

Thiago Santos

# *Dual Stack / Pilha Dupla*



**MOGA**  
Telecom



**solintel**



**VLSM**

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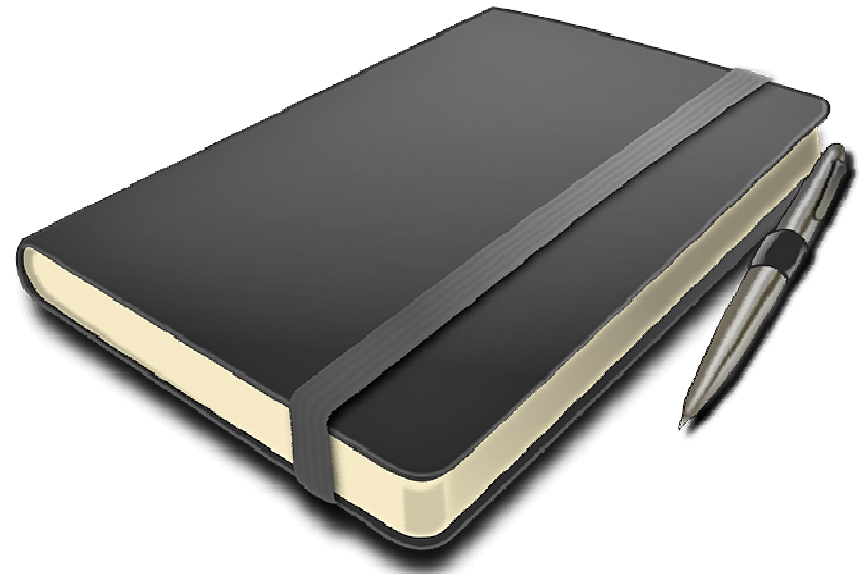
**#juntosomosmais**

# 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 is highlighted in red, and the 'Packages' option is also highlighted in red. The main window displays the 'Package List' dialog, which contains a table of installed packages. The 'ipv6' package is highlighted in red in the table.

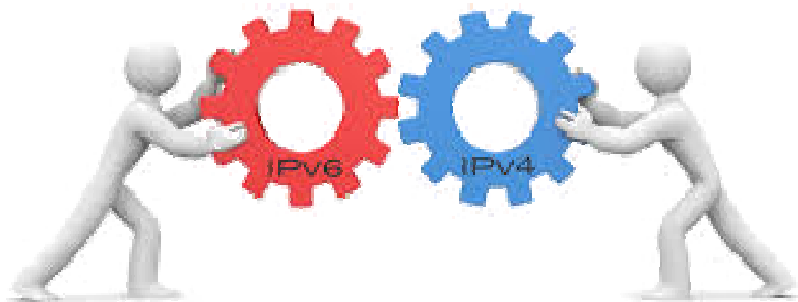
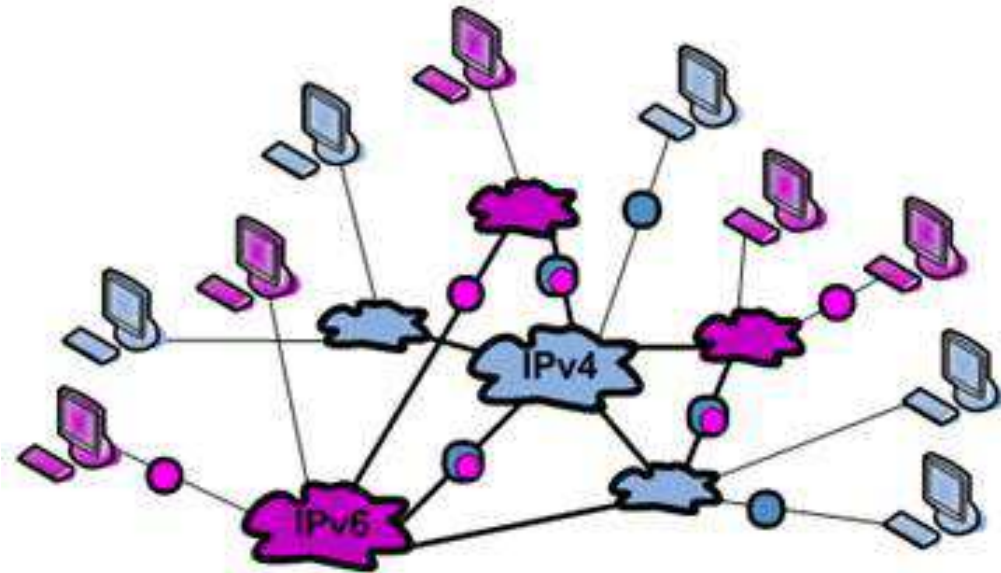
Name	Version	Build Time	Scheduled
dude	6.37.5	Mar/09/2017 11:54:20	
routeros-x86	6.37.5	Mar/09/2017 11:54:20	
advancedt...	6.37.5	Mar/09/2017 11:54:20	
dhcp	6.37.5	Mar/09/2017 11:54:20	
hotspot	6.37.5	Mar/09/2017 11:54:20	
ipv6	6.37.5	Mar/09/2017 11:54:20	
mpls	6.37.5	Mar/09/2017 11:54:20	
ppp	6.37.5	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. On the left is a sidebar menu with categories like IP, MPLS, Routing, System, Queues, Files, Log, Radius, Tools, and New Terminal. The 'IPv6' menu item is highlighted with a red box, and its sub-menu 'Addresses' is also highlighted. The main window displays the 'IPv6 Address List' configuration page. A table with the following columns is visible: Address, From Pool, Interface, and Advertise. A single entry is present in the table, highlighted with a red box: 'G' in the Address column, '2001:db8:3003:2::/64' in the From Pool column, 'ether1' in the Interface column, and 'yes' in the Advertise column. The status bar at the bottom indicates '1 item'.

