End-to-End Routing Behavior in the Internet

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Internet routing and topology studies are something that does not happen very often. The Network Research Group at the University of California decided to dig into the dynamics of internet routing and the effect on the internet. This paper shows the results of analyzing 40,000 end-to-end route measurements from 37 internet sites. These sites are mainly colleges throughout the world. “The main questions we strive to answer are: What sort of pathologies and failures occur in Internet routing? Do routes remain the stable over time or change frequently? Do routes from A to B tend to be symmetrical (the same in reverse) as routes from B to A?”

Several methodologies were used throughout the research. These included “the measurement software; the utility of sampling at exponentially distributed intervals; which aspects of [their] data [is] plausibly representative of Internet traffic and which not; and some problems with [their] experimental design.”(Paxson, pg.3) To conduct the experiments they get the Internet sites to use a “network probe daemon” (NDP) to use the traceroute function periodically. These NDP’s were connected to the local machines of the researchers. The purpose of this was to measure the routes between the 37 NDP sites.

For routing stability, they defined two types of stability, prevalence and persistence. The first one meaning the chance of finding this route and the latter is the likelihood that the route will remain unchanged over time. What they found out was that “internet paths are heavily dominated by a single prevalent route, but that the time periods over which routes persist show wide variation.” (Paxson p.15)

Routing symmetry was to determine whether the route from A to B had any extra hops on the two directions (there and back). They had found that half the time this had occurred and around 30% at least one different autonomous system was visited. (Paxson p.15)

Throughout the research they had found that the presence of pathologies, short-lived routers and major asymmetries show the difficulties in providing a consistent topological view of something as widespread as the internet. A lot of widespread variation occurs when trying to generate these topologies. There is no typical path that a packet must take when it is sent out, the routers will try to find the shortest path but with so many variables going on in the internet, it is a complicated task.

Paxson, V (1995) End-to-End Routing Behavior in the Internet Retrieved from Internet January 29, 2010

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<http://www.ecse.rpi.edu/Homepages/shivkuma/teaching/sp2001/readings/paxson-routing.pdf>