A Harmonized and Reversible Development Framework for HLA-Based Interoperable Application

Zhiying Tu, Gregory Zacharewicz, David Chen

► To cite this version:

Zhiying Tu, Gregory Zacharewicz, David Chen. A Harmonized and Reversible Development Framework for HLA-Based Interoperable Application. INSIGHT - International Council on Systems Engineering (INCOSE), 2011, 14 (4), pp.16-17. hal-00655141

HAL Id: hal-00655141

<https://hal.science/hal-00655141>

Submitted on 25 May 2016

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Camara et al. *continued*

If one can measure interoperability as this approach allows, then one can define a methodology that integrates several techniques and tools for analysis and evaluation, drawn from the business-process engineering or enterprise-engineering domains. For example, business-activity monitoring and business-process simulation will be used to measure improvements in interoperability. **①**

References

- Blanc, S. 2006. "Contribution à la caractérisation et à l'évaluation de l'interopérabilité pour les entreprises collaboratives." PhD diss., University of Bordeaux, France.
- Chen, D., B. Vallespir, and N. Daclin. 2008. "An Approach for Enterprise Interoperability Measurement." Paper presented at the International Workshop on Model Driven Information Systems Engineering: Enterprise, User and System Models, Montpellier, France.
- Ford, T., J. Colombi, S. Graham, and D. Jacques. 2007. "The Interoperability Score." Paper presented at the Fifth Conference on Systems Engineering Research, Stevens Institute of Technology, Hoboken, NJ (US).
- IEEE. 1990. *Standard Computer Dictionary: A Compilation of IEEE Standard Computer Glossaries*. New York, NY (US): IEEE.
- Lebreton, B., and C. Legner. 2007. "Interoperability Impact Assessment Model: An Overview." In *Enterprise Interoperability II: New Challenges and Approaches*, ed. R. J. Gonçalves, J. P. Müller, K. Mertins, and M. Zelm, 725–728. London: Springer.
- Yaxiong, T., X. Zhen, and X. Huibin. 2010. "Bpm Exception Monitoring based on Process Knowledge." Paper presented at the 2010 IEEE Conference on Cybernetics and Intelligent Systems, Singapore, 28–30 June.

A Harmonized and Reversible Development Framework for HLA-Based Interoperable Application

Zhiying Tu, zhiying.tu@ims-bordeaux.fr; Gregory Zacharewicz, gregory.zacharewicz@ims-bordeaux.fr; and David Chen, david.chen@ims-bordeaux.fr

Enterprise collaboration is becoming more and more important because of the globalized economic context. The competitiveness of enterprises depends not only on their internal productivity and performance, but also on their ability to collaborate with others. This necessity leads to the development of interoperability, which makes it possible to improve collaborations between enterprises. Therefore, more and more networked enterprises are being developed. Further, enterprise interoperability is one of the most suitable solutions to total enterprise integration.

In the last decades, a great deal of research has focused on this problem, including the use of high-level architecture (HLA) to solve some interoperability problems. HLA is a software-architecture specification that defines how to create a global software execution composed of distributed simulations and software applications (IEEE 2000). It has succeeded in many aspects, especially in the areas of reuse and interoperability. However, with the rapid pace of technical change and further development of the IEEE standard, HLA faces many new challenges.

Our research focuses on reducing the time and cost of development, making federation more flexible and open while retaining adequate security and synchronization. Our work aims to contribute to the rapid and intelligent development of distributed enterprise information systems by proposing a harmonized and reversible development framework for HLA-based interoperable application, as figure 1 shows.

High-level architecture has many advantages, such as its generalized development process, distributed simulation engineering and execution process (DSEEP), synchronization standard, runtime infrastructure specification, and data standards. In order to keep these advantages,

Figure 1. Harmonized and reversible development framework

HLA needs to benefit from developments in the commercial domain (Tolk 2002). Model-driven architecture (MDA) has the most to offer HLA, since MDA is popular, since it is a compatible development lifecycle with HLADSEEP, and since MDA can facilitate the construction of simulators and provide the standardized meta models to this integration. Elvesaeter and others proposed a model-driven interoperability framework in 2007 to provide a foundation (consisting of a set of reference models) for applying model-driven development in software-engineering disciplines that support the business-interoperability needs of an enterprise.

Basically, the harmonization of MDA and HLA is intended to simulate MDA-based systems using modeling and simulation. Therefore we need to consider the existing MDA-based systems.

» continues on next page

Systems Engineering

Online Certificate Program

- Apply techniques to a broad range of industries
- Complete the entire program online
- Transfer specific coursework towards the Professional Master of Applied Systems Engineering at the Georgia Institute of Technology
- Improve your organization's operational efficiency
- Prepare for INCOSE certification

Georgia Institute of Technology

Curriculum

- Foundations of the Systems Engineering Process
- Systems Requirements Engineering
- System Design and Integration
- System Validation and Verification
- Simulation-Based Engineering for Complex Systems
- Systems Engineering Tools and Methods
- INCOSE Certification Preparation

For more information:

Julie Pai, Program Representative
julie.pai@uci.edu • (949) 824-6333

UCIRVINE | EXTENSION
extension.uci.edu/systemseng

Zhiying et al. *continued*

As a result, finding a way to rapidly acquire the knowledge from legacy systems becomes the key point of reducing the time and cost of development. Fortunately, after MDA became well known as an important change in software-development practice, the Object Management Group launched another project called architecture-driven modernization. This approach, the opposite of model-driven architecture, aims to “rewind” the models from legacy systems. However, sometimes one would like to discover more specific models from a legacy system. This is why the architecture-driven-modernization group has defined several metamodels to this purpose, the best known being the Knowledge Discovery Metamodel and Abstract Syntax Tree Metamodel (Jouault et al. 2009).

In order to adapt to the “Web 2.0” context, IEEE was published 1516TM-2010 in August 2010 (IEEE 2010), which benefits from web services such as support for numerous newer and older languages and operating systems as well as the ease of deployment across wide area networks. Because we are dedicated to developing an open framework, we have chosen an open-source RTI (run time infrastructure), poRTico (Portico Project 2009), which does not provide web-RTI functionality. Thus, we implement a special federate, WebservicesFederate, as a bridge, which takes in charge of providing web services, connecting and synchronizing federates outside traditional federation with federates inside. ⓘ

References

- Elvesaeter, B., A. Hahn, A.-J. Berre, and T. Neple. 2007. “Towards an Interoperability Framework for Model-Driven Development of Software Systems.” In *Interoperability of Enterprise Software and Applications*, ed. D. Konstantas, J.-P. Bourrières, M. Léonard, and N. Boudjlida, 409–420. London, UK: Springer.
- IEEE. 2000. IEEE 1516.2. *IEEE Standard for Modeling and Simulation (M&S) High Level Architecture (HLA)—Federate Interface Specification*. New York, NY (US): IEEE.
- _____. 2010. IEEE 1516TM. *IEEE Standard for Modeling and Simulation (M&S) High Level Architecture (HLA)—Framework and Rules*. New York, NY (US): IEEE.
- Jouault, F., B. Jean, and B. Mikaël. 2009. “Towards an Advanced Model-Driven Engineering Toolbox.” *Innovations in Systems and Software Engineering* 5: 5–12.
- Portico Project. 2009. “Developer Documentation.” Website of the Portico Project. http://porticoproject.org/index.php?title=Developer_Documentation.
- Tolk, A. 2002. “Avoiding Another Green Elephant: A Proposal for the Next Generation HLABased on the Model Driven Architecture.” Paper presented at the 2002 Fall Simulation Interoperability Workshop, Orlando, FL (US).