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CPE Considerations in IPv6 Deployments
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Abstract

Smart metering deployments in residential settings introduce the prospects of ad-hoc deployment of internetworked IPv6 customer premise equipment (CPE). WiFi access points, cable boxes and other home devices with internet access could all be internetworked with smart metering devices by customers with no data networking expertise resulting in a complex multi-segment network with differing prefixes, routing support and service discovery needs.

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1. Introduction

The availability of energy usage information within the Home Area Network, enabled through smart meter deployment, adds a popular interconnection target for electricity customers, service providers and third party suppliers. These opportunities for energy usage management are all assuming a home owner with no data networking expertise can link together a collection of standalone networks and enable a consistent set of services and device addressing modes. This draft starts a discussion on needed standards work to make the deployment of these services a reality in an IPv6 environment.

2. Description

In a regulated utility environment, utilities must deploy energy savings programs accessible to all customers. Broadband internet access cannot be assumed since around 40% of customers don't have broadband. The smart meter is then architected as a standalone border gateway with a unique prefix supplied by the smart meter.

To fully enable deployment of energy savings applications onto a variety of devices, ad hoc internetworking of smart meters with HAN devices and existing networks employing diverse data links such as IEEE 802.15.4, IEEE P1901,and WiFi must be supported. The set of issues to be addressed include:

- o Assignment of /64 prefixes from Globally Unique Address (GUA) and Unique Local Address (ULA) [RFC4193] prefixes available to the residential network
- o Introduction of ULAs for a residence
- o ULA Delegation and Reassignment when network segments with differing ULAs are combined
- o Enablement of intra-network routing when CPEs within the residence are interconnected
- o Extensions to multicast DNS to extend local name resolution across a multi-link residential network

2.1 Assignment of /64 prefixes from GUA and ULA prefixes

The residential network that includes multiple links will need a mechanism for assigning /64 prefixes for each link from one or more shorter prefixes assigned to the network. For example, DOCSIS 3.0 uses DHCPv6-PD [RFC3633] to delegate a prefix to the residential gateway. /64 prefixes from this delegated prefix must be assigned to every link within the residential network.

Similarly, the residential network may have a ULA prefix for local traffic if the residential network does not have any GUA prefixes (see section 2.2). /64 prefixes from the ULA must be assigned to the links in the residential network.

2.2 Unique Local Addresses (ULAs)

IPv6 offers three types of addressing prefixes: GUA, ULA and link-local. ULA prefixes are useful in the residential network scenario for local communication when no GUA prefixes are availalbe; e.g., when the external link to the ISP is unavailable and no delegated prefixes are available.

The first requirement is that gateways in the residential network create a ULA for use within the network rooted at the gateway and no other ULA prefix is available.

The second requirement is that when multiple networks are created, then interconnected in a home, multiple ULAs may be present. When these networked are interconnected (by a homeowner without networking skills), the ULAs for these network segments should be harmonized without user interaction into a single set of ULAs and notification made to hosts holding references to the previous ULAs.

2.3 Intra-network routing with multiple internet connected CPEs

As network segments are interconnected, and CPE devices become border gateways for new bordering network segments, a routing protocol like RIPng needs to be supported. As noted for ULA delegation, the CPE needs to automatically detect the need in support for inter-segment routing and provide support automatically.

2.4 Extensions to multicast DNS for sitewide name resolution

For service discovery, two alternatives exist: user agent based discovery and directory agent based discovery described as follows:

- o User agent: Devices hold service discovery information themselves and respond to discovery requests based on matching criteria in the request. DNS Service Discovery [DNS-SD] resolved over Multicast DNS [mDNS] is an example of this type of solution.
- o Directory agent: Devices register service discovery information with a central repository. A well known example of this type of solution includes uPnP [uPnP] which uses the Simple Service Discovery Protocol (SSDP) [SSDP]. Note that uPnP supports both user agent and directory agent service discovery methods.

mDNS only provides link-local name resolution. Use of mDNS in the residential network requires extensions so that mDNS can use site-local multicast that spans multiple hops using IP forwarding for sitewide local name resolution.

3. Future Work

The following work items are proposed:

- o Create extensions to DHCPv6-PD to delegate prefixes across multiple links
- o Define precoedures for gateways to generate a ULA if required
- o Create procedures for HAN devices to join the ULA and procedures to combine network segments with different ULAs into a single ULA.
- o Define mechanisms for automated provisioning and operation of routing across multiple links in a residential networl
- o Create extensions to multicast DNS to support sitewide local name resolution across multiple links

4. Conclusions

To realize deployment requirements of self installed, ad hoc networking where different segments can be installed and provisioned at different times and where various link technologies may be used, additional features are needed in CPE.

5. Security Considerations

This requirements document introduces no security considerations.

6. IANA Considerations

This requirements document introduces no IANA considerations.

7. Acknowledgments

8. References

8.1. Normative References

8.2. Informative References

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