Section 4: Practical

9. Demonstrate how to troubleshoot network connectivity issues using the ping command.

Ans: Network Troubleshooting is a way to maintain your computer network, ensuring optimal performance, and addressing issues that may disrupt connectivity. when any problems arise, network administrators and IT professionals use tools such as Ping, Traceroute, and PathPing to identify and solve a problem.

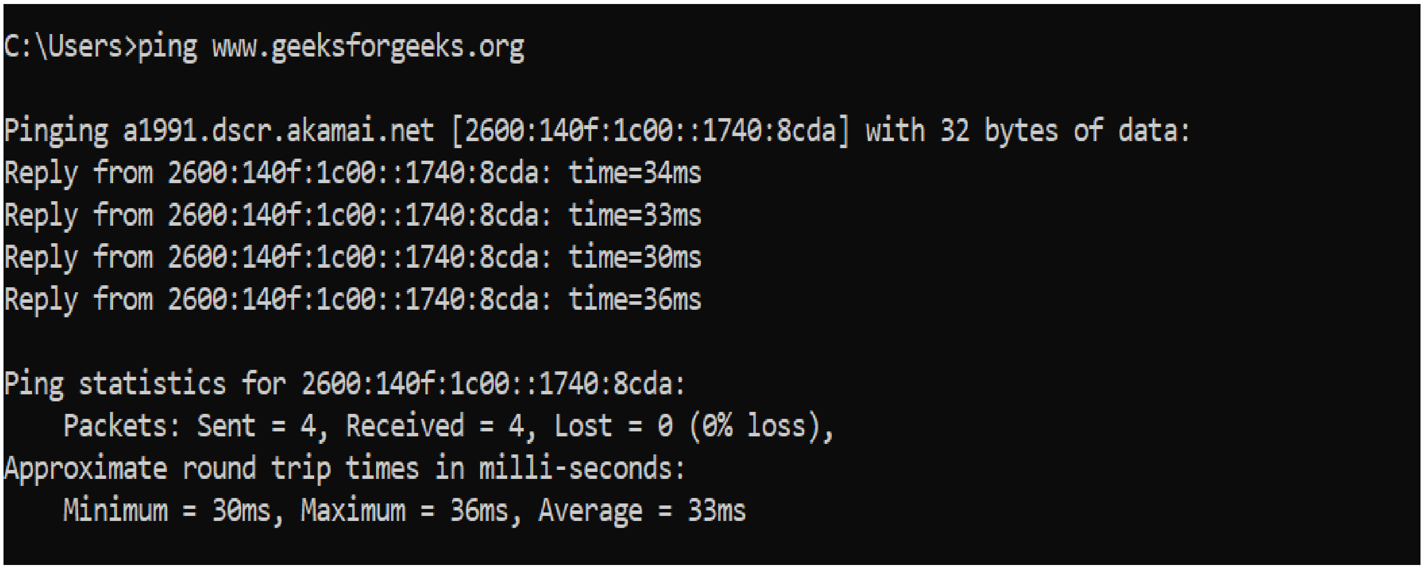
Ping is a command that sends a small packet of data to any network device and waits for its response. Traceroute traces the route from source to destination and it helps identify any delay or bottleneck. PathPing combines the functionality of both Ping and Traceroute commands to troubleshoot the network. In this article, we will learn about Ping, Traceroute, and PathPing tools, and how to use them to troubleshoot the network.

Ping

A Ping stands for Packet Internet Groper. It is a widely used command for identifying connectivity between two network connections. It uses Internet Control Message Protocol (ICMP) to send a request to the target host and wait for a response. It measures the round-trip time for data packets to travel from the source to the destination and back.

