

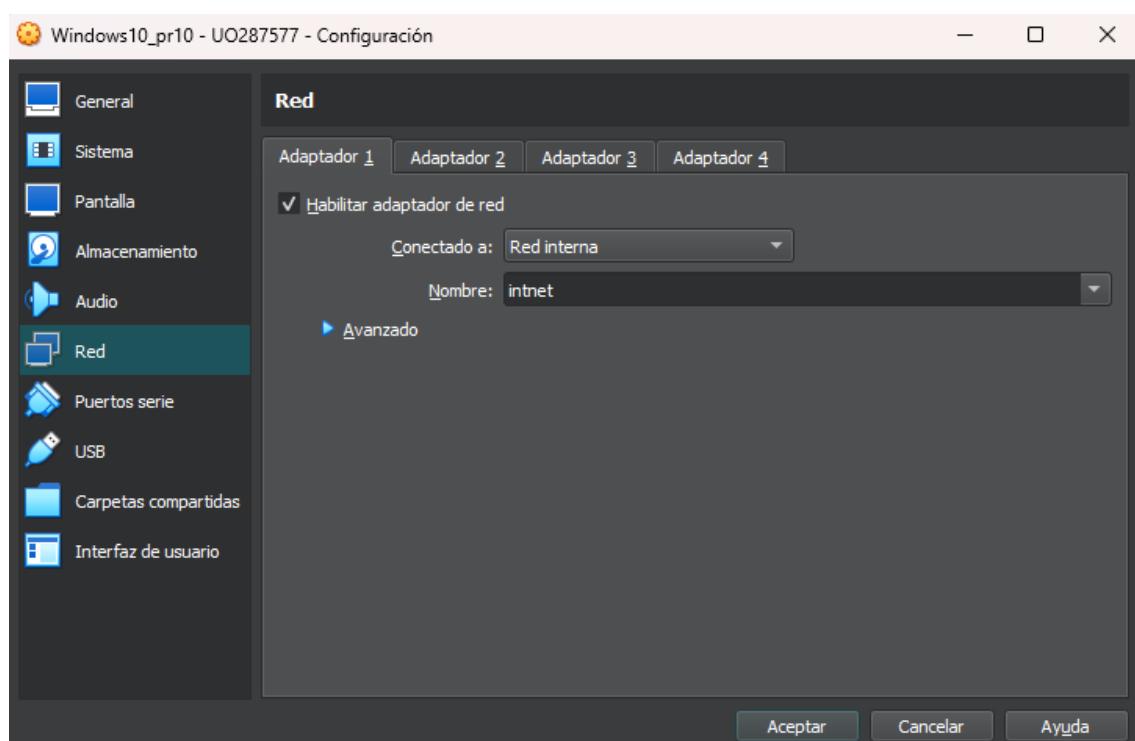
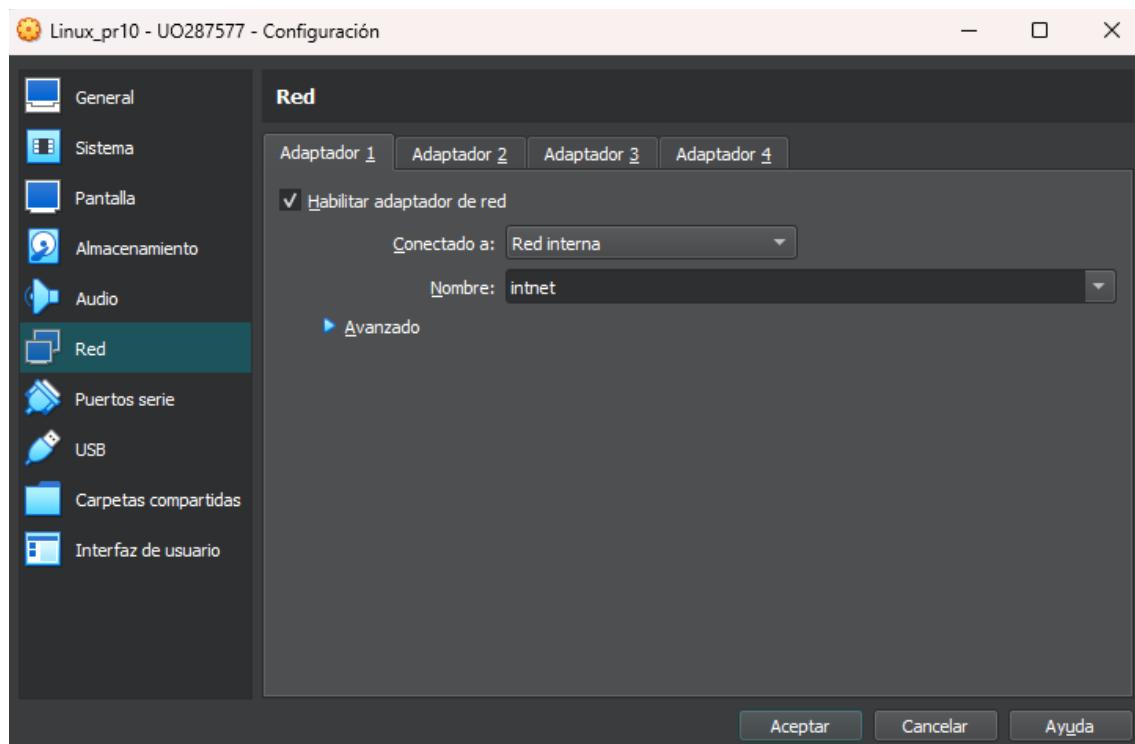
# **Administración de Sistemas y Redes - Práctica 10**

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## Parte 1: Direcciones de enlace local

Dentro de VirtualBox ponemos el adaptador de red de los dos sistemas (Linux y Windows 10) en "Red interna" e iniciamos ambos equipos.



En el caso de Windows dejamos la configuración de red con los parámetros por defecto. En el caso de Linux hacemos que no se autoconfigure con:

```
# nmcli con mod enp0s3 ipv6.method ignore
```

```
[U0287577@linux ~]# nmcli con mod enp0s3 ipv6.method ignore
```

Comprobamos en cada uno de los dos sistemas que el adaptador de red tiene ya una dirección IPv6 de enlace local, recordamos que estas direcciones empiezan por fe80.

En Linux la orden para ver las direcciones de los adaptadores es:

# ip a

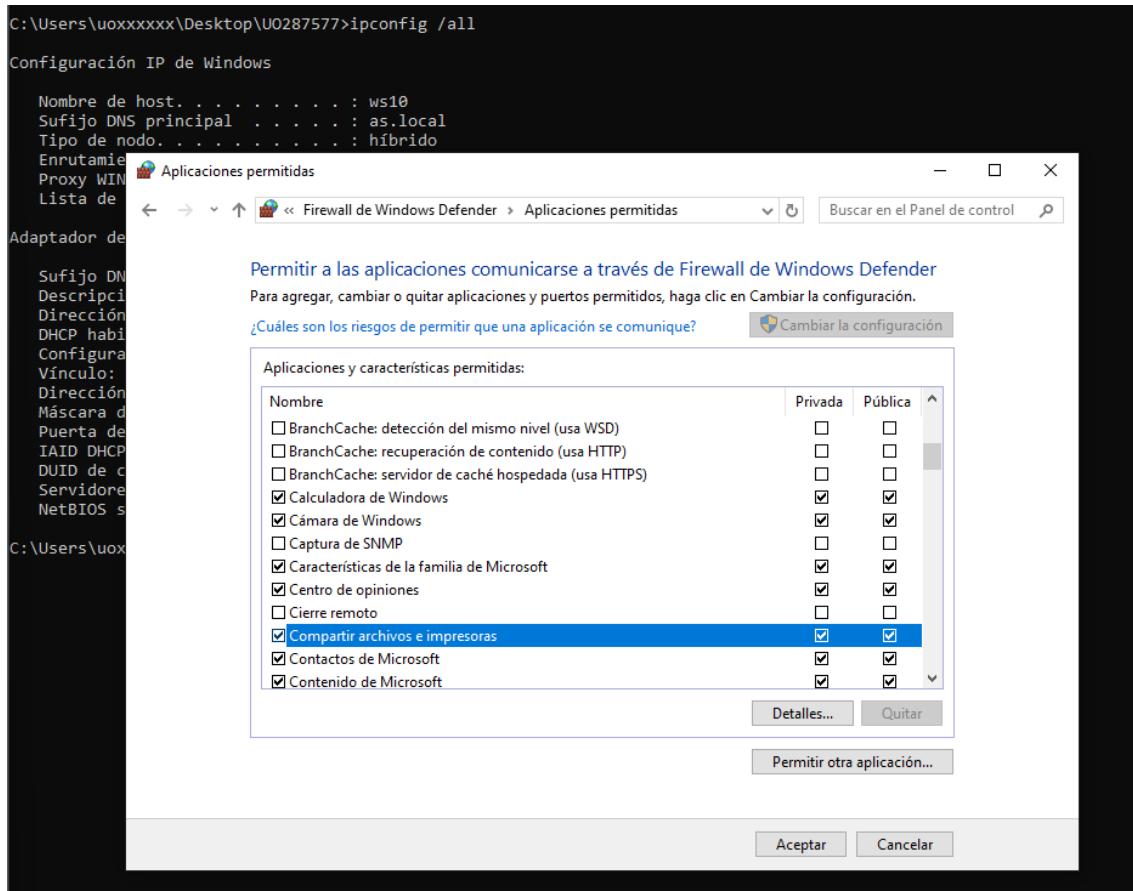
```
[U0287577@linux ~]# ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
        inet 127.0.0.1/8 scope host lo
            valid_lft forever preferred_lft forever
        inet6 ::1/128 scope host
            valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:08:27:d3:e6:6a brd ff:ff:ff:ff:ff:ff
        inet6 fe80::a00:27ff:fed3:e66a/64 scope link
            valid_lft forever preferred_lft forever
[U0287577@linux ~]#
```

Y en Windows:

C:\> ipconfig /all

En el equipo Windows comprobamos que el cortafuegos permite tráfico ICMP 4 y 6 ECO entrante.

De no ser así vamos al panel de control y habilitamos en el cortafuegos la opción Permitir una aplicación o característica a través de Firewall de Windows -> Compartir archivos e impresoras (privada y pública).



Comprobamos que ya hay cierta conectividad entre ambos equipos sin necesidad de configurar nada, para ello hacemos un ping -6 de Windows a Linux.

Si ha transcurrido demasiado tiempo repetimos la orden.

```
# nmcli con mod enp0s3 ipv6.method ignore
```

```
[U028757?@linux ~]# nmcli con mod enp0s3 ipv6.method ignore
[U028757?@linux ~]# ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:a3:e6:6a brd ff:ff:ff:ff:ff:ff
    inet6 fe80::a00:27ff:fed3:e66a/64 scope link
        valid_lft forever preferred_lft forever
[U028757?@linux ~]# _
```

```
C:\Users\uoxxxxxx\Desktop\U0287577>ping -6 fe80::a00:27ff:fed3:e66a

Haciendo ping a fe80::a00:27ff:fed3:e66a con 32 bytes de datos:
Host de destino inaccesible.
Host de destino inaccesible.
Host de destino inaccesible.
Host de destino inaccesible.

Estadísticas de ping para fe80::a00:27ff:fed3:e66a:
  Paquetes: enviados = 4, recibidos = 0, perdidos = 4
              (100% perdidos),
```

C:\Users\uoxxxxxx\Desktop\U0287577>ping -6 fe80::a00:27ff:fed3:e66a

```
Haciendo ping a fe80::a00:27ff:fed3:e66a con 32 bytes de datos:
Respuesta desde fe80::a00:27ff:fed3:e66a: tiempo<1m
Respuesta desde fe80::a00:27ff:fed3:e66a: tiempo=1ms
Respuesta desde fe80::a00:27ff:fed3:e66a: tiempo=1ms
Respuesta desde fe80::a00:27ff:fed3:e66a: tiempo<1m

Estadísticas de ping para fe80::a00:27ff:fed3:e66a:
  Paquetes: enviados = 4, recibidos = 4, perdidos = 0
              (0% perdidos),
Tiempos aproximados de ida y vuelta en milisegundos:
  Mínimo = 0ms, Máximo = 1ms, Media = 0ms
```

C:\Users\uoxxxxxx\Desktop\U0287577>

En algunas versiones de Linux puede ser necesario añadir a la dirección IPv6 de Windows el carácter % seguido del adaptador de salida, por ejemplo: # ping -6 fe80::9d78:452b:61e:278e%enp0s3

```
[U0287577@linux ~]#nmcli con mod enp0s3 ipv6.method ignore
[U0287577@linux ~]#ping -6 fe80::40c1:c3d1:b98c:9731%enp0s3
PING fe80::40c1:c3d1:b98c:9731%enp0s3(fe80::40c1:c3d1:b98c:9731%enp0s3) 56 data bytes
64 bytes from fe80::40c1:c3d1:b98c:9731%enp0s3: icmp_seq=1 ttl=128 time=1.51 ms
64 bytes from fe80::40c1:c3d1:b98c:9731%enp0s3: icmp_seq=2 ttl=128 time=1.56 ms
64 bytes from fe80::40c1:c3d1:b98c:9731%enp0s3: icmp_seq=3 ttl=128 time=1.57 ms
64 bytes from fe80::40c1:c3d1:b98c:9731%enp0s3: icmp_seq=4 ttl=128 time=1.76 ms
64 bytes from fe80::40c1:c3d1:b98c:9731%enp0s3: icmp_seq=5 ttl=128 time=1.50 ms
64 bytes from fe80::40c1:c3d1:b98c:9731%enp0s3: icmp_seq=6 ttl=128 time=1.47 ms
64 bytes from fe80::40c1:c3d1:b98c:9731%enp0s3: icmp_seq=7 ttl=128 time=0.954 ms
64 bytes from fe80::40c1:c3d1:b98c:9731%enp0s3: icmp_seq=8 ttl=128 time=1.01 ms
^C
--- fe80::40c1:c3d1:b98c:9731%enp0s3 ping statistics ---
8 packets transmitted, 8 received, 0% packet loss, time 7015ms
rtt min/avg/max/mdev = 0.954/1.416/1.764/0.265 ms
[U0287577@linux ~]#
```

## Parte 2: Direcciones IPv6 estáticas.

En la máquina Linux ponemos una dirección IPv6 fija con:

```
# nmcli con mod enp0s3 ipv6.method manual ipv6.address fd00:a:b:c::1/64
```

```
[U0287577@linux ~]# nmcli con mod enp0s3 ipv6.method manual ipv6.address fd00:a:b:c::1/64
[U0287577@linux ~]# ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:d3:e6:6a brd ff:ff:ff:ff:ff:ff
    inet6 fe80::a00:27ff:fed3:e66a/64 scope link
        valid_lft forever preferred_lft forever
[U0287577@linux ~]# _
```

Y verificamos que el fichero de configuración en /etc/NetworkManager/system-connections cuyo nombre para el adaptador enp0s3 será enp0s3.nmconnection contiene:

```
[ipv6]
addr-gen-mode=eui64
address1=fd00:a:b:c::1/64
method=manual
```

```
[U0287577@linux ~]# nano /etc/NetworkManager/system-connections/enp0s3.nmconnection
GNU nano 5.6.1
[connection]
id=enp0s3
uuid=de60fc68-b9c2-34b4-a5d6-1afefa8ab4a5
type=ethernet
autoconnect-priority=-999
interface-name=enp0s3
timestamp=1742474283

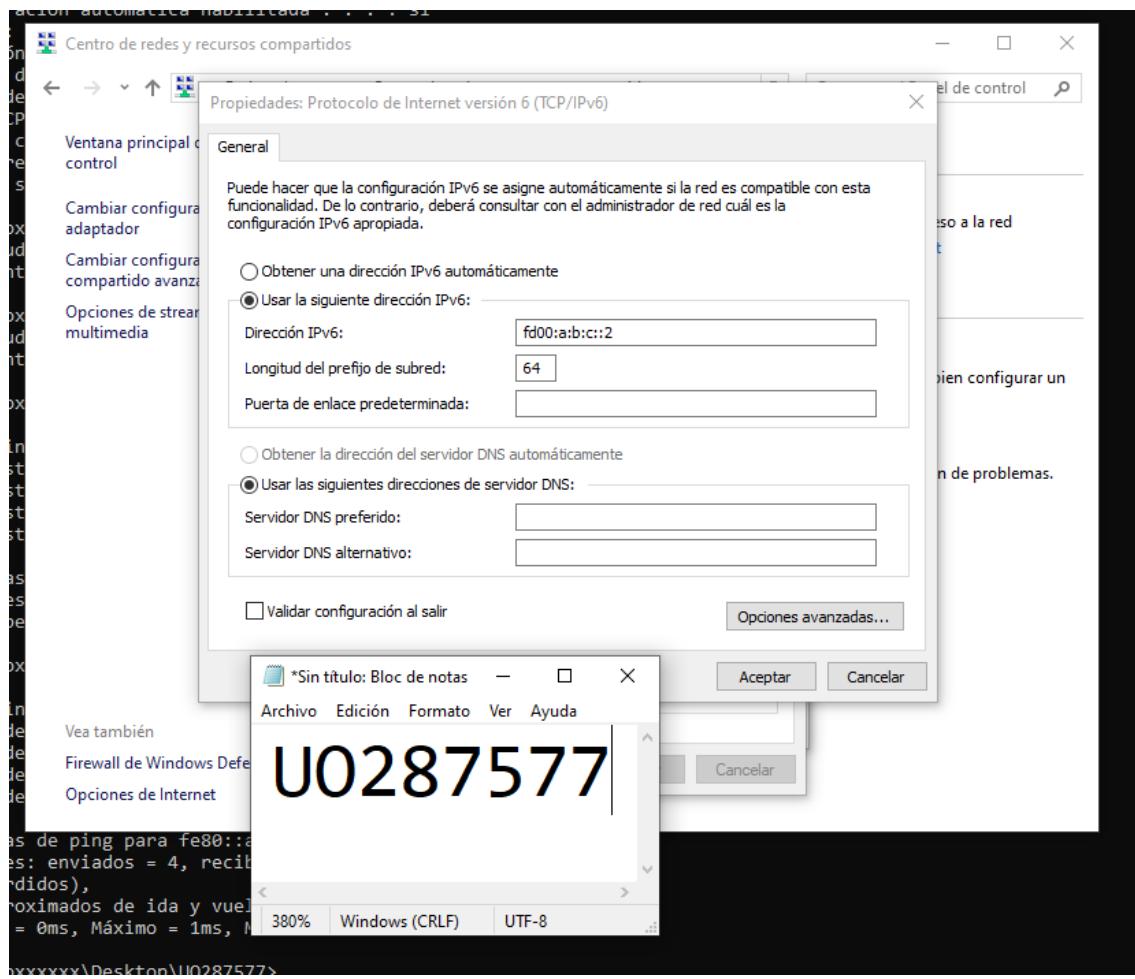
[tethering]

[ipv4]
method=auto

[ipv6]
addr-gen-mode=eui64
address1=fd00:a:b:c::1/64
method=manual

[proxy]
##U0287577
```

En la máquina con Windows abrimos las propiedades del adaptador y ponemos como dirección IPv6 fd00:a:b:c::2 con prefijo 64.



