

Tes Layar 1

Tes Layar 2



Permasalahan Umum (SMB / Micro Provider / ISP Perintis)

1. Tidak Ada Pembagian Beban yang Optimal

- Trafik menumpuk di 1 ISP saja
- ISP lain nganggur (idle)
- Bandwidth tidak dimanfaatkan maksimal

Permasalahan Umum (SMB / Micro Provider / ISP Perintis)

1. Tidak Ada Pembagian Beban yang Optimal

- Trafik menumpuk di 1 ISP saja
- ISP lain nganggur (idle)
- Bandwidth tidak dimanfaatkan maksimal

2. Perbedaan Bandwidth Antar ISP

- Contoh: 50 Mbps + 20 Mbps + 10 Mbps
- Tanpa metode yang tepat → distribusi tidak adil
- Hasilnya:
 - Ada jalur cepat tapi tetap penuh
 - Ada jalur lambat tapi tetap dipakai berlebihan



Permasalahan Umum (SMB / Micro Provider / ISP Perintis)

1. Tidak Ada Pembagian Beban yang Optimal

- Trafik menumpuk di 1 ISP saja
- ISP lain nganggur (idle)
- Bandwidth tidak dimanfaatkan maksimal

3. Tidak Ada Failover yang Cepat & Akurat

- ISP mati tapi default routing masih mengarah ke ISP tersebut
- Delay perpindahan koneksi lama
- User merasakan:
 - Timeout
 - Request gagal
 - Aplikasi putus

2. Perbedaan Bandwidth Antar ISP

- Contoh: 50 Mbps + 20 Mbps + 10 Mbps
- Tanpa metode yang tepat → distribusi tidak adil
- Hasilnya:
 - Ada jalur cepat tapi tetap penuh
 - Ada jalur lambat tapi tetap dipakai berlebihan



Permasalahan Umum (SMB / Micro Provider / ISP Perintis)

1. Tidak Ada Pembagian Beban yang Optimal

- Trafik menumpuk di 1 ISP saja
- ISP lain nganggur (idle)
- Bandwidth tidak dimanfaatkan maksimal

3. Tidak Ada Failover yang Cepat & Akurat

- ISP mati tapi default routing masih mengarah ke ISP tersebut
- Delay perpindahan koneksi lama
- User merasakan:
 - Timeout
 - Request gagal
 - Aplikasi putus

2. Perbedaan Bandwidth Antar ISP

- Contoh: 50 Mbps + 20 Mbps + 10 Mbps
- Tanpa metode yang tepat → distribusi tidak adil
- Hasilnya:
 - Ada jalur cepat tapi tetap penuh
 - Ada jalur lambat tapi tetap dipakai berlebihan

4. Koneksi Tidak Stabil (Flapping / Intermittent)

- ISP tidak benar-benar “down”, koneksi domestik jalan tapi internasional’nya putus
- Router tetap menganggap gateway aktif
- Akibatnya:
 - Loss tinggi
 - User/client tetap merasa “internet jelek”



Permasalahan Umum (SMB / Micro Provider / ISP Perintis)

1. Tidak Ada Pembagian Beban yang Optimal

- Trafik menumpuk di 1 ISP saja
- ISP lain nganggur (idle)
- Bandwidth tidak dimanfaatkan maksimal

3. Tidak Ada Failover yang Cepat & Akurat

- ISP mati tapi default routing masih mengarah ke ISP tersebut
- Delay perpindahan koneksi lama
- User merasakan:
 - Timeout
 - Request gagal
 - Aplikasi putus

2. Perbedaan Bandwidth Antar ISP

- Contoh: 50 Mbps + 20 Mbps + 10 Mbps
- Tanpa metode yang tepat → distribusi tidak adil
- Hasilnya:
 - Ada jalur cepat tapi tetap penuh
 - Ada jalur lambat tapi tetap dipakai berlebihan

4. Koneksi Tidak Stabil (Flapping / Intermittent)

- ISP tidak benar-benar “down”, koneksi domestik jalan tapi internasional’nya putus
- Router tetap menganggap gateway aktif
- Akibatnya:
 - Loss tinggi
 - User/client tetap merasa “internet jelek”

5. Manajemen Routing Masih Sederhana

- Static route biasa tanpa monitoring
- Tidak ada pengecekan real internet (hanya gateway pertama hidup/mati)
- Tidak scalable untuk berkembang/jika ada maintenance

“Untuk menjawab permasalahan tersebut, kita butuh kombinasi teknik yang bukan hanya membagi beban, tapi juga memastikan **koneksi tetap hidup dan terbagi** secara otomatis.”

Tujuan Solusi :

- Membagi beban trafik secara optimal
- Memaksimalkan semua jalur ISP
- Menjaga koneksi tetap aktif
- Meminimalkan downtime

Konsep Solusi :

- Load Balance : PCC
- Failover : Recursive Gateway
- Platform: RouterOS v7

Apa itu PCC?

- Per Connection Classifier,
- Membagi koneksi, bukan bandwidth
- Stabil untuk multi user

“PCC bukan bagi kecepatan, tapi membagi koneksi berdasarkan session.”

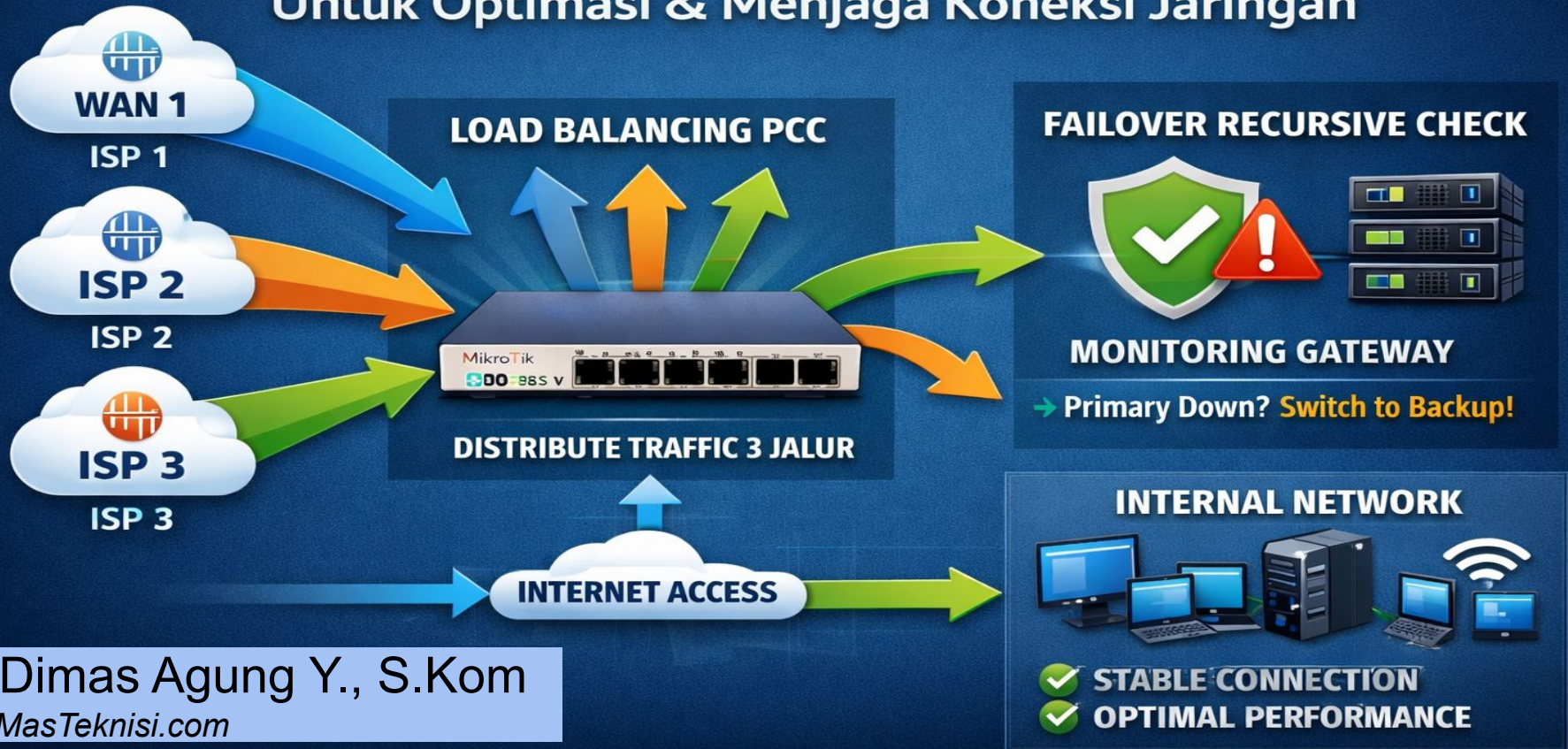
Apa itu Recursive Gateway?

- Teknik pengecekan gateway berlapis
- Tidak hanya cek gateway lokal
- Tapi cek koneksi ke internet (misal 8.8.8.8)
- Failover : jika ISP down route pindah ke jalur lain (auto)

“Ini penting supaya kita tahu ISP benar-benar ‘hidup’, bukan sekadar gateway konek.”

Load Balance PCC 3 Jalur WAN dan Fail Over Recursive Gateway di ROS v.7

Untuk Optimasi & Menjaga Koneksi Jaringan



Dimas Agung Y., S.Kom
MasTeknisi.com

Topologi Simulasi

1RB induk - 1 RB Load Balance - 1 PC/laptop

@RB Induk

Simple-Queue 3 interface WAN

@RB Load balance

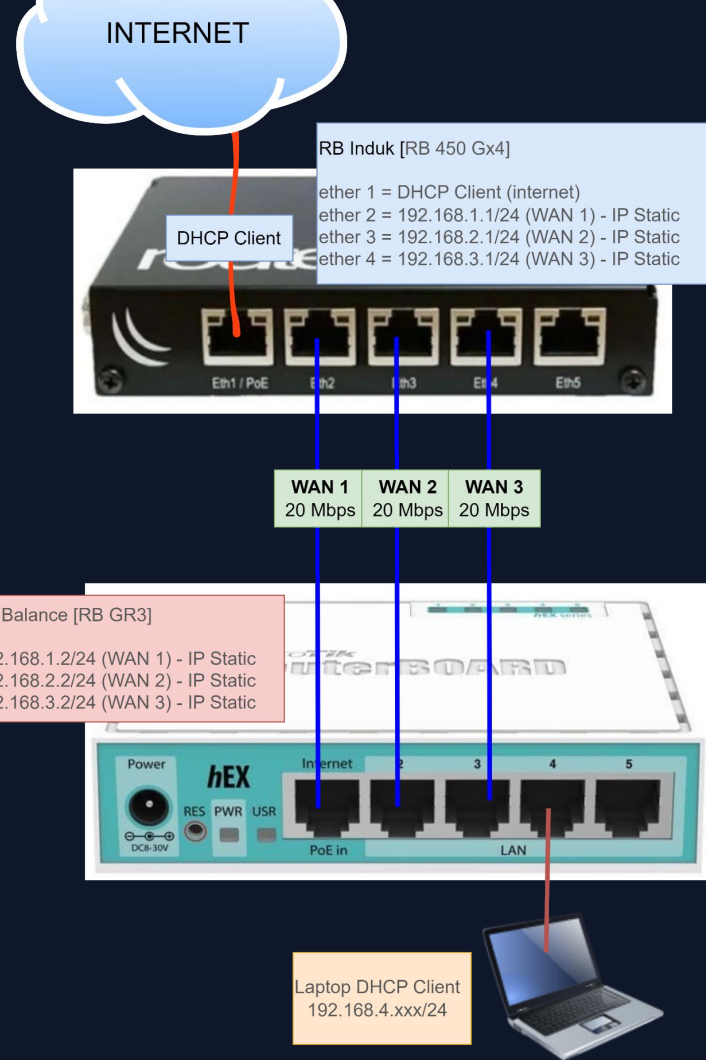
ether 1 = 192.168.1.2/24 (WAN 1) - IP Static

