OSPFv3-Based Home Networking
draft-arkko-homenet-prefix-assignment-02.txt

Jari Arkko, Ericsson
Acee Lindem, Ericsson
Benjamin Paterson, Cisco
The Dream

No matter how many boxes you have  
And how you connect them

- Networks shall have address space
- Routers shall know where to send packets
- Names resolve to addresses
- Human touch is not required
  [Especially by my mother!]
OSPF-Based Home Networking

ISP interface
- IPv6 forwarding
- DHCPv6 PD

Guest segment

Private segment

DNS discovery for
- Finding servers (or starting)
- Informing hosts

Home GW

OSPF extensions for
- Defaults
- Router ID autoconfig
- Prefix assignment

WLAN segment

R

Home automation segment
Implementing and Using HOMENET
Status Report

Two implementations up and running!

Generally, seems to work well

But implementations are early & incomplete

The protocol design is still morphing
(but that was the point of these exercises)
A HOMENET Network

Router ID
Prefix
NAT64 config
RA & PIO
DNS discovery
Enabler for Other Things...

- E.g., automatic 1-wire to IPv6 translation GW; sensors are visible as CoAP servers in the IPv6 Internet

Feel free to try your CoAP client to, e.g., toaster.objez.net
Draft-02 Updates

- Added an algorithm to generate ULAs (S. 7)
- Replaced the old algorithm for prefix allocation with a new one (S. 6.3)
- Added an explicit discussion of hysteresis (S. 8)
- Added a requirement to support DNS discovery (S. 4.2)
- Described the design choices (S. 5)
- Added Benjamin as an author
- Various small bug fixes and editorial changes
Prefix Allocation Algorithm in Draft-02

- Assigns /64 prefixes out of an allocated prefix (e.g., /56, the "usable prefix")
- One or several routers in the network know the usable prefix(es), all routers co-operate to make the assignments
- The algorithm is triggered by changes in the LSA database or the set of interfaces this router has
- Benjamin's thesis demonstrates some properties relating to the algorithm (convergence, some aspects of correctness, ...)
Overview of the Algorithm

- Routers participate in the autoconfiguration protocol as defined in draft-acee-ospf-ospfv3-autoconfig and calculate their router IDs
- AC LSAs are flooded, with the Usable Prefix TLVs included by those routers who know such prefixes
- The algorithm is run for every pair <usable prefix, interface>
- Assignments are flooded in Assigned Prefix TLVs
- Hysteresis and stable storage applied for stability
Allocations in the Algorithm

- An allocation is made for an interface, unless there is already an allocation from someone else on the same link or when a neighbor has a higher router ID.
- Conflicts can occur both on a link and across the network.
- Upon detecting a conflict, the higher router ID "wins" and the other withdraws its allocation.
ULA Generation in Draft-02

- This router does NOT need to generate a ULA prefix if any of the following conditions are true:
  - There already is a usable prefix
  - A router with a higher ID is reachable
  - This router has a global address
  - ... or can reach the IPv4 Internet
- If not, create a new /48 ULA per RFC 4193
- Apply the usual procedures on NVM, hysteresis, ...
DNS Discovery in Draft-02

- The WG has so far focused mostly on the naming issue as an extension of, say, mDNS to work across subnets.
- As I used an autoconfigured network, I realized that while this is useful, it may not be the highest priority task.
- How does a host deep in the network resolve www.ietf.org or other name in the Internet?
DNS Discovery in Draft-02

- A router needs to inform hosts within its networks about the addresses of DNS servers
- RECOMMENDED that homenet router supports
  - RA options (RFC 6106)
  - Stateless DHCP (RFC 3736)
- Leaves open where this information comes from
  - My implementation uses DDD to gather information from all possible sources
- But should the routers distribute this info?
Experiences

Here are some experiences:

- The technology seems to work as intended
- Our understanding of the problems developed as the work continued, e.g., on conflicts, naming, interfaces
- Relatively easy to implement, 2-4 KLOC as long as you are sane enough to not implement all of OSPFv3 from scratch...
- It is important to think about interfaces to other systems
Interactions with Other Parts

DNS Discovery Daemon (DDD)
- DHCPv6
- RFC 5006
- DNS Probing
- Well-known DNS addresses

ISP DHCP PD
- Manual Prefix & DNS configuration
- OSPFv3

ULA generation
- Timing? When to start a process?
- Dual-stack vs. v6-only differences?
- Firewalls and border detection?

R
- RADVD
- NAT64
- DNS Server or Proxy
Topics for Further Discussion 1

• Hysteresis, algorithms, ULA generation probably need more review & experience
• Interactions with other systems need to be described in greater detail
• If a router discovers a DNS server, how does it tell other routers about this find?
• Do we need a priority mechanism to decide allocations when there is not enough space?
  – Or even (shock!) a > 64 bit prefix solution?
Topics for Further Discussion 2

- Alternative designs for LSAs used by the algorithm:
  - Approach 1: TLVs within the AC LSA (draft-02)
  - Approach 2: Just use intra-area-prefix LSAs
  - Approach 3: A provisional assignment LSA followed by actual allocation LSAs (app. 1 or 2)

- There may be use cases for the draft's technology outside the home networks
  - "RFC 3041 for prefixes"
  - Current thinking is that we should be able to deliver prefixes for any purpose