Introduction

★ Traditional Networking - the connection of several dumb terminal to a central mainframe over low-speed lines

★ Modern Networking - the interconnection of several computers, devices and peripherals
Review: TCP/IP

- Transmission Control Protocol/Internet Protocol

TCP/IP is the suite of communications protocols used to connect hosts on the Internet. TCP/IP uses several protocols, the two main ones being TCP and IP. TCP/IP is built into the UNIX operating system and is used by the Internet, making it the de facto standard for transmitting data over networks.
Review: IP

★ Internet Protocol

★ is a connectionless protocol that gateways use to identify networks and paths to networks and hosts

★ handles the routing of data between networks and nodes on those networks
Review: TCP

★ Transmission Control Protocol
★ focuses on getting data across the vast network from one computer to another
★ assures that the data gets delivered to the receiving application intact and in the correct sequence
★ regulates flow information
## Review: IP Addressing

- **IP Address** - an identifier for a computer or device on a TCP/IP network. It is a 32-bit numeric address written as four octets separated by periods.

- **Network Address** - refers to the subnet which the host is native to.

- **Subnet Mask** - defines the segment of the IP Address that refers to the Network Address.

- **Prefix Length** - equal to the number of contiguous one-bits in a subnet mask.

- **Address Class** - defined by the subnet mask and refers to the size of the IP network.

- **Broadcast Address** - the address that refers to all the host in that subnet.

- **Gateway** - machine used to forward packets to a different network.
Review: Address Clauses

★ Class A - address starts with 0.
  ★ 1 - 126 starting addresses
  ★ netmask 255.0.0.0 (16 million addresses)
★ Class B - address starts with 10.
  ★ 128 - 191 starting addresses
  ★ netmask 255.255.0.0 (65000 addresses)
★ Class C - address starts with 110.
  ★ 192 - 223 starting addresses
  ★ netmask 255.255.255.0 (254 addresses)
★ Class D - address starts with 1110.
  ★ 224 - 239 starting addresses
  ★ reserved for multicast routing
★ Class E - address starts with 1111.
⋆ 240 - 255 starting addresses
⋆ reserved for experiments
Review: Non-routable IPs

★ refer to IP addresses that are not routable and can be used for local area networks and other types of non-routable networks

★ 127.0.0.0/8 - reserved for loopback devices

★ 10.0.0.0/8 - reserved for local networks

★ 192.168.0.0/16 - reserved for local networks
Review: Subnetting

Subnetting - is network procreation. It is the act of creating a little network within a large and single parent network.

⋆ isolates and reduces network traffic

⋆ simplified network management

⋆ facilitated spanning of geographical distances
Review: Quick Formulas

★ $2^M - 2 = \text{maximum number of subnets}$

★ $2^{UM} - 2 = \text{maximum number of hosts per subnet}$

★ $256 - \text{last octet of subnet mask} = \text{first valid subnet address}$

where M is the number of masked bits in the subnet mask
where UM is the number of unmasked bits in the subnet mask
Review: Subnet Example

Subnet mask is 255.255.255.224. Therefore, there are 6 valid subnets and the first valid subnet is 32.

<table>
<thead>
<tr>
<th>Subnet</th>
<th>Hosts</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td>33 - 62</td>
</tr>
<tr>
<td>64</td>
<td>65 - 94</td>
</tr>
<tr>
<td>96</td>
<td>97 - 126</td>
</tr>
<tr>
<td>128</td>
<td>129 - 158</td>
</tr>
<tr>
<td>160</td>
<td>161 - 190</td>
</tr>
<tr>
<td>192</td>
<td>193 - 222</td>
</tr>
</tbody>
</table>
The BIG THREE Linux Networking Commands

- `ifconfig` - configure network interfaces
- `route` - configure network routes
- `ipchains` - configure firewall rules
Configuring Network Interfaces

ifconfig [interface] [ip] broadcast [broadcast] netmask [netmask]

★ configure kernel level interfaces

★ sets the IP address, network mask, broadcast address and network address of this interface.

