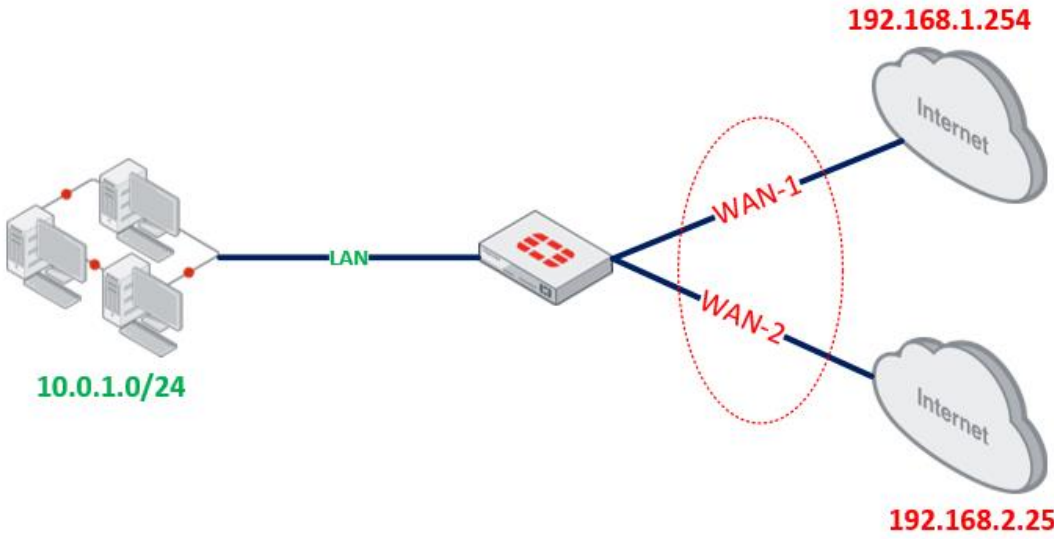
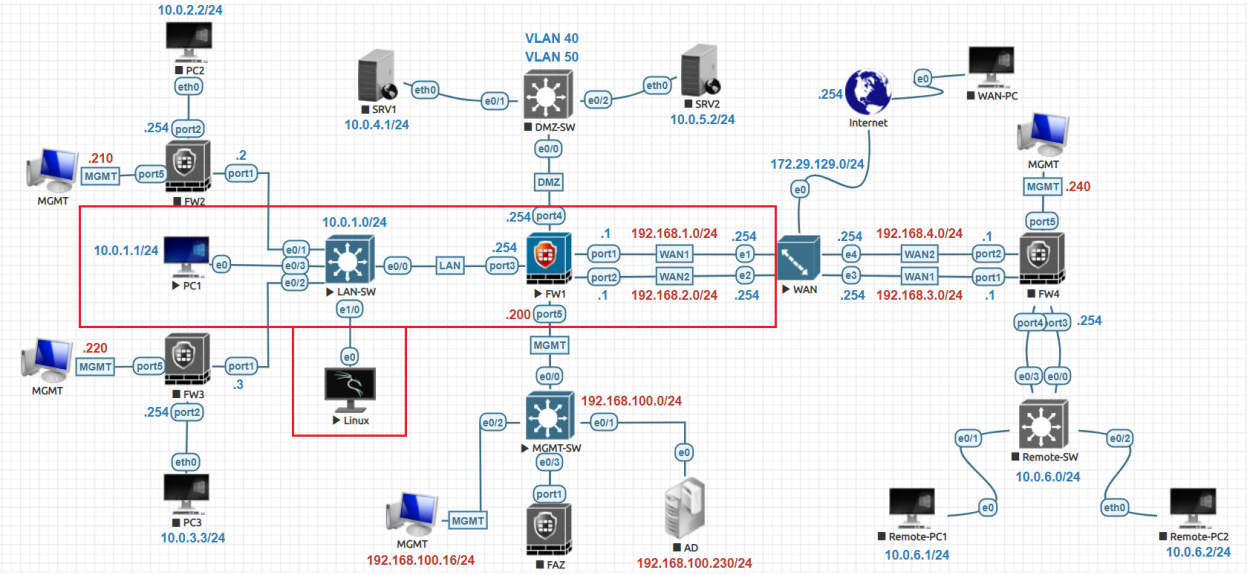
ECMP (Equal-Cost Multi-Path Routing) Lab:

With FortiGate Firewall you can make multiple WAN Lines (Internet Lines) redundant and load balance communication. Here, we will confirm the Load Balancing operation by ECMP (Equal Cost Multiple Path) for two Internet Lines.

