Module III
IPv6 Configuration

- **Module 3.1: Enabling IPv6 on Cisco Routers**

- **Module 3.2: Cisco IOS IPv6 Configuration Examples**

- **Module 3.3 Cisco IOS IPv6 RIPng Configuration Examples**

Module 3.1:
Enabling IPv6 on Cisco Routers

Enabling IPv6 on Cisco Routers
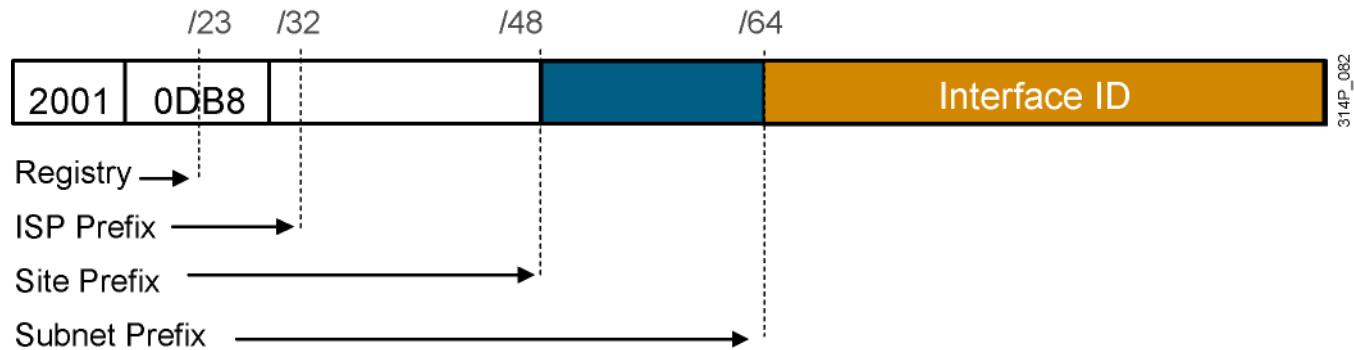
To enable IPv6 on Cisco IOS:

1. **Enable IPv6 traffic forwarding**

2. **Enable IPv6 on the interfaces by configuring an IPv6 address**

```
router(config)#
```

```
ipv6 unicast-routing
```

- **Enables IPv6 traffic forwarding**

IPv6 位址配置方式

Static assignment

    Manual interface ID assignment

    EUI-64 interface ID assignment

Dynamic assignment

    Stateless autoconfiguration

    DHCPv6 (stateful)

IPv6 Address Configuration

The "ipv6 address" command:

- **Enables IPv6 on the interface**
- **Configures the interface link-local, site-local, and global IPv6 addresses**

```
router(config-if)#
```

```
ipv6 address <ipv6addr>[/<prefix-length>] [link-local]
```
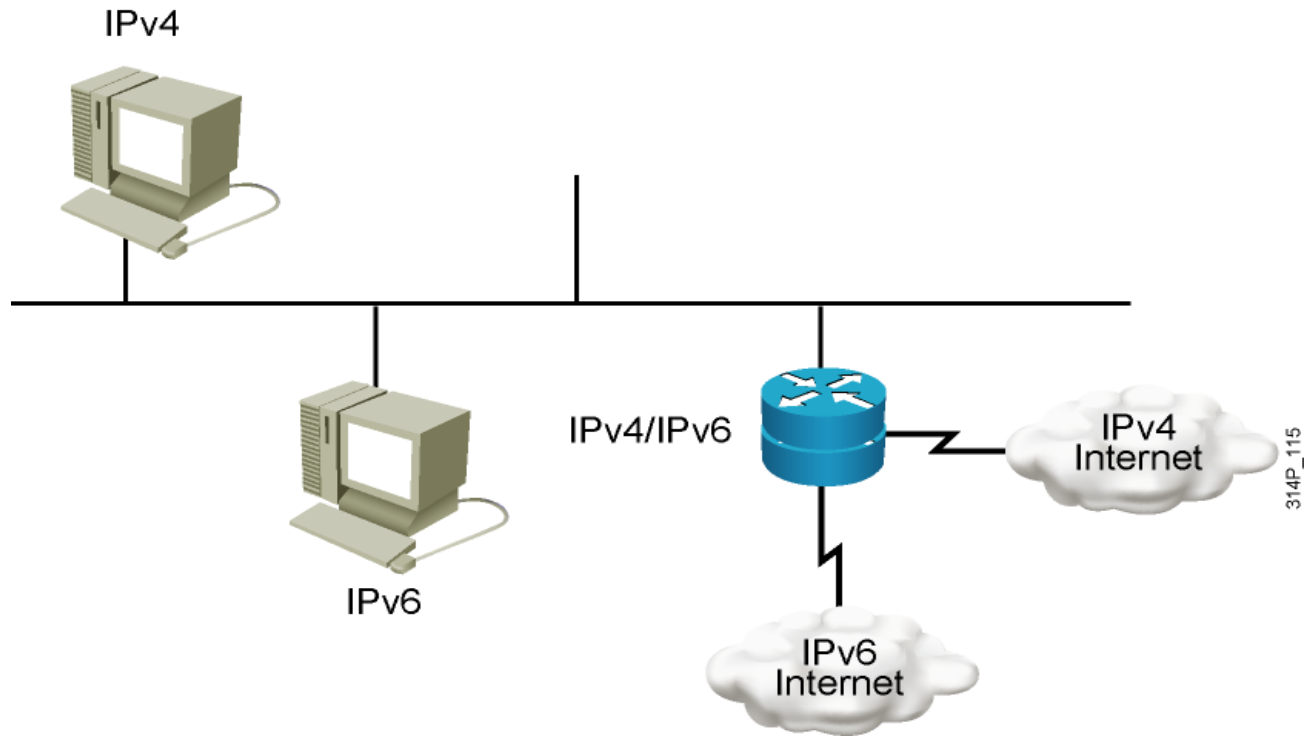
```
ipv6 address <ipv6prefix>/<prefix-length> eui-64
```
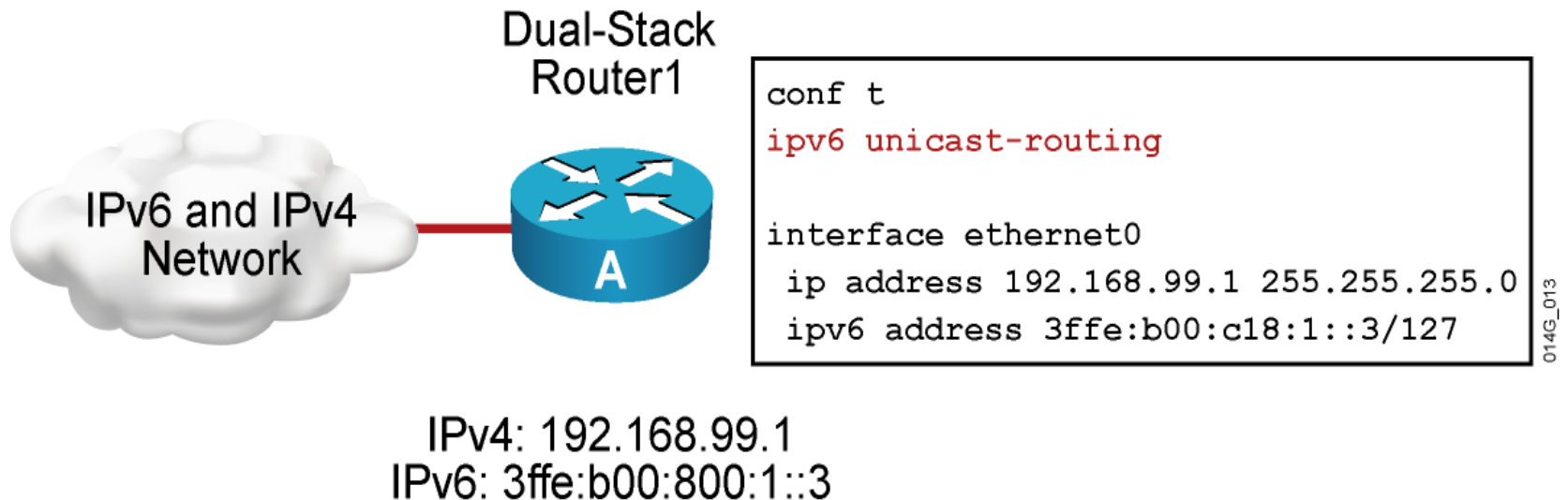
```
ipv6 unnumbered <interface>
```

```
ipv6 enable
```

