Study case 1

Computer netwerken en infrastructuur

Servaes

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- E Beschrijf het IPv6-netwerk
- F Maak een prototype van het netwerk (in het Cisco lab) en laat dit evalueren

A Ontwerp een netwerk IPv4: ip-adressering + routing OSPFv2
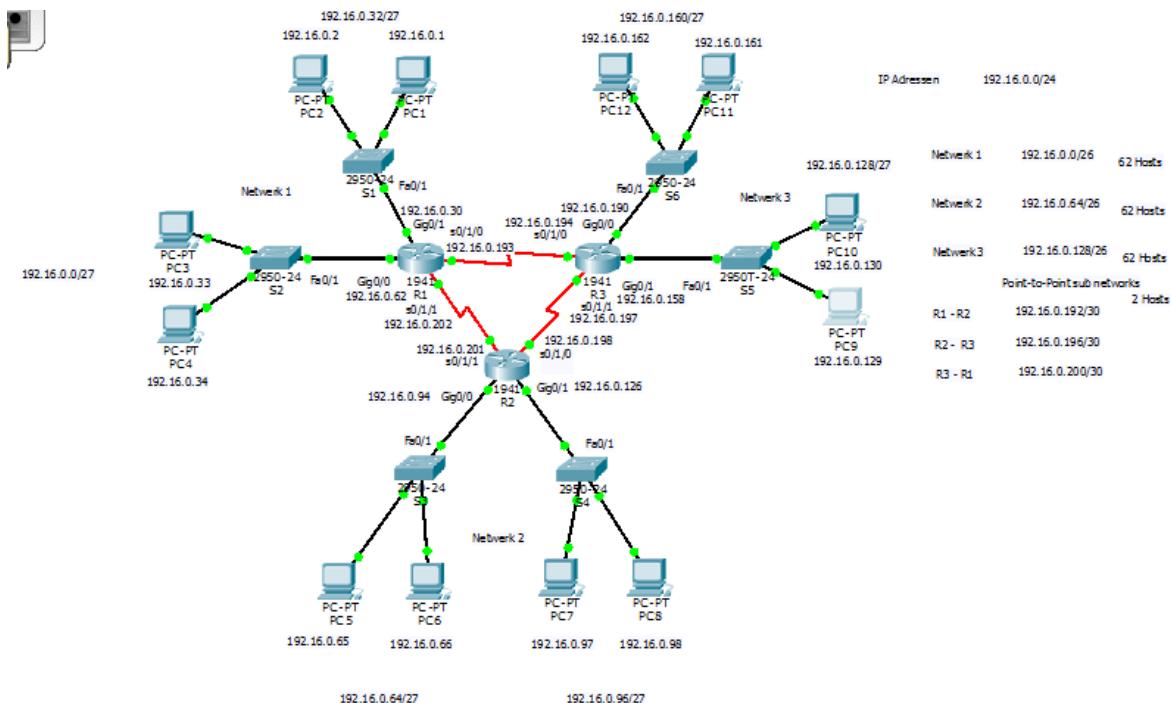
B Beschrijf het IPv4-netwerk

Topology
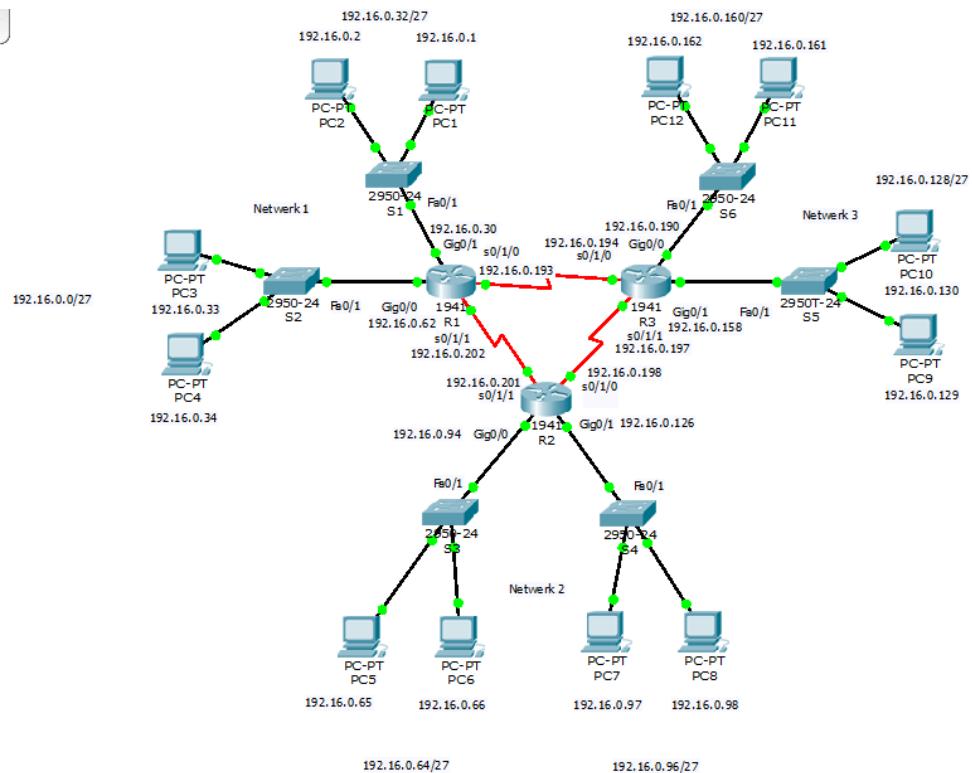
Objectives

- Configureer alle host met statische Ipv4 adressen
- Configureer OSPF
- Voorzie de routers van statische routes

Background

In dit lab kan je een simple netwerk zien dat bestaat uit 3 routers en 6 switches.

Required Resources

- 3 routers (Cisco 1841 with Cisco IOS Release 12.4(24)T1 Advanced IP Services or comparable) + HWIC –T2 card (voor serial connections)
- 6 switch (Cisco 2960 with the Cisco IOS Release 12.2(46)SE C2960-LANBASEK9-M image or comparable)
- Serial and Ethernet cables

Step 1: Installatie van de routers

Sluit de routers aan met serial kabels zoals te zien in de topologie. Zorg er ook voor dat de oude configuratie van de routers verwijderd worden.
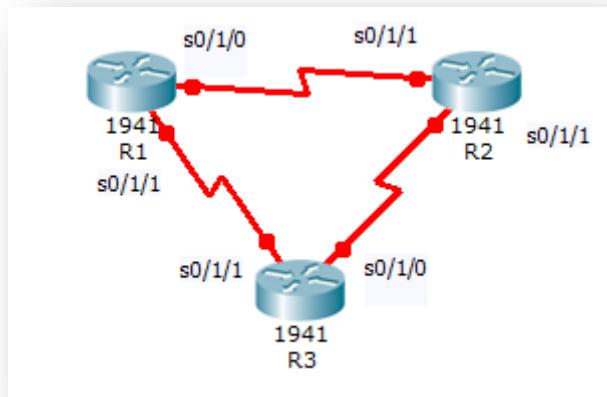
Bij het installeren van de routers mag er zeker niet vergeten worden om een HWIC-T2 kaart toe te voegen. Wanneer men deze kaart wilt toevoegen aan het toestel mag men niet vergeten de stroom uit te schakelen. Anders kan het zijn dat het apparaat beschadigd word !

Step 2: Installatie van de switches en hosts

Net zoals we gedaan hebben bij de routers gaan we de switches gaan aansluiten samen met de hosts. Hierbij kijken we opnieuw naar de topologie.
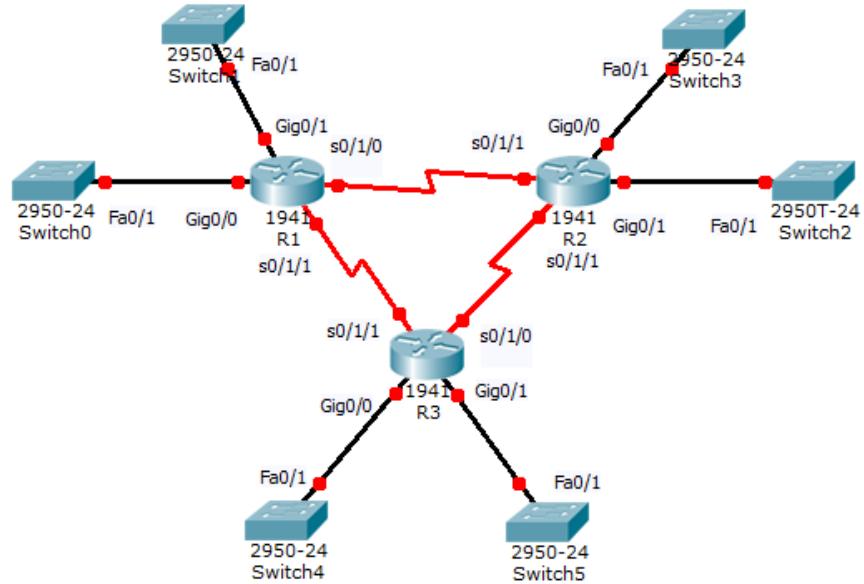
In het totale netwerk is er plaats voorzien voor een 170tal hosts. Deze moeten niet allemaal gebruikt worden, maar het is wel mogelijk.
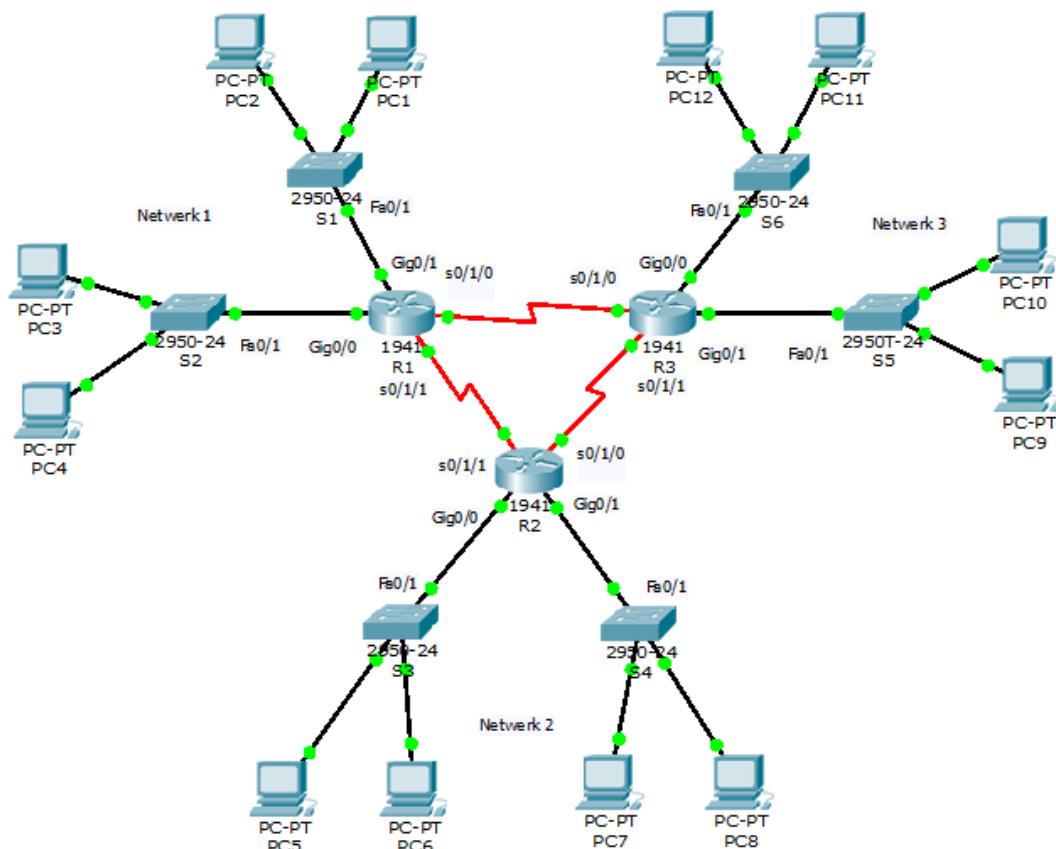
Step 3: Configureer de hostenames van de toestellen

In deze stap gaan we alle toestellen de juiste naam geven. Zodat we duidelijk weten op welk toestel we bezig zijn ..

Routers:

- R1
- R2
- R3

Switches:

- S1 (geconnecteerd met R1)
- S2 (geconnecteerd met R1)
- S3 (geconnecteerd met R2)
- S4 (geconnecteerd met R2)
- S5 (geconnecteerd met R3)
- S6 (geconnecteerd met R3)

Hosts : PC1-12

Step 4: configuratie van de statische IPv4 Adressen

IP adressing schema

	IPv4 Adressing			
Sub-Netwerk 1	192.16.0.0/24	192.16.0.0/25	192.16.0.0/26	192.16.0.0/27
				192.16.0.32/27
Sub-Netwerk 2			192.16.0.64/26	192.16.0.64/27
				192.16.0.96/27
Sub-Netwerk 3			192.16.0.128/26	192.16.0.128/27
				192.16.0.160/27
R1 - R2			192.16.0.192/26	192.16.0.192/30
R2 - R3				192.16.0.196/30
R3 - R1				192.16.0.200/30

Op basis van ons vooropgesteld IP adressing schema gaan we de statische Ipv4 adressen toekennen aan de hosts.

Voorbeeld:

```
PC>ipconfig

FastEthernet0 Connection:(default port)
Link-local IPv6 Address.........: FE80::20D:BDFF:FE72:2BC3
IP Address......................: 192.16.0.1
Subnet Mask.....................: 255.255.255.224
Default Gateway.................: 192.16.0.30
```

Vervolgens gaan we er ook voor zorgen dat de interfaces van de routers deftig worden ingesteld.

