

Workshop IPv6 on MikroTik



Apjii – Postel

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Introduction

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Overview IPv6

Apa itu IPv6 ?

- ✓ Disebut juga IPng (IP Next Generation)
- ✓ Panjang bit 128 bit
- ✓ Banyak IP yang tersedia $2^{128} = 3.4 \times 10^{38}$
- ✓ Pengganti IPv4 dengan permasalahan dasar “alokasi IPv4 yang mulai habis”
- ✓ Direkomendasikan IETF dengan RFC 1752

Pengalamatan IPv6

- Panjang 128 bit dituliskan dalam bentuk hexadesimal yang masing-masing terdiri dari 16 bit yang dipisah dengan tanda titik dua “ : ”, contoh ⇒
3FFE:501:4819:2000:210:F3FF:F303:4D0
- Contoh penulisan yang lain
3FFE:0:0:0:201:F3FF:F303:4D0 dapat ditulis
3FFE::201:F3FF:F303:4D0
0:0:0:0:0:0:0:1 menjadi ::1

Alamat IPv6 –Unicast Address

- Link-Local Address (fe80::/10)
 - Used to communicate between other ipv6 interfaces in the same network link.
 - hanya valid pada single link.
 - Auto assigned
 - Tidak dirouting di Internet.
- Global Address
 - Dapat dirouting ke Internet








IPv6 Addressing –Global Unicast Address

- Global Routing Prefix (48 bit)
 - Alamat site , contoh. 2404:1b8
 - Didesain oleh struktur hirarki dari RIRs and ISPs
- Subnet ID (16 bit)
 - Nomor identifikasi subnet dalam site
 - Digunakan admin untuk membuat struktur internal jaringan sesuai kebutuhan.
- Interface ID (64 bit)
 - Identitas unik dari interface tertentu (host)

Perbandingan Header IPv4 dan IPv6

Version 4 bits	IHL 4 bits	Type of Service 8 bits	Total Length 16 bits	
Identification 16 bits		Flags 4 bits	Fragment Offset 12 bits	
TTL 8 bits	Protocol Header 8 bits	Header Checksum 16 bits		
Source Address 32 bits				
Destination Address 32 bits				
IP options 0 or more IPv4 Header bits				

Legend :

	= Eliminated in IPV6
 → 	=Enhanced in IPv6
 → 	=Enhanced in IPv6
 → 	=Enhanced in IPv6

Version 4 bits	Traffic Class 8 bits	Flow Label 20 bits	
Payload Length 16 bits		Next Header 8 bits	Hop Limits 8 bits
Source Address 128 bits			
Destination Address 128 bits			

IPv6 Autoconfiguration

- Menggunakan Link-Local untuk berkomunikasi dengan perangkat lain dalam link yang sama.
- Support Plug and Play
- tidak ada manual configuration pada client side
- Minimal router configuration
- Stateless – tidak membutuhkan DHCP server
- Statefull – membutuhkan DHCP Server (berjalan pada DHCPv6)

