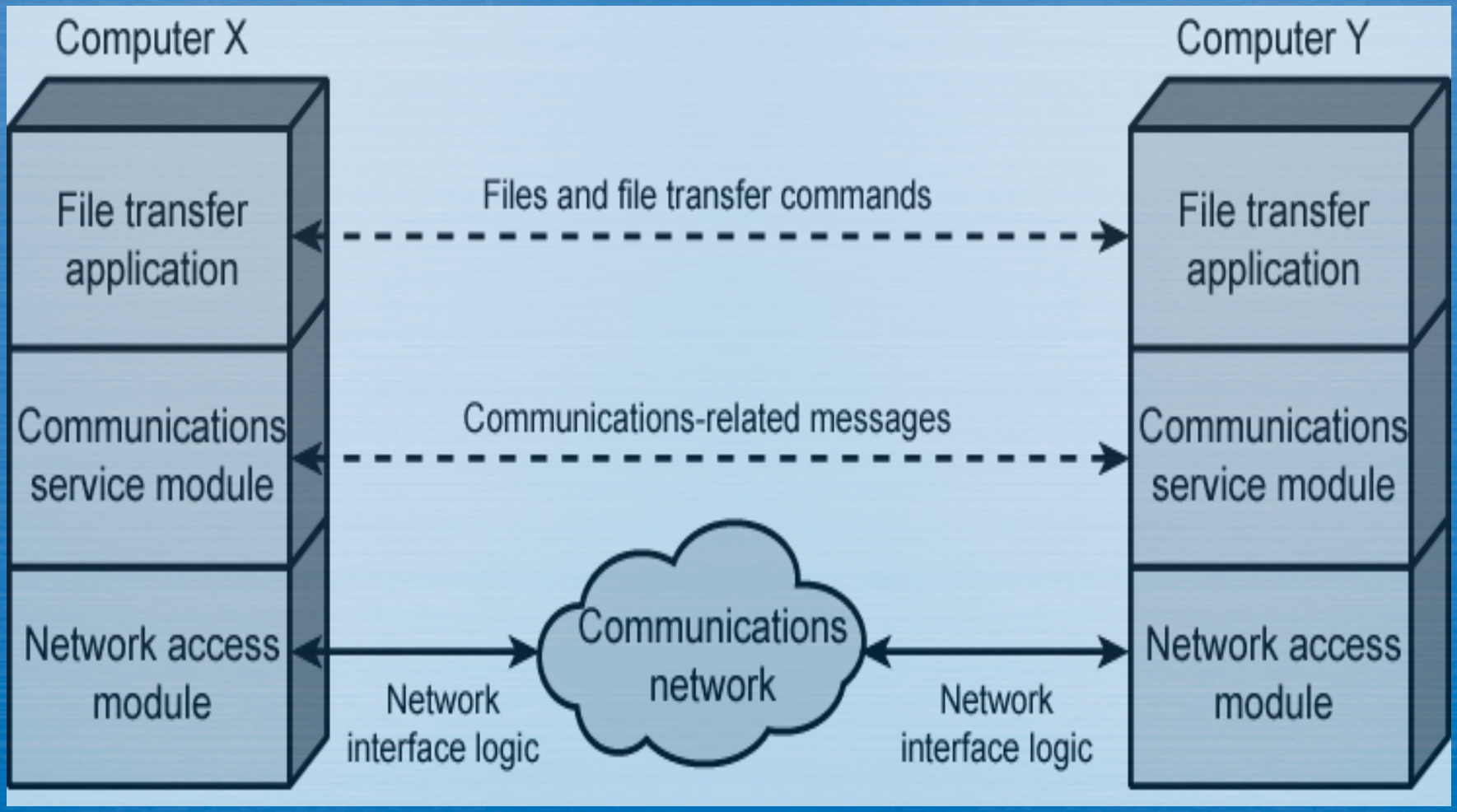
ECE230X Lectures 2-3 Supplementary Slides

Data and Computer Communications Eighth Edition
By William Stallings
Chapter 2 – Protocol Architecture, TCP/IP, and Internet-Based Applications

