Computer Science Department, UWO

CS9668
Assignment 1

Linxiao Wang
250888611

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Problem 1

Command: host stegosaurus

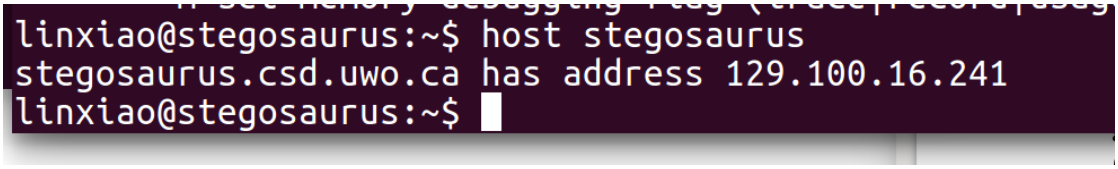

Figure 0.1: Screen shot of “host stegosaurus”

- Symbolic name: stegosaurus.csd.uwo.ca
- IP address: 129.100.16.241 or 10000001 01100100 00010000 11110001
- Class: B. Since the IP address in binary starts with ”10”, it means class B is assigned to the computers in the University’s network.
- Prefix: 129.100 or 10000001 01100100
- There can be 2^{16} = 65536 computers in this network.

Problem 2

I wrote a program that can generate a list of random IP addresses in the network 129.100.

```c
#include <stdio.h>
#include <stdlib.h>
#include <time.h>

int main(){
        time_t t;
        srand((unsigned) time(&t));
        FILE* output = fopen("list.txt","w");
        for(int i = 0; i <100; i ++){
                fprintf(output,"129.100.%d.%d\n",rand()%256,rand()%256);
        }
        return 0;
}
```

Listing 1: C code for generating random IP addresses

I used the code 1 to generate a list of 100 IP addresses. Then I wrote a script 2 to **ping** all these IP, and counted how many of them were up.

```
#!/bin/bash
# Program name: pingip.sh
date
TEMPFILE=/tmp/tempfile.tmp
echo 0 > $TEMPFILE
cat list.txt |  while read output
do
        ping -c 1 -w 5 "$output">/dev/null
        if [ $? -eq 0 ]; then
                echo "node $output is up"
                counter=$[$(cat $TEMPFILE) + 1]
                echo $counter > $TEMPFILE
        else
                echo "node $output is down"
        fi
done
cat $TEMPFILE
}
```

Listing 2: Script for ping all the IP

The complete list of IP is long so the following lists the ones that correspond to actual computer.
linxiao@stegosaurus:/data/d1/student/linxiao/CS9868 ./pingip.sh Thu Sep 27 14:13:39 EDT 2018
node 129.100.252.82 is up
node 129.100.177.10 is up
node 129.100.92.225 is up
node 129.100.75.165 is up
node 129.100.6.219 is up
node 129.100.176.110 is up

node 129.100.234.251 is up
node 129.100.76.255 is up
node 129.100.132.28 is up
node 129.100.85.22 is up
node 129.100.61.221 is up
node 129.100.225.23 is up

There are 12 out of 100 IPs responded to the ping command. So I assume the ratio of IPs that are used in the network is 12%. So my estimation of the size of the network is $65536 \times 12\% \approx 7864$ computers.

Problem 3

Figure 0.2 shows the screenshot of the result of command "ip addr show". My IP address in the CIDR notation is 129.100.18.146/22.
My IP address in binary is: 10000001 01100100 00010010 10010010/22
Network number:10000001 01100100 000100
Computer number:1010010010
There can be $2^{10} = 1024$ computers in the subnetwork to which my computer is connected.

```
linxiao@triceratops:~$ ip addr show
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group defaul
t qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
       valid_lft forever preferred_lft forever
2: enp0s31f6: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state
UP group default qlen 1000
    link/ether 6c:4b:90:1c:4d:ad brd ff:ff:ff:ff:ff:ff
    inet 129.100.18.146/22 brd 129.100.19.255 scope global dynamic enp0s31f6
       valid_lft 8794sec preferred_lft 8794sec
    inet6 fe80::5403:1fee:66bd:e05c/64 scope link
       valid_lft forever preferred_lft forever
3: wlp2s0: <NO-CARRIER,BROADCAST,MULTICAST,UP> mtu 1500 qdisc mq state DOWN grou
p default qlen 1000
    link/ether 1c:4d:70:85:70:82 brd ff:ff:ff:ff:ff:ff
linxiao@triceratops:~$
```

Figure 0.2: ip addr show

Problem 4

Figure 0.3 shows the result of maximum number of hops that I can find, the destination is the host of the website "www.gnu.org" the IP address of the host is "208.118.235.148". Following

list shows the possible location of each server that I got from IP2Location.