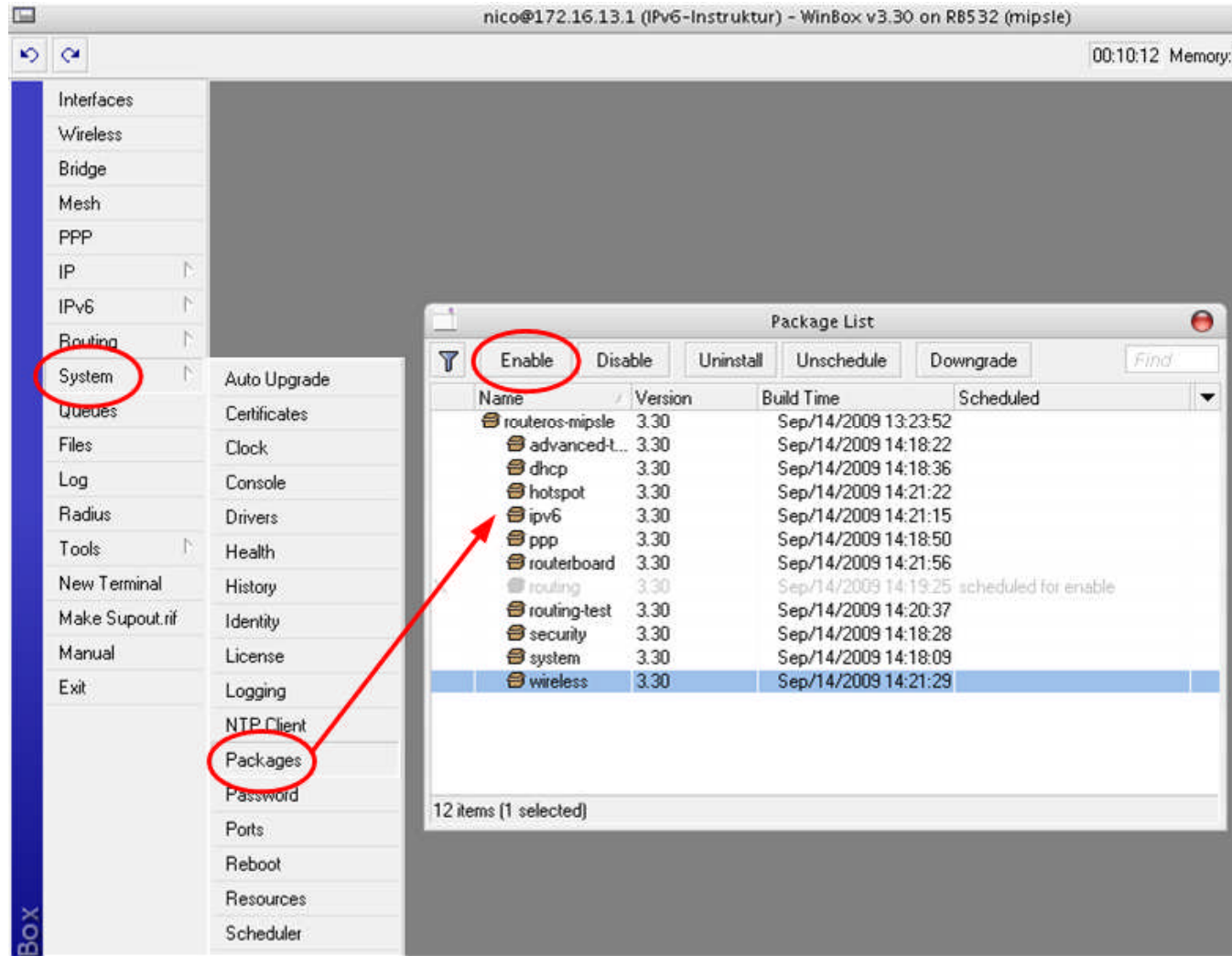
Fitur IPv6 dalam RouterOS

- MikroTik IPv6 mendukung (RouterOS v3.x / 4.x):
 - static addressing and routing;
 - router advertisement daemon (for address autoconfiguration)
 - dynamic routing: BGP+, OSPFv3, and RIPng protocols
 - DNS name servers;
 - 6in4 (SIT) tunnels;
 - telnet , ping and traceroute;
 - web proxy;
 - sniffer and fetch tools;

Fitur IPv6 dalam RouterOS

- Fitur yang tidak didukung RouterOS sbb:
 - DHCPv6;
 - all PPP (Point-to-point protocols);
 - IPSEC;
 - SSH, FTP, API, Winbox access;
 - queues;
 - automatic tunnel creation;
 - policy routing;
 - multicast routing;
 - MPLS;
 - torch, netwatch, bandwidth test dan tools lainnya;

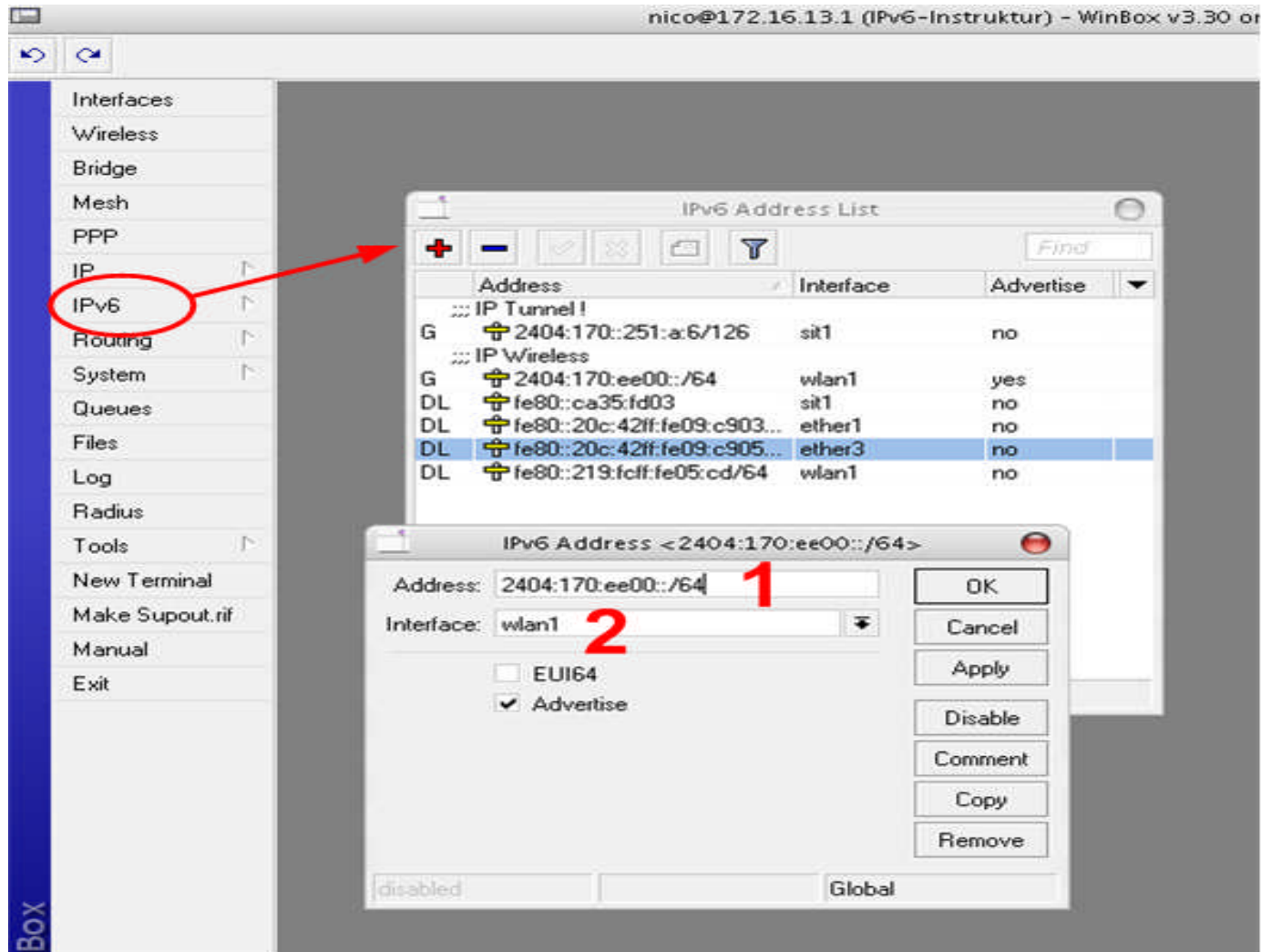
Setup IPv6 di RouterOS



Workshop !