R1

```
interface GigabitEthernet0/0
 ip address 192.16.0.62 255.255.255.224
 duplex auto
 speed auto
!
interface GigabitEthernet0/1
 ip address 192.16.0.30 255.255.255.224
 duplex auto
 speed auto
```

R2

```
interface GigabitEthernet0/0
 ip address 192.16.0.94 255.255.255.224
 duplex auto
 speed auto
!
interface GigabitEthernet0/1
 ip address 192.16.0.126 255.255.255.224
 duplex auto
 speed auto
```

R3

```
interface GigabitEthernet0/0
 ip address 192.16.0.190 255.255.255.224
 duplex auto
 speed auto
!
interface GigabitEthernet0/1
 ip address 192.16.0.158 255.255.255.224
 duplex auto
 speed auto
```

Step 5: Configuratie van OSPF

R1

```
R1(config)#router ospf 1
R1(config-router)#network 192.16.0.0 0.0.0.63 area 0
R1(config-router)#network 192.16.0.192 0.0.0.3 area 0
R1(config-router)#network 192.16.0.200 0.0.0.3 area 0
R1(config-router)#exit
```

R2

```
R2(config)#router ospf 1
R2(config-router)#network 192.16.0.64 0.0.0.63 area 0
R2(config-router)#network 192.16.0.192 0.0.0.3 area 0
R2(config-router)#network 192.16.0.196 0.0.0.3 area 0
R2(config-router)#exit
```

R3

```
R3(config)#router ospf 1
R3(config-router)#network 192.16.0.128 0.0.0.63 area 0
R3(config-router)#network 192.16.0.196 0.0.0.3 area 0
R3(config-router)#network 192.16.0.200 0.0.0.3 area 0
R3(config-router)#exit
```

Step 6: instellen van statische routes

R1

```
R1(config)#ip route 192.16.0.64 255.255.255.192 s0/1/1
R1(config)#ip route 192.16.0.128 255.255.255.192 s0/1/0
```

R2

```
R2(config)#ip route 192.16.0.0 255.255.255.192 s0/1/1
R2(config)#ip route 192.16.0.128 255.255.255.192 s0/1/0
```

R3

```
R3(config)#ip route 192.16.0.0 255.255.255.192 s0/1/0
R3(config)#ip route 192.16.0.64 255.255.255.192 s0/1/1
```

Device Configurations

Router R1

```
R1>enable

R1#show running-config

Building configuration...

Current configuration : 951 bytes

version 15.1

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

!

hostname R1

license udi pid CISCO1941/K9 sn FTX1524DRFA

!

spanning-tree mode pvst

!

interface GigabitEthernet0/0

 ip address 192.16.0.62 255.255.255.224

 duplex auto

 speed auto

!

interface GigabitEthernet0/1

 ip address 192.16.0.30 255.255.255.224

 duplex auto

 speed auto

!

interface Serial0/1/0

 ip address 192.16.0.193 255.255.255.252

!

interface Serial0/1/1
```

```
 ip address 192.16.0.202 255.255.255.252
!
interface Vlan1
 no ip address
 shutdown
!
router ospf 1
 log-adjacency-changes
 network 192.16.0.0 0.0.0.63 area 0
 network 192.16.0.192 0.0.0.3 area 0
 network 192.16.0.200 0.0.0.3 area 0
!
ip classless
ip route 192.16.0.64 255.255.255.192 Serial0/1/1
ip route 192.16.0.128 255.255.255.192 Serial0/1/0
!
line con 0
!
line aux 0
!
line vty 0 4
 login
!
End
```

Router R2

```
Building configuration...

Current configuration : 952 bytes

version 15.1

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

!

hostname R2

!

license udi pid CISCO1941/K9 sn FTX1524V7VF

!

spanning-tree mode pvst

!

interface GigabitEthernet0/0

 ip address 192.16.0.94 255.255.255.224

 duplex auto

 speed auto

!

interface GigabitEthernet0/1

 ip address 192.16.0.126 255.255.255.224

 duplex auto

 speed auto

!

interface Serial0/1/0

 ip address 192.16.0.198 255.255.255.252

!

interface Serial0/1/1

 ip address 192.16.0.201 255.255.255.252

!
```

```
interface Vlan1

 no ip address

 shutdown

!

router ospf 1

 log-adjacency-changes

 network 192.16.0.64 0.0.0.63 area 0

 network 192.16.0.192 0.0.0.3 area 0

 network 192.16.0.196 0.0.0.3 area 0

!

ip classless

ip route 192.16.0.0 255.255.255.192 Serial0/1/1

ip route 192.16.0.128 255.255.255.192 Serial0/1/0

!

line con 0

!

line aux 0

!

line vty 0 4

 login

!

End
```

Router R3

```
Building configuration...

Current configuration : 953 bytes

!

version 15.1

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

!

hostname R3

!

license udi pid CISCO1941/K9 sn FTX15247Y3C

!

spanning-tree mode pvst

!

interface GigabitEthernet0/0

 ip address 192.16.0.190 255.255.255.224

 duplex auto

 speed auto

!

interface GigabitEthernet0/1

 ip address 192.16.0.158 255.255.255.224

 duplex auto

 speed auto

!

interface Serial0/1/0

 ip address 192.16.0.194 255.255.255.252

!

interface Serial0/1/1

 ip address 192.16.0.197 255.255.255.252
```

```
!
interface Vlan1
 no ip address
 shutdown
!
router ospf 1
 log-adjacency-changes
 network 192.16.0.128 0.0.0.63 area 0
 network 192.16.0.196 0.0.0.3 area 0
 network 192.16.0.200 0.0.0.3 area 0
!
ip classless
ip route 192.16.0.0 255.255.255.192 Serial0/1/0
ip route 192.16.0.64 255.255.255.192 Serial0/1/1
!
line con 0
!
line aux 0
!
line vty 0 4
 login
!
End
```

Wegens een slordige en overmoedige werkwijze zijn er nog heel veel fouten gemaakt bij het maken van dit netwerk. Deze fouten zijn er uit gehaald tijdens het troubleshooting bij het fysieke netwerk.

C Maak een prototype van het netwerk (in het Cisco lab) en laat dit evalueren

Topology
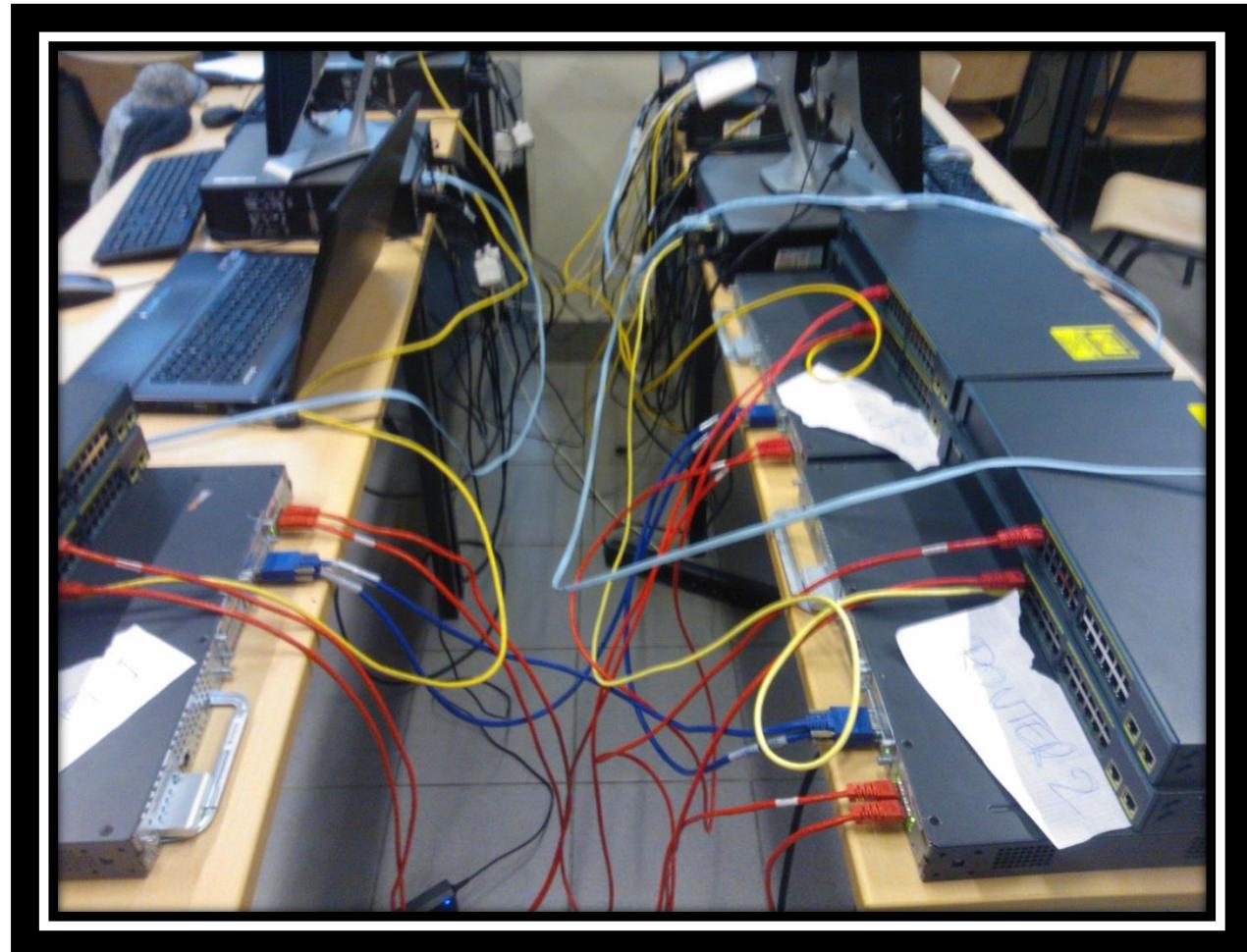
Objectives

- Configureer alle host met statische Ipv4 adressen
- Zorg voor OSPF
- Voorzie de routers van statische routes

Background

In dit lab kan je een simple netwerk zien dat bestaat uit 3 routers en 6 switches.

Required Resources

- 3 routers (Cisco 1841 with Cisco IOS Release 12.4(24)T1 Advanced IP Services or comparable) + HWIC –T2 card (voor serial connections)
- 6 switch (Cisco 2960 with the Cisco IOS Release 12.2(46)SE C2960-LANBASEK9-M image or comparable)
- Serial and Ethernet cables

## Step 1: Installatie van de routers, switches en hosts

Sluit de routers aan met serial kabels zoals te zien in de topologie. Zorg er ook voor dat de oude configuratie van de routers verwijderd worden.

Bij het installeren van de routers mag er zeker niet vergeten worden om een HWIC-T2 kaart toe te voegen. Wanneer men deze kaart wilt toevoegen aan het toestel mag men niet vergeten de stroom uit te schakelen. Anders kan het zijn dat het apparaat beschadigd word !

Net zoals we gedaan hebben bij de routers gaan we de switches gaan aansluiten samen met de hosts. Hierbij kijken we opnieuw naar de topologie.

In het totale netwerk is er plaats voorzien voor een 170tal hosts. Deze moeten niet allemaal gebruikt worden, maar het is wel mogelijk.

Om al de apparatuur te configureren zorgen we dat er console kabels worden aangesloten die ons toegang geven tot de command line van de apparatuur.
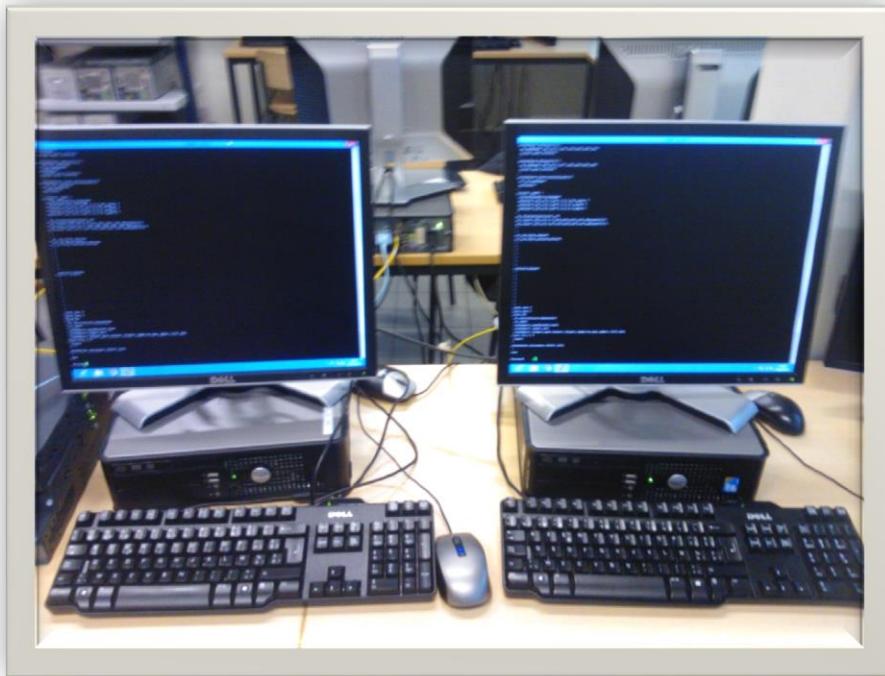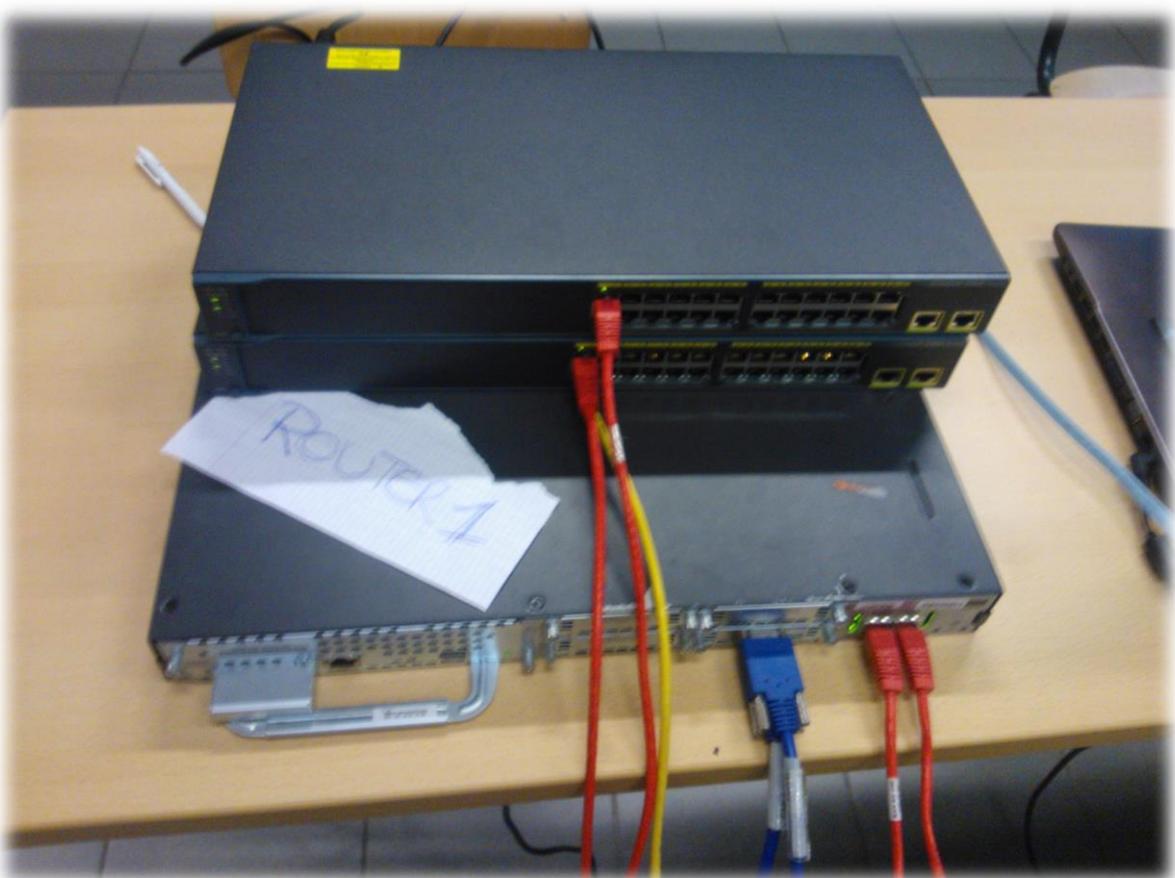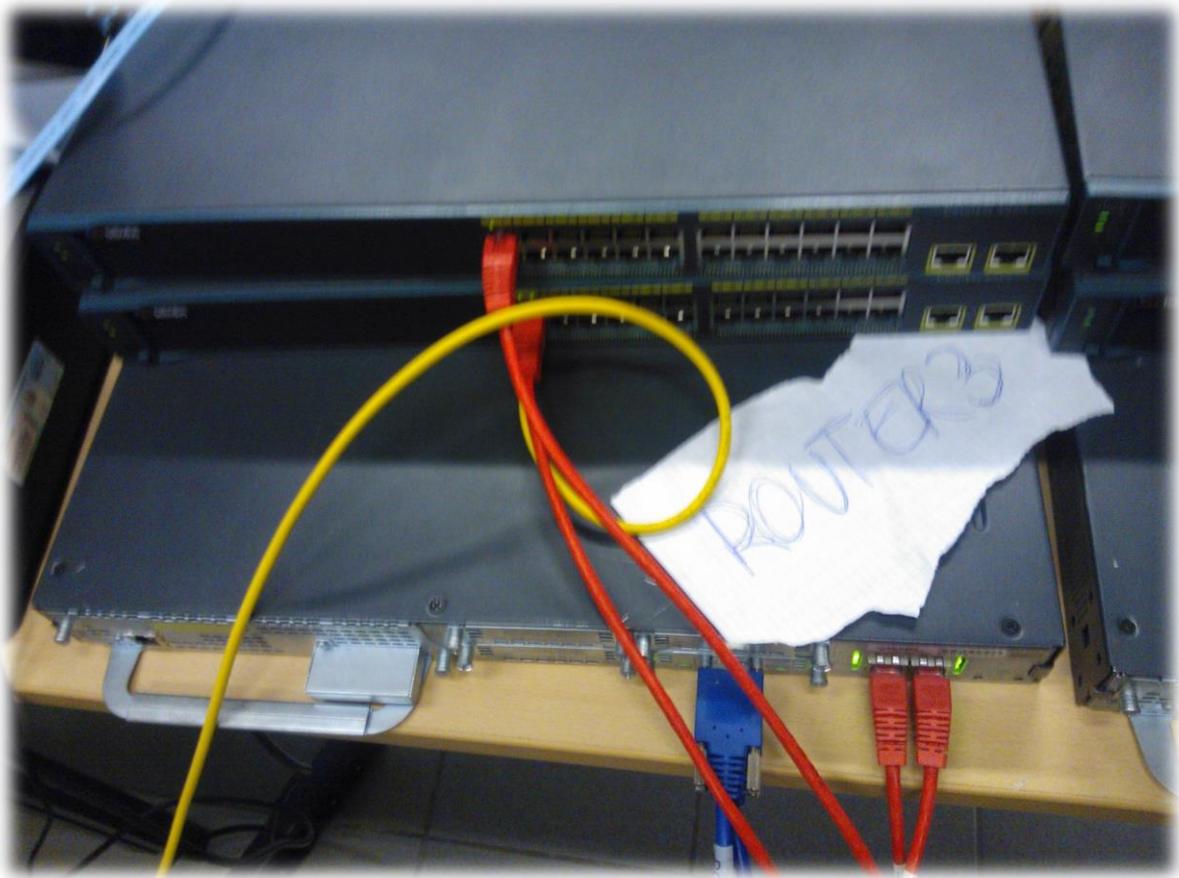
In deze foto's kan je duidelijk de routers zien met de 2 aangesloten switches.

