

Load Balancing Using PCC & RouterOS

About Me



- Steve Discher, from College Station, Texas, USA
- Class of '87 Texas A&M University
- Using MikroTik since early 2004 when I started my first WVISP
- Author of the book “RouterOS by Example”
- MikroTik Certified Trainer and teach RouterOS classes, MyWISPTraining.com
- Operate a wireless distribution company, ISPSupplies.com

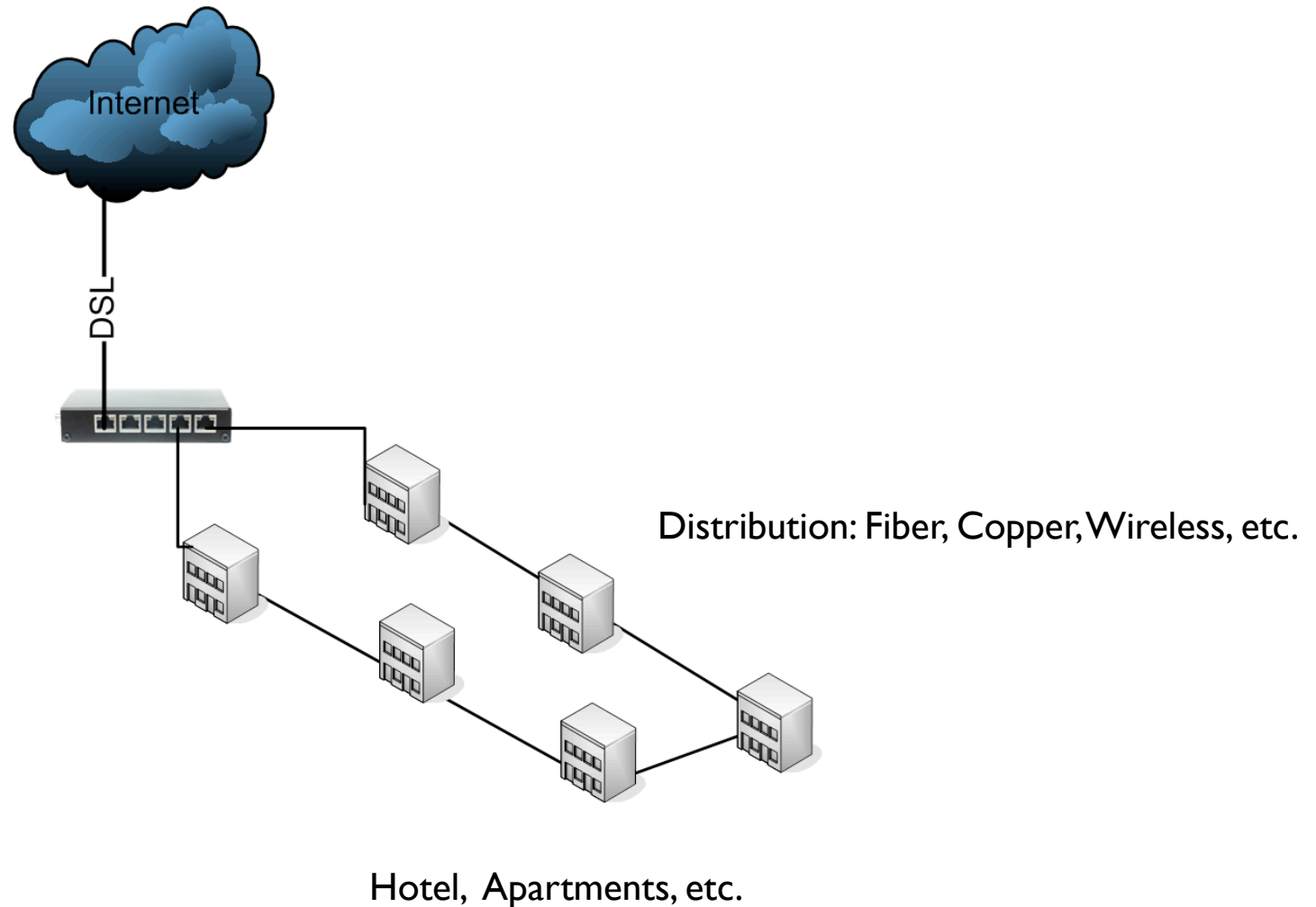
I. What is load balancing and why would I want it?

2. Which method should I pick and how does it work?

**3. Ok, I want it but how do I
set it up?**

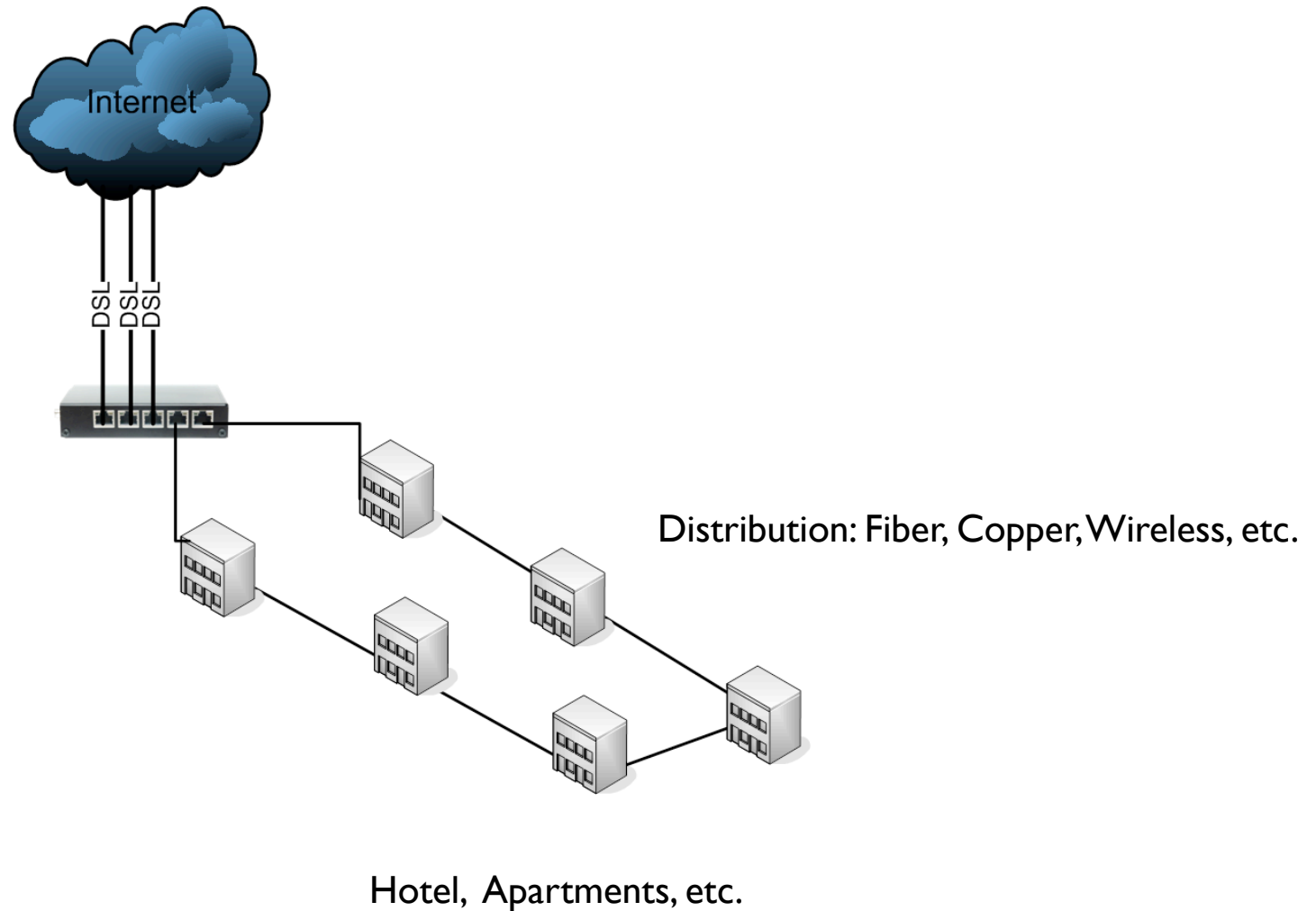
Typical Scenario Requiring Load Balancing

Problem: No high capacity circuits available, DSL only



Typical Scenario Requiring Load Balancing

Solution: Multiple low capacity circuits, RouterOS load balancing



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- Process to utilize multiple internet connections in such a manner as to proportionately distribute internet traffic across all the connections.
- Distribution may be symmetrical or asymmetrical depending on circuit availability.
- Useful when the downstream bandwidth requirement to a single routing device exceeds the capabilities of a single internet circuit.

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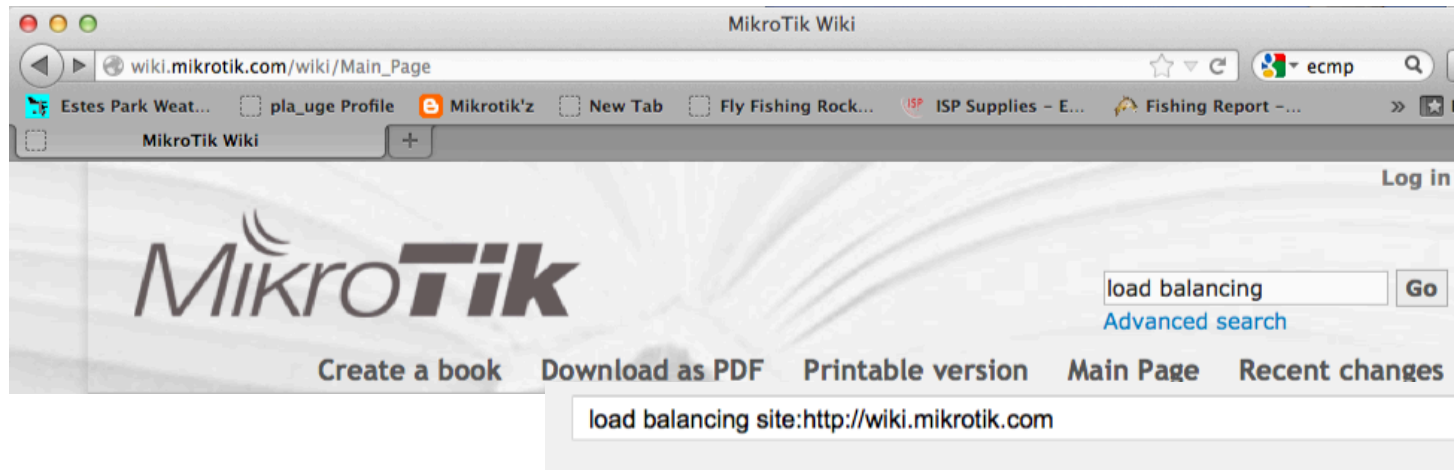
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- Bonding, MLPP, etc. require that the protocol be recognized on both the subscriber and provider ends. Not available with commodity internet connections.
- Can't simply bridge two DSL or Cable modem connections, doesn't work.
- There are several methods to provide load balancing in RouterOS.

Example



88 hits!

Ads related to load balancing site:http://wiki.mikrotik.com

[Why these ads?](#)

[Load Balancing Solution | BarracudaNetworks.com](#)
www.barracudanetworks.com/
Easy-To-Use Appliance Distributes Network Traffic Across Servers.

[Load Balancing 101 | f5.com](#)
www.f5.com/load_balancing
Learn the 'Nuts & Bolts' of **Load Balancing** with F5's White Paper

[Citrix® Load Balancer | Citrix.com](#)
www.citrix.com/NetScaler
5X Capacity On-Demand App Delivery. 10+ Free **Load Balancing** Whitepapers
Choose Your NetScaler Trial - How NetScaler Helps Your Business

[ECMP load balancing with masquerade - MikroTik Wiki](#)
wiki.mikrotik.com/wiki/ECMP_load_balancing_with_masquerade
Apr 7, 2009 – This example is improved (different) version of round-robin **load balancing** example. It adds persistent user sessions, i.e. a particular user ...

[Per-Traffic Load Balancing - MikroTik Wiki](#)
wiki.mikrotik.com/wiki/Per-Traffic_Load_Balancing
Sep 3, 2010 – As a result of this limitation **load-balancing** multiple internet backbone

Options Available

Load Balancing Options With RouterOS:

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- Greatest success with any solution by understanding the pieces and what they do.

Understanding the PCC Load Balancing Solution

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Understanding the PCC Load Balancing Solution

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1. **Packet** - The container for our data, header and payload.
2. **Connections** - “Conduit” through which host to host communication occurs, based on Src/Dst addresses and ports
3. **Mangle Facility** - Firewall function within RouterOS that allows you to create a mark which is then associated with packets that can be identified later by other functions like firewall rules or routing tables.

Understanding the PCC Load Balancing Solution

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4. **PCC** - Per Connection Classifier, function contained with the “Mangle Facility” to sort traffic into streams

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5. **Routing Table** - Route rules, the rules the router uses to determine what to do with a packet. By comparing the destination address in the packet to the list of routes, the router decides which interface to send the packet out. By adding a routing mark with mangle, we can have multiple routing tables!

Understanding the PCC Load Balancing Solution

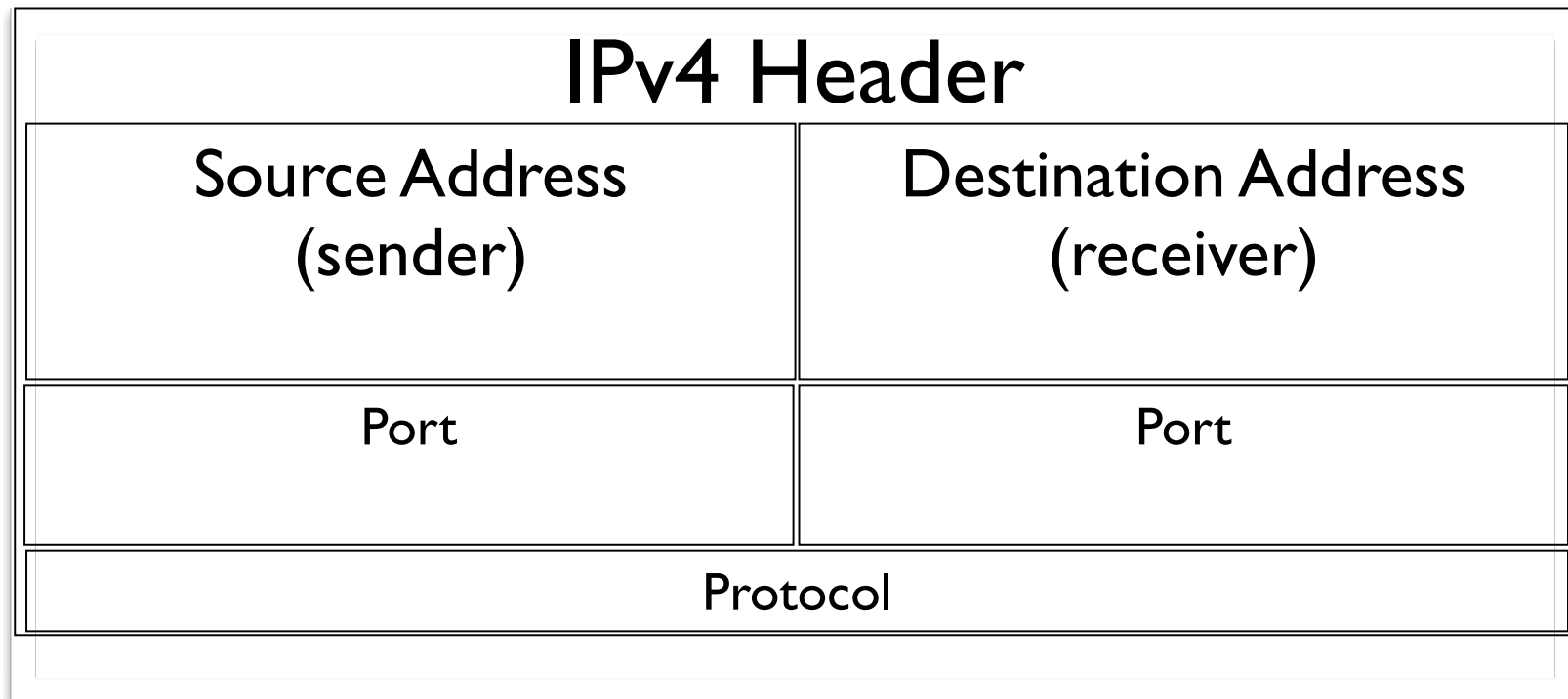
1. What is a packet?

A packet is like a letter & envelope.

The front is the header and the letter inside the envelope is the payload.