- Aktifkan fitur IPv6 di router masing-masing.
- Reboot router anda.
- Pastikan fitur IPv6 apakah sudah aktif.

Static Addressing



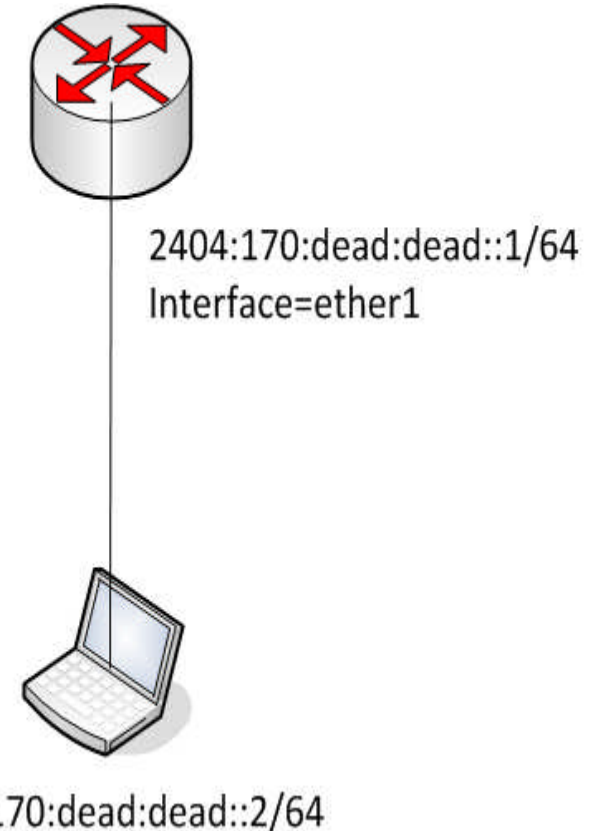
Static Address by Console

- **ipv6 address add** address= 2404:170:dead:dead::1/64
interface=wlan1 advertise=yes
- [nico@IPv6-Instruktur] > ipv6 address print
Flags: X - disabled, I - invalid, D - dynamic, G - global, L - link-local

#	ADDRESS	INTERFACE	ADVERTISE
0	G ;;; IP Tunnel ! 2404:170::251:a:6/126	sit1	no
1	G ;;; IP Wireless 2404:170:dead:dead::1/64	wlan1	yes
2	DL fe80::ca35:fd03/128	sit1	no
3	DL fe80::20c:42ff:fe09:c903/64	ether1	no
4	DL fe80::219:fcff:fe05:cd/64	wlan1	no

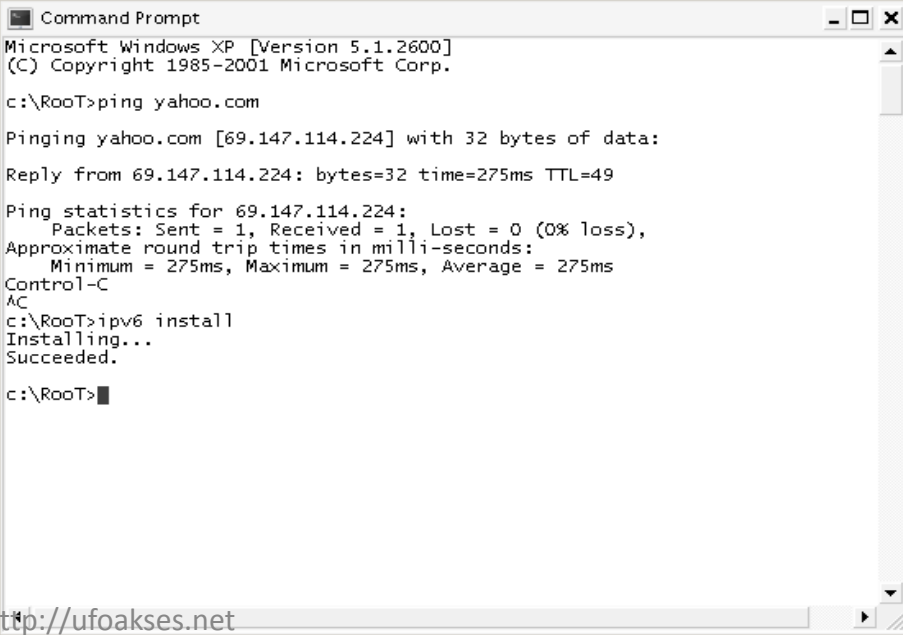
Workshop !

- Tambahkan static ip address IPv6 2404:170:dead:dead::1/64 pada router.
- Tambahkan static ip address IPv6 2404:170:dead:dead::2/64 pada Laptop.
- Cek ping dari laptop dan router !



Static address di XP

- Install IPv6 di CMD
- Dapat menggunakan netsh tool untuk membuat statik address di XP.
 - netsh
 - Interface ipv6 add address “Local address network” 2404:170:dead:dead::2
 - exit



```
Command Prompt
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

c:\Root>ping yahoo.com

Pinging yahoo.com [69.147.114.224] with 32 bytes of data:

Reply from 69.147.114.224: bytes=32 time=275ms TTL=49

Ping statistics for 69.147.114.224:
    Packets: Sent = 1, Received = 1, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 275ms, Maximum = 275ms, Average = 275ms
Control-C
AC
c:\Root>ipv6 install
Installing...
Succeeded.

c:\Root>
```


Network Discovery Protocol (nd)

- Menggantikan fungsi ARP di IPv4.
- Bertanggungjawab pada penemuan node lain dalam link.
- Menentukan alamat link layer node lain.
- Menemukan router lain.
- Mempertahankan reachability informasi tentang jalur aktif lainnya pada node tetangga.
- Digunakan dalam alamat autoconfiguration.

