Fall 2005

Rivier College
Syllabus
CS685A Network Management

1. **Course number and title:** CS685A Network Management

2. **Instructor's name:** Dr. Vladimir V. Riabov, Associate Professor; Office: STH-312; Tel: (603) 897-8613; E-mail: vriabov@rivier.edu; Web site: http://www.rivier.edu/faculty/vriabov/

3. **Course description:** A survey of evolution of a network and the technologies available for network planning, creation, and operation. Topics include: operations, administration, maintenance, management of the configuration, database, security, and modeling techniques with OPNET software.
Prerequisite: CS573 Advanced Wide Area Networks, or equivalent (CS575 Advanced Local Area Networks or CS553 Introduction to Networking Technologies).

4. **Course objectives:**
The task of managing networks, computer systems, and business applications has become of paramount importance for the following reasons: (*i*) the enormous advancements in networking technology in recent years, (*ii*) the increasing dependence of human activities on networks and computers, and (*iii*) the commercialization of information technology (IT) services (e.g. email and electronic commerce). This course focuses on practices, standards, and open issues regarding the management of networks, computers that are connected to networks, and business applications that reside on the computers. The course examines both theoretical and practical issues in the field of network management.

   Upon completion of this course, the student should learn:
   - Standards and Models of Network Management
   - TCP/IP and other networking protocols related to Network Management
   - The Internet Organizations and some RFC Publications
   - SNMPv1 Management issues: Organization and Information Models, and Communication and Functional Models
   - SNMP Network Management issues resolved by SNMPv2, SNMPv3, and RMON
   - LAN Systems (Ethernet, CSMA/CD, Token Ring, FDDI, Fiber Channel, Wireless LANs)
   - Broadband technologies (ISDN, ASDN, xDSL, and cable modem)
   - Broadband Network Management issues in ATM Networks and Access Networks
   - Wide-Area Networks (Circuit-Switching, Packet-Switching, Frame Relay, ATM)
   - Internetworking Protocols (IPv4, IPv6, ICMP, IGMP)
   - Routing Strategies and Protocols
   - Storage Area Networks
   - Telecommunications Network Management
   - Modern Network Management Tools and Systems
   - Various Network Management Applications (SMTP, FTP, TELNET, HTTP, and others)
   - Network Security (Encryption, Digital Signature, IPSec)
   - Networking simulation and modeling techniques with OPNET software.

5. **Class Dates and Time:** September 13, 2005 – December 13, 2005
Tuesdays: 5:30 PM - 7:30 PM

6. **Required textbook:** Mani Subramanian, Network Management: Principles and Practice, 1st edition, Addison Wesley, 2000 (ISBN: 0201357429).

   Kevin Brown and Leann Christianson, OPNET Lab Manual to Accompany Data and Computer Communications (7th edition), Pearson Prentice Hall, 2005 (ISBN: 0-13-148252-1) [***optional***].

