Network Systems Lab

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Long Term Objectives

- Research Goal:
  - Seemless 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

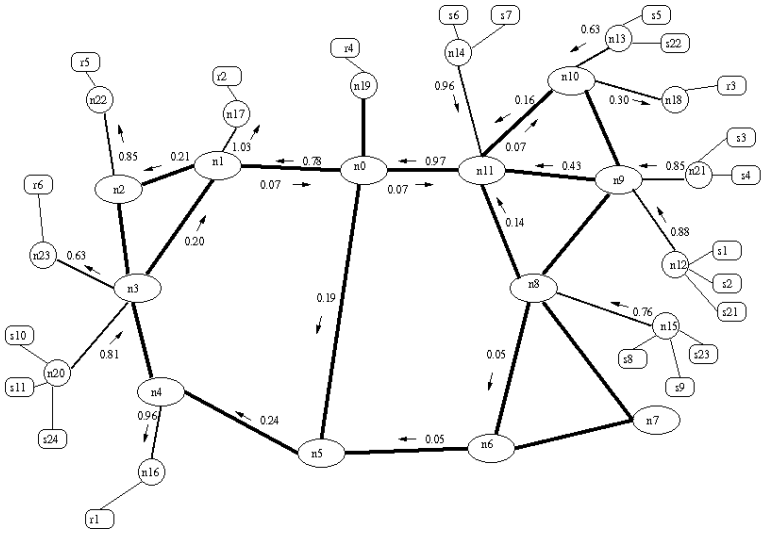
Current Research (Cont.)

- 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

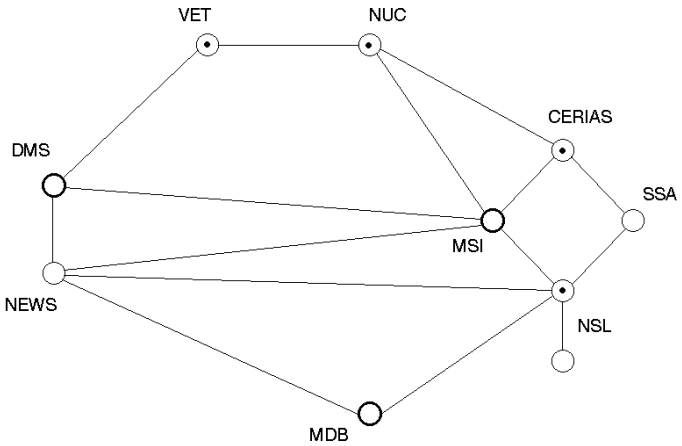
Current Research (Cont.)

- 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.)



vBNS



Purdue Infobahn

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.)

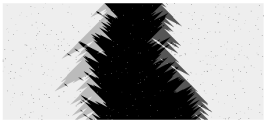
- Adaptive Network Security
  - Sprint ($133,977)
  - G. Nalawade, M. Tripunitara
  - Problem
    - Efficient architecture for network security
    - Impact of security, fault-tolerance on QoS
  - Goal
    - Design of adaptive network security architecture
    - Integration with QoS architecture

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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