Volvemos a repetir las órdenes de la parte 1 para ver las direcciones IPv6 comprobando que además de las que empiezan por fe80 están ahora las nuevas que comienzan por fd00.

```
[U0287577@linux ~]# ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
        inet 127.0.0.1/8 scope host lo
            valid_lft forever preferred_lft forever
        inet6 ::1/128 scope host
            valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:d3:e6:6a brd ff:ff:ff:ff:ff:ff
        inet6 fd00:a:b:c::1/64 scope global nopref ixroute
            valid_lft forever preferred_lft forever
        inet6 fe80::a00:27ff:fed3:e66a/64 scope link nopref ixroute
            valid_lft forever preferred_lft forever
[U0287577@linux ~]#
```

Con la orden ping y empleando las direcciones nuevas comprobamos que hay conectividad entre los dos equipos.

```
C:\Users\uoxxxxxx\Desktop\U0287577>ping -6 fd00:a:b:c::1

Haciendo ping a fd00:a:b:c::1 con 32 bytes de datos:
Respuesta desde fd00:a:b:c::1: tiempo=1ms
Respuesta desde fd00:a:b:c::1: tiempo=1ms
Respuesta desde fd00:a:b:c::1: tiempo=1ms
Respuesta desde fd00:a:b:c::1: tiempo=1ms

Estadísticas de ping para fd00:a:b:c::1:
    Paquetes: enviados = 4, recibidos = 4, perdidos = 0
                (0% perdidos),
Tiempos aproximados de ida y vuelta en milisegundos:
    Mínimo = 1ms, Máximo = 1ms, Media = 1ms

C:\Users\uoxxxxxx\Desktop\U0287577>
```

```
[U0287577@linux ~]# ping -6 fd00:a:b:c::2
PING fd00:a:b:c::2(fd00:a:b:c::2) 56 data bytes
64 bytes from fd00:a:b:c::2: icmp_seq=1 ttl=128 time=0.745 ms
64 bytes from fd00:a:b:c::2: icmp_seq=2 ttl=128 time=1.56 ms
64 bytes from fd00:a:b:c::2: icmp_seq=3 ttl=128 time=1.64 ms
64 bytes from fd00:a:b:c::2: icmp_seq=4 ttl=128 time=1.63 ms
64 bytes from fd00:a:b:c::2: icmp_seq=5 ttl=128 time=1.67 ms
64 bytes from fd00:a:b:c::2: icmp_seq=6 ttl=128 time=1.53 ms
64 bytes from fd00:a:b:c::2: icmp_seq=7 ttl=128 time=1.01 ms
64 bytes from fd00:a:b:c::2: icmp_seq=8 ttl=128 time=1.59 ms
64 bytes from fd00:a:b:c::2: icmp_seq=9 ttl=128 time=1.57 ms
64 bytes from fd00:a:b:c::2: icmp_seq=10 ttl=128 time=1.48 ms
64 bytes from fd00:a:b:c::2: icmp_seq=11 ttl=128 time=1.63 ms
^C
--- fd00:a:b:c::2 ping statistics ---
11 packets transmitted, 11 received, 0% packet loss, time 10025ms
rtt min/avg/max/mdev = 0.745/1.459/1.666/0.283 ms
[U0287577@linux ~]# _
```

Comprobamos que también hay ruta para la red fd00:a:b:c::/64 en ambas máquinas.

Para Windows:

```
C:\> route -6 print
```

```
C:\Users\uoxxxxxx\Desktop\U0287577>route -6 print
=====
ILista de interfaces
11...08 00 27 d8 b7 f7 .....Intel(R) PRO/1000 MT Desktop Adapter
 1.....Software Loopback Interface 1
=====

IPv6 Tabla de enrutamiento
=====
Rutas activas:
 Cuando destino de red métrica      Puerta de enlace
   1    331 ::1/128                  En vínculo
  11    281 fd00:a:b:c::/64          En vínculo
  11    281 fd00:a:b:c::2/128        En vínculo
  11    281 fe80::/64               En vínculo
  11    281 fe80::40c1:c3d1:b98c:9731/128
                                    En vínculo
   1    331 ff00::/8                En vínculo
  11    281 ff00::/8                En vínculo
=====
Rutas persistentes:
 Ninguno

C:\Users\uoxxxxxx\Desktop\U0287577>
```

Para Linux:

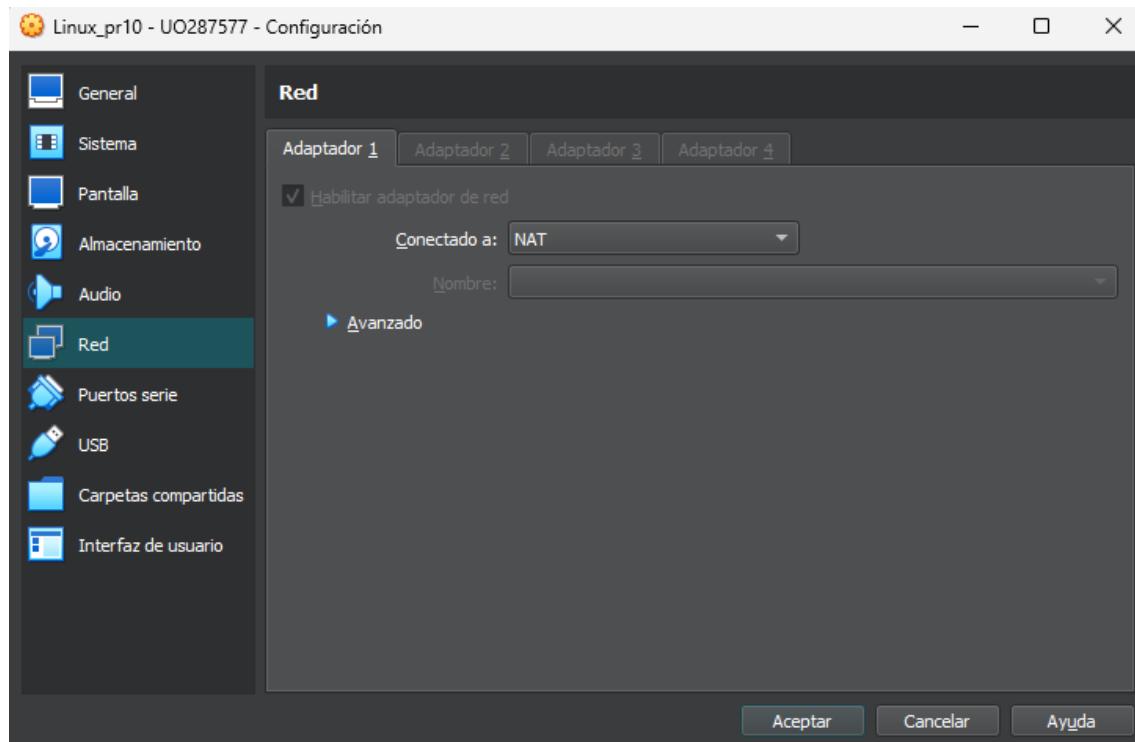
```
# ip -6 route
```

```
[U0287577@linux ~]# ip -6 route
::1 dev lo proto kernel metric 256 pref medium
fd00:a:b:c::/64 dev enp0s3 proto kernel metric 100 pref medium
fe80::/64 dev enp0s3 proto kernel metric 1024 pref medium
[U0287577@linux ~]#
```

### Parte 3: Servidor DHCPv6.

Emplearemos un servidor DHCP en la máquina Linux. La de Windows actuará como cliente.

Sin necesidad de apagar la máquina Linux ni de reiniciar su red, cambiamos su configuración en VirtualBox para conectar el adaptador de red a NAT, de esta forma tendremos salida al exterior con IPv4 para poder instalar paquetes.



Instalamos el DHCP.

```
# dnf install dhcp-server
```

```
[U0287577@linux ~]# dnf install dhcp-server
AlmaLinux 9 - AppStream
AlmaLinux 9 - AppStream
AlmaLinux 9 - BaseOS
AlmaLinux 9 - BaseOS
AlmaLinux 9 - Extras
AlmaLinux 9 - Extras
Dependencias resueltas.
=====
Paquete           Arquitectura      Versión          Repositorio   Tam.
=====
Instalando:
  dhcp-server      x86_64            12:4.4.2-19.b1.e19    baseos        1.2 M
Instalando dependencias:
  dhcp-common       noarch           12:4.4.2-19.b1.e19    baseos        128 k
Resumen de la transacción
=====
Instalar 2 Paquetes

Tamaño total de la descarga: 1.3 M
Tamaño instalado: 4.2 M
¿Está de acuerdo [s/N]? s
Descargando paquetes:
(1/2): dhcp-common-4.4.2-19.b1.e19.noarch.rpm      509 kB/s | 128 kB   00:00
(2/2): dhcp-server-4.4.2-19.b1.e19.x86_64.rpm      1.3 MB/s | 1.2 MB   00:00
Total                                         953 kB/s | 1.3 MB   00:01
Ejecutando verificación de operación
Verificación de operación exitosa.
Ejecutando prueba de operaciones
Prueba de operación exitosa.
Ejecutando operación
  Preparando      : 1/1
  Instalando      : dhcp-common-12:4.4.2-19.b1.e19.noarch 1/2
  Ejecutando scriptlet: dhcp-server-12:4.4.2-19.b1.e19.x86_64 2/2
  Instalando      : dhcp-server-12:4.4.2-19.b1.e19.x86_64 2/2
  Ejecutando scriptlet: dhcp-server-12:4.4.2-19.b1.e19.x86_64 2/2
[ 4132.628217] systemd-rc-local-generator[1913]: /etc/rc.d/rc.local is not marked executable, skipping.
  Verificando      : dhcp-common-12:4.4.2-19.b1.e19.noarch 1/2
  Verificando      : dhcp-server-12:4.4.2-19.b1.e19.x86_64 2/2
Instalado:
  dhcp-common-12:4.4.2-19.b1.e19.noarch           dhcp-server-12:4.4.2-19.b1.e19.x86_64
¡Listo!
[U0287577@linux ~]# _
```

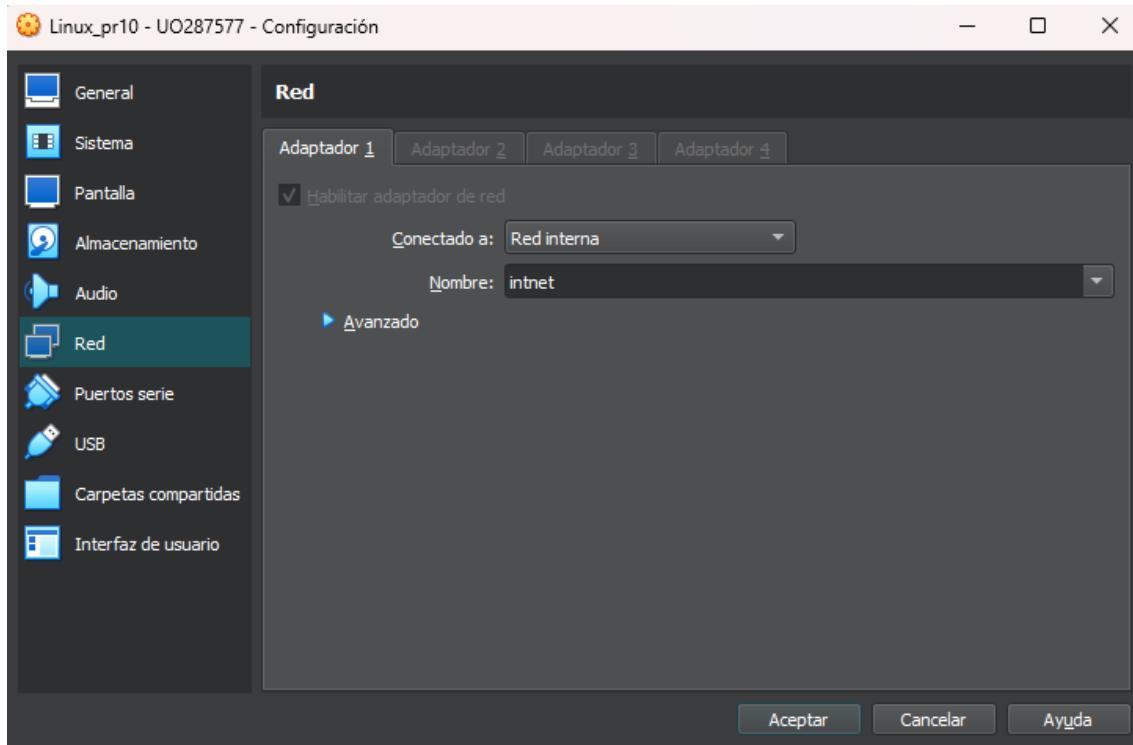
Y modificamos el fichero de configuración /etc/dhcp/dhcpd6.conf poniendo:

```
subnet6 fd00:a:b:c::/64 {
    range6 fd00:a:b:c::10 fd00:a:b:c::19;
}
```

```
[U0287577@linux ~]# nano /etc/dhcp/dhcpd6.conf _
```

```
GNU nano 5.6.1
#
# DHCPv6 Server Configuration file.
#   see /usr/share/doc/dhcp-server/dhcpd6.conf.example
#   see dhcpcd.conf(5) man page
#
subnet6 fd00:a:b:c::/64 {
    range6 fd00:a:b:c::10 fd00:a:b:c::19;
}
#U0287577
```

Volvemos a poner el adaptador en la red interna.



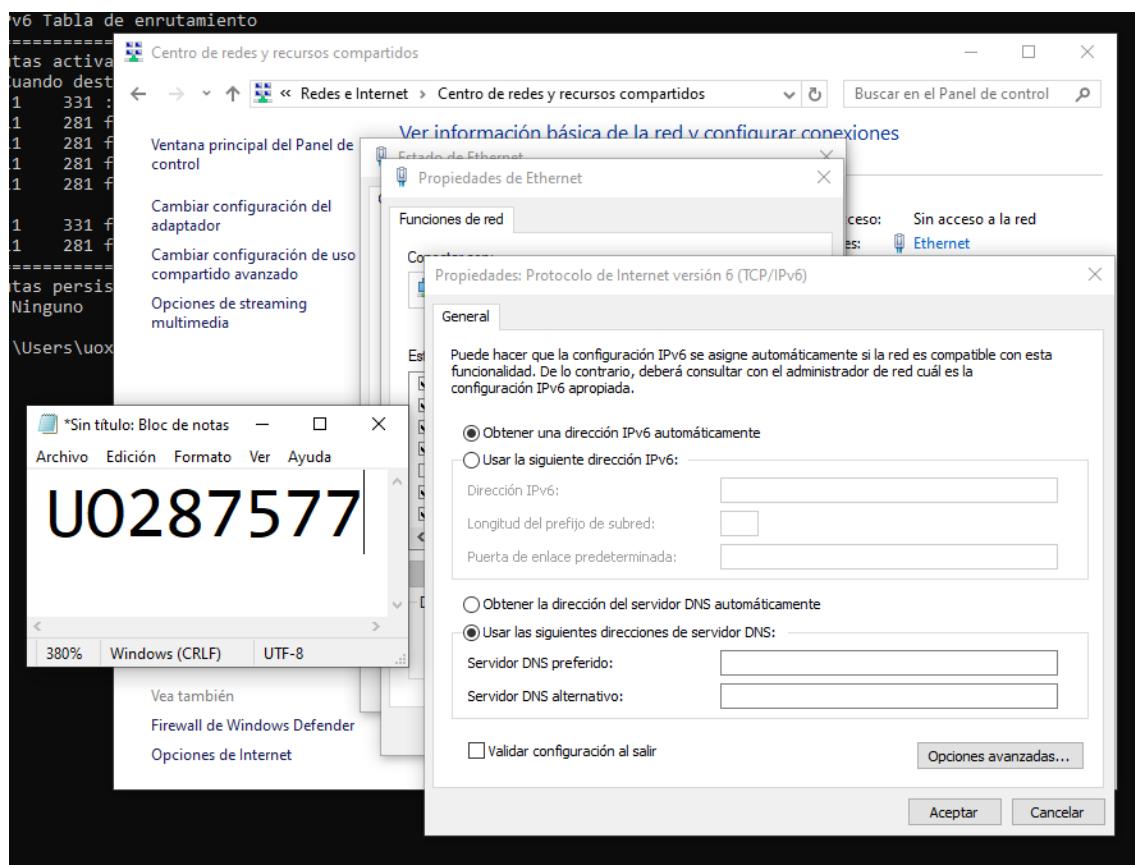
Abrimos el cortafuegos para tráfico DHCPv6 e iniciamos el servidor DHCP:

```
# firewall-cmd --add-service=dhcpv6
# firewall-cmd --add-service=dhcpv6 --permanent
# systemctl start dhcpcd6
# systemctl enable dhcpcd6
```

