Network Programming

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Lab Assignment -1

FTP

```
root@Ubuntu:/home/maninder# sudo cp /etc/vsftpd.conf /etc/vsftpd.conf_default
root@Ubuntu:/home/maninder# sudo useradd -m testuser
root@Ubuntu:/home/maninder# sudo passwd testuser
New password:
Retype new password:
passwd: password updated successfully
root@Ubuntu:/home/maninder# sudo ufw allow 20/tcp
Rules updated
Rules updated (v6)
root@Ubuntu:/home/maninder# sudo ufw allow 21/tcp
Rules updated
Rules updated (v6)
root@Ubuntu:/home/maninder# sudo ftp maninder
ftp: Can't lookup `maninder:ftp': Temporary failure in name resolution
ftp>
ftp> root@ubuntu:/home/maninder
?Invalid command.
ftp> maninder-VirtualBox
?Invalid command.
ftp> xit
?Invalid command.
ftp> exit
root@Ubuntu:/home/maninder# sudo ftp maninder-VirtualBox
ftp: Can't lookup `maninder-VirtualBox:ftp': Temporary failure in name resolution
ftp> exit
root@Ubuntu:/home/maninder# sudo ftp ubuntu
Connected to Ubuntu.myguest.virtualbox.org.
220 (vsFTPd 3.0.5)
Name (ubuntu:maninder): testuser
331 Please specify the password.
Password:
230 Login successful.
Remote system type is UNIX.
Using binary mode to transfer files.
ftp> sudo mkdir /srv/ftp/new_location
?Invalid command.
ftp> exit
221 Goodbye.
root@Ubuntu:/home/maninder# sudo mkdir /srv/ftp/new_location
root@Ubuntu:/home/maninder# sudo usermod -d/srv/ftp/new_location ftp
root@Ubuntu:/home/maninder# sudo systemetl restart vsftpd.service
sudo: systemetl: command not found
root@Ubuntu:/home/maninder# sudo sytemctl restart vsftpd.service
sudo: sytemctl: command not found
root@Ubuntu:/home/maninder# sudo systemctl restart vsftpd.service
root@Ubuntu:/home/maninder# sudo nano /etc/vsftpd.conf
root@Ubuntu:/home/maninder# sudo systemctl restart vsftpd.service
root@Ubuntu:/home/maninder#
```

TELNET

```
root@Ubuntu:/home/maninder# sudo apt install telnetd -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
telnetd is already the newest version (0.17-44build1).
0 upgraded, 0 newly installed, 0 to remove and 361 not upgraded.
root@Ubuntu:/home/maninder# ifconfig
Command 'ifconfig' not found, but can be installed with:
apt install net-tools
root@Ubuntu:/home/maninder# ifconfig
Command 'ifconfig' not found, but can be installed with:
apt install net-tools
root@Ubuntu:/home/maninder# apt install net-tools
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following NEW packages will be installed:
  net-tools
0 upgraded, 1 newly installed, 0 to remove and 361 not upgraded.
Need to get 204 kB of archives.
After this operation, 819 kB of additional disk space will be used.
Get:1 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 net-tools amd64 1.60+git2018
Fetched 204 kB in 4s (50.7 kB/s)
Selecting previously unselected package net-tools.
(Reading database ... 165779 files and directories currently installed.)
Preparing to unpack .../net-tools_1.60+git20181103.0eebece-1ubuntu5_amd64.deb ..
.
Unpacking net-tools (1.60+git20181103.0eebece-1ubuntu5) ...
Setting up net-tools (1.60+git20181103.0eebece-1ubuntu5) ...
Processing triggers for man-db (2.10.2-1) ...
root@Ubuntu:/home/maninder# ifconfig
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 10.0.2.15  netmask 255.255.255.0  broadcast 10.0.2.255
        inet6 fe80::121a:2902:4718:4cda  prefixlen 64  scopeid 0x20<link>
        ether 08:00:27:82:c1:d3  txqueuelen 1000  (Ethernet)
        RX packets 2305  bytes 2243847 (2.2 MB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 2008  bytes 204383 (204.3 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 1391  bytes 124971 (124.9 KB)
```

```
root@Ubuntu:/home/maninder# sudo apt install telnet
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
telnet is already the newest version (0.17-44build1).
telnet set to manually installed.
0 upgraded, 0 newly installed, 0 to remove and 361 not upgraded.
root@Ubuntu:/home/maninder# telnet 127.0.0.1
Trying 127.0.0.1...
Connected to 127.0.0.1.
Escape character is '^]'.
Ubuntu 22.04.2 LTS
Ubuntu login: maninder
Password:
Welcome to Ubuntu 22.04.2 LTS (GNU/Linux 5.19.0-32-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

 * Introducing Expanded Security Maintenance for Applications.
   Receive updates to over 25,000 software packages with your
   Ubuntu Pro subscription. Free for personal use.

     https://ubuntu.com/pro

Expanded Security Maintenance for Applications is not enabled.

0 updates can be applied immediately.

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status


The list of available updates is more than a week old.
To check for new updates run: sudo apt update

The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

maninder@Ubuntu:~$
```

