MAWLANA BHASHANI SCIENCE AND TECHNOLOGY UNIVERSITY

DEPARTMENT OF ICT

Lab Report No : 07

Course Code : ICT-3208

Course Title : Network Planning and Designing Lab

Lab Report name : Python for Networking

Submitted by

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Python for Networking

Objectives :

- Install python and use third-party libraries
- Interact with network interfaces using python
- Getting information from internet using Python

1. Describe some networking common terms ?

i. Packet

ii. Network Interface

iii. LAN

iv. WAN

v. Protocol

vi. Firewall

vii. NAT

viii. VPN

Ans:

i.**Packet:** A packet is, generally speaking, the most basic unit that is transfered over a network. When communicating over a network, packets are the envelopes that carry your data (in pieces) from one end point to the other. Packets have a header portion that contains information about the packet including the source and destination, timestamps, network hops, etc. The main portion of a packet contains the actual data being transfered. It is sometimes called the body or the payload.

ii.**Network Interface :** A network interface can refer to any kind of software interface to networking hardware. For instance, if you have two network cards in your computer, you can control and configure each network interface associated with them individually.A network interface may be associated with a physical device, or it may be a representation of a virtual interface. The "loopback" device, which is a virtual interface to the local machine, is an example of this.

iii.**LAN :** LAN stands for "local area network". It refers to a network or a portion of a network that is not publicly accessible to the greater internet. A home or office network is an example of a LAN.

iv.**WAN :** WAN stands for "wide area network". It means a network that is much more extensive than a LAN. While WAN is the relevant term to use to describe large, dispersed networks in general, it is usually meant to mean the internet, as a whole. If an interface is said to be connected to the WAN, it is generally assumed that it is reachable through the internet.

V. **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. Some familiar examples of application layer protocols, built on these lower protocols, are HTTP (for accessing web content), SSH, TLS/SSL, and FTP. Port: A port is an address on a single machine that can be tied to a specific piece of software. It is not a physical interface or location, but it allows your server to be able to communicate using more than one application.

vi. **Firewall :** A firewall is a program that decides whether traffic coming into a server or going out should be allowed. A firewall usually works by creating rules for which type of traffic is acceptable on which ports. Generally, firewalls block ports that are not used by a specific application on a server.

vii. **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. This is usually implemented in physical LANs as a way to route requests through one IP address to the necessary backend servers.

viii. **VPN :** VPN stands for virtual private network. It is a means of connecting separate LANs through the internet, while maintaining privacy. This is used as a means of connecting remote systems as if they were on a local network, often for security reasons.

2. Exercises :

Ex-1 : Enumerating interfaces on your machine.

Source code :

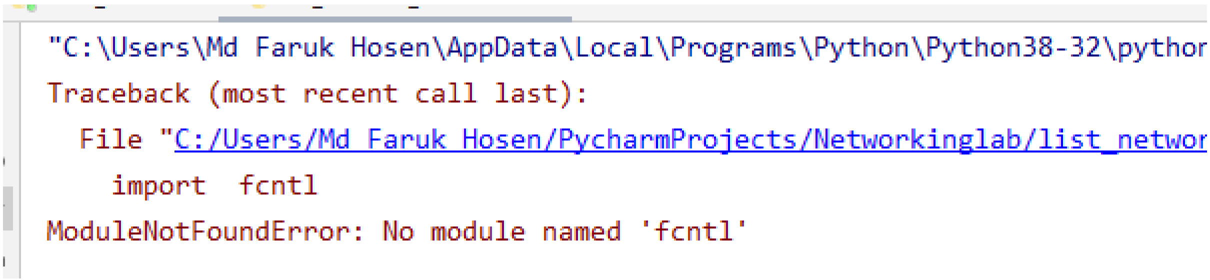
```
import sys
import  socket
import  fcntl
import  struct
import array

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), interfaces))
```

Output :



```
"C:\Users\Md Faruk Hosen\AppData\Local\Programs\Python\Python38-32\pythor
Traceback (most recent call last):
  File "C:/Users/Md Faruk Hosen/PycharmProjects/Networkinglab/list_networ
    import  fcntl
ModuleNotFoundError: No module named 'fcntl'
```

Ex-2 : Finding the IP address for a specific interface on your machine.

