Lab Name: Python For networking
Lab No:06
Name : Md .Abdul Mukit
ID:IT-17055
Theory:
Third-party libraries:
Although the Python's standard library provides a great set of awesome functionalities, there will be times that you will eventually run into the need of making use of third party libraries.
Networking Glossary:
1.Connection: In networking, a connection refers to pieces of related information that are transferred through a network.
2. Packet: A packet is, generally speaking, the most basic unit that is transfered over a network.
3. Network Interface: A network interface can refer to any kind of software interface to networking hardware.
4. Network Interface: A network interface can refer to any kind of software interface to networking hardware. Example : A home or office network.
5. WAN: WAN stands for "wide area network". It means a network that is much more extensive than a LAN.
6. Protocol: A protocol is a set of rules and standards that basically define a language that devices can use to communicate. There are a great number of protocols in use extensively in networking, and they are often implemented in different layers. Some low level protocols are TCP, UDP, IP, and ICMP.
7. Firewall: A firewall is a program that decides whether traffic coming into a server or going out should be allowed.
8. NAT: NAT stands for network address translation. It is a way to translate requests that are incoming into a routing server to the relevant devices or servers that it knows about in the LAN.
9. VPN: VPN stands for virtual private network. It is a means of connecting separate LANs through the internet, while maintaining privacy.
10. Interfaces: Interfaces are networking communication points for your computer. Each interface is associated with a physical or virtual networking device.

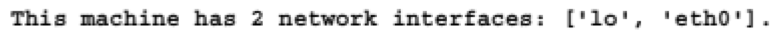
Exercises:
4.1. Enumerating interfaces on your machine
Code:

```
import sys

import socket

import fcntl

import struct

import array
```

```
SIOCGIFCONF = 0x8912 #from C library sockios.h

STUCT_SIZE_32 = 32

STUCT_SIZE_64 = 40

PLATFORM_32_MAX_NUMBER = 2**32

DEFAULT_INTERFACES = 8

def list_interfaces():

interfaces = []

max_interfaces = DEFAULT_INTERFACES

is_64bits = sys.maxsize > PLATFORM_32_MAX_NUMBER

struct_size = STUCT_SIZE_64 if is_64bits else STUCT_SIZE_32

sock = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)

while True:

bytes = max_interfaces * struct_size

interface_names = array.array('B', '\0' * bytes)

sock_info = fcntl.ioctl(

sock.fileno(),

SIOCGIFCONF,

struct.pack('iL', bytes,interface_names.buffer_info()[0])

)

outbytes = struct.unpack('iL', sock_info)[0]

if outbytes == bytes:

max_interfaces *= 2

else:

break

namestr = interface_names.tostring()
```

```
for i in range(0, outbytes, struct_size):

interfaces.append((namestr[i:i+16].split('\0', 1)[0]))

return interfaces

if __name__ == '__main__':

interfaces = list_interfaces()

print( "This machine has %s network interfaces: %s."

%(len(interfaces), interface))
```

Output:



```
This machine has 2 network interfaces: ['lo', 'eth0'].
```

Exercise 4.2: Finding the IP address for a specific interface on your machine
Code:

```
import argparse

import sys

import socket

import fcntl

import struct

import array

def get_ip_address(ifname):

s = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)

return socket.inet_ntoa(fcntl.ioctl(

s.fileno(),

0x8915, # SIOCGIFADDR

struct.pack('256s', ifname[:15])

)[20:24])

if __name__ == '__main__':
```

```
#interfaces = list_interfaces()

parser = argparse.ArgumentParser(description='Python networking

utils')

parser.add_argument('--ifname', action="store", dest="ifname",

required=True)

given_args = parser.parse_args()

ifname = given_args.ifname

print ("Interface [%s] --> IP: %s" %(ifname, get_ip_

address(ifname)))
```

Output:

```
Interface [eth0] --> IP: 10.0.2.15
```

‘Exercise 4.3: Finding whether an interface is up on your machine

Code:

```
import argparse

import socket

import struct

import fcntl

import nmap

SAMPLE_PORTS = '21-23'

def get_interface_status(ifname):

sock = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)

ip_address = socket.inet_ntoa(fcntl.ioctl(

sock.fileno(),

0x8915, #SIOCGIFADDR, C socket library sockios.h

struct.pack('256s', ifname[:15]))[20:24])
nm = nmap.PortScanner()

nm.scan(ip_address, SAMPLE_PORTS)

return nm[ip_address].state()

if __name__ == '__main__':

parser = argparse.ArgumentParser(description='Python networking

utils')

parser.add_argument('--ifname', action="store", dest="ifname",

required=True)

given_args = parser.parse_args()

ifname = given_args.ifname
```

```
print ("Interface [%s] is: %s" %(ifname, get_interface_

status(ifname)))
```