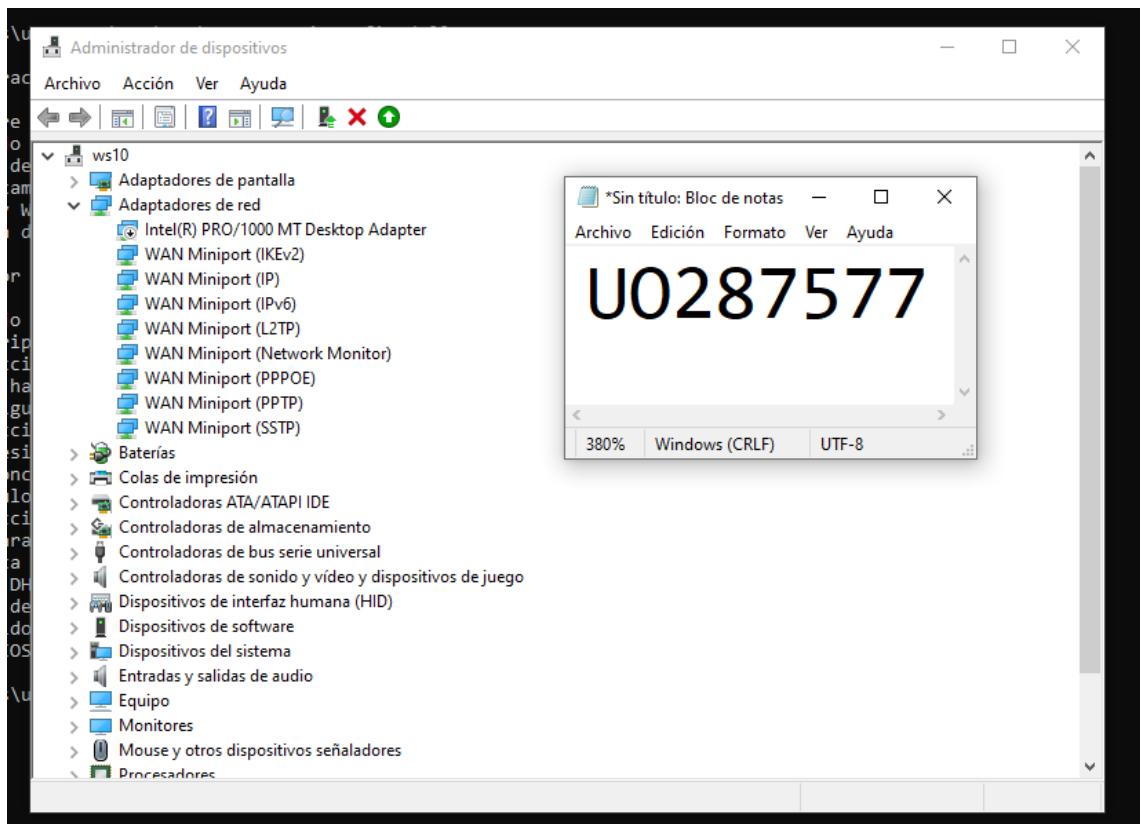
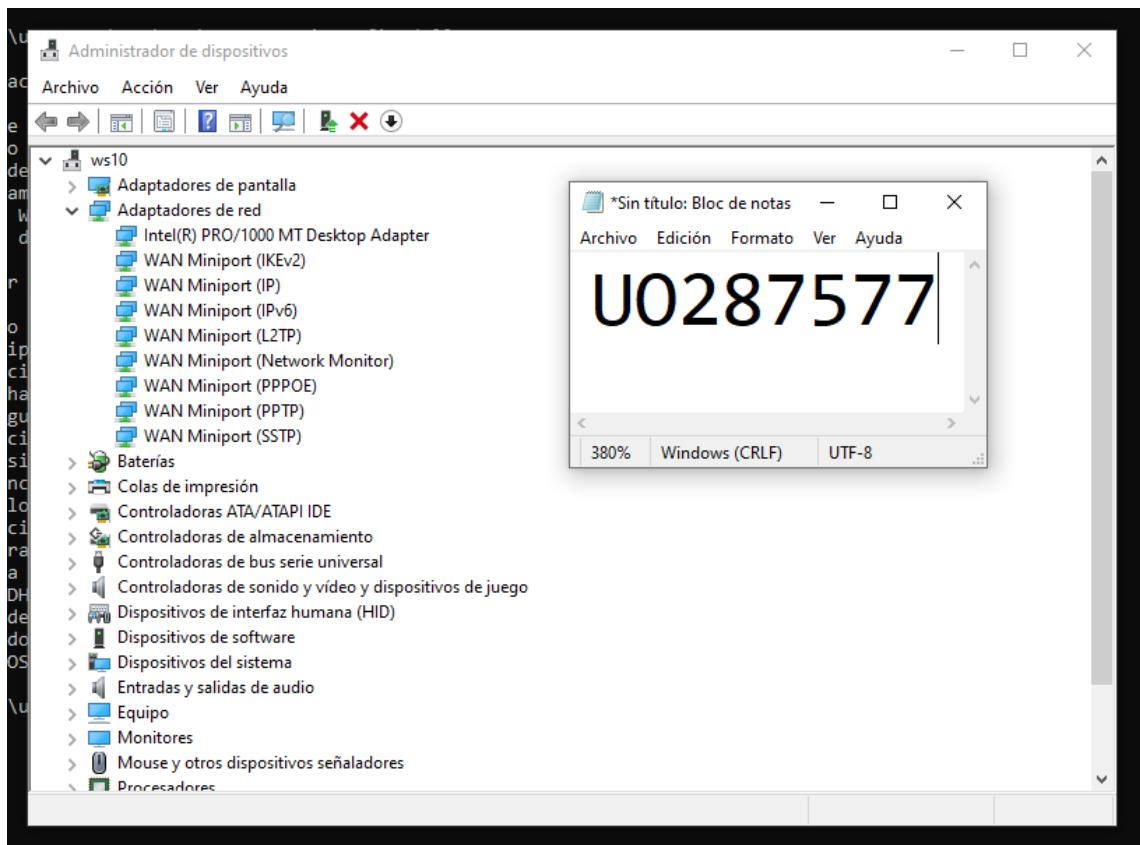
```
[U0287577@linux ~]# firewall-cmd --add-service=dhcpv6
Warning: ALREADY_ENABLED: 'dhcpv6' already in 'public'
success
[U0287577@linux ~]# firewall-cmd --add-service=dhcpv6 --permanent
Warning: ALREADY_ENABLED: dhcpv6
success
[U0287577@linux ~]# systemctl start dhcpcd6
[U0287577@linux ~]# systemctl enable dhcpcd6
Created symlink /etc/systemd/system/multi-user.target.wants/dhcpcd6.service → /usr/lib/systemd/system/dhcpcd6.service.
[ 4718.816657] systemd-rc-local-generator[141651]: /etc/rc.d/rc.local is not marked executable, skipping.
[U0287577@linux ~]# systemctl status dhcpcd6
● dhcpcd6.service - DHCPv6 Server Daemon
   Loaded: loaded (/usr/lib/systemd/system/dhcpcd6.service; enabled; preset: disabled)
   Active: active (running) since Thu 2025-04-03 15:46:01 CEST; 27s ago
     Docs: man:dhcpcd(8)
           man:dhcpcd.conf(5)
     Main PID: 14152 (dhcpcd)
       Status: "Dispatching packets..."
      Tasks: 1 (limit: 10992)
     Memory: 2.4M
        CPU: 12ms
      CGroup: /system.slice/dhcpcd6.service
              └─14152 /usr/sbin/dhcpcd -f -6 -cf /etc/dhcp/dhcpcd6.conf -user dhcpcd -group dhcpcd --no-pid

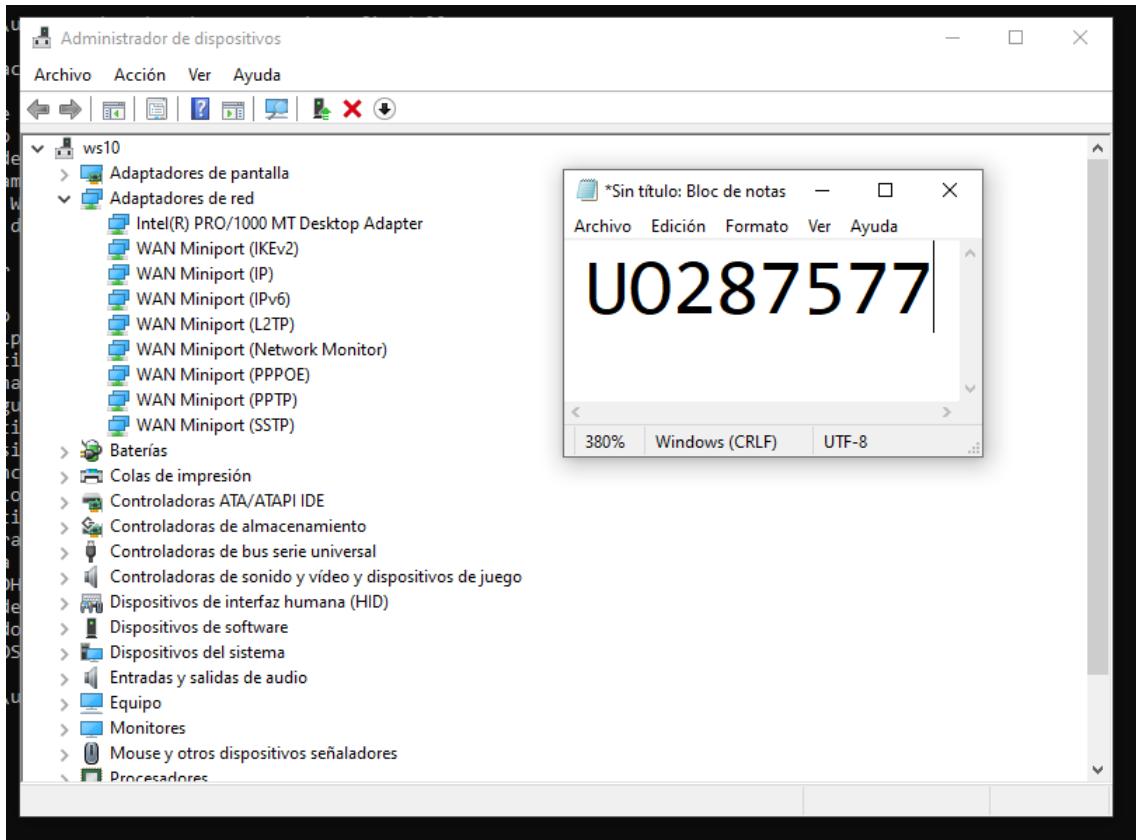
abr 03 15:46:01 linux.as.local dhcpcd[14152]: Not searching LDAP since ldap-server, ldap-port and ldap-base-dn were not specified in the config file
abr 03 15:46:01 linux.as.local dhcpcd[14152]: Config file: /etc/dhcp/dhcpcd6.conf
abr 03 15:46:01 linux.as.local dhcpcd[14152]: Database file: /var/lib/dhcpcd/dhcpcd6.leases
abr 03 15:46:01 linux.as.local dhcpcd[14152]: PID file: /var/run/dhcpcd6.pid
abr 03 15:46:01 linux.as.local dhcpcd[14152]: Wrote 0 NA, 0 TA, 0 PD leases to lease file.
abr 03 15:46:01 linux.as.local dhcpcd[14152]: Bound to *:547
abr 03 15:46:01 linux.as.local dhcpcd[14152]: Listening on Socket/5/emp0s3/fd00:a:b:c::/64
abr 03 15:46:01 linux.as.local dhcpcd[14152]: Sending on Socket/5/emp0s3/fd00:a:b:c::/64
abr 03 15:46:01 linux.as.local dhcpcd[14152]: Server starting service.
abr 03 15:46:01 linux.as.local systemd[1]: Started DHCPv6 Server Daemon.
[U0287577@linux ~]# _
```

En el equipo Windows cambiamos de nuevo la configuración del adaptador de red de IPv6 quitando la dirección estática fd00:a:b:c::2 y poniendo que obtenga una dirección IPv6 automáticamente.



Reiniciamos el adaptador (desactivar seguido de activar).





Y comprobamos con la orden de la parte 1 que su dirección está ahora dentro del rango desde fd00:a:b:c::10 hasta fd00:a:b:c::19.

Si desea monitorizar el servidor DHCPv6 ejecutamos:

```
# tail -f /var/log/messages | grep dhcp
```

```
[U0287577@linux ~]# tail -f /var/log/messages | grep dhcp
Apr 3 15:48:02 linux dhcpd[14152]: Solicit message from fe80::40c1:c3d1:b98c:9731 port 546, transaction ID 0x1F7F7300
Apr 3 15:48:02 linux dhcpd[14152]: Advertise NA: address fd00:a:b:c::18 to client with duid 00:01:00:01:2f:5b:4c:88:00:27:d8:b7:f7 iaid = 101187623 valid for 43200 seconds
Apr 3 15:48:02 linux dhcpd[14152]: Sending Advertise to fe80::40c1:c3d1:b98c:9731 port 546
Apr 3 15:48:03 linux dhcpd[14152]: Request message from fe80::40c1:c3d1:b98c:9731 port 546, transaction ID 0x1F7F7300
Apr 3 15:48:03 linux dhcpd[14152]: Reply NA: address fd00:a:b:c::18 to client with duid 00:01:00:01:2f:5b:4c:88:00:27:d8:b7:f7 iaid = 101187623 valid for 43200 seconds
Apr 3 15:48:03 linux dhcpd[14152]: Sending Reply to fe80::40c1:c3d1:b98c:9731 port 546
Apr 3 15:50:25 linux dhcpd[14152]: Confirm message from fe80::40c1:c3d1:b98c:9731 port 546, transaction ID 0x83950000
Apr 3 15:50:25 linux dhcpd[14152]: Sending Reply to fe80::40c1:c3d1:b98c:9731 port 546
Apr 3 15:50:26 linux dhcpd[14152]: Confirm message from fe80::40c1:c3d1:b98c:9731 port 546, transaction ID 0x5167A00
Apr 3 15:50:26 linux dhcpd[14152]: Sending Reply to fe80::40c1:c3d1:b98c:9731 port 546
```

Si necesitamos renovar la dirección IPv6 en Windows:

```
C:\> ipconfig /renew6
```

```
C:\Users\uoxxxxxx\Desktop\U0287577>ipconfig /renew6

Configuración IP de Windows

Adaptador de Ethernet Ethernet:

    Sufijo DNS específico para la conexión. . . : as.local
    Dirección IPv6 . . . . . : fd00:a:b:c::18
    Vínculo: dirección IPv6 local. . . : fe80::40c1:c3d1:b98c:9731%11
    Dirección IPv4 de configuración automática: 169.254.200.255
    Máscara de subred . . . . . : 255.255.0.0
    Puerta de enlace predeterminada . . . . :
```

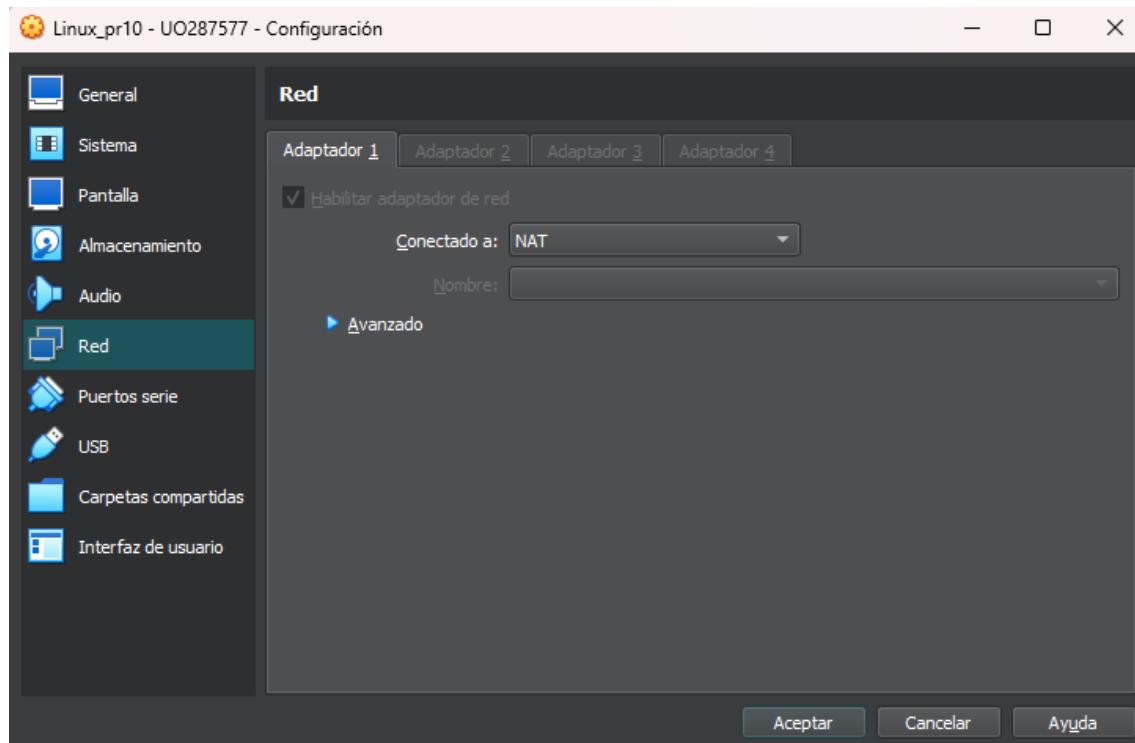
```
C:\Users\uoxxxxxx\Desktop\U0287577>
```

Utilizamos conjuntamente las dos órdenes anteriores para comprobar que en efecto el equipo con Windows pide una dirección IPv6 y que el servidor Linux se la cede o renueva.

```
[U0287577@linux ~]# tail -f /var/log/messages | grep dhcp
Apr 3 15:48:02 linux dhcpd[14152]: Solicit message from fe80::40c1:c3d1:b98c:9731 port 546, transaction ID 0x1F7F7300
Apr 3 15:48:02 linux dhcpd[14152]: Advertise NA: address fd00:a:b:c::18 to client with duid 00:01:00:01:2f:5b:4c:88:00:27:d8:b7:f7 iaid = 101187623 valid for 43200 seconds
Apr 3 15:48:02 linux dhcpd[14152]: Sending Advertise to fe80::40c1:c3d1:b98c:9731 port 546
Apr 3 15:48:03 linux dhcpd[14152]: Request message from fe80::40c1:c3d1:b98c:9731 port 546, transaction ID 0x1F7F7300
Apr 3 15:48:03 linux dhcpd[14152]: Reply NA: address fd00:a:b:c::18 to client with duid 00:01:00:01:2f:5b:4c:88:00:27:d8:b7:f7 iaid = 101187623 valid for 43200 seconds
Apr 3 15:48:03 linux dhcpd[14152]: Sending Reply to fe80::40c1:c3d1:b98c:9731 port 546
Apr 3 15:50:25 linux dhcpd[14152]: Confirm message from fe80::40c1:c3d1:b98c:9731 port 546, transaction ID 0x83950000
Apr 3 15:50:25 linux dhcpd[14152]: Sending Reply to fe80::40c1:c3d1:b98c:9731 port 546
Apr 3 15:50:26 linux dhcpd[14152]: Confirm message from fe80::40c1:c3d1:b98c:9731 port 546, transaction ID 0x5167A00
Apr 3 15:50:26 linux dhcpd[14152]: Sending Reply to fe80::40c1:c3d1:b98c:9731 port 546
Apr 3 15:53:18 linux dhcpd[14152]: Renew message from fe80::40c1:c3d1:b98c:9731 port 546, transaction ID 0xED6C9E00
Apr 3 15:53:18 linux dhcpd[14152]: Reply NA: address fd00:a:b:c::18 to client with duid 00:01:00:01:2f:5b:4c:88:00:27:d8:b7:f7 iaid = 101187623 valid for 43200 seconds
Apr 3 15:53:18 linux dhcpd[14152]: Sending Reply to fe80::40c1:c3d1:b98c:9731 port 546
```

## Parte 4: Servidor RADVD (Router ADVertisement Daemon).

Cambiamos el adaptador de red otra vez a NAT.



E instalamos el RADVD.

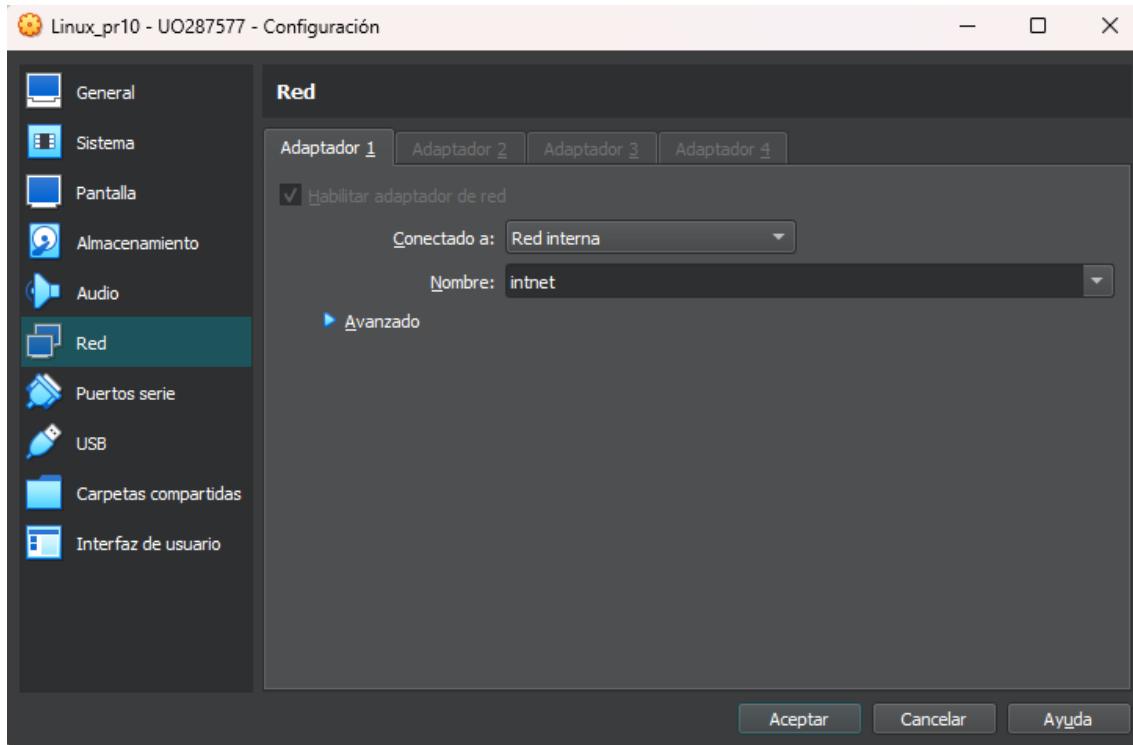
```
# dnf install radvd
```

```
[U0287577@linux ~]# dnf install radvd
Última comprobación de caducidad de metadatos hecha hace 2:17:25, el jue 03 abr 2025 13:40:33.
Dependencias resueltas.
=====
Paquete           Arquitectura      Versión          Repositorio      Tam.
=====
Instalando:
radvd            x86_64           2.19-5.e19       appstream        87 k
Resumen de la transacción
=====
Instalar 1 Paquete

Tamaño total de la descarga: 87 k
Tamaño instalado: 173 k
¿Está de acuerdo [s/N]?: s
Descargando paquetes:
radvd-2.19-5.e19.x86_64.rpm
Total                                         423 kB/s | 87 kB   00:00
Ejecutando verificación de operación
Verificación de operación exitosa.
Ejecutando prueba de operaciones
Prueba de operación exitosa.
Ejecutando operación
  Preparando :                                                 1/1
  Ejecutando scriptlet: radvd-2.19-5.e19.x86_64             1/1
  Instalando  : radvd-2.19-5.e19.x86_64                   1/1
  Ejecutando scriptlet: radvd-2.19-5.e19.x86_64             1/1
[ 5415.70375? ] systemd-rc-local-generator[14259]: /etc/rc.d/rc.local is not marked executable, skipping.
  Verificando   : radvd-2.19-5.e19.x86_64                   1/1
Instalado:
  radvd-2.19-5.e19.x86_64

¡Listo!
[U0287577@linux ~]# _
```

Dejamos de nuevo el adaptador en la red interna.



