Course Objectives
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1. To develop an understanding of modern network architectures from a design and performance perspective.
2. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
3. To clarify network terminology.
Course Objectives

4. To provide an opportunity to do network programming using **TCP/IP**.
5. To give the students experience working in programming teams.
6. To provide a WLAN measurement experience.
7. To expose students to emerging technologies and their potential impact.
Introduction
Network Definitions and Classification

- Preliminary definitions and network terminology
- Sample application paradigms
- Classifying networks by transmission technology
- Classifying networks by size (or scale)
- Classifying networks by topology
Preliminary Definitions

**computer network** :: [Tanenbaum] a collection of “autonomous” computers interconnected by a single technology.

[LG&W] **communications network** :: a set of equipment and facilities that provide a service.

In a **distributed system** the collection of independent computers appears to its users as a single coherent system.
Client-Server Applications

Figure 1.1 A network with two clients and one server.
Figure 1-2. The client-server model involves requests and replies.
Peer-to-Peer Applications

Figure 1.3 In a peer-to-peer system there are no fixed clients and servers.
Mobile Network Users

<table>
<thead>
<tr>
<th>Wireless</th>
<th>Mobile</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>No</td>
<td>Desktop computers in offices</td>
</tr>
<tr>
<td>No</td>
<td>Yes</td>
<td>A notebook computer used in a hotel room</td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
<td>Networks in older, unwired buildings</td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>Portable office; PDA for store inventory</td>
</tr>
</tbody>
</table>

Figure 1-5. Combinations of wireless networks and mobile computing.
Classifying Networks by Transmission Technology

**broadcast** :: a single communications channel shared by all machines (addresses) on the network. Broadcast can be both a logical or a physical concept (e.g. Media Access Control (MAC) sublayer).

**multicast** :: communications to a specified group. This requires a group address (e.g. – multimedia multicast).

**point-to-point** :: connections made via links between pairs of nodes.
## Network Classification by Size

<table>
<thead>
<tr>
<th>Interprocessor distance</th>
<th>Processors located in same</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 m</td>
<td>Square meter</td>
<td>Personal area network</td>
</tr>
<tr>
<td>10 m</td>
<td>Room</td>
<td>Local area network</td>
</tr>
<tr>
<td>100 m</td>
<td>Building</td>
<td>Metropolitan area network</td>
</tr>
<tr>
<td>1 km</td>
<td>Campus</td>
<td>Wide area network</td>
</tr>
<tr>
<td>10 km</td>
<td>City</td>
<td>The Internet</td>
</tr>
<tr>
<td>100 km</td>
<td>Country</td>
<td></td>
</tr>
<tr>
<td>1000 km</td>
<td>Continent</td>
<td></td>
</tr>
<tr>
<td>10,000 km</td>
<td>Planet</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1-6. Classification of interconnected processors by scale.
Network Classification by Size

• **LANs** {Local Area Networks}
  – Wired LANs: typically physically broadcast at the MAC layer (e.g., Ethernet, Token Ring)
  – Wireless LANs

• **MANs** {Metropolitan Area Networks}
  – campus networks connecting LANs logically or physically.
  – often have a **backbone** (e.g., FDDI and ATM)
Wired LANs

Ethernet bus

Ethernet hub

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Figure 1.17
Wireless LANs (WLANs)

Figure 1-35. (a) Wireless networking with a base station. (b) Ad hoc networking.
Figure 1-8. A metropolitan area network based on cable TV.
Hierarchical Network Topology

Metropolitan network A consists of access subnetworks a, b, c, d.

National network consists of regional subnetworks α, β, γ.

Metropolitan network A is part of regional subnetwork α.

Leon-Garcia & Widjaja: Communication Networks

Networks: Introduction
Network Classification by Size

- **WANs** {Wide Area Networks}
  - *also referred to as “point-to-point” networks.*
  - ARPANET ➔ Internet
  - usually hierarchical with a backbone.
  - Enterprise Networks, Autonomous Systems
  - VPNs (Virtual Private Networks).

Networks: Introduction
ARPAnet circa 1972

*a point-to-point network*
Wide Area Networks (WANs)

Figure 1-10. A stream of packets from sender to receiver.
internet - a network of networks

G = gateway

Leon-Garcia & Widjaja: Communication Networks

Networks: Introduction
Network Classification by Topology

Bus

Bidirectional flow assumes baseband cable
Network Classification by Topology

Ring

Note - a ring implies unidirectional flow
Network Classification by Topology

**Tree**

Headend

Networks: Introduction
Network Classification by Topology

Star

hub, switch
or repeater
Network Classification by Topology

Star

Wireless Infrastructure