

Data Communications and Networking Overview

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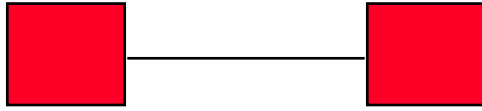
These slides are available on-line at:
<http://www.cse.wustl.edu/~jain/cse473-05/>



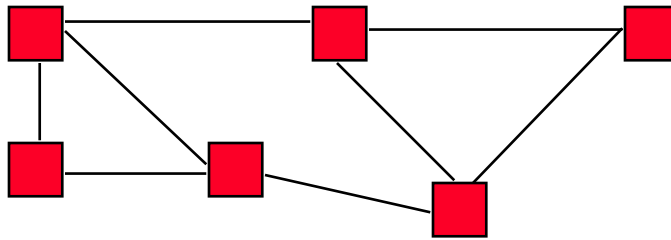
- Data Comm vs Networking vs Distributed Systems
- Communications Tasks
- Types of Networks
- Protocol Layers
- ISO/OSI Reference Model
- TCP/IP Reference Model

Data Communication vs Networking

- Communication: Two Nodes. Mostly EE issues.



- Networking: Two or more nodes. More issues, e.g., routing

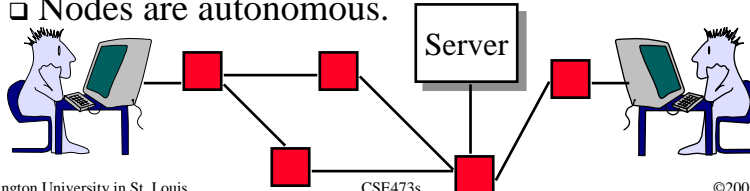


Distributed Systems vs Networks

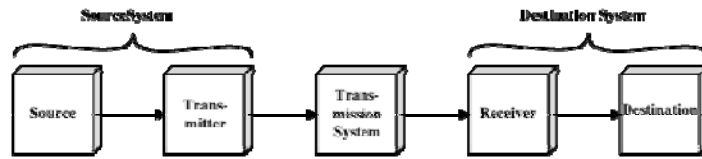
- Distributed Systems:
 - Users are unaware of underlying structure.
E.g., trn instead of \n\bone\0\trn
 - Mostly operating systems issues.
 - Nodes are generally under one organization's control.
- Networks: Users specify the location of resources.

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- Nodes are autonomous.



Simplified Communications Model



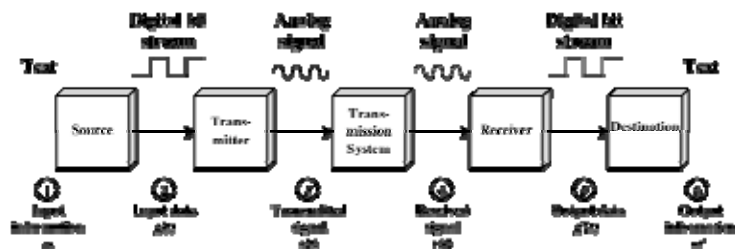
(a) General block diagram



(b) Example

- Transmitter: encodes the information

Data Communications: Example



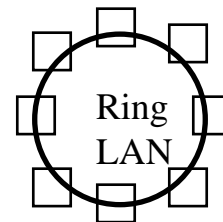
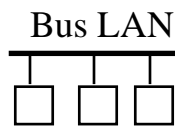
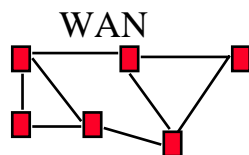
- Modem is used to transmit/receive digital information over analog phone system

Communications Tasks

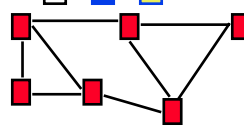
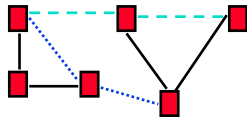
- ❑ Transmission System Utilization (Multiplexing)
- ❑ Interfacing
- ❑ Signal generation (Coding)
- ❑ Synchronization between transmitter and receiver
- ❑ Exchange management (Connection Management)
- ❑ Error detection and correction
- ❑ Flow control
- ❑ Addressing
- ❑ Routing
- ❑ Recovery
- ❑ Message formatting
- ❑ Security
- ❑ Network Management

