Load Balancing and Fail-Over in Router Os

Presented By

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simplifi networks

About Simplifinetworks

- Largest Mikrotik Routerboard Distributor in E/A.
- WiFi AP, PTP, PTMP, Security

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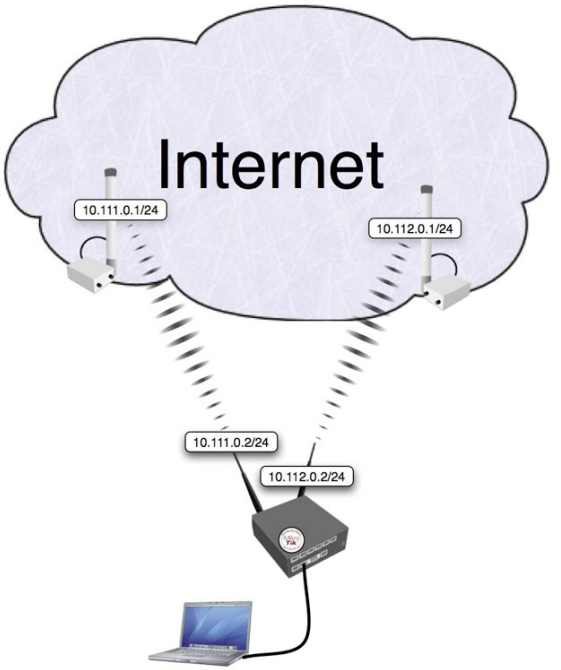
simplifi networks

About Presenter

- Router Os user since 2015
- Big fan of API..(php)
- First MUM :)
- Affiliation
  - Simplifinetworks
  - netLabsUG Research project @ Makerere University Kampala

Agenda

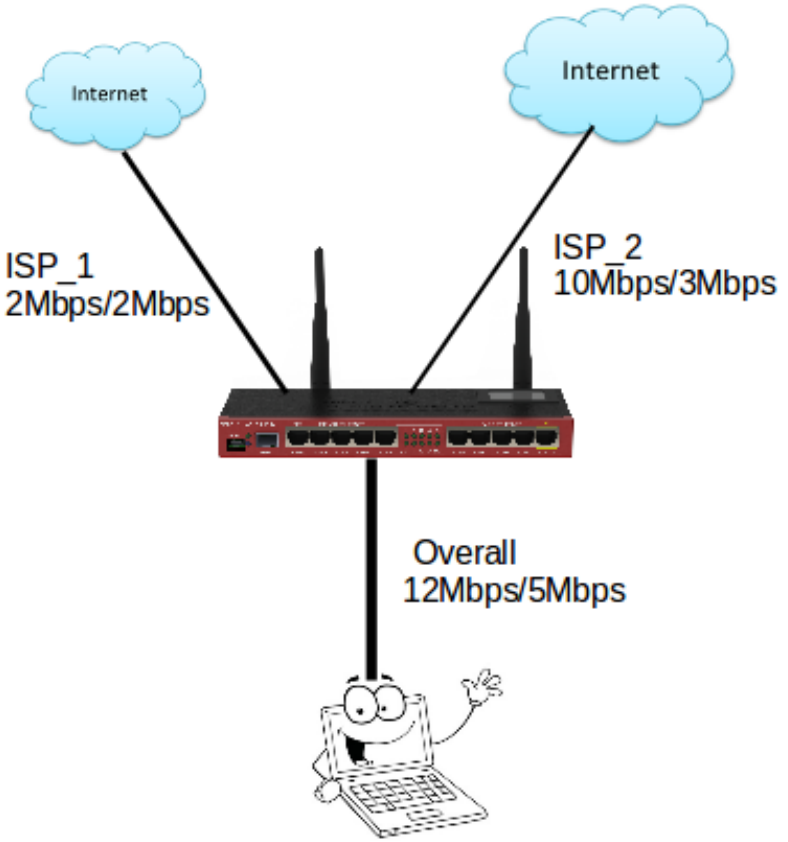
- Load Balancing



- SimplifiApp

SimplifiApp

Load Balancing...



- Hotspot provider
- Hotel /Office/Hostel/Hostel
- Apartments

Why

- Average speeds 2mb/2mb..slow.
- Always on requirement
- High Throughput need
- Cost considerations

Router OS options

- ECMP → Equal Cost Multi path Routing

  Traffic divided up per src-dst-address combination.

  Chances of traffic switching gateways when routing tables are periodically flushed.

- Nth Load Balancing

  Ties user to same source IP address (persistent user sessions)

Router OS options

- PCC→ Per Connection Classifier

  Splits traffic into streams according to a set of options (src-address, src-port, dst-address, dst-port) using a hashing algorithm.

