

疑難排解藉由思科路由器和 Microsoft Windows 電腦進行的 IPv6 動態位址指派

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簡介

本文件說明動態 IPv6 位址指派的可用選項。包括無狀態地址自動配置(SLAAC)和動態主機配置協定第6版(DHCPv6)的故障排除。

必要條件

需求

思科建議您瞭解以下主題：

- IPv6地址體系結構
- Microsoft Windows作業系統
- 基本Wireshark使用

採用元件

本檔案中的資訊是根據以下硬體/軟體版本：

- 採用Cisco IOS®的Cisco路由
- Microsoft Windows® 7 PC

本文中的資訊是根據特定實驗室環境內的裝置所建立。文中使用到的所有裝置皆從已清除（預設）的組態來啟動。如果您的網路運作中，請確保您瞭解任何指令可能造成的影響。

背景資訊

運行Microsoft Windows的電腦和筆記型電腦等IPv6終端主機可能會遇到無法動態接收或按預期顯示IPv6地址的情況。

建議對Cisco IOS和Microsoft Windows作業系統進行故障排除，以確保配置正確。

附註：不同的作業系統可以有不同的行為。這取決於IPv6在其代碼中的實施方式。本文檔旨在為讀者提供在Microsoft Windows for IPv6上所需的配置示例。本文檔中介紹的Microsoft Windows上的配置已在實驗室經過測試，並且發現能夠按預期工作。思科技術支援中心(TAC)不支援Microsoft Windows配置幫助。

IPv6動態地址分配的方法

SLAAC	<ul style="list-style-type: none">• SLAAC是本機IPv6方法，用於動態為終端主機提供IPv6地址和預設網關資訊。• 它使用網際網路控制訊息通訊協定第6版(ICMPv6)封包。• 在啟用IPv6的路由器和終端主機之間交換ICMPv6路由器請求(RS)和ICMPv6路由器通告(RA)。• 路由器定期將RA資料包（在Cisco IOS中預設每200秒傳送一次）傳送到本地網路，或需請求路由器。• 在接收RA資料包時，終端主機必須根據資料包中包含的資訊匯出IPv6地址（通過對主機通告(RA)資料包進行重放）。
DHCPv6無狀態	<ul style="list-style-type: none">• DHCPv6無狀態用於獲取其他配置引數（不由SLAAC提供），例如DNS、域名等。• DHCPv6有狀態資料庫可以為終端主機提供IPv6地址，並跟蹤租用的地址。
DHCPv6有狀態	<ul style="list-style-type: none">• DNS、域名等資訊也可以通過DHCPv6有狀態方法提供。• 路由器在本地網路上傳送RA資料包後，仍必須提供預設網關資訊。• 此選項最類似於IPv4的DHCP。

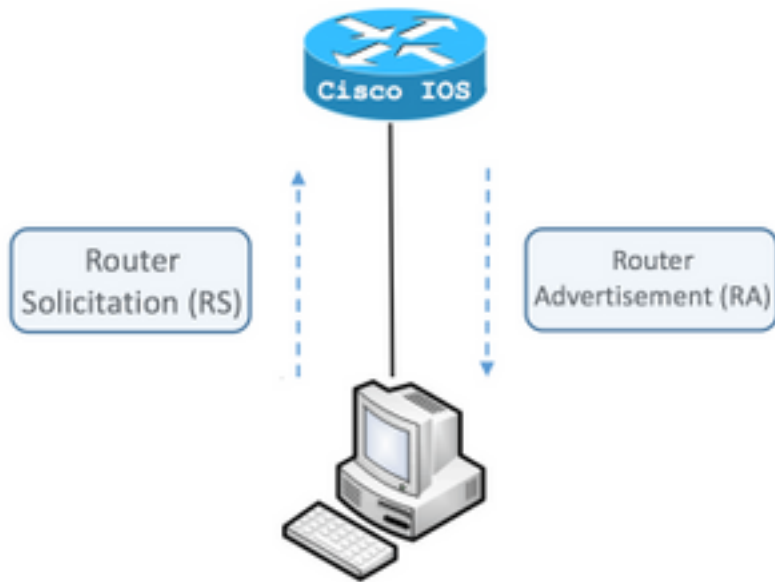
註：終端主機可以動態獲取IPv6預設網關資訊的唯一方法是從本地路由器發起的ICMPv6路由器通告(RA)資料包獲取。DHCPv6資料包當前不攜帶任何IPv6預設網關資訊。

SLAAC

路由器與終端主機之間的資料包交換如下圖所示：

步驟1.終端主機最初傳送ICMPv6 RS資料包。

步驟2.路由器使用ICMPv6 RA資料包進行重放。



若要檢視交換，請在電腦上運行自由開源資料包分析器Wireshark，然後使用以下過濾器：

icmpv6.type == 133

No.	Time	Source
12	0.000000	fe80::5850:6d61:1fb:ef...
19	3.998392	fe80::5850:6d61:1fb:ef...
20	3.992478	fe80::5850:6d61:1fb:ef...

- ▶ Frame 12: 70 bytes on wire (560 bits)
- ▶ Ethernet II, Src: Vmware_80:6c:cc (00:0c:29:80:6c:cc)
- ▶ Internet Protocol Version 6, Src: fe80::5850:6d61:1fb:ef...
- ▼ Internet Control Message Protocol v6
 - Type: Router Solicitation (133)
 - Code: 0
 - Checksum: 0x2eee [correct]
 - Reserved: 00000000
 - ▶ ICMPv6 Option (Source link-layer address)

ICMPv6 icmpv6.type ==
RS 133

ICMPv6
RA icmpv6.nd.ra.flag

icmpv6.nd.ra.flag		
No.	Time	Source
81	0.000000	fe80::c801:b9ff:fef0:8
1...	15.609178	fe80::c801:b9ff:fef0:8
1...	6.344066	fe80::c801:b9ff:fef0:8
1...	6.310120	fe80::c801:b9ff:fef0:8
▶	Frame 81: 118 bytes on wire (944 bits)	
▶	Ethernet II, Src: ca:01:b9:f0:00:08 (
▶	Internet Protocol Version 6, Src: fe80	
▼	Internet Control Message Protocol v6	
	Type: Router Advertisement (134)	
	Code: 0	
	Checksum: 0x4ce1 [correct]	
	Cur hop limit: 64	
▶	Flags: 0x00	
	Router lifetime (s): 1800	
	Reachable time (ms): 0	
	Retrans timer (ms): 0	
▶	ICMPv6 Option (Source link-layer ad	
▶	ICMPv6 Option (MTU : 1500)	
▶	ICMPv6 Option (Prefix information :	

終端主機必須根據接收的ICMPv6 RA資料包中包含的資訊獲取IPv6地址和預設網關資訊。

使用Wireshark獲取ICMPv6 RA資料包的示例：

```

Frame 187: 118 bytes on wire (944 bits), 118 bytes captured (944 bits) on interface 0
Ethernet II, Src: ca:01:b9:f0:00:08 (ca:01:b9:f0:00:08), Dst: IPv6mcast_01 (33:33:00:00:00:01)
Internet Protocol Version 6, Src: fe80::c801:b9ff:fef0:8, Dst: ff02::1          ! Default
Gateway.
Internet Control Message Protocol v6
  Type: Router Advertisement (134)
  Code: 0
  Checksum: 0x4ce1 [correct]
  Cur hop limit: 64
  Flags: 0x00
  Router lifetime (s): 1800
  Reachable time (ms): 0
  Retrans timer (ms): 0
  ICMPv6 Option (Source link-layer address : ca:01:b9:f0:00:08)
  ICMPv6 Option (MTU : 1500)

```

ICMPv6 Option (Prefix information : 2001:abcd::/64)
information.