Example

ping ping www.geeksforgeeks.org



```
C:\Users>ping www.geeksforgeeks.org

Pinging a1991.dscr.akamai.net [2600:140f:1c00::1740:8cda] with 32 bytes of data:
Reply from 2600:140f:1c00::1740:8cda: time=34ms
Reply from 2600:140f:1c00::1740:8cda: time=33ms
Reply from 2600:140f:1c00::1740:8cda: time=30ms
Reply from 2600:140f:1c00::1740:8cda: time=36ms

Ping statistics for 2600:140f:1c00::1740:8cda:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 30ms, Maximum = 36ms, Average = 33ms
```

Explanation

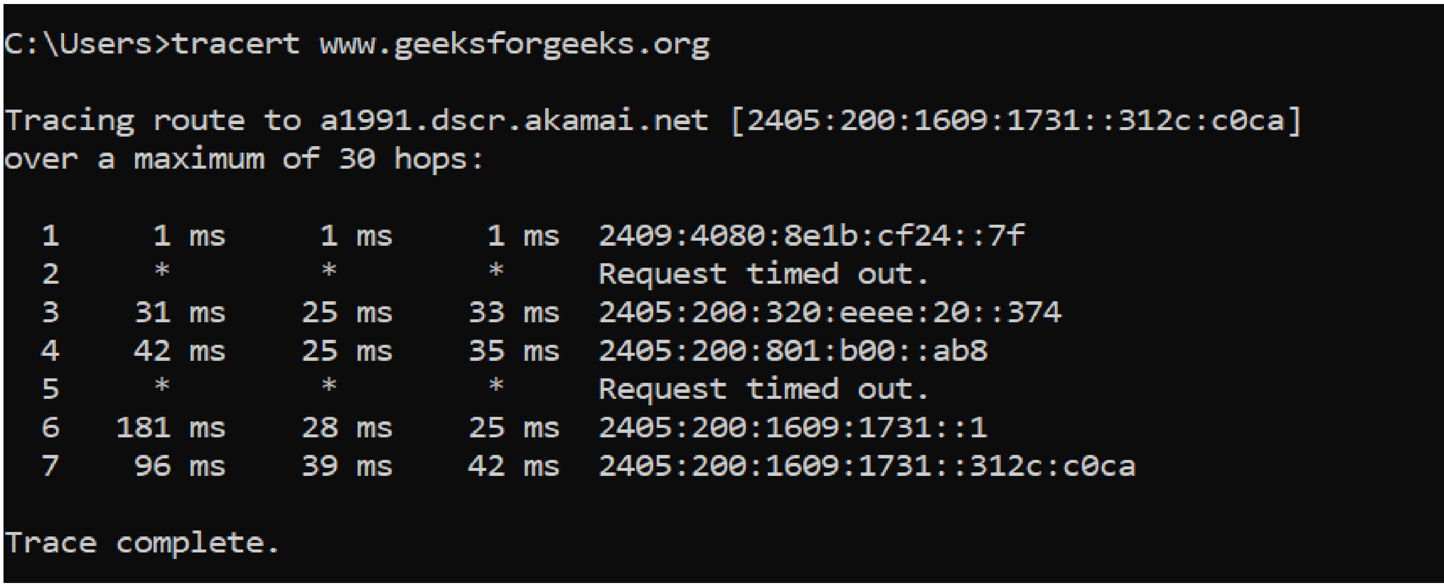
It shows that we have sent 4 request (packet) and received acknowledgment of all the requests and there is Zero loss. and It shows a minimum, maximum and average round trip time in milliseconds.

Traceroute

Traceroute is also called as a tracert. It traces the route from source to the destination. It is achieved by using ICMP to send a request. It revels the all routers between source and destination by displaying their IP Address to detect where the packet loss or latency occurs.