Op volgende foto kan u een algemeen overzicht zien:
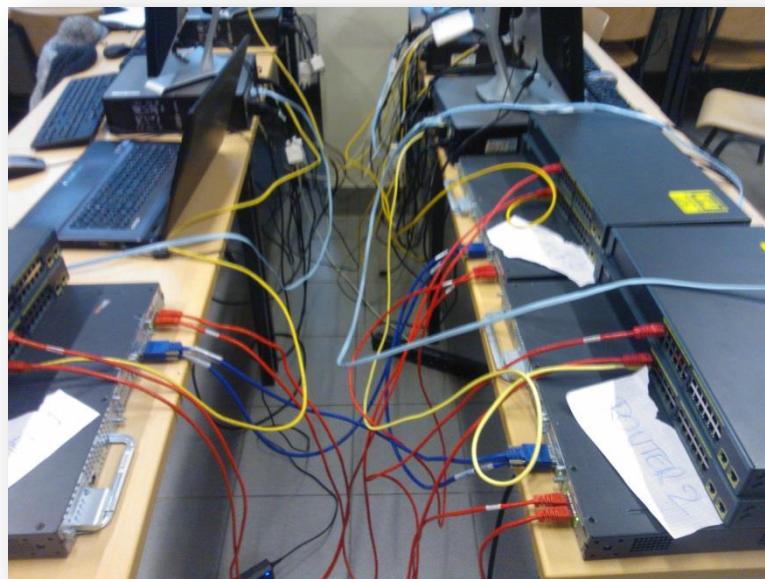
Step 2: configuratie van de statische IPv4 Adressen

Voor we iets gaan configureren gaan we kijken of er al iets geconfigureerd staat op de routers.
Wanneer dit zo is moeten we de voorgaande configuraties wissen.

R1

```
Router#show running-config
Building configuration...

Current configuration : 1129 bytes
!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname Router
!
boot-start-marker
boot-end-marker
!
!
no aaa new-model
!
!
ip cef
!
ip auth-proxy max-nodata-conns 3
ip admission max-nodata-conns 3
!
multilink bundle-name authenticated
!
voice-card 0
 no dspfarm
!
archive
 log config
  hidekeys
```

```
!
interface FastEthernet0/0
 no ip address
 shutdown
 duplex auto
 speed auto
!
interface FastEthernet0/1
 no ip address
 shutdown
 duplex auto
 speed auto
!
interface Serial0/0/0
 no ip address
 shutdown
 no fair-queue
!
interface Serial0/0/1
 no ip address
 shutdown
!
interface Integrated-Service-Engine1/0
 no ip address
 shutdown
 no keepalive
!
ip forward-protocol nd
!
ip http server
no ip http secure-server
!
control-plane
!
line con 0
line aux 0
```

```
line 66
 no activation-character
 no exec
 transport preferred none
 transport input all
 transport output pad telnet rlogin lapb-ta mop udptn v120 ssh
line vty 0 4
 login
!
scheduler allocate 20000 1000
!
end
```

R2

Building configuration...

```
Current configuration : 1251 bytes
!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname Router
!
boot-start-marker
boot-end-marker
!
 no aaa new-model
!
!
ip cef
!
ip auth-proxy max-nodata-conns 3
ip admission max-nodata-conns 3
```

```
!
```

```
multilink bundle-name authenticated
!
voice-card 0
 no dspfarm
!
archive
 log config
  hidekeys
!
interface FastEthernet0/0
 no ip address
 shutdown
 duplex auto
 speed auto
!
interface FastEthernet0/1
 no ip address
 shutdown
 duplex auto
 speed auto
!
interface Serial0/0/0
 no ip address
 shutdown
!
interface Serial0/0/1
 no ip address
 shutdown
 clock rate 2000000
!
interface Serial0/3/0
 no ip address
 shutdown
 clock rate 2000000
```

```
!
interface Serial0/3/1
 no ip address
 shutdown
 clock rate 2000000
!
interface wlan-controller1/0
 no ip address
 shutdown
!
ip forward-protocol nd
!
no ip http server
no ip http secure-server
!
control-plane
!
line con 0
line aux 0
line 66
 no activation-character
 no exec
 transport preferred none
 transport input all
 transport output pad telnet rlogin lapb-ta mop udptn v120 ssh
line vty 0 4
 login
!
scheduler allocate 20000 1000
!
end
```

R3

```
Building configuration...

Current configuration : 1133 bytes
!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname Router
!
boot-start-marker
boot-end-marker
!
no aaa new-model
!
ip cef
!
ip auth-proxy max-nodata-conns 3
ip admission max-nodata-conns 3
!
multilink bundle-name authenticated
!
voice-card 0
 no dspfarm
!
archive
 log config
  hidekeys
!
interface FastEthernet0/0
 no ip address
 shutdown
 duplex auto
 speed auto
```

```
!
interface FastEthernet0/1
 no ip address
 shutdown
 duplex auto
 speed auto
!
interface Serial0/0/0
 no ip address
 shutdown
 clock rate 2000000
!
interface Serial0/0/1
 no ip address
 shutdown
 clock rate 2000000
!
interface wlan-controller1/0
 no ip address
 shutdown
!
ip forward-protocol nd
!
!
no ip http server
no ip http secure-server
!
control-plane
!
line con 0
line aux 0
line 66
 no activation-character
 no exec
 transport preferred none
 transport input all
```

```
 transport output pad telnet rlogin lapb-ta mop udptn v120 ssh
line vty 0 4
 login
!
scheduler allocate 20000 1000
!
end
```

We behouden de zelfde IP adressen structuur zoals in packet tracer.

IP adressing schema

	IPv4 Adressing			
Sub-Netwerk 1	192.16.0.0/24	192.16.0.0/25	192.16.0.0/26	192.16.0.0/27
				192.16.0.32/27
Sub-Netwerk 2			192.16.0.64/26	192.16.0.64/27
				192.16.0.96/27
Sub-Netwerk 3			192.16.0.128/26	192.16.0.128/27
				192.16.0.160/27
R1 - R2			192.16.0.192/26	192.16.0.192/30
R2 - R3				192.16.0.196/30
R3 - R1				192.16.0.200/30

Op basis van ons vooropgesteld IP adressing schema gaan we de statische Ipv4 adressen toekennen aan de hosts.

Voorbeeld:

```
PC>ipconfig

FastEthernet0 Connection:(default port)
Link-local IPv6 Address..........: FE80::20D:BDFF:FE72:2BC3
IP Address.......................: 192.16.0.1
Subnet Mask......................: 255.255.255.224
Default Gateway..................: 192.16.0.30
```

Het instellen van de host was niet mogelijk met de computers van school omdat de IP adressen niet aangepast konden worden aangezien ik daartoe niet bevoegd toe was. Daarom heb ik er voor gekozen om alleen mijn eigen pc aan het netwerk aan te sluiten.

Vervolgens gaan we er ook voor zorgen dat de interfaces van de routers deftig worden ingesteld.

R1

Router(config)#int f0/0

Router(config-if)#ip add 192.16.0.62 255.255.255.224

Router(config-if)#no shut

Router(config-if)#

*Jan 10 15:35:11.791: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up

*Jan 10 15:35:15.095: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

Router(config-if)#int fa0/1

Router(config-if)#ip add 192.16.0.30 255.255.255.224

Router(config-if)#no shut

Router(config-if)#

*Jan 10 15:35:49.795: %LINK-3-UPDOWN: Interface FastEthernet0/1, changed state to up

*Jan 10 15:35:50.795: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up

Router(config-if)#

Router(config)#int s0/0/0

Router(config-if)#ip add 192.16.0.193 0.0.0.3

Bad mask 0x3 for address 192.16.0.193

Router(config-if)#ip add 192.16.0.193 255.255.255.252

Router(config-if)#no shut

*Jan 10 15:53:45.459: %LINK-3-UPDOWN: Interface Serial0/0/0, changed state to up

*Jan 10 15:53:50.807: %SYS-5-CONFIG_I: Configured from console by console

Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#int s0/0/1

Router(config-if)#ip add 192.16.0.202 255.255.255.252

Router(config-if)#no shut

R2

```
Router(config)#int fa0/0

Router(config-if)#ip add 192.16.0.94 255.255.255.224

Router(config-if)#no shut

*Jan 10 15:46:39.971: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up

*Jan 10 15:46:40.971: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0,
changed state up

Router(config)#int fa0/1

Router(config-if)#ip add 192.16.0.126 255.255.255.224

Router(config-if)#no shut

Router(config-if)#

*Jan 10 15:47:14.291: %LINK-3-UPDOWN: Interface FastEthernet0/1, changed state to up

*Jan 10 15:47:17.251: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1,
changed state to up

Router(config)#int s0/0/1

Router(config-if)#ip add 192.16.0.198 255.255.255.252

Router(config-if)#no shut

Router(config-if)#

Router(config-if)#

*Jan 10 16:04:28.063: %LINK-3-UPDOWN: Interface Serial0/0/0, changed state to down

Router(config-if)#ip add 192.16.0.201 255.255.255.252

Router(config-if)#no shut

Router(config)#int s0/0/0

Router(config-if)#ip add 192.16.0.201 255.255.255.252

Router(config-if)#no shut
```

R3

```
Router(config)#int fa0/0

Router(config-if)#ip add 192.16.0.190 255.255.255.224

Router(config-if)#no shut

Router(config-if)#int fa0/1

Router(config-if)#

*Jan 10 17:13:38.119: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up

*Jan 10 17:13:39.119: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0,
changed state to up

Router(config-if)#int fa0/1

Router(config-if)#ip add 192.16.0.158 255.255.255.224

Router(config-if)#no shut

*Jan 10 17:14:14.059: %LINK-3-UPDOWN: Interface FastEthernet0/1, changed state to up

*Jan 10 17:14:15.059: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1,
changed state to up

Router(config)#int s0/0/0

Router(config-if)#ip add 192.16.0.194 255.255.255.252

Router(config-if)#no shut

Router(config-if)#

Router(config-if)#

*Jan 10 17:30:51.891: %LINK-3-UPDOWN: Interface Serial0/0/0, changed state to up

*Jan 10 17:30:52.891: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0,
changed state to up

Router(config-if)#int s0/0/1

Router(config-if)#ip add 192.16.0.197 255.255.255.252

Router(config-if)#no shut
```

Step 3: Configuratie van OSPF

R1

```
Router(config)#router ospf 1
Router(config-router)#network 192.16.0.64 0.0.0.63 area 0
Router(config-router)#network 192.16.0.192 0.0.0.3 area 0
Router(config-router)#network 192.16.0.200 0.0.0.3 area 0
Router(config-router)#exit
```

R2

```
Router(config)#router ospf 1
Router(config-router)#network 192.16.0.64 0.0.0.63 area 0
Router(config-router)#network 192.16.0.192 0.0.0.3 area 0
Router(config-router)#network 192.16.0.196 0.0.0.3 area 0
Router(config-router)#exit
```

R3

```
Router(config)#router ospf 1
Router(config-router)#network 192.16.0.128 0.0.0.63 area 0
Router(config-router)#network 192.16.0.196 0.0.0.3 area 0
Router(config-router)#network 192.16.0.200 0.0.0.3 area 0
Router(config-router)#exit
```

Step 4 : instellen van statische routes

R1

```
Router(config)#ip route 192.16.0.64 255.255.255.192 s0/0/1
Router(config)#ip route 192.16.0.128 255.255.255.192 s0/0/1
Router(config)#exit
```

R2

```
Router(config)#ip route 192.16.0.0 255.255.255.192 s0/0/1
Router(config)#ip route 192.16.0.128 255.255.255.192 s0/0/0
Router(config)#exit
```

R3

```
Router(config)#ip route 192.16.0.64 255.255.255.192 s0/0/1
Router(config)#ip route 192.16.0.0 255.255.255.192 s0/0/0
Router(config)#exit
```

Step 5 : Testen van het network

Ik ben gestart met het pingen op R1 hieruit is gebleken dat 192.16.0.198 & 192.16.0.197 unreacheble waren. Zo ben ik gaan kijkan naar show ip route en hier ben ik het volgende te weten gekomen :

```
Router#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


    192.16.0.0/24 is variably subnetted, 6 subnets, 3 masks

C     192.16.0.192/30 is directly connected, Serial0/0/0

C     192.16.0.200/30 is directly connected, Serial0/0/1

S     192.16.0.128/26 is directly connected, Serial0/0/1

S     192.16.0.64/26 is directly connected, Serial0/0/1

C     192.16.0.0/27 is directly connected, FastEthernet0/1

C     192.16.0.32/27 is directly connected, FastEthernet0/0

Router#

Router#conf t

Enter configuration commands, one per line.  End with CNTL/Z.

Router(config)#ip route 192.16.0.196 255.255.255.252 s0/0/0

Router(config)#end

Router#
```

```
*Jan 10 17:12:34.959: %SYS-5-CONFIG_I: Configured from console by console

Router#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


    192.16.0.0/24 is variably subnetted, 7 subnets, 3 masks

C     192.16.0.192/30 is directly connected, Serial0/0/0

S     192.16.0.196/30 is directly connected, Serial0/0/0

C     192.16.0.200/30 is directly connected, Serial0/0/1

S     192.16.0.128/26 is directly connected, Serial0/0/1

S     192.16.0.64/26 is directly connected, Serial0/0/1

C     192.16.0.0/27 is directly connected, FastEthernet0/1

C     192.16.0.32/27 is directly connected, FastEthernet0/0

Router#
```

Dit wilt dus zeggen dat ik elk point to point sub netwerk vergeten was recht tegen over elke router. Gelukkig dat ik deze testen heb uitgevoerd want dit was ook het geval bij de packet tracer.

