Mawlana Bhashani Science and Technology University

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Lab Report

Department of Information and Communication Technology

Report No: 03

Report Name: Python for Networking.

Course Title: Network Planning and designing Lab.

Course Code: ICT-3208

Submitted By	Submitted To
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Objectives : The main objectives of this lab how to Install python and use third-party libraries , Interact with network interfaces using python and getting information from internet using Python.

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: Before we begin discussing networking with any depth, we must define some common terms that you will see throughout this guide, and in other guides and documentation regarding networking.

Connection: In networking, a connection refers to pieces of related information that are transferred through a network.

Packet: A packet is, generally speaking, the most basic unit that is transfered over a network.

Network Interface ,LAN, WAN, protocol , firewall , NAT, VPN , Interfaces etc .

Methodology :

Installing Python Third-party includes:

Python Third-party includes a setup.py file, it is usually distributed as a tarball (.tar.gz or .tar.bz2 file). The instructions for installing these generally look like:

Download the file from website.

Extract the tarball.

Change into the new directory that has been newly extracted.

Run sudo python setup.py build

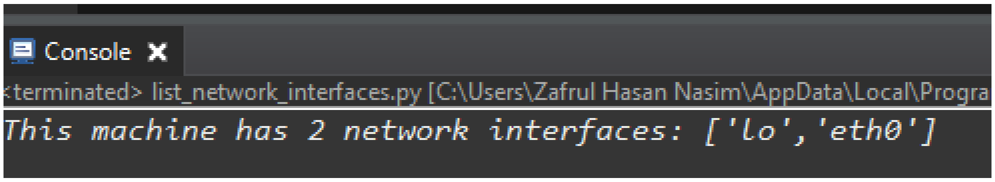
Run sudo python setup.py install.

Exercise 4.1: Enumerating interfaces on your machine

Code :

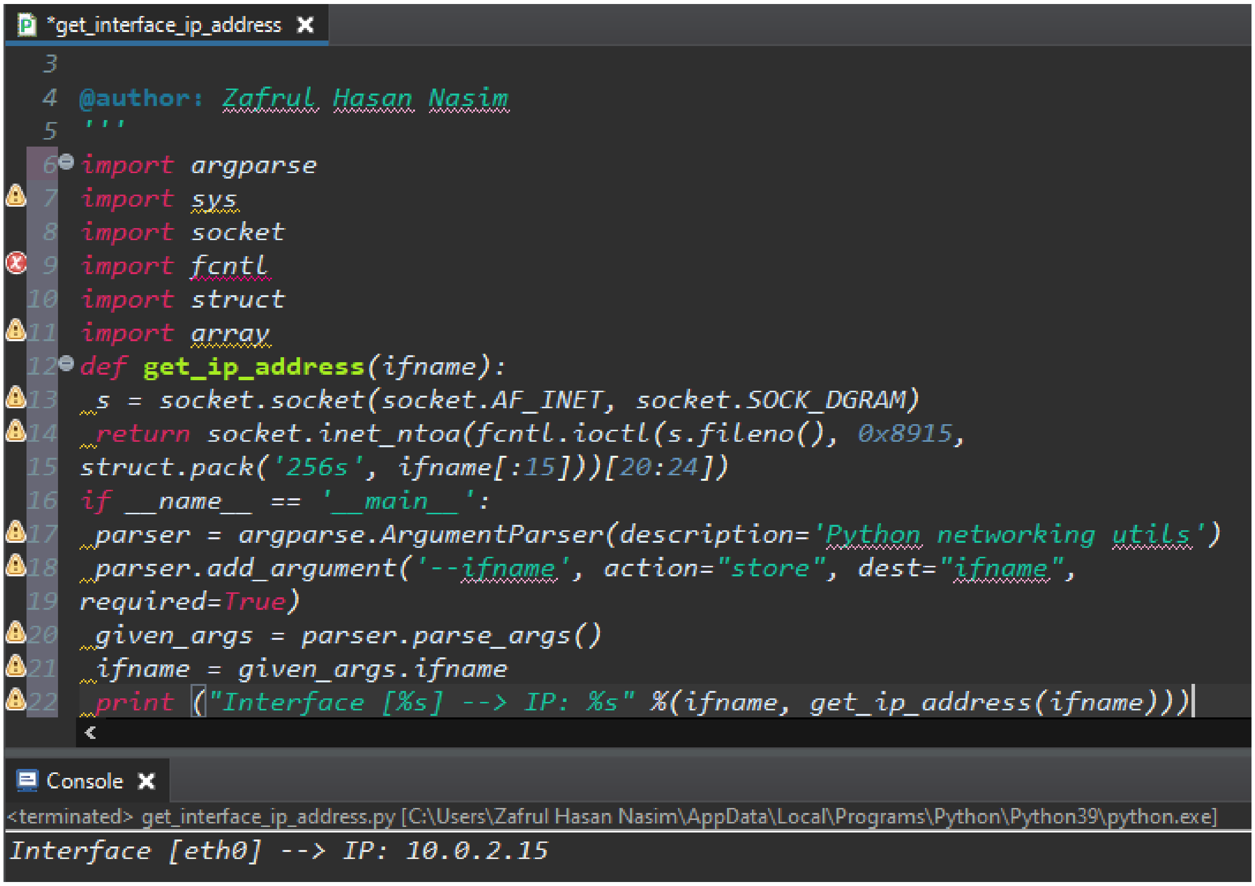
```
import sys
import socket
import fcntl
import struct
import array
SIOCGIFCONF = 0x8912 #from C library sockios.h
STUCT_SIZE_32 = 32
STUCT_SIZE_64 = 40
PLATFORM_32_MAX_NUMBER = 2**32
DEFAULT_INTERFACES = 8
def list_interfaces():
interfaces = []
max_interfaces = DEFAULT_INTERFACES
is_64bits = sys.maxsize > 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:



```
<terminated> list_network_interfaces.py [C:\Users\Zafrul Hasan Nasim\AppData\Local\Progra
This machine has 2 network interfaces: ['lo','eth0']
```

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

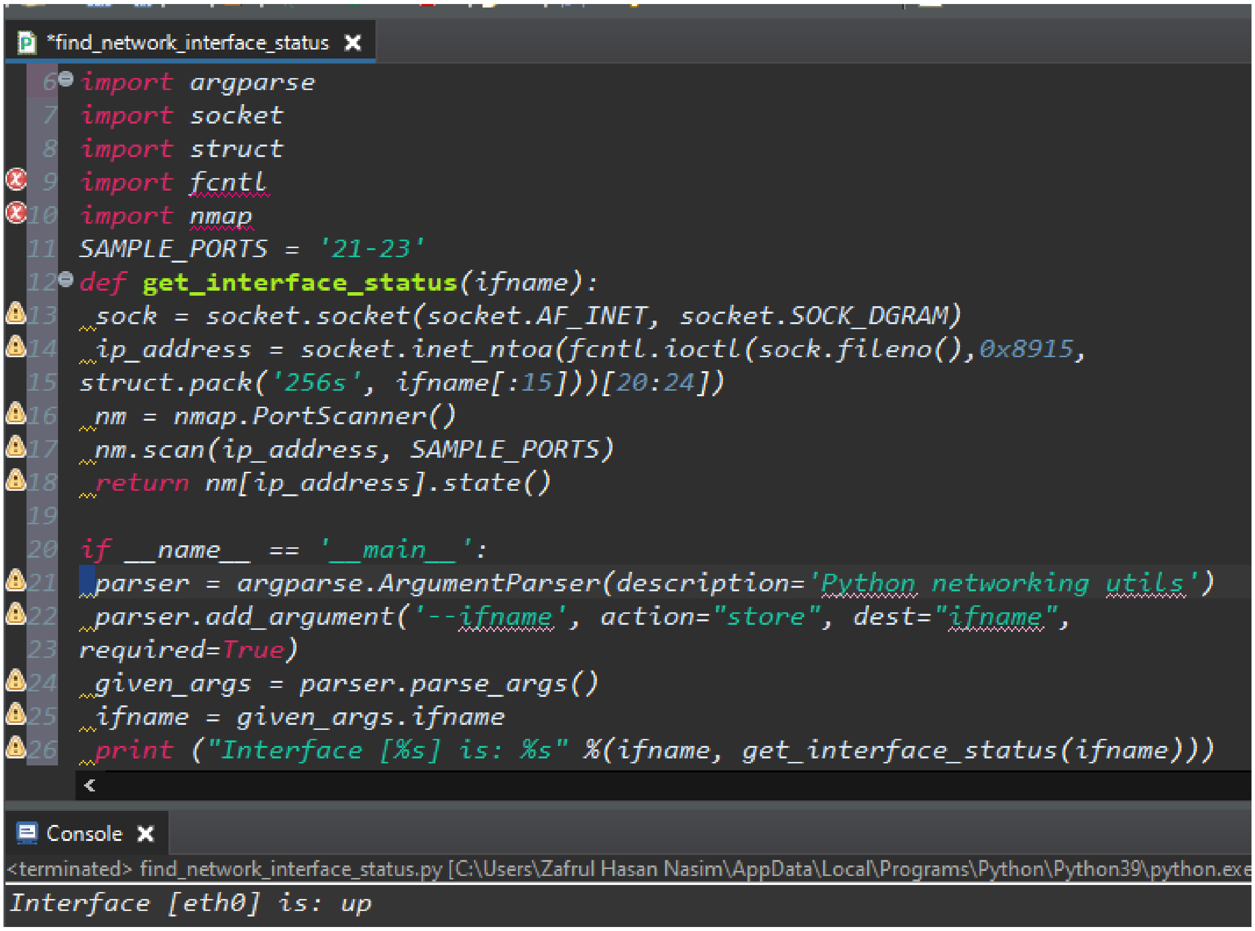