tracert www.geeksforgeeks.org

Example



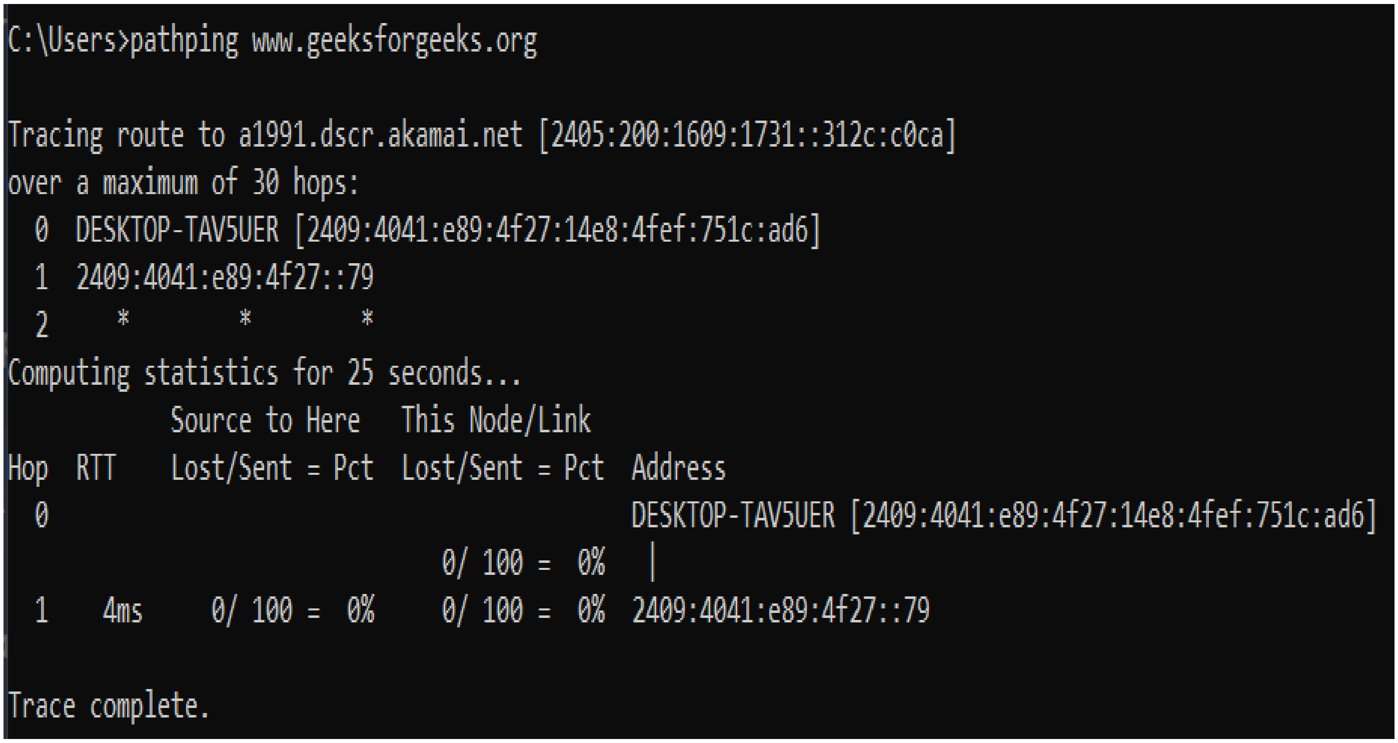
```
C:\Users>tracert www.geeksforgeeks.org

Tracing route to a1991.dscr.akamai.net [2405:200:1609:1731::312c:c0ca]
over a maximum of 30 hops:

  1     1 ms     1 ms     1 ms  2409:4080:8e1b:cf24::7f
  2     *        *        *     Request timed out.
  3    31 ms    25 ms    33 ms  2405:200:320:eeee:20::374
  4    42 ms    25 ms    35 ms  2405:200:801:b00::ab8
  5     *        *        *     Request timed out.
  6   181 ms    28 ms    25 ms  2405:200:1609:1731::1
  7    96 ms    39 ms    42 ms  2405:200:1609:1731::312c:c0ca

Trace complete.
```

