



IPv6 Whitepaper

Testing Residential IPv6 with CDRouter



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Summary

While IPv6 has been in development for over a decade, the availability of residential IPv6 is just beginning. Traditional CPE devices running IPv4 with NAT are now adding IPv6 capabilities and 6to4 transition techniques even before native IPv6 connections are commonly available. CDRouter is now IPv6 capable and provides vendors, ISPs, and test labs with a set of functional test cases to verify the IPv6 readiness of CPE devices.

Early testing with CDRouter against commercially available CPE devices has revealed that these initial IPv6 capable devices have a variety of functional flaws. In some cases, these flaws prevent IPv6 from working. This whitepaper details some of QA Cafe's initial findings testing publicly available IPv6 devices and demonstrates the benefits of using CDRouter IPv6 in a test process.

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 stacks. 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. 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, 6to4 tunneling, IPv6 firewall, and IPv6 forwarding.

Today's IPv6 Residential CPE Devices

While developing CDRouter IPv6, QA Cafe has benchmarked several off-the-shelf IPv6 CPE devices. Right away, the results are somewhat surprising. The following summary points out some of the issues with IPv6 implementations on existing CPE devices.

- **IPv6 firewall support not enabled by default**

Surprisingly, traditional CPE products advertised as firewall devices often do not have a firewall enabled for IPv6. Even worse, some devices do not have an option to enable a firewall for IPv6. CDRouter's IPv6 firewall module quickly determines the state of the IPv6 firewall.

- **IPv6 firewall not as advanced as existing IPv4 firewall**

In cases where the IPv6 firewall does exist, the level of functionality available to IPv4 connections is not always available to IPv6 connections. This is true of advanced applications that normally need an IPv4 ALG to operate through NAT. In IPv6, the firewall must still open incoming ports for applications such as active mode FTP. CDRouter's IPv6 application module can reveal which application protocols may not work as expected through the IPv6 firewall.

- **Routing is not configured correctly for 6to4 connection**

6to4 is the most common way of connecting IPv6 devices across the IPv4 Internet. Some devices are not correctly installing default routes for IPv6 in order to work with 6to4 tunnels and prevent CPE devices from reaching the native IPv6 Internet.

- **Need to test along side of IPv4 to support dual stack devices**

CDRouter IPv6 provides both IPv6 and IPv4 testing at the same time. For transition technologies like 6to4, this provides a mechanism to verify the robustness of the IPv6 implementation when the IPv4 network is dynamic. Some devices have a static implementation that is unable to change when the

IPv4 network changes. These devices require a reboot to handle network changes.

- **New technologies for supporting IPv6 are not well tested or not compatible with existing IPv4 devices**

The roll out of IPv6 is also placing more demands on IPv4 services such as DNS. The size of DNS name records is growing beyond the original UDP 512 byte limitation of DNS and now requires the use of the EDNS0 option and IPv4 fragmentation. However, some IPv4 based CPEs have issues supporting IPv4 fragmented responses from DNS servers. Along with the new IPv6 test cases in CDRouter IPv6, CDRouter 6.0 contains additional DNS tests to verify support of the EDNS0 and larger fragmented IPv4 DNS responses.

- **MTU is clamped to a smaller, more pessimistic value**

Some CPE devices are giving up potential bandwidth by limiting the MTU size to IPv6's minimum MTU size of 1280 bytes. CDRouter Path MTU discovery testing can determine the CPE's IPv6 MTU and verify forwarding of various packet sizes.

- **IPv6 is implemented but not configurable**

Some devices that do not officially support IPv6 actually have an IPv6 implementation that is enabled. These devices send out IPv6 Router Advertisements and support 6to4 tunneling automatically. Worse, they don't have an IPv6 firewall enabled and provide no means of disabling IPv6. Unknowingly, users may expose themselves to IPv6 based attacks since inbound traffic is not blocked.

The Solution

Like any new technology, IPv6 implementations must go through a maturing process. In the coming years, most CPE devices will offer IPv6 with a variety of connection options. CDRouter IPv6 will play an important role in this process as IPv6 is rolled out to residential IPv6 networks. As CPE devices evolve to meet the demands of IPv6, CDRouter IPv6 will provide a testing environment to make sure these devices are working as expected.

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

More Information / References

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

IPv6 on Wikipedia – <http://en.wikipedia.org/wiki/IPv6>

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

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