloud computing, many of which involve data access and transport. For example, in 2018, the RBI mandated all payments system operators working in India to ensure that data related to payment systems operated by them is stored locally in the country.
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### 3. Artificial Intelligence



Artificial Intelligence (AI) is a branch of computer science that aims to create intelligent machines capable of performing tasks that typically require human intelligence. The field encompasses a broad range of techniques, algorithms, and methodologies designed to simulate various aspects of human cognition, perception, learning, reasoning, problem-solving, and decision-making.

#### Symbolic or rule-based AI

One approach to AI is symbolic or rule-based AI, which involves encoding human knowledge and rules into computer systems to enable them to perform tasks. These systems use logic and algorithms to manipulate symbols and make decisions based on predefined rules. Symbolic AI has been used in expert systems, where domain-specific knowledge is encoded in a set of rules to provide advice or make decisions in specific domains.

The examples are as follows:

#### Expert Systems

These are AI systems that emulate the decision-making ability of a human expert in a specific domain. For instance, expert systems have been developed in healthcare to diagnose diseases based on symptoms.

#### Logic Programming

Logic-based AI uses rules of formal logic to represent knowledge and make inferences. An example is Prolog, a programming language used for symbolic reasoning tasks.

#### Machine Learning

Another approach to AI is machine learning, which enables computers to learn from data and experiences without being explicitly programmed. Machine learning algorithms use statistical techniques to identify patterns and make predictions or decisions based on the data. Supervised learning involves training a model on labeled data, while unsupervised learning involves finding patterns in unlabeled data. Reinforcement learning is a type of machine learning where agents learn to make decisions by interacting with an environment and receiving feedback in the form of rewards or penalties.

Recommendation systems, such as those used by Netflix and Amazon, use machine learning algorithms to analyze user preferences and behaviors and recommend personalized content or products. Similarly, fraud detection systems in banking and finance leverage machine learning to detect unusual patterns or anomalies in transaction data and flag potentially fraudulent activities. Recommendation systems, such as those used by Netflix and Amazon, use machine learning algorithms to analyze user preferences and behaviors and recommend personalized content or products. Similarly, fraud detection systems in banking and finance leverage machine learning to detect unusual patterns or anomalies in transaction data and flag potentially fraudulent activities.

#### Deep learning

Deep learning is a subset of machine learning that uses artificial neural networks with multiple layers to learn from large

amounts of data. Deep learning algorithms can automatically discover features and representations from raw data, making them particularly effective for tasks such as image and speech recognition. Convolutional neural networks (CNNs) are commonly used for image recognition tasks, while recurrent neural networks (RNNs) are used for sequence data like text and speech.

Deep learning models can transcribe spoken language into text accurately. For example, voice assistants like Amazon Alexa and Google Assistant use deep learning for speech recognition.

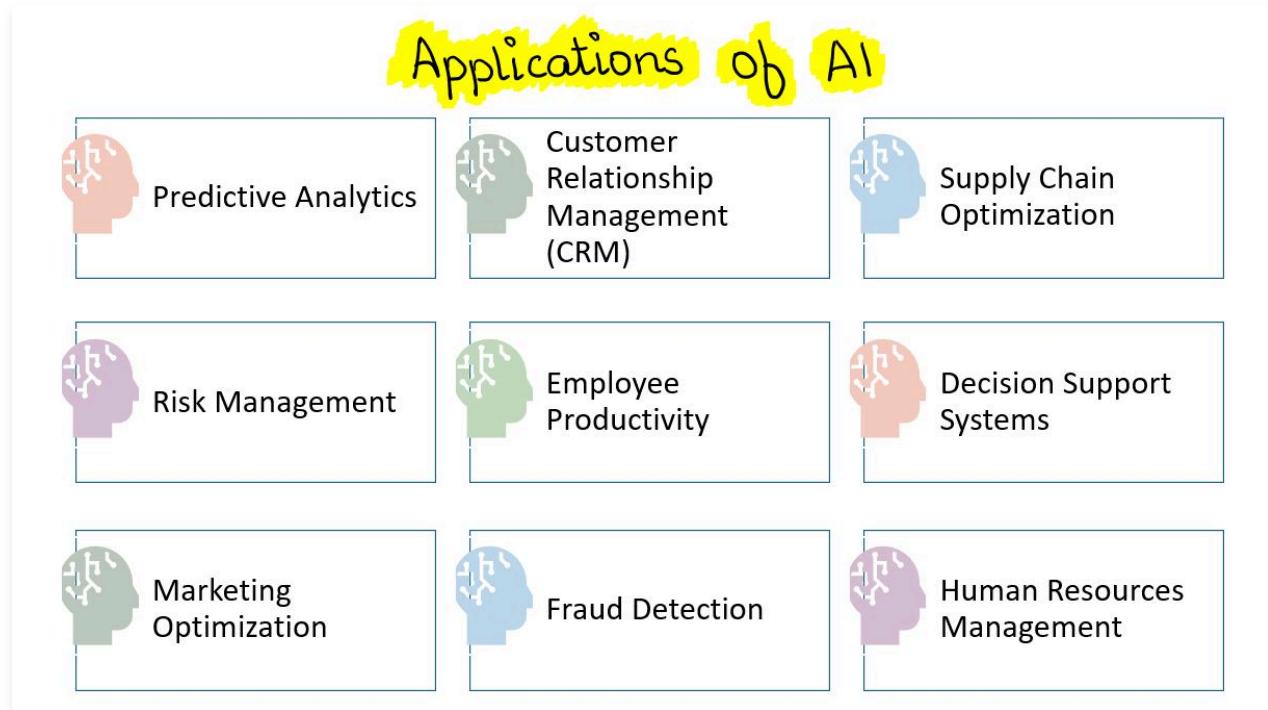
### **Natural Language Processing**

Natural Language Processing (NLP) is another area of AI that enables computers to understand, interpret, and generate human language. NLP involves tasks such as speech recognition, language translation, sentiment analysis, and text summarization. NLP techniques include parsing, part-of-speech tagging, named entity recognition, and language generation.

Chatbots and virtual assistants like Siri, Alexa, and Google Assistant use NLP to interpret user commands, answer questions, and carry out tasks such as setting reminders, sending messages, and searching the web.

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### 3. Artificial Intelligence



Here are some applications of Artificial Intelligence (AI) for business managers:

**Predictive Analytics:** AI-powered predictive analytics tools can analyze large datasets to forecast future trends, customer behavior, and market demand. Business managers can use these insights to make informed decisions about resource allocation, inventory management, and marketing strategies.

**Customer Relationship Management (CRM):** AI-based CRM systems can analyze customer interactions, preferences, and feedback to personalize marketing campaigns, improve customer service, and enhance customer satisfaction. Business managers can leverage AI-driven insights to optimize customer engagement and retention strategies.

**Supply Chain Optimization:** AI algorithms can optimize supply chain operations by predicting demand fluctuations, identifying bottlenecks, and optimizing inventory levels. Business managers can use AI-driven supply chain analytics to streamline logistics, reduce costs, and improve efficiency.

**Risk Management:** AI-powered risk management tools can analyze financial data, market trends, and external factors to identify potential risks and opportunities. Business managers can use AI-driven risk assessments to mitigate risks, optimize investment strategies, and ensure business continuity.

**Employee Productivity:** AI-enabled productivity tools, such as virtual assistants and workflow automation software, can streamline routine tasks, schedule meetings, and prioritize workloads. Business managers can empower employees to focus on high-value tasks and improve overall productivity.

**Decision Support Systems:** AI-driven decision support systems can analyze complex datasets, simulate scenarios, and recommend optimal courses of action. Business managers can use AI-powered decision support tools to make data-driven decisions, minimize uncertainties, and drive business growth.

**Marketing Optimization:** AI algorithms can analyze customer data, market trends, and competitor strategies to optimize marketing campaigns, target specific customer segments, and personalize content. Business managers can use AI-driven marketing platforms to maximize ROI and achieve marketing objectives.

