

# Final Review

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# TCP

- **reliable data transfer:**
  - guaranteed arrival, no error, in order
  - a sliding window protocol (combination of selective repeat and go-back-N)
- **flow controlled:**
  - sender does not overwhelm receiver
- **congestion controlled:**
  - sender does not overwhelm the network
- **connection management**
  - 3-way handshake
- **efficiency**

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# Network Applications

- Web and HTTP
- Electronic Mail: SMTP, POP3, IMAP
- DNS
- Internet load balancing
- Web caching
- Content-distribution networks
- Peer-to-peer networks
- Overlay networks

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# Multimedia Networking and Quality of Service Support

- multimedia applications and their QoS requirements
- applying application-level end-to-end techniques to enhance the "best effort" service of the Internet
- QoS support within the Internet: policing and scheduling mechanisms
- next generation Internet QoS architecture: Intserv, Diffserv

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## Network Security

### Basic techniques.....

- cryptography (symmetric and public)
- authentication
- message integrity
- key distribution

### .... network security in practice

- firewall
- attacks and countermeasures
- secure email (PGP)
- secure transport (SSL)
- secure network (IPsec)

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## Wireless Networks and Mobility

- Wireless networking in the data link layer
  - IEEE 802.11 wireless LAN (Media access protocol): CSMA, ACK, RTS/CTS
- Mobility in the network layer
  - Base station model: mobile IP
  - Ad hoc model

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## Some Trivia Questions

- Size of a IPv4/IPv6/UDP/TCP header?
- What does it mean when a socket call "send()" returns?
- In a TCP socket connection, can a message sent out by a single "send()" being received in pieces? How about UDP?
- How many open sockets can a program have?

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## An Example of Networking Research I Do

- Maintenance of membership subset in a network
- Goal is that those in membership subset are chosen in a uniformly random fashion from all network nodes
- Our approach:
  - employ a random walker to visits network nodes in a way that each node is visited with uniform probability
  - if the walker is at node  $i$  at a step, the probability for it to move to a neighbor node  $j$  at the next step:
    - $\min(1/d_i, 1/d_j)$ .

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