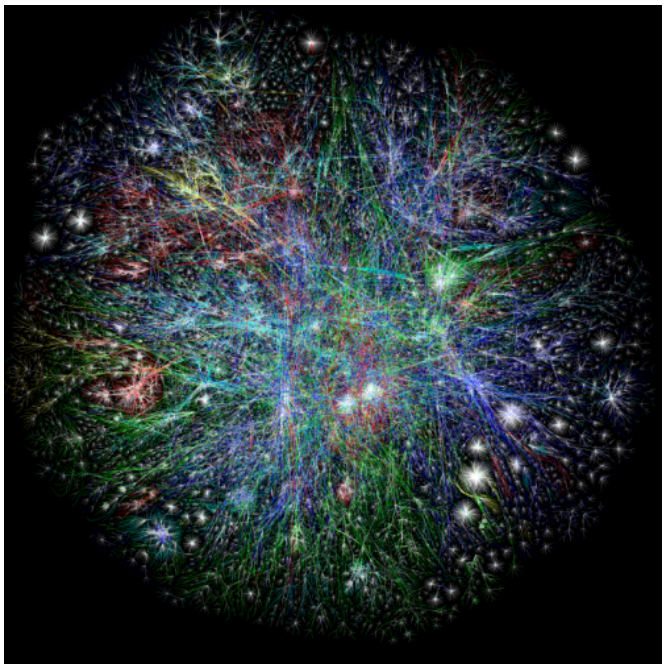
Network theory expert sees Web pages as 19 clicks apart

20 February 2013, by Nancy Owano



Credit: Opte Project

(Phys.org)—The concept of its being a small world after all is now being placed in the scientific context of the wide, wide Web as a small Web after all. According to a physicist, Web pages are actually no greater than 19 clicks apart. Put another way: Everything on the Web is connected by 19 clicks. Put another way? Any two Web pages are no more than 19 clicks apart. How can that be? The paper discussing this, by Albert-László Barabási, has been published in *Philosophical Transactions of the Royal Society*.

Despite enormous "pieces" of Web such as sites, hosted images, and videos—the Indexed Web contains at least 14.33 billion pages, according to the February 19 tally of *WorldWideWebSize.com*, it takes 19 or fewer clicks to get to any of them from another, regardless of scale.

Barabási, who is known for his work on network science, has looked at the Web's structure. The Web is an information network, in which the nodes are documents connected by links, noted in the paper's abstract. "Other well-known network structures include the Internet, a physical network where the nodes are routers and the links are physical connections, and organizations, where the nodes are people and the links represent communications."

The author noted how, with a path length of about 19, connections are made, with massive hubs such as Google and Facebook behaving as the key super-connectors. Similar to the small-world concept of a limited number of degrees of separation, the super-connectors render the Web access experience into a small world. For ease of access and connectivity, the good news is that it only takes a small number of superconnecting sites to get us where we want to go The bad news is the same. Attackers removing this relatively small number of Web pages would cause serious problems if, in the targeted attack, the most connected nodes were deliberately removed first. Knocking out a few critical nodes that connect the Web may isolate various pages and hinder movement.

Barabási is known for his work in network theory and is described as a pioneer in this field. He is a professor at Northeastern University in Massachusetts and he directs the university's Center for Complex Network Research. The Center's studies include the Internet's dynamics and complex networks inside the cell. The Center's premise is that, regardless of the kind of network, whether the network under study is the Web or the economy, the same principles largely apply. Many networks have common principles that can be studied using methods in theoretical physics.

More information: rsta.royalsocietypublishing.or … 87/20120375.abstract
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