**Fraud Detection:** AI-powered fraud detection systems can analyze transaction data, user behavior, and patterns to detect anomalies and potential fraud. Business managers can use AI-driven fraud detection tools to protect against financial losses, safeguard sensitive information, and maintain trust with customers.

**Human Resources Management:** AI-driven HR tools can automate recruitment processes, analyze employee performance, and identify training needs. Business managers can use AI-powered HR analytics to optimize workforce planning, reduce turnover, and foster a culture of continuous learning and development.



### 3. Artificial Intelligence

## Limitations of AI



Here are some limitations of Artificial Intelligence (AI):

**Lack of Creativity and Intuition:** While AI systems excel at performing specific tasks based on predefined rules and patterns, they lack the creativity, intuition, and contextual understanding that humans possess. This limitation restricts their ability to innovate, solve novel problems, and adapt to complex and unpredictable situations.

**Data Dependency and Bias:** AI algorithms heavily rely on vast amounts of data to learn and make decisions. However, if the training data is biased or incomplete, it can lead to biased outcomes and reinforce existing prejudices. Moreover, AI systems may struggle to generalize from limited or skewed datasets, resulting in inaccurate predictions and unreliable recommendations.

**Ethical and Social Implications:** The increasing autonomy and decision-making capabilities of AI systems raise ethical concerns regarding privacy, security, accountability, and fairness. There are also concerns about the potential misuse of AI for surveillance, discrimination, manipulation, and other nefarious purposes. Addressing these ethical and social implications requires careful regulation, oversight, and transparency.

**Interpretability and Explainability:** Many AI algorithms, such as deep learning neural networks, are often referred to as "black boxes" because their decision-making processes are opaque and difficult to interpret or explain. This lack of transparency undermines trust and confidence in AI systems, especially in critical applications where human lives or livelihoods are at stake.

**Robustness and Adversarial Attacks:** AI systems are susceptible to adversarial attacks, where malicious actors can manipulate input data to deceive or mislead the algorithm into making incorrect predictions or decisions. These vulnerabilities pose significant risks in security-sensitive domains, such as cybersecurity, autonomous vehicles, and financial trading.

**Resource Intensiveness and Energy Consumption:** Training and deploying AI models require significant computational resources, including high-performance hardware and large-scale datasets. This resource intensiveness not only limits the accessibility of AI technology to smaller organizations and developing countries but also contributes to environmental concerns, such as energy consumption and carbon emissions.

**Job Displacement and Economic Disruption:** The automation capabilities of AI have the potential to disrupt labor markets, displace jobs, and exacerbate socioeconomic inequalities. While AI can enhance productivity and create new job opportunities in some sectors, it may also lead to unemployment, skill mismatches, and income disparities in others. Addressing these economic challenges requires proactive policies for workforce reskilling, job transition, and social safety nets.

### **3. Artificial Intelligence**

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Here are some applications of AI in e-Governance.

#### **Citizen Service Chatbots**

AI-powered chatbots can handle citizen inquiries, provide information about government services, and assist with common tasks such as filling out forms, checking application status, and accessing public records. These chatbots leverage natural language processing (NLP) to understand and respond to citizen queries effectively, thereby enhancing accessibility and responsiveness of government services.

#### **Predictive Analytics for Policy Planning**

AI algorithms can analyze vast amounts of data from various sources to identify trends, patterns, and correlations that can inform policy decisions. By leveraging predictive analytics, governments can anticipate future needs, forecast demand for public services, and allocate resources more efficiently to address emerging challenges and opportunities.

#### **Fraud Detection and Prevention**

AI-powered systems can detect fraudulent activities, such as identity theft, tax evasion, and benefit fraud, by analyzing transactional data and identifying suspicious patterns or anomalies. These systems help government agencies mitigate financial losses, protect citizen data, and maintain the integrity of public programs and services.

#### **Smart Governance Platforms**

AI-enabled platforms can streamline administrative processes, automate routine tasks, and improve decision-making across various government departments and agencies. These platforms encompass functionalities such as document management, workflow automation, intelligent routing of requests, and real-time monitoring of key performance indicators (KPIs), enhancing operational efficiency and transparency in governance.

#### **Sentiment Analysis for Citizen Feedback**

AI algorithms can analyze social media feeds, online forums, and citizen feedback surveys to gauge public sentiment, identify issues of concern, and monitor public perception of government policies and initiatives. Sentiment analysis enables governments to proactively address citizen grievances, improve communication strategies, and foster greater trust and engagement with the public.

#### **Emergency Response and Disaster Management**

AI-powered systems can support emergency response efforts and disaster management operations by analyzing real-time data from sensors, satellites, and social media platforms to assess the impact of natural disasters, predict their trajectories, and coordinate rescue and relief efforts more effectively. AI algorithms can also optimize resource allocation and evacuation routes to minimize casualties and property damage during emergencies.

#### **Personalized Service Delivery**

AI technologies enable governments to personalize service delivery based on individual preferences, needs, and demographic characteristics. By leveraging data analytics and machine learning algorithms, governments can tailor information, recommendations, and assistance to each citizen's specific circumstances, thereby enhancing the relevance and effectiveness of government services.

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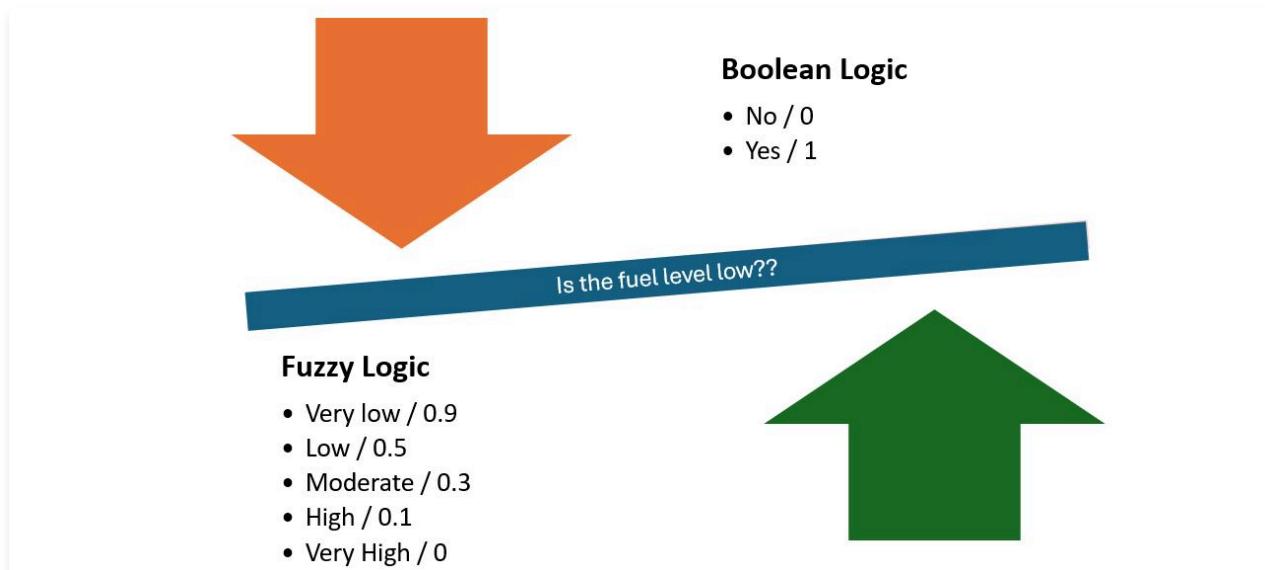
## 4. Fuzzy Logic

Fuzzy logic is an approach to computing based on "degrees of truth" rather than the usual "true or false" (1 or 0) Boolean logic on which the modern computer is based. The idea of fuzzy logic was first advanced by Dr. Lotfi Zadeh of the University of California at Berkeley in the 1960s.

