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School of Applied Sciences (B.Sc. In Computing)

COMP 225: Network and System Administration
Notes #8: Network Interface Assignments

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Academic Year 2nd Semester, 2019-2020

Network Interface Cards

- Computers nowadays are set with at least one network card
- Easily to add a few more if deemed needed
- Run `ping` to test if network card working and connecting to the network

```
$ ping www.google.com
```

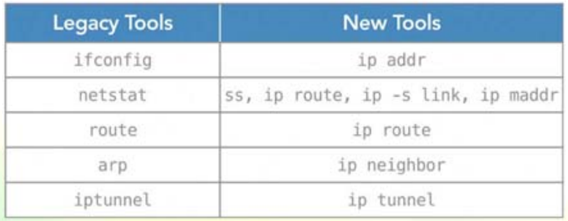
IP Commands

- Evolving commands to set IP addresses for network interfaces
- The old time favorites were
  - `ifconfig`
  - `netstate`
  - `route`
- These commands can still be re-installed on Ubuntu again using

```
$ sudo apt install net-tools
```

Newer IP Tools

- The new “ip” tool is adopted by Ubuntu and Red Hat (in fact, Red Hat supports both tools)



Legacy Tools	New Tools
ifconfig	ip addr
netstat	ss, ip route, ip -s link, ip maddr
route	ip route
arp	ip neighbor
iptunnel	ip tunnel

To Check Network Interfaces

- For the Link layer hardware interfaces, usually
  - Wired – Ethernet card, its name usually starts with an "e..."
  - Wireless – wifi card, its name usually starts with an "w..."
  - These address are the MAC (Medium Access Control) addresses
- To check the names of all hardware interfaces, we can use either

```
$ ip link {list}
$ ip addr {show}
```

- Both commands showing all found network interfaces, the word "show" and "`list`" are interchangeable; but in these cases, they are both redundant

MAC Addresses

- Hardware interfaces have names, and MAC addresses
  - 6-byte in size, similar to IPv6, uses colon-hexadecimal notation
  - One byte then a colon, and so on
  - No shorten notations, as those available for IPv6
- Device name and the associated MAC address can be found with

```
$ ip link
```

  - For example

```
1: lo: <LOOPBACK,UP,LOWER)UP> mtu 65535 qdisc noqueue state…
   link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER,UP> mtu 1500 qdisc…
   link/ether 08:00:27:a7:6e:d2 brd ff:ff:ff:ff:ff:ff
```

Name of the interface

MAC address

The IP Address

- Through the command

```
$ IP addr
```

  - We may get

```
1: lo: <LOOPBACK,UP,LOWER)UP> mtu 65535 qdisc noqueue state…
   link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00:00
   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: enp0s3: <BROADCAST,MULTICAST,UP,LOWER,UP> mtu 1500 qdisc…
   link/ether 08:00:27:a7:6e:d2 brd ff:ff:ff:ff:ff:ff
   inet 10.0.2.15/24 brd 10.0.2.255 scope global dynamic enp0s3
      valid_lft 76196sec preferred_lft 76196sec
   inet6 fe80::a00:27ff:fea7:6ed2/64 scope link
      valid_lft forever preferred_lft forever
```

IPv4 address

IPv6 address

Find "up" Devices or Find One Device

- Sometimes, only listing those some interfaces that are up

```
$ ip link list up
$ ip addr show up
```

- Like to get information about one interface only, e.g.,

```
$ ip link list enp0s3      ← My interface card only
$ ip -4 addr show enp0s3   ← IPv4 address only
$ ip -6 addr show enp0s3   ← IPv6 address only
```

- For hostname, can use

```
$ hostname
$ hostnamectl
```

To Change the State of an Interface

- Change the setting of an interface

```
$ sudo ip link set dev [device name] [up | down]
```

- E.g., turn off the enp0s3 interface

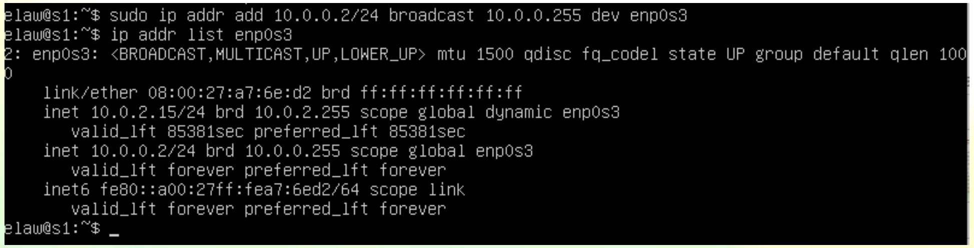
```
$ sudo ip link set dev enp0s3 down
$ ip link list
$ ip link show up
```