ND Protocol di RouterOS

The screenshot shows the WinBox interface for configuring IPv6 Neighbor Discovery (ND) on the wlan1 interface. The 'Neighbor Discovery' window is open, displaying a table of ND entries and a configuration dialog for the selected entry.

Neighbor Discovery Table:

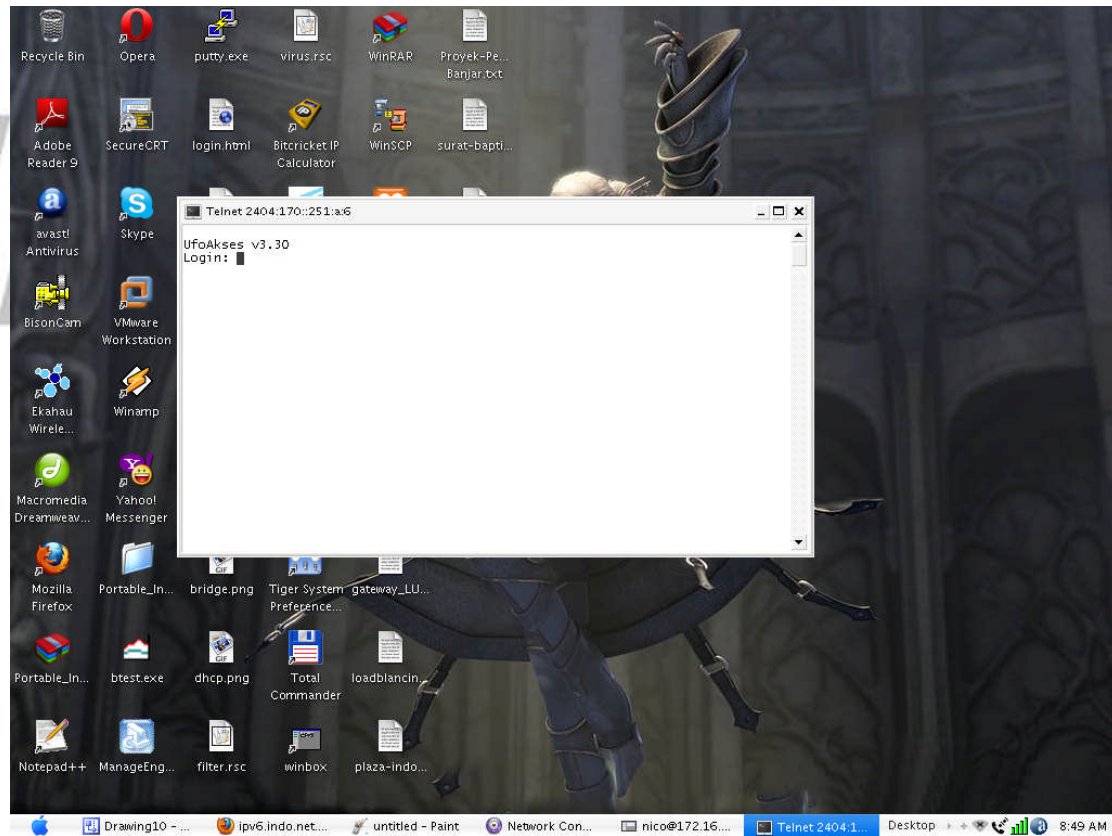
Interface	RA Interv...	RA Dela...	MTU	Reachabl...	Retransmi...	RA Lifeti...	Hop Limit	Advertise MAC A...	Advertise DNS
wlan1	200-600	3				1800		yes	yes

ND <wlan1> Configuration Dialog:

- Interface: wlan1
- RA Interval: 200-600 s
- RA Delay: 3 s
- MTU: [Dropdown]
- Reachable Time: [Dropdown] s
- Retransmit Interval: [Dropdown] s
- RA Lifetime: 1800 s
- Hop Limit: [Dropdown]
- Advertise MAC Address
- Advertise DNS
- Managed Address Configuration
- Other Configuration

