The Network Blocking Game

Áron Lászka
BME

Abstract

In order to be able to design robust networks, which resist malicious attacks, one must be able, first of all, to measure the robustness of network topologies. We use a game-theoretic model, the network blocking game, where a network operator and an adversary interact in a zero-sum game played on a network topology, to study the robustness of topology graphs. In this model, the network operator chooses a subset of the links of the topology graph to connect the nodes, and simultaneously, the adversary chooses a link to be attacked. The optimal strategies of such an attacker-defender game can be used to *identify critical links* that are likely to be attacked, and the equilibrium payoff can be interpreted as a *measure of robustness* of the network topology at hand. We study multiple network communications models, which determine the payoff function of the game and the subsets of links that the operator can choose, and show how to compute optimal strategies, and consequently, the equilibrium payoff of the game. Furthermore, we show that the resulting game-theoretic robustness metrics are related to previously proposed graph-theoretic metrics, such as the persistence or the Cheeger constant of the topology graph.