Cisco IOS Dual Stack

Dual stack is an integration method in which a node has implementation and connectivity to both an IPv4 and IPv6 network.

Cisco IOS Dual Stack 設定範例

Dual-Stack
Router1

IPv6 and IPv4
Network

```
conf t
ipv6 unicast-routing

interface ethernet0
 ip address 192.168.99.1 255.255.255.0
 ipv6 address 3ffe:b00:c18:1::3/127
```

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IPv4: 192.168.99.1
IPv6: 3ffe:b00:800:1::3

When both IPv4 and IPv6 are configured on an interface, the interface is considered dual-stacked.

IPv6 Address 設定範例

LAN: 2001:db8:c18:1::/64

Ethernet 0

```
ipv6 unicast-routing
interface Ethernet0
 ipv6 address 2001:db8:c18:1::/64 eui-64
```

MAC address: 0260.3e47.1530

```
RouterX# show ipv6 interface Ethernet0
Ethernet0 is up, line protocol is up
   IPv6 is enabled, link-local address is FE80::260:3EFF:FE47:1530
Global unicast address(es):
    2001:DB8:C18:1:260:3EFF:FE47:1530, subnet is 2001:DB8:C18:1::/64
   Joined group address(es):
    FF02::1:FF47:1530
    FF02::1
    FF02::2
   MTU is 1500 bytes
```
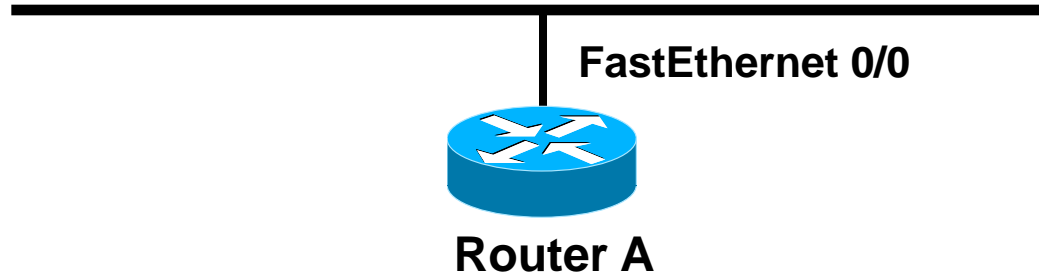
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Module 3.2:
Cisco IOS IPv6 Configuration Examples

Cisco IOS Configuration Example 1

Prefix #1: 2001:410:0;1::/64
Prefix #2: FEC0:0:0:1::/64

FastEthernet 0/0

Router A

```
RouterA# show interface fastEthernet 0/0

FastEthernet0/0 is up, line protocol is up
  Hardware is AmdFE, address is 0050.3ee4.4c00 (bia 0050.3ee4.4c00)
  MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec
```

```
RouterA#config terminal
RouterA(config)#ipv6 unicast-routing
RouterA(config)#int fastethernet 0/0
RouterA(config-if)#ipv6 address 2001:410:0:1::/64 eui-64
RouterA(config-if)#ipv6 address FEC0::1:0:0:1:1/64
```
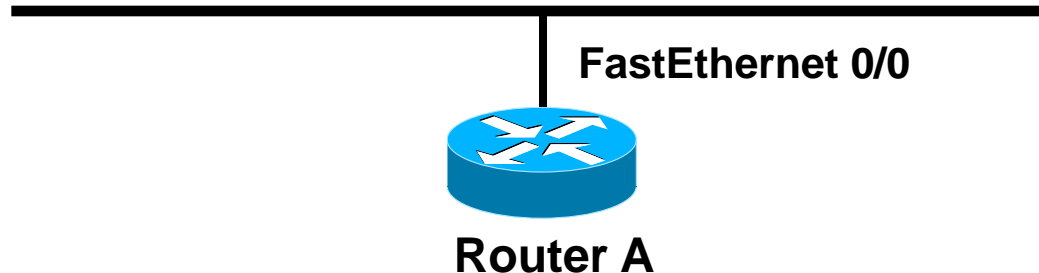
Cisco IOS Configuration Example 1 (Cont.)

