Lab 4 Network

Objective 1

Task1:

The tracert (short for “trace route”) utility is a network diagnostic tool used to determine the path data packets take from your computer to a specified destination. It helps identify the route and measure transit delays of packets across an IP network. This information is crucial for diagnosing network issues, such as identifying where delays or failures occur.

Use : tracert <host name or IP address>

Example tracert google.com

Task 2:

```
PS C:\Users\hp> tracert youtube.com

Tracing route to youtube.com [142.250.194.110]
over a maximum of 30 hops:

  1    16 ms    10 ms    18 ms  10.15.6.1
  2    11 ms     6 ms     4 ms  172.29.1.17
  3    10 ms     5 ms     9 ms  172.16.0.22
  4     5 ms     4 ms     7 ms  14.139.194.1
  5    10 ms     7 ms    11 ms  ws197-251-252-122.rcil.gov.in [122.252.251.197]
  6     *        *       16 ms  172.31.251.85
  7     *        *        *     Request timed out.
  8    36 ms     *       53 ms  136.232.74.101
  9     *        *        *     Request timed out.
 10    39 ms    32 ms    35 ms  10.119.234.162
 11    83 ms    45 ms    59 ms  72.14.194.160
 12    68 ms    72 ms    67 ms  142.251.226.85
 13    74 ms    48 ms    62 ms  142.251.52.225
 14    56 ms    70 ms    70 ms  del12s04-in-f14.1e100.net [142.250.194.110]

Trace complete.
```

Task3:

- -d: Do not resolve addresses to hostnames.
- -h <maximum_hops>: Specifies the maximum number of hops to search for the target
- -w <timeout>: Waits the specified time in milliseconds for each reply.

Examples:

Use of -d:

```
PS C:\Users\hp> tracert -d google.com

Tracing route to google.com [142.250.206.142]
over a maximum of 30 hops:

  1    11 ms     5 ms     4 ms  10.15.6.1
  2    16 ms     7 ms     6 ms  172.29.1.17
  3     8 ms     6 ms     4 ms  172.16.0.22
  4     7 ms     7 ms     5 ms  122.252.251.241
  5    10 ms     4 ms    13 ms  122.252.251.197
  6    14 ms    13 ms    12 ms  172.31.251.85
  7    14 ms     *       12 ms  172.31.251.84
  8     *        *       19 ms  136.232.74.101
  9     *        *        *     Request timed out.
 10     *       24 ms    22 ms  10.119.234.162
 11    72 ms    95 ms    61 ms  74.125.147.192
 12    48 ms    46 ms    45 ms  192.178.80.159
 13    61 ms    60 ms    50 ms  142.251.76.197
 14    58 ms    70 ms    54 ms  142.250.206.142

Trace complete.
```

Use of -h:

```
PS C:\Users\hp> tracert -h 10 google.com

Tracing route to google.com [142.250.194.174]
over a maximum of 10 hops:

  1     2 ms     5 ms     5 ms  10.38.0.1
  2     2 ms     4 ms     8 ms  172.16.0.22
  3    33 ms    56 ms     1 ms  ws240-251-252-122.rcil.gov.in [122.252.251.241]
  4    42 ms    12 ms    55 ms  ws197-251-252-122.rcil.gov.in [122.252.251.197]
  5     *        *       14 ms  172.31.251.85
  6     *      256 ms    40 ms  172.31.251.84
  7    14 ms     *       17 ms  136.232.74.101
  8     *        *        *     Request timed out.
  9    91 ms     *        *     10.119.234.162
 10    90 ms    47 ms    92 ms  72.14.195.22

Trace complete.
```

Use of -w:

```
PS C:\Users\hp> tracert -w 1000 google.com

Tracing route to google.com [142.250.206.142]
over a maximum of 30 hops:

  1    39 ms    19 ms     3 ms  10.38.0.1
  2     *        *        *     Request timed out.
  3     *      728 ms   441 ms  14.139.194.1
  4    76 ms    87 ms    58 ms  ws197-251-252-122.rcil.gov.in [122.252.251.197]
  5     *       18 ms     *     172.31.251.85
  6     *        *        *     Request timed out.
  7   502 ms   319 ms     *     136.232.74.101
  8     *        *        *     Request timed out.
  9   708 ms    63 ms    37 ms  10.119.234.162
 10    66 ms    70 ms    58 ms  72.14.195.56
 11    55 ms    57 ms    55 ms  142.251.54.111
 12   157 ms     *      216 ms  142.251.76.199
 13   278 ms   254 ms   313 ms  del11s21-in-f14.1e100.net [142.250.206.142]

Trace complete.
```

Task 4:

Scenario: Diagnosing Slow Network Speeds

Imagine you're experiencing slow network speeds when trying to access a specific website, such as www.example.com. You suspect there might be an issue somewhere along the route your data takes to reach the website.