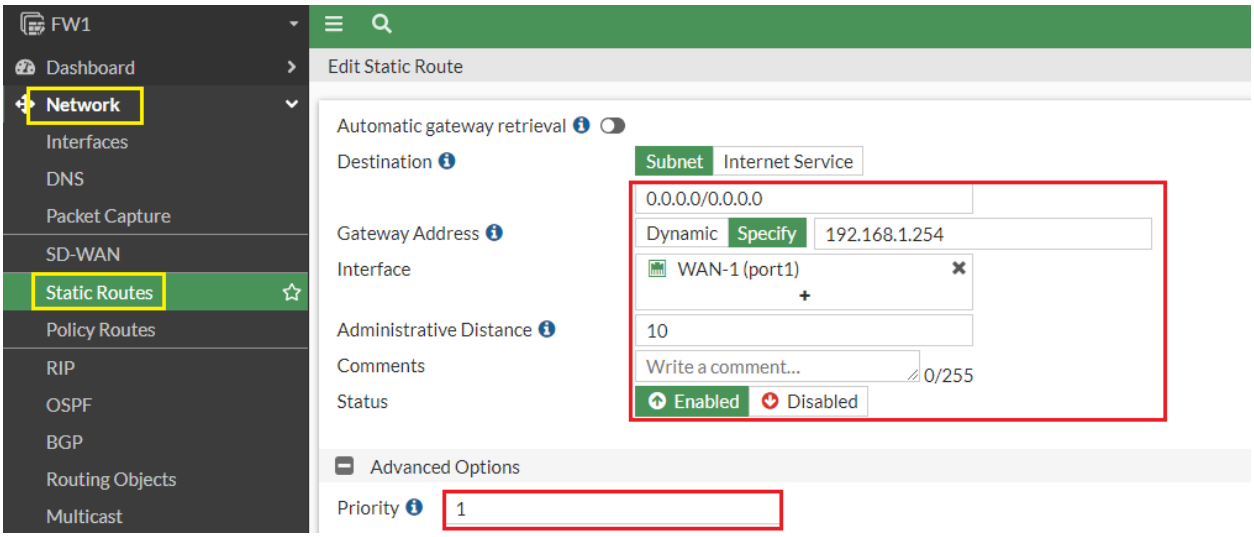


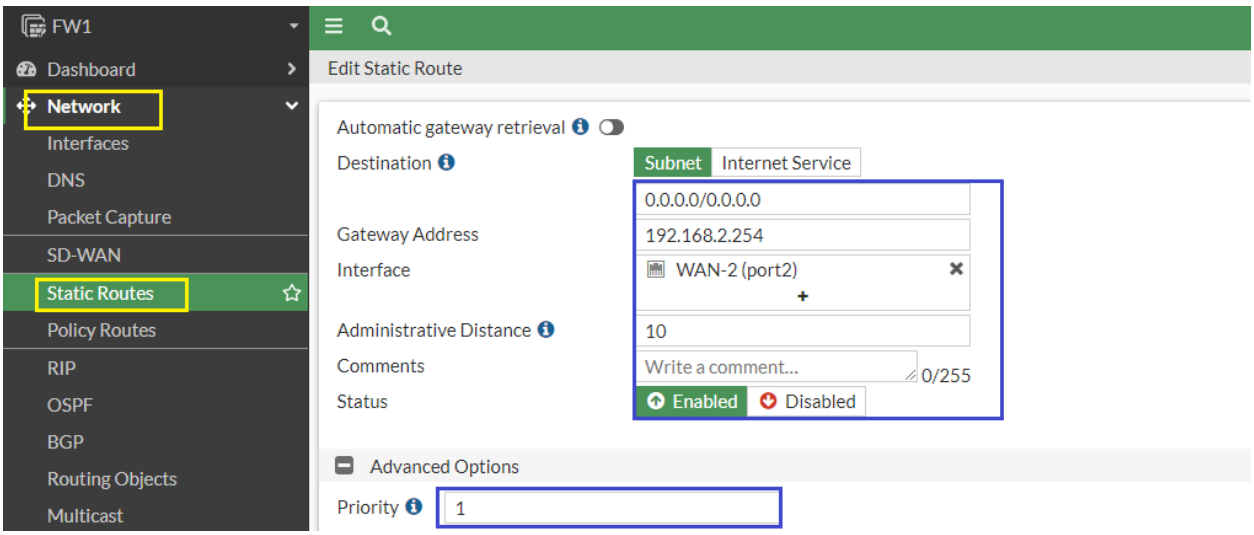


WAN-1 Gateway	192.168.1.254
WAN-2 Gateway	192.168.2.254
WAN-1 Port	Port1
WAN-2 Port	Port2
Server to check	8.8.8.8
Protocols to use	Ping

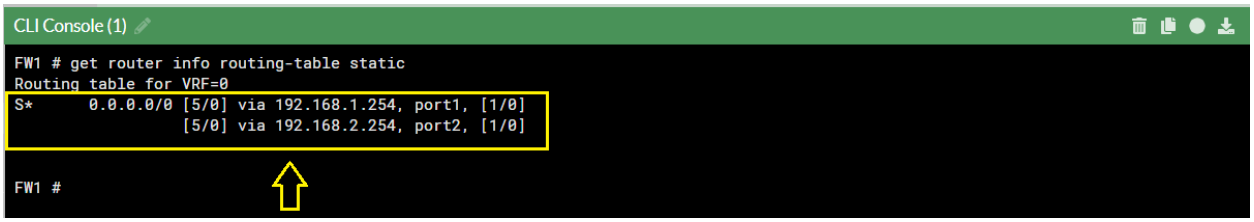
Default Routes:

Create two default routes for the redundant Internet connections, both the default static routes have to be active in the routing table. Set the same Distance and Priority of both the routes. To configure these routes in the GUI, go to Network -> Static Routes and create two default routes.

