

Client Server and Parallel Programming

31666

Spring 2013, Ort Braude College
Electrical Engineering Department



Client Server Programming - Slide Figures/quotes from Andrew Tanenbaum Computer Networks book (Teacher Slides)

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Course Program

- **Lecturer:** Dr. Samy Zafrany
- **Credits:** 5.0
- **Hours:** 3 lecture, 2 laboratory
- **Grade Composition:**
 - 20% - mid-term exam
 - 30% - laboratory projects
 - 50% - final exam
- **Prerequisites:** 31616 (Programming)

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Course Web Site

tinyurl.com/samyz/cliserv/index.html

This is a temporary location until we move
To the college Moodle system

Slides and most figures and images are based
on the Slides of Tanenbaum Book:
Computer Networks, Fourth Edition,
Andrew S. Tanenbaum, Prentice Hall 4th
Edition, Teacher Complimentary Materials

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Course Description

- Client/server application architecture
- Interface, Protocols, Basic Networking Concepts (TCP/IP, UDP) and basic networking tools
- Socket programming
- Internet, WWW, SQL, and client/server systems
- Multitasking, multithreading, and distributed programming
- Database systems, distributed systems, distributed programming
- Client technologies, languages and tools
- Server technologies, languages and tools
- Security and social issues of client/server systems.

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Course Outline

- Client/Server systems overview: www client/server, email, ftp, File Server (NFS), DBMS, SQL, RPC
- Networking concepts: protocols, TCP/IP, UDP, MIME, POP, SMTP, DNS, HTML, HTTP, XML
- Networking concepts: OSI model
- Operating systems, processes, and threads Overview. Multithreading models. Threading issues.
- Socket Programming. Synchronous vs. Asynchronous socket calls.
- Networking testing tools: ping, nslookup, ipconfig, traceroute, netstat
- Distributed system structures. Network Structure. Network Topologies. Communication Structure. Communication Protocols.
- Client/Server system design: chat client/server, simple DBMS client/server, Poker game client/server
- Client/Server system implementation: chat client/server, simple DBMS client/server, Poker game client/sever
- Communication Security. Social issues. Cryptography. SSL.

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Lab Projects

- Multi processing and multithreading (parallel programming)
- File system search/indexing using single process, multiple processes, and multithreading
- Client communication with server
- Multiple clients communicating with server (Chat server, simple DBMS, Poker game server)
- RPC client/server
- Implement a simple distributed parallel algorithm

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Expected Learning Outcomes

- Students will get familiar with basic networking concepts, the basic structure and organization of networking
- Common types of networking paradigms, and common Internet applications and protocols
- Particular emphasis will be put on the prevalent client/server model, and its associated parallel programming computing methods
- Multitasking, multithreading, and distributed programming
- Ability to apply solid engineering principles and methods in building network-aware applications.

Bibliography

- *Silberschatz and Galvin*. Operating Systems Concepts. 8th edition, 2008, John Wiley & Sons, Inc.
- *Andrwes S. Tanenbaum*. Computer Networks, 5th Edition, 2010, Prentice Hall.
- *W. Richard Stevens, Bill Fenner, Andrew Rudoff*. UNIX network programming, 3rd edition, 2003, Prentice Hall.
- *Allen B. Downey*. Think Python, O'Reilly 2012, <http://www.greenteapress.com/thinkpython>
- *Mark Pilgrim*. Dive into Python, Apress 2004, <http://www.diveintopython.net>
- *John Goerzen, Brandon Rhodes*. Foundations of Python Network Programming. 2nd Edition, 2010, Apress.
- www.python.org

Software

- All needed software should be downloaded from <https://dl.dropbox.com/u/60773652/PYTHON/index.html>
- Into a personal flash drive (diskonkey)
 - at least 2GB drive is needed
- All software can be executed from the flash drive on any standard Windows PC
- So you can do all your coding work at home and everywhere you have an access to a windows PC
- We may however need a session or two in the College Linux labs

Computer Networks

- The old model of a single computer serving all of the organization's computational needs has been replaced by one in which a large number of separate but interconnected computers do the job.
- "computer network" is a collection of autonomous computing devices interconnected by a single technology
- Connection is achieved by:
 - Copper wires (Ethernet cables)
 - Fiber optics
 - Microwaves
 - Infrared,
 - Communication satellites
- Computing devices: personal computers, tablets, smart phones, routers, blade servers, car controllers, televisions, refrigerators, cameras, ewatches, hard drive controllers, robot systems (unmanned aerial vehicle), etc.