ether 2 = 192.168.2.2/24 (WAN 2) - IP Static

ether 3 = 192.168.3.2/24 (WAN 3) - IP Static

ether 4 = 192.168.4.1/24 (LAN/Local) -

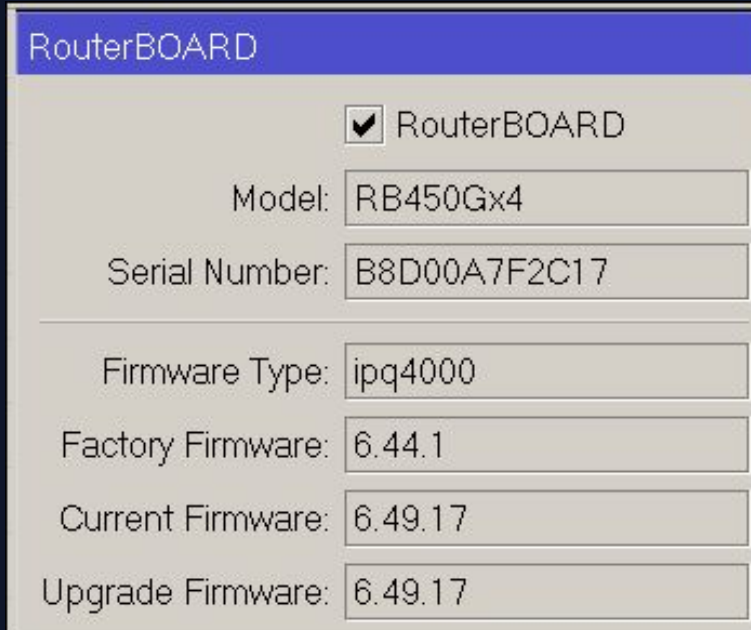
DHCP Server aktif di port 4



Perangkat Simulasi

RB Induk =
RB 450 Gx4
ROS 6.44.1
Firmware 6.49.17

RB Load Balance =
RB GR3
ROS 7.16 hEX (mmips)
Firmware 7.16



RouterBOARD

RouterBOARD

Model: RB450Gx4

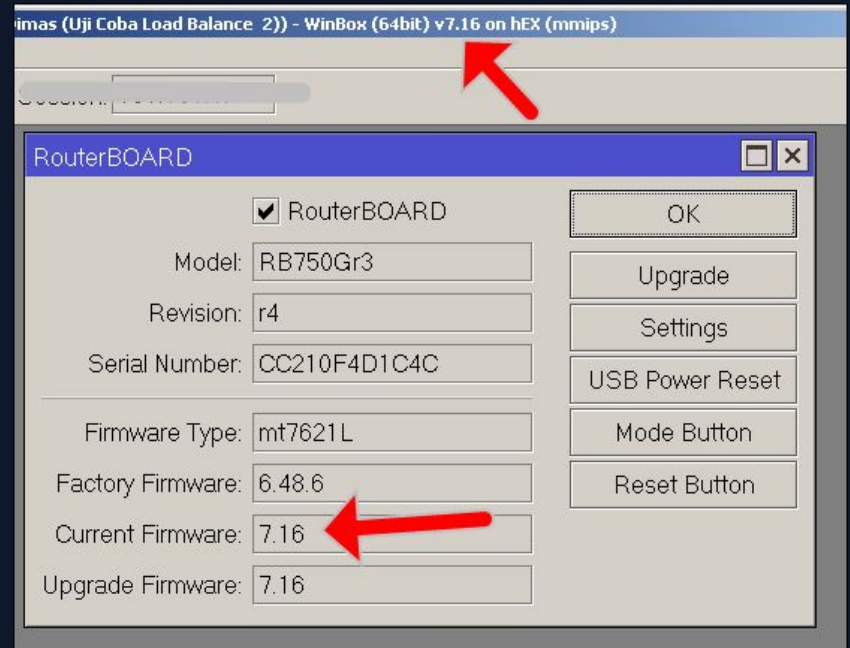
Serial Number: B8D00A7F2C17

Firmware Type: ipq4000

Factory Firmware: 6.44.1

Current Firmware: 6.49.17

Upgrade Firmware: 6.49.17



Simas (Uji Coba Load Balance 2)) - WinBox (64bit) v7.16 on hEX (mmips)

RouterBOARD

RouterBOARD

Model: RB750Gr3

Revision: r4

Serial Number: CC210F4D1C4C

Firmware Type: mt7621L

Factory Firmware: 6.48.6

Current Firmware: 7.16

Upgrade Firmware: 7.16

OK

Upgrade

Settings

USB Power Reset

Mode Button

Reset Button

Set name interface @RB Load Balance

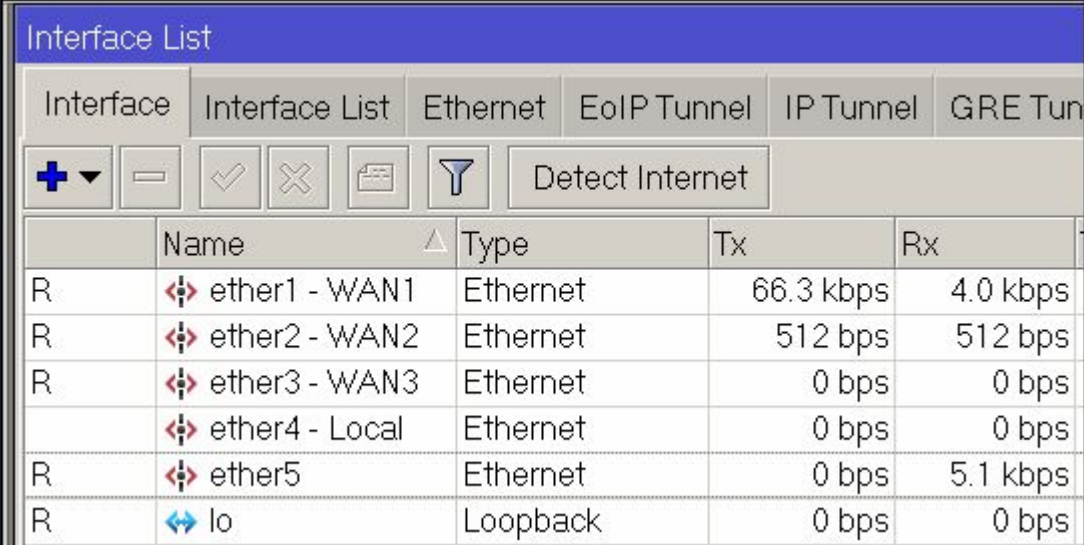
```
/interface ethernet
```

```
set [ find default-name=ether1 ]  
name="ether1 - WAN1"
```

```
set [ find default-name=ether2 ]  
name="ether2 - WAN2"
```

```
set [ find default-name=ether3 ]  
name="ether3 - WAN3"
```

```
set [ find default-name=ether4 ]  
name="ether4 - Local"
```



The screenshot shows the 'Interface List' window in Mikrotik WinBox. The window title is 'Interface List'. Below the title bar, there are several tabs: 'Interface', 'Interface List', 'Ethernet', 'EoIP Tunnel', 'IP Tunnel', and 'GRE Tunnel'. The 'Interface List' tab is active. Below the tabs, there is a toolbar with icons for adding (+), removing (-), checking (✓), unchecking (✗), deleting (trash), and filtering (funnel), along with a 'Detect Internet' button. The main area contains a table with the following data:

	Name	Type	Tx	Rx
R	ether1 - WAN1	Ethernet	66.3 kbps	4.0 kbps
R	ether2 - WAN2	Ethernet	512 bps	512 bps
R	ether3 - WAN3	Ethernet	0 bps	0 bps
	ether4 - Local	Ethernet	0 bps	0 bps
R	ether5	Ethernet	0 bps	5.1 kbps
R	lo	Loopback	0 bps	0 bps

Buat Routing Table

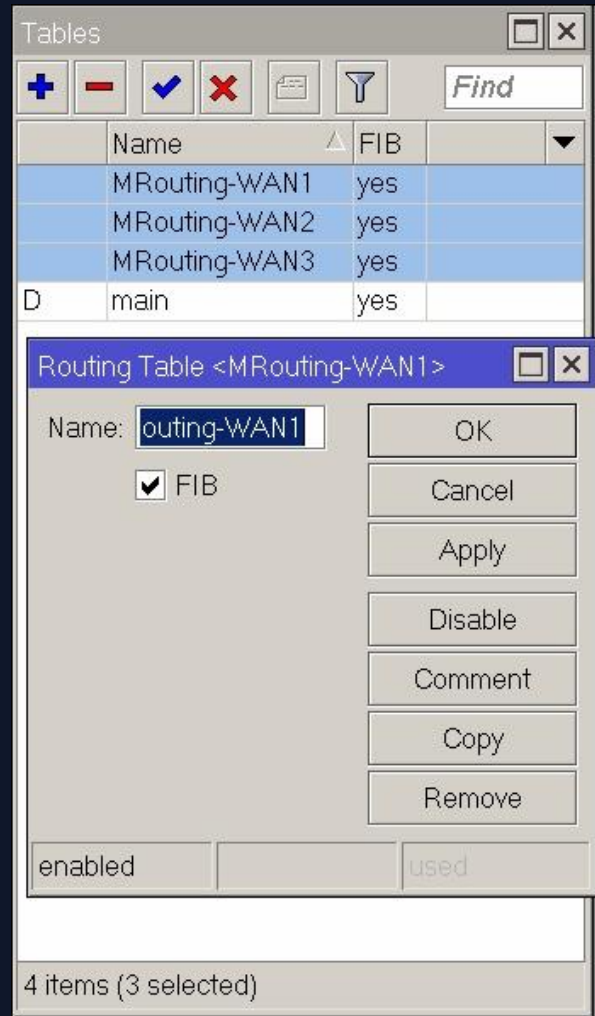
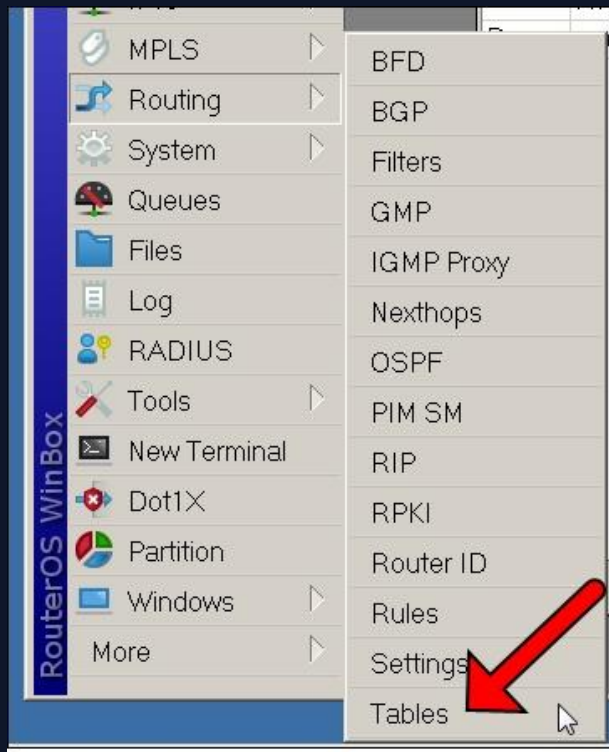
/routing table

add
name=MRouting-WAN1
disabled=no fib

add
name=MRouting-WAN2
add disabled=no fib

add
name=MRouting-WAN3
add disabled=no fib

Hal baru yg
diperkenalkan di ROS 7



Set DNS

```
/ip dns
```

```
set allow-remote-requests=yes
```

```
servers=8.8.8.8,1.1.1.1,9.9.9.9
```

DNS Settings

Servers: 8.8.8.8

1.1.1.1

9.9.9.9

Dynamic Servers:

Use DoH Server:

mDNS Repeater Interfaces:

Allow Remote Requests

VRF: main

Max UDP Packet Size: 4096

Query Server Timeout: 2.000 s

Query Total Timeout: 10.000 s

Max. Concurrent Queries: 100

Max. Concurrent TCP Sessions: 20

Cache Size: 2048 KIB

Cache Max TTL: 7d 00:00:00

Cache Used: 37 KIB

Set Interface List

```
/interface list
```

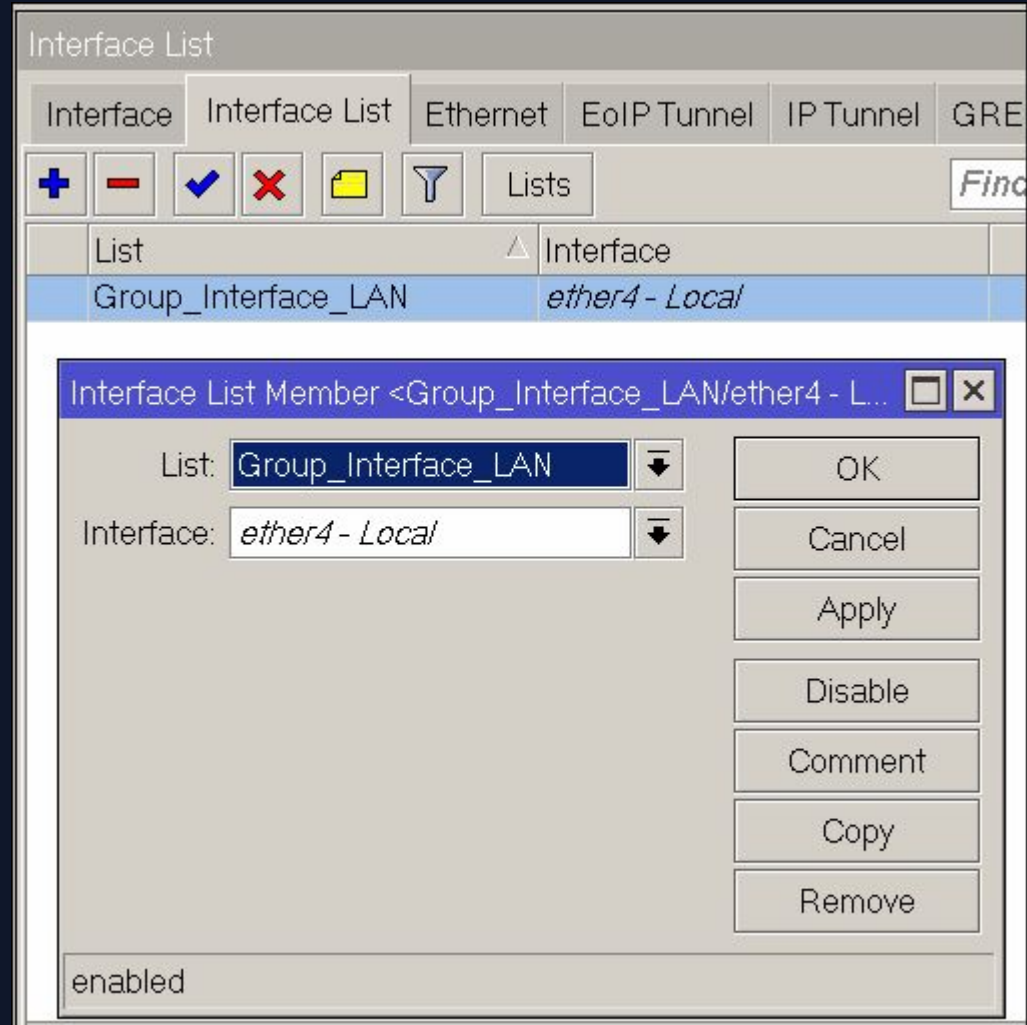
```
add name=Group_Interface_LAN
```

```
/interface list member
```

```
add interface="ether4 - Local"
```

```
list=Group_interface_LAN
```

konfig ini bisa di-alternatifkan dengan menyebutkan langsung scope IP address di firewall Mangle nantinya. Pembuatan "interface list" akan *terasa* ketika jaringan local ada banyak



