Topics and Research Areas

Congestion Control
- TCP {responsive flows}
  - Old and Newer 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)
  - Video

- 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 with Access Points
  - 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, hierarchical
- Cellular Networks
  - 3G
  - 4G LTE
  - WIMAX
- Location detection
- Network Coding
- Interference Modeling

Wireless Sensor Networks (WSNs)
- Zigbee (IEEE 802.15.4)
- TinyOS
- Contiki
  - IETF 6LoWPAN (Sensor Protocol Stack)
- Clustering
- Power Issues
  - Power-Aware MAC Protocols
  - Power Control Protocols
- Two-Tier
- Indoor versus Outdoor Applications
- Body Area Networks

Network Simulators
- NS-3 simulations
- NS-2 simulations
- OPNET
- NIST tools
- **MatLab** Tools
- Wireless Simulators
  - OMNET++
  - GloMoSim

**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. httperf, 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

**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