7. Recommended books:

- Lundy Lewis, Managing Business and Service Networks, 1st edition, 2001, Kluwer Academic/Plenum Publishers; ISBN: 0306465590.
- Stephen B. Morris, Network Management, MIBs and MPLS: Principles, Design and Implementation, Prentice Hall PTR, 2003, ISBN: 0-13-101113-8.
- Mahbub Hassan and Raj Jain, High Performance TCP/IP Networking, Prentice Hall, 2004, ISBN: 013064634-2.
- W. Stallings, Data and Computer Communications, 7th edition, Prentice Hall, 2004, ISBN: 0-13-100681-9.
- James M. Kretchmar, Open Source Network Administration, Prentice Hall, 2004, ISBN: 0-13-046210-1.
- Andrew S. Tanenbaum, Computer Networks, 4th edition, Prentice-Hall, Inc., 2003, ISBN: 0-13-066102-3.
- Larry L. Peterson and Bruce S. Davie, Computer Networks: A Systems Approach, 3rd edition, 2003, Morgan Kaufmann Publishers, ISBN: 1-55860-832-X.
- Tom Sheldon, McGraw-Hill's Encyclopedia of Networking & Telecommunications, 2nd edition, McGraw-Hill Professional Publishing, June 2001, ISBN: 0072120053.
- B. A. Forouzan, Data Communications and Networking, 3rd edit., McGraw-Hill, 2004, ISBN: 0-07-251584-8.
- A. Dennis, Networking in the Internet Age, 5th edition, Wiley, 2002, ISBN: 0471201898.
- James F. Kurose and Keith W. Ross, Computer Networking: A Top-Down Approach Featuring the Internet, 3rd edition (2005), Pearson Education, Inc., ISBN: 0-321-22735-2.
- L. G. Raman, Fundamentals of Telecommunications Network Management, IEEE Press, 1999.
- J. Ghetie, Network and Systems Management Platforms, Kluwer Academic Publishers, 1997.
- S. Keshav, An Engineering Approach to Computer Networking, 1997, Addison-Wesley, ISBN: 0201634422.
- J. Huntington-Lee, K. Terplan, and J. Gibson, HP OpenView: A Manager's Guide, McGraw-Hill, 1997.
- M. Kean and R. Caruso, Power Programming in HP OpenView: Developing CMIS Applications, Prentice Hall, 1996.
- W. Stallings, Wireless Communications and Networks, 1st edition (2001), Prentice Hall, ISBN: 0130408646.
- Radia Perlman, Interconnections: Bridges, Routers, Switches, and Internetworking Protocols (Addison Wesley Professional Computing Series), 2 edition (October 1999), Addison-Wesley Pub Co; ISBN: 0201634481.
- Leon-Garcia and Widjaja, Communication Networks: Fundamental Concepts and Key Architectures, McGraw-Hill Professional Publishing, 1999.
- Ata Elahi, Network Communications Technology, 1st edition, Delmar Publishers, 2000, ISBN: 0766813886.
- E. Gray, MPLS: Implementing the Technology (with CD-ROM), Addison-Wesley, 2001; ISBN: 0201657627.
- D. E. Comer, Internetworking with TCP/IP, Vol. I: Principles, Protocols, and Architecture, 4th edition, Prentice Hall, 2000; ISBN: 0130183806.
- L. Lewis, Service Level Management for Enterprise Networks, Artech House, 1999.
- H. Beyer and K. Holtzblatt, Contextual Design: Defining Customer-Centered Systems, Morgan Kaufman Publishers, Inc., 1998.
- Darren L. Spohn, Data Network Design (McGraw-Hill Communications Series), 2nd edition, McGraw-Hill, 1997, ASIN: 0070603634.
- William Stallings, ISDN and Broadband ISDN with Frame Relay and ATM, 4th edition (1999), Prentice Hall.
- *Articles* published in IEEE and other Technical Journals.
- *Technical information* and *white papers* published on the Internet.

Partial List of Excellent Reference Sources for Classes and Project Assignments:

- Integrated Management (IEEE Publishing, 1999-present);
- Network Operations and Management Symposium (IEEE Publishing, 2000-present);
- IEEE Communications Magazine (technical journal);
- IEEE Journal on Selected Areas in Communications (technical journal);
- IEEE Network (technical journal);
- IEEE Spectrum (technical journal);
- IEEE Transactions on Communications (technical journal);
- Computer Communications (technical journal);
- Computer Networks and ISDN Systems (technical journal);
- Bell System Technical Journal;
- Lightware, The Journal of Fiber Optics (technical journal).

8. Classroom Policies:

a) Attendance: As college students, it is your responsibility to be present for lectures. Missed notes, etc. are also your responsibility. Not attending class more than two times may result in a reduction of your grade, unless prior permission is received from the instructor. Please notify me of extenuating circumstances.

b) Project Assignment (individual project): The project can be either (*i*) **an implementation exercise** (related to Network Management) **using the OPNET software** (or any other software, e.g., Spectrum, OMneT++, etc.) **or** (*ii*) **a paper on an important topic in network management**. The purpose of implementing the software exercise or writing the paper is for you to gain an in-depth understanding of a particular topic that you are interested, or the technical knowledge that you learned will benefit you for your work or for your career development. It also gives you an opportunity to learn how to do independent research work, develop a study case, as well as how to write a technical report/paper.
The potential topics for your paper or software exercise in network management are listed as follows:

- Policy-based management;
- Web-based management;
- Quality of Service (QoS) management;
- Response time management;
- Broadband technologies, multimedia applications, and related network management issues;
- Service level management;
- Event correlation;
- Differences between SNMPv1, SNMPv2, and SNMPv3;
- Internet2;
- IPv6 and SNMP;
- A topic of your own selection (may be related to your work).

