





RouterOS v6 to v7 – *The Routing guide!*

According to ...

Barry Higgins

Key to symbols used

If you see this symbol -  please laugh!

Presenter bio...

Name: Barry Higgins.

DoB: Before Arpnet

Country of Origin: England (UK)

Trainer: TR0372 (Feb 2016)

Likes: yes please 👍

Dislikes: Top posting!

Hobbies: Hiking



Shameless plug #1 - Consultancy

MikroTik Consultant since 2015

- **Consultancy available – Many aspects covered including connection of MikroTik → ‘other brands’**
- **Find details at <https://www.allness.net>**

Shameless plug #2 - Training

MikroTiK Trainer : Since 2016

- **Public sessions held in the UK and Ireland**
- **Private sessions can be arranged!**
- **All countries covered so long as you want it in English!**
To date I have trained in Germany, Austria, Norway, Latvia, Italy (Ron & Lorenzo were there), Wales, Scotland, Ireland and now Czechia (Ron and Lorenzo followed me here too!).

Shameless plug #2 – Training – the BUS!



Shameless plug #3 cont...



Shameless plug #3 cont...



Shameless plug #3 cont...



Shameless plug #3 – Riga BootCamp

Riga Bootcamp summer 2024...



21-29 June 2024

Shameless plug #3 – Riga BootCamp

Riga Bootcamp summer 2024...

<https://www.mikrotik.camp/>

21-29 June 2024

Onward with v7 we go...

And so version 7 continues to roll out week after week with new updates, features and even undocumented ones (bugs)!

Love it or hate it, there is no choice with the roll out of newer routerboard models requiring v7 due to Arm(64) architecture.

V6 is no more. Time to move on!

Routing has changed

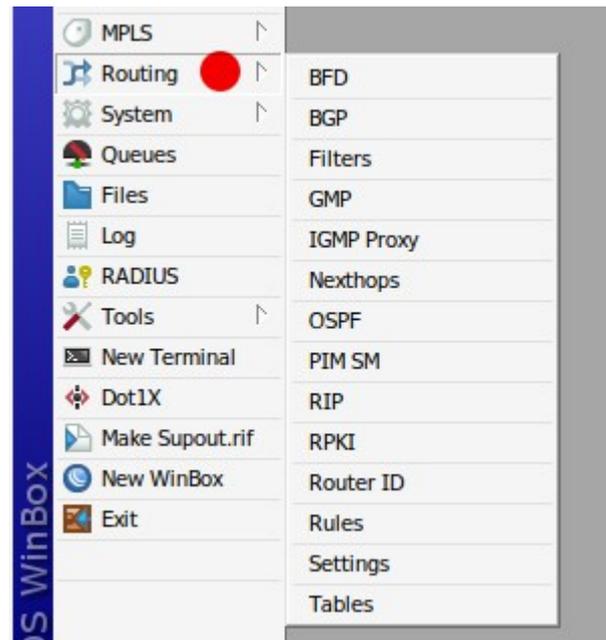
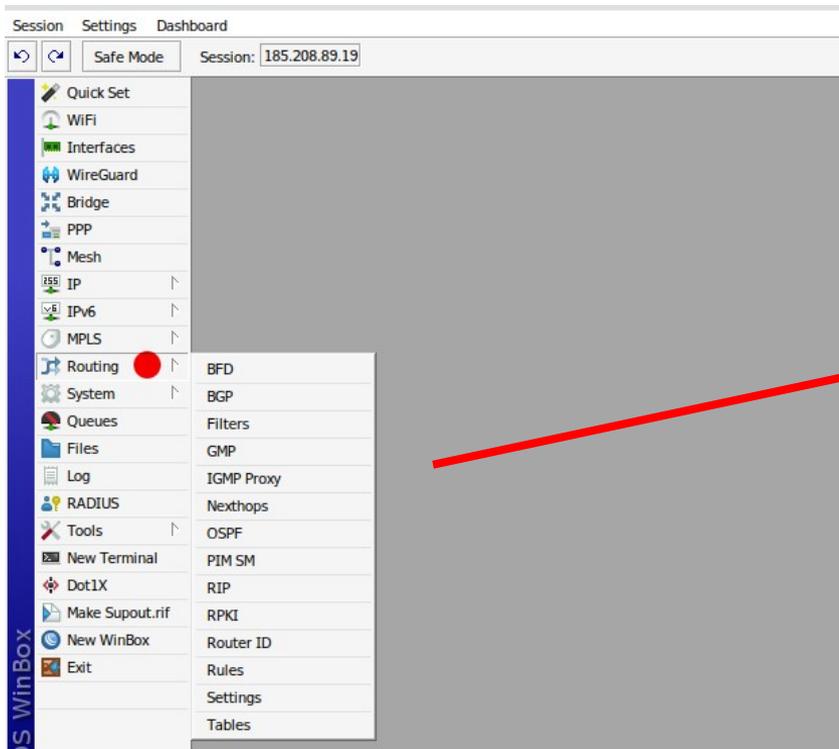
There have been lots of changes in how routing is handled in version 7. A newer linux kernel has meant that how routing was being handled in the 'backend' now requires a new 'frontend' to handle the changes.

A quick guide to the changes

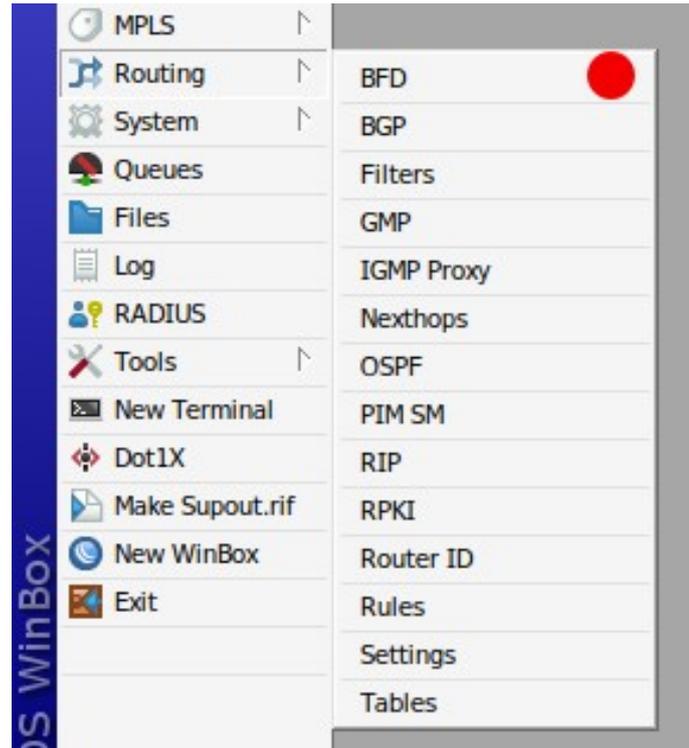
Buckle up its going to be a fast ride!

(I hear Lorenzo shouting <NEXT> already) 😊

Winbox → Routing



BFD



Bidirectional Forwarding Detection

- A protocol to monitor link failure.
- Reintroduced into RouterOS in v7.10
- v7 now includes RFC 5883 in addition to 5880, 5881 & 5882

BGP



BGP

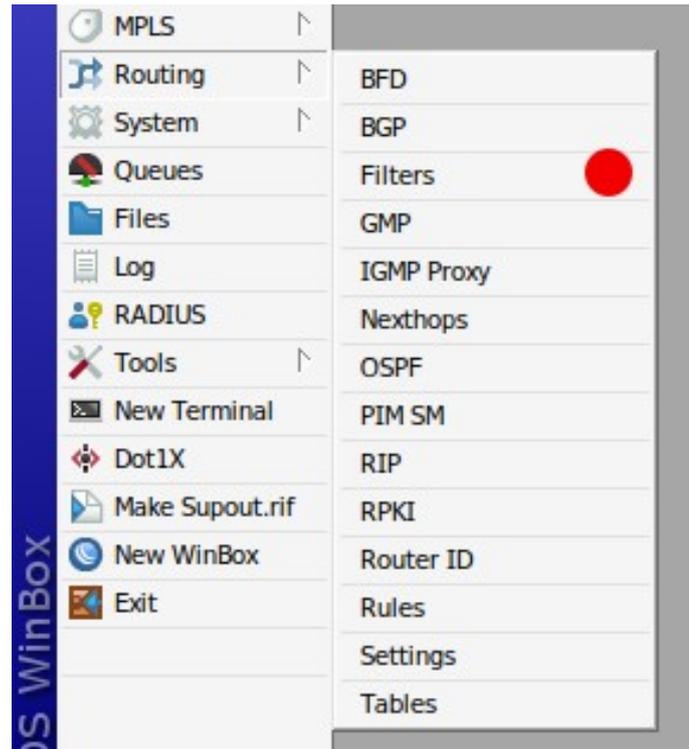
Border Gateway Protocol

(Or as Sky TV experts call it - 'Bridging Gap Protocol' !!)



