

CS102 (New) - Advanced Networking

Unit 1. Review of Basic Concepts	[3]
TCP/IP Protocol Suite [T1 2.3]	
Underlying Technologies : LAN (802.3) T 1 3.1	
Wireless Lans (802.11) T 1 3.2	
Point-to-point WANS T 1 3.3	
Switched WANS T 1 3.4	
Unit 2. The Internet Layer Protocols	[4]
Review of IPv4 Protocol T 1 7.1,7.2,7.3,7.4,7.5	
IPv6 T 1 27.1,27.2	
Transition from IPv4 to IPv6 T 1 27.3	
ICMPv4 T 1 9.1,9.2,9.3,9.4	
ICMPv6 T 1 28.1,28.2,28.3,28.4	
Unit 3. Routing Protocols	[6]
Forwarding T 1 6.2	
Structure of a Router T 1 6.3	
Routing Tables T 1 11.1	
Intra – And Inter-Domain Routing T 1 11.2	
Distance Vector Routing T 1 11.3	
RIP T 1 11.4	
OSPF T 1 11.6	
BGP T 1 11.8	
Multicast Routing T 1 .4	
Unit 4. The Transport Layer	[6]
The Transport Service T 2 6.1	
Elements of Transport Protocols T 2 6.2	
UDP T 2 6.4.1	
TCP T 2 6.5.1 to 6.5.9	
Unit 5. Multimedia	[3]
Digitizing Audio and Video T 1 25.2	
Streaming stored Audio / Video T 1 25.4	
Streaming Live Audio / Video T 1 25.5	
Real-Time Interactive Audio / Video T 1 25.6	
RTP T 1 25.7	
RTCP T 1 25.8	
Voice Over IP T 1 25.9	
Unit 6. Introduction To Security	[2]
The need for Security T 3 1.2	
Security Approaches T 3 1.3	
Principles of Security T 3 1.4	
Types of Attacks T 3 1.5	
Unit 7. Cryptography: Concepts and Techniques	[3]
Introduction T 3 2.1	
Plain Text and Cipher Text T 3 2.2	
Substitution Techniques T 3 2.3.1,2.3.2,2.3.3,2.3.7	
Transposition Techniques T 3 2.4.1,2.4.2,2.4.3	

Symmetric and Asymmetric key cryptography	T 3 2.6.1,2.6.2	
Unit 8. Symmetric Key Algorithms		[3]
Algorithms types and modes	T 3 3.2.1,3.2.2	
DES	T 3 3.4	
Unit 9. Asymmetric key Algorithms		[2]
RSA	T 3 4.4	
Symmetric and Asymmetric key Cryptography	T 3 4.5	
Digital Signatures	T 3 4.6.1,4.6.2	
Unit 10. Digital Certificates		[2]
Introduction	T 3 5.1	
Digital Certificates	T 3 5.2	
Unit 11. Internet Security Protocols		[10]
Secure Socket Layer	T 3 6.3	
TLS	T 3 6.4	
SHTTP	T 3 6.5	
TSP	T 3 6.6	
SET	T 3 6.7	
SSL Verses SET	T 3 6.8	
3-D Secure Protocol	T 3 6.9	
Electronic Money	T 3 6.10	
Email Security	T 3 6.11	
Firewalls	T 3 9.3	
IP Security	T 3 9.4	
VPN	T 3 9.5	
Unit 12. User Authentication		[4]
Passwords	T 3 7.3	
Certificate-based Authentication	T 3 7.5	
Kerberos	T 3 7.7	
Security Handshake Pitfalls	T 3 7.9	

Text Books:

T1 : TCP / IP Protocol Suite Fourth Edition – Behrouz A. Forouzan

T2 : Computer Networks Fourth Edition – Andrew Tanenbaum

T3 : Cryptography and Network Security Second Edition – Atul Kahate

Supplementary but very useful references/texts: (Few of the references below contain latest research and trends related to Networks and Security and are useful for seminar/presentations by the students.)

1. Computer Network Security, Kizza, Springer, 9780387204734
2. Guide to Computer Network Security, Kizza, Springer, 978-1-84800-916-5
3. Network Security, Harrington, Elsevier, ISBN 9788131202166
4. Douglas E. Comer, Internetworking with TCP/IP, Vol. 1, Principles, Protocols and Architecture Fifth Edition, Prentice Hall, 2000, ISBN 0-13-018380-6.
5. William Stallings, Data and Computer Communications , Seventh Edition, Pearson Education
6. Douglas E. Comer, Internetworking with TCP/IP, Vol. 2, Design, Implementation and Internals, Prentice Hall Publisher.

7. Internetworking with TCP/IP, Vol. 3, Client-server Programming and Applications by Douglas E. Comer, Prentice Hall Publisher. (Excellent reference for distributed programming over TCP/IP networks)
8. Richard Stevens, TCP/IP Illustrated, Vol. 1, by, Addison Wesley (A very practical book with lots of useful network diagnostic tools and programs.)
9. Craig Hunt, TCP/IP Network Administration O'Reilly & Associates, Inc. (A must for network and system administrators dealing with internetworking.)
10. L. Peterson and B. Davie. Morgan , Computer Networks: A Systems Approach by Kaufmann Publishers Inc., ISBN 9788131210451
11. J. Kurose, K. Ross ``Computer Networking: A Top-Down Approach Featuring the Internet" Addison-Wesley, '00
12. William Stallings, " Cryptography And Network Security" Prentice Hall /Pearson Education

Guidelines to paper setters:

Frame formats of protocols are not expected

Problems should be asked on Routing Protocols , TCP, Cryptography, RSA

CS-202(New): Advanced Operating Systems

Prerequisites:

- Working knowledge of C programming.
- Basic Computer Architecture concepts.
- Basic algorithms and data structure concepts.