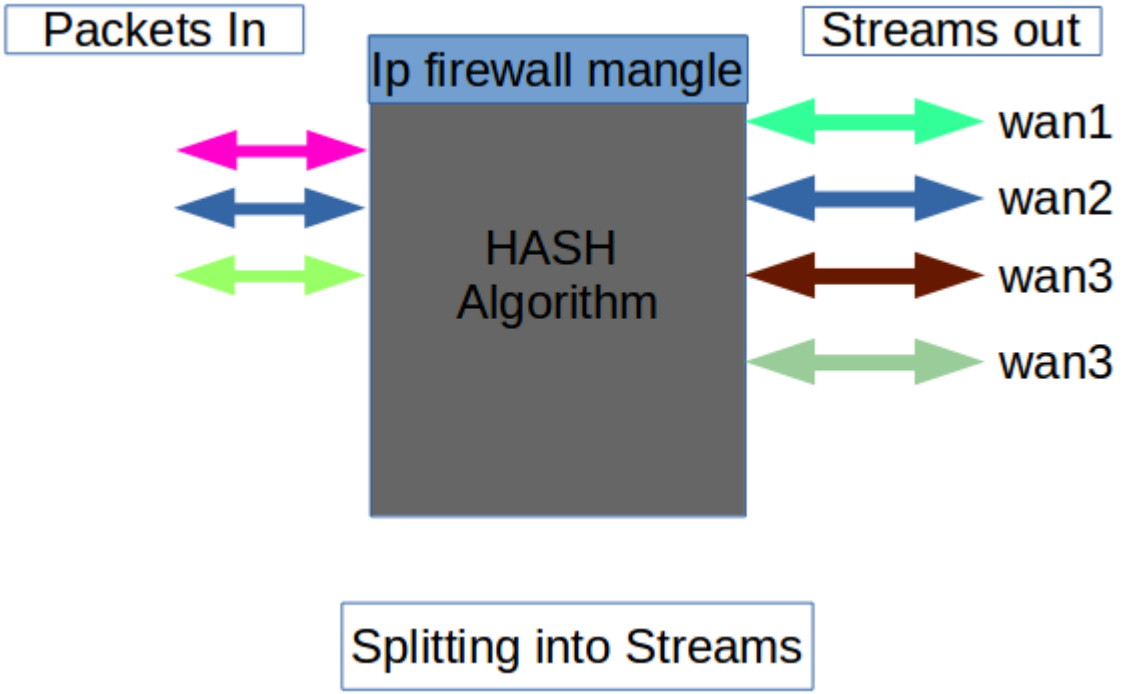
  For example:

  PCC= Hash(dst-address-and-port)/Denominator-> Reminder

  - Remainder=> 0-4294967295 (integer number)
  - Denominator=> 1-4294967295 (integer number)
  - ValuesToHash ::= both-addresses|both-ports|dst-address-and-port|
  - src-address|src-port|both-addresses-and-ports|dst-address|dst-port|src-address-and-port

  If reminder equals X label connection 1/stream1

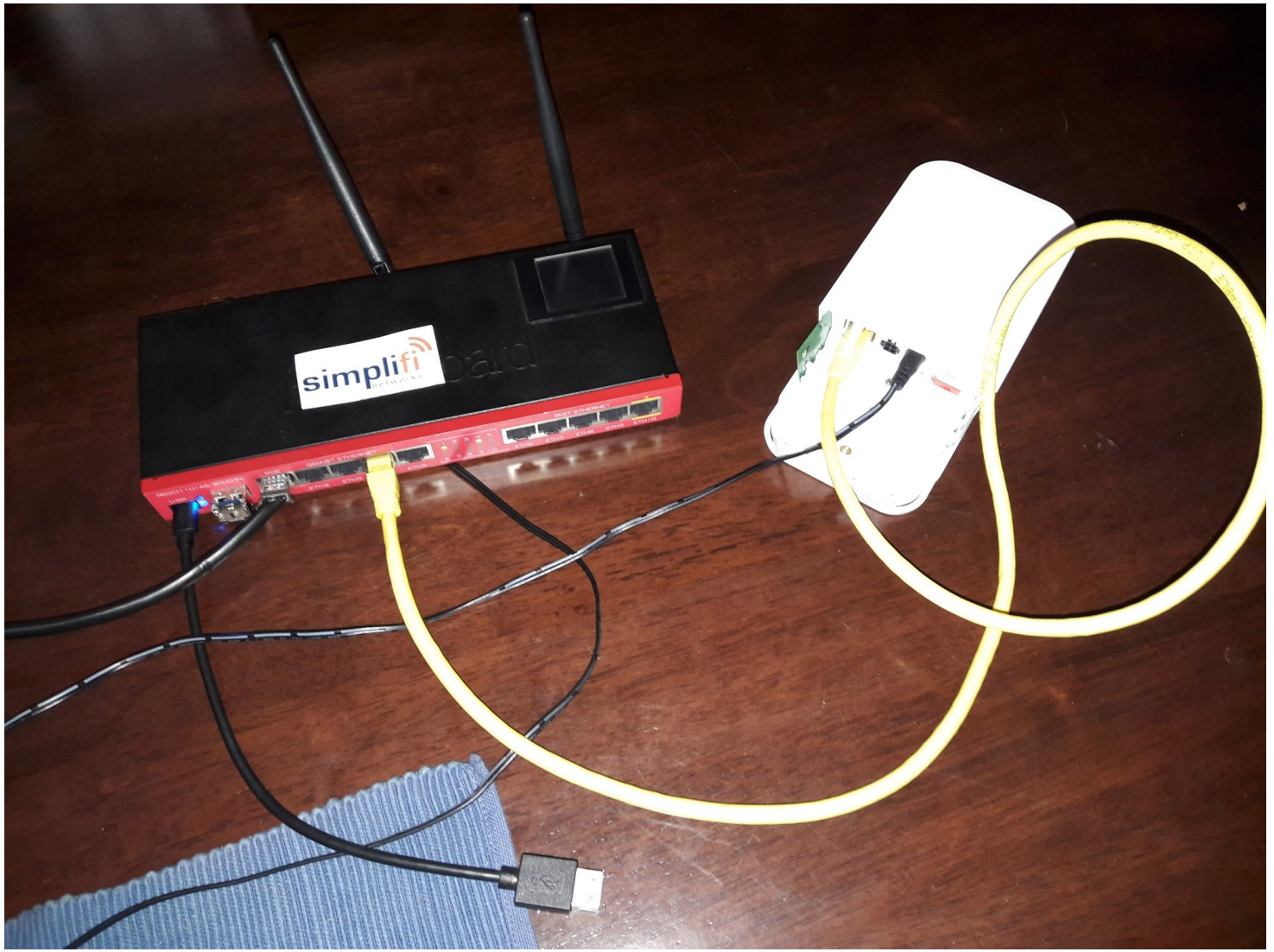
Router Os Options



What you need!!