OUTPUT:

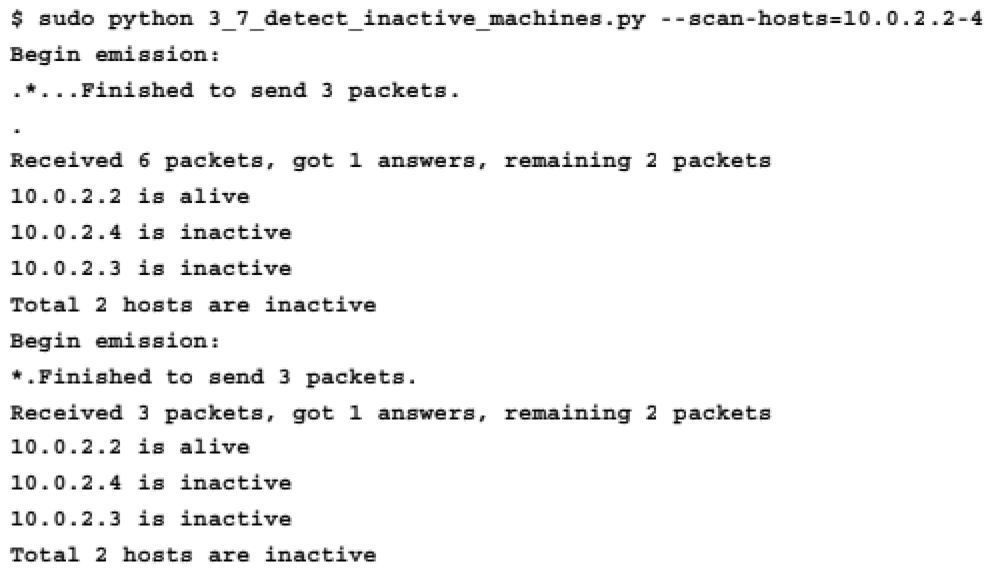
Interface [eth0] is: up

Exercise 4.4: Detecting inactive machines on your network
Code:

```
import argparse

import time

import sched

from scapy.all import sr, srp, IP, UDP, ICMP, TCP, ARP, Ether

RUN_FREQUENCY = 10

scheduler = sched.scheduler(time.time, time.sleep)

def detect_inactive_hosts(scan_hosts):

"""

Scans the network to find scan_hosts are live or dead

scan_hosts can be like 10.0.2.2-4 to cover range.

See Scapy docs for specifying targets.

"""

global scheduler

scheduler.enter(RUN_FREQUENCY, 1, detect_inactive_hosts, (scan_

hosts, ))

inactive_hosts = []

try:

ans, unans = sr(IP(dst=scan_hosts)/ICMP(),retry=0, timeout=1)

ans.summary(lambda(s,r) : r.sprintf("%IP.src% is alive"))
```

```
for inactive in unans:

print "%s is inactive" %inactive.dst

inactive_hosts.append(inactive.dst)

print "Total %d hosts are inactive" %(len(inactive_hosts))

except KeyboardInterrupt:

exit(0)

if __name__ == "__main__":

parser = argparse.ArgumentParser(description='Python networking

utils')

parser.add_argument('--scan-hosts', action="store", dest="scan_

hosts", required=True)

given_args = parser.parse_args()

scan_hosts = given_args.scan_hosts

scheduler.enter(1, 1, detect_inactive_hosts, (scan_hosts, ))

scheduler.run()
```

OUTPUT:



```
$ sudo python 3_7_detect_inactive_machines.py --scan-hosts=10.0.2.2-4
Begin emission:
.*...Finished to send 3 packets.
.
Received 6 packets, got 1 answers, remaining 2 packets
10.0.2.2 is alive
10.0.2.4 is inactive
10.0.2.3 is inactive
Total 2 hosts are inactive
Begin emission:
*.Finished to send 3 packets.
Received 3 packets, got 1 answers, remaining 2 packets
10.0.2.2 is alive
10.0.2.4 is inactive
10.0.2.3 is inactive
Total 2 hosts are inactive
```

