**Chapter 2**

1. **What is the internet?**

The Internet is an enormous global network of networks that can connect every computing device to its vast resources, and to every other computer on the planet.

1. **What was the precursor to Internet as we know it today?**

In the 1960s, the Advanced Research Projects Agency (ARPA), part of the Department of Defense, funded a proposed network project called the Advanced Research Projects Agency Network (ARPANET), through the Association for Computing Machinery (ACM). In 1969, the experimental ARPANET was constructed. Arpanet was the precursor to the Internet.

1. **What is a protocol?**

Protocols are sets of specifications and procedures used by systems to communicate with each another.

* + - Important protocols are the Transmission Control Protocol (TCP) and Hypertext Transfer Protocol Secure (HTTPS).

1. **What is the World Wide Web?**

The web is a way to view and share information over the internet. Tim Berners-Lee invented the World Wide Web (WWW). His idea was the creation of a service that merged HTML, URL and HTTP, so that all computers could understand each other in an easy to use global information system.

1. **What do the terms client/server mean?**

Server refers to a piece of hardware or software used to provide resources for other computers or devices, called "clients".

A “client” is a computing device that can utilize and share network resources.

A computing device on a TCP/IP network that handles network and node requests for applications, and offers resources and services is called a “host”.

1. **What is a node?**

In networking, a **“node”** refers to any addressable device, redistribution point, connection point, or communication endpoint that is connected to a network.

1. **What is an access point?**

An Access Point (AP) or Wireless Access Point (WAP) is a networking device that contains a radio transmitter and a receiver signal, enabling other computing devices to connect to the network and communicate with each other.

* + - An access point can connect routers, switches and hubs via Ethernet cables or Wi-Fi signals.

For example, we may want to enable Wi-Fi access to a specific area, but we are not within range of the router.

* + - The solution is to install an access point and run an ethernet cable from it to the server.
    - This small, wired connection allows the wireless network to broadcast in a designated area. Access Points operate at Layer 2, Data Link, of the OSI model.

1. **What is an Address Resolution Protocol (ARP)?**

An ARP is a network protocol that finds the Media access control addresses (MAC) address of a device from an IP address.

1. **What is a network bridge?**

A network bridge is a network device that connects two or more networks or segments.

* + - The bridge is responsible for regulating incoming traffic by inspecting it and deciding whether to forward it or to filter it (block it), thereby reducing unnecessary traffic.
    - A bridge can also store Media access control addresses (MAC).

1. **What is an Internet Protocol address (IP address)?**

Internet Protocol address (IP address) is a unique identifier assigned to every single computing device on a TCP/IP network.

* + - The IP address has two primary functions: it identifies the host’s or network interface identification and location addressing.
    - When a computing device sends data to another device, the data headers that are sent contain information about the sending device’s IP address along with the destination device’s IP address.

1. **What is a Dynamic Host Configuration Protocol (DHCP)?**

The DHCP is the client or server that is responsible for assigning a dynamic IP address to client computers and other related configuration information.

1. **What is the Domain Name System (DNS)?**

The DNS is a directory of the IP addresses of the entire Internet.

The DNS translates domain addresses into names, which people can remember, or maps host names into IP addresses.

* + - The DNS allows people to use words in place of an IP address when searching.
    - For example, when we type www.CISCO.com into a browser, the browser asks the DNS to find CISCO’s IP address.
    - The DNS will return the IP address for CISCO’s domain name (72.163.4.185) and the browser will connect to the IP address.

1. **Describe Hub, Switch, and Router?**

A Hub connects computing devices and serves as a connection point within a private network or local area network (LAN) by broadcasting packets of data to other connected computing devices.

Routers are virtual or physical network devices that function as dispatchers by forwarding data packets between different IP networks.

Switches are multiport devices that connect computing devices in a network and act like controllers.

1. **What is bandwidth?**

Bandwidth is defined as the maximum rate of data transmitted across a network path per unit of time and measured in bits per second.

1. **What is the role of the Internet Assigned Numbers Authority (IANA)?**

This organization is responsible for allocating and maintaining global IP addresses.

1. **What is the purpose of the ARIN?**

ARIN (American Registry for Internet Numbers) primary function is the registration of IP addresses in Canada, the United States, and many Caribbean and North Atlantic islands.

1. **What are the main differences between IPv4 and IPv6?**

The main differences are the address size of IP addresses. IPv4 is a 32-bit address, whereas IPv6 is a 128-bit hexadecimal address.

* + - IPv4, first deployed in 1983, uses a 32-bit address and can handle 4,294,967,296 **(232)** unique addresses. It is still the most widely used IP version.
    - The IPv4 is currently running out of addresses, ISPs are switching to IPv6. At the present time, IPv4 coexists harmoniously with the newer IPv6, which will eventually replace it, at which point IPv4 will become a legacy protocol.
  + The IPv6 uses a 128-bit address, theoretically delivering 2128 unique addresses.
    - It offers about 340 undecillions.
    - As opposed to IPv4, which is written in dotted decimal notation, IPv6 is written using hexadecimal notation.

