Potential Thesis Topics in Networking

Prof. Geoffrey Xie

xie@cs.nps.navy.mil, SP 544C

April 2002

http://www.saamnet.org

1

What my Research Projects Offer

- Total learning experience for you
  - You will work on an interesting and practical problem
  - You will have a chance to obtain in-depth knowledge the Internet and other networking technologies
- Typical steps of thesis research
  - accumulate background
    - network track courses
    - independent studies, research group meetings
  - define problem, search literature, and develop solution
  - implement a prototype (in JAVA or C/C++)
  - measure and analyze performance of prototype
  - summarize results in one technical paper / thesis

2

Related Network Courses

- **CS 3502: Introduction to Computer Networks**
  - physical and link layers, and local area networks
- **CS 4550: Advanced Topics in Networking**
  - network and transport layers, selected advanced topics
- **CS 4552: Network Design and Programming**
  - hands-on experience of building a local area network and writing client/server applications
- **CS4554: Network Modeling and Analysis**
  - how to model and evaluate performance of network protocols

3

How to contact me

- Office: SP 544C
  - 656-2693

- E-mail: xie@cs.nps.navy.mil

- Personal Web page:
  http://www.cs.nps.navy.mil/people/faculty/xie

4

Current Research Projects

- Next Generation Internet --- SAAM project
  - funded by Defense Advanced Research Project Agency (DARPA), NASA, & National Science Foundation (NSF)
  - direct impact on Internet performance
  - more than 20 students graduated and we have a running prototype!
- Wireless Networking
  - funded by NSF
  - chance to learn wireless network technologies
- Experimental Gigabit ATM switches
  - a chance to play with state of art equipment (10Gbps!)
  - four students graduated

5

Sample Thesis Topics

- **Programming of CISCO Routers**
  - How to deploy new services without modifying IOS?
- **Policy-based Networking**
  - How to efficiently detect conflicts among policy rules specified in the Path-based Policy Language (PPL)?
  - How to automate policy deployment via COPS?
- **Smart Routing and Rerouting Algorithms**
  - How to reduce call blocking probability and data loss rate?
- **Study of Distributed Denial of Service attacks**
  - How to identify sources of attacks?
  - How to filter out malicious traffic early?
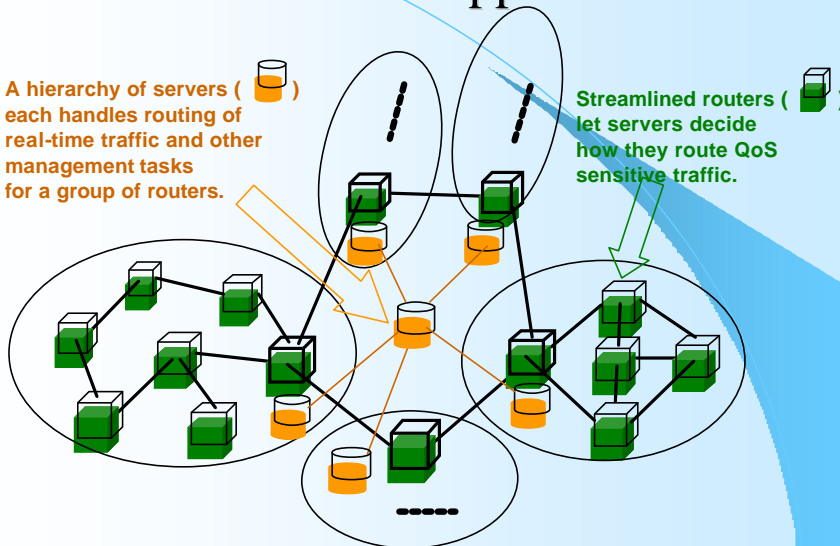
6

