



COLLEGE OF ENGINEERING, TRIVANDRUM

EXPERIMENT 18

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## Network Programming Lab

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# **1 Network with multiple subnets with wired and wireless LANs**

## **1.1 Aim**

Design and configure a network with multiple subnets with wired and wireless LANs using required network devices. Configure the following services in the network - TELNET, SSH, FTP server, Web server, File server, DHCP server and DNS server.

## **1.2 Theory**

### **1.2.1 Network**

A computer network is a digital telecommunications network which allows nodes to share resources. In computer networks, computing devices exchange data with each other using connections (data links) between nodes. These data links are established over cable media such as wires or optic cables, or wireless media. Network computer devices that originate, route and terminate the data are called network nodes. Nodes are generally identified by network addresses, and can include hosts such as personal computers, phones, and servers, as well as networking hardware such as routers and switches. Two such devices can be said to be networked together when one device is able to exchange information with the other device, whether or not they have a direct connection to each other.

### **1.2.2 Subnet**

A subnetwork or subnet is a logical subdivision of an IP network. The practice of dividing a network into two or more networks is called subnetting. Computers that belong to a subnet are addressed with an identical most-significant bitgroup in their IP addresses. This results in the logical division of an IP address into two fields, the network number or routing prefix and the rest field or host identifier. The rest field is an identifier for a specific host or network interface. A network may also be characterized by its subnet mask or netmask, which is the bitmask that when applied by a bitwise AND operation to any IP address in the network, yields the routing prefix.

## 1.3 Configuring the Services

The following shows how the different services can be configured in a linux pc :

### 1.3.1 Telnet

Telnet is a protocol used on the Internet or local area network to provide a bidirectional interactive text-oriented communication facility using a virtual terminal connection. User data is interspersed in-band with Telnet control information in an 8-bit byte oriented data connection over the Transmission Control Protocol (TCP).

Take the following steps to configure Telnet:

1. Install Telnet

```
sudo apt install telnet xinetd
```

2. Edit /etc/inetd.conf with root permission, add this line:

```
telnet stream tcp nowait telnetd /usr/sbin/tcpd /usr/sbin/in.telnetd
```

3. Edit /etc/xinetd.conf, copy the following configuration:

```
# Simple configuration file for xinetd
#
# Some defaults, and include /etc/xinetd.d/
defaults
{
# Please note that you need a log_type line to be able to use log_on_success
# and log_on_failure. The default is the following :
# log_type = SYSLOG daemon info
instances = 60
log_type = SYSLOG authpriv
log_on_success = HOST PID
log_on_failure = HOST
cps = 25 30
}
```

4. Change telnet port by using the following command in the terminal:

```
telnet 23/tcp
```

5. Then restart the service:

```
sudo /etc/init.d/xinetd restart
```

## 1.4 SSH

Secure Shell (SSH) is a cryptographic network protocol for operating network services securely over an unsecured network. Typical applications include remote command-line login and remote command execution, but any network service can be secured with SSH. SSH provides a secure channel over an unsecured network in a client-server architecture, connecting an SSH client application with an SSH server. Take the following steps to configure SSH:

- Install SSH:

```
sudo apt-get install openssh-server
```

(Installing the client can be done by replacing openssh-server by openssh-client)

- Configure SSH:

```
sudo nano /etc/ssh/sshd_config
```

Then make the changes you want to make.

- Restart SSH:

```
sudo systemctl restart ssh
```

We can login to the SSH server from an SSH client.

## 1.5 FTP Server

The File Transfer Protocol (FTP) is a standard network protocol used for the transfer of computer files between a client and server on a computer network. FTP is built on a client-server model architecture using separate control and data connections between the client and the server. FTP users may authenticate themselves with a clear-text sign-in protocol, normally in the form of a username and password, but can connect anonymously if the server is configured to allow it.

The following steps show setting up an FTP server on the computer:

- Install FTP daemon:

```
sudo apt install vsftpd
```

- Configuring FTP can be done by editing the following file:

```
/etc/vsftpd.conf
```

- Restart the service:

```
sudo systemctl restart vsftpd.service
```

## 1.6 Web Server

A web server is server software, or hardware dedicated to running said software, that can satisfy World Wide Web client requests. A web server can, in general, contain one or more websites. A web server processes incoming network requests over HTTP and several other related protocols.

