

# IPv6 網路環境及服務的建置

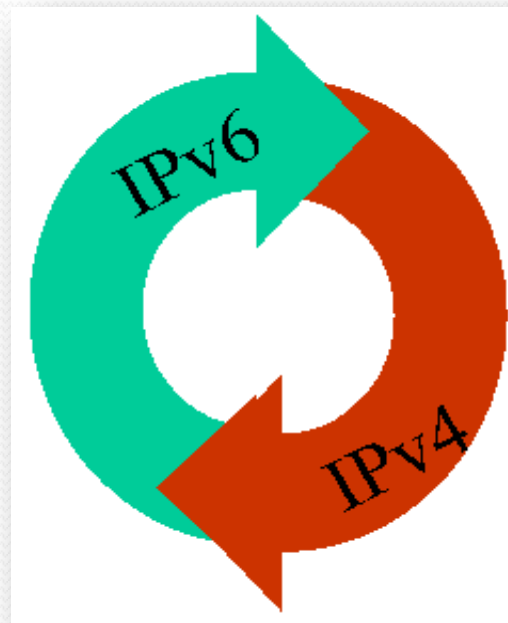
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# 大綱

- 簡介
- 路由協定
- 連接 IPv6
- 設定 IPv6
- 測試 IPv6
- IPv6 網站

# 簡介

- 原有 IPv4 網路空間不足 (RFC 791, 1981)
- IPv6 標準提出 (RFC 2460, 1998)
- 轉換技術
  - Dual Stack
  - Tunnel



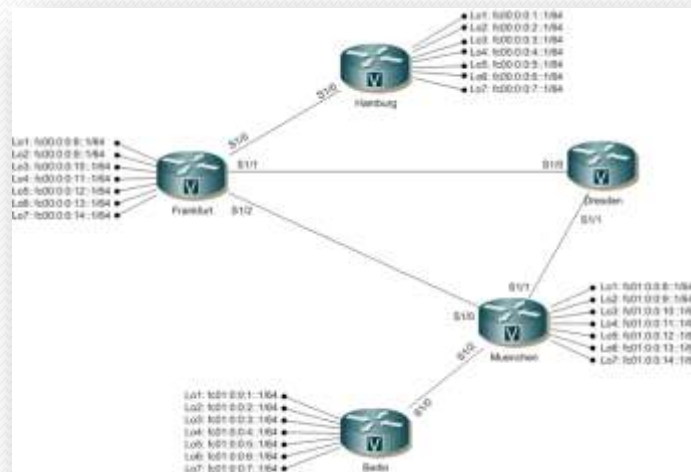
# 簡介(續)

- IPv6 與 IPv4 的差異

差異	IPv4	IPv6
可用位址數量	2的32次方 (32 bits)	2的128次方(128 bits)
位址格式	192.168.1.254	2001:288:a001:5::fdf:684
位址不足解決方式	NAT	不需要

# 路由協定

- RIPng
  - 距離向量(Distance Vector)方式
  - UDP埠號521
- OSPFv3
  - 鏈路狀態(Link State)方式
  - 用來克服RIP所產生的問題
- BGP-4
  - 在多個自治系統間交換網路可到達資訊
  - 強化路由的政策及避免路由迴圈
  - 使用TCP作為傳輸協定，並以埠號179來建立連線



# 路由協定(續)

- 路由器設定 (以 RIPng 設定在 cisco 2600 為例)

```
ipv6 unicast-routing
!
interface Ethernet0/0
  no ip address
  full-duplex
  ipv6 address 2001:E10:FFFF:2101::2/64
  ipv6 enable
  ipv6 nd ns-interval 1000
  ipv6 nd ra-interval msec 1000
  ipv6 nd prefix 2001:E10:FFFF:2101::/64
  ipv6 rip DEMO enable
!
interface Ethernet0/1
  no ip address
  full-duplex
  ipv6 address 2001:E10:1440:FFFF::1/64
  ipv6 enable
  ipv6 nd prefix 2001:E10:1440:FFFF::/64
  ipv6 rip DEMO enable
!
ipv6 route ::/0 2001:E10:FFFF:2101::1
ipv6 router rip DEMO
  redistribute connected
```

