Chapter 40
Supply Chain Simulation using Business Process Modeling in Service Oriented Architecture

Taejong Yoo
Sangmyung University, South Korea

ABSTRACT

For supply chain optimization, as a key determinant of strategic resources mobility along the value-added chain, simulation is widely used to test the impact on supply chain performance for the strategic level decisions, such as the number of plants, the modes of transport, or the relocation of warehouses. Traditionally, a single centralized model that encompasses multiple participants in the supply chain is built when optimization of the supply chain through simulation is required. However, due to the heterogeneity of supply chain, a centralized simulation model has a limit to reflect the dynamics of each supply chain participant. This research focuses on the conceptual and the technical issues about the supply chain simulation with a parallel and distributed simulation (PADS) concept. In particular, to ensure the decomposition of supply chain simulation model by each supply chain participant, the simulation framework is proposed using Service Oriented Architecture (SOA) in e-collaboration environment. For a clear proof of concept, the virtual supply chain simulation model is implemented and experienced using business process modeling tools in SOA. Due to the reusable, interoperable, and scalable characteristics of the proposed supply chain simulation framework, various alternatives for supply chin optimization can be generated and evaluated.

INTRODUCTION

Accompanying the globalization of business, competition has transformed from company versus company to supply chain versus supply chain. A supply chain is a network of participants (e.g. suppliers, manufacturers, warehouses, distributors, retailers) who, through coordinated plans and activities, develop products by converting raw materials to finished goods (Chandra & Grabis, 2007). Global leading companies have already reaped significant benefits from proper supply chain configuration, and other

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companies have chased to capture that value. As companies continue to clear these hurdles, they confront a host of new challenges: Systematic approach for strategic discovering the collaborative partner to configure supply chain network.

To either establish a new supply chain or reconfigure an existing one, the decision making process should be initiated. The supply chain configuration initiative is put forward by supply chain managers. It is assumed that they exactly know the purpose of the supply chain to be established. Furthermore, they can improve their understanding about supply chain if the process is broken down in specific and systematic approaches. With deeper understanding, they can make more secure decision making, action plans and the preparation for future situations (Kart et al., 2010; Meixell & Gargeya, 2005; Núñez-Muñoz & Montoya-Torres, 2009; Papakiriakopoulos, 2006).

To solve these problems, decision support tools that can analyze various alternatives can be very useful in impartially quantifying gains and helping the company make the right decision. Either qualitative analysis or customized simulation analysis are generally used as a decision support tool (Sánchez et al., 2011). Recently, to apply the simulation model of the supply chain participants', PADS is suggested as one of the solution for supply chain simulation. However, its implementation issues have been still on-going research subjects.

In reality, due to self-interest and difference goals of the participants in supply chain and the heterogeneity of simulation systems, the simulation model cannot reach full integration through supply chain, also it cannot be up to information sharing of all participants (Lin et al., 2012; Zhao, 2009). It causes two major problems associated with building customized simulation models: 1) too long time to develop and 2) very specific and limited interoperability and reusability. Practically, supply chain simulation insufficiently reflects the dynamics of the simulation objectives (i.e. production planning, logistics planning, network redesign, etc.) in supply chain. It is essential to understand important issues and common processes to develop an interoperable and reusable simulation framework for supply chain.

Nothing has impacted the research field of the interoperability and reusability of supply chain like the emergence of Internet Technology (IT). In an ideal e-Business environment, companies of all sizes could contact each other in a completely ad hoc fashion, without any kind of prior agreement. To this end, with the emergence of the Extensible Markup Language (XML), e-collaboration methodologies such as SOA are introduced and investigated as one of the most promising solution for the integration of the heterogeneous supply chain systems. The success of e-collaboration depends on how effectively information is shared between various processes and more specifically between the participants in the supply chain.

The objective of this research is to achieve a fully interoperable and reusable supply chain simulation framework using business process modeling in service oriented architecture. Since the process to design and execute the supply chain simulation model can be regard as one of the business process integration processes among supply chain participants, the research fundamentals focus on the application of the business process integration tools to the supply chain simulation. In particular, supply chain simulation can reflect more realities and dynamics with PADS. To this end, the eventual objective of this research is two-fold: The first one is to propose SOA based simulation framework to enhance the free plug-and-simulate simulation model of each participant. The second one is to propose and detail PADS for supply chain.

The remainder of the paper is organized as follows. Section 2 presents a literature survey of the relevant researches. Section 3 describes the proposed framework. Its prototype implementation is detailed in Section 4. Finally, Section 5 provides the current research efforts and future work.