D. Richard Brown III
Worcester Polytechnic Institute
Electrical and Computer Engineering Department

Adapted from Prentice Hall instructor resources

Simplified Protocol Architecture



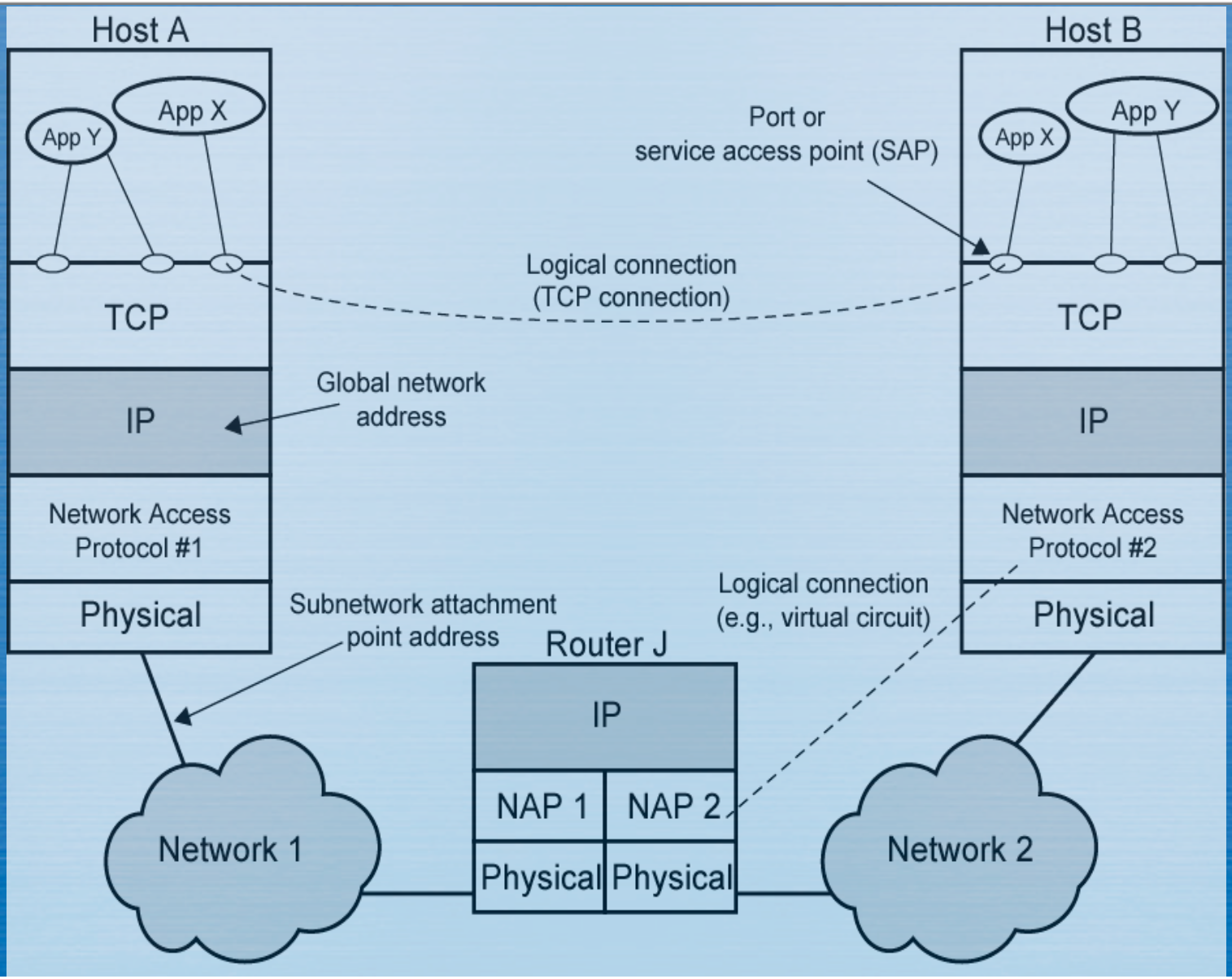
TCP/IP Protocol Architecture

- developed by US Defense Advanced Research Project Agency (DARPA)
- for ARPANET packet switched network
- used by the global Internet
- protocol suite comprises a large collection of standardized protocols

