

Chapter 13

Configuring Network Boards

The roles of Linux

- You can configure a Linux system to fill a wide variety of roles on your computer network
 - A networked workstation
 - A gateway router
 - A DHCP server
 - A DNS server
 - A file and print server
 - A database server and Web server
 - A packet-filtering /stateful / application-level firewall

Content

- TCP/IP Configuration
- Use view /test commands
 - ifconfig
 - ping
 - netstat
 - traceroute
- Configure Linux system as a router

Name of Ethernet Interface

- After the system has booted, the Ethernet adapter's kernel module has been loaded and an alias has been created for it
 - `eth0`, `eth1`, ...
 - > alias for the first (the second, ...) Ethernet adapter .
 - >or the name of Ethernet Interfaces
- In SuSE, the name of Ethernet Interface is stored `/etc/udev/rules.d/70-persistent-net.rules`
 - Can edit this file to rename of Ethernet interface

TCP/IP configuration

- Include the following:
 - Configure hostname
 - Assign IP addresses
 - Define routing information
 - Configure name resolution
- Configuring possible
 - By hand
 - By using the configuration tool of your distribution
 - redhat-config-network (in Red Hat)
 - YaST2 (in SuSE)

TCP/IP configuration

Configuration hostname

- **hostname** command
 - view and reset the name of the host
- hostname** ->view
- hostname pc1** ->reset
- To configure your hostname permanently,
 - SuSE stores the hostname in **/etc/HOSTNAME** file.

TCP/IP configuration

Assign IP Addresses

- There are two ways
 - Static address assignment
 - Using ifconfig
 - Using configuration file
 - Dynamic address assignment
 - Must to install a DHCP client-server model
- To view network interface information
ifconfig

TCP/IP configuration

Assign IP Addresses

- IP address assignment options

Option	Description	Advantages	Disadvantages
Static address assignment	In this configuration, you manually configure a network host with IP address parameters.	The address used by a particular host never changes. This option is usually used by servers, routers, etc. in the network.	The host consumes the address regardless of whether the system is powered on or off. This strategy also requires a lot of legwork on the part of the system administrator. He or she has to visit each computer in the network and manually specify IP parameters.
Dynamic address assignment	In this configuration, a network host contacts a Dynamic Host Configuration Protocol (DHCP) server when it boots. The DHCP server dynamically assigns an IP address to the host for a specified period of time called a <i>lease</i> .	This option makes configuring IP parameters for a large number of network hosts very easy. Just power the system on and it gets its IP address information. It also conserves IP address usage. Addresses used by systems that are powered off can be reassigned to other network hosts.	You must have a DHCP server installed and configured before you can use this option. In addition, the address assigned to a particular host can change frequently, making it an unsuitable option for network infrastructure systems such as servers. Because of this, this option is usually used for workstations.

TCP/IP configuration

Assign IP Addresses

- Using **ifconfig** command

```
ifconfig inteface x.x.x.x netmask x.x.x.x  
broadcast x.x.x.x
```

```
ifconfig eth0 192.168.1.1 netmask  
255.255.255.0 broadcast 192.168.1.255
```

This IP address assignment isn't persistent !

TCP/IP configuration

Assign IP Addresses

- Set persistent parameters for a network interface by using the configuration file

– */etc/sysconfig/network/ifcfg-**<interface>*** file

Or

*/etc/sysconfig/network/eth-id-**<MACaddress>*** file

An example : ifcfg-eth-id-00:0c:29:d1:52:d4 or ifcfg-eth0

(if the configuration file not exists associate with a network interface , you can make new a file)

- To apply the changes in this configuration file, you need to restart the network interface

ifdown interface

ifup interface

TCP/IP configuration

Assign IP Addresses

- Parameters for a network interface in the configuration file

Option	Description	Other Possible Values
BOOTPROTO="static"	This option specifies that the interface use a static IP address assignment.	Set to <code>dhcp</code> to dynamically assign an address.
STARTMODE="onboot"	This option specifies that the interface be brought online when the system is booted.	Set to <code>manual</code> to manually start the interface.
IPADDR="192.168.1.10"	Assigns an IP address of 192.168.1.10 to the interface.	
NETMASK="255.255.255.0"	Assigns a subnet mask of 255.255.255.0 to the interface.	
NETWORK="192.168.1.0"	Specifies the network address of the segment that the interface is connected to.	
BROADCAST="192.168.1.255"	Specifies the broadcast address of the segment the interface is connected to.	

