



SELECTION OF ACTIVITIES IN DYNAMIC BUSINESS PROCESS SIMULATION

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Abstract. Maintaining dynamicity of business processes is one of the core issues of today's business as it enables businesses to adapt to constantly changing environment. Upon changing the processes, it is vital to assess possible impact, which is achieved by using simulation of dynamic processes. In order to implement dynamicity in business processes, it is necessary to have an ability to change components of the process (a set of activities, a content of activity, a set of activity sequences, a set of rules, performers and resources) or dynamically select them during execution. This problem attracted attention of researches over the past few years; however, there is no proposed solution, which ensures the business process (BP) dynamicity. This paper proposes and specifies dynamic business process (DBP) simulation model, which satisfies all of the formulated DBP requirements.

Keywords: dynamic business process, dynamicity, simulation model.

Introduction

Enterprises are involved in a competitive environment, which often imposes them to improve their business processes (BP) in terms of activities and their contents, rules, activity sequences, possible decisions, performers and resources. It is hard to adapt existing static BP to new business needs. Therefore, it is necessary to introduce to BP with the highest level of dynamicity. In this paper, we understand such processes as dynamic business processes (DBP). Trinkunas *et al.* (2015) proposed that DBP are a set of activities that implements BP models whose components may vary and if necessary change with low latency at run time due to changes of the context.

Regarding the fast changes in business requirements, one of main tools to estimate possible results of changes, becomes simulation. However, simulation tools are limited and especially if we are trying to adapt it to DBP context.

In this paper we analyse related works in DBP topic and propose generic DBP simulation model which represents how simulation of DBP should be implemented, specifically paying attention to dynamic selection of activities, and presents a set of requirements for DBP simulation. The remainder of the paper is structured as follows: a short overview of related work with DBP is presented, then, the proposed DBP simulation is discussed, and conclusions are given.

Related works

DBP is a wide area of research and is understood differently by researchers. Therefore, authors (Rusinaite *et al.* 2015a) presented five requirements for the dynamic business processes:

1. The DBP should support changes of any process component;
2. Activity sequences are formed at runtime and should not be predefined;
3. The DBP should support changes caused by any process context;
4. The duration of alteration of context is much shorter than the whole duration of the process;
5. The process changes can be initiated by any performer role, at any time, with very low latency compared with the duration of the process.

Based on requirements above we perform related works analysis to indicate what solutions exist to solve BP dynamicity.

Zeng *et al.* (2002) proposed PLM flow tool, which is able to adapt flexibly to the changing business environment and is capable of determining the sequence of activities at BP runtime. Although, this solution provides flexibility to systems, but this tool functionality not fully support DBP.

Hermosillo *et al.* (2010) proposed ceviche system framework, which combines the processing of complex events and events activated by changes in BP. Ceviche is

composed of three main parts: a user interface to create the SBPL files, a translation framework to manage the plug-ins for each CEP engine, and an aspect manager to deal with the process adaptation. The system uses aspect-oriented approach, so it can modify functionality at runtime.

Wörzberger, Heer (2011) provided DYPROTO tool, which can insert new activities, delete old activities or dynamically implement activity.

Weber *et al.* (2008) provided an overview over different aspects of flexibility in workflow management (WFM) systems and defined the change patterns used in WFM systems. Heer *et al.* (2010) continued research and proposed a tool supporting changes of patterns.

Narendra *et al.* (2007) proposed aspect-oriented approach, which enables adaptation of web services without impacting user experience.

Gong, Janssen (2011) propose an architecture based on business rules and Semantic Web Services to create DBP.

Yoo *et al.* (2008) presented a rule-driven approach for DBP schema modification and instance adaptation. This approach uses rules that contain schema modification operations and conditions in which those operations are performed, thus enabling rapid schema modification when business environments change. They have also proposed specific system architecture by making best use of existing technologies and components.

There are many ongoing research efforts in the DBP area, however proposed solutions do not cover the full DBP requirements (Table 1), which was contained in (Rusinaite *et al.* 2015b; Rusinaite *et al.* 2016) research.

DBP simulation

There are different ways to analyse how changes affect business processes. The most direct approach is to perform

a real experiment. However, experiments with real business processes can be too expensive. Simulation is a more cost-effective way to analyse possible alternatives and it is always cheaper to generate a temporary process, which meets business goals than implementation of it in real business. In this chapter, we suggest a general simulation model of DBP, which enables creation of DBP simulation tool prototype.

Suggested model is represented in Figure 1. Generic dynamic business process simulation model. The model supports all of the requirements specified in the previous section. User initiates simulation subprocess. The simulation tool performs the simulation by initiated the selection of activity to be performed. It evaluates all of the possible activities' rules and the context to select the activity, which is most appropriate in the current situation. After the activity is selected, the simulation tool executes the activity and updates execution log history.

At any point during the simulation, the tool can accept various events. All of the events that simulation tool might receive during the simulation contain a message. These messages might be send either by external context or by the user of the simulation tool. The simulation tool processes all of the messages and it changes the components of simulation model or updates the context based on the content of the messages.

This activity selection/execution loop is performed until the tool cannot find any more activities to execute. In such case, the simulation tool makes a few more attempts at selection. If none are found until waiting threshold is reached, the tool generates an event that it has ended. The simulation result is the history log of BP execution, which can be analysed by the user of the simulation tool.

