High Performance Communication Networks

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20th Anniversary of ECE Dept. at GMU

Outline

• Broadband Switch Architectures
• Handoff in Cellular Networks
• Mobility Tracking in Wireless Networks
• Security and Quality-of-Service in MANETs
• Educational Networking Laboratory
Recent Graduate Students

- 3 PhD, 1 M.S. Thesis

Current Graduate Students / Postdoc

- 1 Postdoc, 2 PhD (one part-time), 1 M.S. Thesis

External Research Funding


High-Speed Internet Backbone
Broadband Switch Architectures


Multi-hop Node Architecture for Edge Networks

Optical Burst Switch for Core Networks

Research Results: Scheduling algorithms and performance models for multi-hop edge switch and optical burst switch architectures.
Research Results:

- Closed-form analysis of handoff probabilities for hysteresis and timer-based handoff algorithms.
- Local averaging technique for faster handoff.
Autoregressive Mobility Model

\[ s_{n,i} = A_i s_{n-1,i} + w_n \]

Mobility Tracking Scheme

- Observation: \( o_{n,1} \)
- Pre-filter: \( \hat{o}_{n,1} \)
- Initialization: \( \hat{s}_{0,1} \)
- Kalman Filter: \( \hat{s}_{n,1} \)
- Coordinate adjustment: \( \bar{s}_{n,1} \)

Parameter Estimator: \( (\hat{A}^{(n)}, \hat{Q}^{(n)}) \)
Mobile Ad Hoc Networks (MANETs)

- No infrastructure
- Mobile nodes serve as relays
SEQUOIA Project
“SEcurity and QUality-Of-service Integration in Ad hoc wireless networks

- Funded under *NSF Trusted Computing Program*

Co-investigators:
- Dr. Roshan Thomas, McAfee Research
- Dr. Kris Gaj

Research associate:
- Dr. Zainab Zaidi

Graduate students:
- Marek Hejmo, PhD, “Quality-of-Service Provisioning”
- Charikleia Zouridaki, PhD, “Security Mechanisms”
- Stefan Velica, MS, “Secure Routing”
Mobility-aware routing for MANETs

1. Distributed Mobility Tracking

2. Prediction of link availability

3. Routing based on link availability
Security-inclusive Routing for MANETs

Enemy Territory

Routing with multiple security attributes
Educational Networking Laboratory

Jose Rivera, “Data Networking Laboratory,” MS Project, 2001

An Early Version…

Asynchronous Port Connectivity

- GMU, Fairfax
  - Ethernet access
  - Cisco 4000
  - Dallas
  - Cisco 7000
  - Atlanta
- Fairfax_GMU
  - Cisco 2820
- Boston
  - Cisco 3000
- Miami
  - Cisco 3000
- Washington DC