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Modeling IT Availability Risks in Smart Factories - A Stochastic Petri Nets Approach

by

Daniel Miehle¹, Björn Häckel, Stefan Pfosser², Jochen Übelhör

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¹ Employed by BMW, Promotion at TU München

² Employed by BMK

WI-713

University of Augsburg, D-86135 Augsburg
Visitors: Universitätsstr. 12, 86159 Augsburg
Phone: +49 821 598-4801 (Fax: -4899)

University of Bayreuth, D-95440 Bayreuth
Visitors: Wittelsbacherring 10, 95444 Bayreuth
Phone: +49 921 55-4710 (Fax: -844710)



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Daniel Miehle, Technical University of Munich, daniel.miehle@tum.de

Prof. Dr. Björn Häckel, Project Group Business & Information Systems Engineering of the Fraunhofer FIT, Professorship for Digital Value Networks, University of Applied Sciences Augsburg, Germany, bjoern.haekkel@fim-rc.de

Dr. Stefan Pfosser, BMK Group, Augsburg, Germany, stefan.pfosser@bmk-group.de

Dr. Jochen Übelhör, Project Group Business & Information Systems Engineering of the Fraunhofer FIT, Research Center Finance & Information Management, University of Augsburg, Germany, jochen.uebelhoer@fim-rc.de

Abstract:

In the course of the ongoing digitalization of production, production environments have become increasingly intertwined with information and communication technology. As a consequence, physical production processes depend more and more on the availability of information networks. Threats such as attacks and errors can compromise the components of information networks. Due to the numerous interconnections, these threats can cause cascading failures and even cause entire smart factories to fail due to propagation effects. The resulting complex dependencies between physical production processes and information network components in smart factories complicate the detection and analysis of threats. Based on generalized stochastic Petri nets, this paper presents an approach that enables the modeling, simulation, and analysis of threats in information networks in the area of connected production environments. Different worst-case threat scenarios regarding their impact on the operational capability of a close-to-reality information network are investigated to demonstrate the feasibility and usability of the approach. Furthermore, expert interviews with an academic Petri net expert and two global leading companies from the automation and packaging industry complement the evaluation from a practical perspective. The results indicate that the developed artifact offers a promising approach to better analyze and understand availability risks, cascading failures, and propagation effects in information networks in connected production environments.

Keywords: Smart Factory, Information Network, Information Network Analysis, IT Availability Risks, Petri Nets