Exercise 4.5: Pinging hosts on the network with ICMP

Code:

```
import os

import argparse

import socket

import struct

import select

import time
ICMP_ECHO_REQUEST = 8 # Platform specific

DEFAULT_TIMEOUT = 2

DEFAULT_COUNT = 4

class Pinger(object):

""" Pings to a host -- the Pythonic way"""

def __init__(self, target_host, count=DEFAULT_COUNT,

timeout=DEFAULT_TIMEOUT):

self.target_host = target_host

self.count = count

self.timeout = timeout

def do_checksum(self, source_string):

""" Verify the packet integritity """

sum = 0

max_count = (len(source_string)/2)*2

count = 0

while count < max_count:

val = ord(source_string[count + 1])*256 + ord(source_

string[count])
```

```
sum = sum + val

sum = sum & 0xffffffff

count = count + 2

if max_count<len(source_string):

sum = sum + ord(source_string[len(source_string) - 1])

sum = sum & 0xffffffff

sum = (sum >> 16) + (sum & 0xffff)

sum = sum + (sum >> 16)

answer = ~sum

answer = answer & 0xffff

answer = answer >> 8 | (answer << 8 & 0xff00)

return answer

def receive_pong(self, sock, ID, timeout):

"""

Receive ping from the socket.

"""

time_remaining = timeout

while True:

start_time = time.time()

readable = select.select([sock], [], [], time_remaining)

time_spent = (time.time() - start_time)

if readable[0] == []: # Timeout

return

time_received = time.time()

recv_packet, addr = sock.recvfrom(1024)
```

```
icmp_header = recv_packet[20:28]
type, code, checksum, packet_ID, sequence = struct.unpack(

"bbHHh", icmp_header

)

if packet_ID == ID:

bytes_In_double = struct.calcsize("d")

time_sent = struct.unpack("d", recv_packet[28:28 +

bytes_In_double])[0]

return time_received - time_sent

time_remaining = time_remaining - time_spent

if time_remaining <= 0:

return
```

We need a send_ping() method that will send the data of a ping request to the target host.

Also, this will call the do_checksum() method for checking the integrity of the ping data,

as follows:

```
def send_ping(self, sock, ID):

"""

Send ping to the target host

"""

target_addr = socket.gethostbyname(self.target_host)

my_checksum = 0

# Create a dummy header with a 0 checksum.

header = struct.pack("bbHHh", ICMP_ECHO_REQUEST, 0, my_

checksum, ID, 1)

bytes_In_double = struct.calcsize("d")

data = (192 - bytes_In_double) * "Q"
data = struct.pack("d", time.time()) + data

# Get the checksum on the data and the dummy header.

my_checksum = self.do_checksum(header + data)

header = struct.pack(

"bbHHh", ICMP_ECHO_REQUEST, 0, socket.htons(my_checksum),

ID, 1

)

packet = header + data

sock.sendto(packet, (target_addr, 1))



def ping_once(self):

icmp = socket.getprotobyname("icmp")
try:

sock = socket.socket(socket.AF_INET, socket.SOCK_RAW,

icmp)

except socket.error, (errno, msg):

if errno == 1:

# Not superuser, so operation not permitted

msg += "ICMP messages can only be sent from root user

processes"

raise socket.error(msg)

except Exception, e:

print "Exception: %s" %(e)

my_ID = os.getpid() & 0xFFFF

self.send_ping(sock, my_ID)

delay = self.receive_pong(sock, my_ID, self.timeout)
```