TCP/IP configuration

IP alias

- Configuration IP aliases
 - IP aliases allows to configure multiple IP addresses onto an adapter
 - An alias is configured as if it were a separate device
 - To configure an alias on eth0, configure **eth0:0** (eth0:1, ...)
- ```
ifconfig eth0:0 x.x.x.x netmask x.x.x.x
```

# TCP/IP configuration

## Define routing information

- Define the **default gateway**
  - Use **route** command
    - route add default gw x.x.x.x**
  - Use the configuration file to make permanent
    - SuSE uses the **/etc/sysconfig/network/routes** file
    - Add the line
      - default x.x.x.x**

# TCP/IP configuration

## Define routing information

- Remember restarting the network service to apply the changes in this configuration file  
**/etc/init.d/network restart**
- View the routing table  
**route**

# TCP/IP configuration

## Configure name resolution

- Hostnames is easier to remember than IP addresses
- To use hostnames, either :
  - Edit local **/etc/hosts** file and add all hostnames to be used
  - Set up name resolution through **DNS** in **/etc/resolv.conf**

# TCP/IP configuration

## Configure name resolution

- The method of name resolution bases on the **/etc/hosts** file
  - The file should contain an entry for each system on the network
  - Keep all /etc/hosts file synchronized
  - Can suitable for small organizations
- The format for the /etc/hosts file  
**<IP address> <hostname> <aliases>**

# TCP/IP configuration

## Configure name resolution

- The format for the /etc/hosts file in host that has IP address 192.168.10.1

```
127.0.0.1 localhost b11130
192.168.10.2 b11129
192.168.10.3 b11128
192.168.10.4 b11127 router
```

# Commands for test configuration

- Commands for test configuration
  - ifconfig -> view interface's configuration information
  - route -> view routing table
  - netstat -> view information for sockets, protocol, interface, routing table
  - ping -> test connectivity between hosts

# Commands for test configuration

- View configuration information by using ifconfig command

// display the status of the currently active interfaces

`ifconfig`

// display the status of the given interfaces only

`ifconfig eth0`

//display the status of all interfaces

`ifconfig -a`

//active/deactive the given interface

`ifconfig eth0 up`

`ifconfig eth0 down`

```

linux1:/etc # ifconfig
eth0 Link encap:Ethernet HWaddr 00:0C:29:D1:52:D4
 inet addr:192.168.1.10 Bcast:192.168.1.255 Mask:255.255.255.0
 inet6 addr: fe80::20c:29ff:fed1:52d4/64 Scope:Link
 UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
 RX packets:17276 errors:0 dropped:0 overruns:0 frame:0
 TX packets:20 errors:0 dropped:0 overruns:0 carrier:0
 collisions:0 txqueuelen:1000
 RX bytes:5529809 (5.2 Mb) TX bytes:1855 (1.8 Kb)
 Interrupt:185 Base address:0x1080

lo Link encap:Local Loopback
 inet addr:127.0.0.1 Mask:255.0.0.0
 inet6 addr: ::1/128 Scope:Host
 UP LOOPBACK RUNNING MTU:16436 Metric:1
 RX packets:2749 errors:0 dropped:0 overruns:0 frame:0
 TX packets:2749 errors:0 dropped:0 overruns:0 carrier:0
 collisions:0 txqueuelen:0
 RX bytes:662452 (646.9 Kb) TX bytes:662452 (646.9 Kb)

```

| <b>ifconfig Parameter</b> | <b>Description</b>                                                                |
|---------------------------|-----------------------------------------------------------------------------------|
| HWaddr                    | The MAC address of the network board.                                             |
| inet addr                 | The IP address assigned to the interface.                                         |
| Bcast                     | The broadcast address of the network segment.                                     |
| Mask                      | The subnet mask assigned to the interface.                                        |
| RX packets                | Statistics for received packets.                                                  |
| TX packets                | Statistics for transmitted packets.                                               |
| collisions                | The number of Ethernet collisions detected.                                       |
| RX bytes                  | The number of bytes of data received by the interface since it was brought up.    |
| TX bytes                  | The number of bytes of data transmitted by the interface since it was brought up. |

# Commands for test configuration

- Test connectivity between hosts by using Ping command
  - `ping destination_IPaddress`
  - or `ping destination_hostname`

***Be warned that the **firewall** on the host can be stopping the ping packets !***

# Commands for test configuration

- netstat command

- netstat -a** -> list all listening and non-listening sockets
- netstat -l** -> list listening sockets
- netstat -i** -> displays statistics for the network interfaces
- netstat -s** -> displays summary information for each protocol
- netstat -r** -> display the routing table

