

Thiago Santos

# *Dual Stack / Pilha Dupla*



**MOGA**  
Telecom



**solintel**



**VLSM**

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**#juntosomosmais**

# Thiago Santos

- Graduando em Engenharia Elétrica com ênfase em Telecomunicações;
- 5 anos de experiência no mercado de telecomunicações;
- Experiência em redes HFC;
- Serviços de numeração ASN;
- Conhecimento regulatório para provedores.

# Agenda

- Nivelamento IPv6;
- Protocolos utilizáveis na implementação;
- Apresentação laboratório prático.



# Esgotamento IPv4



## Um pouco sobre IPv6

- O IP versão 6 começou a ser desenvolvido no início da década de 1990, com o objetivo de ser a solução definitiva para o esgotamento de endereços IPs na Internet;
- O IPv6 aumentou o endereçamento IP de 32 para 128 bits.



# IPv6 no Mikrotik RouterOS:

The screenshot shows the Mikrotik WinBox interface. On the left, the 'System' menu item is highlighted with a red box, and the 'Packages' sub-menu item is also highlighted with a red box. The main window displays the 'Package List' window, which contains a table of installed packages. The 'ipv6' package is highlighted with a red box in the table.

Name	Version	Build Time	Scheduled
dude	6.37.5	Mar/09/2017 11:54:20	
routeros-x86	6.37.5	Mar/09/2017 11:54:20	
advancedt...	6.37.5	Mar/09/2017 11:54:20	
dhcp	6.37.5	Mar/09/2017 11:54:20	
hotspot	6.37.5	Mar/09/2017 11:54:20	
ipv6	6.37.5	Mar/09/2017 11:54:20	
mpls	6.37.5	Mar/09/2017 11:54:20	
ppp	6.37.5	Mar/09/2017 11:54:20	
routing	6.37.5	Mar/09/2017 11:54:20	
security	6.37.5	Mar/09/2017 11:54:20	
system	6.37.5	Mar/09/2017 11:54:20	
ups	6.37.5	Mar/09/2017 11:54:20	
wireless	6.37.5	Mar/09/2017 11:54:20	

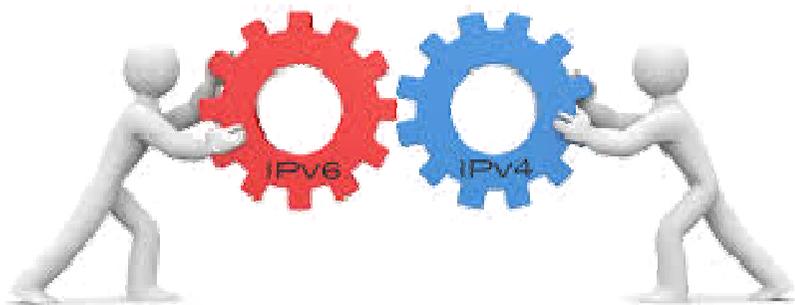
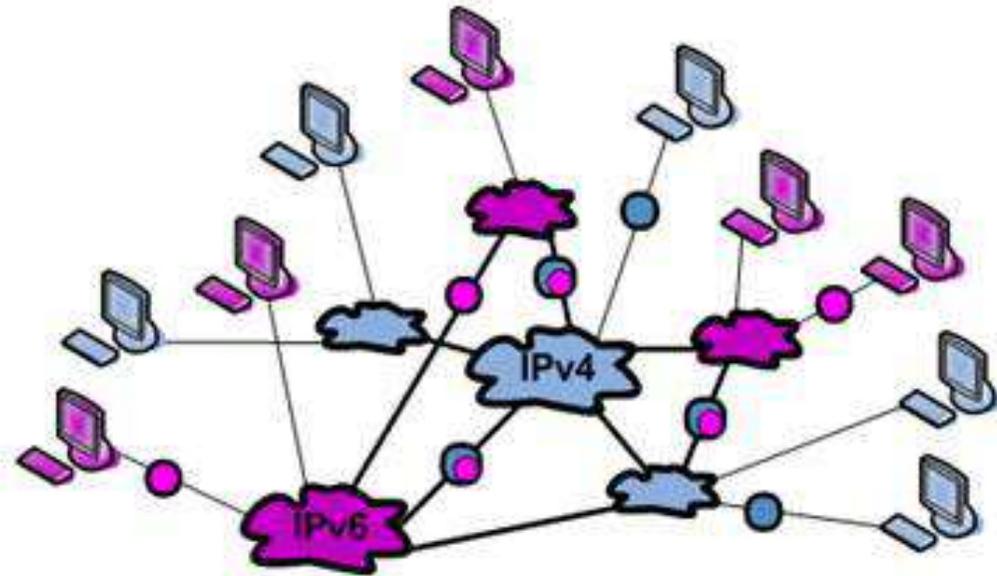
# IPv6 no Mikrotik RouterOS:

The screenshot shows the Mikrotik WinBox interface for IPv6 configuration. The left sidebar contains a menu with 'IPv6' highlighted in red. The main window displays the 'IPv6 Address List' configuration window. The table below shows the configuration details:

Address	From Pool	Interface	Advertise
G 2001:db8:3003:2::/64		ether1	yes

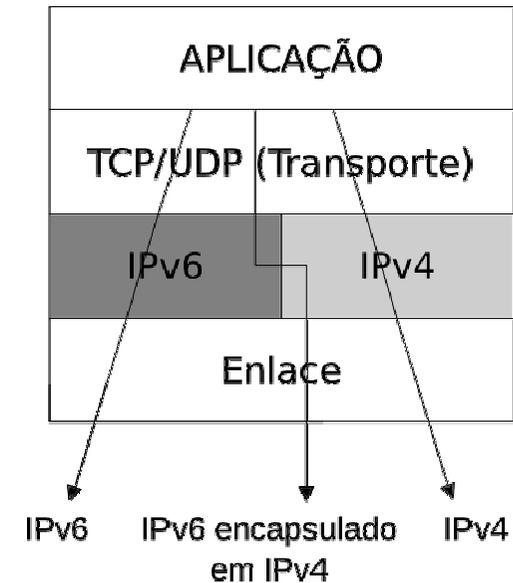
1 item

# O que é pilha dupla (Dual Stack)?



## Características da Pilha Dupla:

- Deverá ser utilizada sempre que possível!
- Coexistência de IPv4/IPv6
- Elimina a necessidade de mecanismos reais de tradução

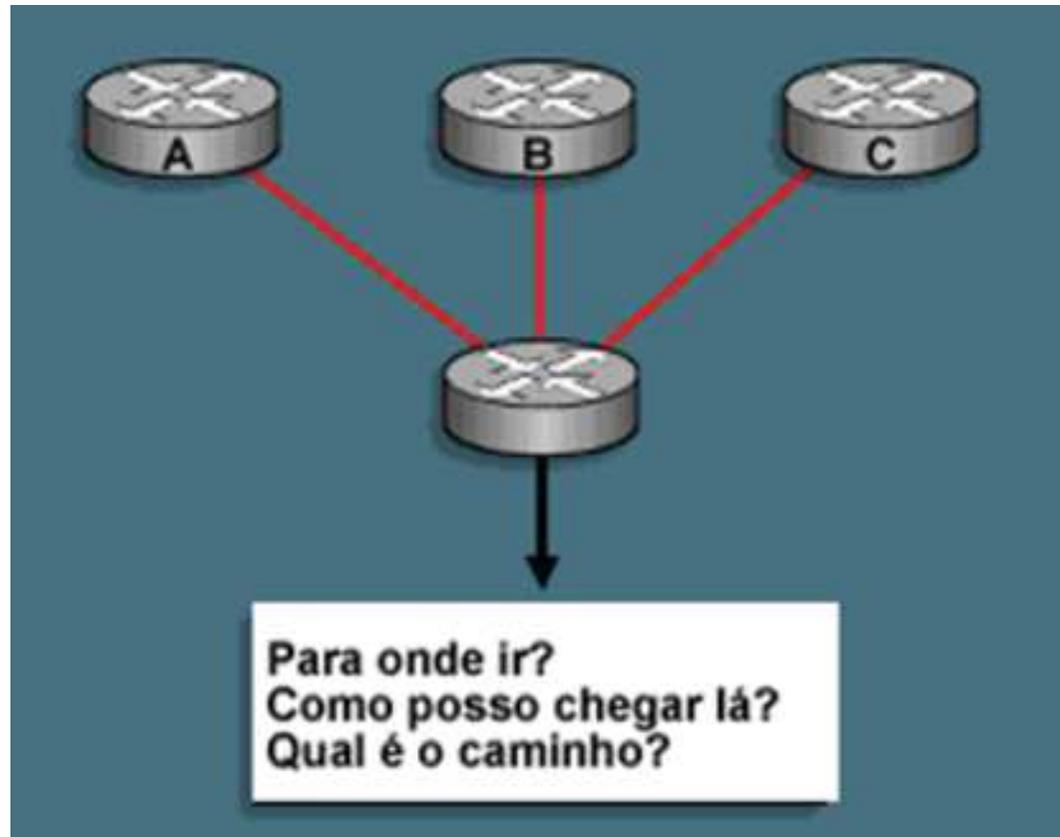


## Agenda

- ✓ Nivelamento IPv6;
- Protocolos utilizáveis na implementação;
- Apresentação laboratório prático.



## Protocolos de roteamento IPv6:



## Protocolos de Roteamento/autenticação IPv6:

- Rota estática
- OSPFv3
- BGP4
- PPPoE + DHCP-PD



## **Rota estática IPv6:**

- A rota estática define um caminho distinto entre dois roteadores;
- Não atualiza automaticamente;
- Não utiliza nenhum ciclo da CPU para calcular e analisar atualizações de roteamento.

# Rota estática IPv6 no MikroTik:

admin@192.168.147.130 (PE1) - WinBox v6.37.5 on CHR (x86\_64)

Session Settings Dashboard

Safe Mode Session:

Quick Set  
Interfaces  
Bridge  
PPP  
Mesh  
IP  
**IPv6**  
MPLS  
Routing  
System  
Queues  
Files  
Log  
Radius  
Tools  
New Terminal  
Make Supout.rtf  
Manual  
New WinBox  
Exit

Addresses  
DHCP Client  
DHCP Relay  
DHCP Server  
Firewall  
ND  
Neighbors  
Pool  
**Routes**  
Settings

**IPv6 Route List**

	Dst. Address	Gateway	Distance
Db	:::0	fe80::5200:ff:fe09:0%ether1 reachable	20
AS	:::0	2001:db1.2::12 reachable ether1	1

**IPv6 Route <:::0>**

General Attributes

Dst. Address: :::0

Gateway: 2001.db1.2::12 reachable ether1

Check Gateway:

Type: unicast

Distance: 1

Scope: 30

Target Scope: 10

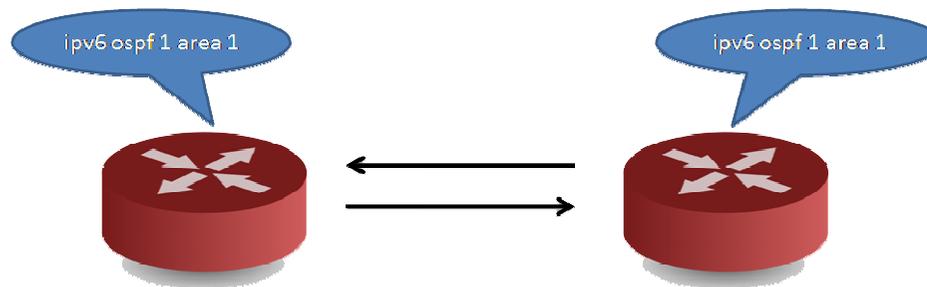
Received From:

enabled active static

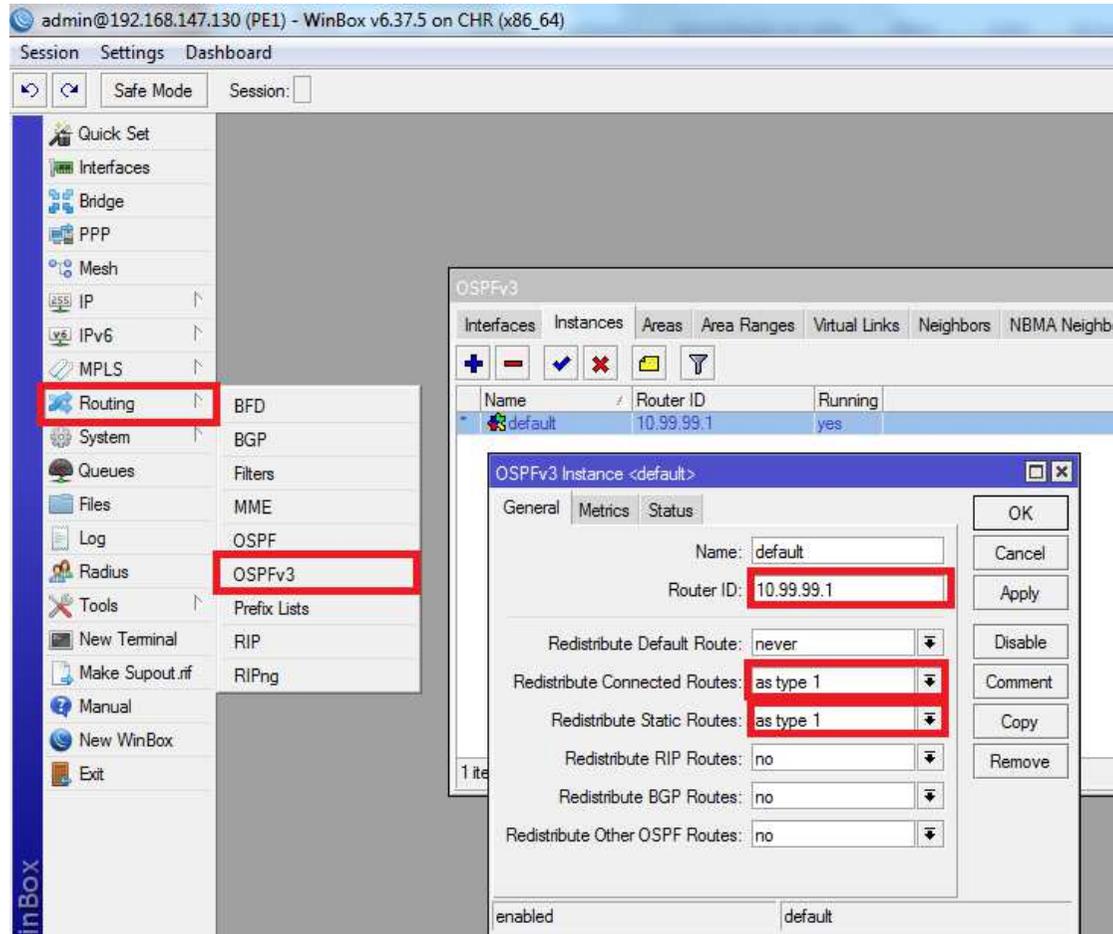
## OSPFv3

- Plataforma independente de implantação;
- processamento por enlace ao invés de processamento por nó.

### OSPF for IPv6



# OSPFv3 no MikroTik:



The screenshot shows the MikroTik WinBox interface. The left sidebar has 'Routing' and 'OSPFv3' highlighted with red boxes. The main window shows the 'OSPFv3' configuration page with a table of instances and a configuration dialog for the 'default' instance.

Name	Router ID	Running
default	10.99.99.1	yes

**OSPFv3 Instance <default>**

General Metrics Status

Name: default

Router ID: 10.99.99.1

Redistribute Default Route: never

Redistribute Connected Routes: as type 1

Redistribute Static Routes: as type 1

Redistribute RIP Routes: no

Redistribute BGP Routes: no

Redistribute Other OSPF Routes: no

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

# OSPFv3 no Mikrotik:

admin@192.168.147.130 (PE1) - WinBox v6.37.5 on CHR (x86\_64)

Session Settings Dashboard

Safe Mode Session: [ ]

- Quick Set
- Interfaces
- Bridge
- PPP
- Mesh
- IP
- IPv6
- MPLS
- Routing**
  - BFD
  - BGP
  - Filters
  - MME
  - OSPF
  - OSPFv3**
  - Prefix Lists
  - RIP
  - RIPng
- System
- Queues
- Files
- Log
- Radius
- Tools
- New Terminal
- Make Supout.tif
- Manual
- New WinBox

**OSPF**

Interfaces Instances Networks Areas Area Ranges Virtual Links Neighbors NBMA Neighbors Sham Links LSA Routes ...

Interface	Cost	Priority	Authentic...	Authenticatio...	Network Type	Instance	Area	Neig...	State
ether2	10	1	none	*****	broadcast	default	backbone	0	designated ro...

**OSPFv3**

Interfaces Instances Areas Area Ranges Virtual Links Neighbors NBMA Neighbors LSA Routes AS Border Routers OSPFv3 Routers

Area	Interface	Cost	Priority	Network Type	Instance	Neig...	State
backb...	ether2	10	1	default	default	0	designated ro...
backb...	ether3	10	1	default	default	0	designated ro...

## **BGP4:**

- O BGP, protocolo de roteamento dinâmico, utilizado para comunicação entre sistemas autônomos (AS's);
- O BGP foi projetado para evitar loops de roteamento entre AS's.

# BGP4 no MikroTik:

The screenshot shows the MikroTik WinBox interface. The left sidebar has the 'Routing' menu expanded, with 'BGP' selected. The main window displays the 'BGP' configuration page. A 'BGP Instance <default>' dialog box is open, showing the following configuration:

Name	AS	Router ID	Out Filter	Confeder...	Confeder...	Cluster ID
default	65000	10.99.99.1				

The 'BGP Instance <default>' dialog box contains the following fields and options:

- Name: default
- AS: 65000
- Router ID: 10.99.99.1
- Redistribute Connected
- Redistribute Static
- Redistribute RIP
- Redistribute OSPF
- Redistribute Other BGP
- Out Filter: [dropdown]
- Confederation: [dropdown]
- Confederation Peers: [dropdown]
- Cluster ID: [dropdown]
- Routing Table: [dropdown]
- Client To Client Reflection
- Ignore AS Path Length

# BGP4 no MikroTik:

admin@192.168.147.130 (PE1) - WinBox v6.37.5 on CHR (x86\_64)

Session Settings Dashboard

Safe Mode Session:

- Quick Set
- Interfaces
- Bridge
- PPP
- Mesh
- IP
- IPv6
- MPLS
- Routing**
  - BFD
  - BGP**
- System
  - Filters
  - MME
  - OSPF
  - OSPFv3
  - Prefix Lists
  - RIP
  - RIPng
- Queues
- Files
- Log
- Radius
- Tools
- New Terminal
- Make Supout.nf
- Manual
- New WinBox
- Exit

Instances VRFs Peers Networks Aggregates VPN4 Routes Advertisements

Refresh Refresh All Resend Resend All

Name	Instance	Remote Address	Remote AS	M...	R...	TTL
peer1_oper1v6	default	2001:db1:2::12	65001	no	no	d...
peer_oper1	default	10.1.0.2	65001	yes	no	d...
peer_oper2	default	10.2.0.2	65002	no	no	d...
peer_oper2v6	default	2001:db1:4::12	65002	no	no	d...

4 items (1 selected)

# BGP4 no MikroTik:

admin@192.168.147.130 (PE1) - WinBox v6.37.5 on CHR (x86\_64)

Session Settings Dashboard

Safe Mode Session:

- Quick Set
- Interfaces
- Bridge
- PPP
- Mesh
- IP
- IPv6
- MPLS
- Routing**
  - BFD
  - BGP**
- System
  - Filters
  - MME
  - OSPF
  - OSPFv3
  - Prefix Lists
  - RIP
  - RIPng
- Queues
- Files
- Log
- Radius
- Tools
  - New Terminal
  - Make Supout.rf
- Manual
- New WinBox
- Exit

**BGP**

Instances VRFs Peers Networks Aggregates VPN4 Routes Advertisements

Network	Synchroni...
192.168.0.0/24	no
192.168.1.0/24	no
192.168.2.0/24	no
192.168.3.0/24	no
2001:db1::/33	no
2001:db2::/33	no

6 items

## **PPPoE + DHCP-PD:**

- O cliente PPPoE obtém o endereço IPv6 da interface WAN através do DHCP - PD. e um prefixo delegado para ser usado para o segmento;
- DHCP - PD.

# PPPoE IPv6 no MikroTik:

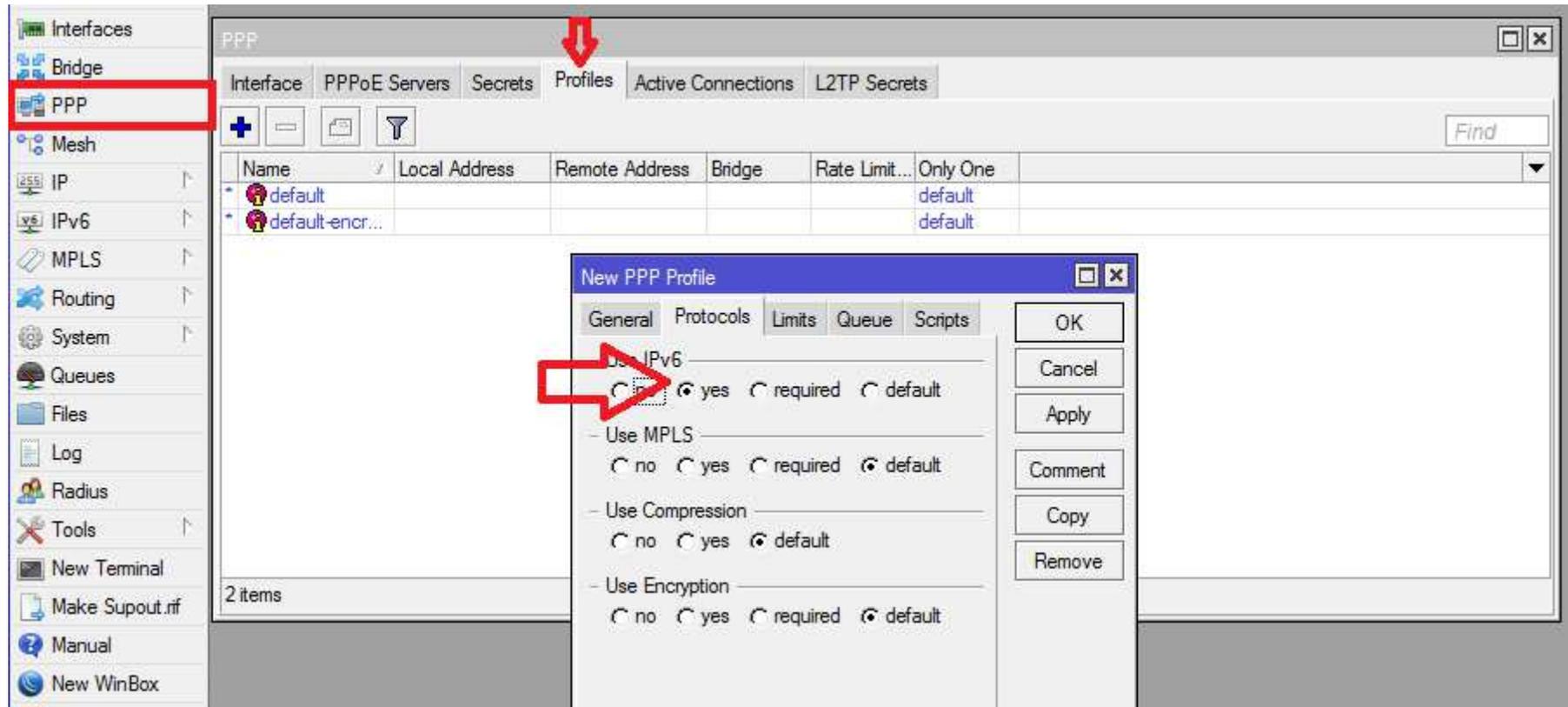
The screenshot shows the MikroTik WinBox interface. On the left, the 'IPv6' menu is highlighted with a red box, and the 'Pool' option is selected. A red arrow points to the '+' button in the 'IPv6 Pool' window. The table below shows the configuration for two pools:

Name	Prefix	Prefix Length	Expire Time
poolPD	2001:db8:1::/48		56
pooltunnel	2001:db8::/48		64

The 'pooltunnel' pool is selected, and a dialog box is open for its configuration. The fields are as follows:

- Name: pooltunnel
- Prefix: 2001:db8::/48
- Prefix Length: 64
- Expire Time: (empty)

# PPPoE IPv6 no MikroTik:



# PPPoE IPv6 no MikroTik:

admin@50:00:00:01:00:00 (PPPoE1) via 192.168.147.130 - WinBox v6.37.5 on CHR (x86\_64)

Session Settings Dashboard

Safe Mode Session: [ ]

Quick Set  
Interfaces  
Bridge  
**PPP**  
Mesh  
IP  
IPv6  
MPLS  
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Radius  
Tools  
New Terminal  
Make Supout.tif  
Manual  
New WinBox  
Exit

PPP

Name	Local Address	Remote Address	Bridge	Rate Limit...	Only One
default	10.99.99.7	pool_PPPoE			default
default-encr...					default

PPP Profile <default>

General Protocols Limits Queue Scripts

Name: default

Local Address: 10.99.99.7

Remote Address: pool\_PPPoE

Remote IPv6 Prefix Pool: pool\_remoto

DHCPv6 PD Pool: pool\_local

Bridge: [ ]

Bridge Port Priority: [ ]

Bridge Path Cost: [ ]

Incoming Filter: [ ]

Outgoing Filter: [ ]

Address List: [ ]

DNS Server: 8.8.8.8

WINS Server: [ ]

- Change TCP MSS  
 no  yes  default

- Use UPnP  
 no  yes  default

OK  
Cancel  
Apply  
Comment  
Copy  
Remove

## Agenda

- ✓ Nivelamento IPv6;
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# Perguntas ?



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**OBRIGADO !!!**



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