```

@author: Zafrul Hasan Nasim
'''
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,
struct.pack('256s', ifname[:15]))[20:24])
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] --> IP: %s" %(ifname, get_ip_address(ifname)))
```

```
<terminated> get_interface_ip_address.py [C:\Users\Zafrul Hasan Nasim\AppData\Local\Programs\Python\Python39\python.exe]
Interface [eth0] --> IP: 10.0.2.15
```

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



```
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,
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)))
```

```
<terminated> find_network_interface_status.py [C:\Users\Zafrul Hasan Nasim\AppData\Local\Programs\Python\Python39\python.exe
Interface [eth0] is: up
```

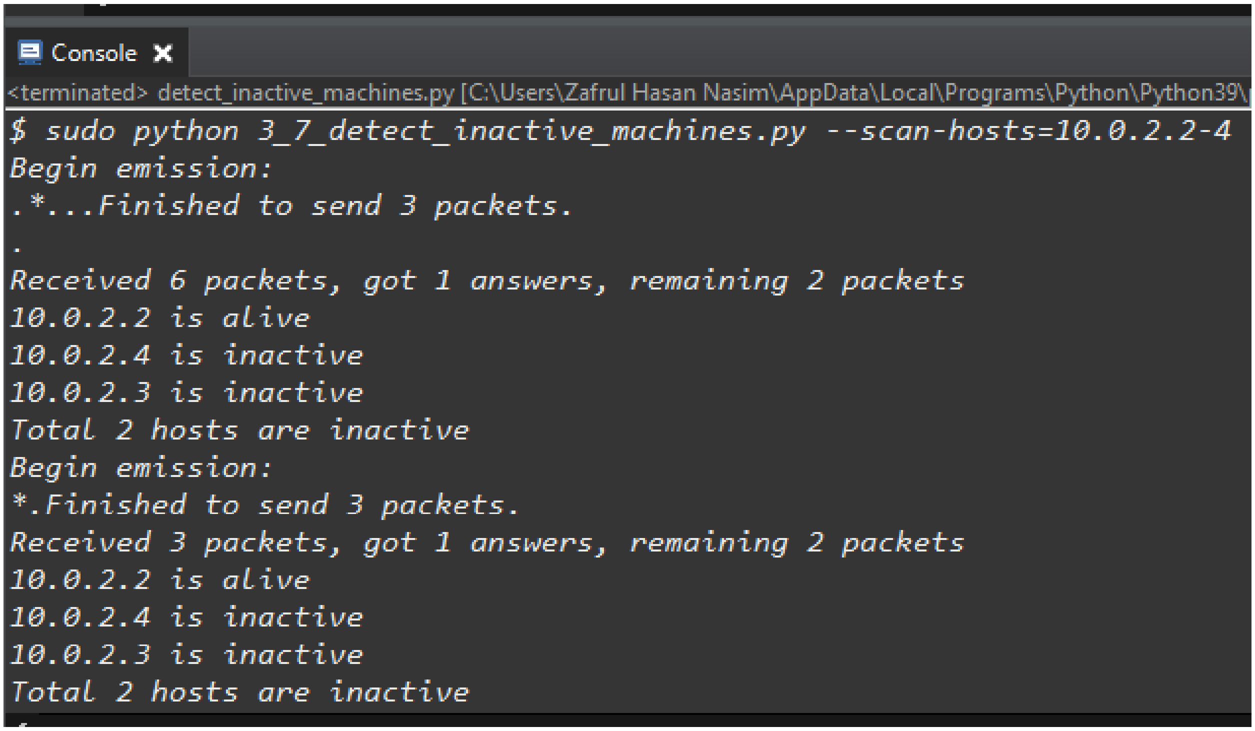
Exercise 4.4: Detecting inactive machines on your network

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 :



