

Mapping of course outcomes with program outcomes

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|
| co1 | ✓ | ✓ | ✓ | | | | | ✓ | | ✓ | | ✓ | |
| co2 | ✓ | ✓ | ✓ | ✓ | | | | ✓ | | ✓ | | ✓ | |
| co3 | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | | ✓ | | ✓ | |
| co4 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | ✓ | | ✓ | |
| co5 | ✓ | ✓ | ✓ | ✓ | ✓ | | | ✓ | | ✓ | | ✓ | |

Abstract POs defined by National Board of Accreditation

| po# | Broad PO | po# | Broad PO |
|-----|--|------|--------------------------------|
| po1 | Engineering Knowledge | po7 | Environment and Sustainability |
| po2 | Problem Analysis | po8 | Ethics |
| po3 | Design/Development of solutions | po9 | Individual and teamwork |
| po4 | Conduct investigations of complex problems | po10 | Communication |
| po5 | Modern tool usage | po11 | Project Management and Finance |
| po6 | The Engineer and Society | po12 | Lifelong learning |

Reference Books:

1. W. Richard Stevens, Bill Fenner, Andy Rudoff, UNIX Network Programming: Volume 1, The Sockets Networking API, 3rd Edition, Pearson, 2015
2. Lisa Bock, Learn Wireshark: Confidently navigate the Wireshark interface and solve real-world networking problems, Packt Publishing, 2019
3. Teerawat Issariyakul, Ekram Hossain, Introduction to Network Simulator NS2, 2nd Edition, Springer, 2019

Experiment 1

Getting started with Basics of Network configurations files and Networking

Commands in Linux.

The important network configuration files in Linux operating systems are

1. /etc/hosts

This file is used to resolve hostnames on small networks with no DNS server. This text file contains a mapping of an IP address to the corresponding host name in each line. This file also contains a line specifying the IP address of the loopback device i.e, 127.0.0.1 is mapped to localhost.

A typical hosts file is as shown

```
127.0.0.1 localhost
127.0.1.1 anil-300E4Z-300E5Z-300E7Z
```

2. /etc/resolv.conf

This configuration file contains the IP addresses of DNS servers and the search domain.

A sample file is shown

```
# DO NOT EDIT THIS FILE BY HAND -- YOUR CHANGES WILL BE OVERWRITTEN
nameserver 127.0.1.1
```

3. /etc/sysconfig/network

This configuration file specifies routing and host information for all network interfaces. It contains directives that are global specific. For example if NETWORKING=yes, then /etc/init.d/network activates network devices.

4. /etc/nsswitch.conf

This file includes database search entries. The directive specifies which database is to be searched first.

The important Linux networking commands are

1. ifconfig

This command gives the configuration of all interfaces in the system. It can be run with an interface name to get the details of the interface.

```
ifconfig wlan0
```

```
Link encap:Ethernet HWaddr b8:03:05:ad:6b:23
inet addr:192.168.43.15 Bcast:192.168.43.255 Mask:255.255.255.0
inet6 addr: 2405:204:d206:d3b1:ba03:5ff:fead:6b23/64 Scope:Global
inet6 addr: fe80::ba03:5ff:fead:6b23/64 Scope:Link
inet6 addr: 2405:204:d206:d3b1:21ee:5665:de59:bd4e/64 Scope:Global
UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
RX packets:827087 errors:0 dropped:0 overruns:0 frame:0
TX packets:433391 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:1117797710 (1.1 GB) TX bytes:53252386 (53.2 MB)
```

This gives the IP address, subnet mask, and broadcast address of the wireless LAN adapter. Also tells that it can support multicasting.

If eth0 is given as the parameter, the command gives the details of the Ethernet adapter.

2. netstat

This command gives network status information.

```
Netstat -i
```

| Iface | MTU | Met | RX-OK | RX-ERR | RX-DRP | RX-OVR | TX-OK | TX-ERR | TX-DRP | TX-OVR | Flg |
|-------|-------|-----|--------|--------|--------|--------|--------|--------|--------|--------|------|
| eth0 | 1500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | BMU |
| lo | 65536 | 0 | 12166 | 0 | 0 | 0 | 12166 | 0 | 0 | 0 | LRU |
| wlan0 | 1500 | 0 | 827946 | 0 | 0 | 0 | 434246 | 0 | 0 | 0 | BMRU |

As shown above, the command with -i flag provides information on the interfaces. lo stands for loopback interface.

3. ping

This is the most commonly used command for checking connectivity.

```
ping www.google.com
PING www.google.com (172.217.163.36) 56(84) bytes of data.
64 bytes from maa05s01-in-f4.1e100.net (172.217.163.36): icmp_seq=1 ttl=53 time=51.4 ms
64 bytes from maa05s01-in-f4.1e100.net (172.217.163.36): icmp_seq=2 ttl=53 time=50.3 ms
64 bytes from maa05s01-in-f4.1e100.net (172.217.163.36): icmp_seq=3 ttl=53 time=48.5 ms
64 bytes from maa05s01-in-f4.1e100.net (172.217.163.36): icmp_seq=4 ttl=53 time=59.8 ms
64 bytes from maa05s01-in-f4.1e100.net (172.217.163.36): icmp_seq=5 ttl=53 time=57.8 ms
64 bytes from maa05s01-in-f4.1e100.net (172.217.163.36): icmp_seq=6 ttl=53 time=59.2 ms
64 bytes from maa05s01-in-f4.1e100.net (172.217.163.36): icmp_seq=7 ttl=53 time=68.2 ms
64 bytes from maa05s01-in-f4.1e100.net (172.217.163.36): icmp_seq=8 ttl=53 time=58.8 ms
^C
--- www.google.com ping statistics ---
8 packets transmitted, 8 received, 0% packet loss, time 7004ms
rtt min/avg/max/mdev = 48.533/56.804/68.266/6.030 ms
```

A healthy connection is determined by a steady stream of replies with consistent times. Packet loss is shown by discontinuity of sequence numbers. Large scale packet loss indicates problem along the path.