Fuzzy logic is a branch of mathematics that deals with uncertainties by simulating the processes of human reasoning. The rationale behind fuzzy logic is that decision making is not always a matter of black or white, or true or false. Rather, it frequently involves gray areas where the term maybe is more appropriate.

Fuzzy logic seems closer to the way our brains work. We aggregate data and form a number of partial truths which we aggregate further into higher truths, which in turn, when certain thresholds are exceeded, cause certain further results such as motor reaction. A similar kind of process is used in neural networks, expert systems and other artificial intelligence applications.

A computer programmed to use fuzzy logic precisely defines subjective concepts that humans do not define precisely. For example, for the concept "income," descriptive terms such as "high" and "moderate" are subjective and imprecise. Using fuzzy logic, however, a computer could define "high" incomes as those exceeding Rs 2,00,000 per year, and "moderate" incomes as those ranging from Rs 1,00,000 to Rs 2,00,000 per year. A loan officer at a bank might then use these values when considering a loan application.



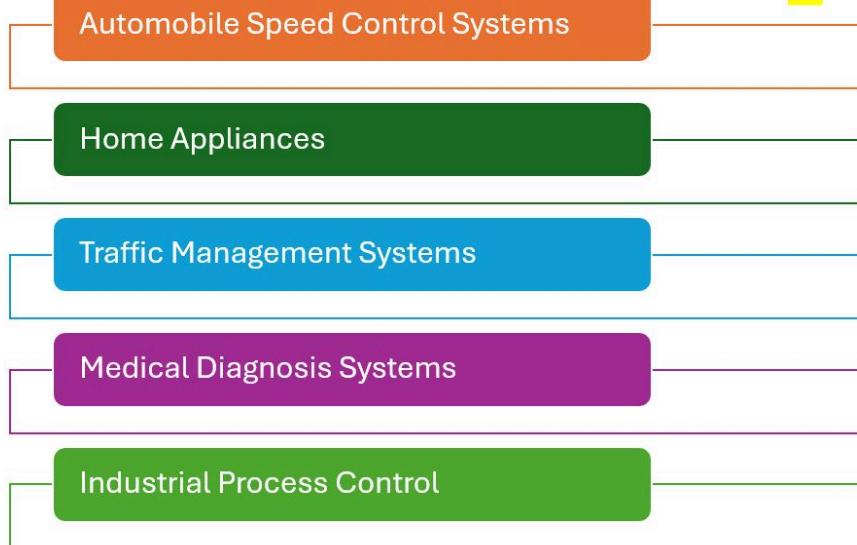
Take another example, in boolean logic, the decision about whether the fuel level is low or not is a binary one: either it's low (1) or it's not low (0).

In fuzzy logic, however, we can express the degree to which the fuel level is low using linguistic variables. For example, "Very Low" (0.9) would indicate that the fuel level is critically low, "Low" (0.5) suggests a moderately low level, "Moderate" (0.3) indicates a somewhat low level, "High" (0.1) indicates a relatively high level, and "Very High" (0) indicates a full tank.

Fuzzy logic has also been used in financial analysis and internet searches. In accounting and finance, fuzzy logic allows you to analyze assets expressed in imprecise values (e.g., intangible ones like goodwill). As an example, Google uses fuzzy logic to locate answers to your search terms, based on your perception of the topic as reflected in how you phrase your query, which determines the relevance of the Web pages that Google delivers to you.

## 4. Fuzzy Logic

### Applications of Fuzzy Logic



Here are a few use cases of fuzzy logic:

**Automobile Speed Control Systems:** Fuzzy logic is used in automobile speed control systems to adjust vehicle speed based on various factors such as road conditions, traffic density, and driver preferences. By considering these factors and applying fuzzy logic algorithms, the vehicle's speed can be controlled smoothly and efficiently, leading to improved safety and comfort for passengers.

**Home Appliances:** Fuzzy logic is applied in various home appliances such as washing machines, air conditioners, and refrigerators to optimize their performance based on user inputs and environmental conditions. For example, a washing machine equipped with fuzzy logic can adjust washing parameters such as water level, detergent amount, and wash cycle duration to ensure optimal cleaning results for different types of fabrics and soil levels.

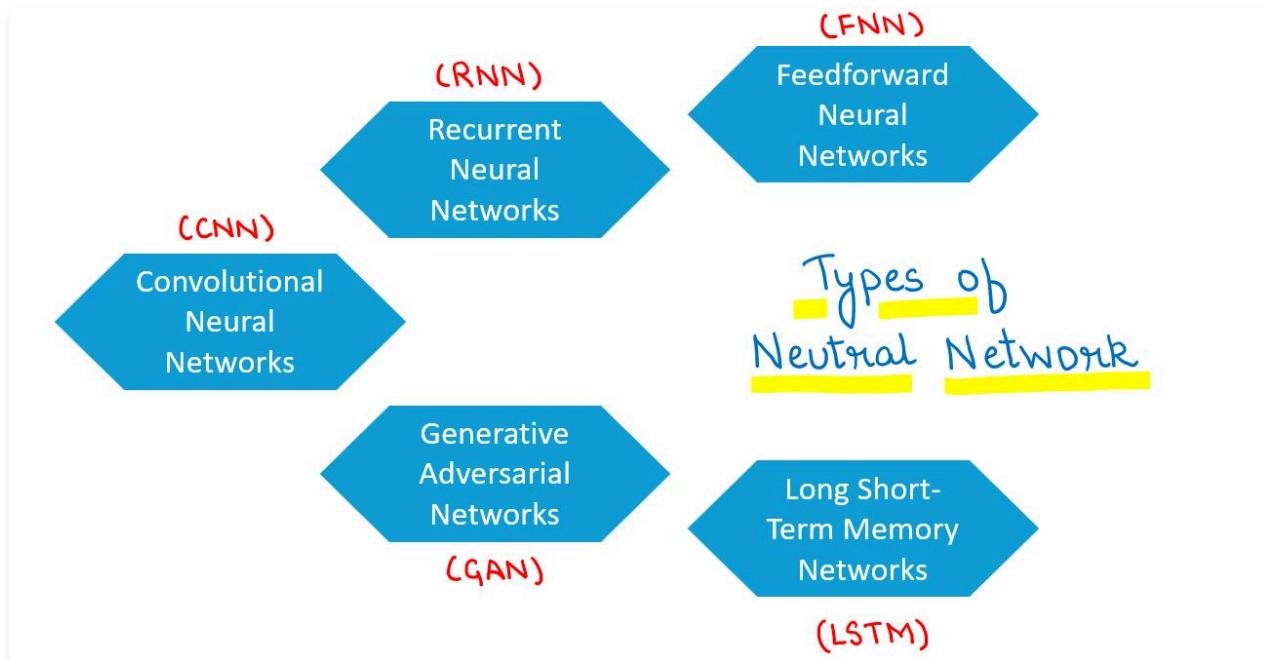
**Traffic Management Systems:** Fuzzy logic is utilized in traffic management systems to control traffic signals, optimize traffic flow, and reduce congestion on road networks. By analyzing real-time traffic data and adjusting signal timings dynamically, traffic management systems can improve traffic efficiency and reduce travel times for commuters.

**Medical Diagnosis Systems:** Fuzzy logic is employed in medical diagnosis systems to interpret diagnostic data and assist healthcare professionals in making accurate diagnoses. By considering uncertain and incomplete information from medical tests and patient symptoms, fuzzy logic algorithms can generate probabilistic diagnoses and recommend appropriate treatment options.

**Industrial Process Control:** Fuzzy logic is used in industrial process control systems to regulate and optimize manufacturing processes such as temperature control, pressure regulation, and chemical mixing. By incorporating fuzzy logic controllers into process control systems, manufacturers can improve production efficiency, minimize waste, and ensure product quality consistency.

## 5. Neural Network

A neural network is a computational model inspired by the structure and functioning of the human brain's biological neural networks. It consists of interconnected nodes, called neurons, organized in layers. Each neuron receives input signals, processes them using an activation function, and produces an output signal.