- 16:00 – 16:45 - Guilherme Ramirez

Filters



Filters

Filter creation has changed. No more ticking of boxes and selection options.

Filters are now created using a type of scripting using the formula of -

“if ([MATCH]) then { [ACTION] } else { [ACTION] }”

Filters – syntax example

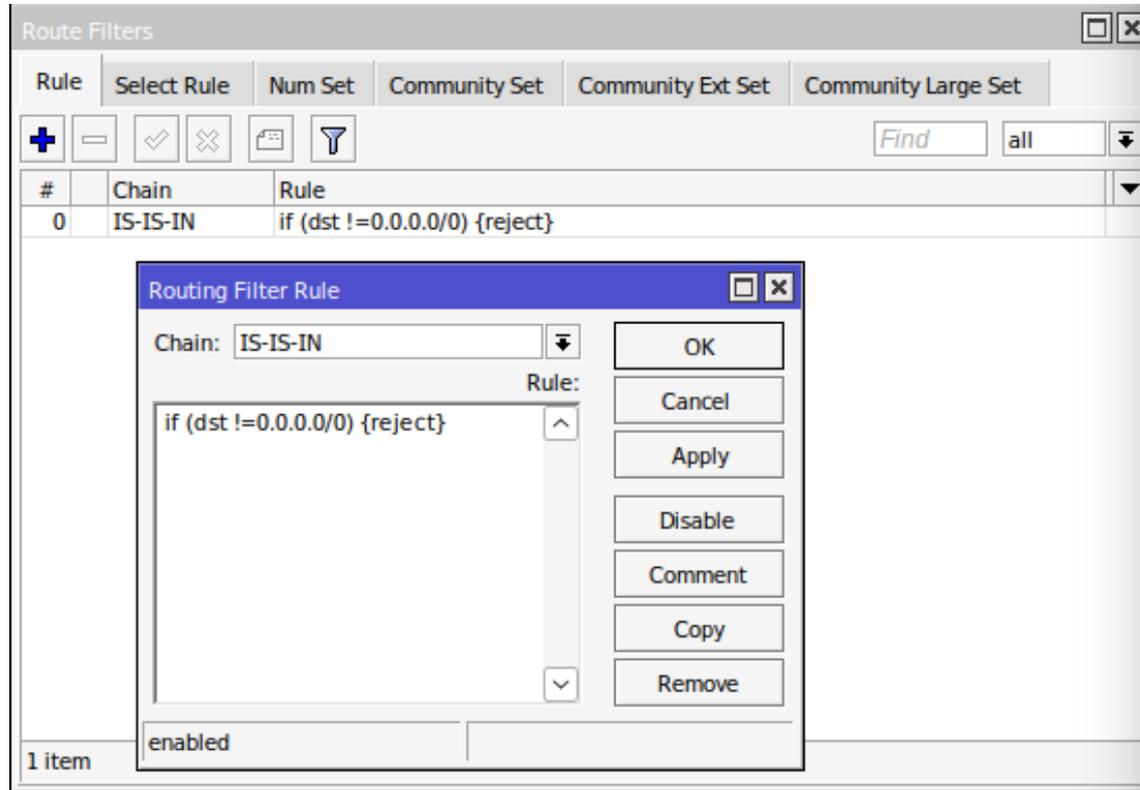
‘()’ encloses the matching criteria

‘{ }’ encloses the actions should a match occur.

e.g.

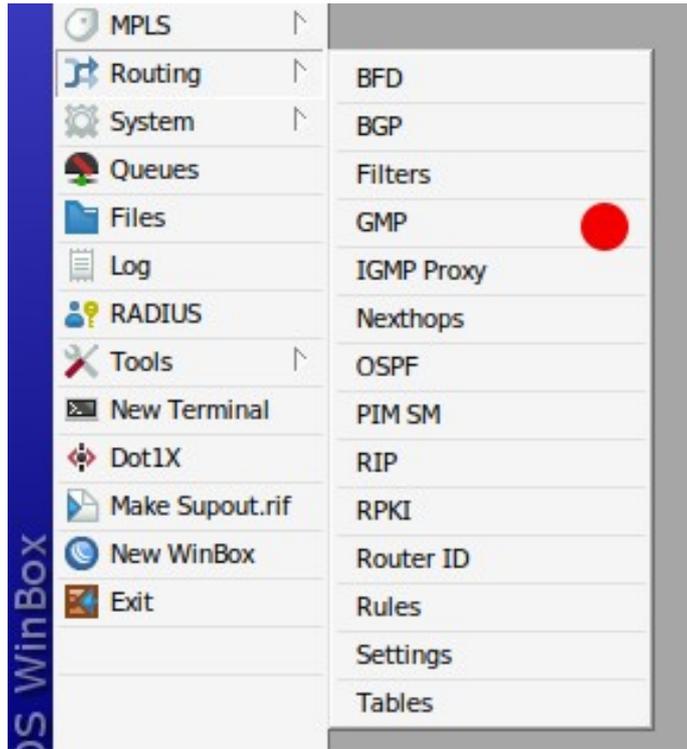
```
if ( dst in 10.0.0.0/8 || 192.168.0.0/16 ) {reject} else {set distance 5; accept}
```

Filters – filter window



Filters

GMP

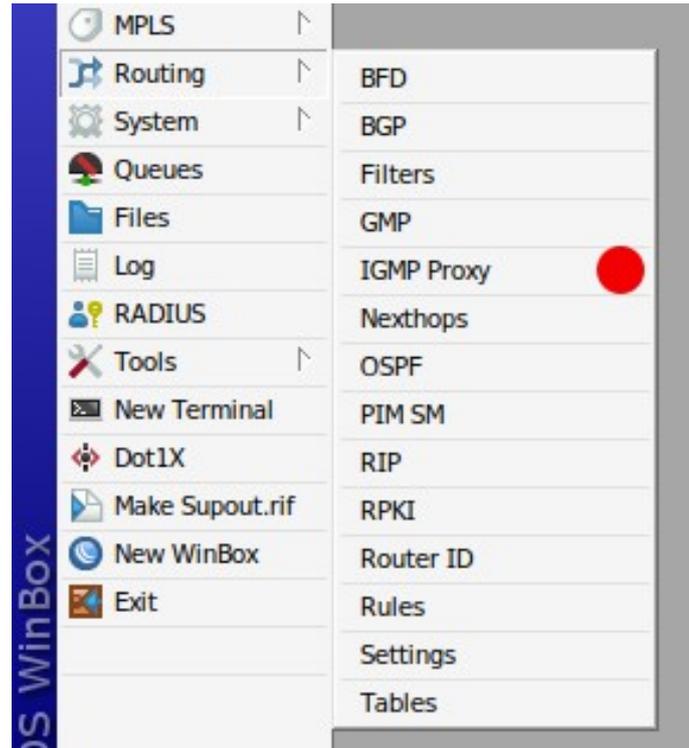


Group Management Protocol Multicasting – no time to cover this

<NEXT> !