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

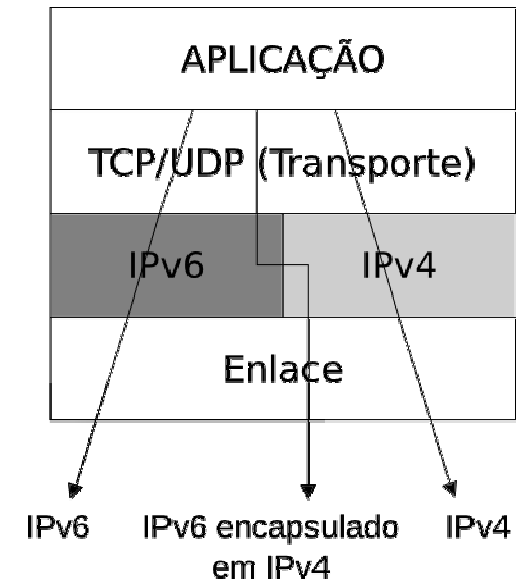
# O que é pilha dupla (Dual Stack)?





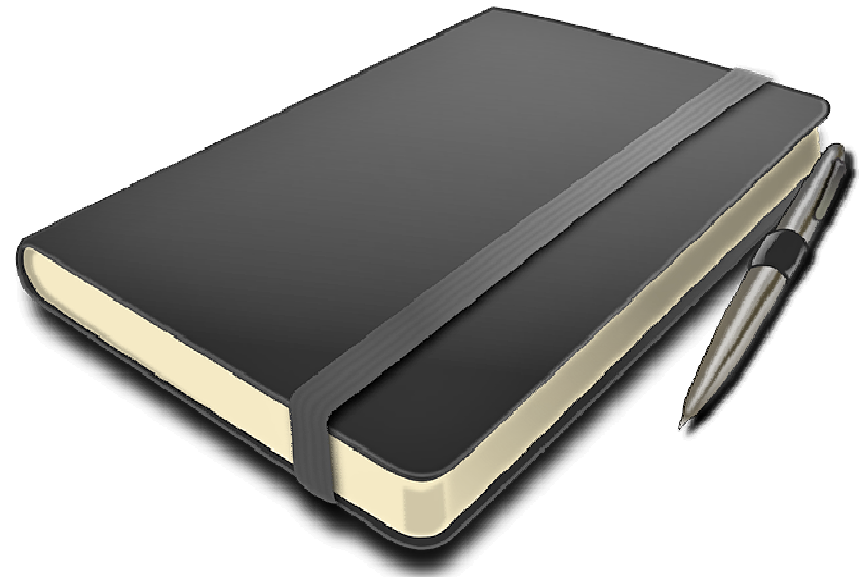
## Características da Pilha Dupla:

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

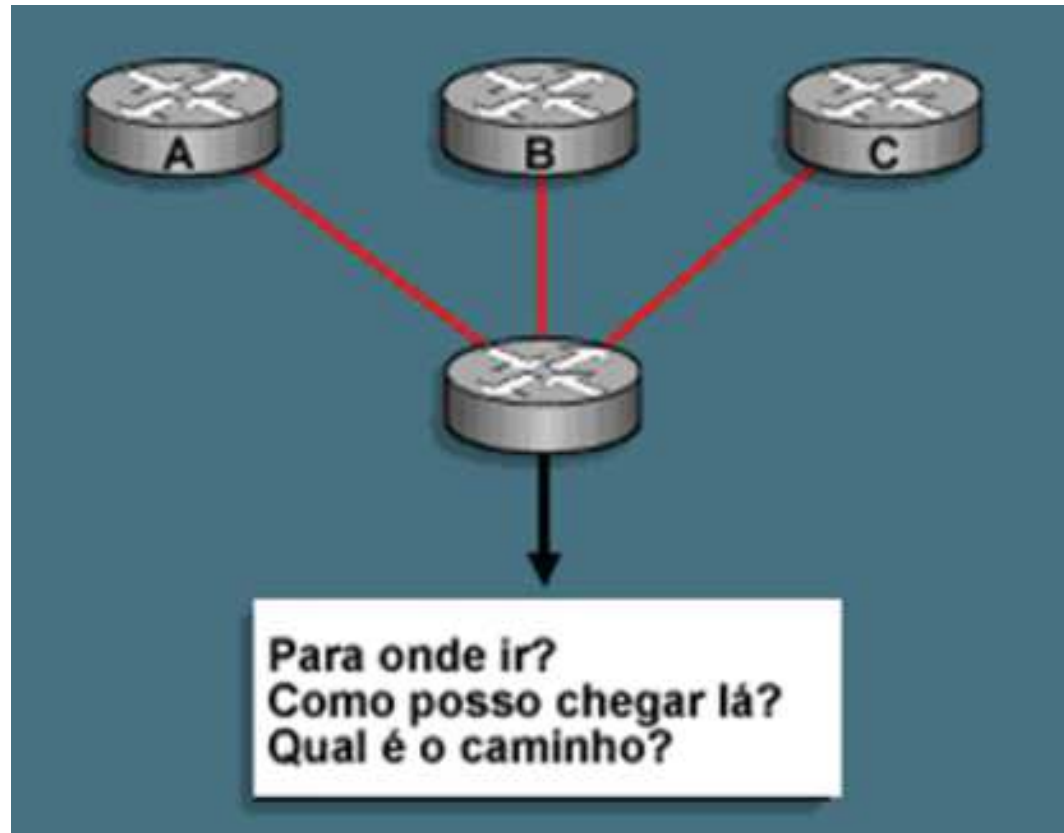


# Agenda

- ✓ 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**

- Addresses
- MPLS
- DHCP Client
- Routing
- DHCP Relay
- System
- DHCP Server
- Queues
- Firewall
- Files
- ND
- Log
- Neighbors
- Radius
- Pool
- Tools
- Routes**
- Settings
- New Terminal
- Make Supout.nf
- Manual
- New WinBox
- Exit