Als we vervolgens nog eens naar het ip route commando gaan kijken zien we duidelijk dat de statische routes niet noodzakelijk zijn in dit netwerk. Zo kan ospf zelf zorgen voor de routes van de packetten.

```
Router#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


    192.16.0.0/24 is variably subnetted, 7 subnets, 3 masks

C    192.16.0.192/30 is directly connected, Serial0/0/0

S    192.16.0.196/30 is directly connected, Serial0/0/0

C    192.16.0.200/30 is directly connected, Serial0/0/1

S    192.16.0.128/26 is directly connected, Serial0/0/1

S    192.16.0.64/26 is directly connected, Serial0/0/1

C    192.16.0.0/27 is directly connected, FastEthernet0/1

C    192.16.0.32/27 is directly connected, FastEthernet0/0
```

We starten bij het verwijderen van de statische routes

R1

```
Router(config)#no ip route 192.16.0.64 255.255.255.192 s0/0/1
Router(config)#no ip route 192.16.0.128 255.255.255.192 s0/0/1
Router(config)#exit
```

R2

```
Router(config)#no ip route 192.16.0.0 255.255.255.192 s0/0/1
Router(config)#no ip route 192.16.0.128 255.255.255.192 s0/0/0
Router(config)#exit
```

R3

```
Router(config)#no ip route 192.16.0.64 255.255.255.192 s0/0/1
Router(config)#no ip route 192.16.0.0 255.255.255.192 s0/0/0
Router(config)#exit
```

Vervolgens gaan we kijken wat er gebeurt met de ip routes:

R1

```
    192.16.0.0/24 is variably subnetted, 8 subnets, 3 masks
C      192.16.0.0/27 is directly connected, GigabitEthernet0/1
L      192.16.0.30/32 is directly connected, GigabitEthernet0/1
C      192.16.0.32/27 is directly connected, GigabitEthernet0/0
L      192.16.0.62/32 is directly connected, GigabitEthernet0/0
C      192.16.0.192/30 is directly connected, Serial0/1/0
L      192.16.0.193/32 is directly connected, Serial0/1/0
C      192.16.0.200/30 is directly connected, Serial0/1/1
L      192.16.0.202/32 is directly connected, Serial0/1/1
```

R2

```
   192.16.0.0/24 is variably subnetted, 10 subnets, 3 masks
C     192.16.0.64/27 is directly connected, GigabitEthernet0/0
L     192.16.0.94/32 is directly connected, GigabitEthernet0/0
C     192.16.0.96/27 is directly connected, GigabitEthernet0/1
L     192.16.0.126/32 is directly connected, GigabitEthernet0/1
O     192.16.0.128/27 [110/65] via 192.16.0.197, 00:05:24, Serial0/1/0
O     192.16.0.160/27 [110/65] via 192.16.0.197, 00:05:24, Serial0/1/0
C     192.16.0.196/30 is directly connected, Serial0/1/0
L     192.16.0.198/32 is directly connected, Serial0/1/0
C     192.16.0.200/30 is directly connected, Serial0/1/1
L     192.16.0.201/32 is directly connected, Serial0/1/1
```

R3

```
   192.16.0.0/24 is variably subnetted, 10 subnets, 3 masks
O     192.16.0.64/27 [110/65] via 192.16.0.198, 00:06:04, Serial0/1/1
O     192.16.0.96/27 [110/65] via 192.16.0.198, 00:06:04, Serial0/1/1
C     192.16.0.128/27 is directly connected, GigabitEthernet0/1
L     192.16.0.158/32 is directly connected, GigabitEthernet0/1
C     192.16.0.160/27 is directly connected, GigabitEthernet0/0
L     192.16.0.190/32 is directly connected, GigabitEthernet0/0
C     192.16.0.192/30 is directly connected, Serial0/1/0
L     192.16.0.194/32 is directly connected, Serial0/1/0
C     192.16.0.196/30 is directly connected, Serial0/1/1
L     192.16.0.197/32 is directly connected, Serial0/1/1
```

Uit deze commando's kunnen we duidelijk concluderen dat R3 kan communiseren met router R2.
Maar R1 communiseert met niemand. Dus moeten we opzoek naar de oorzaak hiervan.

Na een lange zoektocht heb ik het probleem kunnen localiseren:

R2

```
Router(config)#router ospf 1
Router(config-router)#network 192.16.0.64 0.0.0.63 area 0
Router(config-router)#network 192.16.0.192 0.0.0.3 area 0
Router(config-router)#network 192.16.0.196 0.0.0.3 area 0
Router(config-router)#exit
```

R3

```
Router(config)#router ospf 1
Router(config-router)#network 192.16.0.128 0.0.0.63 area 0
Router(config-router)#network 192.16.0.196 0.0.0.3 area 0
Router(config-router)#network 192.16.0.200 0.0.0.3 area 0
Router(config-router)#exit
```

Het probleem in het netwerk zit in het omwisselen van 2 netwerken in de configuratie van ospf

Vervolgens ben ik verder gegaan met het testen van het netwerk door gebruik te maken van de commandline van de host computer. Zo wou ik weten of ik overal naar toe kon pingen. Als dit lukte zoun heel het netwerk moeten werken:

Microsoft Windows [Version 6.2.9200]

(c) 2012 Microsoft Corporation. All rights reserved.

C:\Users\Servaes>ping 192.16.0.30

Pinging 192.16.0.30 with 32 bytes of data:

Reply from 192.16.0.30: bytes=32 time=2ms TTL=255

Reply from 192.16.0.30: bytes=32 time<1ms TTL=255

Reply from 192.16.0.30: bytes=32 time=1ms TTL=255

Reply from 192.16.0.30: bytes=32 time<1ms TTL=255

Ping statistics for 192.16.0.30:

    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

    Minimum = 0ms, Maximum = 2ms, Average = 0ms

C:\Users\Servaes>ping 192.16.0.62

Pinging 192.16.0.62 with 32 bytes of data:

Reply from 192.16.0.62: bytes=32 time<1ms TTL=255

Reply from 192.16.0.62: bytes=32 time=1ms TTL=255

Reply from 192.16.0.62: bytes=32 time=1ms TTL=255

Reply from 192.16.0.62: bytes=32 time=1ms TTL=255

Ping statistics for 192.16.0.62:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\Users\Servaes>ping 192.16.0.193

Pinging 192.16.0.193 with 32 bytes of data:

Reply from 192.16.0.193: bytes=32 time=2ms TTL=255

Reply from 192.16.0.193: bytes=32 time<1ms TTL=255

Reply from 192.16.0.193: bytes=32 time<1ms TTL=255

Reply from 192.16.0.193: bytes=32 time=1ms TTL=255

Ping statistics for 192.16.0.193:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

Minimum = 0ms, Maximum = 2ms, Average = 0ms

C:\Users\Servaes>ping 192.16.0.202

Pinging 192.16.0.202 with 32 bytes of data:

Reply from 192.16.0.202: bytes=32 time=1ms TTL=255

Reply from 192.16.0.202: bytes=32 time=1ms TTL=255

Reply from 192.16.0.202: bytes=32 time<1ms TTL=255

Reply from 192.16.0.202: bytes=32 time=1ms TTL=255

Ping statistics for 192.16.0.202:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

   Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\Users\Servaes>ping 192.16.0.201

Pinging 192.16.0.201 with 32 bytes of data:

Reply from 192.16.0.201: bytes=32 time=1ms TTL=254

Reply from 192.16.0.201: bytes=32 time=1ms TTL=254

Reply from 192.16.0.201: bytes=32 time=1ms TTL=254

Reply from 192.16.0.201: bytes=32 time=1ms TTL=254

Ping statistics for 192.16.0.201:

   Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

   Minimum = 1ms, Maximum = 1ms, Average = 1ms

C:\Users\Servaes>ping 192.16.0.94

Pinging 192.16.0.94 with 32 bytes of data:

Reply from 192.16.0.94: bytes=32 time=1ms TTL=254

Reply from 192.16.0.94: bytes=32 time=1ms TTL=254

Reply from 192.16.0.94: bytes=32 time=1ms TTL=254

Reply from 192.16.0.94: bytes=32 time=2ms TTL=254

Ping statistics for 192.16.0.94:

   Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

Minimum = 1ms, Maximum = 2ms, Average = 1ms

C:\Users\Servaes>ping 192.16.0.126

Pinging 192.16.0.126 with 32 bytes of data:

Reply from 192.16.0.126: bytes=32 time=1ms TTL=254

Reply from 192.16.0.126: bytes=32 time=2ms TTL=254

Reply from 192.16.0.126: bytes=32 time=4ms TTL=254

Reply from 192.16.0.126: bytes=32 time=1ms TTL=254

Ping statistics for 192.16.0.126:

   Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

   Minimum = 1ms, Maximum = 4ms, Average = 2ms

C:\Users\Servaes>ping 192.16.0.198

Pinging 192.16.0.198 with 32 bytes of data:

Reply from 192.16.0.198: bytes=32 time=2ms TTL=254

Reply from 192.16.0.198: bytes=32 time=2ms TTL=254

Reply from 192.16.0.198: bytes=32 time=1ms TTL=254

Reply from 192.16.0.198: bytes=32 time=1ms TTL=254

Ping statistics for 192.16.0.198:

   Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

   Minimum = 1ms, Maximum = 2ms, Average = 1ms

C:\Users\Servaes>ping 192.16.0.197

Pinging 192.16.0.197 with 32 bytes of data:

Reply from 192.16.0.197: bytes=32 time=1ms TTL=254

Reply from 192.16.0.197: bytes=32 time=1ms TTL=254

Reply from 192.16.0.197: bytes=32 time=1ms TTL=254

Reply from 192.16.0.197: bytes=32 time=1ms TTL=254

Ping statistics for 192.16.0.197:

    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

    Minimum = 1ms, Maximum = 1ms, Average = 1ms

C:\Users\Servaes>ping 192.16.0.194

Pinging 192.16.0.194 with 32 bytes of data:

Reply from 192.16.0.194: bytes=32 time=1ms TTL=254

Reply from 192.16.0.194: bytes=32 time=1ms TTL=254

Reply from 192.16.0.194: bytes=32 time=1ms TTL=254

Reply from 192.16.0.194: bytes=32 time=1ms TTL=254

Ping statistics for 192.16.0.194:

    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

    Minimum = 1ms, Maximum = 1ms, Average = 1ms

```
C:\Users\Servaes>ping 192.16.0.193


Pinging 192.16.0.193 with 32 bytes of data:

Reply from 192.16.0.193: bytes=32 time<1ms TTL=255

Reply from 192.16.0.193: bytes=32 time=1ms TTL=255

Reply from 192.16.0.193: bytes=32 time=1ms TTL=255

Reply from 192.16.0.193: bytes=32 time<1ms TTL=255


Ping statistics for 192.16.0.193:

    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

    Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

D Ontwerp hetzeflde netwerk IPv6: ipv6-adressering + routing OSPFv3
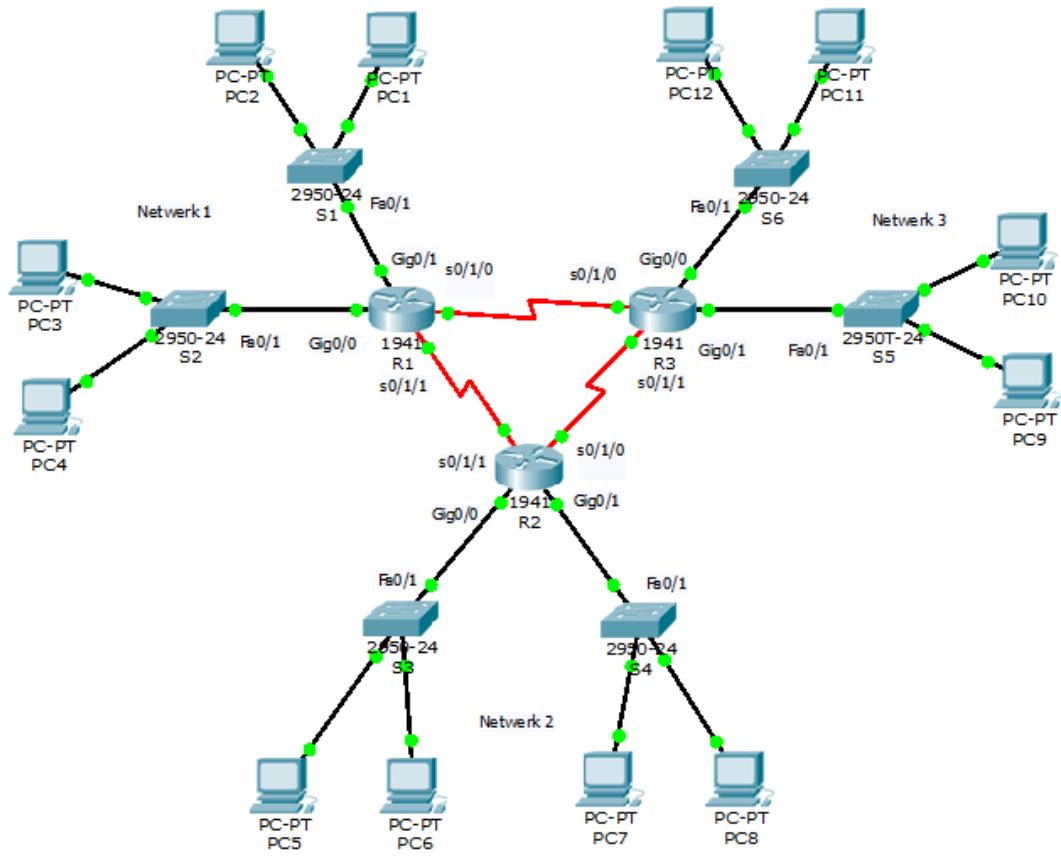
E Beschrijf het IPv6-netwerk

Topology
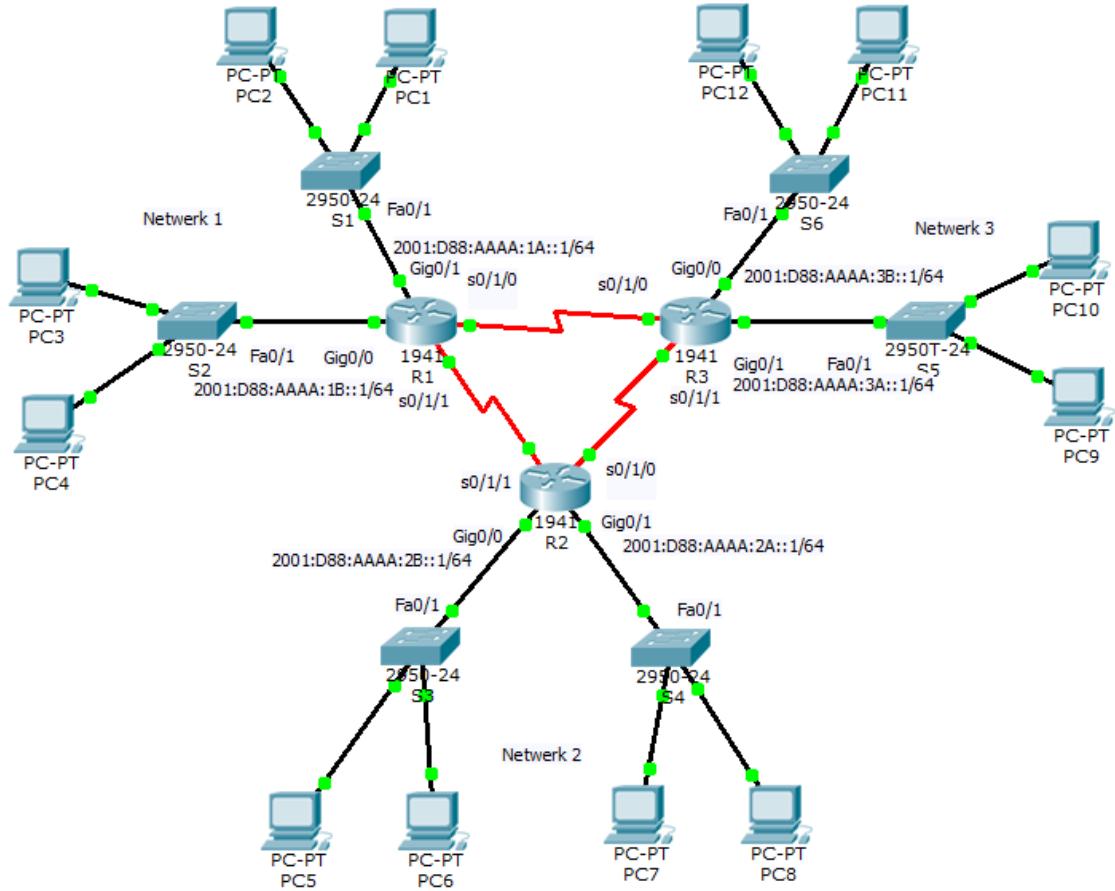
Objectives

- Configureer Link-local adressen
- Test Link-local addressen
- Configureer Global Ipv6 Adressen
- Configureer alle host met Ipv6 Adressen
- Zorg voor OSPFv6

Background

In dit lab kan je zien hoe we Ipv6 en ospfv3 gaan instellen op een al bestaand netwerk.

Required Resources

- 3 routers (Cisco 1841 with Cisco IOS Release 12.4(24)T1 Advanced IP Services or comparable) + HWIC –T2 card (voor serial connections)
- 6 switch (Cisco 2960 with the Cisco IOS Release 12.2(46)SE C2960-LANBASEK9-M image or comparable)
- Serial and Ethernet cables

Step 1: We starten met het reeds geconfigureerde Ipv4 netwerk
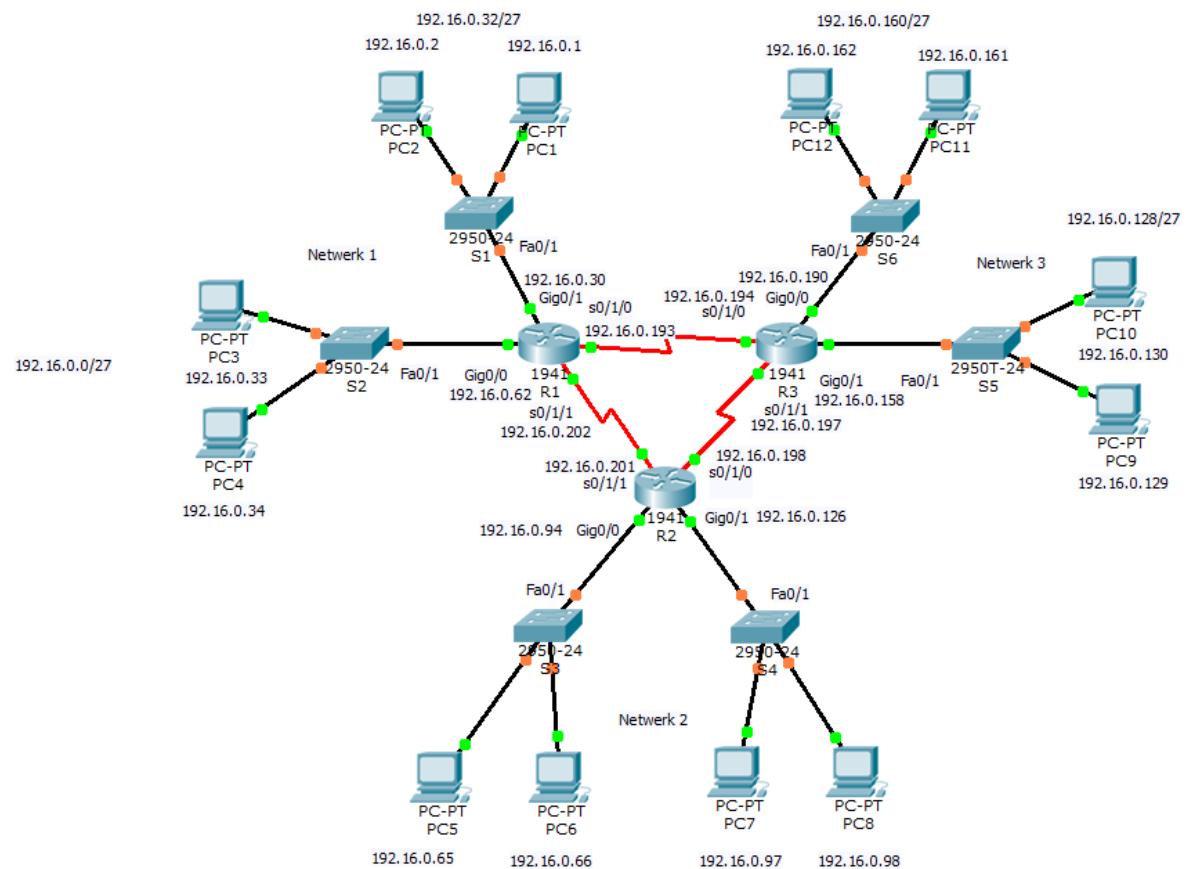
De bedoeling is dat men parallel met dit net werk geconfigureerd met Ipv4 nu ook Ipv6 gaan configureren.

Het is niet nodig om de eerdere configuraties van Ipv4 te verwijderen.

Step 2: Configuratie Local-link adressen

Eerst beginnen we met het enablen van Ipv6 op de routers, dit doet u door volgend commando uit te voeren op alle routers:

Voorbeeld :

    R1

```
R1(config)#ipv6 unicast-routing
```

Configuratie Link-Local adressen :

Voorbeeld:

R1

```
R1(config-if)#int g0/0
R1(config-if)#ipv6 add fe80::1 link-local
```

Als dit met alle poorten van de routers doet verbonden met een subnetwerk geeft dit het volgende resultaat:

R1

```
interface GigabitEthernet0/0
 ip address 192.16.0.62 255.255.255.224
 duplex auto
 speed auto
 ipv6 address FE80::1 link-local
!
interface GigabitEthernet0/1
 ip address 192.16.0.30 255.255.255.224
 duplex auto
 speed auto
 ipv6 address FE80::1 link-local
```

R2

```
interface GigabitEthernet0/0
 ip address 192.16.0.94 255.255.255.224
 duplex auto
 speed auto
 ipv6 address FE80::1 link-local
!
interface GigabitEthernet0/1
 ip address 192.16.0.126 255.255.255.224
 duplex auto
 speed auto
 ipv6 address FE80::1 link-local
```

R3

```
interface GigabitEthernet0/0
 ip address 192.16.0.190 255.255.255.224
 duplex auto
 speed auto
 ipv6 address FE80::1 link-local
!
interface GigabitEthernet0/1
 ip address 192.16.0.158 255.255.255.224
 duplex auto
 speed auto
 ipv6 address FE80::1 link-local
```

Step 3: Testen Local-link adressen

Local-link adressen zjin niet routeble. Dit wilt zeggen dat men nu binnen elk subnetwerk zou moeten kunnen pingen. Dit gaan we dan ook testen.

PC1

```
PC>ping fe80::1

Pinging fe80::1 with 32 bytes of data:


Reply from FE80::1: bytes=32 time=0ms TTL=255

Reply from FE80::1: bytes=32 time=0ms TTL=255

Reply from FE80::1: bytes=32 time=0ms TTL=255

Reply from FE80::1: bytes=32 time=0ms TTL=255


Ping statistics for FE80::1:

    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

Step 4 : adressing schema

Vervolgens gaan we een overzicht maken van hoe we de verdeling van de IPv6 adressen gaan doen. Zo is het bij het configureren van het netwerk veel overzichtelijker.

Register Prefix		ISP Sight Prifix	Subnetwork	Host portion			
2001	D88	AAAA	1A				

subnetwork	1	A
	Router 1	Subnetwerk A

subnetwork	C
	Router

R1	2001:D88:AAAA:1A::/64
	2001:D88:AAAA:1B::/64
R2	2001:D88:AAAA:2A::/64
	2001:D88:AAAA:2B::/64
R3	2001:D88:AAAA:3A::/64
	2001:D88:AAAA:3B::/64
Routers	2001:D88:AAAA:C::1/126
	2001:D88:AAAA:C::2/126
	2001:D88:AAAA:C::5/126
	2001:D88:AAAA:C::6/126
	2001:D88:AAAA:C::9/126
	2001:D88:AAAA:C::A/126

R1
    s0/1/1: ipv6 add
2001:D88:AAAA:C::1/126
    s0/1/0: ipv6 add
2001:D88:AAAA:C::a/126

R2
    s0/1/1: ipv6 add
2001:D88:AAAA:C::2/126
    s0/1/0 : ipv6 add
2001:D88:AAAA:CB::5/126

R3
    s0/1/1: ipv6 add
2001:D88:AAAA:C::6/126
    s0/1/0 : ipv6 add
2001:D88:AAAA:C::9/126

Step 5: Configuratie global IPv6 adressen

R1

```
R1(config-if)#int g0/1

R1(config-if)#ipv6 add 2001:d88:aaaa:001a::1/64

R1(config-if)#int g0/0

R1(config-if)#ipv6 add 2001:d88:aaaa:001b::1/64
```

R2

```
R2(config)#int g0/1

R2(config-if)#ipv6 add 2001:d88:aaaa:2a::1/64

R2(config-if)#int g0/0

R2(config-if)#ipv6 add 2001:d88:aaaa:2b::1/64
```

R3

```
R3(config)#int g0/1

R3(config-if)#ipv6 add 2001:d88:aaaa:3a::1/64

R3(config-if)#int g0/0

R3(config-if)#ipv6 add 2001:d88:aaaa:3b::1/64
```

Step 6 : Configuratie van de IPv6 Adressen op de Computers

We gaan naar het IP configuratie scherm van de computer en zin in het 2de deel van dit scherm Ipv6 configuration staan.
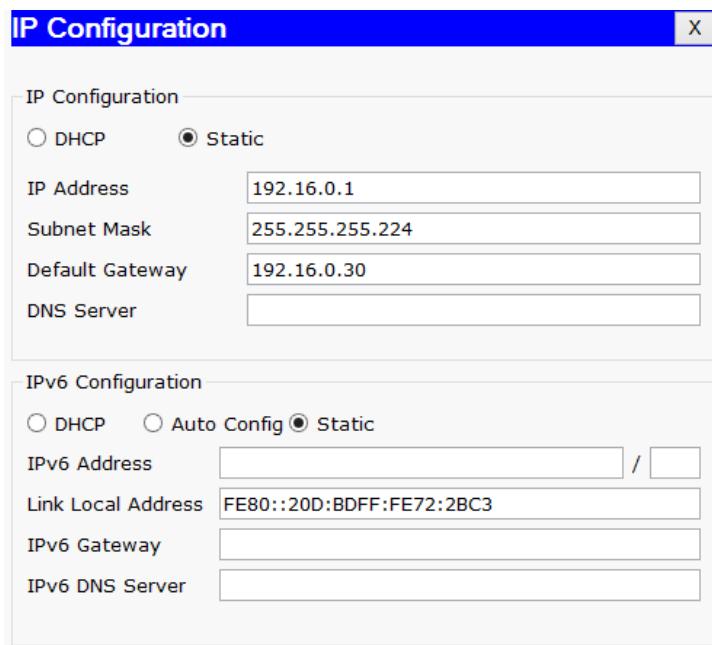
Wanneer men op Auto config drukt zal er op basis van het reeds geconfigureerd Ipv6 adres op de router en het link-local adres een nieuw global ipv6 adres worden gemaakt. Dit gebeurt automatisch, het enige dat men moet doen isn de auto config selecteren.
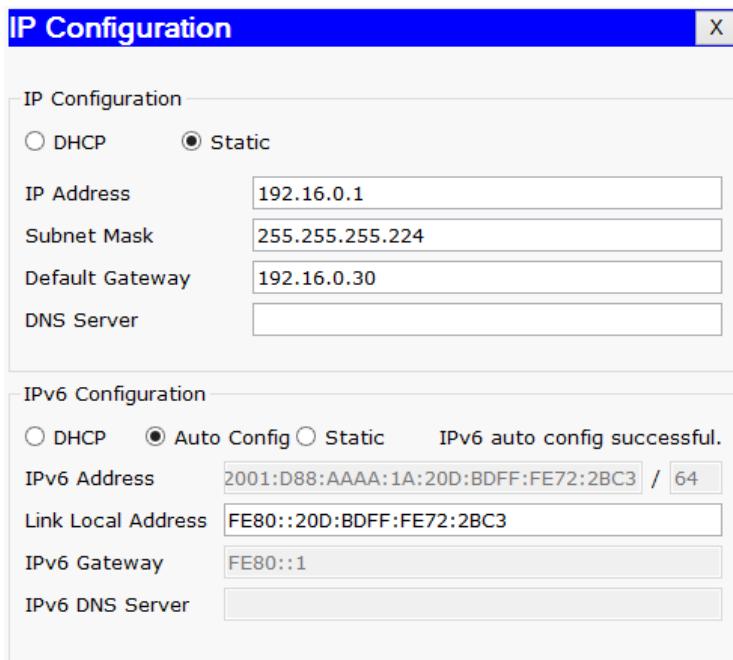
Step 7 : Testen Global ipv6 adressen

PC1

```
PC>ping 2001:d88:aaaa:1b:200:CFF:FE45:7941

Pinging 2001:d88:aaaa:1b:200:CFF:FE45:7941 with 32 bytes of data:

Reply from 2001:D88:AAAA:1B:200:CFF:FE45:7941: bytes=32 time=0ms TTL=127

Reply from 2001:D88:AAAA:1B:200:CFF:FE45:7941: bytes=32 time=0ms TTL=127

Reply from 2001:D88:AAAA:1B:200:CFF:FE45:7941: bytes=32 time=1ms TTL=127

Reply from 2001:D88:AAAA:1B:200:CFF:FE45:7941: bytes=32 time=0ms TTL=127

Ping statistics for 2001:D88:AAAA:1B:200:CFF:FE45:7941:

    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

    Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

PC5

```
PC>ping 2001:d88:aaaa:2a:202:17FF:FECE:319A

Pinging 2001:d88:aaaa:2a:202:17FF:FECE:319A with 32 bytes of data:

Reply from 2001:D88:AAAA:2A:202:17FF:FECE:319A: bytes=32 time=1ms TTL=127

Reply from 2001:D88:AAAA:2A:202:17FF:FECE:319A: bytes=32 time=0ms TTL=127

Reply from 2001:D88:AAAA:2A:202:17FF:FECE:319A: bytes=32 time=0ms TTL=127

Reply from 2001:D88:AAAA:2A:202:17FF:FECE:319A: bytes=32 time=0ms TTL=127

Ping statistics for 2001:D88:AAAA:2A:202:17FF:FECE:319A:

    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

    Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

PC12

```
PC>ping 2001:d88:aaaa:3b:201:64FF:FE51:27E0

Pinging 2001:d88:aaaa:3b:201:64FF:FE51:27E0 with 32 bytes of data:

Reply from 2001:D88:AAAA:3B:201:64FF:FE51:27E0: bytes=32 time=1ms TTL=127

Reply from 2001:D88:AAAA:3B:201:64FF:FE51:27E0: bytes=32 time=0ms TTL=127

Reply from 2001:D88:AAAA:3B:201:64FF:FE51:27E0: bytes=32 time=9ms TTL=127

Reply from 2001:D88:AAAA:3B:201:64FF:FE51:27E0: bytes=32 time=0ms TTL=127

Ping statistics for 2001:D88:AAAA:3B:201:64FF:FE51:27E0:

    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milli-seconds:

    Minimum = 0ms, Maximum = 9ms, Average = 2ms
```

Step 8: Configuratie van OSPF

R1

```
R1(config)#ipv6 router ospf 1
R1(config-rtr)#router-id 1.1.1.1
R1(config-rtr)#exit
R1(config)#int g0/0
R1(config-if)#ipv6 ospf 1 area 0
R1(config-if)#int g0/1
R1(config-if)#ipv6 ospf 1 area 0
R1(config-if)#int s0/1/0
R1(config-if)#ipv6 ospf 1 area 0
R1(config-if)#int s0/1/1
R1(config-if)#ipv6 ospf 1 area 0
R1(config-if)#end
```

R2

```
R2(config)#ipv6 router ospf 2
R2(config-rtr)#router-id 2.2.2.2
R2(config-rtr)#exit
R2(config)#int s0/1/1
R2(config-if)#ipv6 ospf 2 area 0
R2(config-if)#int s0/1/1
12:36:42: %OSPFv3-5-ADJCHG: Process 2, Nbr 1.1.1.1 on Serial0/1/1 from LOADING to FULL,
Loading Done
R2(config-if)#int s0/1/0
R2(config-if)#ipv6 ospf 2 area 0
R2(config-if)#int g0/0
R2(config-if)#ipv6 ospf 2 area 0
R2(config-if)#int g0/1
R2(config-if)#ipv6 ospf 2 area 0
R2(config-if)#end
R2#
%SYS-5-CONFIG_I: Configured from console by console


12:38:45: %OSPFv3-5-ADJCHG: Process 2, Nbr 3.3.3.3 on Serial0/1/0 from LOADING to FULL,
Loading DoneR3
```

R3

R3(config)#ipv6 router ospf 3
R3(config-rtr)#router-id 3.3.3.3
R3(config-rtr)#exit
R3(config)#int s0/1/1
R3(config-if)#ipv6 ospf 3 area 0
R3(config-if)#int s0/1/0
R3(config-if)#ipv6 ospf 3 area 0
12:38:45: %OSPFv3-5-ADJCHG: Process 3, Nbr 2.2.2.2 on Serial0/1/1 from LOADING to FULL, Loading Done
R3(config-if)#int g0/1
12:38:55: %OSPFv3-5-ADJCHG: Process 3, Nbr 1.1.1.1 on Serial0/1/0 from LOADING to FULL, Loading Done
R3(config-if)#ipv6 ospf 3 area 0
R3(config-if)#int g0/0
R3(config-if)#ipv6 ospf 3 area 0
R3(config-if)#end
R3#

Step 9: Testen OSPFv3

2 voorbeelden van het pingen naar de schillende computers om te kijken of ospfv3 werkt:

Ping PC1 – PC9

```
PC>ping 2001:d88:aaaa:3a:2d0:ffff:fe87:7343

Pinging 2001:d88:aaaa:3a:2d0:ffff:fe87:7343 with 32 bytes of data:

Reply from 2001:D88:AAAA:3A:2D0:FFFF:FE87:7343: bytes=32 time=10ms TTL=126
Reply from 2001:D88:AAAA:3A:2D0:FFFF:FE87:7343: bytes=32 time=2ms TTL=126
Reply from 2001:D88:AAAA:3A:2D0:FFFF:FE87:7343: bytes=32 time=1ms TTL=126
Reply from 2001:D88:AAAA:3A:2D0:FFFF:FE87:7343: bytes=32 time=1ms TTL=126

Ping statistics for 2001:D88:AAAA:3A:2D0:FFFF:FE87:7343:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 10ms, Average = 3ms
PC>
```

Ping PC2 – PC8

```
PC>ping 2001:d88:aaaa:2a:202:17ff:feec:41ac

Pinging 2001:d88:aaaa:2a:202:17ff:feec:41ac with 32 bytes of data:

Reply from 2001:D88:AAAA:2A:202:17FF:FEEC:41AC: bytes=32 time=2ms TTL=126
Reply from 2001:D88:AAAA:2A:202:17FF:FEEC:41AC: bytes=32 time=6ms TTL=126
Reply from 2001:D88:AAAA:2A:202:17FF:FEEC:41AC: bytes=32 time=5ms TTL=126
Reply from 2001:D88:AAAA:2A:202:17FF:FEEC:41AC: bytes=32 time=1ms TTL=126

Ping statistics for 2001:D88:AAAA:2A:202:17FF:FEEC:41AC:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 6ms, Average = 3ms

PC>
```

Ook gaan we kijken wat de uitkomsten zijn van het Ipv6 route commando.

R1

```
R1#show ipv6 route

IPv6 Routing Table - 15 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:D88:AAAA:C::/126 [0/0]

    via ::, Serial0/1/1

L   2001:D88:AAAA:C::1/128 [0/0]

    via ::, Serial0/1/1

O   2001:D88:AAAA:C::4/126 [110/128]

    via FE80::201:43FF:FEC9:1301, Serial0/1/0

C   2001:D88:AAAA:C::8/126 [0/0]

    via ::, Serial0/1/0

L   2001:D88:AAAA:C::A/128 [0/0]

    via ::, Serial0/1/0

C   2001:D88:AAAA:1A::/64 [0/0]

    via ::, GigabitEthernet0/1

L   2001:D88:AAAA:1A::1/128 [0/0]

    via ::, GigabitEthernet0/1

C   2001:D88:AAAA:1B::/64 [0/0]

    via ::, GigabitEthernet0/0

L   2001:D88:AAAA:1B::1/128 [0/0]
```

```
        via ::, GigabitEthernet0/0

O   2001:D88:AAAA:2A::/64 [110/65]

      via FE80::201:63FF:FE5D:AB02, Serial0/1/1

O   2001:D88:AAAA:2B::/64 [110/65]

      via FE80::201:63FF:FE5D:AB02, Serial0/1/1

O   2001:D88:AAAA:3A::/64 [110/65]

      via FE80::201:43FF:FEC9:1301, Serial0/1/0

O   2001:D88:AAAA:3B::/64 [110/65]

      via FE80::201:43FF:FEC9:1301, Serial0/1/0

O   2001:D88:AAAA:CB::4/126 [110/128]

      via FE80::201:63FF:FE5D:AB02, Serial0/1/1

L   FF00::/8 [0/0]

      via ::, Null0
```

R2

```
R2#show ipv6 route

IPv6 Routing Table - 15 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:D88:AAAA:C::/126 [0/0]

      via ::, Serial0/1/1

L   2001:D88:AAAA:C::2/128 [0/0]

      via ::, Serial0/1/1

O   2001:D88:AAAA:C::4/126 [110/128]
```

via FE80::201:43FF:FEC9:1302, Serial0/1/0

O   2001:D88:AAAA:C::8/126 [110/128]

   via FE80::1, Serial0/1/1

   via FE80::201:43FF:FEC9:1302, Serial0/1/0

O   2001:D88:AAAA:1A::/64 [110/65]

   via FE80::1, Serial0/1/1

O   2001:D88:AAAA:1B::/64 [110/65]

   via FE80::1, Serial0/1/1

C   2001:D88:AAAA:2A::/64 [0/0]

   via ::, GigabitEthernet0/1

L   2001:D88:AAAA:2A::1/128 [0/0]

   via ::, GigabitEthernet0/1

C   2001:D88:AAAA:2B::/64 [0/0]

   via ::, GigabitEthernet0/0

L   2001:D88:AAAA:2B::1/128 [0/0]

   via ::, GigabitEthernet0/0

O   2001:D88:AAAA:3A::/64 [110/65]

   via FE80::201:43FF:FEC9:1302, Serial0/1/0

O   2001:D88:AAAA:3B::/64 [110/65]

   via FE80::201:43FF:FEC9:1302, Serial0/1/0

C   2001:D88:AAAA:CB::4/126 [0/0]

   via ::, Serial0/1/0

L   2001:D88:AAAA:CB::5/128 [0/0]

   via ::, Serial0/1/0

L   FF00::/8 [0/0]

   via ::, Null0

R3#show ipv6 route

IPv6 Routing Table - 15 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

O 2001:D88:AAAA:C::/126 [110/128]

 via FE80::20C:85FF:FE8C:8301, Serial0/1/0

 via FE80::201:63FF:FE5D:AB01, Serial0/1/1

C 2001:D88:AAAA:C::4/126 [0/0]

 via ::, Serial0/1/1

L 2001:D88:AAAA:C::6/128 [0/0]

 via ::, Serial0/1/1

C 2001:D88:AAAA:C::8/126 [0/0]

 via ::, Serial0/1/0

L 2001:D88:AAAA:C::9/128 [0/0]

 via ::, Serial0/1/0

O 2001:D88:AAAA:1A::/64 [110/65]

 via FE80::20C:85FF:FE8C:8301, Serial0/1/0

O 2001:D88:AAAA:1B::/64 [110/65]

 via FE80::20C:85FF:FE8C:8301, Serial0/1/0

O 2001:D88:AAAA:2A::/64 [110/65]

 via FE80::201:63FF:FE5D:AB01, Serial0/1/1

O 2001:D88:AAAA:2B::/64 [110/65]

```
    via FE80::201:63FF:FE5D:AB01, Serial0/1/1

C   2001:D88:AAAA:3A::/64 [0/0]

    via ::, GigabitEthernet0/1

L   2001:D88:AAAA:3A::1/128 [0/0]

    via ::, GigabitEthernet0/1

C   2001:D88:AAAA:3B::/64 [0/0]

    via ::, GigabitEthernet0/0

L   2001:D88:AAAA:3B::1/128 [0/0]

    via ::, GigabitEthernet0/0

O   2001:D88:AAAA:CB::4/126 [110/128]

    via FE80::201:63FF:FE5D:AB01, Serial0/1/1

L   FF00::/8 [0/0]

    via ::, Null0
```

Hieruit blijfkt dat OSPFv3 juist is geconfigureerd.

Device Configurations

Router R1

```
Building configuration...


Current configuration : 1263 bytes

!

version 15.1

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

!

hostname R1

!

ipv6 unicast-routing

!

license udi pid CISCO1941/K9 sn FTX1524DRFA

!

spanning-tree mode pvst

!

interface GigabitEthernet0/0

 ip address 192.16.0.62 255.255.255.224

 duplex auto

 speed auto

 ipv6 address FE80::1 link-local

 ipv6 address 2001:D88:AAAA:1B::1/64

 ipv6 ospf 1 area 0

!
```

```
interface GigabitEthernet0/1

 ip address 192.16.0.30 255.255.255.224

 duplex auto

 speed auto

 ipv6 address FE80::1 link-local

 ipv6 address 2001:D88:AAAA:1A::1/64

 ipv6 ospf 1 area 0

!
interface Serial0/1/0

 ip address 192.16.0.193 255.255.255.252

 ipv6 address 2001:D88:AAAA:C::A/126

 ipv6 ospf 1 area 0

!
interface Serial0/1/1

 ip address 192.16.0.202 255.255.255.252

 ipv6 address FE80::1 link-local

 ipv6 address 2001:D88:AAAA:C::1/126

 ipv6 ospf 1 area 0

!
interface Vlan1

 no ip address

 shutdown

!
router ospf 1

 log-adjacency-changes

 network 192.16.0.0 0.0.0.63 area 0

 network 192.16.0.192 0.0.0.3 area 0
```

```
 network 192.16.0.200 0.0.0.3 area 0
!
ipv6 router ospf 1
 router-id 1.1.1.1
 log-adjacency-changes
!
ip classless
!
line con 0
!
line aux 0
!
line vty 0 4
 login
!
end
```

Router R2

```
Building configuration...

Current configuration : 1271 bytes
!
version 15.1
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname R2
!
ipv6 unicast-routing
!
license udi pid CISCO1941/K9 sn FTX1524V7VF
!
spanning-tree mode pvst
!
interface GigabitEthernet0/0
 ip address 192.16.0.94 255.255.255.224
 duplex auto
 speed auto
 ipv6 address FE80::1 link-local
 ipv6 address 2001:D88:AAAA:2B::1/64
 ipv6 ospf 2 area 0
!
```

```
interface GigabitEthernet0/1

 ip address 192.16.0.126 255.255.255.224

 duplex auto

 speed auto

 ipv6 address FE80::1 link-local

 ipv6 address 2001:D88:AAAA:2A::1/64

 ipv6 ospf 2 area 0

!

interface Serial0/1/0

 ip address 192.16.0.198 255.255.255.252

 ipv6 address 2001:D88:AAAA:CB::5/126

 ipv6 ospf 2 area 0

!

interface Serial0/1/1

 ip address 192.16.0.201 255.255.255.252

 ipv6 address 2001:D88:AAAA:C::2/126

 ipv6 ospf 2 area 0

!

interface Vlan1

 no ip address

 shutdown

!

router ospf 1

 log-adjacency-changes

 network 192.16.0.64 0.0.0.63 area 0

 network 192.16.0.196 0.0.0.3 area 0

 network 192.16.0.192 0.0.0.63 area 0
```

```
!
ipv6 router ospf 2
 router-id 2.2.2.2
 log-adjacency-changes
!
ip classless
!
line con 0
!
line aux 0
!
line vty 0 4
 login
!
end
```

Router R3

```
Building configuration...


Current configuration : 1206 bytes

!

version 15.1

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

!

hostname R3

!

ipv6 unicast-routing

!

license udi pid CISCO1941/K9 sn FTX15247Y3C

!

spanning-tree mode pvst

!

interface GigabitEthernet0/0

 ip address 192.16.0.190 255.255.255.224

 duplex auto

 speed auto

 ipv6 address 2001:D88:AAAA:3B::1/64

 ipv6 ospf 3 area 0

!

interface GigabitEthernet0/1
```

```
 ip address 192.16.0.158 255.255.255.224

 duplex auto

 speed auto

 ipv6 address 2001:D88:AAAA:3A::1/64

 ipv6 ospf 3 area 0

!
interface Serial0/1/0

 ip address 192.16.0.194 255.255.255.252

 ipv6 address 2001:D88:AAAA:C::9/126

 ipv6 ospf 3 area 0

!
interface Serial0/1/1

 ip address 192.16.0.197 255.255.255.252

 ipv6 address 2001:D88:AAAA:C::6/126

 ipv6 ospf 3 area 0

!
interface Vlan1

 no ip address

 shutdown

!
router ospf 1

 log-adjacency-changes

 network 192.16.0.128 0.0.0.63 area 0

 network 192.16.0.196 0.0.0.3 area 0

 network 192.16.0.200 0.0.0.3 area 0

 network 192.16.0.192 0.0.0.63 area 0

!
```

```
ipv6 router ospf 3

 router-id 3.3.3.3

 log-adjacency-changes

!

ip classless

!

line con 0

!

line aux 0

!

line vty 0 4

 login

!

end
```

F Maak een prototype van het netwerk (in het Cisco lab) en laat dit evalueren

Topology

Objectives

- Configureer Link-local adressen
- Test Link-local addressen
- Configureer Global Ipv6 Adressen
- Configureer alle host met Ipv6 Adressen
- Zorg voor OSPFv6

Background

In dit lab kan je zien hoe we Ipv6 en ospfv3 gaan instellen op een al bestaand netwerk.