IGMP Proxy

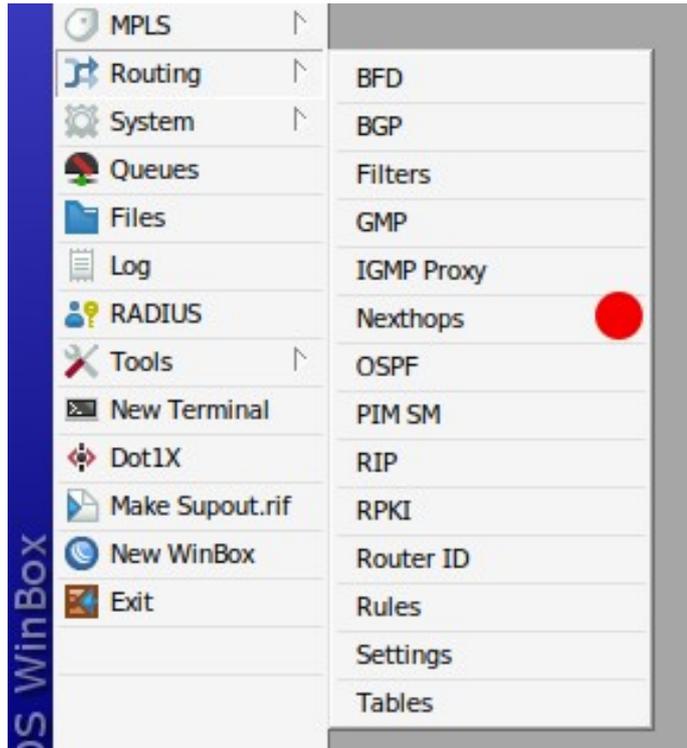


Internet Group Management Protocol
Multicasting – no time to cover this either

<NEXT> !



Nexthops



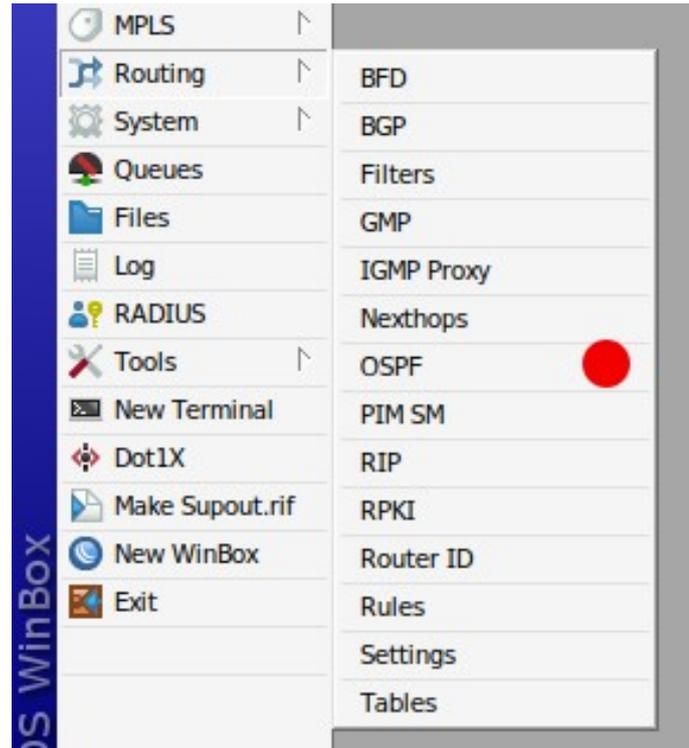
Nexthops

	AFI	Address	Scope	Target Sc...	Check Gateway	Gateway Check Ok	Interface Ok	Gw. Address	Weight	Flap Count	MPLS Peer ID	MPLS Label	
R	link	PittStreet-Brid...	10	5	none	yes	yes	PittStreet-Bridge	1	3816266641	0	4294967295	▲
R	link	MGNT-Bridge	10	5	none	yes	yes	MGNT-Bridge	1	4055616969	0	4294967295	
R	link	loopback1	10	5	none	yes	yes	loopback1	1	2802362399	0	4294967295	
R	link	BGP-VPLS_PP...	10	5	none	yes	yes	BGP-VPLS_PPPoE	1	1309757500	0	4294967295	
R	link	HooFarm-Brid...	10	5	none	yes	yes	HooFarm-Bridge	1	1788458157	0	4294967295	
R	link	loopback2	10	5	none	yes	yes	loopback2	1	3576916312	0	4294967295	
R	link	LAN-Bridge	10	5	none	yes	yes	LAN-Bridge	1	2027808485	0	4294967295	
R	link	WAN-Bridge	10	5	none	yes	yes	WAN-Bridge	1	1013904243	0	4294967295	
R	link	VoIP-Bridge	10	5	none	yes	yes	VoIP-Bridge	1	774553915	0	4294967295	
R	link	loopback3	10	5	none	yes	yes	loopback3	1	295853258	0	4294967295	
R	link	zerotier1	10	5	none	yes	yes	zerotier1	1	113005860	0	4294967295	
R	link	zerotier-voip	10	5	none	yes	yes	zerotier-voip	1	1126910102	0	4294967295	
R	link	zerotier-voip	10	5	none	yes	yes	zerotier-voip	1	1126910102	0	4294967295	
R	link	zerotier1	10	5	none	yes	yes	zerotier1	1	113005860	0	4294967295	
R	link	lte-kh-bridge	10	5	none	yes	yes	lte-kh-bridge	1	3596551917	0	4294967295	▼

60 items (1 selected)

A new addition to aid visual/informative details of valid nexthops

OSPF



OSPF – Open Shortest Path First

OSPF in v7... where the &*\$^ do we start?!!

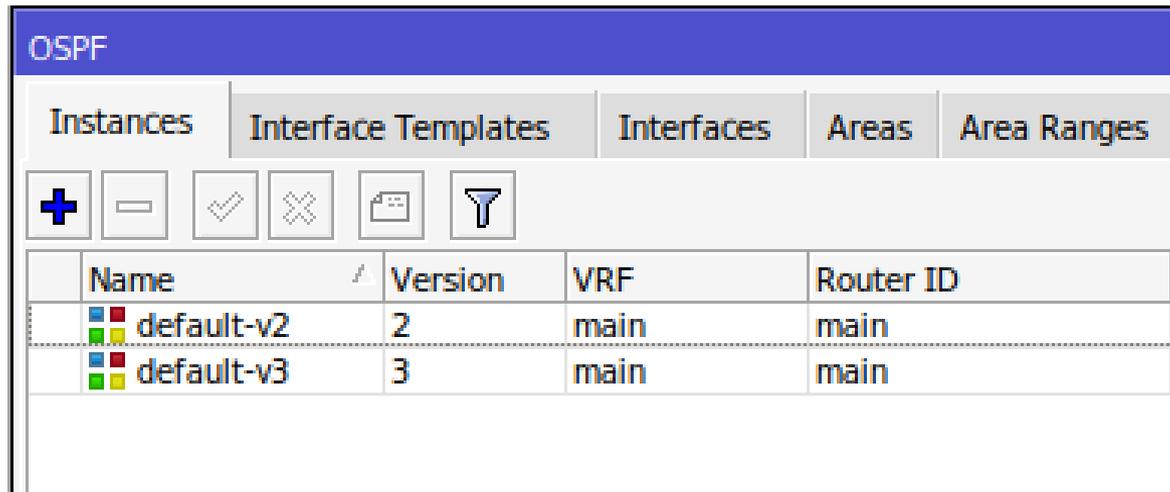
Without doubt, along with BGP, it is a complete change in how configuration is constructed compared to v6.

- Originally OSPF in v7 was CLI only.
- Thankfully it is now configurable in winbox.

OSPF

The first major change to notice is that OSPFv2 and OSPFv3 are now configured in the same place.

First define which OSPF version to use in the 'Instance'

