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Academic year 2025-2026

Networks / IPv_6

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1 Objective

The purpose of this lab is to understand IPv_6 addressing. **This lab was borrowed from the Certa network**.

2 Exercise

Consider the following network topology :

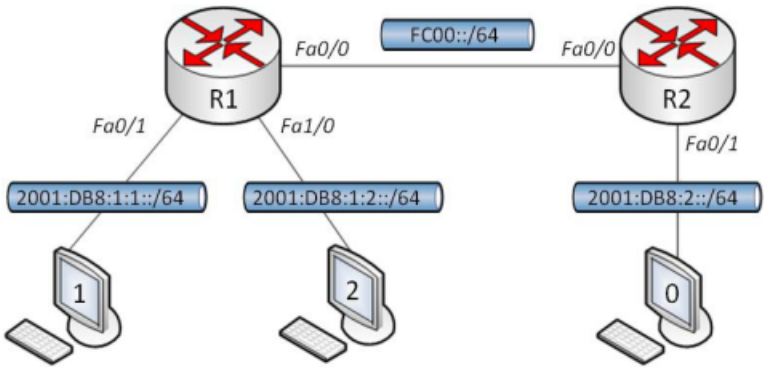

FIGURE 1 – Network topology.

Device	Interf.	Addr IPv_6/Length. prefix	Gateway
R1	Fa0/1 Fa1/0 Fa0/0	2001 :db8 :1 :1 : :/64 eui-64 2001 :db8 :1 :2 : :/64 eui-64 fc00 : :1/64	
R2	Fa0/1 Fa0/0	2001 :db8 :2 : :/64 eui-64 fc00 : :2/64	
Stations 0,1,2	Network card	Auto-configuration	Auto-configuration

1. Explain the differences between the types of IPv_6 addresses shown in the network diagram.
2. Indicate for each type whether the IPv6 address is routable on the Internet.
3. Also try to find its IPv_4 equivalent category.

3 Reminder

1. For autoconfiguration of global unicast addresses, the **SLAAC** (Stateless Address Autoconfiguration) method will be used.
2. **SLAAC** allows a host to automatically configure its global address from the announcement of a given prefix by a router :
   — The first 64 bits are therefore given by the router.
   — The last 64 bits are taken from the MAC address (EUI-64) or randomly generated.

   The identifier obtained becomes the right part of the address after the concatenation of a prefix.

   ## Note on EUI-64 (https://www.it-connect.fr/ipv6-quest-ce-que-leui-64-13/ :

   EUI-64 for "Extended Unique Identifier" is a way to form IPv_6 addresses using the MAC address [EUI-48] of the network card it uses. Concretely, this allows a host to self-assign a unique IPv_6 address. The last 64 bits of an IPv_6 address are derived from the MAC address of the interface.

   To change from a 48-bit MAC address to a 64-bit IPv_6 interface ID :

   a) First 24 bits : constructor number with inverted 7^{th} bit.
   b) The next 16 bits have the value FFFE
   c) Last 24 bits : interface serial number

   The value obtained is an EUI-64.
3. Cisco routers are configured in SLAAC **by default**. The IPv_6 address of the fa0/1 interface of the router is configured with a network prefix and the eui-64 option by the following commands It is worth noting that the first command enables IPv_6 routing, essential for enabling ICMPv_6 state messages :"
   — R1(config)# ipv6 unicast-routing
   — R1(config)#interface fa0/1
   — R1(config-if)#ipv6 address 2001 :db8 :54 :1 : :/64 eui-64
   — R1(config-if)#no shutdown

   After executing the aforementioned commands, interface fa0/1 will acquire a complete IPv6 address derived from its network prefix and MAC address. To identify the obtained IPv6 address, enter the following command :
   — Router#show ipv6 interface brief

   The full Global IPv6 IPv_6 address obtained by interface fa0/1 is :

   2001 :db8 :54 :1 :20a :f3ff :fec8 :6e1
4. The client station is in IPv_6 autoconfiguration mode. It sends an RS (Router Solicitation) message **in multicast** in order to request a network prefix from a router (see Figure 2). This provides the network prefix to the client which completes its address with the MAC address of its network card :
   — Link local : fe80 : :206 :2aff :fe67 :17ba
   — @IPv6 :2001 :db8 :54 :1 :206 :2aff :fe67 :17ba/64

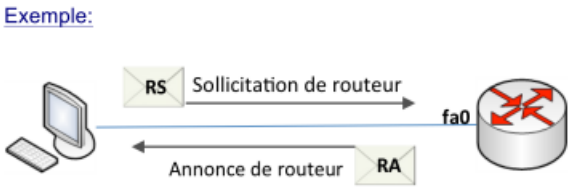

FIGURE 2 – IPv_6 autoconfiguration.

— @gateway : fe80 : :20a :f3ff :fec8 :6e10

Note that the gateway address is the link-local address of the router

5. Continue to configure Router R1
6. Set the IPv_6 address of the fa0/0 interface :
   — R1(config)# interface fa0/0
   — R1(config-if)#ipv6 address fc00 : :1/64
   — R1(config-if)#no shutdown
7. Set the IPv_6 address of fa1/0
   — R1(config)# interface fa0/0
   — R1(config-if)#ipv6 address 2001 :db8 :1 :2 : :/64 eui-64
   — R1(config-if)#no shutdown
8. Perform validation tests with the following commands :
   — R1# show ipv6 interface brief (Display interface settings)
   — R1# show ipv6 interface (Display interface settings)
   — R1# show ipv6 route (Show routing table)
9. Configure the network interface of workstations 1 and 2
   — Enable IPv_6 addressing in automatic configuration
   — Display the IP configuration obtained, using the command **ipv6config /all**.
   — Analyze how addresses were formed.
10. Perform connection tests between the stations of the two networks
11. On the R2 router, set the IPv_6 address of the fa0/1 interface
   — R1(config)# ipv6 unicast-routing
   — R2(config)# interface fa0/1
   — R2(config-if)#ipv6 address 2001 :db8 :2 : :/64 eui-64
   — R2(config)# ipv6 address fe80 : :1 link-local (Configuration of a link-local address statically)
   — R2(config-if)#no shutdown
   — R2(config-if)#exit
   — R2(config)# interface fa0/0
   — R2(config-if)#ipv6 address fc00 : :2/64
   — R2(config-if)#no shutdown
12. Configure station 0 and check its IPv_6 configuration, using the **ipv6config /all** command.
   — Enable IPv_6 addressing in automatic configuration
   — Display the IP configuration obtained, using the command **ipv6config /all**.

— Analyze how addresses were formed.

13. Set up a default route on router R1 :
14. Set up two static routes on router R2, respectively to networks 1 and 2.
15. Display routing tables and test routing via ping between the two ends of the network.

Important remarks

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— You can enable ipv_6 on any interface after having enabled it administratively :
  — R1(config)# interface fa0/0
  — R1(config)# no shutdown
  — R1(config-if)# ipv6 enable
— By activating ipv_6 on a router interface, then typing the command sh ipv_6 interface in global mode, we realize that the interface in question will respond to three addresses :
  — A Link-Local auto-configured address (Stateless Address Auto Configuration) : FE80 : :20F :1FF :FEC7 :3200
  — A Well-Know Multicast address “All nodes on the link” : FF02 : :1
  — A Solicited-Node Multicast address : FF02 : :1 :FFC7 :3200
— We can configure a link-local address statistically :
  — R1(config-if)# ipv6 address FE80 : :1 link-local