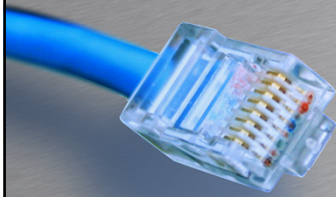


IP version 6



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Kapitel 4: IPv6 Integration and Coexistence Strategies

Baseret på bogen: Cisco Self-study: Implementing Cisco IPv6 Networks

Henrik Thomsen V1.0




Indhold

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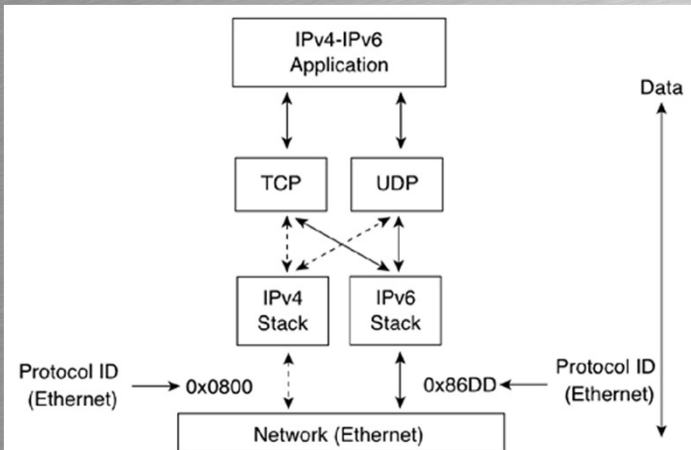
- Dual-Stack
- Tunneling
- Protokol Translation



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Dual-Stack Applikationer

- IPv4-only applikationer skal modificeres
 - Hvis både IPv4 og IPv6 stakken





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Dual-Stack på Cisco

- Når der tildeles en IPv4 og IPv6 adresse på et Interface er Dual-Stack enablet
- I eksemplet herunder startes IPv6 Routing

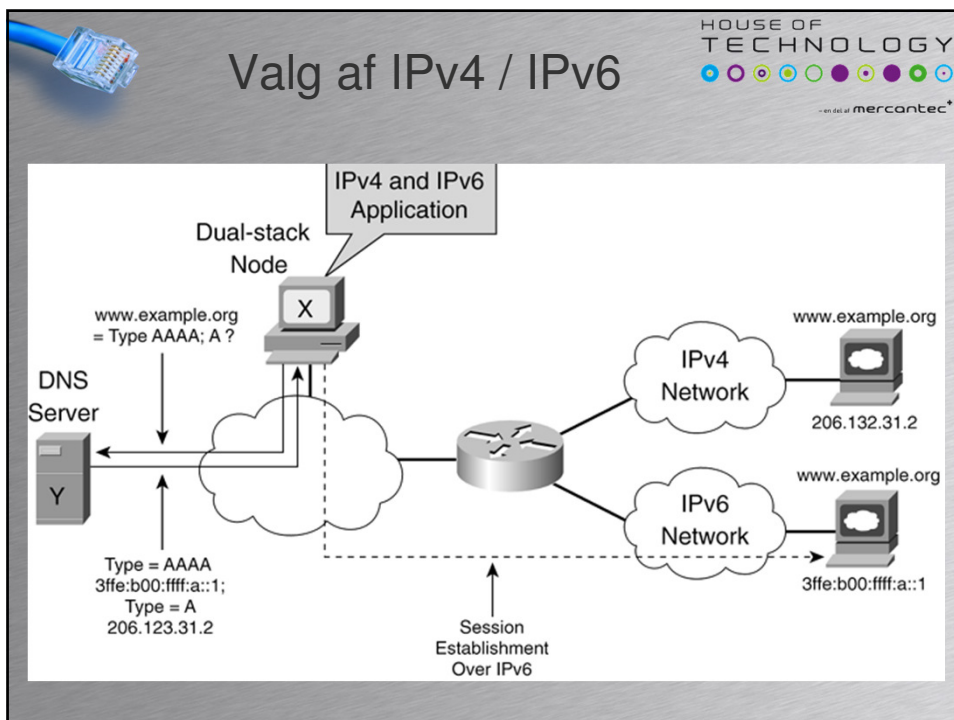
```
ip routing
ip cef
ipv6 unicast-routing
ipv6 cef
!
interface fastethernet 0/0
  ipv6 address 2001:410:ffff:1::1/64
  ip address 206.31.23.22 255.255.255.0
```