- Ok, enough fun, put it back up

```
$ sudo ip link set dev enp0s3 up
```

The Command “ip addr”

- $ sudo ip addr [add|change|replace|del] IPADDR dev [device name]
  - Where IPADDR is typical IP address with netmask, support CIDR notation
  - Broadcast address not set in this command! (different from the old “ifconfig”)
- E.g., add an IPv4 and associated broadcast address to enp0s3
  - $ sudo ip addr add 10.0.0.2/24 broadcast 10.0.0.255 dev enp0s3



```
elaw@s1:~$ sudo ip addr add 10.0.0.2/24 broadcast 10.0.0.255 dev enp0s3
elaw@s1:~$ ip addr list enp0s3
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 100
0
    link/ether 08:00:27:a7:6e:d2 brd ff:ff:ff:ff:ff:ff
    inet 10.0.2.15/24 brd 10.0.2.255 scope global dynamic enp0s3
       valid_lft 85381sec preferred_lft 85381sec
    inet 10.0.0.2/24 brd 10.0.0.255 scope global enp0s3
       valid_lft forever preferred_lft forever
    inet6 fe80::a00:27ff:fea7:6ed2/64 scope link
       valid_lft forever preferred_lft forever
elaw@s1:~$ _
```

Other Settings

- Remove the added-on IPv4 address
  - $ sudo ip add del 10.0.0.2/24 broadcast 10.0.0.255 dev enp0s3
- The interface get IPv4 dynamically, as it said on screen; if not, we can set it using dhcp
  - $ sudo dhclient -4 enp0s3
  - Use “-6” for IPv6

- However, all we have done on screen are only working for the current active session. All added/changed/modified/ settings do **NOT** survive a system reboot!

Netplan: Setting Network Interfaces on Booting

- For Ubuntu version 19.04 or after uses “Netplan”
- Go check the file `$ ls /etc/netplan`
  - Suppose it shows a file named `50-cloud-init.yaml`
  - If the filename is different, it is ok if it is a “yaml” file
  - Display it on screen could be:

```
network:
  ethernets:
    enp0s3:
      dhcp4: true
  version: 2
```

Quite easy to read, but not covering it in the course.
If you modify it, run command `$ sudo netplan apply`
to facilitate the changes

Gateway and Friends

- To get to the Internet , we need a gateway or router
- To find the default gateway

```
$ ip route
```

  - And it shows, for example,

```
default via 10.0.2.2 dev enp0s3 proto dhcp src 10.0.2.15 metric
100
10.0.2.0/24 dev enp0s3 proto kernel scope link src 10.0.2.15
10.0.2.2 dev enp0s3 proto dhcp scope link src 10.0.2.15 metric
100
```

- Any neighboring computers around??

```
$ ip neigh show
```

  - If any shown, the last field can be STALE, DELAY, or REACHABLE

Routing Table Stuff (Will NOT be in Exam)

- Following commands are for adding new routes or deleting routes
- For adding:

“default” is optional, add it to change the default route

```
$ sudo ip route add {default} [network/netmask] via [gatewayIP]
$ sudo ip route add {default} [network/netmask] dev [deviceName]
```

- For deleting:

```
$ sudo ip route del default
```

Delete the default route

```
$ sudo ip route del [network/netmask] dev [deviceName]
```

Simple Network Troubleshooting

Sources of Network Slowness

- NIC duplex and speed incompatibilities
- Network congestion
- Poor routing
- Bad cabling
- Electrical interference
- An overloaded server at the remote end of the connection
- Misconfigured DNS

Sources of Lacking Connectivity

- All sources of slowness can become so severe that connectivity is lost
- Additional sources of disconnections are:
  - Power failures
  - The remote server or an application on the remote server being shut down

Basic Cable and Link Tests

- Server cannot communicate with any other networking devices unless the light of the NIC “link” indicator is on
- This indicates that the connection between server and the switch/router is functioning correctly
- In most cases, the light does not turn on due to using wrong cable type
- There are two types of Ethernet cables crossover and straight-through, always make sure using the correct type

Other Sources of Link Failure

- The switch, router, or gateway, to which the server is connecting, is powered off
- Bad cables
- Cable not plugged in properly
- If it is a large network, investment in a battery-operated cable tester for basic connectivity testing is invaluable
- More sophisticated testers are able to inform the approximate location of a cable break and whether an Ethernet cable is too long to be used

Remark

- We learnt to use the new and powerful “ip” command for
  - Setting up network interface cards
  - Starting to know some concepts about routing tables (you can know more on network routing in future network course)
- Remember to test the network interface if changing its setting… use “ping” command, pick one common address to ping
  - $ ping www.google.com

QA