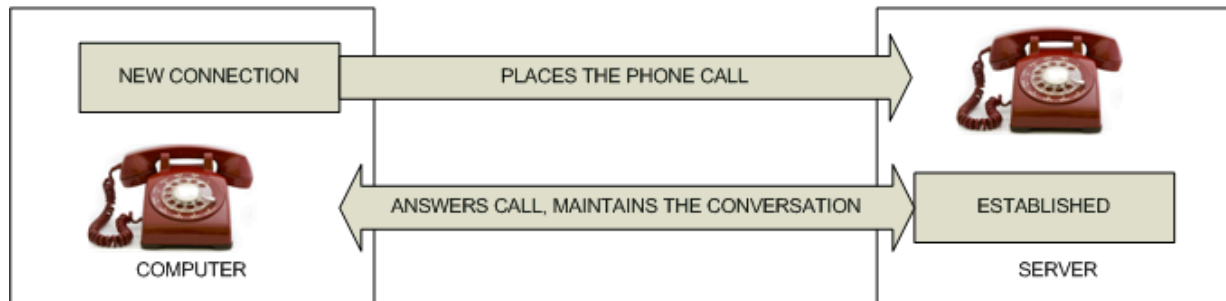


Understanding the PCC Load Balancing Solution

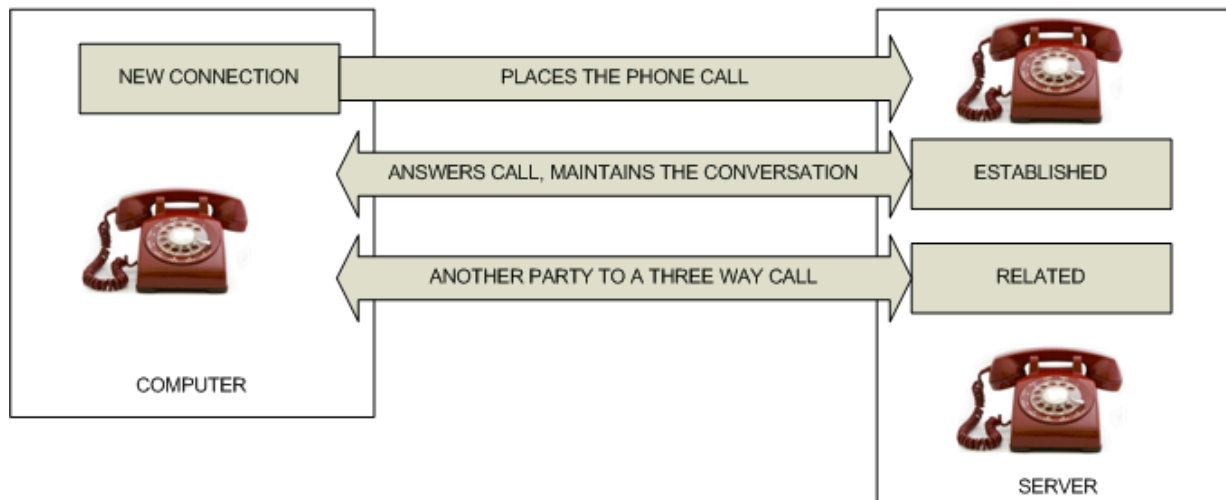


Understanding the PCC Load Balancing Solution

2. What are connections?



Connections are always in one of three states - new, established, or related.



Understanding the PCC Load Balancing Solution

3. What is the mangle facility?

If - Then: Identify and then perform some action.

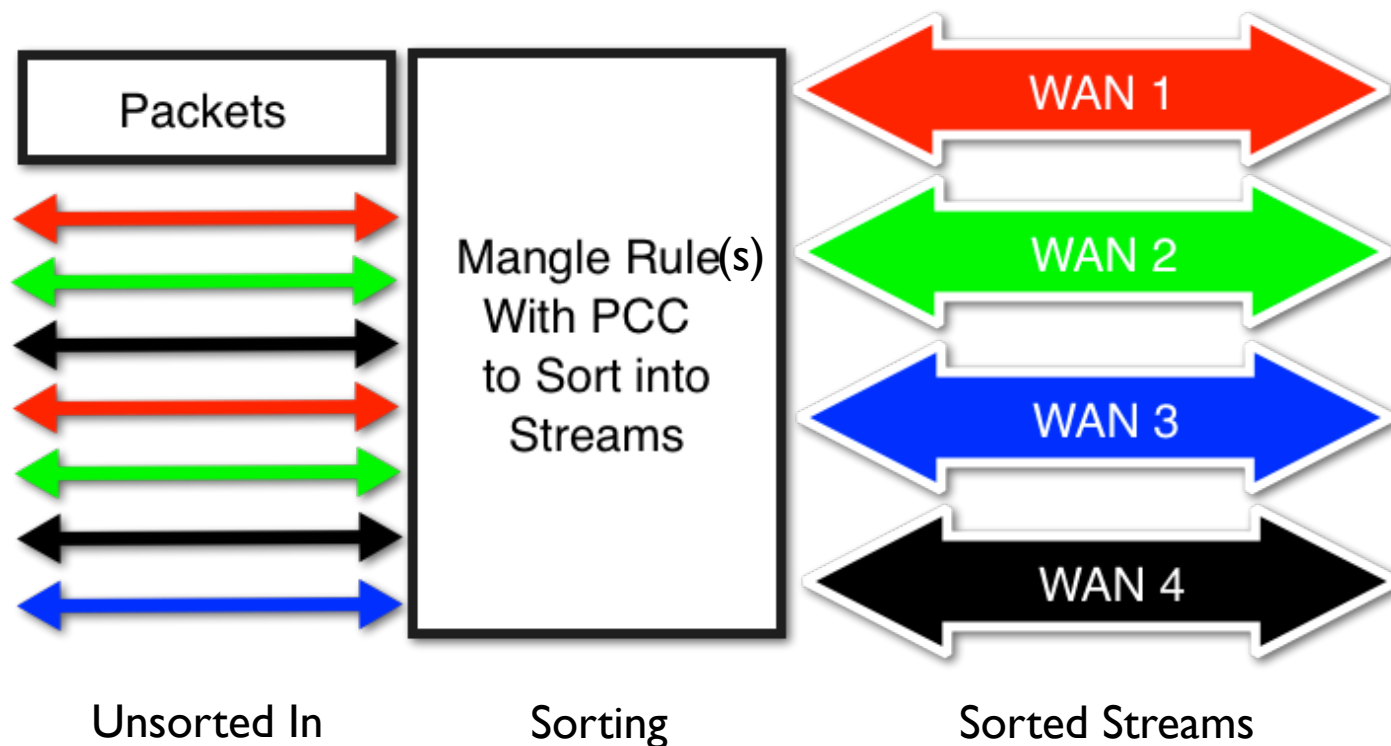
The screenshot shows the Mikrotik WinBox Firewall configuration interface. The 'Mangle' tab is selected, displaying a list of rules. A 'New Mangle Rule' dialog box is open, showing the 'General' tab with 'Chain' set to 'prerouting'. A callout box explains the 'If-Then' logic: 'If - Then: Identify and then perform some action.'

#	Action	Chain	Any. Port	Ro...	Src. Ad...	Ds...	New Packet Mark	New Connection ...	Bytes	Packets
5	passthrough	prerouting							13.0 GiB	40 88
6	jump	prerout								
10	mark connection	prerout								
11	mark connection	prerout								
12	mark connection	prerout								
13	mark connection	prerout								
14	mark connection	prerout								
15	change DSCP (TOS)	prerout								
16	mark connection	prerout								

Understanding the PCC Load Balancing Solution

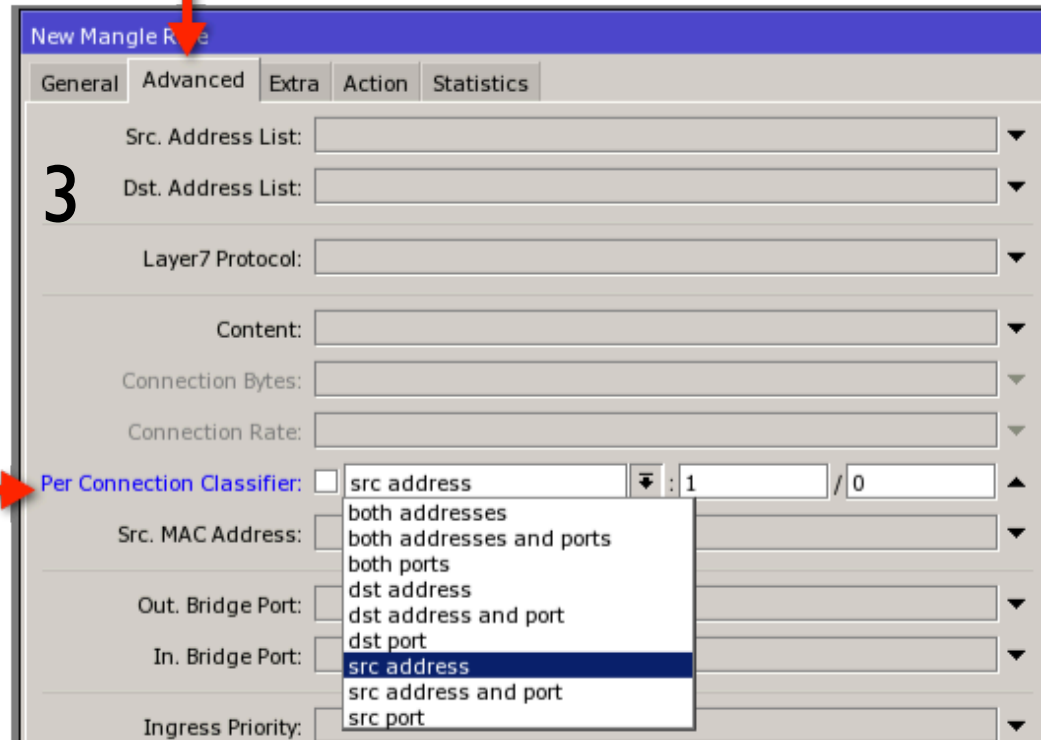
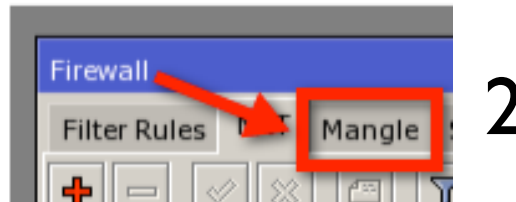
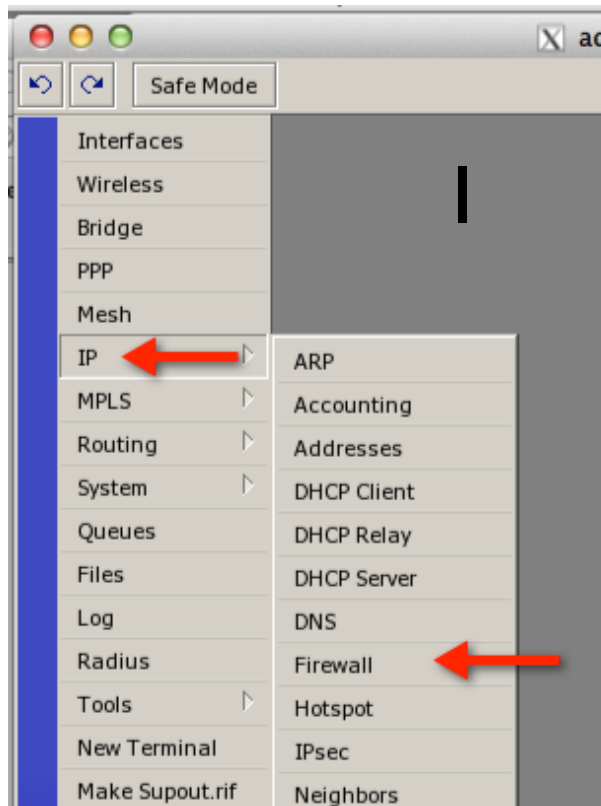
4. What is PCC?

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



Understanding the PCC Load Balancing Solution

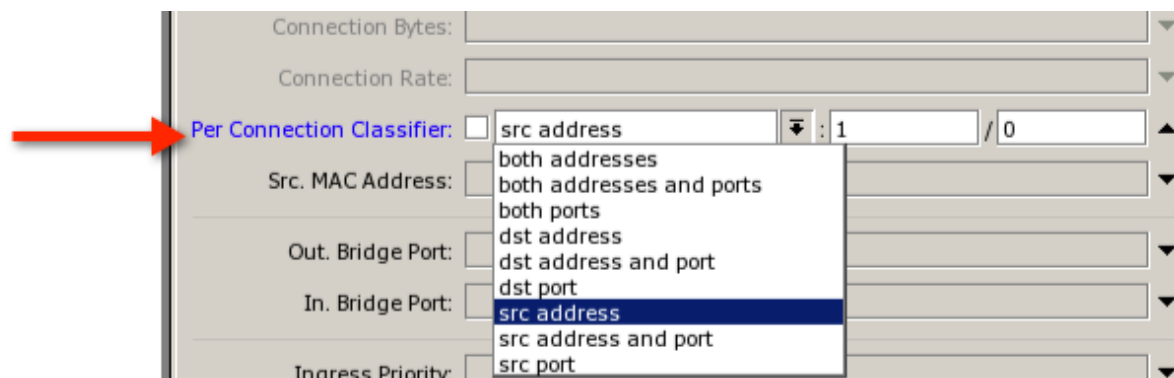
Where is it found?



Understanding the PCC Load Balancing Solution

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."



Understanding the PCC Load Balancing Solution

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:

Input x 100 = hash value

Understanding the PCC Load Balancing Solution

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

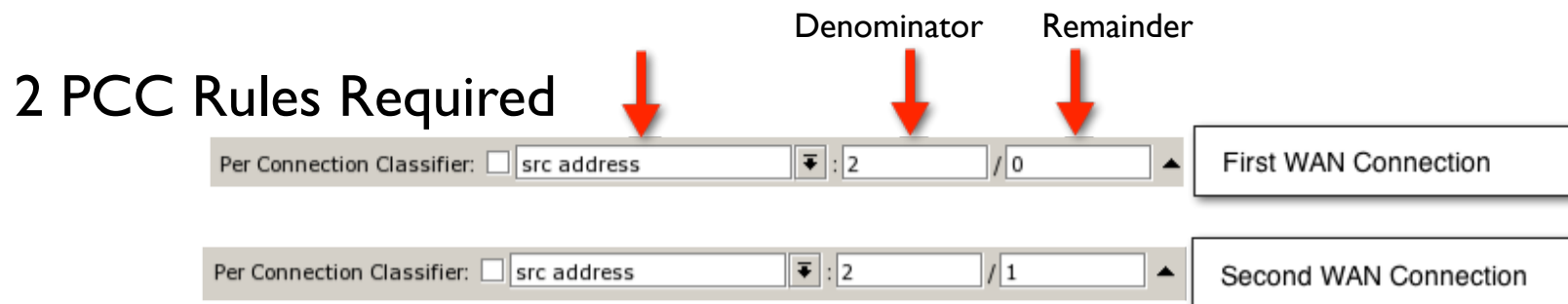
$5 \% 3 = 2$ because $5 - 3 = 2$ left over

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

Understanding the PCC Load Balancing Solution

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

Example: 2 WAN Connections



- 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".