```
<terminated> detect_inactive_machines.py [C:\Users\Zafrul Hasan Nasim\AppData\Local\Programs\Python\Python39\
$ 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 & 0xffffffff)
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
```

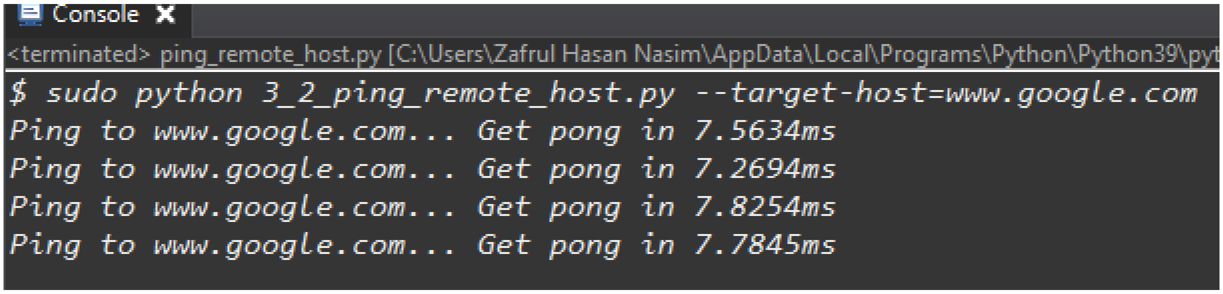
We need a send_ping() method that will send the data of a ping request to the target host.

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):
```

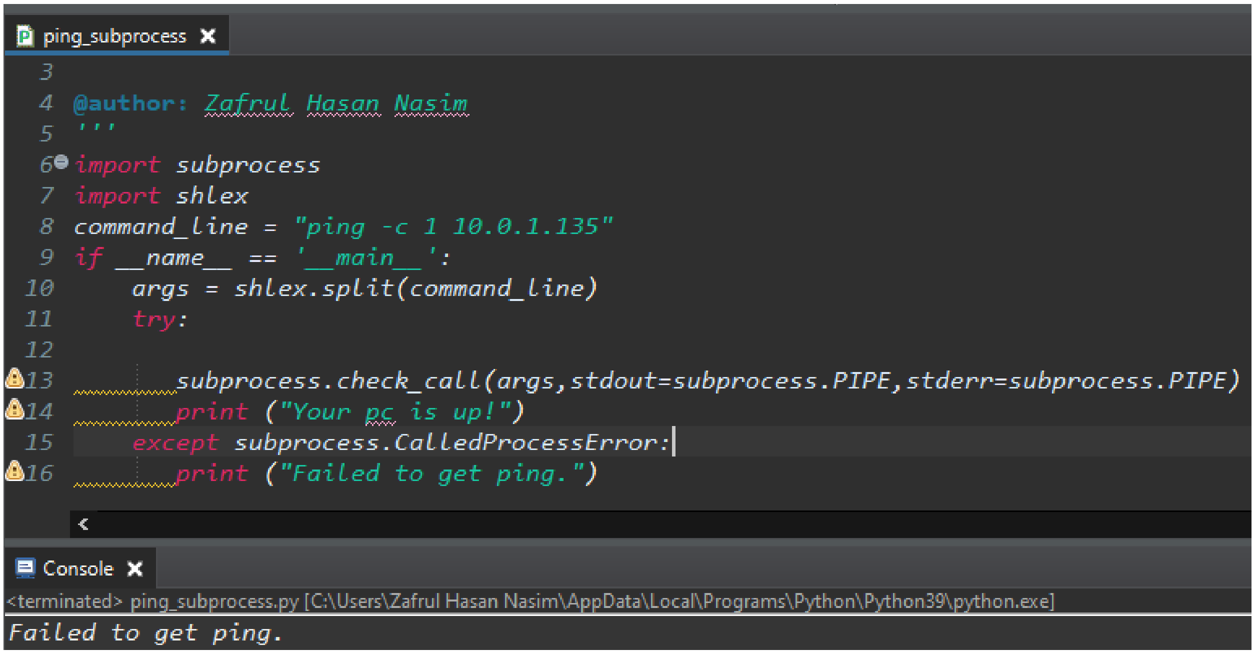
```
icmp = socket.getprotobyname("icmp")
try:
sock = socket.socket(socket.AF_INET, socket.SOCK_RAW,
icmp)
except socket.error, (errno, msg):
if errno == 1:
# Not superuser, so operation not permitted
msg += "ICMP messages can only be sent from root user
processes"
raise socket.error(msg)
except Exception, 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 :