- Mikrotik Routerboard -> RouterOs v3.48 & above.
- 2 or more Internet connections.
  - Wan1 192.168.30.2
  - Wan2 192.168.42.2
  - Lan 192.168.88.0/24

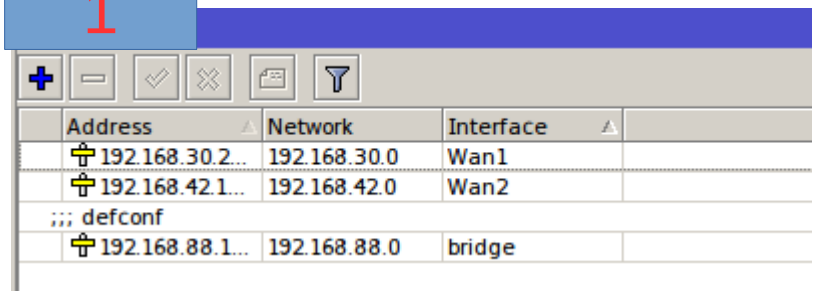
Set Up



Set Up

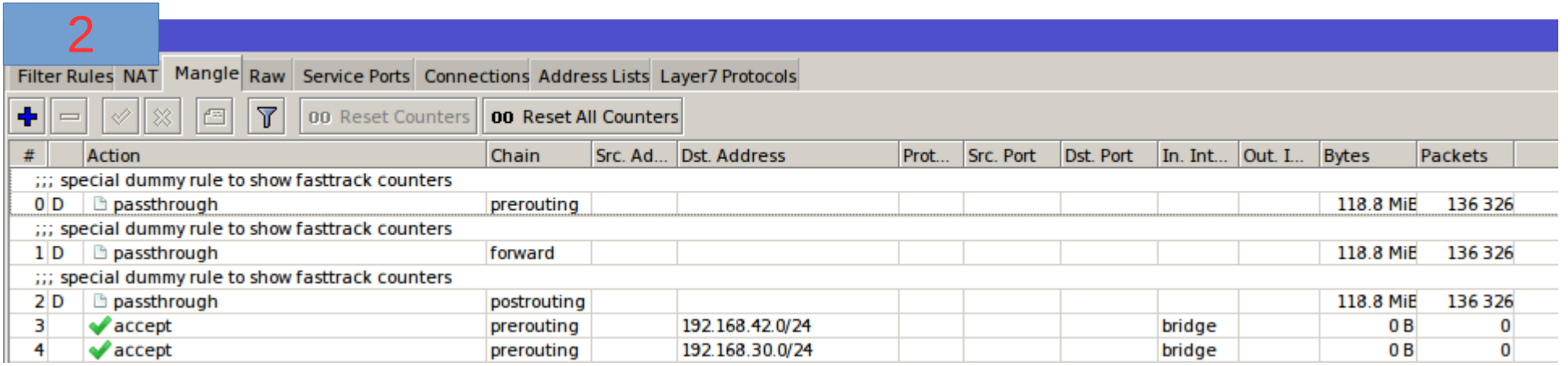
- Add addresses
- Accept traffic in the prerouting chain

1



Address	Network	Interface
192.168.30.2...	192.168.30.0	Wan1
192.168.42.1...	192.168.42.0	Wan2
;;; defconf		
192.168.88.1...	192.168.88.0	bridge

2



Filter Rules | NAT | Mangle | Raw | Service Ports | Connections | Address Lists | Layer7 Protocols

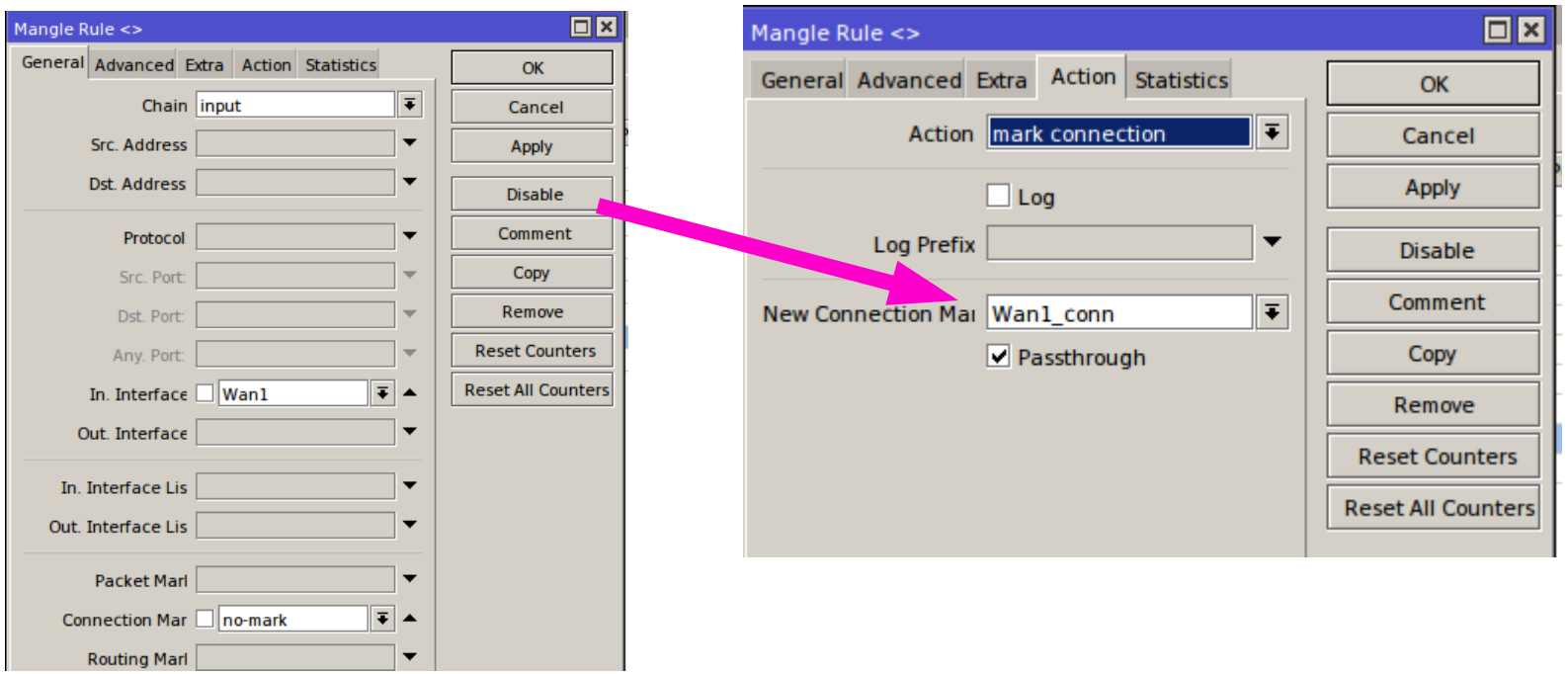
00 Reset Counters | 00 Reset All Counters

