

Network Systems Lab

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Long Term Objectives

◆ Research Goal:

- Seamless provisioning of end-to-end QoS

◆ Components:

- Network QoS architecture
- Traffic control
- Distributed real-time scheduling
- Network management

Impact

- ◆ Theoretical
 - Fundamental advances in network QoS
 - Modeling & analysis
- ◆ Empirical
 - Design and implementation of new protocols
 - Building of prototype systems
 - Measurement-based benchmarking

Research Methodology

Top-down

- Top: Modeling & analysis
 - ➔ framework, qualitative properties
- Middle: Simulation
 - ➔ quantitative controlled study
- Bottom: System building
 - ➔ implementation, benchmarking

... with bottom-up feedback

Current Research

- ◆ Self-Similar/Multimedia Traffic Control
 - NSF ANI-9714707 (\$215,000)
 - T. Tuan, A. Balakrishnan, K. Liu
 - Problem
 - ◆ Bursty (fractal) network traffic
 - ◆ Internet, compressed video, WWW, etc.
 - Goal
 - ◆ Effective traffic control protocols

Current Research (Cont.)

- Accomplishments
 - ◆ Next generation protocols for
 - Bulk traffic (e.g., TCP-MT, rate-based ATM)
 - Real-time traffic (e.g., AFEC, AFEC-MT)
 - ◆ Implementation and benchmarking
- Related applications
 - ◆ Internet telephony, WWW server design, etc.
- Recent publications
 - ◆ Tuan & Park. Multiple time scale congestion control for self-similar traffic. *Performance Evaluation*, '99
 - ◆ Park & Willinger. *Self-Similar Network Traffic and Performance Evaluation*. Wiley, '99

Current Research (Cont.)

◆ Network QoS Architecture

- NSF CAREER ANI-9875789 (\$348,401),
NSF EIA-9972883 (\$2,200,000)
- S. Chen, H. Ren
- Problem
 - ◆ Scalable WAN QoS architecture
 - ◆ Diverse QoS requirements
 - ◆ Noncooperative network environment
- Goal: Design feasible QoS architecture

Current Research (Cont.)

- Accomplishments
 - ◆ New QoS provision framework: SBS
 - ◆ Integration of pricing, fairness into network substrate
 - ◆ Benchmarking using large scale simulations (vBNS)
 - ◆ Development of prototype SBS system
- Related applications
 - ◆ Infrastructure for e-commerce, distance learning, etc.
- Recent publications
 - ◆ Chen & Park. An architecture for noncooperative QoS provision in many-switch systems. *IEEE INFOCOM*, '99
 - ◆ Park *et al.* QoS provision in noncooperative networks with diverse user requirements. *Decision Support Systems*, '99

Current Research (Cont.)

- ◆ Distributed Real-Time Scheduling
 - NSF ESS-9806741 (\$564,107), PRF
 - J. Cruz, G. Cheng
 - Problem
 - ◆ Integrated computation/communication control
 - ◆ Distributed real-time scheduling
 - Goal
 - ◆ QoS-sensitive distributed system design
 - ◆ Completion of end-to-end QoS control path

Current Research (Cont.)

- Accomplishments
 - ◆ Communication-sensitive load balancing
 - ◆ Distributed real-time scheduling
 - ◆ DUNES (Distributed Unix Extension) distributed OS
- Related applications
 - ◆ End system scheduling, parallel distributed computing
- Recent publications
 - ◆ Cruz & Park. Towards performance-driven system support for distributed computing in clustered environments. *Journal of Parallel & Distributed Computing*, '99
 - ◆ Cruz & Park. DUNES: A performance-oriented system support environment for dependency maintenance in workstation networks. *IEEE HPDC*, '99

Current Research (Cont.)

◆ Adaptive Network Security

- Sprint (\$133,977)
- G. Nalawade, M. Tripunitara
- Problem
 - ◆ Efficient architecture for network security
 - ◆ Impact of security, fault-tolerance on QoS
- Goal
 - ◆ Design of adaptive network security architecture
 - ◆ Integration with QoS architecture

Current Research (Cont.)

- Accomplishments
 - ◆ Reactive/proactive security service architecture
 - ◆ IP and ATM platforms
 - ◆ Prototype system based on SNMP
 - ◆ Benchmarking for intrusion detection and denial-of-service attacks
- Related applications
 - ◆ Network management, e-commerce, integrated scheduling

For More Information

◆ Network Systems Lab



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