Set IP Address

/ip address

```
add address=192.168.1.2/24
```

```
interface="ether1 - WAN1" network=192.168.1.0
```

```
add address=192.168.2.2/24
```

```
interface="ether2 - WAN2" network=192.168.2.0
```

```
add address=192.168.3.2/24
```

```
interface="ether3 - WAN3" network=192.168.3.0
```

```
add address=192.168.4.1/24
```

```
interface="ether4 - Local" network=192.168.4.0
```

The screenshot shows the Mikrotik WinBox 'Address List' window. It contains a table with the following data:

Address	Network	Interface
192.168.1.2/24	192.168.1.0	ether1 - WAN1
192.168.2.2/24	192.168.2.0	ether2 - WAN2
192.168.3.2/24	192.168.3.0	ether3 - WAN3
192.168.4.1/24	192.168.4.0	ether4 - Local

A dialog box titled 'Address <192.168.1.2/24>' is open, showing the following fields:

- Address: 192.168.1.2/24
- Network: 192.168.1.0
- Interface: ether1 - WAN1

The dialog box also features several buttons: OK, Cancel, Apply, Disable, Comment, Copy, and Remove. At the bottom of the dialog, there are two checkboxes: 'enabled' (checked) and 'slave' (unchecked).

Buat Address list

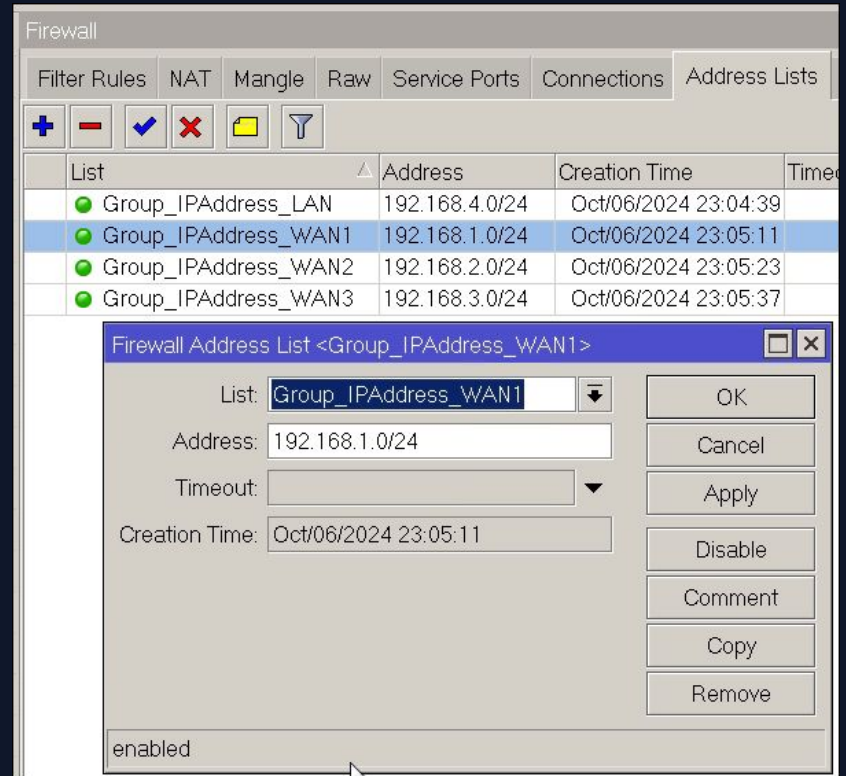
```
/ip firewall address-list
```

```
add address=192.168.4.0/24  
list=Group_IPAddress_LAN
```

```
add address=192.168.1.0/24  
list=Group_IPAddress_WAN1
```

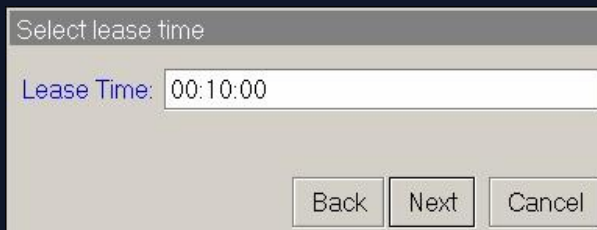
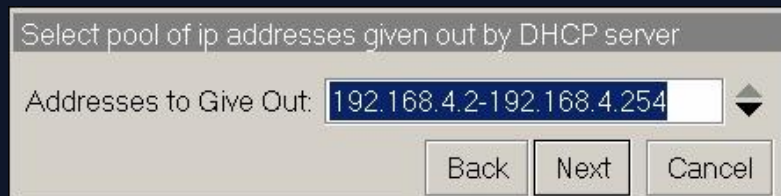
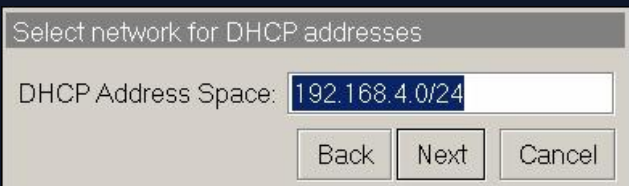
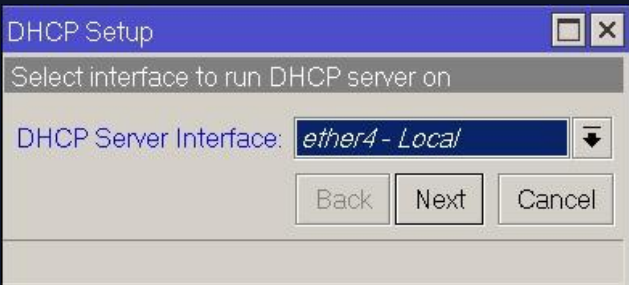
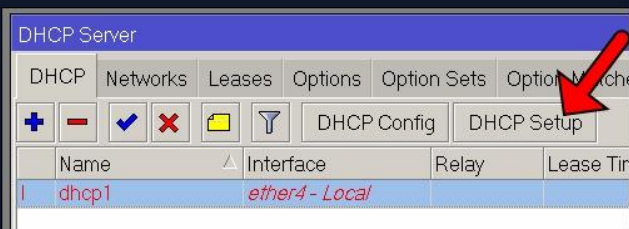
```
add address=192.168.2.0/24  
list=Group_IPAddress_WAN2
```

```
add address=192.168.3.0/24  
list=Group_IPAddress_WAN3
```



konfig ini bisa di-alternatifkan dengan menyebutkan langsung scope IP address di firewall Mangle nantinya. Pembuatan "Firewall Address-list" memudahkan dalam penyebutan (daripada menyebutkan angka/IP Address)

Set DHCP Server (GUI)



Set DHCP Server (command line)

```
/ip pool  
add name=dhcp_pool0  
ranges=192.168.4.2-192.168.4.254
```

```
/ip dhcp-server  
add address-pool=dhcp_pool0  
interface="ether4 - Local"  
lease-time=10m name=dhcp1
```

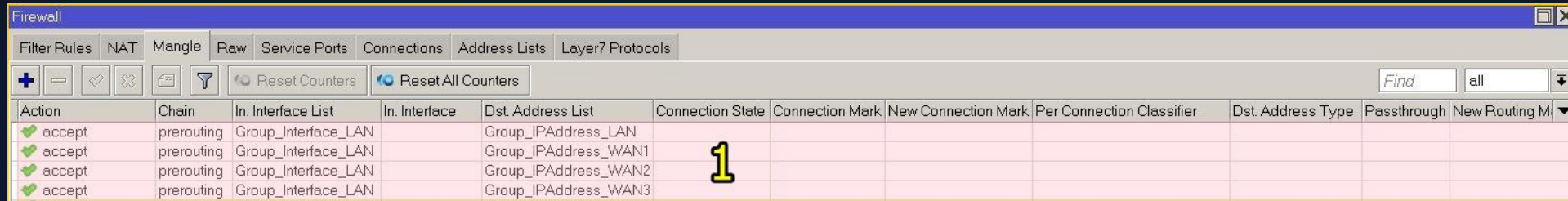
```
/ip dhcp-server network  
add address=192.168.4.0/24  
gateway=192.168.4.1
```

Menandai Paket (Firewall Mangle) - Hasil Akhir

Action	Chain	In. Interface List	In. Interface	Dst. Address List	Connection State	Connection Mark	New Connection Mark	Per Connection Classifier	Dst. Address Type	Passthrough	New Routing M
accept	prerouting	Group_Interface_LAN		Group_IPAddress_LAN							
accept	prerouting	Group_Interface_LAN		Group_IPAddress_WAN1	1						
accept	prerouting	Group_Interface_LAN		Group_IPAddress_WAN2							
accept	prerouting	Group_Interface_LAN		Group_IPAddress_WAN3							
mark connection	prerouting		ether1 - WAN1		new	no-mark	MConnn-WAN1			yes	
mark connection	prerouting		ether2 - WAN2		new	no-mark	MConnn-WAN2			yes	
mark connection	prerouting		ether3 - WAN3		new	no-mark	MConnn-WAN3			yes	
mark routing	output						MConnn-WAN1			no	MRouting-WAN1
mark routing	output						MConnn-WAN2			no	MRouting-WAN2
mark routing	output						MConnn-WAN3			no	MRouting-WAN3
mark connection	prerouting	Group_Interface_LAN			new	no-mark	MConnn-WAN1	both addresses and ports:3/0	llocal	yes	
mark connection	prerouting	Group_Interface_LAN			new	no-mark	MConnn-WAN2	both addresses and ports:3/1	llocal	yes	
mark connection	prerouting	Group_Interface_LAN			new	no-mark	MConnn-WAN3	both addresses and ports:3/2	llocal	yes	
mark routing	prerouting	Group_Interface_LAN					MConnn-WAN1			no	MRouting-WAN1
mark routing	prerouting	Group_Interface_LAN					MConnn-WAN2			no	MRouting-WAN2
mark routing	prerouting	Group_Interface_LAN					MConnn-WAN3			no	MRouting-WAN3

1. Menandai (Action = Accept) Paket yang masuk dari **interface** LAN yang menuju IP Router (contoh IP ISP-1, ISP-2, ISP-3 & IP LAN)
2. Menandai Koneksi (Mark Connection) yg masuk dari **interface** ISP-1, ISP-2, ISP-3
3. Menandai Jalur (Mark Routing) yang keluar (**output**) dari RB Load Balance yg merupakan koneksi ISP-1, ISP-2, ISP-3
4. Menandai Koneksi (Mark Connection) yg masuk dari **Interface LAN** untuk dilakukan **Load Balance PCC**
5. Menandai Jalur (Mark Routing) yg masuk dari **Interface LAN** yang menuju koneksi ISP-1, ISP-2, ISP-3

1. Menandai (Action = Accept) Paket yang masuk dari interface LAN yang menuju IP ISP-1, ISP-2, ISP-3 & IP LAN



Action	Chain	In. Interface List	In. Interface	Dst. Address List	Connection State	Connection Mark	New Connection Mark	Per Connection Classifier	Dst. Address Type	Passthrough	New Routing M
accept	prerouting	Group_Interface_LAN		Group_IPAddress_LAN	1						
accept	prerouting	Group_Interface_LAN		Group_IPAddress_WAN1							
accept	prerouting	Group_Interface_LAN		Group_IPAddress_WAN2							
accept	prerouting	Group_Interface_LAN		Group_IPAddress_WAN3							

```
/ip firewall mangle
```

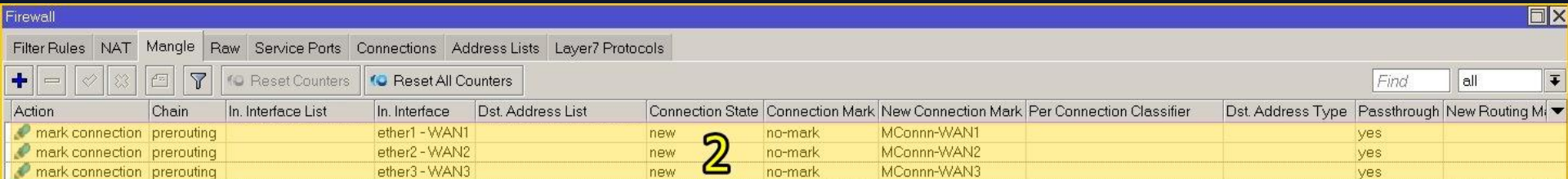
```
add action=accept chain=prerouting dst-address-list=Group_IPAddress_LAN \  
in-interface-list=Group_Interface_LAN
```

```
add action=accept chain=prerouting dst-address-list=Group_IPAddress_WAN1 \  
in-interface-list=Group_Interface_LAN
```

```
add action=accept chain=prerouting dst-address-list=Group_IPAddress_WAN2 \  
in-interface-list=Group_Interface_LAN
```

```
add action=accept chain=prerouting dst-address-list=Group_IPAddress_WAN3 \  
in-interface-list=Group_Interface_LAN
```

2. Menandai Koneksi (Mark Connection) yg masuk dari interface ISP-1, ISP-2, ISP-3



The screenshot shows the Mikrotik WinBox Firewall configuration window, specifically the Mangle tab. It displays three rules for marking connections based on their source interface. A large yellow '2' is overlaid on the 'Connection State' column of the second rule.