Goals of Networking

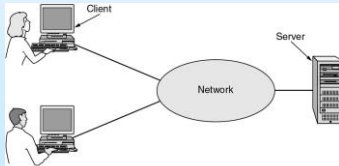
- Resource and load sharing and balancing
 - Programs do not need to run on a single machine
 - Files can span several disks (even on different continents – Hadoop)
 - Reduced cost
 - Several machines can share printers, tape drives, etc.
- Reliability & Redundancy:
 - If a machine goes down, another takes over
 - If a file or disk is damaged, data can be recovered
- Social Connectivity: mail, chat, messages, video, multimedia business, games, recreation (YouTube, Facebook, Twitter, Steam)
- Business applications: DB sharing, e-commerce, m-commerce (Amazon, eBay), Banking, Stock market, Sensor networks
- Mobile applications: tablets, smart phones, VOIP
- Scientific applications
 - knowledge bases
 - distributed computing
 - shared information systems, telelearning (education)

Computer Network & Distributed System

- In a distributed system, a collection of independent computers appears to its users as a single coherent system.
- In a computer network, users are exposed to the actual machines
 - If the machines have different hardware and different operating systems, that is fully visible to the users
 - If a user wants to run a program on a remote machine, he has to log onto that machine and run it there.
- In effect, a distributed system is a software system built on top of a network
- A well-known example of a distributed system is the World Wide Web. It runs on top of the Internet and presents a model in which everything looks like a document (Web page).

Client-Server System

- network architecture in which two computers are connected in such a way that one computer (the client) sends service requests to another computer (the server).
- Examples: WWW, Email, Waze
- Usually, the server is a powerful computer to which many less powerful personal computers or workstations (clients) are connected. The clients run programs and access data that are stored on the server.
- Usually on distant locations but can be also on the same machine

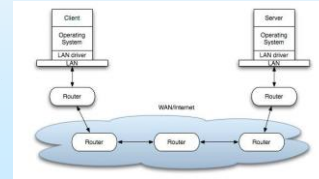
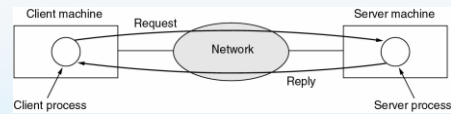


Client Server Programming

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Client Server Data Flow

The client-server model involves requests and replies.

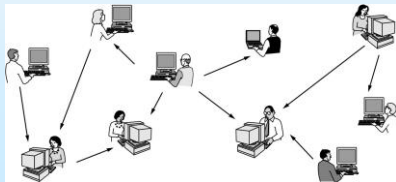


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Peer-to-Peer System

- In peer-to-peer system there are no fixed clients and servers
- Any node can be sometimes a client and sometimes a server
- Examples: Napster, Kazaa, Emule, BitTorrent (content exchange)
- DEC president, Ken Olsen, 1977: "There is no reason for any individual to have a computer in his home."
 - Digital Equipment Corporation** no longer exists



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Some forms of e-commerce

Tag	Full name	Example
B2C	Business-to-consumer	Ordering books on-line
B2B	Business-to-business	Car manufacturer ordering tires from supplier
G2C	Government-to-consumer	Government distributing tax forms electronically
C2C	Consumer-to-consumer	Auctioning second-hand products on-line
P2P	Peer-to-peer	File sharing

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Network Hardware

- Personal Area Networks (PAN)
- Local Area Networks (LAN)
- Metropolitan Area Networks (MAN)
- Wide Area Networks (WAN)
- Wireless Networks (LAN/WiFi)
- Home Networks (LAN/WiFi)
- Internetworks