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Valg af IPv4 / IPv6

- Applikationer kan ikke selv vælge
- For at vælge
 - Tast adressen ind manuelt ☺
 - DNS forespørgsel
 - IPv4-only hosts spørger efter IPv4 (A-Record)
 - IPv6-only spørger på IPv6 (AAAA-record)
 - Dual-Stack spørger på IPv4 og IPv6 (A+AAAA)
 - IPv6 er foretrukket over IPv4
 - Brug af HOSTS fil også mulig
 - /etc/hosts,
 - C:\windows\drivers\system32\etc\hosts



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Tunneling IPv6 trafik

- IPv6 trafik gennem IPv4 netværk

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Tunneling IPv6 trafik

- IPv6 trafik gennem IPv4 netværk
 – Hvordan virker en tunnel

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Tunneling IPv6 trafik

- Forskellige scenarier

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Tunneling eksempel R1

```

Hostname R1
!
int tunnel0
ipv6 address 3fe:b00:fff:2::1/64
tunnel source 206.123.31.200
tunnel destination 132.214.1.10
tunnel mode ipv6ip
!
ipv6 route 2001:420:fff::/48 tunnel0
  
```

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Tunneling eksempel R2

```

Hostname R2
!
int tunnel5
ipv6 address 3fe:b00:fff:2::2/64
tunnel source 132.214.1.10
tunnel destination 206.123.31.200
tunnel mode ipv6ip
!
ipv6 route 2001:420:b00::/48 tunnel5
  
```

Diagram illustrating IPv6 tunneling setup between two Dual-Stack Routers (R1 and R2) connected via an IPv4 cloud. The tunnel is configured to carry IPv6 traffic between IPv6 Network B (2001:420:fff::/48) and IPv6 Network A (3fe:b00:fff::/48).

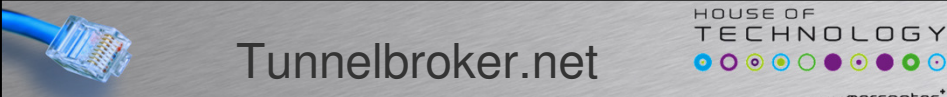
Router R2 (Left):
 - IPv6 Network B: 2001:420:fff::/48
 - Interface: 2001:420:fff:a::1/64
 - Tunnel Source: 132.214.1.10
 - IPv6 Address: 3fe:b00:fff:2::2/64

Router R1 (Right):
 - IPv6 Network A: 3fe:b00:fff::/48
 - Interface: 3fe:b00:fff:a::1/64
 - Tunnel Destination: 206.123.31.200
 - IPv6 Address: 3fe:b00:fff:2::1/64


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Tunnelbrokers

- Firmaer/organisationer tilbyder IPv6 prefix
 - Opkobling til IPv6 gennem IPv4
- Tunnel broker eksempler
 - <http://www.sixxs.net>
 - <http://tunnelbroker.net>
- Gratis at oprette og få en ::/48
- Konfiguration af end-udstyr vises
 - <http://www.tunnelbroker.net/>



Tunnelbroker.net

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Tunnel Details

IPv6 Tunnel
Example Configurations

Tunnel ID: 116478 [Delete Tunnel](#)

Creation Date: May 30, 2011

Description:

IPv6 Tunnel Endpoints


Server IPv4 Address:	216.66.80.26
Server IPv6 Address:	2001:470:1f08:197d::1/64
Client IPv4 Address:	83.90.47.30
Client IPv6 Address:	2001:470:1f08:197d::2/64

Available DNS Resolvers


Anycasted IPv6 Caching Nameserver:	2001:470:20::2
Anycasted IPv4 Caching Nameserver:	74.82.42.42

Routed IPv6 Prefixes

Routed /64:	2001:470:1f09:197d::/64
Routed /48:	2001:470:97cc::/48 <input checked="" type="checkbox"/>



www.tunnelbroker.net

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- Hurricane electric
– Hvor er de?

mars.tekkom.dk - PuTTY

```

[root@mars ~]#date
Fri Jun 10 06:03:49 CEST 2011
[root@mars ~]#traceroute 216.66.80.26
traceroute to 216.66.80.26 (216.66.80.26), 64 hops max, 40 byte packets
 0  10.10.10.1 (10.10.10.1)  0.000 ms  0.000 ms  0.000 ms
 1  atm2-0-75146.vgnxx2.ip.tele.dk (83.90.47.29)  7.320 ms  7.992 ms
 2  ge-1-1-0-50.vgnxu4.dk.ip.tdc.net (83.88.3.29)  7.853 ms  7.571 ms
 3  ae1.kst-peer1.sto.se.ip.tdc.net (62.95.54.122)  23.873 ms  22.101 ms
 4  10gigabitethernet1-2.core1.stol.he.net (194.68.123.187)  31.509 ms  31.509 ms
 5  10gigabitethernet3-3.core1.fral.he.net (72.52.92.233)  41.858 ms  41.858 ms
 6  10gigabitethernet1-4.core1.ams1.he.net (72.52.92.94)  50.509 ms  50.509 ms
 7  10gigabitethernet1-4.core1.lon1.he.net (72.52.92.81)  67.934 ms  67.934 ms
 8  tserv5.lon1.ipv6.he.net (216.66.80.26)  49.552 ms  50.181 ms
 9  10.10.10.1 (10.10.10.1)  0.000 ms  0.000 ms