Required Resources

- 3 routers (Cisco 1841 with Cisco IOS Release 12.4(24)T1 Advanced IP Services or comparable) + HWIC –T2 card (voor serial connections)
- 6 switch (Cisco 2960 with the Cisco IOS Release 12.2(46)SE C2960-LANBASEK9-M image or comparable)
- Serial and Ethernet cables

Step 1: Installatie van de routers, switches en hosts

Sluit de routers aan met serial kabels zoals te zien in de topologie. Zorg er ook voor dat de oude configuratie van de routers verwijderd worden.

Bij het installeren van de routers mag er zeker niet vergeten worden om een HWIC-T2 kaart toe te voegen. Wanneer men deze kaart wilt toevoegen aan het toestel mag men niet vergeten de stroom uit te schakelen. Anders kan het zijn dat het apparaat beschadigd word !

Net zoals we gedaan hebben bij de routers gaan we de switches gaan aansluiten samen met de hosts. Hierbij kijken we opnieuw naar de topologie.

Om al de apparatuur te configureren zorgen we dat er console kabels worden aangesloten die ons toegang geven tot de command line van de apparatuur.
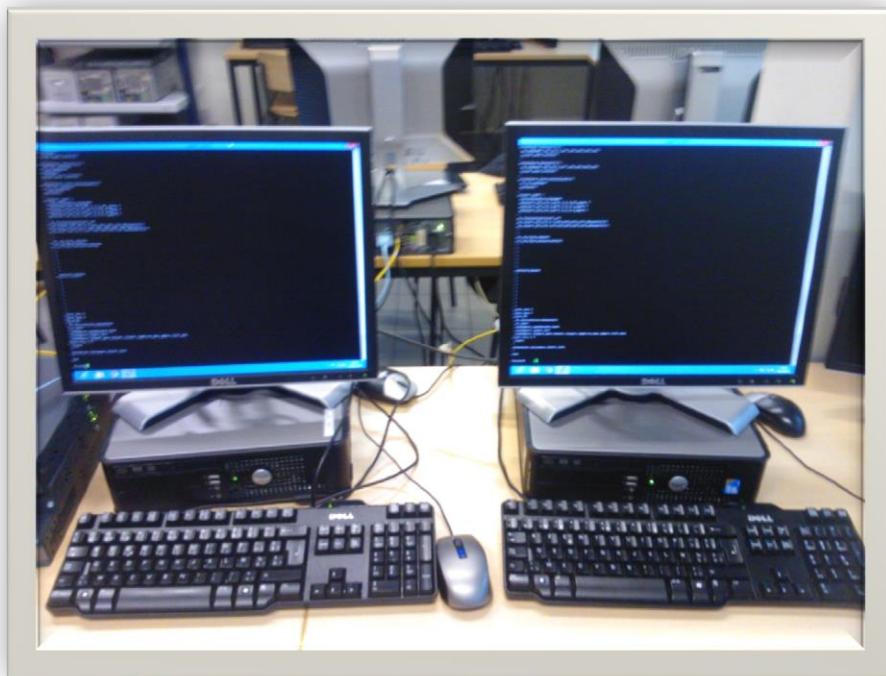
deze foto's kan je duidelijk de routers zien met de 2 aangesloten switches.

Op volgende foto kan u een algemeen overzicht zien:
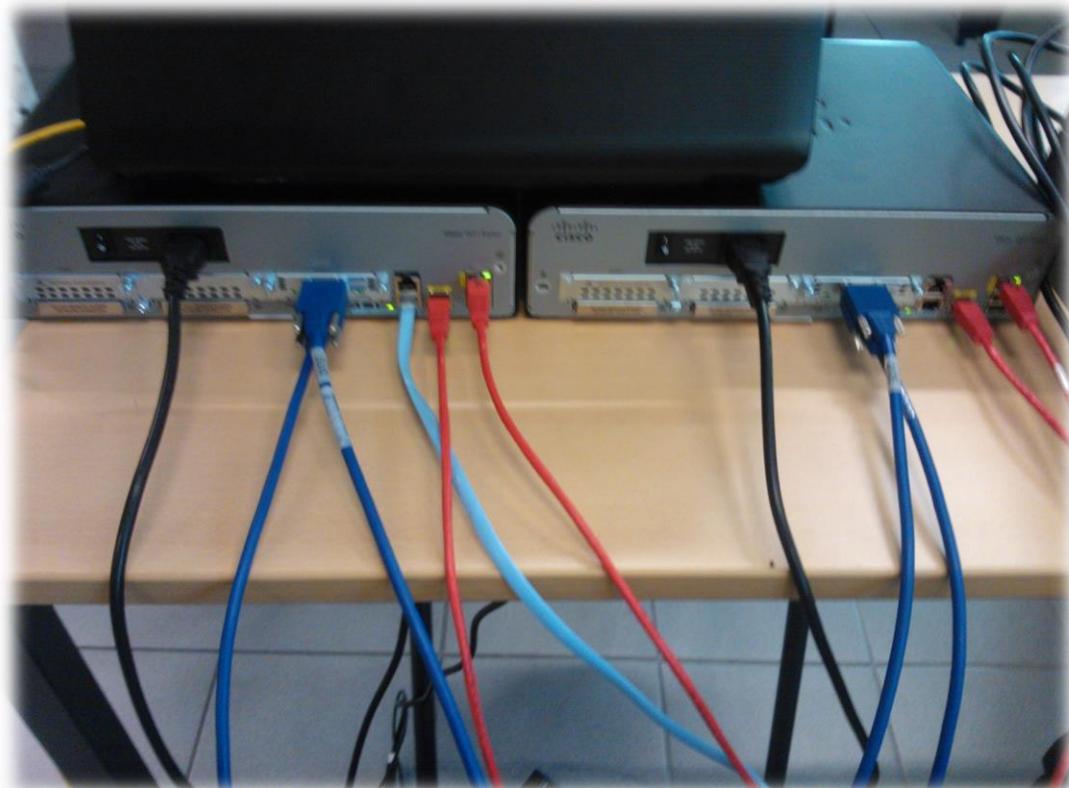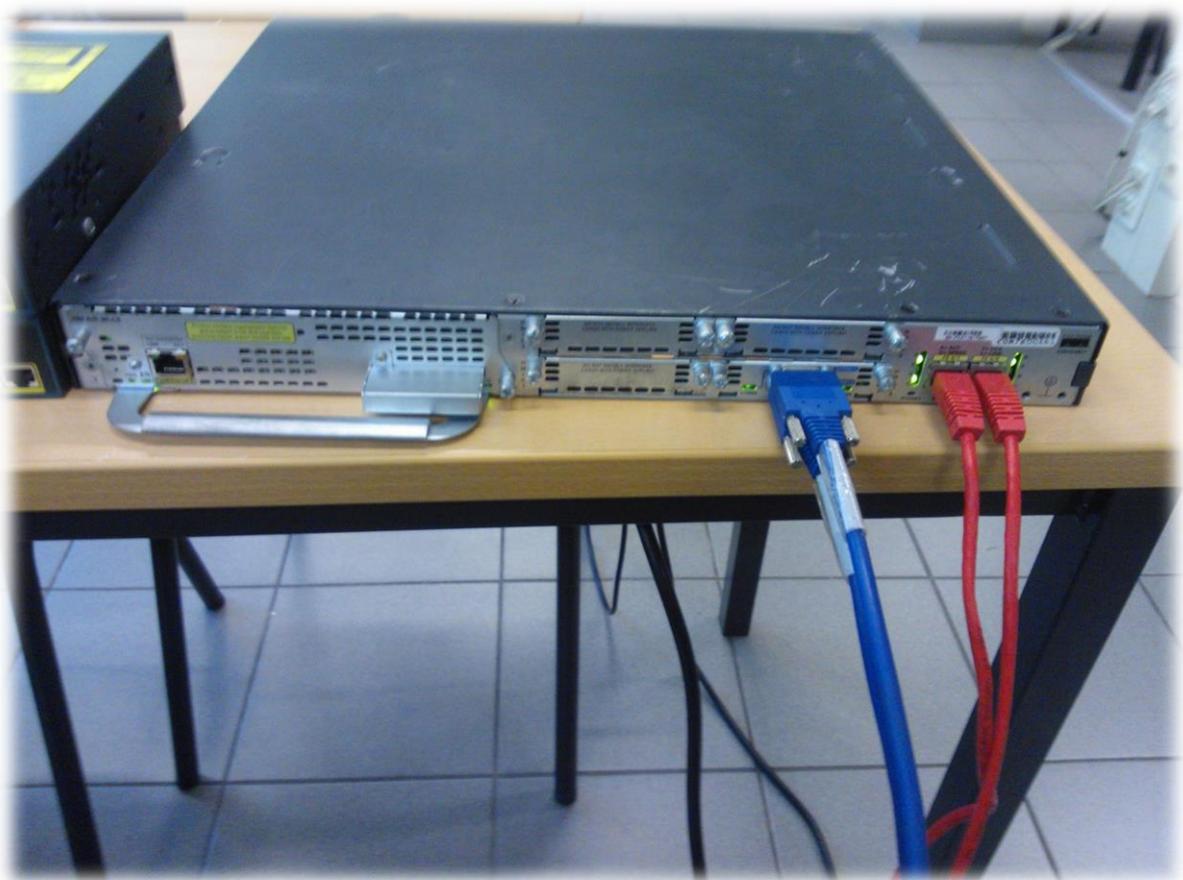
Step 2: configuratie Interface van de routers

R1

```
Router#conf t

Enter configuration commands, one per line.  End with CNTL/Z.

Router(config)#ipv6 unicast-routing

Router(config)#int g0/0

Router(config-if)#ipv6 add fe80::1 link-local

Router(config-if)#ipv6 add 2001:d88:aaaa:1b::1/64

Router(config-if)#exit

Router(config)#ipv6 router ospf 1

Router(config-rtr)#

Jan 13 12:52:03.635: %OSPFv3-4-NORTRID: OSPFv3 process 1 could not pick a router-id, please
configure manually

Router(config-rtr)#router-id 1.1.1.1

Router(config-rtr)#exit

Router(config)#int g0/0

Router(config-if)#ipv6 ospf 1 area 0

Router(config-if)#exit

Router(config)#int g0/1

Router(config-if)#ipv6 add fe80::1 link-local

Router(config-if)#ipv6 add 2001:d88:aaaa:1a::1/64

Router(config-if)#ipv6 ospf 1 area 0

Router(config-if)#int s0/0/1

Router(config-if)#ipv6 add fe80::1 link-local

Router(config-if)#

Router(config-if)#ipv6 ospf 1 area 0

Router(config-if)#exit
```

```
Router(config)#int s0/0/0

Router(config-if)#ipv6 add fe80::2 link-local

Router(config-if)#ipv6 ospf 1 area 0

Router(config)#int s0/0/1

Router(config-if)#en

Router(config-if)#encapsulation ppp

Router(config-if)#ppp authentication chap

Router(config-if)#end

Jan 13 12:58:59.211: %SYS-5-CONFIG_I: Configured from console by console

Router#conf t

Enter configuration commands, one per line.  End with CNTL/Z.

Router(config)#host

Router(config)#hostname R1

R1(config)#int s0/0/0

R1(config-if)#encapsulation ppp

R1(config-if)#ppp authentication chap

R1(config-if)#end

R1#

R1#conf t

Enter configuration commands, one per line.  End with CNTL/Z.

R1(config)#username R2 password cisco

R1(config)#username R3 password cisco

R1(config)#end
```

R2

```
Router>

Router>enable

Router#conf t

Enter configuration commands, one per line.  End with CNTL/Z.

Router(config)#host

Router(config)#hostname R2

R2(config)#ipv6 unicast-routing

R2(config)#int s0/0/1

R2(config-if)#ipv6 add fe80::2 link-local

R2(config-if)#exit

R2(config)#ipv6 router ospf 1

R2(config-rtr)#

Jan 13 14:14:01.619: %OSPFv3-4-NORTRID: OSPFv3 process 1 could not pick a router-id, please
configure manually

R2(config-rtr)#router-id 2.2.2.2

R2(config-rtr)#exit

R2(config)#int s0/0/1

R2(config-if)#ipv6 ospf 1 area 0

R2(config-if)#exit

R2(config)#int g0/0

R2(config-if)#ipv6 add fe80::1 link-local

R2(config-if)#ipv6 add 2001:d88:aaaa:2b::1/64

R2(config-if)#ipv6 ospf 1 area 0

R2(config-if)#int g0/1

R2(config-if)#ipv6 add fe80::1 link-local

R2(config-if)#ipv6 add 2001:d88:aaaa:2a::1/64

R2(config-if)#ipv6 ospf 1 area 0
```

```
R2(config-if)#int s0/0/0

R2(config-if)#ipv6 add fe80::1 link-local

R2(config-if)#encap

R2(config-if)#encapsulation ppp

R2(config-if)#ppp authe

R2(config-if)#ppp authentication chap

R2(config-if)#ipv6 ospf 1 area 0

R2(config-if)#exit

R2(config)#int s0/0/1

R2(config-if)#encap

R2(config-if)#encapsulation ppp

R2(config-if)#ppp auth

R2(config-if)#ppp authen

R2(config-if)#ppp authentication chap

R2(config-if)#exit

R2(config)#username R1 password cisco

R2(config)#username R3 password cisco
```

R3

```
Router#conf t

Enter configuration commands, one per line.  End with CNTL/Z.

Router(config)#ipv6 unicast-routing

Router(config)#int s0/0/0

Router(config-if)#ipv6 add fe80::1 link-local

Router(config-if)#exit

Router(config)#ipv6 router ospf 1

Router(config-rtr)#

*Jan 13 15:54:30.887: %OSPFv3-4-NORTRID: OSPFv3 process 1 could not pick a router-id,

please configure manuallyrouter-id 3.3.3.3

Router(config-rtr)#exit

Router(config)#hostname R3

R3(config)#int s0/0/0

R3(config-if)#ipv6 ospf 1 area 0

R3(config-if)#no shut

R3(config-if)#exi

*Jan 13 15:55:06.975: %LINK-3-UPDOWN: Interface Serial0/0/0, changed state to up

*Jan 13 15:55:07.975: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed
state to upt

R3(config)#int s0/0/1

R3(config-if)#ipv6 add fe80::2 link-local

R3(config-if)#ipv6

*Jan 13 15:55:29.899: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed
state to

R3(config-if)#ipv6 ospf 1 area 0

R3(config-if)#no shut

R3(config-if)#exit
```

```
R3(config)#

*Jan 13 15:55:51.263: %LINK-3-UPDOWN: Interface Serial0/0/1, changed state to up

*Jan 13 15:55:52.263: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed
state to up

R3(config)#int f0/1

*Jan 13 15:56:19.911: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed
state to

R3(config-if)#ipv6 add fe80::1 link-local

R3(config-if)#ipv6 add 2001:d88:aaaa:3a::1/64

R3(config-if)#ipv6 ospf 1 area 0

R3(config-if)#no shut

*Jan 13 15:57:13.215: %LINK-3-UPDOWN: Interface FastEthernet0/1, changed state to up

*Jan 13 15:57:14.215: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1,
changed state to u

R3(config-if)#int f0/0

R3(config-if)#ipv6 fe80::1 link-local

R3(config-if)#ipv6 add fe80::1 link-local

R3(config-if)#ipv6 add 2001:d88:aaaa:3b::1/64

R3(config-if)#ipv6 ospf 1 area 0

R3(config-if)#no shut

R3(config-if)#

*Jan 13 15:58:24.863: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up

*Jan 13 15:58:25.863: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0,
changed state to up

R3(config-if)#exit

R3(config)#username R1 password cisco

R3(config)#username R2 password cisco

R3(config)#int s0/0/1

R3(config-if)#encapsulation ppp
```

```
R3(config-if)#ppp authentication

*Jan 13 15:59:14.523: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed
state to upchap

R3(config-if)#ppp authentication chap

R3(config-if)#exit

R3(config)#int s0/0/0

R3(config-if)#encap

R3(config-if)#encapsulation ppp

*Jan 13 15:59:44.707: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed
state to up

R3(config-if)#ppp authentication chap
```

Step 3 : Testen van het network

Bij het bekijken van het netwerk was er iets dat opviel, ospfv3 is geconfigureerd op R3 maar er is niets van te zien in de show ipv6 route.

