

CSE 123b

Communications Software

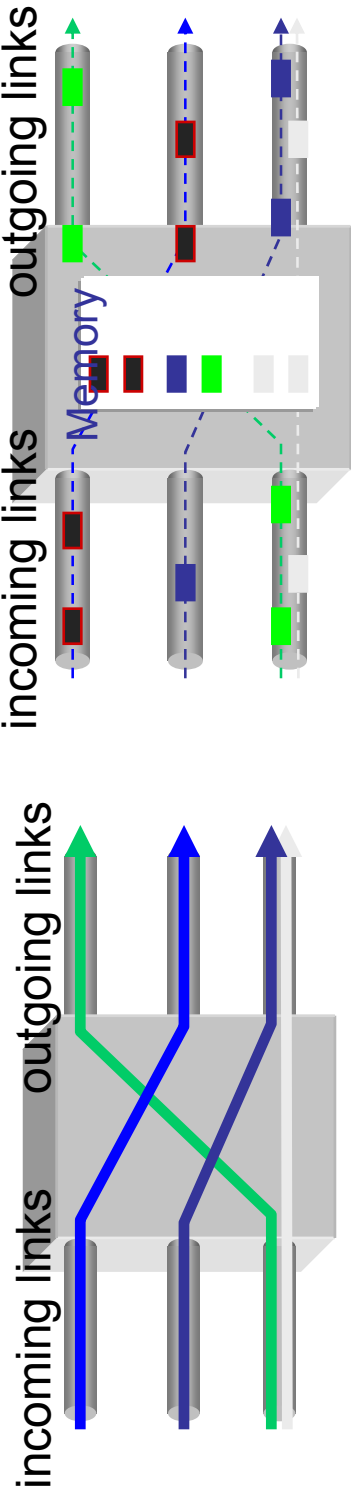
Spring 2003

Review

Stefan Savage
savage@cs.ucsd.edu

Basics

- Circuit Switching vs Packet Switching



- Network metrics (BW, latency, etc)
- Layering (why, what are layers for, layers in Internet protocols, etc)

Internet Arch & Internetworking

- Internetworking (IP)
 - ♦ Why? What problem solved?
- End-to-end principle
- How IP works
 - ♦ Addressing, Error control, etc

Reliable transmission

- When to retransmit
 - ♦ Timers
 - ♦ Fast retransmit
- Forward Error Correction (not ARQ)
 - ♦ Basic idea, when applicable?

Connections & Flow control

- Associating packets with processes
 - ◆ Port numbers, connection tuples
- TCP (connection-oriented)
 - ◆ Three-way handshake – connection establishment
 - ◆ Sender/receiver buffering & flow control
 - » Purpose of flow control
 - » Advertised window (how flow control is implemented)
- UDP (connectionless)
 - ◆ Applications that want more control (over retransmission or not, framing, flow control, scheduling, etc.)

Congestion control

- Queuing
 - ♦ Scheduling & buffer management
- Congestion control design issues
 - ♦ How to detect, how to control data rate, what data rate to use, how to ensure stability, etc.
- TCP congestion control
 - ♦ Window-based, congestion control – detects congestion via packet loss
 - ♦ AIMD adaptation (with fast recovery)
 - ♦ Slow start
 - ♦ Fast retransmit

Routing: distance vector

- Kinds of routing
 - ◆ Destination-based, source routing, virtual circuit
- Routing vs Forwarding
- Distance vector routing
 - ◆ Distributed Bellman-Ford Algorithm
 - ◆ Tell your neighbors everything you know
- Problems: count-to-infinity
 - ◆ Split horizon/poison reverse
- When to send route updates?

Routing: link state

- Tell everyone about your neighbors
 - ◆ Reliable flooding & link-state packets
- Dijkstra's algorithm
- Timestamps to reject old LSPs?
- What if router crashes?

Routing: inter-domain

- Routing between organizations
 - ◆ Policy-oriented not optimizing global metric
 - ◆ Autonomous systems (AS)
- BGP
 - ◆ Path-vector protocol
 - ◆ Per AS policy (which routes to accept/advertise)
 - ◆ BGP decision procedure
 - ◆ Example implementations of policy:
 - » Localpref, AS path, lowest IGP cost
 - ◆ Peering vs Transit (routing economics)

Routing: multicast

- Why multicast?
- How to use
 - ◆ Host API, addressing
- IGMP
- Routing
 - ◆ Source-based vs shared-tree
 - » Tradeoffs
 - » DV: Reverse Path Flooding, Reverse Path Multicast (prune)
 - ◆ Tunnelling/Mbone deployment issues

Mobile IP

- Mobility problem
- Mobile IP
 - ◆ Home Agent & Mobile agent
 - ◆ How packet forwarding works during mobility
 - ◆ Performance/security
- Transport-level mobility
 - ◆ TCP migrate option

Domain Naming System (DNS)

- Distributed database
- DNS records
 - ◆ A, NS, CNAME, etc
- Primary/secondary servers
- Name resolution
 - ◆ Hierarchy of servers
- Name caching

HTTP/Web

- Basic protocol
 - ◆ GET & response
- Parts of HTTP transfer (DNS, TCP handshake, request per object, etc)
- Persistent connections
- Pipelining
- Caching mechanisms
 - ◆ Expires, If-Modified-Since request

Load Balancing/CDN

- Other applications
 - ◆ SMTP, Telnet, NFS
- Load balancing
 - ◆ How to replicate content, push vs pull
 - ◆ How to select replica (mechanisms & policy)
 - » Routing, application-specific, using DNS
- CDN (Akamai example)
 - ◆ Use DNS to redirect requests for Web objects
 - ◆ Consistent hashing for matching object to servers

Peer-to-peer networks

- Lookup problem
- Centralized vs Distributed
- Flooding vs structured (routing)
 - ◆ Gnutella (flood request)
 - ◆ Freenet (non-deterministic routing table)
 - ◆ Chord (deterministic routing using consistent hashing)

Network Security I

- Kinds of security problems
- Channel security
 - ◆ Basic cryptography
 - » Authentication, confidentiality, integrity
- Perimeter security
 - ◆ Firewalls
 - ◆ Intrusion-detection systems
- Protocol security
 - ◆ Misbehaving TCP + modified protocol

Network Security II

- Denial-of-service attacks
 - ◆ How they work
 - ◆ Estimating DoS attacks
 - » Backscatter analysis
- Network worms
 - ◆ How they grow
 - ◆ How to defend against

Distributed Web Caching

- Where to cache
 - ◆ Host, proxy cache, server accelerator, server
- What to cache
 - ◆ Impact of object popularity
 - ◆ Impact of # of users
 - ◆ Sources of cache misses
- Prefetching
- Consistency
- Cooperative Web caching