



# Experiences of host behavior in broken IPv6 networks

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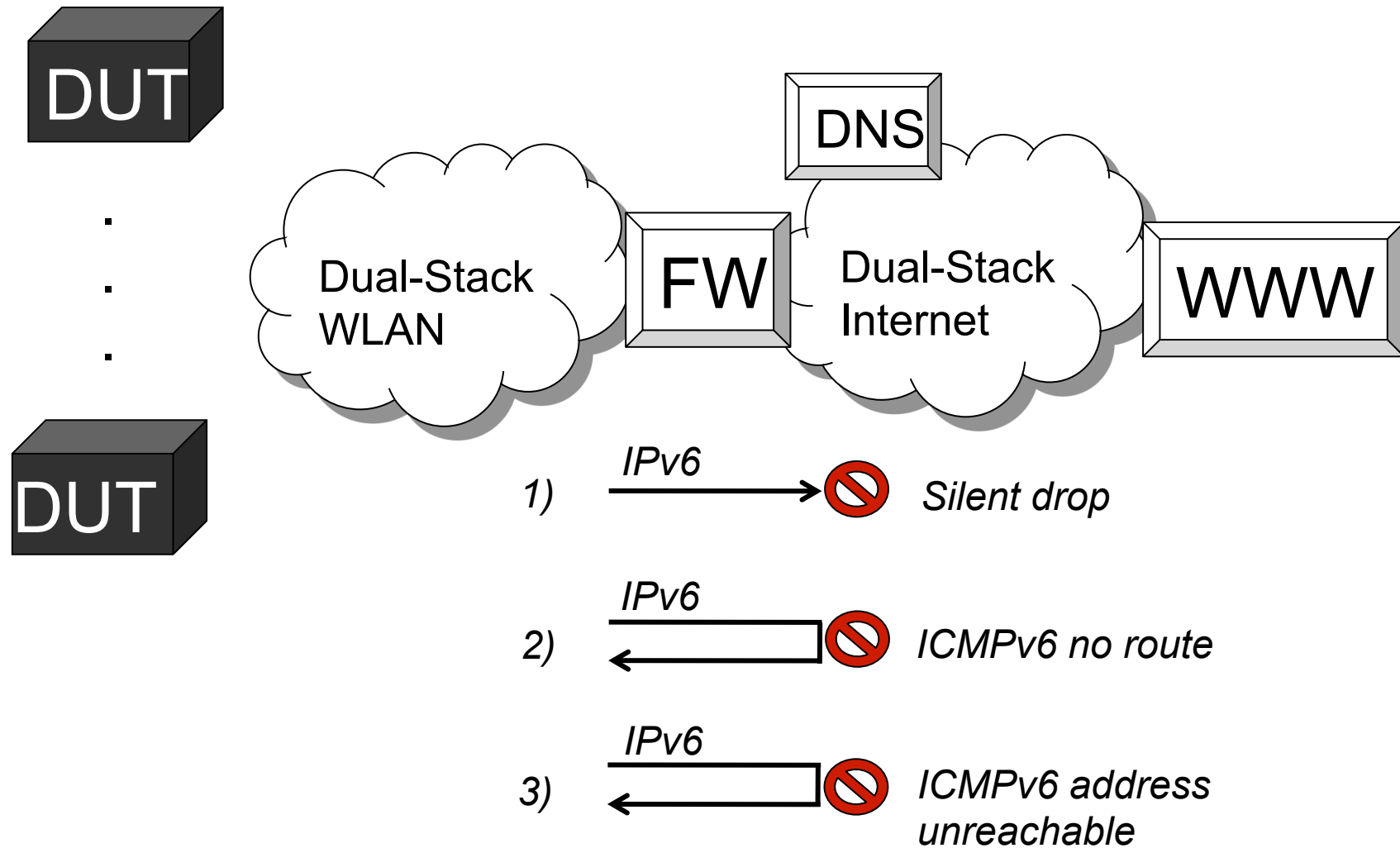
Slide about Rogue RA relation to Happy

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# Used test setup and three test cases



