LPIC-1 102-400 – Lesson 15

109.2 Basic network configuration

Network Interfaces

- To connect a system to a network a Network Interface Card (NIC) is needed. A typical protocol used by these cards can Ethernet, Wi-Fi (wireless cards) and in legacy systems modems and RS-232 serial ports.
- Examples of network interfaces:
  - **lo (loopback)**: use to check the TCP/IP stack and for private access to local services. The localhost hostname and the 127.0.0.0/8 (IPv4) and ::1 (IPv6) IP addresses, point here
  - Legacy Device Naming:
    - **eth0**: The first Ethernet card starts from id 0**.** If there are more, this naming scheme increases the card id by 1 e.g. **eth1**, **eth2** etc
    - **wlan0**: A **Wi-Fi** example
  - Consistent Network Device Naming:
    - **enp0s25**: an Ethernet example
    - **Wlp3s0**: a Wi-Fi example
  - **ppp0**: A modem example

Setting hostnames with */etc/hostname* and */etc/hosts*

- The **/etc/hostname** is used on most distros for setting up the hostname, e.g. web01. In RedHat systems the **/etc/sysconfig/network** file is used which contains the **HOSTNAME** variable e.g.: HOSTNAME=web01
- The hostname is also included in the **/etc/hosts** file:
  127.0.0.1 web01
- Often ot is combined with the domain name:
  127.0.0.1 web01.example.com web01

The `hostname` command

- The **hostname** command can be used for setting and displaying the hostname and domainname
- **$ hostname** # show hostname
  name-lpi
- **$ hostname -f** # show host and domain name
  name-lpi.example.com
- **# hostname other-name** # change hostname. This change is temporary and the name will roll back on the next reboot unless we set the hostname in **/etc/hostname** and **/etc/hosts**

Associating hostnames with IP addresses in */etc/hosts*

- The **/etc/hosts** file is used to associate hostnames with IP addresses and it is a simple way to resolve hostnames in networks without DNS or in cases where you do not have access to the DNS server. You can also set easy to remember names for hosts you use often

- `$ cat /etc/hosts`

```
127.0.0.1       localhost
127.0.1.1       name-lpi
69.64.38.128    web01.example.com web01
```

- `$ ping malena`

```
PING web01 (69.64.38.128) 56(84) bytes of data.
64 bytes from web01 (69.64.38.128): icmp_req=1 ttl=50 time=189 ms
64 bytes from web01 (69.64.38.128): icmp_req=2 ttl=50 time=189 ms
^C
--- web01 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1000ms
rtt min/avg/max/mdev = 189.017/189.067/189.117/0.050 ms
```

Set name resolution systems with */etc/nsswitch.conf*

- The **/etc/nsswitch.conf** file configures the name resolution systems to be used and their priority that should be obeyed when resolving names of users, groups, password and hostnames
- **$ cat /etc/nsswitch.conf**

```
passwd:   files # resolve user names from /etc/passwd
shadow:   files # resolve passwords from /etc/shadow
group:    files # resolve group names from /etc/group
hosts:    files dns # resolv hostnames from /etc/hosts and
then DNS
```

Set name resolution systems with */etc/nsswitch.conf*

- ```
  $ cat /etc/nsswitch.conf
  passwd:  files ldap # resolve usernames from
                      # /etc/passwd first and then LDAP
  shadow:  files ldap # resolve passwords from
                     # /etc/shadow first and then LDAP
  group:   files ldap # resolve group from /etc/group
                      # and then LDAP
  hosts:      files dns ldap # resolve hostnames from
                             # /etc/hosts first, the
                             # DNS and then LDAP
  ```
- Othe possible authentication systems, instead of **ldap**, could be **nis** and **nisplus** of Sun Microsystems and **winbind** which can join a Linux system to Microsoft Active Directory

  ```

# Configure a network interface with `ifconfig`

- The **ifconfig** command is used to configure a network interface and display network card settings. This configuration is not persistent!

- `# ifconfig # show only active network interfaces`