Y configuramos el servidor RADVD editando el fichero /etc/radvd.conf con esto:

```
interface enp0s3 { # interfaz a utilizar
    AdvSendAdvert on; # on = envia avisos periodicamente
    AdvManagedFlag on; # on = stateful (DHCP)
    prefix fd00:a:b:c::/64 { # direcciones a generar
        AdvAutonomous off; # on = direcciones stateless autonomas
    };
}
```

```
[U0287577@linux ~]# nano /etc/radvd.conf _
```

```

GNU nano 5.6.1                               /etc/radvd.conf
# NOTE: there is no such thing as a working "by-default" configuration file.
#       At least the prefix needs to be specified. Please consult the radvd.conf(5)
#       man page and/or /usr/share/doc/radvd-*/radvd.conf.example for help.
#
#
#interface eth0
#{{
#    AdvSendAdvert on;
#    MinRtrAdvInterval 30;
#    MaxRtrAdvInterval 100;
#    prefix 2001:db8:1:0::/64
#    {
#        AdvOnLink on;
#        AdvAutonomous on;
#        AdvRouterAddr off;
#    };
#};
#};

interface enp0s3 {
    AdvSendAdvert on;
    AdvManagedFlag on;
    prefix fd00:a:b:c::/64 {
        AdvAutonomous off;
    };
};

#U0287577_

```

Iniciamos el servicio:

```
# systemctl start radvd
```

```
# systemctl enable radvd
```

```
[U0287577@linux ~]# systemctl start radvd
[U0287577@linux ~]# systemctl enable radvd
Created symlink /etc/systemd/system/multi-user.target.wants/radvd.service → /usr/lib/systemd/system/radvd.service.
[ 5788.039893] systemd-rc-local-generator[14471]: /etc/rc.d/rc.local is not marked executable, skipping.
[U0287577@linux ~]# systemctl status radvd
● radvd.service - Router advertisement daemon for IPv6
   Loaded: loaded (/usr/lib/systemd/system/radvd.service; enabled; preset: disabled)
   Active: active (running) since Thu 2025-04-03 16:04:09 CEST; 21s ago
     Main PID: 14456 (radvd)
        Tasks: 2 (limit: 10992)
       Memory: 1.0M
          CPU: 7ms
        CGroup: /system.slice/radvd.service
            └─14456 /usr/sbin/radvd -u radvd
               ├─14457 /usr/sbin/radvd -u radvd

abr 03 16:04:09 linux.as.local systemd[1]: Starting Router advertisement daemon for IPv6...
abr 03 16:04:09 linux.as.local radvd[14455]: version 2.19 started
abr 03 16:04:09 linux.as.local radvd[14455]: IPv6 forwarding setting is: 0, should be 1 or 2
abr 03 16:04:09 linux.as.local radvd[14455]: IPv6 forwarding seems to be disabled, but continuing anyway
abr 03 16:04:09 linux.as.local systemd[1]: Started Router advertisement daemon for IPv6.
abr 03 16:04:09 linux.as.local radvd[14456]: IPv6 forwarding on interface seems to be disabled, but continuing anyway
[U0287577@linux ~]# _
```

Comprobamos con la orden ping que vuelve a haber conectividad entre los equipos.

```
C:\Users\uoxxxxxx\Desktop\U0287577>ping -6 fe80::a00:27ff:fed3:e66a

Haciendo ping a fe80::a00:27ff:fed3:e66a con 32 bytes de datos:
Respuesta desde fe80::a00:27ff:fed3:e66a: tiempo<1ms
Respuesta desde fe80::a00:27ff:fed3:e66a: tiempo=1ms
Respuesta desde fe80::a00:27ff:fed3:e66a: tiempo=1ms
Respuesta desde fe80::a00:27ff:fed3:e66a: tiempo=1ms

Estadísticas de ping para fe80::a00:27ff:fed3:e66a:
  Paquetes: enviados = 4, recibidos = 4, perdidos = 0
    (0% perdidos),
Tiempos aproximados de ida y vuelta en milisegundos:
  Mínimo = 0ms, Máximo = 1ms, Media = 0ms

C:\Users\uoxxxxxx\Desktop\U0287577>ping -6 fd00:a:b:c::1

Haciendo ping a fd00:a:b:c::1 con 32 bytes de datos:
Respuesta desde fd00:a:b:c::1: tiempo=1ms
Respuesta desde fd00:a:b:c::1: tiempo=1ms
Respuesta desde fd00:a:b:c::1: tiempo=1ms
Respuesta desde fd00:a:b:c::1: tiempo=1ms

Estadísticas de ping para fd00:a:b:c::1:
  Paquetes: enviados = 4, recibidos = 4, perdidos = 0
    (0% perdidos),
Tiempos aproximados de ida y vuelta en milisegundos:
  Mínimo = 1ms, Máximo = 1ms, Media = 1ms

C:\Users\uoxxxxxx\Desktop\U0287577>
```

```
[U0287577@linux ~]# ping -6 fd00:a:b:c::18
PING fd00:a:b:c::18(fd00:a:b:c::18) 56 data bytes
64 bytes from fd00:a:b:c::18: icmp_seq=1 ttl=64 time=0.746 ms
64 bytes from fd00:a:b:c::18: icmp_seq=2 ttl=64 time=1.46 ms
64 bytes from fd00:a:b:c::18: icmp_seq=3 ttl=64 time=1.46 ms
64 bytes from fd00:a:b:c::18: icmp_seq=4 ttl=64 time=1.38 ms
64 bytes from fd00:a:b:c::18: icmp_seq=5 ttl=64 time=1.22 ms
64 bytes from fd00:a:b:c::18: icmp_seq=6 ttl=64 time=1.23 ms
64 bytes from fd00:a:b:c::18: icmp_seq=7 ttl=64 time=1.42 ms
64 bytes from fd00:a:b:c::18: icmp_seq=8 ttl=64 time=1.53 ms
64 bytes from fd00:a:b:c::18: icmp_seq=9 ttl=64 time=1.50 ms
64 bytes from fd00:a:b:c::18: icmp_seq=10 ttl=64 time=1.55 ms
^C
--- fd00:a:b:c::18 ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9073ms
rtt min/avg/max/mdev = 0.746/1.350/1.547/0.228 ms
[U0287577@linux ~]# ping -6 fe80::40c1:c3d1:b98c:9731%enp0s3
PING fe80::40c1:c3d1:b98c:9731%enp0s3(fe80::40c1:c3d1:b98c:9731%enp0s3) 56 data bytes
64 bytes from fe80::40c1:c3d1:b98c:9731%enp0s3: icmp_seq=1 ttl=64 time=0.683 ms
64 bytes from fe80::40c1:c3d1:b98c:9731%enp0s3: icmp_seq=2 ttl=64 time=1.39 ms
64 bytes from fe80::40c1:c3d1:b98c:9731%enp0s3: icmp_seq=3 ttl=64 time=1.40 ms
64 bytes from fe80::40c1:c3d1:b98c:9731%enp0s3: icmp_seq=4 ttl=64 time=1.45 ms
64 bytes from fe80::40c1:c3d1:b98c:9731%enp0s3: icmp_seq=5 ttl=64 time=1.38 ms
64 bytes from fe80::40c1:c3d1:b98c:9731%enp0s3: icmp_seq=6 ttl=64 time=1.33 ms
64 bytes from fe80::40c1:c3d1:b98c:9731%enp0s3: icmp_seq=7 ttl=64 time=1.39 ms
64 bytes from fe80::40c1:c3d1:b98c:9731%enp0s3: icmp_seq=8 ttl=64 time=1.33 ms
64 bytes from fe80::40c1:c3d1:b98c:9731%enp0s3: icmp_seq=9 ttl=64 time=1.39 ms
64 bytes from fe80::40c1:c3d1:b98c:9731%enp0s3: icmp_seq=10 ttl=64 time=1.48 ms
^C
--- fe80::40c1:c3d1:b98c:9731%enp0s3 ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9073ms
rtt min/avg/max/mdev = 0.683/1.322/1.482/0.217 ms
[U0287577@linux ~]# _
```

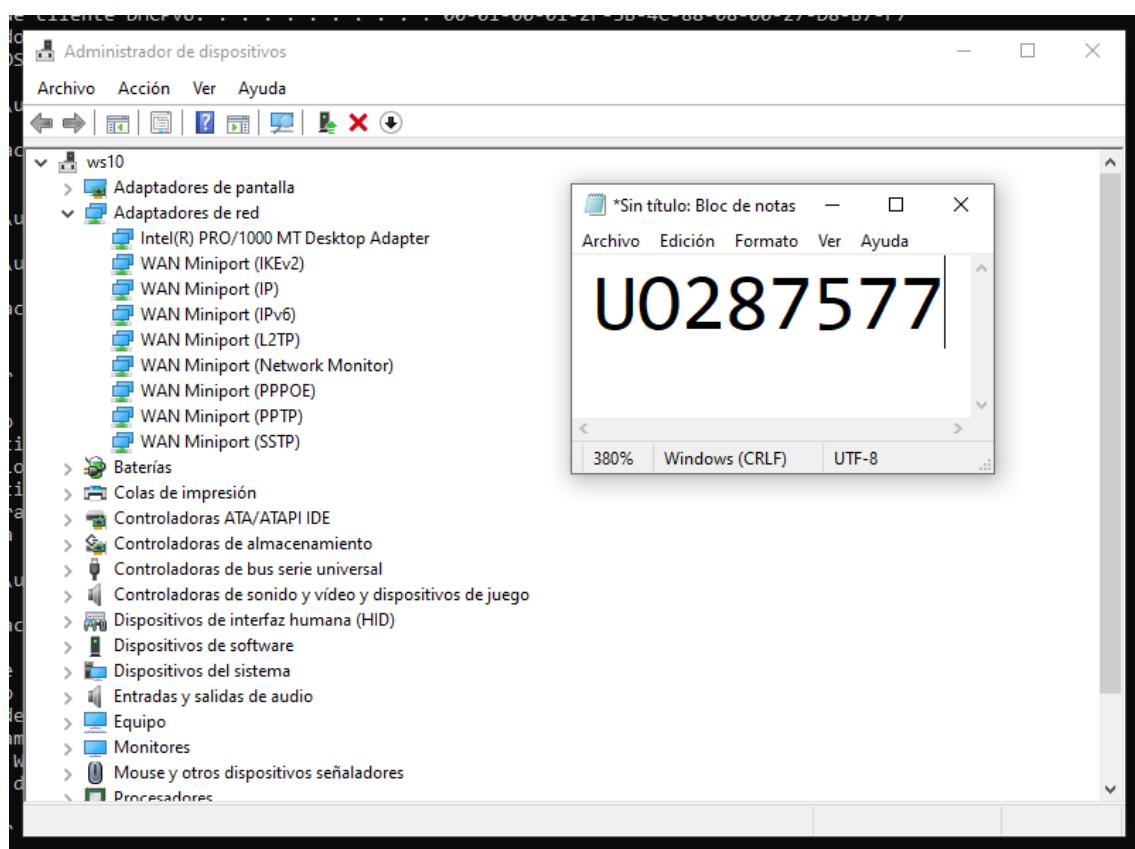
## Parte 5: Servidor RADVD y autoconfiguración stateless.

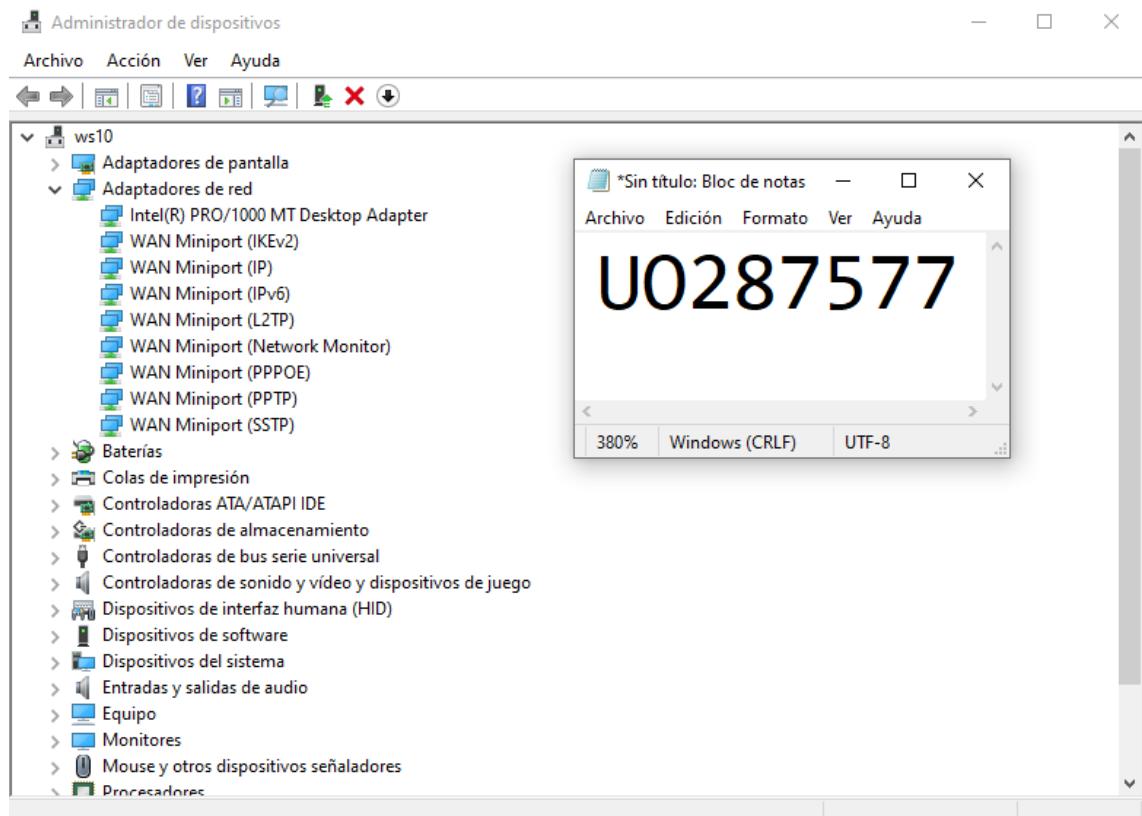
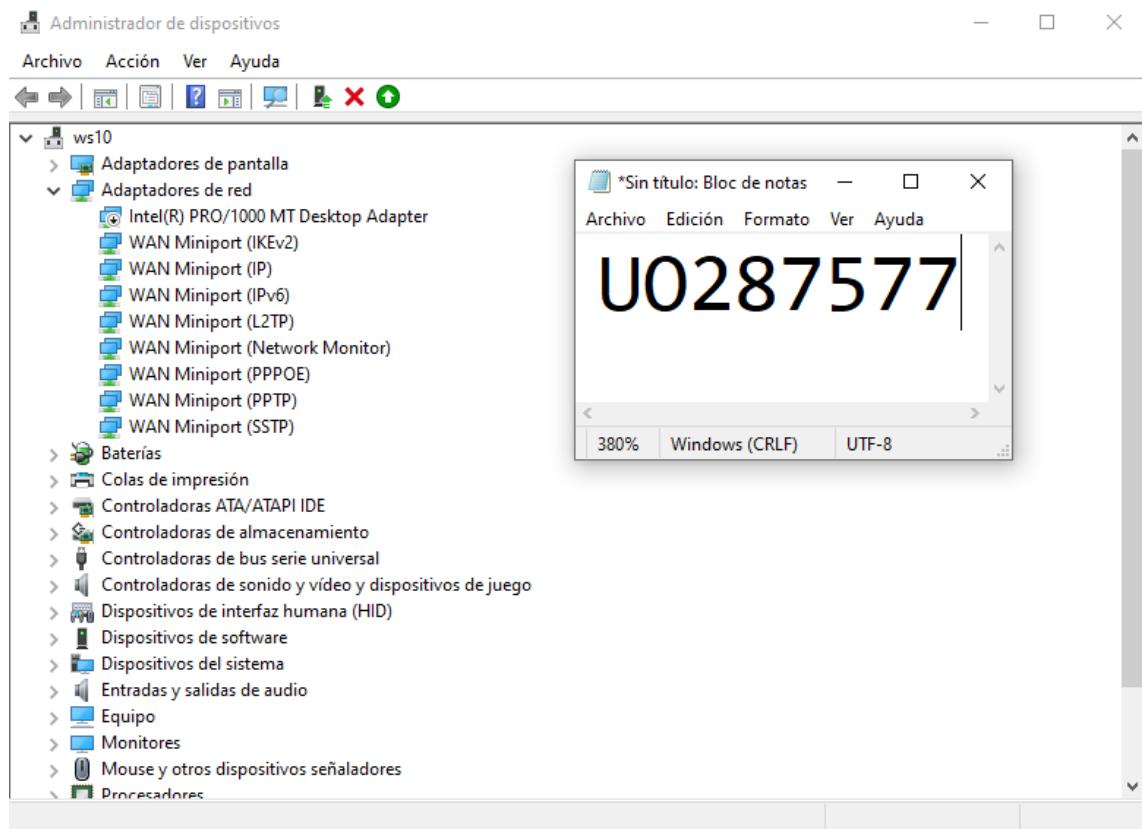
Detenemos el servicio DHCP en la máquina Linux, ya no será necesario.

```
# systemctl stop dhcpcd6  
# systemctl disable dhcpcd6
```

```
[U0287577@linux ~]# systemctl stop dhcpcd6  
[U0287577@linux ~]# systemctl disable dhcpcd6  
Removed "/etc/systemd/system/multi-user.target.wants/dhcpcd6.service".  
[ 6589.094399] systemd-rc-local-generator[14507]: /etc/rc.d/rc.local is not marked executable, skipping.  
[U0287577@linux ~]# systemctl status dhcpcd6  
● dhcpcd6.service - DHCPv6 Server Daemon  
  Loaded: loaded (/usr/lib/systemd/system/dhcpcd6.service; disabled; preset: disabled)  
  Active: inactive (dead)  
    Docs: man:dhcpcd(8)  
           man:dhcpcd.conf(5)  
  
abr 03 15:50:26 linux.as.local dhcpcd[14152]: Sending Reply to fe80::40c1:c3d1:b98c:9731 port 546  
abr 03 15:53:18 linux.as.local dhcpcd[14152]: Renew message from fe80::40c1:c3d1:b98c:9731 port 546, transaction ID 0xED6C9E00  
abr 03 15:53:18 linux.as.local dhcpcd[14152]: Reply MA: address fd00:a:b:c::18 to client with duid 00:01:00:01:2f:5b:4c:88:00:00:27:d8:b7:f7 iaid = 101187623 va  
abr 03 15:53:18 linux.as.local dhcpcd[14152]: Reusing lease for: fd00:a:b:c::18, age 315 secs < 25%, sending shortened lifetimes - preferred: 26685, valid 42885  
abr 03 15:53:18 linux.as.local dhcpcd[14152]: Sending Reply to fe80::40c1:c3d1:b98c:9731 port 546  
abr 03 16:04:10 linux.as.local dhcpcd[14152]: Confirm message from fe80::40c1:c3d1:b98c:9731 port 546, transaction ID 0x5F46D800  
abr 03 16:04:10 linux.as.local dhcpcd[14152]: Sending Reply to fe80::40c1:c3d1:b98c:9731 port 546  
abr 03 16:17:30 linux.as.local systemd[1]: Stopping DHCPv6 Server Daemon...  
abr 03 16:17:30 linux.as.local systemd[1]: dhcpcd6.service: Deactivated successfully.  
abr 03 16:17:30 linux.as.local systemd[1]: Stopped DHCPv6 Server Daemon.  
[U0287577@linux ~]#
```

Reiniciamos el adaptador de red de Windows.





Comprobamos que no hay otras direcciones IPv6 salvo la local que empieza por fe80.

```
C:\> ipconfig /all
```

Y verificamos que tampoco existen rutas salvo las locales de bucle ::1, enlace fe80 y multidifusión ff00.

C:\> route -6 print

```
C:\Users\uoxxxxxx\Desktop\U0287577>route -6 print
=====
ILista de interfaces
 11...08 00 27 d8 b7 f7 .....Intel(R) PRO/1000 MT Desktop Adapter
 1.....Software Loopback Interface 1
=====

IPv6 Tabla de enrutamiento
=====
Rutas activas:
 Cuando destino de red métrica      Puerta de enlace
 11    281 ::/0                      fe80::a00:27ff:fed3:e66a
  1    331 ::1/128                   En vínculo
 11    281 fd00:a:b:c::/64          En vínculo
 11    281 fe80::/64                En vínculo
 11    281 fe80::40c1:c3d1:b98c:9731/128
                                         En vínculo
   1   331 ff00::/8                 En vínculo
 11    281 ff00::/8                 En vínculo
=====

Rutas persistentes:
 Ninguno
=====
```

En la máquina con Linux mantenemos la configuración de red, es decir va a seguir teniendo la dirección IPv6 estática fd00:a:b:c::1 pero vamos a modificar la configuración del RADVD.