Understanding the PCC Load Balancing Solution

How to set PCC, Remember:

2 WAN connections:

2 / 0 First WAN

2 / 1 Second WAN

3 WAN connections:

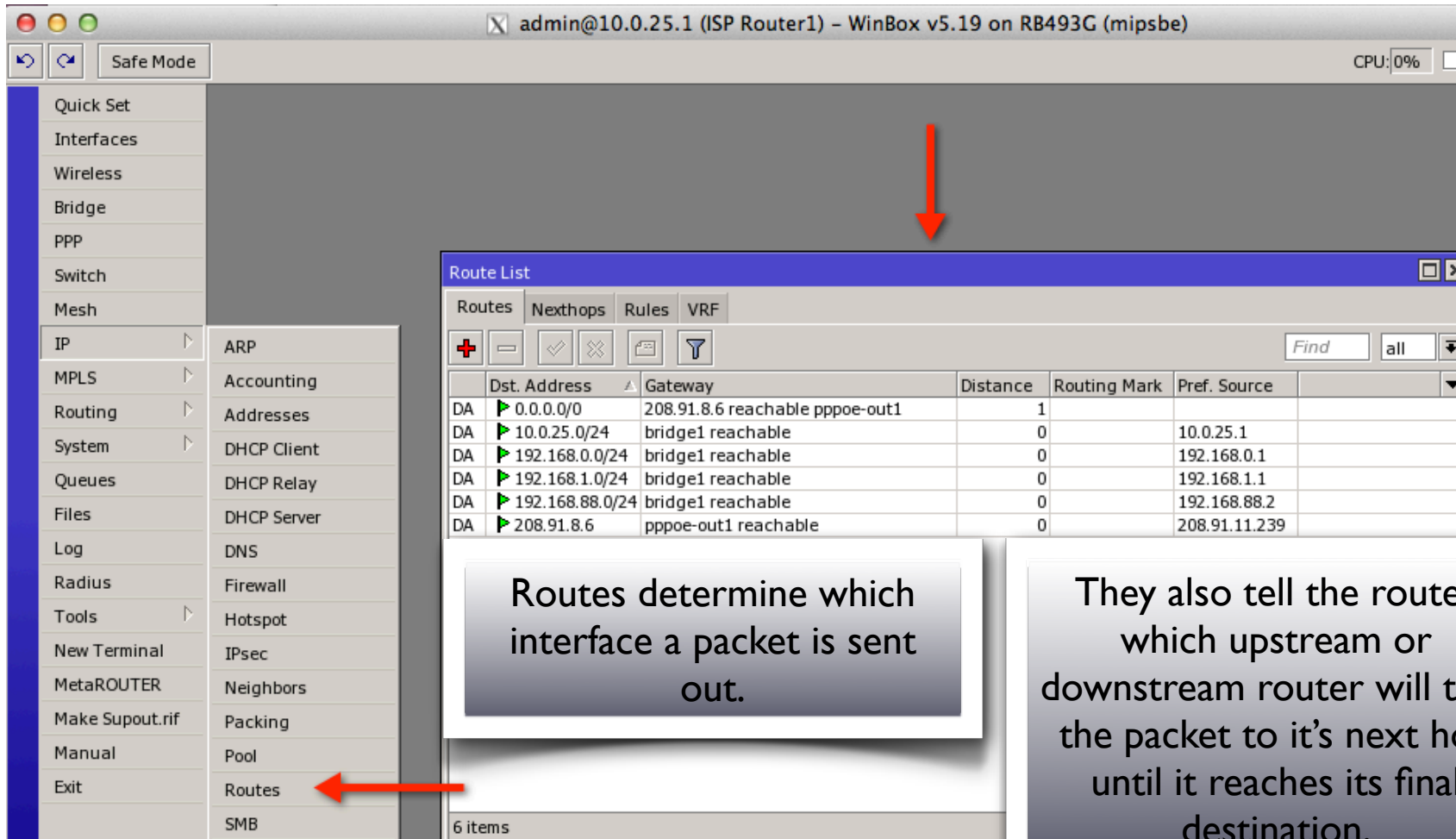
3 / 0 First WAN

3 / 1 Second WAN

3 / 2 Third WAN and so on...

Understanding the PCC Load Balancing Solution

5. What is a routing table?



The screenshot shows the WinBox interface for an ISP Router. The 'Route List' window is open, displaying a table of routes. The table has columns for Dst. Address, Gateway, Distance, Routing Mark, and Pref. Source. The routes listed are:

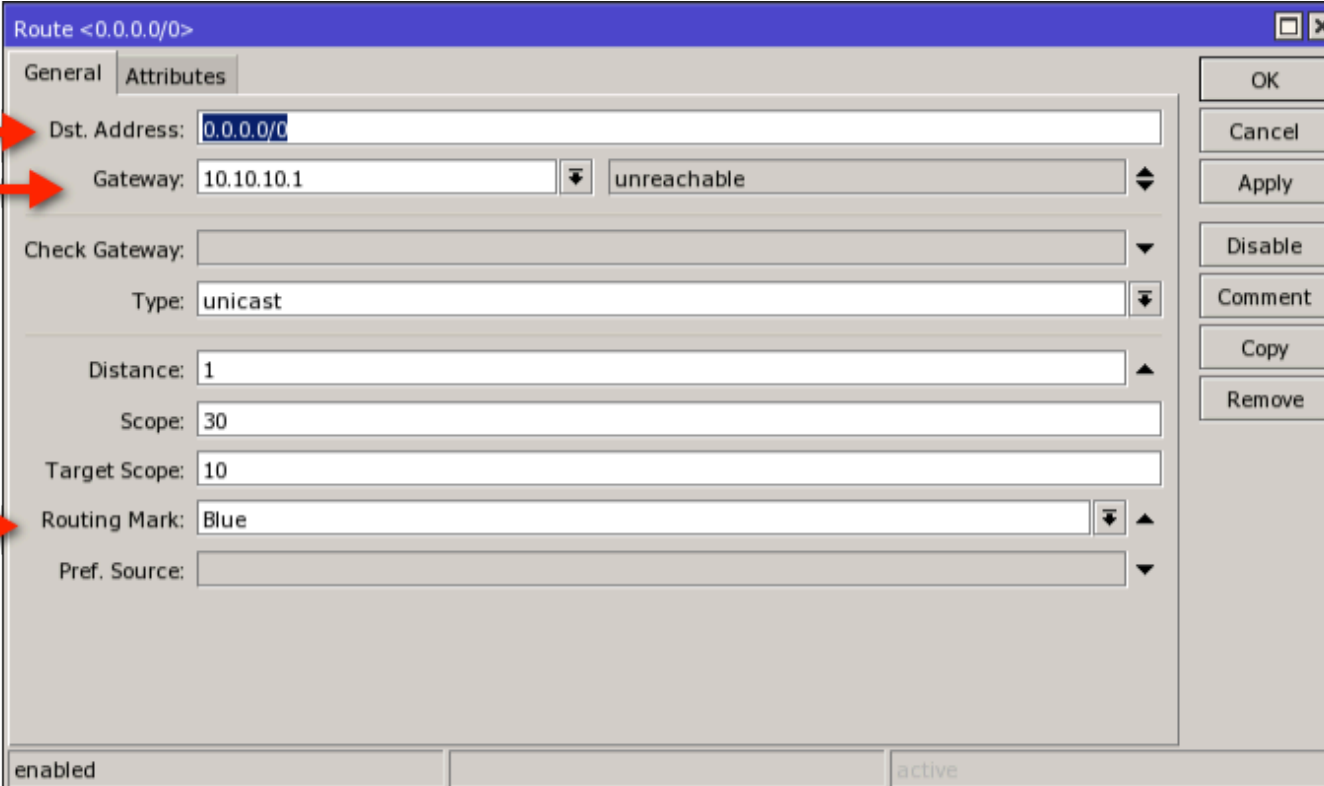
Dst. Address	Gateway	Distance	Routing Mark	Pref. Source
0.0.0.0/0	208.91.8.6 reachable pppoe-out1	1		
10.0.25.0/24	bridge1 reachable	0		10.0.25.1
192.168.0.0/24	bridge1 reachable	0		192.168.0.1
192.168.1.0/24	bridge1 reachable	0		192.168.1.1
192.168.88.0/24	bridge1 reachable	0		192.168.88.2
208.91.8.6	pppoe-out1 reachable	0		208.91.11.239

Two callout boxes provide additional information:

- Routes determine which interface a packet is sent out.**
- They also tell the router which upstream or downstream router will take the packet to its next hop until it reaches its final destination.**

Understanding the PCC Load Balancing Solution

Details of a route, key pieces are destination and gateway.



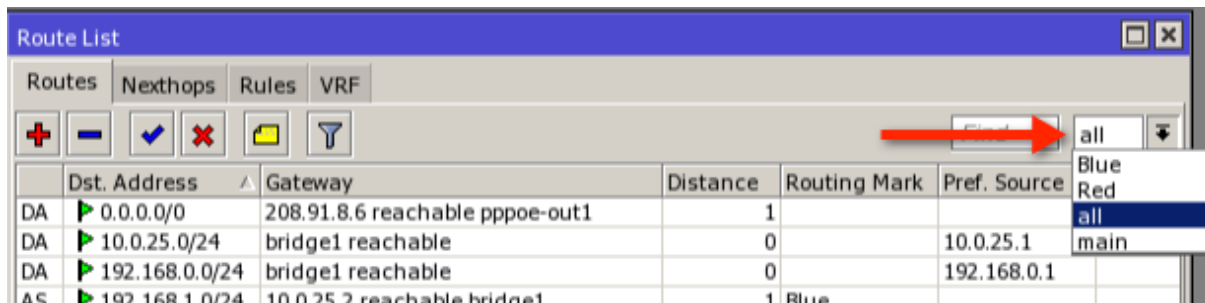
The screenshot shows the Mikrotik configuration window for a route titled "Route <0.0.0.0/0>". The window has two tabs: "General" and "Attributes". The "General" tab is active. The configuration fields are as follows:

- Dst. Address:** 0.0.0.0/0 (highlighted with a red arrow)
- Gateway:** 10.10.10.1 (highlighted with a red arrow)
- Check Gateway:** (empty)
- Type:** unicast
- Distance:** 1
- Scope:** 30
- Target Scope:** 10
- Routing Mark:** Blue (highlighted with a red arrow)
- Pref. Source:** (empty)

On the right side of the window, there are several buttons: OK, Cancel, Apply, Disable, Comment, Copy, and Remove. At the bottom of the window, there are two status indicators: "enabled" and "active".

Understanding the PCC Load Balancing Solution

Multiple routing tables with route marks



The screenshot shows the 'Route List' window in Mikrotik WinBox. The 'Routing Mark' column is highlighted, and a dropdown menu is open, showing options: 'all', 'Blue', 'Red', 'all', and 'main'. A red arrow points to the 'all' option in the dropdown. The table below shows the routing entries.

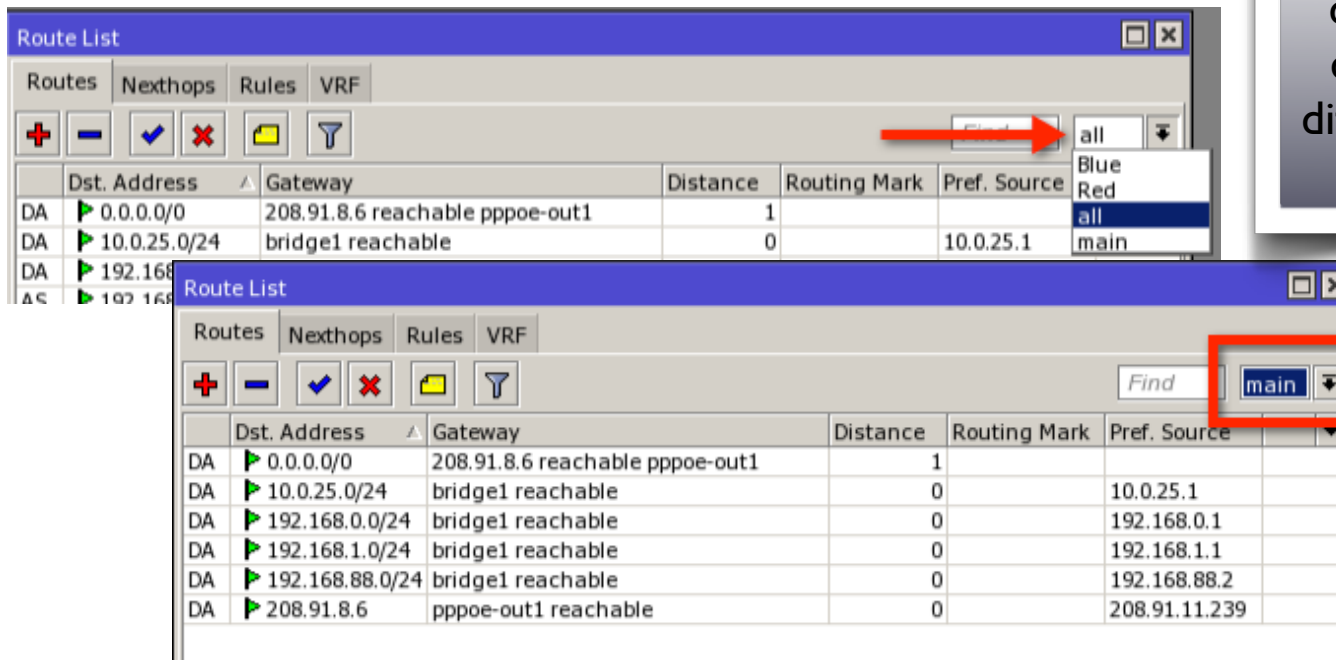
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DA	0.0.0.0/0	208.91.8.6 reachable pppoe-out1	1		
DA	10.0.25.0/24	bridge1 reachable	0		10.0.25.1
DA	192.168.0.0/24	bridge1 reachable	0		192.168.0.1
AS	192.168.1.0/24	10.0.25.2 reachable bridge1	1	Blue	

May have multiple routes to same destination network, different gateways in different routing tables!

Understanding the PCC Load Balancing Solution

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The image shows three overlapping screenshots of the Mikrotik WinBox 'Route List' window, illustrating how multiple routing tables can be used for load balancing. Each window has a 'Find' dropdown menu.

- The top window shows a dropdown menu with options: 'all', 'Blue', 'Red', 'all', and 'main'. A red arrow points to the 'all' option.
- The middle window has the 'Find' dropdown set to 'main'.
- The bottom window has the 'Find' dropdown set to 'Red'.

The bottom window's table shows routes with different 'Routing Mark' values:

Dst. Address	Gateway	Distance	Routing Mark	Pref. Source
AS 192.168.4.0/24	10.0.25.2 reachable bridge1	1	Red	
AS 192.168.5.0/24	10.0.25.2 reachable bridge1	1	Red	

Understanding the PCC Load Balancing Solution

Multiple routing tables with route marks

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The image displays four overlapping screenshots of the Mikrotik WinBox 'Route List' window, illustrating how different routing tables are used for load balancing. Each window shows a table of routes with columns for Dst. Address, Gateway, Distance, Routing Mark, and Pref. Source.

- Top Window:** Shows a route for 0.0.0.0/0 with gateway 208.91.8.6 and a routing mark of 'all'. A red arrow points to the 'Find' dropdown menu, which is open and shows options: 'all', 'Blue', 'Red', 'all', and 'main'.
- Second Window:** Shows a route for 10.0.25.0/24 with gateway bridge1 and a routing mark of 'main'. The 'Find' dropdown menu is set to 'main'.
- Third Window:** Shows a route for 192.168.4.0/24 with gateway 10.0.25.2 and a routing mark of 'Red'. The 'Find' dropdown menu is set to 'Red'.
- Bottom Window:** Shows three routes for 192.168.1.0/24, 192.168.2.0/24, and 192.168.3.0/24, all with gateway 10.0.25.2 and a routing mark of 'Blue'. The 'Find' dropdown menu is set to 'Blue'.

Understanding the PCC Load Balancing Solution

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I. **Packet** - Container for IP data

Understanding the PCC Load Balancing Solution

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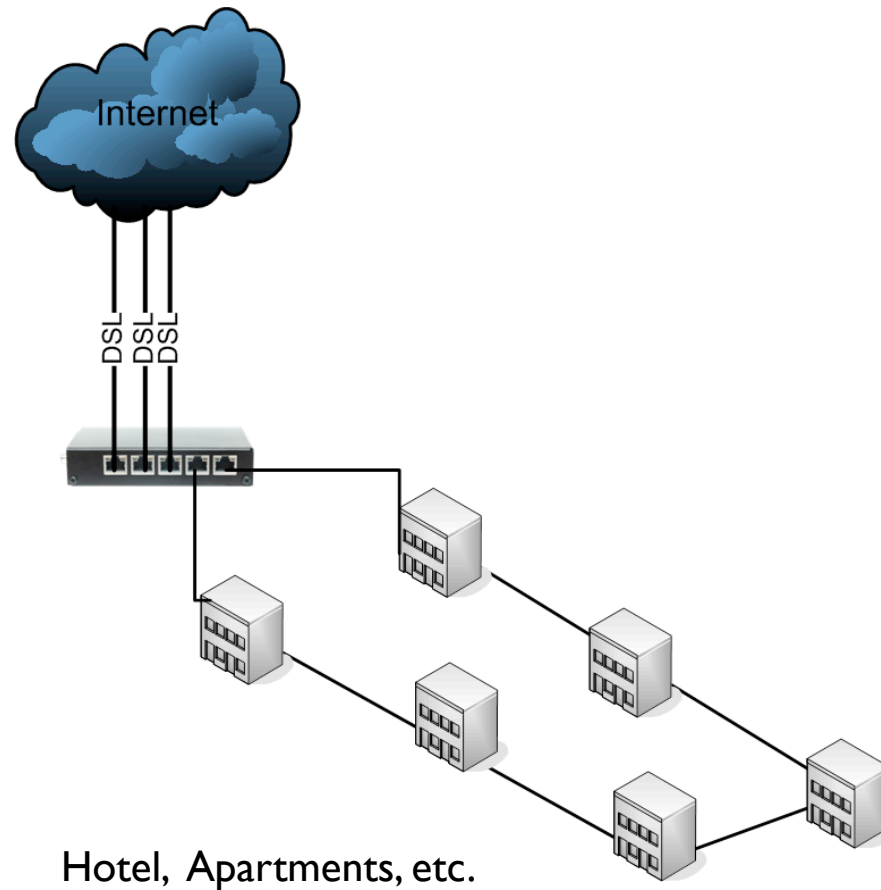
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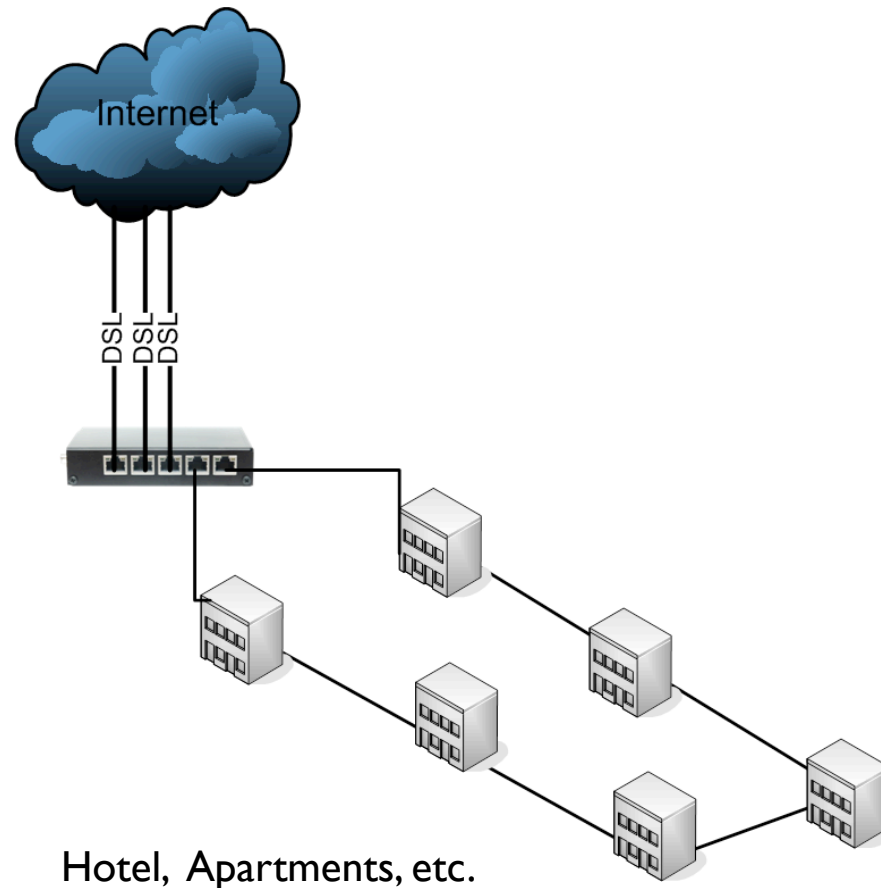
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5. **Routing Table** - List of route rules to direct packets and we can have multiple tables based on routing marks