TCP/IP Five-Layer Model

- Not an official model but a working one
  - Application layer
  - Host-to-host, or transport layer
  - Internet layer
  - Network access layer
  - Physical layer

Operation of TCP and IP



Addressing Requirements

- two levels of addressing required
- each host on a subnet needs a unique global network address
  - its IP address
- each application on a (multi-tasking) host needs a unique address within the host
  - known as a port

Physical Layer

- concerned with physical interface between computer and network
- concerned with issues like:
  - characteristics of transmission medium
  - signal levels
  - data rates
  - other related matters

Network Access Layer

- exchange of data between an end system and attached network
- concerned with issues like :
  - destination address provision
  - invoking specific services like priority
  - access to & routing data across a network link between two attached systems
- allows layers above to ignore link specifics

Internet Layer (IP)

- routing functions across multiple networks
- for systems attached to different networks
- using IP protocol
- implemented in end systems and routers
- routers connect two networks and relays data between them

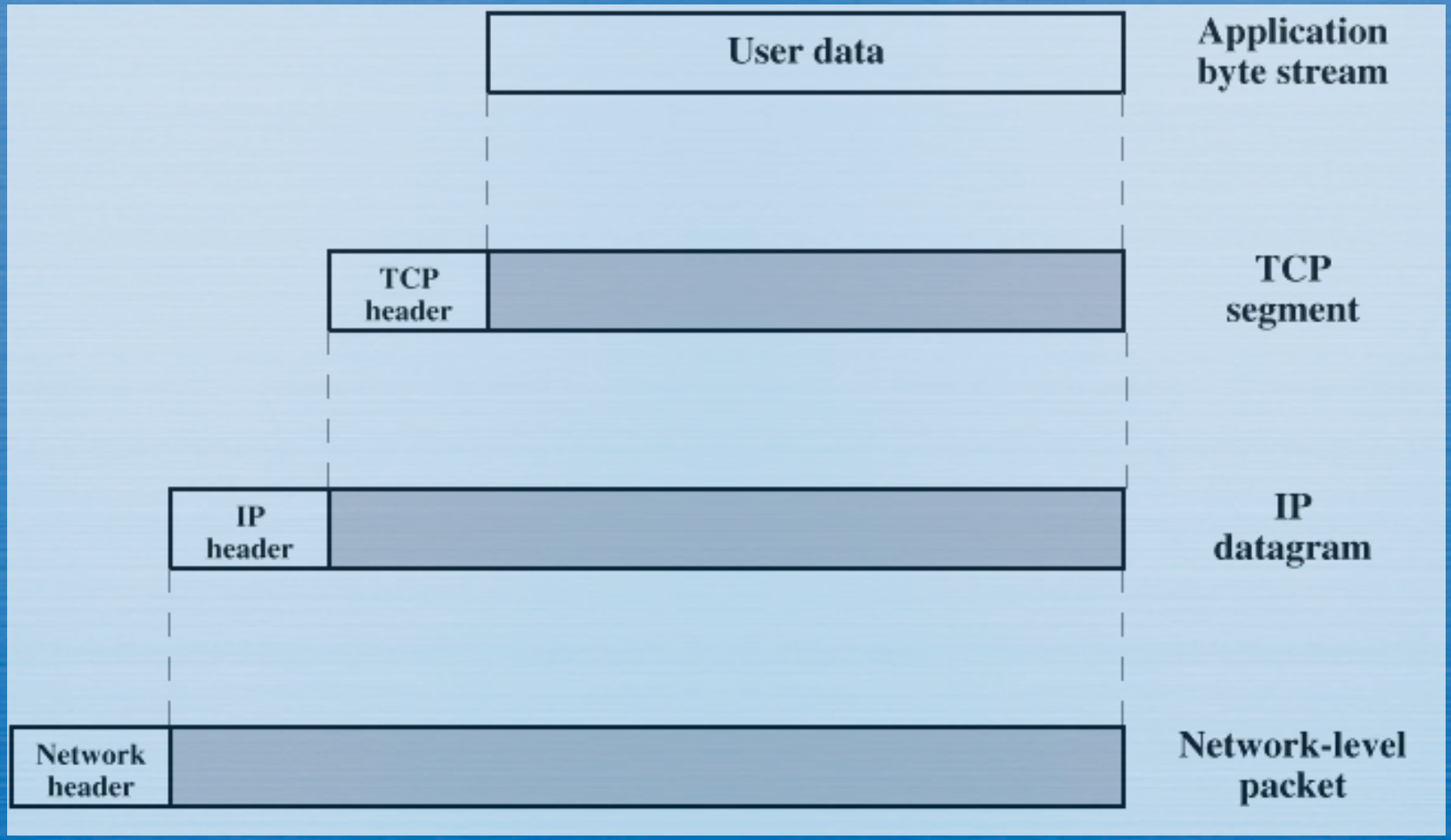
Transport Layer (TCP)