#		Action	Chain	Src. Ad...	Dst. Address	Prot...	Src. Port	Dst. Port	In. Int...	Out. I...	Bytes	Packets
;;; special dummy rule to show fasttrack counters												
0	D	passthrough	prerouting								118.8 MiB	136 326
;;; special dummy rule to show fasttrack counters												
1	D	passthrough	forward								118.8 MiB	136 326
;;; special dummy rule to show fasttrack counters												
2	D	passthrough	postrouting								118.8 MiB	136 326
3		accept	prerouting		192.168.42.0/24				bridge		0 B	0
4		accept	prerouting		192.168.30.0/24				bridge		0 B	0

/ ip address
add address=192.168.88.1/24 network=192.168.88.0 interface=bridge
add address= 192.168.30.2/24 network=192.168.30.0 interface=Wan1
add address=192.168.42.2/24 network=192.168.42.0 interface=Wan2
/ip firewall mangle
add action=accept chain=prerouting dst-address=192.168.42.0/24 in-interface=bridge
add action=accept chain=prerouting dst-address=192.168.30.0/24 in-interface=bridge

Set Up

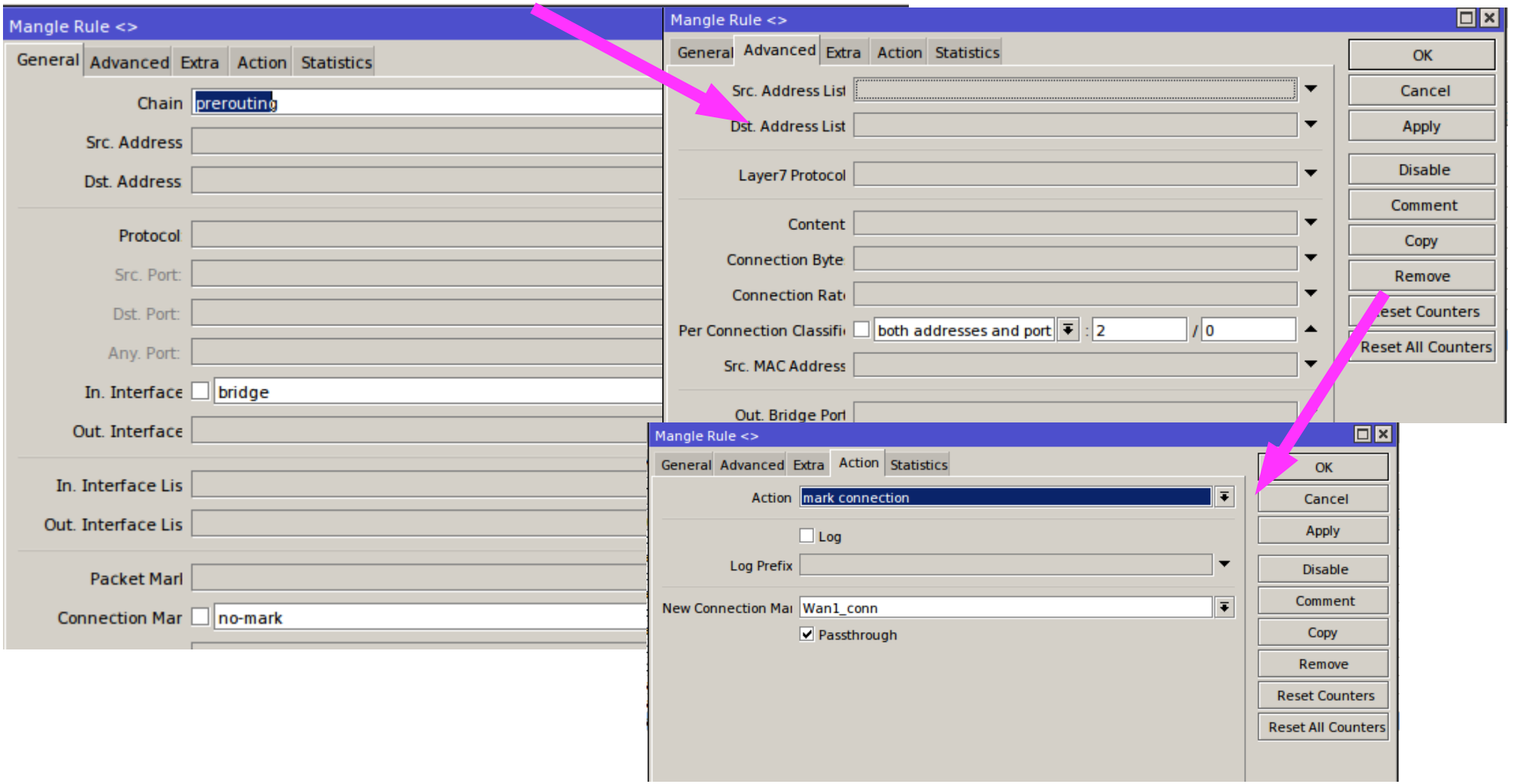
- Mark traffic from the Internet to avoid replies using wrong gateway.