En /etc/radvd.conf ponemos en "off" el parámetro AdvManagedFlag y en "on" el AdvAutonomous. El primero indica que no se van a obtener direcciones vía DHCP y el segundo que se generarán direcciones autónomas (autoconfiguración).

```
interface enp0s3 { # interfaz a utilizar

    AdvSendAdvert on; # on = envia avisos periodicamente

    AdvManagedFlag off; # on = stateful (DHCP)

    prefix fd00:a:b:c::/64 { # direcciones a generar

        AdvAutonomous on; # on = direcciones stateless autonomas

    };

};
```

```
[U028757?@linux ~]# nano /etc/radvd.conf _
```

```
GNU nano 5.6.1                                     /etc/radvd.conf
# NOTE: there is no such thing as a working "by-default" configuration file.
#       At least the prefix needs to be specified. Please consult the radvd.conf(5)
#       man page and/or /usr/share/doc/radvd-*/radvd.conf.example for help.
#
#
#interface eth0
#{{
#    AdvSendAdvert on;
#    MinRtrAdvInterval 30;
#    MaxRtrAdvInterval 100;
#    prefix 2001:db8:1:0::/64 {
#        {
#            AdvOnLink on;
#            AdvAutonomous on;
#            AdvRouterAddr off;
#        };
#    };
#};

interface enp0s3 {
    AdvSendAdvert on;
    AdvManagedFlag off;
    prefix fd00:a:b:c::/64 {
        AdvAutonomous on;
    };
};
#U028757?
```

Reiniciamos el servicio RADVD en la máquina Linux.

```
# systemctl restart radvd
```

```
[U028757?@linux ~]# systemctl restart radvd
[U028757?@linux ~]#
```

Y volvemos a mirar las direcciones y rutas en la Windows.

Aparecerá ahora una dirección IPv6 con el prefijo fd00:a:b:c::/64 permanente y quizá otra temporal.

En cuanto a rutas aparecerá ahora la fd00:a:b:c::/64 ya que nuestro equipo está en esa red.

```
C:\Users\uoxxxxxx\Desktop\U0287577>route -6 print
=====
ILista de interfaces
 1...08 00 27 d8 b7 f7 .....Intel(R) PRO/1000 MT Desktop Adapter
 1.....Software Loopback Interface 1
=====

IPv6 Tabla de enrutamiento
=====
Rutas activas:
 Cuando destino de red métrica      Puerta de enlace
 11    281 ::/0                      fe80::a00:27ff:fed3:e66a
   1    331 ::1/128                  En vínculo
 11    281 fd00:a:b:c::/64          En vínculo
 11    281 fd00:a:b:c:8c58:dd7:916:83c3/128
                                En vínculo
 11    281 fd00:a:b:c:f58a:ac99:3976:daf/128
                                En vínculo
 11    281 fe80::/64                En vínculo
 11    281 fe80::40c1:c3d1:b98c:9731/128
                                En vínculo
   1    331 ff00::/8                 En vínculo
 11    281 ff00::/8                 En vínculo
=====

Rutas persistentes:
 Ninguno
```

Comprobamos que podemos hacer un ping a la máquina Linux que aún conserva la fd00:a:b:c::1.

```
C:\Users\uoxxxxxx\Desktop\U0287577>ping -6 fd00:a:b:c::1

Haciendo ping a fd00:a:b:c::1 con 32 bytes de datos:
Respuesta desde fd00:a:b:c::1: tiempo<1m
Respuesta desde fd00:a:b:c::1: tiempo=1ms
Respuesta desde fd00:a:b:c::1: tiempo<1m
Respuesta desde fd00:a:b:c::1: tiempo=1ms

Estadísticas de ping para fd00:a:b:c::1:
  Paquetes: enviados = 4, recibidos = 4, perdidos = 0
    (0% perdidos),
Tiempos aproximados de ida y vuelta en milisegundos:
  Mínimo = 0ms, Máximo = 1ms, Media = 0ms

C:\Users\uoxxxxxx\Desktop\U0287577>_
```

Como curiosidad, eliminamos la dirección IPv6 de la máquina Linux.

```
# nmcli con mod enp0s3 ipv6.method auto
```

```
[U0287577@linux ~]# nmcli con mod enp0s3 ipv6.method auto
[U0287577@linux ~]# _
```

Y aplicamos los cambios al adaptador de red.

```
# nmcli device reapply enp0s3
```

```
[U0287577@linux ~]# nmcli device reapply enp0s3
La conexión se reaplicó con éxito al dispositivo «enp0s3».
[U0287577@linux ~]# [ 7872.456993] ICMPv6: RA: ndisc_router_discovery failed to add default route
```

Observaremos que la máquina Linux también recibe una dirección IPv6 dentro de fd00:a:b:c::/64. Lo comprobamos.

```
# ip address
```

```
[U0287577@linux ~]# ip address
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
  link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
      valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
      valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
  link/ether 08:00:27:d3:e6:6a brd ff:ff:ff:ff:ff:ff
    inet6 fd00:a:b:c::1/64 scope global noprefixroute
      valid_lft forever preferred_lft forever
    inet6 fd00:a:b:c:a00:27ff:fed3:e66a/64 scope global dynamic noprefixroute
      valid_lft 86395sec preferred_lft 14395sec
    inet6 fe80::a00:27ff:fed3:e66a/64 scope link noprefixroute
      valid_lft forever preferred_lft forever
[U0287577@linux ~]#
```

Y examinamos también las rutas.

```
# ip -6 route
```

```
[U0287577@linux ~]# ip -6 route
::1 dev lo proto kernel metric 256 pref medium
fd00:a:b:c::/64 dev enp0s3 proto ra metric 100 pref medium
fe80::/64 dev enp0s3 proto kernel metric 1024 pref medium
default dev lo proto ra metric 1024 pref medium
[U0287577@linux ~]#
```

Verificamos con la orden ping que hay conectividad entre los dos equipos.

```
C:\Users\uoxxxxxx\Desktop\U0287577>ping -6 fd00:a:b:c::1

Haciendo ping a fd00:a:b:c::1 con 32 bytes de datos:
Respuesta desde fd00:a:b:c::1: tiempo<1m
Respuesta desde fd00:a:b:c::1: tiempo=1ms
Respuesta desde fd00:a:b:c::1: tiempo=1ms
Respuesta desde fd00:a:b:c::1: tiempo=1ms

Estadísticas de ping para fd00:a:b:c::1:
  Paquetes: enviados = 4, recibidos = 4, perdidos = 0
    (0% perdidos),
Tiempos aproximados de ida y vuelta en milisegundos:
  Mínimo = 0ms, Máximo = 1ms, Media = 0ms

C:\Users\uoxxxxxx\Desktop\U0287577>ping -6 fd00:a:b:c:a00:27ff:fed3:e66a

Haciendo ping a fd00:a:b:c:a00:27ff:fed3:e66a con 32 bytes de datos:
Respuesta desde fd00:a:b:c:a00:27ff:fed3:e66a: tiempo<1m
Respuesta desde fd00:a:b:c:a00:27ff:fed3:e66a: tiempo=1ms
Respuesta desde fd00:a:b:c:a00:27ff:fed3:e66a: tiempo=1ms
Respuesta desde fd00:a:b:c:a00:27ff:fed3:e66a: tiempo=1ms

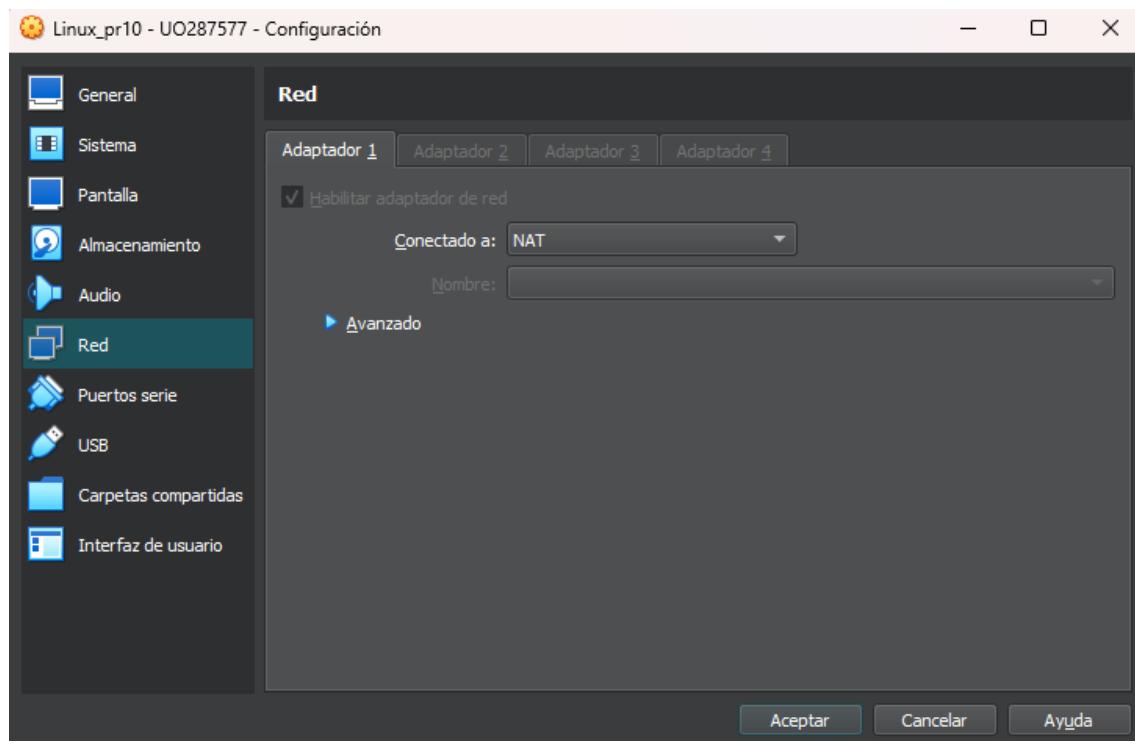
Estadísticas de ping para fd00:a:b:c:a00:27ff:fed3:e66a:
  Paquetes: enviados = 4, recibidos = 4, perdidos = 0
    (0% perdidos),
Tiempos aproximados de ida y vuelta en milisegundos:
  Mínimo = 0ms, Máximo = 1ms, Media = 0ms

C:\Users\uoxxxxxx\Desktop\U0287577>
```

```
[U0287577@linux ~]# ping -6 fd00:a:b:c:8c58:dd7:916:83c3
PING fd00:a:b:c:8c58:dd7:916:83c3(fd00:a:b:c:8c58:dd7:916:83c3) 56 data bytes
64 bytes from fd00:a:b:c:8c58:dd7:916:83c3: icmp_seq=1 ttl=64 time=0.620 ms
64 bytes from fd00:a:b:c:8c58:dd7:916:83c3: icmp_seq=2 ttl=64 time=1.30 ms
64 bytes from fd00:a:b:c:8c58:dd7:916:83c3: icmp_seq=3 ttl=64 time=1.32 ms
64 bytes from fd00:a:b:c:8c58:dd7:916:83c3: icmp_seq=4 ttl=64 time=1.33 ms
64 bytes from fd00:a:b:c:8c58:dd7:916:83c3: icmp_seq=5 ttl=64 time=0.599 ms
64 bytes from fd00:a:b:c:8c58:dd7:916:83c3: icmp_seq=6 ttl=64 time=1.15 ms
64 bytes from fd00:a:b:c:8c58:dd7:916:83c3: icmp_seq=7 ttl=64 time=1.45 ms
64 bytes from fd00:a:b:c:8c58:dd7:916:83c3: icmp_seq=8 ttl=64 time=1.43 ms
64 bytes from fd00:a:b:c:8c58:dd7:916:83c3: icmp_seq=9 ttl=64 time=1.48 ms
64 bytes from fd00:a:b:c:8c58:dd7:916:83c3: icmp_seq=10 ttl=64 time=1.38 ms
^C
--- fd00:a:b:c:8c58:dd7:916:83c3 ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9078ms
rtt min/avg/max/mdev = 0.599/1.206/1.484/0.311 ms
[U0287577@linux ~]# ping -6 fd00:a:b:c:f58a:ac99:3976:daf
PING fd00:a:b:c:f58a:ac99:3976:daf(fd00:a:b:c:f58a:ac99:3976:daf) 56 data bytes
64 bytes from fd00:a:b:c:f58a:ac99:3976:daf: icmp_seq=1 ttl=64 time=0.484 ms
64 bytes from fd00:a:b:c:f58a:ac99:3976:daf: icmp_seq=2 ttl=64 time=1.47 ms
64 bytes from fd00:a:b:c:f58a:ac99:3976:daf: icmp_seq=3 ttl=64 time=1.40 ms
64 bytes from fd00:a:b:c:f58a:ac99:3976:daf: icmp_seq=4 ttl=64 time=1.51 ms
64 bytes from fd00:a:b:c:f58a:ac99:3976:daf: icmp_seq=5 ttl=64 time=1.50 ms
64 bytes from fd00:a:b:c:f58a:ac99:3976:daf: icmp_seq=6 ttl=64 time=1.39 ms
64 bytes from fd00:a:b:c:f58a:ac99:3976:daf: icmp_seq=7 ttl=64 time=1.11 ms
64 bytes from fd00:a:b:c:f58a:ac99:3976:daf: icmp_seq=8 ttl=64 time=1.42 ms
64 bytes from fd00:a:b:c:f58a:ac99:3976:daf: icmp_seq=9 ttl=64 time=1.57 ms
64 bytes from fd00:a:b:c:f58a:ac99:3976:daf: icmp_seq=10 ttl=64 time=1.39 ms
^C
--- fd00:a:b:c:f58a:ac99:3976:daf ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9053ms
rtt min/avg/max/mdev = 0.484/1.323/1.573/0.303 ms
[U0287577@linux ~]#
```

## Parte 6: Servidores Samba, Web y DNS.

A la máquina Linux le ponemos el adaptador en NAT.

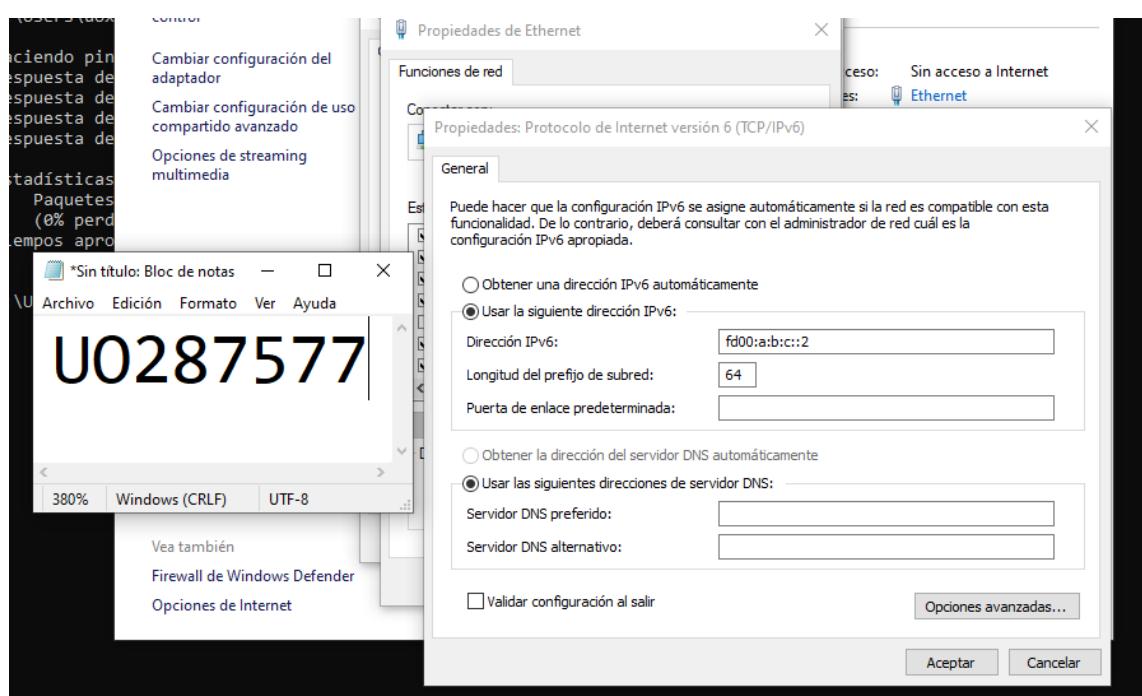
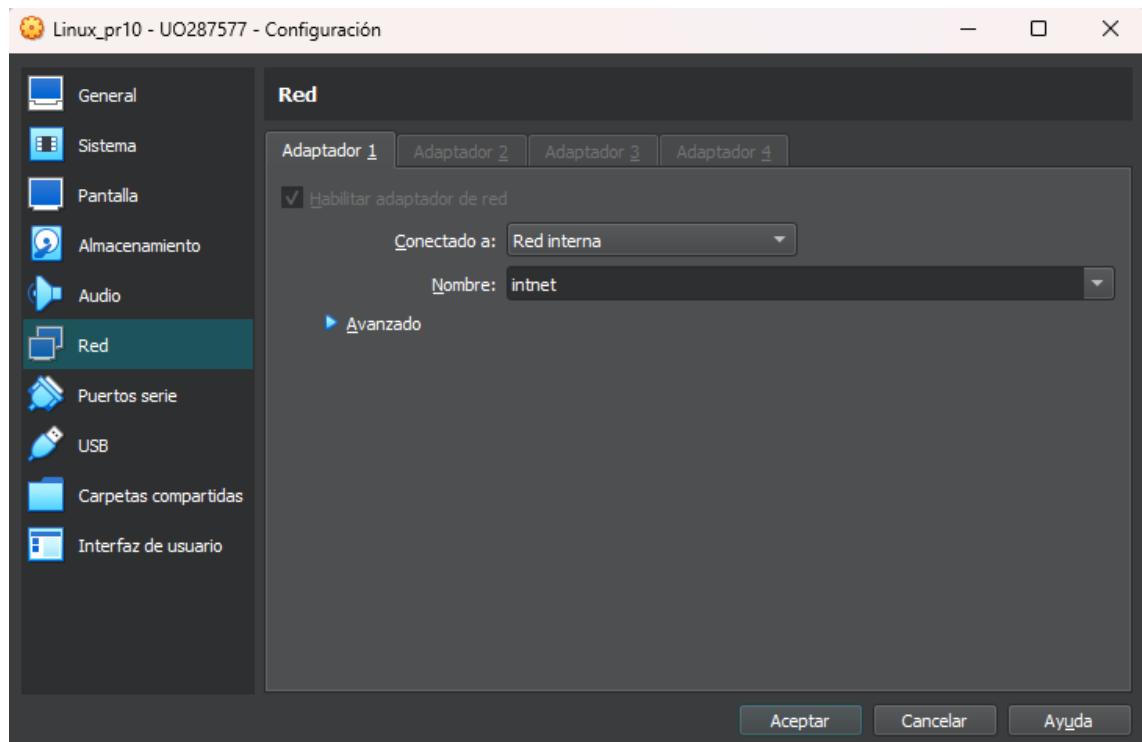


E instalamos los paquetes necesarios para los servicios samba y httpd así como para la consulta con nslookup.

```
# dnf install samba samba-client httpd bind-utils
```

```
[U0287577@linux ~]# dnf install samba samba-client httpd bind-utils
Última comprobación de caducidad de metadatos hecha hace 3:10:45, el jue 03 abr 2025 13:40:33.
El paquete samba-4.20.2-2.el9_5.alma.1.x86_64 ya está instalado.
El paquete samba-client-4.20.2-2.el9_5.alma.1.x86_64 ya está instalado.
El paquete httpd-2.4.62-1.el9_5.2.x86_64 ya está instalado.
El paquete bind-utils-32:9.16.23-24.el9_5.3.x86_64 ya está instalado.
Dependencias resueltas.
Nada por hacer.
¡Listo!
[U0287577@linux ~]# _
```

De nuevo con el adaptador en red interna pondremos las direcciones IPv6 estáticas en ambos equipos: fd00:a:b:c::1 en Linux y fd00:a:b:c::2 en Windows.



```
[U0287577@linux ~]# nmcli con mod enp0s3 ipv6.method manual ipv6.address fd00:a:b:c::1/64
[U0287577@linux ~]# ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
        inet 127.0.0.1/8 scope host lo
            valid_lft forever preferred_lft forever
        inet6 ::1/128 scope host
            valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:d3:e6:6a brd ff:ff:ff:ff:ff:ff
        inet6 fd00:a:b:c::1/64 scope global nopref ixroute
            valid_lft forever preferred_lft forever
        inet6 fd00:a:b:c:a00:27ff:fed3:e66a/64 scope global dynamic nopref ixroute
            valid_lft 86228sec preferred_lft 14228sec
        inet6 fe80::a00:27ff:fed3:e66a/64 scope link nopref ixroute
            valid_lft forever preferred_lft forever
[U0287577@linux ~]#
```

