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Networks Lab Assignment 4 Solution

Objective 1: Tracert Utility Analysis

1. Tracert Basics

Purpose of the Tracert Utility:

- The tracert (short for "trace route") utility is a network diagnostic tool used to trace the path that packets take from your computer to a destination host. It provides a list of hops (routers) between your computer and the target, helping to identify where delays or failures occur.

Basic Syntax:

- The basic syntax of the tracert command is:

  tracert [options] target_host

  - target_host: The domain name or IP address of the destination.

Examples:

- To trace the route to a website (e.g., google.com):

  Command :- tracert google.com

```
PS C:\Users\ujjaw> tracert google.com

Tracing route to google.com [142.250.193.238]
over a maximum of 30 hops:

  1    15 ms    14 ms    14 ms  10.15.6.1
  2     4 ms    10 ms     6 ms  172.29.1.17
  3    12 ms     8 ms    12 ms  172.16.0.22
  4     9 ms     5 ms     9 ms  ws240-251-252-122.rcil.gov.in [122.252.251.241]
  5     9 ms     5 ms    14 ms  ws197-251-252-122.rcil.gov.in [122.252.251.197]
  6     *        *        *     Request timed out.
  7    13 ms    22 ms     *     172.31.251.84
  8     *        *        *     Request timed out.
  9     *        *        *     Request timed out.
 10    31 ms    23 ms     *     10.119.234.162
 11    45 ms    78 ms    46 ms  72.14.194.160
 12    47 ms    48 ms    46 ms  192.178.80.159
 13    58 ms    49 ms    47 ms  142.251.54.99
 14    73 ms    82 ms    67 ms  del11s18-in-f14.1e100.net [142.250.193.238]

Trace complete.
```

To trace the route to a local host:

Code :- tracert 127.0.0.1

```
Trace complete.
PS C:\Users\ujjaw> tracert 127.0.0.1

Tracing route to kubernetes.docker.internal [127.0.0.1]
over a maximum of 30 hops:

  1    <1 ms    <1 ms    <1 ms  kubernetes.docker.internal [127.0.0.1]

Trace complete.
```

2. Tracert Output Analysis

Running Tracert:

- **Command:** tracert google.com
- **Sample Output:**

```
PS C:\Users\ujjaw> tracert google.com

Tracing route to google.com [142.250.193.238]
over a maximum of 30 hops:

  1    15 ms    14 ms    14 ms  10.15.6.1
  2     4 ms    10 ms     6 ms  172.29.1.17
  3    12 ms     8 ms    12 ms  172.16.0.22
  4     9 ms     5 ms     9 ms  ws240-251-252-122.rcil.gov.in [122.252.251.241]
  5     9 ms     5 ms    14 ms  ws197-251-252-122.rcil.gov.in [122.252.251.197]
  6     *        *        *     Request timed out.
  7    13 ms    22 ms     *     172.31.251.84
  8     *        *        *     Request timed out.
  9     *        *        *     Request timed out.
 10    31 ms    23 ms     *     10.119.234.162
 11    45 ms    78 ms    46 ms  72.14.194.160
 12    47 ms    48 ms    46 ms  192.178.80.159
 13    58 ms    49 ms    47 ms  142.251.54.99
 14    73 ms    82 ms    67 ms  del11s18-in-f14.1e100.net [142.250.193.238]

Trace complete.
```

Tracing route to google.com [142.250.193.238] over a maximum of 30 hops:

Output Explanation:

- **Hop Number:** The sequence number of the router the packet passes through.
- **IP Address:** The IP address of the router.
- **RTT (Round-Trip Time):** The time it takes for a packet to go from the source to the destination and back, measured in milliseconds.

Local Host Tracert:

- **Command:** tracert 127.0.0.1
- **Output :**

```
Trace complete.
PS C:\Users\ujjaw> tracert 127.0.0.1

Tracing route to kubernetes.docker.internal [127.0.0.1]
over a maximum of 30 hops:

  1    <1 ms    <1 ms    <1 ms  kubernetes.docker.internal [127.0.0.1]

Trace complete.
```

- **Output Explanation:**
    - Since 127.0.0.1 is the loopback address, the output will typically show just one hop with minimal RTT.

