

Advanced Computer Networks Topics and Research Areas

Congestion Control

- TCP {responsive flows}
 - Versions - Tahoe, Reno, NewReno, Vegas, Westwood
 - Approaches
 - RED (Random Early Detection)
 - FRED (Fair RED)
 - ECN (Explicit Congestion Notification)
 - Blue
 - PI Controller
 - REM
 - AVQ
 - XCP
 - Traffic Types
 - FTP
 - Short, Web traffic
- UDP {unresponsive flows}
 - TCP Friendly
 - Streaming Traffic (Audio and/or Video)
 - Approaches
 - CSFQ
 - SFB

Wireless/ Mobile Networks

- **MANET (Mobile Ad-hoc NETWORKS)**
 - Routing
- Loss Issues versus Congestion
- Wired to Wireless
- Power Issues
- Protocol Issues
 - TCP
 - 802.11 Protocols
- Performance of MAC layer

Streaming Media

- Streaming Protocols
- Congestion techniques
- Repair (FEC)
- Compression

Benchmarking and Performance Studies for Networks

- Benchmarks for network performance and “tuning”

- Benchmarks specifically for routers
 - issues in "wire speed" routing
 - bias in routers for certain type messages
- End-to-end delay measurements
- The state of current network measurement tools (e.g. httpperf, netperf, pathchar, tcpdump)
- Measuring whether TCP can deliver bandwidth for "new applications"
- Measuring high performance technologies (Gigabit Ethernet, ATM)
- Estimating RTT of a flow for TCP and link characteristics
 - packet pair techniques

Network Simulators

- **NS-2** simulations
- **NIST** tools

Security and Firewalls

- IPSec
- Kerberos
- Denial of Service attacks
- Viruses, Worms and Wormholes
- Firewalls
- Intrusion Detection
- VPN's (Virtual Private Networks)

Web Technologies

- HTTP 1.1
- Web caching
- Web proxies
- Content Delivery Networks
- Web performance

Basic Routing

- Distance Vector, Link State
 - RIP, OSPF
- **BGP**
 - instability and flapping

Multicast Routing

- Mbone
- Multicast Layering
- Multicast Protocols
 - DVMRP, MOSPF, CBT, PIM-SM, ECMP, RSVP
- Reliable Multicast
- Secure Multicast
- Multimedia Routing

- **Overlay Networks** - Application Level Multicast

Differentiated Services (Diffserv)

- Absolute differential services
- Edge node architectures
- GPS (Generalized Processor Sharing)
- Per flow state information
- Proportional differential services
- **QoS Issues**
- Relative differential services

Future of the Internet

- Internet2
- IPv6
- Internet topology studies

Networking Technology Differences

- Internetworking basics
 - Repeaters, bridges, hubs, routers, switches
- Faster routers/switches
 - Fast IP lookup
- ATM basics
- Advanced ATM topics
 - IP over ATM
 - Admission Control for ATM
 - Congestion Control mechanisms for ATM
 - Quality of Service for ATM
- Switching in IP networks
 - CSR, IP switches, Tag switching, ARIS, MPLS, MPOA

Network Management

- SNMP
 - Scalability on SNMP-based tools
 - Integrating network management tools
- SNMPv3

Miscellaneous

MPLS

Keying and Rekeying Issues

End point admission control

NAT Issues

Using Qbone

Packet Classification

Topology Discovery in LANs

IP Traceback