Neural networks are typically used for tasks involving pattern recognition, classification, regression, and optimization. They excel in tasks where traditional algorithms struggle to capture complex relationships or where large amounts of data are available for training.

There are several types of neural networks, each designed for specific tasks and structured in different ways:

### **Feedforward Neural Networks (FNN)**

In a feedforward neural network, information flows in one direction, from the input layer through one or more hidden layers to the output layer. These networks are commonly used for tasks such as classification and regression.

### **Recurrent Neural Networks (RNN)**

Recurrent neural networks have connections between neurons that form directed cycles, allowing them to retain information over time. They are well-suited for sequential data processing tasks, such as speech recognition, language modeling, and time series prediction.

### **Convolutional Neural Networks (CNN)**

Convolutional neural networks are designed to process grid-like data, such as images. They use convolutional layers to automatically learn hierarchical representations of features in the input data, making them highly effective for tasks such as image classification, object detection, and image segmentation.

### **Generative Adversarial Networks (GAN)**

Generative adversarial networks consist of two neural networks, a generator and a discriminator, trained simultaneously in a competitive manner. GANs are used to generate new data samples that resemble the training data, making them useful for tasks such as image generation, data augmentation, and image-to-image translation.

### **Long Short-Term Memory Networks (LSTM)**

LSTM networks are a type of recurrent neural network that includes specialized memory cells capable of storing information over long sequences. They are particularly effective for tasks involving sequential data processing and have been widely used in natural language processing, speech recognition, and time series analysis.

## 5. Neural Network

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Neural networks have a wide range of applications across various fields due to their ability to learn complex patterns and relationships from data. Some common applications of neural networks include:

**Image Recognition and Computer Vision:** Neural networks, particularly convolutional neural networks (CNNs), are widely used for tasks such as image classification, object detection, facial recognition, and image segmentation. Applications include autonomous vehicles, surveillance systems, medical imaging, and augmented reality.

**Natural Language Processing (NLP):** Recurrent neural networks (RNNs) and transformer-based models like the BERT and GPT series are used for tasks such as language translation, sentiment analysis, text summarization, speech recognition, and language generation. These applications are used in virtual assistants, chatbots, search engines, and machine translation services.

**Speech Recognition:** Neural networks are used for speech recognition tasks, including speech-to-text conversion, speaker identification, and emotion recognition from speech. Applications include voice-controlled devices, voice search, dictation software, and voice authentication systems.

**Healthcare:** Neural networks are used for medical image analysis, disease diagnosis, drug discovery, personalized medicine, and health monitoring. CNNs are used for tasks such as detecting tumors in medical images, while RNNs are used for analyzing time-series data from medical sensors.

**Financial Forecasting:** Neural networks are used for predicting stock prices, market trends, credit risk, and fraud detection in financial markets. They analyze large volumes of financial data to identify patterns and make predictions for investment decisions, risk management, and fraud prevention.

**Autonomous Vehicles:** Neural networks are used in self-driving cars for tasks such as object detection, lane detection, path planning, and decision-making. CNNs process sensor data from cameras and LiDAR sensors to detect and classify objects in the vehicle's environment.

**Gaming and Entertainment:** Neural networks are used in video games for tasks such as character animation, behavior prediction, and game testing. They are also used in content recommendation systems for personalized movie, music, and video recommendations based on user preferences and behavior.

**Manufacturing and Industry:** Neural networks are used for predictive maintenance, quality control, process optimization, and supply chain management in manufacturing industries. They analyze sensor data from equipment to detect anomalies, optimize production processes, and reduce downtime.

**Marketing and Customer Relationship Management (CRM):** Neural networks are used for customer segmentation, personalized marketing campaigns, churn prediction, and sentiment analysis of customer feedback. They help businesses understand customer behavior, preferences, and needs to improve customer engagement and satisfaction.

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## 6. Big Data

### Big Data Statistics: Global Big Data Market Size

1. Global big data analytics market is projected to reach US\$ 234.6 billion by 2026, growing at a CAGR of 10.2% between 2022 to 2026.

(PR Newswire)



**Big data** is an evolving term that describes a large volume of structured, semi-structured and unstructured data that has the potential to be mined for information and used in machine learning projects and other advanced analytics applications.

The Big Data are vast data sets that:

- exhibit variety;
- include structured, unstructured, and semi-structured data;
- are generated at high velocity with an uncertain pattern;
- do not fit neatly into traditional, structured, relational databases;
- can be captured, processed, transformed, and analyzed in a reasonable amount of time only by sophisticated information systems.

Big Data generally consists of the following information. Please keep in mind that this list is not inclusive. It will expand as new sources of data emerge.

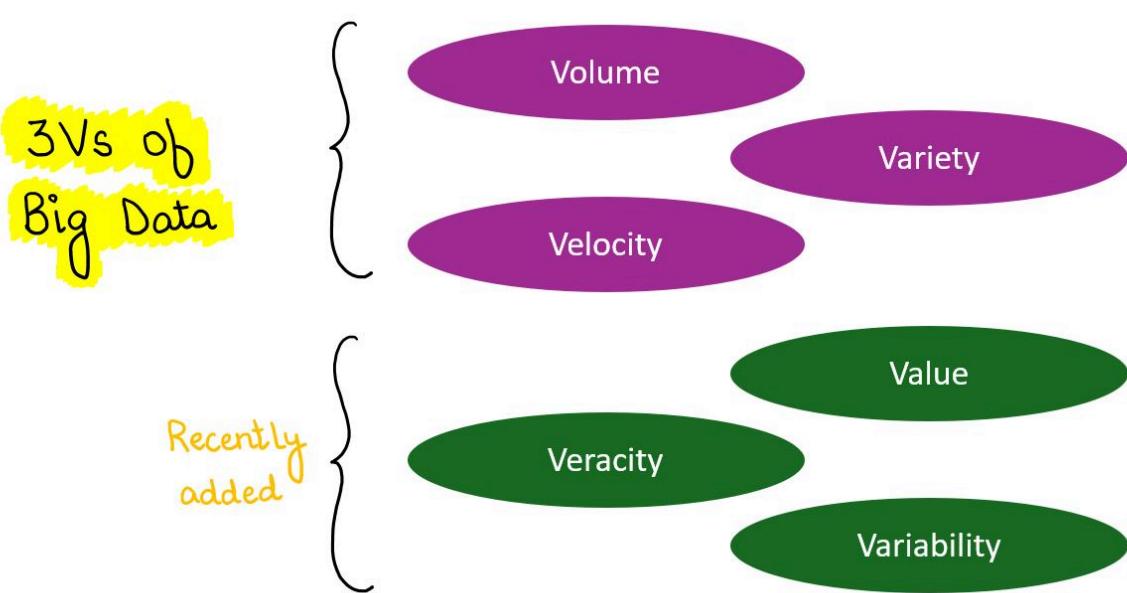
- **Traditional enterprise data**—examples are customer information from customer relationship management systems, transactional enterprise resource planning data, web store transactions, operations data, and general ledger data
- **Machine-generated/sensor data**—examples are smart meters; manufacturing sensors; sensors integrated into smartphones, automobiles, airplane engines, and industrial machines; equipment logs; and trading systems data
- **Social data**—examples are customer feedback comments; microblogging sites such as Twitter; and social media sites such as Facebook, YouTube, and LinkedIn
- **Images captured by billions of devices** located throughout the world, from digital cameras and camera phones to medical scanners and security cameras

Here are just a few examples of how organizations are employing big data to improve their day-to-day operations, planning, and decision making:

- Retail organizations monitor social networks such as Facebook, Google, LinkedIn, Twitter, and Yahoo to engage brand advocates, identify brand adversaries (and attempt to reverse their negative opinions), and even enable passionate customers to sell their products
- Advertising and marketing agencies track comments on social media to understand consumers' responsiveness to ads, campaigns, and promotions
- Hospitals analyze medical data and patient records to try to identify patients likely to need readmission within a few months of discharge, with the goal of engaging with those patients in the hope of preventing another expensive hospital stay
- Consumer product companies monitor social networks to gain insight into customer behavior, likes and dislikes, and product perception to identify necessary changes to their products, services, and advertising
- Financial services organizations use data from customer interactions to identify customers who are likely to be attracted to increasingly targeted and sophisticated offers

- Manufacturers analyze minute vibration data from their equipment, which changes slightly as it wears down, to predict the optimal time to perform maintenance or replace the equipment to avoid expensive repairs or potentially catastrophic failure.
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## 6. Big Data



Big data is often characterized by the 3Vs: the extreme **volume** of data, the wide **variety** of data types and the **velocity** at which the data must be processed. Those characteristics were first identified by Gartner analyst Doug Laney in a report published in 2001. More recently, several other Vs have been added to descriptions of big data, including veracity, value and variability.

