



DHCPv6 Prefix Delegation Whitepaper

Implementation issues with DHCPv6 Prefix Delegation

qa | cafe
ip test solutions

QA Cafe © 2010
<http://www.qacafe.com>

Implementation Issues with DHCPv6 Prefix Delegation

Summary

Now that IPv6 is moving out of the core and into residential networks, DHCPv6 prefix delegation has emerged as the leading technique to provision IPv6 CPE devices. In the IPv4 world, NAT is used to allow a single subscriber to share an IPv4 address with multiple devices. With IPv6, providers are looking to provision subscribers with an IPv6 prefix to allow each device in the residential network to have its own global address. DHCPv6 prefix delegation accomplishes this goal by allowing a CPE device to dynamically obtain an IPv6 prefix using DHCPv6. The IPv6 prefix is then used on the LAN side of the CPE device using either autoconf, DHCPv6, or a combination of both techniques.

The CDRouter IPv6 add-on supports prefix delegation configurations on the CPE and provides the testing framework needed to ensure a robust implementation. Beyond the DHCPv6 protocol interactions, the CPE device must maintain synchronization between the WAN side DHCPv6 server and its own LAN side DHCPv6 server and router advertisements. In the course of developing the test suite for DHCPv6 prefix delegation, QA Cafe encountered a number of implementation issues that impact the functionality of IPv6 connectivity. Some of these potential implementation issues are discussed below.

CDRouter IPv6

CDRouter IPv6 is QA Cafe's latest add-on for the CDRouter family. Once enabled, CDRouter IPv6 provides an automated IPv6 testing environment for IPv6 CPE devices running dual IPv4 and IPv6. Similar to CDRouter with IPv4, the CDRouter IPv6 test setup is created by connecting CDRouter to both the LAN and WAN sides of a device under test. CDRouter maintains IPv6 clients on the LAN side of the device and provides IPv6 connectivity on the WAN side of the device using native IPv6 or tunnels. Within this test environment, a number of test modules can be executed to look at a range of IPv6 behavior including router discovery, neighbor discovery, ICMPv6, path MTU discovery, DHCPv6 with IA_NA and IA_PD, 6to4/6rd tunneling, IPv6 firewall, and IPv6 forwarding.

DHCPv6 Prefix Delegation Implementation Issues

The followings list showcases some of the potential implementation issues highlighted by CDRouter IPv6 during DHCPv6 prefix delegation testing.

- **IPv6 Prefix not announced**

For devices using DHCPv6 on the LAN to obtain a global IPv6 address, learning an IPv6 prefix in the router advertisement is not required. However, without any prefix information, all local unicast traffic must be sent to the default router. This usually ends up triggering an ICMPv6 redirect back to the LAN client. Unfortunately, not all devices consistently generate ICMPv6 redirects making this type of LAN configuration very inefficient and undesirable.

- **DHCPv6 DUID changes after reboot**

The DUID is the DHCP Unique Identifier. DHCPv6 clients and servers use this to identify each other. RFC 3315 recommends that the DUID remain constant over time and not change across reboots, etc. QA Cafe has already encountered CPEs that are changing their DHCPv6 server DUID after each reboot. This leads to poorly performing DHCPv6 networks on the LAN side and over consumption of IPv6 addresses and prefixes on the WAN side. Each time you reboot the CPE device, the provider treats the new DHCPv6 request as a unique DHCPv6 host since the DUID has changed.

- **No DHCPv6 Solicit response on LAN if WAN is down**

With DHCPv6 prefix delegation, the LAN side configuration is tied to learning an IA_PD on the WAN. If the WAN link is not established, no LAN side global address is available. This means that IPv6 connectivity on the LAN may be appear broken until the WAN is fully established. The use of Unique Local Addresses (RFC4193) is recommended to provision local global address that is not dependent on WAN connectivity. However, ULA is not widely implemented in current CPE devices.

- **DHCPv6 protocol okay, but packets are not forwarded**

Unlike DHCPv4, DHCPv6 does not provision the default gateway for a client. CPE devices running DHCPv6 on the WAN should be learning and installing a default gateway based on router advertisements. However, in some DHCPv6 PD configurations, this behavior is inconsistent leaving CPE devices unable to forward IPv6 packets even though DHCPv6 appears to be working on the WAN and LAN.

- **Inconsistencies in learning DNS information on WAN**

Most CPEs will request DNS information when running DHCPv6 on the WAN. However, when running DHCPv6-PD without requesting an IPv6 address, some devices leave out the DNS request options. In these configurations, DNS must be statically configured.

- **Lots of modes to test**

There are many configuration options at play in a DHCPv6 prefix delegation configuration. The LAN side of the CPE could be using autoconf, DHCPv6, or both. On the WAN, DHCPv6 prefix delegation can be used with or without DHCPv6 address configuration. The number of test permutations grows quickly. This makes CDRouter IPv6 an ideal testing tool since all of the possible provisioning models can be explored.

The Solution

The deployment model for residential IPv6 is evolving. CDRouter IPv6 helps with this evolution by providing the testing framework needed to quickly verify the IPv6 protocols at play in a residential IPv6 network. Use of CDRouter will help minimize potential implementation issues and lead to a smoother roll out of residential IPv6.

QA Cafe's CDRouter IPv6 test suite provides an automated testing environment for residential IPv6 CPE devices. With the release of CDRouter IPv6, CPE vendors now have the tools to help speed up the development and testing of IPv6.

CDRouter IPv6 offers over 180 unique test cases. More details on CDRouter IPv6 can be found at <http://qacafe.com/show/ipv6>.

More Information / References

CDRouter IPv6
<http://www.qacafe.com/show/ipv6>

RFC 2460 IPv6
<http://www.ietf.org/rfc/rfc2460.txt>

RFC 3315 DHCPv6
<http://www.ietf.org/rfc/rfc3315.txt>

RFC 3633 DHCPv6 Prefix Delegation
<http://www.ietf.org/rfc/rfc3633.txt>

IETF Draft Basic Requirements for IPv6 Customer Edge Routers
<http://datatracker.ietf.org/doc/draft-ietf-v6ops-ipv6-cpe-router/>

NOTICE

CDRouter™ is a registered trademark of QA Cafe. Without the prior written consent of QA Cafe, no part of the document may be reproduced by any means.

Additional Information

For additional information, contact:

QA Cafe
155 Fleet Street
Portsmouth, NH 03801
Tel: (877) 332 0784
Email: info@qacafe.com