# 連接 IPv6

- Native IP
  - 網路環境中已具備 IPv6 能力, 電腦可透過路由器或 DHCPv6 主機取得 IPv6 的 IP 的位址
  - 作業系統須支援 IPv6 協定
- Tunnel Broker
  - 既有的 IPv4 網路環境中, 在兩端建立一條 Tunnel 來連接兩端之後的 IPv6 網路環境。
  - 會需要另外安裝 Tunnel Broker Client 軟體

# 設定 IPv6

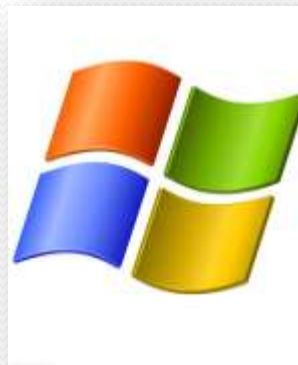
- 透過 RA/DHCPv6 取得 IP
  - 在路由器上設定 Router Advertisement 後, 透過該介面所連接的電腦, 可以藉由 Router Advertisement 與 Router Solicitation
  - 也可以利用有提供 DHCPv6 服務的網路主機或路由器來派送 IP 給電腦



# 設定 IPv6 (續)

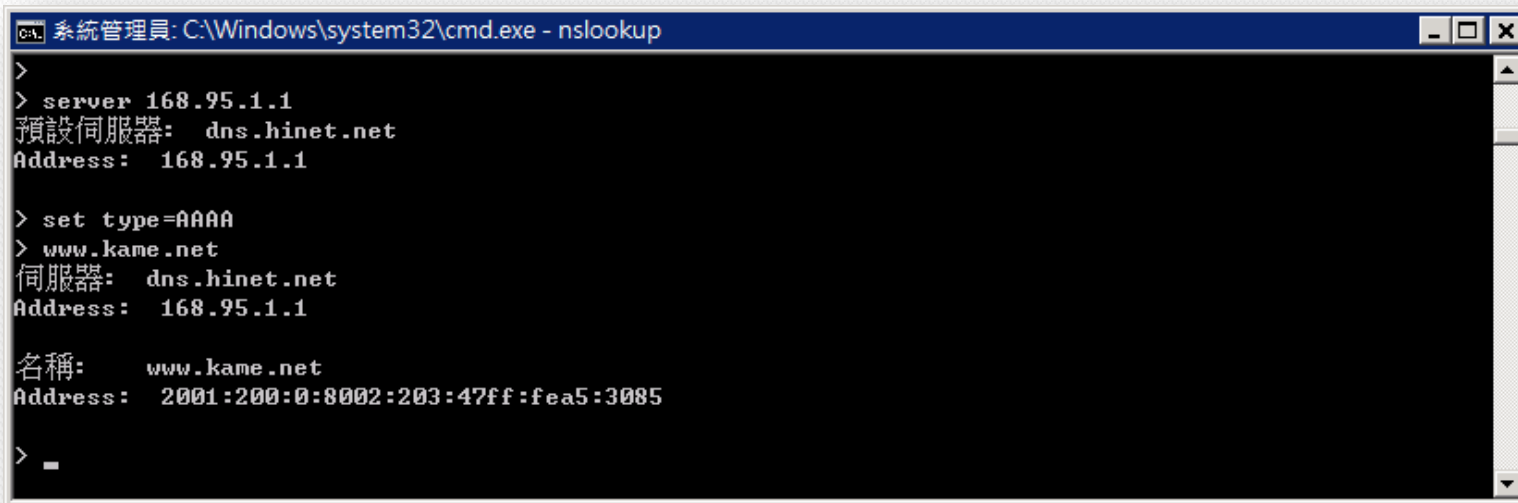