3. Ok, I want it but how do I set it up?



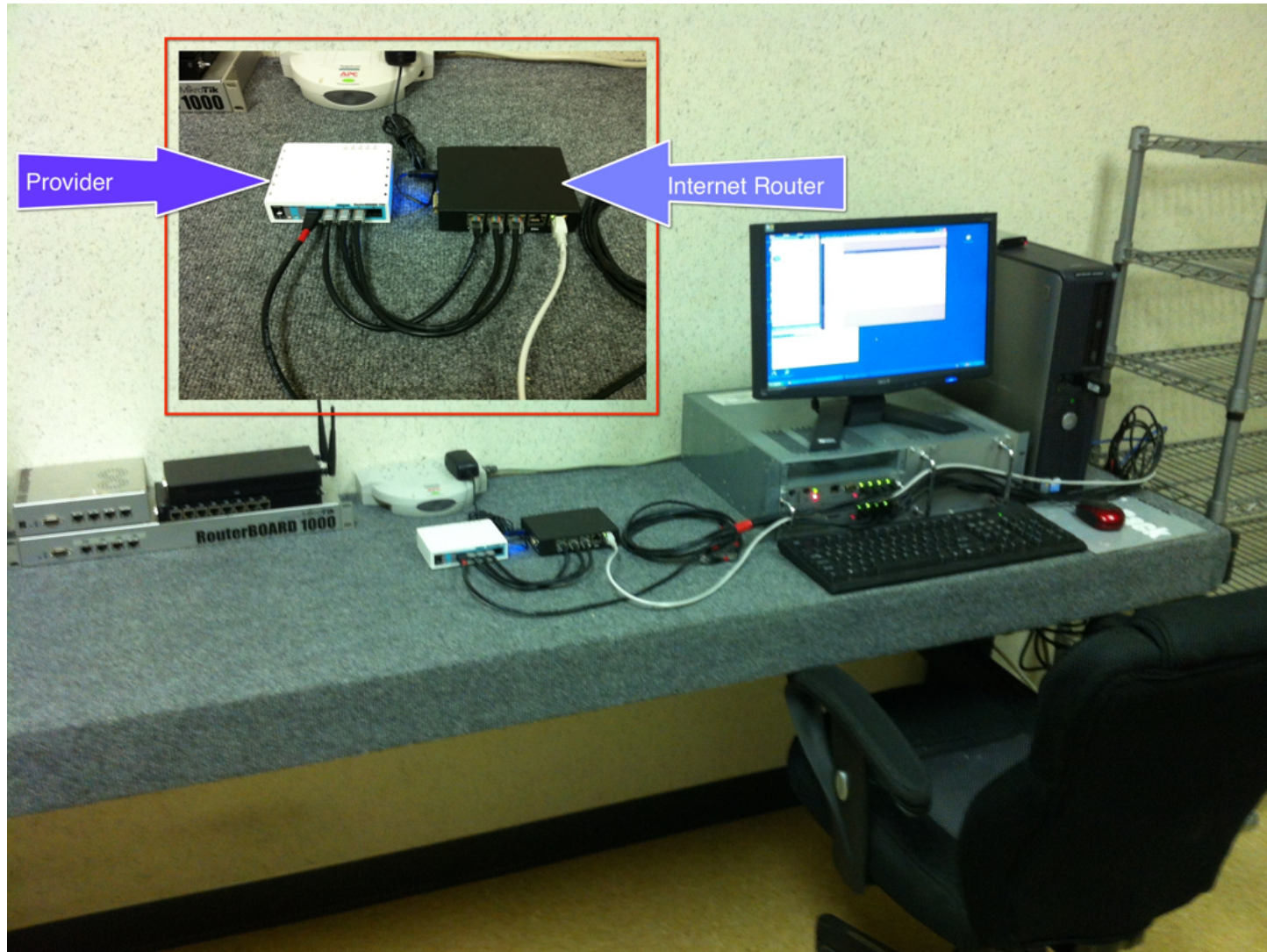
3. Ok, I want it but how do I set it up?

Scenario: One router, many clients, three DSL connections



Step by Step Configuration

Test Setup



Step by Step Configuration

I. Set up the basic portion of the network (MTCNA, Wiki, etc):

- Private IP address on LAN interface
- DHCP Server on LAN interface
- DNS server
- Static IP for WAN or DHCP client on WAN
- Firewall if required

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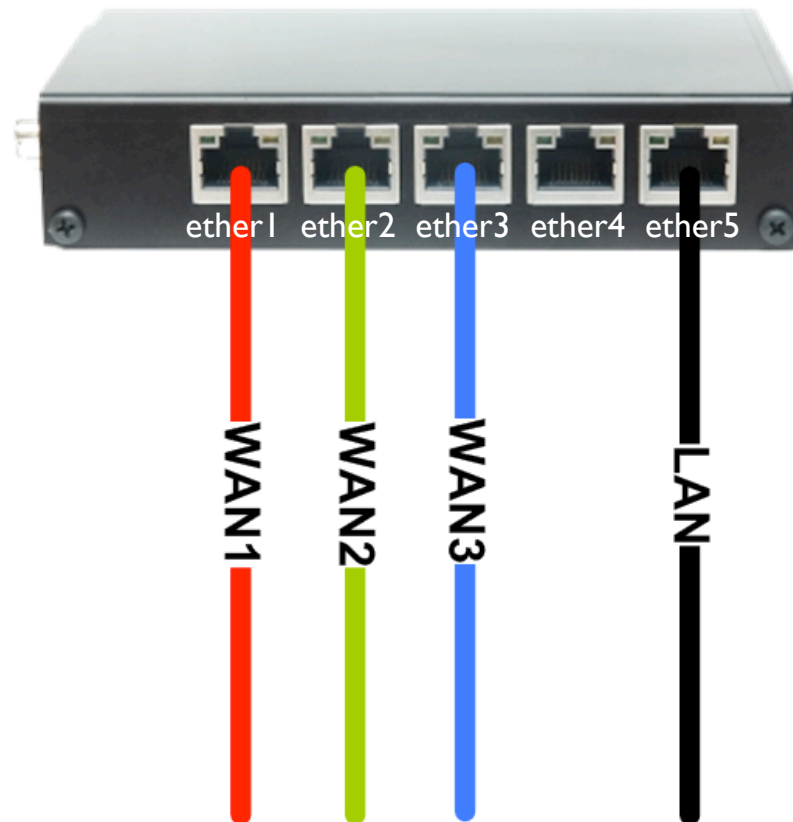
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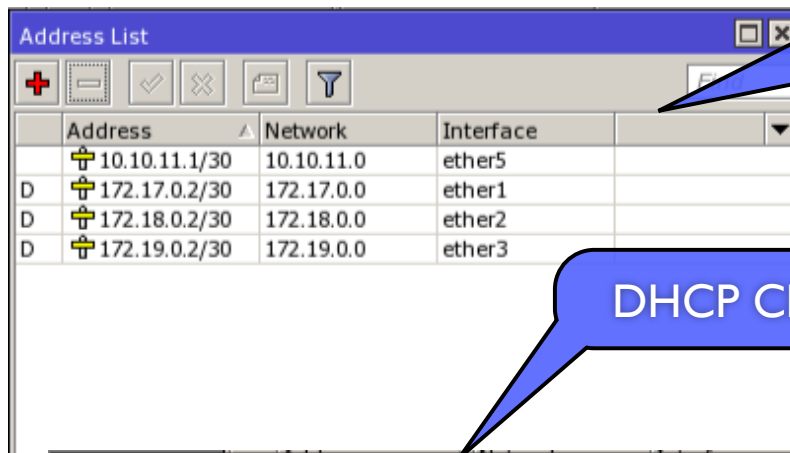
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Physical interface connections



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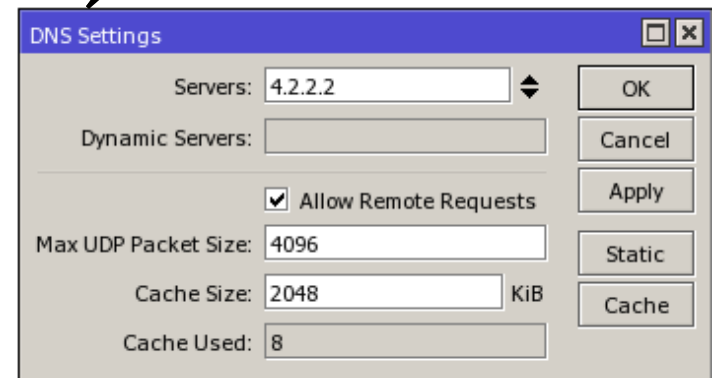


Address List

Address	Network	Interface
10.10.11.1/30	10.10.11.0	ether5
D 172.17.0.2/30	172.17.0.0	ether1
D 172.18.0.2/30	172.18.0.0	ether2
D 172.19.0.2/30	172.19.0.0	ether3

IP Addresses

DNS Client & Caching



DNS Settings

Servers: 4.2.2.2

Dynamic Servers:

Allow Remote Requests

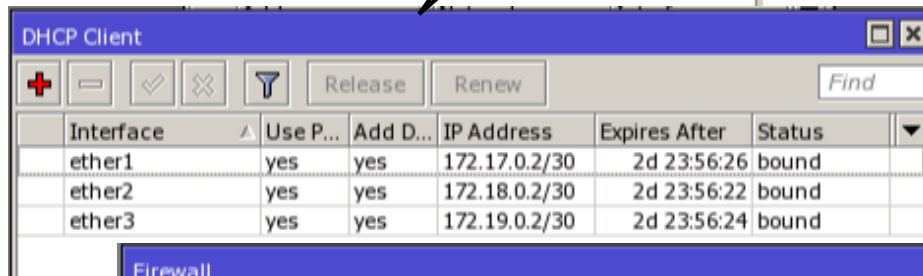
Max UDP Packet Size: 4096

Cache Size: 2048 KiB

Cache Used: 8

Buttons: OK, Cancel, Apply, Static, Cache

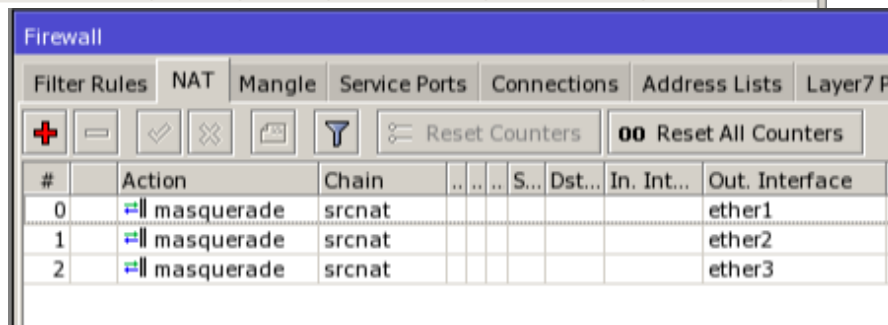
DHCP Client - WAN



DHCP Client

Interface	Use P...	Add D...	IP Address	Expires After	Status
ether1	yes	yes	172.17.0.2/30	2d 23:56:26	bound
ether2	yes	yes	172.18.0.2/30	2d 23:56:22	bound
ether3	yes	yes	172.19.0.2/30	2d 23:56:24	bound

Masquerade Rules



Firewall

Filter Rules NAT Mangle Service Ports Connections Address Lists Layer7 P...

Reset Counters 00 Reset All Counters

#	Action	Chain	In. Int...	Out. Interface
0	masquerade	srcnat		ether1
1	masquerade	srcnat		ether2
2	masquerade	srcnat		ether3

Step by Step Configuration

2. Create load balancing part of the configuration:

- Create various mangle rules to mark connections
- Create mangle rules to associate routing marks with packets based on their connection mark.
- Create routes to send traffic out the WAN connections in a predetermined manner.

Step by Step Configuration

Step 1: Create some accept rules.

We have to manually force local traffic to connected networks to stay in the main routing table.

- Background - Any subnet for which the router has an IP address configured is called a connected network, meaning packets to that network are sent out an interface and can reach their destination without using another router to get there.

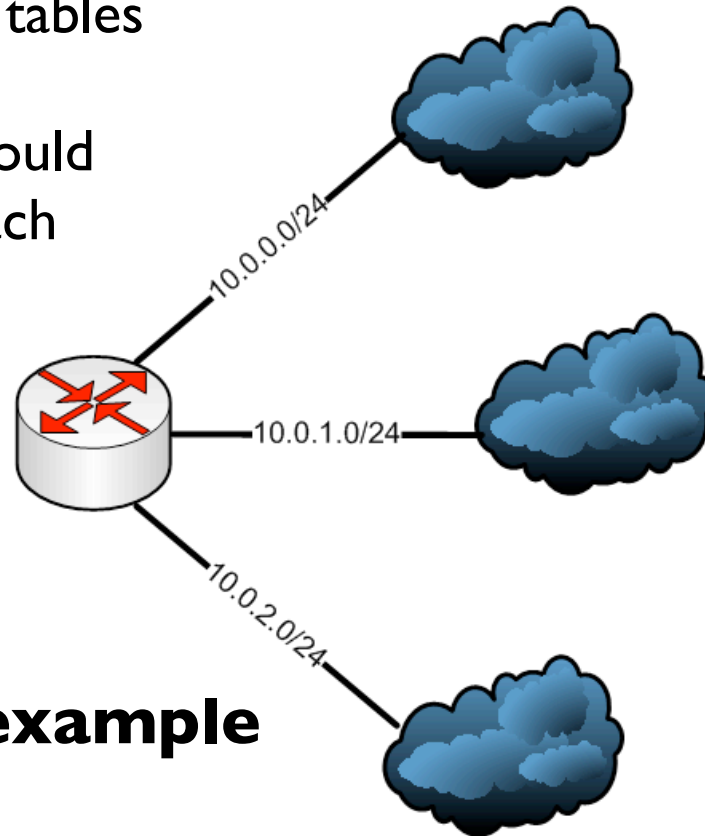
Step by Step Configuration

Step 1 continued...

The problem using mangles here is it will force traffic to follow alternate routing tables (not main)

Traffic to these connected networks would go out the WAN interfaces and not reach their intended destinations.

10.0.0.1/24
10.0.1.1/24
10.0.2.1/24



Connected network example

Step by Step Configuration

Step 1 continued...

Solution:

- The “accept” action causes the packet to leave the mangle chain, thereby not marking it and allowing that traffic to use the main routing table.

