Dynamics of Continuous, Discrete and Impulsive Systems
Series **B:** *Applications & Algorithms* **13 (2006)** 681-692

ROUTER-LEVEL INTERNET AS A LOCAL-WORLD WEIGHTED EVOLVING NETWORK†

Gang Peng[1], King-Tim Ko[2], Liansheng Tan[3], and Guanrong Chen[4]

[1,3]Department of Computer Science
Central China Normal University, Wuhan 430079, P. R. China

[2,4]Department of Electronic Engineering
City University of Hong Kong, Hong Kong SAR, P. R. China

Abstract. For most networks in engineering and technology, the interplay of system dynamics, data traffics and network topology is critical to the network evolution and performance evaluation. Using the router-level Internet as a precise case study, this paper discusses a model that describes the growth of local-world weighted complex networks. This model combines the new vertices and new edges with the dynamical evolution of the weights locally, thereby generating a growing network with many statistical properties observed from real-world network examples. In particular, the model yields non-trivial time evolution of various vertex properties, including such as exponential and scale-free distributions of weights, strengths and degrees.

Keywords. Internet, router, local-world network, weighted network, evolving network.

1 Introduction

In recent years, there have a great deal of theoretical and empirical studies devoted to the understanding and characterization of various complex networks, including the Internet [1], the WWW [2], world-wide airport networks [3, 4] and scientific collaboration networks [5, 6], to name just a few. These networks generally possess fairly complex topological properties, such as the small-world feature [7] with large clustering and small average-path properties, as well as scale-free behavior [8] that can explain the 'rich gets richer' phenomenon observed in many real-life complex networks. There are two major categories of models that were formulated to capture the scale-free properties of such networks. One type of models focuses on the pure topological structures of the networks (i.e., un-weighted networks), and considers their dynamical evolution and growth. This includes the representative BA model [9], which introduces a liner preferential attachment mechanism to generate un-weighted scale-free networks. Another type of models takes

†The authors completed this paper before knowing the work of [19], which develops the same model but has different emphasis on model properties and applications.