MAWLANA BHASHANI SCIENCE AND TECHNOLOGY UNIVERSITY

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Department of ICT

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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 transfer 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: 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 : 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 : 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 : 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 : 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
```

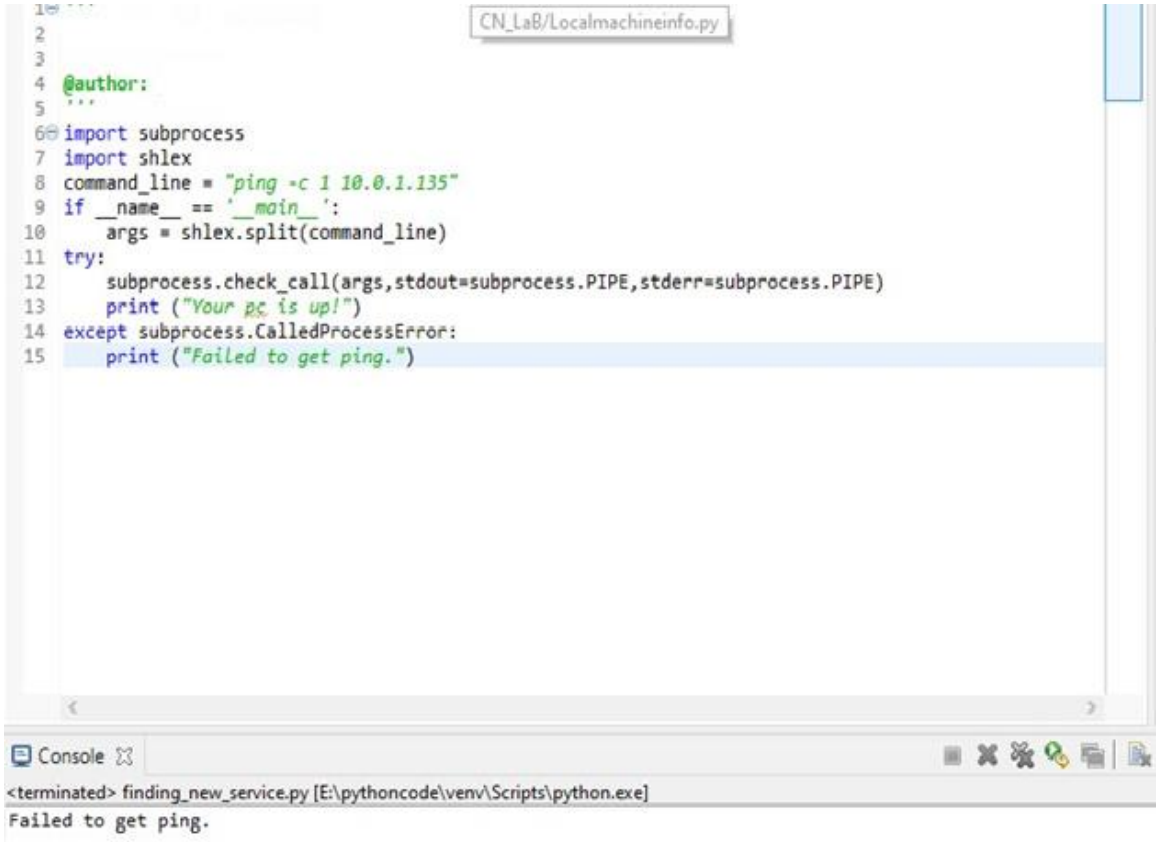
```
print "Get pong in %0.4fms" % delay if     name       == ' main ':
parser=argparse.ArgumentParser(description='Pythonping')
parser.add_argument('--target-host',  action="store",  dest="target_  host",
required=True)
given_args  =  parser.parse_args()  target_host  =  given_args.target_host
pinger = 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 : 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 Python programming language to implement a simple NTP (Network Time Protocol) client that determines the discrepancy between your computer's time and a NTP server. 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.