3.1

Protocols: standardized method for transmitting data and/or establishing communications between different devices.

PROTOCOL SUITES AND LAYERING MODELS

* Protocols can also be used to distinguish among:
  + Multiple computers on network
  + Multiple applications…
  + Multiple copies…
* Sender: Data goes from application lower down all the way to data link layer (data encapsulation)
* Receiver: Data goes from data link layer to application layers (data decapsulation)

3.2

TCP/IP Layering

* New design and consists of only 5 layers
  + Application 🡪 Layer 5
  + Transport 🡪 Layer 4
  + Internet 🡪 Layer 3
  + Network Interface 🡪 Layer 2
  + Physical 🡪 Layer 1
* Layer 4: Transport (TCP/UDP)
  + Data exchange in this layer is called a segment, in the 7 Layer OSI model, the this data was called message
* Layer 5: Data In this layer is called message

Performance

* Bandwidth
  + Is the maximum number of bits that can be transmitted in a certain amount over time (per second)
  + Bandwidth is always measured in bits per seconds, not Mbps
    - Note: 1Mbps: 1 x 10^6 bits/second
* Throughput
  + Not the same as Bandwidth
  + The throughput is the maximum number of bit/sec an application can expect to receive
  + The speed of which your device can send through bandwidth
  + Bandwidth >= Effective Throughput
  + Bandwidth is bigger main pipe, while throughput is the smaller device pipe
  + Throughput: actual rate (bits/time unit) at which bits transferred between sender/receiver
* Latency or delay
  + Definition: the amount of time it takes for a single bit to propagate from one end of a network to another
  + Round Trip Time (RTT) is the time it takes for a bit to travel from sender to receiver and back again
  + 3 factors the determine the latency
    - Propagation delay
      * Calculated using the speed-of-light propagation delay:
        + In vaccum, 3.0 \* 10^8 meters/sec
        + In a cable, 2.3 \* 10^8 meters/sec
        + In fiber optics, 2.0 \*10^8 meters/sec
    - Transmission time
    - Queuing & Processing Delays
      * Time waiting at output link for transmission
      * Depends on congestion level of router
  + Calculating Latency
    - Latency = Propagation delay + Transmit Time + Queueing & Processing Delay = Tp + Tx + Tq
    - Tp (Propagation Delay) = (Distance across link) / (speed-of-light delay)
    - Tx (Transmit Time) = (size of data) / (Throughput)
    - Tq (Queueing & Processing Delay) = This is hard to measure so a statistically generated value or a constant is used. (depends on congestion) (if ignored, this value will be ZERO)