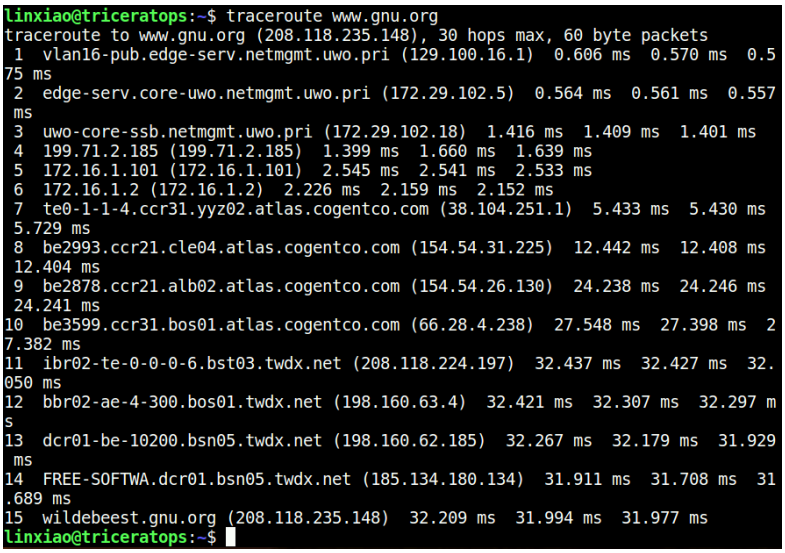

Figure 0.3: Trace route result

1 129.100.16.1 London,ON,Canada

2 172.29.102.5 private IP address

3 172.29.102.18 private IP address

4 199.71.2.185 London,ON,Canada,N6A 5B7

5 172.16.1.101 private IP address

6 172.16.1.2 private IP address

7 38.104.251.1 Atlanta,Georgia,US,30301

8 154.54.31.225 Cleveland,Ohio,US,44101

9 154.54.26.130 Albany,New York,US,12201

10 66.28.4.238 Miami,Florida,US,33010

11 208.118.224.197 Boston,Massachusetts,US,02110

12 198.160.63.4 Boston,Massachusetts,US,02210

13 198.160.62.185 Boston,Massachusetts,US,02210

14 185.134.180.134 Somerville,Massachusetts,US,02143

15 208.118.235.148 Boston,Massachusetts,US,02110

Problem 5

Part 1

If A chose a number between 1 to 3, there are two possible choice for B that is different from A. So the possibility of not having the second collision is $\frac{2}{3}$.

Part 2

For the first $k-1$ rounds, the possibility of having a collision in each round is always $\frac{1}{3}$, so the possibility of having collision in the all $k-1$ rounds is $(\frac{1}{3})^{k-1}$. In the k-th round, the possibility of not having a collision is $\frac{2}{3}$. So the possibility of exactly k rounds are needed before one of the computers can transmit is

$$(\frac{1}{3})^{k-1} \times \frac{2}{3} = \frac{2}{3^k}$$

Problem 6

Problem 7

Table 0.1 gives the routing table for router R_1.

Destination	Nest hop
132.32.16.10	deliver direct
164.80.22.31	deliver direct
192.10.4.2	192.10.4.16
129.1.44.12	129.1.7.12
194.8.11.55	deliver direct
196.3.7.4	196.3.7.18

Table 0.1: Routing table for R_1.

Problem 8

Network 1 packet:
1. [**packet header:** MAC address of A, MAC address of R_1, control bits of Network 1
packet data: {**datagram header:** IP address of A, IP address of B, rest of header. **datagram data:** 500 bytes}]

Network 2 packets:
1. [**packet header:** MAC address of R_1, MAC address of R_2, control bits of Network 2
packet data: {**datagram header:** IP address of A, IP address of B, rest of header. **datagram data:** 350 bytes}]
2. [**packet header:** MAC address of R_1, MAC address of R_2, control bits of Network 2

packet data: {**datagram header:** IP address of A, IP address of B, rest of header. **datagram data:** 150 bytes}]

Network 3 packets:
1. [**packet header:** MAC address of R_2, MAC address of B, control bits of Network 3
packet data: {**datagram header:** IP address of A, IP address of B, rest of header. **datagram data:** 350 bytes}]
2. [**packet header:** MAC address of R_2, MAC address of B, control bits of Network 2
packet data: {**datagram header:** IP address of A, IP address of B, rest of header. **datagram data:** 150 bytes}]