```
eth0   Link encap:Ethernet HWaddr 00:1c:25:9b:19:65
          inet addr:192.168.2.10 Bcast:192.168.2.255
  Mask:255.255.255.0
          inet6 addr: fe80::21c:25ff:fe9b:1965/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
          RX packets:5364 errors:0 dropped:0 overruns:0 frame:0
          TX packets:5047 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:5400323 (5.4 MB) TX bytes:785883 (785.8 KB)
          Interrupt:20 Memory:fc200000-fc220000

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:260 errors:0 dropped:0 overruns:0 frame:0
          TX packets:260 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:83809 (83.8 KB) TX bytes:83809 (83.8 KB)
```

Configure a network interface with `ifconfig`

- **# ifconfig -a** # show inactive interfaces as well
- **# ifconfig eth0** # show **eth0** network settings
- **# ifconfig eth0 192.168.0.34 netmask 255.255.255.0** # set IP and netmask for eth0
- **# ifconfig eth0 192.168.0.34 netmask 255.255.255.0 \ broadcast 192.168.0.255** # set IP, netmask and broadcast address in eth0
- **# ifconfig eth0 down** # disable eth0
- **# ifconfig eth0 up** # enable eth0
- **# ifconfig eth0 up 192.168.0.34 netmask 255.255.255.0** # configure the network interface and enable it at the same time

Persistent network settings with */etc/network/interfaces* (Debian)

- In Debian systems the **/etc/network/interfaces** file is used for persistent network setup
- **$ cat /etc/network/interfaces**

```
auto lo
iface lo inet loopback

auto eth0
iface eth0 inet static # iface eth0 inet
                       # dhcp for automatic
                       # IP assignment
    address   10.0.2.15
    netmask 255.255.255.0
    network 10.0.2.0
    broadcast 10.0.2.250
    gateway 10.0.2.250
```

} # not needed for dhcp

Persistent network settings with */etc/sysconfig/network-scripts/ifcfg-ethX* (RedHat)

- In RedHat systems, every network interface has its own configuration file under: **/etc/sysconfig/network-scripts**.
- **$ cat /etc/sysconfig/network-scripts/ifcfg-eth0**

```
DEVICE=eth0
BOOTPROTO=none # =dhcp for automatic assignment
ONBOOT=yes
HWADDR=00:50:56:98:6e:d9
NETMASK=255.255.255.0
IPADDR=172.16.255.14
GATEWAY=172.16.255.250
TYPE=Ethernet
```

Enable/Disable network interfaces with `ifup` and `ifdown`

- The **ifup** and **ifdown** are used to enable and disable the network interfaces
- `# ifdown eth0 # disable interface eth0`
- `# ifup eth0 # enable interface eth0`

Configure static routing with `route`

- The **route** command is used to show the routing table and also for adding and removing static routes
- **$ route** # show routing table with hostnames
- **$ route -n** # show routing table numerically (IP Addresses)
- **# route add default gw 10.0.2.2 eth0** # set 10.0.2.2 as default gateway
- **# route add -net 10.200.0.0 netmask 255.255.0.0 gw 10.10.10.250**
  # set the 10.10.0.0/16 network over the 10.10.10.250 gateway into the routing table
- **# route del -host 10.5.4.6 netmask 255.255.255.0 gw 172.16.1.1**
  # delete host 10.5.4.6 with gateway 172.16.1.1 from the routing table

Configure a Linux system as a router

- Most Linux systems are not set as a router. This means that if a packet arrives at an interface it cannot be forwarded from another interface
- `# echo '1' > /proc/sys/net/ipv4/ip_forward # set IPv4 packet forwarding (non persistent)`
- For a more persisten solution set the following variable in the **/etc/sysctl.conf** file:
  net.ipv4.ip_forward = 1

Configure network settings with `ip`

- The **ip** command is a better replacement for the legacy **ifconfig** and **route** commands
- `# ip addr # show interfaces with ip information`

```
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN
group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
       valid_lft forever preferred_lft forever