**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

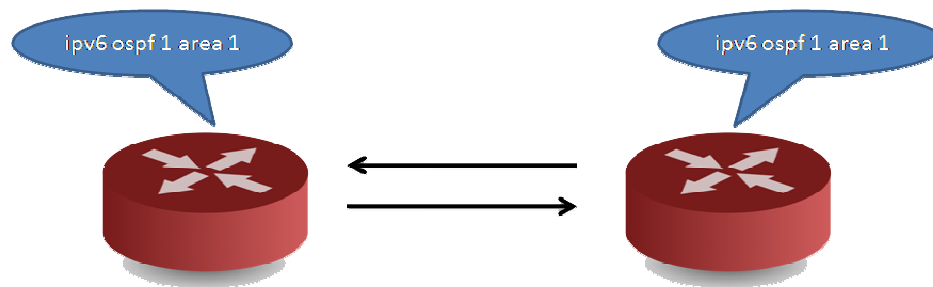
Received From:

enabled active static

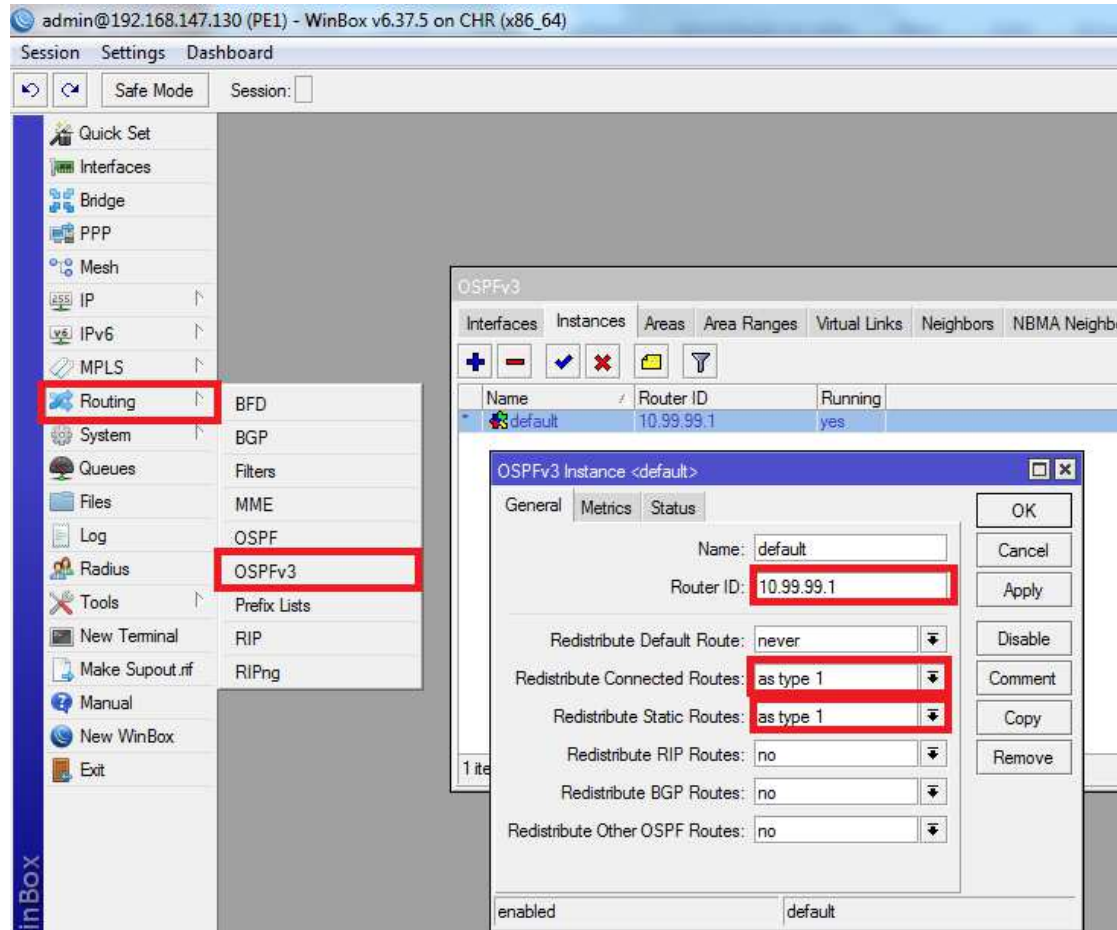
## OSPFv3

- 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 a menu with 'Routing' and 'BGP' highlighted in red. The main window displays the 'BGP' configuration page. A dialog box titled 'BGP Instance <default>' is open, showing the following configuration:

- Name: default
- AS: 65000
- Router ID: 10.99.99.1
- Redistribute Connected:
- Redistribute Static:
- Redistribute RIP:
- Redistribute OSPF:
- Redistribute Other BGP:
- Out Filter:
- Confederation:
- Confederation Peers:
- Cluster ID:
- Routing Table:
- 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

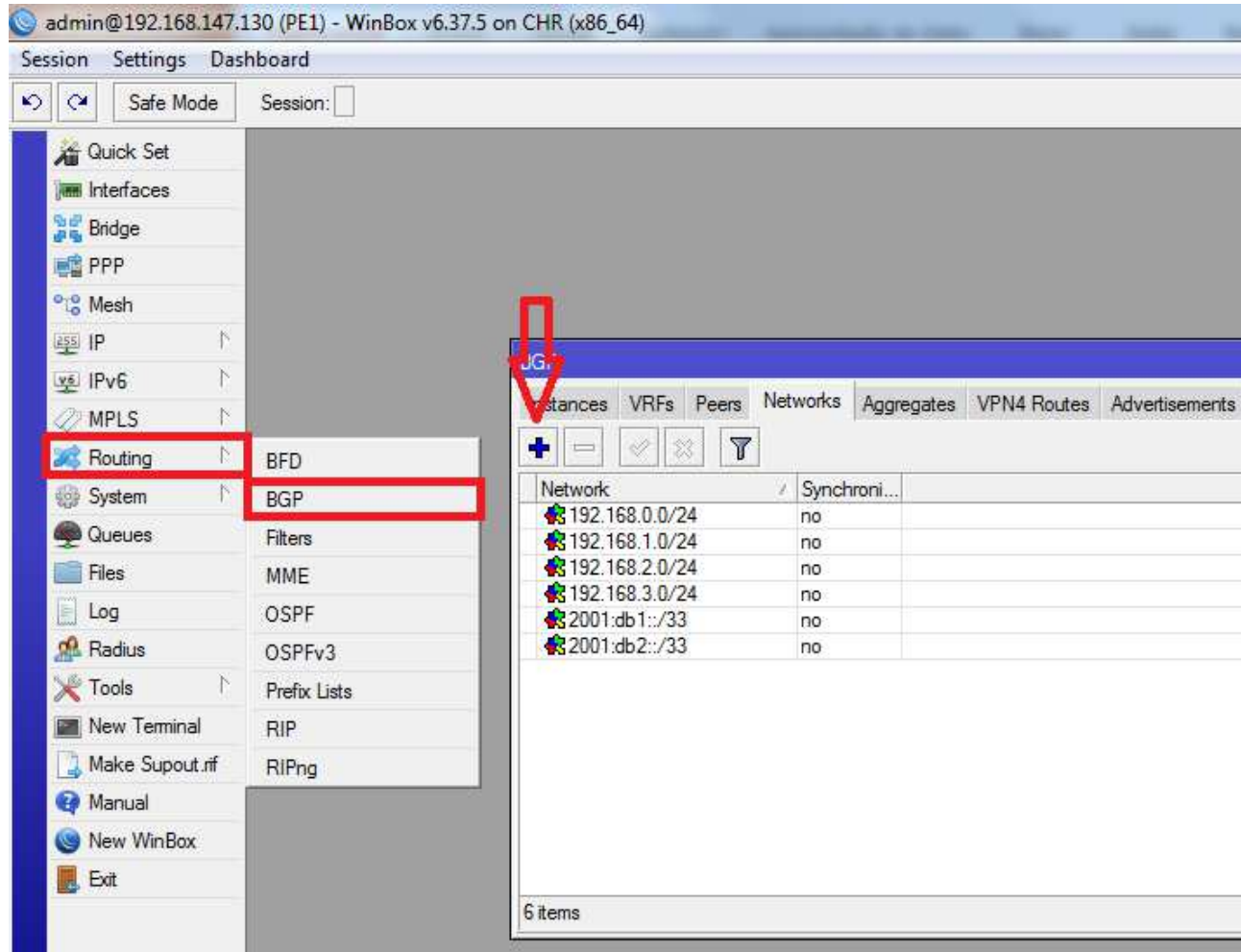
Instances VRFs Peers Networks Aggregates VPN4 Routes Advertisements