## Samba

Si no está ya hecho, configuramos Samba para usar una carpeta de nombre publicar y añadimos un usuario asuser con su contraseña para samba.

```
[U0287577@linux ~]# mkdir /publicar
[U0287577@linux ~]# useradd asuser
useradd: el usuario «asuser» ya existe
[U0287577@linux ~]# smbpasswd -a asuser
New SMB password:
Retype new SMB password:
[U0287577@linux ~]#
```

```
[U0287577@linux ~]# setsebool -P samba_enable_home_dirs on
[ 9847.819000] SELinux: Converting 435 SID table entries...
[ 9847.824600] SELinux: policy capability network_peer_controls=1
[ 9847.824617] SELinux: policy capability open_perms=1
[ 9847.824624] SELinux: policy capability extended_socket_class=1
[ 9847.824631] SELinux: policy capability always_check_network=0
[ 9847.824638] SELinux: policy capability cgroup_seclabel=1
[ 9847.824645] SELinux: policy capability nmp_nosuid_transition=1
[ 9847.824652] SELinux: policy capability genfs_seclabel_symlinks=1
[U0287577@linux ~]# _
```

Hay que poner la protección adecuada a la carpeta, etiquetarla con chcon, abrir el cortafuegos e iniciar el servicio.

```
[U0287577@linux ~]# nano /etc/samba/smb.conf
```

```

GNU nano 5.6.1                               /etc/samba/smb.conf
# Run 'testparm' to verify the config is correct after
# you modified it.
#
# Note:
# SMB1 is disabled by default. This means clients without support for SMB2 or
# SMB3 are no longer able to connect to smbd (by default).

[global]
    workgroup = SAMBA
    security = user

    passdb backend = tdbsam

    printing = cups
    printcap name = cups
    load printers = yes
    cups options = raw

[homes]
    comment = Home Directories
    valid users = %S, %D\%S
    browseable = Yes
    read only = No
    inherit acls = Yes

[printers]
    comment = All Printers
    path = /var/tmp
    printable = Yes
    create mask = 0600
    browseable = No

[print$]
    comment = Printer Drivers
    path = /var/lib/samba/drivers
    write list = @printadmin root
    force group = @printadmin
    create mask = 0664
    directory mask = 0775

[publicar]
    path = /publicar
    comment = Compartida
    guest ok = Yes
    public = Yes
    writable = Yes
#U0287577_

```

```

[U0287577@linux ~]# chcon -t samba_share_t /publicar
[U0287577@linux ~]#

```

```

[U0287577@linux ~]# firewall-cmd --add-service=samba --permanent
success
[U0287577@linux ~]# firewall-cmd --reload
success
[U0287577@linux ~]#

```

```
[U0287577@linux ~]# systemctl start smb.service
[U0287577@linux ~]# systemctl enable smb.service
[10577.548294] systemd-rc-local-generator[14782]: /etc/rc.d/rc.local is not marked executable, skipping.
[U0287577@linux ~]# systemctl status smb.service
● smb.service - Samba SMB Daemon
   Loaded: loaded (/usr/lib/systemd/system/smb.service; enabled; preset: disabled)
     Active: active (running) since Thu 2025-04-03 12:33:21 CEST; 4h 51min ago
       Docs: man:smbd(8)
              man:samba(7)
              man:smb.conf(5)
     Main PID: 1163 (smbd)
    Status: "smbd: ready to serve connections..."
      Tasks: 3 (limit: 10992)
     Memory: 22.3M
        CPU: 209ms
      CGroup: /system.slice/smb.service
              └─1163 /usr/sbin/smbd --foreground --no-process-group
                  ├─1203 /usr/sbin/smbd --foreground --no-process-group
                  ├─1204 /usr/sbin/smbd --foreground --no-process-group
                  └─1205 /usr/sbin/smbd --foreground --no-process-group

abr 03 12:33:21 linux.as.local systemd[1]: Starting Samba SMB Daemon...
abr 03 12:33:21 linux.as.local smbd[1163]: [2025/04/03 12:33:21.829204,  0] ../../source3/smbd/server.c:1746(main)
abr 03 12:33:21 linux.as.local smbd[1163]: smbd version 4.20.2 started.
abr 03 12:33:21 linux.as.local smbd[1163]: Copyright Andrew Tridgell and the Samba Team 1992-2024
abr 03 12:33:21 linux.as.local systemd[1]: Started Samba SMB Daemon.
abr 03 16:58:22 linux.as.local smbd[14685]: [2025/04/03 16:58:22.033773,  0] ../../source3/printing/printer_list.c:58
abr 03 16:58:22 linux.as.local smbd[14685]: get_printer_list_db: Failed to open printer_list.tdb
abr 03 16:58:40 linux.as.local smbd[14689]: [2025/04/03 16:58:40.701501,  0] ../../source3/printing/printer_list.c:58
abr 03 16:58:40 linux.as.local smbd[14689]: get_printer_list_db: Failed to open printer_list.tdb
[U0287577@linux ~]#
```

Comprobamos que se puede acceder localmente con IPv6 además de con IPv4.

```
# smbclient //::1/publicar -U asuser
```

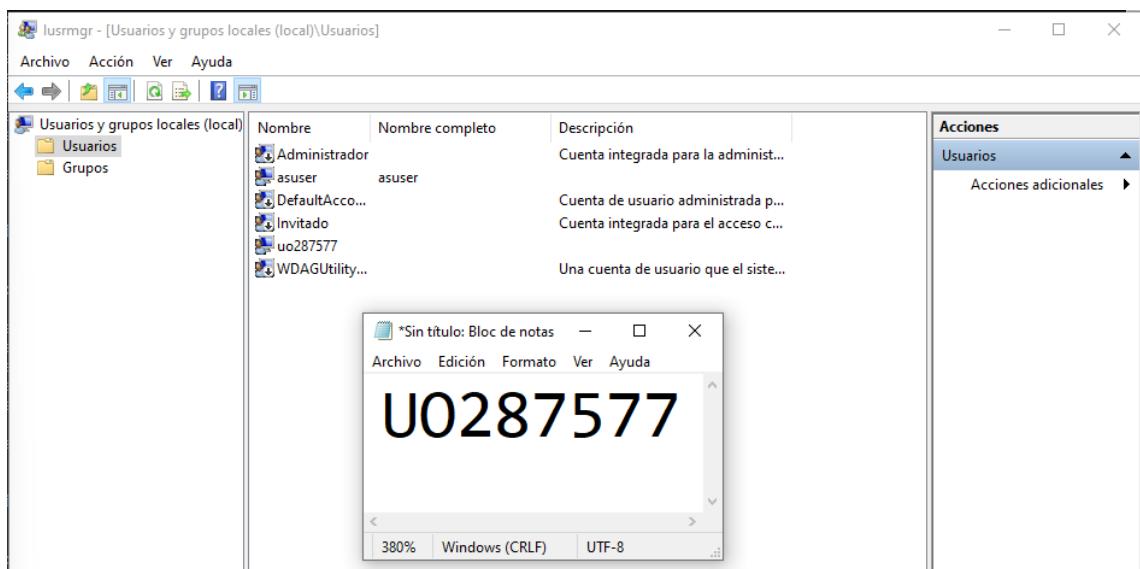
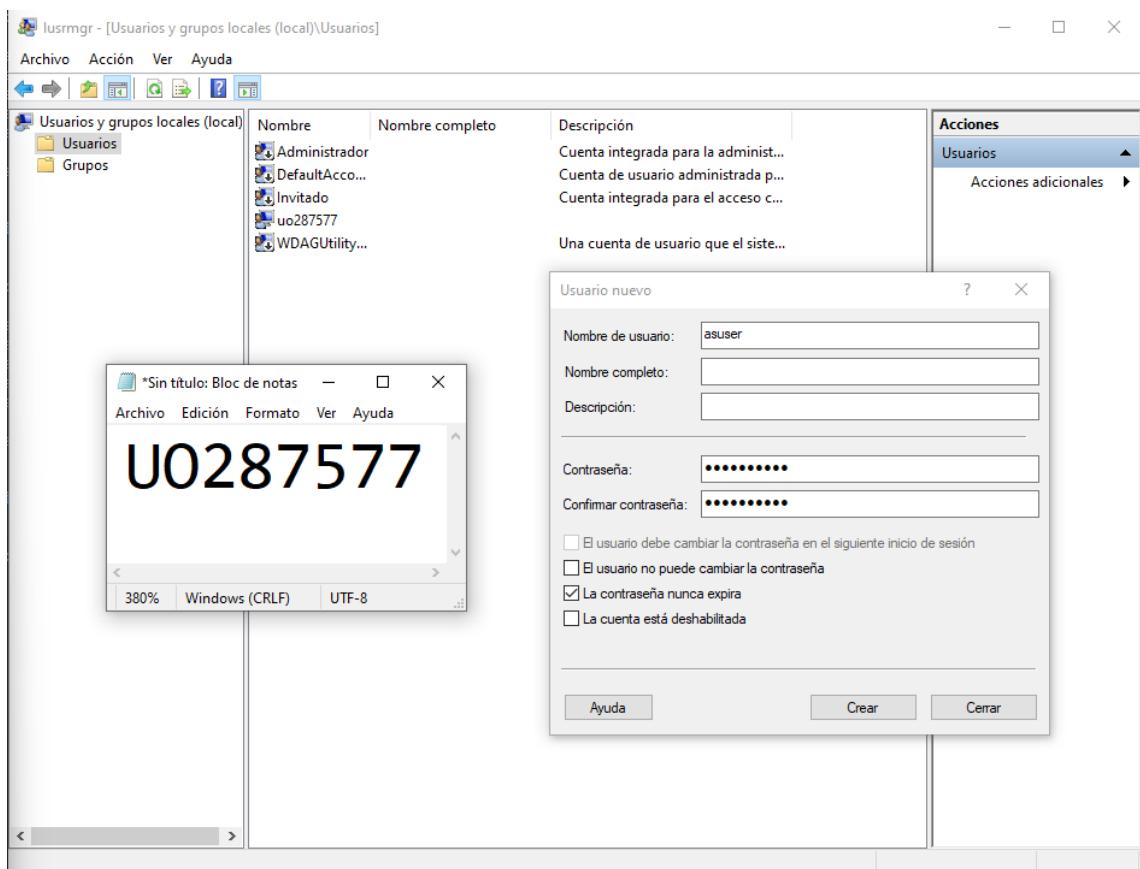
```
# smbclient //fd00:a:b:c::1/publicar -U asuser
```

```
[U0287577@linux ~]# smbclient //::1/publicar -U asuser
Password for [SAMBA\asuser]:
Try "help" to get a list of possible commands.
smb: \> ls
.
D          0  Thu Apr  3 17:10:49 2025
..
D          0  Thu Apr  3 17:10:49 2025

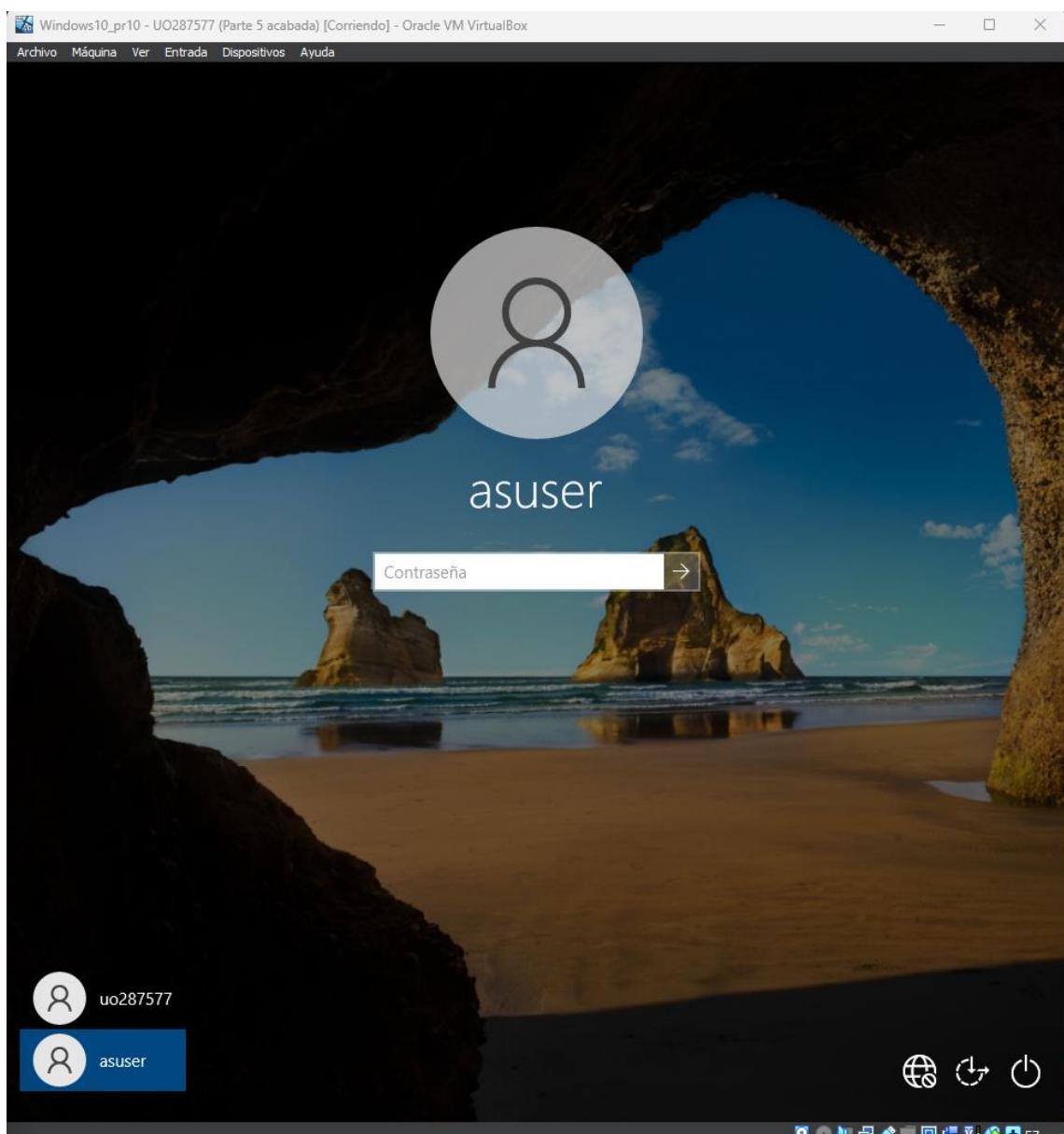
17141760 blocks of size 1024. 14955680 blocks available
smb: \> exit
[U0287577@linux ~]# smbclient //fd00:a:b:c::1/publicar -U asuser
Password for [SAMBA\asuser]:
Try "help" to get a list of possible commands.
smb: \> ls
.
D          0  Thu Apr  3 17:10:49 2025
..
D          0  Thu Apr  3 17:10:49 2025

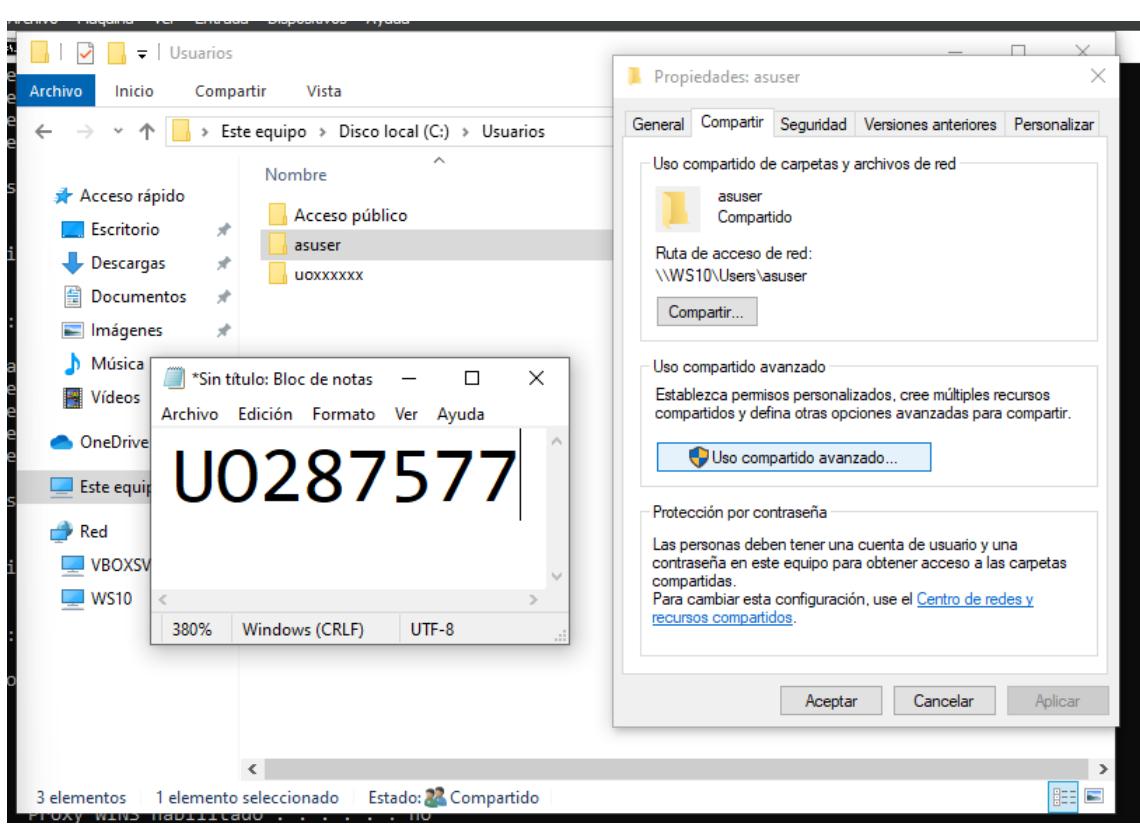
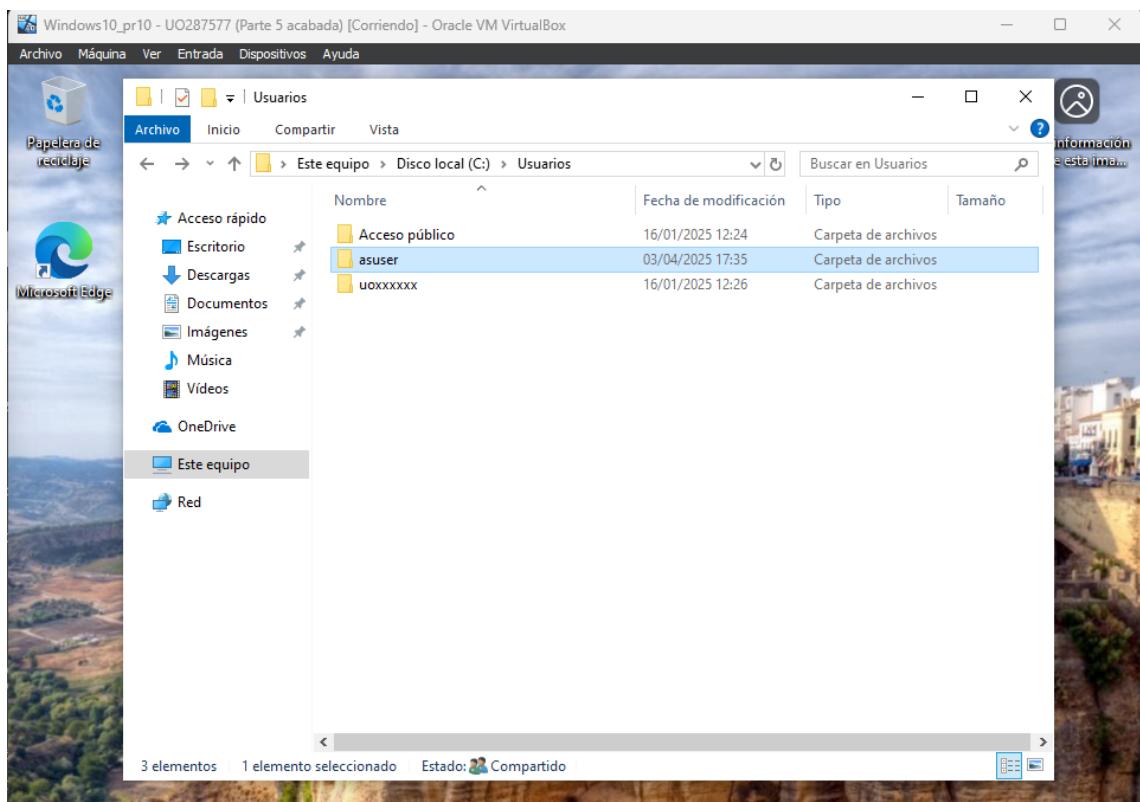
17141760 blocks of size 1024. 14955680 blocks available
smb: \>
```