- common layer shared by all applications
- provides reliable delivery of data
- in same order as sent
- commonly uses TCP

Application Layer

- provide support for user applications
- need a separate module for each type of application, e.g.
  - Simple Mail Transfer Protocol (SMTP)
  - Hyper text transfer protocol (HTTP)
  - File Transfer Protocol (FTP)
  - Telnet
  - SSH
  - Etc.

Operation of TCP/IP



OSI

- Open Systems Interconnection
- developed by the International Organization for Standardization (ISO)
- has seven layers
- is a theoretical system delivered too late!
- TCP/IP is the de facto standard

OSI Layers

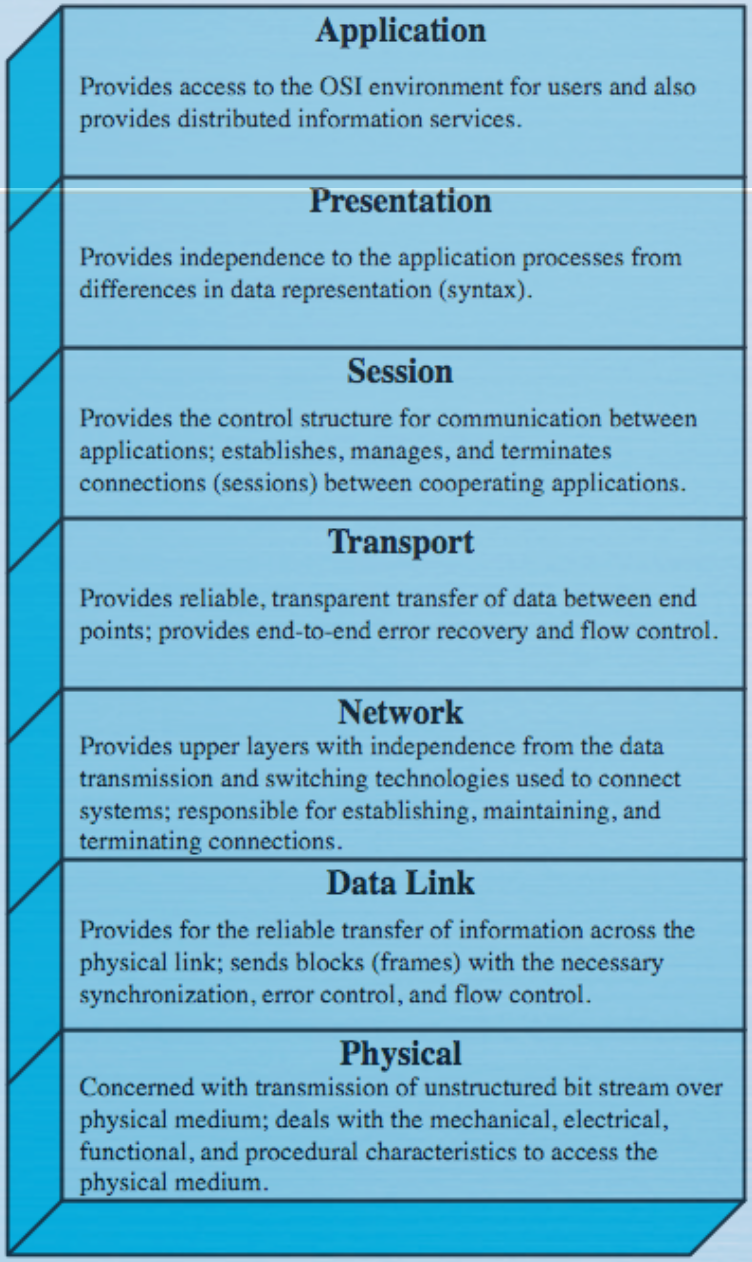