Although big data doesn't equate to any specific volume of data, the term is often used to describe terabytes, petabytes and even exabytes of data captured over time. Such **voluminous** data can come from myriad different sources, such as business transaction systems, customer databases, medical records, internet clickstream logs, mobile applications, social networks, the collected results of scientific experiments, machine-generated data and real-time data sensors used in Internet of Things (IoT) environments. Data may be left in its raw form or preprocessed using data mining tools or data preparation software before it is analyzed.

Big data also encompasses a wide **variety** of data types, including structured data in SQL databases and data warehouses, unstructured data, such as text and document files held in Hadoop clusters, or NoSQL systems, and semi-structured data, such as web server logs or streaming data from sensors. Further, big data includes multiple, simultaneous data sources, which may not otherwise be integrated. For example, a big data analytics project may attempt to gauge a product's success and future sales by correlating past sales data, return data and online buyer review data for that product.

**Velocity** refers to the speed at which big data is generated and must be processed and analyzed. In many cases, sets of big data are updated on a real- or near-real-time basis, compared with daily, weekly or monthly updates in many traditional data warehouses. Big data analytics projects ingest, correlate and analyze the incoming data, and then render an answer or result, based on an overarching query. This means data scientists and other data analysts must have a detailed understanding of the available data and possess some sense of what answers they're looking for, to make sure the information they get is valid and up to date. Velocity is also important as big data analysis expands into fields like machine learning and artificial intelligence (AI), where analytical processes automatically find patterns in the collected data and use them to generate insights.

Data **veracity** refers to the degree of certainty in data sets. Uncertain raw data collected from multiple sources, such as social media platforms and webpages, can cause serious data quality issues that may be difficult to pinpoint. For example, a company that collects data from hundreds of sources may be able to identify inaccurate data, but its analysts need data lineage information to trace where the data is stored so they can correct the issues.

Some data scientists also add another V- **Value** - to the list of characteristics of big data. As explained above, not all data collected have real business value and the use of inaccurate data can weaken insights provided by analytics applications. It is critical that organizations employ practices such as data cleansing and confirm that data relates to relevant business issues before they use it in a big data analytics project.

**Variability** also often applies to sets of big data, which are less consistent than conventional transaction data and may have multiple meanings or be formatted in different ways from one data source to another- things that further complicate efforts to

process and analyze the data.

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## 6. Big Data

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The first step for many organizations toward managing Big Data was to integrate information silos into a database environment and then, to develop data warehouses for decision making. After completing this step, many organizations turned their attention to the business of information management—making sense of their proliferating data.

Many organizations are turning to NoSQL databases (think of them as “not only SQL” databases) to process Big Data. These databases provide an alternative for firms that have more and different kinds of data (Big Data) in addition to the traditional, structured data that fit neatly into the rows and columns of relational databases. The traditional relational databases such as Oracle and MySQL store data in tables organized into rows and columns. Each row is associated with a unique record, for instance a customer account, and each column is associated with a field that defines an attribute of that account (e.g., customer name, customer identification number, customer address, etc.).

In contrast, NoSQL databases can manipulate structured as well as unstructured data and inconsistent or missing data. For this reason, NoSQL databases are particularly useful when working with Big Data. Many products utilize NoSQL databases, including Cassandra, CouchDB, MongoDB, and Hadoop.

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## 6. Big Data

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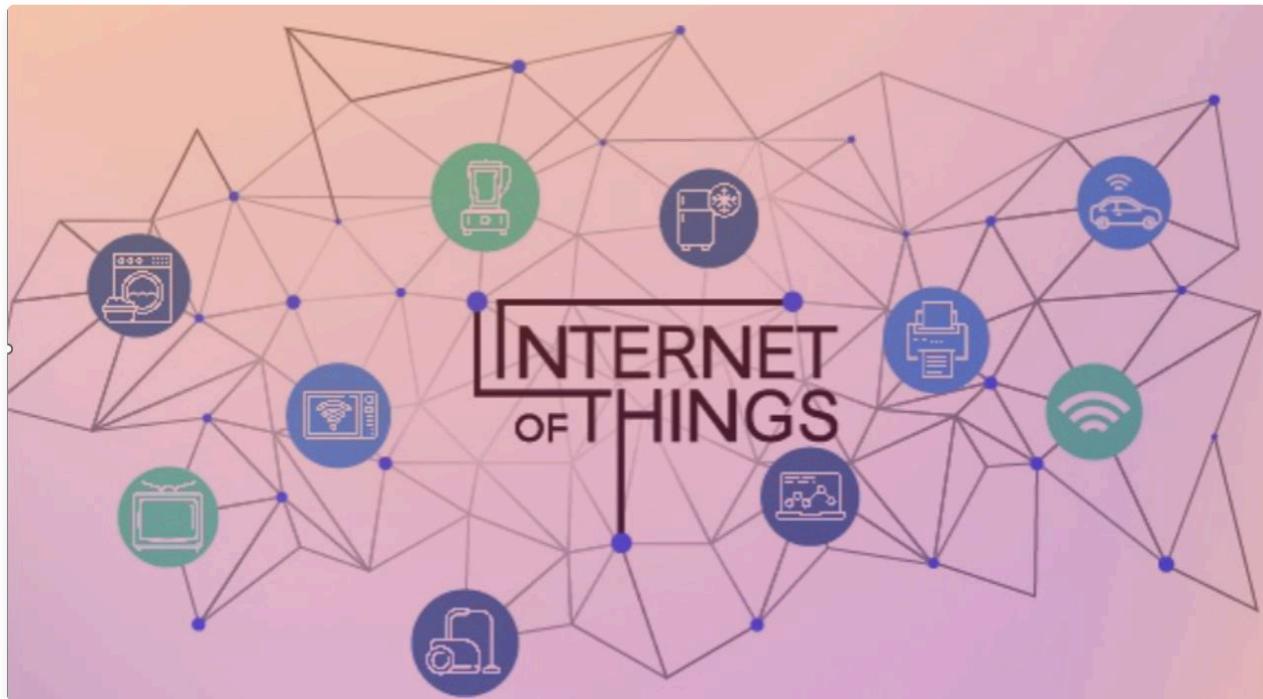
Hadoop is an open-source software framework that includes several software modules that provide a means for storing and processing extremely large data sets. Hadoop has two primary components: a data processing component (a Java-based system called **MapReduce**) and a distributed file system (**Hadoop Distributed File System, HDFS**) for data storage.

Hadoop divides data into subsets and distributes the subsets onto different servers for processing. A Hadoop cluster may consist of thousands of servers. In a Hadoop cluster, a subset of the data within the HDFS and the MapReduce system are housed on every server in the cluster. This places the data processing software on the same servers where the data is stored, thus speeding up data retrieval. This approach creates a highly redundant computing environment that allows the application to keep running even if individual servers fail.

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## 7. Internet of Things

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The Internet of Things (IoT) refers to the network of physical devices, vehicles, home appliances, and other items embedded with sensors, software, and connectivity that enables them to connect and exchange data over the internet. In simple terms, IoT devices are everyday objects that are connected to the internet and can communicate with each other and with other internet-enabled devices.

