IPv6 Autoconfiguration

Stateless and Stateful

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Prerequisites

- You must have followed previously the modules:
  - 010-IPv6 Introduction
  - 020-IPv6 Protocol
  - 030-IPv6 Addressing
  - 040-IPv6 Associated Protocols
Agenda

- Stateless Autoconfiguration
- Stateful Autoconfiguration (DHCPv6)
- Conclusions
Stateless Autoconfiguration

- Hosts should be plug & play
- Uses some of the Neighbor Discovery ICMPv6 messages
- When booting, the host asks for network parameters:
  - IPv6 prefix(es)
  - default router address(es)
  - hop limit
  - (link local) MTU
Stateless Autoconfiguration

- Only routers have to be manually configured
  - but work on prefix delegation is in progress

- Hosts can get automatically an IPv6 address
  - BUT it isn’t automatically registered in the DNS

- but servers should be manually configured
Stateless Autoconfiguration

- IPv6 Stateless Address Autoconfiguration is described in RFC 2462
- Hosts are listening for Router Advertisements (RA) messages, periodically transmitted by routers
- RA messages coming from the router[s] on the link identify the subnet
- Allows a host to create a global IPv6 address from:
  - Its interface identifier (EUI-64 address)
  - Link Prefix (obtained via Router Advertisement)
- Global Address = combine Link Prefix with EUI-64 address
Stateless Autoconfiguration

• Usually, the router sending the RA messages is used, by hosts, as the default router
• If the RA doesn’t carry any prefix
  – The hosts don’t configure (automatically) any global IPv6 address [but may configure the default gateway address]
• RA messages contain two flags indicating what type of stateful autoconfiguration (if any) should be performed
• It’s impossible to automatically send DNS server addresses
• IPv6 addresses depends on NIC card
Stateless Autoconfiguration example

MAC address is 00:0E:0C:31:C8:1F

Internet

FF02::2 (All routers)
FE80::20F:23FF:FEF0:551A

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Stateless Autoconfiguration example

MAC address is 00:0E:0C:31:C8:1F

EUI-64 address is 20E:0CFF:FE31:C81F

FF02::2 (All routers)
FE80::20F:23FF:FEF0:551A

IPv6DISSemination and Exploitation
Stateless Autoconfiguration example

1. Create the link local address

FE80::20E:0CFF:FE31:C81F

EUI-64 address is
20E:0CFF:FE31:C81F

Internet

FF02::2 (All routers)
FE80::20F:23FF:FEF0:551A
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Stateless Autoconfiguration example

2. Do a Duplicate Address Detection

EUI-64 address is 20E:0CFF:FE31:C81F

FE80:20E:0CFF:FE31:C81F

FF02::2 (All routers)
FE80::20F:23FF:FEF0:551A
Stateless Autoconfiguration example

Internet

3. Send Router Solicitation

EUI-64 address is 20E:0CFF:FE31:C81F

FE80::20E:0CFF:FE31:C81F

Router Advertisement 2001:690:1:1

FF02::2 (All routers)
FE80::20F:23FF:FEF0:551A

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Stateless Autoconfiguration example

4. Create global address

EUI-64 address is 20E:0CFF:FE31:C81F

FE80::20E:0CFF:FE31:C81F

Router Advertisement 2001:690:1:1

FF02::2 (All routers)
FE80::20F:23FF:FEF0:551A
Stateless Autoconfiguration example

Internet

4. Create global address

EUI-64 address is 20E:0CFF:FE31:C81F

FE80::20E:0CFF:FE31:C81F

2001:690:1:1::

Router Advertisement 2001:690:1:1

FF02::2 (All routers)
FE80::20F:23FF:FEF0:551A
Stateless Autoconfiguration example

4. Create global address

EUI-64 address is
20E:0CFF:FE31:C81F

FE80::20E:0CFF:FE31:C81F
2001:690:1:1:20E:0CFF:FE31:C81F

Router Advertisement
2001:690:1:1

FF02::2 (All routers)
FE80::20F:23FF:FEF0:551A
Stateless Autoconfiguration example

EUI-64 address is
20E:0CFF:FE31:C81F

FE80::20E:0CFF:FE31:C81F
2001:690:1:1:20E:0CFF:FE31:C81F

5. Do a DAD

FF02::2 (All routers)
FE80::20F:23FF:FEF0:551A

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Stateless Autoconfiguration example