Action	Chain	In. Interface List	In. Interface	Dst. Address List	Connection State	Connection Mark	New Connection Mark	Per Connection Classifier	Dst. Address Type	Passthrough	New Routing M
mark connection	prerouting		ether1 - WAN1		new	no-mark	MConnn-WAN1			yes	
mark connection	prerouting		ether2 - WAN2		new	no-mark	MConnn-WAN2			yes	
mark connection	prerouting		ether3 - WAN3		new	no-mark	MConnn-WAN3			yes	

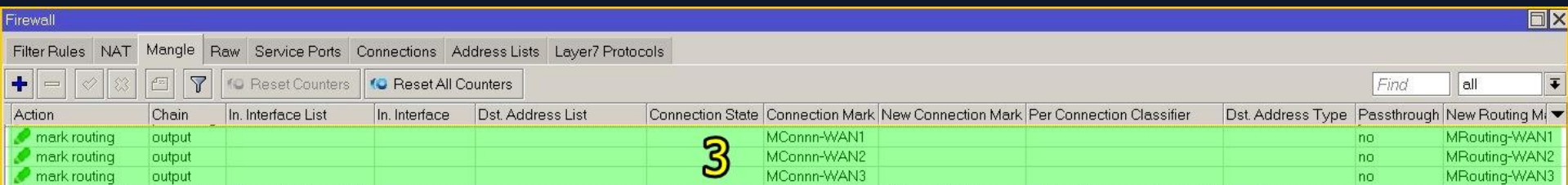
```
/ip firewall mangle
```

```
add action=mark-connection chain=prerouting connection-mark=no-mark \  
connection-state=new in-interface="ether1 - WAN1" new-connection-mark=\  
MConnn-WAN1 passthrough=yes
```

```
add action=mark-connection chain=prerouting connection-mark=no-mark \  
connection-state=new in-interface="ether2 - WAN2" new-connection-mark=\  
MConnn-WAN2 passthrough=yes
```

```
add action=mark-connection chain=prerouting connection-mark=no-mark \  
connection-state=new in-interface="ether3 - WAN3" new-connection-mark=\  
MConnn-WAN3 passthrough=yes
```

3. Menandai Jalur (Mark Routing) yang keluar (**output**) dari RB Load Balance yg merupakan koneksi ISP-1, ISP-2, ISP-3, untuk dipakai *routing decision* nantinya



The screenshot shows the Mikrotik WinBox Firewall configuration window, specifically the Mangle tab. The table below represents the data visible in the rule list:

Action	Chain	In. Interface List	In. Interface	Dst. Address List	Connection State	Connection Mark	New Connection Mark	Per Connection Classifier	Dst. Address Type	Passthrough	New Routing M
mark routing	output				3	MConnn-WAN1				no	MRouting-WAN1
mark routing	output					MConnn-WAN2				no	MRouting-WAN2
mark routing	output					MConnn-WAN3				no	MRouting-WAN3

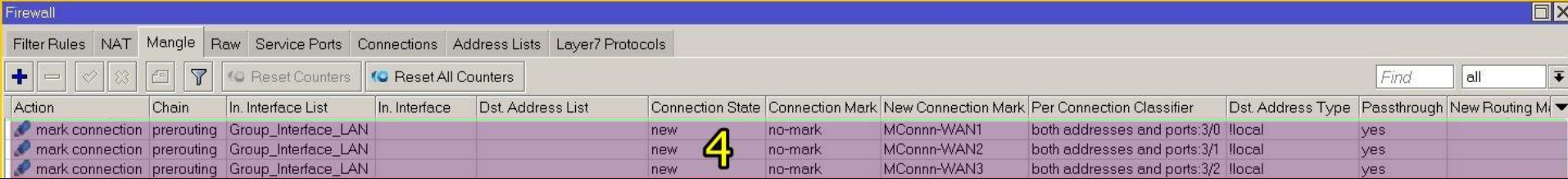
```
/ip firewall mangle
```

```
add action=mark-routing chain=output connection-mark=MConnn-WAN1 \  
new-routing-mark=MRouting-WAN1 passthrough=no
```

```
add action=mark-routing chain=output connection-mark=MConnn-WAN2 \  
new-routing-mark=MRouting-WAN2 passthrough=no
```

```
add action=mark-routing chain=output connection-mark=MConnn-WAN3 \  
new-routing-mark=MRouting-WAN3 passthrough=no
```

4. Menandai Koneksi (Mark Connection) yg masuk dari Interface LAN untuk dilakukan Load Balance PCC



Action	Chain	In. Interface List	In. Interface	Dst. Address List	Connection State	Connection Mark	New Connection Mark	Per Connection Classifier	Dst. Address Type	Passthrough	New Routing M
mark connection	prerouting	Group_Interface_LAN			new	no-mark	MConnn-WAN1	both addresses and ports:3/0	!local	yes	
mark connection	prerouting	Group_Interface_LAN			new	no-mark	MConnn-WAN2	both addresses and ports:3/1	!local	yes	
mark connection	prerouting	Group_Interface_LAN			new	no-mark	MConnn-WAN3	both addresses and ports:3/2	!local	yes	

```
add action=mark-connection chain=prerouting connection-mark=no-mark \  
connection-state=new dst-address-type=!local in-interface-list=\  
Group_Interface_LAN new-connection-mark=MConnn-WAN1 passthrough=yes \  
per-connection-classifier=both-addresses-and-ports:3/0
```

```
add action=mark-connection chain=prerouting connection-mark=no-mark \  
connection-state=new dst-address-type=!local in-interface-list=\  
Group_Interface_LAN new-connection-mark=MConnn-WAN2 passthrough=yes \  
per-connection-classifier=both-addresses-and-ports:3/1
```

```
add action=mark-connection chain=prerouting connection-mark=no-mark \  
connection-state=new dst-address-type=!local in-interface-list=\br/>Group_Interface_LAN new-connection-mark=MConnn-WAN3 passthrough=yes \  
per-connection-classifier=both-addresses-and-ports:3/2
```

Chain **prerouting** dipakai untuk menangkap saat awal paket datang ke router.

`dst-address-type=!local` digunakan agar paket yang ditujukan ke router tidak ikut ditandai.



LOAD BALANCE

PCC (PER CONNECTION CLASSIFIER)

Mangle Rule <>

General Advanced Extra Action Statistics

Layer7 Protocol:

Content:

Connection Bytes:

Connection Rate:

Per Connection Classifier: both addresses and ports : 3 / 2

Src. MAC Address:

Out. Bridge Port:

In. Bridge Port:

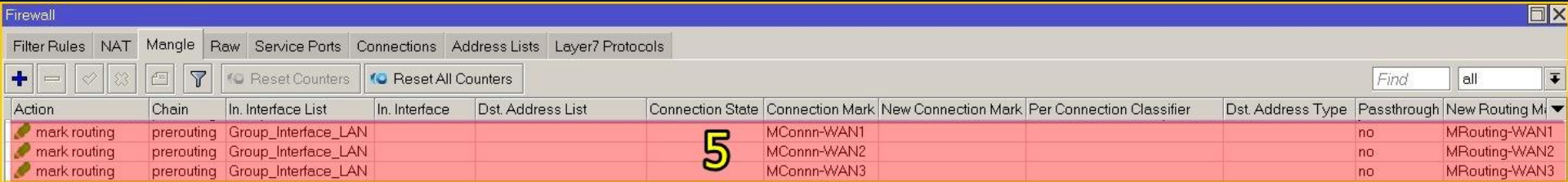
In. Bridge Port List:

Out. Bridge Port List:

- both addresses and ports
- both addresses
- both addresses and ports
- both ports
- dst address
- dst address and port
- dst port
- src address
- src address and port
- src port

Rules **PCC (Per-Connection Classifier)** dapat dibuat dengan memilih informasi dari **src-address**, **dst-address**, **src-port** atau **dst-port** dari *header IP*. PCC merupakan metode yang menspesifikasikan suatu paket menuju *gateway* koneksi tertentu. PCC mengelompokkan trafik koneksi yang akan melalui atau keluar masuk router menjadi beberapa kelompok. **Mikrotik akan mengingat-ingat gateway yang telah dilewati di awal trafik koneksi, sehingga pada paket-paket data selanjutnya yang masih berkaitan dengan paket data sebelumnya akan dilewatkan pada jalur gateway yang sama.**

5. Menandai Jalur (Mark Routing) yg masuk dari **Interface LAN** yang akan menuju koneksi ISP-1, ISP-2, ISP-3, untuk dipakai *routing decision* nantinya



The screenshot shows the Mikrotik WinBox Firewall configuration window, specifically the Mangle tab. Three rules are visible, each with the action 'mark routing' and chain 'prerouting'. The rules are configured to mark connections based on the source interface (Group_Interface_LAN) and assign them to different connection marks (MConnn-WAN1, MConnn-WAN2, MConnn-WAN3). The 'New Routing Mark' column shows MRouting-WAN1, MRouting-WAN2, and MRouting-WAN3 respectively. The 'Passthrough' is set to 'no' for all rules. A large yellow number '5' is overlaid on the table.

Action	Chain	In. Interface List	In. Interface	Dst. Address List	Connection State	Connection Mark	New Connection Mark	Per Connection Classifier	Dst. Address Type	Passthrough	New Routing Mark
mark routing	prerouting	Group_Interface_LAN				MConnn-WAN1				no	MRouting-WAN1
mark routing	prerouting	Group_Interface_LAN				MConnn-WAN2				no	MRouting-WAN2
mark routing	prerouting	Group_Interface_LAN				MConnn-WAN3				no	MRouting-WAN3

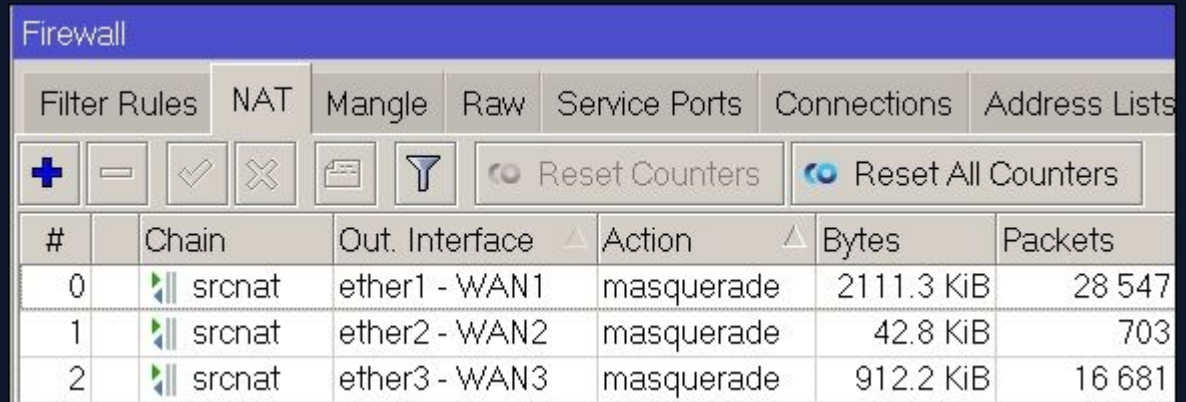
```
/ip firewall mangle
```

```
add action=mark-routing chain=prerouting connection-mark=MConnn-WAN1 \  
in-interface-list=Group_Interface_LAN new-routing-mark=MRouting-WAN1 \  
passthrough=no
```

```
add action=mark-routing chain=prerouting connection-mark=MConnn-WAN2 \  
in-interface-list=Group_Interface_LAN new-routing-mark=MRouting-WAN2 \  
passthrough=no
```

```
add action=mark-routing chain=prerouting connection-mark=MConnn-WAN3 \  
in-interface-list=Group_Interface_LAN new-routing-mark=MRouting-WAN3 \  
passthrough=no
```

Firewall NAT



The screenshot shows the Mikrotik WinBox Firewall configuration interface. The 'NAT' tab is selected, displaying a table of NAT rules. The table has columns for rule number, chain, out-interface, action, bytes, and packets. Three rules are listed, all using the 'srcnat' chain and 'masquerade' action, each associated with a different WAN interface.

