How to configure IPv6 over IPv4 tunnelling interoperability between an Allied Telesyn AR740 router and a CISCO 4500 router

Introduction

This document introduces tunnelling IPv6 packets over an IPv4 network, and a method of obtaining interoperability between Allied Telesyn AR740 and Cisco 4500 routers.

IPv6 is enabled on Allied Telesyn routers via a special feature licence. To obtain a special feature licence contact an Allied Telesyn authorised distributor or reseller.

This document assumes you have a working knowledge of IPv6 as well as Allied Telesyn and Cisco routers.

Hardware and software used

The configuration example in this document uses:

- an AR740 router running software release 2.5.1 patch 05.
- a Cisco 4500 router running Cisco operating system version 12.2(2)T.

IPv6 Static Tunnel

Tunnelling is one of the mechanisms that facilitates the IPv6 transition. It provides a way to utilise an existing IPv4 network infrastructure to carry IPv6 traffic while the IPv6 network infrastructure is being implemented.

An IPv6 static tunnel is a "virtual link" which is manually configured between the edge routers of two IPv6 domains that are interconnected by an IPv4 network infrastructure. IPv6 packets are then tunnelled simply by encapsulating them within the IPv4 packets.

Configuration example

Router Configuration

This section describes the steps for configuring the AR740 and Cisco 4500 routers for the scenario illustrated in Figure 1.

Figure 1 shows AR740 and Cisco 4500 routers, which are the edge routers of two IPv6 domains. The two IPv6 domains are interconnected by the IPv4 network infrastructure.

Figure 1: Configuration setup for AR740 and Cisco 4500 routers
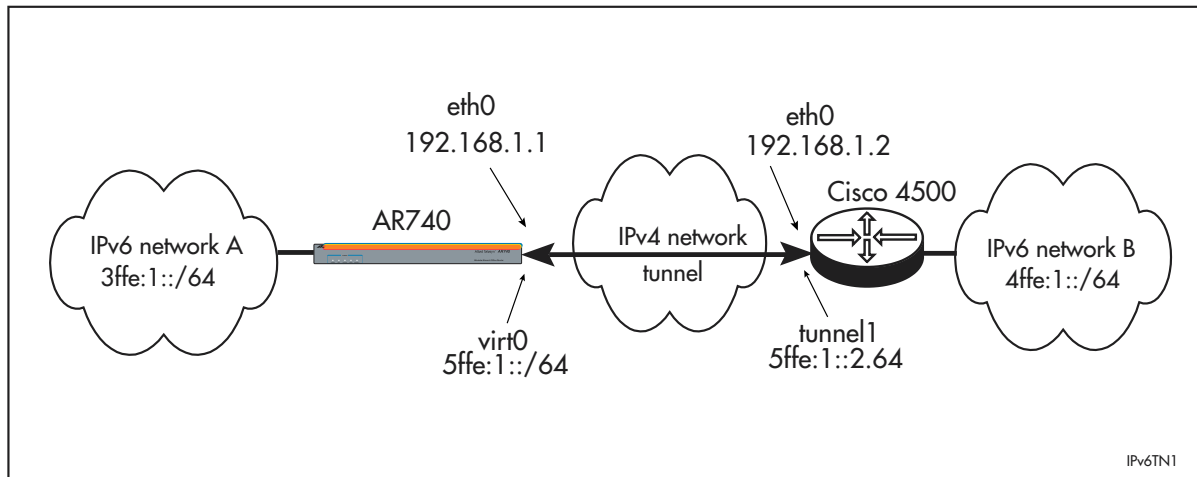
Configuration for AR740 router

1. **Enable IP and add an interface to the AR740 router**

   ```
   enable ip

   add ip int=eth0 ip=192.168.1.1
   ```

2. **Enable IPv6**

   ```
   enable ipv6
   ```

3. **Create a tunnel between the AR740 and the Cisco 4500**

   ```
   add ipv6 tunnel local=192.168.1.1 target=192.168.1.2 int=virt0
       ip=5ffe:1::1/64

   create ipv6 int=eth1

   add ipv6 int=eth1 ip=3ffe:1::1/64

   add ipv6 route=4ffe:1::/64 next=:: int=virt0
   ```

For detailed information on the command syntax and additional configuration information, please refer to the Internet Protocol Version 6 (IPv6) chapter of your AR Series Router's software reference.

