

Exercise 1a: Working with Command Line Tools – ping

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ping

Prerequisites

- Linux or UNIX-like system
- Access to a terminal
- A user with the necessary permissions to run the commands

What is ping?

- ping stands for **P**acket **I**nternet or Inter-**N**etwork **G**roper.
- One of the **most popular** command line tools used both by IT professionals and users.
- Verify that the **local machine** has an internet connection **without launching a web browser**.
- Relies on the **Internet Control Message Protocol (ICMP)** at the **internet layer of TCP/IP**.
- Most basic use is **to confirm network connectivity between two hosts**.
- **Ping sends out an ICMP echo request** to a destination for which **it expects an ICMP echo reply response**.
- You can perform this test by using either the **destination node's hostname** or **IP address**.
- For example, you could run **ping google.com** or **ping 173.194.33.174** to ping a domain name (google.com) or IP address respectively.
- When you try to “**ping**” a remote host, your machine starts sending ICMP echo requests and waits for a response. If the connection is established, you receive an echo reply for every request.

How to Use the ping Command

- The basic ping syntax includes **ping** followed by a hostname, a name of a website, or the exact IP address.

Syntax:

- ping [option] [hostname] or [IP address]

Note: Press **Ctrl + C** or **Ctrl +Z** on your keyboard to stop the process.

To ping a domain name:

- Open the terminal on your machine.
- In the command prompt and then type **ping.google.com**

```
C:\Users\Admin>ping google.com

Pinging google.com [142.250.76.46] with 32 bytes of data:
Reply from 142.250.76.46: bytes=32 time=3ms TTL=118
Reply from 142.250.76.46: bytes=32 time=3ms TTL=118
Reply from 142.250.76.46: bytes=32 time=4ms TTL=118
Reply from 142.250.76.46: bytes=32 time=3ms TTL=118

Ping statistics for 142.250.76.46:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 3ms, Maximum = 4ms, Average = 3ms

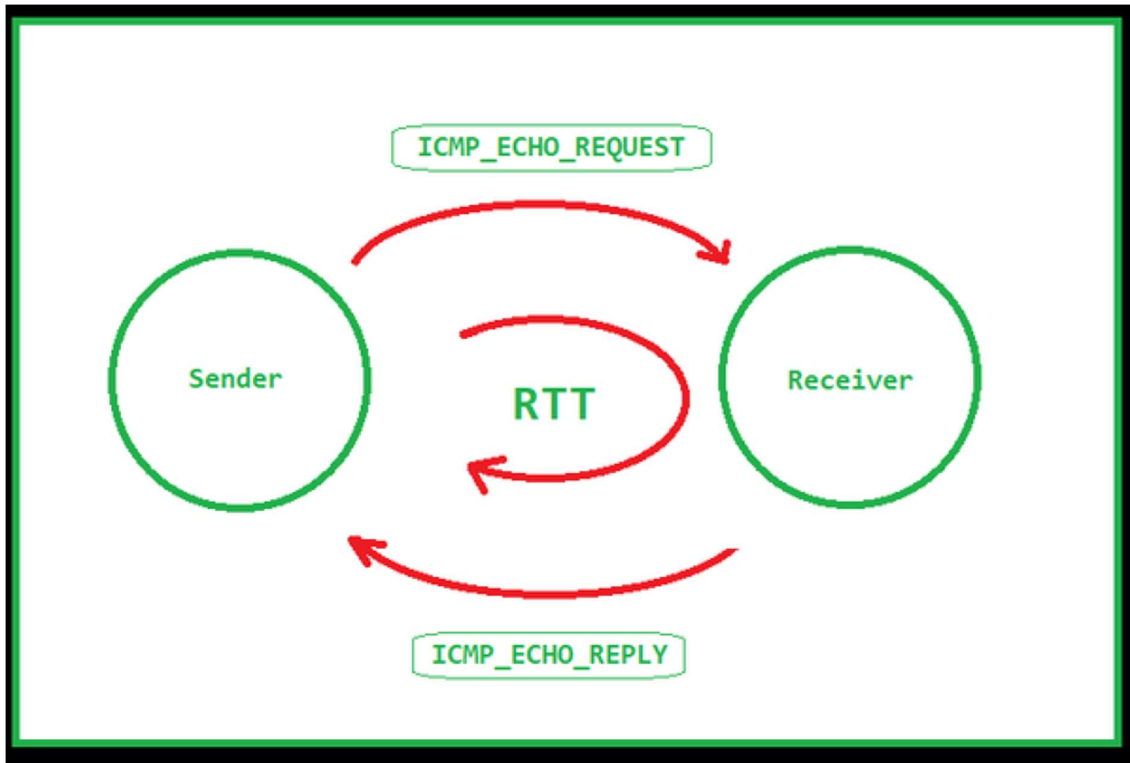
C:\Users\Admin>
```