Course Objectives:

This course teaches Advanced Operating Systems Concepts using Unix/Linux and Windows as representative examples. This course strikes a delicate balance between theory (covered in TextBook-2, 3) and practical applications (covered in TextBook-1, 4). In fact, most Units start with the theory and then switches focus on how the concepts are implemented in a C program. This course describes the programming interface to the Unix/Linux system - the system call interface. It is intended for anyone writing C programs that run under Unix/Linux. Finally, it concludes with an overview of Windows Threads Management. This course provides an understanding of the functions of Operating Systems. It also provides provide an insight into functional modules of Operating Systems. It discusses the concepts underlying in the design and implementation of Operating Systems.

Syllabus:

Unit 1. Introduction to UNIX/Linux Kernel

[03]

- System Structure, User Perspective, Assumptions about Hardware, Architecture of UNIX Operating System (TextBook-3: Chapter Topics: 1.2, 1.3, 1.5, 2.1)
- Concepts of Linux Programming- Files and the Filesystem, Processes, Users and Groups, Permissions, Signals, Interprocess Communication (TextBook-1: Chapter 1- relevant topics)

Unit 2. File and Directory I/O

[13]

- Buffer headers, structure of the buffer pool, scenarios for retrieval of a buffer, reading and writing disk blocks, inodes, structure of regular file, open, read, write, lseek, close, pipes, dup (TextBook- 3: Chapter Topics: 3.1-3.4, 4.1, 4.2, 5.1-5.3, 5.5-5.7, 5.12, 5.13)
- open, creat, file sharing, atomic operations, dup2, sync, fsync, and fdatasync, fcntl, /dev/fd, stat, fstat, lstat, file types, Set-User-ID and Set-Group-ID, file access permissions, ownership of new files and directories, access function, umask function, chmod and fchmod, sticky bit, chown, fchown, and lchown, file size, file truncation, file systems, link, unlink, remove, and rename functions, symbolic links, symlink and readlink functions, file times, utime, mkdir and rmdir, reading directories, chdir, fchdir, and getcwd, device special files (TextBook-4: Chapter Topics: 3.3, 3.4, 3.10-3.14, 3.16, 4.2-4.23)

- Scatter/Gather I/O, Mapping Files into Memory, Advice for Normal File I/O, I/O Schedulers and I/O Performance, Directories, Copying and Moving files, Device Nodes, Out-of-Band Communication (TextBook-1: Chapters: 4 and 7-relevant topics)

Unit 3. Process Environment, Process Control and Process Relationships [14]

- Process states and transitions, layout of system memory, the context of a process, saving the context of a process, sleep, process creation, signals, process termination, awaiting process termination, invoking other programs, the user id of a process, changing the size of the process, The Shell, Process Scheduling (TextBook-3: Chapter Topics: 6.1-6.4, 6.6, 7.1-7.8, 8.1)
- Process termination, environment list, memory layout of a C program, shared libraries, environment variables, setjmp and longjmp, getrlimit and setrlimit, process identifiers, fork, vfork, exit, wait and waitpid, waitid, wait3 and wait4, race conditions, exec, changing user IDs and group IDs, system function, user identification, process times (TextBook-4: Chapter Topics: 7.3, 7.5-7.7, 7.9-7.11, 8.2-8.11, 8.13, 8.15, 8.16)
- The Process ID, Running a New Process, Terminating a Process, Waiting for Terminated Child Processes, Users and Groups, Daemons, Process Scheduling, Yielding the Processor, Process Priorities, Processor Affinity (TextBook-1: Chapter 5 and 6 [Relevant Topics])

Unit 4. Memory Management [06]

- The Process Address Space, Allocating Dynamic Memory, Managing Data Segment, Anonymous Memory Mappings, Advanced Memory Allocation, Debugging Memory Allocations, Stack-Based Allocations, Choosing a Memory Allocation Mechanism, Manipulating Memory, Locking Memory, Opportunistic Allocation (TextBook-1: Chapter 8)
- Swapping, Demand Paging (TextBook-3: Chapter Topics: 9.1, 9.2)

Unit 5. Signal Handling [06]

- Signal concepts, signal function, unreliable signals, interrupted system calls, reentrant functions, SIGCLD semantics, reliable-signal technology, kill and raise, alarm and pause, signal sets, sigprocmask, sigpending, sigsetjmp and siglongjmp, sigsuspend, abort, system function revisited, sleep (TextBook-4: Topics: 10.2-10.13, 10.15-10.19)
- Signal Concepts, Basic Signal Management, Sending a Signal, Reentrancy, Signal Sets, Blocking Signals, Advanced Signal Management, Sending a Signal with a Payload (TextBook-1: Chapter 9)

Unit 6. Windows Thread Management (TextBook-2: Chapter 5 [relevant topics]) [06]

- Thread Internals
 - Data Structures, Kernel Variables, Performance Counters, Relevant Functions, Birth of a Thread Examining Thread Activity : Limitations on Protected Process Threads, Worker Factories (Thread Pools)

- Thread Scheduling
 - Overview of Windows Scheduling, Priority Levels, Windows Scheduling APIs, Relevant Tools, Real-Time Priorities, Thread States, Dispatcher Database, Quantum, Scheduling Scenarios, Context Switching, Idle Thread, Priority Boosts

Recommended Text:

1. Linux System Programming, O'Reilly, by Robert Love.
2. Windows Internals, Microsoft Press, by Mark E. Russinovich and David A. Soloman.
3. The Design of the UNIX Operating System, PHI, by Maurice J. Bach.
4. Advanced Programming in the UNIX Environment, Addison-Wesley, by Richard Stevens.