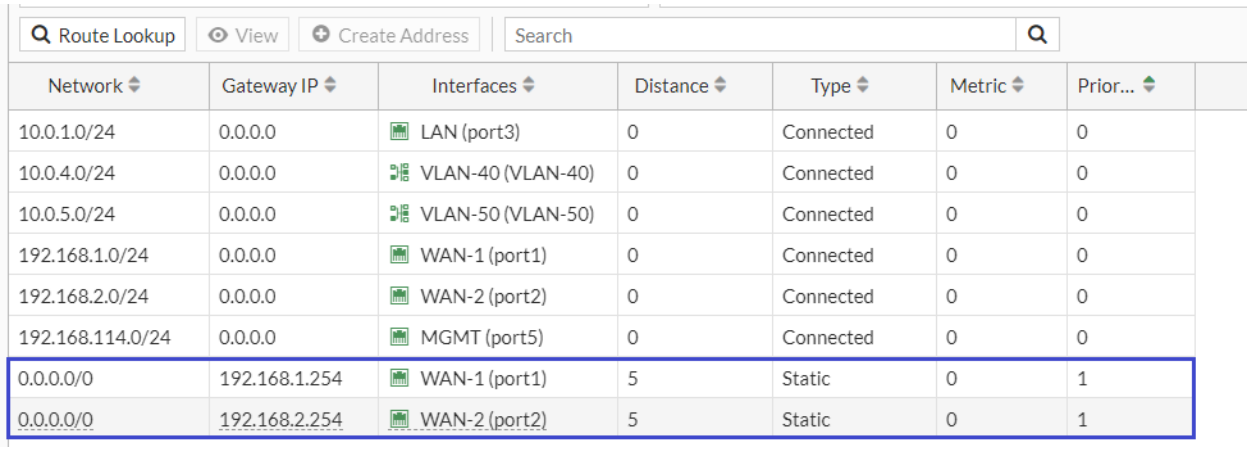




A default route is set for each Internet Line. You can check the routing table with the CLI command get router info routing-table static.



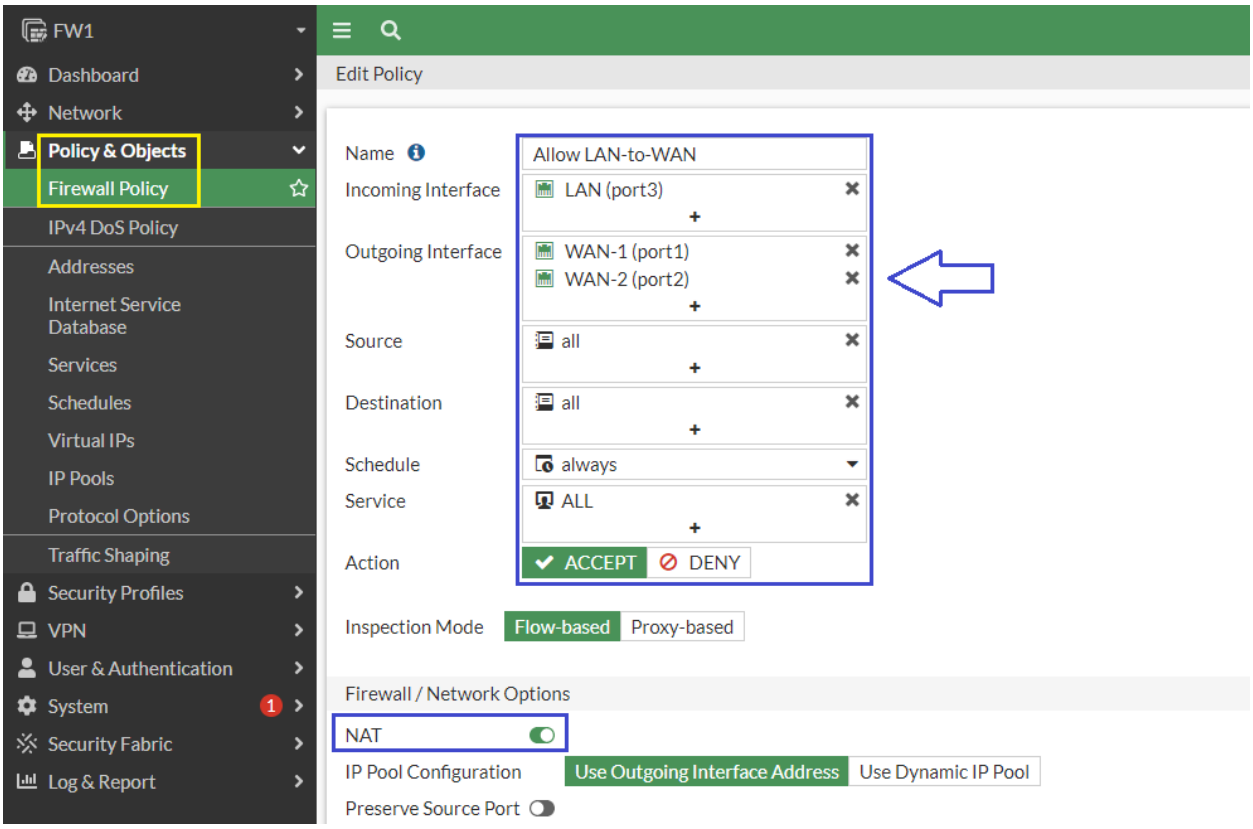
You can also verify from GUI go to Dashboard >Network click on Static & Dynamic Routing.