2: enp0s25: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc
fq_codel state UP group default qlen 1000
    link/ether 28:d2:44:33:84:9c brd ff:ff:ff:ff:ff:ff
    inet 192.168.10.225/24 brd 192.168.10.255 scope global dynamic
noprefixroute enp0s25
       valid_lft 38044sec preferred_lft 38044sec
    inet6 fd64:d180:8b30:0:2ad2:44ff:fe33:849c/64 scope global
dynamic mngtmpaddr
       valid_lft 6993sec preferred_lft 1593sec
    inet6 fe80::2ad2:44ff:fe33:849c/64 scope link
       valid_lft forever preferred_lft forever
```

Configure network settings with `ip`

- **# ip ro** # show routing table

```
default via 192.168.10.1 dev enp0s25 proto
dhcp metric 100
169.254.0.0/16 dev virbr0 scope link metric
1000 linkdown
192.168.10.0/24 dev enp0s25 proto kernel
scope link src 192.168.10.225 metric 100
192.168.122.0/24 dev virbr0 proto kernel
scope link src 192.168.122.1 linkdown
```

Configure network settings with `ip`

- **# ip addr add 192.168.1.7/24 dev enp0s2** # set non-persistent IP address on **enp0s2**
- **# ip addr del 192.168.1.7/24 dev enp0s2** # delete IP address from **enp0s2** (non-persistent)
- **# ip ro add default via 192.168.4.1 dev eno1** # set default gateway
- **# ip ro add 192.168.5.0/24 via 192.168.5.1 dev enp0s3** # Add static route
- **# ip link set wlp3s0 down** # disable interface
- **# ip link set wlp3s0 up** # enable interface

The *DHCP* Protocol

- For the automatic assignment of IP addresses and the rest of the network configuration, the **DHCP** (Dynamic Host Configuration Protocol) protocol is used
- The DHCP protocols works on the client-server model. The computers set as DHCP clients send a broadcast message in the local network. If there is a DHCP server in the network it will reply with an available IP Address, the netmask, the Default Gateway, the DNS Servers and any other secondary configuration settings
- `# dhclient eth0 # send a DHCP request from the eth0 interface`

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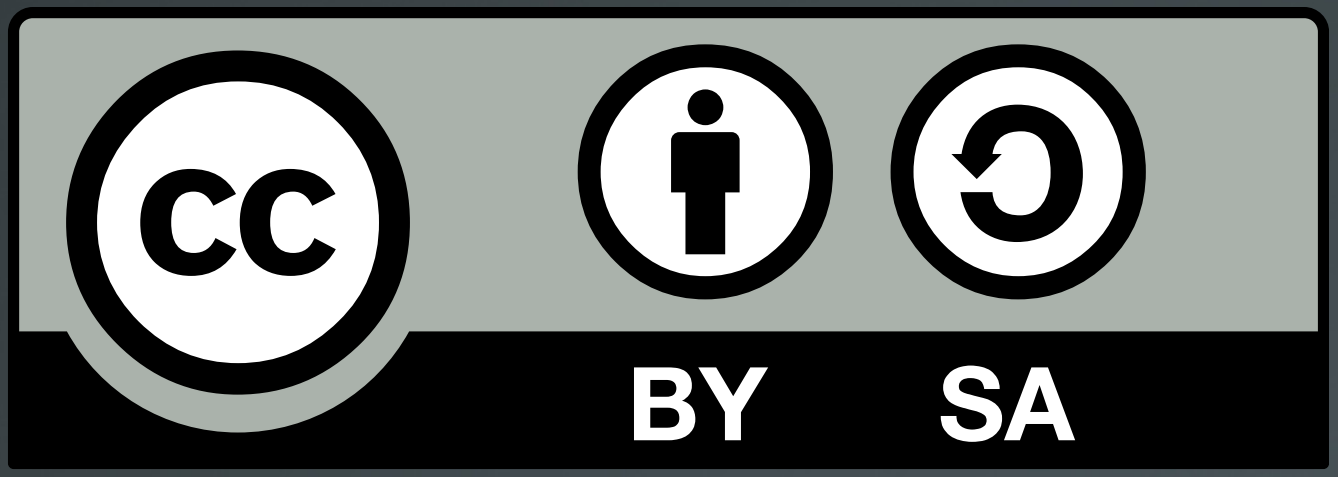

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