Broadband *AND OPTICAL* Network*ING* ECSE-6660

http://www.pde.rpi.edu/

Or

http://www.ecse.rpi.edu/Homepages/shivkuma/

Shivkumar Kalyanaraman

Rensselaer Polytechnic Institute

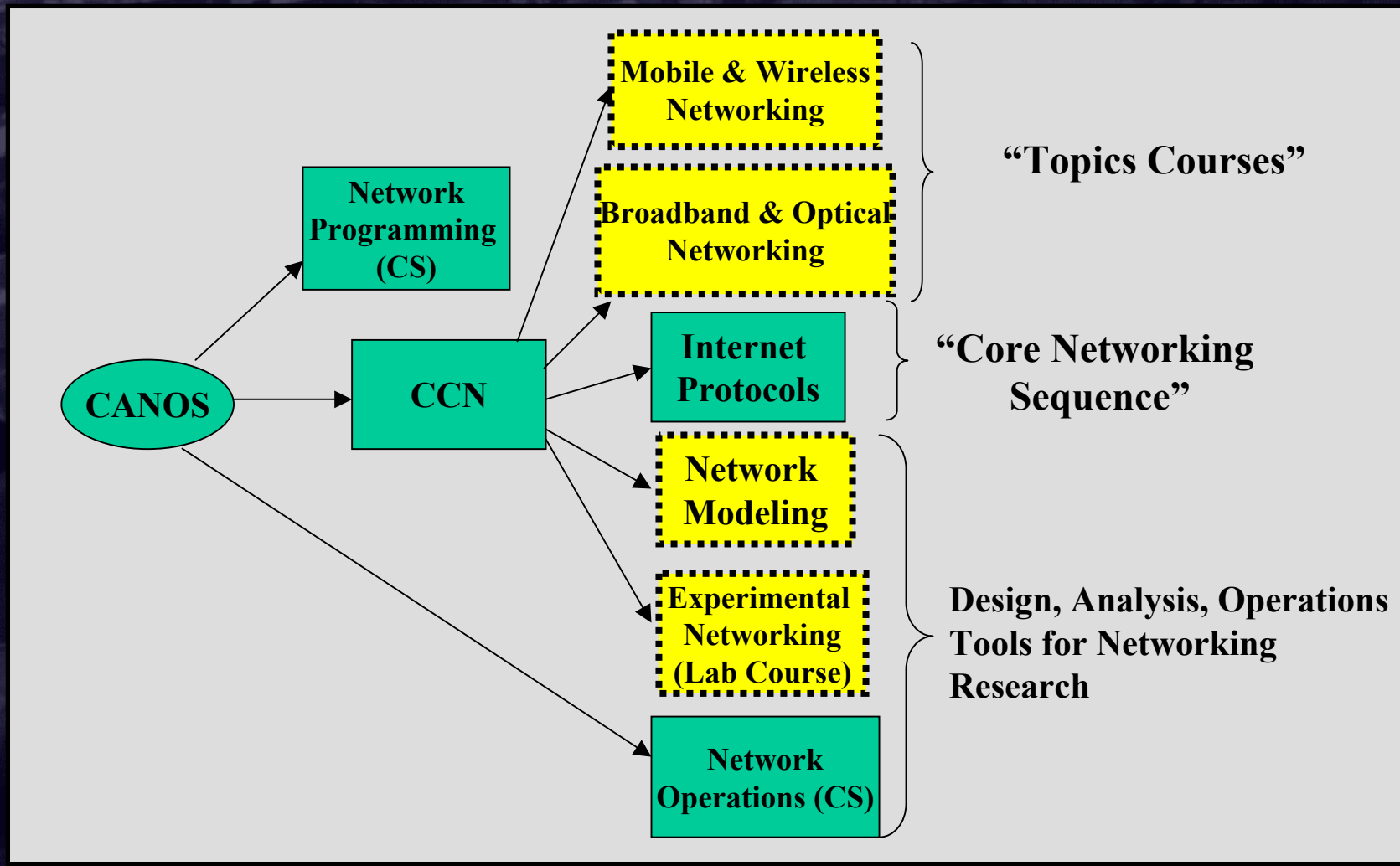
shivkuma@ecse.rpi.edu

- Introductions:course description & calendar
- Answers to frequently asked questions
- Prerequisites
- Informal Quiz

Who's Who

- **Instructor:** Shiv Kalyanaraman; kalyas@rpi.edu,
  - Room: JEC 6042, Phone: x8979
- **Course secretary:** (on-campus)
  - Melissa Reardon; reardm@rpi.edu,
  - Room: JEC 6049 ; Phone: x6313
- **PDE/RSVP Point-of-contact:**
  - Kari Lewick; lewick@rpi.edu, CII 4011; x2347
- **Production/Videostream/WebCT Point-of-contact:**
  - John Hughes: hughej2@pde.rpi.edu, x2421
- **TA:**
  - Omesh Tickoo: tickoo@networks.ecse.rpi.edu, JEC 6212; x8289