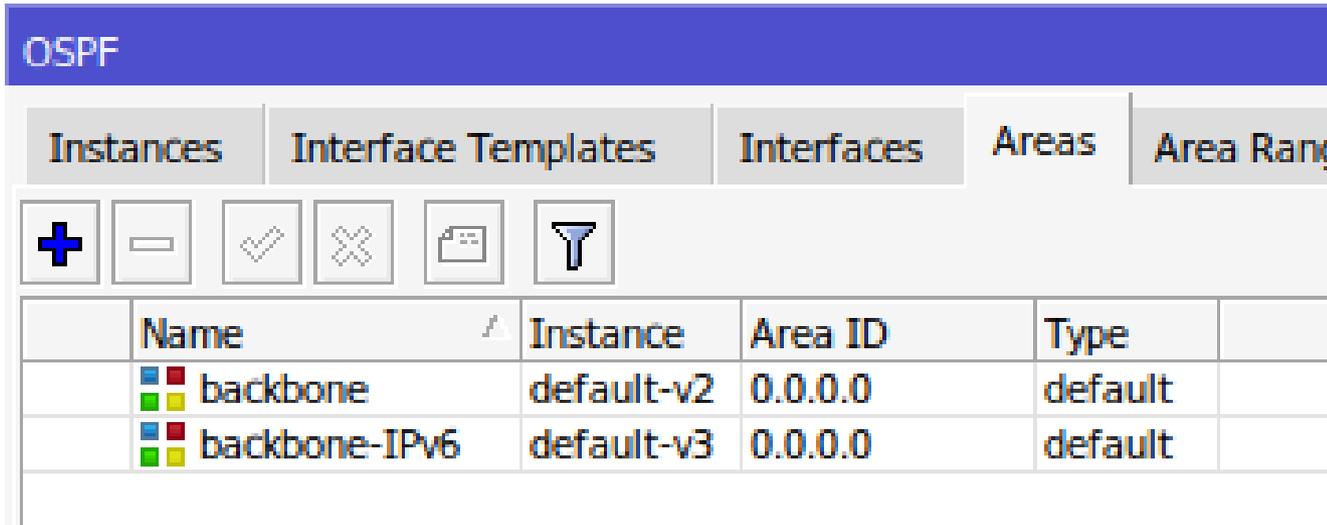


The screenshot shows a configuration window titled "OSPF" with a blue header. Below the header are five tabs: "Instances", "Interface Templates", "Interfaces", "Areas", and "Area Ranges". The "Instances" tab is selected. Below the tabs is a toolbar with icons for adding (+), removing (-), saving (checkmark), deleting (X), help (question mark), and filtering (funnel). Below the toolbar is a table with the following data:

Name	Version	VRF	Router ID
default-v2	2	main	main
default-v3	3	main	main

OSPF

Next you need to configure an area as there is no default 'backbone' area.



The screenshot shows a network configuration interface for OSPF. The 'Areas' tab is selected, displaying a table of existing areas. The table has columns for Name, Instance, Area ID, and Type. Two areas are listed: 'backbone' (Instance: default-v2, Area ID: 0.0.0.0, Type: default) and 'backbone-IPv6' (Instance: default-v3, Area ID: 0.0.0.0, Type: default). Above the table are several icons for actions like adding, deleting, and filtering.

	Name	Instance	Area ID	Type
	backbone	default-v2	0.0.0.0	default
	backbone-IPv6	default-v3	0.0.0.0	default

OSPF

You are now at a configuration point similar to how v6 would be presented 'out of the box'.

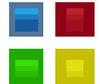
In v6 if you wanted OSPF to start running you would add an active subnet running on your router

OSPF – v6 ‘Networks’

OSPF

Interfaces Instances **Networks** Areas

+ - ✓ ✗ 📄 🔍

	Network	Area
	 10.250.0.1	backbone

OSPF – v6 Instances (running = yes!)

OSPF

Interfaces

Instances

Networks

Areas

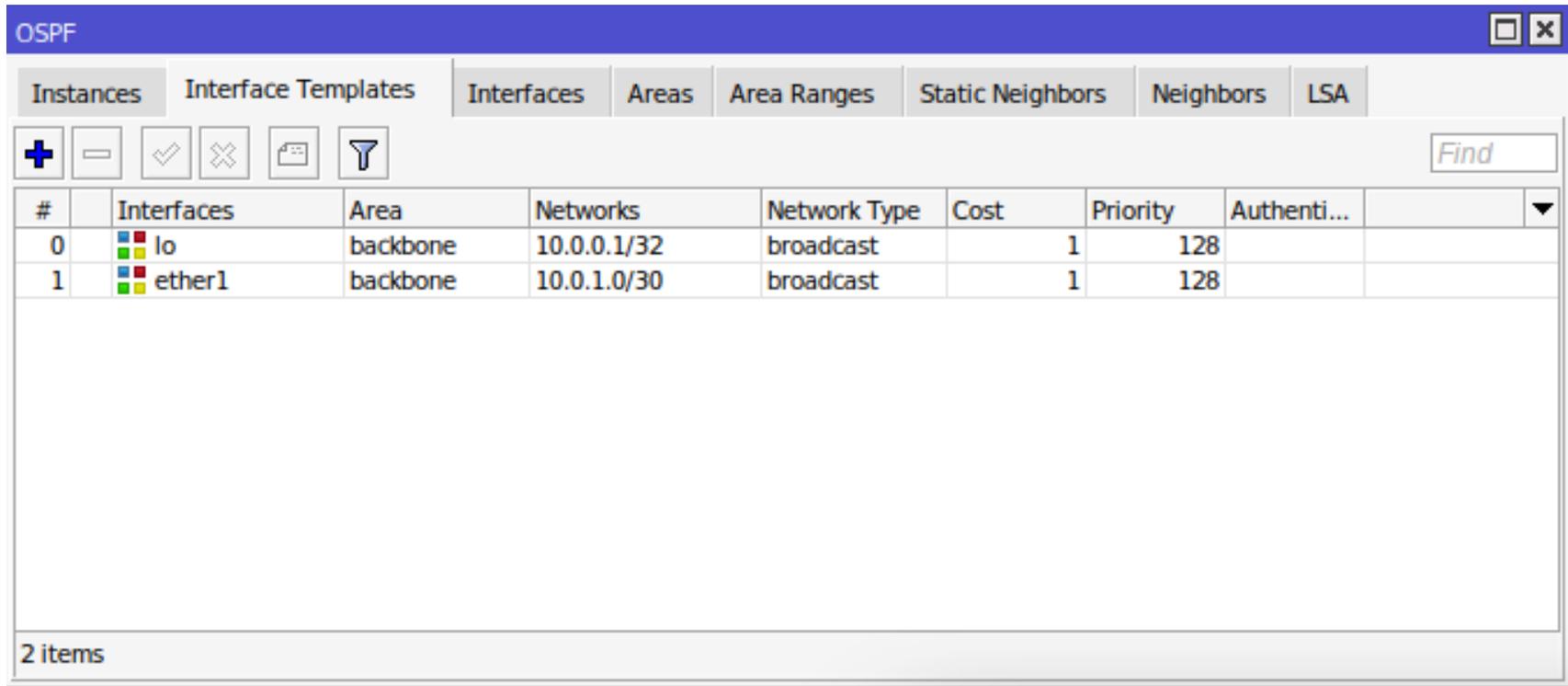
Area Ranges



	Name 	Router ID	Running
*	 default	10.250.0.1	yes

With v7 you need to add an 'interface template' which has combined both the v6 'interface' and 'network' tab as one.

OSPF – Interface Template



OSPF

Instances Interface Templates Interfaces Areas Area Ranges Static Neighbors Neighbors LSA

+ - ✓ ✗ 📄 🔍 Find

#	Interfaces	Area	Networks	Network Type	Cost	Priority	Authenti...	
0	lo	backbone	10.0.0.1/32	broadcast	1	128		
1	ether1	backbone	10.0.1.0/30	broadcast	1	128		

2 items

OSPF – Interface Template (top half)

OSPF Interface Template

Interfaces: lo

Area: backbone

Networks: 10.0.0.1/32

Network Type: broadcast

Prefix List:

Instance ID: 0

Cost: 1

Priority: 128

Passive

OK

Cancel

Apply

Disable

Comment

Copy

Remove

N.B – Cost and priority differ from v6 defaults -
Cost = 10
priority = 1

OSPF – Interface Template (bottom half)

