Visualizing Networks

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It’s difficult to manage something if you can’t picture it. Visualization tools help give a concrete form to the abstract spaces of networks, as shown in these examples.

- [Top] Internet connectivity is depicted in this snapshot of the relationships between nodes that approximately map to individual Internet service providers (ISPs). Each node is plotted in radial coordinates according to the location of the ISP’s administrative headquarters and the number of connections to other ISPs. By combining connectivity with geography, the graph clearly shows the highly connected regions in the United States (at six o’clock), in Western Europe (at two o’clock), and in the Pacific Rim (at 11 o’clock). It also points out the relative lack of direct connections between Europe and Asia.

For more information, visit the Cooperative Association for Internet Data Analysis (CAIDA) at the University of California at San Diego’s Supercomputer Center at http://www.caida.org.

- [Middle, left] This map of part of Stanford University’s Web site shows a Web page (blue box) in relation to the site’s other elements, or nodes. About 4000 nodes are visible in this snapshot. A few hundred are individually distinguishable, and those at the periphery provide aggregate information about their presence. The systematic distortion of faraway Web pages—loosely defined as the number of steps required to move from one page to another—allows a relatively large part of the network to be visualized without information overload.

Tamara Munzner created the image with Silicon Graphics’ Site Manager software. More details about this image and network visualization can be found in Munzner’s recent Ph.D. thesis at http://graphics.stanford.edu/papers/munznerthesis/.

- [Middle, right] Graham Wills of Lucent Technologies Inc. created this graph to reveal linkage patterns on his Web site. Most of the green dots in the map refer to Web pages, but others refer to supporting elements such as graphics files. From this, Wills can determine which elements are repeatedly used across the site and how the links (blue lines) are distributed. The map can also show a search query (red) to an external database.

Wills uses his own software, NicheWorks, and applies it to visualize linked systems in general. In another project, he has traced what groups of products people tend to buy on a single visit to a retail store.

For more information, visit the NicheWorks page at http://www.bell-labs.com/user/gwills/NICHEguide/niche.html.