- 支援手動設定 IPv6位址的OS

- Windows
  - Windows Vista
  - Windows 7
- Linux
  - Fedora
  - Ubuntu



# 測試 IPv6

- nslookup (AAAA)
  - Set type=AAAA



```
C:\Windows\system32\cmd.exe - nslookup
>
> server 168.95.1.1
預設伺服器: dns.hinet.net
Address: 168.95.1.1

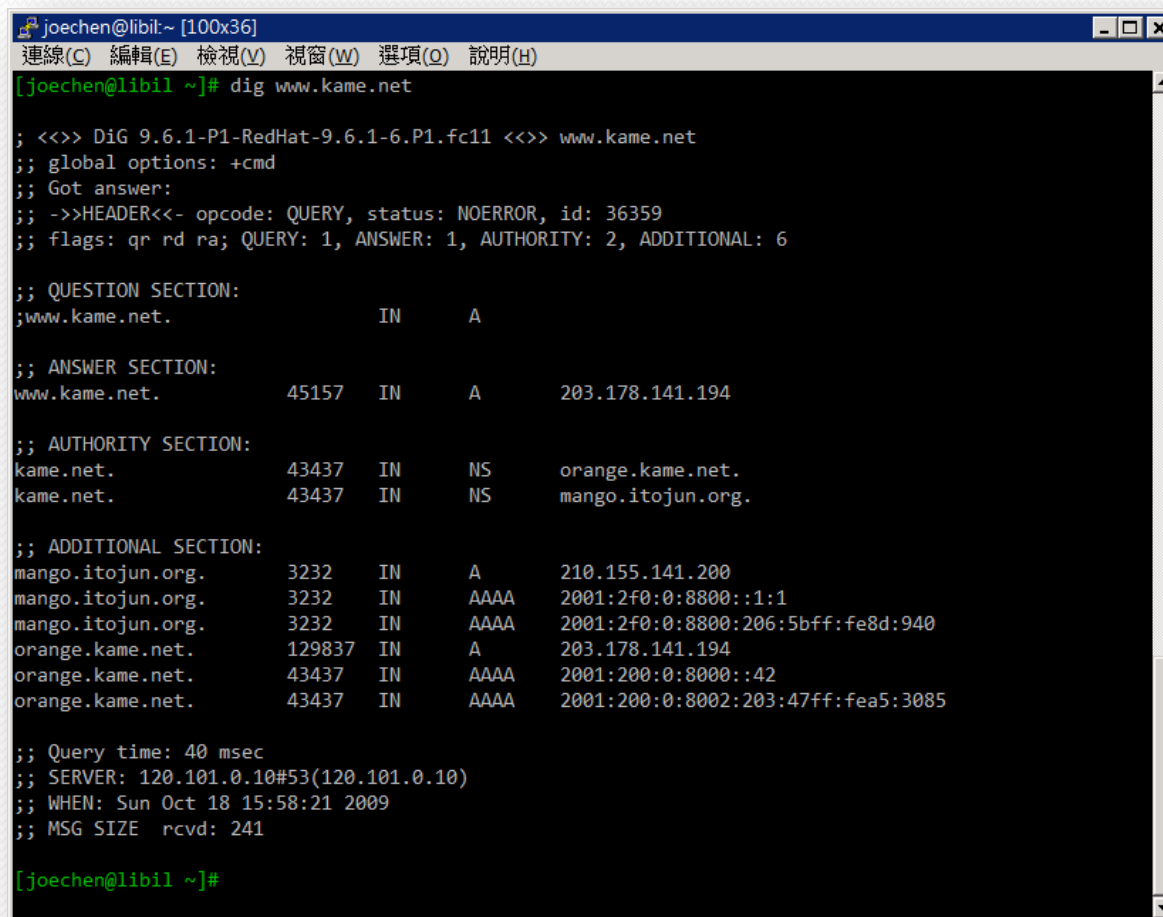
> set type=AAAA
> www.kame.net
伺服器: dns.hinet.net
Address: 168.95.1.1

名稱: www.kame.net
Address: 2001:200:0:8002:203:47ff:fea5:3085

> -
```

