2021 INTERNET PERSPECTIVES

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Four and half years ago, Erik Nygren posted a blog at Akamai [1] on the likelihood that IPv6-only mobile networks might drive IPv6 deployment. So far, that speculation has not proven dispositive, but a 5G initiative toward IPv6-only could mark a turning point. Six months ago, Geoff Huston, chief scientist of APNIC, published an in-depth evaluation of the state of IPv6 play in the Internet [2]. Despite a number of attempts to stimulate IPv6 provision, it is still on average only about 30 percent available on a global scale although this can vary from 0 percent to 100 percent depending on which Internet Service Provider is considered. Of course, access to IPv6 can depend on local router implementation, to say nothing of Wi-Fi access points and end-user equipment configuration. Most end-user devices are equipped to use IPv6 if an address is assigned, but whether that assignment takes place and whether traffic is successfully routed to its intended destination depends a great deal on what happens in between.

In his pithy and penetrating analysis, Huston evaluates the features of IPv6 and, despite a number of worthy criticisms, concludes that it is really the only practical way forward to avoid fragmentation of the Internet at the IP address level. Of course, there are other aspects of fragmentation such as DNS response variations, other filtering practices that also contribute to "fragmentation." The U.S. Defense Department, the original developer of the Internet, has made several attempts to mandate IPv6 operation, and in March 2020 the U.S. Office of Management and Budget (OMB) urged that at least 80 percent of U.S. Government network services be capable of IPv6-only operation by the end of FY25 (i.e. 30 September 2025) [3].

Huston finds that about 70 percent of all IPv6 usage is found in the U.S., India, China, Brazil, Germany or Japan. Independent data from China suggests at least 50 percent implementation there. Given the wide and variable range of implementation and a significant number of implementation issues, it seems timely to examine IPv6 implementation options and to develop guidelines for application that increase the likelihood of successful implementation and use. That might mean eschewing extension headers, for example, which cannot be processed at the high backbone data rates now commonly in use (40-100 Gb/s) according to Huston's analysis. There may be other implementation barriers including access to Domain Name services that impede successful IPv6-only operation. Given the history of IPv6 implementation over the past 25 years, the IETF and the IAB might usefully convene an effort to summarize implementation challenges and to characterize feasible paths forward taking into account Huston's clear-eyed analysis among other studies of IPv6 and IPv4 limitations. A growing number of devices including mobiles, Cloud servers and other Internet-enabled things are populating the Internet and will need addresses. The use of IPv4 Network Address Translation (NAT) to satisfy this need has already been superseded in some Cloud systems that require more address space than is available with private IPv4 addressing! A catalog of problematic features of IPv6 might be a place to start with an eye toward remediation or even exclusion from use in the interest of progress.

The IPv6 design was a compromise after a four-year competition among several possible "next generation" Internet protocol choices. As Huston amply outlines, compromises often have blemishes but given where we are in Internet terms and our growing dependence on its availability, it is time to lay out implementation plans and to acknowledge that some features of its design might be avoided in the interest of ubiquity. This decade's Internet "moonshot" should be ubiquitous implementation of IPv6-only networking on a global scale.

REFERENCES

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BIOGRAPHIES

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