MECO43 Book of Abstracts

43rd Conferences of the Middle European Cooperation in Statistical Physics

Kraków, May 1-4, 2018

FACULTY OF PHYSICS AND APPLIED COMPUTER SCIENCE
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Scaling in the space-time of the Internet

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The Internet on router level, is a complex network embedded in a geographical space. Beside it's topological scaling properties (scale-free degree distribution) [1,2], it exhibits also a dynamical scaling: the communication speed on the Internet depends in a nontrivial manner as a function of the geographical distance[3]. Several 'ping' and 'traceroute' experiments prove that the average speed is increasing with the distance, following a roughly square root trend. To explain this novel scaling law and other measurable topological properties of the Internet a realistic model has to be built. Such a model must be based on realistic assumptions on the wiring process and has to reproduce the measured topological properties of the Internet, including the observed scaling of the communication speed versus distance. In our work, we present experimental results concerning the Internet topology, dynamical scaling and a simple model that can reproduce the measured features. We use both an original experimental protocol based on ping and the freely available results of the CAIDA UCSD IPv4 Routed /24 Topology Dataset [4].

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