The concept of IoT revolves around the idea of creating a network where objects can collect and exchange data without requiring human-to-human or human-to-computer interaction. These devices can range from smart thermostats and wearable fitness trackers to industrial machinery and smart city infrastructure.

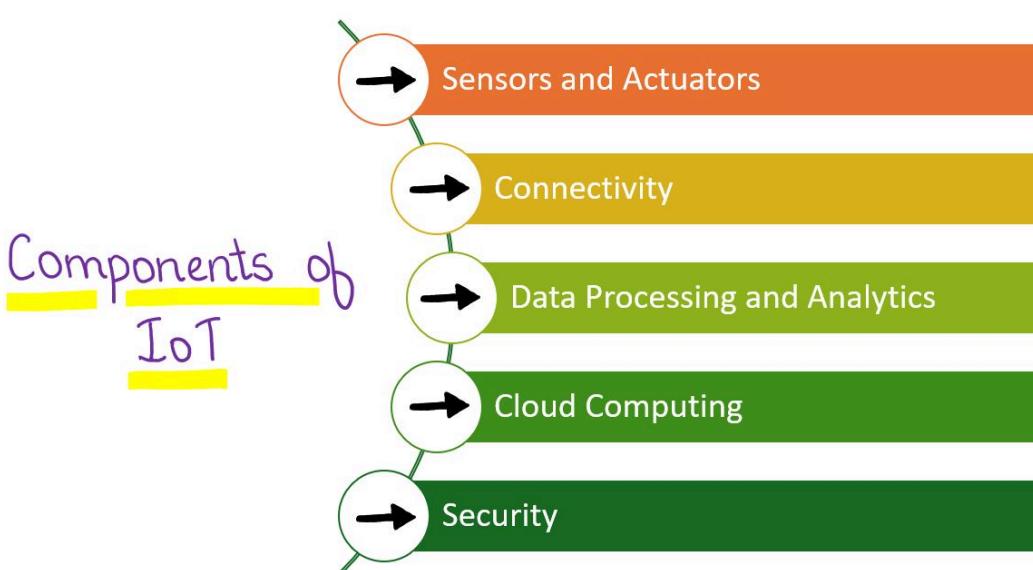
Two examples of IoT are discussed below:

**Smart Home:** In a smart home, IoT devices such as smart thermostats, lights, and security cameras enable homeowners to control and monitor their home remotely using a smartphone or voice commands. For example, a smart thermostat can adjust the temperature based on occupancy patterns, while smart lights can be programmed to turn on and off automatically.

**Industrial IoT (IIoT):** In industrial settings, IoT sensors and monitoring systems are used for predictive maintenance of machinery and equipment. For instance, sensors installed on manufacturing equipment can detect abnormalities in operating conditions and send alerts to maintenance personnel, allowing them to perform preventive maintenance before a breakdown occurs. Additionally, IIoT enables real-time monitoring of production processes and optimization of factory operations for improved efficiency and productivity.

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## 7. Internet of Things



Key Components of IoT include:

### **Sensors and Actuators**

IoT devices are equipped with sensors that collect data from the environment, such as temperature, humidity, light, motion, and location. Actuators, on the other hand, allow IoT devices to perform actions based on the data they receive, such as adjusting the temperature of a room or controlling the speed of a motor.

### **Connectivity**

IoT devices use various communication technologies to connect to the internet and to each other. These technologies include Wi-Fi, Bluetooth, Zigbee, cellular networks, and low-power wide-area networks (LPWANs), among others.

### **Data Processing and Analytics**

The data collected by IoT devices is processed and analyzed either locally on the device itself or in the cloud. Advanced analytics techniques, including machine learning and artificial intelligence, are often used to derive insights from the data and make intelligent decisions.

### **Cloud Computing**

Cloud platforms play a crucial role in IoT by providing storage, processing power, and services for managing and analyzing IoT data. Cloud-based IoT platforms enable scalability, flexibility, and accessibility for IoT applications.

### **Security**

Security is a critical consideration in IoT, given the large number of connected devices and the potential risks associated with data privacy and device vulnerabilities. IoT security measures include encryption, authentication, access control, and secure communication protocols.

## 7. Internet of Things

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Here are some common applications of IoT across various domains:

**Smart Buildings:** IoT devices are integrated into building systems for smart building management, energy efficiency, and occupant comfort. Smart thermostats, lighting controls, occupancy sensors, and building automation systems enable facility managers to optimize energy usage, maintain indoor comfort, and reduce operational expenses in commercial and residential buildings.

**Industrial IoT (IIoT):** In manufacturing and industrial settings, IoT sensors and connected devices are used for predictive maintenance, asset tracking, inventory management, and process optimization. IIoT enables real-time monitoring of equipment performance, reduces downtime, and improves overall efficiency.

**Smart Cities:** IoT technology is deployed in urban infrastructure for various applications such as traffic management, waste management, environmental monitoring, and public safety. Smart sensors and connected devices collect data to optimize city operations, reduce congestion, enhance public services, and improve quality of life for residents.

**Healthcare:** IoT devices are used in healthcare for remote patient monitoring, telemedicine, medical asset tracking, and medication management. Wearable devices, smart medical implants, and connected healthcare systems enable continuous monitoring of patient health, early detection of medical issues, and personalized treatment.

**Agriculture:** IoT solutions are employed in agriculture for precision farming, crop monitoring, livestock tracking, and irrigation management. Smart sensors, drones, and autonomous vehicles collect data on soil conditions, weather patterns, crop health, and animal behavior to optimize agricultural practices, increase yields, and conserve resources.

**Retail:** IoT technology is used in retail environments for inventory management, supply chain optimization, personalized marketing, and customer engagement. RFID tags, beacons, and smart shelves enable retailers to track inventory levels, analyze customer behavior, and deliver targeted promotions and services.

**Energy Management:** IoT devices are deployed in energy systems for smart grid management, energy monitoring, and demand response. Smart meters, sensors, and energy management systems enable utilities and consumers to monitor energy consumption in real time, optimize energy usage, and reduce costs.

**Transportation and Logistics:** IoT technology is utilized in transportation and logistics for fleet management, vehicle tracking, route optimization, and predictive maintenance. Connected vehicles, GPS trackers, and smart logistics platforms enable companies to monitor their fleets in real time, improve delivery efficiency, and reduce transportation costs.

**Environmental Monitoring:** IoT sensors are deployed for environmental monitoring applications such as air quality monitoring, water quality monitoring, and weather forecasting. These sensors collect data on pollution levels, water conditions, and weather patterns, which helps in assessing environmental health, identifying pollution sources, and implementing mitigation measures.

**Remote Asset Management:** IoT solutions are employed for remote asset monitoring and management in industries such as oil and gas, mining, and utilities. Connected sensors and monitoring devices track the condition and performance of assets such as machinery, equipment, and infrastructure in remote or hazardous environments, enabling proactive maintenance, minimizing downtime, and ensuring safety.

**Supply Chain Visibility:** IoT technology is used to enhance supply chain visibility and transparency by tracking goods and shipments throughout the supply chain. IoT-enabled tracking devices, RFID tags, and blockchain technology provide real-time visibility into the movement, location, and condition of products, enabling better inventory management, logistics planning, and compliance with regulations.

These applications demonstrate the diverse range of IoT deployments across different sectors, highlighting the versatility and transformative potential of IoT technology in addressing various business challenges and improving operational efficiency.

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## 8. Blockchain and Bitcoins

Blockchain is a specific type of database. It differs from a typical database in the way it stores information. The blockchains store data in blocks that are then chained together. As new data comes in it is entered into a fresh block. Once the block is filled with data it is chained onto the previous block, which makes the data chained together in chronological order.



Different types of information can be stored on a blockchain but the most common use so far has been as a ledger for transactions.

Thus, a blockchain is a decentralized ledger of all transactions across a peer-to-peer (P2P, and thus it is distributed and public). Using this technology, participants can confirm transactions without a need for a central clearing authority.

