LAU
الجامعة اللبنانية الأميركية
Lebanese American University

CSC 634: Networks Programming

Lecture 01: Course Review and Introduction

Instructor: Haidar M. Harmanani

Course Introduction

- Lectures
  - T, 4:30-7:30 from January 16, 2018 until April 26, 2018
  - Prerequisites
    - Know how to program
    - Introductory networks course

Grading and Class Policies

- Grading
  - Midterm: 15%
  - Final: 15%
  - Individual Programming Assignments [4-6]: 40%
  - Course Project: 15%
  - Research Presentations: 15%
- Exam Details
  - Exams are closed book, closed notes
- No Late Programs will be accepted
- All assignments must be your own original work.
  - Cheating/copying/partnering will not be tolerated

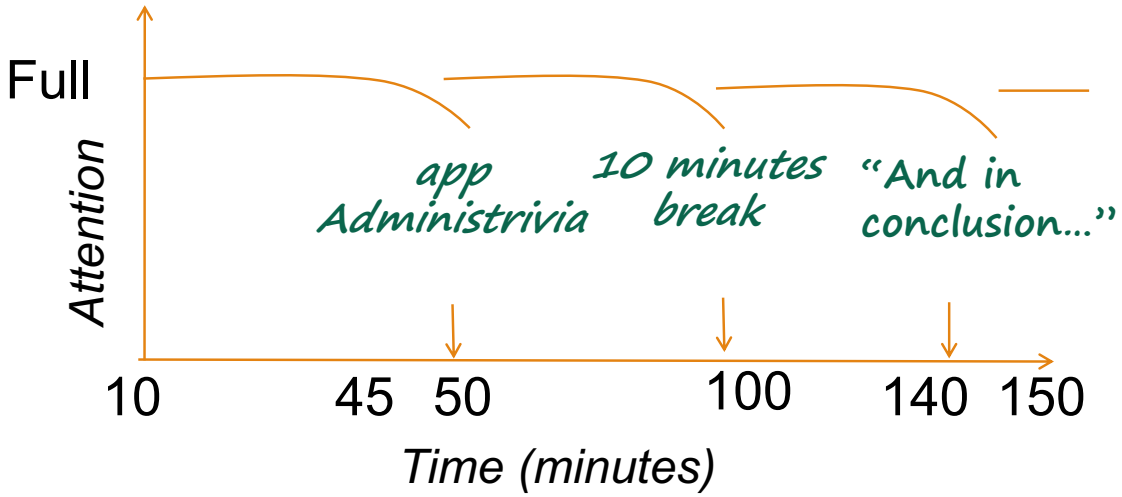
Late Policy …

- Assignments are due at start of the class time
- For every day your project or homework is late (even by a day), a 15 points is assessed
- No credit if more than 3 days late

Policy on Assignments and Independent Work

- With the exception of assignments that explicitly permit you to work in groups, all homework and projects are to be YOUR work and your work ALONE.
- It is NOT acceptable to copy solutions from other students.
- It is NOT acceptable to copy (or start your) solutions from the Web from github.
- PARTNER TEAMS MAY NOT WORK WITH OTHER PARTNER TEAMS
- You are encouraged to help teach other to debug. Beyond that, we don't want you sharing approaches or ideas or code or whiteboarding with other students, since sometimes the point of the assignment is the "algorithm" and if you share that, they won't learn what they are supposed to learn.
- It is NOT acceptable to leave your code anywhere where an unscrupulous student could find and steal it (e.g., public GITHUBs, walking away while leaving yourself logged on, leaving printouts lying around, etc)
- The first offense is a zero on the assignment while the second is an F on the course
- Both *giver* and *receiver* are equally culpable and suffer equal penalties

Architecture of a typical Lecture



Contact Information

- Haidar M. Harmanani
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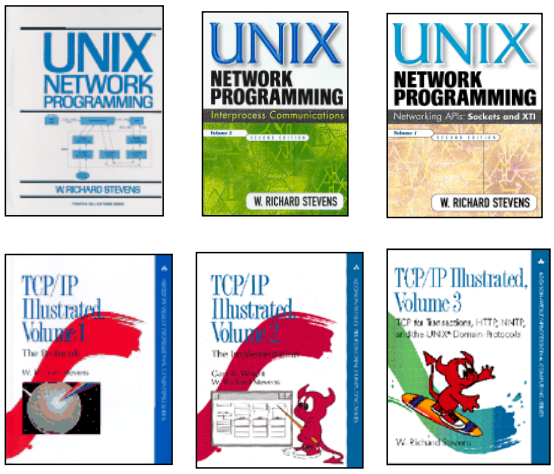
  - Hours: TTh 8:00-9:30 and T 3:00-4:30 or by appointment.
  - Email: haidar@lau.edu.lb

Course Materials



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Administrative Questions?