#	Chain	Out. Interface	Action	Bytes	Packets
0	srcnat	ether1 - WAN1	masquerade	2111.3 KiB	28 547
1	srcnat	ether2 - WAN2	masquerade	42.8 KiB	703
2	srcnat	ether3 - WAN3	masquerade	912.2 KiB	16 681

```
/ip firewall nat
```

```
add action=masquerade chain=srcnat out-interface="ether1 - WAN1"
```

```
add action=masquerade chain=srcnat out-interface="ether2 - WAN2"
```

```
add action=masquerade chain=srcnat out-interface="ether3 - WAN3"
```

Hasil Akhir Memetakan Jalur (Routing Decision) / IP Route

1. Jalur yg tersambung langsung di Router LB

2. Recursive Gateway untuk 3 WAN

3. Internet utama untuk WAN1, WAN2, WAN3

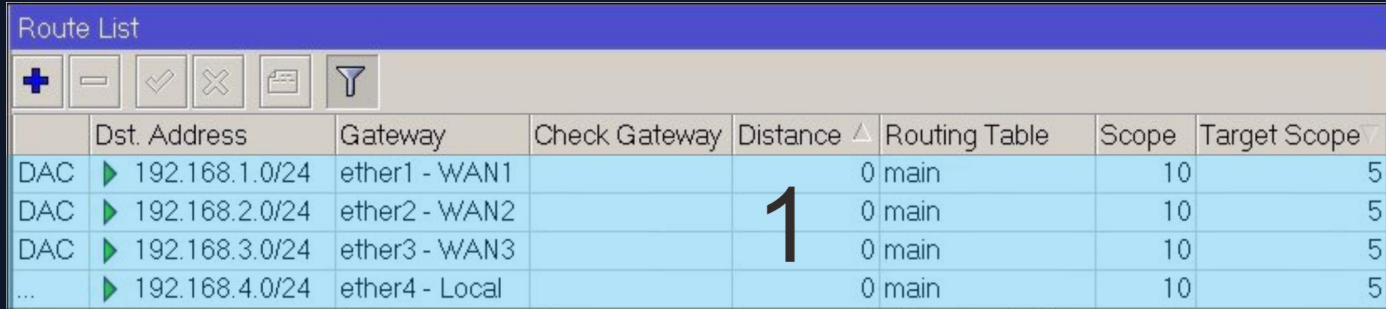
4. Internet utama untuk WAN1, WAN2, WAN3 (backup 1)

5. Internet utama untuk WAN1, WAN2, WAN3 (backup 2)

6. Internet untuk Router LB sendiri

Route List							
	Dst. Address	Gateway	Check Gateway	Distance Δ	Routing Table	Scope	Target Scope
DAC	▶ 192.168.1.0/24	ether1 - WAN1		1	0 main	10	5
DAC	▶ 192.168.2.0/24	ether2 - WAN2		1	0 main	10	5
DAC	▶ 192.168.3.0/24	ether3 - WAN3		1	0 main	10	5
...	▶ 192.168.4.0/24	ether4 - Local		1	0 main	10	5
AS	▶ 0.0.0.0/0	1.1.1.1	ping	3	1 MRouting-WAN1	30	30
AS	▶ 0.0.0.0/0	8.8.8.8	ping	3	1 MRouting-WAN2	30	30
AS	▶ 0.0.0.0/0	9.9.9.9	ping	3	1 MRouting-WAN3	30	30
;;; unt router sendiri							
AS	▶ 0.0.0.0/0	192.168.1.1		6	1 main	30	10
AS	▶ 1.1.1.1/32	192.168.1.1		2	1 main	30	10
AS	▶ 8.8.8.8/32	192.168.2.1		2	1 main	30	10
AS	▶ 9.9.9.9/32	192.168.3.1		2	1 main	30	10
S	▶ 0.0.0.0/0	1.1.1.1	ping	4	2 MRouting-WAN2	30	30
S	▶ 0.0.0.0/0	1.1.1.1	ping	4	2 MRouting-WAN3	30	30
S	▶ 0.0.0.0/0	8.8.8.8	ping	4	2 MRouting-WAN1	30	30
S	▶ 0.0.0.0/0	8.8.8.8	ping	5	3 MRouting-WAN3	30	30
S	▶ 0.0.0.0/0	9.9.9.9	ping	5	3 MRouting-WAN1	30	30
S	▶ 0.0.0.0/0	9.9.9.9	ping	5	3 MRouting-WAN2	30	30

1. Jalur yg tersambung langsung di Router LB



	Dst. Address	Gateway	Check Gateway	Distance Δ	Routing Table	Scope	Target Scope
DAC	▶ 192.168.1.0/24	ether1 - WAN1		0	main	10	5
DAC	▶ 192.168.2.0/24	ether2 - WAN2		0	main	10	5
DAC	▶ 192.168.3.0/24	ether3 - WAN3		0	main	10	5
...	▶ 192.168.4.0/24	ether4 - Local		0	main	10	5

auto muncul rule tersebut di routing protocol
DAC (Dynamic, Active, Connect)

2. Recursive Gateway untuk 3 WAN

Route List							
	Dst. Address	Gateway	Check Gateway	Distance	Routing Table	Scope	Target Scope
AS	▶ 1.1.1.1/32	192.168.1.1		1	main	30	10
AS	▶ 8.8.8.8/32	192.168.2.1		2	main	30	10
AS	▶ 9.9.9.9/32	192.168.3.1		1	main	30	10

/ip route

add disabled=no distance=1

dst-address=1.1.1.1/32 gateway=192.168.1.1 \
routing-table=main scope=30 target-scope=10

add disabled=no distance=1

dst-address=8.8.8.8/32 gateway=192.168.2.1 \
routing-table=main scope=30 target-scope=10

add disabled=no distance=1

dst-address=9.9.9.9/32 gateway=192.168.3.1 \
routing-table=main scope=30 target-scope=10

Route <8.8.8.8/32->192.168.2.1>			Route <1.1.1.1/32->192.168.1.1>		
General	Status	MPLS	General	Status	MPLS
Dst. Address: 8.8.8.8/32			Dst. Address: 1.1.1.1/32		
Gateway: 192.168.2.1			Gateway: 192.168.1.1		
Immediate Gateway: 192.168.2.1%ether2 - WAN2			Immediate Gateway: 192.168.1.1%ether1 - WAN1		
Local Address: <input type="text"/>			Local Address: <input type="text"/>		
Check Gateway: <input type="text"/>			Check Gateway: <input type="text"/>		
<input type="checkbox"/> Suppress Hw Offload			<input type="checkbox"/> Suppress Hw Offload		
Distance: 1			Distance: 1		
Scope: 30			Scope: 30		
Target Scope: 10			Target Scope: 10		
VRF Interface: <input type="text"/>			VRF Interface: <input type="text"/>		
Routing Table: main			Routing Table: main		
Pref. Source: <input type="text"/>			Pref. Source: <input type="text"/>		
<input type="checkbox"/> Blackhole			<input type="checkbox"/> Blackhole		
enabled	enabled

Recursive Gateway

3. Internet utama untuk WAN1, WAN2, WAN3

Route List							
	Dst. Address	Gateway	Check Gateway	Distance Δ	Routing Table	Scope	Target Scope
AS	▶ 0.0.0.0/0	1.1.1.1	ping	3	1 MRouting-WAN1	30	30
AS	▶ 0.0.0.0/0	8.8.8.8	ping		1 MRouting-WAN2	30	30
AS	▶ 0.0.0.0/0	9.9.9.9	ping		1 MRouting-WAN3	30	30

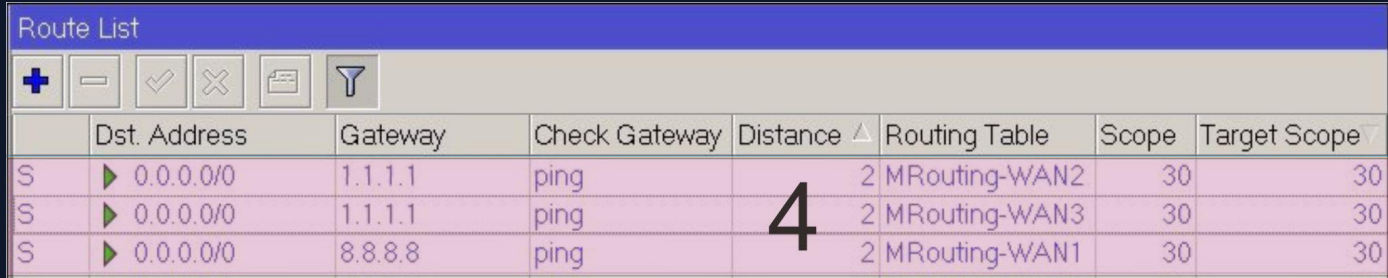
```
/ip route
```

```
add check-gateway=ping disabled=no distance=1 dst-address=0.0.0.0/0 gateway=\  
1.1.1.1 routing-table=MRouting-WAN1 scope=30 \  
target-scope=30
```

```
add check-gateway=ping disabled=no distance=1 dst-address=0.0.0.0/0 gateway=\  
8.8.8.8 routing-table=MRouting-WAN2 scope=30 \  
target-scope=30
```

```
add check-gateway=ping disabled=no distance=1 dst-address=0.0.0.0/0 gateway=\  
9.9.9.9 routing-table=MRouting-WAN3 scope=30 \  
target-scope=30
```

4. Internet backup untuk WAN1, WAN2, WAN3 (backup 1 / Failover 1)



	Dst. Address	Gateway	Check Gateway	Distance Δ	Routing Table	Scope	Target Scope
S	▶ 0.0.0.0/0	1.1.1.1	ping	2	MRouting-WAN2	30	30
S	▶ 0.0.0.0/0	1.1.1.1	ping	2	MRouting-WAN3	30	30
S	▶ 0.0.0.0/0	8.8.8.8	ping	2	MRouting-WAN1	30	30

/ip route

```
add check-gateway=ping disabled=no distance=2 dst-address=0.0.0.0/0 gateway=\  
8.8.8.8 routing-table=MRouting-WAN1 scope=30 \  
target-scope=30
```

```
add check-gateway=ping disabled=no distance=2 dst-address=0.0.0.0/0 gateway=\  
1.1.1.1 routing-table=MRouting-WAN2 scope=30 \  
target-scope=30
```

```
add check-gateway=ping disabled=no distance=2 dst-address=0.0.0.0/0 gateway=\  
1.1.1.1 routing-table=MRouting-WAN3 scope=30 \  
target-scope=30
```

5. Internet

backup untuk
WAN1, WAN2,
WAN3 (backup 2
/ Fail over 2)



	Dst. Address	Gateway	Check Gateway	Distance Δ	Routing Table	Scope	Target Scope
S	▶ 0.0.0.0/0	8.8.8.8	ping	3	MRouting-WAN3	30	30
S	▶ 0.0.0.0/0	9.9.9.9	ping	3	MRouting-WAN1	30	30
S	▶ 0.0.0.0/0	9.9.9.9	ping	3	MRouting-WAN2	30	30

/ip route

```
add check-gateway=ping disabled=no distance=3 dst-address=0.0.0.0/0 gateway=\
9.9.9.9 routing-table=MRouting-WAN1 scope=30 \
target-scope=30
```

```
add check-gateway=ping disabled=no distance=3 dst-address=0.0.0.0/0 gateway=\
9.9.9.9 routing-table=MRouting-WAN2 scope=30 \
target-scope=30
```

```
add check-gateway=ping disabled=no distance=3 dst-address=0.0.0.0/0 gateway=\
8.8.8.8 routing-table=MRouting-WAN3 scope=30 \
target-scope=30
```

Fail Over Recursive Gateway



Route List

Fail Over

	Dst. Address	Gateway	Check Gateway	Distance	Routing Table	Scope	Target Scope
AS	▶ 0.0.0.0/0	1.1.1.1	ping	1	MRouting-WAN1	30	30
S	▶ 0.0.0.0/0	8.8.8.8	ping	2	MRouting-WAN1	30	30
S	▶ 0.0.0.0/0	9.9.9.9	ping	3	MRouting-WAN1	30	30
AS	▶ 0.0.0.0/0	8.8.8.8	ping	1	MRouting-WAN2	30	30
S	▶ 0.0.0.0/0	1.1.1.1	ping	2	MRouting-WAN2	30	30
S	▶ 0.0.0.0/0	9.9.9.9	ping	3	MRouting-WAN2	30	30
AS	▶ 0.0.0.0/0	9.9.9.9	ping	1	MRouting-WAN3	30	30
S	▶ 0.0.0.0/0	1.1.1.1	ping	2	MRouting-WAN3	30	30
S	▶ 0.0.0.0/0	8.8.8.8	ping	3	MRouting-WAN3	30	30