Types of Networks

- ❑ Point to point vs Broadcast



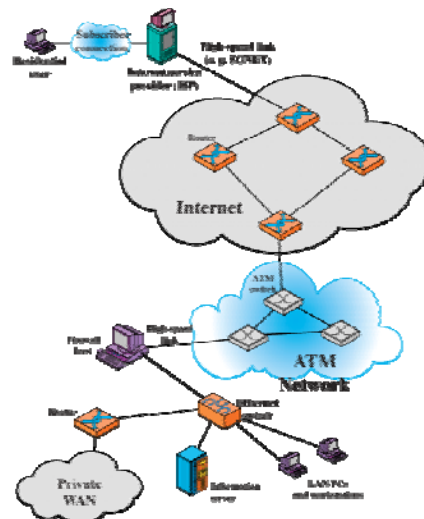
- ❑ Circuit switched vs packet switched



Types of Networks (Cont)

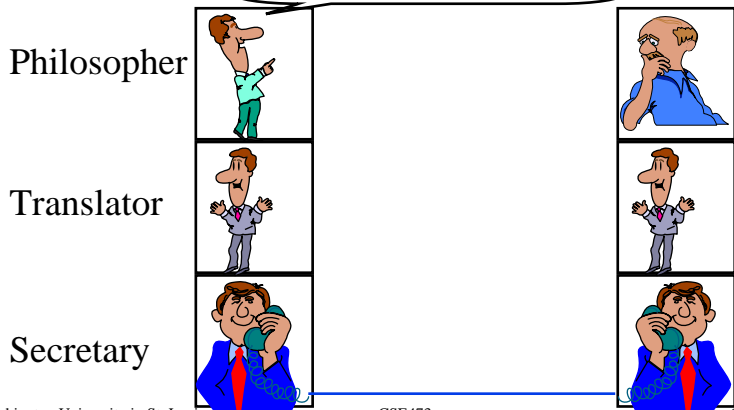
- ❑ Enterprise vs Telecom Networks
 - Ethernet is the most common interface in Enterprise
 - Frame relay and ATM are common in Telecom Networks
- ❑ Local Area Networks (LAN) 0-2 km, Single Ownership
- ❑ Metropolitan Area Networks (MAN) 2-50 km,
- ❑ Wide Area Networks (WAN) 50+ km
- ❑ Telecom Networks:
 - ❑ Access: Between subscriber and the service provider
 - ❑ Metro: Covering a city
 - ❑ Core: Between cities

An Example Configuration

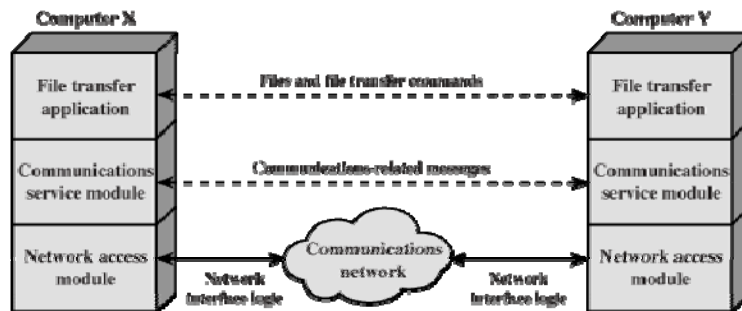


Protocol Layers

- Problem: Philosophers in different countries speak different languages. The Telex system works only with English. I believe there is a God!

