TCP/IP: AN OVERVIEW

ARPANET and TCP/IP

- In 1957, the Advanced Research Projects Agency (ARPA) was created in response to the Soviet Union's launching its Sputnik satellite
- ARPA had the mission of advancing technology that might be useful to the military
- ARPA had no scientists or laboratories; it has no thing more than an office and a *small* (by Pentagon standards) budget to contract universities and companies whose ideas looked promising to it
- In 1969, ARPA funded a research and development project to create an experimental packet-switching network, called ARPANET
- The experimental ARPANET was so successful that many of the organizations attached to it
- In 1975, the ARPANET was converted from an experimental network to an operational network
- The ARPANET protocols were not suitable for running over multiple networks

- This observation led to more research on protocols, which crowned with the invention of the TCP/IP model and protocols
- Although there are many other protocols in the TCP/IP protocol stack, the *Transmission Control Protocol* (TCP) and the *Internet Protocol* (IP) are certainly two of the most important protocols in this protocol stack, and hence the name TCP/IP
- To encourage the adoption of TCP/IP, ARPA awarded several contracts to the *University of California at Berkeley* to implement and integrate them into *Berkeley UNIX*
- Researchers at Berkeley developed a convenient program interface to the network (called *sockets*) and wrote many applications, utilities, and management programs to make networking easier
- When *UNIX 4.2BSD* came along, with TCP/IP, sockets, and many network utilities, the complete package was adopted immediately, since many university has just acquired a second or third *VAX* computer and a LAN to connect them, but they had no networking software
- During the 1980's, additional networks, especially LANs, were connected to

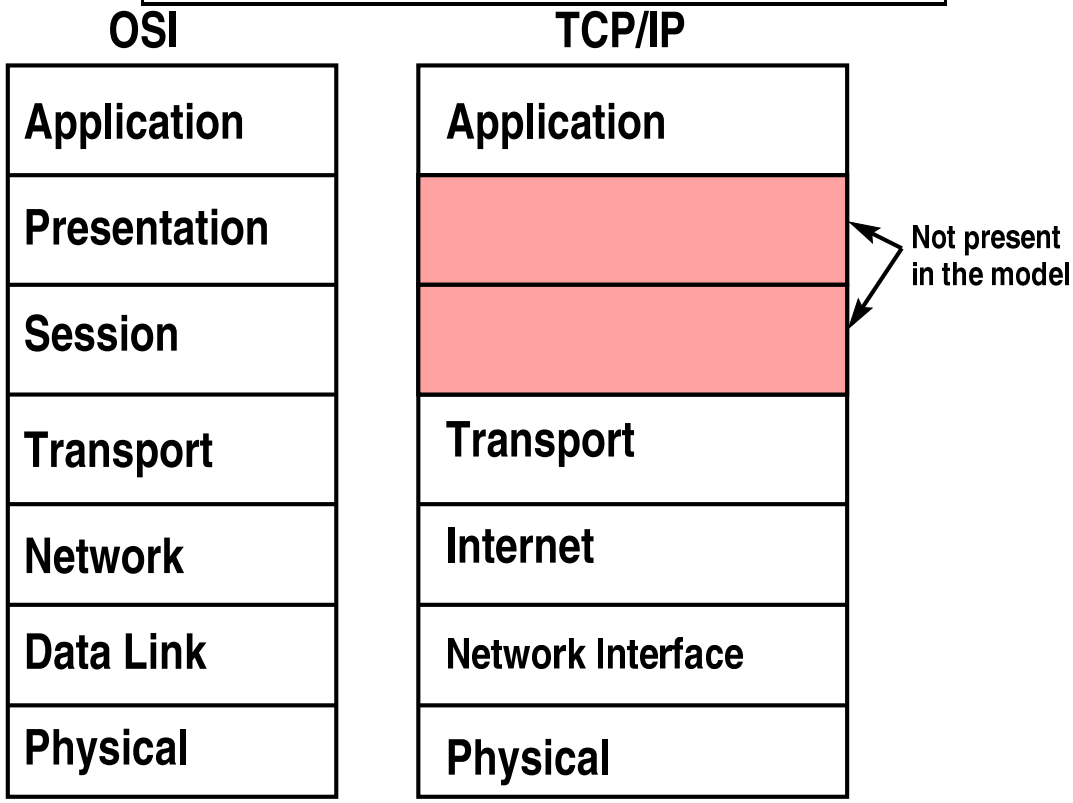
the ARPANET

- As the scale increased, finding hosts became increasingly expensive, so the *Domain Name System* (DNS) was created to organize machines into domains and map host names onto IP addresses
- Since then, DNS has become a generalized, distributed database system for storing a variety of information related to naming
- By 1990, ARPANET has been overtaken by newer networks and it was shut down and dismantled, but it lives on the hearts and minds of network researchers everywhere

TCP/IP Features

- Developed independently from any specific
  - Computer hardware
  - Operating system
  - Physical network hardware
- Has a common addressing scheme that allows any TCP/IP device to uniquely address any other device in the entire network
- *Freely* available protocol software
- Has a widely available user services

The TCP/IP Reference Model



- The protocols and implementation came first,
- The model was really just a description of existing protocols
- There is no universal agreement about how to describe TCP/IP with a layered model, i.e., it is common to find a book considers it 4 layers, while another book considers it 5 layers; moreover layer names are not universal

TCP/IP Protocols

- Application layer
  - Telnet protocol
  - File Transfer Protocol (FTP)
  - Simple Mail Transfer Protocol (SMTP)
  - Hypertext Transfer Protocol (HTTP)
  - Domain Name System (DNS) Protocol
  - Network File System (NFS) protocol
- Transport layer
  - Transmission Control Protocol (TCP)
  - User Datagram Protocol (UDP)
- Internet layer
  - Internet Protocol (IP) (connectionless protocol)
  - Internet Control Message Protocol (ICMP)

Terms Used by Different Layers of TCP/IP

- Application layer
  - Stream (in case of TCP)
  - Message (in case of UDP)
- Transport layer
  - Segment (in case of TCP)
  - Packet (in case of UDP)
- Internet layer
  - Datagram
- Network interface layer
  - Frame