Bitcoin is one of many applications of blockchain technology. In Bitcoin's case, blockchain is used in a decentralized way so that no single person or group has control—rather, all users collectively retain control. Decentralized blockchains are immutable, which means that the data entered is irreversible. For Bitcoin, this means that transactions are permanently recorded and viewable to anyone.

In a blockchain, each node has a full record of the data that has been stored on the blockchain since its inception. For Bitcoin, the data is the entire history of all Bitcoin transactions. If one node has an error in its data it can use the thousands of other nodes as a reference point to correct itself. This way, no one node within the network can alter information held within it. Because of this, the history of transactions in each block that make up Bitcoin's blockchain is irreversible.

A **Cryptocurrency** is a medium of exchange, such as the Indian Rupees, but is digital and uses encryption techniques to control the creation of monetary units and to verify the transfer of funds. The *Bitcoin* is one example of Cryptocurrency.

The Blockchain is the technology that enables the existence of Cryptocurrency (among other things). Satoshi Nakamoto (Japan) is the name used by the presumed pseudonymous person or persons who developed bitcoin.

In April 2018, the RBI published a circular that the "entities regulated by the RBI" shall not deal in Virtual Currencies (Crypto Currencies) This was done considering the risks associated in dealing with such virtual currencies.

The Government is also considering a law through "Banning of Cryptocurrency and Regulation of Official Digital Currency Bill 2019" to regulate Cryptocurrencies.

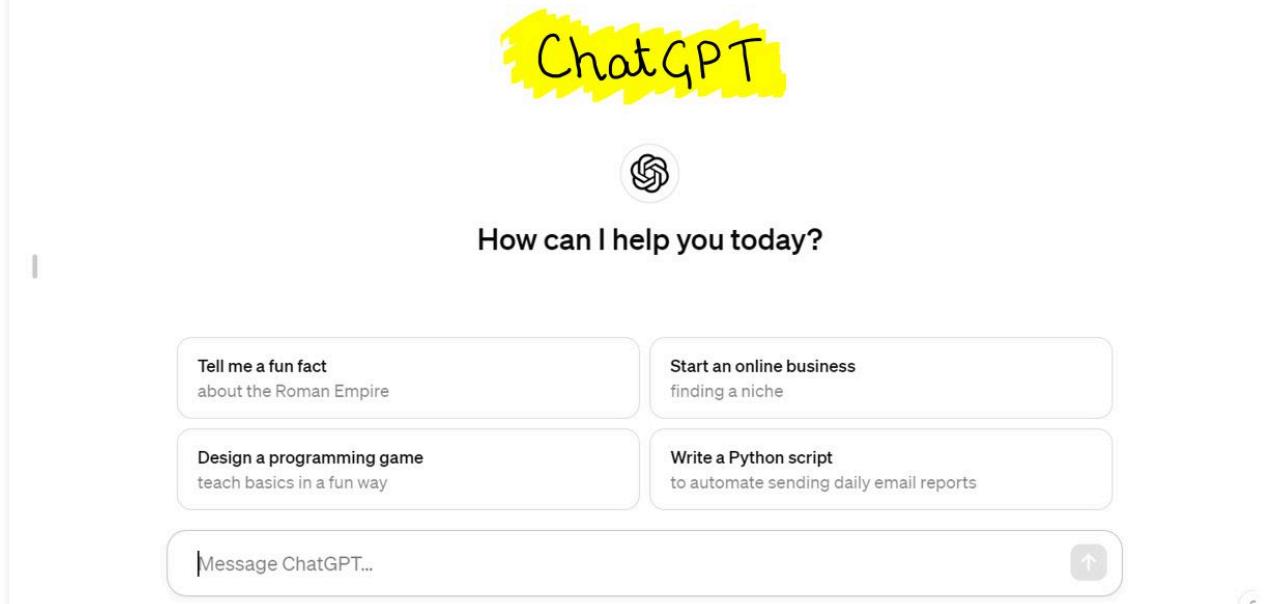
Some of other applications of blockchain are listed below:

- Secure sharing of medical data
- Music royalties tracking
- Cross-border payments

- Real-time IoT operating systems
  - Personal identity security
  - Anti-money laundering tracking system
  - Supply chain and logistics monitoring
  - Voting mechanism
  - Original content creation
  - Land records processing platform.
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## 9. Generative AI and ChatGPT

ChatGPT 3.5 ▾



Generative AI, also known as **generative artificial intelligence**, is a branch of artificial intelligence that focuses on creating models capable of generating new and original content. These models are designed to mimic human creativity and generate content such as text, images, music, or even videos. By learning patterns and structures from vast amounts of training data, generative AI models can generate content that closely resembles the examples they were trained on.

One prominent example of generative AI is ChatGPT, developed by OpenAI. ChatGPT is based on the GPT (Generative Pre-trained Transformer) architecture, which is a deep learning model known for its ability to process and generate text data. ChatGPT has been specifically trained on a diverse range of internet text, allowing it to understand and generate human-like responses in conversations.

The underlying technology of generative AI involves leveraging neural networks and advanced machine learning techniques. Neural networks are computational models inspired by the human brain, consisting of interconnected layers of artificial neurons. These networks are trained on large datasets, adjusting the connection weights between neurons to learn the patterns and relationships within the data.

In the case of generative AI, the training process involves exposing the model to massive amounts of data and training it to predict the next likely element in a sequence. For example, in the case of text generation, the model is trained to predict the next word or character based on the preceding context. By repeating this process over many iterations, the model gradually learns the statistical patterns and dependencies in the data.

Once trained, generative AI models like ChatGPT can generate new content by sampling from the learned distribution of possible outputs. The model takes an input prompt and generates a response that is coherent and contextually relevant based on the patterns it learned during training. While the generated content may not be entirely original, it can exhibit remarkable creativity and produce outputs that are indistinguishable from human-generated content in some cases.

However, it is important to note that generative AI models like ChatGPT are not truly conscious or understanding entities. They lack genuine comprehension or intention behind their responses. Instead, they excel at pattern recognition and statistical inference, using the vast amount of data they were trained on to generate plausible and coherent text.

ChatGPT and similar generative AI models have numerous applications across various domains. They can be used for chatbots and virtual assistants, providing natural language interaction and assistance. They can also support content generation, aiding writers, artists, and musicians in the creative process by generating ideas or providing inspiration. Additionally, generative AI models have potential applications in education, research, and even entertainment, where they can simulate virtual characters or generate interactive narratives.

Despite their impressive capabilities, generative AI models also present certain challenges and ethical considerations. They can inadvertently generate biased or inappropriate content if not properly monitored or guided. OpenAI, the organization behind ChatGPT, has implemented mechanisms to mitigate such issues, including the use of reinforcement learning from human feedback and employing safety measures to prevent malicious use of the technology.

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# 10. Trends in Information Technology

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Several top trends in information technology (IT) are shaping the business landscape and are crucial for organizations to understand and leverage for competitive advantage. Some of the key trends include:

## **Artificial Intelligence (AI) and Machine Learning**

AI and machine learning technologies are revolutionizing business processes by automating tasks, predicting outcomes, and providing valuable insights from data. Businesses are using AI for customer service chatbots, personalized recommendations, predictive maintenance, and more.

## **Internet of Things (IoT)**

The IoT involves connecting everyday objects to the internet, enabling them to collect and exchange data. Businesses are leveraging IoT devices for asset tracking, remote monitoring, smart manufacturing, and improving operational efficiency.

## **Cybersecurity**

With the increasing frequency and sophistication of cyber threats, cybersecurity has become a top priority for businesses. Organizations are investing in robust cybersecurity measures to protect sensitive data, secure networks, and safeguard against cyber attacks and data breaches.

## **Cloud Computing**

Cloud computing offers scalable and flexible IT infrastructure and services over the internet, allowing businesses to access computing resources on-demand. Cloud technologies are driving digital transformation initiatives, enabling remote work, enhancing collaboration, and reducing IT costs.