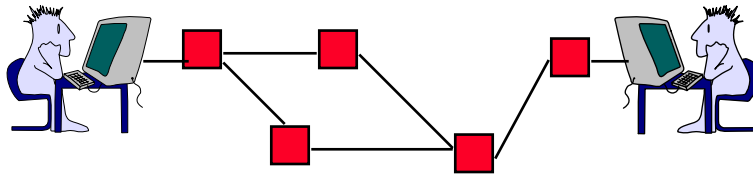


A Sample Protocol Architecture

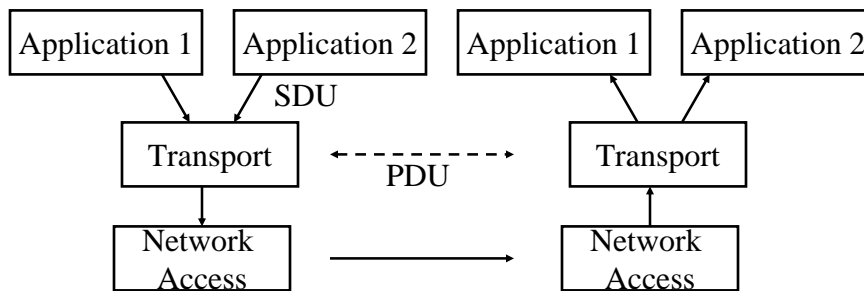


ISO/OSI Reference Model

3	Application	File transfer, Email, Remote Login
	Presentation	ASCII Text, Sound
	Session	Establish/manage connection
2	Transport	End-to-end communication: TCP
	Network	Routing, Addressing: IP
1	Datalink	Two party communication: Ethernet
	Physical	How to transmit signal: Coding

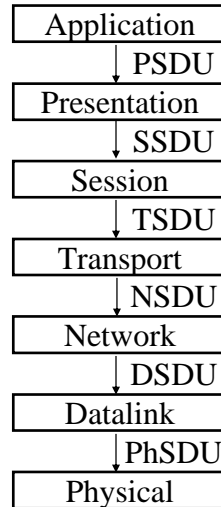


Service and Protocol Data Units

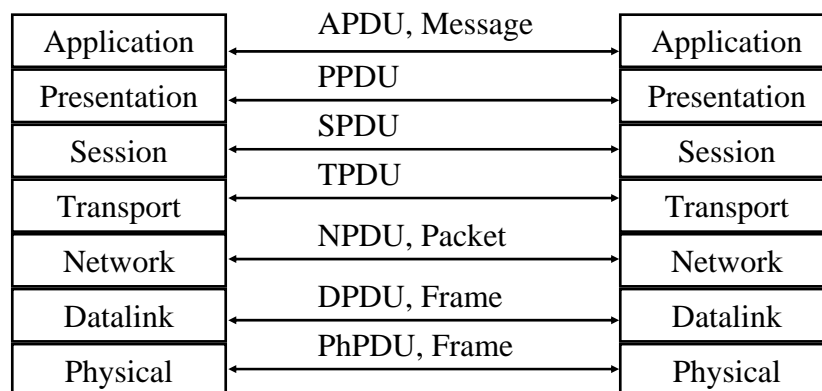


- Service Access Points (SAPs)
- Service Data Units (SDUs)
- Protocol Data Units (PDUs)

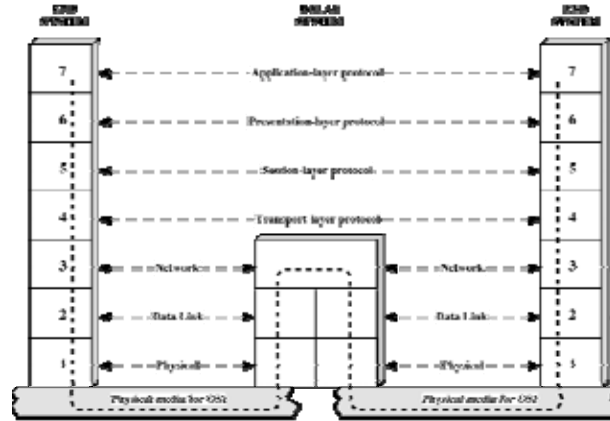
Service Data Unit (SDU)



