

MICIE: An Alerting Framework for Interdependent Critical Infrastructures

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Abstract. In this demonstration we present the MICIE platform for on-line risk assessment in scenarios with heterogeneous interdependent Critical Infrastructures (CIs) such as power distribution networks, power plants, refineries, water distribution networks, transportation systems and telecommunication networks. These CIs are highly exposed to a large number of threats, including natural hazards, component failures and intentional attacks. Moreover, the increasing interdependence between CIs amplifies the effects of such threats and adds novel challenges to risk assessment tools. In this context, MICIE is the first systematic approach to integrate CI interdependence factors in on-line risk assessment, addressing both the development of on-line risk assessment models and the development of an information sharing platform for continuous exchange of relevant risk information between interdependent CIs.

Keywords: Critical Infrastructure Protection, On-line Alerting Systems.

1 Introduction

By their own nature, CIs have always been potentially weak points, exposed to a number of safety and security threats. Nevertheless, current CIs are more vulnerable than ever, as the need for efficiency and economic optimization pushes for increasingly complex systems with narrower safety margins, more complex technology and higher interdependency with external entities. CI sectors do not exist alone but interact each other, implying that protection needs to be cross sector and cross border: impacts occurring on one specific CI quickly propagate to others.

There is now a wide recognition of those risks, materialized in public initiatives such as the well-known Critical Infrastructure Protection Program, launched in 1998 by the US government, and the European Programme for Critical Infrastructure Protection. The alerting system we present is a core component of the MICIE FP7 Project [1] and is in line with the European initiative to establish a Critical Infrastructure Warning Information Network (CIWIN).

2 The MICIE Framework

A complete and updated list of MICIE-related publications is available at [1]. In addition to the proposal of several off-line risk models able to integrate specialized risk assessment methods with generic interdependency models [2-3], MICIE proposes an on-line risk prediction tool able to provide CI operators with the estimated risk levels associated with each component or service of their infrastructure. This risk prediction tool, based on an evolution of the input-output interdependency model [3], is able to integrate low level details with high-level dependencies, whilst still keeping performance and scalability.

According to the MICIE framework each CI keeps its own risk prediction tool, fed by the monitoring of internal CI components and by metadata provided by interconnected CIs – with the risk of failure or degradation of the services outsourced to those CIs. The output of the risk prediction tool is then used by the operators of the CI and also to automatically feed the risk prediction tools of other infrastructures that consume services provided by that CI.

CI-to-CI communication is based on so-called Secure Mediation Gateways (SMGW) [4]. Interdependent CIs directly exchange relevant information, enhancing simplicity, privacy and scalability. According to the circumstances, multiple access models are available and multiple security and availability mechanisms can be applied, including trust-based mechanisms.

Overall, to the best of our knowledge, the MICIE Project is the first systematic approach to risk management in scenarios with interdependent CIs, addressing multiple levels: improvements to off-line CI-interdependency models and tools, a reference platform for on-line exchange of risk-level information between interdependent critical infrastructures, and the first prediction tool able to estimate risk levels based on monitoring data collected on-line from the internal components of the Critical Infrastructure and metadata received from other interconnected CIs providing outsourced services. This platform is now being integrated and evaluated in a real use-case scenario, provided by Israel Electric Corporation (IEC).

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