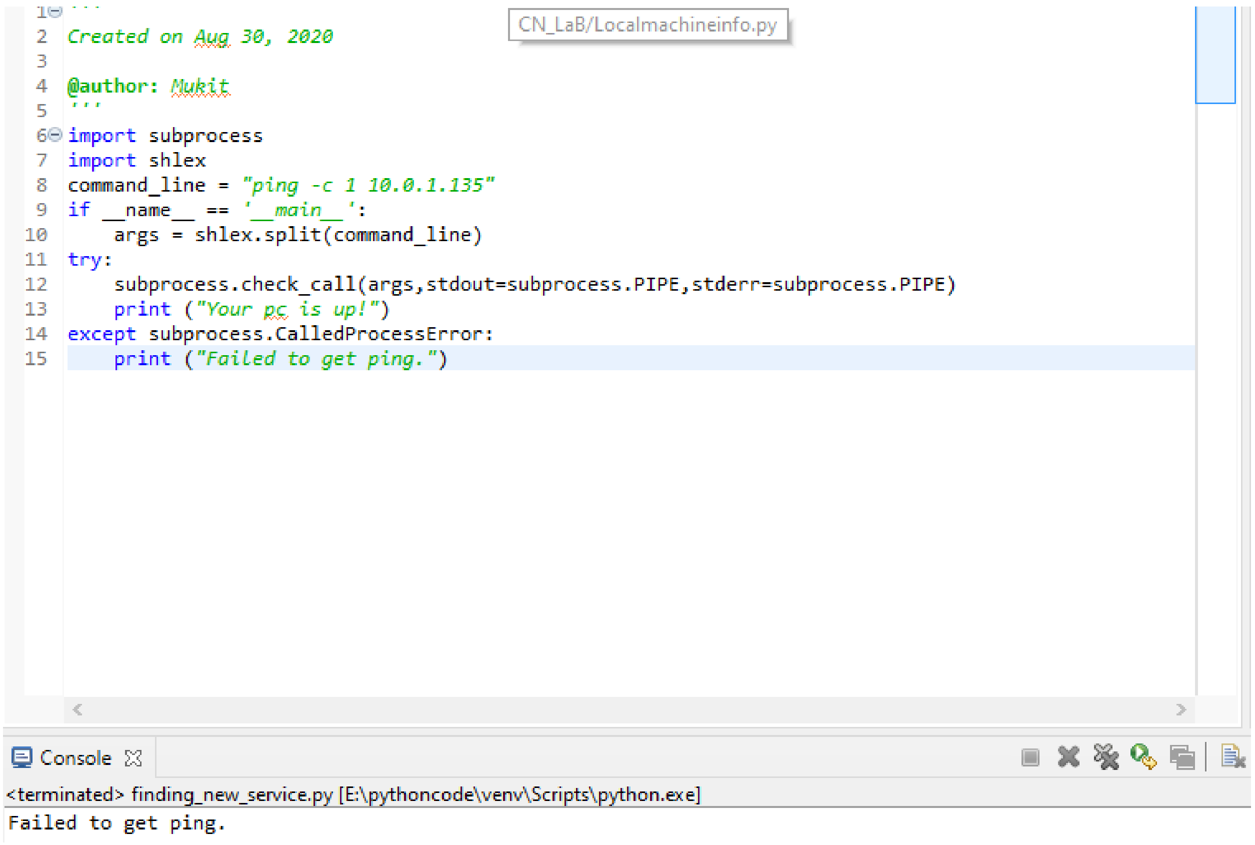
```
sock.close()

return delay
def ping(self):

"""

Run the ping process

"""

for i in xrange(self.count):

print "Ping to %s..." % self.target_host,

try:

delay = self.ping_once()

except socket.gaierror, e:

print "Ping failed. (socket error: '%s')" % e[1]

break

if delay == None:

print "Ping failed. (timeout within %ssec.)" % \ \

self.timeout

else:

delay = delay * 1000

print "Get pong in %0.4fms" % delay

if __name__ == '__main__':

parser = argparse.ArgumentParser(description='Python ping')

parser.add_argument('--target-host', action="store", dest="target_

host", required=True)

given_args = parser.parse_args()

target_host = given_args.target_host

pinger = Pinger(target_host=target_host)
```

pinger.ping()

OUTPUT:

```
$ sudo python 3_2_ping_remote_host.py --target-host=www.google.com
Ping to www.google.com... Get pong in 7.6921ms
Ping to www.google.com... Get pong in 7.1061ms
Ping to www.google.com... Get pong in 8.9211ms
Ping to www.google.com... Get pong in 7.9899ms
```

Exercise 4.6: Pinging hosts on the network with ICMP using pc resources
Code:



```
'''
Created on Aug 30, 2020

@author: Mukit
'''
import subprocess
import shlex
command_line = "ping -c 1 10.0.1.135"
if __name__ == '__main__':
    args = shlex.split(command_line)
try:
    subprocess.check_call(args,stdout=subprocess.PIPE,stderr=subprocess.PIPE)
    print ("Your pc is up!")
except subprocess.CalledProcessError:
    print ("Failed to get ping.")
```

```
<terminated> finding_new_service.py [E:\pythoncode\venv\Scripts\python.exe]
Failed to get ping.
```