Figure 2: Output of the SHOW IPV6 INTERFACE=VIRTUAL0 command for the AR740 router

```
IPV6 Interface Configuration
-----------------------------------------------------------------------
Interface ............................... virt0
Ipv6 Interface Index ..................... 1
Link-layer address ....................... ipv4 tunnel
Link-layer state ......................... ipv4 tunnel
EUI-64 Interface Identifier .............. ipv4 tunnel
IPSec .................................... No
True MTU/Link MTU ........................ -/1280
Multicast status ......................... Enabled
Send Router Advertizements ? ............. No
Ipv6 Interface Addresses :
  Int   Addresses                          PLen   Decrement
    Type      Scope State      Enabled  Valid      Preferred      Publish
-----------------------------------------------------------------------
  0    5ffe:0001::0001                         /64    No
    unicast  global preferred   Yes      infinite  infinite      No
```

Figure 3: Output of the SHOW IPV6 TUNNEL command for the AR740 router

```
IPv6 Tunnels:

Interface   Ipv6 Tunnel Address
   Tunnel start          Tunnel end
----------------------------------------------------------------
virt0       5ffe:0001::0001
   192.168.1.1           192.168.1.2
----------------------------------------------------------------
```

Figure 4: Output of the SHOW IPV6 ROUTE command for the AR740 router

```
Destination prefix    --->   Next Hop
Int.      Age  Policy Protocol    Metric  Pref     Tunnel DLCI Flags
----------------------------------------------------------------
5ffe:0001::/64 ---> ::
virt0    no   0     interface    1      0        yes      -
3ffe:0001::/64 ---> ::
eth1     no   0     interface    1      0        no       -
4ffe:0001::/64 ---> ::
virt0    no   0     static       1      60       yes      -
----------------------------------------------------------------
Codes: P=publish, D=default, A=addrconf, S=stale, L=onlink
N=nonexthop, C=cache, F=flow, Y=policy, U=unknown
```

Figure 5: Output of the PING 4FFE:1::1 command for the AR740 router

```
Echo reply 1 from 4ffe:0001::0001 time delay 1 ms
Echo reply 2 from 4ffe:0001::0001 time delay 1 ms
Echo reply 3 from 4ffe:0001::0001 time delay 1 ms
Echo reply 4 from 4ffe:0001::0001 time delay 1 ms
Echo reply 5 from 4ffe:0001::0001 time delay 1 ms
```

Configuration for the Cisco 4500 router

```
ipv6 unicast-routing

!

!interface Tunnel1
     description IPv6 tunnel
     no ip address
     ipv6 address 5FFE:1::2/64
     tunnel source Ethernet0
     tunnel destination 192.168.1.1
     tunnel mode ipv6ip

!

interface Ethernet0
     ip address 192.168.1.2 255.255.255.0
     media-type auto-select

!

interface Ethernet1
     no ip address
     media-type auto-select
     ipv6 enable
     ipv6 address 4FFE:1::1/64

!

ipv6 route 3FFE:1::/64 Tunnel1

end
```

Figure 6: Output of the SHOW INTERFACE TUNNEL1 command for the Cisco 4500 router

```
R4500#sh int tunnel1
Tunnel1 is up, line protocol is up
  Hardware is Tunnel
  Description: IPv6 tunnel
  MTU 1514 bytes, BW 9 Kbit, DLY 500000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation TUNNEL, loopback not set
  Keepalive set (10 sec)
  Tunnel source 192.168.1.2 (Ethernet0), destination 192.168.1.1
  Tunnel protocol/transport IPv6/IP, key disabled, sequencing disabled
  Checksumming of packets disabled
  Last input 00:05:25, output 00:05:25, output hang never
  Last clearing of "show interface" counters never
  Queueing strategy: fifo
  Output queue 0/0, 1 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     40 packets input, 3960 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     41 packets output, 4744 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
```

Figure 7: Output of the SHOW IPV6 ROUTE command for the Cisco 4500 router

```
R4500#sh ipv6 route
IPv6 Routing Table - 6 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
Timers: Uptime/Expires

S 3FFE:1::/64 [1/0]
  via ::, Tunnel1, 00:26:55/never
L 4FFE:1::1/128 [0/0]
  via ::, Ethernet1, 00:10:04/never
C 4FFE:1::1/64 [0/0]
  via ::, Ethernet1, 00:10:04/never
L 5FFE:1::2/128 [0/0]
  via ::, Tunnel1, 00:26:55/never
C 5FFE:1::2/64 [0/0]
  via ::, Tunnel1, 00:26:55/never
L FE80::/64 [0/0]
  via ::, Null0, 00:33:13/never
```

Figure 8: Output of the PING 3FFE:1::1 command for the Cisco 4500 router

```
R4500#ping 3ffe:1::1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 3FFE:1::1, timeout is 2
seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max =
1/2/4 ms
```