6. Internet untuk Router LB itu sendiri

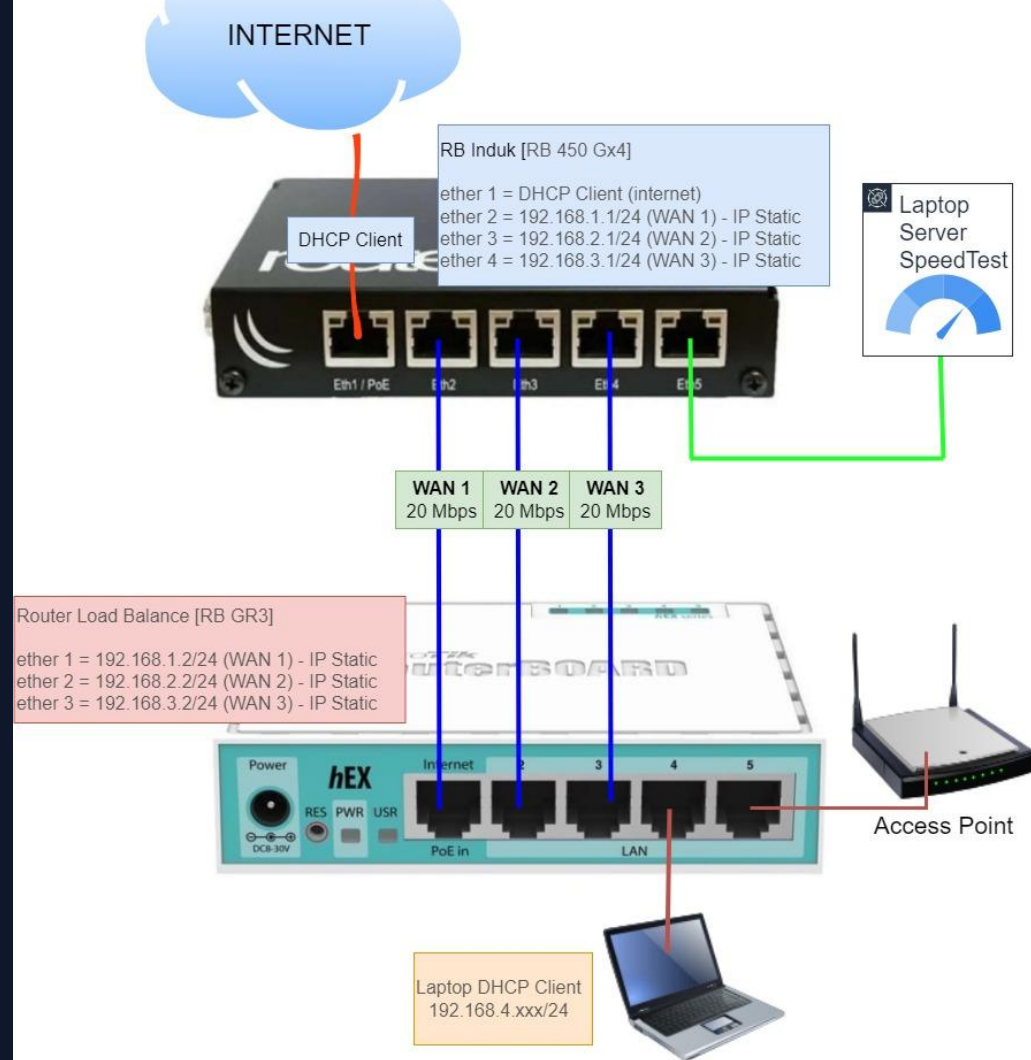
	Dst. Address	Gateway	Check Gateway	Distance Δ	Routing Table	Scope	Target Scope
AS	0.0.0.0/0	192.168.1.1		6	1 main	30	10

```
/ip route
```

```
add comment="unt router sendiri" disabled=no distance=1 dst-address=0.0.0.0/0 \  
gateway=192.168.1.1 routing-table=main scope=30 \  
target-scope=10
```

Topologi Demo Load Balance PCC Video Youtube

- 1 RB Induk
- 1 RB Load Balance
- 1 Laptop Pemateri
- 1 Laptop Server OpenSpeedTest
- Access Point (bisa diabaikan)



Video Pengujian LB PCC + Fail Over Mikrotik ROS 7

https://youtu.be/25m4VzWMO1o?si=Wc9sVze8_PEK-tq

The screenshot displays the Mikrotik WinBox interface for two routers. The top window, titled 'admin@192.168.1.1 (88 Meja Dimas) - WinBox (64bit) v6.49.17 on R8450G4 (arm)', shows a speed test window on the left with download speed at 20.2 Mbps and upload speed at 19.9 Mbps. The main window shows the 'Queue List' configuration for the 'Router Induk'.

#	Name	Upload	Downl.	Download Avg.	Upload Avg.	Total Max Limit (bit)	Target
0	ether2 192.168.1.1	20M	20M	27.1 kbps	3.6 kbps		ether2 192.168.1.1
1	ether3 192.168.2.1	20M	20M	672 bps	392 bps		ether3 192.168.2.1
2	ether4 192.168.3.1	20M	20M	490.9 kbps	13.9 Mbps		ether4 192.168.3.1

The bottom window, titled 'admin@DC2C6E:E398:B0 (Meja Dimas D3j Coka Load Balance) - WinBox (64bit) v7.16 on M3 (mips3)', shows the 'Route List' configuration for the 'Router Load Balance'.

Dst. Address	Gateway	Distance	Routing Table
USHI 0.0.0.0	1.1.1.1	1	MRouting-WAN1
USHI 0.0.0.0	8.8.8.8	2	MRouting-WAN1
AS 0.0.0.0	9.9.9.9	3	MRouting-WAN1
USHI 0.0.0.0	8.8.8.8	1	MRouting-WAN2
USHI 0.0.0.0	1.1.1.1	2	MRouting-WAN2
AS 0.0.0.0	9.9.9.9	3	MRouting-WAN2
USHI 0.0.0.0	1.1.1.1	2	MRouting-WAN3
USHI 0.0.0.0	8.8.8.8	3	MRouting-WAN3

The 'Interface List' window shows the following data:

Interface	Type	Tx	Rx	Tx Packet (p/s)	Rx Packet (p/s)	FP Tx	FP Rx
R ether1 - WAN1	Ethernet	2.2 kbps	9.5 kbps	3	2	0 bps	0 bps
R ether2 - WAN2	Ethernet	592 bps	816 bps	1	1	0 bps	0 bps
R ether3 - WAN3	Ethernet	24.6 Mbps	885.0 kbps	2040	1513	0 bps	0 bps
R ether4 - Local	Ethernet	966.7 kbps	24.6 Mbps	1525	2041	0 bps	0 bps
R ether5	Ethernet	0 bps	0 bps	0	0	0 bps	0 bps

Contoh Load Balance PCC 3 WAN Mikrotik v.7



MasTeknisi (Dimas Agung)
1,33 rb subscriber

Analytics

Edit video

1



Bagikan



Promosikan





Load Balance
3 WAN
(Download)

admin@192.168.1.1 (RB Meja Dimas) - WinBox (64bit) v6.49.17 on RB450Gx4 (arm)

Session: 192.168.1.1

Firewall

#	Action	Chain	Src. Address	Dst. Address	Proto...	Src. Port	Dst. Port	In. Interf.
0 X	reject	forward		1.1.1.1				
1 X	reject	forward		8.8.8.8				
2 X	reject	forward		9.9.9.9				

3 items (1 selected)

Interface Queues

#	Name	Upload...	Downl...	Download Avg...	Upload Avg...	Total Max Limit (bit...	Target
0	ether2 192.168.1.1	20M	20M	20.1 Mbps	280.7 kbps		ether2 192.168.1.1
1	ether3 192.168.2.1	20M	20M	20.1 Mbps	289.0 kbps		ether3 192.168.2.1
2	ether4 192.168.3.1	20M	20M	20.0 Mbps	304.8 kbps		ether4 192.168.3.1

Router
Induk

admin@DC:2C:6E:E3:98:B0 (Meja Dimas (Uji Coba Load Balance 2)) - WinBox (64bit) v7.16 on hEX (mmpis)

Session: DC:2C:6E:E3:98:B0

Route List

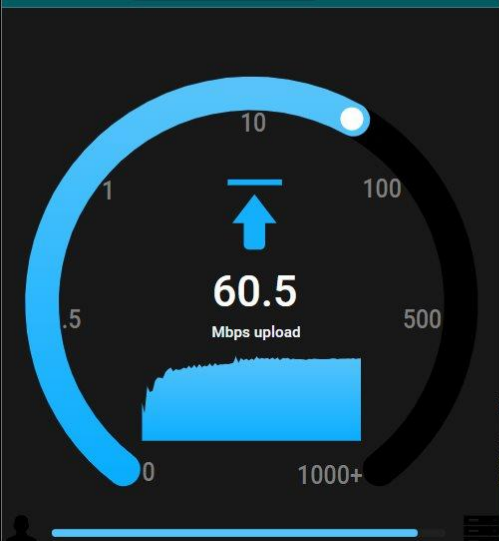
	Dst. Address	Gateway	Distance	Routing Table
AS	0.0.0.0/0	1.1.1.1		1 MRouting-WAN1
S	0.0.0.0/0	8.8.8.8		2 MRouting-WAN1
S	0.0.0.0/0	9.9.9.9		3 MRouting-WAN1
AS	0.0.0.0/0	8.8.8.8		1 MRouting-WAN2
S	0.0.0.0/0	1.1.1.1		2 MRouting-WAN2
S	0.0.0.0/0	9.9.9.9		3 MRouting-WAN2
AS	0.0.0.0/0	9.9.9.9		1 MRouting-WAN3
S	0.0.0.0/0	1.1.1.1		2 MRouting-WAN3
S	0.0.0.0/0	8.8.8.8		3 MRouting-WAN3
DAC	192.168.4.0/24	ether4 - Local	0	main
DAC	192.168.3.0/24	ether3 - WAN3	0	main
DAC	192.168.2.0/24	ether2 - WAN2	0	main
DAC	192.168.1.0/24	ether1 - WAN1	0	main
AS	9.9.9.9/32	192.168.3.1	1	main
AS	8.8.8.8/32	192.168.2.1	1	main
AS	1.1.1.1/32	192.168.1.1	1	main
unt	unt router sendiri			
AS	0.0.0.0/0	192.168.1.1	1	main

Interface List

Interface	Interface List	Ethernet	EoIP Tunnel	IP Tunnel
R	ether1 - WAN1	Ethernet	459.4 kbps	20.3 Mbps
R	ether2 - WAN2	Ethernet	518.8 kbps	20.3 Mbps
R	ether3 - WAN3	Ethernet	472.1 kbps	20.3 Mbps
R	ether4 - Local	Ethernet	61.0 Mbps	1460.8 kbps
	ether5	Ethernet	0 bps	0 bps

6 items (3 selected)

Router
Load
Balance



DOWNLOAD 60.7 Mbps

PING 2 Jitter 0.1 ms

UPLOAD --- Mbps

Load Balance
3 WAN
(Upload)

admin@192.168.1.1 (RB Meja Dimas) - WinBox (64bit) v6.49.17 on RB450Gx4 (arm)

Session Settings Dashboard

Safe Mode Session: 192.168.1.1

Firewall

#	Action	Chain	Src. Address	Dst. Address	Proto...	Src. Port	Dst. Port	In. Interf.
0 X	reject	forward		1.1.1.1				
1 X	reject	forward		8.8.8.8				
2 X	reject	forward		9.9.9.9				

3 items (1 selected)

Simple Queues Interface Queues Queue Tree Queue Types

#	Name	Upload...	Downl...	Download Avg...	Upload Avg...	Total Max Limit (bit...	Target
0	ether2 192.168.1.1	20M	20M	339.5 kbps	20.1 Mbps		ether2 192.168.1.1
1	ether3 192.168.2.1	20M	20M	323.2 kbps	20.1 Mbps		ether3 192.168.2.1
2	ether4 192.168.3.1	20M	20M	347.4 kbps	20.1 Mbps		ether4 192.168.3.1

Router Induk

admin@DC:2C:6E:E3:98:B0 (Meja Dimas (Uji Coba Load Balance 2)) - WinBox (64bit) v7.16 on hEX (mmips)

Session Settings Dashboard

Safe Mode Session: DC:2C:6E:E3:98:B0

Route List

AS	Dst. Address	Gateway	Distance	Routing Table
AS	0.0.0.0/0	1.1.1.1	1	MRouting-WAN1
S	0.0.0.0/0	8.8.8.8	2	MRouting-WAN1
S	0.0.0.0/0	9.9.9.9	3	MRouting-WAN1
AS	0.0.0.0/0	8.8.8.8	1	MRouting-WAN2
S	0.0.0.0/0	1.1.1.1	2	MRouting-WAN2
S	0.0.0.0/0	9.9.9.9	3	MRouting-WAN2
AS	0.0.0.0/0	9.9.9.9	1	MRouting-WAN3
S	0.0.0.0/0	1.1.1.1	2	MRouting-WAN3
S	0.0.0.0/0	8.8.8.8	3	MRouting-WAN3
DAC	192.168.4.0/24	ether4 - Local	0	main
DAC	192.168.3.0/24	ether3 - WAN3	0	main
DAC	192.168.2.0/24	ether2 - WAN2	0	main
DAC	192.168.1.0/24	ether1 - WAN1	0	main
AS	9.9.9.9/32	192.168.3.1	1	main
AS	8.8.8.8/32	192.168.2.1	1	main
AS	1.1.1.1/32	192.168.1.1	1	main
unt router sendiri				
AS	0.0.0.0/0	192.168.1.1	1	main

Interface List

Interface	Interface List	Ethernet	EoIP Tunnel	IP Tunnel
R	ether1 - WAN1	Ethernet	20.4 Mbps	503.8 kbps
R	ether2 - WAN2	Ethernet	20.3 Mbps	513.4 kbps
R	ether3 - WAN3	Ethernet	20.4 Mbps	490.7 kbps
R	ether4 - Local	Ethernet	1593.7 kbps	61.2 Mbps
	ether5	Ethernet	0 bps	0 bps

6 items (3 selected)

Router Load Balance

Akses uplink ke 1.1.1.1 di block

Fail Over Recursive Gateway WAN 1

Router Induk

Session: 192.168.1.1

#	Action	Chain	Src. Address	Dst. Address	Proto...	Src. Port	Dst. Port	In. Interf...
0	reject	forward		1.1.1.1				
1	reject	forward		8.8.8.8				
2	reject	forward		9.9.9.9				

3 items (1 selected)

#	Name	Upload...	Downl...	Download Avg...	Upload Avg...	Total Max Limit (bit...	Target
0	ether2 192.168.1.1	20M	20M	27.3 kbps	3.3 kbps		ether2 192.168.1.1
1	ether3 192.168.2.1	20M	20M	36.2 kbps	19.6 kbps		ether3 192.168.2.1
2	ether4 192.168.3.1	20M	20M	22.6 kbps	5.0 kbps		ether4 192.168.3.1