Remote akses RouterOS

- Hanya berlaku dengan metode telnet
- Contoh :
 - telnet 2404:170::251:a:6/

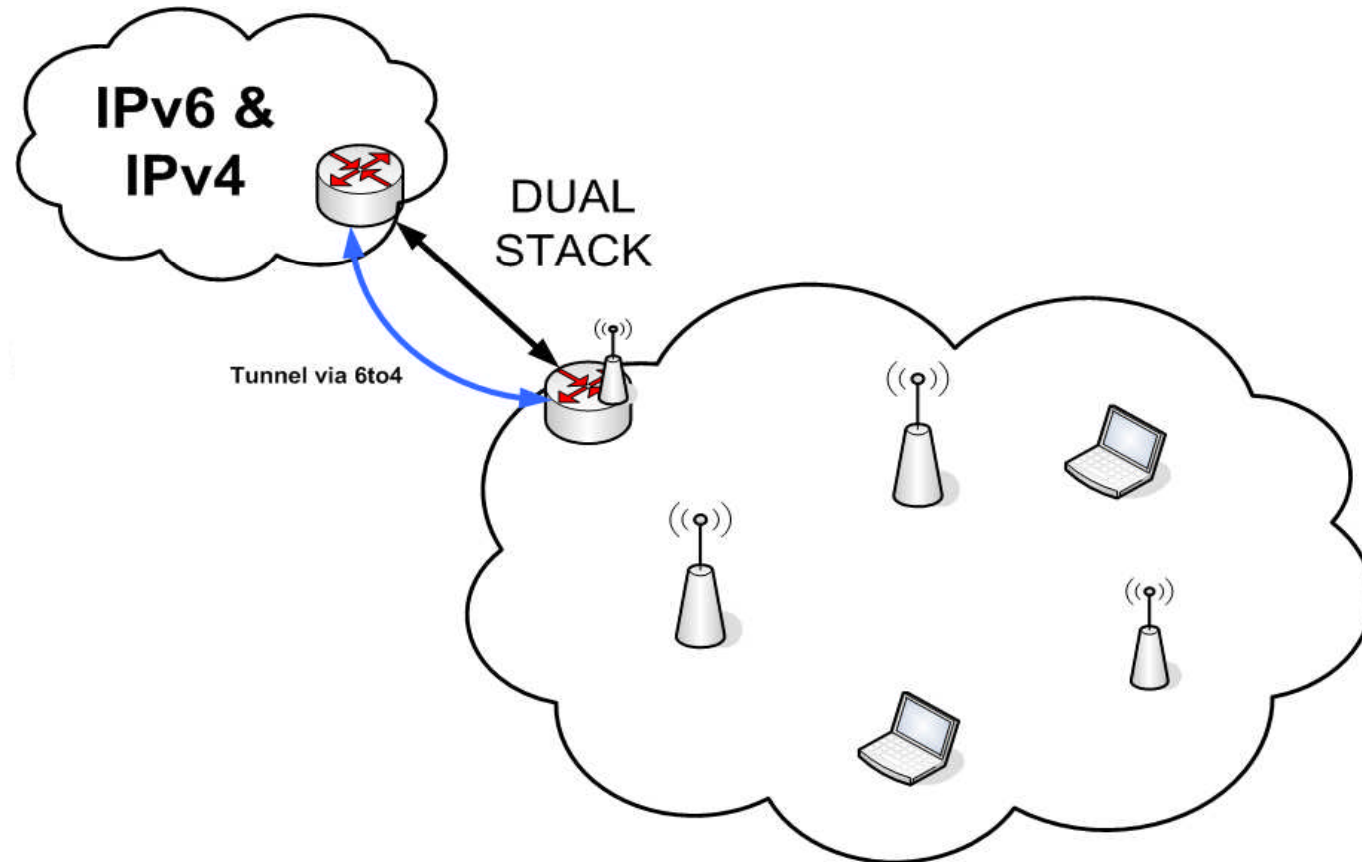


Workshop !

- Pinglah router anda dengan IPv6 yang telah dibuat.
- Gunakan telnet untuk remote akses ke dalam router.
- Explore router dengan metode CLI

Metode Transisi IPv6

- Dual Stack



Create Tunnel Interface 6to4

The screenshot shows the Mikrotik WinBox interface. The main window displays the 'Interface List' with the following data:

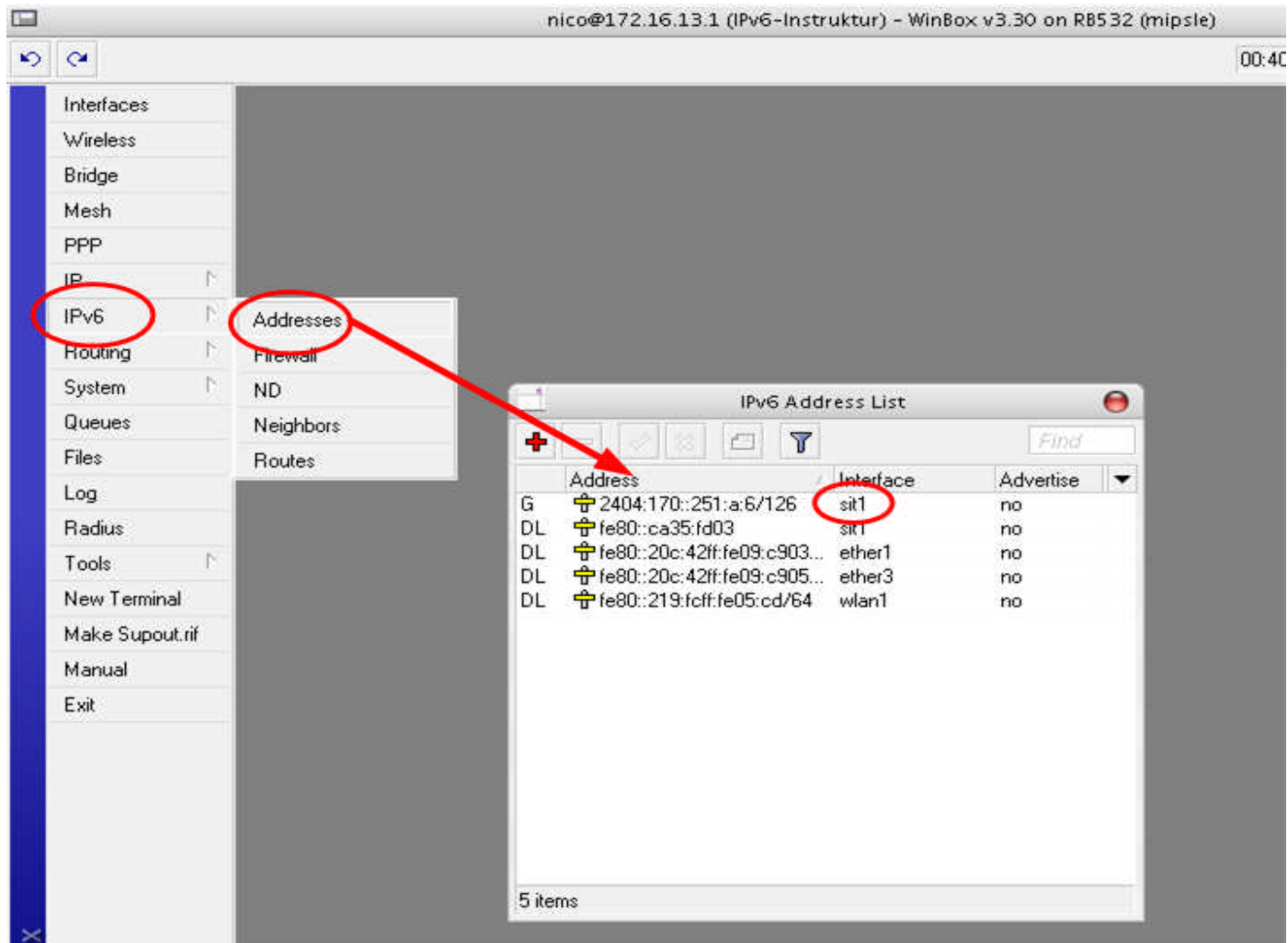
Interface	Name	Type	L2 MTU	Tx	Rx	Tx Pac...	Rx Pac...	Tx Drops
X	bridge1	Bridge	65535	0 bps	0 bps	0	0	0
R	ether1	Ethernet	1600	0 bps	2.8 kbps	0	3	0
R	ether2	Ethernet	1600	0 bps	0 bps	0	0	0
R	ether3	Ethernet	1600	28.3 kbps	7.0 kbps	6	9	0
R	sit1	6to4		0 bps	0 bps	0	0	0
	wlan1	Wireless (Atheros AR5...	2304	0 bps	0 bps	0	0	0

