

Apps Requirements → Network Research Requirements

Linda Winkler, Brian Tierney, Harvey Neuman,
Matt Mathis, Ray Bair, Wu-chen Feng, Peter Oneil,
James Bury, Tom Dunigan, Guy Almes, Steve
Wallace, Javad Boroumand, Aaron Falk, Karen
Sollins

Communications Gap

- Network Researchers need to communicate to Apps and Middleware developers what is feasible
- Apps and Middleware developers need to communicate what is needed

Narrow DOE needs vs. widespread National needs

- DOE continues to have needs which do not directly apply to broader community

Viz requirement

- If a network service can indicate the bandwidth available, the app will adapt accordingly

Instrument (Control) requirement

- Need network services which learn more about the network

Monitoring

- End-to-end
 - Thru the host protocol stack
 - Achievable bandwidth
- Hop-by-hop and end-to-end
 - Delay
 - Jitter
 - Available bandwidth
 - Capacity
 - Utilization
 - Loss
- End system broadcast domain = Layer 2 topology discovery
- Need middleware to bridge wizard gap

Measurement

- Require a monitoring & measurement infrastructure/architecture
 - Problem on the order of $N*(N-1)/2$
 - Avoid redundant probing
- Approaches
 - Active probe vs real-time database
 - Data repository available for mining
 - Side affect of apps- have apps/stacks report/record achievable performance
- ESNet basic SNMP data a reasonable start
 - Internet2 an example of publicly available info
 - <http://loadrunner.uits.iu.edu/%7Erouterproxy/abilene>
 - <http://netflow.internet2.edu>
 - API which applications can query
 - <http://cil.cern.ch:8080/MONALISA>

Transport protocols

- TCP
 - byte oriented
 - running out of bits
 - Algorithm enhancements for high speed networks
 - Mtu issues
 - Will be difficult to replace; incremental changes worth making
- Private domain protocol approach
 - SCTP (Stream Control Transmission Protocol) is block oriented
 - <http://www.sctp.de>
 - Scheduled transfer (ST)
 - <http://www.hippi.org/cST.html>
- OS bypass- a technique used in host to speed communications

New Protocols Needs

- XCP (eXplicit Control Protocol)
 - <http://www.acm.org/sigs/sigcomm/sigcomm2002/papers/xcp.pdf>
 - www.icir.org/mjh/xcp.ps
 - Rapid convergence on congestion window
 - Requires new router paradigm
- deployment feasibility a shortcoming of current protocol research
- reliable transport protocols over very large datasets
- SNMP replacement needed
 - Transport an issue
 - Security to make the protocol useful interdomain

Multicast

- Scaling function different than the rest of internet
- Complex issue
- Current network layer multicast solution (ASM: Any-Source Multicast) solution should be avoided
- Alternatives-
 - Unicast relay (ie, VRVS, IRQ, IM)
 - Peer-to-peer technology

New Service Models (aka QoS)

- Next problem after TCP (transport) and end-to-end issues are resolved
- On demand reconfiguration of network paths (i.e., MPLS/TE, lambda switching)
- Quantifiable service
- Scavenger service
- Circuit switching- manufacturing more bandwidth
- Advanced reservations
- RFC2990 Next Steps for the IP QoS Architecture. G. Huston. November 2000
- Active queue management
- Interdomain diffserv model is dead
- Guaranteed timely delivery a requirement

Early Warning System

- A method for a system to inform the network what is about to happen (i.e., predictive scheduler)
 - Then report on whether warning was accurate
- Network services architecture
 - Publish results as well as receive predictions

Circuit switched model

- Research into control, manage, & measure
- Manual intervention not an option
- Need isolated networks (controlled environment) for experiments

Applied Research/Engineering

- Network control mechanisms
- MTU (Maximum Transfer Unit) enhancements
- TCP algorithms
- ECN: (Explicit Congestion Notification)
- High-speed intrusion detection
- High-speed netflow

Glossary

- **SNMP:** Simple Network Management Protocol
- **ASM** - Any Source Multicast service
- **XCP:** eXplicit Control Protocol
- **ST:** Scheduled transfer
- **SCTP:** Stream Control Transmission Protocol
- **MPLS:** Multiprotocol Label Switching
- **ECN:** Explicit Congestion Notification
- **TE:** Traffic Engineering