# 測試 IPv6(續)

- dig (UNIX-Like)



```
joechen@libil:~ [100x36]
連線(C) 編輯(E) 檢視(V) 視窗(W) 選項(O) 說明(H)
[joechen@libil ~]# dig www.kame.net

; <<>> DiG 9.6.1-P1-RedHat-9.6.1-6.P1.fc11 <<>> www.kame.net
;; global options: +cmd
;; Got answer:
;; ->HEADER<<- opcode: QUERY, status: NOERROR, id: 36359
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 2, ADDITIONAL: 6

;; QUESTION SECTION:
;www.kame.net.                IN      A

;; ANSWER SECTION:
www.kame.net.                45157  IN      A      203.178.141.194

;; AUTHORITY SECTION:
kame.net.                    43437  IN      NS     orange.kame.net.
kame.net.                    43437  IN      NS     mango.itojun.org.

;; ADDITIONAL SECTION:
mango.itojun.org.            3232   IN      A      210.155.141.200
mango.itojun.org.            3232   IN      AAAA   2001:2f0:0:8800::1:1
mango.itojun.org.            3232   IN      AAAA   2001:2f0:0:8800:206:5bff:fe8d:940
orange.kame.net.             129837 IN      A      203.178.141.194
orange.kame.net.             43437  IN      AAAA   2001:200:0:8000::42
orange.kame.net.             43437  IN      AAAA   2001:200:0:8002:203:47ff:fea5:3085

;; Query time: 40 msec
;; SERVER: 120.101.0.10#53(120.101.0.10)
;; WHEN: Sun Oct 18 15:58:21 2009
;; MSG SIZE rcvd: 241

[joechen@libil ~]#
```

# 測試 IPv6(續)

- ping, tracert (Windows)

```
系統管理員: C:\Windows\system32\cmd.exe
C:\Users\Joe>tracert www.kame.net

在上限 30 個躍點上
追蹤 www.kame.net [2001:200:0:8002:203:47ff:fea5:3085] 的路由:

 1  <1 ms  <1 ms  <1 ms  2001:288:a001:5::1
 2  6 ms   <1 ms  <1 ms  2001:288:0:f:107::f0
 3  1 ms   1 ms   1 ms   2001:288:e200::1
 4  1 ms   1 ms   1 ms   2001:288:0:7::1
 5  1 ms   1 ms   1 ms   2001:288:3b0:5::9264:1
 6  1 ms   1 ms   1 ms   2001:288:3b0:4::1
 7  1 ms   1 ms   1 ms   2001:c08:7f:10::a
 8  1 ms   1 ms   1 ms   2001:c08:7f::2e
 9  31 ms  31 ms  31 ms  2001:c08:7f::21
10  33 ms  33 ms  33 ms  2001:200:0:fe00:9c4:11
11  31 ms  31 ms  31 ms  2001:200:0:1802:20c:dbff:fe1f:7200
12  32 ms  31 ms  31 ms  ve42.foundry4.nezu.wide.ad.jp [2001:200:0:11::66]
13  32 ms  32 ms  32 ms  ve45.foundry2.yagami.wide.ad.jp [2001:200:0:12::74]
14  33 ms  *      33 ms  2001:200:0:4803:212:e2ff:fe28:1ca2
15  33 ms  33 ms  33 ms  orange.kame.net [2001:200:0:8002:203:47ff:fea5:3085]

追蹤完成。
```

```
系統管理員: C:\Windows\system32\cmd.exe
C:\Users\Joe>ping www.kame.net

Ping www.kame.net [2001:200:0:8002:203:47ff:fea5:3085] <使用 32 位元組的資料>:
回覆自 2001:200:0:8002:203:47ff:fea5:3085: 時間=33ms
回覆自 2001:200:0:8002:203:47ff:fea5:3085: 時間=33ms
回覆自 2001:200:0:8002:203:47ff:fea5:3085: 時間=33ms
回覆自 2001:200:0:8002:203:47ff:fea5:3085: 時間=33ms

2001:200:0:8002:203:47ff:fea5:3085 的 Ping 統計資料:
    封包: 已傳送 = 4, 已收到 = 4, 已遺失 = 0 (0% 遺失),
    大約的來回時間 <毫秒>:
        最小值 = 33ms, 最大值 = 33ms, 平均 = 33ms

C:\Users\Joe>
```

