Lab 1.2.3 Mapping ISP Connectivity Using Traceroute

Objectives

- Run the Windows **tracert** utility from a local host computer to a website on a different continent.

- Interpret the traceroute output to determine which ISPs the packets passed through on their way from the local host to the destination website.

- Draw a diagram of the traceroute path, showing the routers and ISP clouds passed through from the local host to the destination website, including IP addresses for each device.

Background / Preparation

In this activity, you will use the Windows **tracert** utility to map Internet connectivity between your local ISP and the other ISPs that it uses to provide global Internet access. You will also map connectivity to the following major Regional Internet Registries (RIRs). However, your instructor may choose different destination websites.

- AfriNIC (African Network Information Centre) – Africa Region

- APNIC (Asia Pacific Network Information Centre) – Asia/Pacific Region

- ARIN (American Registry for Internet Numbers) – North America Region

- LACNIC (Regional Latin-American and Caribbean IP Address Registry) – Latin America and some Caribbean Islands

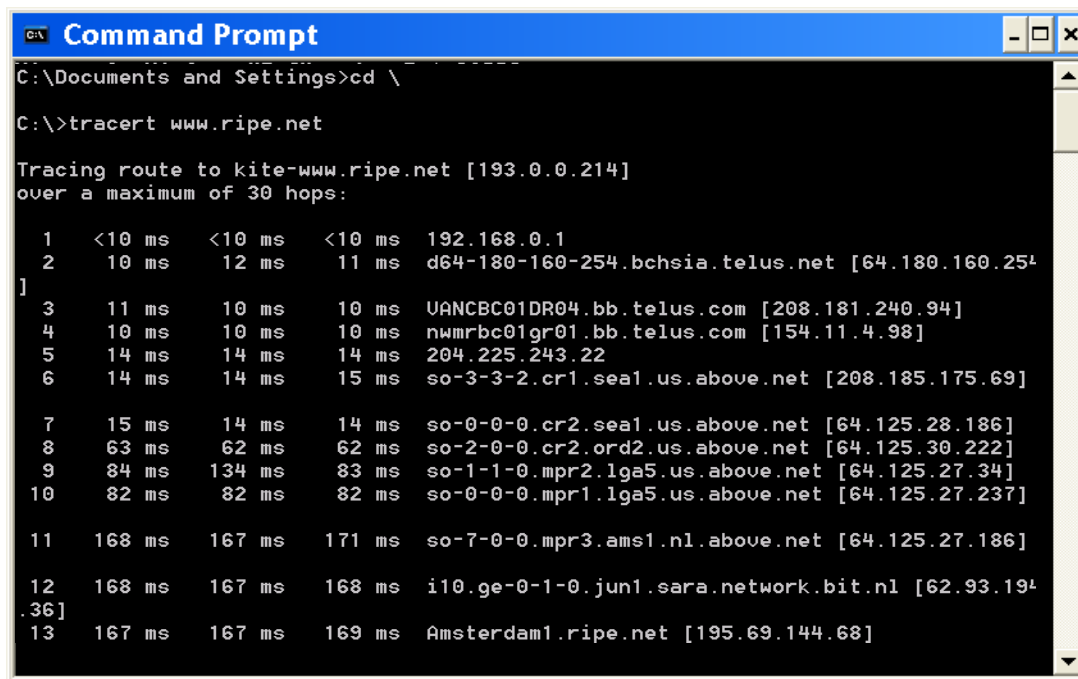- RIPE NCC (Réseaux IP Européens) – Europe, the Middle East, and Central Asia

This activity can be done individually, in pairs, or in teams. It can be done as an in-class activity or as a homework assignment, depending on whether the classroom computers have access to the Internet.

The following resources are required:

- Host computer with the Windows operating system

- Access to the command prompt

- Internet connection

- Routes Traced worksheet for each destination URL. The worksheet is attached to this lab. Each student completes their own worksheets and gives them to the instructor.

- Global Connectivity Map, which is attached at the end of this lab

- Access to the PC command prompt

Step 1: Run the tracert utility from a host computer

a. Verify that the host computer has a connection to the Internet.

b. Open a Command Prompt window by clicking **Start > Run** and typing **cmd**. Alternatively, you may click **Start > All programs > Accessories > Command Prompt**.