Networking Courses @RPI



Course Description Highlights

- This course will develop fundamental concepts, protocols & architectures of broadband and optical networking.
- Broadband networking driven by the imminent **convergence** of telephony (voice), Internet (data), cable (video), and wireless networks.
- Fundamental ideas in telephone, networking, cable systems, wireless
- Convergence architectures: B-ISDN, ATM, Frame Relay, Internet

Course Description Highlights

- Issues:
  - High-speed switching & router-design,
  - Quality of service (QoS) building blocks and architectures
  - Traffic engineering (MPLS, ATM, frame-relay),
  - Fiber optical communications,
  - Optical networking concepts,
  - Protection/restoration/survivability,
  - Optical link layers (SONET, WDM)

Course Description Highlights

- LANs/MANs/Last-Mile:
  - Gigabit Ethernet,
  - 802.11a/b and community/hot-spot networks
  - Cable-modem, DSL principles and economics
  - Free-space-optical network
  - Multihop/3G wireless data, smart antennas, OFDM
  - The course will involve substantial reading and a term project to help student synthesize the variety of concepts and appreciate the broad techno-economic challenges.

Format and Grading

Format		Grading	
Homework	4	Homework	25%
Projects	1	Term Project	15%
Exams	2	Exams	60%

- Access to Email and the World Wide Web required for course communications and materials.
  - Download class material from WebCT for each class
  - **WebCT bulletin board:** Post your questions!
  - **WebCT:** Grades, papers, homework dropbox etc
- Lots of reading & critical thinking involved! (credit given in homeworks)

Prerequisites

- Required ***(no exceptions):***
  - Computer Communication Networks (ECSE-4670)
  - Probability for Engineering Applications (ECSE-4500)
  - Suggested complementary course: Internet Protocols (ECSE-6600)
- Desirable:
  - Operating Systems
  - Computer Architecture (ECSE-4730 or equivalent)
- If you **do not have the required prerequisites**, you **must drop the course** and take it later.

Textbooks

REQUIRED:

- Srinivasan Keshav, **An Engineering Approach to Computer Networking,1997**.

- Rajiv Ramaswami, Kumar Sivarajan, **Optical Networks: A Practical Perspective (Second Edition)**, 2001

REFERENCE Textbooks

1. John Bellamy, **Digital Telephony**, Third Edition, 2000

2. James Farmer, David Large, Walter S. Ciciora**, Modern Cable Television Technology: Video, Voice, & Data Communications**, 1st edition (1999).

Answers to FAQ's

- Lot of paper readings in the class (due every homework) + research case study (writing skills)
- Informal quizzes given occasionally to complement homeworks. These are not graded.

- All homeworks due at the beginning of the class indicated on the course calendar
  - Up to one late submission: no penalty
  - Beyond that 20% penalty: only if submitted before solutions are posted (max one week grace period)

- All quizzes are open-book and extremely time limited.
  - Quizzes consist of design qns, numerical, and short answer questions.

Informal Quiz: Prerequisites

T F (True or False)

- ☐ ☐ Datalink refers to the 3rd layer in the ISO/OSI reference model
- ☐ ☐ If peak rate = 10 Mbps, Avg rate = 2 Mbps and Service rate = 4 Mbps, multiplexing gain = 2.
- ☐ ☐ An even parity bit value for the 8-bit string 01101010 is 0.
- ☐ ☐ Packet forwarding is a control-plane function and routing is a data-plane function.
- ☐ ☐ Bridges and switches in Ethernet allow separation of collision domains, and reduce the degree of sharing of the physical media.
- ☐ ☐ Finding path from one node to another in a large network is a transport layer function.
- ☐ ☐ It is impossible to send 3000 bits/second through a wire which has a bandwidth of 1000 Hz.
- ☐ ☐ Randomness (in service and arrival) is what causes queuing at buffers.
- ☐ ☐ Little's law which relates expected queuing delay E(T) and expected # in the system E(n) is applicable only to M/M/1 queues.
- ☐ ☐ Little's law also holds for *instantaneous* (as opposed to average) queuing delay and instantaneous number in the system

Informal Quiz (Continued)

- ☐ ☐ Bit stuffing is used so that framing characters do not occur in the frame payload.
- ☐ ☐ CRC is based upon the idea that it is highly unlikely for an uncorrupted packet to be perfectly divisible by the CRC polynomial.
- ☐ ☐ Random access MAC protocols tend to perform very well at low loads in terms of channel multiplexing; but suffer from high delay at high loads.
- ☐ ☐ "Taking turns" or token-based protocols like token-ring offer a best of both partitioning and random access worlds.
- ☐ ☐ For long delay paths, on-off flow control is better than window flow control.
- ☐ ☐ Ethernet uses a CSMA/CD access method.
- ☐ ☐ The packets sent in a connection-oriented network are called datagrams.
- ☐ ☐ The distance-vector protocol involves checking neighbors' distance vectors and updating its own distance vector.
- ☐ ☐ Address structure is required to recognize whether the destination is one-hop or multiple-hops away.

Informal Quiz: Solutions

T F (True or False)

- ☐ √ Datalink refers to the 3rd layer in the ISO/OSI reference model
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- ☐ √ It is impossible to send 3000 bits/second through a wire which has a bandwidth of 1000 Hz.
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Informal Quiz Solutions…

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