EE400 **Telecommunication Networks**

Lecture 1: **Overview**

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KFUPM
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Announcements & Lecture Outline

- Outline of Lecture #1
  - Syllabus and Course Outline
  - Introduction to data communications
  - Introduction to networking

- Reading
  - *Leon-Garcia*: Chapter 1

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Syllabus (1/2)

- **EE 400: Telecommunication Networks**
- **Instructor: Dr. Salam Zummo**
  - **Office:** 59/1071
  - **Phone:** 1634
  - **E-mail:** zummo@kfupm.edu.sa
  - **Office Hours:** U, T: 10:0-11:00 AM, or by Appointment (via e-mail)
  - **Instructor's Web Page:** http://faculty.kfupm.edu.sa/ee/zummo

- **Class Hours:** U.T 8:30 - 9:45 AM (Sec. 2)
- **WWW:** WebCT where all course handouts will be posted as PDF files.

- **Textbook and Resources:**
  - Leon-Garcia and Widjaja, *COMMUNICATION NETWORKS*, McGraw Hill, 2000
  - Lecture Slides
  - Your own notes
  - Various material will be recommended for reading throughout the semester

- **Background**
  - Basic knowledge of probability and communication systems is required.

Syllabus (2/2)

- **Grading:**
  - **Exams (2 in-class) = 2x15% = 30%**
  - **Final = 30%**
  - **Quizzes = 10%**
  - **Project/Presentation = 10%**
  - **Lab = 20%**

- **Grading and Exam Policies:**
  - No makeup exams or quizzes. Missed exams or quizzes will be recorded as zero. If an official excuse is available, the average of all quizzes will be given.
  - 5 Quizzes will be given on Tuesday of Weeks 3, 5, 9, 11, 14.
  - There will be no graded homeworks. However, I encourage you to study carefully the problems at the end of the textbook chapters.
  - The project may require computer programming.
  - Refer to the course outline for exam tentative dates.

- **E-mail:**
  - You are required to check my website and WebCT on a daily basis. Announcements will be made during lectures, via my website or WebCT.

- **Attendance:**
  - You are responsible for any announcements made in class. Lecture slides are incomplete and you need to refer to your Textbook, notes, and assigned readings for complete material coverage.

Class Preparation and Participation

- Everyday:
  - Check your KFUPM e-mail
  - Check WebCT and my website

- Before Class:
  - Read the chapter in the textbook before lecture
  - Bring a hardcopy of the slides to the lecture (to be available in the night before the lecture)

- In Class:
  - Active
  - Ask questions
  - Answer questions

Outline

| Topic	Chapter	# Lectures
• **INTRODUCTION TO NETWORKS:** Network Services Network Topologies Circuit switching and packet switching	1.1 - 1.2	2
COMPUTER NETWORKS		
LAYER ARCHITECTURE: Concept of Layering, OSI Model, TCP/IP, IP Addressing	2.1-2.3, 8.1-8.2	4
• **PHYSICAL LAYER:** Digital Transmission Fundamentals, Transmission Media, Devices and Components	3.1 - 3.8	4
DATA LINK LAYER (DLC) PROTOCOLS: Error Control, ARQ, Framing (external material)	3.9, 5.2	4
• **MEDIUM ACCESS CONTROL PROTOCOLS:** • ALOHA, CSMA, Polling, Token Ring	6.1 - 6.4	4
• **ROUTING:** • Routing Tables, Routing Algorithms, Shortest Path, ATM	7.3 - 7.6	4
• **LANs and PANs:** • Protocols, Ethernet, Token-Ring, FDDI, WLANs, Bluetooth (external material)	6.6 - 6.6	3
TELEPHONE NETWORK		
• Network Elements, Multiplexing, Switching, Signaling, Traffic Analysis, Cellular Networks	4.1- 4.8	5

Brainstorming

- What is "communications"?

- What do humans communicate?

- What do computers communicate?

- How do computers communicate?

