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Lab 3: Traceroute Lab

Python Code (`traceroute.py`)

```
import socket
import os
import sys
import struct
import time
import select

ICMP_ECHO_REQUEST = 8
MAX_HOPS = 30
TIMEOUT = 2.0
TRIES = 2

def checksum(string: str):
    """Generate a checksum for the ICMP header.

    Args:
        string (str): String for checksum

    Returns:
        int: Checksum for header
    """

    csum = 0
    count_to = (len(string) // 2) * 2
    count = 0
    while count < count_to:
        cur_val = string[count+1] * 256 + string[count]
        csum = csum + cur_val
        csum = csum & 0xffffffff
        count = count + 2
    if count_to < len(string):
        csum = csum + string[len(string) - 1]
        csum = csum & 0xffffffff
    csum = (csum >> 16) + (csum & 0xffff)
    csum = csum + (csum >> 16)
    answer = ~csum
    answer = answer & 0xffff
    answer = answer >> 8 | (answer << 8 & 0xff00)
    return answer


def build_packet():
    """Generate an ICMP packet for use in the traceroute function
```

```
    Returns:
        bytes: ICMP Packet (Header + Data)
            Header = Header is icmp_type (8), code (8), checksum (16), id (16),
seq (16)

    """
    packet_checksum = 0

    # Get Current Process PID
    process_pid = os.getpid() & 0xFFFF

    # Make a dummy header with a 0 checksum.
    header = struct.pack("bbHHh", ICMP_ECHO_REQUEST, 0, packet_checksum,
process_pid, 1)

    # Setup data for the packet
    data = struct.pack("d", time.time())

    # Calculate the checksum on the data and the dummy header.
    packet_checksum = checksum(header + data)

    # Get the right checksum, and put in the header
    if sys.platform == 'darwin':

        #Convert 16-bit integers from host to network byte order.
        packet_checksum = socket.htons(packet_checksum) & 0xffff
    else:
        packet_checksum = socket.htons(packet_checksum)

    # Build actual header
    header = struct.pack("bbHHh", ICMP_ECHO_REQUEST, 0, packet_checksum,
process_pid, 1)

    # Build actual packet
    packet = header + data
    return packet

def get_route(hostname):
    """Get the route between the current host and the provided hostname. Outputs
route to STDOUT

    Args:
        hostname (str): Hostname to trace route to.
    """
    print(hostname)
    time_left = TIMEOUT
    for ttl in range(1,MAX_HOPS):
        for tries in range(TRIES):
            dest_addr = socket.gethostbyname(hostname)
            # Make a raw socket called current_socket
            icmp = socket.getprotobyname("icmp")
            current_socket = socket.socket(socket.AF_INET, socket.SOCK_RAW, icmp)
            current_socket.setsockopt(socket.IPPROTO_IP, socket.IP_TTL,
```

```
    struct.pack('I', ttl))
                current_socket.settimeout(TIMEOUT)
                try:
                    d = build_packet()
                    current_socket.sendto(d, (hostname, 0))
                    t = time.time()
                    start_select = time.time()
                    ready = select.select([current_socket], [], [], time_left)
                    select_time_elapsed = (time.time() - start_select)
                    if ready[0] == []: # Timeout
                        print(" * * * Request timed out.")
                    received_packet, addr = current_socket.recvfrom(1024)
                    time_received = time.time()
                    time_left = time_left - select_time_elapsed
                    if time_left <= 0:
                        print(" * * * Request timed out.")
                except socket.timeout:
                    continue
                else:
                    # Fetch the ICMP Type from the IP Packet
                    icmp_header_content = received_packet[20:28]
                    icmp_type, _code, _checksum, _packet_id, _sequence =
    struct.unpack("bbHHh", icmp_header_content)
                    if icmp_type == 11:
                        bytes = struct.calcsize("d")
                        time_sent = struct.unpack("d", received_packet[28:28 + bytes])
    [0]
                        print(" %d rtt=%.0f ms %s" % (ttl, (time_received -t)*1000,
    addr[0]))
                    elif icmp_type == 3:
                        bytes = struct.calcsize("d")
                        time_sent = struct.unpack("d", received_packet[28:28 + bytes])
    [0]
                        print(" %d rtt=%.0f ms %s" % (ttl, (time_received-t)*1000,
    addr[0]))
                    elif icmp_type == 0:
                        bytes = struct.calcsize("d")
                        time_sent = struct.unpack("d", received_packet[28:28 + bytes])
    [0]
                        print(" %d rtt=%.0f ms %s" % (ttl, (time_received -
    time_sent)*1000, addr[0]))
                        return
                    else:
                        print("error")
                    break
                finally:
                    current_socket.close()


    if __name__ == '__main__':
        get_route("www.google.com")
        get_route("www.yahoo.com")
        get_route("www.twitter.com")
        get_route("www.facebook.com")
```

Traceroute Output

```
python_programming_lab_03 assignments-python-traceroute* $ pipenv run python .\traceroute.py
www.google.com
 1 rtt=6 ms 192.168.128.1
 2 rtt=2 ms 144.121.124.161
 3 rtt=3 ms 144.121.35.40
 4 rtt=3 ms 173.205.63.17
 5 rtt=10 ms 89.149.142.242
 6 rtt=28 ms 69.174.23.134
 7 rtt=12 ms 108.170.246.1
 8 rtt=9 ms 216.239.54.105
 9 rtt=9 ms 216.239.38.120
www.yahoo.com
 1 rtt=1 ms 192.168.128.1
 2 rtt=2 ms 144.121.124.161
 3 rtt=2 ms 144.121.35.40
 4 rtt=2 ms 216.66.50.105
 5 rtt=1 ms 206.126.115.19
 6 rtt=26 ms 216.115.111.28
 7 rtt=12 ms 72.30.223.54
 8 rtt=21 ms 74.6.227.133
 9 rtt=14 ms 74.6.122.17
 10 rtt=28 ms 98.139.128.73
 11 rtt=12 ms 72.30.35.10
www.twitter.com
 1 rtt=1 ms 192.168.128.1
 2 rtt=4 ms 144.121.124.161
 3 rtt=3 ms 144.121.35.40
 4 rtt=2 ms 216.66.50.105
 5 rtt=3 ms 72.52.92.101
 6 rtt=2 ms 198.32.160.50
 * * * Request timed out.