```
<terminated> ping_remote_host.py [C:\Users\Zafrul Hasan Nasim\AppData\Local\Programs\Python\Python39\pyt
$ sudo python 3_2_ping_remote_host.py --target-host=www.google.com
Ping to www.google.com... Get pong in 7.5634ms
Ping to www.google.com... Get pong in 7.2694ms
Ping to www.google.com... Get pong in 7.8254ms
Ping to www.google.com... Get pong in 7.7845ms
```

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



```

@author: Zafrul Hasan Nasim
'''
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> ping_subprocess.py [C:\Users\Zafrul Hasan Nasim\AppData\Local\Programs\Python\Python39\python.exe]
Failed to get ping.
```

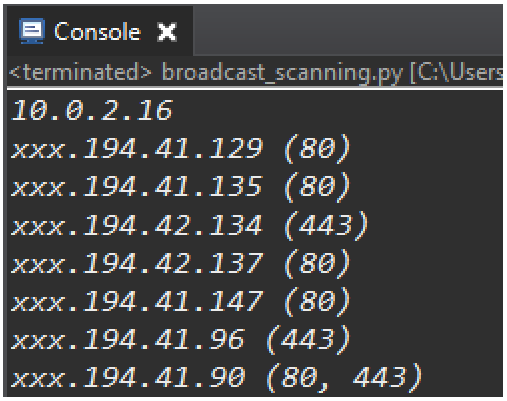
Exercise 4.7: Scanning the broadcast of packets

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:
```

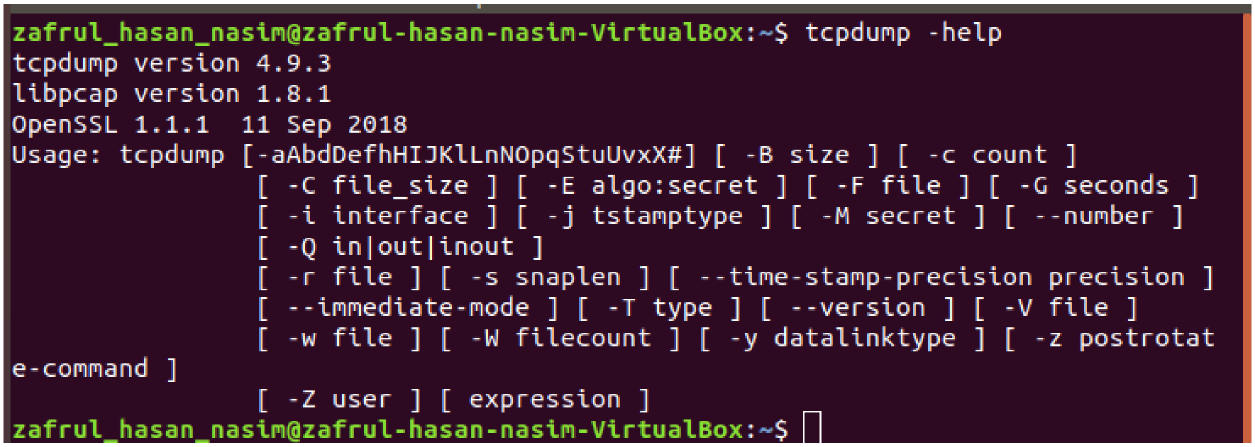
```
if not str(pkt[TCP].sport) in captured_data[pkt[IP].src]:
captured_data[pkt[IP].src].append(str(pkt[TCP].sport))
os.system('clear')
ip_list = sorted(captured_data.keys())
for key in ip_list:
ports=', '.join(captured_data[key])
if len (captured_data[key]) == 0:
print '%s' % key
else:
print '%s (%s)' % (key, ports)
if __name__ == '__main__':
sniff(prn=monitor_packet, store=0)
```

Output:



```
10.0.2.16
xxx.194.41.129 (80)
xxx.194.41.135 (80)
xxx.194.42.134 (443)
xxx.194.42.137 (80)
xxx.194.41.147 (80)
xxx.194.41.96 (443)
xxx.194.41.90 (80, 443)
```

Exercise 4.8: Sniffing packets on your network



```
zafrul_hasan_nasim@zafrul-hasan-nasim-VirtualBox:~$ tcpdump -help
tcpdump version 4.9.3
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 ]
zafrul_hasan_nasim@zafrul-hasan-nasim-VirtualBox:~$ 
```

Conclusion: From this lab , I have known that how to Install python and use third-party libraries . I have understood that how to python's standard library provides a great set of awesome functionalities, there will be times that I will eventually run into the need of making use of third party libraries. I learnt that Interact with network interfaces using python and getting information from internet using Python. I also learnt that networking with any depth, discuss some common terms .