## **Digital Transformation**

Digital transformation involves adopting digital technologies to fundamentally change business processes, operations, and customer experiences. Businesses are embracing digital transformation initiatives to enhance agility, innovate new products and services, and stay competitive in the digital age.

## **Remote Work and Collaboration Tools**

The COVID-19 pandemic has accelerated the adoption of remote work and collaboration tools, transforming how businesses operate and engage with employees and customers. Organizations are investing in remote work technologies, such as video conferencing, project management platforms, and virtual collaboration tools, to enable seamless communication and collaboration.

## **Mobile Apps**

Mobile applications have only grown in popularity over the past few years, and every year, they are surfacing in bigger and better ways. The industries all over the world are trying to find ways in which one can improve their work through the use of mobile apps and through the implementation of new resources that can make working on-the-go more efficient.

## **Big Data Analytics**

Big data analytics allows companies to process their information in a better manner and enables them to reach a much better understanding of the areas they need to develop. Many modern tech organizations are deploying big data analytics to cost reduction, improve decision making, and market new products or services. With big data analytics solutions equipped, you can improve the processing of technical information, enhance your data security, and boost your overall digital agility.

## **Chatbots**

Chatbots have improved the customer service experience for firms. Chatbots are a program used to respond to certain queries in certain ways and are designed to help customers with some of the more basic functions that they would need. These are, of course, still not in a position wherein they are a complete substitute for real live customer service, which is what has helped them still stay in development.

## **Hardware is becoming faster, cheaper and smaller**

Because of their portability and wireless capabilities, lightweight laptop and notebook computers are replacing larger desktop machines in offices today. They can be carried into meetings, taken on business trips, and used at home to remotely connect to

office systems. Smaller, handheld devices have also continued to improve in functionality and have become indispensable tools to access e-mail and other applications inside and outside of the office, on the factory floor, as well as in hospital corridors.

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## 1. Introduction

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The **International Business** refers to all commercial transactions, including sales, investments, and transportation, that take place between two or more countries. Though many people use the terms international business and international trade synonymously, the former is a much broader term. International business involves not only trade in goods and services, but also other operations, such as production and marketing of goods and services in foreign countries.

Countries all over the world are undergoing a fundamental shift in the way they produce and market various products and services. The national economies which so far were pursuing the goal of self-reliance are now becoming increasingly dependent upon others for procuring as well as supplying various kinds of goods and services. Due to increased cross border trade and investments, countries are no more isolated.

The prime reason behind this radical change is the development of communication, technology, infrastructure etc. Emergence of newer modes of communication and development of faster and more efficient means of transportation have brought nations closer to one another. Countries that were cut-off from one another due to geographical distances and socio-economic differences have now started increasingly interacting with others. The World Trade Organization (WTO) and reforms carried out by the governments of different countries have also been a major contributory factor to the increased interactions and business relations amongst the nations.

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## 2. Scope of International Business

As pointed out earlier, international business is much broader than international trade. It includes not only international trade (i.e., export and import of goods and services), but also a wide variety of other ways in which the firms operate internationally.



Major forms of business operations that constitute international business are as follows:

(i) **Merchandise exports and imports:** Merchandise means goods that are tangible, i.e., those that can be seen and touched. When viewed from this perspective, it is clear that while merchandise exports mean sending tangible goods abroad, merchandise imports mean bringing tangible goods from a foreign country to one's own country. Merchandise exports and imports, also known as trade in goods, include only tangible goods and exclude trade in services.

(ii) **Service exports and imports:** It is because of the intangible aspect of services that trade in services is also known as invisible trade. A wide variety of services are traded internationally and these include: tourism and travel, boarding and lodging (hotel and restaurants), entertainment and recreation, transportation, professional services (such as training, recruitment, consultancy and research), communication (postal, telephone, fax, courier and other audio-visual services), construction and engineering, marketing (e.g., wholesaling, retailing, advertising, marketing research and warehousing), educational and financial services (such as banking and insurance). Of these, tourism, transportation and business services are major constituents of world trade in services.

(iii) **Licensing and franchising:** Permitting another party in a foreign country to produce and sell goods under your trademarks, patents or copy rights in lieu of some fee is another way of entering into international business. It is under the licensing system that Pepsi and Coca Cola are produced and sold all over the world by local bottlers in foreign countries.

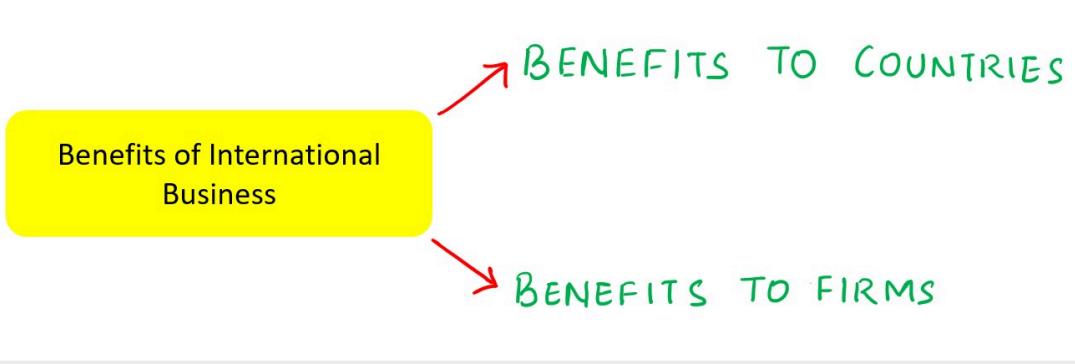
Franchising is similar to licensing, but it is a term used in connection with the provision of services. McDonalds, for instance, operates fast food restaurants all over the world through its franchising system.

(iv) **Foreign investments:** Foreign investment is another important form of international business. Foreign investment involves investments of funds abroad in exchange for financial return. Foreign investment can be of two types: direct and portfolio investments.

A **Direct Investment** takes place when a company directly invests in properties such as plant and machinery in foreign countries with a view to undertake production and marketing of goods and services in those countries. Direct investment provides the investor a controlling interest in a foreign company, known as Direct Investment, i.e., FDI. It can be in the form of Joint Venture. A company, if it so desires, can also set up a wholly owned subsidiary abroad by making 100 per cent investment in foreign ventures, and thus acquiring full control over subsidiary's operations in the foreign market.

A **Portfolio Investment**, on the other hand, is an investment that a company makes into another company by the way of acquiring shares or providing loans to the latter and earns income by way of dividends or interest on loans. Unlike foreign direct investments, the investor under portfolio investment does not get directly involved into production and marketing operations. It simply earns an income by investing in shares, bonds, bills, or notes in a foreign country or providing loans to foreign business firms.

### 3. Benefits of International Business



Some of the benefits of international business to the nations and business firms are discussed next.

### 3. Benefits of International Business

The benefits of international business to the countries are listed below:

- (i) **Earning of foreign exchange:** International business helps a country to earn foreign exchange which it can later use for meeting its imports of capital goods, technology, petroleum products and fertilizers, pharmaceutical products and a host of other consumer products which otherwise might not be available domestically.
- (ii) **More efficient use of resources:** The international business operates on a simple principle. Produce what your country can produce more efficiently, and trade the surplus production, so generated, with other countries to procure what they can produce more efficiently.
- (iii) **Improving growth prospects and employment potentials:** Producing solely for the purposes of domestic consumption severely restricts a country's prospects for growth and employment. Many countries, such as Singapore, South Korea and China which saw markets for their products in the foreign countries embarked upon the strategy 'export and flourish', and soon became the star performers on the world map. This helped them not only in improving their growth prospects, but also created opportunities for employment of people living in these countries.
- (iv) **Increased standard of living:** In the absence of international trade of goods and services, it would not have been possible for the world community to consume goods and services produced in other countries. Now the people in these countries are able to consume and enjoy a higher standard of living.