The 'Interface < sit1 >' configuration dialog is open, showing the following settings:

- Name: sit1
- Type: 6to4
- MTU: 1480
- L2 MTU: (empty)
- Local Address: 202.53.253.3
- Remote Address: 202.53.251.195

The dialog also includes buttons for OK, Cancel, Apply, Disable, Comment, Copy, Remove, and Torch.

Tambahkan IPv6 Address



The screenshot shows the MikroTik WinBox interface. The left sidebar contains a menu with 'IPv6' highlighted. A sub-menu is open, showing 'Addresses' highlighted. A red arrow points from the 'Addresses' sub-menu to the 'IPv6 Address List' window. The window displays a table of IPv6 addresses and their interfaces.

	Address	Interface	Advertise
G	2404:170::251:a/126	sit1	no
DL	fe80::ca35:fd03	sit1	no
DL	fe80::20c:42ff:fe09:c903...	ether1	no
DL	fe80::20c:42ff:fe09:c905...	ether3	no
DL	fe80::219:fcff:fe05:cd/64	wlan1	no

5 items

Gateway IPv6

The screenshot shows the Mikrotik WinBox interface. The left sidebar has 'IPv6' and 'Routes' highlighted with red circles. Red arrows point from these circles to the 'IPv6 Route List' and 'Route <::/0>' windows respectively.

The 'IPv6 Route List' window displays the following table:

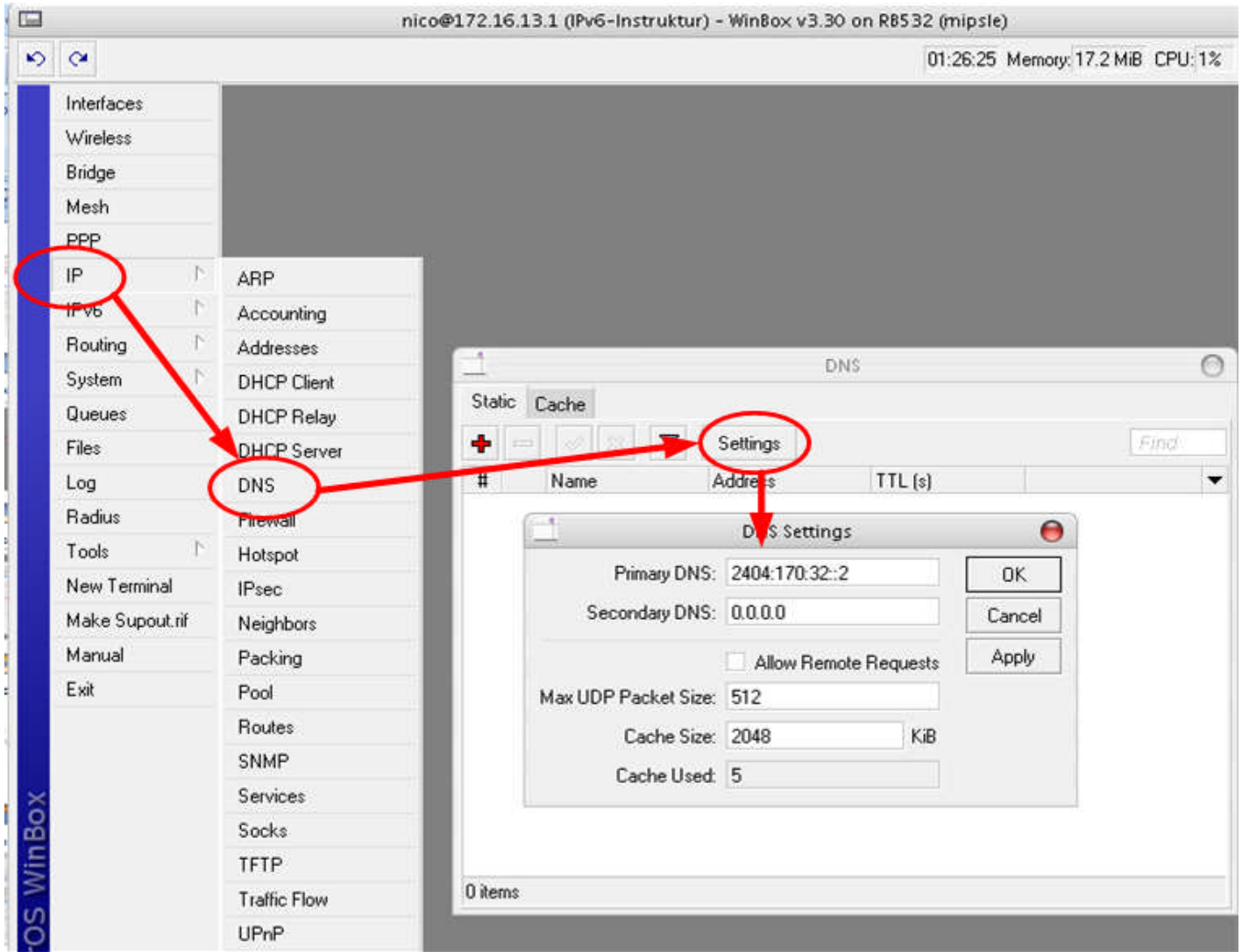
	Destination	Gateway	Interface	Distance
DAC	2404:170:dead:dead::/64		wlan1	0
DAC	2404:170::251:a:4/126		sit1	0
AS!	::/0	2404:170::251:a:5	sit1	1

