Kutztown University
Kutztown, Pennsylvania

Computer Science Department
College of Liberal Arts and Sciences

I. Course Description: CSC 411: Advanced Networking

This course deals with the theory, implementation and administration of networks. It is also concerned with the various layers of the Internet architecture stack, with concentration on layers 3 and 4. The primary protocols for these layers, Transmission Control Protocol (TCP) and Internet Protocol (IP), will be studied in detail. Network addressing and related protocols will also be covered.

3 s.h. 3.ch. Prerequisites: CSC 311 or unconditional admission to the Graduate program.

II. Course Rationale

The use of networks in every day life has been increasing exponentially over time. It is important for computer science and information technology students to have a strong foundation in networking concepts, including the various protocols in the network architecture stack. Students will be learn about the main protocols used in networks today, primarily TCP, User Datagram Protocol (UDP) and IP.

III. Course Objectives

Upon satisfactory completion of this course the student will be able to:

A. Explain the differences between the various types of network devices, such as switches and routers.

B. Demonstrate the correct usage of various types of network addresses, including MAC, IP, and CIDR (Classless Internet Domain Routing).

C. Describe how TCP is used to exchange data on a network.

D. Explain TCP flow control and congestion control.

E. Explain the basic IP functionality, including routing.

F. Describe the procedures used to perform network management, including SNMP (Simple Network Management Protocol) and common troubleshooting tools.

G. Explain how wireless networks are established and behave.

IV. Course Assessment

The course assessment will be a subset of tests, projects, papers, presentations, quizzes, homework, team assignments and final exam.

V. Course Outline

A) Network topologies
   1) Components
      a) Media
      b) Network devices
      c) Protocols
   2) Documentation

B) Addressing
   1) MAC
   2) IP
   3) Subnets
   4) CIDR
   5) NAT
   6) ARP and RARP

C) Transport Layer
   1) UDP
   2) TCP
      a) Overview
      b) Segment structure
      c) Packet sequencing
      d) Congestion control overview
      e) Flow control

D) Network Layer
   1) Overview
   2) IP
      a) Overview
      b) Datagram structure
      c) Fragmentation
   3) Routing
   4) ICMP

E) Network Management
   1) Introduction
   2) Tools
   3) Infrastructure

a) SNMP

F) Wireless Networks
1) Types
2) Protocols
3) Security

G) Network Security Fundamentals
1) Cryptography principles
2) Integrity
3) Authentication
4) Operational security
a) Introduction to firewalls
b) Introduction to VPNs

VI. Instructional Resources

Black, U. D. *Internet architecture: an introduction to IP protocols*. Upple Saddle River, NJ., Prentice Hall PTR, 2000. (TK5105.585 B536 2000)

Comer, Douglas E. *Internetworking with TCP/IP, Volume I: Principles, Protocols, andArchitecture*. Fifth edition. Addison-Wesley, 2005.
(Fourth edition: TK5105.585.C66 2000)

Comer, Douglas E. *The Internet Book: Everything You Need to Know About Computer Networking and How the Internet Works*. Fourth edition. Addison-Wesley, 2006.

Comer, Douglas E. and Droms, Ralph E. *Computer Networks and Internets.* Fifth edition. Addison-Wesley, 2001. (Fourth edition: TK5105.5 .C5897 2004)

Dodd, A. Z. *The Essential Guide to Telecommunications*. Fifth edition. Prentice Hall, 2012.

Flickenger, Rob., *Building Wireless Community Networks*. Second edition. O'Reilly, 2003. (Available in KU's Safari Books Online)

Forouzan, B. A. with Fegan, S. C. *Data communications and networking*. Fourth edition. New York, McGraw-Hill Higher Education, 2007. (TK5105 .F6617 2007)

Freeman, R. L. *Fundamentals of telecommunications*. Second edition. Hoboken, NJ., Wiley, 2005. (TK5101 .F6595 2005)

Gast, Matthew. *802.11 Wireless Networks: The Definitive Guide*. Second edition. O'Reilly Media, Inc. 2005.

Gilbert, H. Managing *TCP/IP networks: techniques, tools and security considerations*. New York, Wiley, 2000. (TK5105.585 .H447 2000)

Goleniewski, L. and Jarrett, K. W. *Telecommunications essentials, second edition: the complete global source*. Second edition. Addison Wesley Professional, 2007.

Halsall, Fred. *Computer networking and the Internet.* Fifth edition. Addison-Wesley, 2005. (TK5105 .H35 2005)

Kurose, James F., and Keith W. Ross, *Computer Networking: A Top-Down Approach Featuring the Internet*. Sixth edition. Pearson/Addison Wesley, Boston, 2012. (Third edition: TK5105.875.I57 K88 2005)

Leon-Garcia, A. and Wadjaja, I. *Communication networks: fundamental ceoncepts and key architectures*. Second edition. McGraw-Hill Science/Engineering/Math, 2003. (First edition: TK5101 .L46 2000a)

Noam, E. M. *Interconnecting the network of networks*. Cambridge, MA., MIT Press, 2001. (TK5105.5 .N62 2001)

Olifer, Natalia and Olifer, Victor. *Computer networks: principles, technologies and protocols for network design*. Wiley, 2006.

Peterson, L.L. and Davie, B.S. *Computer networks: a systems approach*. Fifth edition. Morgan Kauffman, 2011.

Rowe, S. H. *Computer Networking*. Prentice Hall, 2005.

Seifert, R. *The all-new switch book: the complete guide to LAN switching technology*. Second edition. John Wiley & Sons, 2008. (First edition: TK5105.7 .S455 2000)

Stallings, William. *Computer networking with Internet protocols and technology*. Pearson/Prentice Hall, Upper Saddle River, NJ, 2004. (TK5105.5 .S725 2004)

Stallings, W. *Data and computer communications*. Ninth edition. Prentice Hall, 2010. (Eigth edition: TK5105 .S73 2007)

Tanenbaum, A. S. *Computer Networks*. Fifth edition. Prentice Hall, 2010.

Tittel, E. and Chappell, L. *Guide to TCP/IP*. Fourth edition. Course Technology, 2012.

Winter, C. *A comprehensive introduction to computer networks*. Winter Communication Design, 2012.