+ - ✓ ✗ 📁 🔍 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:



## **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:

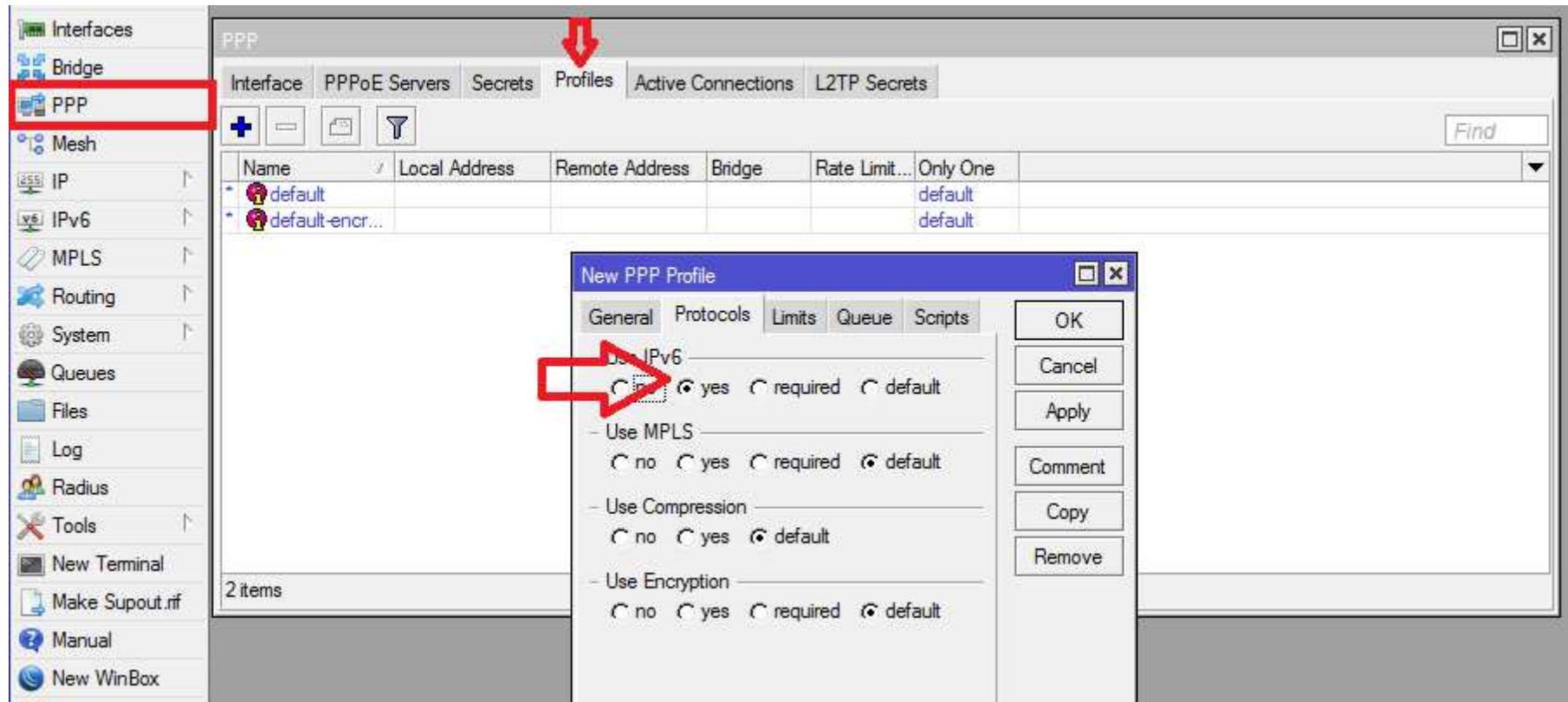
Name	Prefix	Prefix Length	Expire Time
poolPD	2001:db8:1::/48		56
pooltunnel	2001:db8::/48	64	