c. At the prompt, type **tracert** and your first destination website. The output should look similar to the following:

```
Command Prompt                                                    _ □ ✕
C:\Documents and Settings>cd \

C:\>tracert www.ripe.net

Tracing route to kite-www.ripe.net [193.0.0.214]
over a maximum of 30 hops:

  1    <10 ms    <10 ms    <10 ms   192.168.0.1
  2     10 ms     12 ms     11 ms   d64-180-160-254.bchsia.telus.net [64.180.160.254]
  3     11 ms     10 ms     10 ms   VANCBC01DR04.bb.telus.com [208.181.240.94]
  4     10 ms     10 ms     10 ms   nwmrbc01gr01.bb.telus.com [154.11.4.98]
  5     14 ms     14 ms     14 ms   204.225.243.22
  6     14 ms     14 ms     15 ms   so-3-3-2.cr1.sea1.us.above.net [208.185.175.69]

  7     15 ms     14 ms     14 ms   so-0-0-0.cr2.sea1.us.above.net [64.125.28.186]
  8     63 ms     62 ms     62 ms   so-2-0-0.cr2.ord2.us.above.net [64.125.30.222]
  9     84 ms    134 ms     83 ms   so-1-1-0.mpr2.lga5.us.above.net [64.125.27.34]
 10     82 ms     82 ms     82 ms   so-0-0-0.mpr1.lga5.us.above.net [64.125.27.237]

 11    168 ms    167 ms    171 ms   so-7-0-0.mpr3.ams1.nl.above.net [64.125.27.186]

 12    168 ms    167 ms    168 ms   i10.ge-0-1-0.jun1.sara.network.bit.nl [62.93.194.36]

 13    167 ms    167 ms    169 ms   Amsterdam1.ripe.net [195.69.144.68]
```
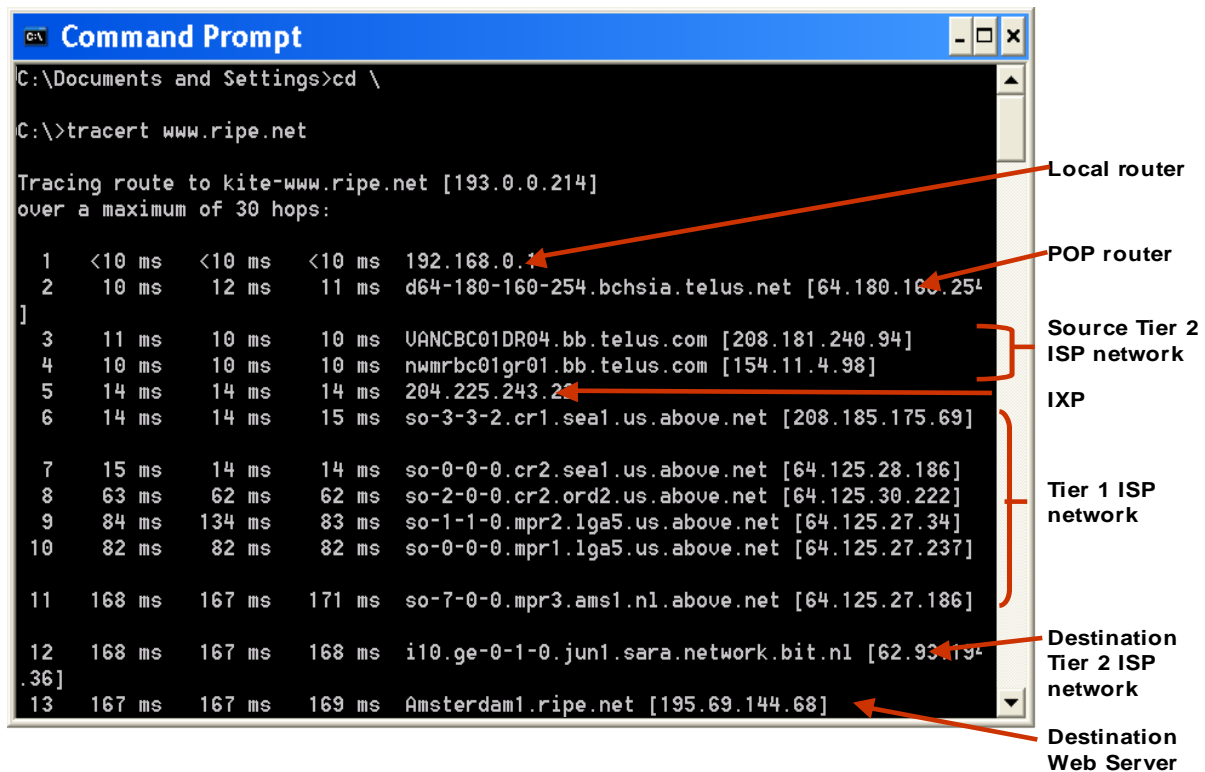
d. Save the **tracert** output in a text file as follows:

1) Right-click the title bar of the Command Prompt window and choose **Edit > Select All**.

2) Right-click the title bar of the Command Prompt window again and choose **Edit > Copy**.

3) Open the **Windows Notepad** program: **Start > All Programs > Accessories > Notepad.**

4) To paste the output into Notepad, choose **Edit > Paste**.