Data Communications

- Deals with the transmission of signals in a reliable and efficient manner

- Topics covered include
  - Signal transmission
  - Transmission media
  - Signal encoding
  - Interfacing
  - Data link protocol
  - Multiplexing

A Simplified Communications Model (1/3)
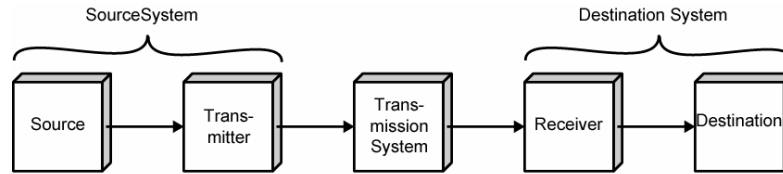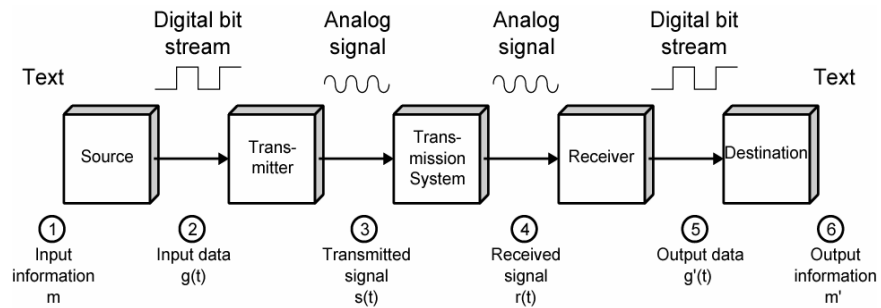

(a) General block diagram

(b) Example

A Simplified Communications Model (2/3)

- Source
  - Generates data to be transmitted
- Transmitter
  - Converts data into transmittable signals
- Transmission System
  - Carries data
- Receiver
  - Converts received signal into data
- Destination
  - Takes incoming data

A Simplified Communications Model (3/3)

Digital bit stream	Analog signal	Analog signal	Digital bit stream

Text — Source — Trans-mitter — Trans-mission System — Receiver — Destination — Text

① Input information m
② Input data g(t)
③ Transmitted signal s(t)
④ Received signal r(t)
⑤ Output data g'(t)
⑥ Output information m'

Networking

- **Interconnectivity between users at various geographical points.**

- **Used for:**
  - Distributions (Electric Network)
  - Collection (Sewage Network)
  - Enabling services (Transportation Network)

- **Communication networks are used for all of the above**

Networking

- Point-to-point communication not usually practical
  - Devices are too far apart
  - Large set of devices would need impractical number of connections

- Solution is a communications network

Computer Networks Topology

- Networks are classified on the basis of their geographic span to:
  - **Local Area Networks (LANs)**
  - **Metropolitan Area Networks (MANs)**
  - **Wide Area Networks (WANs)**

- The difference in geographical extent implies significant differences in respective design issues.
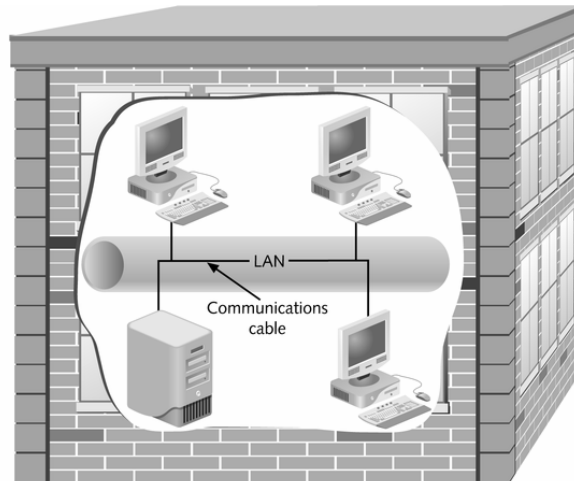
Local Area Networks