Show ipv6 route van R3 :

R3#show ipv6 route

IPv6 Routing Table - default - 9 entries

Codes: C - Connected, L - Local, S - Static, U - Per-user Static route

    B - BGP, R - RIP, I1 - ISIS L1, I2 - ISIS L2

    IA - ISIS interarea, IS - ISIS summary, D - EIGRP, EX - EIGRP external

    ND - Neighbor Discovery, l - LISP

    O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2

    ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2

C   2001:D88:AAAA:3A::/64 [0/0]

    via GigabitEthernet0/1, directly connected

L   2001:D88:AAAA:3A::1/128 [0/0]

    via GigabitEthernet0/1, receive

C   2001:D88:AAAA:3B::/64 [0/0]

    via GigabitEthernet0/0, directly connected

L   2001:D88:AAAA:3B::1/128 [0/0]

    via GigabitEthernet0/0, receive

L   FF00::/8 [0/0]

    via Null0, receive

Na lang zoeken naar de oorzaak heb ik de oplossing niet gevonden. Daarom heb ik beslist om een andere router te configureren om te kijken of het niet aan het toestel ligt.

Configuratie van router 3 :

```
Router(config)#host R3

R3(config)#username R1 password cisco

R3(config)#username R2 password cisco

R3(config)#ipv6 router ospf 1

% IPv6 routing not enabled

R3(config)#ipv6 unicast-routing

R3(config)#ipv6 router ospf 1

R3(config-rtr)#

Jan 13 16:08:24.543: %OSPFv3-4-NORTRID: OSPFv3 process 1 could not pick a router-id, please
configure manually

R3(config-rtr)#router-id 3.3.3.3

R3(config-rtr)#int s0/0/0

R3(config-if)#ipv6 add fe80::1 link-local

R3(config-if)#en

R3(config-if)#encapsulation ppp

R3(config-if)#ppp auth

R3(config-if)#ppp authen

R3(config-if)#ppp authentication chap

R3(config-if)#ipv6 ospf 1 area 0

R3(config-if)#no shut

R3(config-if)#

Jan 13 16:10:02.643: %LINK-3-UPDOWN: Interface Serial0/0/0, changed state to up

Jan 13 16:10:02.699: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed
state to up

Jan 13 16:10:02.707: %OSPFv3-5-ADJCHG: Process 1, Nbr 1.1.1.1 on Serial0/0/0 from LOADING to
FULL, Loading Done
```

```
R3(config-if)#int s0/0/1

R3(config-if)#ipv6 add fe80::2 link-local

R3(config-if)#en

R3(config-if)#encapsulation ppp

R3(config-if)#ppp auth

R3(config-if)#ppp authen

R3(config-if)#ppp authentication chap

R3(config-if)#ipv6 ospf 1 area 0

R3(config-if)#no shut

R3(config-if)#

Jan 13 16:11:14.643: %LINK-3-UPDOWN: Interface Serial0/0/1, changed state to up

Jan 13 16:11:14.679: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed
state to up

Jan 13 16:11:14.795: %OSPFv3-5-ADJCHG: Process 1, Nbr 2.2.2.2 on Serial0/0/1 from LOADING to
FULL, Loading Done

R3(config-if)#int g0/0

R3(config-if)#ipv6 add fe80::1 link-local

R3(config-if)#ipv6 add 2001:d88:aaaa:3b::1/64

R3(config-if)#ipv6 ospf 1 area 0

R3(config-if)#no shut

R3(config-if)#

Jan 13 16:12:58.559: %LINK-3-UPDOWN: Interface GigabitEthernet0/0, changed state to down

Jan 13 16:13:01.571: %LINK-3-UPDOWN: Interface GigabitEthernet0/0, changed state to up

Jan 13 16:13:02.571: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0,
changed state to up

R3(config-if)#int g0/1

R3(config-if)#ipv6 add fe80::1 link-local

R3(config-if)#ipv6 add 2001:d88:aaaa:3a::1/64
```

R3(config-if)#ipv6 ospf 1 area 0

R3(config-if)#no shut

R3(config-if)#

Jan 13 16:14:42.759: %LINK-3-UPDOWN: Interface GigabitEthernet0/1, changed state to down

Jan 13 16:14:46.571: %LINK-3-UPDOWN: Interface GigabitEthernet0/1, changed state to up

Jan 13 16:14:47.571: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to up

Na deze configuratie valt er geen probleem meer te vinden.

Show ipv6 route

R1

R1#show ipv6 route

IPv6 Routing Table - default - 9 entries

Codes: C - Connected, L - Local, S - Static, U - Per-user Static route

    B - BGP, R - RIP, I1 - ISIS L1, I2 - ISIS L2

    IA - ISIS interarea, IS - ISIS summary, D - EIGRP, EX - EIGRP external

    ND - Neighbor Discovery, l - LISP

    O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2

    ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2

C   2001:D88:AAAA:1A::/64 [0/0]

    via GigabitEthernet0/1, directly connected

L   2001:D88:AAAA:1A::1/128 [0/0]

    via GigabitEthernet0/1, receive

C   2001:D88:AAAA:1B::/64 [0/0]

    via GigabitEthernet0/0, directly connected

L   2001:D88:AAAA:1B::1/128 [0/0]

    via GigabitEthernet0/0, receive

O   2001:D88:AAAA:2A::/64 [110/65]

```
   via FE80::2, Serial0/0/1

O  2001:D88:AAAA:2B::/64 [110/65]

   via FE80::2, Serial0/0/1

O  2001:D88:AAAA:3A::/64 [110/65]

   via FE80::1, Serial0/0/0

O  2001:D88:AAAA:3B::/64 [110/65]

   via FE80::1, Serial0/0/0

L  FF00::/8 [0/0]

   via Null0, receive
```

R2

```
R2(config)#do show ipv6 route

IPv6 Routing Table - default - 9 entries

Codes: C - Connected, L - Local, S - Static, U - Per-user Static route

    B - BGP, R - RIP, I1 - ISIS L1, I2 - ISIS L2

    IA - ISIS interarea, IS - ISIS summary, D - EIGRP, EX - EIGRP external

    ND - Neighbor Discovery, l - LISP

    O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2

    ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2

O  2001:D88:AAAA:1A::/64 [110/65]

   via FE80::1, Serial0/0/1

O  2001:D88:AAAA:1B::/64 [110/65]

   via FE80::1, Serial0/0/1

C  2001:D88:AAAA:2A::/64 [0/0]

   via GigabitEthernet0/1, directly connected

L  2001:D88:AAAA:2A::1/128 [0/0]

   via GigabitEthernet0/1, receive
```

```
C   2001:D88:AAAA:2B::/64 [0/0]

    via GigabitEthernet0/0, directly connected

L   2001:D88:AAAA:2B::1/128 [0/0]

    via GigabitEthernet0/0, receive

O   2001:D88:AAAA:3A::/64 [110/65]

    via FE80::2, Serial0/0/0

O   2001:D88:AAAA:3B::/64 [110/65]

    via FE80::2, Serial0/0/0

L   FF00::/8 [0/0]

    via Null0, receive
```

R3

```
R3#show ipv6 route

IPv6 Routing Table - default - 9 entries

Codes: C - Connected, L - Local, S - Static, U - Per-user Static route

    B - BGP, R - RIP, I1 - ISIS L1, I2 - ISIS L2

    IA - ISIS interarea, IS - ISIS summary, D - EIGRP, EX - EIGRP external

    ND - Neighbor Discovery, l - LISP

    O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2

    ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2

O   2001:D88:AAAA:1A::/64 [110/65]

    via FE80::2, Serial0/0/0

O   2001:D88:AAAA:1B::/64 [110/65]

    via FE80::2, Serial0/0/0

O   2001:D88:AAAA:2A::/64 [110/65]

    via FE80::1, Serial0/0/1
```

O   2001:D88:AAAA:2B::/64 [110/65]

    via FE80::1, Serial0/0/1

C   2001:D88:AAAA:3A::/64 [0/0]

    via GigabitEthernet0/1, directly connected

L   2001:D88:AAAA:3A::1/128 [0/0]

    via GigabitEthernet0/1, receive

C   2001:D88:AAAA:3B::/64 [0/0]

    via GigabitEthernet0/0, directly connected

L   2001:D88:AAAA:3B::1/128 [0/0]

    via GigabitEthernet0/0, receive

L   FF00::/8 [0/0]

    via Null0, receive

Device configurations

R1

```
R1#show run

Building configuration...


Current configuration : 1650 bytes

!

! Last configuration change at 15:11:02 UTC Mon Jan 13 2014

version 15.1

service timestamps debug datetime msec

service timestamps log datetime msec

no service password-encryption

!

hostname R1

!

boot-start-marker

boot-end-marker

!

no aaa new-model

!

ipv6 unicast-routing

ipv6 cef

ip source-route

ip cef

!

multilink bundle-name authenticated

!
```

```
crypto pki token default removal timeout 0
!
license udi pid CISCO1941/K9 sn FGL170310BH
!
username R2 password 0 cisco
username R3 password 0 cisco
!
redundancy
!
interface Embedded-Service-Engine0/0
 no ip address
 shutdown
!
interface GigabitEthernet0/0
 no ip address
 duplex auto
 speed auto
 ipv6 address FE80::1 link-local
 ipv6 address 2001:D88:AAAA:1B::1/64
 ipv6 ospf 1 area 0
!
interface GigabitEthernet0/1
 no ip address
 duplex auto
 speed auto
 ipv6 address FE80::1 link-local
 ipv6 address 2001:D88:AAAA:1A::1/64
```

```
 ipv6 ospf 1 area 0

!

interface Serial0/0/0

 no ip address

 encapsulation ppp

 ipv6 address FE80::2 link-local

 ipv6 ospf 1 area 0

 no fair-queue

 ppp authentication chap

 clock rate 115200

!

interface Serial0/0/1

 no ip address

 encapsulation ppp

 ipv6 address FE80::1 link-local

 ipv6 ospf 1 area 0

 ppp authentication chap

!

ip forward-protocol nd

!

no ip http server

no ip http secure-server

!

ipv6 router ospf 1

 router-id 1.1.1.1

!

control-plane
```

```
!

!

!

line con 0

line aux 0

line 2

 no activation-character

 no exec

 transport preferred none

 transport input all

 transport output pad telnet rlogin lapb-ta mop udptn v120 ssh

 stopbits 1

line vty 0 4

 login

 transport input all

!

scheduler allocate 20000 1000

end
```

R2

```
R2#show run

Building configuration...


Current configuration : 1669 bytes

!

! Last configuration change at 16:18:05 UTC Mon Jan 13 2014

version 15.1

service timestamps debug datetime msec

service timestamps log datetime msec

no service password-encryption

!

hostname R2

!

boot-start-marker

boot-end-marker

!

no aaa new-model

!

ipv6 unicast-routing

ipv6 cef

ip source-route

ip cef

!

multilink bundle-name authenticated

!

crypto pki token default removal timeout 0
```

```
!
license udi pid CISCO1941/K9 sn FGL170310BM
!
username R1 password 0 cisco
username R3 password 0 cisco
!
redundancy
!
interface Embedded-Service-Engine0/0
 no ip address
 shutdown
!
interface GigabitEthernet0/0
 no ip address
 duplex auto
 speed auto
 ipv6 address FE80::1 link-local
 ipv6 address 2001:D88:AAAA:2B::1/64
 ipv6 ospf 1 area 0
!
interface GigabitEthernet0/1
 no ip address
 duplex auto
 speed auto
 ipv6 address FE80::1 link-local
 ipv6 address 2001:D88:AAAA:2A::1/64
 ipv6 ospf 1 area 0
```

```
!
interface Serial0/0/0

 no ip address

 encapsulation ppp

 ipv6 address FE80::1 link-local

 ipv6 ospf 1 area 0

 no fair-queue

 ppp authentication chap

 clock rate 115200

!
interface Serial0/0/1

 no ip address

 encapsulation ppp

 ipv6 address FE80::2 link-local

 ipv6 ospf 1 area 0

 ppp authentication chap

 clock rate 115200

!
ip forward-protocol nd

!
no ip http server

no ip http secure-server

!
!
ipv6 router ospf 1

 router-id 2.2.2.2

!
```

```
!
control-plane
!
line con 0
line aux 0
line 2
 no activation-character
 no exec
 transport preferred none
 transport input all
 transport output pad telnet rlogin lapb-ta mop udptn v120 ssh
 stopbits 1
line vty 0 4
 login
 transport input all
!
scheduler allocate 20000 1000
end
```

R3

```
R3#show run

Building configuration...


Current configuration : 1672 bytes

!

! Last configuration change at 16:15:09 UTC Mon Jan 13 2014

version 15.1

service timestamps debug datetime msec

service timestamps log datetime msec

no service password-encryption

!

hostname R3

!

boot-start-marker

boot-end-marker

!

no aaa new-model

!

ipv6 unicast-routing

ipv6 cef

ip source-route

ip cef

!

multilink bundle-name authenticated

!

crypto pki token default removal timeout 0
```

```
!
license udi pid CISCO1941/K9 sn FCZ1651939Q
license boot module c1900 technology-package securityk9
!
username R1 password 0 cisco
username R2 password 0 cisco
!
redundancy
!
interface Embedded-Service-Engine0/0
 no ip address
 shutdown
!
interface GigabitEthernet0/0
 no ip address
 duplex auto
 speed auto
 ipv6 address FE80::1 link-local
 ipv6 address 2001:D88:AAAA:3B::1/64
 ipv6 ospf 1 area 0
!
interface GigabitEthernet0/1
 no ip address
 duplex auto
 speed auto
 ipv6 address FE80::1 link-local
 ipv6 address 2001:D88:AAAA:3A::1/64
```

```
 ipv6 ospf 1 area 0

!

interface Serial0/0/0

 no ip address

 encapsulation ppp

 ipv6 address FE80::1 link-local

 ipv6 ospf 1 area 0

 ppp authentication chap

!

interface Serial0/0/1

 no ip address

 encapsulation ppp

 ipv6 address FE80::2 link-local

 ipv6 ospf 1 area 0

 ppp authentication chap

!

ip forward-protocol nd

!

no ip http server

no ip http secure-server

!

ipv6 router ospf 1

 router-id 3.3.3.3

!

control-plane

!

line con 0
```

```
line aux 0

line 2

 no activation-character

 no exec

 transport preferred none

 transport input all

 transport output pad telnet rlogin lapb-ta mop udptn v120 ssh

 stopbits 1

line vty 0 4

 login

 transport input all

!

scheduler allocate 20000 1000

end
```