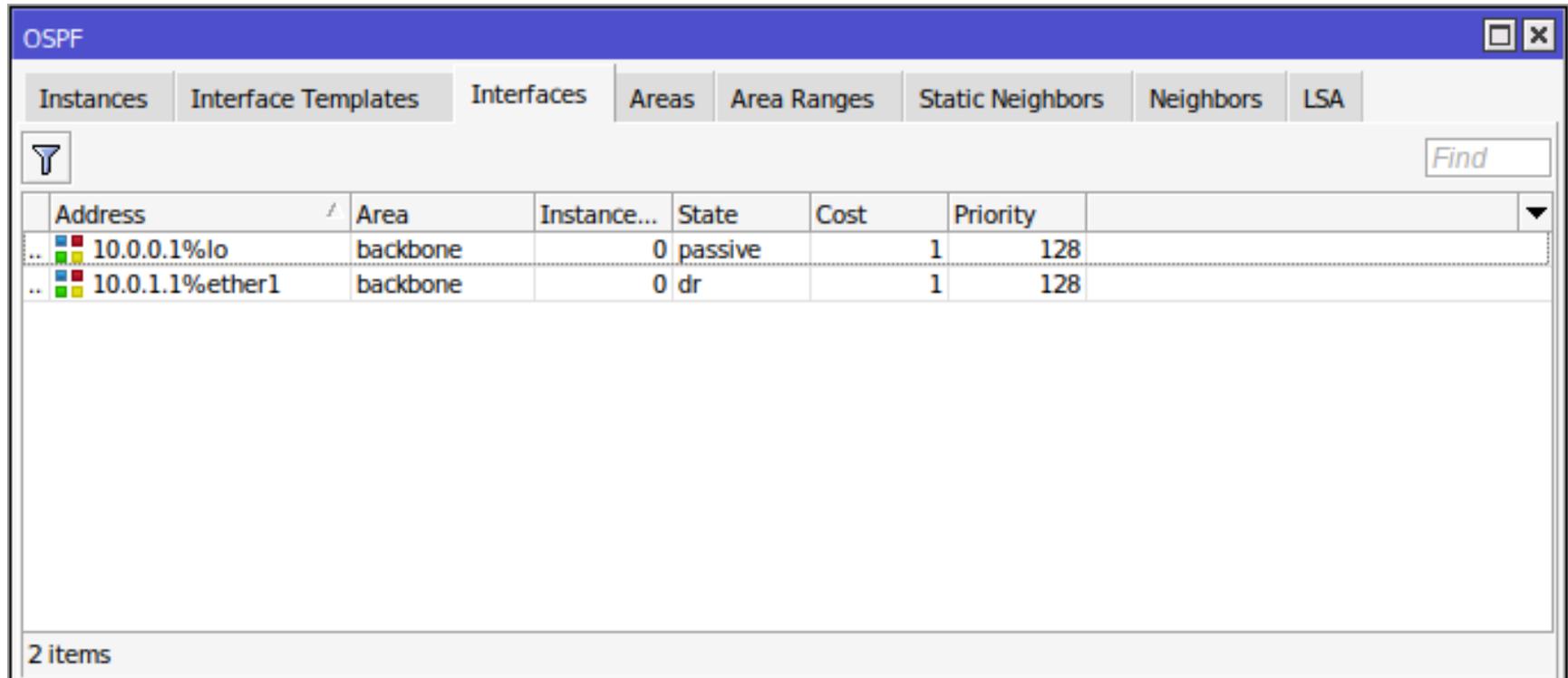
Authentication:	<input type="text"/>	▼
Auth. Key:	<input type="text"/>	▼
Auth. ID:	<input type="text"/>	▼
<hr/>		
Vlink Transit Area:	<input type="text"/>	▼
Vlink Neighbor ID:	<input type="text"/>	▼
Use BFD:	<input type="text"/>	▼
<hr/>		
Retransmit Interval:	<input type="text" value="00:00:05"/>	
Transmit Delay:	<input type="text" value="1"/>	
Hello Interval:	<input type="text" value="00:00:10"/>	
Dead Interval:	<input type="text" value="00:00:40"/>	
<hr/>		
<input checked="" type="checkbox" value="enabled"/>		

OSPF – Interface Template - Authentication options

Authentication:	<input type="text"/>	▼
Auth. Key:	<input type="text"/>	▼
Auth. ID:	<input type="text"/>	▼
<hr/>		
Vlink Transit Area:	<input type="text"/>	▼
Vlink Neighbor ID:	<input type="text"/>	▼
Use BFD:	<input type="text"/>	▼
<hr/>		
Retransmit Interval:	<input type="text" value="00:00:05"/>	
Transmit Delay:	<input type="text" value="1"/>	
Hello Interval:	<input type="text" value="00:00:10"/>	
Dead Interval:	<input type="text" value="00:00:40"/>	
<hr/>		
enabled		

MD5
sha1
sha256
sha384
sha512
Simple

OSPF - Interfaces



The screenshot shows a software window titled "OSPF" with a blue header bar. Below the header is a tabbed interface with tabs for "Instances", "Interface Templates", "Interfaces", "Areas", "Area Ranges", "Static Neighbors", "Neighbors", and "LSA". The "Interfaces" tab is selected. Below the tabs is a search bar with a filter icon on the left and a "Find" input field on the right. The main area contains a table with the following columns: Address, Area, Instance..., State, Cost, and Priority. There are two rows of data. At the bottom left of the window, it says "2 items".

Address	Area	Instance...	State	Cost	Priority
10.0.0.1%lo	backbone	0	passive	1	128
10.0.1.1%ether1	backbone	0	dr	1	128

OSPF – routes / costs

The OSPF route table has now moved to IP → Routes

OSPF – routes / costs

Route List

Find all

OSPF is yes

	Dst. Address /	Gateway	Distance	Routing Table	Pref. Source	OSPF Metric	OSPF Type	
DAo	▶ 10.0.0.2/32	10.0.1.2%ether1	110	main		2	intra area	
DAo	▶ 10.0.0.3/32	10.0.1.2%ether1	110	main		3	intra area	
DAo	▶ 10.0.0.5/32	10.0.1.2%ether1	110	main		3	intra area	
DAo	▶ 10.0.1.4/30	10.0.1.2%ether1	110	main		2	intra area	
DAo	▶ 10.0.1.8/30	10.0.1.2%ether1	110	main		3	intra area	
DAo	▶ 10.0.1.12/30	10.0.1.2%ether1	110	main		2	intra area	
DAo	▶ 10.0.1.16/30	10.0.1.2%ether1	110	main		3	intra area	

7 items out of 21

IP Route

IP Route

Before I forget this important little part of routing changes, there is the route table we all know so well.

Found in both v6 and v7 but there changes worth noting when it comes to the 'flags'

IP Route - Flags

D – Dynamic

r - rip

m - modem

X – Disabled

b – bgp

y - bgp-mpls-vpn

I – Inactive

o – ospf

H - hw-offloaded

A – Active

i – is-is

+ - ECMP

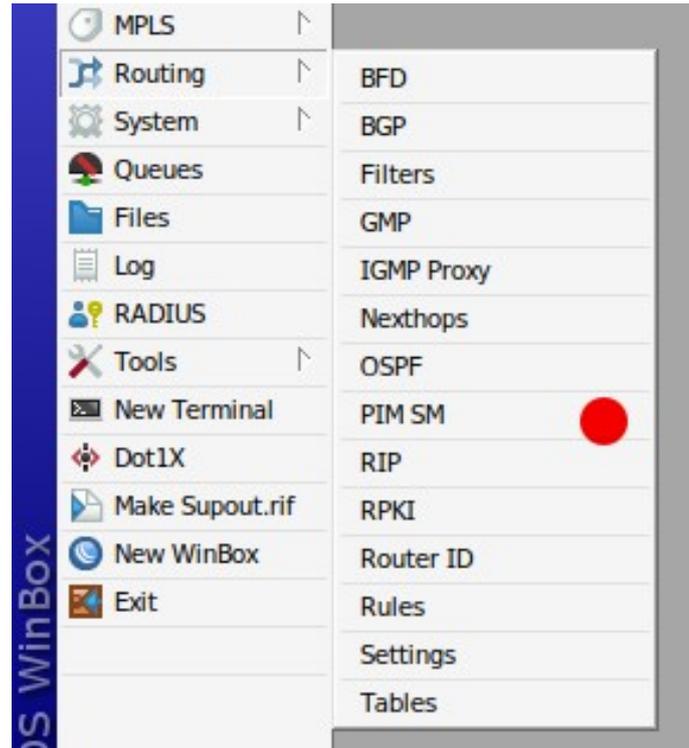
c – Connect(ed)

d - dhcp

S – static

v - vpn

PIM SM



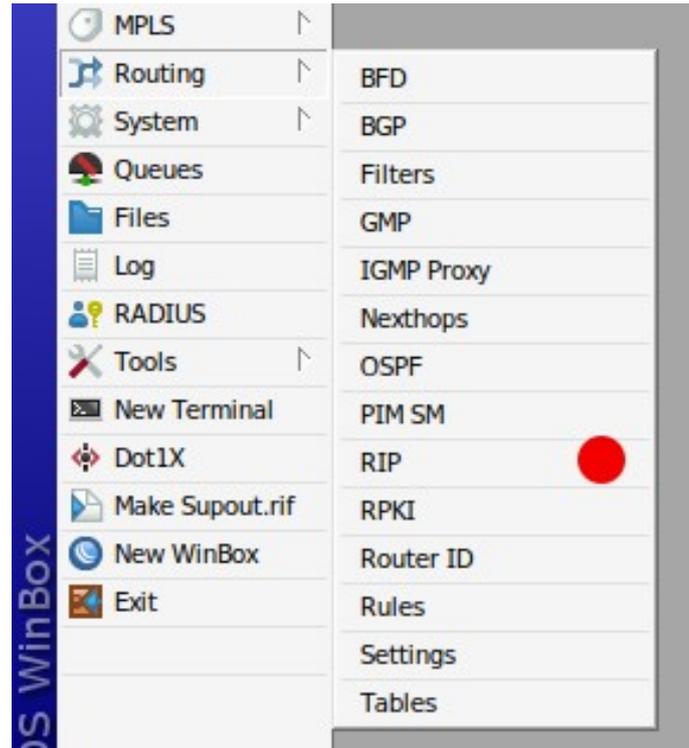
Protocol Independent Multicast

More multicast stuff. No time

<next>!