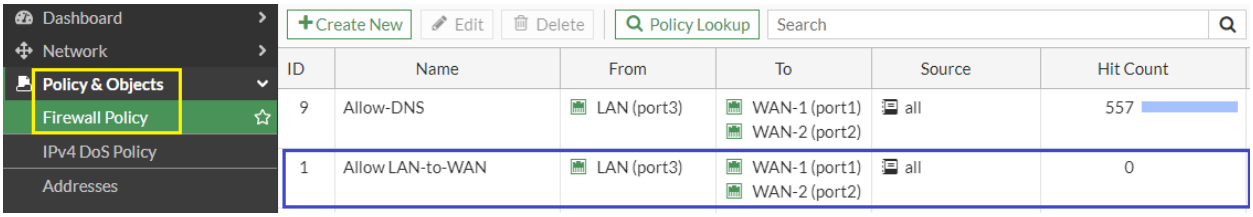


Network	Gateway IP	Interfaces	Distance	Type	Metric	Prior...
10.0.1.0/24	0.0.0.0	LAN (port3)	0	Connected	0	0
10.0.4.0/24	0.0.0.0	VLAN-40 (VLAN-40)	0	Connected	0	0
10.0.5.0/24	0.0.0.0	VLAN-50 (VLAN-50)	0	Connected	0	0
192.168.1.0/24	0.0.0.0	WAN-1 (port1)	0	Connected	0	0
192.168.2.0/24	0.0.0.0	WAN-2 (port2)	0	Connected	0	0
192.168.114.0/24	0.0.0.0	MGMT (port5)	0	Connected	0	0
0.0.0.0/0	192.168.1.254	WAN-1 (port1)	5	Static	0	1
0.0.0.0/0	192.168.2.254	WAN-2 (port2)	5	Static	0	1

Firewall Policy:

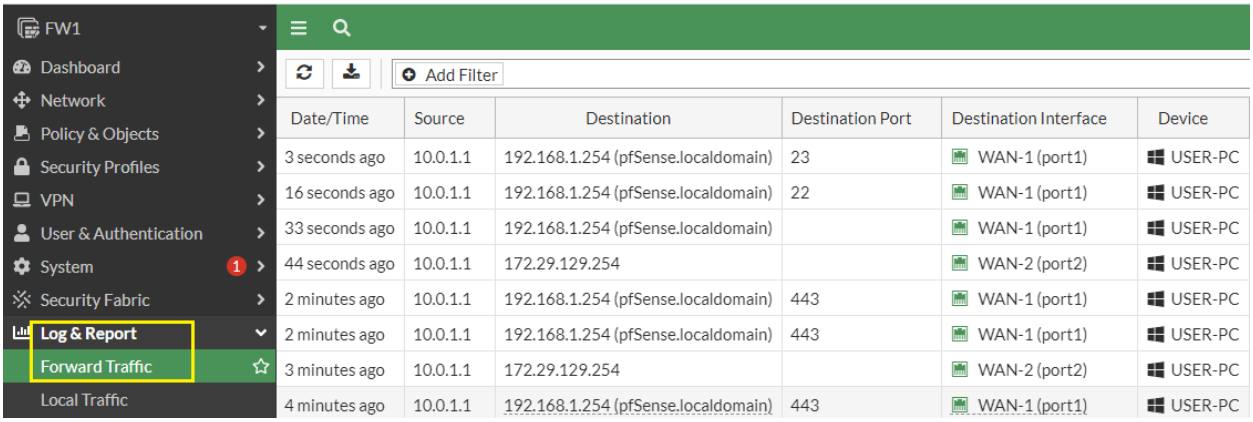
Set a policy to allow all communication from LAN to WAN1 and LAN to WAN2 respectively.





Test and Verification:

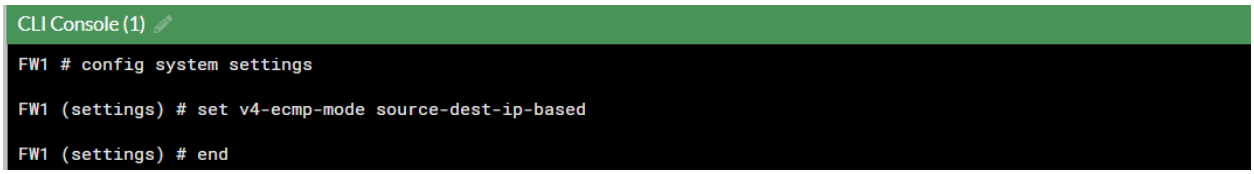
Access multiple sites such as Google and Yahoo from your device and check Log & Report> Forwarding Traffic. You will see that all sites are using the WAN1 primary Line. As FortiGate's default, load balancing to multiple routes (ECMP) distributes the Source IP Address. Therefore, the same source uses the same route (in this case, for the primary Line of the WAN1).



