1

Centrality and vulnerability in weighted complex networks with spatial constraints

Luca Dall'Asta†, Alain Barrat†,
Marc Barthélemy‡ and Alessandro Vespignani†§

May 8, 2005

Abstract

Structure and functionality of real weighted networks are results of a complex interplay between topological and weights properties. The present work is devoted to understand the influence that topology and weights have on the vulnerability of weighted networks under intentional damage. In particular, weighted networks with spatial constraints are considered, the world-wide air-transportation network being a typical example. Since different attacking strategies can lead to very different conclusions on the vulnerability of a network, we first characterize some relevant topological and weighted centrality measures. These quantities are then used as selection criteria for the removal of vertices, in order to find which measure of centrality is the most effective. We also apply the same analysis on a recent model of growing weighted network with spatial constraints, that has been shown to reproduce some particular characteristics observed in air-transportation networks. By comparing the results, we gain useful information for a better understanding of the properties of growing weighted networks with spatial constraints.

*† Laboratoire de Physique Théorique (UMR du CNRS 8627), Bâtiment 210 Université de Paris-Sud 91405 ORSAY Cedex - France
‡ CEA-Service de Physique de la Matière Condensée, 91191 Bruyeres-Le-Chatel, France
§School of Informatics and Department of Physics, Indiana University, Bloomington, IN 47408, USA