! Prefix

1)ICMPv6選項 (字首資訊) 欄位。

這是終端主機用於其IPv6地址的網路部分的字首資訊。

介面識別符號 (主機部分) 由使用EUI-64方法的終端主機建立。

Microsoft Windows可以隨機建立主機部分。

2)Internet Protocol Version 6, Source欄位。

終端主機使用RA資料包的IPv6源地址配置其IPv6預設網關。

排除SLAAC故障

從Cisco IOS

步驟1.確保在全域性配置模式下配置**ipv6 unicast-routing**命令。

步驟2.確保本地網路中的介面配置了有效的IPv6地址。

```
ipv6 unicast-routing          ! Enable IPv6 Routing. In absence of this command !! the  
Router does not send any ICMPv6 RA packet. interface GigabitEthernet0/0/0 ipv6 address  
2001:ABCD::1/64 end
```

步驟3.確保ICMPv6 RA資料包中通告的字首為字首長度/64。否則，終端主機無法通過SLAAC建立任何IPv6地址：

```
ipv6 unicast-routing  
!  
interface GigabitEthernet0/0/0  
  ipv6 address 2001:ABCD::1/64      ! Prefix length defined as /64 on the Router.  
end
```

ICMPv6 RA資料包捕獲：

```
Frame 187: 118 bytes on wire (944 bits), 118 bytes captured (944 bits) on interface 0  
Ethernet II, Src: ca:01:b9:f0:00:08 (ca:01:b9:f0:00:08), Dst: IPv6mcast_01 (33:33:00:00:00:01)  
Internet Protocol Version 6, Src: fe80::c801:b9ff:fef0:8, Dst: ff02::1  
Internet Control Message Protocol v6  
  Type: Router Advertisement (134)  
  Code: 0  
  Checksum: 0x4ce1 [correct]  
  Cur hop limit: 64  
  Flags: 0x00  
  Router lifetime (s): 1800  
  Reachable time (ms): 0  
  Retrans timer (ms): 0  
  ICMPv6 Option (Source link-layer address : ca:01:b9:f0:00:08)  
  ICMPv6 Option (MTU : 1500)  
  ICMPv6 Option (Prefix information : 2001:abcd::/64)          ! Prefix & prefix lenght  
information.
```

步驟4. 命令debug ipv6 nd 即時顯示本地網路上接收ICMPv6 RS資料包和通告ICMPv6 RA的資訊。

```
Router# debug ipv6 nd
ICMP Neighbor Discovery events debugging is on
Router#
Router# show logging | include RS
ICMPv6-ND: Received RS on GigabitEthernet0/0/0 from FE80::5850:6D61:1FB:EF3A
R1#

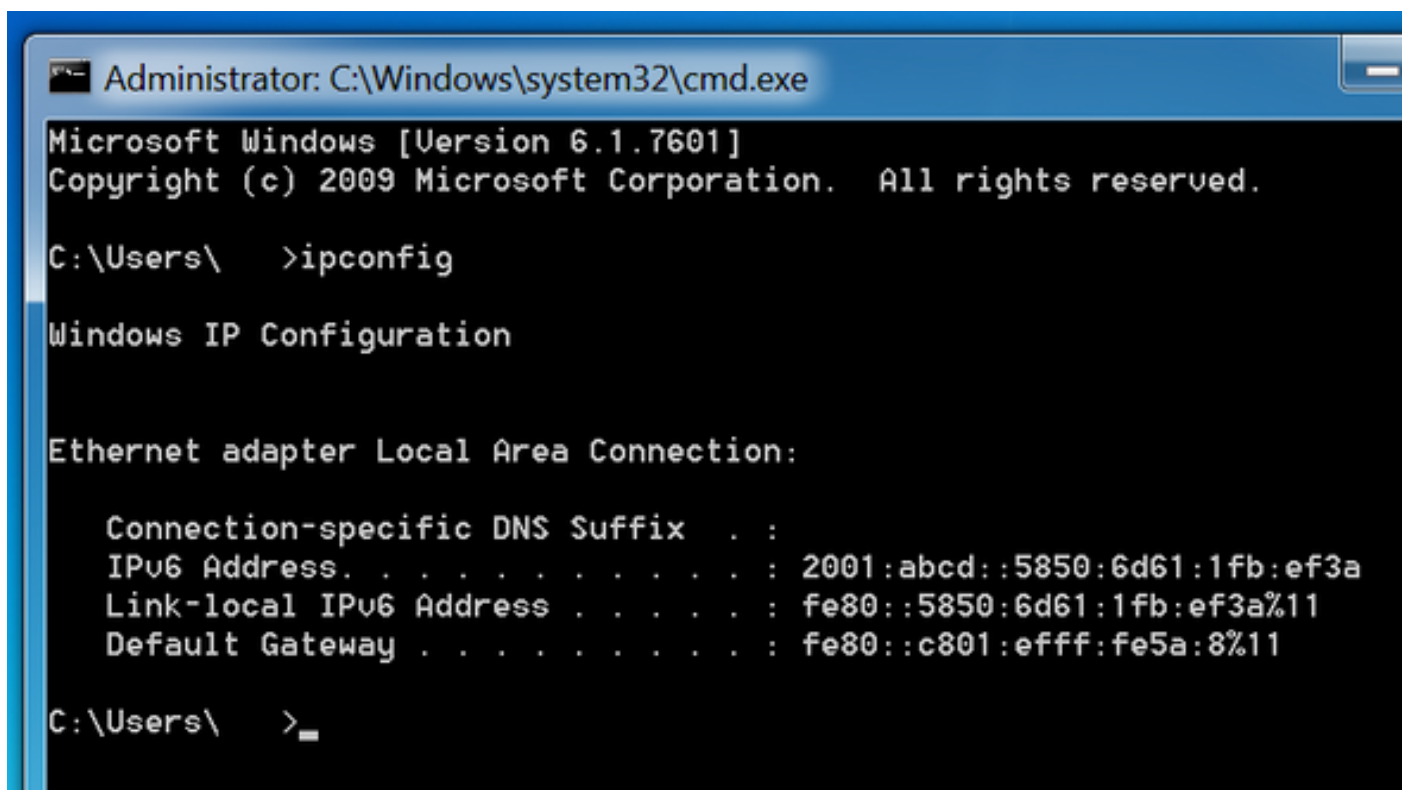
Router# show logging | include RA
ICMPv6-ND: Sending solicited RA on GigabitEthernet0/0/0
ICMPv6-ND: Request to send RA for FE80::C801:EFF:FE5A:8
ICMPv6-ND: Setup RA from FE80::C801:EFF:FE5A:8 to FF02::1 on GigabitEthernet0/0/0
Router#
```