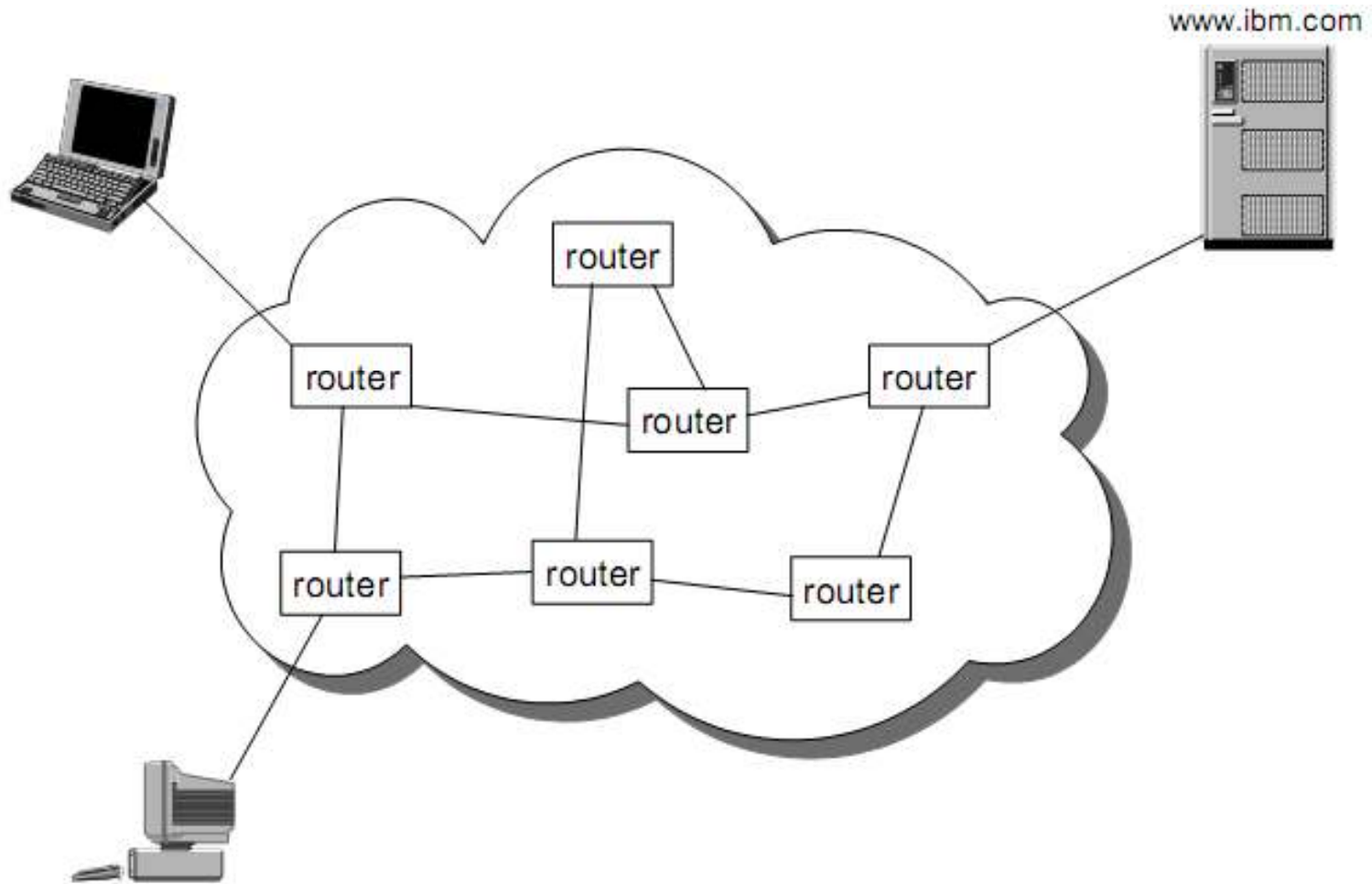
# Commands for test configuration

- Traceroute command
  - Print the route packets must traverse through these routers to arrive at its destination
  - Syntax:

**traceroute** *destination\_hostname*

**traceroute** *destination\_IPaddress*

# Routing



# Routing

## Router Characteristics

- Device with multiple interface
- Uses a routing table to store the best next hop for every destination on the network
- Forward IP packets to next hop
  - Based on destination IP address and looks up this address in a “routing table”
- Can be implemented in Software or Hardware
- Every host ( not a router itself ) needs minimal routing capabilities for outgoing packets

# Routing

## Routing table

- Kept in RAM
  - Uses route command and netstat -r command to view it
- Final destination specification
  - Host route
  - Network route
  - Default route

| <u>Destination</u> | <u>Gateway</u> | <u>Netmask</u> | <u>Interface</u> |
|--------------------|----------------|----------------|------------------|
| 10.200.200.5/24    | 192.168.1.10   | -              | eth0             |
| 10.200.200.0/24    | 192.168.1.10   | -              | eth0             |
| default            | 192.168.1.10   | -              | eth0             |