SSH

```
maninder@Ubuntu:~$ sudo apt-get install openssh-server -y
[sudo] password for maninder:
maninder is not in the sudoers file.  This incident will be reported.
maninder@Ubuntu:~$ su root
Password:
root@Ubuntu:/home/maninder# sudo apt-get install openssh-server -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  ncurses-term openssh-client openssh-sftp-server ssh-import-id
Suggested packages:
  keychain libpam-ssh monkeysphere ssh-askpass molly-guard
The following NEW packages will be installed:
  ncurses-term openssh-server openssh-sftp-server ssh-import-id
The following packages will be upgraded:
  openssh-client
1 upgraded, 4 newly installed, 0 to remove and 360 not upgraded.
Need to get 1,661 kB of archives.
After this operation, 6,059 kB of additional disk space will be used.
Get:1 http://in.archive.ubuntu.com/ubuntu jammy-updates/main amd64 openssh-client amd64 1:8.9p1-3ubuntu0.3 [910 kB]
Get:2 http://in.archive.ubuntu.com/ubuntu jammy-updates/main amd64 openssh-sftp-server amd64 1:8.9p1-3ubuntu0.3 [38.8 kB]
Get:3 http://in.archive.ubuntu.com/ubuntu jammy-updates/main amd64 openssh-server amd64 1:8.9p1-3ubuntu0.3 [434 kB]
Get:4 http://in.archive.ubuntu.com/ubuntu jammy-updates/main amd64 ncurses-term all 6.3-2ubuntu0.1 [267 kB]
Get:5 http://in.archive.ubuntu.com/ubuntu jammy/main amd64 ssh-import-id all 5.11-0ubuntu1 [10.1 kB]
Fetched 1,661 kB in 16s (103 kB/s)
Preconfiguring packages ...
(Reading database ... 165828 files and directories currently installed.)
Preparing to unpack .../openssh-client_1%3a8.9p1-3ubuntu0.3_amd64.deb ...
Unpacking openssh-client (1:8.9p1-3ubuntu0.3) over (1:8.9p1-3ubuntu0.1) ...
Selecting previously unselected package openssh-sftp-server.
Preparing to unpack .../openssh-sftp-server_1%3a8.9p1-3ubuntu0.3_amd64.deb ...
Unpacking openssh-sftp-server (1:8.9p1-3ubuntu0.3) ...
Selecting previously unselected package openssh-server.
Preparing to unpack .../openssh-server_1%3a8.9p1-3ubuntu0.3_amd64.deb ...
Unpacking openssh-server (1:8.9p1-3ubuntu0.3) ...
Selecting previously unselected package ncurses-term.
Preparing to unpack .../ncurses-term_6.3-2ubuntu0.1_all.deb ...
Unpacking ncurses-term (6.3-2ubuntu0.1) ...
Selecting previously unselected package ssh-import-id.
Preparing to unpack .../ssh-import-id_5.11-0ubuntu1_all.deb ...
Unpacking ssh-import-id (5.11-0ubuntu1) ...
Setting up openssh-client (1:8.9p1-3ubuntu0.3) ...
Setting up ssh-import-id (5.11-0ubuntu1) ...
Setting up ncurses-term (6.3-2ubuntu0.1) ...
Setting up openssh-sftp-server (1:8.9p1-3ubuntu0.3) ...
Setting up openssh-server (1:8.9p1-3ubuntu0.3) ...
```

```
Creating config file /etc/ssh/sshd_config with new version
Creating SSH2 RSA key; this may take some time ...
3072 SHA256:Uh0Vd4okCdQ69pEF3M69KoxCfvh+p5gXfJoVJ8DWjD8 root@Ubuntu (RSA)
Creating SSH2 ECDSA key; this may take some time ...
256 SHA256:I4Ps3qBNjMYym6Da+DRbLQ2Y2vxxTbs1EMZ/zHhdQoY root@Ubuntu (ECDSA)
Creating SSH2 ED25519 key; this may take some time ...
256 SHA256:2WAzJNBUDtHf6jRk30qNP8VplO9nw8F7S3bZDoWYFMU root@Ubuntu (ED25519)
Created symlink /etc/systemd/system/sshd.service → /lib/systemd/system/ssh.service.
Created symlink /etc/systemd/system/multi-user.target.wants/ssh.service → /lib/systemd/system/ssh.service.
rescue-ssh.target is a disabled or a static unit, not starting it.
ssh.socket is a disabled or a static unit, not starting it.
Processing triggers for man-db (2.10.2-1) ...
Processing triggers for ufw (0.36.1-4build1) ...
root@Ubuntu:/home/maninder# sudo nano /etc/ssh/sshd_config
root@Ubuntu:/home/maninder# sudo ufw allow 1337
Rules updated
Rules updated (v6)
root@Ubuntu:/home/maninder# sudo service ssh restart
root@Ubuntu:/home/maninder#
```