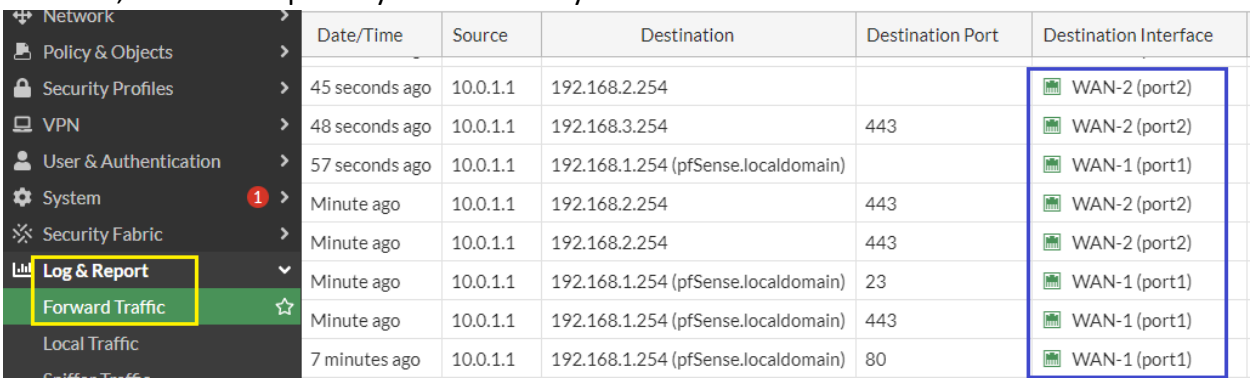
Date/Time	Source	Destination	Destination Port	Destination Interface	Device
3 seconds ago	10.0.1.1	192.168.1.254 (pfSense.localdomain)	23	WAN-1 (port1)	USER-PC
16 seconds ago	10.0.1.1	192.168.1.254 (pfSense.localdomain)	22	WAN-1 (port1)	USER-PC
33 seconds ago	10.0.1.1	192.168.1.254 (pfSense.localdomain)		WAN-1 (port1)	USER-PC
44 seconds ago	10.0.1.1	172.29.129.254		WAN-2 (port2)	USER-PC
2 minutes ago	10.0.1.1	192.168.1.254 (pfSense.localdomain)	443	WAN-1 (port1)	USER-PC
2 minutes ago	10.0.1.1	192.168.1.254 (pfSense.localdomain)	443	WAN-1 (port1)	USER-PC
3 minutes ago	10.0.1.1	172.29.129.254		WAN-2 (port2)	USER-PC
4 minutes ago	10.0.1.1	192.168.1.254 (pfSense.localdomain)	443	WAN-1 (port1)	USER-PC

Let's change Load Balancing (ECMP) which should be performed based on the pair of source IP address and destination IP address. Settings are made using the CLI.

FW1 Change ECMP
config system settings set v4-ecmp-mode source-dest-ip-based end



Access multiple sites such as Google and Yahoo again from the terminal and check the Log & Report>Forwarding Traffic. The source IP address is fixed, but the destination IP address is different, so both the primary and secondary WAN lines are used.



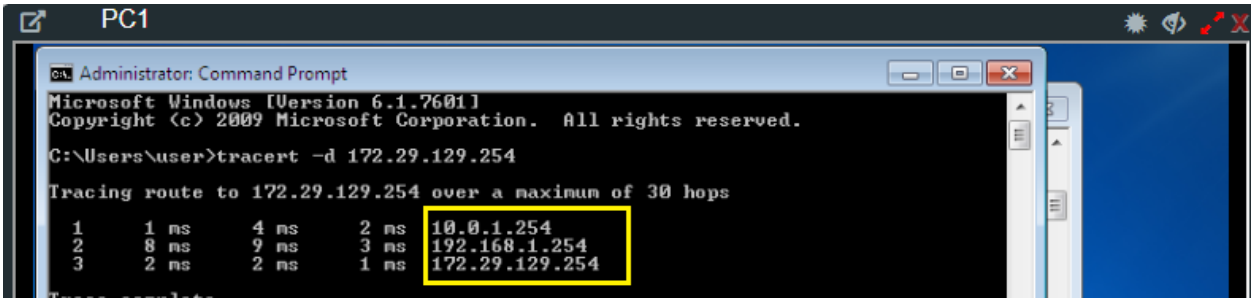
Date/Time	Source	Destination	Destination Port	Destination Interface
45 seconds ago	10.0.1.1	192.168.2.254		WAN-2 (port2)
48 seconds ago	10.0.1.1	192.168.3.254	443	WAN-2 (port2)
57 seconds ago	10.0.1.1	192.168.1.254 (pfSense.localdomain)		WAN-1 (port1)
Minute ago	10.0.1.1	192.168.2.254	443	WAN-2 (port2)
Minute ago	10.0.1.1	192.168.2.254	443	WAN-2 (port2)
Minute ago	10.0.1.1	192.168.1.254 (pfSense.localdomain)	23	WAN-1 (port1)
Minute ago	10.0.1.1	192.168.1.254 (pfSense.localdomain)	443	WAN-1 (port1)
7 minutes ago	10.0.1.1	192.168.1.254 (pfSense.localdomain)	80	WAN-1 (port1)