Step by Step Configuration

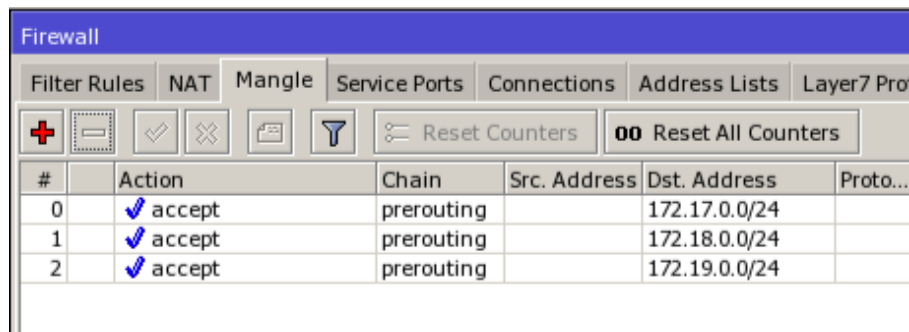
Step 1 continued...

The image shows three overlapping Mikrotik WinBox configuration windows for Mangle Rules. Each window is titled 'Mangle Rule <[IP Address]/24>'. The first window is for 172.17.0.0/24, the second for 172.18.0.0/24, and the third for 172.19.0.0/24. All three windows have the 'Chain' field set to 'prerouting'. The 'Dst. Address' field is set to the respective network address. The 'Action' field in the third window is set to 'accept'. The windows are arranged in a staggered fashion, with the third window in the foreground.

- One rule for each connected network, in this example these are our WAN networks

Step by Step Configuration

Step 1 Completed



The screenshot shows the Mikrotik WinBox Firewall configuration interface. The 'Mangle' tab is selected. A table lists three rules:

#	Action	Chain	Src. Address	Dst. Address	Proto...
0	✓ accept	prerouting		172.17.0.0/24	
1	✓ accept	prerouting		172.18.0.0/24	
2	✓ accept	prerouting		172.19.0.0/24	

Create one rule for each connected network (WAN's)

Completed accept mangle rules

```
/ip firewall mangle
add action=accept chain=prerouting disabled=no dst-address=172.17.0.0/24
add action=accept chain=prerouting disabled=no dst-address=172.18.0.0/24
add action=accept chain=prerouting disabled=no dst-address=172.19.0.0/24
```

Step by Step Configuration

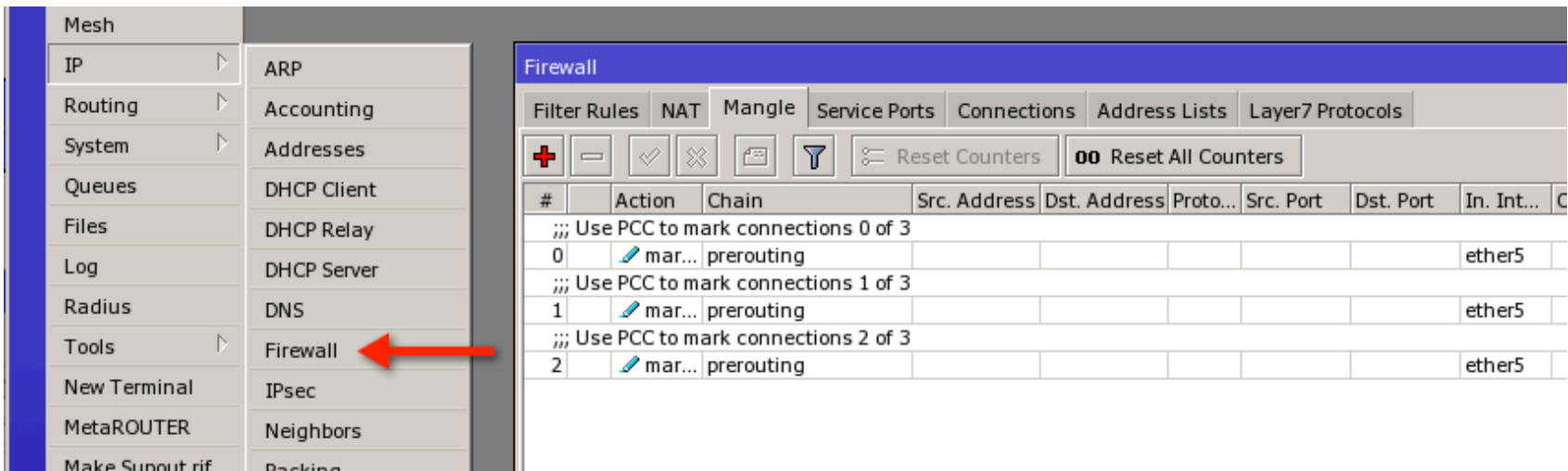
Step 2: Create Mangle rules that will sort the traffic into streams.

Create the PCC mangles:

- We will use optimal mangle method of marking connections first and then packets because it is the most efficient way to mark traffic, uses least resources.
 - First identify traffic and mark the connection.
 - Second, look for that connection mark and mark the routes.

Step by Step Configuration

Step 2 Continued...



The screenshot shows the Mikrotik WinBox interface for Firewall configuration. The left sidebar has a red arrow pointing to the 'Firewall' menu item. The main window displays the Firewall configuration page with the following table:

#	Action	Chain	Src. Address	Dst. Address	Proto...	Src. Port	Dst. Port	In. Int...	C
;;; Use PCC to mark connections 0 of 3									
0	mar...	prerouting						ether5	
;;; Use PCC to mark connections 1 of 3									
1	mar...	prerouting						ether5	
;;; Use PCC to mark connections 2 of 3									
2	mar...	prerouting						ether5	

Step by Step Configuration

Step 2 Continued...

The screenshot shows the Mikrotik WinBox configuration interface for a Firewall Mangle Rule. The left sidebar contains a menu with items: Mesh, IP, Routing, System, Queues, Files, Log, Radius, Tools, New Terminal, MetaROUTER, and Make Support rif. The main window is titled 'Firewall' and shows the 'Mangle Rule <>' configuration page. The 'General' tab is active, and the 'Chain' is set to 'prerouting'. The 'In. Interface' is set to 'ether5' and the 'Connection Mark' is set to 'no-mark'. A table on the right side of the configuration shows the rule's configuration for different ports.

Proto...	Src. Port	Dst. Port	In. Int...	C
			ether5	
			ether5	
			ether5	

Step by Step Configuration

Step 2 Continued...

The screenshot shows the Mikrotik WinBox configuration interface for a Firewall Mangle Rule. The left sidebar contains a navigation menu with items: Mesh, IP, Routing, System, Queues, Files, Log, Radius, Tools, New Terminal, MetaROUTER, and Make Support rif. The main window is titled 'Firewall' and shows the configuration for a 'Mangle Rule <>' in the 'prerouting' chain. The 'General' tab is active, showing the following fields:

- Chain: prerouting
- Src. Address List: [Empty]
- Dst. Address List: [Empty]
- Layer7 Protocol: [Empty]
- Content: [Empty]
- Connection Bytes: [Empty]
- Connection Rate: [Empty]
- Per Connection Classifier: both addresses : 3 / 0
- Src. MAC Address: [Empty]
- Connection Mark: no-mark

On the right side, there is a table with columns: 'Photo...', 'Src. Port', 'Dst. Port', 'In. Int...', and 'C'. The table contains three rows, each with 'ether5' in the 'In. Int...' column.

Step by Step Configuration

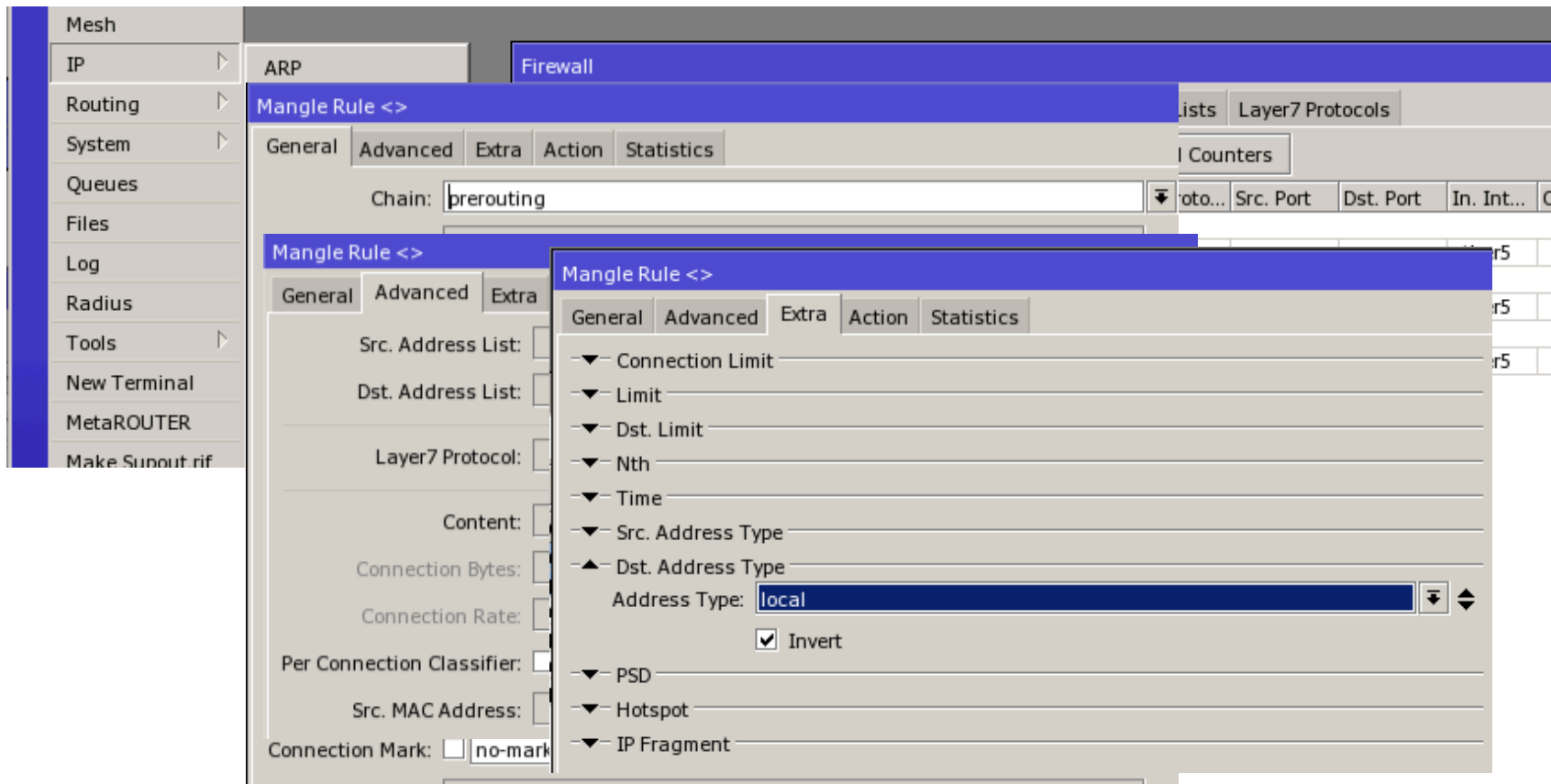
Step 2 Continued...

Several choices here, both addresses is the safest option, best balance of performance and reliability.

Photo...	Src. Port	Dst. Port	In. Int...	C
			ether5	
			ether5	
			ether5	

Step by Step Configuration

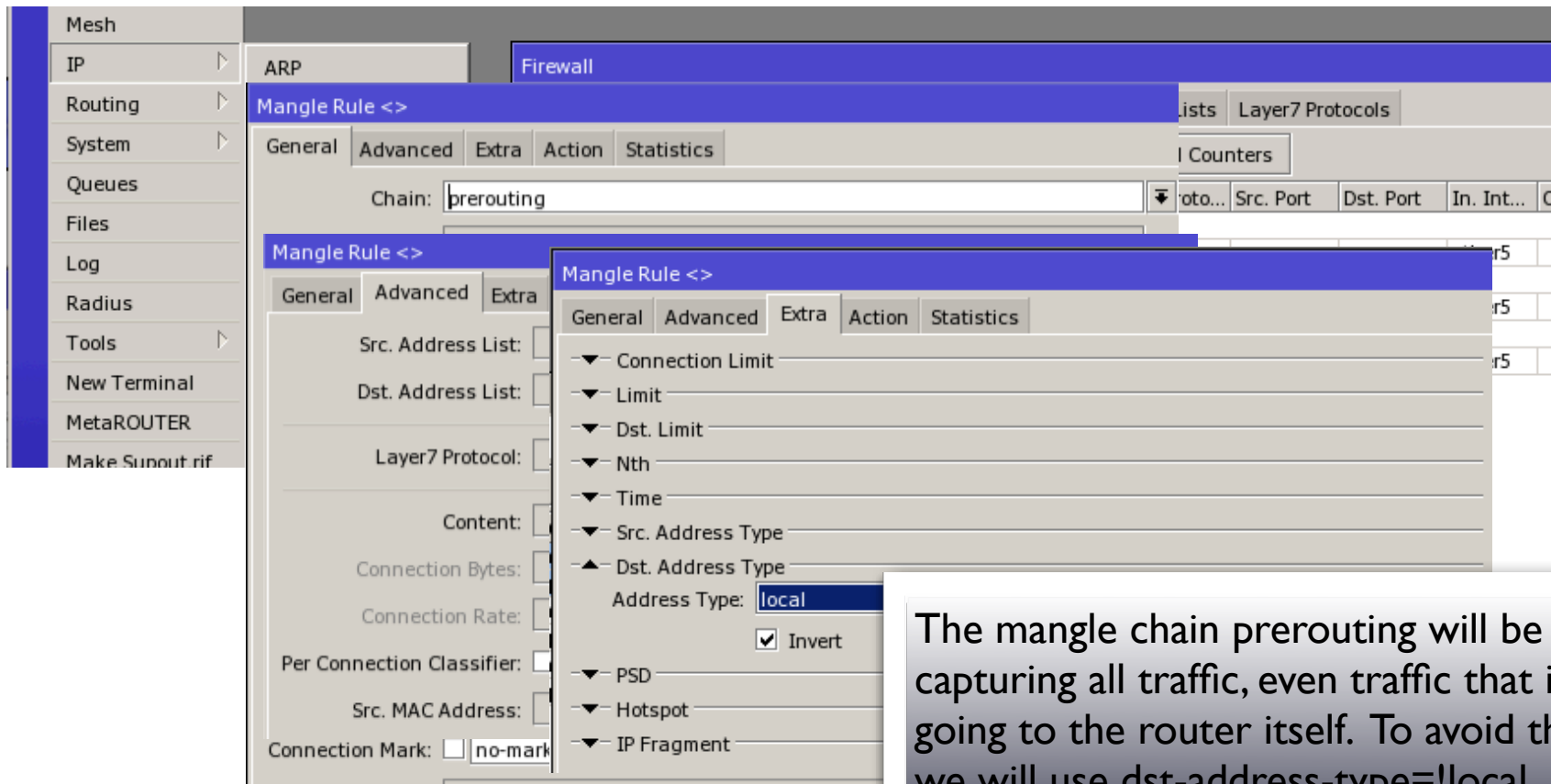
Step 2 Continued...



The screenshot displays the Mikrotik WinBox interface for configuring a Firewall Mangle Rule. The left sidebar shows the navigation menu with options like Mesh, IP, Routing, System, Queues, Files, Log, Radius, Tools, New Terminal, MetaROUTER, and Make Support. The main window is titled 'Firewall' and shows the 'Mangle Rule <>' configuration page. The 'Chain' is set to 'prerouting'. The 'General' tab is active, showing fields for 'Src. Address List', 'Dst. Address List', 'Layer7 Protocol', 'Content', 'Connection Bytes', 'Connection Rate', 'Per Connection Classifier', 'Src. MAC Address', and 'Connection Mark' (set to 'no-mark'). A secondary window is open over the 'Advanced' tab, showing a list of advanced options: 'Connection Limit', 'Limit', 'Dst. Limit', 'Nth', 'Time', 'Src. Address Type', 'Dst. Address Type', 'Address Type' (set to 'local'), 'Invert' (checked), 'PSD', 'Hotspot', and 'IP Fragment'.

Step by Step Configuration

Step 2 Continued...



The screenshot shows the Mikrotik WinBox Firewall Mangle Rule configuration. The 'Chain' is set to 'prerouting'. The 'Advanced' tab is selected, showing the following options:

- Connection Limit
- Limit
- Dst. Limit
- Nth
- Time
- Src. Address Type
- Dst. Address Type
- PSD
- Hotspot
- IP Fragment

The 'Address Type' is set to 'local' and 'Invert' is checked.

The mangle chain prerouting will be capturing all traffic, even traffic that is going to the router itself. To avoid this we will use `dst-address-type=!local`.

Step by Step Configuration

Step 2 Continued...