A Bit of History

- <1960: Data transportation in the form of bits
- 1960: Transportation of data packets
- 1965: Bell Labs, General Electrics and MIT develop Multix (Multiplexed Information and Computing Service)
- 1969: Ken Thompson and Dennis Ritchie in AT&T begin to develop UNICS (UNiplexed Information and Computing Service)
- 1971-75: First releases of UNIX in AT&T
- 1976: First UNIX network application UUCP (UNIX-to-UNIX copy program), File transfer and electronic mail
- 1978: AT&T Version 7 UNIX
- 1978 : Berkley Version 7 UNIX (Eric Schmidt, Berkley University): File transfer, e-mail, remote printing
- 1980: DARPA (Defense Advanced Research Projects Agency) ARPANET, TCP/IP protocols development for Berkley Unix
- 1983: 4.2BSD UNIX system (Berkley Software Distribution) with Socket Interface
- 1983: Richard Stallman announces the GNU Project, an attempt to create a free operating system

More Bits…

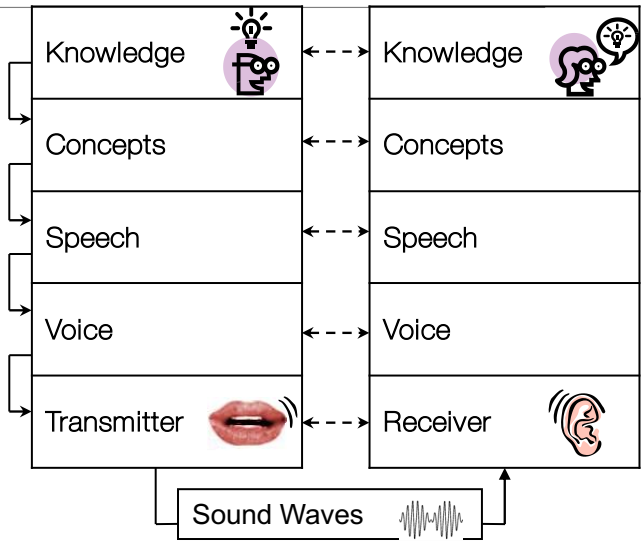
- 1984-86: AT&T System V UNIX with Transport Layer Interface (TLI)
  - File transfer, e-mail, remote printing, remote command execution.
- 1986: NSFNET (National Science Foundation)
  - Remote access to super-computer network.
- 1988: 4.3 BSD UNIX. Available source code of DARPA TCP/IP, Xerox NS protocols.
- End 80s: Microsoft Xenix, System V for Intel 8086, 80286, 80386 processors
- 1988: IEEE (Institute of Electrical & Electronical Engineers) defines POSIX standard operation system interface.
- 1989: Unix System V Release 4.0 (SVR4). Merger of AT&T System V with SunOS (4.xBSD derivative)
  - Provides ANSI compliant C compiler.
- 1991: Linus Torvalds (Finland) introduces Linux – freeware OS for PC.
- 1992: Sun introduces Solaris based on SVR4.
- 1994: Red Hat Linux released.
- 2000: Sun releases Solaris 8 having big success
- >2000: Multiple releases and popularity growth of Linux derivatives

Basic Terms

- Computer Network
  - Communication system for connecting end-systems. Enables to share data, programs and resources (distributed systems).
  - There are physical networks and logical networks.
- Host
  - Single computer, end-system.
  - Could be personal computer, dedicated system (print or file server) or time-sharing system.

Layering and Protocol Family

- Layering is decomposition of task into subsystems (pieces), designed as sequence of horizontal layers.
- As result, each layer:
  - Focuses on providing a particular function
  - is built in terms of one layer below
  - provides means to building various types of upper neighbor
  - layer.
- Protocol Family (Suite) is set of interfaces between layers or inside layer.
- Peer-to-Peer Protocol is the protocol used between two entities of the same layer.



7-Layer OSI Model

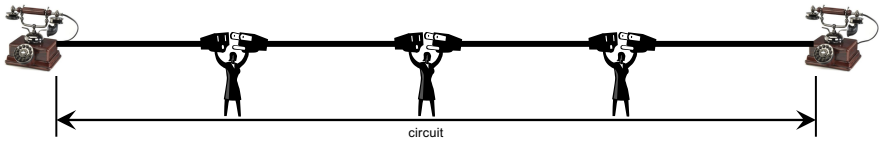
7	**Application**	messages
6	**Presentation** (kinds of compression)	messages
5	**Session** (dialog management)	messages
4	**Transport** (inter-process level)	datagrams
3	**Network** (inter-host level)	packets
2	**Data Link** (network topology)	frames
1	**Physical**	bits

7	Application	messages	Application (Communication end-point)	4
6	Presentation (kinds of compression)			
5	Session (dialog management)			
4	Transport (inter-process level)	datagrams	Transport (inter-process level)	3
3	Network (inter-host level)	packets	Network (inter-host level)	2
2	Data Link (network topology)	frames	Data Link (Network topology & physical connection)	1
1	Physical	bits		

4-Layer Simplified Model of TCP/IP

Communication Networks can be divided into two basic types by method of data transmission: circuit-switched and packet-switched.