Device	DNS query sending style	IPv6 broken, time until fallback to IPv4			Comments
	Dual-stack destination	Black hole	No route	Address unreachable	
Symbian^3 on Nokia N8 (11.012)	<b>A</b> first and used if possible. <b>AAAA</b> if no IPv4.	N/A	N/A	N/A	Symbian^3 prefers IPv4 hence tested fallback scenarios are N/A. The DNS query order is a configuration parameter.
Windows 7 Starter Edition on HP <i>IE 8.0.7600 &amp; Google Chrome 8.0.552.224 &amp; Safari 5.0.2</i>	<b>A</b> and after reply <b>AAAA</b> . Uses IPv6 if both available.	~21s	~21s (after 3 SYN & ICMPv6 errors)	~21s (after 3 SYN & ICMPv6 errors)	Same initial delay with those browsers. <b>The 21 seconds is TCP timeout after 3rd SYN failed.</b>
iOS4 4.2.1 on Apple iPhone4 <i>Safari</i>	<b>A</b> first and <b>AAAA</b> immediately after. Uses IPv6 if both available.	<b>No fallback</b>	~4s (After 5 SYN & ICMPv6)	~4s (After 5 SYN & ICMPv6)	Lucky observation: waits ~350 ms for AAAA to arrive after A is received before going for IPv4
Apple OS/X 10.6.6 on iMac <i>Safari 5.0.3 Firefox 3.6.13</i>	<b>A</b> first and <b>AAAA</b> immediately after. Uses IPv6 if both available.	~75s	~4s (After 5 SYN & ICMPv6)	~4s (After 5 SYN & ICMPv6) <b>Firefox: no fallback at all!</b>	Special note that Firefox did not fallback on address unreachable error.
Android 2.3.1 on Samsung Nexus S <i>Native browser</i>	<b>AAAA</b> and after reply <b>A</b> . Uses IPv6 if both available.	~21s	~0s (acts on first ICMPv6)	~0s (acts on first ICMPv6)	<b>The 21 seconds is TCP timeout after 3rd SYN failed.</b>
Maemo5 IPv6 enabled version on Nokia N900 <i>Firefox &amp; native</i>	<b>AAAA</b> and after reply <b>A</b> . Uses IPv6 if both available.	~189s	~0s (acts on first ICMPv6)	~0s (acts on first ICMPv6)	189s is after 6th SYN failed. Kernel: 2.6.28-based
Ubuntu 10.04 /10.10 on "PC" <i>Firefox 3.6.13</i>	<b>AAAA</b> and after reply <b>A</b> . Uses IPv6 if both available	~21s	~0s (acts on first ICMPv6)	~0s (acts on first ICMPv6)	Note: immediate fallback to IPv4 happens also during complex page load (i.e. minimizes damage when IPv6 is always preferred)

# Browsers learning something?

- A quick test was conducted to see if five popular browsers running on Windows 7 Service Pack 1 and loading [www.ietf.org](http://www.ietf.org) on broken IPv6 network learn IPv6 is broken

Browser	All fine (page load time in s)	IPv6 broken, page load time in seconds		Summary
		Black hole	No route	
Internet Explorer 9.0.8112.16421	~4.95s	~25.33s	~24.65s	<b>Seems to learn</b> that IPv4 works and opens following TCP sessions with IPv4 (or perhaps browser just wants to ensure all requests are sent from the same source address?)
Opera 11.01 (1190)	~4.84s	~23.91s	~23.97s	<b>Seems to learn</b> – see IE9 comments
Chrome 10.0.648.151	~4.59s	~26.66s	~24.11s	As TCP sessions started during page load fail to open, Chrome <b>falls back</b> into using the TCP session that it has initially managed to open (after falling back fallback to IPv4).
Firefox 3.6.15	~4.48s	~44.11s	~44.33s	Does not learn. Each socket jams for 21 seconds before fallback. Parallel connection attempts help decrease overall time (e.g. 5 sockets trying to connect simultaneously)
Safari 5.0.4 (7533.20.27)	~4.97s	~44.32s	~45.74s	Similar to Firefox – no learning

**NOTE:** Please don't take absolute timing values very seriously, as only single/few samples per browser was captured in a not fully controlled setup (hence prone to some variance)

# Happy Eyeballs and Rogue RAs



- Rogue Router Advertisements may put hosts unexpectedly into broken IPv6 scenario
- A study was made on campus:
- Used RAmond (<http://ramond.sourceforge.net>) on a ~50 AP dual-stack wireless network
  - RAmond issues deprecating RA against rogues
  - Rogue may not actually be turned off for some time
- Period of 376 days (2010-02-18 to 2011-03-01)
  - Rogue RA seen on 228 of those days (60%)
  - 257,669 rogue RAs seen, **all** for 2002::/16 (connection sharing?)
  - 35 different MAC sources using 38 different link layer sources
  - Only two devices used EUI-64 addresses, one was an HTC
  - Four devices sent only one rogue RA
- Presence of a rogue RA may cause connectivity problems
  - Whether on a dual-stack or IPv4-only network if the hosts have IPv6 enabled – can Happy Eyeballs help mitigate this?



Clearly the eyeballs are not very happy.

It may not be so big deal whether the delay is 20 or 40 seconds, as both are unacceptable.

Need to do something.