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Mathematical Model for Simulating an Application Integration Solution in the Academic Context of Unijuí University

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Abstract

The enterprise applications consist of a set of applications that make up the software ecosystem. These can be developed in-house or acquired from third party companies. Generally these applications are developed in order to meet a demands/specific business need of the company without worrying of interacting with another existing system. The area of Enterprise Application Integration (EAI) is able to provide all techniques and tools in order to integrate heterogeneous applications software ecosystem of companies. The Guaraná DSL is a language that enables designing conceptual models of integration solutions using a concrete graphical and intuitive syntax. Integrating the applications is not a trivial task and solution development involves addition of costs (time and resources), risks such as the appearance of bugs that most often are observed only after the implementation of the conceptual model. In this paper we propose a simulation model using Petri Nets that enable the analysis of the behavior of an integration solution developed to a real-world integration problem at Unijuí University.

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1. Introduction

Software applications have become indispensable in the business environments. Enterprises usually buy third-party software packages or develop their own applications. In both cases it is common that there is no concern for their integration. Usually, this creates a problem and makes difficult software reuse whenever there is a new business process, or a current process that needs to be evolved and uses support of existing applications in the enterprise. There are software packages what can be purchased by companies, generally developed without having integration in mind.

It is common for the enterprise to create or buy, external applications to address their demands, when your software ecosystem becomes inefficient with respect to new data or functionality. A software ecosystem consists of a set of software solutions that support and automate activities and transactions of users¹. A software ecosystem refers to a set of applications that provide a degree of relation².

To avoid unnecessary additional costs with the implementation of an integration solution it is important to analyze it to ensure the solution does not have any problem, chiefly regarding its performance¹². An alternative would simulate the integration solution. The simulation is a way to analyze the behavior of a system, which is represented by a simulation model.

An integration solution is modeled using the Domain-Specific Language (DSL) of Guaraná platform. Guaraná DSL is composed of a set of applications and tasks that cooperate to integrate the different applications. In an integration solution messages are transmitted and contain information that is synchronized amongst applications³. Its representation is by means of a conceptual model, which describes the organization of the components in a high-level of abstraction. There are several platforms to implement integration solutions. Integrating applications is not a trivial task and solution development may involve additional costs, risks, such as the appearance of bugs and performance bottlenecks that are usually observed after implementation.

Enterprise Application Integration (EAI) consists of a response to decades of building monolithic applications, which were not designed to work together with other applications. The EAI aims to solve a problem that has existed since the beginning of the first applications development: the difficulty of integrating applications that were created separately⁴. It is a combination of technologies that have the role of organizing business processes, offering integration between applications with no changes in its data structures. From a business point of view, is a unified information system with easy access to valuable and decisive information inside an enterprise. Proposes the use of integration solution, to provide communication between applications.

A method of Enterprise Application Integration should be functional and inexpensive⁴. Enterprises generally seek to analyze, still in the design phase, the integration solutions. All analysis done at this stage leads the possibility to observe the behavior of the solution, and identify potential performance bottlenecks. The identification of bottlenecks in the early stages of development can contribute to improve the quality of integration solutions. This paper proposes a formal simulation model, using Petri Nets, to analyze the behavior of the integration solution that synchronizes several services to students in the academic context of the Unijuí University.

This paper is structured as follows: Section 2 presents background information of Guaraná DSL and Petri Nets; Section 3, presents the case study; Section 4, comes up the simulation model using Petri Nets; and, Section 5 comes up the conclusion and future work.

2. Background

This section provides a brief introduction to Guaraná DSL, which is used for conceptual modeling of the integration solutions, and Petri Nets, which are used for the development of the formal simulation model.

2.1. Guaraná DSL

A Domain Specific Language (DSL) is tailored to focus on a single and concrete domain and accurately describes its semantics⁵. Guaraná DSL is among the various technologies available to develop conceptual models of enterprise application integration solutions. The models designed with Guaraná DSL have a high-level of abstraction and are platform-independent⁶. This language has a graphical concrete syntax and it provides support for application integration patterns documented by Gregor Hohpe and Bobby Woolf⁷. Guaraná DSL provides building blocks to

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