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

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

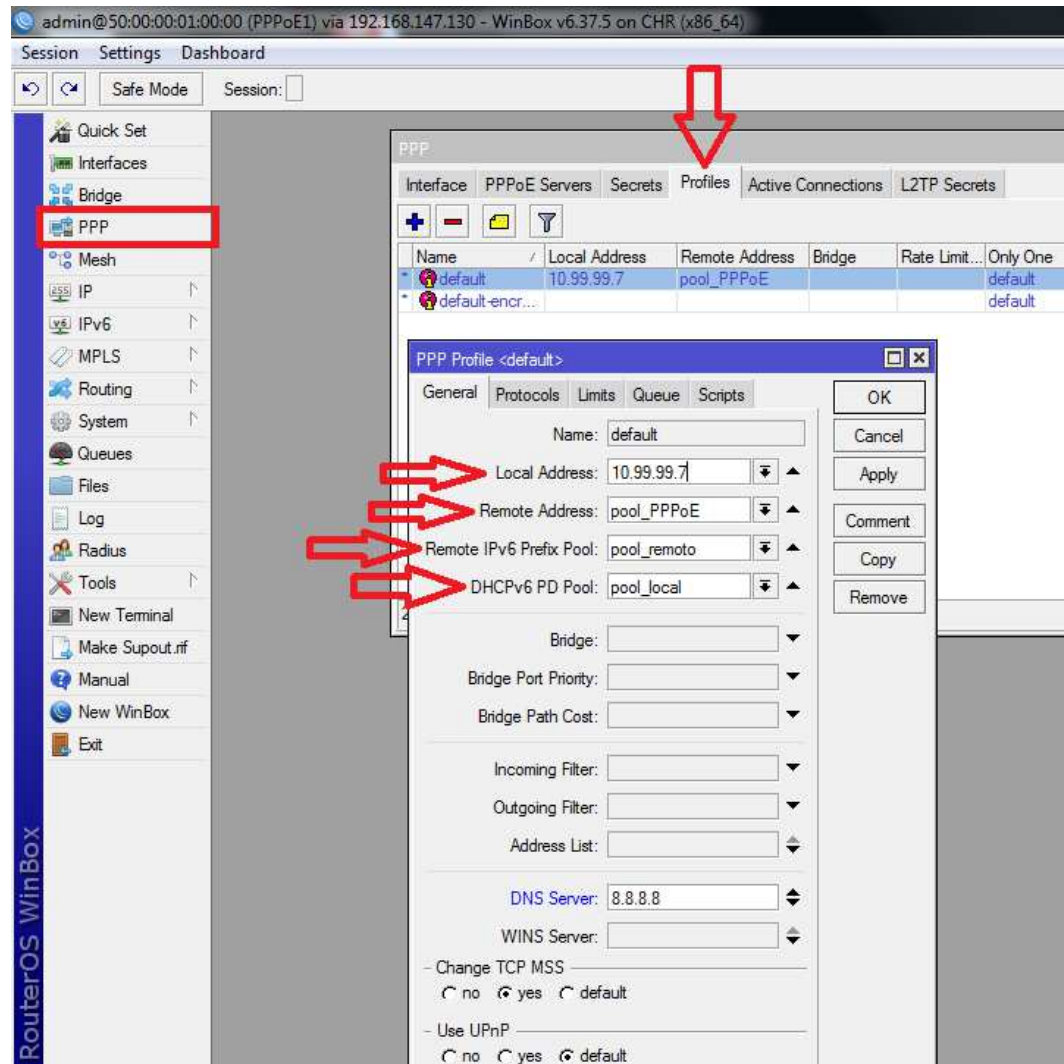
Buttons: OK, Cancel, Apply, Copy, Remove.

