COT 5930: Internet Routing Protocols

Jie Wu

Department of Computer Science and Engineering

Florida Atlantic University

Boca Raton, FL 33431

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1 This Course: What is and What is Not

- Not a course for undergradute 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 (celluar/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 acccss 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)
- UDP (User Datagram Protocol): an unreliable, connectionless protocol (datagram).

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 Histroy

- ARPANET is the predecessor of Internet.
- The number of machines connected to Internet:
  - hundreds in 1982.
  - 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.
  - IEFT (Internet Engineering Task Force): on short-term engineering issues.
  - 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, celluar/PCS, and ad hoc wireless networks.