

# How To Use Traceroute and MTR to Diagnose Network Issues

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## Introduction

An important part of administering servers is monitoring network connectivity.

There are a few tools that are simple to use, but valuable to know. In this guide, we will discuss how to use a tool called `traceroute` to diagnose where a network issue may be happening.

We will also look at a utility called `mtr` which combines much of the functionality of ping and traceroute into one interface.

## How To Use Traceroute

Traceroute is a simple tool to show the pathway to a remote server. This can be anything from a website that you are attempting to visit, to a printer on your local network.

The traceroute program is installed by default on just about every Linux distribution, so you shouldn't need to install it.

To call it, we simply need to provide a website or IP address that we would like to explore:

```
traceroute google.com
```

```
traceroute to google.com (173.194.38.137), 30 hops max, 60 byte packets
 1  192.241.160.253 (192.241.160.253)  0.564 ms  0.539 ms  0.525 ms
 2  192.241.164.241 (192.241.164.241)  0.487 ms  0.435 ms  0.461 ms
 3  xe-3-0-6.ar2.nyc3.us.nlayer.net (69.31.95.133)  1.801 ms  1.802 ms  1.762 ms
 4  144.223.28.73 (144.223.28.73)  0.583 ms  0.562 ms  0.550 ms
 5  144.232.1.21 (144.232.1.21)  1.044 ms  1.048 ms  1.036 ms
 6  74.125.49.212 (74.125.49.212)  0.494 ms  0.688 ms  0.643 ms
 7  209.85.248.180 (209.85.248.180)  0.650 ms  209.85.248.178 (209.85.248.178)
0.621 ms  0.625 ms
 8  72.14.236.208 (72.14.236.208)  0.618 ms  72.14.236.206 (72.14.236.206)  0.898
ms 72.14.236.208 (72.14.236.208)  0.872 ms
 9  72.14.239.93 (72.14.239.93)  7.478 ms  7.989 ms  7.466 ms
10  72.14.232.73 (72.14.232.73)  20.002 ms  19.969 ms  19.975 ms
11  209.85.248.228 (209.85.248.228)  30.490 ms  72.14.238.106 (72.14.238.106)
34.463 ms  209.85.248.228 (209.85.248.228)  30.707 ms
12  216.239.46.54 (216.239.46.54)  42.502 ms  42.507 ms  42.487 ms
13  216.239.46.159 (216.239.46.159)  76.578 ms  74.585 ms  74.617 ms
14  209.85.250.126 (209.85.250.126)  80.625 ms  80.584 ms  78.514 ms
15  72.14.238.131 (72.14.238.131)  80.287 ms  80.560 ms  78.842 ms
16  209.85.250.228 (209.85.250.228)  171.997 ms  173.668 ms  170.068 ms
17  66.249.94.93 (66.249.94.93)  238.133 ms  235.851 ms  235.479 ms
18  72.14.233.79 (72.14.233.79)  233.639 ms  239.147 ms  233.707 ms
19  sin04s01-in-f9.1e100.net (173.194.38.137)  236.241 ms  235.608 ms  236.843
```

## How To Read Traceroute's Output

The first line tells us the conditions that traceroute is operating under:

```
traceroute to google.com (173.194.38.137), 30 hops max, 60 byte packets
```

It gives the specified host, the IP address that DNS returns for that domain, the maximum number of hops to check, and the size of the packet that will be used.

The maximum number of hops can be adjusted with the `-m` flag. If the host you are trying to route to is over 30 hops away, you may need to specify a larger value here. The maximum value you can set is 255.

```
traceroute -m 255 obiwan.scrye.net
```

You can adjust the size of the packet that is sent to each hop by giving the integer after the hostname:

```
traceroute google.com 70
```

```
traceroute to google.com (173.194.38.128), 30 hops max, 70 byte packets 1
192.241.160.254 (192.241.160.254) 0.364 ms 0.330 ms 0.319 ms
 2 192.241.164.237 (192.241.164.237) 0.284 ms 0.343 ms 0.321 ms
```

After the first line, each subsequent line represents a "hop", or intermediate host that your traffic must pass through to reach the computer represented by the host you specified.

Each line has the following format:

```
hop_number    host_name    (IP_address)  packet_round_trip_times
```

Here is an example of a hop you might see:

```
3  nyk-b6-link.telia.net (62.115.35.101) 0.311 ms 0.302 ms 0.293 ms
```

Here is what each field means:

- **hop\_number:** A sequential count of the number of degrees of separation the host is from your computer. Traffic from hosts with higher numbers have to go through more computers to get routed.
- **host\_name:** This field contains the result of a reverse DNS lookup on the host's IP address, if available. If no information is returned from the reverse DNS query, the IP address itself is given.
- **IP\_address:** This field contains the IP address for this network hop.
- **packet\_round\_trip\_times:** The remainder of the line gives the round-trip times for a packet to the host and back again. By default, three packets are sent to each host and each attempt is appended to the

end of the line.