/ip firewall mangle
add action=mark-connection chain=input connection-mark=no-mark in-interface=Wan1 new-connection-mark=Wan1_conn passthrough=yes
add action=mark-connection chain=input connection-mark=no-mark in-interface=Wan2 new-connection-mark=Wan2_conn passthrough=yes

Set Up

- Add the PCC rules in Ip mangle menu and mark connections



Set Up

/ip firewall mangle
add action=mark-connection chain=prerouting connection-mark=no-mark dst-address-type=!local in-interface=bridge new-connection-mark=Wan1_conn passthrough=yes per-connection-classifier=both-addresses-and-ports:2/0
add action=mark-connection chain=prerouting connection-mark=no-mark dst-address-type=!local in-interface=bridge new-connection-mark=Wan2_conn passthrough=yes per-connection-classifier=both-addresses-and-ports:2/1

- **Add routing mark in prerouting and output chains**

/ip firewall mangle
add action=mark-routing chain=prerouting connection-mark=Wan1_conn in-interface=bridge new-routing-mark=to_Wan1 passthrough=no
add action=mark-routing chain=prerouting connection-mark=Wan2_conn in-interface=bridge new-routing-mark=to_Wan2 passthrough=no

add action=mark-routing chain=output connection-mark=Wan1_conn new-routing-mark=to_Wan1
add action=mark-routing chain=output connection-mark=Wan2_conn new-routing-mark=to_Wan2

Set Up

Firewall

Filter Rules | NAT | Mangle | Raw | Service Ports | Connections | Address Lists | Layer7 Protocols

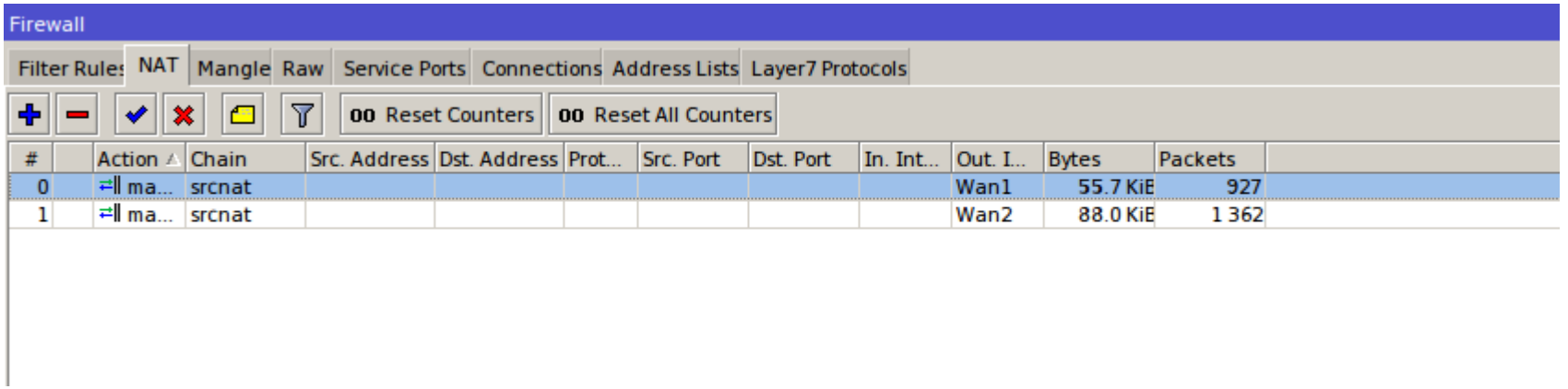
00 Reset Counters | 00 Reset All Counters | Find

#		Action	Chain	Src. Ad...	Dst. Address	Prot...	Src. Port	Dst. Port	In. Int...	Out. I...	Bytes	Packets
;;; special dummy rule to show fasttrack counters												
0	D	passthrough	prerouting								118.8 MiB	136 433
;;; special dummy rule to show fasttrack counters												
1	D	passthrough	forward								118.8 MiB	136 433
;;; special dummy rule to show fasttrack counters												
2	D	passthrough	postrouting								118.8 MiB	136 433
3		accept	prerouting		192.168.42.0/24				bridge		0 B	0
4		accept	prerouting		192.168.30.0/24				bridge		0 B	0
5		mark connection	input						Wan1		20.7 KiB	254
6		mark connection	input						Wan2		73.5 KiB	561
7		mark connection	prerouting						bridge		21.0 KiB	339
8		mark connection	prerouting						bridge		33.3 KiB	436
9		mark routing	prerouting						bridge		436.7 KiB	3 147
10		mark routing	prerouting						bridge		473.1 KiB	7 536
11		mark routing	output								549 B	6
12		mark routing	output								2699 B	39