RIP



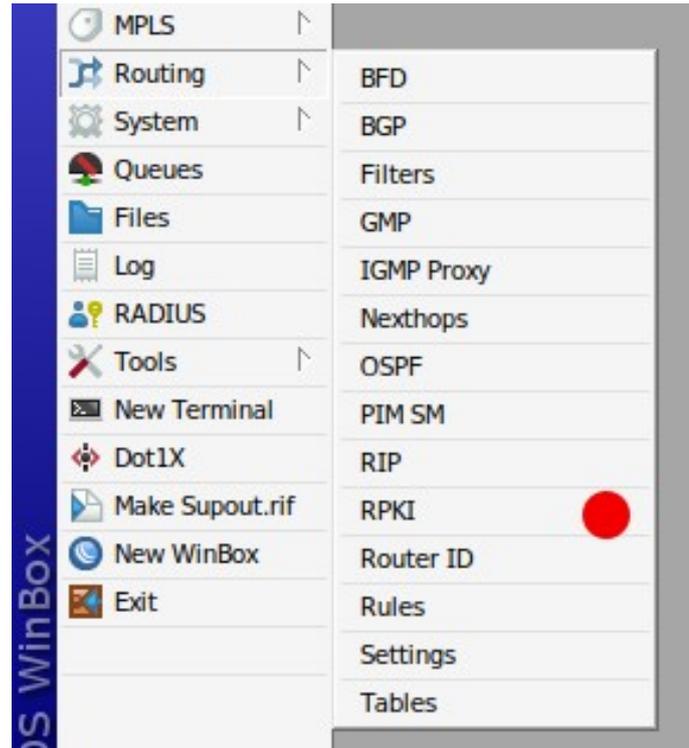
RIP



Adobe Stock | #124012709



RPKI



RPKI – Resource Public Key Infrastructure

A simple but worthy implementation to validate the authenticity of incoming prefixes.

RPKI

The screenshot displays the RPKI configuration interface. At the top, there is a toolbar with icons for adding (+), removing (-), saving (checkmark), deleting (X), and filtering (funnel), along with a search field labeled "Find". Below the toolbar is a table with the following columns: Group, VRF, Address, Port, Preference, Refresh Interval, Retry Interval, and Expire Interval. The table contains one entry:

Group	VRF	Address	Port	Preference	Refresh Interval	Retry Interval	Expire Interval
routinator	main	172.22.0.4	3323		3600	600	7200

Below the table, a configuration dialog box titled "RPKI <routinator>" is open, showing the following fields and controls:

- Group: routinator (dropdown menu)
- VRF: main (dropdown menu)
- Address: 172.22.0.4 (text input)
- Port: 3323 (text input)
- Preference: (empty text input)
- Refresh Interval: 3600 (text input)
- Retry Interval: 600 (text input)
- Expire Interval: 7200 (text input)

On the right side of the dialog, there are buttons for OK, Cancel, Apply, Disable, Copy, and Remove. The status "enabled" is shown at the bottom of the dialog.

You can run the RPKI validator 'routinator' within a container if you so wish.

RPKI

The screenshot displays a container management application window titled "Container". It features a tabbed interface with "Container", "Mounts", and "Envs" tabs. Below the tabs are control buttons: a plus sign, a minus sign, a folder icon, a funnel icon, "Start", "Stop", and "Config". A "Find" search box is located in the top right corner.

Interface	Name	Tag	Status
veth1-pihole	3e877060-253e-42f8-8375-0a45406d2a1f	pihole/pihole:latest	running
veth3-Routinator	49205f5f-6b20-4490-bedb-b97e68505375	nlnetlabs/routinator:latest	running
veth2-smokeping	f539a604-b93d-47bb-97e5-9476e66f28bd	linuxserver/smokeping:latest	running
veth4-so			running
veth5-sa			running

An "OK" button is visible in the top right of the container list area.

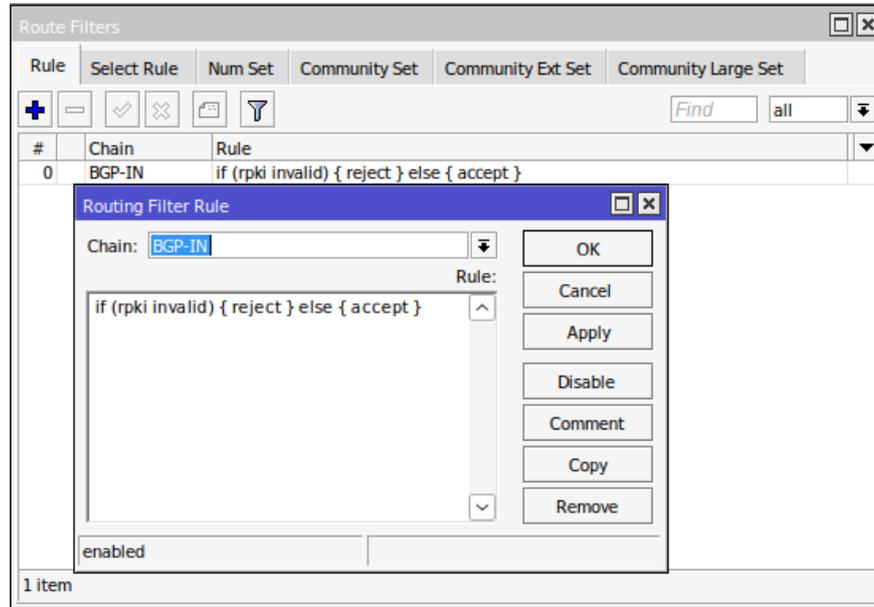
A configuration dialog box is open over the "veth3-Routinator" container. It contains the following fields and controls:

- Interface: veth3-Routinator
- Envlist: (empty)
- Cmd: (empty)
- Entrypoint: (empty)
- Hostname: (empty)
- Domain Name: (empty)
- Workdir: (empty)
- Stop Signal: (empty)
- Root Dir: /sata1/container/routinator
- Mounts: Routinator, Routinator-cache
- DNS: (empty)

On the right side of the dialog, there are buttons for: OK, Cancel, Apply, Comment, Copy, Remove, Start, and Stop. A "More actions for this window" button is also present.

RPKI – Using it via a filter

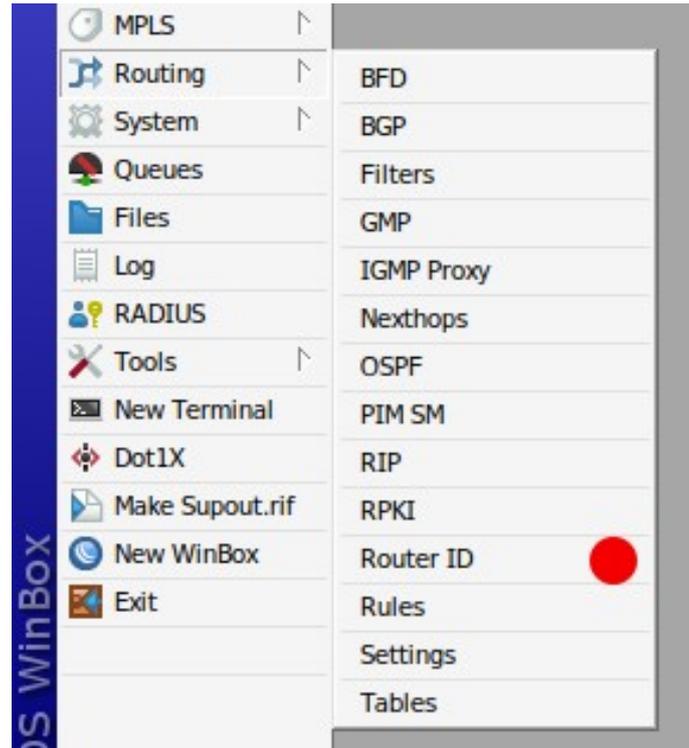
If (rpki invalid) {reject} else {accept}



More about RPKI later today by

14:30 - Michael Takeuchi

Router ID



Router ID

A new addition for v7 (as in not found in v6)

Router ID

The screenshot shows a 'Router ID' window with a table containing one item. A dialog box titled 'Router ID <main>' is open over the table, showing the configuration for the selected item.