★ Example: ifconfig eth0 192.168.0.1 broadcast 192.168.255.255 netmask 255.255.0.0
Configuring Network Routes

route [operation] [network address] netmask [netmask] [interface] metric [metric number]

★ sets up the static routes to be used in the network

★ Example: route add -net 192.168.0.0 netmask 255.255.0.0 eth0 metric 1

★ Example: route add default gw 192.168.0.1 netmask 255.255.0.0 metric 1
Configuring Firewall Rules

```
ipchains -[operation] [type] -s [source] -d [destination] -j [rule]
```
★ sets up a chain by performing the operation on type that is qualified by the source and destination address and performs the rule on them

★ Example: `ipchains -A forward -s 192.168.0.1 -j MASQ`

★ Example: `ipchains -A forward -s 0/0 -d 0/0 6000:8999 -j DENY`
Services

★ Applications written for TCP/IP that run on the process/application layer

★ Protocol - the language in which different services communicate

★ Generally are client-server in nature in which the client requests a service from the server

★ Some common requests: information searches, printing, e-mail, application services and file transfers
Telnet

★ Telnet is a chameleon of protocol whose specialty is terminal emulation
★ part of the basic networking services provided by Linux
★ in.telnetd is the name of telnet server in Linux
FTP

★ File Transfer Protocol
★ is a protocol that allows one to transfer files
★ part of the basic networking services provided by Linux
★ in.ftpd is the name of a common ftp server in Linux
TFTP

★ Trivial File Transfer Protocol

★ is a stripped down version of FTP

★ it is the protocol of choice if you know where and what exactly you would like to transfer

★ in.tftpd is the name of TFTP server in Linux
NFS

★ Networked File System
★ protocol specifically tailored for sharing files among different systems
★ is also capable of executing remote files
★ nfsd is the name of a common NFS server in Linux
SMB

- Server Message Block
- another protocol specifically tailored for sharing files among different systems
- also referred to a common internet file system (CIFS), NetBIOS and LAN manager
- smbd and nmbd is the names of the SMB server and NetBIOS name server for Linux
- the SMB implementation used by Linux is called SAMBA.
SMTP

Simple Mail Transport Protocol

★ applications that do SMTP are also known as MTAs or Mail Transport Agents

★ protocol responsible for the queuing, sending, receiving of e-mail.

★ some common MTAs in Linux are:
  ★ sendmail
  ★ qmail
  ★ postfix
LPD

★ Line Printer Daemon
★ protocol designed for printer spooling
★ lpd is the name of LPD in Linux
X Windows

★ responsible for the GUI display of Linux
★ capable of doing client-server connections
★ allows client machines to connect to a Xwindows server and run applications on that server.
★ XFree86 is the Xwindows implementation used by Linux.
SNMP

★ Simple Network Management Protocol
★ protocol specifically designed for getting information about the network’s present condition and performance history
★ collection and manipulation of valuable network information
★ smnpd is the name of a common NFS server in Linux
DNS

★ Domain Name Service
★ protocol for converting IP addresses to its fully qualified domain name and vice versa
★ is also responsible for propagating this information across the internet and getting updates
★ BIND is a commonly used DNS server for Linux
HTTP

★ Hypertext Transport Protocol
★ protocol used to serve web pages to be viewed by a requesting web browser
★ httpd is the name of a common HTTPD server in Linux
★ some common HTTPD servers are:
  ★ apache
  ★ cern httpd
  ★ aolserver
Configuring Services

★ services can be configured manually by editing each service’s configuration files.

★ Here are some of them:
  ★ General - /etc/inetd.conf and /etc/services
  ★ Sendmail - /etc/sendmail.cf
  ★ Apache - /etc/httpd/conf/http.conf
  ★ SAMBA - /etc/smb.conf
  ★ BIND - /etc/bind.conf
  ★ NFS - /etc/exports
  ★ and many many more
★ However, there is an easier way of doing things. Use Linuxconf or WEBMIN!

★ Website http://www.webmin.com/ or you can download it from http://cersa.admu.edu.ph/ftp/linux/admin/

★ Web based configuration program for common internet services.
Webmin

★ download webmin
★ untar webmin into a source directory
★ follow the interactive install program
★ or install from a RPM
DEMO