Masquerade Rule

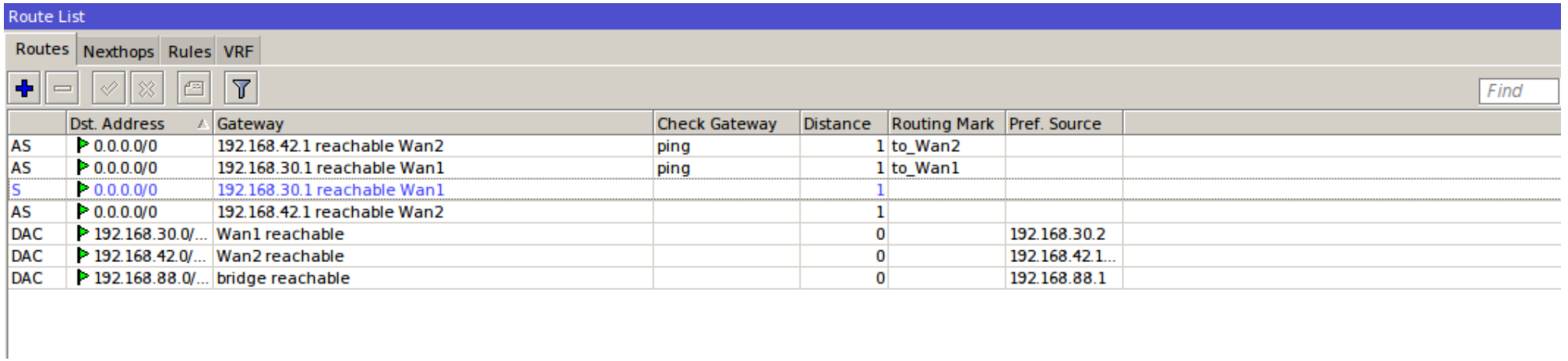
- Add a masquerade rule for each Wan connection in *ip firewall nat;*

  /ip firewall nat
  add action=masquerade chain=srcnat out-interface=Wan1
  add action=masquerade chain=srcnat out-interface=Wan2



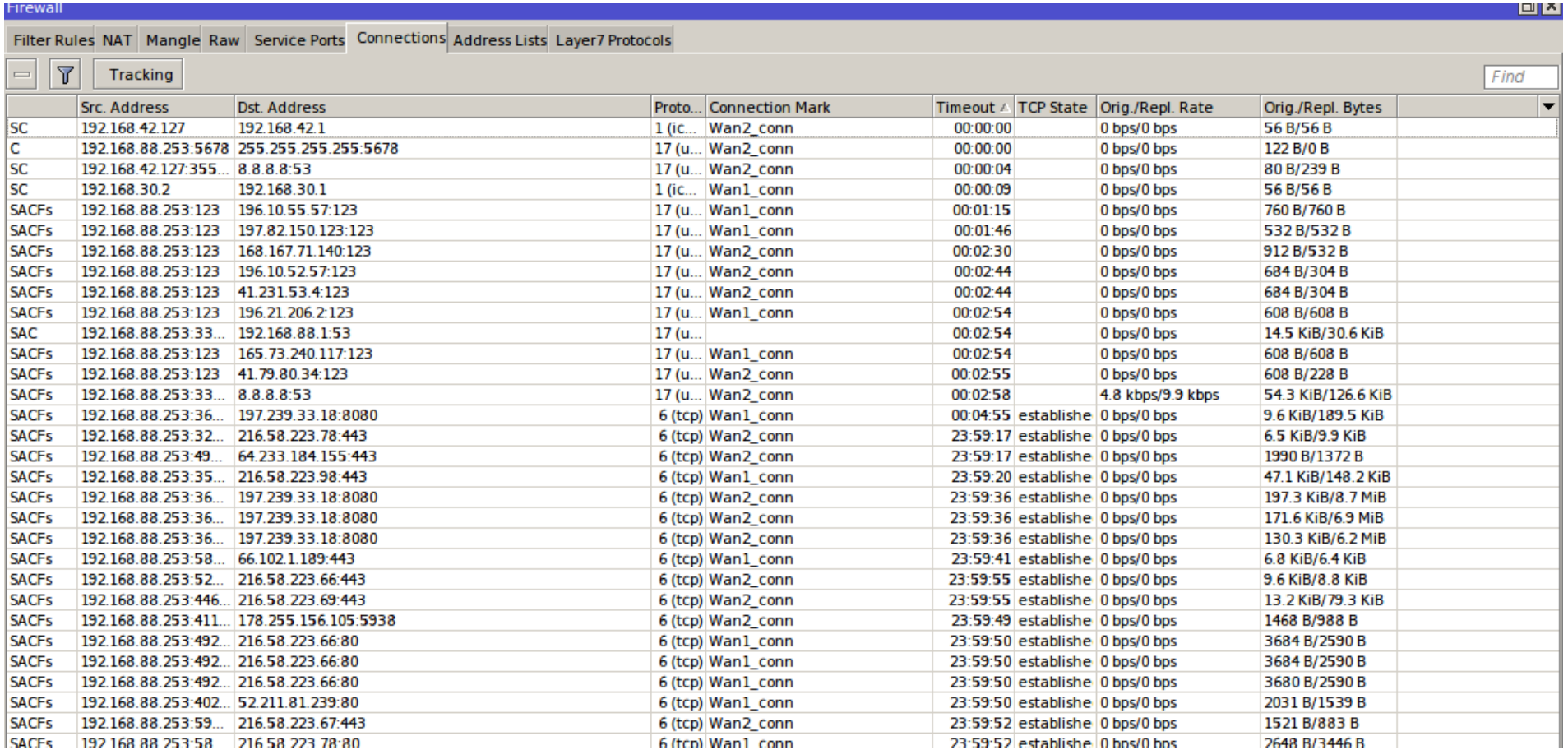
Set Up

- **Routing Table**



	Dst. Address	Gateway	Check Gateway	Distance	Routing Mark	Pref. Source
AS	0.0.0.0/0	192.168.42.1 reachable Wan2	ping	1	to_Wan2	
AS	0.0.0.0/0	192.168.30.1 reachable Wan1	ping	1	to_Wan1	
S	0.0.0.0/0	192.168.30.1 reachable Wan1		1		
AS	0.0.0.0/0	192.168.42.1 reachable Wan2		1		
DAC	192.168.30.0/...	Wan1 reachable		0		192.168.30.2
DAC	192.168.42.0/...	Wan2 reachable		0		192.168.42.1...
DAC	192.168.88.0/...	bridge reachable		0		192.168.88.1

