This visualization represents macroscopic snapshots of IPv4 and IPv6 Internet topology samples captured in January 2009. The plotting method illustrates both the extensive geographical scope as well as rich interconnectivity of nodes participating in the global Internet routing system.

For the IPv4 map, CAIDA collected data from 33 monitors located in 33 countries on 5 continents. Coordinated by our active measurement infrastructure, Argo (AAA), the monitors probed paths toward 3.4 million IPv4 networks that cover 95% of the available IPv4 address space in the Route Views' Border Gateway Protocol (BGP) routing tables on 1 January 2009.

For the IPv6 map, CAIDA collected data from 6 AS monitors located in 4 countries on 2 continents. This subset of monitors probed paths toward 1.401 prefixes which represent 68.9% of the globally routed IPv6 prefixes seen in Route Views BGP tables on 1 January 2009.

We aggregate the IP-level data to construct IPv4 and IPv6 Internet connectivity graphs at the Autonomous System (AS) level. Each AS approximately corresponds to an Internet Service Provider (ISP). We map each observed IPv4 address to the AS responsible for routing traffic to it, i.e., to the origin (end-of-path) AS for the IP prefix. The IP prefix represents the best match of this address in the BGP routing traffic to it. For the IPv4 graphs, we used the BGP IPv4 routing table provided by Route Views. For the IPv6 graph, we used the IPv6 routing table collected by RIPE NCC.

The position of each AS node is plotted in polar coordinates (radius, angle), that are calculated as follows.

The x-coordinate of an AS node is the number of AS hops from the AS to the origin (end-of-path) AS for the IP prefix. The y-coordinate of an AS node is the weighted average (by number of IP addresses in each mapped prefix) of the angular coordinates of all such correlated prefixes.

To determine the longitude of an AS, we used the IPv6 BGP table from Route Views to find a set of announced IPv6 prefixes for each AS. We weighted each prefix of the weighted average that Digital Anarchy’s Netacuity mapped to a single geographic location in January 2009. We then calculated the AS angle coordinate from the weighted average by number of IP addresses in each mapped prefix. The longitude coordinates of all such weighted prefixes.

Calculating AS coordinates as described above results in a large number of overlapping nodes (hundreds in the case of the IPv4 graph) which distort the graph’s edge. To better visualize all ASes, we refined our node placement algorithm to spread out overlapping nodes. This modification creates bulges in the outermost ring of the AS-core, corresponding to longitudes with substantial Internet infrastructure deployment, which also correlates with populous regions of the globe.

The IPv4 graph grew from 486 AS nodes in January 2008 to 515 nodes in January 2009. Over the same period, we saw an increase in the number of IPv6 ASes from 186 to almost 219. Whether these changes reflect actual new AS allocations or result from modifications in our measurement methodology is not clear. Compared with the AS-core graph of January 2008, we observed a westward shift in the position of ISP TelstraClear due to its increased presence (per Netacuity’s mapping) in Australia.

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