LAB ASSIGNMENT 2

TCP Echo:
SERVER CODE

```c
#include <sys/types.h>
#include <sys/socket.h>
#include <netdb.h>
#include <stdio.h>
#include <unistd.h>
#include<string.h>
int main()
{
char str[100];
int listen_fd, comm_fd;
struct sockaddr_in servaddr;
listen_fd = socket(AF_INET, SOCK_STREAM, 0);
bzero( &servaddr, sizeof(servaddr));
servaddr.sin_family = AF_INET;
servaddr.sin_addr.s_addr = htonl(INADDR_ANY);
servaddr.sin_port = htons(22000);
bind(listen_fd, (struct sockaddr *) &servaddr, sizeof(servaddr));
listen(listen_fd, 10);
while(1)
{
comm_fd = accept(listen_fd, (struct sockaddr*) NULL, NULL);
bzero( str, 100);
recv(comm_fd,str,100,0);
printf("Echoing back - %s",str);
send(comm_fd,str,strlen(str),0);
close(comm_fd);
}
}
```

CLIENT CODE

```c
#include <sys/types.h>
#include <sys/socket.h>
#include <netdb.h>
#include <stdio.h>
#include<string.h>
#include<arpa/inet.h>
int main(int argc,char **argv)
{
int sockfd,n;
char sendline[100];
char recvline[100];
struct sockaddr_in servaddr;
sockfd=socket(AF_INET,SOCK_STREAM,0);
bzero(&servaddr,sizeof servaddr);
servaddr.sin_family=AF_INET;
servaddr.sin_port=htons(22000);
servaddr.sin_addr.s_addr = inet_addr("127.0.0.1");
//inet_pton(AF_INET,"127.0.0.1",&(servaddr.sin_addr));
connect(sockfd,(struct sockaddr *)&servaddr,sizeof(servaddr));
while(1)
{
bzero( sendline, 100);
bzero( recvline, 100);
fgets(sendline,100,stdin); /*stdin = 0 , for standard input */
send(sockfd,sendline,strlen(sendline),0);
recv(sockfd,recvline,100,0);
printf("%s",recvline);
}
}
```

Message from Client

```
maninder@Ubuntu:~$ su root
Password:
root@Ubuntu:/home/maninder# gcc practiceclient.c -o practiceclient
root@Ubuntu:/home/maninder# ./practiceclient
hi
root@Ubuntu:/home/maninder# gcc practiceclient.c -o practiceclient
root@Ubuntu:/home/maninder# ./practiceclient
hi
hi
```

Output from server

```
maninder@Ubuntu:~$ su root
Password:
root@Ubuntu:/home/maninder# gcc practiceserver.c -o practiceserver
root@Ubuntu:/home/maninder# ./practiceserver
hi
Echoing back -hi
```

Lab Assignment 3

Udp echo

Server code

```c
1 #include<stdio.h>
2 #include<sys/types.h>
3 #include<netdb.h>
4 #include<arpa/inet.h>
5 #include<unistd.h>
6 #include<string.h>
7 #define PORT 22000
8 int main(){
9 char sendline[100];
10 char str[100];
11 int listen_fd;
12 struct sockaddr_in servaddr,caddr;
13 listen_fd=socket(AF_INET, SOCK_DGRAM,0);
14 bzero(&servaddr, sizeof (servaddr));
15 socklen_t len;
16 servaddr.sin_family=AF_INET;
17 servaddr.sin_addr.s_addr=htonl( INADDR_ANY);
18 servaddr.sin_port=htons(PORT);
19 bind(listen_fd, (struct sockaddr*)&servaddr, sizeof(servaddr ));
20 while(1){
21 bzero(str, 100);
22 len=sizeof(caddr);
23 recvfrom(listen_fd,str,sizeof(str),0,(struct sockaddr*)& caddr,&len);
24 printf("Echoing back: %s\n",str);
25 strcpy(sendline,str);
26 sendto(listen_fd, sendline,sizeof(sendline),0,(struct sockaddr*)& caddr,sizeof(caddr));
27 printf("Echo msg sent\n");
28
29 }
30 }
```

