

System Survivability in Networks

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Abstract : We consider the problem of attacks on networks. We define the concept of system survivability in networks in the presence of intelligent threats. Our setting of the problem assumes a flow to be sent from one source node to a destination node. The attacker attempts to disable the network by preventing the flow to reach its destination while the defender attempts to identify the best path-set to use to maximize the chance of arrival of the flow to the destination node. Our concept is shown to be different from the classical concept of network reliability. We distinguish two types of network survivability related to the defender and to the attacker of the network, respectively. We prove that the defender-based-network survivability plays the role of a lower bound while the attacker-based-network survivability plays the role of an upper bound of network reliability. We also prove that both concepts almost never agree nor coincide with network reliability. Moreover, we use the shortest-path problem to determine the defender-based-network survivability and the min-cut problem to determine the attacker-based-network survivability. We extend the problem to a variety of models including the minimum-spanning-tree problem and the multiple source-/destination-network problems.

Keywords : defense/attack strategies, information, networks, reliability, survivability

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