Prefix #1: 2001:410:0;1::/64
Prefix #2: FEC0:0:0:1::/64

FastEthernet 0/0

Router A

```
RouterA# show ipv6 interface fastEthernet 0/0

FastEthernet0/0 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::250:3EFF:FEE4:4C00
  Global Unicast addres(es):
    2001:410:0:1:250:3EFF:FEE4:4C00, subnet is 2001:410:0:1::/64
    FEC0::1:0:0:1:1, subnet is FEC0:0:0:1::/64
  Joined group address(es):
    FF02::1
    FF02::2
    FF02::1:FF01:1
    FF02::1:FFE4:4C00
  MTU is 1500 bytes
```

Cisco IOS Configuration Example 2

IPv6 Internet

Router2

fe80::260:3eff:fe47:1530

LAN1: 3ffe:b00:c18:1::/64

Ethernet0

Router1

Ethernet1

LAN2: 3ffe:b00:c18:2::/64
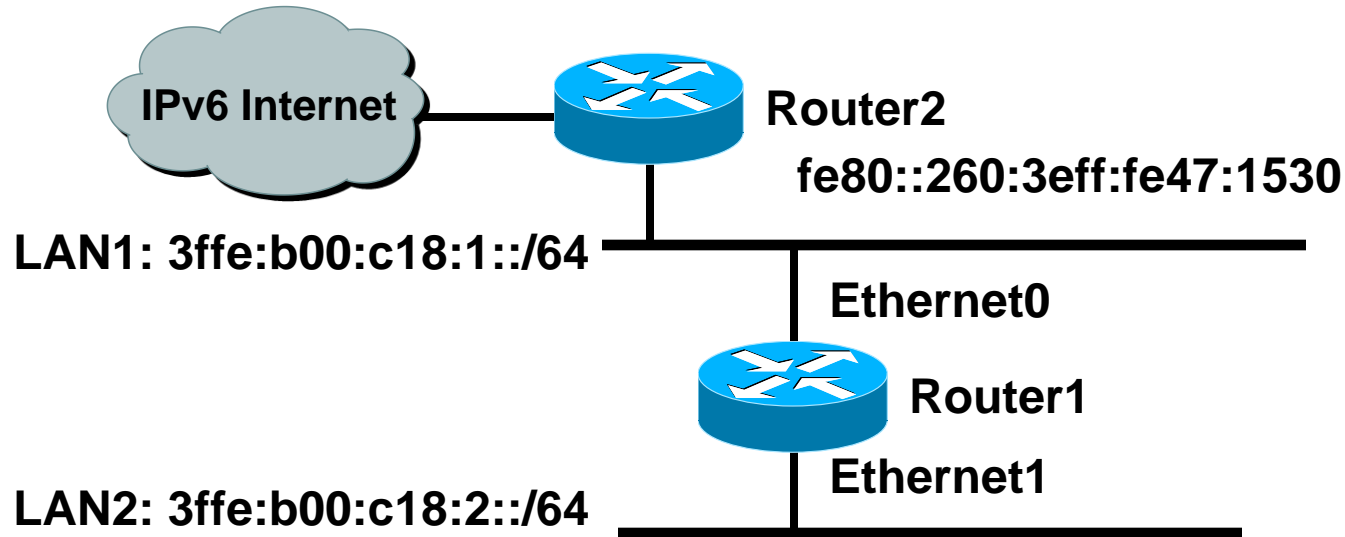
Router1 configuration scenario:

- **Manually configure IPv6 address on all interfaces**
- **Configure Router Advertisement for LAN1 and LAN2 only**
- **Install default route to Router2**