Protocol Data Unit (PDU)

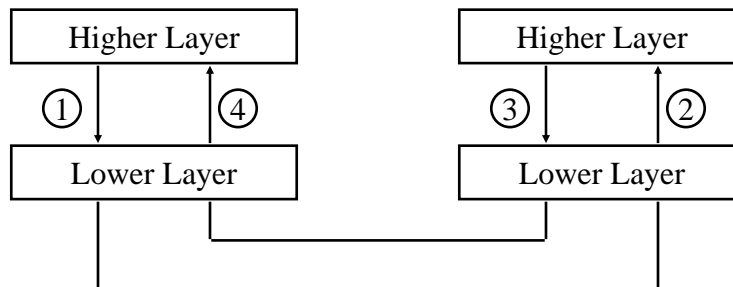


Use of a Relay



Service Primitives

- Indication = Interrupt



- | | |
|---------------|-------------|
| 1. Request | 3. Response |
| 2. Indication | 4. Confirm |

Unconfirmed service: No confirmation or response

TCP/IP Reference Model

- TCP = Transport Control Protocol
- IP = Internet Protocol (Routing)

TCP/IP Ref Model TCP/IP Protocols

Application	FTP	Telnet	HTTP
Transport	TCP		UDP
Internetwork	IP		
Host to Network	Ethernet	Point-to-Point	Packet Radio
Physical	Coax	Fiber	Wireless

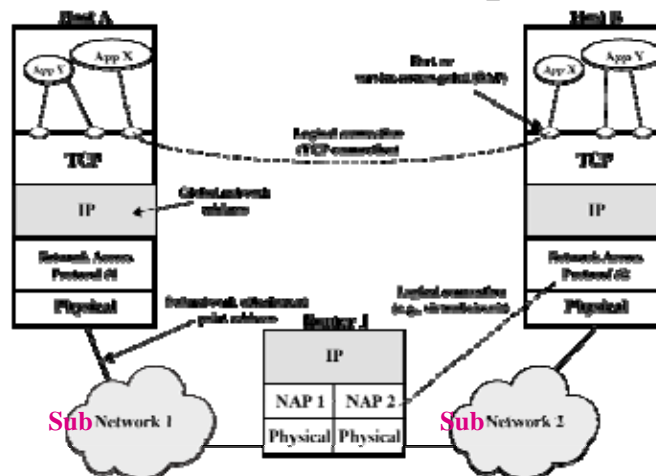
OSI vs TCP/IP

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

OSI vs TCP Reference Models

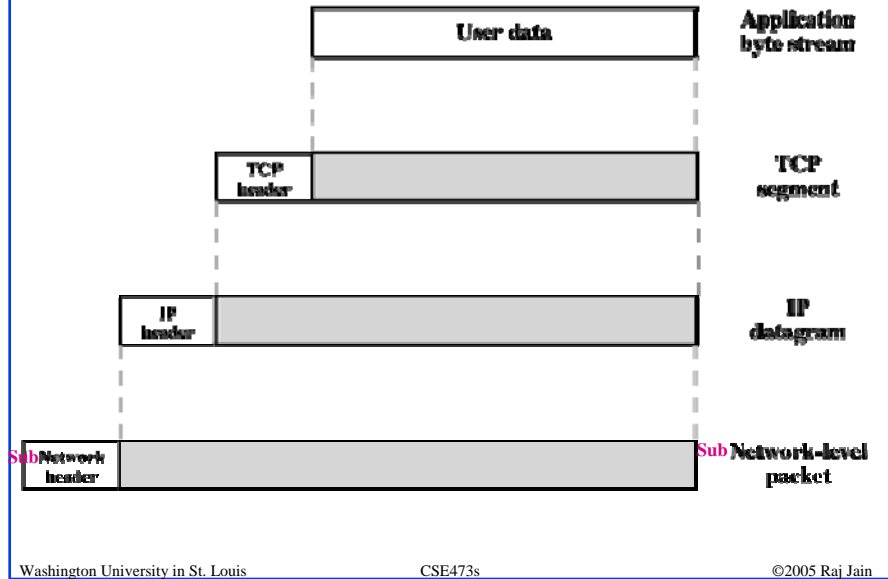
- ❑ OSI introduced concept of services, interface, protocols. These were force-fitted to TCP later
⇒ It is not easy to replace protocols in TCP.
- ❑ In OSI, reference model was done before protocols. In TCP, protocols were done before the model
- ❑ OSI: Standardize first, build later
TCP: Build first, standardize later
- ❑ OSI took too long to standardize. TCP/IP was already in wide use by the time.
- ❑ OSI became too complex.
- ❑ TCP/IP is not general. Ad hoc.