Health Link Monitor:

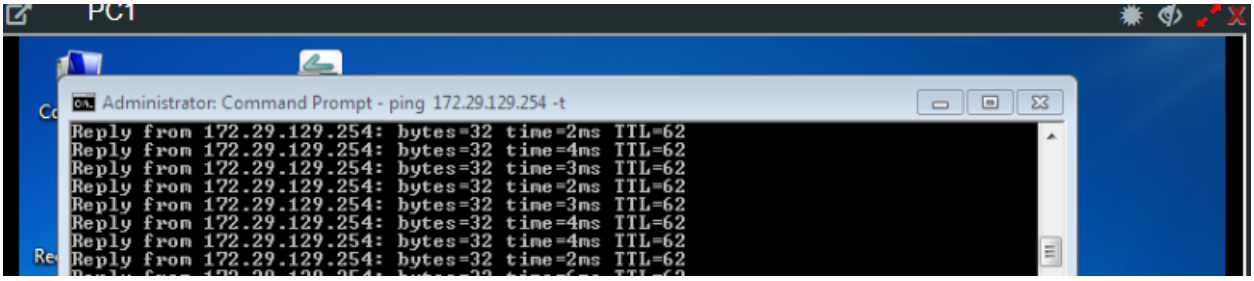
Let's set up the Health Link Monitor and configure ping servers CLI Only. The following will ping a server of your choice, and if it stops receiving replies at the set rate, it will pull the static route from the routing table and the secondary connection will be used.

FW1 CLI Configuration
config system link-monitor edit WAN1 set srcintf port1 set server 8.8.8.8 set protocol ping set gateway-ip 192.168.1.254 set source-ip 0.0.0.0 set interval 500 set failtime 5 set recoverytime 5 set ha-priority 1 set update-cascade-interface enable set update-static-route enable set status enable end
config system link-monitor edit WAN2 set srcintf port2 set server 8.8.8.8 set protocol ping set gateway-ip 192.168.2.254 set source-ip 0.0.0.0 set interval 500 set failtime 5 set recoverytime 5 set ha-priority 1 set update-cascade-interface enable set update-static-route enable set status enable end
diagnose sys link-monitor status

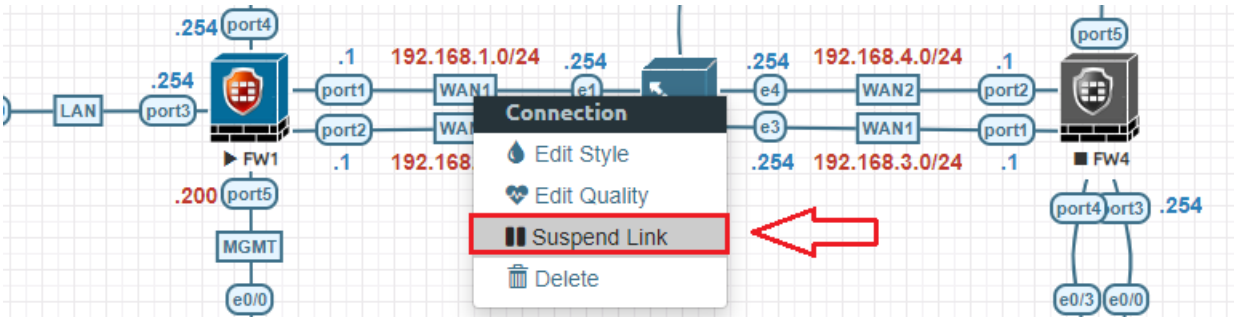
Let's verify traceroute from internal PC1, it is using WAN1 primary link for communication.



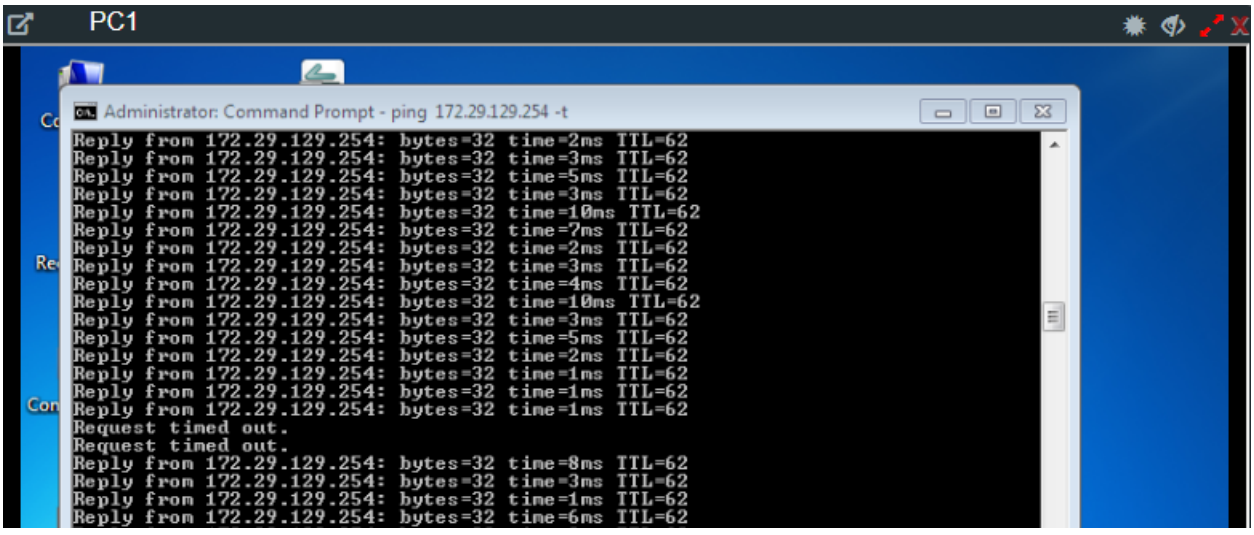
Start continue ping from Internal PC1 to any external IP Address such as 8.8.8.8.