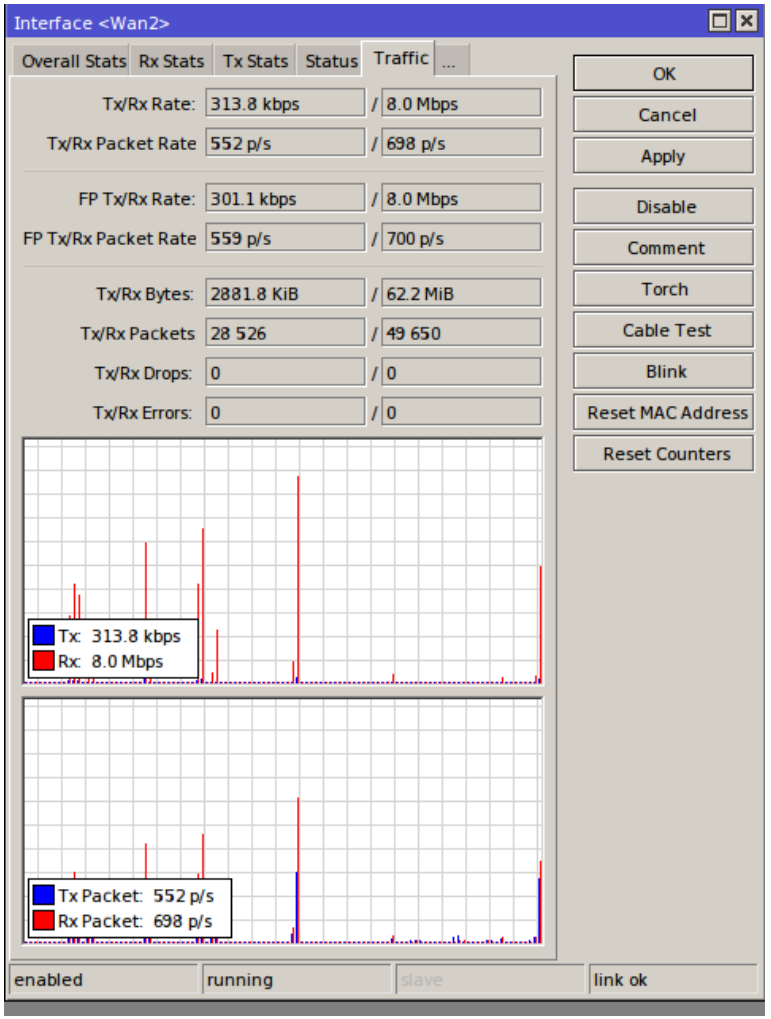
Set Up

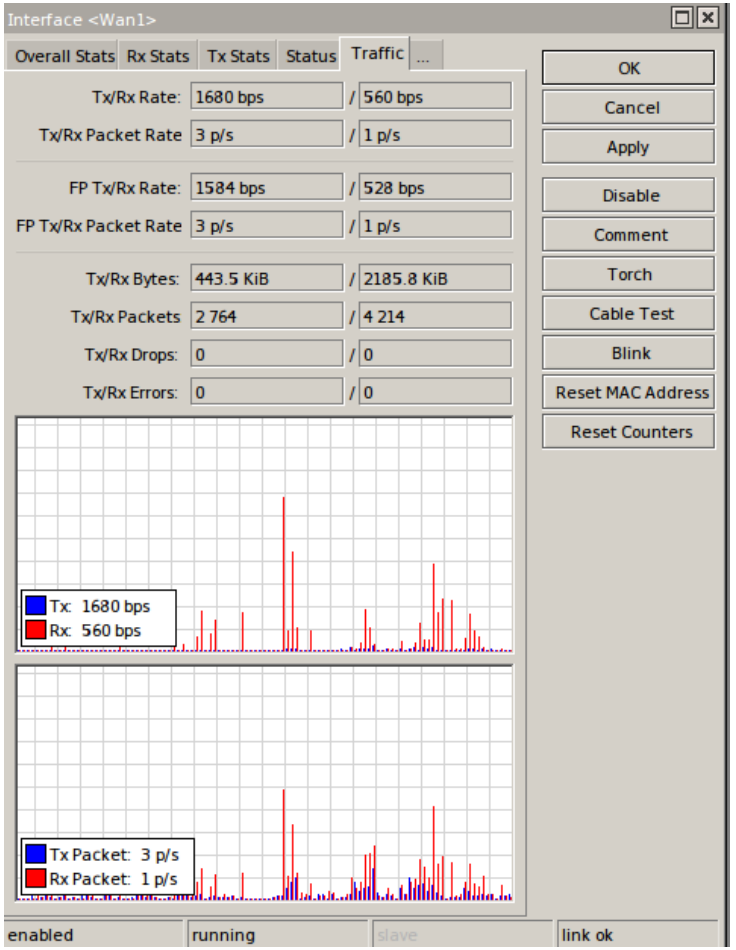


	Src. Address	Dst. Address	Proto...	Connection Mark	Timeout	TCP State	Orig./Repl. Rate	Orig./Repl. Bytes
SC	192.168.42.127	192.168.42.1	1 (ic...	Wan2_conn	00:00:00		0 bps/0 bps	56 B/56 B
C	192.168.88.253:5678	255.255.255.255:5678	17 (u...	Wan2_conn	00:00:00		0 bps/0 bps	122 B/0 B
SC	192.168.42.127:355...	8.8.8.8:53	17 (u...	Wan2_conn	00:00:04		0 bps/0 bps	80 B/239 B
SC	192.168.30.2	192.168.30.1	1 (ic...	Wan1_conn	00:00:09		0 bps/0 bps	56 B/56 B
SACFs	192.168.88.253:123	196.10.55.57:123	17 (u...	Wan1_conn	00:01:15		0 bps/0 bps	760 B/760 B
SACFs	192.168.88.253:123	197.82.150.123:123	17 (u...	Wan1_conn	00:01:46		0 bps/0 bps	532 B/532 B
SACFs	192.168.88.253:123	168.167.71.140:123	17 (u...	Wan2_conn	00:02:30		0 bps/0 bps	912 B/532 B
SACFs	192.168.88.253:123	196.10.52.57:123	17 (u...	Wan2_conn	00:02:44		0 bps/0 bps	684 B/304 B
SACFs	192.168.88.253:123	41.231.53.4:123	17 (u...	Wan2_conn	00:02:44		0 bps/0 bps	684 B/304 B
SACFs	192.168.88.253:123	196.21.206.2:123	17 (u...	Wan1_conn	00:02:54		0 bps/0 bps	608 B/608 B
SAC	192.168.88.253:33...	192.168.88.1:53	17 (u...		00:02:54		0 bps/0 bps	14.5 KiB/30.6 KiB
SACFs	192.168.88.253:123	165.73.240.117:123	17 (u...	Wan1_conn	00:02:54		0 bps/0 bps	608 B/608 B
SACFs	192.168.88.253:123	41.79.80.34:123	17 (u...	Wan2_conn	00:02:55		0 bps/0 bps	608 B/228 B
SACFs	192.168.88.253:33...	8.8.8.8:53	17 (u...	Wan2_conn	00:02:58		4.8 kbps/9.9 kbps	54.3 KiB/126.6 KiB
SACFs	192.168.88.253:36...	197.239.33.18:8080	6 (tcp)	Wan1_conn	00:04:55	establishe	0 bps/0 bps	9.6 KiB/189.5 KiB
SACFs	192.168.88.253:32...	216.58.223.78:443	6 (tcp)	Wan2_conn	23:59:17	establishe	0 bps/0 bps	6.5 KiB/9.9 KiB
SACFs	192.168.88.253:49...	64.233.184.155:443	6 (tcp)	Wan2_conn	23:59:17	establishe	0 bps/0 bps	1990 B/1372 B
SACFs	192.168.88.253:35...	216.58.223.98:443	6 (tcp)	Wan1_conn	23:59:20	establishe	0 bps/0 bps	47.1 KiB/148.2 KiB
SACFs	192.168.88.253:36...	197.239.33.18:8080	6 (tcp)	Wan2_conn	23:59:36	establishe	0 bps/0 bps	197.3 KiB/8.7 MiB
SACFs	192.168.88.253:36...	197.239.33.18:8080	6 (tcp)	Wan2_conn	23:59:36	establishe	0 bps/0 bps	171.6 KiB/6.9 MiB
SACFs	192.168.88.253:36...	197.239.33.18:8080	6 (tcp)	Wan2_conn	23:59:36	establishe	0 bps/0 bps	130.3 KiB/6.2 MiB