TCP/IP Concepts

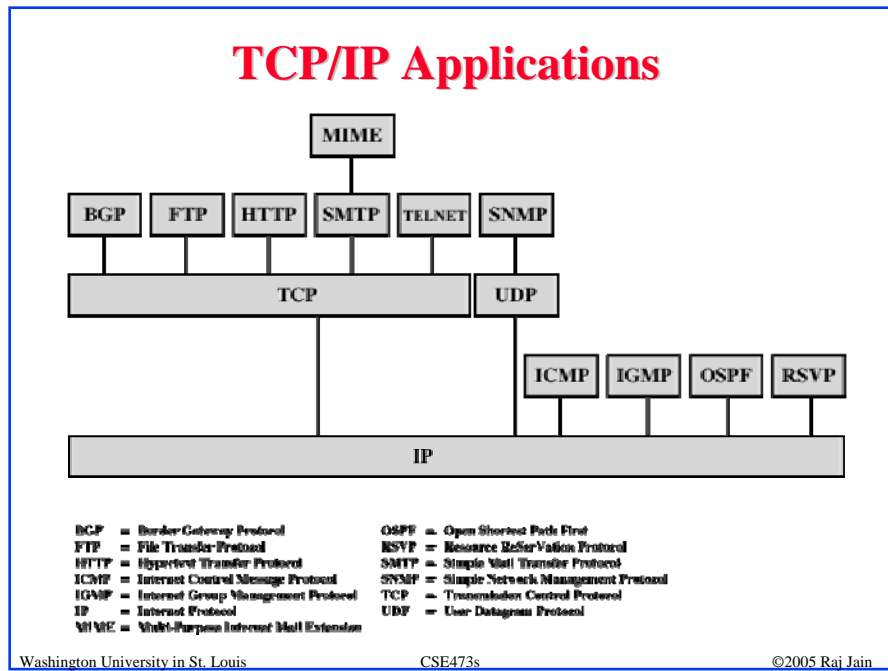


- ❑ Network Attachment Point (NAP)

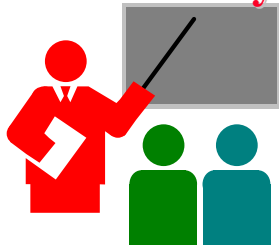
PDUs in TCP/IP Architecture



TCP/IP Applications



Summary



- Communication, Networks, and Distributed systems
- ISO/OSI's 7-layer reference model
- TCP/IP has a 5-layer model
- PDU, SDU, SAP
- Request, Indication, Response, Confirmation

Reading Assignment

- Read Chapters 0, 1, and 2 of Stallings 7th Edition
Appendix 2A can be skipped at this time
- 0.2 Internet and Web Resources
- 0.3 Standards
- Visit some of the web sites mentioned in 0.2 and 0.3

Homework

- ❑ Visit www.ietf.org and find the titles of RFC 1 and RFC 780
- ❑ Submit answers to Problems 2.2 and 2.7 of Stallings 7th Edition
 - ❑ Problem 2.2: Communications between France and China
 - ❑ Problem 2.7: Segmentation and Blocking