從Microsoft Windows PC

步驟1. 確保終端主機收到RA資料包。

可以使用Wireshark完成此操作，也可以使用icmpv6.nd.ra.flag過濾器進行捕獲。

步驟2. 使用命令ipconfig驗證IPv6地址。



```
Administrator: C:\Windows\system32\cmd.exe
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

C:\Users\ >ipconfig

Windows IP Configuration

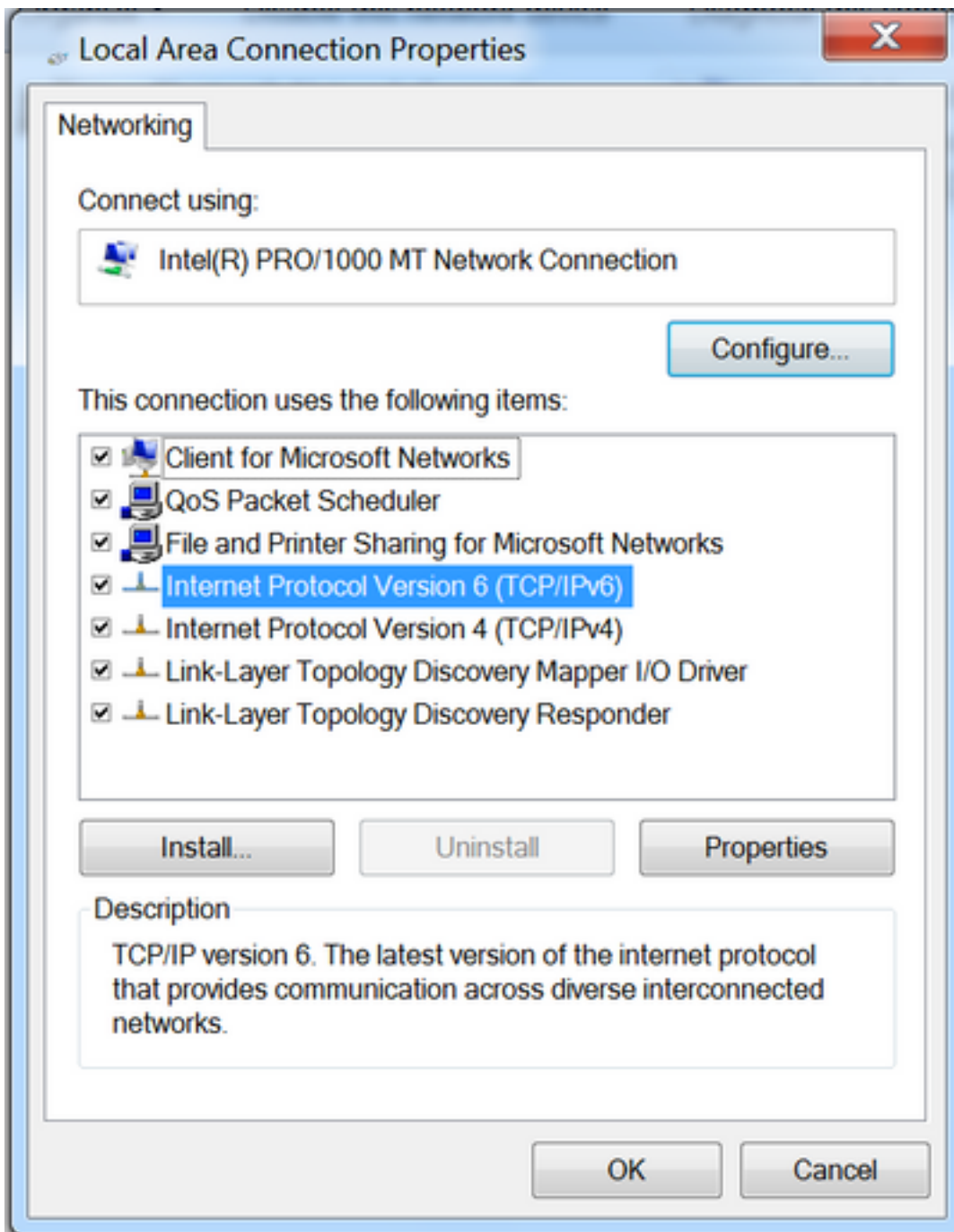
Ethernet adapter Local Area Connection:

    Connection-specific DNS Suffix . . . :
    IPv6 Address. . . . . : 2001:abcd::5850:6d61:1fb:ef3a
    Link-local IPv6 Address . . . . . : fe80::5850:6d61:1fb:ef3a%11
    Default Gateway . . . . . : fe80::c801:eff:fe5a:8%11

C:\Users\ >_
```

如果IPv6地址仍未顯示，請按照以下步驟操作。

步驟3. 確保在Windows電腦上啟用了網路介面卡的Internet協定第6版(TCP/IPv6)覈取方塊。



在Windows上，您可以在以下位置找到此配置：

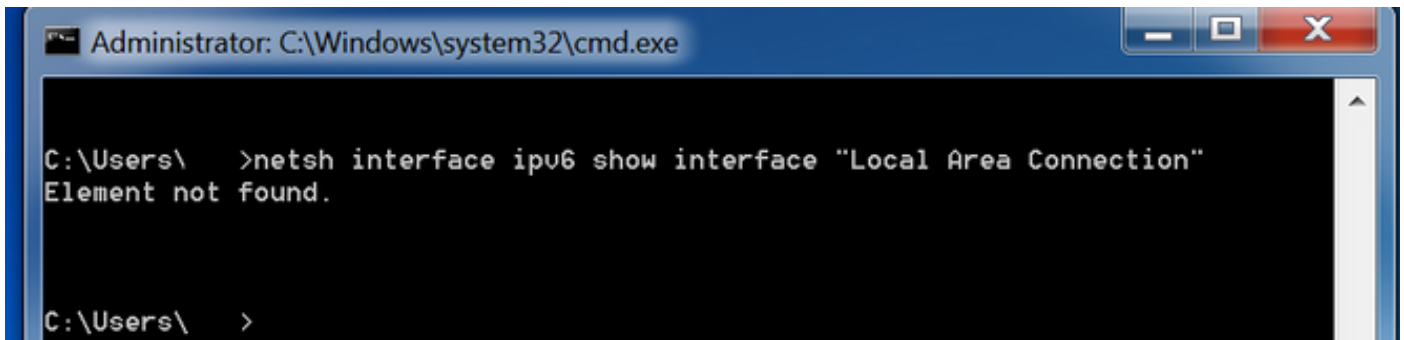
步驟1. 導航至控制面板>網路和共用中心>更改介面卡設定

步驟2. 按一下右鍵所選的網路介面卡>屬性

當您使用命令 `netsh interface ipv6 show interface "Local Area Connection"` 在Windows命令提示符 (CMD) 中收到下一條消息時，網路介面卡未啟用Internet協定第6版(TCP/IPv6)。

附註：在此命令中，可以將本地連線替換為Microsoft Windows用於連線到網路的網路介面卡的名稱。

提示：開啟命令提示符。按鍵盤中的Windows + R開啟運行框。運行命令 `cmd`，然後按OK

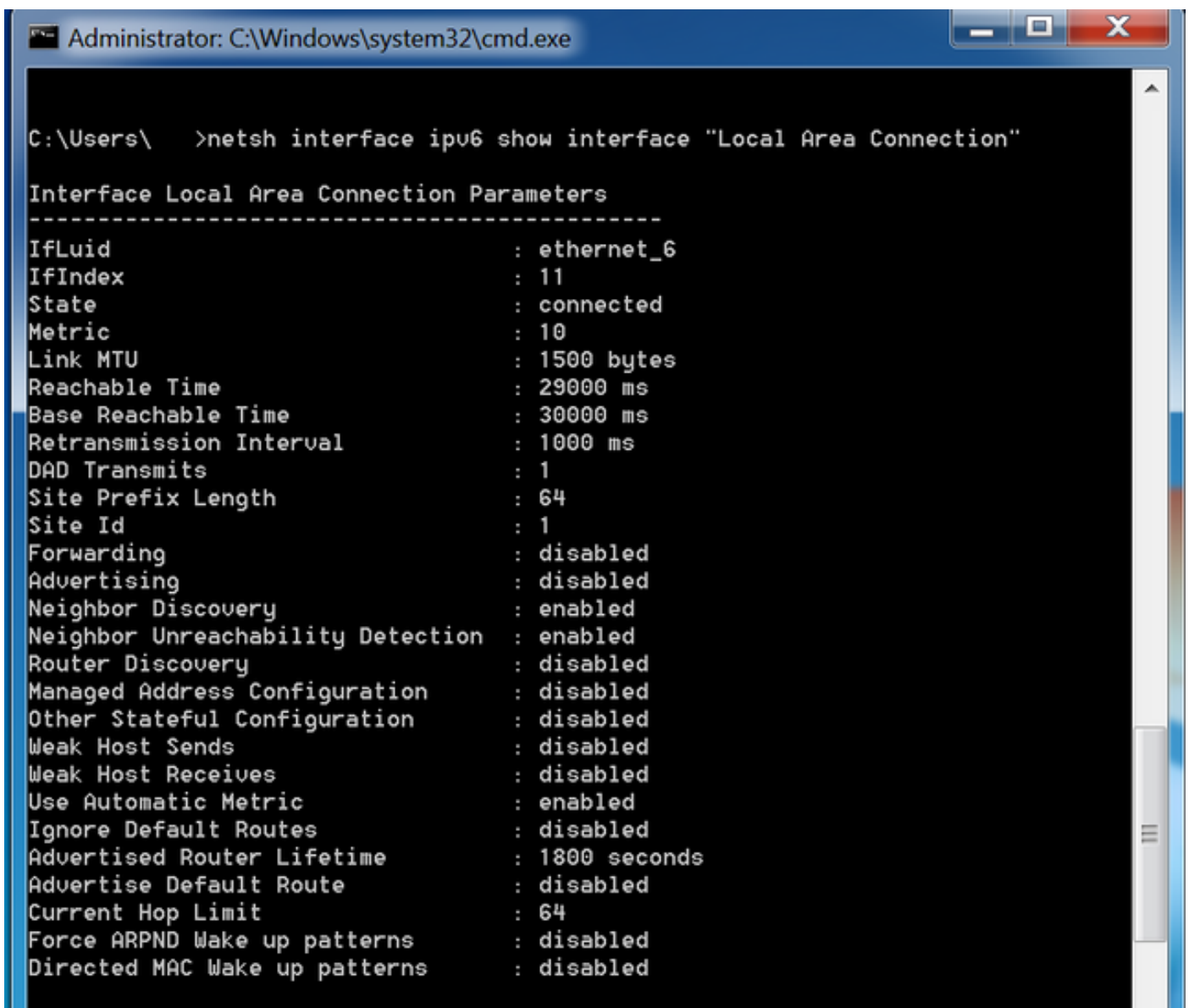


```
Administrator: C:\Windows\system32\cmd.exe
C:\Users\ >netsh interface ipv6 show interface "Local Area Connection"
Element not found.
C:\Users\ >
```

