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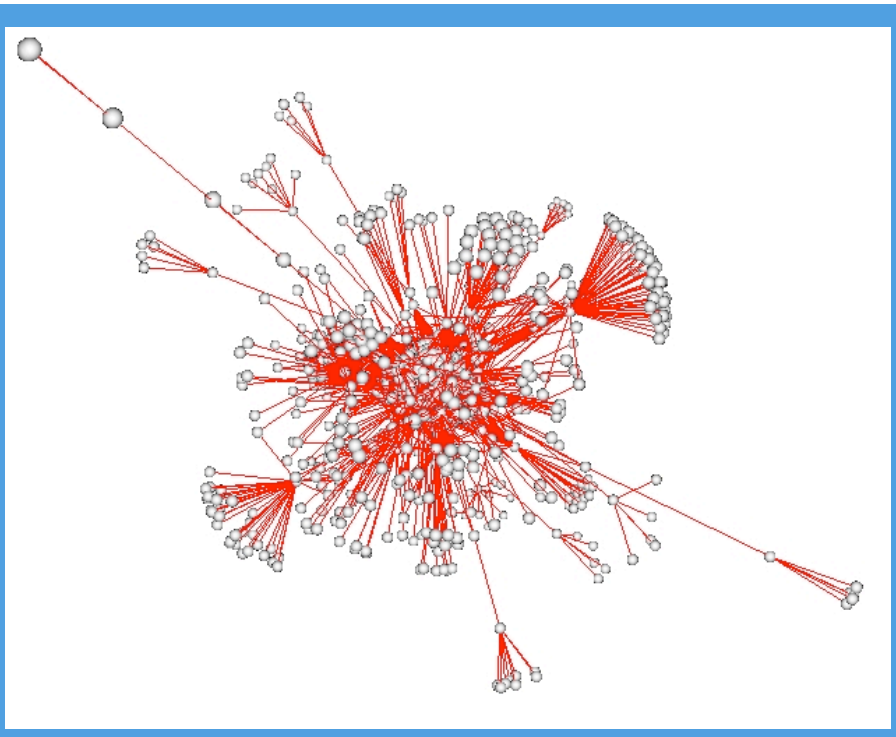
complex systems

IMAGE OF THE MONTH

June

Extracting the true nature of the World Wide Web: *gathering quality data for the evaluation and analysis of complex networks*



This figure shows a subgraph (1237 nodes & 9172 edges) of a particular domain (the computer science department at George Washington University), with each node being an individual web page (or other document comprising a unit of information). To create such data, we have developed our own web crawlers that record individual time stamps, and employ cryptographic hashing functions (developed at NSA and NIST) to ensure the unique identity of each pages' contents. This resolves common aliasing problems (where the contents of two different URLs are the same), ensures that quality graph data is maintained, and allows for validation and verification of each page. These graphs are then prepared for immersive visualization on the NIST RAVE environment (http://math.nist.gov/mcsd/highlights/rave.html), using a three-dimensional projection system, where researches can walk around and examine these complex structures interactively. Graph layout was performed using algorithms from Yifan Hu of AT&T Labs.

More information available at: http://www.itl.nist.gov/ITLPrograms/ComplexSystems/

One of the active areas in network science has been the analysis of graphs denoting the structure of the World Wide Web. These graphs denote the organic nature of information flow and ideas across hyperlinks, connecting one page to another. It is the result of a cooperative and emergent construction, not the work of a single design, that make such graphs interesting and instrumental in developing the basic theory in the network science (e.g. scale-free networks, node clustering, and small-world characteristics).

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Information Technology Laboratory

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The Complex Systems Program is part of the National Institute of Standards and Technology's Information Technology Laboratory. Complex Systems are composed of large interrelated, interacting entities which taken together, exhibit macroscopic behavior which is not predictable by examination of the individual entities. The Complex Systems program seeks to understand the fundamental science of these systems and develop rigorous descriptions (analytic, statistical, or semantic) that enable prediction and control of their behavior.

Program information at: `www.itl.nist.gov/ITLPrograms/ComplexSystems`