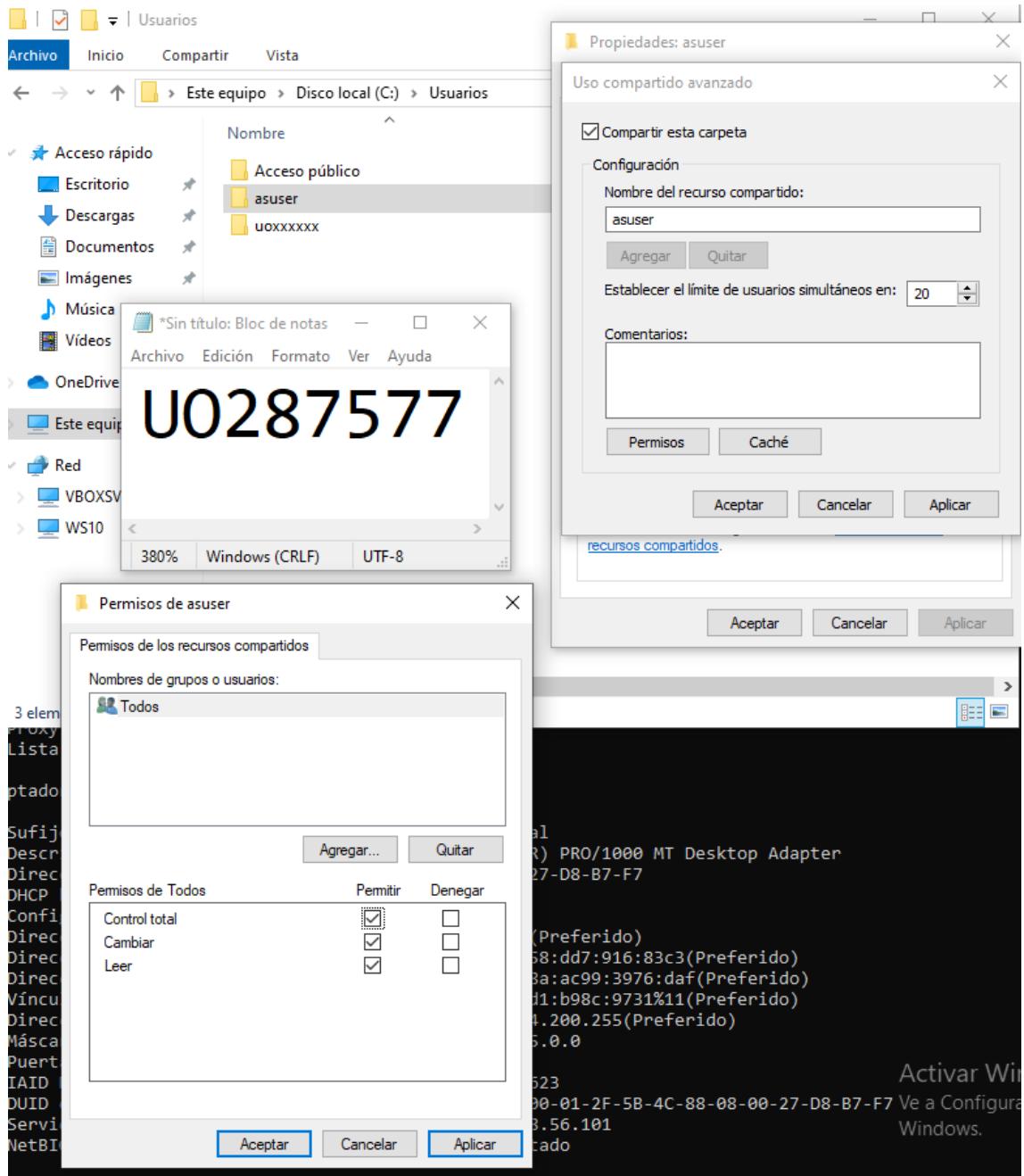
En Windows hacemos lo mismo con el usuario asuser si no está ya hecho.



Recordemos iniciar sesión en Windows con dicho usuario para que se cree su directorio.







Desde Linux conectamos con la carpeta de Windows:

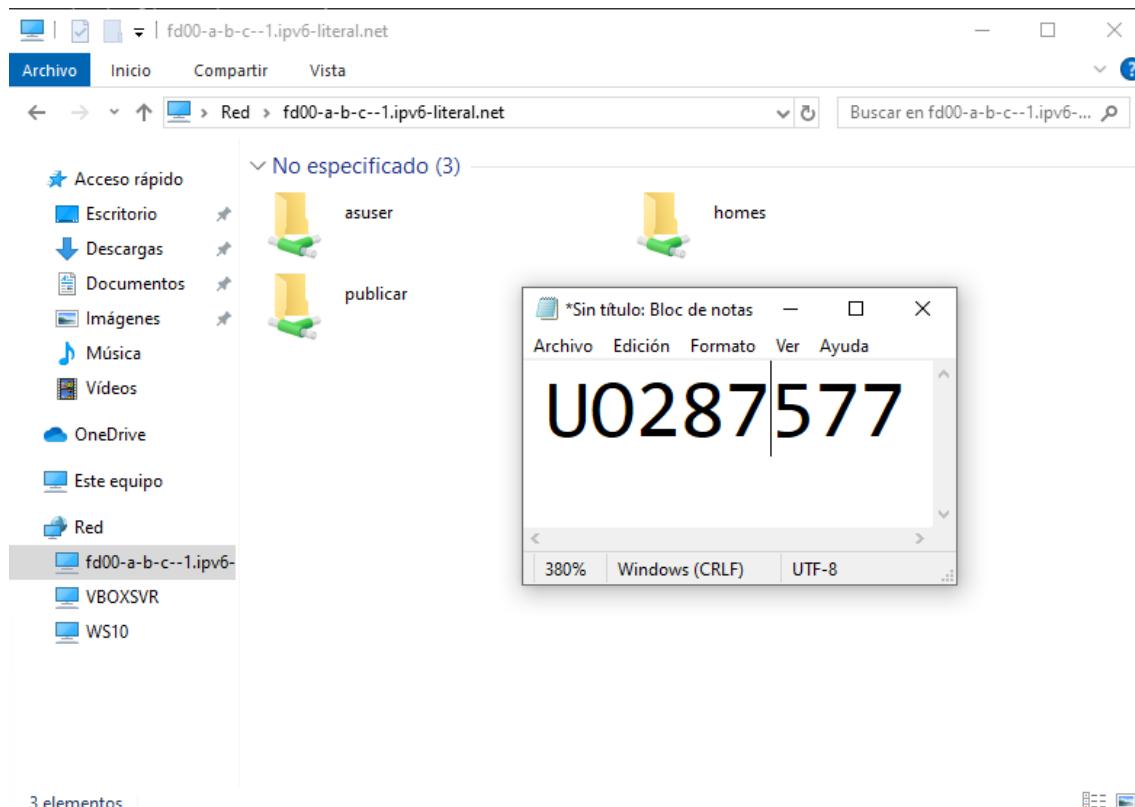
```
# smbclient //fd00:a:b:c::2/asuser -U asuser
```

```
[U0287577@linux ~]# smbclient //fd00:a:b:c::2/asuser -U asuser
Password for [SAMBAsasuser]:
Try "help" to get a list of possible commands.
smb: \> ls
.
..
3D Objects DR 0 Thu Apr 3 17:35:35 2025
AppData DHSrn 0 Thu Apr 3 17:32:29 2025
Configuración local DHSrn 0 Thu Apr 3 17:32:29 2025
Contacts DR 0 Thu Apr 3 17:32:36 2025
Cookies DHSrn 0 Thu Apr 3 17:32:29 2025
Datos de programa DHSrn 0 Thu Apr 3 17:32:29 2025
Desktop DR 0 Thu Apr 3 17:32:36 2025
Documents DR 0 Thu Apr 3 17:32:36 2025
Downloads DR 0 Thu Apr 3 17:32:36 2025
Entorno de red DHSrn 0 Thu Apr 3 17:32:29 2025
Favorites DR 0 Thu Apr 3 17:32:36 2025
Impresoras DHSrn 0 Thu Apr 3 17:32:29 2025
Links DR 0 Thu Apr 3 17:32:36 2025
Menú Inicio DHSrn 0 Thu Apr 3 17:32:29 2025
Mis documentos DHSrn 0 Thu Apr 3 17:32:29 2025
Music DR 0 Thu Apr 3 17:32:36 2025
NTUSER.DAT AHN 1048576 Thu Jan 16 13:15:59 2025
ntuser.dat.LOG1 AHS 315392 Thu Apr 3 17:32:28 2025
ntuser.dat.LOG2 AHS 53248 Thu Apr 3 17:32:28 2025
NTUSER.DAT{53b39e88-18c4-11ea-a811-000d3aa4692b}.TM.b1f AHS 0 Thu Apr 3 17:32:28 2025
NTUSER.DAT{53b39e88-18c4-11ea-a811-000d3aa4692b}.TMContainer00000000000000000001.regtrans-ms AHS 0 Thu Apr 3 17:32:28 2025
NTUSER.DAT{53b39e88-18c4-11ea-a811-000d3aa4692b}.TMContainer00000000000000000002.regtrans-ms AHS 0 Thu Apr 3 17:32:28 2025
ntuser.ini AHS 20 Thu Apr 3 17:32:29 2025
OneDrive DR 0 Thu Apr 3 17:35:35 2025
Pictures DR 0 Thu Apr 3 17:32:36 2025
Plantillas DHSrn 0 Thu Apr 3 17:32:29 2025
Reciente DHSrn 0 Thu Apr 3 17:32:29 2025
Saved Games DR 0 Thu Apr 3 17:32:36 2025
Searches DR 0 Thu Apr 3 17:34:02 2025
SendTo DHSrn 0 Thu Apr 3 17:32:29 2025
Videos DR 0 Thu Apr 3 17:32:36 2025

12933157 blocks of size 4096. 6224695 blocks available
smb: \> _
```

Como Windows no permite el uso del carácter ":" en las especificaciones de carpetas de red, para conectar desde Windows con la carpeta Linux es necesario usar esta ubicación:

<\\fd00:a:b:c--1.ipv6-literal.net\\>



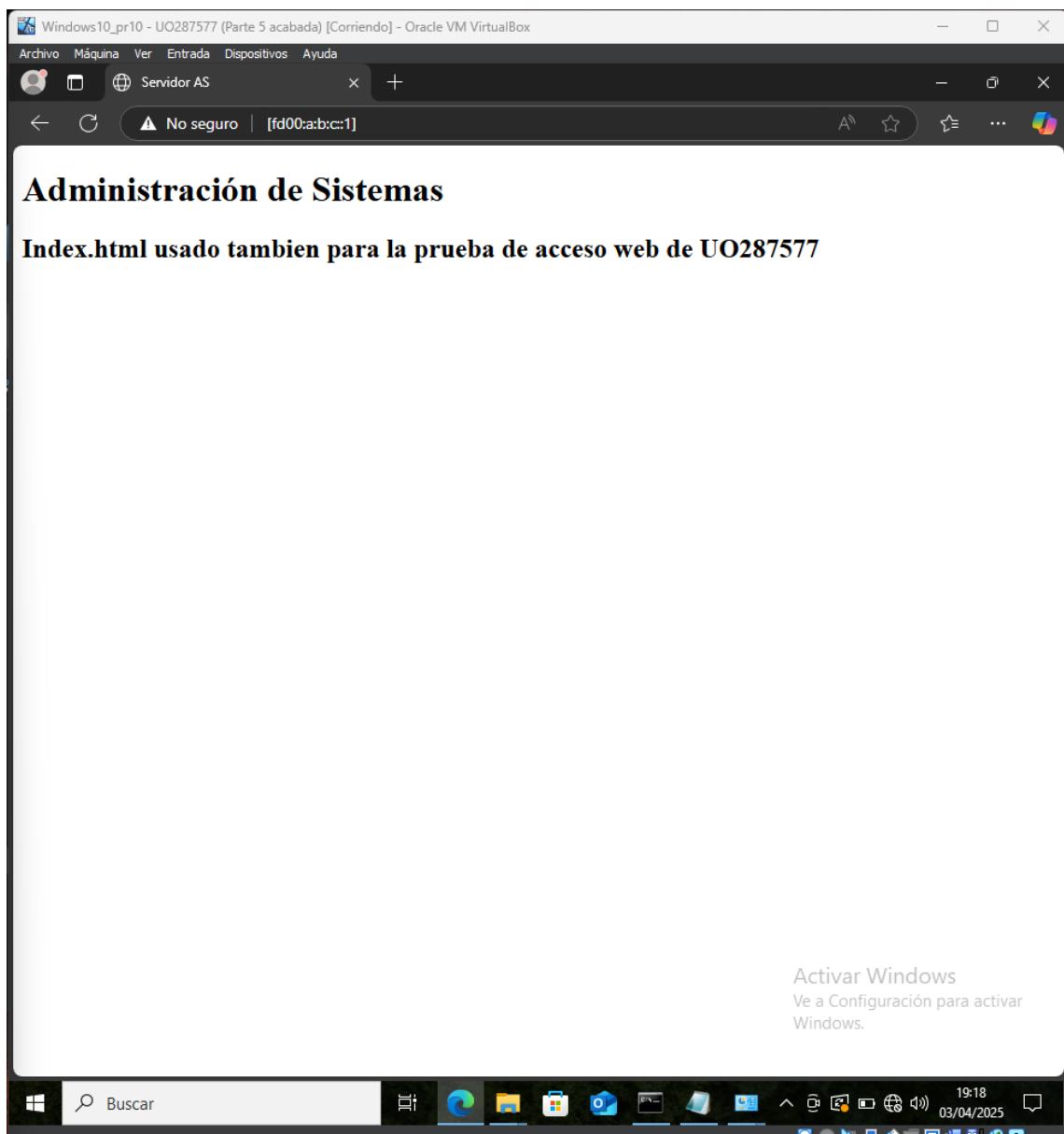
## Web

Para el servidor web en Linux no hace falta nada extra con respecto a IPv4.

Si tenemos un /var/www/html/index.html basta navegar a [http://\[fd00:a:b:c::1\]/](http://[fd00:a:b:c::1]/) desde la máquina con Windows.

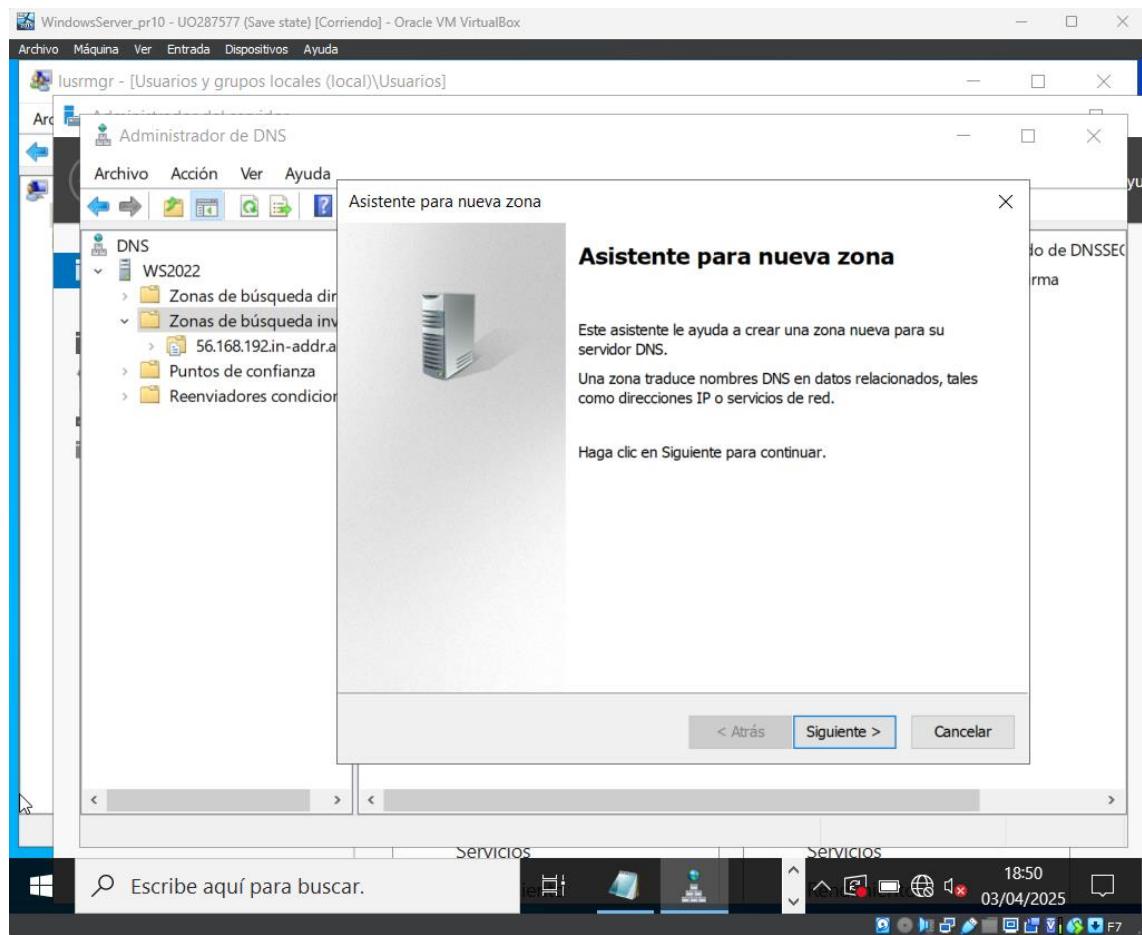
```
[U0287577@linux ~]# cd /var/www/html
[U0287577@linux html]$ ls
index.html  joomla  prueba
[U0287577@linux html]$ nano index.html
```

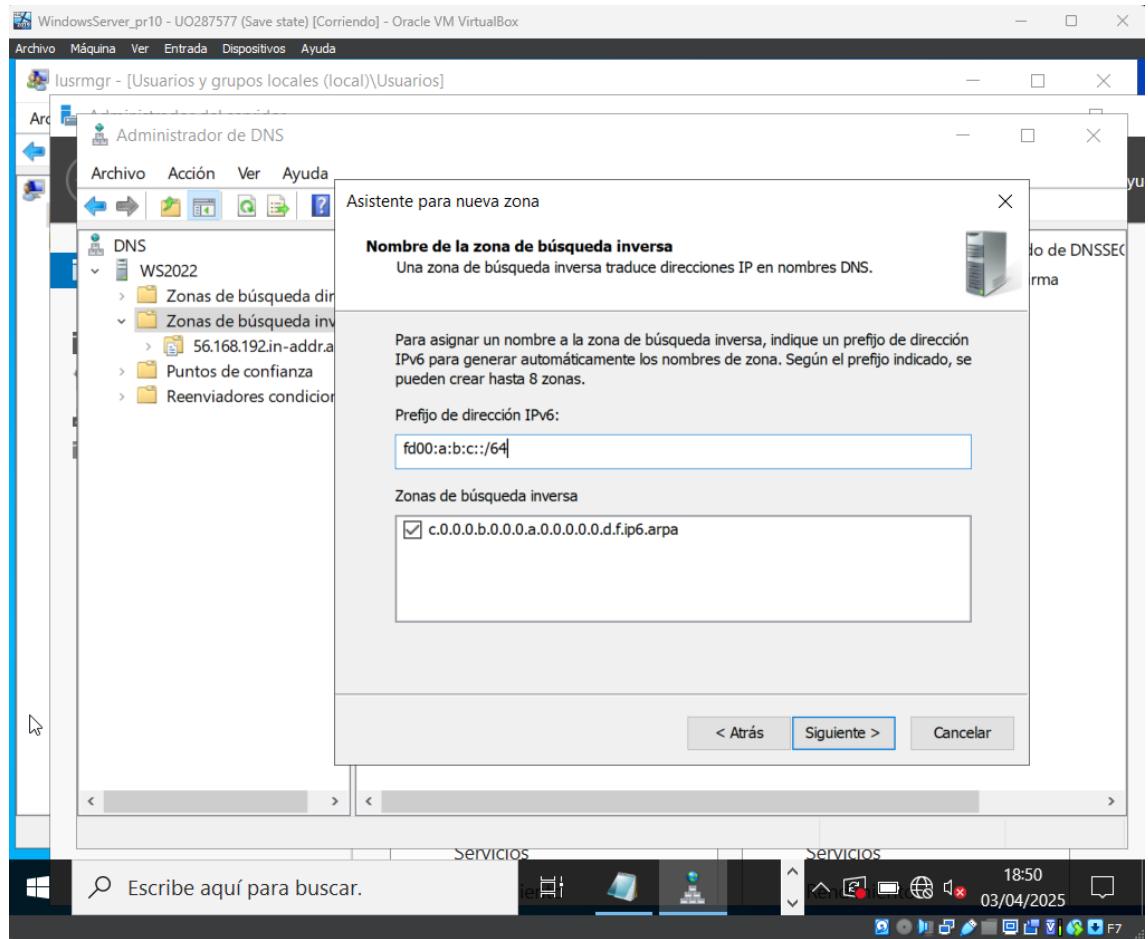
```
<!DOCTYPE html>
<head>
  <meta charset="utf-8" />
  <title>Servidor AS</title>
</head>
<body>
  <h1>Administración de Sistemas</h1>
  <h2>Index.html usado tambien para la prueba de acceso web de U0287577</h2>
</body>
</html>
```