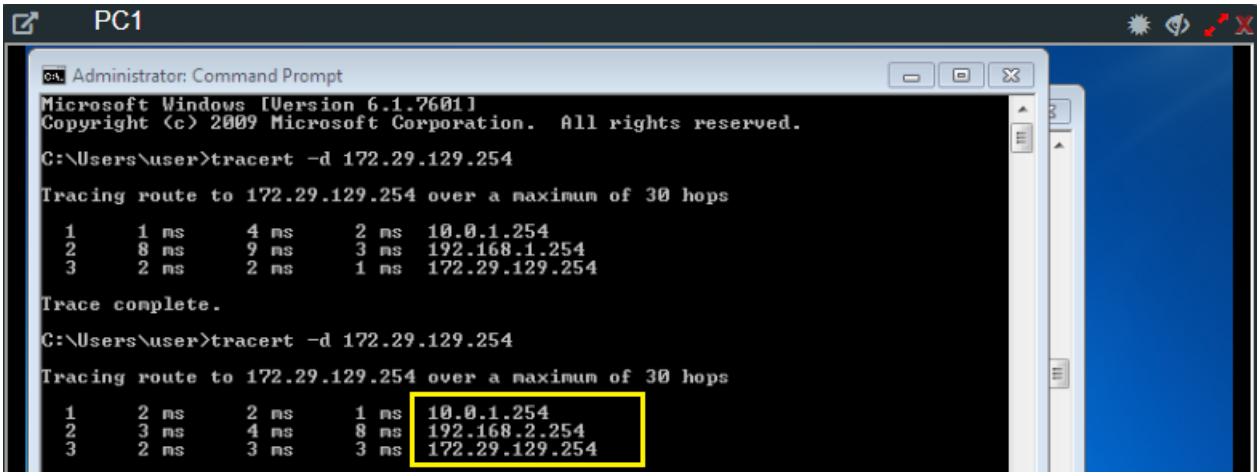
Let's Suspend Primary WAN1 Link to bring them down.



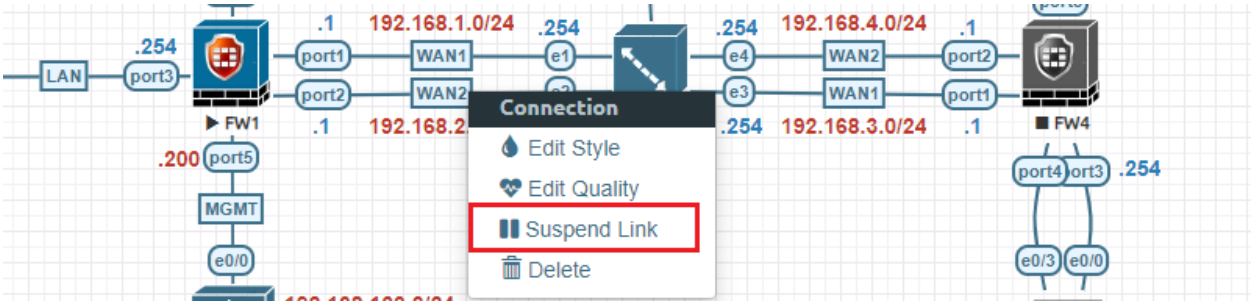
The ping is still continuing only few drops.



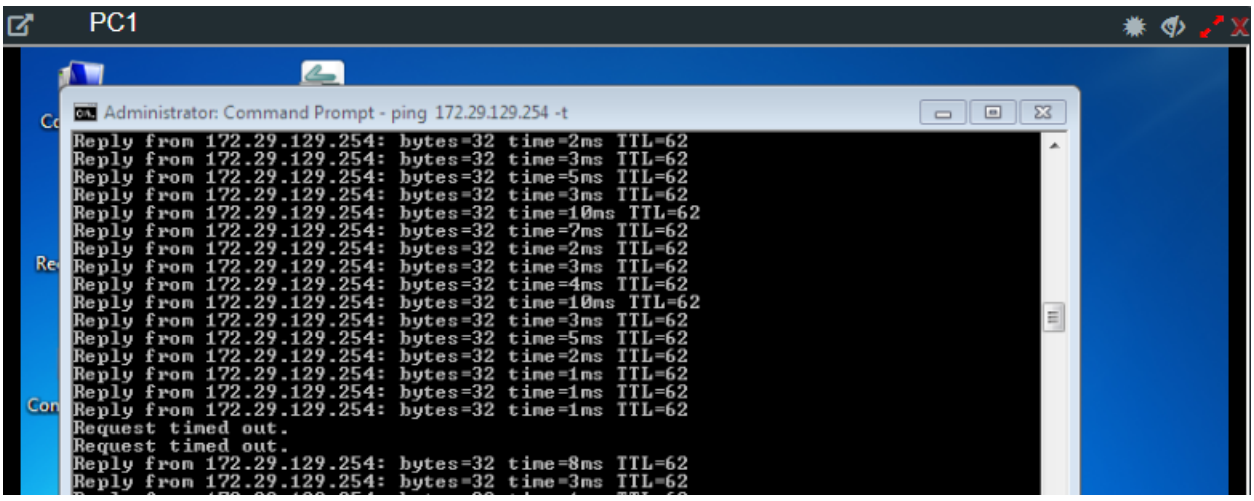
Let’s check the traceroute again this time it is using WAN2 secondary internet Link.