# Routing

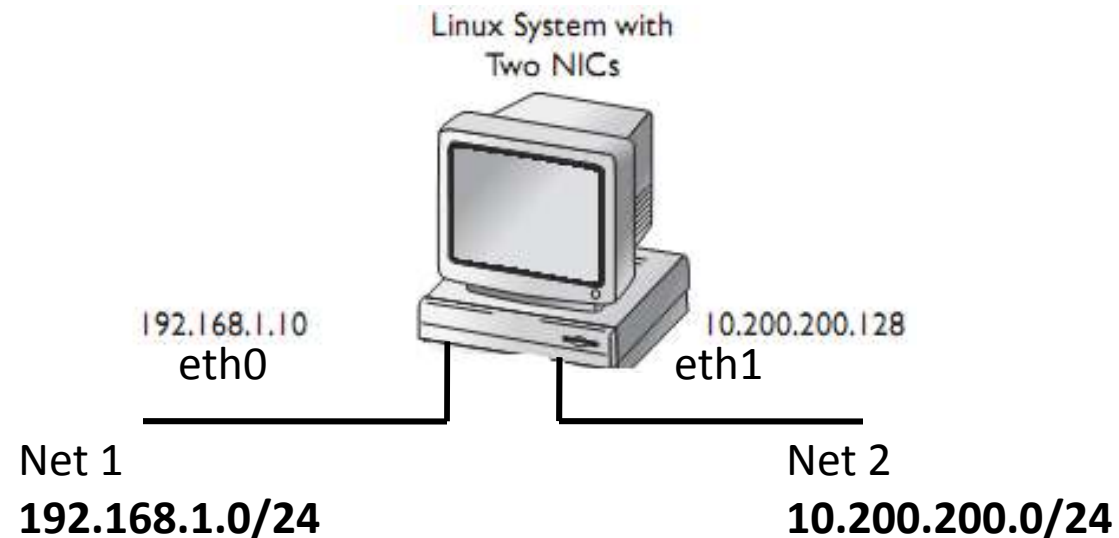
## Configure Linux system as a router

- We must perform
  - (1)Configure the Hardware for routing
  - (2)Configure the Linux kernel to support routing

# Routing

## Configure Linux system as a router

- Configure the Hardware for routing
  - To connect two network segments together, the Linux system, as a router, needs to have one network interface installed for each network segment to be connected.



# Routing

## Configure Linux system as a router

- Configure the Linux kernel to support routing

- (1) Turn on IP forwarding

- echo 1 > /proc/sys/net/ipv4/ip\_forward**

- Or make permanent by changing the configuration file **/etc/sysctl.conf** in SuSE , add the following

- line : **net.ipv4.ip\_forward = 1**

- (2) Fill routing tables

# Routing

## Fill routing tables in a router

- Fill routing tables
  - Implicit Routes
    - Automatically added when an interface is configured
  - Explicit or Static Routes
    - Added with the **route** command
    - Or Use the configuration file **`/etc/sysconfig/network/routes`** file in SuSE
  - Dynamic Routes
    - Added through the routed, gated or zebra daemon

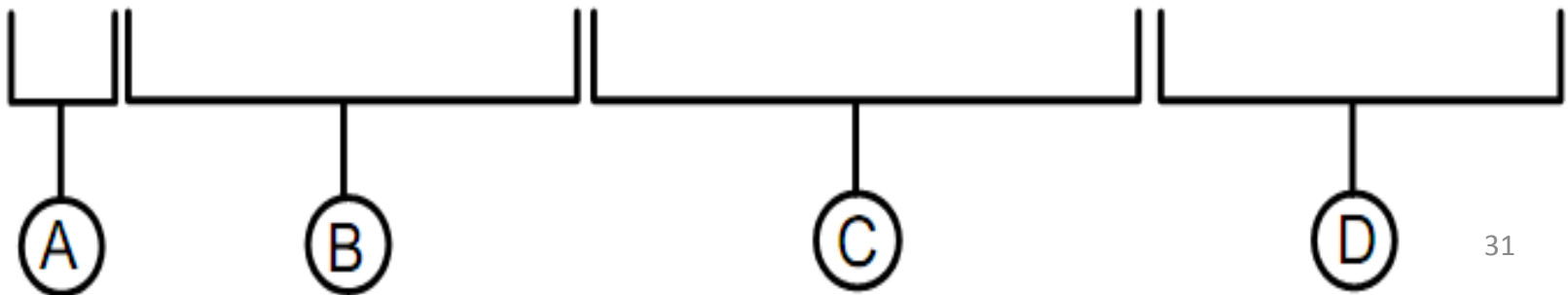
# Routing

## Fill routing tables in a router

- Using **route** command

```
route add | del [-net | -host] target [netmask net]
 [gw Gw] [dev interface]
```

```
route add -net 129.33.151.0 netmask 255.255.255.0 gw 129.33.150.1
route add -host 192.168.2.2 gw 192.168.1.8
route add default gw 129.33.151.1
```



# Routing

## Fill routing tables in a router

- Using the configuration file
  - Add default route and static routes to `/etc/sysconfig/network/routes`

# Routing

## an example