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Game-theoretic approach to attack planning and controller placement in software defined networks

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Abstract: The paper addresses a game-theoretic

approach to controller placement and targeted attack planning problems. The two models are presented. The first model, the attacker's point of view, allows for efficient attack planning using mixed strategies to maximize damage in the network (minimize expected availability measure). The second model, the operator's point of view, allows for efficient controller placement using mixed strategies to maximize the expected availability measure and to defend against mixed-strategy attacks. The assumption is that attacks and placements occur in multiple rounds in the form of a game. Within Software Defined Network (SDN), such a game can technically be conducted using network programmability since the controllers may be relocated. The two mixed-strategy models were implemented and tested using linear programming solvers and compared to the min-max and max-min models (single best strategy), respectively. This paper was originally presented at the NATO Science and Technology Organization Symposium (ICMCIS) organized by the Information Systems Technology (IST) Panel, IST-200RSY - the ICMCIS, held in Skopje, North Macedonia, 16–17 May 2023

Keywords: Controller Placement Problem, targeted attack planning, placement planning, Software Defined Network, network availability optimization, controller-attacker game.

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