Using tracert to Diagnose the Issue

1. Open Windows Terminal: Start by opening Windows Terminal and selecting Command Prompt or PowerShell.
2. Run the Basic tracert Command:
3. tracert www.example.com

This will show you the path your data takes to reach the website, including each hop (router) along the way and the time it takes to reach each hop.

4. Analyze the Results:
    - Look for any hops with significantly higher response times compared to others. This could indicate a bottleneck or congestion at that point.
    - If you see * * * for several hops, it means those routers are not responding to the tracert requests, which could be normal or indicate an issue.
5. Use the -d Option:

6. tracert -d www.example.com

This will speed up the trace by not resolving IP addresses to hostnames, allowing you to quickly identify problematic hops based on IP addresses alone.

7. Limit the Number of Hops with -h:
8. tracert -h 15 www.example.com

If you suspect the issue is within the first few hops, you can limit the trace to 15 hops to focus on the initial part of the route.

9. Adjust the Timeout with -w:
10. tracert -w 2000 www.example.com

If you want to reduce the waiting time for each hop, you can set a timeout of 2000 milliseconds (2 seconds). This can help you get quicker results, especially if some routers are slow to respond.

Task 5:

Summary of tracert Utility and Its Applications

The tracert (or traceroute) utility is a powerful network diagnostic tool used to trace the path that data packets take from your computer to a specified destination, such as a website or IP address. It provides detailed information about each hop (router) along the route, including the time it takes for packets to travel to each hop. This can help identify where delays or failures are occurring in the network.

Key Applications:

- **Diagnosing Connectivity Issues**: By showing the path and response times, tracert helps pinpoint where connectivity problems are occurring.
- **Identifying Network Bottlenecks**: High response times at specific hops can indicate congestion or issues with particular routers.
- **Verifying Network Paths**: Ensures that data is taking the expected route, which can be useful for network planning and optimization.
- **Troubleshooting Slow Network Speeds**: Helps identify if slow speeds are due to issues within your local network or further along the route to the destination.

Limitations and Potential Issues with tracert

While tracert is a valuable tool, it does have some limitations and potential issues:

1. **ICMP Blocking**: Some routers and firewalls block ICMP packets, which tracert uses, resulting in * * * for those hops. This can make it difficult to get a complete picture of the route.

2. **Asymmetric Routing**: The path that data takes to a destination might be different from the path it takes back. tracert only shows the outbound path, which can sometimes be misleading.
3. **Variable Network Conditions**: Network conditions can change rapidly, so the results of a tracert command might not always reflect the current state of the network.
4. **Limited to 30 Hops by Default**: While you can adjust this with the -h option, the default limit of 30 hops might not be sufficient for very long routes.
5. **Interpretation of Results**: Understanding and interpreting tracert results requires some network knowledge. High response times at a hop might not always indicate a problem if the router is prioritizing other traffic over ICMP responses.

Despite these limitations, tracert remains a useful tool for network diagnostics, especially when combined with other tools and methods for a comprehensive analysis.

Objective2

Task 1:

```
PS C:\Users\hp\OneDrive - Indian Institute of Technology Patna\Desktop\network code'> python task1.py
WARNING: Wireshark is installed, but cannot read manuf !
Enter the destination IP: 8.8.8.8
Enter the max TTL value: 10
Enter the timeout value: 1
Enter the number of pings per hop: 1
Enter the delay between pings (in seconds): 1
Enter the output file name (leave blank for console output):
1 10.38.0.1 15.71 ms
2 172.16.0.22 5.09 ms
3 14.139.194.1 6.74 ms
4 10.118.248.49 8.03 ms
5 * * * Request timed out.
6 * * * Request timed out.
7 * * * Request timed out.
8 * * * Request timed out.
9 10.119.234.162 24.25 ms
10 72.14.195.56 47.77 ms
PS C:\Users\hp\OneDrive - Indian Institute of Technology Patna\Desktop\network code'>
```