步驟3.確保Router Discovery引數設定為enabled。

在CMD中運行netsh interface ipv6 show interface "Local Area Connection" 命令。

當Router Discovery引數設定為disabled時，Microsoft Windows可以忽略已接收的ICMPv6 RA資料包的內容。這可能導致Microsoft Windows無法生成任何IPv6地址。



```
Administrator: C:\Windows\system32\cmd.exe
C:\Users\ >netsh interface ipv6 show interface "Local Area Connection"
Interface Local Area Connection Parameters
-----
IfLuid                : ethernet_6
IfIndex               : 11
State                 : connected
Metric                : 10
Link MTU              : 1500 bytes
Reachable Time        : 29000 ms
Base Reachable Time   : 30000 ms
Retransmission Interval : 1000 ms
DAD Transmits         : 1
Site Prefix Length    : 64
Site Id               : 1
Forwarding            : disabled
Advertising           : disabled
Neighbor Discovery    : enabled
Neighbor Unreachability Detection : enabled
Router Discovery      : disabled
Managed Address Configuration : disabled
Other Stateful Configuration : disabled
Weak Host Sends       : disabled
Weak Host Receives    : disabled
Use Automatic Metric  : enabled
Ignore Default Routes : disabled
Advertised Router Lifetime : 1800 seconds
Advertise Default Route : disabled
Current Hop Limit     : 64
Force ARPND Wake up patterns : disabled
Directed MAC Wake up patterns : disabled
```

使用以下命令啟用路由器發現：

```
C:\> netsh interface ipv6 set interface "Local Area Connection" routerdiscovery=enabled
```

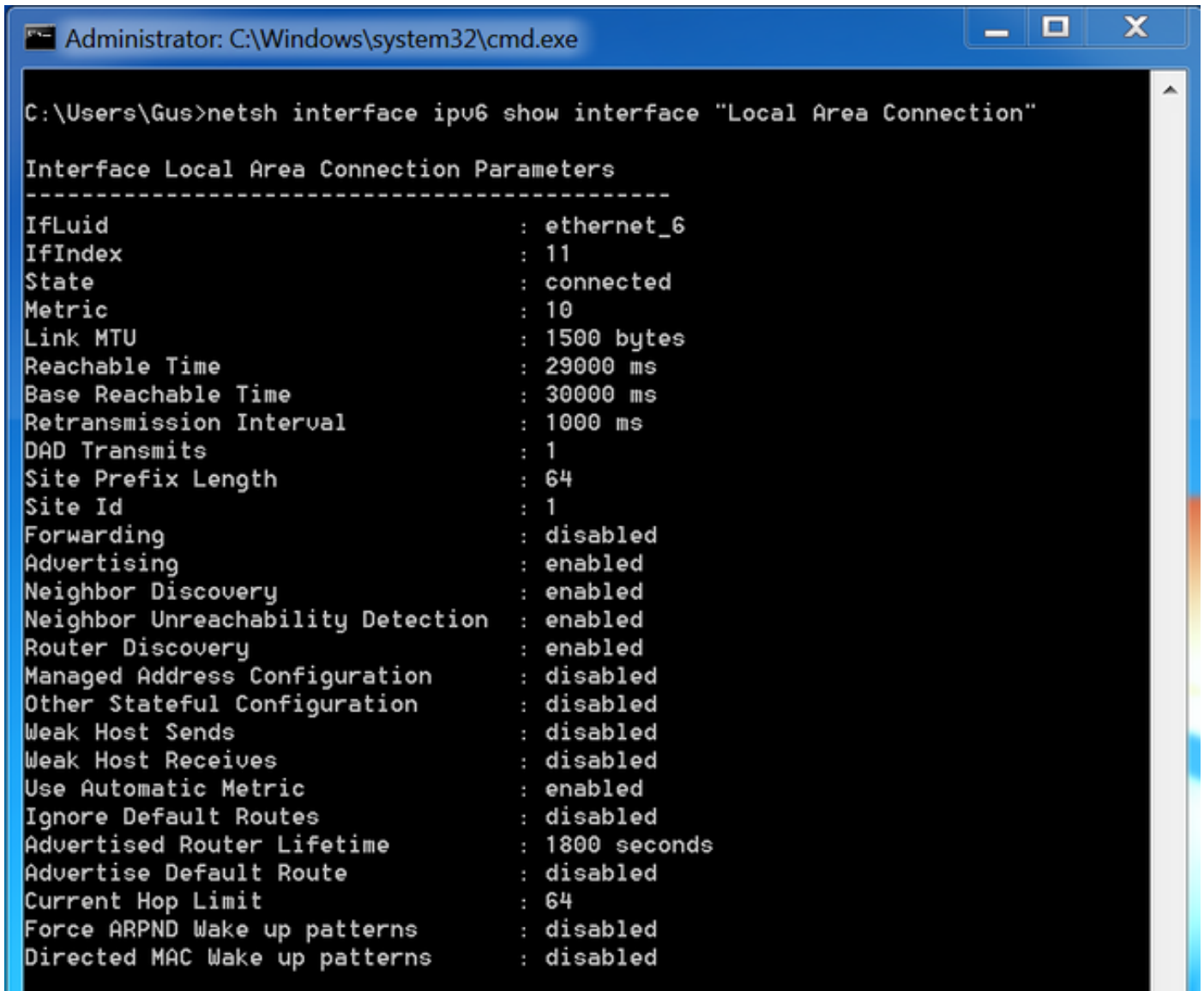
步驟4.確保Advertising引數設定為disabled。

在CMD中運行netsh interface ipv6 show interface "Local Area Connection" 命令。

如果Advertising引數設定為enabled,Microsoft Windows可以忽略收到的ICMPv6 RA資料包的內容。

已啟用Advertising引數會導致Microsoft Windows的行為與IPv6路由器相同，並生成自己的ICMPv6 RA資料包並將其傳送到本地網路。

必須禁用Advertising參數的預設狀態。



```
Administrator: C:\Windows\system32\cmd.exe
C:\Users\Gus>netsh interface ipv6 show interface "Local Area Connection"
Interface Local Area Connection Parameters
-----
IfLuid           : ethernet_6
IfIndex          : 11
State            : connected
Metric           : 10
Link MTU         : 1500 bytes
Reachable Time   : 29000 ms
Base Reachable Time : 30000 ms
Retransmission Interval : 1000 ms
DAD Transmits    : 1
Site Prefix Length : 64
Site Id          : 1
Forwarding       : disabled
Advertising      : enabled
Neighbor Discovery : enabled
Neighbor Unreachability Detection : enabled
Router Discovery  : enabled
Managed Address Configuration : disabled
Other Stateful Configuration : disabled
Weak Host Sends   : disabled
Weak Host Receives : disabled
Use Automatic Metric : enabled
Ignore Default Routes : disabled
Advertised Router Lifetime : 1800 seconds
Advertise Default Route : disabled
Current Hop Limit : 64
Force ARPND Wake up patterns : disabled
Directed MAC Wake up patterns : disabled
```

使用以下命令禁用廣告：

```
C:\> netsh interface ipv6 set interface "Local Area Connection" advertise=disabled
```