Gateway 1.1.1.1 menjadi in-active lalu pindah (fail over) ke gateway backup

sekitar 30 detik untuk pindah gateway

Router Load Balance

Session: DC:2C:6E:E3:98:B0

	Dst. Address	Gateway	Distance	Routing Table
USHI	0.0.0.0/0	1.1.1.1		1 MRouting-WAN1
AS	0.0.0.0/0	8.8.8.8	2	MRouting-WAN1
S	0.0.0.0/0	9.9.9.9	3	MRouting-WAN1
AS	0.0.0.0/0	8.8.8.8	1	MRouting-WAN2
USHI	0.0.0.0/0	1.1.1.1	2	MRouting-WAN2
S	0.0.0.0/0	9.9.9.9	3	MRouting-WAN2
AS	0.0.0.0/0	9.9.9.9	1	MRouting-WAN3
USHI	0.0.0.0/0	1.1.1.1	2	MRouting-WAN3
S	0.0.0.0/0	8.8.8.8	3	MRouting-WAN3
DAC	192.168.4.0/24	ether4 - Local	0	main
DAC	192.168.3.0/24	ether3 - WAN3	0	main
DAC	192.168.2.0/24	ether2 - WAN2	0	main
DAC	192.168.1.0/24	ether1 - WAN1	0	main
AS	9.9.9.9/32	192.168.3.1	1	main
AS	8.8.8.8/32	192.168.2.1	1	main
AS	1.1.1.1/32	192.168.1.1	1	main
unt router sendiri				
AS	0.0.0.0/0	192.168.1.1	1	main

Interface	Interface List	Ethernet	EoIP Tunnel	IP Tunnel
Name	Type	Tx	Rx	
R ether1 - WAN1	Ethernet	1024 bps	9.2 kbps	
R ether2 - WAN2	Ethernet	41.2 kbps	33.5 kbps	
R ether3 - WAN3	Ethernet	62.6 kbps	25.5 kbps	
R ether4 - Local	Ethernet	136.9 kbps	110.0 kbps	
ether5	Ethernet	0 bps	0 bps	

6 items (3 selected)

Akses uplink ke 1.1.1.1 & 8.8.8.8 di block

Firewall configuration showing rules for blocking access to 1.1.1.1 and 8.8.8.8.

#	Action	Chain	Src. Address	Dst. Address	Proto...	Src. Port	Dst. Port	In. Interf...
0	reject	forward		1.1.1.1				
1	reject	forward		8.8.8.8				
2 X	reject	forward		9.9.9.9				

#	Name	Upload...	Downl...	Download Avg...	Upload Avg...	Total Max Limit (bit...	Target
0	ether2 192.168.1.1	20M	20M	27.5 kbps	4.5 kbps		ether2 192.168.1.1
1	ether3 192.168.2.1	20M	20M	168 bps	392 bps		ether3 192.168.2.1
2	ether4 192.168.3.1	20M	20M	50.6 kbps	15.2 kbps		ether4 192.168.3.1

Router Induk

Fail Over Recursive Gateway WAN 1 & WAN 2

Route List configuration showing multiple routes for USHI and DAC.

	Dst. Address	Gateway	Distance	Routing Table	
USHI	0.0.0.0/0	1.1.1.1	1	MRouting-WAN1	
USHI	0.0.0.0/0	8.8.8.8	2	MRouting-WAN1	
AS	0.0.0.0/0	9.9.9.9	3	MRouting-WAN1	
USHI	0.0.0.0/0	8.8.8.8	1	MRouting-WAN2	
USHI	0.0.0.0/0	1.1.1.1	2	MRouting-WAN2	
AS	0.0.0.0/0	9.9.9.9	3	MRouting-WAN2	
AS	0.0.0.0/0	9.9.9.9	1	MRouting-WAN3	
USHI	0.0.0.0/0	1.1.1.1	2	MRouting-WAN3	
USHI	0.0.0.0/0	8.8.8.8	3	MRouting-WAN3	
DAC	192.168.4.0/24	ether4 - Local	0	main	
DAC	192.168.3.0/24	ether3 - WAN3	0	main	
DAC	192.168.2.0/24	ether2 - WAN2	0	main	
DAC	192.168.1.0/24	ether1 - WAN1	0	main	
AS	9.9.9.9/32	192.168.3.1	1	main	
AS	8.8.8.8/32	192.168.2.1	1	main	
AS	1.1.1.1/32	192.168.1.1	1	main	
unt router sendiri	AS	0.0.0.0/0	192.168.1.1	1	main

Interface	Interface List	Ethernet	EoIP Tunnel	IP Tunnel
R	ether1 - WAN1	Ethernet	7.6 kbps	47.9 kbps
R	ether2 - WAN2	Ethernet	0 bps	0 bps
R	ether3 - WAN3	Ethernet	8.7 kbps	26.0 kbps
R	ether4 - Local	Ethernet	144.8 kbps	23.4 kbps
	ether5	Ethernet	0 bps	0 bps

Router Load Balance

Gateway 1.1.1.1 & 8.8.8.8 menjadi in-active lalu pindah (fail over) ke gateway backup

Karakteristik Load Balance PCC

Karakteristik =

- PCC adalah load balance berdasar **connection-base** (bukan volume base)
- Makin besar traffic yang perlu diolah maka RB Load Balance perlu spek yg lebih tinggi agar *smooth* latency jaringan
- RB Load Balance bisa pakai RB tersendiri untuk kemudahan management & troubleshooting
- Load Balancing menggunakan teknik PCC ini akan berjalan efektif dan mendekati seimbang jika semakin banyak koneksi (dari client) yang terjadi
- Perpindahan waktu antar gateway recursive 1 ke 2 (dst) adalah 30 detik, tetapi ketika link gateway UP (terkoneksi kembali) maka prosesnya sekitar 6 detik untuk kembali ke routing utama

Plus =

- + bisa di atur menyesuaikan sikon
- + distribusi koneksi merata/mendekati
- + tidak overload di 1 jalur
- + Cocok untuk banyak koneksi (banyak user/multi koneksi)

Minus =

- Tidak cocok untuk 1 koneksi besar (single session)
- setting'nya agak rumit (memahami alur kerjanya agar hasil sesuai harapan)

Kesimpulan

Load Balance PCC adalah metode untuk membagi koneksi jaringan sesuai kebutuhan pada jalur Multi-WAN

Dengan menggabungkan PCC dan fitur **Failover Recursive Gateway**, jaringan tidak hanya terbagi bebannya ke 3 WAN, tetapi juga menjadi lebih handal karena mampu otomatis berpindah ke jalur cadangan saat terjadi gangguan (dengan kemampuan deteksi hingga beberapa hop).

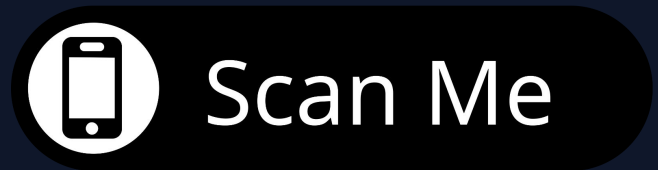
Presentasi ini bertujuan memberikan pemahaman, sharing dan update terkait implementasi load balancing dan failover di RouterOS v7 agar jaringan lebih optimal dan tetap terkoneksi.

Sumber-sumber

- https://citraweb.com/artikel_lihat.php?id=34 [Load Balance] Load Balance menggunakan Metode PCC
- <https://www.youtube.com/watch?v=EnjGvhPTt70> “LOAD BALANCE METODE PCC – MIKROTIK TUTORIAL [ENG SUB]“
- <https://www.youtube.com/watch?v=OVBCltNzMg0> “Tutorial Load Balance dengan metode PCC – Menggabungkan 2 Sumber / koneksi Internet pada Mikrotik“
- <https://citraweb.com/artikel/417/> “[Load Balance] Load Balance dengan Menggunakan Metode PCC (Simple)”
- <https://mum.mikrotik.com/presentations/US12/steve.pdf>

Slide
Tambahan

Download Materi :



Load Balance PCC 3 Jalur WAN dan Fail Over Recursive Gateway di ROS v.7 Untuk Optimasi & Menjaga Koneksi Jaringan

Dimas Agung Yulianto, S.Kom
MasTeknisi.com

 **Perbandingan Singkat**

Metode	Stabilitas	Kompleksitas	Distribusi	Cocok untuk
PCC	★★★★★	★★★★★	★★★★★	Umum (recommended)
NTH	★★	★★	★★★★★	Testing
ECMP	★★★	★	★★★	Simple setup
PBR	★★★★★	★★★★★	✗	Policy / kontrol

Sumber :
ChatGPT

- Load Balance PCC (Per Connection Classifier)
 - lebih stabil dari pada ECMP
 - PCC dipisah berdasarkan koneksi, untuk ECMP random
- NTH (integer)
 - algoritma round robin
- ECMP (Equal Cost Multiple Path)
 - Paling mudah
 - jika PCC dipisah berdasarkan koneksi, untuk ECMP random
- Load Balance PBR (Policy Based Route)
 - digunakan untuk memetakan jalur (contoh LAN 1 via ISP-A, LAN 2 via ISP-B)

Slide Tambahan

Introduction

Network load balancing is the ability to balance traffic across two or more WAN links without using routing protocols like BGP.

Load Balancing's aim is to spread traffic across multiple links to get better link usage. This can be done on one per-packet or per-connection basis.

Method		Per-connection	Per-packet
With the Firewall features	Firewall marking	Yes	Yes
	ECMP (Equal Cost Multi-Path)	Yes	No
	PCC (Per Connection Classifier)	Yes	No
	Nth	Yes	Yes
Bonding		No	Yes
OSPF		Yes	No
BGP		Yes	No

sumber

<https://help.mikrotik.com/docs/display/R/OS/Load+Balancing>

Slide Tambahan

PCC (Per Connection Classifier) + Hotspot memang sering bentrok kalau urutan rule, bypass, dan NAT tidak tepat. Masalah seperti:

- user tidak muncul halaman login hotspot,
- redirect login gagal,
- setelah login internet jalan tapi **load balance tidak bekerja**,



Penjelasan Logika

Sebelum login:

Client → Hotspot redirect → Login page

Setelah login:

Client authenticated → PCC → Route mark ISP1 / ISP2

Seharusnya:

Hotspot / bypass local / authenticated user dulu, baru PCC.

Traffic ke:

- DNS hotspot
- login page
- router gateway
- IP binding

harus di-accept dulu.

Urutan ideal:

1. Bypass traffic hotspot & local

```
/ip firewall mangle  
add chain=prerouting hotspot=from-client action=accept
```

2. Bypass dst-address local/router

```
dst-address-type=local action=accept
```

3. Baru PCC untuk user internet

```
per-connection-classifier=both-addresses-and-ports:2/0  
per-connection-classifier=both-addresses-and-ports:2/1
```

Rumus aman:

Hotspot dulu → Authentication → PCC → Routing → NAT

Slide Tambahan

Contoh Config Beberapa Metode Load Balance

Failover Recursive

	Dst. Address	Gateway	Ch...	Di...	Scope	Target Scope
AS	▶ 0.0.0.0/0	8.8.8.8 recursive via 172.16.0.1 ether1	ping	1	30	30
S	▶ 0.0.0.0/0	10.10.10.100 reachable wlan1	ping	2	30	10
AS	▶ 8.8.8.8	172.16.0.1 reachable ether1		1	30	10

LB ECMP

General | Attributes

Dst. Address: 0.0.0.0

Gateway: 172.16.0.1 reachable ether1

10.10.10.100 reachable wlan1

Failover Network

	Dst. Address	Gateway	Distance
...ISP2			
S	▶ 0.0.0.0/0	10.10.10.100 reachable wlan1	2
...ISP1			
AS	▶ 0.0.0.0/0	172.16.0.1 reachable ether1	1
AS	▶ 8.8.8.8	172.16.0.1 reachable ether1	1

Host Up Down

Host: 8.8.8.8

Interval: 00:00:10

Timeout: 1000

Host Up Down

ip route enable [find comment=ISP1]

Host Up Down

ip route disable [find comment=ISP1]

LB PCC

	Dst. Address	Gateway	(Routing Mark
AS	▶ 0.0.0.0/0	172.16.0.1 reachable ether1	to-ISP1
AS	▶ 0.0.0.0/0	10.10.10.100 reachable wlan1	to-ISP2

PCC+Failover

	Dst. Address	Gateway	Check Gateway	Distance	Routing Mark
AS	▶ 0.0.0.0/0	172.16.0.1 reachable ether1	ping	1	to-ISP1
AS	▶ 0.0.0.0/0	10.10.10.100 reachable wlan1	ping	1	to-ISP2
S	▶ 0.0.0.0/0	10.10.10.100 reachable wlan1		2	to-ISP1
S	▶ 0.0.0.0/0	172.16.0.1 reachable ether1		2	to-ISP2

