

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
 - Peer-to-Peer (P2P)
- UDP {unresponsive flows}
 - TCP Friendly
 - Streaming Traffic (Audio and/or Video)
 - Approaches
 - CSFQ
 - SFB

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

Wireless Networks

- MANET (Mobile Ad-hoc NETWORKS)
 - Routing
 - **VANET (Vehicular Ad Hoc Networks) and Traffic models**

- Infrastructure
 - 802.11 Protocols
 - MAC layer Performance
 - Wireless Loss versus Congestion
 - Dynamic Rate Adaptation
 - Home Wireless Issues
- RFID
- Cross-Layering Protocols
- Mesh Networks
- **GNU Radio**
- **Cognitive Radio**
- **MIMO**
 - cooperative, distributed, hierarchial
- **Cell Networks**
- **Location detection**
- **WIMAX**
- **Network Coding**
- **Interference Modeling**

Wireless Sensor Networks (WSNs)

- **Zigbee**
- **TinyOS**
- **IETF 6LoWPAN (Sensor Protocol Stack)**
- Clustering
- Power Issues
 - New Power-Aware MAC Protocols
- Two-Tier
- Indoor versus Outdoor Applications

Security and Firewalls

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

Streaming Multimedia

- Streaming Protocols

- Scaling
- Repair (FEC)
- Quality of Service
- Compression

Benchmarking and Performance Measurement

- 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
- **OPNET**
- **NIST** tools
- **MatLab** Tools
- Wireless Simulators
 - OMNET++
 - GloMoSim

Web Technologies

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

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
- 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