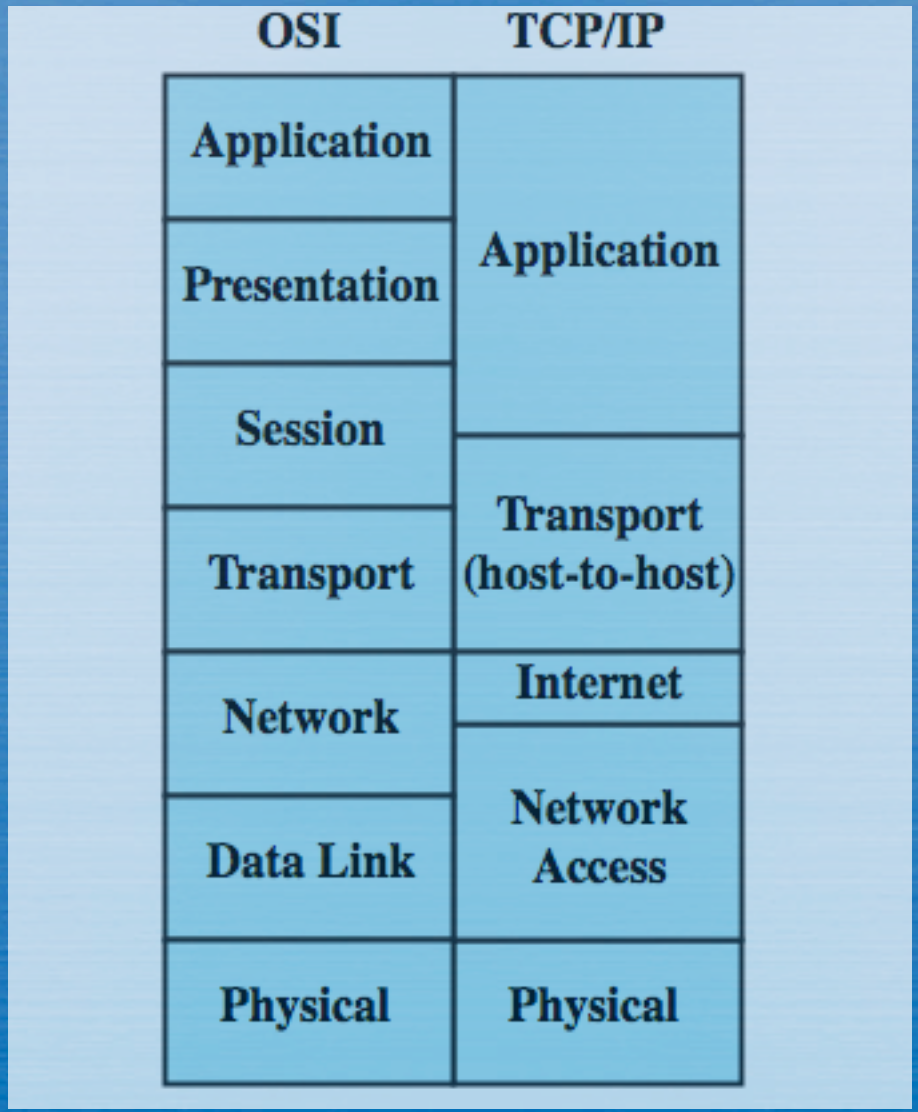


Figure 2.6 The OSI Layers

OSI v TCP/IP


OSI
TCP/IP
Application
Presentation
Session
Transport
Network
Data Link
Physical
Application
Transport (host-to-host)
Internet
Network Access
Physical

Summary

- Protocol architecture: layering of functionality
- Advantages:
  - Simplifies design and analysis of communication networks
  - Increases flexibility (easier to upgrade parts of network, rather than the whole thing)
- Disadvantages:
  - Increased overhead
  - Lightweight protocols needed for multimedia applications
- Well-known layering models:
  - TCP/IP five-layer model
  - OSI seven-layer model