5) Choose **File > Save As** and save the Notepad file to your desktop as tracert1.txt.

e. Run **tracert** for each destination website and save the output in sequentially numbered files.

f. Run **tracert** from a different computer network, for example, from the public library or from a friend's computer that accesses the Internet using a different ISP (for instance, cable instead of DSL). Save a copy of that output in Notepad and print it out for later reference.

Step 2: Interpret tracert outputs to determine ISP connectivity

Routes traced may go through many hops and a number of different ISPs depending on the size of your ISP and the location of the source and destination hosts. In the example output shown below, the tracert packets travel from the source PC to the local router default gateway to the ISPs Point of Presence (POP) router and then to an Internet Exchange Point (IXP). From there they pass through two Tier 2 ISP routers and then though several Tier 1 ISP routers as they move across the Internet backbone. When they leave the Tier 1 ISPs backbone, they move through another Tier 2 ISP on the way to the destination server at www.ripe.net.

```
Command Prompt                                              _ □ ×

C:\Documents and Settings>cd \

C:\>tracert www.ripe.net

Tracing route to kite-www.ripe.net [193.0.0.214]              ──Local router
over a maximum of 30 hops:

  1   <10 ms   <10 ms   <10 ms  192.168.0.1            ──POP router
  2    10 ms    12 ms    11 ms  d64-180-160-254.bchsia.telus.net [64.180.160.254
]
  3    11 ms    10 ms    10 ms  VANCBC01DR04.bb.telus.com [208.181.240.94]   ──Source Tier 2
  4    10 ms    10 ms    10 ms  nwmrbc01gr01.bb.telus.com [154.11.4.98]         ISP network
  5    14 ms    14 ms    14 ms  204.225.243.21                            ──IXP
  6    14 ms    14 ms    15 ms  so-3-3-2.cr1.sea1.us.above.net [208.185.175.69]

  7    15 ms    14 ms    14 ms  so-0-0-0.cr2.sea1.us.above.net [64.125.28.186]
  8    63 ms    62 ms    62 ms  so-2-0-0.cr2.ord2.us.above.net [64.125.30.222]   ──Tier 1 ISP
  9    84 ms   134 ms    83 ms  so-1-1-0.mpr2.lga5.us.above.net [64.125.27.34]      network
 10    82 ms    82 ms    82 ms  so-0-0-0.mpr1.lga5.us.above.net [64.125.27.237]

 11   168 ms   167 ms   171 ms  so-7-0-0.mpr3.ams1.nl.above.net [64.125.27.186]

 12   168 ms   167 ms   168 ms  i10.ge-0-1-0.jun1.sara.network.bit.nl [62.93.19   ──Destination
.36]                                                                              Tier 2 ISP
 13   167 ms   167 ms   169 ms  Amsterdam1.ripe.net [195.69.144.68]               network
                                                                               ──Destination
                                                                                 Web Server
```

a. Open the first traceroute output file and answer the following questions.

1) What is the IP address of your local POP router?
_____

2) How many hops did the traceroute packet take on its journey from the host computer to the destination?
_____

3) How many different ISPs did the traceroute packet pass through on its journey from the host computer to the destination?
_____

4) List the IP addresses and URLs of all the devices in the traceroute output in the order that they appear on the Routes Traced worksheet.

5) In the Network Owner column of the worksheet, identify which ISP owns each router. If the router belongs to your LAN, write "LAN". The last two parts of the URL indicates the ISP name. For example, a router that has "sprint.net" in its URL belongs to the network of an ISP called Sprint.

6) Did the traceroute pass through an unidentified router between two ISPs? This might be an IXP. Run the **whois** command utility or **whois** function of a visual traceroute program to identify ownership of that router. Alternatively, go to http://www.arin.net/whois to determine to whom the IP is assigned.

b. Complete the worksheet using the traceroute output file for each of the other destination URLs.

c. Compare your results from the different traceroute output files. Did your ISP connect to different ISPs to reach different destinations?

_____

d. If you ran a traceroute from a different computer network, check the output for that traceroute file as well. Was the number of hops different to reach the same destination from different local ISPs? Which ISP was able to reach the destination in fewer hops?

_____

Step 3: Map the connectivity of your ISP

a. For each traceroute output, draw a diagram on a separate sheet of paper showing how your local ISP interconnects with other ISPs to reach the destination URL, as follows:

1) Show all of the devices in sequence from the LAN router to the destination website server. Label all of the devices with their IP addresses.

2) Draw a box around the local POP router that you identified, and label the box "POP".

3) Draw an ISP cloud around all the routers that belong to each ISP, and label the cloud with the ISP name.

4) Draw a box around any IXP routers that you identified, and label the box "IXP".

b. Use the Global Connectivity Map to create a combined drawing showing only ISP clouds and IXP boxes.

Worksheet for Routes Traced

Destination URL: _____ **Total Number of Hops:** _____

Router IP Address	Router URL (if any)	Network Owner (LAN, Name of ISP or IXP)

Global Connectivity Map