The 'Route <::/0>' window shows the configuration for the selected route:

- Destination: `::/0`
- Gateway: `2404:170::251:a:5`
- Interface: `sit1`
- Type: `unicast`
- Distance: `1`
- Scope: `30`
- Target Scope: `10`

At the bottom of the configuration window, the status is shown as `disabled`, `active`, `static`, and `unicast`.

DNS IPv6



Contoh Dual Stack !

The screenshot displays the Mikrotik WinBox interface with three overlapping windows:

- IPv6 Address List:** Shows the configuration of IPv6 addresses on interfaces.

	Address	Interface	Advertise
G	2404:1b8:300:0:abcd/64	ether2	no
DL	fe80::20c:42ff:fe18f304/...	wlan1	no
DL	fe80::20c:42ff:fe1e:b7c8...	ether2	no
- Address List:** Shows the configuration of IPv4 addresses.

	Address	Network	Broadcast	Interface
::: hotspot network:				
	195.165.50.1/24	195.165.50.0	195.165.50.255	wlan1
	202.148.1.62/27	202.148.1.32	202.148.1.63	ether2
- Terminal:** Shows the execution of ping commands to verify connectivity.


```
[admin@D-NET:~] > ping 2001:dc0:2001:b:4608::115
2001:dc0:2001:b:4608::115 64 byte ping: ttl=52 time=426 ms
2001:dc0:2001:b:4608::115 64 byte ping: ttl=52 time=423 ms
2001:dc0:2001:b:4608::115 64 byte ping: ttl=52 time=427 ms
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max = 423/425.3/427 ms

[admin@D-NET:~] > ping 216.239.61.104
216.239.61.104 64 byte ping: ttl=243 time=24 ms
216.239.61.104 64 byte ping: ttl=243 time=18 ms
216.239.61.104 64 byte ping: ttl=243 time=22 ms
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max = 18/21.3/24 ms

[admin@D-NET:~] >
```

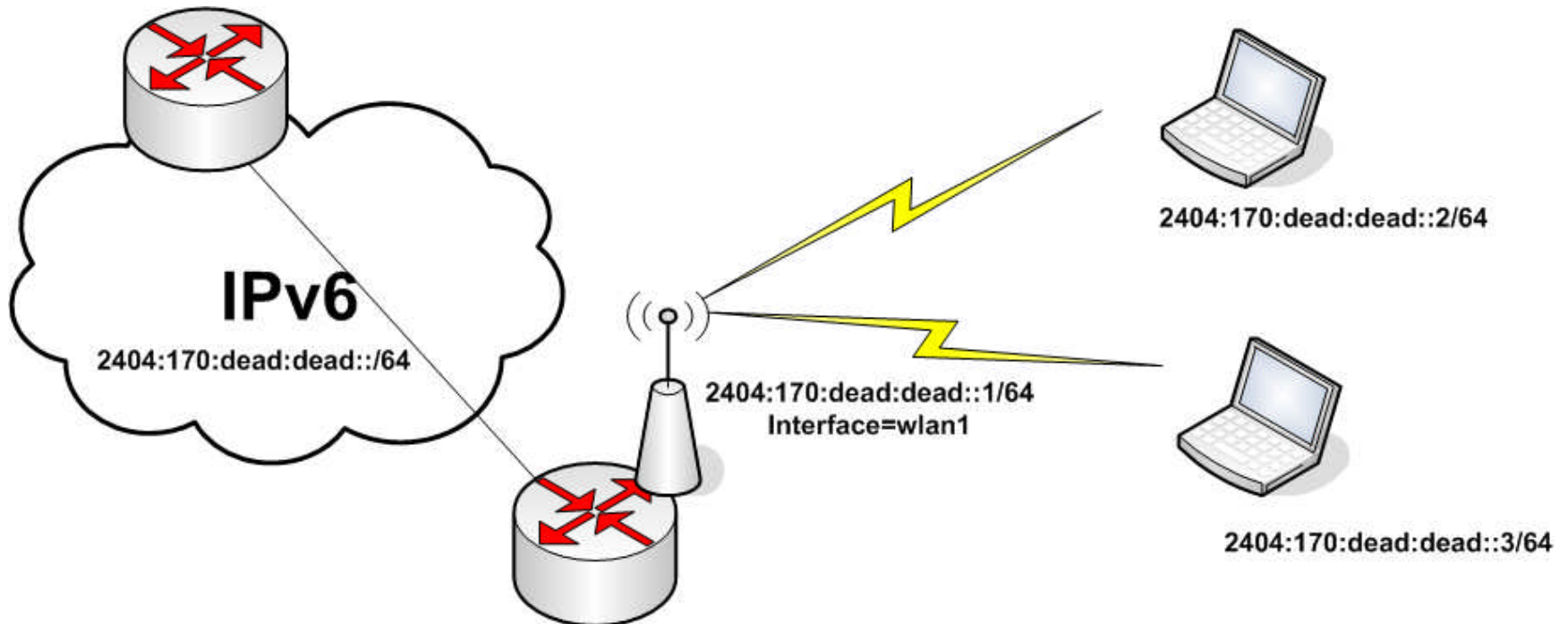
Akses Browser !