ID	Select D...	Select From ...	Dynamic ID	
D	only vrf	main	10.0.0.1	

Router ID <main> configuration details:

- Name: main
- ID:
- Select Dynamic ID: only vrf
- Select From VRF: main
- Dynamic ID: 10.0.0.1
- dynamic:
- enabled: enabled

Buttons: OK, Copy, Remove

Router ID - v6

A simple config window to aid creation of a router ID typically used in e.g. OSPF.

In OSPF v6 Router ID if not set would automatically be set from the lowest active IP

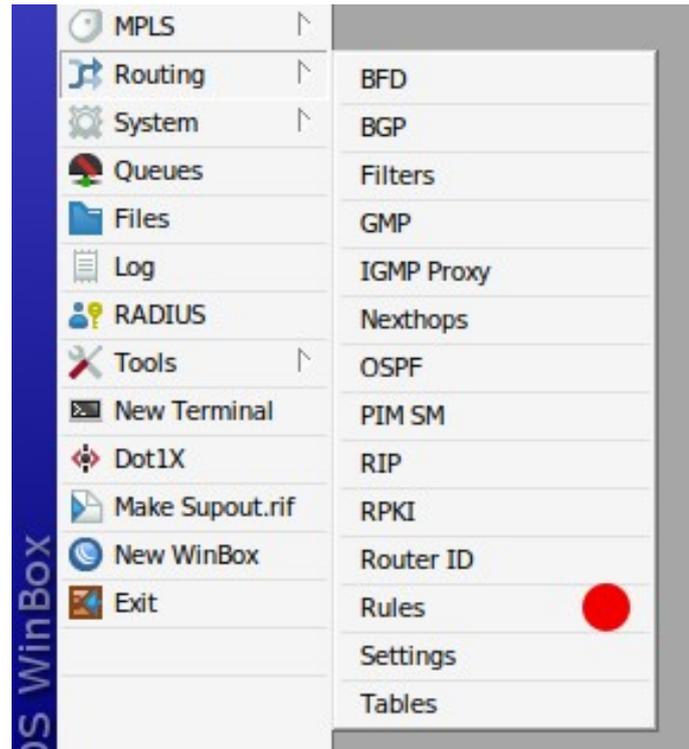
Router ID - v7

However, in v7 you can either use the dynamically generated ID using the highest active IP with the smallest prefix length or of course fix it like you should!

Credit must be given to Michal, Steve, Thomas and Troels for allowing me to waste time during their MTCRE this week on discovering the specific formula that creates the dynamic router ID

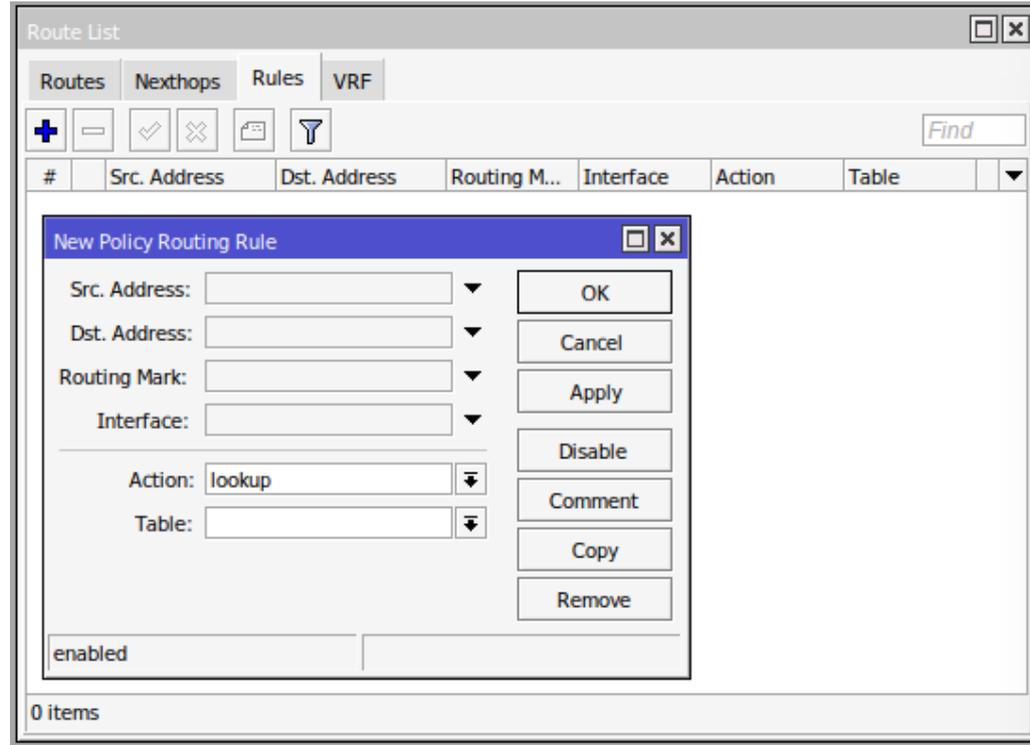
A big thanks to you guys!

Rules



Rules - v6

IP → Route



Rules - v7

The screenshot displays a 'Rules' window with a toolbar and a table. A 'New Policy Routing Rule' dialog box is open, allowing configuration of a new rule. The dialog includes fields for Src. Address, Dst. Address, Routing Mark, Interface, Action, Table, and Min Prefix. The Action is set to 'lookup' and the Table is set to 'main'. The rule is currently 'enabled'. The main window shows a table with 0 items.