More Thesis Topics

- **Security Protocols for Wireless LANs**
  - How to strengthen WEP?
  - How to detect intrusions?
- **Extreme (Ad hoc) Networking**
  - How to mitigate effect of large propagation delays?
  - How to guarantee performance to selected traffic?
- **Mobile Agents and Survivable Networking**
  - How to make a service liquid, i.e., moving around the network and regenerating if necessary
- **Software Architecture for Dynamically Reconfigurable Systems**
  - How to reduce programming complexity of these systems?
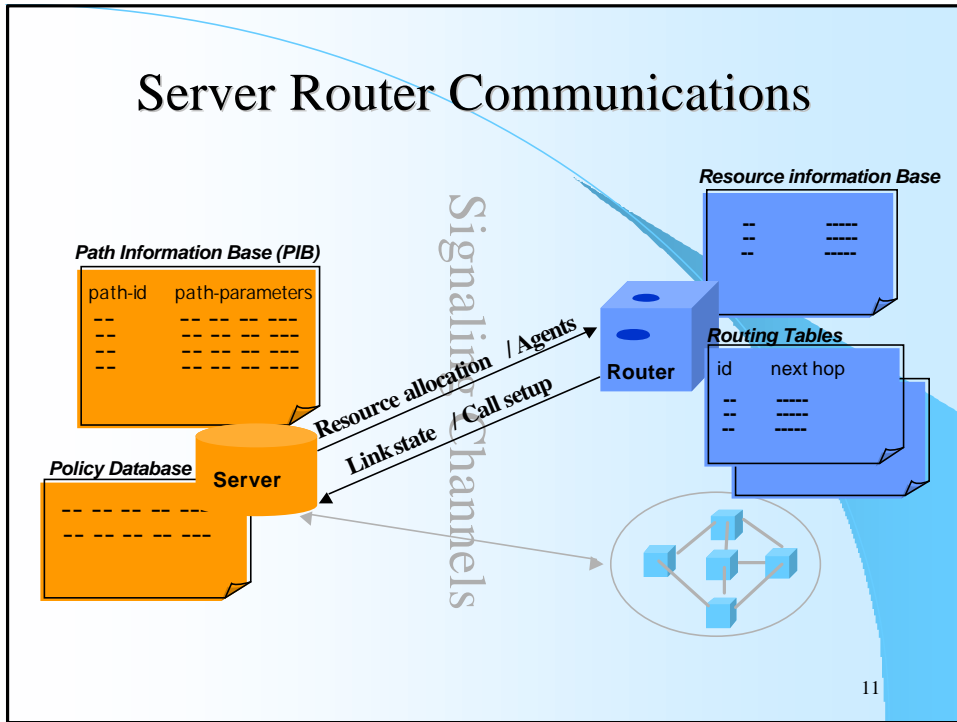
7

Server-based Approach

A hierarchy of servers ( ) each handles routing of real-time traffic and other management tasks for a group of routers.

Streamlined routers ( ) let servers decide how they route QoS sensitive traffic.

10

Server Router Communications

Resource information Base

Path Information Base (PIB)

path-id	path-parameters
--	-- -- -- ---
--	-- -- -- ---
--	-- -- -- ---
--	-- -- -- ---

Signaling Channels

Resource allocation / Agents

Link state / Call setup

Router

Routing Tables

id	next hop
--	-----
--	-----

Policy Database   **Server**

-- -- -- -- ---
-- -- -- -- ---

11

For more info about SAAM

- Please visit
  - http://www.saamnet.org

12

Gigabit Switch Research

- SAAM-NPS participant in GigabitKits Program
  Cutting-edge collaboration with universities world-wide

- ASSETS include two 20 Gb/S ATM switches and a variety of "SMART" linecards – all with open research architecture and support... including:

- APIC - Asynch Peripheral Interface Cards | PCI Bus | ATM

- SPC - Smart Port Cards | Embedded Intel "PC" ASICs for network controller

- FPX – Field Programmable Extender Cards | "Line-rate" FPGA controller

- ATM, NetBSD and Linux, kernel, C/C++, VHDL, FPGA Design work

- Hands-on Tutorials and Workshops Jan 10, July 2001 Washington University in St. Louis