# 測試 IPv6(續)

- ping6, traceroute6 (UNIX-Like)

```
joechen@libil:~ [100x28]
連線(C) 編輯(E) 檢視(V) 視窗(W) 選項(O) 說明(H)
[joechen@libil ~]# traceroute6 -n www.kame.net
traceroute to www.kame.net (2001:200:0:8002:203:47ff:fea5:3085), 30 hops max, 80 byte packets
 1 2001:288:a001:5::1 1.986 ms 1.261 ms 0.780 ms
 2 2001:288:0:f:107::f0 0.913 ms 1.012 ms 0.588 ms
 3 2001:288:e200::1 1.716 ms 1.508 ms 1.605 ms
 4 2001:288:0:7::1 3.224 ms 2.207 ms 1.419 ms
 5 2001:288:3b0:5::9264:1 3.348 ms 2.954 ms 3.417 ms
 6 2001:288:3b0:4::1 3.279 ms 1.753 ms 3.921 ms
 7 2001:c08:7f:10::a 2.472 ms 2.473 ms 2.004 ms
 8 2001:c08:7f:2e 2.316 ms 2.125 ms 2.358 ms
 9 2001:c08:7f::21 33.006 ms 32.915 ms 34.049 ms
10 2001:200:0:fe00::9c4:11 34.732 ms 33.009 ms 35.766 ms
11 2001:200:0:1802:20c:dbff:fe1f:7200 31.426 ms 31.282 ms 32.785 ms
12 2001:200:0:11::66 32.594 ms 32.443 ms 32.831 ms
13 2001:200:0:12::74 33.035 ms 32.892 ms 35.515 ms
14 2001:200:0:4803:212:e2ff:fe28:1ca2 33.270 ms * *
15 2001:200:0:8002:203:47ff:fea5:3085 34.864 ms 34.716 ms 34.904 ms
[joechen@libil ~]#
```

```
joechen@libil:~ [120x32]
連線(C) 編輯(E) 檢視(V) 視窗(W) 選項(O) 說明(H)
[joechen@libil ~]# ping6 -n www.kame.net
PING www.kame.net(2001:200:0:8002:203:47ff:fea5:3085) 56 data bytes
64 bytes from 2001:200:0:8002:203:47ff:fea5:3085: icmp_seq=1 ttl=49 time=34.0 ms
64 bytes from 2001:200:0:8002:203:47ff:fea5:3085: icmp_seq=2 ttl=49 time=34.4 ms
64 bytes from 2001:200:0:8002:203:47ff:fea5:3085: icmp_seq=3 ttl=49 time=34.3 ms
64 bytes from 2001:200:0:8002:203:47ff:fea5:3085: icmp_seq=4 ttl=49 time=34.6 ms
64 bytes from 2001:200:0:8002:203:47ff:fea5:3085: icmp_seq=5 ttl=49 time=33.5 ms
^C
--- www.kame.net ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4702ms
rtt min/avg/max/mdev = 33.554/34.205/34.614/0.389 ms
[joechen@libil ~]#
```

# IPv6 網站

- 日本 Kame 網站
  - <http://www.kame.net>
- IPv6 Ready Logo
  - <http://www.ipv6ready.org/>
- 中華電信研究所IPv6測試實驗室
  - <http://interop.ipv6.org.tw/>
- IPv6 影音網 (HiNet)
  - <http://www.ipv6.hinet.net/media/index1.htm>
- 台灣NGN IPv6移轉技術入口網
  - <http://www.rd.ipv6.org.tw/>



# END