The paper should consist of about 15 typed pages plus illustrations, bibliography, and appendices (if necessary). A minimum of six technical articles and/or books must be used as sources for your paper. At least thirty percent of your reference materials should be technical articles published within two years.

You ***must*** submit your outline by and discuss it with me before you start writing the paper or start your project. If you need advice regarding the topic to select, the format of the paper, the contents of the paper, or reference material, you should discuss it with me. Discussing the same with your classmates is also encouraged. The outline discussion process is very important, because, only through this process, I may help you to organize your paper, advise you on the contents of the paper, advise you on where to find references, and guide you to the right direction. A student should make the project presentation at the end of the semester (see the course schedule). **The Project Paper is due on December 6, 2005**.

c) FOUR homework assignments are scheduled (September 27, October 11, November 8, and November 29).

d) FOUR in-class labs are scheduled (September 20, October 4, November 1, and November 15).

9. **Evaluation Mechanism:**
Students are required to pass all exams and complete all assignments. Exams will be based on textbooks, lecture material, and handouts. All exams will be comprehensive, closed book and open notes, and will be conducted in-class. See "***Project Assignments***" for detailed project assignment requirements. Grades for all exams and assignments will not be determined by curves. Letter grades submitted to the Registrar's Office would be based on the Rivier College Grading system. The conversion from numerical grade to letter grade will be based on the following table:

Letter Grade	Honor Points	Numerical Grade
A	4.0	94-100
AB	3.5	90-93
B	3.0	84-89
BC	2.5	80-83
C	2.0	73-79
F	0.0	Below 73

The grade is made up of your performance on your homeworks, labs, project, midterm and final exams. Approximate weightings are as follows:

Homeworks	10%
Labs	10%
Midterm Exam	25%
Final Exam	25%
Project&Presentation	30%

10. **Due Dates:**

Homeworks #1-4 due	September 27, October 11, November 8, and November 29, 2005
Labs #1-4 (in-class) due	September 20, October 4, November 1, and November 15, 2005
Project Proposal:	October 11, 2005
Midterm Exam:	October 18, 2005
Project presentation:	November 29 or December 6, 2005
Project paper due:	December 6, 2005
Final Exam:	December 13, 2005

11. **Topic Outline:**

SESSION	TOPIC	READING	HOMEWORKS
1 (09/13)	Data Communications and Network Management Overview. Lab00.	Ch. 1 OPNET	
2 (09/20)	Review of Computer Network Technologies. Lab01.	Ch. 2 OPNET	In-class Lab01 due
3 (09/27)	Standards, Models, and Language. SNMPv1 Network Management: Organization and Information Models	Ch. 3 Ch. 4 Ch. 4	Homework #1 due
4 (10/04)	SNMPv1 Network Management: Communication and Functional Models. Lab02.	Ch. 5 OPNET	In-class Lab02 due
5 (10/11)	SNMP Management: SNMPv2. SNMP Management: SNMPv3. *Mid-term Exam Preparation* **[PROJECT PROPOSAL DUE]**	Ch. 6 Ch. 7	Homework #2 due
6 (10/18)	**[MID-TERM EXAM]**	**[MID-TERM EXAM]**	**Chs. 1-7**
7 (10/25)	SNMP Management: RMON. Broadband Network Management: ATM Networks.	Ch. 8 Ch. 9	
8 (11/01)	Broadband Network Management: Access Networks. Lab03.	Ch. 10 OPNET	In-class Lab03 due
9 (11/08)	Telecommunications Network Management. Network Management Tools and Systems.	Ch. 11 Ch. 12	Homework #3 due
10 (11/15)	Network Management Applications. Lab04.	Ch. 13 OPNET	In-class Lab04 due

SESSION	TOPIC	READING	HOMEWORKS
11 (11/22)	Web-Based Management.	Ch. 14	
12 (11/29)	**Project Presentations** *Course Material Overview*		**Project Presentations** Homework #4 due
13 (12/06)	**Project Presentations** *Final Exam Preparation* **[PROJECT DUE]**		**Project Presentations** **[PROJECT DUE]**
14 (12/13)	**[FINAL EXAM]**	**[FINAL EXAM]**	**Chs. 8-14**