DHCPv6無狀態

終端主機可以使用DHCPv6無狀態地址請求其他IPv6配置引數，如DNS、域名等。為此，ICMPv6 RA資料包必須設定其他配置標誌(O位)。

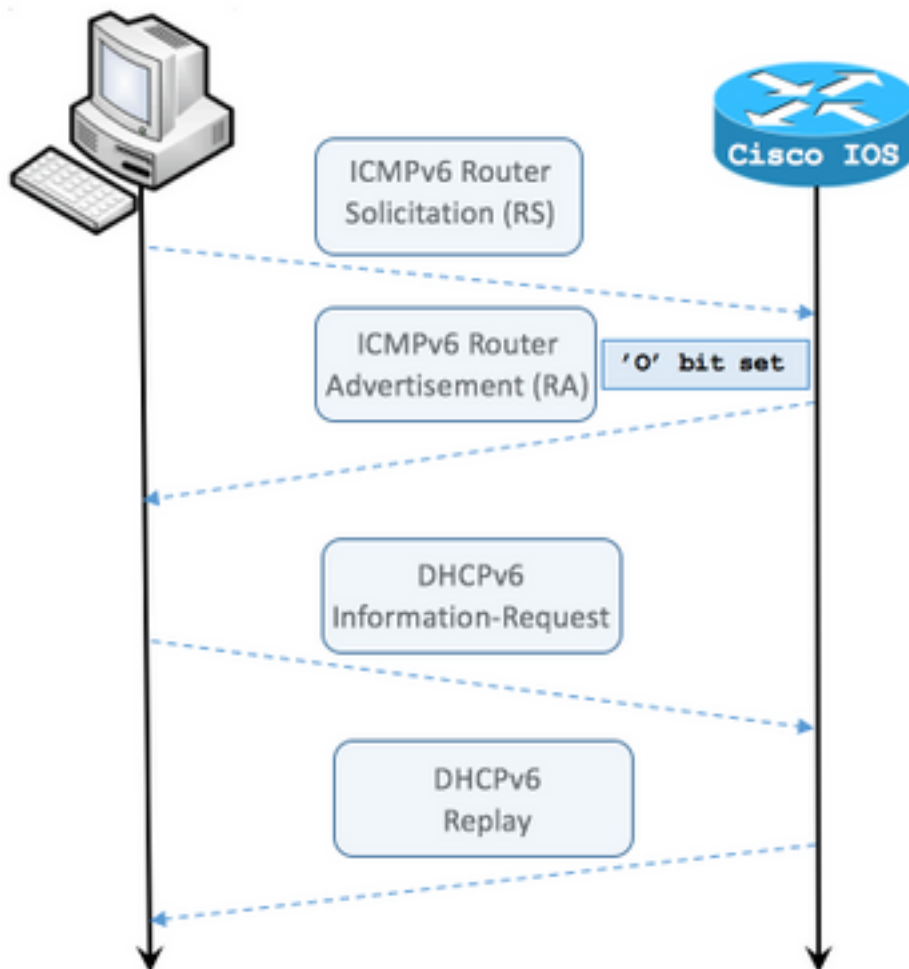
當ipv6 nd other-config-flag命令出現在Cisco IOS介面配置模式下時，路由器會設定O標誌。

Router#

```
interface GigabitEthernet0/0/0
  ipv6 address 2001:ABCD::1/64
  ipv6 nd other-config-flag
```

!

路由器與終端主機之間的封包交換如圖所示。



步驟1.終端主機最初傳送ICMPv6 RS

步驟2.路由器使用ICMPv6 RA進行重放，並包含O標誌集

步驟3.終端主機傳送DHCPv6 Information-request

步驟4.路由器使用DHCPv6回覆重放

ICMPv6 RA(帶有其他配置標誌設定資料包捕獲):

```
Frame 9: 118 bytes on wire (944 bits), 118 bytes captured (944 bits) on interface 0
Ethernet II, Src: ca:01:b9:f0:00:08 (ca:01:b9:f0:00:08), Dst: IPv6mcast_01 (33:33:00:00:00:01)
Internet Protocol Version 6, Src: fe80::c801:b9ff:fef0:8, Dst: ff02::1
Internet Control Message Protocol v6
  Type: Router Advertisement (134)
  Code: 0
  Checksum: 0x4ca1 [correct] Cur hop limit: 64 Flags: 0x40 0... .... = Managed address
configuration: Not set .1.. .... = Other configuration: Set ! Cisco IOS command ipv6 nd other-
```

```

config-flag sets the O flag
    ..0. .... = Home Agent: Not set
    ...0 0... = Prf (Default Router Preference): Medium (0)
    .... .0.. = Proxy: Not set
    .... ..0. = Reserved: 0
Router lifetime (s): 1800
Reachable time (ms): 0
Retrans timer (ms): 0
ICMPv6 Option (Source link-layer address : ca:01:b9:f0:00:08)
ICMPv6 Option (MTU : 1500)
ICMPv6 Option (Prefix information : 2001:abcd::/64)

```

在Wireshark上，使用**dhcpv6**過濾器顯示DHCPv6資料包的交換：

Source Destination Protocol Length Info

```

PC IPv6 link local ff02::1:2 DHCPv6 120 Information-request XID: 0x8018f9 CID:
000100011f3e8772000c29806ccc

```

```

Frame 3884: 120 bytes on wire (960 bits), 120 bytes captured (960 bits) on interface 0
Ethernet II, Src: Vmware_80:6c:cc (00:0c:29:80:6c:cc), Dst: IPv6mcast_01:00:02
(33:33:00:01:00:02)

```

```

Internet Protocol Version 6, Src: PC IPv6 link local (fe80::5850:6d61:1fb:ef3a), Dst: ff02::1:2
(ff02::1:2)

```

```

User Datagram Protocol, Src Port: 546 (546), Dst Port: 547 (547) DHCPv6 Message type:

```

```

Information-request (11) Transaction ID: 0x8018f9 Elapsed time Client Identifier Vendor Class
Option Request Source Destination Protocol Length Info Router IPv6 link local PC IPv6 link local
DHCPv6 136 Reply XID: 0x8018f9 CID: 000100011f3e8772000c29806ccc Frame 3887: 136 bytes on wire
(1088 bits), 136 bytes captured (1088 bits) on interface 0 Ethernet II, Src: ca:01:b9:f0:00:08
(ca:01:b9:f0:00:08), Dst: Vmware_80:6c:cc (00:0c:29:80:6c:cc) Internet Protocol Version 6, Src:
Router IPv6 link local (fe80::c801:b9ff:fef0:8), Dst: PC IPv6 link local
(fe80::5850:6d61:1fb:ef3a) User Datagram Protocol, Src Port: 547 (547), Dst Port: 546 (546)
DHCPv6 Message type: Reply (7) Transaction ID: 0x8018f9 Server Identifier Client Identifier DNS
recursive name server Domain Search List

```

Cisco IOS上的DHCPv6無狀態伺服器配置示例

從Cisco IOS

此示例顯示Cisco IOS中DHCPv6無狀態伺服器的配置。

步驟1.在全域性配置模式下運行命令**ipv6 dhcp pool NAME**。

步驟2.使用**dns-server**和**doman-name**子命令定義通過DHCPv6傳送到終端主機的引數。

步驟3.使用命令**ipv6 dhcp server NAME**應用介面配置模式下定義的池。

步驟4.在介面配置模式下新增命令**ipv6 nd other-config-flag**。

```

ipv6 unicast-routing
!
ipv6 dhcp pool LAN_POOL
  dns-server 2001:4860:4860::8888
  domain-name lab-test.net ! interface GigabitEthernet0/0/0 ipv6 address 2001:ABCD::1/64 ipv6 nd
other-config-flag ! Sets the Other Configuration flag in the RA packet.
  ipv6 dhcp server LAN_POOL
!

