NLANR MEASUREMENT & NETWORK ANALYSIS

AMP IPv6

Figure 1. Location of AMP IPv6 monitors in the US. From left to right: University of Oregon, San Diego Supercomputer Center/UCSD, University of Utah, University of Missouri at Columbia, University of Wisconsin, Michigan Technological University, Georgia Institute of Technology, NYSERnet, Columbia University. (June 2003)

The NLANR Active Measurement Project (NLANR/AMP) is collecting IPv6 performance data between a mesh of eleven active monitors. Nine of these monitors are located in the U.S.; Figure 1 shows their locations, and the wide spread coverage included. Two additional monitors are placed internationally, one in Australia (AARnet), and the other in Japan (APAN).

The aim of the AMP IPv6 project is to perform measurements which enable systems administrators and engineers to monitor infrastructure improvements to the IPv6 component of HPC networks, relative to the performance seen by IPv4 paths, as they occur. This project was initiated at the request of two site administrators where we already had AMP monitors as part of the AMP mesh (130+ active measurement monitors). We have been collecting IPv6 performance data since October 2002.

The general characteristics of current IPv6 paths - compared to IPv4 paths - are that they incur a larger base delay, a larger jitter, and greater loss. We believe this is an artifact of tunnel paths that follow less-than optimal paths, under-powered tunnel entry and exit points, and an inefficient forwarding path inside some routers that route IPv6 natively.

We have seen continuous improvements to IPv6 paths (and expect to see more) as IPv6-in-IPv4 tunnels are replaced with native IPv6 paths, and the IPv6 forwarding capability of routers in the path is improved.

We collect path and delay information using IPv4 and IPv6 versions of ping and traceroute, and compare the data on a path-by-path basis. All monitors run FreeBSD 4.6, use the KAME IPv6 stack, and are located on high performance networks such as the Internet2 network. The data and related graphical representations are publicly available at http://watt.nlanr.net/active/cgi-bin/v6_portal.cgi

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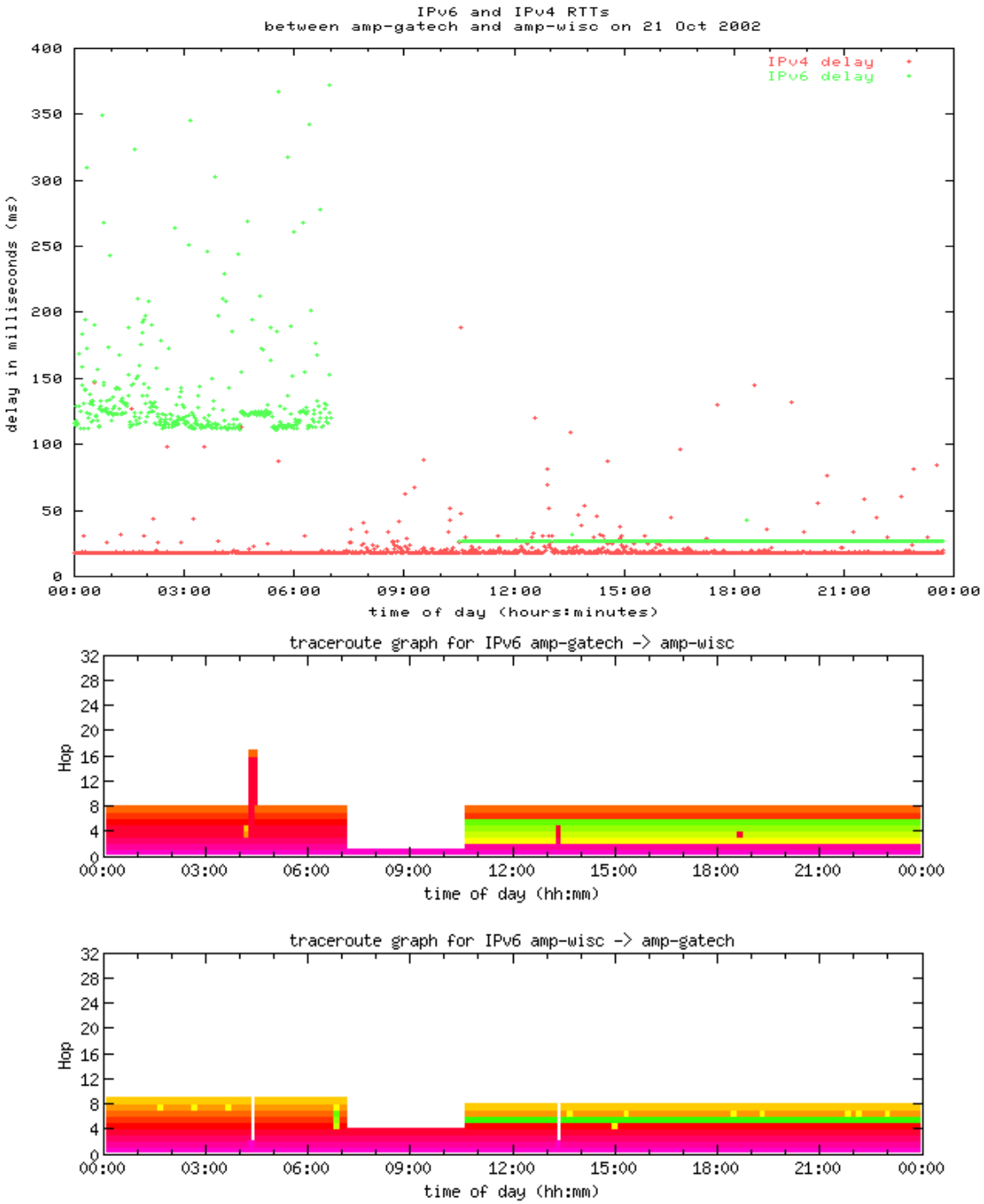

*Figures 2a, 2b, 2c: A **path change** between amp-gatech and amp-wisc that takes place on the 21st of October 2002 at 7:00am PDT and completes at 9:30am PDT.*

The IPv6 tunnel server in this path was changed from a Cisco GSR router located in Kansas City to a Juniper T640 router in Indianapolis. The new path is topologically much closer to the path followed by IPv4 packets, which results in a substantially lower base round trip time (RTT) delay, and less jitter as shown in Figure 2a. Figures 2b and 2c show which components of the path changed over the course of the day. We can see that the forward path (Figure 2b) changes markedly after the tunnel change. The reverse path (Figure 2c) is a hop shorter after the topology change, which is the result of two hops being replaced with one new IPv6 hop.

http://moat.nlanr.net/AMP/IPv6