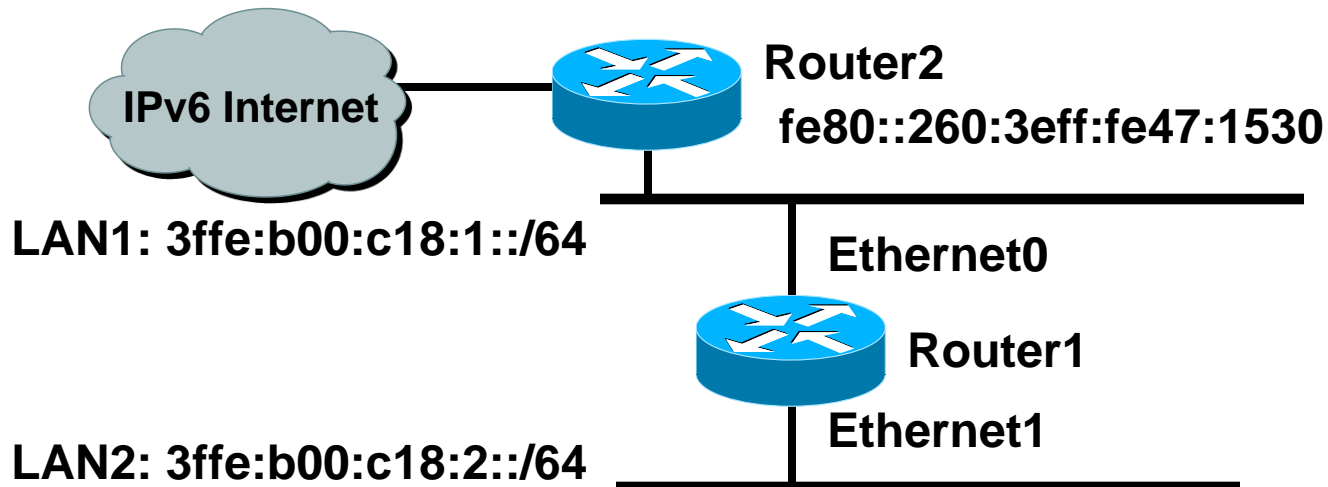# Cisco IOS Configuration Example (Cont.)

IPv6 Internet

Router2
fe80::260:3eff:fe47:1530

LAN1: 3ffe:b00:c18:1::/64

Ethernet0

Router1

Ethernet1

LAN2: 3ffe:b00:c18:2::/64

```
ipv6 unicast-routing

interface Ethernet0
 ipv6 address 3ffe:b00:c18:1::a/64
 ipv6 nd prefix 3ffe:b00:c18:1::/64 43200 43200

interface Ethernet1
 ipv6 address 3ffe:b00:c18:2::a/64
 ipv6 nd prefix 3ffe:b00:c18:2::/64 43200 43200


ipv6 route ::/0 Ethernet0 fe80::260:3eff:fe47:1530
```

IPv6 address on Ethernet interfaces

Router Advertisement on LAN2

Default route to Router2

Cisco IOS show Commands

IPv6 ICMP echo request to the default router:

```
router# ping 3FFE:B00:C18:1:260:3EFF:FE47:1530

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 3FFE:B00:C18:1:260:3EFF:FE47:1530, timeout
is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
```

Display the neighbor discovery cache on the router:

```
router# show ipv6 neighbors

IPv6 Address                          Age Link-layer Addr State Interface
FE80:: 260:3EFF:FE47:1530             26 0060.3e47.1530   REACH Ethernet0
3FFE:B00:C18:1:260:3EFF:FE47:1530      0 0060.3e47.1530   REACH Ethernet0
```

Cisco IOS debug Commands

Some debug commands are available:

`router#`

```
debug ipv6 packet
```

- **IPv6 packet-level debugging**

```
debug ipv6 icmp
```

- **ICMPv6 debugging**

```
debug ipv6 nd
```

- **Neighbor Discovery debugging**

```
debug ipv6 routing
```

- **IPv6 routing table event debugging**

Cisco IOS debug Command Example

IPv6 ICMP echo request and reply to router

```
router# debug ipv6 icmp

ICMPv6: Sending echo request to 3FFE:B00:C18:1::666
ICMPv6: Received ICMPv6 packet from 3FFE:B00:C18:1::666, type 129


ICMPv6: Received ICMPv6 packet from FE80::260:3EFF:FE47:1530, type 134
```

Router Advertisement message

Module 3.3:
Cisco IOS IPv6 RIPng
Configuration Examples

Configure and Verify IPv6 RIPng

RouterX(config)#

```
ipv6 router rip tag
```

- Creates and enters RIP router configuration mode

RouterX(config-if)#

```
ipv6 rip tag enable
```
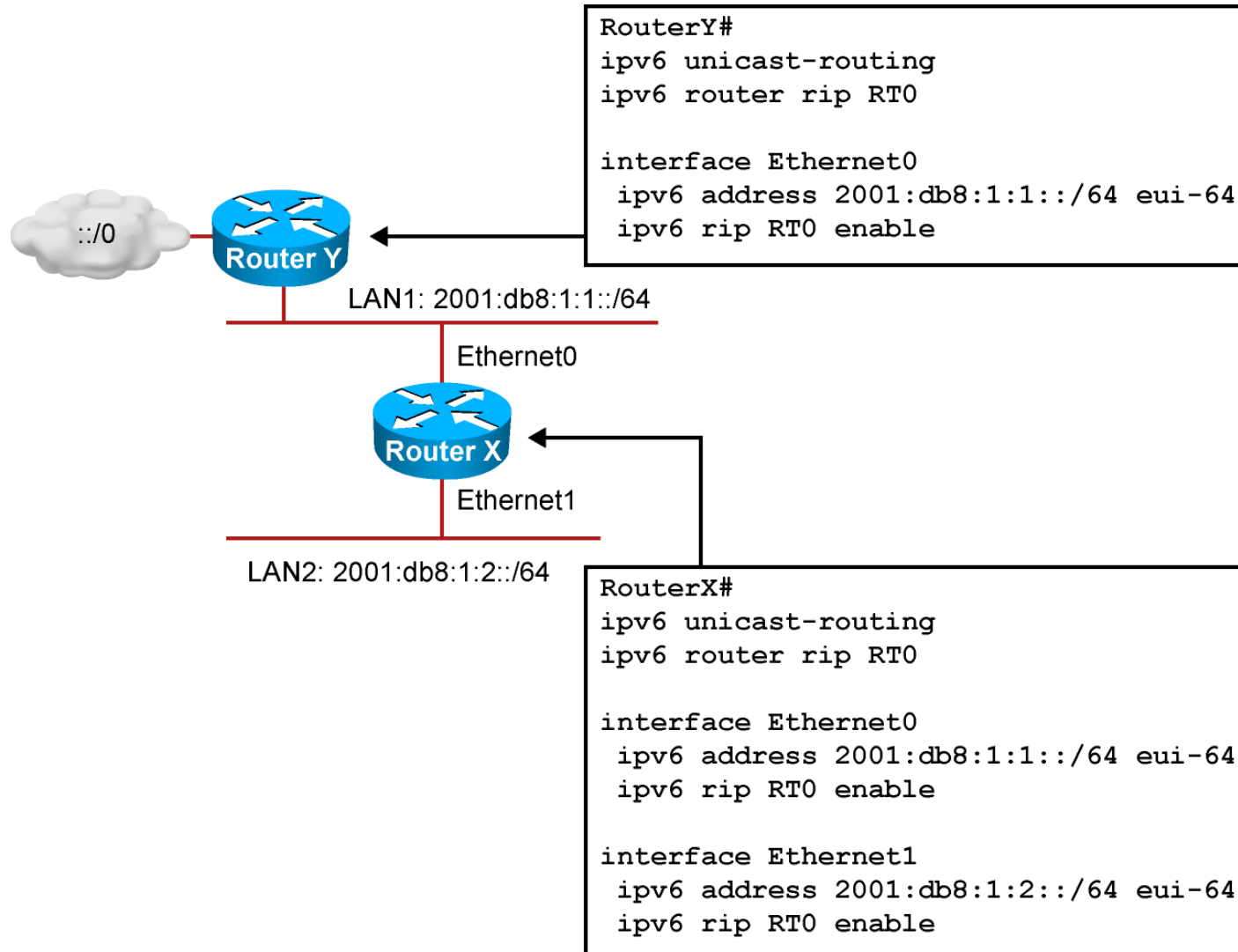
- Configures RIP on an interface

```
show ipv6 rip
```

