### **Experiences in Setting Up Automatic Home Networking**



Jari Arkko Ericsson Research



### Background



- This is NOT about home gateway routers
- And NOT about ISPs and their IPv6 services
- But it IS about IPv6 networks at home





### 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!]

### «But one subnet is enough!«

#### Is it?

- Guest vs. private vs. utility
- Differing link technologies; Gigabit Ethernet vs. sensor networks
- Explosion in the number of devices we'll have
- You'll buy that new device anyway and chain it to the rest of your network

### **The Nightmare**

We could get this wrong, too

- "IPv6 is too hard to use"
- NAT66 connecting your IPv6 networks together ("the number of the beast")
- Similar effects as chained NATs have had on IPv4

### **IETF HOMENET WG**

Established in summer 2011(after a few attempts) Has very active participation and held an interim Architecture is being defined and various solutions have been submitted as individual drafts

- Starting point: basic IPv6 specifications, RFC 6204 (CPE), RFC 6092 ("simple security"), ...
- Support multiple subnets and routers
- Prefix configuration, turning routing on automatically, naming and service discovery across the home, improved security, ...

### **A Real-World Example**













### **Some Experiences from Past Years**

Automation is needed (even for us geeks):

- It all started out manually... then I realized that I had to run a routing protocol
- and a tool that discovers what devices I have
- and now I've lost track of what prefixes I have where

And then I realized I really need automation

One morning I found that my ISP had renumbered me

### Making a Useful HOMENET WG Recommendation

- Make recommendations to turn on the things that already exist: DHCP PD, RAs, RIP/OSPF, ...
- Add small enhancements where needed to ensure automatic self-configuration

# Current Directions in the HOMENET WG (1/2)

- Focus on running code + some improvements
- "Route where you had NAT44" architecture
- Various routing solutions exist based on OSPFv3, RIPng, RPL, ND prefix options, and so on
- Prefix configuration solutions could be based on a routing protocol or hierarchical DHCP-PD

#### **OSPF-Based Home Networking**



# Current Directions in the HOMENET WG (2/2)

- Multihoming is outside the scope, except for potentially trying to use the right source address when there are multiple upstreams
- Need to support address assignment before the home is connected (ULAs)

### Implementing and Using HOMENET

### The World's First HOMENET Network



hord: debug: 21897, OSPF: Timeout causes a message resend March hord: debug: 21897, RAW: sendto destination fe80:20c:46ff:fe16:9c86 ^C root@newrouter:/tmp# cat /etc/hord/events/ Selected own router ID: 16.191.119.86 Selected own hardware fingerprint: 16.191.119.86 Automatically assigned a prefix to an interface on interface eth1: 2001:db8:beef:ddd6::/64 Added a new neighbor on interface eth1: 49.66.233.220 Received a valid DD message from neighbor with sequence number on interface eth1: 49.66.233.220 1954 Neighbor moves to EXSTART state on interface eth1: 49.66.233.220 DD sequence number to a neighbor initialized on interface eth1: 1008170920 Tentatively selecting ourselves as the master for the neighbor on interface eth1: 49.66.233.220 New DD message sent with sequence number, in response to a sequence number on interface eth1: 10081. This router becomes a slave to the following peer on interface eth1: 49.66.233.220 Negotiation done, moving to state EXCHANGE with neighbor on interface eth1: 49.66.233.220



### Goals

- Understanding real needs through implementation
- Validate OSPF-based homenet specifications
- Build an implementation that will keep my home network autoconfigured, including:
  - Prefix assignment for network segments
  - Routing automatically turned on
  - Automatic configuration of NAT64
  - Automatic DNS server discovery
- Make me understand routing better
- Building something that can be used in interoperability testing

### Experiences

My implementation is so far quite incomplete, but here are some experiences:

- The technology works as intended, and may even be useful outside home environments
- OSPFv3 autoconfiguration was very easy to implement

   draft-acee-ospf-ospv3-autoconfig-03.txt
- Prefix assignment was easy to implement
  - draft-arkko-homenet-prefix-assignment-01.txt
- OSPF itself is difficult to implement, but any sane person would use an existing implementation
- It is important to think about interfaces to other systems (NAT64, sensor gateways, ISP PD interface, or anything else that needs or gives address space)

### **Interactions with Other Parts**



Firewalls and border detection?

### Summary

- I believe this technology is useful and interesting for many applications
- The HOMENET WG is actively discussing the topic; please join the discussions
- Several implementation efforts under way
- We are still in exploration stage and trying to understand the full scope of automatic network configuration



### ERICSSON