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Game theory-based Security Vulnerability Quantification for Social Internet of Things

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Abstract

In modern society, information and communication technology (ICT) has been applied to various areas such as home, industry, and finance. Therefore, social networks using Internet of Things (IoT) technologies have been constructed. As ICT continues to be used in various modern applications, security vulnerabilities from legacy ICT have been inherited by social IoT network systems. To guarantee the safety of these applications, these networks must be protected from various cyberattacks. A variety of security technologies and products have been developed for this purpose. However, the most important task in dealing with cyberattacks is to inspect the current security status of a social IoT network system. Many types of vulnerability quantification methods exist for inspecting the security vulnerabilities of network systems. However, with legacy methods, quantification results lack objectivity. In this study, to compensate for this limitation, we propose a game-theory-based vulnerability quantification method using attack tree, which consists of three steps: game strategy modeling, cost-impact analyzation, and payoff calculation. We present a case study for a social-IoT-based network environment. Using the proposed method, we believe social IoT network system security experts will be able to cope with security incidents more effectively. The proposed method can be used as a reference for constructing a safer social IoT network system.

Keywords: Game Theory, Cyber security, Vulnerability Quantification, Social IoT

I. Introduction

As information and communication technologies (ICTs) continue to develop, they are being increasingly applied to various areas of modern society. A variety of systems, from home to industrial control networks that employ IoT technology, are evolving by using ICT to enhance user convenience and improve industrial efficiency. Examples of applications of social IoT are remote health care, smart buildings, smart homes, and smart grids. As this trend has progressed, whole societies are becoming connected to the network, and social IoT networks are in turn being constructed. Many cases exist in

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