```

若要確認Cisco IOS上的組態是否正確，請使用以下命令：

步驟1. `show ipv6 dhcp pool`必須確認配置中應用的引數。

步驟2. `show ipv6 dhcp binding`不能顯示任何資訊，因為DHCPv6無狀態不會跟蹤IPv6客戶端。

步驟3. `show ipv6 dhcp interface`必須顯示地址池已應用於本地網路中的介面。

```
Router#show ipv6 dhcp pool
DHCPv6 pool: LAN_POOL
  DNS server: 2001:4860:4860::8888
  Domain name: lab-test.net
  Active clients: 0          ! DHCPv6 Stateless does not keep track of IPv6 clients.
Router#
```

```
Router#show ipv6 dhcp binding
Router#
```

```
Router#show ipv6 dhcp interface
FastEthernet0/0 is in server mode
  Using pool: LAN_POOL
  Preference value: 0
  Hint from client: ignored
  Rapid-Commit: disabled
Router#
```

`debug ipv6 dhcp`命令必須顯示路由器和終端主機之間的消息交換：

```
Router#debug ipv6 dhcp
IPv6 DHCP debugging is on
IPv6 DHCP: Received INFORMATION-REQUEST from FE80::5850:6D61:1FB:EF3A on FastEthernet0/0
IPv6 DHCP: Option VENDOR-CLASS(16) is not processed
IPv6 DHCP: Using interface pool LAN_POOL
IPv6 DHCP: Source Address from SAS FE80::C801:B9FF:FEF0:8
IPv6 DHCP: Sending REPLY to FE80::5850:6D61:1FB:EF3A on FastEthernet0/0
Router#
```

從Microsoft Windows

在命令提示符下運行命令`ipconfig /all`，以確保Microsoft Windows已收到DNS伺服器資訊和域名：

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

Windows IP Configuration

Host Name . . . . . : MY-LAPTOP
Primary Dns Suffix . . . . . :
Node Type . . . . . : Hybrid
IP Routing Enabled. . . . . : No
WINS Proxy Enabled. . . . . : No
DNS Suffix Search List. . . . . : lab-test.net

Ethernet adapter Local Area Connection: Connection-specific DNS Suffix . : lab-test.net
Description . . . . . : Intel(R) PRO/1000 MT Network Connection
Physical Address. . . . . : 00-0C-29-80-6C-CC
DHCP Enabled. . . . . : No
Autoconfiguration Enabled . . . . . : Yes
IPv6 Address. . . . . : 2001:abcd::5850:6d61:1fb:ef3a(Preferred)

Temporary IPv6 Address. . . . . : 2001:abcd::7151:b553:1a0a:80bb(Preferred)
```

```
Link-local IPv6 Address . . . . . : fe80::5850:6d61:1fb:ef3a%11(Preferred)
Default Gateway . . . . . : fe80::c801:b9ff:fef0:8%11
DHCPv6 IAID . . . . . : 234884137
DHCPv6 Client DUID. . . . . : 00-01-00-01-1F-3E-87-72-00-0C-29-80-6C-CC
```

```
DNS Servers . . . . . : 2001:4860:4860::8888
NetBIOS over Tcpip. . . . . : Disabled
Connection-specific DNS Suffix Search List :
                                lab-test.net
```

C:\Users\ >

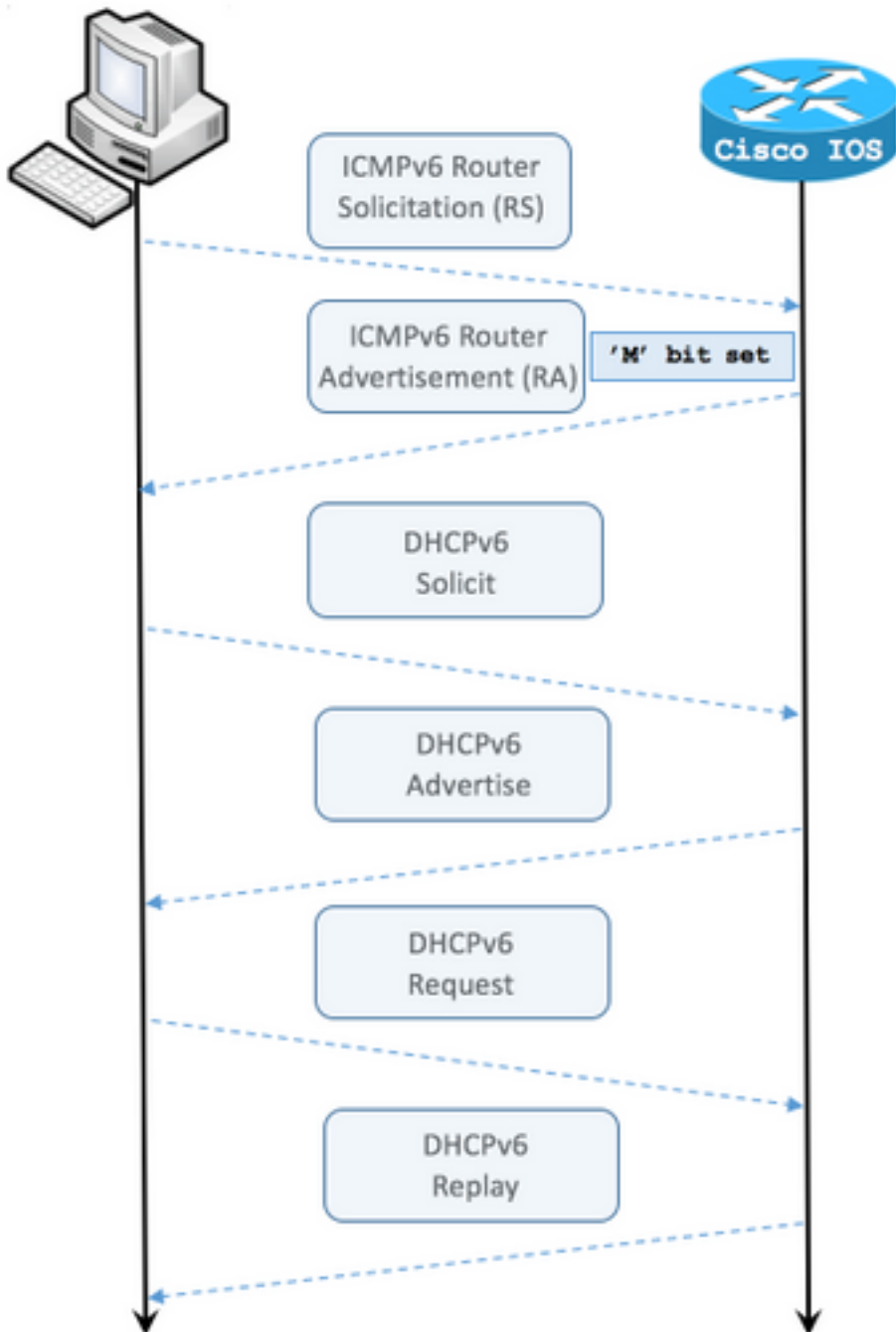
DHCPv6有狀態

終端主機可以使用DHCPv6 Stateful請求IPv6地址和其他引數。為此，ICMPv6 RA資料包必須設定託管地址配置標誌 (M標誌)。

當ipv6 nd managed-config-flag命令出現在Cisco IOS介面配置模式下時，路由器會設定M標誌。

```
Router#
interface GigabitEthernet0/0/0
  ipv6 address 2001:ABCD::1/64
  ipv6 nd managed-config-flag
!
```

路由器與終端主機之間的封包交換如圖所示。



步驟1.終端主機最初傳送ICMPv6 RS。

步驟2.路由器使用已設定M標誌的ICMPv6 RA重放。

步驟3.終端主機傳送DHCPv6 Solicit。

步驟4.路由器使用DHCPv6通告進行重播。

步驟5.終端主機傳送DHCPv6請求。

步驟6.路由器使用DHCPv6應答進行重放。

帶有託管地址配置標誌設定資料包捕獲的ICMPv6 RA:

```

Ethernet II, Src: ca:01:b9:f0:00:08 (ca:01:b9:f0:00:08), Dst: IPv6mcast_01 (33:33:00:00:00:01)
Internet Protocol Version 6, Src: Router IPv6 link local (fe80::c801:b9ff:fef0:8), Dst: ff02::1
(ff02::1)
Internet Control Message Protocol v6
  Type: Router Advertisement (134)
  Code: 0 Checksum: 0x0642 [correct] Cur hop limit: 64 Flags: 0x80 1... .... = Managed address
configuration: Set
  .0... .... = Other configuration: Not set
  ..0. .... = Home Agent: Not set
  ...0 0... = Prf (Default Router Preference): Medium (0)
  .... .0.. = Proxy: Not set
  .... ..0. = Reserved: 0
Router lifetime (s): 1800
Reachable time (ms): 0
Retrans timer (ms): 0
ICMPv6 Option (Source link-layer address : ca:01:b9:f0:00:08)
ICMPv6 Option (MTU : 1500)
ICMPv6 Option (Prefix information : 2001:abcd::/64)
Type: Prefix information (3)
Length: 4 (32 bytes)
Prefix Length: 64
Flag: 0x80
  1... .... = On-link flag(L): Set
  .0.. .... = Autonomous address-configuration flag(A): Not set
  ..0. .... = Router address flag(R): Not set
  ...0 0000 = Reserved: 0
Valid Lifetime: 1800
Preferred Lifetime: 1800
Reserved
Prefix: 2001:abcd:: (2001:abcd::)

```

在Wireshark中，使用dhcpv6過濾器顯示DHCPv6資料包的交換：