Client Code

```c
1 #include<stdio.h>
2 #include<sys/socket.h>
3 #include<sys/types.h>
4 #include<netdb.h>
5 #include<arpa/inet.h>
6 #include<unistd.h>
7 #include<string.h>
8 #define PORT 22000
9 int main (){
10 char sendl[100],recvl[100];
11 int sockfd=socket(AF_INET, SOCK_DGRAM, 0);
12 struct sockaddr_in servaddr;
13
14 bzero(&servaddr, sizeof(servaddr));
15
16 socklen_t len=sizeof(servaddr);
17 servaddr.sin_family=AF_INET;
18 servaddr.sin_addr.s_addr=inet_addr("127.0.0.1");
19 servaddr.sin_port=htons(PORT);
20
21 while(1){
22 bzero(sendl,100);
23 bzero(recvl,100);
24 printf("To Server: ");
25 fgets(sendl, 100, stdin);
26 sendto(sockfd, sendl,sizeof (sendl),0,(struct sockaddr*)&servaddr,len);
27 recvfrom(sockfd,recvl,sizeof(recvl) ,0,(struct sockaddr*)&servaddr,&len);
28 printf("\tFrom Server: %s\n",recvl);
29 }
30 }
```

Message from client

```
maninder@Ubuntu:~$ su root
Password:
root@Ubuntu:/home/maninder# gcc udpclient.c -o udpclient
root@Ubuntu:/home/maninder# ./udpclient
To serverhi
From server hi

To server
```

Output to server

```
maninder@Ubuntu:~$ su root
Password:
root@Ubuntu:/home/maninder# gcc udpserver.c -o udpserver
root@Ubuntu:/home/maninder# ./udpserver
Echoing back hi

Echo msg sent
```

Lab Assignment 4

TCP Chat ServerServer code

```c
#include<stdio.h>
#include<string.h>
#include<sys/socket.h>
#include<sys/types.h>
#include<arpa/inet.h>
#include<unistd.h>
#include<netdb.h>

int main(){
        char str[100];
        int listen_fd,comm_fd,b;
        struct sockaddr_in servaddr;
        listen_fd=socket(AF_INET,SOCK_STREAM,0);

        if(listen_fd != -1){
                printf("Socket Succesfully created...\n");
        }
        else if(listen_fd == -1){
                printf("Error in socket creation");
        }

        bzero(&servaddr,sizeof(servaddr));

        servaddr.sin_family=AF_INET;
        servaddr.sin_addr.s_addr=htonl(INADDR_ANY);
        servaddr.sin_port=htons(22000);

        b=bind(listen_fd,(struct sockaddr*)&servaddr,sizeof(servaddr));
        if(b==0){
                printf("Binded Successfully...\n");
        }

        listen(listen_fd,10);
        comm_fd=accept(listen_fd,(struct sockaddr*)NULL,NULL);

        while(1){
                bzero(str,100);
                recv(comm_fd,str,100,0);
                printf("From Client: %s\n",str);
                if(strncmp("exit",str,4)==0){
                        close(comm_fd);break;
                }

                printf("\tTo Client: ");
                fgets(str,100,stdin);

                if(strncmp("exit",str,4)==0){
                        close(comm_fd);break;
                }
                send(comm_fd,str,strlen(str),0);
        }
}
```

