Chapter 1- Computer Networks and the Internet

* 1. – 1.3
* Blue: Sample question topics
* Green: Terms
* Red: No need to memorize

**(1.1.1) Hosts:** An **end system** that runs an application, which are connected together by a **communications link.**

* This term is interchangeable with **end system** and can be divided into two categories:
  + Clients: Desktops, mobile pc’s, smart phones, ..
  + Servers: Powerful machines that store and distribute WebPages, stream videos, relay email, ..

**Hosts** are connected together a network of **Communication links** and **Packet Switches**

**(1.1.2) Service Description**

**(1.1.3) Protocols** define the format and the order of messages exchanged between two or more communicating entities, as well as the actions taken on the transmission and/or receipt of a message or other event.

**(1.2.1) Access Networks** are the network that physically connects an **end system** to the first router (**edge router**) to any other distant **end system**.

Access Networks are either **Dedicated** or **Shared.**

**Dedicated Access Networks** is Internet access and bandwidth dedicated to one user and one user alone. All users have a portion of bandwidth dedicated to them solely.

**Shared Access Networks** is a single Internet service among many users, which is then accessed on various devices and internal networks. All bandwidth is split among all users and devices.

* For Home Access there are several categories of access networks:
  + DSL [**Dedicated**]
  + Cable Internet [**Shared**]
  + Fiber to the home (FTTH) [**Shared**]
* For Enterprise Access (plus the home) there are two other access networks:
  + Ethernet [**Shared**]
  + WiFi [**Shared**]

**(1.2.2) Communication links** are made up of different types of **Physical media,** including coaxial cable, copper wire, optical fiber, radio spectrum.

**(1.3.1) Packet Switches** often come in the form of **routers** and link-layer switches. They **forward** packets towards their destination, depending on the form they come in. It’s noted for its burst data behavior, but having possible excessive congestion problems and loss without congestion control.

* **Packet Switching** is the procedure by which **communication link** hosts break **Application Layer** messages into **packets** and **forwards** it to an ongoing **Communication link**.
* An old method of delivering **packets** war through **Store-and-forward** which dictates that the entire **packet** must arrive at router before it be transmitted on the next link.

The router would store the **packet** and decide where it needs to go, which overall added a **delay** on top of **packet transmission delay (PTD)** also known as a **serialization delay.**

* **PTD** = L (bits) / R (bits/sec) = time needed to transmit L bit packet into link.

This was initially to reduce failure in the form of **packet loss**, but, since then, a new method is to access part of the data instead of at the entire thing.

**(1.3.2) Circuit Switches** are end to end resources allocated to reserve “calls” between source and destination. It is no dedication between calls so it inherits the old phone dialing algorithm, where the circuit segment is idle if not used by a call.

**Circuit Switching** is handled two methods of multiplexing:

* **Frequency-Division multiplexing (FDM)** a link is divided up among the connections established across the link. The link dedicates a frequency band to each connection for the duration of the connection.
  + The end result is that each user is granted a frequency band to access a divided portion of the total bandwidth for the duration of the connection.
* **Time-Division multiplexing (TDM)** time is divided into frames of fixed duration, and each frame is divided into a fixed number of time slots. The network dedicates one time slot in every frame to this connection.
  + The end result is that each user is granted a frame and, as calls are made, user frames must wait their turn to have full access to the bandwidth for a time slot.

**(1.3.3) Internet service providers (ISP’s)** are a network of **packet switches** and **communication links** that grant **end systems** access to the internet.

**ISP’s** are tiered based on their services:

* **Tier 1 ISP’s:** Large scale; Network of **Regional ISP’s**
* **Regional ISP:** Region; Network of **Access ISP’s**
* **Access ISP:** Local area

Where ISPs facilitate the framework for the internet, a majority of the connections are made through **Points of Pressure (PoP’s), multihoming, peering,** and **Internet Exchange Points.**

* **PoP** is a group of one or more routers at the same location in the provider’s network where customer **ISPs** can connect into the **Provider ISP**. These exist on all levels of the **ISP** hierarchy, except for the bottom (**Access ISP**) level.
* **Multihome** is a method of connecting to two or more **Provider ISPs**. This allows the sending and receiving of **packets** to continue even if one of its providers has a failure. The only place **multihoming** is not found is on the **Tier 1 ISP** level.
* **Peering** is a method to reduce costs a customer ISP must may a **Provider** **ISP** to obtain global Internet interconnectivity by pairing with nearby **ISP’s** at the same level. This allows them to directly connect networks together so that all the traffic between them passes over direct connection rather than through upstream intermediaries.
* A version of **peering** is implemented on a grand scale through **Internet Exchange Points**, which allows multiple **ISP’s** to peer together. This is recognized as **Network Structure 4**, as it includes all other forms of ISP.