```

Source Destination Protocol Length Info
PC IPv6 link local ff02::1:2 DHCPv6 157 Solicit
XID: 0x328090 CID: 000100011f3e8772000c29806ccc
Frame 965: 157 bytes on wire (1256 bits), 157 bytes
captured (1256 bits) on interface 0 Ethernet II, Src: Vmware_80:6c:cc
(00:0c:29:80:6c:cc), Dst: IPv6mcast_01:00:02
(33:33:00:01:00:02) Internet Protocol Version 6, Src: PC IPv6 link local
(fe80::5850:6d61:1fb:ef3a), Dst: ff02::1:2
(ff02::1:2) User Datagram Protocol, Src Port: 546
(546), Dst Port: 547 (547) DHCPv6 Message type: Solicit (1)
Transaction ID: 0x328090
Elapsed time
Client Identifier
Identity Association for Non-temporary Address
Fully Qualified Domain Name
Vendor Class
Option Request

```

```

Source Destination Protocol Length Info
Router IPv6 link local PC IPv6 link local DHCPv6 180 Advertise
XID: 0x328090 CID: 000100011f3e8772000c29806ccc
IAA: 2001:abcd::70a1:36a7:3e72:fa95

```

```

Frame 966: 180 bytes on wire (1440 bits), 180 bytes captured (1440 bits) on interface 0
Ethernet II, Src: ca:01:b9:f0:00:08 (ca:01:b9:f0:00:08), Dst: Vmware_80:6c:cc
(00:0c:29:80:6c:cc)
Internet Protocol Version 6, Src: Router IPv6 link local (fe80::c801:b9ff:fef0:8), Dst: PC IPv6
link local (fe80::5850:6d61:1fb:ef3a)
User Datagram Protocol, Src Port: 547 (547), Dst Port: 546 (546)
DHCPv6 Message type: Advertise (2)
Transaction ID: 0x328090
Server Identifier
Client Identifier
Identity Association for Non-temporary Address

```

```
DNS recursive name server
Domain Search List
```

```
Source          Destination Protocol Length Info
PC IPv6 link local ff02::1:2 DHCPv6      199 Request XID: 0x328090 CID:
000100011f3e8772000c29806ccc IAA: 2001:abcd::70a1:36a7:3e72:fa95

Frame 967: 199 bytes on wire (1592 bits), 199 bytes captured (1592 bits) on interface 0
Ethernet II, Src: Vmware_80:6c:cc (00:0c:29:80:6c:cc), Dst: IPv6mcast_01:00:02
(33:33:00:01:00:02)
Internet Protocol Version 6, Src: PC IPv6 link local (fe80::5850:6d61:1fb:ef3a), Dst: ff02::1:2
(ff02::1:2)
User Datagram Protocol, Src Port: 546 (546), Dst Port: 547 (547)
DHCPv6 Message type: Request (3)
  Transaction ID: 0x328090
  Elapsed time
  Client Identifier
  Server Identifier
  Identity Association for Non-temporary Address
  Fully Qualified Domain Name
  Vendor Class
  Option Request
```

```
Source          Destination Protocol Length Info
Router IPv6 link localPC IPv6 link local DHCPv6      180 Reply XID: 0x328090 CID:
000100011f3e8772000c29806ccc IAA: 2001:abcd::70a1:36a7:3e72:fa95

Frame 968: 180 bytes on wire (1440 bits), 180 bytes captured (1440 bits) on interface 0
Ethernet II, Src: ca:01:b9:f0:00:08 (ca:01:b9:f0:00:08), Dst: Vmware_80:6c:cc
(00:0c:29:80:6c:cc)
Internet Protocol Version 6, Src: Router IPv6 link local (fe80::c801:b9ff:fef0:8), Dst: PC IPv6
link local (fe80::5850:6d61:1fb:ef3a)
User Datagram Protocol, Src Port: 547 (547), Dst Port: 546 (546)
DHCPv6 Message type: Reply (7)
  Transaction ID: 0x328090
  Server Identifier
  Client Identifier
  Identity Association for Non-temporary Address
  DNS recursive name server
  Domain Search List
```

Cisco IOS上的DHCPv6有狀態伺服器配置示例

從Cisco IOS

此示例顯示了Cisco IOS中DHCPv6有狀態伺服器的配置。

步驟1.在全域性配置模式下運行命令**ipv6 dhcp pool NAME**。

步驟2.使用**address prefix**、**dns-server**和**doman-name**子命令定義通過DHCPv6傳送到終端主機的引數。

步驟3.使用命令**ipv6 dhcp server NAME**應用介面配置模式下定義的池。

步驟4.在介面配置模式下新增命令**ipv6 nd managed-config-flag**。

步驟5.在介面配置模式下新增命令**ipv6 nd prefix default 1800 1800 no-autoconfig**，以禁用ICMPv6 RA資料包中的**Autonomous address-configuration(A)**標誌。

附註：使用DHCPv6有狀態伺服器方法時，終端主機可以為自身配置兩個不同的IPv6地址。第一個包含ICMPv6 RA資料包中包含資訊的資料包。第二個包含DHCPv6資料包中包含的資訊。為避免這種情況，ICMPv6 RA資料包可以禁用**A**標誌，以指示終端主機不要根據其中包含的資訊生成IPv6地址。

附註：在介面配置模式下，可以使用**ipv6 nd prefix default no-advertise**命令從ICMPv6 RA資料包的內容中刪除字首資訊。

```
ipv6 unicast-routing
!ipv6 dhcp pool LAN_POOL  address prefix 2001:ABCD::/64 ! Includes the IPv6 prefix in the DHCPv6
packet exchange.
  dns-server 2001:4860:4860::8888
  domain-name lab-test.net
!
interface GigabitEthernet0/0/0
  ipv6 address 2001:ABCD::/64 eui-64
  ipv6 nd prefix default 1800 1800 no-autoconfig ! Disables the Autonomous address-
configuration(A) flag in the ICMPv6 RA packet.
  ipv6 nd managed-config-flag ! Sets the Managed address configuration flag in the ICMPv6 RA
packet.
  ipv6 dhcp server LAN_POOL
end
```

若要確認Cisco IOS上的組態是否正確，請使用以下命令：

步驟1. **show ipv6 dhcp pool**必須確認配置中應用的引數。

步驟2. **show ipv6 dhcp binding**必須為租給終端主機的IPv6地址提供資訊。

步驟3. **show ipv6 dhcp interface**必須顯示地址池已應用於本地網路中的介面。

```
Router#show ipv6 dhcp pool
DHCPv6 pool: LAN_POOL
  Address allocation prefix: 2001:ABCD::/64 valid 172800 preferred 86400 (1 in use, 0 conflicts)
  DNS server: 2001:4860:4860::8888
  Domain name: lab-test.net Active clients: 1 Router#
```

```
Router#show ipv6 dhcp binding
Client: FE80::5850:6D61:1FB:EF3A
  DUID: 000100011F3E8772000C29806CCC
  Username : unassigned
  IA NA: IA ID 0x0E000C29, T1 43200, T2 69120
  Address: 2001:ABCD::3DD4:77BB:E035:9375
           preferred lifetime 86400, valid lifetime 172800
           expires at Dec 28 2016 10:44 PM (172488 seconds)
Router#
```

```
Router#show ipv6 dhcp interface
FastEthernet0/0 is in server mode
  Using pool: LAN_POOL
  Preference value: 0
```

```
Hint from client: ignored
Rapid-Commit: disabled
Router#
```

debug ipv6 dhcp命令必須顯示路由器和終端主機之間的消息交換：