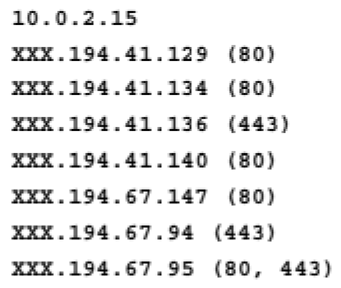
Exercise 4.7: Scanning the broadcast of packets
Code:

from scapy.all import *

import os

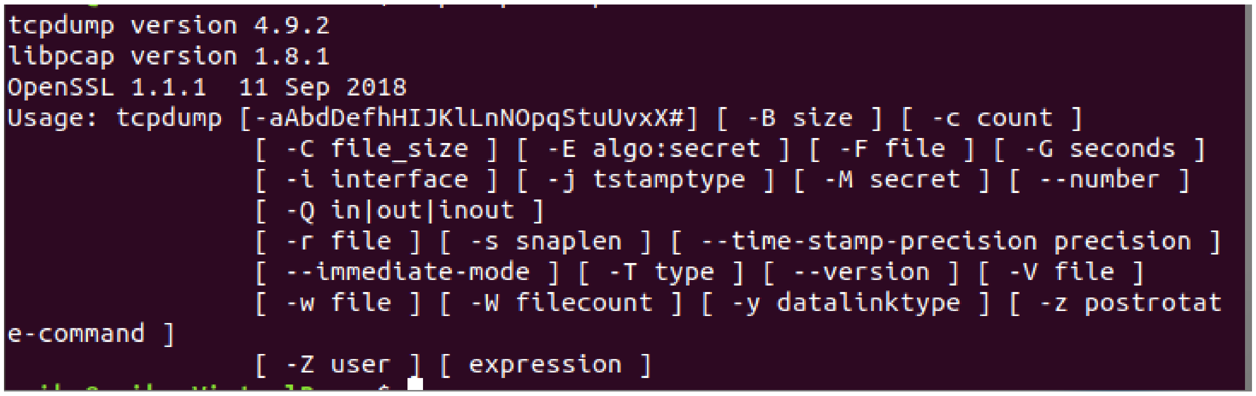
```
captured_data = dict()

END_PORT = 1000

def monitor_packet(pkt):

if IP in pkt:

if not captured_data.has_key(pkt[IP].src):

captured_data[pkt[IP].src] = []

if TCP in pkt:

if pkt[TCP].sport <= END_PORT:

if not str(pkt[TCP].sport) in captured_data[pkt[IP].src]:

captured_data[pkt[IP].src].append(str(pkt[TCP].sport))
os.system('clear')

ip_list = sorted(captured_data.keys())

for key in ip_list:

ports=', '.join(captured_data[key])

if len (captured_data[key]) == 0:

print '%s' % key

else:

print '%s (%s)' % (key, ports)

if __name__ == '__main__':

sniff(prn=monitor_packet, store=0)
```

Output:



```
10.0.2.15
XXX.194.41.129 (80)
XXX.194.41.134 (80)
XXX.194.41.136 (443)
XXX.194.41.140 (80)
XXX.194.67.147 (80)
XXX.194.67.94 (443)
XXX.194.67.95 (80, 443)
```

Exercise 4.8: Sniffing packets on your network



```
tcpdump version 4.9.2
libpcap version 1.8.1
OpenSSL 1.1.1  11 Sep 2018
Usage: tcpdump [-aAbdDefhHIJKlLnNOpqStuUvxX#] [ -B size ] [ -c count ]
                [ -C file_size ] [ -E algo:secret ] [ -F file ] [ -G seconds ]
                [ -i interface ] [ -j tstamptype ] [ -M secret ] [ --number ]
                [ -Q in|out|inout ]
                [ -r file ] [ -s snaplen ] [ --time-stamp-precision precision ]
                [ --immediate-mode ] [ -T type ] [ --version ] [ -V file ]
                [ -w file ] [ -W filecount ] [ -y datalinktype ] [ -z postrotat
e-command ]
                [ -Z user ] [ expression ]
```