Adaptive Prefix Distribution for Home Routers

Adaptive Prefix Distribution for Home Routers describes a method for home routers to determine the size of prefix they sub-delegate within a home network based on their number of ports.

When a self-configuring, a home network relies on DHCPv6 Prefix Delegation (PD), a decision must be made regarding how to break up the assigned prefix for sub-delegation. This invention is to use the number of ports/interfaces available on a given home router as the basis for this decision.

Table 1 - Subdelegation Options (Bits)

Bits	/56 depth	/52 depth	/48 depth	width
1	9	13	17	1
2	5	7	9	3
3	4 (*)	5	7 (*)	7
4	3	4	5	15
5	3 (*)	4 (*)	5 (*)	31
6	3 (*)	3	4 (*)	63
7	3 (*)	3 (*)	4 (*)	127
8	2	3 (*)	3	255
9	N/A	3 (*)	3 (*)	511
10	N/A	3 (*)	3 (*)	1023
11	N/A	3 (*)	3 (*)	2047

12	N/A	2	3 (*)	4095
13	N/A	N/A	3 (*)	8191
14	N/A	N/A	3 (*)	16383
15	N/A	N/A	3 (*)	32767
16	N/A	N/A	2 (*)	65535

As illustrated in Table 1, regardless of the prefix size allocated to a home network, the "width" of that network is determined solely by the number of bits used for sub-delegation. In this context width refers to the number of routers that any router can have directly connected downstream of it (i.e. how many prefixes it has available to sub-delegate to directly attached downstream routers).

Since the number of directly attached downstream routers is typically limited by the number of ports available, this invention is to subnet on the bit-boundary that allows a width greater than or equal to the number of LAN ports available on a particular router. The rule can be summarized in the equation $b = \lceil \log_2(p + 1) \rceil$ where 'p' is the number of LAN ports and 'b' is the appropriate number of bits to subnet with. For example, a router with 4 LAN ports: $b = \lceil \log_2(4 + 1) \rceil = \lceil \log_2(5) \rceil = \lceil 2.322 \rceil = 3$. This means that a typical home router today with 4 LAN ports would choose to subdelegate on 3-bit boundaries while a larger, 8-LAN-port device would select a 4-bit-boundary.

In order to use PD to auto-configure a home network, the home routers need to decide how to subdelegate prefixes assigned to them. One method is to create a new dynamic protocol to share this information; another method is to add extensions to an existing protocol (E.g. DHCPv6); the third possible method is to choose a default. Creating a new protocol is difficult and takes large amounts of time to gain consensus and deployment. Adding extensions to an existing protocol has the same downside to a lesser degree. Choosing a static default can often produce a non-optimal result. One concept chooses the third method (using a default) but makes it algorithmic, dependent on physical properties of the router. With this concept, each router's default choice is to ensure that it can service the maximum number of downstream routers without unnecessarily limiting the network topology.

Complex, self-configuring home networks are coming. This concept has the potential to be deployed in all of them. It allows router manufacturers to set a common (and thus predictable) default without locking customers into potentially sub-optimal network architectures.