COT 5930: Internet Routing Protocols

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1 This Course: What is and What is Not

- Not a course for undergraduate students.
- Not a course for network programming using TCP/IP.
- Not an “easy course”.
- Internet Routing Protocols not Internet Protocols.
- Routing is the main function in the network layer of OSI and the IP layer of TCP/IP. (OSI’s seven layers vs. TCP/IP’s four layers).
2 What

The key technology in 20th Century has been: information gathering, processing, and distribution

Computer Networks: an interconnected collection of autonomous computers.

Distributed Systems: the user is not aware that there are multiple processors; it looks like a virtual uniprocessor.
3 Why

Networks for company

- resource sharing
- high reliability
- saving money

Networks for people

- Access to remote information
- Person-to-person communication
- Interactive entertainment
4 Types of networks

Classification of networks:

- Scale (LAN, MAN, WAN, Internet)
- Transmission technology (broadcast vs. point-to-point)
- Service (single service vs. integrated service)
- Transmission medium (wired networks vs. wireless networks)
Internet (internetworks): a loose collection of interconnected networks.
Sample mobile and wireless networks/applications

- Cellular/PCS (cellular telephones)
- Cordless telephones
- Paging (one-way service)
- Personal digital assistants (PDAs)
- Satellites (ubiquitous coverage with low-bit-rate services)
  - Two-way comm. between satellites and vehicles (and ships)
  - One-way comm. Global Positioning Systems (GPS)
- Wireless LANs (small service area with high-bit-rate services)
- Wireless loops (local or metropolitan)
- Wireless ATM
- Mobile IP
**Wireless vs. Mobile**

- Mobile users do not necessarily need to use wireless interfaces.
- Wireless interfaces do not necessarily support mobility.

**Classification** (endpoint: host, switch: router)

- Stationary switches and stationary endpoints (wired networks)
- Mobile switches and stationary endpoints (satellites)
- Stationary switches and mobile endpoints (cellular/PCS)
- Mobile switches and mobile endpoints (ad hoc wireless networks)

**Infrastructured networks vs. infrastructureless networks**
5 Network Layers

Most networks are organized as a series of layers or levels.
• **Protocol**: the rules and conventions used in conversation between peer layers.

• **Service**: tells what the layer does, not how entities (hardware or software) above it access it or how the layer works.

Layer $n$ may use the services of layer $n - 1$ in order to provide its service.

• **Interface**: tells the processes above it how to access it.

Services are available at SAPs (Service Access Points) of the relevant interface.
OSI (Open System Interconnection) Reference Model
The TCP/IP Reference Model
**TCP**: Transmission Control Protocol

- **Transport layer** is designed to allow peer entities on the source and destination hosts to carry on a conversation.
- TCP: a reliable connection-oriented protocol (virtual circuit)

**IP**: Internet Protocol

- **Internet layer** defines an official packet format and protocol called IP.
- The job of the internet layer is to deliver IP packets where they are supposed to go.
- IP over everything
Comparisons between OSI and TCP/IP:
6 Some History

- ARPANET is the predecessor of Internet.

- The number of machines connected to Internet:
  - 2.5 millions in 1994
  - 60 millions in 1999
  - 100-200 millions now

- Internet society
  - IAB (Internet Architecture Board) with two groups: IRTF and IETF
  - IRTF (Internet Research Task Force): on long-term research.
  - Internet Society (comparable to ACM to IEEE).
7 Routing Protocols

Routing packets from the source machine to the destination machine:
Routing algorithms

- point-to-point (unicast) vs. collective (multicast and broadcast)
- static routing vs. adaptive routing
- shortest-path-routing vs. flow-based (QoS-based) routing
- different networks: fixed, satellites, cellular/PCS, and ad hoc wireless networks.