The screenshot displays the Mikrotik WinBox interface for configuring a Firewall Mangle Rule. The left sidebar shows the navigation menu with 'Firewall' selected. The main window is titled 'Mangle Rule <>' and has the 'Action' tab selected. The 'Chain' is set to 'prerouting'. A table below shows the rule's configuration:

Chain	Proto...	Src. Port	Dst. Port	In. Int...	C
prerouting					
					r5
					r5
					r5

The 'Action' tab is configured with the following settings:

- Action: mark connection
- New Connection Mark: WAN1
- Passthrough

Other tabs visible include General, Advanced, Extra, and Statistics. The 'General' tab shows 'Src. Address List', 'Dst. Address List', 'Layer7 Protocol', 'Content', 'Connection Bytes', 'Connection Rate', 'Per Connection Classifier', 'Src. MAC Address', and 'Connection Mark' (set to 'no-mark'). The 'Advanced' tab shows 'Connection Limit', 'Limit', 'Dst. Limit', 'Nth', 'Time', 'Src. Address Type', 'Dst. Address', 'Address T', 'PSD', 'Hotspot', and 'IP Fragm'.

Step by Step Configuration

Step 2 Continued...

The screenshot displays the Mikrotik WinBox interface for configuring a Firewall Mangle Rule. The left sidebar shows the navigation menu with 'Firewall' selected. The main window is titled 'Mangle Rule <>' and has the 'Action' tab selected. The 'Chain' is set to 'prerouting'. A table below shows a list of rules with columns for 'Action', 'Src. Port', 'Dst. Port', and 'In. Int...'. The 'Action' column contains 'mark connection'. A modal dialog box is open over the 'Action' tab, showing the configuration for the 'mark connection' action. The 'New Connection Mark' is set to 'WAN1' and the 'Passthrough' checkbox is checked.

Mesh

IP

Routing

System

Queues

Files

Log

Radius

Tools

New Terminal

MetaROUTER

Make Support rif

Firewall

Mangle Rule <>

General Advanced Extra Action Statistics

Chain: prerouting

Photo... Src. Port Dst. Port In. Int... C

Mangle Rule <>

General Advanced Extra Action Statistics

Src. Address List: - Connection Limit

Dst. Address List: - Limit

Layer7 Protocol: - Dst. Limit

Content: - Nth

Connection Bytes: - Time

Connection Rate: - Src. Address Type

Per Connection Classifier: - Dst. Addr

Src. MAC Address: - Address T

Connection Mark: no-mark - PSD

Mangle Rule <>

General Advanced Extra Action Statistics

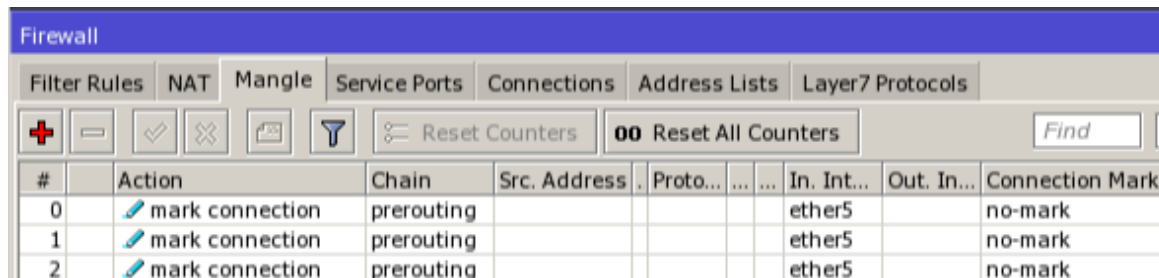
Action: mark connection

New Connection Mark: WAN1

Passthrough

Step by Step Configuration

Step 2 Completed



#	Action	Chain	Src. Address	Proto...	...	In. Int...	Out. In...	Connection Mark
0	mark connection	prerouting				ether5		no-mark
1	mark connection	prerouting				ether5		no-mark
2	mark connection	prerouting				ether5		no-mark

Create one PCC mangle rule for each WAN connection

Completed PCC Mangle Rules

```
ip firewall mangle
```

```
add action=mark-connection chain=prerouting connection-mark=no-mark disabled=no dst-address-type=!local \
in-interface=ether5 new-connection-mark=WAN1 passthrough=yes per-connection-classifier=both-addresses:3/0
```

```
add action=mark-connection chain=prerouting connection-mark=no-mark disabled=no dst-address-type=!local \
in-interface=ether5 new-connection-mark=WAN2 passthrough=yes per-connection-classifier=both-addresses:3/1
```

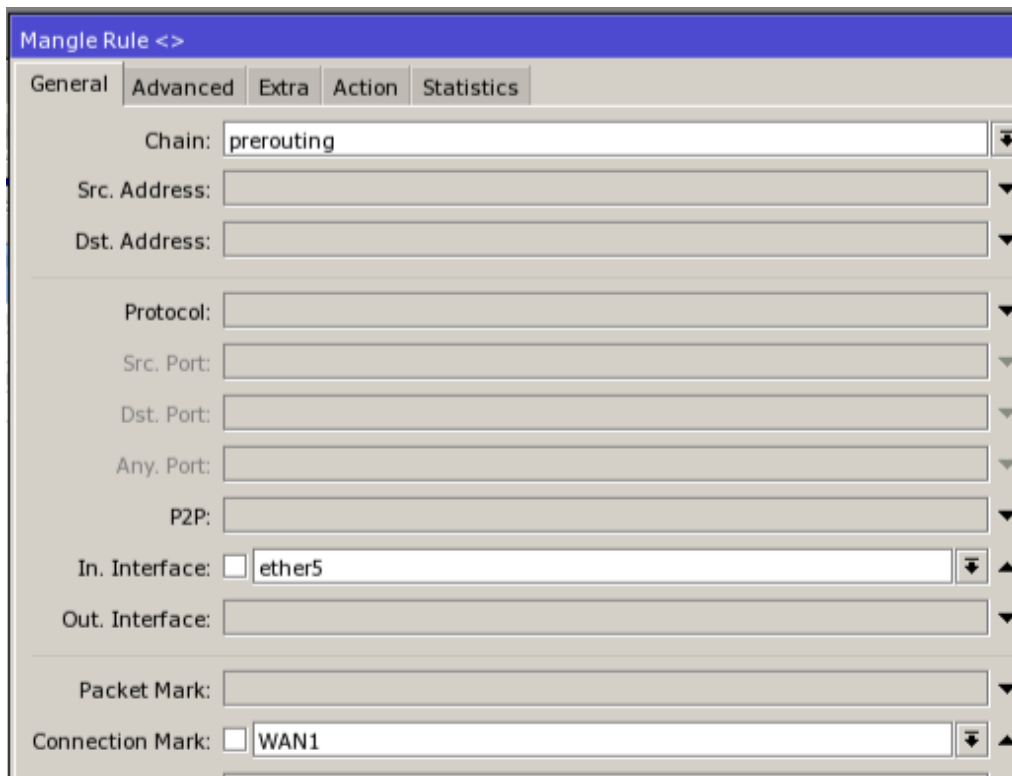
```
add action=mark-connection chain=prerouting connection-mark=no-mark disabled=no dst-address-type=!local \
in-interface=ether5 new-connection-mark=WAN3 passthrough=yes per-connection-classifier=both-addresses:3/2
```

Step by Step Configuration

Step 3: Create the mangles to add the routing marks to the packets based on the connection mark in the PREROUTING CHAIN:

Step by Step Configuration

Step 3: Create the mangles to add the routing marks to the packets based on the connection mark in the PREROUTING CHAIN:



The screenshot shows the Mikrotik WinBox configuration window for a Mangle Rule. The window title is "Mangle Rule <>". It has several tabs: "General", "Advanced", "Extra", "Action", and "Statistics". The "General" tab is selected. The configuration fields are as follows:

- Chain: prerouting
- Src. Address: (empty)
- Dst. Address: (empty)
- Protocol: (empty)
- Src. Port: (empty)
- Dst. Port: (empty)
- Any. Port: (empty)
- P2P: (empty)
- In. Interface: ether5
- Out. Interface: (empty)
- Packet Mark: (empty)
- Connection Mark: WAN1

Step by Step Configuration

Step 3: Create the mangles to add the routing marks to the packets based on the connection mark in the PREROUTING CHAIN:

The screenshot displays the Mikrotik WinBox interface for configuring a Mangle Rule. The main window is titled "Mangle Rule <>" and has tabs for General, Advanced, Extra, Action, and Statistics. The "General" tab is active, showing the following configuration:

- Chain: prerouting
- Src. Address: (empty)
- Dst. Address: (empty)
- Protocol: (empty)
- Src. Port: (empty)
- Dst. Port: (empty)
- Any. Port: (empty)
- P2P: (empty)
- In. Interface: ether5
- Out. Interface: (empty)
- Packet Mark: (empty)
- Connection Mark: WAN1

An inset window, also titled "Mangle Rule <>", shows the "Action" tab configuration:

- Action: mark routing
- New Routing Mark: ether1-mark
- Passthrough

Step by Step Configuration

Step 3: Create the mangles to add the routing marks to the packets based on the connection mark in the PREROUTING CHAIN:

The screenshot displays the Mikrotik WinBox interface for configuring a Mangle Rule. The rule is named "prerouting" and is applied to the "prerouting" chain. The "Action" tab is selected, showing the action "mark routing" with a "New Routing Mark" of "ether1-mark" and the "Passthrough" checkbox checked. The "Connection Mark" is set to "WAN1".

Field	Value
Chain	prerouting
Src. Address	
Dst. Address	
Protocol	
Src. Port	
Dst. Port	
Any. Port	
P2P	
In. Interface	<input type="checkbox"/> ether5
Out. Interface	
Packet Mark	
Connection Mark	<input type="checkbox"/> WAN1
Action	mark routing
New Routing Mark	ether1-mark
Passthrough	<input checked="" type="checkbox"/>

This is where we mark routing for the bulk of our traffic

Step by Step Configuration

Step 3 Continued for OUTPUT CHAIN...

Step by Step Configuration

Step 3 Continued for OUTPUT CHAIN...

Mangle Rule <>

General | Advanced | Extra | Action | Statistics

Chain: output

Src. Address:

Dst. Address:

Protocol:

Src. Port:

Dst. Port:

Any. Port:

P2P:

In. Interface:

Out. Interface:

Packet Mark:

Connection Mark: WAN1

Routing Mark:

Routing Table:

Step by Step Configuration

Step 3 Continued for OUTPUT CHAIN...

The image shows two overlapping screenshots of the Mikrotik WinBox Mangle Rule configuration window. The background window is on the 'General' tab, and the foreground window is on the 'Action' tab.

Background Window (General Tab):

- Chain: output
- Src. Address: [Empty]
- Dst. Address: [Empty]
- Protocol: [Empty]
- Src. Port: [Empty]
- Dst. Port: [Empty]
- Any. Port: [Empty]
- P2P: [Empty]
- In. Interface: [Empty]
- Out. Interface: [Empty]
- Packet Mark: [Empty]
- Connection Mark: WAN1
- Routing Mark: [Empty]
- Routing Table: [Empty]

Foreground Window (Action Tab):

- Action: mark routing
- New Routing Mark: ether1-mark
- Passthrough

Step by Step Configuration

Step 3 Continued for OUTPUT CHAIN...

The screenshot shows the Mikrotik WinBox interface for configuring a Mangle Rule. The main window is titled "Mangle Rule <>" and has tabs for General, Advanced, Extra, Action, and Statistics. The "General" tab is active, showing the following configuration:

- Chain: output
- Src. Address: (empty)
- Dst. Address: (empty)
- Protocol: (empty)
- Src. Port: (empty)
- Dst. Port: (empty)
- Any. Port: (empty)
- P2P: (empty)
- In. Interface: (empty)
- Out. Interface: (empty)
- Packet Mark: (empty)
- Connection Mark: WAN1
- Routing Mark: (empty)
- Routing Table: (empty)

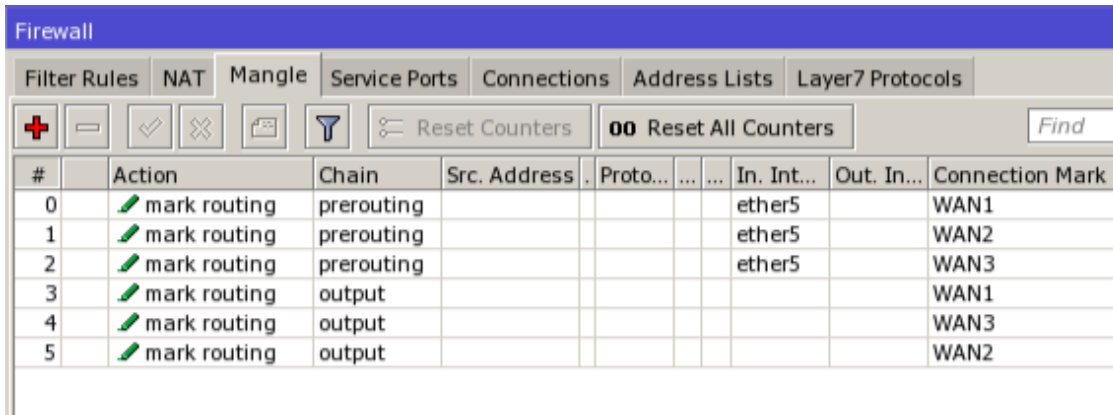
An inset window, also titled "Mangle Rule <>", shows the "Action" tab configuration:

- Action: mark routing
- New Routing Mark: ether1-mark
- Passthrough

This rule ensures traffic from the router itself returns through the proper interface

Step by Step Configuration

Step 3 Completed



#	Action	Chain	Src. Address	Proto...	...	In. Int...	Out. In...	Connection Mark
0	✓ mark routing	prerouting				ether5		WAN1
1	✓ mark routing	prerouting				ether5		WAN2
2	✓ mark routing	prerouting				ether5		WAN3
3	✓ mark routing	output						WAN1
4	✓ mark routing	output						WAN3
5	✓ mark routing	output						WAN2

Create one rule for for each WAN connection, in prerouting chain and same in output chain

Completed route marking rules

```
/ip firewall mangle
```

```
add action=mark-routing chain=prerouting connection-mark=WAN1 disabled=no in-interface=ether5 \  
new-routing-mark=ether1-mark passthrough=yes
```

```
add action=mark-routing chain=prerouting connection-mark=WAN2 disabled=no in-interface=ether5 \  
new-routing-mark=ether2-mark passthrough=yes
```

```
add action=mark-routing chain=prerouting connection-mark=WAN3 disabled=no in-interface=ether5 \  
new-routing-mark=ether3-mark passthrough=yes
```

```
add action=mark-routing chain=output connection-mark=WAN1 disabled=no new-routing-mark=ether1-mark passthrough=yes
```

```
add action=mark-routing chain=output connection-mark=WAN3 disabled=no new-routing-mark=ether3-mark passthrough=yes
```

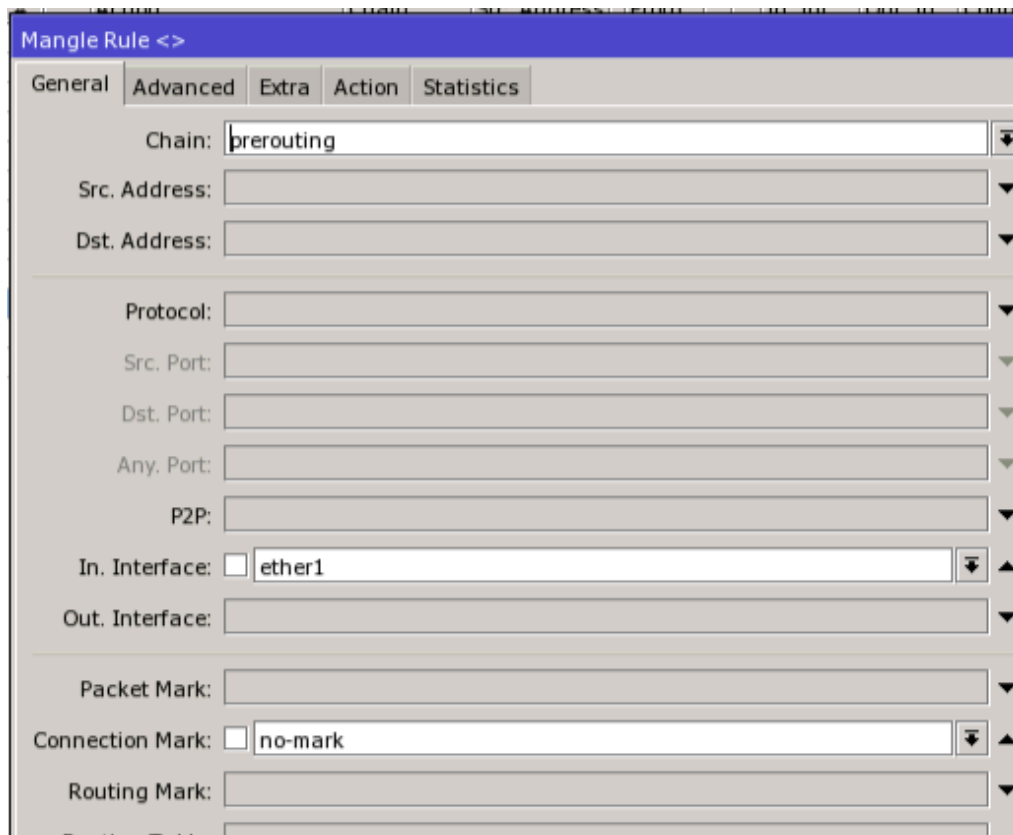
```
add action=mark-routing chain=output connection-mark=WAN2 disabled=no new-routing-mark=ether2-mark passthrough=yes
```

Step by Step Configuration

Step 4: Identify which WAN interface the traffic came in and mark the connections appropriately.

