Topics and Research Areas

Congestion Control
- TCP {responsive flows}
  - Versions - Tahoe, Reno, NewReno, Vegas, Westwood, BIC, Cubic, Compound
  - 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
- DCCP

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

Multicast Routing
- 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 (IEEE 802.15.4)
- TinyOS
- IETF 6LoWPAN (Sensor Protocol Stack)
- Clustering
- Power Issues
  - Power-Aware MAC Protocols
  - Power Control 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
Cloud Networking Issues
MPLS
Keying and Rekeying Issues
End point admission control
NAT Issues
Using Qbone
Packet Classification
Topology Discovery in LANs
IP Traceback