Dylan Bourgeois

Antoine Mougeot

6 MININET

ANALYZING LATENCY VERSUS NUMBER OF NODES (BONUS)

Method

We chose 2 different `mininet` topologies to test the influence on performance : **single** and **linear**. For simplicity we decided not to use a custom configuration for the link performances (e.g. delays and bandwiths), using instead the default nodes and predefined topologies provided by `mininet`. This is of course not ideal for performance testing on a real network but should be sufficient to study trends that depend on the number of nodes on the network.

We study two metrics :

- **ping time** : measured from the first to the last host on the network, averaged over 5 pings (`mininet> h1 ping -c5 hn`).
- **bandwidth** : measures the TCP bandwith (`mininet> iperf`)

Again this is out of convenience as these are predefined tests in `mininet` though they are telling indicators of a network's performance.

Single

This topology is `mininet`'s expression of a star network, as requested in the exercise.

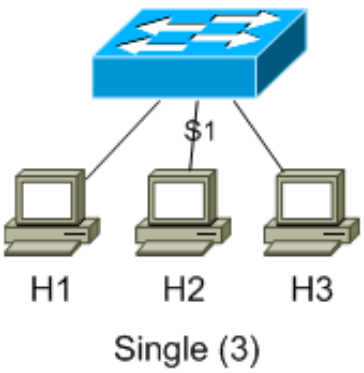


Figure 1 : Single topology Source

The above tree can be created in mininet with the command :

```
sudo mn --topo single,3 -v info
```

Note The same result can be achieved with `mininet`'s tree topology, with `depth=1` and `fanout=<nb_nodes>` .

Linear

This is a simple *bus-like* topology, where nodes are aligned on a single link, with switches in between each.

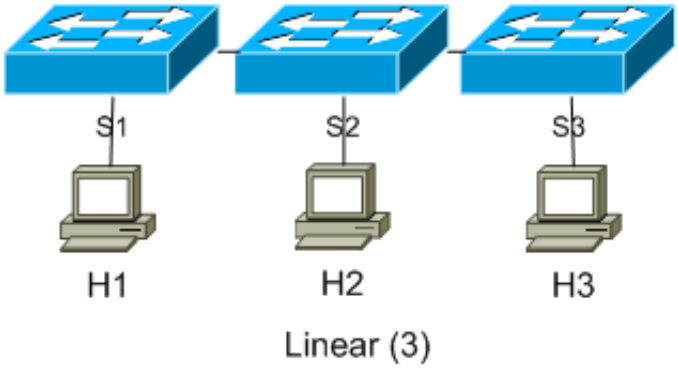


Figure 2 : Linear topology Source

```
sudo mn --topo linear,5 -v info
```

Note unfortunately we weren't able to scale the network to more than 15 hosts, after which the first host wasn't able to ping the last (we checked by manually pinging and using `pingall` which would not be able to reach host 16+).

Results

Table 1 : Network topology and performance

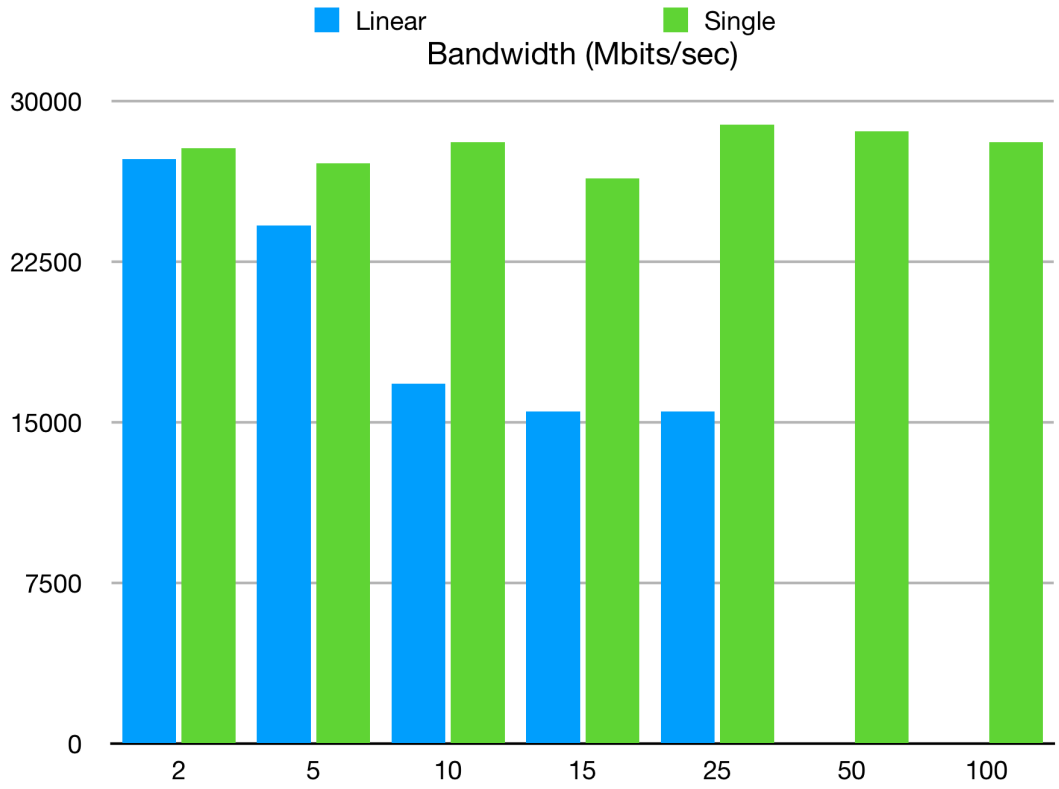
Network Topology	Size	Ping time (ms)	Bandwith (Mbits/s)
Linear	**2**	0.113	27300
	5	0.108	24200
	10	0.179	16800
	15	0.310	15500
	25	0.310	15500
Single	**2**	0.408	27800
	5	0.351	27100
	10	0.424	28100
	15	0.397	26400
	25	0.110	28900
	50	0.078	28600
	100	0.056	28100