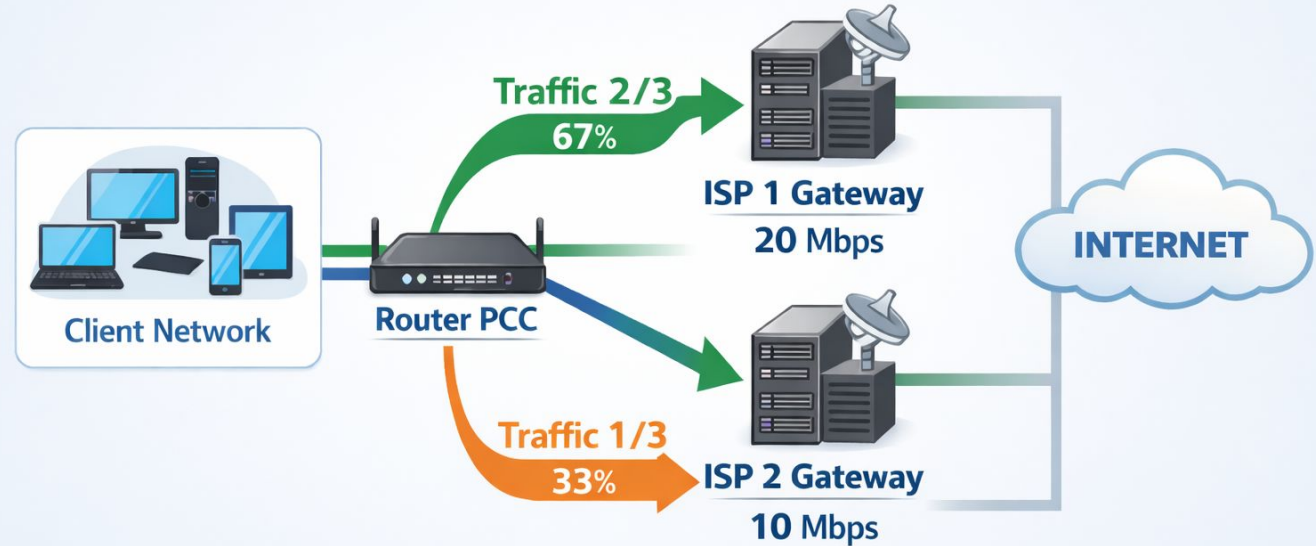
diolah dari berbagai sumber

Slide Tambahan

Jika menggunakan 2 ISP & kecepatan koneksi kedua ISP tersebut berbeda (20 Mbps dan 10 Mbps), maka bagi beban trafiknya menjadi 3 (tiga) bagian. Dua bagian pertama akan melewati gateway ISP-1 (20 Mbps), dan 1 bagian terakhir akan melewati gateway ISP-2 (10 Mbps).

PCC 2 WAN Beda Bandwidth

Pembagian Trafik Berdasarkan Rasio 3:1



Slide Tambahan

Scope & Target Scope Recursive Gateway

Sumber
<https://citraweb.com/artikel/174/>

Scope & Target Scope

Contoh diatas apabila link yang putus adalah link yang terhubung langsung dengan router gateway. Namun, bagaimana jika kasusnya adalah apabila yang putus adalah diatas router gateway yang tidak terhubung langsung (*Recursive*). Apabila kita melihat mekanisme pengecekan gateway sebelumnya yang memakai metode **ARP Request** dan **Test ping** akan mengecek jalur yang ke router gateway sehingga tidak bisa melakukan pengecekan pada jalur diatasnya.

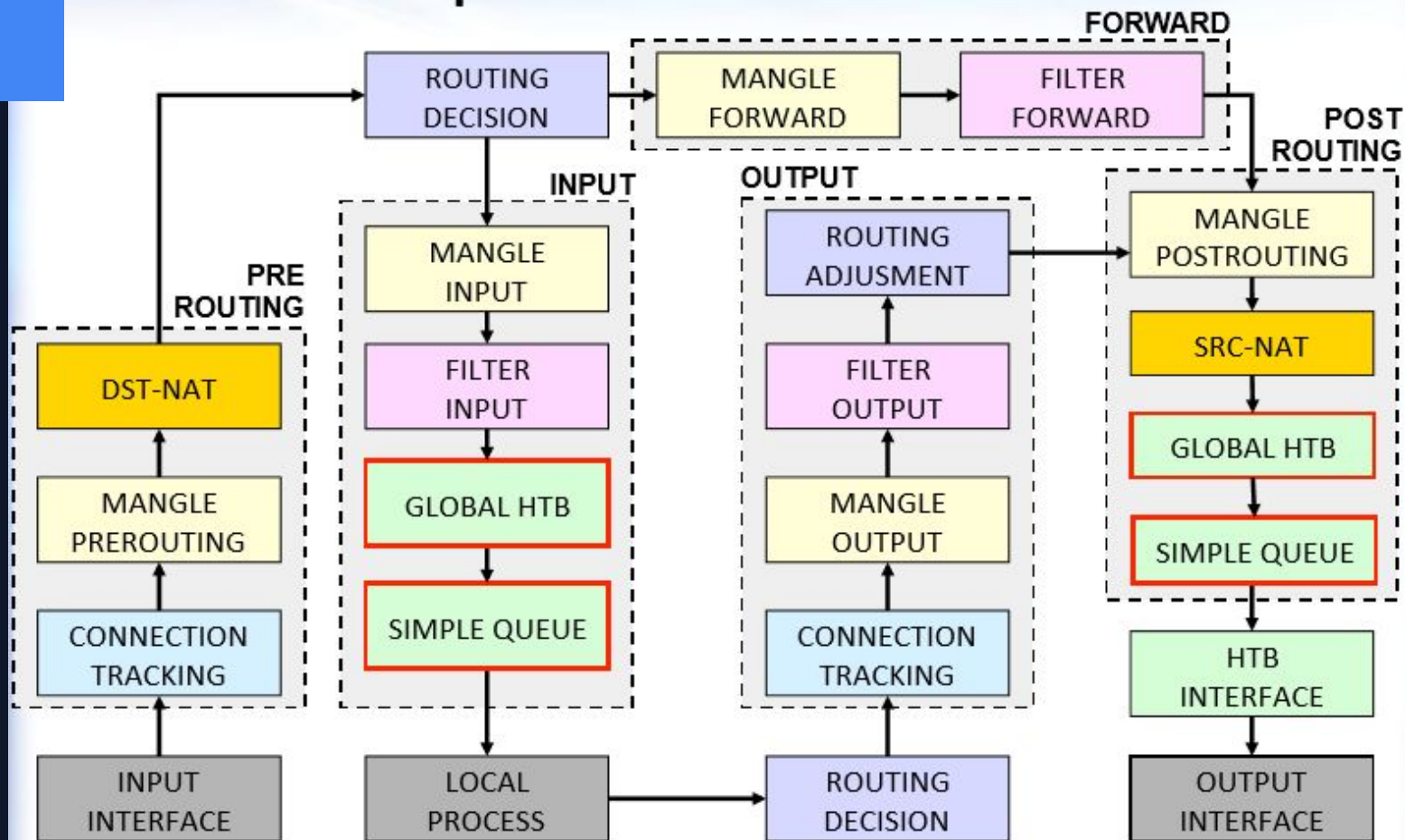
Untuk mengatasi hal tersebut kita bisa menggunakan parameter "**Scope & Target Scope**" pada konfigurasi routing. Secara default router akan memberikan nilai dari scope dan target scope untuk masing-masing type routing yang nilainya juga berbeda.

Scope	Route type	Target Scope
0		
10	Connected (running)	10
20	OSPF, RIP, MME	10
30	Static	10
40	eBGP	10
40	iBGP	30
200	Connected (not active)	

Berkaitan dengan masalah diatas kita bisa mengubah nilai dari "**Target Scope**" sehingga pengecekan gateway akan langsung ke jalur yang diatas router gateway, walaupun secara real trafik masih tetap melewati router gateway tersebut. Sebagai contoh seperti tampilan berikut:

Simple Packet Flow v6

QoS ROS v.6



Sumber :
<https://i.imgur.com/RHHffc9.png>

PCC membagi traffic berdasarkan koneksi bukan berdasarkan usage bandwidth

jika punya IP sendiri (ada **AS Number**) lalu kadang terjadi :

- $ISP_2 < ISP_1$ (besar traffic ISP_1)
- $ISP_2 > ISP_1$ (besar traffic ISP_2)
- $ISP_2 = ISP_1$ (sama besar traffic'nya)

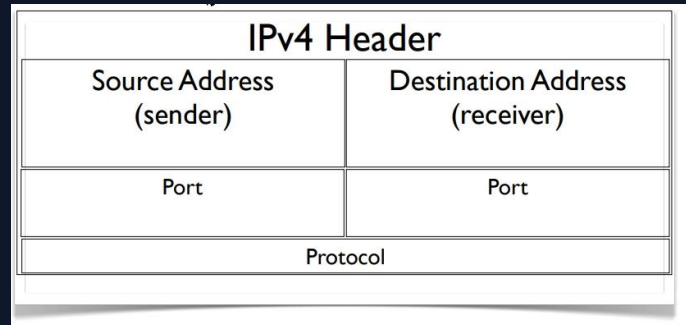
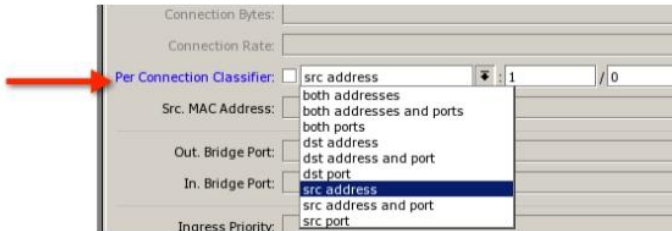
strategi pendekatan solusi :

- pelajari pola'nya, lalu lakukan tuning, bisa :
ISP_1 bobot 3 & ISP_2 bobot 1 atau
ISP_1 bobot 2 & ISP_2 bobot 1, dst'nya

Slide Tambahan (Detail PCC)

How does PCC work?

- "PCC takes selected fields from IP header, and with the help of a hashing algorithm converts selected fields into 32-bit value.
- This value then is divided by a Denominator and the Remainder then is compared to a specified Remainder, if equal then packet will be captured.
- You can choose from src-address, dst-address, src-port, dst-port (or various combinations) from the header to use in this operation."



PCC uses a hashing algorithm.

- A hashing algorithm is a mathematical function that takes an input and returns an output.
- The output will always be the same for a specified input.
- Example of a simple hash:
$$\text{Input} \times 100 = \text{hash value}$$

Slide Tambahan (Detail PCC)

PCC uses modular arithmetic (clock arithmetic).

- Numerators, Denominators and Remainders are parts of modular arithmetic.
- It is represented by a % sign and it is spoken as "mod".
- To work modular math, think of it as "how many are left over (Remainder) after you've subtracted the second value (Denominator) from the first (Numerator) as many times as possible without going negative?"
- Here are some examples of modular math:

Numerator = 3 Denominator = 3

$3 \% 3 = 0$ because $3 - 3 = 0$ left over

or

$4 \% 3 = 1$ because $4 - 3 = 1$ left over

$5 \% 3 = 2$ because $5 - 3 = 2$ left over

$6 \% 3 = 0$, because $6 - 3 = 3$, subtract 3 again = 0 left over

Sisa hasil bagi =
0 / 1 / 2

Modular math helps us understand how to create the PCC rules!

Example: 2 WAN Connections

2 PCC Rules Required

Denominator Remainder

Per Connection Classifier: src address : 2 / 0 First WAN Connection

Per Connection Classifier: src address : 2 / 1 Second WAN Connection

- The first line means "produce the output of the hash function given the packet's source IP address, divide it by 2 and if the remainder is 0, perform the action of marking the connection as WAN1".
- The second line means "produce the output of the hash function given the packet's source IP address, divide it by 2 and if the remainder is 1, perform the action of marking the connection as WAN2".

Slide Tambahan (Detail PCC)

2 WAN connections:

2 / 0 First WAN

2 / 1 Second WAN

3 WAN connections:

3 / 0 First WAN

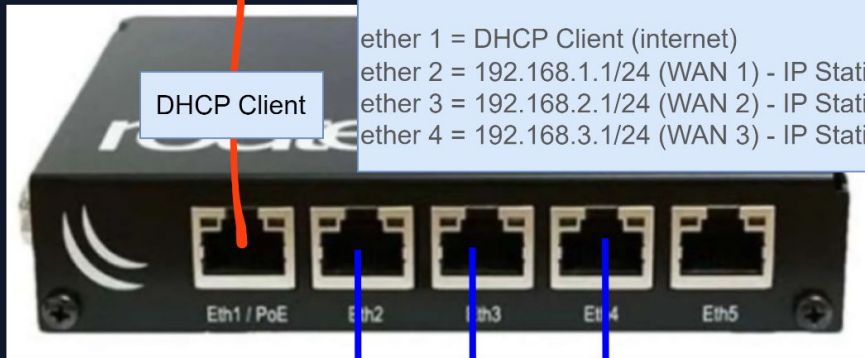
3 / 1 Second WAN

3 / 2 Third WAN and so on...



RB Induk [RB 450 Gx4]

- ether 1 = DHCP Client (internet)
- ether 2 = 192.168.1.1/24 (WAN 1) - IP Static
- ether 3 = 192.168.2.1/24 (WAN 2) - IP Static
- ether 4 = 192.168.3.1/24 (WAN 3) - IP Static



WAN 1 20 Mbps	WAN 2 20 Mbps	WAN 3 20 Mbps
-------------------------	-------------------------	-------------------------

... [RB GR3]

- .1.2/24 (WAN 1) - IP Static
- .2.2/24 (WAN 2) - IP Static
- .3.2/24 (WAN 3) - IP Static



Per Connection Classifier is a mangle option that sorts data into streams that can be marked for identification later.