tracert www.geeksforgeeks.org



```
C:\Users>pathping www.geeksforgeeks.org

Tracing route to a1991.dscr.akamai.net [2405:200:1609:1731::312c:c0ca]
over a maximum of 30 hops:
  0  DESKTOP-TAV5UER [2409:4041:e89:4f27:14e8:4fef:751c:ad6]
  1  2409:4041:e89:4f27::79
  2     *        *        *
Computing statistics for 25 seconds...
            Source to Here   This Node/Link
Hop  RTT    Lost/Sent = Pct  Lost/Sent = Pct  Address
  0                                           DESKTOP-TAV5UER [2409:4041:e89:4f27:14e8:4fef:751c:ad6]
                                0/ 100 =  0%   |
  1    4ms     0/ 100 =  0%     0/ 100 =  0%  2409:4041:e89:4f27::79

Trace complete.
```

Explanation

Each lines shows a route with round-trip time. the first line shows a router has 2409:4080:8e1b:cf24::7f IPv6 address and round-trip time is 1ms. and the second line has a timeout. This means that the router at hop 2 did not response to the ICMP request within the time limit.

PathPing

PathPing command is a combination of ping and tracert command. It sends request to each routers that comes between source and destination and compute result based on response from each router. It provide continues monitoring of the network path which allow network administrator to observe changes in performance.

Example

pathping www.geeksforgeeks.org

Explanation

It shows Hop 0 is a source with no packet loss, Hop 1 with round-time of 4ms with no packet loss and Hop 2 shows a timeout with * * * indicating that there was no response from this Hop (Router).

Conclusion

Learning of Troubleshooting commands such as Ping, Traceroute, PathPing is necessary for Network Administrator and IT Professional to maintain computer network and solve a problem

Section 5:Essay

10. Discuss the importance of regular network maintenance and the key tasks involved in maintaining network infrastructure.

Ans: ensuring a network remains stable, secure, and efficient, minimizing downtime and protecting data from cyber threats. Key tasks include monitoring performance and security, applying software and firmware updates, performing regular data backups, inspecting hardware for wear, optimizing network settings, and conducting vulnerability assessments to prevent issues before they impact operations andproductivity.

Importance of Network Maintenance

Prevents Downtime & Improves Performance:

Regular checks and updates keep the network running smoothly, preventing minor issues from escalating into major disruptions that cause costly downtime and slow performance.

Enhances Security:

It ensures security patches are applied, misconfigurations are fixed, and new threats are identified and addressed, closing potential vulnerabilities and protecting against cyberattacks.

Supports Growth & Scalability:

A well-maintained network can better accommodate organizational growth, integrate new systems, and support the increasing demands of emerging technologies like AI and IoT devices.

Ensures Reliability & Data Integrity:

Maintenance tasks such as data backups and regular diagnostics ensure the network's components are in good shape, minimizing the risk of hardware failures and data loss.

Maintains Compliance:

Regular monitoring, updates, and documentation help organizations meet industry regulations and legal standards, avoiding penalties and legal repercussions.

Key Tasks in Network Maintenance

Performance Monitoring:

Continuously track network performance metrics to identify bottlenecks and areas that need optimization to maintain speed and efficiency.

Security Updates & Vulnerability Management:

Apply the latest firmware and software updates to all network devices and conduct regular vulnerability assessments to patch security gaps proactively.

Hardware Inspection & Replacement:

Routinely check hardware components like routers, switches, and cables for signs of wear or damage and replace them as needed to prevent failures.

Data Backup & Disaster Recovery:

Implement a schedule for backing up critical data and perform disaster recovery drills to ensure data can be quickly restored in the event of an unexpected incident.

Configuration Optimization:

Regularly review and optimize network settings to improve bandwidth utilization and overall network efficiency.

Network Auditing:

Conduct regular audits to check access control lists, review security policies, and ensure the network's overall integrity and configuration are sound.

Documentation:

Maintain comprehensive documentation of the network infrastructure, including network maps, device configurations, and maintenance logs, to aid in troubleshooting and planning.