Step by Step Configuration

Step 4: Identify which WAN interface the traffic came in and mark the connections appropriately.



The screenshot shows the Mikrotik WinBox configuration window for a Mangle Rule. The window title is "Mangle Rule <>". The "General" tab is selected, and the "Chain" is set to "prerouting". The "In. Interface" is set to "ether1". The "Connection Mark" is set to "no-mark".

Field	Value
Chain	prerouting
Src. Address	
Dst. Address	
Protocol	
Src. Port	
Dst. Port	
Any. Port	
P2P	
In. Interface	ether1
Out. Interface	
Packet Mark	
Connection Mark	no-mark
Routing Mark	
Routing Table	

Step by Step Configuration

Step 4: Identify which WAN interface the traffic came in and mark the connections appropriately.

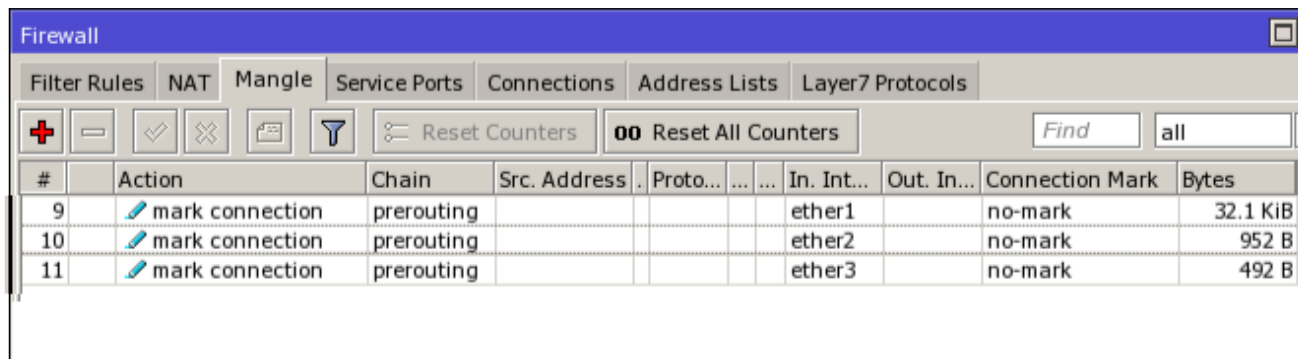
The screenshot displays the Mikrotik WinBox interface for configuring a Mangle Rule. The main window is titled "Mangle Rule <>" and has tabs for "General", "Advanced", "Extra", "Action", and "Statistics". The "General" tab is active, showing the following fields:

- Chain: prerouting
- Src. Address: (empty)
- Dst. Address: (empty)
- Protocol: (empty)
- Src. Port: (empty)
- Dst. Port: (empty)
- Any. Port: (empty)
- P2P: (empty)
- In. Interface: ether1
- Out. Interface: (empty)
- Packet Mark: (empty)
- Connection Mark: no-mark
- Routing Mark: (empty)

An inset window, also titled "Mangle Rule <>", shows the "Action" tab. The "Action" field is set to "mark connection", and the "New Connection Mark" field is set to "WAN1". The "Passthrough" checkbox is checked.

Step by Step Configuration

Step 4 Completed



#	Action	Chain	Src. Address	Proto...	In. Int...	Out. In...	Connection Mark	Bytes
9	mark connection	prerouting			ether1		no-mark	32.1 KiB
10	mark connection	prerouting			ether2		no-mark	952 B
11	mark connection	prerouting			ether3		no-mark	492 B

Create one rule for each WAN connection

Completed WAN connection marking rules

```
/ip firewall mangle
```

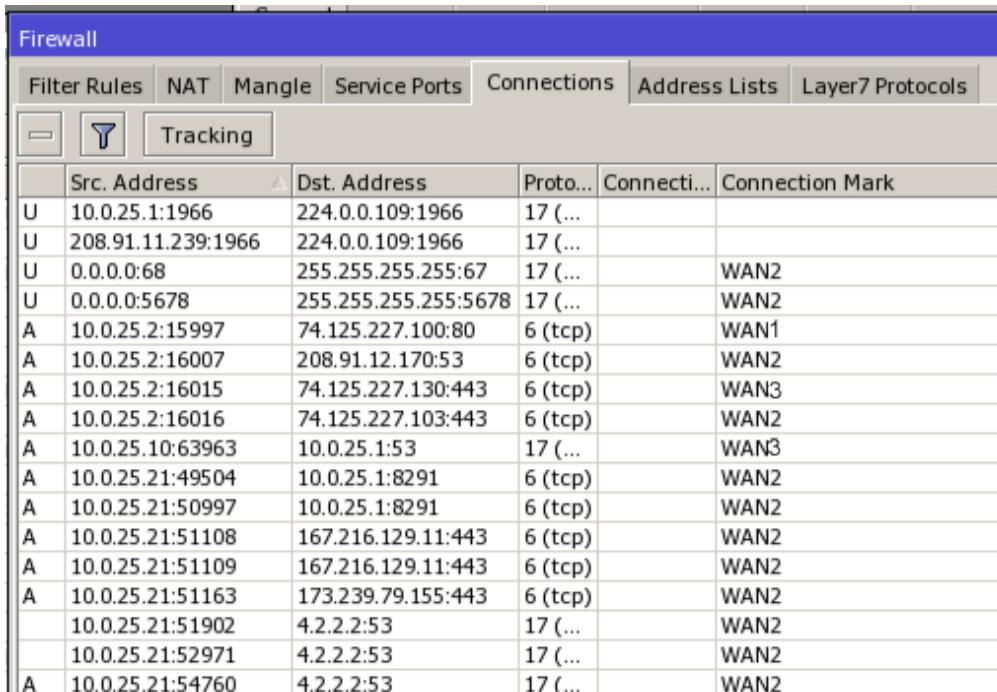
```
add action=mark-connection chain=prerouting connection-mark=no-mark disabled=no \
in-interface=ether1 new-connection-mark=WAN1 passthrough=yes
```

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

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


Step by Step Configuration

Final result: Connections should be marked, route marks added to packets based on connection mark.



The screenshot shows the Mikrotik WinBox Firewall configuration interface. The 'Connections' tab is selected, and the 'Tracking' sub-tab is active. A table displays the current connections, with columns for Src. Address, Dst. Address, Proto..., Connecti..., and Connection Mark. The table contains 20 rows of connection data, including source and destination IP addresses, protocols, and assigned connection marks like WAN1, WAN2, and WAN3.

	Src. Address	Dst. Address	Proto...	Connecti...	Connection Mark
U	10.0.25.1:1966	224.0.0.109:1966	17 (...		
U	208.91.11.239:1966	224.0.0.109:1966	17 (...		
U	0.0.0.0:68	255.255.255.255:67	17 (...		WAN2
U	0.0.0.0:5678	255.255.255.255:5678	17 (...		WAN2
A	10.0.25.2:15997	74.125.227.100:80	6 (tcp)		WAN1
A	10.0.25.2:16007	208.91.12.170:53	6 (tcp)		WAN2
A	10.0.25.2:16015	74.125.227.130:443	6 (tcp)		WAN3
A	10.0.25.2:16016	74.125.227.103:443	6 (tcp)		WAN2
A	10.0.25.10:63963	10.0.25.1:53	17 (...		WAN3
A	10.0.25.21:49504	10.0.25.1:8291	6 (tcp)		WAN2
A	10.0.25.21:50997	10.0.25.1:8291	6 (tcp)		WAN2
A	10.0.25.21:51108	167.216.129.11:443	6 (tcp)		WAN2
A	10.0.25.21:51109	167.216.129.11:443	6 (tcp)		WAN2
A	10.0.25.21:51163	173.239.79.155:443	6 (tcp)		WAN2
	10.0.25.21:51902	4.2.2.2:53	17 (...		WAN2
	10.0.25.21:52971	4.2.2.2:53	17 (...		WAN2
A	10.0.25.21:54760	4.2.2.2:53	17 (...		WAN2

Always check the connection table to ensure mangles are working for connections

Step by Step Configuration

Mangles are done, we now create the routes:

Step by Step Configuration

Mangles are done, we now create the routes:

- We will need one default route for each routing mark, corresponding to each of the WAN connections.

Step by Step Configuration

Mangles are done, we now create the routes:

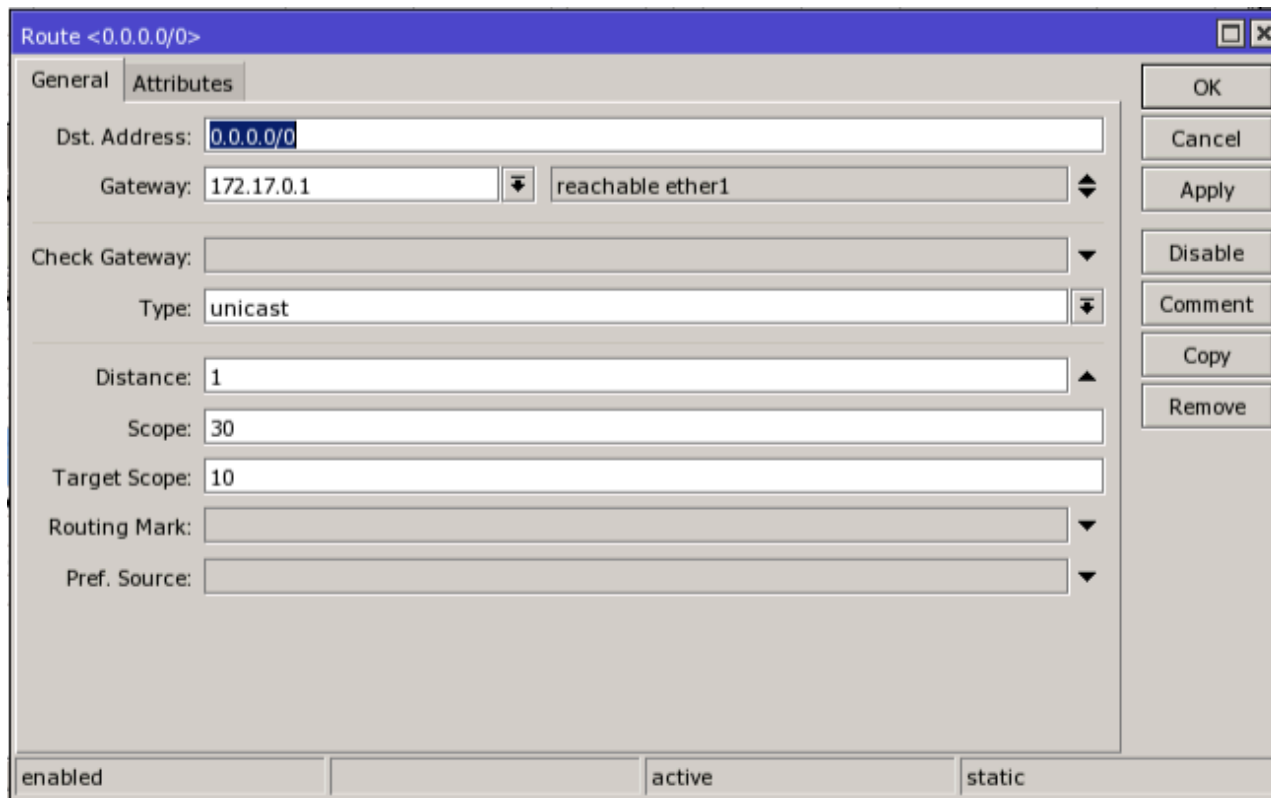
- We will need one default route for each routing mark, corresponding to each of the WAN connections.
- We will also need one unmarked default route corresponding to each of the WAN connections.

Step by Step Configuration

Step 5: Create the unmarked default routes.

Step by Step Configuration

Step 5: Create the unmarked default routes.



The screenshot shows the 'Route' configuration window in Mikrotik WinBox, titled 'Route <0.0.0.0/0>'. The window has two tabs: 'General' and 'Attributes'. The 'General' tab is active. The configuration fields are as follows:

- Dst. Address:** 0.0.0.0/0
- Gateway:** 172.17.0.1 (with a dropdown menu showing 'reachable ether1')
- Check Gateway:** (empty dropdown)
- Type:** unicast
- Distance:** 1
- Scope:** 30
- Target Scope:** 10
- Routing Mark:** (empty dropdown)
- Pref. Source:** (empty dropdown)

On the right side of the window, there are several buttons: OK, Cancel, Apply, Disable, Comment, Copy, and Remove. At the bottom of the window, there are three status indicators: 'enabled', 'active', and 'static'.

Step by Step Configuration

Step 5: Create the unmarked default routes.

The screenshot shows the Mikrotik WinBox configuration window for a static route. The window title is 'Route <0.0.0.0/0>'. The 'General' tab is selected, and the 'Attributes' sub-tab is active. The configuration fields are as follows:

- Dst. Address:** 0.0.0.0/0
- Gateway:** 172.18.0.1 (with a dropdown arrow) and reachable ether2 (with a double-headed arrow)
- Check Gateway:** (empty dropdown)
- Type:** unicast (with a dropdown arrow)
- Distance:** 1 (with an up arrow)
- Scope:** 30
- Target Scope:** 10
- Routing Mark:** (empty dropdown)
- Pref. Source:** (empty dropdown)

On the right side of the window, there are several buttons: OK, Cancel, Apply, Disable, Comment, Copy, and Remove. At the bottom of the window, there are four status indicators: 'enabled', 'active', and 'static'.

Step by Step Configuration

Step 5: Create the unmarked default routes.

The screenshot shows the Mikrotik WinBox configuration window for a static route. The window title is 'Route <0.0.0.0/0>'. The 'General' tab is selected, and the 'Attributes' sub-tab is active. The configuration fields are as follows:

- Dst. Address:** 0.0.0.0/0
- Gateway:** 172.19.0.1 (with a dropdown arrow) and reachable ether3 (with a double-headed arrow)
- Check Gateway:** (dropdown menu)
- Type:** unicast (with a dropdown arrow)
- Distance:** 1 (with an up arrow)
- Scope:** 30
- Target Scope:** 10
- Routing Mark:** (dropdown menu)
- Pref. Source:** (dropdown menu)

On the right side of the window, there are several buttons: OK, Cancel, Apply, Disable, Comment, Copy, and Remove. At the bottom of the window, there are three status indicators: 'enabled', 'active', and 'static'.

Step by Step Configuration

Step 5: Create the unmarked default routes.

The screenshot displays the Mikrotik WinBox interface for configuring a static route. The window title is "Route <0.0.0.0/0>". The "General" tab is selected, showing the following configuration:

- Dst. Address: 0.0.0.0/0
- Gateway: 172.19.0.1 (with a dropdown menu showing "reachable ether3")
- Check Gateway: (unchecked)
- Type: unicast
- Distance: 1
- Scope: 30
- Target Scope: 10
- Routing Mark: (empty)
- Pref. Source: (empty)

At the bottom of the window, the status is shown as "enabled", "active", and "static". On the right side, there are buttons for "OK", "Cancel", "Apply", "Disable", "Comment", "Copy", and "Remove".

Provides failover - ensures traffic always has a default route because if there is no active marked route to match a packet, it follows the main routing table!

Step by Step Configuration

Step 5: Create the unmarked default routes.

The screenshot shows the Mikrotik WinBox interface for configuring a static route. The window title is "Route <0.0.0.0/0>". The "General" tab is selected, and the "Attributes" sub-tab is active. The configuration fields are as follows:

- Dst. Address: 0.0.0.0/0
- Gateway: 172.19.0.1 (with a dropdown menu showing "reachable ether3")
- Check Gateway: (unchecked)
- Type: unicast
- Distance: 1
- Scope: 30
- Target Scope: 10
- Routing Mark: (empty)
- Pref. Source: (empty)

At the bottom of the window, there are three status indicators: "enabled", "active", and "static". On the right side of the window, there are several buttons: "OK", "Cancel", "Apply", "Disable", "Comment", "Copy", and "Remove".

Provides failover - ensures traffic always has a default route because if there is no active marked route to match a packet, it follows the main routing table!

Considering using distance to prefer one default over another.

Step by Step Configuration

Step 6: Create the marked default routes.

Step by Step Configuration

Step 6: Create the marked default routes.

Route <0.0.0.0/0>

General Attributes

Dst. Address: 0.0.0.0/0

Gateway: 172.17.0.1 reachable ether1

Check Gateway: ping

Type: unicast

Distance: 1

Scope: 30

Target Scope: 10

Routing Mark: ether1-mark

Pref. Source:

OK
Cancel
Apply
Disable
Comment
Copy
Remove

enabled active static

Step by Step Configuration

Step 6: Create the marked default routes.