 * * * Request timed out.
 8 rtt=26 ms 104.244.42.65
www.facebook.com
 1 rtt=1 ms 192.168.128.1
 2 rtt=1 ms 144.121.124.161
 3 rtt=2 ms 144.121.35.40
 4 rtt=1 ms 216.66.50.105
 5 rtt=3 ms 206.126.115.64
 6 rtt=2 ms 157.240.47.33
 7 rtt=2 ms 173.252.67.193
 8 rtt=2 ms 31.13.71.36

python_programming_lab_03 assignments-python-traceroute* $
```

```
python_programming_lab_03 assignments-python-traceroute* $ tracert www.google.com; tracert www.yahoo.com; tracert www.twitter.com; tracert www.facebook.com

Tracing route to forcesafesearch.google.com [216.239.38.120]
over a maximum of 30 hops:

  1     1 ms     1 ms     2 ms  my.meraki.net [192.168.128.1]
  2     7 ms     2 ms     2 ms  ae25-nycmnyzrjp1.lightower.net [104.207.214.185]
  3     6 ms     2 ms    19 ms  ae10-nycmnyzrj42.lightower.net [144.121.35.40]
  4     5 ms     2 ms     2 ms  ae8.cr0-nyc2.ip4.gtt.net [173.205.63.17]
  5    21 ms    20 ms    12 ms  et-0-0-65.cr3-was1.ip4.gtt.net [89.149.142.242]
  6    12 ms     8 ms    27 ms  as15169.cr3-was1.ip4.gtt.net [69.174.23.134]
  7    12 ms     8 ms     8 ms  108.170.246.1
  8    12 ms     8 ms    12 ms  216.239.54.105
  9    10 ms     9 ms     8 ms  any-in-2678.1e100.net [216.239.38.120]

Trace complete.

Tracing route to atsv2-fp-shed.wg1.b.yahoo.com [72.30.35.9]
over a maximum of 30 hops:

  1     1 ms     1 ms     1 ms  my.meraki.net [192.168.128.1]
  2     3 ms     4 ms     5 ms  ae25-nycmnyzrjp1.lightower.net [104.207.214.185]
  3     2 ms     1 ms     2 ms  ae10-nycmnyzrj42.lightower.net [144.121.35.40]
  4     1 ms     2 ms     2 ms  10ge4-7.core1.nyc5.he.net [216.66.50.105]
  5     7 ms     2 ms     3 ms  yahoo.tienyc.telxgroup.net [206.126.115.19]
  6   124 ms    16 ms    15 ms  ae-1.pat2.bfw.yahoo.com [216.115.111.26]
  7    14 ms    15 ms    16 ms  et-0-0-1.pat1.bfz.yahoo.com [72.30.223.24]
  8    21 ms    16 ms    15 ms  et-0-0-0.msr1.bf1.yahoo.com [74.6.227.129]
  9    17 ms    17 ms    17 ms  et-0-1-0.clr1-a-gdc.bf1.yahoo.com [74.6.122.13]
 10    22 ms    17 ms    21 ms  eth-17-3.bas2-1-flk.bf1.yahoo.com [98.139.128.71]
 11    21 ms    16 ms    17 ms  media-router-fp1.prod1.media.vip.bf1.yahoo.com [72.30.35.9]
```

```
Trace complete.

Tracing route to twitter.com [104.244.42.1]
over a maximum of 30 hops:

  1     4 ms     2 ms     4 ms  my.meraki.net [192.168.128.1]
  2     8 ms     4 ms     4 ms  ae25-nycmnyzrjp1.lightower.net [104.207.214.185]
  3     4 ms     4 ms     4 ms  ae10-nycmnyzrj42.lightower.net [144.121.35.40]
  4     8 ms     2 ms     4 ms  10ge4-7.core1.nyc5.he.net [216.66.50.105]
  5     8 ms     6 ms    12 ms  100ge14-1.core1.nyc6.he.net [72.52.92.101]
  6     8 ms     2 ms     7 ms  Twitter.nyiix.net [198.32.160.56]
  7     *        *        *     Request timed out.
  8    26 ms    22 ms    21 ms  104.244.42.1

Trace complete.
```

```
Tracing route to star-mini.c10r.facebook.com [31.13.71.36]
over a maximum of 30 hops:

  1     5 ms     5 ms     3 ms  my.meraki.net [192.168.128.1]
  2     6 ms     1 ms     1 ms  ae25-nycmnyzrjp1.lightower.net [104.207.214.185]
  3     6 ms     1 ms     1 ms  ae10-nycmnyzrj42.lightower.net [144.121.35.40]
  4     7 ms     2 ms     2 ms  10ge4-7.core1.nyc5.he.net [216.66.50.105]
  5     5 ms     3 ms     5 ms  206.126.115.64
  6     4 ms     2 ms     2 ms  po104.psw04.lga3.tfbnw.net [157.240.47.33]
  7     7 ms     2 ms     2 ms  173.252.67.193
  8     4 ms     2 ms     2 ms  edge-star-mini-shv-01-lga3.facebook.com [31.13.71.36]

Trace complete.

python_programming_lab_03 assignments-python-traceroute* $
```