The trends can be shown in the following barplots :

Bandwith

We clearly see a downwards trend for the *Linear* network configuration, whereas the *Single* / *Star* network stays constant. This makes sense as the time spent by a packet in a linear network is linear as well (the number of hops is the number of hosts), which means that the longer the network the longer it takes for a TCP packet to confirm its arrival, slowing the bandwith. (*Note* we suppose that this behaviour should not be observed for UDP packets).

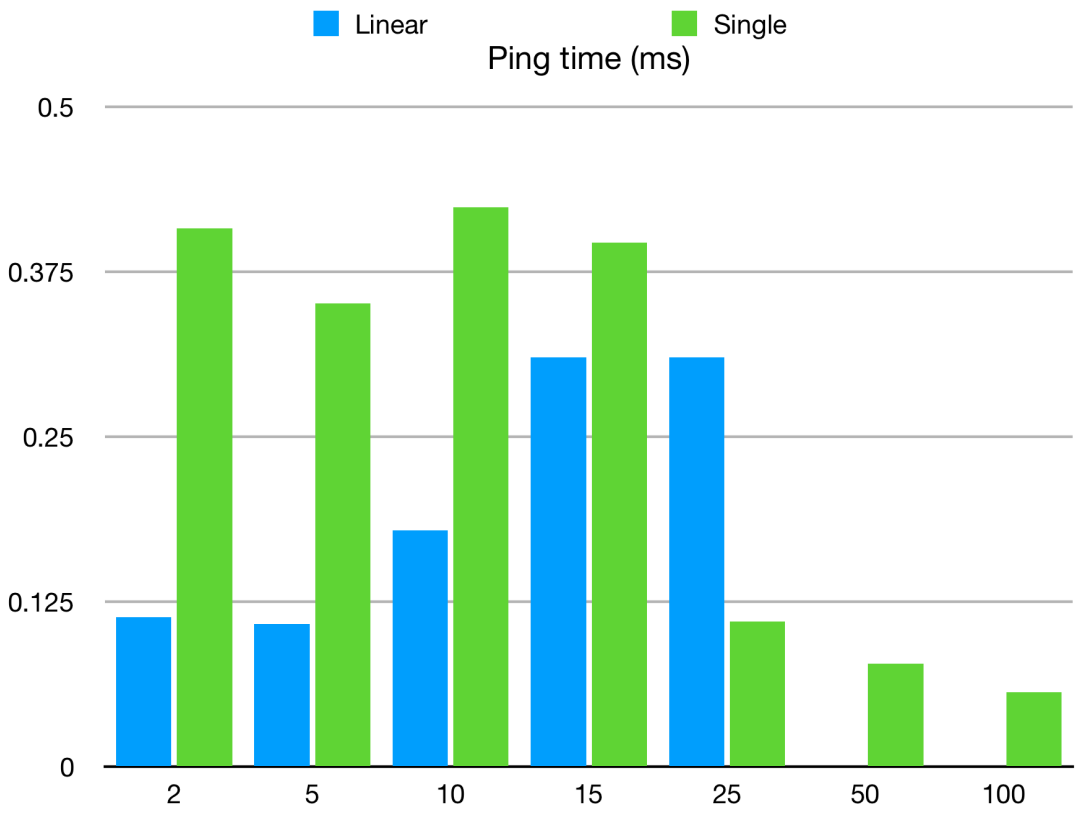
On the other hand, a packet in a star network doesn't have to do more hops to arrive to its destination no matter the amount of hosts in the LAN (its travel time is constant).



Ping time

The same reasoning as above holds for the *ping time* behaviour observed :

- Linear networks grow linearly hence the time spent in the LAN grows linearly as well
- Star networks are time constant. The fact that the ping time is slower than for a linear network for smaller networks would be due to the problem of finding an unknown host, which is linear in a star network.


Linear
Single
Ping time (ms)
0.5
0.375
0.25
0.125
0
2
5
10
15
25
50
100