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Networks Classification

- Network are usually classified according to transmission technology and Scale
- there are two types of transmission technology that are in widespread use:
 - broadcast** links
 - point-to-point** links.
- Broadcast network:** the communication channel is shared by all the machines on the network; packets sent by any machine are received by all the others
- Point-to-point network:** shortest routes between two peers are used for communications

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Interconnected Processors by Scale

Interprocessor distance	Processors located in same	Example
1 m	Square meter	Personal area network
10 m	Room	
100 m	Building	
1 km	Campus	Local area network
10 km	City	
100 km	Country	Metropolitan area network
1000 km	Continent	
10,000 km	Planet	The Internet

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Personal Area Network (PAN)

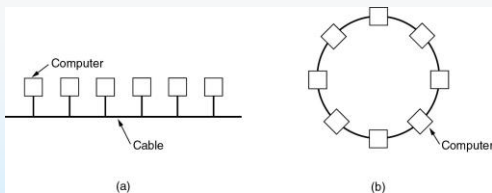


- (a) Wired connection
- (b) Bluetooth configuration
- (c) Wireless connection
- (a) Wireless keyboard/mouse/headset
- (b) Wireless Printers
- (c) External disks

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Local Area Network (LAN)

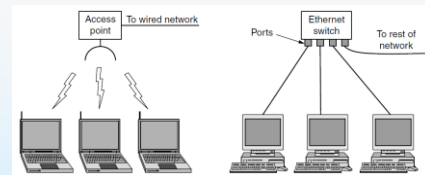


Two broadcast networks
(a) Bus
(b) Ring

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Wireless and wired LANs

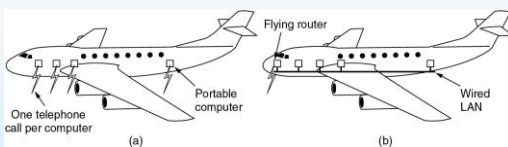


Wireless LAN: IEEE 802.11 (WiFi)
(a) 1-100 Mbps, 10 Gbps
(b) Copper wires, optical fibers
- faster than wireless LAN
(c) 802.3 (Ethernet) most popular LAN

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Flying LAN

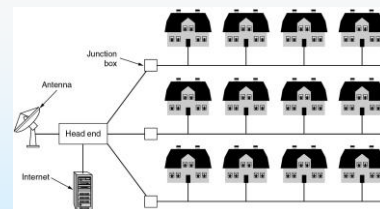


- (a) Individual mobile computers
- (b) Tablets, smartphones
- (c) Other small factor devices

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Metropolitan Area Networks (MAN)

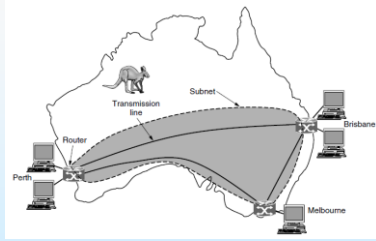


- (a) A metropolitan area network based on cable TV
- (b) New MAN: IEEE 802.16 (WiMax)
- Worldwide Interoperability for Microwave Access
- (c) Related standards: GSM, 3G (3rd generation of mobile technology)

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Wide Area Networks (WAN)



WAN that connects three branch offices in Australia

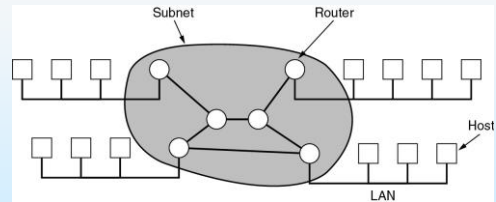
Transmission lines: copper, optical fiber, radio links

Switching elements: computers that connect two or more transmission lines (routers) - **internetworks**

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Wide Area Networks (WAN)

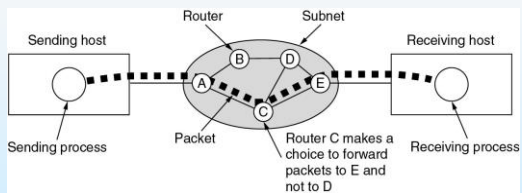


Relation between hosts on LANs and the subnet.

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Wide Area Networks (2)



A stream of packets from sender to receiver.

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