- The example above shows a **ping** session to google.com.
- From the output, you can see the IP address being contacted (142.250.76.46), and the round-trip time. In this case, 4 packets were sent with an average RTT of 3ms.
- One thing to note about the output above and the **ping** utility, in general, is that **ping** is strictly an **IPv4 tool**.
- If you're testing in an IPv6 network you'll need to use the **ping6** utility.
- ping6 behaves roughly identical to the **ping** utility with the exception that it uses IPv6.

How ping command works?

- Ping uses two ICMP message types: **type 8 (Echo Request)** and **type 0 (Echo Reply)**.
- The ICMP Echo request packets ask the remote destination to reply.

- If the remote destination is configured to reply, it will respond with Echo Reply packets of its own.
- You'll be able to see how long the **round-trip time (RTT)** is between your computer and the destination.



Working of ping

- The RTT can be an indicator of the latency between the source and the destination.

Summary of the ping session

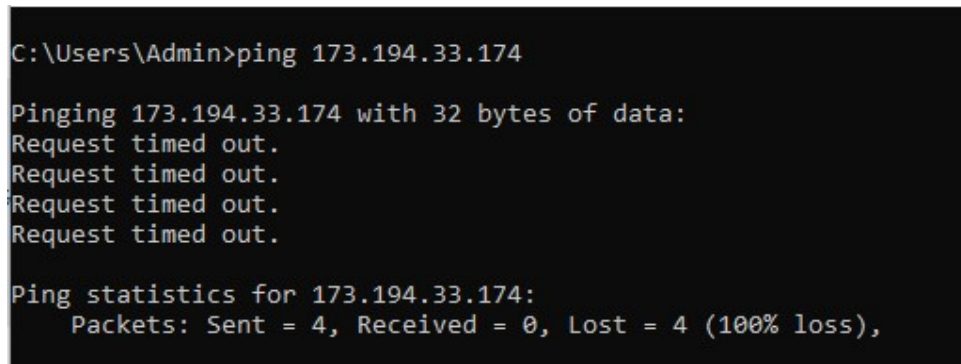
- When the **ping** command completes, it displays a summary of the ping session.
- This summary tells you **how many packets were sent and received, how much packet loss there was, and statistics on the RTT of the traffic.**
- ping is an excellent first step for identifying **whether or not a destination is "alive".**
- **Keep in mind, however, that some networks block ICMP traffic, so a failure to respond is not a guarantee that the destination is offline.**

Fields in the summary:

- **from:** The destination and its IP address. Note that the IP address may be different for a website depending on your geographical location.
- **icmp_seq:** The sequence number of each ICMP packet. Increases by one for every subsequent echo request. (**Check whether it is displayed on your machine**).
- **time:** The time it took a packet to reach the destination and come back to the source. Expressed in milliseconds.
- **ttl:** The **Time to Live(ttl)** value from 1 to 255. It represents the [number of network hops a packet can take](#) before a router discards it.

Request timed out

- You'll see a "**Request timed out**" message if packet loss is occurring.



```
C:\Users\Admin>ping 173.194.33.174

Pinging 173.194.33.174 with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 173.194.33.174:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

Note: The **Request Timed Out** error message is very common when you use the ping command. Essentially, this error message indicates that your host did not receive the **ICMP Echo Reply** back from the destination node within the designated time period.

You'll see an **error message** if your computer can't communicate with the remote host at all.

ping "localhost" to Check Local Network

- If you encounter issues reaching a website or a remote machine, you can ping localhost to confirm you have a network connection. Use one of the three ways to check the local network interface:

1. **ping 0** – This is the quickest way to ping localhost. Once you type this command, the terminal resolves the IP address and provides a response.
2. **ping localhost** – You can use the name to ping localhost. The name refers to your computer, and when we use this command, we say: “ping this computer.”
3. **ping 127.0.0.1** – Some people prefer using the IP address [127.0.0.1](#) to ping localhost.
4. Whichever method you choose, the ping output looks the same.

Whichever method you choose, observe the ping output and come up with the findings..

Specify the Internet Protocol

- [IPv6 is the IP address alphanumeric format that will supersede IPv4.](#) The reason for this is there is a limited number of IPv4 address, and we are running out of possible combinations.
- To request IPv6 or IPv4 address, add **-6** or **-4** after the **ping** command and before a hostname/IP.

