IPv6 Address autoconfiguration
stateless & stateful
Agenda

Stateless Autoconfiguration
Stateful Autoconfiguration (DHCPv6)
Conclusions
Stateless Autoconfiguration

Provides plug & play networking for hosts

On network initialisation a node can obtain:
- IPv6 prefix(es)
- Default router address(es)
- Hop limit
- (link local) MTU
- validity lifetime

DNS server addresses are not normally supplied
- Though there is an experimental DNS extension (RFC5006)
  - Though not yet available in any OS
Stateless Autoconfiguration

Hosts can automatically get an IPv6 address

Only routers have to be manually configured
  • Or can use the *Prefix Delegation* option (RFC 3633)

Servers should be manually configured

Link-local (as opposed to Global) addresses are usually autoconfigured on all nodes
Stateless Autoconfiguration

IPv6 Stateless Address Autoconfiguration

• Defined in RFC 4862

Hosts listen for Router Advertisements (RA) messages

• Periodically sent out by routers on the local link, or requested by the host using an RA using a solicitation message
• RA messages provide information to allow for automatic configuration

Hosts can create a Global unicast IPv6 address by combining:

• Its interface’s EUI-64 (based on MAC) address or random ID
• Link Prefix (obtained via Router Advertisement)

Global Address = Link Prefix + EUI-64 address
Stateless Autoconfiguration

Usually, the router sending the RA messages is the default router

If the RA doesn’t carry a prefix

• The hosts don’t configure (automatically) any global IPv6 address (but may configure the default gateway address)

RA messages contain two flags

• Indicate what type of stateful autoconfiguration (if any) should be performed
  • Though the interpretation of ManagedFlag and OtherConfigFlag is currently a little ambiguous

IPv6 addresses usually based on NIC MAC address

• Though hosts can use Privacy Extensions (RFC4941)
  • E.g. Vista uses random EUI-64 as default
Stateless Autoconfiguration / 2

1. Create the link local address
2. Do a **Duplicate Address Detection**
3. Send Router Solicitation
   4. Create global address
   5. Do a DAD
   6. Set Default Router
   And the DNS Server Address ?!

MAC address is 00:0E:0C:31:C8:1F
EUI-64 address is 20E:0CFF:FE31:C81F

Internet

Router Solicitation
Dest. FF02::2

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

Router Advertisement
2001:690:1:1:

FE80::20F:23FF:FE00:551A

FF02::2 (All routers)

FE80::20F:23FF:FE00:551A
Stateful Autoconfiguration
DHCPv6

Dynamic Host Configuration Protocol for IPv6
- Defined in 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 enables use of DHCP
  - Using ManagedFlag and OtherConfigFlag

There is also ‘stateless DHCPv6’ (RFC3736)
- Used by clients that already have an address
- Based upon standard DHCPv6
Statefull Autoconfiguration

DHCPv6 / 2

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...)
  - Listens on the following multicast addresses:
    - All_DHCP_Relay_Agents_and_Servers (FF02::1:2)
    - All_DHCP_Servers (FF05::1:3)
  - Provides means for securing access control to network resources
  - Usually storing client’s state, though ‘stateless operation’ is also possible (the usual method used for IPv4 today)
Statefull Autoconfiguration
DHCPv6 / 3

• Client
  ▪ Initiates requests on a link to obtain configuration parameters
  ▪ Uses its link local address to connect the server
  ▪ Sends requests to FF02::1:2 multicast address (All_DHCP_Relay_Agents_and_Servers)

• Relay agent
  ▪ A node that acts as an intermediary to deliver DHCP messages between clients and servers
  ▪ On the same link as the client
  ▪ Listens on multicast address:
    – All_DHCP_Relay_Agents_and_Servers (FF02::1:2)
Statefull Autoconfiguration
DHCPv6 / 4

1. What’s the DNS servers’ Address
2. Host execute an DHCPv6 Client
3. Client will send an Information-Request
4. Server responds with a Reply Message
5. Host configures the DNS server

Example: in /etc/resolve.conf file

Internet

DHCPv6 Server
FF02::1:2
(All_DHCP_Relay_Agents_and_Servers)

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

Information-Request
(DNS Server’s address?)
Conclusion

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 IPv4 DNS server addresses from DHCPv4

DHCPv6 clients not shipped in all Operating Systems

- Vista/Windows7 contains DHCPv6 client
- Third party clients are available for all Oses
  - E.g. Dibbler, ISC DHCP, Red Hat DHCPv6