Client Code

```c
#include<stdio.h>
#include<string.h>
#include<arpa/inet.h>
#include<sys/socket.h>
#include<sys/types.h>
#include<unistd.h>
#include<netdb.h>

int main(){
        char sendl[100];
        char recvl[100];
        int sockfd;
        struct sockaddr_in servaddr;
        sockfd=socket(AF_INET,SOCK_STREAM,0);

        if(sockfd != -1){
                printf("Socket Succesfully created...");
        }
        else if(sockfd == -1){
                printf("Error in socket creation");
        }

        bzero(&servaddr,sizeof(servaddr));

        servaddr.sin_family=AF_INET;
        servaddr.sin_addr.s_addr=inet_addr("127.0.0.1");
        servaddr.sin_port=htons(22000);

        connect(sockfd,(struct sockaddr*)&servaddr,sizeof(servaddr));

        while(1){
                bzero(sendl,100);
                bzero(sendl,100);
                printf("\nTo Server: ");
                fgets(sendl,100,stdin);
                send(sockfd,sendl,strlen(sendl),0);
                if(strncmp("exit",sendl,4)==0){
                        close(sockfd);break;
                }


                recv(sockfd,recvl,100,0);
                if(strncmp("exit",recvl,4)==0){
                        close(sockfd);break;
                }
                else{
                printf("From Server: %s",recvl);
                }
        }
}
```

Message from client

```
root@Ubuntu:/home/maninder# gcc tcpchatclient.c -o tcpchatclient
root@Ubuntu:/home/maninder# ./tcpchatclient
You: hi
Server: hello
You: how are you
Server: im good and you?
You: exit
Chat ended.
root@Ubuntu:/home/maninder# █
```

Message from server

```
root@Ubuntu:/home/maninder# gcc tcpchat.c -o tcpchat
root@Ubuntu:/home/maninder# ./tcpchat
Client: hi
You: hello
Client: how are you
You: im good and you?
exit
Client: exit
Chat ended.
root@Ubuntu:/home/maninder# exit
exit
```

Lab Assignment 5

UDP Chat Application

Server Code

```c
#include<stdio.h>
#include<sys/types.h>
#include<netdb.h>
#include<arpa/inet.h>
#include<unistd.h>
#include<string.h>
#define PORT 22000
int main(){

char sendline[100];
char recvline[100];
int listen_fd,comm_fd;
struct sockaddr_in servaddr,caddr;
listen_fd=socket(AF_INET, SOCK_DGRAM,0);
bzero(&servaddr, sizeof (servaddr));
socklen_t len=sizeof(caddr);
servaddr.sin_family=AF_INET;
servaddr.sin_addr.s_addr=htonl( INADDR_ANY);
servaddr.sin_port=htons(PORT);
bind(listen_fd, (struct sockaddr*)&servaddr, sizeof(servaddr ));
while(1){
bzero(recvline, 100);
bzero(sendline,100);
recvfrom(listen_fd,recvline,sizeof(recvline),0,(struct sockaddr*)& caddr,&len);
printf("From Client: %s\n",recvline);
if(strncmp("exit",recvline,4)==0){
                        close(comm_fd);break;
                }

printf("\tTo Client: ");
fgets(sendline,100,stdin);
sendto(listen_fd, sendline,sizeof(sendline),0,(struct sockaddr*)& caddr,sizeof(caddr));
if(strncmp("exit",sendline,4)==0){
                        close(comm_fd);break;
                }


}
}
```

Client Code

```c
#include<stdio.h>
#include<sys/socket.h>
#include<sys/types.h>
#include<netdb.h>
#include<arpa/inet.h>
#include<unistd.h>
#include<string.h>
#define PORT 22000
int main (){
char sendl[100],recvl[100];
int sockfd=socket(AF_INET, SOCK_DGRAM, 0);
struct sockaddr_in servaddr;

bzero(&servaddr, sizeof(servaddr));

socklen_t len=sizeof(servaddr);
servaddr.sin_family=AF_INET;
//servaddr.sin addr.s addr=inet addr("127.");
servaddr.sin_port=htons(PORT);

while(1){
bzero(sendl,100);
bzero(recvl,100);
printf("To Server: ");
fgets(sendl, 100, stdin);
sendto(sockfd, sendl,sizeof (sendl),0,(struct sockaddr*)&servaddr,sizeof(servaddr));
if(strncmp("exit",sendl,4)==0){
                    close(sockfd);break;
            }

recvfrom(sockfd,recvl,sizeof(recvl) ,0,(struct sockaddr*)&servaddr,&len);
printf("\tFrom Server: %s\n",recvl);
if(strncmp("exit",recvl,4)==0){
                    close(sockfd);break;
            }
}
}
```

Chat Between server and client

```
Chat ended.
root@Ubuntu:/home/maninder# gcc udpchatclient.c -o udpchatclient
root@Ubuntu:/home/maninder# ./udpchatclient
Enter a message: hello
Server: hello
Enter a message: whats up
Server: whats up
Enter a message: █
```