6. Set Default Router

EUI-64 address is
20E:0CFF:FE31:C81F

FE80::20E:0CFF:FE31:C81F
2001:690:1:1:20E:0CFF:FE31:C81F

FF02::2 (All routers)
FE80::20F:23FF:FEF0:551A
Stateless Autoconfiguration example

6. Set Default Router

EUI-64 address is
20E:0CFF:FE31:C81F

FE80::20E:0CFF:FE31:C81F
2001:690:1::20E:0CFF:FE31:C81F

::/0

FF02::2 (All routers)
FE80::20F:23FF:FEF0:551A
Stateless Autoconfiguration example

6. Set Default Router

- EUI-64 address is 20E:00FF:FE31:C81F
- FE80::20E:00FF:FE31:C81F
- 2001:690:1:1:20E:00FF:FE31:C81F
- FE80::20F:23FF:FE0:551A
- ::/0

IPv6DISSemination and Exploitation

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Stateless Autoconfiguration example

EUI-64 address is
20E:0CFF:FE31:C81F

And the DNS Server Address ?!

FE80::20E:0CFF:FE31:C81F
2001:690:1:1:20E:0CFF:FE31:C81F
FE80::20F:23FF:FEF0:551A

::/0

FF02::2 (All routers)
FE80::20F:23FF:FEF0:551A
Stateful autoconfiguration (DHCPv6)

- Dynamic Host Configuration Protocol for IPv6
  - RFC 3315
  - stateful counterpart to IPv6 Stateless Address Autoconfiguration.

- According to RFC 3315 DHCPv6 is used when:
  - no router is found
  - Or if Router advertisement message enable use of DHCP
Stateful autoconfiguration (DHCPv6)

- DHCPv6 works in a client-server model
  - **Server**
    - Responds to requests from clients
    - Optionally provides the client with:
      - IPv6 addresses
      - Other configuration parameters (DNS servers...)
    - Is listening on multicast addresses:
      - All_DHCP_Relay_Agents_and_Servers (FF02::1:2)
      - All_DHCP_Servers (FF05::1:3)
  - Memorize client’s state
  - Provide means for securing access control to network resources
Stateful autoconfiguration (DHCPv6)

- **Client**
  - initiates requests on a link to obtain configuration parameters
  - use its link local address to connect the server
  - Send requests to FF02::1:2 multicast address [All_DHCP_Relay_Agents_and_Servers]

- **Relay agent**
  - node that acts as an intermediary to deliver DHCP messages between clients and servers
  - is on the same link as the client
  - Is listening on multicast addresses:
    - All_DHCP_Relay_Agents_and_Servers (FF02::1:2)
Stateful Autoconfiguration example
Stateful Autoconfiguration example

Internet

DHCPv6 Server
Stateful Autoconfiguration example

DHCPv6 Server
FF02::1:2
(All_DHCP_Relay_Agents_and_Servers)
Stateful Autoconfiguration example

1. What’s the DNS servers’ Address

Internet

DHCPv6 Server
FF02::1:2
(All_DHCP_Relay_Agents_and_Servers)
Stateful Autoconfiguration example

2. Host execute an DHCPv6 Client

Internet

DHCPv6 Server
FF02::1:2
(All_DHCP_Relay_Agents_and_Servers)
Stateful Autoconfiguration example

3. Client will send an Information-Request

DHCPv6 Server
FF02::1:2
(All_DHCP_Relay_Agents_and_Servers)

Information-Request
(DNS Server’s address?)

Internet
Stateful Autoconfiguration example

3. Client will send an Information-Request

Internet

DHCPv6 Server
FF02::1:2
(All_DHCP_Relay_Agents_and_Servers)
Stateful Autoconfiguration example

4. Server responds with a Reply Message

DHCPv6 Server
FF02::1:2
(All_DHCP_Relay_Agents_and_Servers)

Reply-message
DNS 2001:690:5:0::10
Stateful Autoconfiguration example

5. Host configures the DNS server

Example: in /etc/resolver.conf file

DHCPv6 Server
FF02::1:2
(All_DHCP_Relay_Agents_and_Servers)

Reply-message
DNS 2001:690:5:0::10

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IPv6DISSemination and Exploitation
Conclusions

- The two types of configuration complement each other
  - Example: we can obtain the address from stateless autoconfiguration and the DNS server address from DHCPv6

- In dual-stack networks we can obtain DNS server addresses from **DHCPv4**

- DHCPv6 clients still aren’t available in Operating Systems.
  - So, we still need to run a client
  - No transparent to users
Questions?