# 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  
Routing  
System  
Queues  
Files  
Log  
Radius  
Tools  
New Terminal  
Make Supout.tif  
Manual  
New WinBox  
Exit

RouterOS WinBox

PPP

Interface PPPoE Servers Secrets Profiles Active Connections L2TP Secrets

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: [ ]

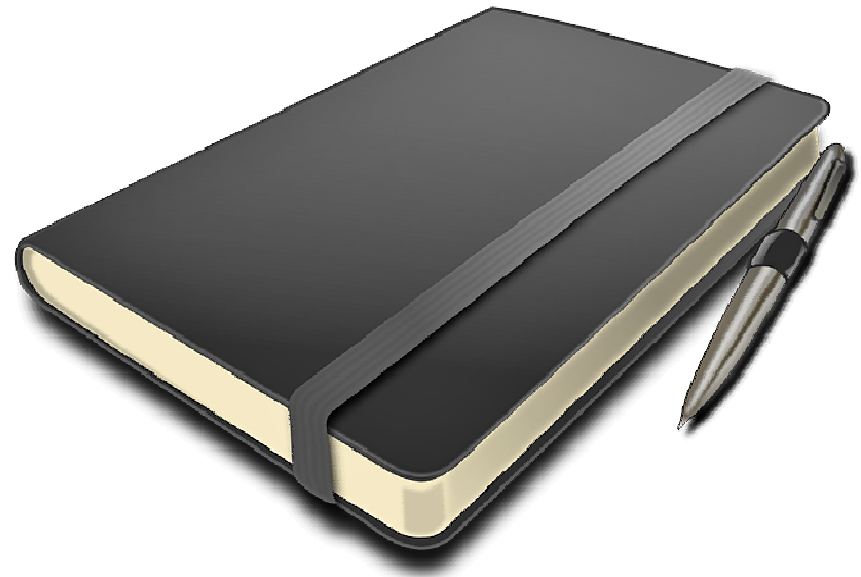
- Change TCP MSS  
 no  yes  default

- Use UPnP  
 no  yes  default

OK  
Cancel  
Apply  
Comment  
Copy  
Remove

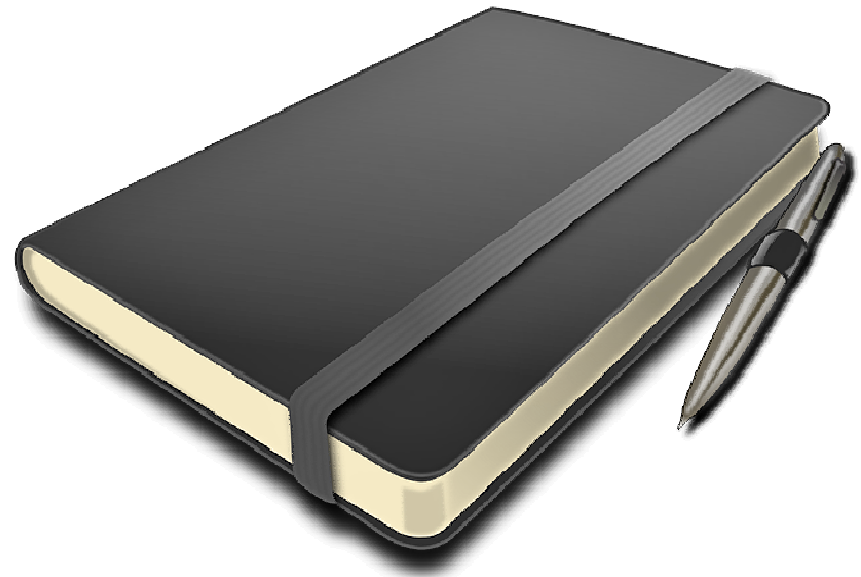
## Agenda

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# Perguntas ?



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**OBRIGADO !!!**



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