

NOTICE

Oral Defense of Dissertation Volgenau School of Information Technology and Engineering

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May 14th, 2009
Thursday, 10:30 am

New Engineering Building, room 3202

ON PERFORMANCE ANALYSIS OF SERVICE ORIENTED ARCHITECTURES

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ABSTRACT

ON PERFORMANCE ANALYSIS OF SERVICE-ORIENTED ARCHITECTURES

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Architectural models must provide insight into the logical, behavioral and performance aspects of the systems that are to be deployed conformant to the architecture. Recently, service orientation was introduced as a design paradigm to build Service-Oriented Architectures (SOAs). Service-Oriented Architecture behavior and performance doesn't only depend on its business services but also on the Enterprise Service Bus (ESB) services that enable loose coupling, services implemented by other systems, and the underlying technological network supporting the SOA environment. Traditional executable architectural models synthesized for stovepipe architectures cannot capture the complexity of an SOA.

In this dissertation, an approach for constructing an ESB-based SOA compliant to DoDAF v.1.1.5 and a systematic methodology for performance evaluation and prediction of the architecture are presented. The architecture defines business services and processes necessary to accomplish its operational concept, and is capable of participating in the net-centric environment (NCE). The participation in NCE is achieved by allowing the SOA to dynamically federate with NCE systems through COI registries and by utilizing the net-centric enterprise services to share enterprise-level information.

The performance evaluation and prediction methodology involves the development and implementation of a hybrid executable model that is capable of capturing and predicting the dynamic behavioral and performance aspects of an ESB-based SOA. The architecture of the executable model makes use of two models: Colored Petri Nets generated using CPN Tools to capture the logical and behavioral aspects of the SOA and a communication network model generated using the OMNeT++ network simulator to capture the underlying technological network that enables the SOA. The executable model utilizes the services of the ESB to predict the performance of business processes. The methodology starts by synthesizing the hybrid executable model from the DoDAF v.1.5 architecture artifacts produced during the architecture design phase and produces relevant Measures of Performance (MOPs) and Measures of Effectiveness (MOEs).

From the view point of the system architect, the proposed methodology will produce an executable model that can help him to debug, verify, evaluate, and demonstrate the capabilities of the SOA design and how well it will perform. From a customer view point, the methodology will help him verify that an architecture will satisfy his requirements, evaluate how well these requirements are satisfied, and help him choose among alternative architectures. The methodology is illustrated through a case study which highlights the capabilities of the tools, the underlying methodology, and the hybrid executable model.