

Computer Networks Topics and Research Areas

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Congestion Control

- TCP
 - Basic topics - sliding window, slow start, fast retransmit, fast recovery
 - Classic queueing - FCFS, FQ, WRQ, priority
 - Versions - Tahoe, Reno, NewReno, Vegas
 - Metrics
 - Throughput, goodput, fairness, delay
 - Improvements
 - RED (Random Early Detection)
 - FRED (Fair RED)
 - TCP with SACK (Selective ACKnowledgements)
 - ECN (Explicit Congestion Notification)
 - Rate-adaptation algorithms
- UDP
 - TCP Friendly
 - Streaming Traffic (Audio and/or Video)

Differentiated Services (Diffserv)

- Absolute differential services
- Edge node architectures
- GPS (Generalized Processor Sharing)
- Per flow state information
- Proportional differential services
- Relative differential services
- VPNs (Virtual Private Networks)

Routing

- Basic topics
 - Distance Vector, Link State
 - RIP, OSPF, BGP, CIDR
- Multicast Routing
 - Mbone
 - Multicast Layering
 - Multicast Protocols
 - DVMRP, MOSPF, CBT, PIM-SM, ECMP, RSVP
 - Reliable Multicast
 - Secure Multicast
- Multimedia Routing

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

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. httperf, netperf, 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

Web Technologies

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

Network Management

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

Security and Firewalls

- IPSec
- Denial of service attacks on Web Sites
- Firewalls

Future of the Internet

- Internet2
- IPv6
- Internet topology predictions

Newer Ideas {2002}

Repair Techniques for network traffic (e.g. FEC)
New Streaming Protocols
Wireless/ Mobile Networks (e.g., Bluetooth)
MPLS
Application Level Multicast (Overlays)
QoS Issues
Secure and Reliable Multicast
Keying and Rekeying Issues
End point admission control

From SIGCOMM2001:

Packet Loss Recovery
VPNs – the hose model vs the pipe model
NAT Issues
Using Qbone
Digital fountain approach – erasure codes
Packet Classification
Topology Discovery in LANs
IP Traceback