MAWLANA BHASHANI SCIENCE AND TECHNOLOGY UNIVERSITY

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Department of ICT

LAB REPORT NO-06

Course Code : ICT – 3207
Course Title : Computer Networks

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Report Name : Python for networking lab.
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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()
```

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

```
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

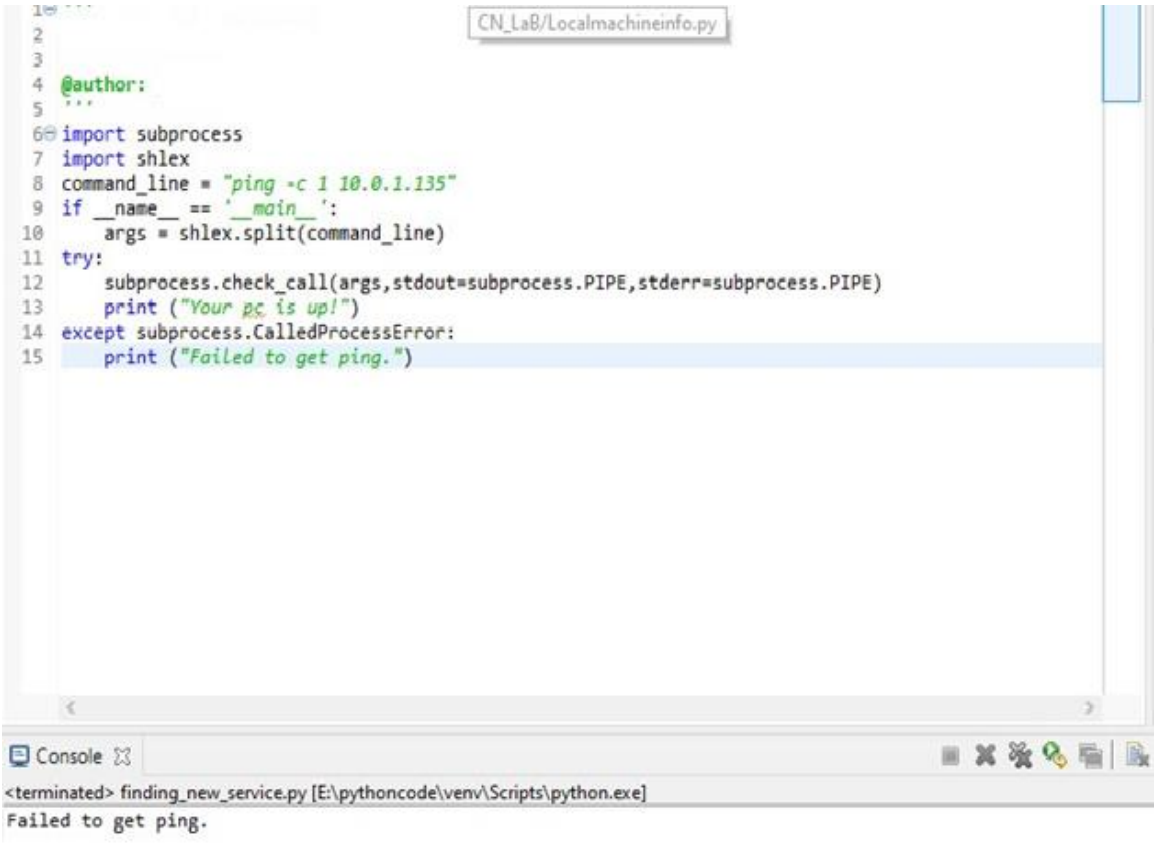
print "Get pong in %0.4fms" % delay if name == ' main ':
parser=argparse.ArgumentParser(description='Pythonping')
parser.add_argument('--target-host', action="store", dest="target_ host", required=True)
given_args = parser.parse_args() target_host = given_args.target_host
pinger = Pinger(target_host=target_host)

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:



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)
```

Conclusion :

In this lab we learn networking with python. We face some of problem while doing this lab.While doing Enumerating interfaces on my machine at the first time we can’t able to run the code.Then we able to fix the problem.