ping, traceroute and mtr Network path testing

CONCEPTS

ping tests the round trip to one host; traceroute and mtr find where along the path it breaks or slows.

TTL 1 router 1 replies
↓ TTL+1
TTL 2 router 2 replies
↓ TTL+1
TTL n last router
↓ reaches
Target final reply

Probes with rising TTL; each router answers with ICMP Time Exceeded

Many routers rate-limit or drop probe replies, so loss on one hop that does not continue to later hops is usually harmless.

traceroute defaults to UDP probes and may need root for some modes; mtr and ping use ICMP unless told otherwise.

PING BASICS

ping *<host>*
Ping until interrupted (Ctrl+C)

ping -c *<count> <host>*
Stop after <count> replies

ping -4 *<host>*
Use IPv4 only

ping -6 *<host>*
Use IPv6 only

ping -i *<seconds> <host>*
Wait between packets

ping -s *<bytes> <host>*
Set payload size (default 56)

ping -W *<seconds> <host>*
Wait this long for each reply

ping -w *<seconds> <host>*
Give up after a total deadline

ping -n *<host>*
Skip reverse DNS lookups

ping -q -c *<count> <host>*
Show only the summary

ping -I *<interface> <host>*
Send from an interface or address

ping -M do -s *<bytes> <host>*
Probe path MTU, never fragment

READING PING

Output fields

Field	Means
`icmp_seq`	Packet number; gaps mean loss
`ttl`	Remaining hops on the reply
`time`	Round-trip time in ms
`% packet loss`	Share of requests unanswered
`rtt min/avg/max/mdev`	Latency summary and jitter

Exit status

Code	Means
`0`	At least one reply
`1`	No reply received
`2`	Other error

A reply time that jumps on the first packet only is usually ARP or DNS warm-up, not a slow link.

TRACEROUTE

traceroute *<host>*
Trace the path (UDP probes)

traceroute -n *<host>*
Do not resolve names

traceroute -I *<host>*
Probe with ICMP echo

traceroute -T -p *<port> <host>*
Probe with TCP SYN to a port

traceroute -m *<hops> <host>*
Set maximum hops (default 30)

Reading hop lines

Shown	Means
`* * *`	No answer; filtered or rate-limited
`three times`	RTT of each of the 3 probes
`!H / !N / !X`	Host, network or admin unreachable
`different IPs on a hop`	Load-balanced paths

MTR LIVE VIEW

mtr *<host>*
Live trace with loss and latency

MTR LIVE VIEW (cont.)

mtr -n *<host>*
Show IPs only, no DNS

Interactive keys

Key	Does
`d`	Cycle display mode
`n`	Toggle DNS
`p / Space`	Pause / resume
`r`	Reset counters
`j`	Toggle latency / jitter
`o`	Choose columns
`u`	Switch ICMP / UDP
`q`	Quit

MTR REPORT AND PROTOCOLS

mtr -r -c *<count> <host>*
Report mode: run, print, exit

mtr -rw -c *<count> <host>*
Wide report, full hostnames

mtr -T -P *<port> <host>*
TCP SYN trace to a port

Report columns

Column	Means
`Loss%`	Share of probes lost at this hop
`Snt`	Probes sent
`Last`	Latest RTT in ms
`Avg`	Mean RTT
`Best / Wrst`	Fastest / slowest RTT
`StDev`	Spread of RTT; high means jitter

Judge loss by the last hops: loss that appears at one hop and disappears further on is rate limiting; loss that continues to the target is real.

Run at least 50-100 cycles for a report, and run it from both ends when you can.

RECIPES

Is the network or DNS broken?

```
ping -c 3 1.1.1.1
ping -c 3 example.com
# IP works, name fails: DNS
problem (see dig)
```

Evidence for your ISP

```
mtr -rwn -c 100 example.com >
mtr.txt
mtr -rwn -T -P 443 -c 100
example.com >> mtr.txt
```

Find the path MTU

```
ping -c 2 -M do -s 1472 <host>
# fails? lower -s until it
passes; MTU = size + 28
```