The screenshot shows the Mikrotik WinBox configuration window for a static route. The window title is "Route <0.0.0.0/0>". The "General" tab is selected. The configuration fields are as follows:

- Dst. Address: 0.0.0.0/0
- Gateway: 172.18.0.1 (with a dropdown arrow) and reachable ether2 (with a double-headed arrow)
- Check Gateway: ping (with a dropdown arrow and an up arrow)
- Type: unicast (with a dropdown arrow)
- Distance: 1 (with an up arrow)
- Scope: 30
- Target Scope: 10
- Routing Mark: ether2-mark (with a dropdown arrow and an up arrow)
- Pref. Source: (empty dropdown)

On the right side of the window, there are several buttons: OK, Cancel, Apply, Disable, Comment, Copy, and Remove. At the bottom of the window, there are four checkboxes: "enabled" (checked), "active" (checked), and "static" (checked).

Step by Step Configuration

Step 6: Create the marked default routes.

The screenshot shows the Mikrotik WinBox configuration window for a static route. The window title is "Route <0.0.0.0/0>". The "General" tab is selected, and the "Attributes" sub-tab is also visible. The configuration fields are as follows:

- Dst. Address: 0.0.0.0/0
- Gateway: 172.19.0.1 (with a dropdown arrow) and reachable ether3 (with a double-headed arrow)
- Check Gateway: ping (with a dropdown arrow)
- Type: unicast (with a dropdown arrow)
- Distance: 1 (with an up arrow)
- Scope: 30
- Target Scope: 10
- Routing Mark: ether3-mark (with a dropdown arrow)
- Pref. Source: (empty)

On the right side of the dialog, there are several buttons: OK, Cancel, Apply, Disable, Comment, Copy, and Remove. At the bottom of the dialog, there are three status indicators: "enabled", "active", and "static".

Step by Step Configuration

Step 6: Create the marked default routes.

The screenshot shows the Mikrotik WinBox configuration window for a static route. The window title is "Route <0.0.0.0/0>". The "General" tab is selected. The configuration fields are as follows:

- Dst. Address: 0.0.0.0/0
- Gateway: 172.19.0.1 (with a dropdown menu showing "reachable ether3")
- Check Gateway: ping (with a dropdown menu showing "unicast")
- Distance: 1
- Scope: 30
- Target Scope: 10
- Routing Mark: ether3-mark
- Pref. Source: (empty)

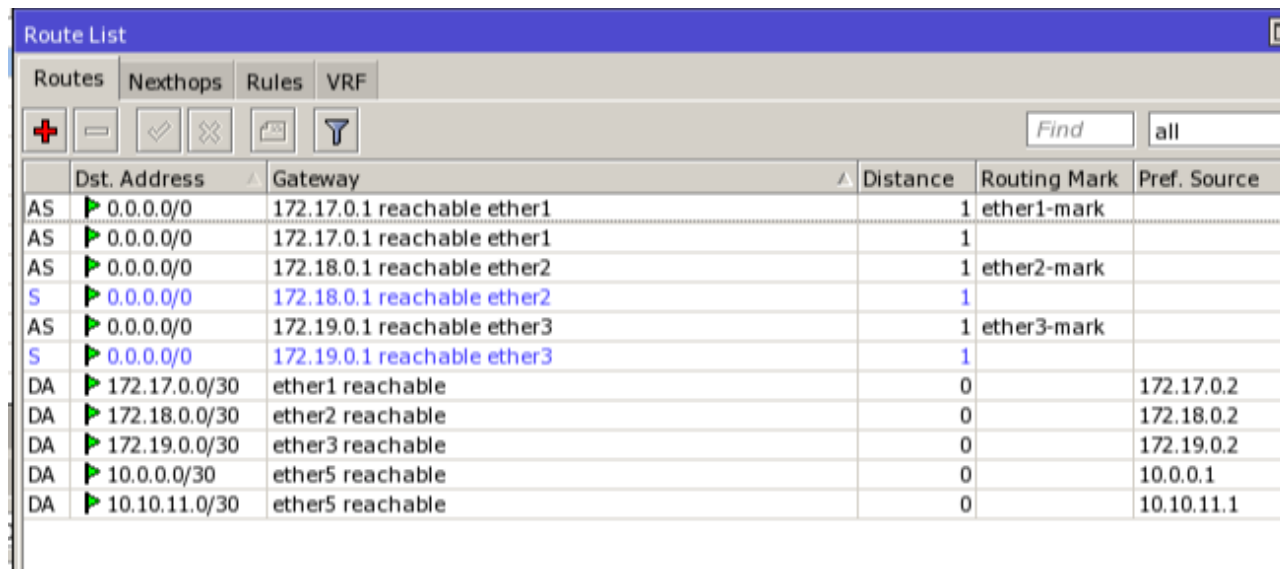
At the bottom of the window, there are three checkboxes: "enabled" (checked), "active" (checked), and "static" (checked). On the right side of the window, there are buttons for "OK", "Cancel", "Apply", "Disable", "Comment", "Copy", and "Remove".

Use “check-gateway” to ensure gateway is alive.

Only need to use “check-gateway” on marked routes because any routes with that gateway become inactive if it fails thereby affecting marked routes too.

Step by Step Configuration

Final result - Routing table



The screenshot shows the Mikrotik Router OS 'Route List' window. It displays a table of routes with columns for Dst. Address, Gateway, Distance, Routing Mark, and Pref. Source. The routes include three marked default routes (AS) and five unmarked default routes (DA).

	Dst. Address	Gateway	Distance	Routing Mark	Pref. Source
AS	0.0.0.0/0	172.17.0.1 reachable ether1	1	ether1-mark	
AS	0.0.0.0/0	172.17.0.1 reachable ether1	1		
AS	0.0.0.0/0	172.18.0.1 reachable ether2	1	ether2-mark	
S	0.0.0.0/0	172.18.0.1 reachable ether2	1		
AS	0.0.0.0/0	172.19.0.1 reachable ether3	1	ether3-mark	
S	0.0.0.0/0	172.19.0.1 reachable ether3	1		
DA	172.17.0.0/30	ether1 reachable	0		172.17.0.2
DA	172.18.0.0/30	ether2 reachable	0		172.18.0.2
DA	172.19.0.0/30	ether3 reachable	0		172.19.0.2
DA	10.0.0.0/30	ether5 reachable	0		10.0.0.1
DA	10.10.11.0/30	ether5 reachable	0		10.10.11.1

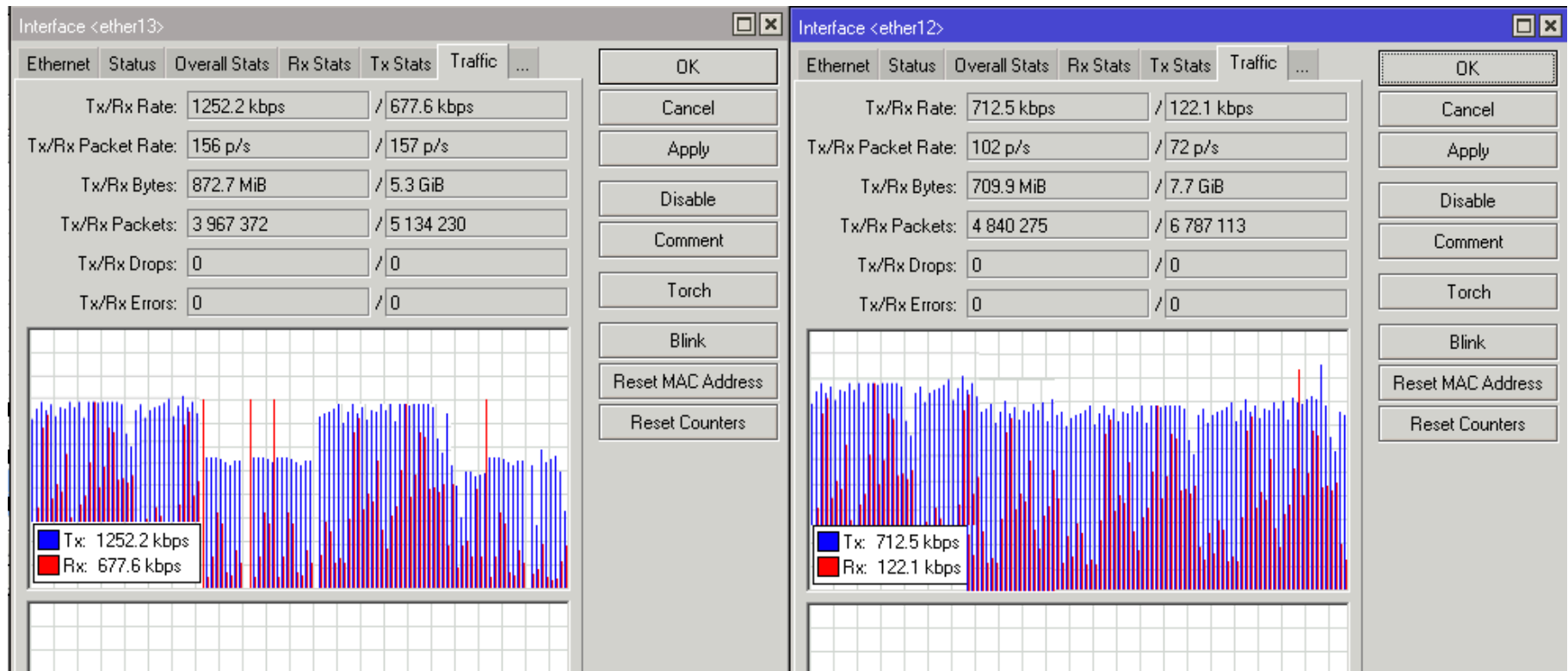
One marked default for each WAN connection, and one unmarked default route for each WAN connection

Completed routing table

Step by Step Configuration

Final result!

Actual screen shots from a load balance configuration in production with 2 WAN connections.



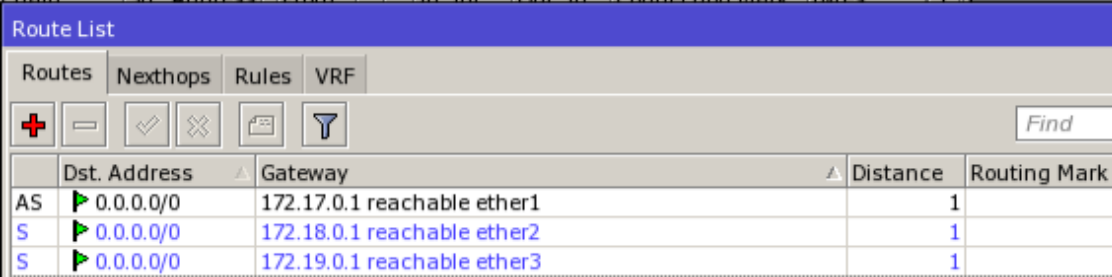
Common Problems

I use DHCP for my WAN addressing, how can I get the marked routes created properly?

```
/system script
add name=ConfigureDHCPRoutes policy=\
ftp,reboot,read,write,policy,test,winbox,password,sniff,sensitive,api source=":local cli\
entcounter\r\
\n:local routecounter\r\
\n:local duplicatecounter\r\
\n:local routeupdated "no\r\
\n:foreach clientcounter in=[/ip dhcp-client find] do={\r\
\n:local routingmarkname ([/ip dhcp-client get \$clientcounter interface] . \"-mark\r\
\n:local newroutinggateway [ip dhcp-client get \$clientcounter gateway]\r\
\n:foreach routecounter in=[/ip route find where routing-mark=\$routingmarkname] do={\r\
\n :local routinggateway [/ip route get [find routing-mark=\$routingmarkname] gateway]\
\r\
\n\t:if ([:len \$newroutinggateway] > 0) do={\r\
\n\t :if (\$\"routinggateway\" != \$\"newroutinggateway\") do={ \r\
\n\t /ip route set \$routecounter gateway=\$newroutinggateway \r\
\n\t\t:set routeupdated \"yes\r\
\n\t } \r\
\n\t} \r\
\n } \r\
\n :if ([:len \$newroutinggateway] > 0) do={\r\
\n :if (\$routeupdated = \"no\") do={\r\
\n /ip route add routing-mark=\$routingmarkname gateway=\$newroutinggateway dst-add\
ress=0.0.0.0/0\r\
\n } \r\
\n } \r\
\n} \r\
\n"
```

Common Problems

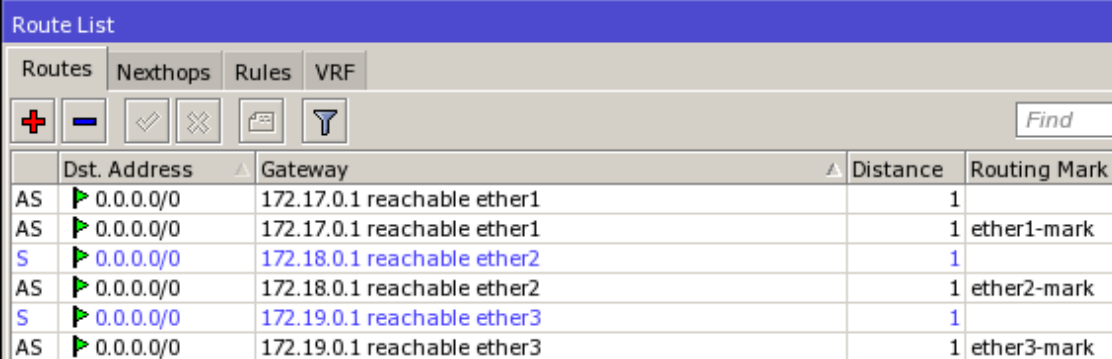
Before Running Script



The screenshot shows the Mikrotik WinBox 'Route List' window. The 'Routes' tab is selected. The table displays three routes:

	Dst. Address	Gateway	Distance	Routing Mark
AS	0.0.0.0/0	172.17.0.1 reachable ether1	1	
S	0.0.0.0/0	172.18.0.1 reachable ether2	1	
S	0.0.0.0/0	172.19.0.1 reachable ether3	1	

After Running Script



The screenshot shows the Mikrotik WinBox 'Route List' window after running a script. The 'Routes' tab is selected. The table displays six routes, including the original three and three new ones with routing marks:

	Dst. Address	Gateway	Distance	Routing Mark
AS	0.0.0.0/0	172.17.0.1 reachable ether1	1	
AS	0.0.0.0/0	172.17.0.1 reachable ether1	1	ether1-mark
S	0.0.0.0/0	172.18.0.1 reachable ether2	1	
AS	0.0.0.0/0	172.18.0.1 reachable ether2	1	ether2-mark
S	0.0.0.0/0	172.19.0.1 reachable ether3	1	
AS	0.0.0.0/0	172.19.0.1 reachable ether3	1	ether3-mark

Common Problems

PCC doesn't seem to work properly with HotSpot or IP Webproxy

- It is possible to make it work but the rules get very detailed and complicated.

Solution: Use two routers, one for load balancing, one for HotSpot or IP Webproxy.

Solution: Use metarouter with host router doing main routing functions, virtual router doing the load balancing.

Common Problems

DNS resolves from some clients, not others

- If you are using two different ISP's and their respective name servers, possibly some clients are accessing ISP1's DNS server through ISP2's connection and ISP1 is blocking DNS requests from outside their IP space.

Solution: Consider OpenDNS, destination NAT with redirect to DNS cache, etc.

Common Problems

Strange http issues, some images load, other don't, problems with some secure sites

Solution: Try using “both addresses” or “source address “ for PCC classifier. While “both addresses and ports” gives the greatest chance for randomization and better possibility for even distribution, it can create these types of issues.

Common Problems

I can only get asymmetrical connections, one DSL and one cable modem.

Solution: You can “weight” one interface higher and force more traffic through it by repeating the connection marking PCC rule more than once for that connection.

Example for added weight to WAN3.

```
/ip firewall mangle
add action=mark-connection chain=prerouting connection-mark=no-mark disabled=\
    no dst-address-type=!local in-interface=ether5 new-connection-mark=WAN1 \
    passthrough=yes per-connection-classifier=both-addresses:3/0
add action=mark-connection chain=prerouting connection-mark=no-mark disabled=\
    no dst-address-type=!local in-interface=ether5 new-connection-mark=WAN2 \
    passthrough=yes per-connection-classifier=both-addresses:3/1
add action=mark-connection chain=prerouting connection-mark=no-mark disabled=\
    no dst-address-type=!local in-interface=ether5 new-connection-mark=WAN3 \
    passthrough=yes per-connection-classifier=both-addresses:3/2
add action=mark-connection chain=prerouting connection-mark=no-mark disabled=\
    no dst-address-type=!local in-interface=ether5 new-connection-mark=WAN3 \
    passthrough=yes per-connection-classifier=both-addresses:3/3
```

Thank You!

- MyWISPTraining.com
- LearnMikroTik.com
- ISPSupplies.com
- “RouterOS by Example” available for many distributors or Amazon.com, iTunes