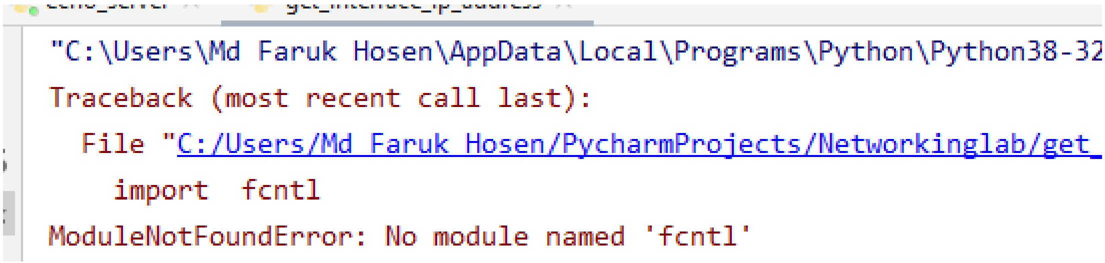
Source code :

```
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,
    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=False)
    given_args  =  parser.parse_args()
    ifname  =  given_args.ifname
    print  ("Interface  [%s]  -->  IP:  %s"  %(ifname,
get_ip_address(ifname))
```

Output:



```
"C:\Users\Md Faruk Hosen\AppData\Local\Programs\Python\Python38-32
Traceback (most recent call last):
  File "C:/Users/Md Faruk Hosen/PycharmProjects/Networkinglab/get_
    import  fcntl
ModuleNotFoundError: No module named 'fcntl'
```

Ex-3 : Finding whether an interface is up on your machine.

Source code :

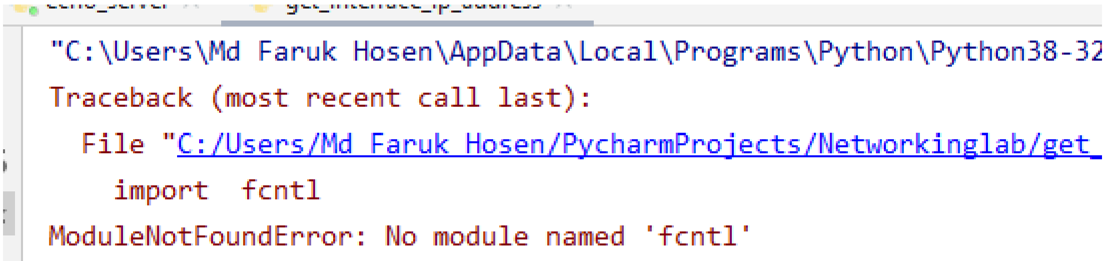
```
import argparse
import  socket
import  struct
import  fcntl
import nmap

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,
    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 :



```
"C:\Users\Md Faruk Hosen\AppData\Local\Programs\Python\Python38-32
Traceback (most recent call last):
  File "C:/Users/Md Faruk Hosen/PycharmProjects/Networkinglab/get_
    import  fcntl
ModuleNotFoundError: No module named 'fcntl'
```

Ex-4 : Detecting inactive machines on your network .

Source code:

```
import argparse
import  time
import sched
from  scapy.layers.inet
```

```
import  sr,  srp,  IP,  UDP,  ICMP,  TCP,  ARP,  Ether
#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):

    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()
```

Ex-5 : Pinging hosts on the network with ICMP

Source 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):
    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):
    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

    def send_ping(self, sock, ID):
        """
        Send  ping  to  the  target  host """

    target_addr = socket.gethostbyname(self.target_host)

    my_checksum = 0


ID, 1)

#  Create  a  dummy  heder  with  a  0  checksum.
header = struct.pack("bbHHh", ICMP_ECHO_REQUEST, 0, my_checksum,

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):
    """
    Returns  the  delay  (in  seconds)  or  none  on  timeout. """


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()
```