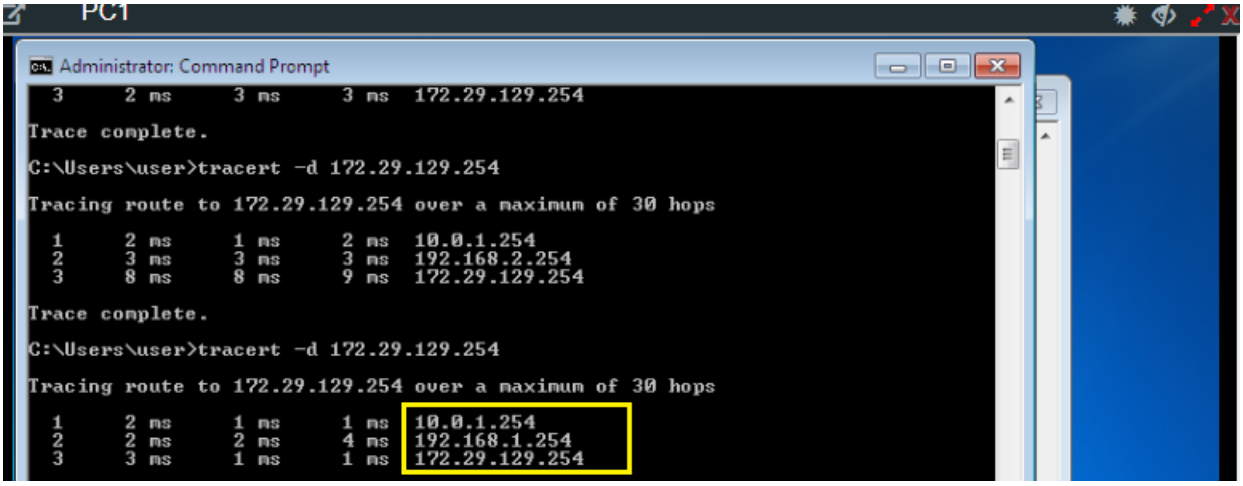
Let’s enable Primary WAN1 link and bring down and suspend WAN2 Link.



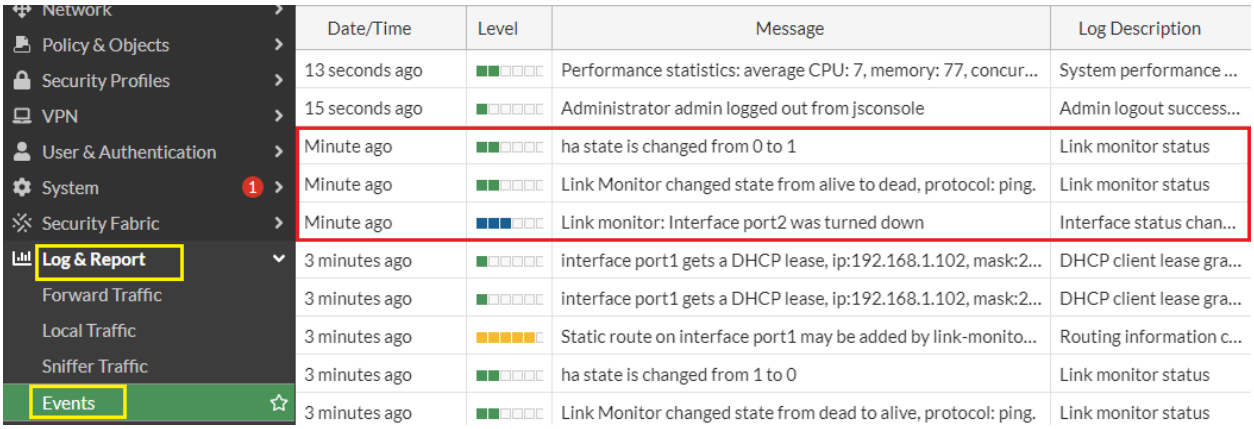
The ping is still continuing only few drops.



Let’s check the traceroute again this time it is using WAN1 Primary Internet Link again.



When WAN1 link goes down, navigate to system event logs as below and verify the logs FortiGate GUI -> Log and Report >Events >System Events.



When one link is down verifying the Routing table through CLI it will show only one route.