```
ping -6 hostname/IPv6
```

```
ping -4 hostname/IPv4
```

Change Time Interval Between Ping Packets

The default interval between each ping request is set to one second. You can increase or decrease that time using the **-i** switch. To decrease the ping interval, use values lower than 1.

```
ping -i 0.5 google.com
```

To increase the ping interval, enter any value higher than 1.

Change Ping Packet Size

- In some scenarios, you may want to use **-s** to increase the packet size from the default value of 56 (84) bytes. The number in parenthesis represents the ping bytes sent including 28 bytes of the header packet.
- For example, to increase the packet size to 1000 bytes:

```
ping -s 1000 google.com
```

- This command is useful when testing network performance. You can test if a network link throttles when you increase the packet size to a few thousand bytes.

Flood a Network Using ping to Test Performance

You can use **ping flood** to test your network performance under heavy load.

Ping flood **-f** option requires root to execute.

Otherwise, apply **sudo** to your **ping** command to flood a host.

This command sends a large number of packets as soon as possible.

```
sudo ping -f hostname-IP
```

(Check whether sudo is recognized as an internal or external command).

Observe the output of this command.

How to Limit the Number of Pings

The default setting for the **ping** command is to keep sending the request until you interrupt it. You can limit the number of pings using one of the two methods.

Limit Number of Ping Packets

- To make the **ping** command automatically stop after it sends a certain number of packets, use **-c** and a number. This sets the desired amount of ping requests, as shown in this example:

```
ping -c 2 google.com
```

- When you observe the output, The **ping** command stop sending packets after two requests.

Set Time Limit for ping Command

- To stop receiving a ping output after a specific amount of time, add **-w** and an interval in seconds to your command.
- For example, to stop printing ping results after 25 seconds, enter the **ping** command:

```
ping -w 25 google.com
```

Other Uses for ping

Suppress Ping Output to Print only Summary Statistics

- If you do not want to clog your screen with information for every packet, use the **-q** switch to display the summary only.
- The **-q** option prints one line with the regular ping information and then provides the statistics at the end. The letter “**q**” in this command stands for “quiet” output.

```
ping -c 10 -q google.com
```

- We usually combine the quiet output with other options. In this case, we will limit the ping to send 10 packets and suppress the output.

Add Timestamp Before Each Line in ping Output

- If you want to note the time of day when you execute the **ping** command, add the **-D** option.

```
ping -D google.com
```

- This prints a timestamp in UNIX format before each line.

Get an Audible Ping When a Host is Reachable

- When you use the **-a** switch, the system plays a sound when there is a response from a host.
- An audible ping is useful when you are troubleshooting network issues and do not want to look at the screen until there is a response.

```
ping -a google.com
```

- The output looks the same as a regular **ping** command output.

Show Ping Version and Exit

- At any time, you can check the version of the ping tool on your system.
- Append **-V** to the **ping** command to display the version of this utility.

```
ping -V google.com
```

Commonly used ping Commands include:

Ping Option	What The Command Does
a	Generates a sound when the peer can be reached.
b	Allows to ping a broadcast IP address.
B	Prevents the ping to change the source address of the probe.
c (count)	Limits the number of sent ping requests.
d	Sets the SO-DEBUG option on the used socket.
f	Floods the network by sending hundreds of packets per second.
i (interval)	Specifies an interval between successive packet transmissions. The default value is one second.
I (interface address)	Sets the source IP address to the specified interface IP address. The option is required when pinging IPv6 link local address. You can use an IP address or name of the device.
l (preload)	Defines the number of packets to send without waiting for a reply. To specify a value higher than 3, you need superuser permissions.
n	Displays IP addresses in the ping output rather than hostnames.
q	Shows a quiet output. One ping line is displayed and the summary of the ping command at the end.
T (ttl)	Sets the Time To Live.
v	Provides verbose output.
V	Displays the ping version and exits to a new command prompt line.

Ping Option	What The Command Does
w (deadline)	Specifies a time limit before the ping command exits, regardless of how many packets have been sent or received.
W (timeout)	Determines the time, in seconds, to wait for a response.
