Laboratory Manual

for

Advanced Network Programming
(MF 105)

M.Tech (IT) SEM - I

June 2011

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Laboratory Manual
M.Tech. – IT, Sem: 1, Subject Name: Advanced Network Programming

List of Experiments:

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EXPERIMENT 2: Multithreading and synchronization using pthread library.

EXPERIMENT 3: Inter-process communication (pipe, fifo, shared memory, and message passing)

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EXPERIMENT 6: TCP socket options

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EXPERIMENT 10: Study of network simulator (ns)

LABWORK BEYOND CURRICULA

EXPERIMENT 1: Using wireshark tool to grab information exchanged between TCP client and server programs that are running in two VMs.

EXPERIMENT 2: Use ioctl() call to retrieve IP configuration information.

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COMMON PROCEDURE

The common procedure for solving programming related problems is as follows:

Step 1: For given problem statement, find out the names of required system calls.
Step 2: Study and understand the usage of those system calls.
Step 3: Design the logic for solving the given problem.
Step 4: Implement the logic in C programming code.
Step 5: Compile the program using make utility
Step 6: Run the program by passing the appropriate command line arguments
Step 7: Note down the output and draw your conclusion.

EXPERIMENT 1:

Aim: Study of various Linux system commands

a) Information Management
   cal, date, tty, sh, env, set, man, who, whoami
b) Utility commands
   wc, echo, tail, less, more, sort, grep, bc, cmp, comm.
c) File System Management
   ls, ln, rm, rmdir, mkdir, file, chmod, find, od, pwd, locate, updated, mount, umount, mv
d) Process Management
   ps, kill
e) Compilation and debugging
   cc, gdb
f) Editors
   vi, mcedit
g) Network support
   netstat, ifconfig, ping, telnet

Tools / Apparatus: Linux OS and man pages

Procedure:

1. For each command, read the documentation from man pages, e.g., using man command.
2. Study important options
3. Execute the command with options and study the output.

EXPERIMENT 2:

Aim: Multithreading and synchronization using pthread library.
Tools / Apparatus: Linux OS, gcc, and pthread library

EXPERIMENT 3:

Aim: Inter-process communication (pipe, fifo, shared memory, and message passing)

Tools / Apparatus: Linux OS, and gcc

Procedure:
Use common procedure

EXPERIMENT 4:

Aim: TCP client server programming (iterative and concurrent)

Tools / Apparatus: Linux OS, and gcc

Procedure:
Use common procedure

EXPERIMENT 5:

Aim: Programming of Robust TCP Server and Robust TCP client

Tools / Apparatus: Linux OS, and gcc

Procedure:
Use common procedure

EXPERIMENT 6:

Aim: TCP socket options

Tools / Apparatus: Linux OS, and gcc

Procedure:
Use common procedure

EXPERIMENT 7:

Aim: UDP client server programming

Tools / Apparatus: Linux OS and gcc

Procedure:
Use common procedure

EXPERIMENT 8:

Aim: I/O multiplexing in TCP server programming

Tools / Apparatus: Linux OS and gcc

Procedure:
Use common procedure

EXPERIMENT 9:

Aim: System call tracing of commands. Using strace, trace system calls used in ps, ping, ifconfig, and netstat commands.

Tools / Apparatus: Linux OS and strace

Procedure:

1. Run a linux command using strace
2. Note down system calls/functions used by the command
3. For each command, understand which system calls are used for getting desired functionality.

EXPERIMENT 10:

Aim: Study of network simulator (ns)

Tools / Apparatus: Linux OS and NS-2 simulator

Procedure:

1. Study architecture of NS-2
2. Study sample .tcl file used for experimentation
3. Design your own network topology by doing modifications in sample .tcl file.

4. Perform simulation
5. Study trace file.
6. Perform animation of trace file using nam tool.

LABWORK BEYOND CURRICULA

EXPERIMENT 1:

Aim: Using wireshark tool to grab information exchanged between TCP client and server programs that are running in two VMs.

Tools / Apparatus: Windows 7 OS, Ubuntu 12.04 LTS, Oracle Virtual Box

Procedure:

1. Prepare two VMs running Ubuntu 12.04 LTS
    a. Install Oracle Virtual Box software on Windows 7 OS.
    b. Run Virtual Box
    c. Click New to set up a new virtual machine profile and follow the wizard.
    d. Title your virtual machine. e.g. Ubuntu-1
    e. VirtualBox will try to guess how much RAM to allocate for the virtual machine. If you have 1 GB of RAM, 512 MB might be a good allocation.
    f. Create a virtual hard drive to install OS.
    g. Configure Network as internal network
    h. Configure CD ROM settings.
    i. Select the newly created virtual machine profile and click Start.
    j. After it boots up, click the Install icon on the desktop.
    k. Answer all the questions.
    l. After installation is over, now you can do installation of second VM using above steps.
2. Configure two VMs for network IP addresses
3. Install and run wireshark with appropriate configuration on Ubuntu-1
4. Run TCP Server program on Ubuntu-1
5. Run TCP Client program on Ubuntu-2
6. Observe connection establishment sequence, data exchange, and connection termination sequence.

EXPERIMENT 2:

Aim: Use ioctl() call to retrieve IP configuration information.

Tools / Apparatus: Linux OS

Procedure:
Use common procedure

Required Reading Materials
Books:

1. UNIX Network Programming, Volume-1 By Richard Stevens, Second Edition, PHI publication
2. UNIX Network Programming, Volume-2 By Richard Stevens, Second Edition, PHI publication

Online material

- Online materials/tutorials on NS-2, available at http://www.isi.edu/nsnam/ns/
- Online materials/tutorials on wireshark, available at https://www.wireshark.org/