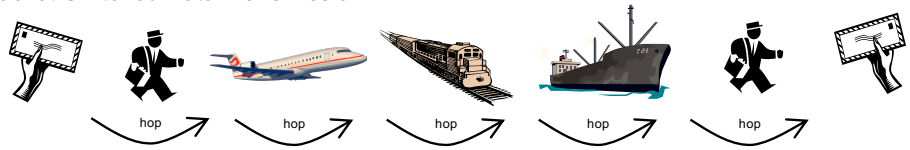
Circuit-Switched Data Transmission



- Non-shared dedicated communication line is established
- Information transmitted without division
- Connection established once, then all data transmitted through this connection.

The TCP/IP Internet uses packet-switched data transmission, provided by IP (Network) layer, responsible for forwarding of IP packets.

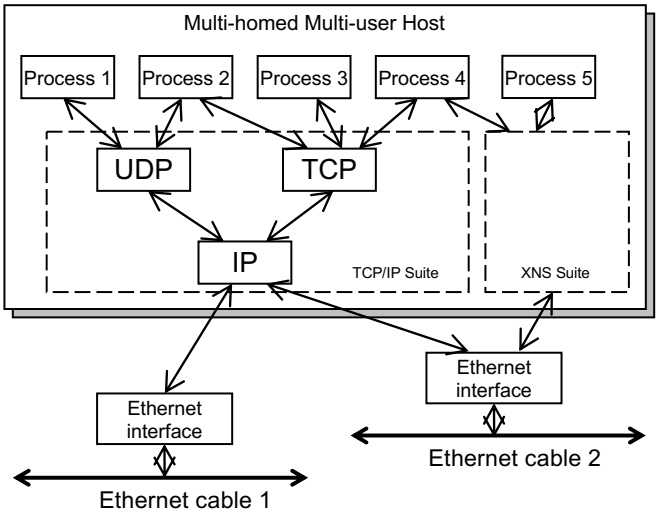
Packet-Switched Data Transmission

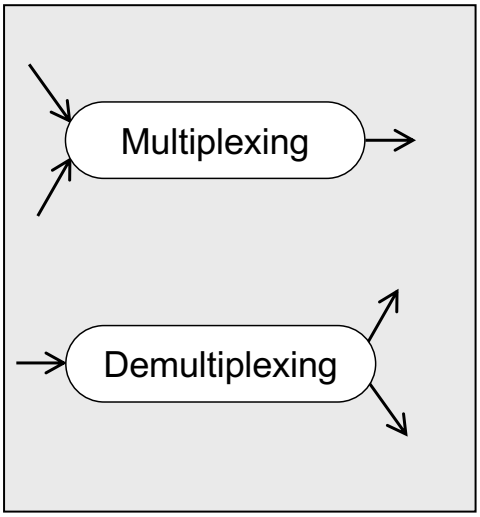


- Shared communication links are used instead of dedicated line
- Information is divided into pieces – packets.
- Each packet contains the address of destination and separately routed over shared data links.

Data Transmission Method

Multiplexing means "to combine many into one".
For network this means combining of data accepted from different functionalities of neighbor layer.
Demultiplexing is reverse of multiplexing.





Course Outline

- Review of basic networking concepts
- Review of the Internet Protocol
- Review of the Transmission Control Protocol and User Data Protocol
- Basic Network Programming
  - Processes
  - Threading and multi-threading
  - Inter-thread and Inter-process Communication
- Client/server programming
  - Sockets
  - TCP and UDP sockets
  - Basic client/server programming
  - Multi-threaded Server Application
- Secure Sockets Programming

Course Outline

- Client-side network programming
  - Web documents
  - Active documents
  - Web Sockets
- Advanced Client–Server Network Programming
  - Blocking
  - Synchronous I/O Multiplexing
  - Asynchronous Servers
  - Serialization
  - RMI and RPC
- Peer to Peer Communication
  - Torrent
  - Blockchains
- Caching and messages queues

Course Outline

- Web technology
  - A brief intro to NodeJS
  - Django
  - Web scraping
- Applications
  - Building and parsing emails
  - Webmail services