The screenshot illustrates the process of accessing a website via IPv6. It shows three overlapping windows:

- Mozilla Firefox:** The address bar contains the URL `http://[2404:170:253::26]/`, which is circled in red. The browser tabs show two instances of ".Ervin Web Site."
- Wireless Network Connection Status:** The 'General' tab shows the connection status as 'Connected' (circled in red) for the network 'postel-ipv6'. It also displays a signal strength indicator and packet statistics (Sent: 1,396, Received: 62).
- Command Prompt:** This window displays the network configuration for the 'Wireless Network Connection'. The IP address is `2404:170:dead:dead:b7:6762:b050:6bad` (circled in red). Other details include the physical address `00-0C-42-0C-CA-09`, the default gateway `172.16.255.1`, and DNS servers `172.16.255.1` and `202.159.32.2`.

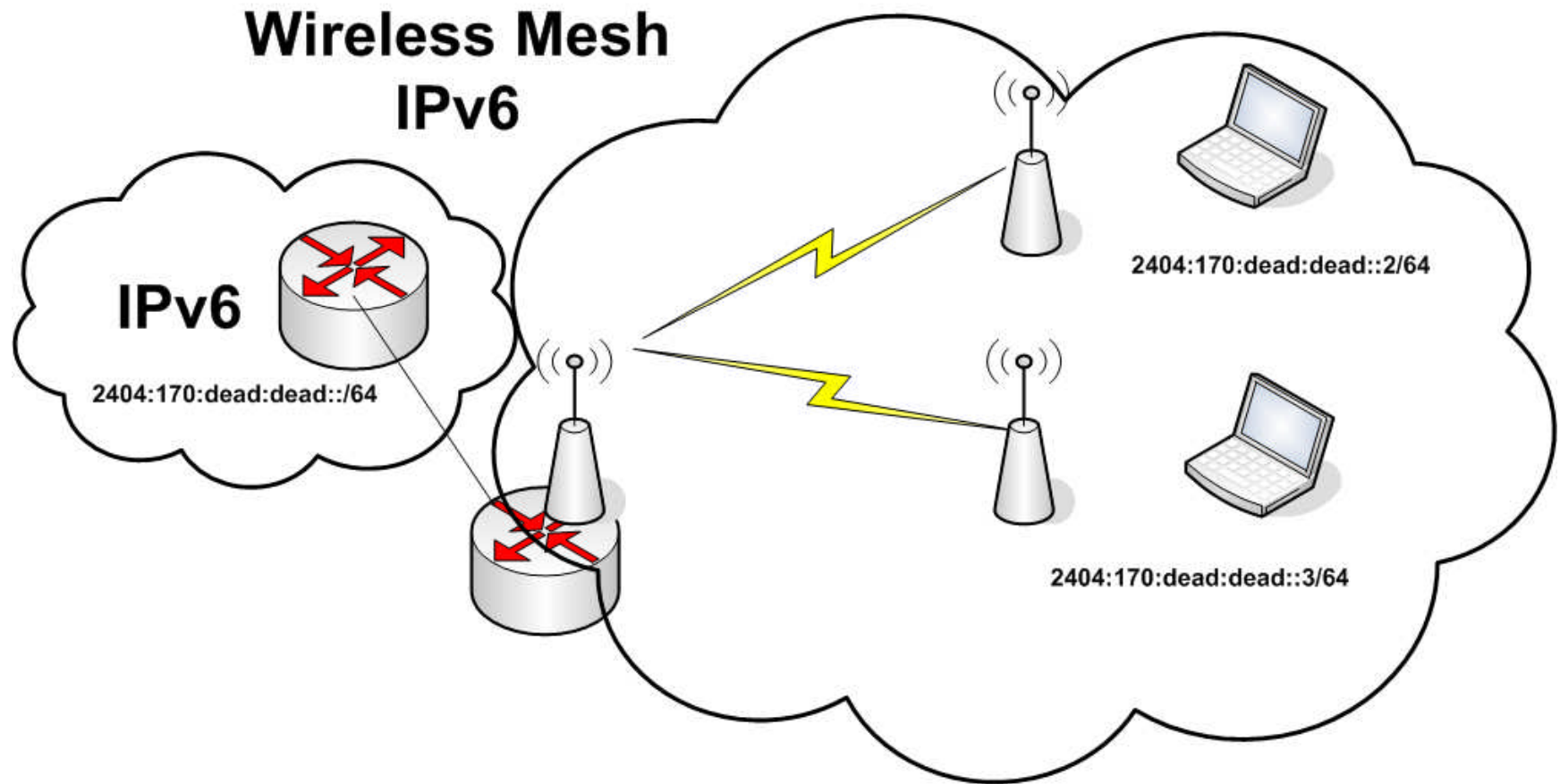
At the bottom of the browser window, the text "You are accessing this site u" is partially visible, and the status bar shows "Done".

Native Network !



- Jaringan Yang terhubung langsung dengan backbone IPv6

Study case !



Solution !

- Native network
- Stateless configuration
- Create Wlan & WDS
- Create Bridge
- Enable RSTP
- Menggunakan IPv6 Addressing



Thank You !