- Displays the status of the various RIP processes

```
show ipv6 route rip
```

- Shows RIP routes in the IPv6 route table

IPv6 RIPng 設定範例

```
RouterY#
ipv6 unicast-routing
ipv6 router rip RT0

interface Ethernet0
 ipv6 address 2001:db8:1:1::/64 eui-64
 ipv6 rip RT0 enable
```

::/0
Router Y

LAN1: 2001:db8:1:1::/64

Ethernet0

Router X

Ethernet1

LAN2: 2001:db8:1:2::/64

```
RouterX#
ipv6 unicast-routing
ipv6 router rip RT0

interface Ethernet0
 ipv6 address 2001:db8:1:1::/64 eui-64
 ipv6 rip RT0 enable

interface Ethernet1
 ipv6 address 2001:db8:1:2::/64 eui-64
 ipv6 rip RT0 enable
```

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IPv6 Routing Lab

IPv6 Routing Lab Topology

Loopback 0:
10.123.123.1/24
2001:410:X:1::/64 eui-64

IPv4 EIGRP

Loopback 0:
10.132.132.1/24
2001:410:X:2::/64 eui-64

10.123.123.1/24

10.140.1.0/24

10.132.132.1/24

.1

s0/0/0

RouterA

.2

s0/0/0

RouterB

2001:410:X:1::/64

2001:410:X:10::/64

2001:410:X:2::/64
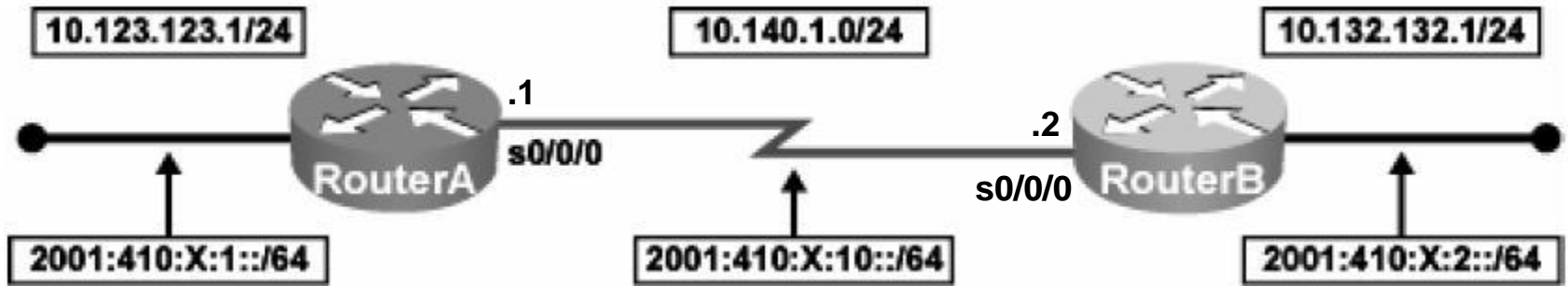
IPv6 RIPng

RouterA loopback:	2001:410:14:1::/64
RouterB loopback:	2001:410:14:2::/64
Serial interface:	2001:410:14:10::/64

RouterA Configuration

```
ipv6 unicast-routing
!
interface loopback0
  ip address 10.123.123.1 255.255.255.0
  ipv6 address 2001:410:14:1::/64 eui-64
  ipv6 rip ccna enable
!
interface Serial0/0/0
  ip address 10.140.1.1 255.255.255.0
  ipv6 address 2001:410:14:10::/64 eui-64
  ipv6 rip ccna enable
!
router eigrp 100
  network 10.0.0.0
  no auto-summary
!
ipv6 router rip ccna
```

