# ITS323 – Protocol Architectures Summary

- A protocol is a set of rules that peer entities obey in order to communicate
  - A protocol is defined by the set of messages used to communicate, the meaning of the messages and the events/actions that are allowed
  - Example protocols: TCP, HTTP, IP, CSMA, Token Bus, PPP, …
- A standard is an agreed upon set of rules (such as a protocol) established by an organisation
  - Example standards organisations: IETF, IEEE, ISO, ITU, ANSI, W3C, …
  - Example standards: IEEE 802.11, IETF RFC 793, EIA RS-232, ITU X.25, …
- A protocol architecture defines the mechanisms for two entities to communicate, usually by dividing the functionality into layers
  - Example protocol architectures: TCP/IP, OSI, DECnet, IPX, SNA, AppleTalk, …
- TCP/IP Protocol Architecture is most commonly used today
  - Application layer: functionality to support common applications used for communications
  - Transport layer: efficiently deliver data from a software process on the source host to a software process at the destination host
  - Network layer: deliver data across a network (i.e. multiple links)
  - Data link layer: ensure data is delivered correctly over a physical link
  - Physical layer: transmit bits using appropriate signals over physical media
- The Physical and Data Link layers are often implemented as hardware/software on network interface cards; Network and Transport layers are implemented in software within an operating system; and application layer is implemented by specific applications.
- Addresses are used to identify resources (computers, people, applications, devices) in a network
  - Physical addresses identify an interface on a communications device. E.g. IEEE 48 bit addresses such as 07:01:02:01:2C:4B. Address (and address type) is local to the link.
  - Network addresses identify an interface in a network. This is independent of the type of link (and physical address) used. E.g. IP address of 125.25.71.189
  - Port addresses identify a software application on a computer. E.g. port 80 identifies a web server application.
  - Application-specific addresses are used in some cases. E.g. http://www.google.co.th/; steve@siit.tu.ac.th
- A protocol at each layer processes data from the higher/lower layer and sends it to the lower/ higher layer.
  - Most protocols will add extra control information to the data (called headers and/or

trailers) – this control information carries details necessary for the protocol to operate correctly.

- Key performance metrics for most communication systems include:
  - Bandwidth [Hz], Capacity (or Bandwidth or Data Rate) [bits/sec], Throughput [bits/sec], Delay [sec] and Jitter [sec]
  - Delay consists of four components:
    - Transmission: (message size / data rate)
    - Propagation: (distance / speed)
    - Queuing: time messages spend waiting at intermediate devices
    - Processing: time devices spend processing messages
- Traffic is the information moving through a communications system. 3 types:
  - Data (e.g. text files, Word docs, images)
    - Generally requires zero/low packet loss, low to high data rates
  - Audio (e.g. telephone calls, audio streaming)
    - Generally require low delay and jitter; can tolerate packet loss
  - Video (e.g. video-conference, TV or movie streaming)
    - Generally require low delay and jitter, and moderate to high data rate; can tolerate packet loss