Ex-6 : Pinging hosts on the network with ICMP using pc resources Create

Source code :

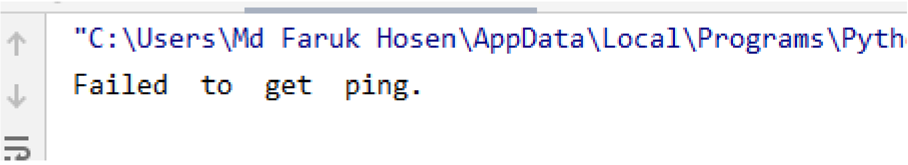
```
import subprocess
import shlex

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.PIP
E)
        print ("Your pc is up!")
    except subprocess.CalledProcessError:
        print ("Failed to get ping.")
```

Output :



```
"C:\Users\Md Faruk Hosen\AppData\Local\Programs\Pyth
Failed to get ping.
```

Ex-7 : Scanning the broadcast of packets

Source code :

```
from scapy import all
from scapy.layers.inet
import sr, srp, IP, UDP, ICMP, TCP, ARP, Ether, sniff
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)
```

Ex-8 : Sniffing packets on your network

Ans: **Tcpdump** is a common packet analyzer that runs under the command line. It allows the user to display TCP/IP and other packets being transmitted or received over a network to which the computer is attached. Distributed under the BSD license,[3] tcpdump is free software.

- Open a linux terminal and check the usage of tcpdump using the command line tcpdum –help
- Using tcpdump get the traffic present in the Ethernet interface of your pc (10 packet only), which is the command line?
- Using the subprocess write a program for sniffing 1 packet of the Ethernet interface? (Save as packet_sniffer.py).

Ex-9 : Performing a basic Telnet

Source code :

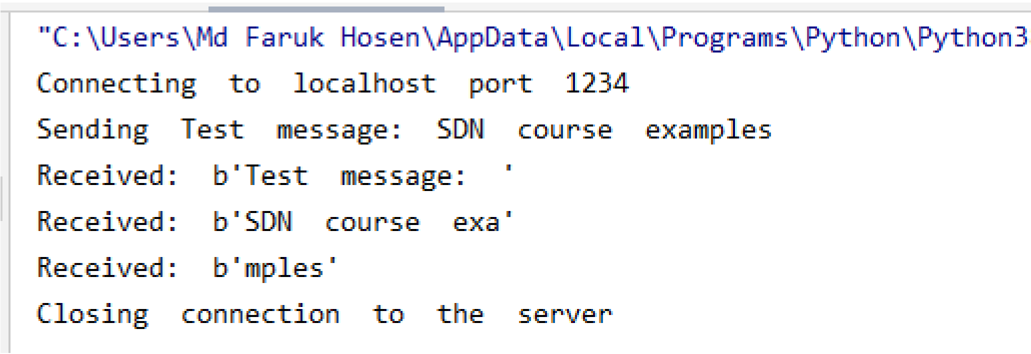
```
import socket
TCP_IP = '127.0.0.1'
TCP_PORT = 62
BUFFER_SIZE = 20 # Normally 1024, but we want fast response

s = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
s.bind((TCP_IP, TCP_PORT))
s.listen(1)

conn, addr = s.accept()
print ('Connection address:', addr)
while 1:
    data = conn.recv(BUFFER_SIZE)
    if not data:
```

```
    break
print ("received data:", data) conn.send(data) # echo
conn.close()
```

Output :



```
"C:\Users\Md Faruk Hosen\AppData\Local\Programs\Python\Python3
Connecting to localhost port 1234
Sending Test message: SDN course examples
Received: b'Test message: '
Received: b'SDN course exa'
Received: b'mples'
Closing connection to the server
```

Conclusion :

From this lab, I learn a lot of python code that is related to networking. I also learn telnet. When I do this lab, I face some problem. But I overcome these with the help of my course teacher(Nazrul Islam).