- Small scope
  - Building or small campus

- Usually owned by same organization as attached devices

- Data rates much higher than WANs

LAN Configurations

- Switched
  - Switched Ethernet
    - May be single or multiple switches
  - ATM LAN
  - Fiber Channel

- Wireless
 - Mobility
  - Easy installation

Example of a LAN

Wide Area Networks

- Large geographical area crossing public rights-of-way
- Rely in part on common carrier circuits
- Implemented technologies:
  - Circuit switching
    - Dedicated communications path established for the duration of the conversation
    - e.g. telephone network
  - Packet switching
    - Data sent out of sequence
    - Small chunks (packets) of data at a time
    - Packets passed from node to node between source and destination
    - Used for terminal to computer and computer to computer communications
  - Frame relay
  - Asynchronous Transfer Mode (ATM)

Metropolitan Area Networks

- MAN
- Middle ground between LAN and WAN
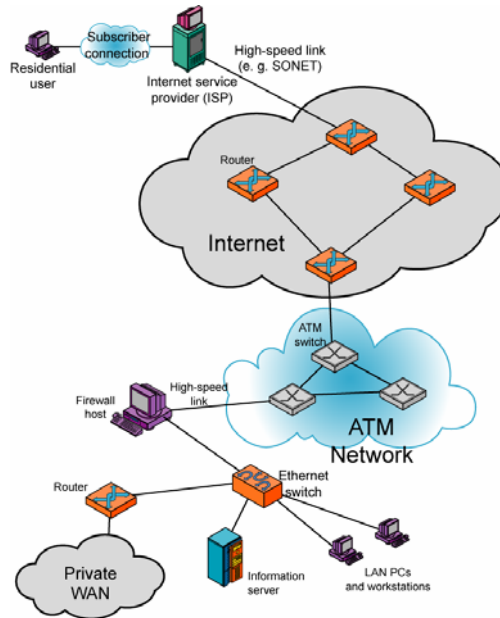- Private or public network
- High speed
- Large area

Example of a MAN
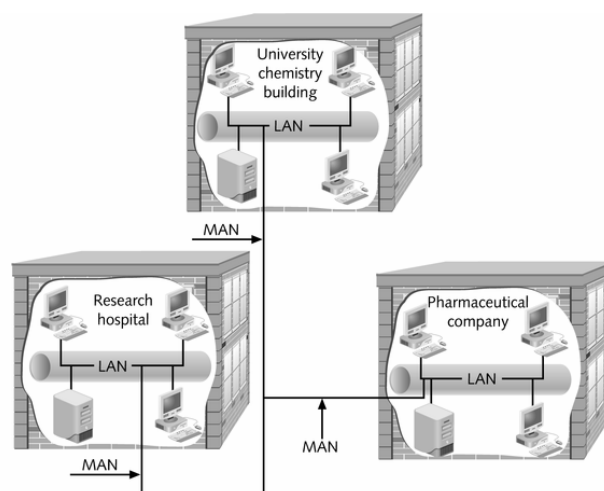
Enterprise Network

A combination of LANs, MANs, or WANs that provides users with an array of computer and network resources to complete different tasks

An Example Configuration

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Services (1/3)

- Radio and Television Broadcasting
  - One-way communication (Passive users)
  - No connectivity required between users

- Telephone (PSTN/PABX)
  - Real-time service (sensitive to delay)
  - Connection oriented
  - Subject to blockage (availability problem)
  - Advanced features (call collect, caller ID, credit card, …)

Services (2/3)

- Cellular phones: A telephone network with more concerns:
  - Quality
  - Security
  - Network management
    - Hand off
    - Roaming

Services (3/3)

- Email:
  - Not real-time (not sensitive to delays)
  - Connectionless oriented
  - Reliability (in contrast to quality) - error free

- Internet:
  - Not real-time, however large delays not tolerated
  - Client/server interaction
  - Integrated service (data, audio, image, video)
  - Quality is less an issue

Service Requirements

- In conclusion, different applications have different requirements in terms of:
  - Delay
  - Reliability
  - Quality
  - Availability
  - Capacity
  - Security
  - …