IPv6 routing 設定步驟

- **Step 1: Configure IPv6 addresses**
- **Step 2: Enable RIPng for IPv6**

show ip route

```
RouterA# show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS
level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static
route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0 255.255.255.0 is subnetted, 4 subnets
D        10.132.132.0 [90/40640000] via 10.140.1.1, 01:41:03, Serial0/0/0
C        10.123.123.0 is directly connected, Loopback0
C        10.140.1.0 is directly connected, Serial0/0/0
```

```
RouterA#ping 10.132.132.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.132.132.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/28/32 ms
```

show ipv6 interface

```
RouterA# show ipv6 interface
Serial0/0/0 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::207:EFF:FE28:C610
  No Virtual link-local address(es):
  Global unicast address(es):
    2001:410:14:10:207:EFF:FE28:C610, subnet is 2001:410:14:10::/64 [EUI]
  Joined group address(es):
    FF02::1
    FF02::2
    FF02::9
    FF02::1:FF28:C610
  MTU is 1500 bytes
  ICMP error messages limited to one every 100 milliseconds
  ICMP redirects are enabled
  ICMP unreachables are sent
  ND DAD is enabled, number of DAD attempts: 1
  ND reachable time is 30000 milliseconds
  Hosts use stateless autoconfig for addresses.
Loopback0 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::207:EFF:FE28:C610
  No Virtual link-local address(es):
  Global unicast address(es):
    2001:410:14:1:207:EFF:FE28:C610, subnet is 2001:410:14:1::/64 [EUI]
  Joined group address(es):
    FF02::1
    FF02::2
    FF02::9
    FF02::1:FF28:C610
  MTU is 1514 bytes
  ICMP error messages limited to one every 100 milliseconds
  ICMP redirects are enabled
  ICMP unreachables are sent
  ND DAD is not supported
  ND reachable time is 30000 milliseconds
  Hosts use stateless autoconfig for addresses.
RouterA#
```

show ipv6 route

```
RouterA# show ipv6 route
IPv6 Routing Table - 6 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
       U - Per-user Static route, M - MIPv6
       I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
       O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext
2
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
       D - EIGRP, EX - EIGRP external
C   2001:410:14:1::/64 [0/0]
     via ::, Loopback0
L   2001:410:14:1:207:EFF:FE28:C610/128 [0/0]
     via ::, Loopback0
R   2001:410:14:2::/64 [120/2]
     via FE80::213:1AFF:FE7F:3E18, Serial0/0/0
C   2001:410:14:10::/64 [0/0]
     via ::, Serial0/0/0
L   2001:410:14:10:207:EFF:FE28:C610/128 [0/0]
     via ::, Serial0/0/0
L   FF00::/8 [0/0]
     via ::, Null0
```

show cdp neighbor detail

```
RouterA# show cdp neighbor detail
-------------------------
Device ID: wan18
Entry address(es):
  IP address: 10.140.1.1
  IPv6 address: FE80::213:1AFF:FE7F:3E18   (link-local)
  IPv6 address: 2001:410:14:10:213:1AFF:FE7F:3E18   (global unicast)
Platform: Cisco 2811,   Capabilities: Router Switch IGMP
Interface: Serial0/0/0,   Port ID (outgoing port): Serial1/13
Holdtime : 175 sec

Version :
Cisco IOS Software, 2800 Software (C2800NM-ADVIPSERVICESK9-M), Version
12.4(16),
 RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2007 by Cisco Systems, Inc.
Compiled Wed 20-Jun-07 07:19 by prod_rel_team

advertisement version: 2
VTP Management Domain: ''
```

```
RouterA#ping 2001:410:14:10:213:1AFF:FE7F:3E18

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:410:14:10:213:1AFF:FE7F:3E18,
timeout is
2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/28/32 ms
RouterA#ping 2001:410:14:2:213:1AFF:FE7F:3E18

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:410:14:2:213:1AFF:FE7F:3E18,
timeout is 2
 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/28/32 ms
RouterA#
```

Thanks