1. **What is the difference between static and dynamic IP?**
   * The static IP does not change until the device is retired. This type of IP is assigned by the Internet Service Provider (ISP) or by a network administrator.
   * The dynamic IP is subject to change and is assigned by Dynamic Host Configuration Protocol (DHCP) servers.
2. **What is a network port?**
   * A port is a number used to identify a communication endpoint on a network.
     + More specifically, it is a programming docking point to which information flows.
     + Ports help computing devices sort the network traffic they receive.
3. **What is a MAC address?**
   * Media Access Control Address (MAC address) or Physical Address is a unique, 48-bit, identification number allocated to every computing device’s network interface card (NIC) by the manufacturer.
     + The MAC address does not change; it is hard coded into the NIC or stored in Read Only Memory (ROM).
     + The MAC address is used to connect the device to the network and to filter the process on wireless networks.
4. **What are the different types of networks?**
   * CAN (Campus Area Network)
   * PAN (Personal Area Network)
   * LAN (Local Area Network
   * MAN (Metropolitan Area Network)
   * WAN (Wide Area Network)
   * Virtual Local Area Network (VLAN)
   * VPN (Virtual Private Network)
5. **What is a LAN?**
   * A LAN is a medium range network that spans an area inside a single room, building or group of buildings, office, factory or school, allowing the sharing of data, files, and resources.
     + A LAN might connect all the computers in a school or a building and could contain both wired and wireless devices.
6. **What is the network topology and types?**
   * Network topology shows the layout of the network and how its nodes and links are structured to forward, receive, send, and store data. Types of topologies include:
     1. A bus network topology
     2. A mesh topology
     3. A point-to-point topology
     4. A ring topology
     5. A star network topology
7. **What is OSI (Open Systems Interconnection) and what role does it play in computer networks?**
   * The OSI model is not meant to be an exact science, but it does define the network framework and should be viewed as a guideline in networking; often it does not match the real world exactly.
8. **Explain the different layers of the OSI model.**
   * Layer 7 – Application, is the interface between the user and the network.
   * Layer 6 – Presentation, handles the syntax, which is the structure, format or organization of data, and semantics, the “meaning” of the data, of the information being transmitted by the network.
   * Layer 5 – Session, coordinates the mechanisms that organize and structure communication between application processes.
   * Layer 4 – Transport, delivers end-to-end reliable communication over the network.
   * Layer 3 – Network, is responsible for transferring and routing packets through different routers between sub-networks.
   * Layer 2 – Data Link, coordinates node-to-node data transfers, detects and corrects transmitting errors, forms packets into frames, and synchronizes the frames.
   * Layer 1 – Physical,represents the mechanical and electrical interfaces, a setup of physical connections between devices such as ethernet cables, optical fiber or radio signals, NIC cards, procedures and functions of the network.
9. **Explain the TCP IP protocol suite.** 
   * The TCP/IP protocol suite is a large family of protocols that is named after TCP and IP.
   * TCP/IP enables the Internet to work by helping computers talk to each other from anywhere on the Internet.
     + The TCP/IP model contains four layers and constitutes a simplified version of the OSI model.
     + The OSI and TCP/IP models are the two most widely used networking models for Internet communications.
     + The data is then directed to the transport layer and is managed there by either TCP or UDP (User Datagram Protocol)
   * TCP/IP is essentially a shorter version of the OSI model, consisting of four instead of seven layers. The four layers are: Application Layer, Host-to-Host Layer, Internet Layer and Network Access or Network Interface.
10. **What is the difference between TCP and UDP?**
    * The Transmission Control Protocol (TCP) is a reliable host-to-host, connection-based protocol.
      + Connection-based protocol means that before any data can be transmitted, a reliable connection between hosts must be achieved and acknowledged.
      + Its speed is slower than UDP, but it is more reliable, with fewer errors occurring.
      + TCP, unlike UDP, requires the recipient and the sender to communicate and establish a connection acknowledging that packets have been received. If packets are not acknowledged by the recipient, they are sent again.
      + If the message has still not been received the TCP sends it again.
    * The User Datagram Protocol (UDP) is a faster communication protocol than TCP, but it is unreliable. UDP is a transport layer protocol defined by RFC 768.
      + Like TCP, this protocol divides data into datagrams or packets. The term datagram is a basic transfer unit associated with a packet-switched network and provides a connectionless communication.
      + Both protocols are built on top of the Internet Protocol (IP), and both send data across the internet from one IP address to another.
      + UDP does not offer reliable delivery and extra security overhead, offering no acknowledgement that packets have been received.
      + This speeds up its connections and reduces latency. With UDP, when one computing device sends packets of data to another, delivery cannot be guaranteed, a kind of ‘send it and forget it’ technique.
      + UDP is faster than TCP because it eliminates functions like error checking and recovery services. UDP chooses speed over integrity, and data received may not exactly match data sent.
      + UDP is faster and TCP is more reliable. UDP is used for streaming games, live broadcasts, and video.