Table 1. Research on DBP with regards to DBP requirements

1 lentelė. Dinaminio verslo proceso srities tyrimų atitiktis dinaminio verslo proceso reikalavimams

Authors	First requirement	Second requirement	Third requirement	Fourth requirement	Fifth requirement
Gong, Janssen 2011	–	–	+	+/-	+/-
Heer <i>et al.</i> 2010	–	–	+	+/-	+/-
Hermosillo <i>et al.</i> 2010	–	–	+	+/-	+/-
Kalibatiene <i>et al.</i> 2016	+/-	+/-	+/-	+/-	+/-
Narendra <i>et al.</i> 2007	–	–	+	+/-	+/-
Rajabi <i>et al.</i> 2010	–	+	+	+/-	+/-
Rusinaite <i>et al.</i> 2015a	+/-	+/-	+/-	+/-	+/-
Weber <i>et al.</i> 2008	–	–	+/-	–	–
Wörzberger <i>et al.</i> 2011	–	–	+	+/-	+/-
Yoo <i>et al.</i> 2008	–	–	+	+/-	+/-
Zeng <i>et al.</i> 2002	–	+	–	–	–

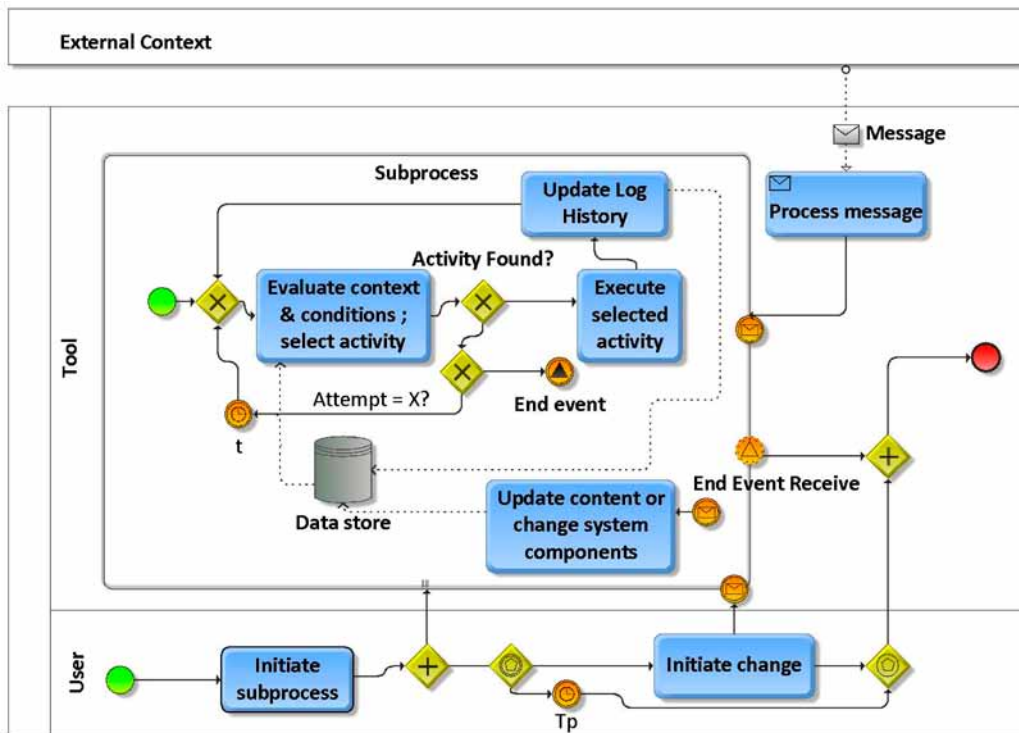


Fig. 1. Generic dynamic business process simulation model

Conclusions

The literature review shows that there is no approach suitable for dynamic business process simulation. There are some attempt to simulate dynamicity, but none of them fully satisfy the formulated requirements.

The proposed approach dynamically selects activities, facilitates changes of components during simulation, is suitable to simulate dynamic business processes and satisfies the defined requirements. It still needs to be fully evaluated and experiments have to be performed to validate it.

In future research, this model will be implemented in simulation tool prototype and experiments with dynamic business processes simulation will be performed.

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VEIKLŲ PASIRINKIMAS DINAMINIO VERSLO MODELIO SIMULIACIJOJE

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Santrauka

Šiuolaikiniam verslui svarbu vykdyti procesus dinamiškai, norint laiku prisitaikyti prie besikeičiančios aplinkos. Keičiant procesus reikia įvertinti keitimo pasekmes, o įvertinimui galima naudoti dinaminių procesų imitaciją. Siekiant realizuoti procesų dinamiką, reikia imitacijos metu turėti galimybę keisti proceso komponentus. Problema pritraukia daug dėmesio jau kelerius metus, tačiau vis dar nepasiūlytas sprendimas, kuris užtikrintų verslo proceso dinamiškumą. Šis straipsnis siūlo ir pateikia dinaminio verslo proceso imitacinį modelį, kuris atitinka anksčiau suformuotus dinaminio verslo proceso reikalavimus.

Reikšminiai žodžiai: dinaminis veiklos procesas, dinamiškumas, imitacinis modelis.