#	Src. Address	Dst. Address	Routing M...	Interface	Action	Table	Min Prefix
0 items							

New Policy Routing Rule

Src. Address: ▼

Dst. Address: ▼

Routing Mark: ▼

Interface: ▼

Action: lookup ▼

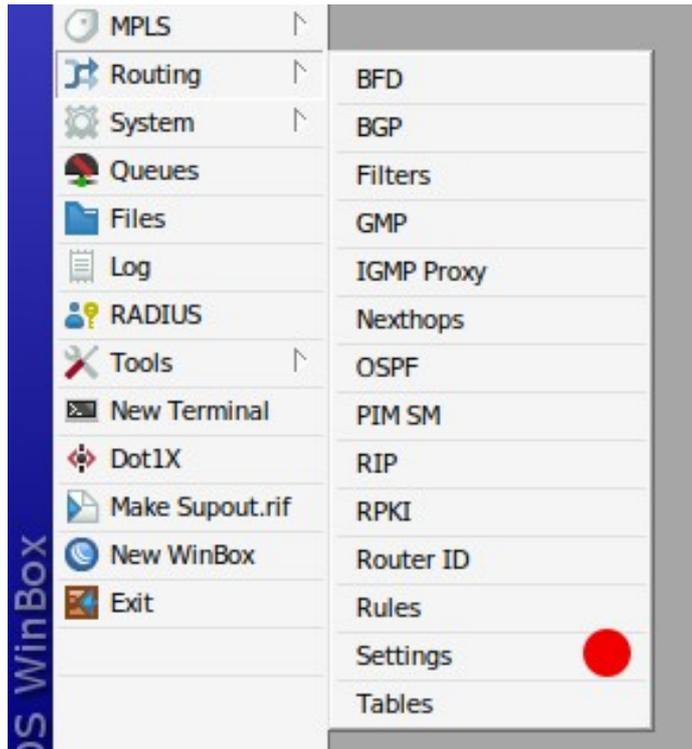
Table: main ▼

Min Prefix: ▼

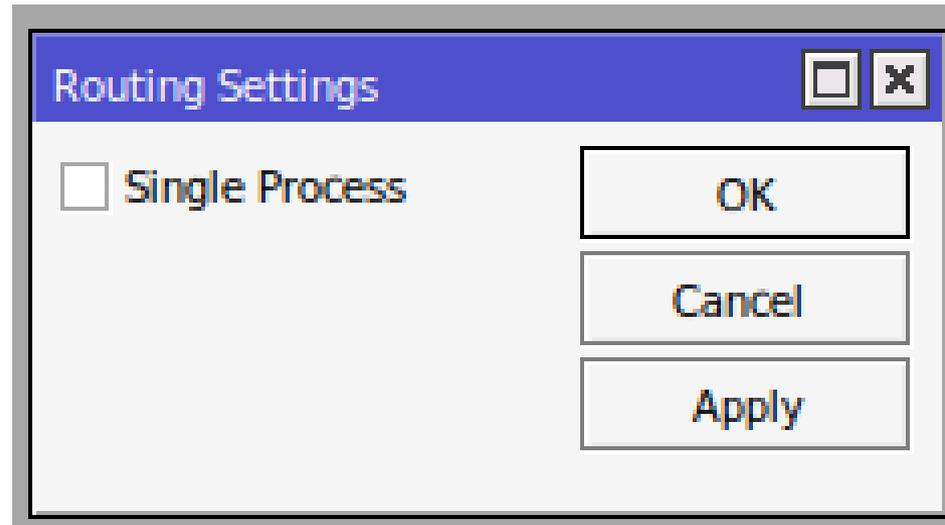
enabled

Buttons: OK, Cancel, Apply, Disable, Comment, Copy, Remove

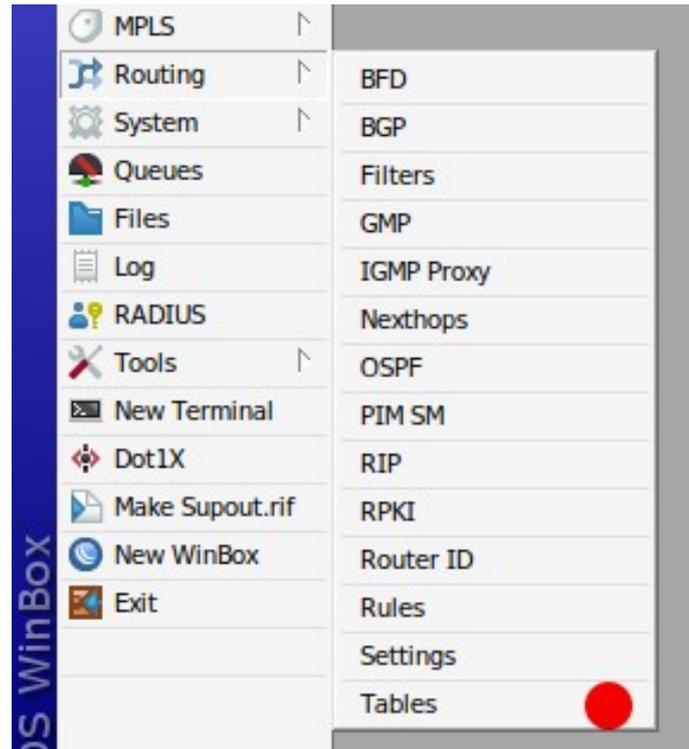
Settings



Settings – hmm



Tables

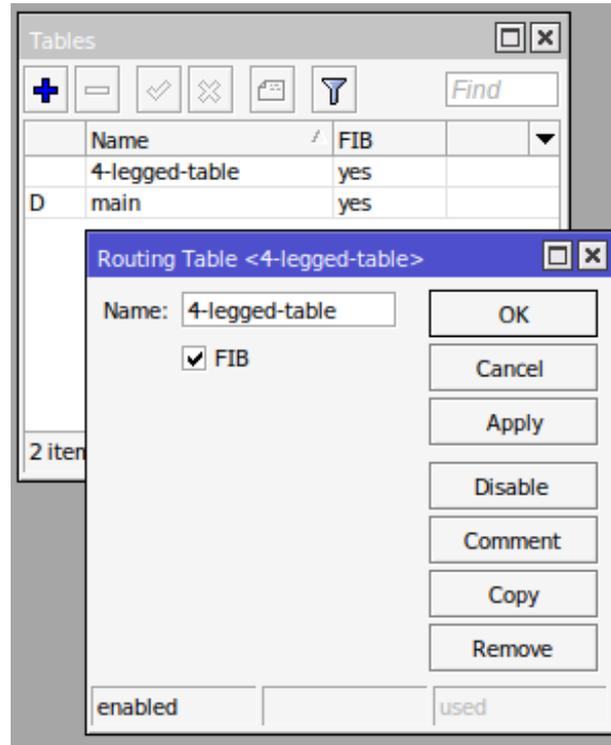


Tables

What used to be known as 'Route Mark'.

You now have to create a 'table' and add to the FIB for it to be accessible/usable in mangle or the routing table

Tables



CLI →

Not everything is available via winbox at present.

The CLI (Command Line Interface) is the only option for these extra routing functions and tools

(Based on \leq v7.14)

The missing functions / tools are as follows :

- Fantasy
- IS-IS
- Route
- Stats
- Discourse
- Reinstall-fib

CLI →

```
[user@demo] /routing> <tab>
```

```
bfd          id          pimsm      settings   reinstall-fib
bgp          igmp-proxy  rip        stats
Fantasy     isis        route      table
filter      nexthop    rpki       discourse
gmp         ospf       rule       export
```

Create / generate prefixes to add to your route table for testing purposes

Fantasy

```
[user@demo] /routing> fantasy add count=255 \  
disabled=no dst-address=10.0.0.0/8 gateway=ether1 \  
name=Prague-test prefix-length=24
```

```
[user@demo] /routing> fantasy remove 0
```

At last a new IGP to RouterOS...! I'd love to show you more but I'll leave it to Kevin Myers (Stub area 51) later on this morning to show you this new shiney tool in the box –

11:00- 11:45

An alternative to the IP → Route table

Route

```
[user@demo] /routing> route print
```

```
Flags: A - ACTIVE; c - CONNECT, o - OSPF, d - DHCP; H - HW-OFFLOADED
```

```
Columns: DST-ADDRESS, GATEWAY, AFI, DISTANCE, SCOPE, TARGET-SCOPE, IMMEDIATE-GW
```

	DST-ADDRESS	GATEWAY	AFI	DISTANCE	SCOPE	TARGET-SCOPE	IMMEDIATE-GW
Ad	0.0.0.0/0	185.208.89.1	ip4	1	30		10
	185.208.89.1%ether2						
Ac	10.0.0.1/32	lo	ip4	0	10		lo
Ao	10.0.0.2/32	10.0.1.2%ether1	ip4	110	20		10
	10.0.1.2%ether1						
Ao	10.0.0.3/32	10.0.1.2%ether1	ip4	110	20		10
	10.0.1.2%ether1						

A more detailed route debugging tool

Stats

```
[user@demo] /routing> stats process print
```

```
Columns: TASKS, PRIVATE-MEM-BLOCKS, SHARED-MEM-BLOCKS, PSS, RSS, VMS, ID, PID, RPID, PROCESS-TIME, KERNEL-TIME, CUR-BUSY
```

# TASKS	PRIVATE-M	SHARED-ME	PSS	RSS	VMS	ID	PID	RPID	PROCE	KERNE	CUR-
0 routing tables	1536.0KiB	1792.0KiB	1085.0KiB	3384.0KiB	19.2MiB	main	96	0	140ms	300ms	10ms
rib											
1 fib	256.0KiB	0	757.0KiB	3048.0KiB	19.2MiB	fib	116	1	50ms	250ms	
2 routing policy configuration	256.0KiB	256.0KiB	688.0KiB	2856.0KiB	19.2MiB	bgp	125	1	50ms	100ms	

Discourse

No Idea!

Discourse

```
[user@demo] /routing>
```

Reinstall-FIB

I have assumed this cli command refreshes the FIB
(Forwarding information base)

Reinstall-FIB

```
[user@demo] /routing> reinstall-fib <enter> [y/N]:  
Refreshing FIB
```

...and crash!



Wait.. what is that I can hear? It's Lorenzo!



<next>

The End / Fini / Kaput / No more / TTFN

Thank you for listening!