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If you would like to change the number of packets that are tested against each host, you can specify a number with the `-q` option, like this:

```
tracert -q1 google.com
```

If you would like to forgo the reverse DNS lookup to speed up the trace, you can pass the `-n` flag:

```
tracert -n google.com
```

```
tracert to google.com (74.125.235.7), 30 hops max, 60 byte packets
```

```
 1  192.241.160.253  0.626 ms  0.598 ms  0.588 ms
 2  192.241.164.241  2.821 ms  2.743 ms  2.819 ms
 3  69.31.95.133    1.470 ms  1.473 ms  1.525 ms
```

If your traceroute dissolves into some asterisks (\*), there is a problem with the route to the host.

```
15  209.85.248.220 (209.85.248.220) 121.809 ms 72.14.239.12 (72.14.239.12)
76.941 ms 209.85.248.220 (209.85.248.220) 78.946 ms
16  72.14.239.247 (72.14.239.247) 101.001 ms 92.478 ms 92.448 ms
17  * * 209.85.250.124 (209.85.250.124) 175.083 ms
18  * * *
19  * * *
```

## What Does a Route Issue Mean?

If your traceroute attempt stops at a particular hop or node and cannot find a route to the host, you have a problem.

While the hop where the route fails to return may be the location of the networking issue, it isn't always that easy to diagnose.

Due to the fact that each ping represents a round-trip packet, and the situation where packets often use different pathways in either direction, it may indicate a problem in a completely different, possibly closer route.

It also may be the case that the problem is with the hop directly after the last hop you see. It is difficult to diagnose the exact location of the problem unless you can get a return traceroute from that specific hop. This is usually not possible outside of your own network.

## How To Use MTR

A dynamic alternative to the traceroute program is `mtr`. Combining the functionality of ping and traceroute, `mtr` allows you to constantly poll a remote server and see how the latency and performance changes over time.

Unlike traceroute, `mtr` is not installed by default on most systems. You can get it by typing the following commands.

Ubuntu/Debian:

```
sudo apt-get install mtr
```

CentOS/Fedora:

```
yum install mtr
```

Arch:

```
pacman -S mtr
```

Once it is installed, you can call it by typing:

```
mtr google.com
```

```
My traceroute [v0.80]
traceroute (0.0.0.0) Tue Oct 22 20:39:42 2013
Resolver: Received error response 2. (server failure)er of fields q
uit
          Packets
Host      Loss%  Snt   Last   Avg   Best  Wrst  StDev
1. 192.241.160.253 0.0%  371   0.4   0.6  0.1  14.3  1.0
2. 192.241.164.241 0.0%  371   7.4   2.5  0.1  37.5  4.8
3. xe-3-0-6.ar2.nyc3.us. 2.7%  371   3.6   2.6  1.1  5.5  1.1
4. sl-gw50-nyc-.sprintli 0.0%  371   0.7   5.0  0.1  82.3  13.1
```

While the output may look similar, the big advantage over traceroute is that the output is constantly updated. This allows you to accumulate trends and averages, and also allows you to see how the network performance varies over time.

If you ran a traceroute, there is a possibility that the packets that were sent to each hop happened to make the trip without incident, even in a situation where the route is suffering from intermittent packet loss. The mtr utility allows you to monitor for this situation by gathering data over a wider range of time.

It is also possible to run mtr with the `--report` option, which returns the results of sending 10 packets to each hop.

```
mtr --report google.com
```

```
HOST: traceroute
          Loss%  Snt   Last   Avg   Best  Wrst  StDev
1. |-- 192.241.160.254 0.0%  10    1.5   0.9  0.4  1.5  0.4
2. |-- 192.241.164.237 0.0%  10    0.6   0.9  0.4  2.7  0.7
3. |-- nyk-b6-link.telialia.net 0.0%  10    0.5   0.5  0.2  0.7  0.2
4. |-- nyk-bb2-link.telialia.net 0.0%  10   67.5  18.5  0.8  87.3  31.8
```

This can be useful when you don't necessarily want to measure in real-time, but you want a greater range of data than traceroute provides.

## Conclusion

With traceroute and mtr, you can get a sense as to which servers on your way to a specific domain or address are causing problems. This can be useful when troubleshooting an internal network, and also when

trying to provide information to support members or ISPs when you are experiencing network problems.