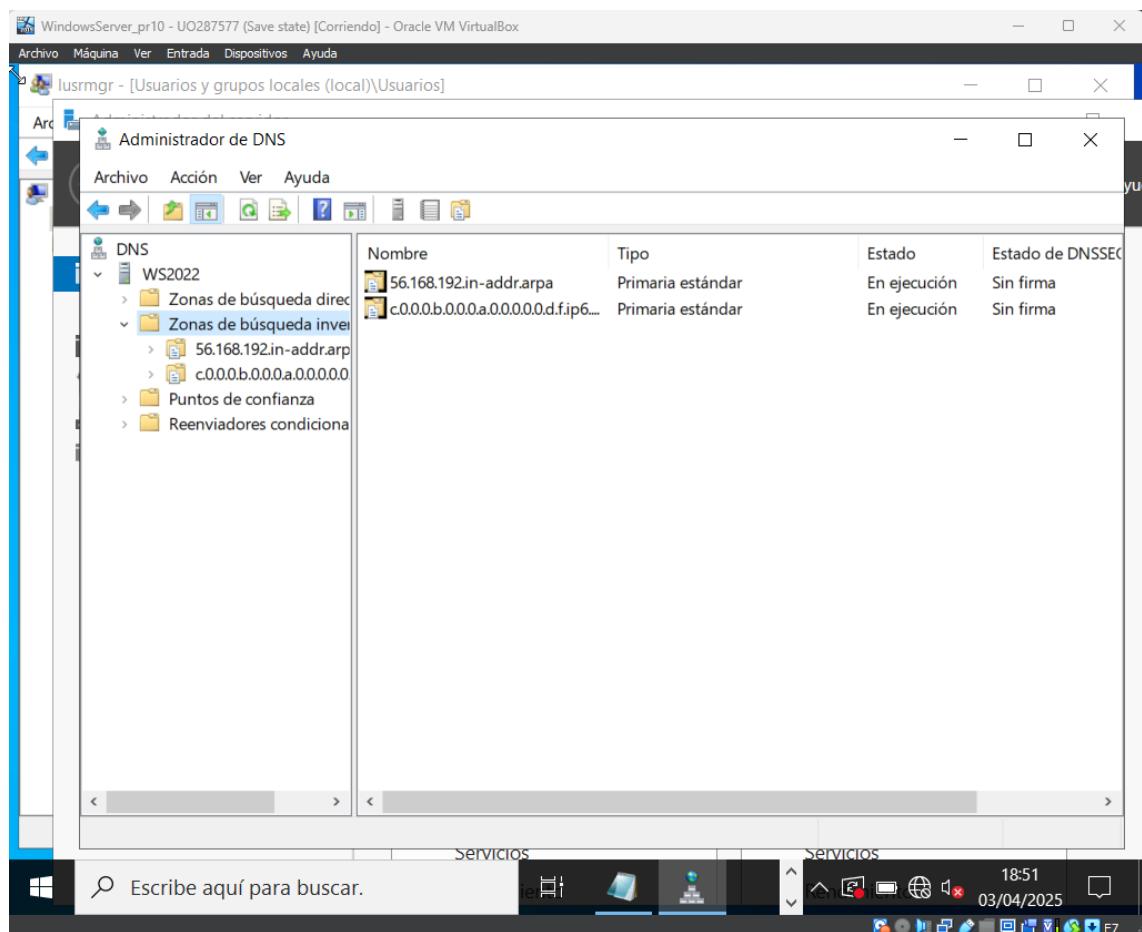


## DNS

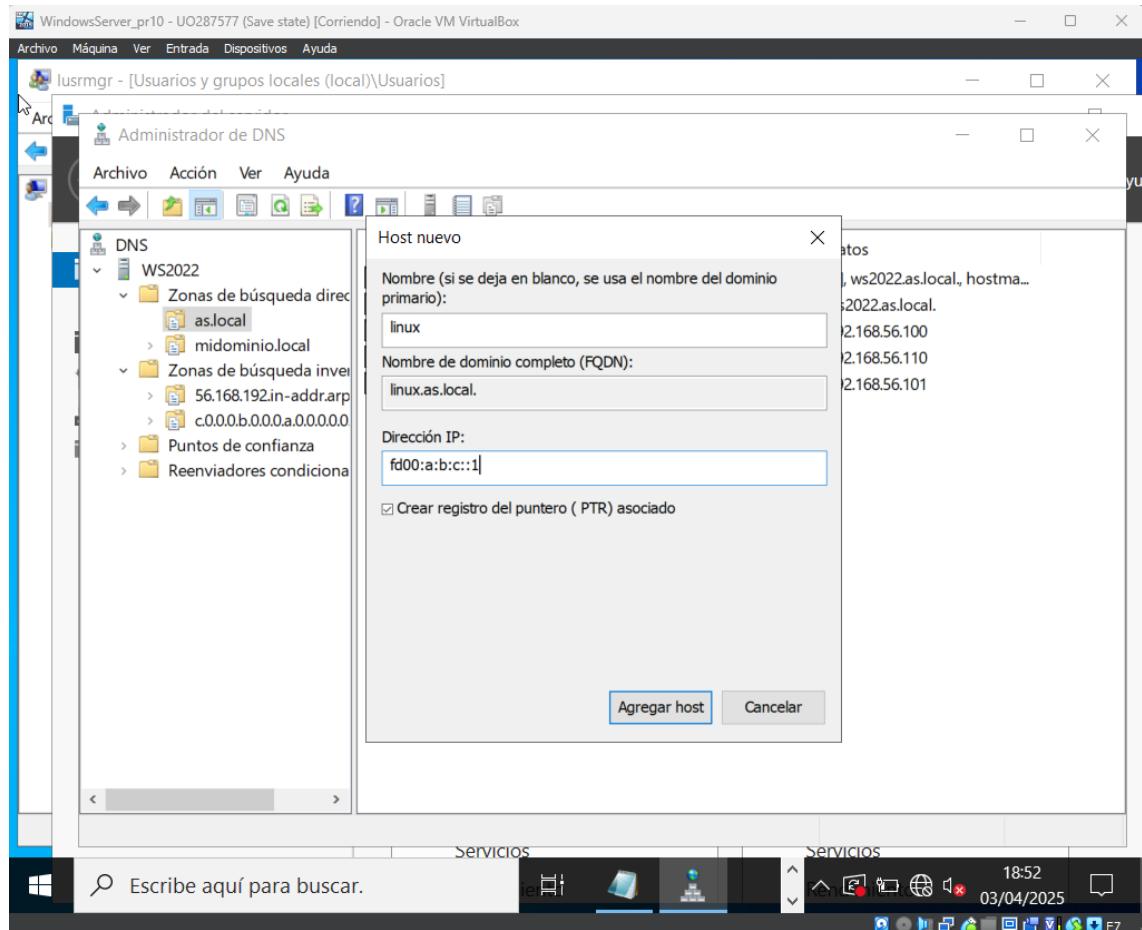
En el servidor Windows creamos la zona inversa de IPv6 especificando como prefijo fd00:a:b:c::/64

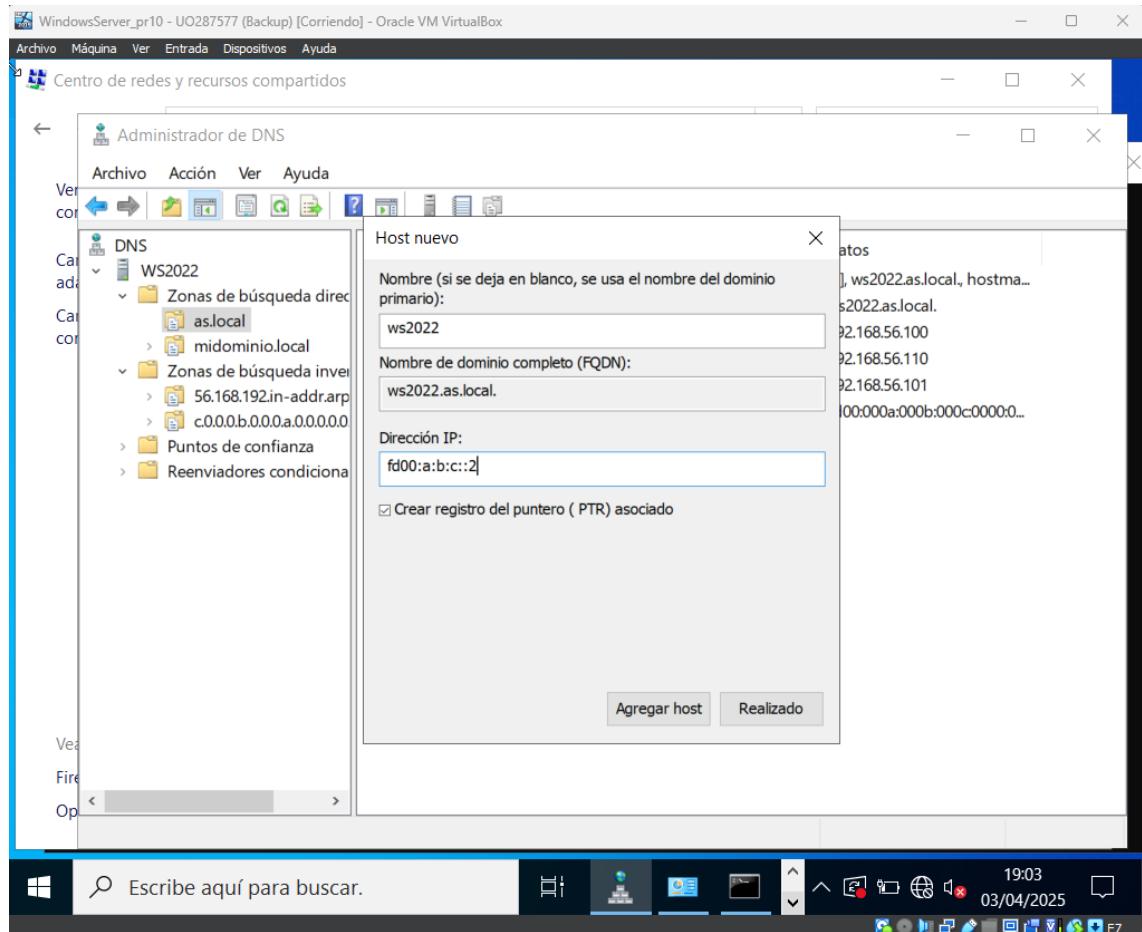


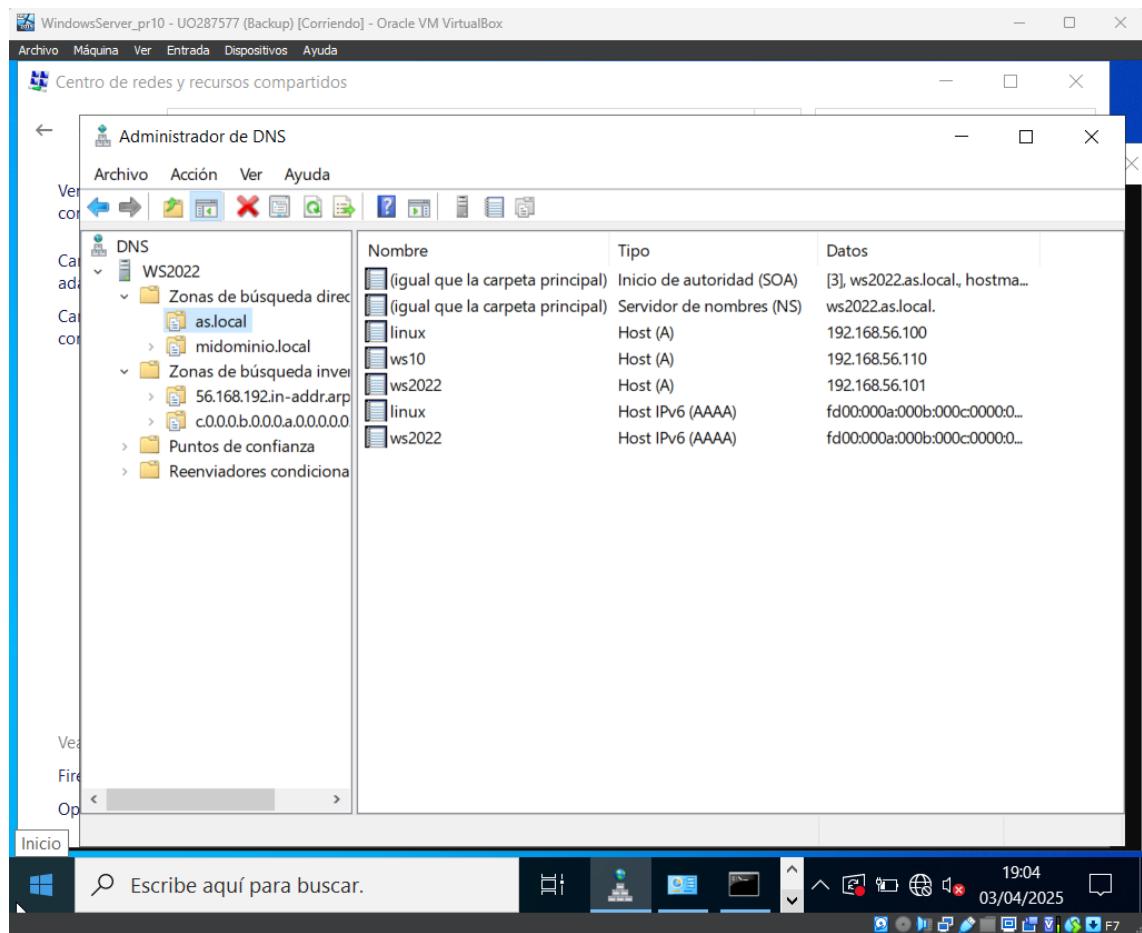




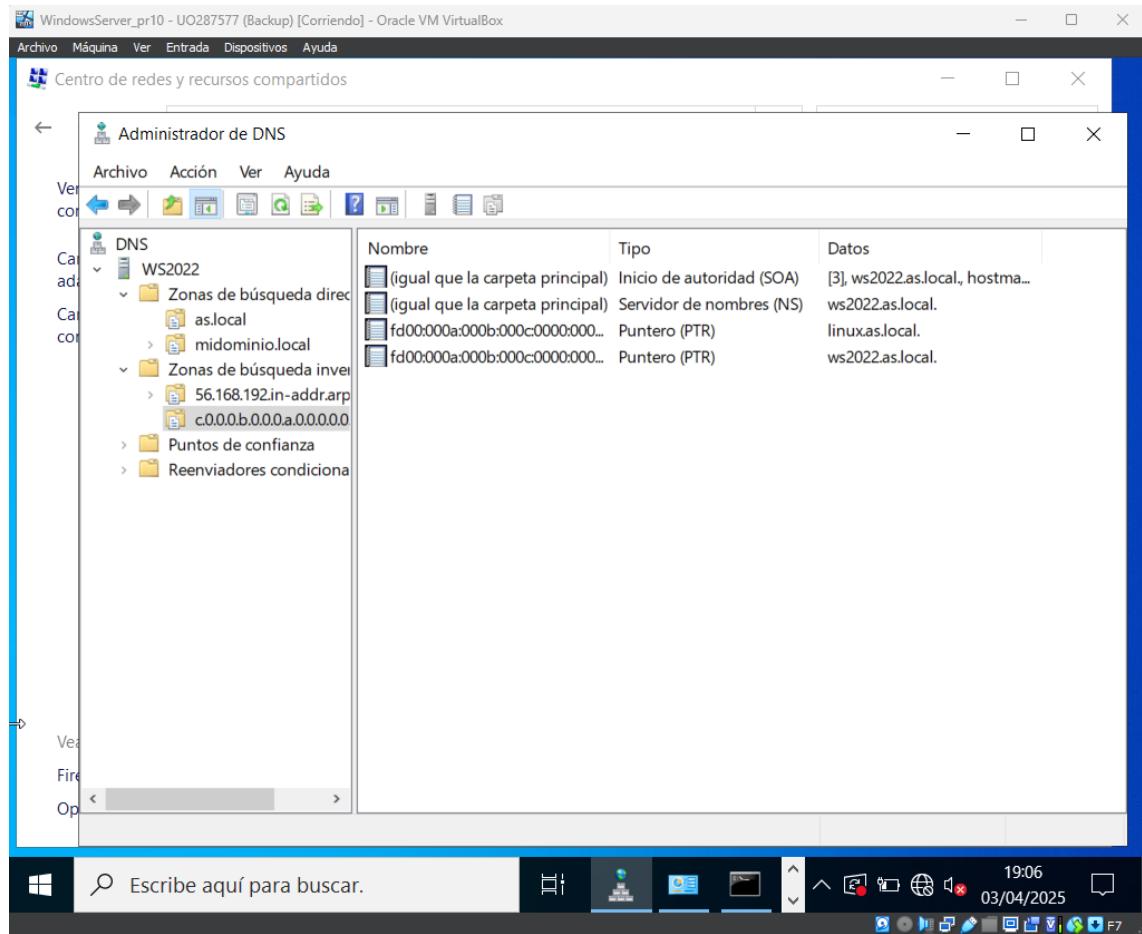
Y añadimos bajo as.local los hosts AAAA linux y ws2022.







Comprobamos que se han añadido correctamente también los punteros inversos de IPv6.



Desde la máquina con Linux consultamos con nslookup el servidor DNS de Windows con IPv4 y con IPv6. En ambos casos debe devolver las dos direcciones, la IPv4 y la IPv6.

Consulta con IPv4:

```
# nslookup
> server 192.168.56.101
Default server: 192.168.56.101
Address: 192.168.56.101#53
> linux.as.local
Server: 192.168.56.101
Address: 192.168.56.101#53
Name: linux.as.local
Address: 192.168.56.100
Name: linux.as.local
Address: fd00:a:b:c::1
```

```
[U0287577@linux ~]# nslookup  
> server 192.168.56.101  
Default server: 192.168.56.101  
Address: 192.168.56.101#53  
> linux.as.local  
Server: 192.168.56.101  
Address: 192.168.56.101#53  
  
Name: linux.as.local  
Address: 192.168.56.100  
Name: linux.as.local  
Address: fd00:a:b:c::1  
> _
```

Consulta con IPv6:

```
# nslookup  
  
> server fd00:a:b:c::2  
  
Default server: fd00:a:b:c::2  
  
Address: fd00:a:b:c::2#53  
  
> linux.as.local  
  
Server: fd00:a:b:c::2  
  
Address: fd00:a:b:c::2#53  
  
Name: linux.as.local  
  
Address: 192.168.56.100  
  
Name: linux.as.local  
  
Address: fd00:a:b:c::1
```

```
[U0287577@linux ~]# nslookup  
> server fd00:a:b:c::2  
Default server: fd00:a:b:c::2  
Address: fd00:a:b:c::2#53  
> linux.as.local  
Server: fd00:a:b:c::2  
Address: fd00:a:b:c::2#53  
  
Name: linux.as.local  
Address: 192.168.56.100  
Name: linux.as.local  
Address: fd00:a:b:c::1  
> _
```