SACFs	192.168.88.253:58...	66.102.1.189:443	6 (tcp)	Wan1_conn	23:59:41	establishe	0 bps/0 bps	6.8 KiB/6.4 KiB
SACFs	192.168.88.253:52...	216.58.223.66:443	6 (tcp)	Wan2_conn	23:59:55	establishe	0 bps/0 bps	9.6 KiB/8.8 KiB
SACFs	192.168.88.253:446...	216.58.223.69:443	6 (tcp)	Wan2_conn	23:59:55	establishe	0 bps/0 bps	13.2 KiB/79.3 KiB
SACFs	192.168.88.253:411...	178.255.156.105:5938	6 (tcp)	Wan2_conn	23:59:49	establishe	0 bps/0 bps	1468 B/988 B
SACFs	192.168.88.253:492...	216.58.223.66:80	6 (tcp)	Wan1_conn	23:59:50	establishe	0 bps/0 bps	3684 B/2590 B
SACFs	192.168.88.253:492...	216.58.223.66:80	6 (tcp)	Wan1_conn	23:59:50	establishe	0 bps/0 bps	3684 B/2590 B
SACFs	192.168.88.253:492...	216.58.223.66:80	6 (tcp)	Wan1_conn	23:59:50	establishe	0 bps/0 bps	3680 B/2590 B
SACFs	192.168.88.253:402...	52.211.81.239:80	6 (tcp)	Wan1_conn	23:59:50	establishe	0 bps/0 bps	2031 B/1539 B
SACFs	192.168.88.253:59...	216.58.223.67:443	6 (tcp)	Wan2_conn	23:59:52	establishe	0 bps/0 bps	1521 B/883 B
SACFs	192.168.88.253:58...	216.58.223.78:80	6 (tcp)	Wan1_conn	23:59:52	establishe	0 bps/0 bps	2648 B/3446 B

Set Up

- Traffic





Speed Test


Speed Results
DOWNLOAD SPEED
UPLOAD SPEED
11.12 Mbps
5.34 Mbps
Latency
301 ms
Protocol
IPv4
Host
Foxboro, MA
Learn about the things that may affect your test results.
Test Again
Speed Survey

Considerations

PCC with Hotspot

- See: https://wiki.mikrotik.com/wiki/Manual:Hotspot_with_PCC

Third WAN connection

- Just modify PCC rule and corresponding routing mark and default route

/ip firewall mangle
add action=mark-connection chain=prerouting connection-mark=no-mark dst-address-type=!local in-interface=bridge new-connection-mark=Wan1_conn passthrough=yes per-connection-classifier=both-addresses-and-ports:3/0
add action=mark-connection chain=prerouting connection-mark=no-mark dst-address-type=!local in-interface=bridge new-connection-mark=Wan2_conn passthrough=yes per-connection-classifier=both-addresses-and-ports:3/1

add action=mark-connection chain=prerouting connection-mark=no-mark dst-address-type=!local in-interface=bridge new-connection-mark=Wan3_conn passthrough=yes per-connection-classifier=both-addresses-and-ports:3/2

Resources

- https://wiki.mikrotik.com/wiki/Manual:PCC
- https://wiki.mikrotik.com/wiki/ECMP_load_balancing_with_masquerade
- https://mum.mikrotik.com/presentations/US12/steve.pdf


Q&A


THANK
YOU !