```
Router#debug ipv6 dhcp
IPv6 DHCP debugging is on
Router#IPv6 DHCP: Received SOLICIT from FE80::5850:6D61:1FB:EF3A on FastEthernet0/0
IPv6 DHCP: Option UNKNOWN(39) is not processed
IPv6 DHCP: Option VENDOR-CLASS(16) is not processed
IPv6 DHCP: Using interface pool LAN_POOL
IPv6 DHCP: Creating binding for FE80::5850:6D61:1FB:EF3A in pool LAN_POOL
IPv6 DHCP: Binding for IA_NA 0E000C29 not found
IPv6 DHCP: Allocating IA_NA 0E000C29 in binding for FE80::5850:6D61:1FB:EF3A
IPv6 DHCP: Looking up pool 2001:ABCD::/64 entry with username
'000100011F3E8772000C29806CCC0E000C29'
IPv6 DHCP: Poolentry for user not found
IPv6 DHCP: Allocated new address 2001:ABCD::D9F7:61C:D803:DCF1
IPv6 DHCP: Allocating address 2001:ABCD::D9F7:61C:D803:DCF1 in binding for
FE80::5850:6D61:1FB:EF3A, IAID 0E000C29
IPv6 DHCP: Updating binding address entry for address 2001:ABCD::D9F7:61C:D803:DCF1
IPv6 DHCP: Setting timer on 2001:ABCD::D9F7:61C:D803:DCF1 for 60 seconds
IPv6 DHCP: Source Address from SAS FE80::C801:B9FF:FEF0:8
IPv6 DHCP: Sending ADVERTISE to FE80::5850:6D61:1FB:EF3A on FastEthernet0/0
IPv6 DHCP: Received REQUEST from FE80::5850:6D61:1FB:EF3A on FastEthernet0/0
IPv6 DHCP: Option UNKNOWN(39) is not processed
IPv6 DHCP: Option VENDOR-CLASS(16) is not processed
IPv6 DHCP: Using interface pool LAN_POOL
IPv6 DHCP: Looking up pool 2001:ABCD::/64 entry with username
'000100011F3E8772000C29806CCC0E000C29'
IPv6 DHCP: Poolentry for user found
IPv6 DHCP: Found address 2001:ABCD::D9F7:61C:D803:DCF1 in binding for FE80::5850:6D61:1FB:EF3A,
IAID 0E000C29
IPv6 DHCP: Updating binding address entry for address 2001:ABCD::D9F7:61C:D803:DCF1
IPv6 DHCP: Setting timer on 2001:ABCD::D9F7:61C:D803:DCF1 for 172800 seconds
IPv6 DHCP: Source Address from SAS FE80::C801:B9FF:FEF0:8
IPv6 DHCP: Sending REPLY to FE80::5850:6D61:1FB:EF3A on FastEthernet0/0
Router#
```

從Microsoft Windows

運行命令**ipconfig /all**以確保Microsoft Windows已收到IPv6地址、預設網關、DNS伺服器資訊和域名：

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

```
Windows IP Configuration
```

```
Host Name . . . . . : MY-LAPTOP
Primary Dns Suffix . . . . . :
Node Type . . . . . : Hybrid
IP Routing Enabled. . . . . : No
WINS Proxy Enabled. . . . . : No
DNS Suffix Search List. . . . . : lab-test.net
Ethernet adapter Local Area Connection: Connection-specific DNS Suffix . : lab-test.net
Description . . . . . : Intel(R) PRO/1000 MT Network Connection
Physical Address. . . . . : 00-0C-29-80-6C-CC
DHCP Enabled. . . . . : No
Autoconfiguration Enabled . . . . : Yes
IPv6 Address. . . . . : 2001:abcd::3dd4:77bb:e035:9375(Preferred)
```

```
Lease Obtained. . . . . : Sunday, January 01, 2017 4:47:02 PM
Lease Expires . . . . . : Tuesday, January 03, 2017 4:47:02 PM
Link-local IPv6 Address . . . . . : fe80::5850:6d61:1fb:ef3a%11(Preferred)
Default Gateway . . . . . : fe80::c801:b9ff:fef0:8%11
DHCPv6 IAID . . . . . : 234884137
DHCPv6 Client DUID. . . . . : 00-01-00-01-1F-3E-87-72-00-0C-29-80-6C-CC
```

```
DNS Servers . . . . . : 2001:4860:4860::8888
```

```
NetBIOS over Tcpi. . . . . : Disabled
```

```
Connection-specific DNS Suffix Search List :
lab-test.net
```

```
C:\Users\ >
```

禁用Windows隨機生成的介面ID

預設情況下，Microsoft Windows為自動配置的IPv6地址（使用SLAAC）生成隨機介面ID，而不是使用EUI-64方法。

```
C:\Users\ >ipconfig
```

```
Windows IP Configuration
```

```
Ethernet adapter Local Area Connection: Connection-specific DNS Suffix . : IPv6 Address. . . . .
. . . . . : 2001:abcd::5850:6d61:1fb:ef3a ! Randomly generated interface ID.
Temporary IPv6 Address. . . . . : 2001:abcd::8d1:8bbb:14e4:658e
Link-local IPv6 Address . . . . . : fe80::5850:6d61:1fb:ef3a%11
Default Gateway . . . . . : fe80::c801:b9ff:fef0:8%11
```

可以更改此行為以使Windows使用EUI-64進程。

```
netsh interface ipv6 set global randomizeidentifiers=disabled
```

現在您可以看到使用EUI-64進程生成的介面ID。

```
C:\Users\ >ipconfigWindows IP Configuration Ethernet adapter Local Area Connection:
Connection-specific DNS Suffix . : IPv6 Address. . . . . :
2001:abcd::20c:29ff:fe80:6ccc ! Interface ID now generated by EUI-64 method.
Temporary IPv6 Address. . . . . : 2001:abcd::9818:d729:fadb:8812
Link-local IPv6 Address . . . . . : fe80::20c:29ff:fe80:6ccc%11
Default Gateway . . . . . : fe80::c801:b9ff:fef0:8%11
```

要再次使用隨機介面ID進程，可以運行命令：

```
netsh interface ipv6 set global randomizeidentifiers=enabled
```

禁用Windows臨時IPv6地址

出於安全考慮，Windows可以臨時建立IPv6地址並將這些地址用作出站連線的源。

如果預期終端主機使用某個IPv6地址來傳送通訊（如網路中定義了防火牆規則），則可能會造成混亂。

臨時IPv6地址是因為Windows實施了[RFC 4941](#)。

```
C:\Users\ >ipconfig
Windows IP Configuration Ethernet adapter Local Area Connection: Connection-specific DNS Suffix
. : IPv6 Address. . . . . : 2001:abcd::5850:6d61:1fb:ef3a Temporary IPv6 Address. .
. . . . : 2001:abcd::8d1:8bbb:14e4:658e Link-local IPv6 Address . . . . . :
fe80::5850:6d61:1fb:ef3a%11 Default Gateway . . . . . : fe80::c801:b9ff:fef0:8%11
```

```
C:\Users\ >netsh interface ipv6 show privacy
Querying active state...
```

```
Temporary Address Parameters
-----
Use Temporary Addresses           : enabled
Duplicate Address Detection Attempts: 5
Maximum Valid Lifetime           : 7d
Maximum Preferred Lifetime       : 1d
Regenerate Time                   : 5s
Maximum Random Time              : 10m
Random Time                       : 0s
```

```
C:\Users\Gus>
```

要禁用自動建立臨時IPv6地址，請運行命令：

```
netsh interface ipv6 set privacy state=disabled
```

應用該命令後，輸出顯示：

```
C:\Users\ >ipconfig
Windows IP Configuration
Ethernet adapter Local Area Connection: Connection-specific DNS Suffix . : IPv6 Address. . . .
. . . . . : 2001:abcd::5850:6d61:1fb:ef3a Link-local IPv6 Address . . . . . :
fe80::5850:6d61:1fb:ef3a%11 Default Gateway . . . . . : fe80::c801:b9ff:fef0:8%11
```

```
C:\Users\ >netsh interface ipv6 show privacy
Querying active state...
```

```
Temporary Address Parameters
-----
Use Temporary Addresses : disabled
Duplicate Address Detection Attempts: 5
Maximum Valid Lifetime   : 7d
Maximum Preferred Lifetime : 1d
Regenerate Time          : 5s
Maximum Random Time      : 10m
Random Time              : 0s
```

要再次使用臨時IPv6地址，可以運行以下命令：

```
netsh interface ipv6 set privacy state=enable
```

IPv6動態地址分配提供的選項比IPv4中的DHCP多。必須瞭解主要的配置點，以及在過程沒有按預期完成時檢查什麼。在Cisco IOS和Microsoft Windows上提供了基本配置命令，用於檢視整個過程的完整檢視。

相關資訊

- [Cisco IOS IPv6命令參考](#)
- [使用Windows工具獲取IPv6配置資訊](#)