```



www.sixxs.net

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- Sixxs
 - Hvor er de?


```

mars.tekkom.dk - PuTTY
[root@mars ~]#date
Fri Jun 10 06:05:41 CEST 2011
[root@mars ~]#traceroute 93.158.77.42
traceroute to 93.158.77.42 (93.158.77.42), 64 hops max, 40
 1 atm2-0-75146.vgnxx2.ip.tele.dk (83.90.47.29)  7.203 ms
 2 ge-0-1-0-40.vgnxu4.dk.ip.tdc.net (83.88.15.225)  6.893
 3 tel-1.ign-peer2.got.se.ip.tdc.net (88.131.143.118)  17.
 4 tel-1.ign-peer2.got.se.ip.tdc.net (88.131.143.118)  16.
 5 netnod-ix-ge-b-gbg-1500.port80.se (194.68.130.143)  16.
 6 te2-3-r74.cr0-r72.svv-cph.dk.p80.net (82.96.1.54)  17.7
 7 dkcph01.sixxs.net (93.158.77.42)  17.771 ms  18.172 ms

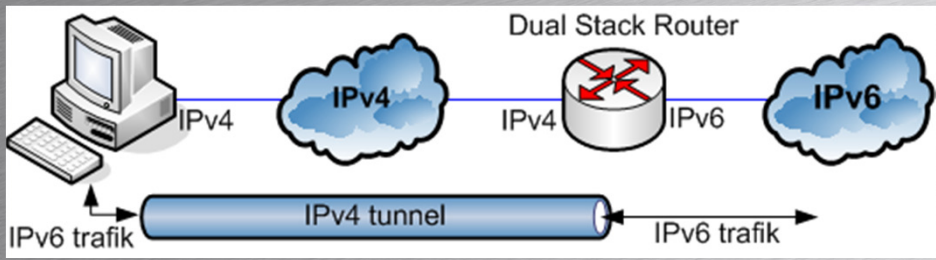
```




IPv6 ISATAP

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- ISATAP
 - Intra-Site Automatic Tunnel Addressing Protocol
- Automatisk oprettelse af tunnel
 - IPv6 over IPv4
 - Beskrevet i rfc5214





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Windows 7 ISATAP

- For at finde en ISATAP enable gateway
 - Manuel konfigiguration

```

Administrator: Command Prompt
C:\>netsh interface isatap set router 172.16.4.21

```


- FQDN forespørgsel: ISATAP.EXAMPLE.COM
- DHCPv4 option

```

C:>ipconfig
Ethernet-netværkskort LAN-forbindelse:
    Forbindelsesspecifikt DNS-suffiks . . . . . : example.com
    Link-local-IPv6-adresse . . . . . : fe80::1566:42de:fb93:42fc%10
    IPv4-adresse . . . . . : 10.13.37.150
    Undernetmaske . . . . . : 255.255.255.0
    Standardgateway. . . . . : 10.13.37.1

Tunnel-netværkskort isatap.example.com:
    Forbindelsesspecifikt DNS-suffiks . . . . . : example.com
    IPv6-adresse. . . . . : 2001:db8:0:0:0:5efe:10.13.37.150
    Link-local-IPv6-adresse . . . . . : fe80::5efe:10.13.37.150%24
    Standardgateway. . . . . : fe80::5efe:172.16.0.1%24

```



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Cisco ISATAP Gateway

```

interface FastEthernet 0
description <IPv4 only Interface>
ip address 172.16.0.1 255.255.255.0
no shutdown
!
interface FastEthernet 1
description <Dual-Stack Interface>
ip address 172.16.200.1 255.255.255.0
ipv6 address 2001:db8:2000::/64 eui64
!
interface tunnel 1
tunnel source FastEthernet 0
tunnel mode ipv6ip isatap
ipv6 address 2001:DB8:2001::/64 eui-64
no ipv6 nd ra suppress

```



Cisco ISATAP Client

```
interface FastEthernet0
ip address 172.16.0.10 255.255.255.0
!
interface Tunnel1
no ip address
ipv6 address autoconfig
ipv6 enable
tunnel mode ipv6ip
tunnel source FastEthernet0
tunnel destination 172.16.0.1
```