Virtual Incident Response Functions in Control Systems

Andrés F. Murillo Piedrahita, Vikram Gaur, Jairo Giraldo, Alvaro A. Cardenas, Sandra Julieta Rueda

PII: S1389-1286(18)30043-4
DOI: 10.1016/j.comnet.2018.01.040
Reference: COMPNW 6388

To appear in: Computer Networks

Received date: 1 August 2017
Revised date: 9 December 2017
Accepted date: 18 January 2018

Please cite this article as: Andrés F. Murillo Piedrahita, Vikram Gaur, Jairo Giraldo, Alvaro A. Cardenas, Sandra Julieta Rueda, Virtual Incident Response Functions in Control Systems, Computer Networks (2018), doi: 10.1016/j.comnet.2018.01.040

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.
Virtual Incident Response Functions in Control Systems

Andrés F. Murillo Piedrahita\textsuperscript{a,b}, Vikram Gaur\textsuperscript{b}, Jairo Giraldo\textsuperscript{b}, Alvaro A. Cardenas\textsuperscript{b}, Sandra Julieta Rueda\textsuperscript{a}

\textsuperscript{a}Department of Computer Science, Universidad de Los Andes, Colombia
\textsuperscript{b}Department of Computer Science, University of Texas at Dallas, USA

Abstract
In the past decade the security of industrial control systems has emerged as a research priority in order to safeguard our critical infrastructures. A large number of research efforts have focused on intrusion detection in industrial networks, however, few of them discuss what to do after an intrusion has been detected. Because the safety of most of these control systems is time-sensitive, we need new research on automatic incident response. In this article we show how software-defined networks, and network-function virtualization can facilitate automatic incident response to a variety of attacks against industrial networks. We also prototype an incident response solution that detects and responds automatically to sensor attacks and controller attacks. Our work shows the promise that cloud-enabled software-defined networks and virtual infrastructures hold as a way to provide novel defense-in-depth solutions for industrial systems.

1. Introduction
Industrial Control Systems (ICS) are responsible for operating various safety-critical infrastructures, such as power grids, water management, oil systems, and manufacturing. Recent events, like the blackout caused by the cyber-attack against the power-grid in Ukraine \cite{1} show the dire need for improving the security of ICS.

Cybersecurity is a process consisting on (1) protecting, (2) detecting, and (3) responding to attacks \cite{2}. Most of the literature on ICS security has focused on preventing and detecting attacks \cite{3}; however, responding to attacks has received much less attention \cite{3, 4}. In particular, most of the research papers focusing on intrusion detection for control systems do not discuss what to do after an attack has been detected \cite{5}.

In this paper we address this gap in the literature by designing intrusion response mechanisms that keep the control system operating safely while sustaining attacks. To design and implement our intrusion response architecture we use Software-Defined Networking (SDN), and cloud-based virtual infrastructures. While the use of SDN for protecting power systems has been considered before \cite{6}, previous work has focused on proactive defenses, and not as a response to detected attacks. Similarly while cloud-based intrusion detection sys-
دریافت فوری
متن کامل مقاله
امکان دانلود نسخه تمام متن مقالات انگلیسی
امکان دانلود نسخه ترجمه شده مقالات
پذیرش سفارش ترجمه تخصصی
امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
امکان دانلود رایگان ۲ صفحه اول هر مقاله
امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
دانلود فوری مقاله پس از پرداخت آنلاین
پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات