DEVELOPMENT OF AN E-OPERATION FRAMEWORK FOR SOPC-BASED RECONFIGURABLE APPLICATIONS

Yenog-Hwa Chang¹, Yung-Te Chen¹, Min-Hsiung Hung² and Allen Y. Chang²

¹Department of Electrical Engineering
Chang Gung University
No. 259, Wen-Hwa 1st Road, Kwei-Shan, Tao-Yuan 333, Taiwan
yhchang@mail.cgu.edu.tw

²Department of Computer Science and Information Engineering
Chinese Culture University
No. 55, Hwa-Kang Road, Yang-Ming-Shan, Taipei 11114, Taiwan
hmx4@faculty.pccu.edu.tw

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Abstract. In recent years, due to the progress of information and Internet technologies, reconﬁgurable manufacturing systems have attracted a lot of attention over the ﬁelds of reusable SIP (Silicon Intellectual Property) and remote maintenance. Motivated by the need of information sharing and reuse, this paper aims to develop a conceptual framework for e-operations with the capability of e-maintenance, e-commerce and e-reconﬁguring. The Web Services technologies are exploited as the communication infrastructure, which conveniently integrates the processes of e-diagnostic, SIP transactions and remote re-conﬁguring. In addition, the proposed framework can also meet various security requirements, such as basic authentication and authorization, XML signature and authentication. In particular, to increase the overall efﬁciency for system development, UML (Uniﬁed Modeling Language) is used as the tool to accomplish the object-oriented analysis and design (OOA and OOD) of system components in the proposed e-operation framework. Finally, to validate the convenience and effectiveness of the proposed framework, a reconﬁgurable controller for a virtual AS/RS (Automatic Storage/Retrieval System) is constructed as an application paradigm. The integration test results show that the proposed development framework can certainly comply with the design objectives. It is believed that the developed technologies and concepts can be applied to constructing next-generation remote maintenance systems for the future industry automation.

Keywords: Web service, e-Maintenance, e-Commerce, e-Reconﬁguring, SoPC, SIP

1. Introduction. E-Work was deﬁned and described by the PRISM Center [1] as any collaborative, computer-supported and communication-enabled productive activities. In essence, e-Work is comprised of e-activities, namely, activities based on and executed through information technologies. To the advancement of information and Internet technologies, the concept of e-maintenance has been recently proposed in the ﬁeld of industrial control. The e-maintenance system provides the experts of equipment supplier with the capability that allows remote linking to factory equipment through Internet with some remote actions, such as setup, control, conﬁguration, diagnosis, de-bugging/ﬁxing, performance monitoring and data collection/analysis. Accordingly, equipment can be rapidly repaired and maintained, and the equipment performance can be continuously improved.

Some remote maintenance systems were developed and applied in different industry applications. For example, Chen et al. [2] developed an e-maintenance embedded collaborative commerce system. Muller et al. [3] proposed the deployment and experimentation