3. Tracert Options

-d (Do not resolve hostnames):

- **Description:** This option prevents the tracert utility from resolving IP addresses to their corresponding domain names, which can speed up the trace process.
- **Example:** tracert -d google.com
- **OUTPUT**

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

Tracing route to google.com [172.217.27.174]
over a maximum of 30 hops:

  1    29 ms    18 ms    10 ms  10.15.6.1
  2    13 ms     7 ms     6 ms  172.29.1.17
  3    20 ms    13 ms    18 ms  172.16.0.22
  4    13 ms    17 ms    13 ms  14.139.194.1
  5    23 ms    37 ms    18 ms  122.252.251.197
  6    32 ms     *       17 ms  172.31.251.85
  7    12 ms    13 ms    17 ms  172.31.251.84
  8     *       24 ms    26 ms  136.232.74.101
  9     *        *        *     Request timed out.
 10     *        *        *     Request timed out.
 11    77 ms    92 ms    93 ms  72.14.195.56
 12    77 ms    77 ms    61 ms  172.253.68.93
 13    63 ms    65 ms    56 ms  172.253.67.97
 14    44 ms    67 ms    50 ms  172.217.27.174

Trace complete.
```

-h (Maximum number of hops):

- **Description:** This option allows you to set the maximum number of hops (routers) to be traced before the utility stops.
- **Example:** tracert -h 5 google.com

- **OUTPUT**

```
PS C:\Users\ujjaw> tracert -h 5 google.com

Tracing route to google.com [172.217.27.174]
over a maximum of 5 hops:

  1    13 ms    13 ms    19 ms  10.15.6.1
  2    14 ms    12 ms     5 ms  172.29.1.17
  3    12 ms    10 ms    11 ms  172.16.0.22
  4    18 ms    28 ms    14 ms  ws240-251-252-122.rcil.gov.in [122.252.251.241]
  5    14 ms    15 ms    18 ms  ws197-251-252-122.rcil.gov.in [122.252.251.197]

Trace complete.
```

-w (Timeout in milliseconds):

- **Description:** This option sets the wait time in milliseconds for each reply before moving on to the next hop.
- **Example:** tracert -w 500 google.com
- **OUTPUT**

```
PS C:\Users\ujjaw> tracert -w 500 google.com

Tracing route to google.com [172.217.27.174]
over a maximum of 30 hops:

  1    39 ms    17 ms    23 ms  10.15.6.1
  2     4 ms     9 ms     8 ms  172.29.1.17
  3    10 ms     5 ms    10 ms  172.16.0.22
  4    70 ms    40 ms    45 ms  14.139.194.1
  5    19 ms    19 ms    18 ms  ws197-251-252-122.rcil.gov.in [122.252.251.197]
  6     *        *        *     Request timed out.
  7    20 ms     *        *     172.31.251.84
  8     *        *       29 ms  136.232.74.101
  9     *        *        *     Request timed out.
 10     *       31 ms     *     10.119.234.162
 11     *       81 ms    99 ms  72.14.195.56
 12    74 ms    73 ms    80 ms  142.251.54.111
 13   234 ms    65 ms   165 ms  172.253.67.97
 14    65 ms    65 ms    63 ms  kix05s07-in-f174.1e100.net [172.217.27.174]

Trace complete.
```

4. Troubleshooting with Tracert

Scenario:

- **Problem:** A user is experiencing slow network speeds when accessing a particular website.
- **Using Tracert:**
    - **Command:** tracert google.com
    - **Analysis:** The tracert output can show if there is a specific hop that is causing delays, indicating a possible network bottleneck or misconfiguration at a specific router.

Options to Use:

- **-h:** To limit the number of hops traced if the destination is known to be within a few hops.
- **-d:** To speed up the process by skipping hostname resolution.

5. Conclusion

Summary:

- The tracert utility is a powerful tool for network diagnostics, helping identify where delays or failures occur along a packet's route to its destination.

Limitations:

- Tracert may not work effectively if ICMP traffic is blocked by routers, or if the destination is unreachable, leading to incomplete or misleading results.