A web server can be hosted on the localhost of the PC by following the following steps:

- Installing the server: The most common server on Linux systems and it is called the LAMP server. It can be installed on Ubuntu by:

```
sudo apt install lamp-server^
```

- Hosting a website: By creating a *.conf* file in the */etc/apache2/sites-available/* folder, we inform the server of the location of the code for our website.
- Enabling the website by using the command:

```
sudo a2ensite <nameOfFile.conf>
```

- By editing */etc/hosts* file, we can give the domain name for the website
- The configuration the server is in the file: */etc/apache2/apache2.conf*
- Restart the server by the command:

```
sudo systemctl restart apache2.service
```

## 1.7 File Server

A file server is a computer attached to a network that provides a location for shared disk access, i.e. shared storage of computer files (such as text, image, sound, video) that can be accessed by the workstations that are able to reach the computer that shares the access through a computer network.

The following steps can be followed to setup a file server:

- Installing Samba File Server:

```
sudo apt install samba
```

- Configuring the file server by editing */etc/samba/smb.conf*

First, edit the following key/value pairs in the [global] section of */etc/samba/smb.conf*:

```
workgroup = EXAMPLE
...
security = user
```

Create a new section at the bottom of the file, or uncomment one of the examples, for the directory to be shared:

```
[share]
comment = Ubuntu File Server Share
path = /srv/samba/share
browsable = yes
guest ok = yes
read only = no
create mask = 0755
```

- Make a directory for hosting files and setting permission for the directory:

```
sudo mkdir -p /srv/samba/share
sudo chown nobody:nogroup /srv/samba/share/
```

- Restart Samba service:

```
sudo systemctl restart smbd.service nmbd.service
```

## 1.8 DHCP Server

The Dynamic Host Configuration Protocol (DHCP) is a network management protocol used on UDP/IP networks whereby a DHCP server dynamically assigns an IP address and other network configuration parameters to each device on a network so they can communicate with other IP networks. A DHCP server enables computers to request IP addresses and networking parameters automatically from the Internet service provider (ISP), reducing the need for a network administrator or a user to manually assign IP addresses to all network devices.

The following steps shows how DHCP server can be run:

- Install DHCP server:

```
sudo apt-get install isc-dhcp-server
```

- Configure DHCP server, the config file is */etc/dhcp/dhcpd.conf*:

```
# Sample /etc/dhcpd.conf
# (add your comments here)
default-lease-time 600;
max-lease-time 7200;
option subnet-mask 255.255.255.0;
option broadcast-address 192.168.1.255;
option routers 192.168.1.254;
option domain-name-servers 192.168.1.1, 192.168.1.2;
option domain-name "mydomain.example";

subnet 192.168.1.0 netmask 255.255.255.0 {
    range 192.168.1.10 192.168.1.100;
    range 192.168.1.150 192.168.1.200;
}
```

- Starting and stopping services can be achieved using:

```
sudo service isc-dhcp-server restart
sudo service isc-dhcp-server start
sudo service isc-dhcp-server stop
```

After editing configuration files, we have to restart the service.

## 1.9 DNS Server

A name server is a computer application that implements a network service for providing responses to queries against a directory service. It translates an often humanly meaningful, text-based identifier to a system-internal, often numeric identification or addressing component. This service is performed by the server in response to a service protocol request. An example of a name server is the server component of the Domain Name System (DNS).

The Domain Name System (DNS) is a hierarchical and decentralized naming system for computers, services, or other resources connected to the Internet or a private network. It associates various information with domain names assigned to each of the participating entities. Most prominently, it translates more readily memorized domain names to the numerical IP addresses needed for locating and identifying computer services and devices with the underlying network protocols.

The following steps show the setup:

- Installing:



```
sudo apt install bind9
```

- The configuration is in the */etc/bind* folder
- Setting as a catching name server by editing the file */etc/bind/named.conf.options*:

```
forwarders {  
    1.2.3.4; # replace with the ip address  
    5.6.7.8; # of the name servers  
};
```

- BIND9 can be configured with the primary and the secondary master as a custom DNS server to access all the subnets.
- Restarting bind9:

```
sudo systemctl restart bind9.service
```

## 1.10 Result

For accessing the different nodes in the subnet, TELNET, SSH, FTP server, Web server, File server, DHCP server and DNS server have been configured and runs successfully in an Ubuntu 18.04 PC.