27th Bled eConference

eEcosystems

June 1 - 5, 2014; Bled, Slovenia

Towards Business Process Management in Networked Ecosystems

Jeroen van Grondelle

HU University of Applied Sciences Utrecht, The Netherlands

jeroen.vangrondelle@hu.nl

Martijn Zoet

HU University of Applied Sciences Utrecht, The Netherlands

martijn.zoet@hu.nl

Johan Versendaal

HU University of Applied Sciences Utrecht, The Netherlands

johan.versendaal@hu.nl

Research in Progress

Abstract

Managing and supporting the collaboration between different actors is key in any organizational context, whether of a hierarchical or a networked nature. In the networked context of ecosystems of service providers and other stakeholders, BPM is faced with different challenges than in a conventional hierarchical model, based on up front consolidation and consensus on the process flows used in collaboration. In networked ecosystems of potential business partners, designing collaboration upfront is not feasible. Coalitions are formed situationally, and sometimes even ad-hoc. This paper presents a number of challenges for conventional BPM in such environments, and explores how declarative process management technology could address them, indicating topics for further research.

Keywords: Ecosystems, BPM, Declarative Business Processes, Business Models

1 Introduction

Today's business is increasingly performed in networked ways, offering composite products and services (Kortuem et al., 2010). The production of these products and services crosses organizational boundaries, and they have features or coverage that no single participant in the network is able to deliver by itself (Lusch and Vargo, 2010; Vargo and Akaka, 2009). Examples of this range from governments that delegate

execution of its policies to decentralized agencies, or even commercial companies, to increasingly dynamic and cloud based outsourcing scenarios, to logistic and financial service providers cooperating with dedicated marketing organizations and manufacturers to create end-to-end online shopping experiences (Demirkan et al., 2009). All these examples require partners in the network to collaborate to deliver the integrated product, and comply with (local) rules and regulations at the same time.

The field of business process management (BPM) has developed tools and methods to support such collaboration and make sure all requirements are met. At the same time, these tools and methods have mainly been developed in intra organizational settings. This has led to a design-based approach, where analysts design process flows that they believe meet all requirements that apply. With the rise of ecosystems of smaller, autonomous entities, this does no longer work. Situational, ad-hoc coalitions of partners cannot afford to align and design a shared process, neither in terms of cost or time spent.

Although these same challenges have been recognized by different authors (Oasis, 2006; Demirkan, 2009), this problem has often been approached from a services-oriented architecture approach. Based on functional decomposition, different partners in the ecosystem offer their contribution by standardized contracts, providing a degree of interchangeability of partners. When truly interactive collaboration is needed, including dialog between partners throughout the process, this is not enough.

So-called networked BPM should help to enable ecosystems of partners to provide a multitude of services, at different quality and price levels, with unique processes of collaboration for each unique coalition of partners.

In this position paper we present a number of challenges for BPM technology when supporting collaboration in networked ecosystems, and present preliminary results that suggest that declarative business processes could be a foundational technique to address these challenges, identifying a way for further research.

2 Challenges for BPM in Networked Ecosystems

This section presents a number of challenges that BPM faces when supporting business processes in networked ecosystems.

2.1 Networked Business Models

The process support in a networked environment will have to deal with the new, networked business models that are emerging and that dictate new ways of coalition forming. Malone et al. (2007) identified 16 possible business models, which organizations can apply. Business models can be configured into various value constellations. In the last decade the frequency of value constellation configuration has increased. This can be found in organizations that form networks to be able to perform disaster rescuing or networks of care centers with healthcare institutions, relatives and elderly care (Camarinha-Matros and Afsarmanesh, 2006). But also in traditional networks a higher frequency of value constellation is required to stay competitive. For example network-orchestrating organizations like Nike, Li & Fung and, Cisco configure their collaboration per process instantiation. Brown et al. (2002) even state that organization only have one product / service: the configurable process. Camarinha-

Matros and Afsarmanesh (2006) analyzed such networks and identified that the composition of the network can exist of a variety of entities which are autonomous, geographically distributed, and differ in operating environment, culture, social capital and goals. In specific situations value constellations are forced upon market players by government. An example of such value constellations is the energy market. First the energy supply was controlled by a few big firms. Later, the production of energy, the transport of energy and sales of energy was divided by law. The last laws also dictate that organization must buy back the surplus that energy consumers produce, but consumers can also sell to other consumers. Conventional flow-oriented business process design and execution cannot follow the speed of individual configuration let alone the process as product.

2.2 Situational Coalitions of Stakeholders

Classically, actor selection in BPM is implicitly dealt within business processes. Typically, only actor roles are modeled, for instance using swim lanes, and all actors fulfilling a certain role are expected to act the same. When organizations are for instance optionally involved in a process, or an organization or user has to be selected to fulfill a role within the process dynamically, there are specific sub flows for this weaved into the process itself.

In networks, it is highly situational who the stakeholders are of a specific process instance. It may for instance depend on the product variants ordered, local considerations or contractual reasons. In addition, there may be stakeholders who have requirements the actors in the collaboration must meet, but are not actors themselves. A good example of course is legislators and regulators. In international context, this leads to 'the same' process being different in different places, as local regulations apply. Other examples of passive stakeholders are the often cross cutting requirements by legal and risk departments, on for instance archival policies.

2.3 Distributed Ownership and Traceability

In a networked setting, having the different stakeholders exercise distributed ownership over the process models is important. This means that individual stakeholders are able to express their requirements and are able to review how they are formalized in business process analysis efforts. Traceability of these formalized models to source texts, that for instance contain policies and regulations, is crucial to allow for impact analyses on policy change.

3 Supporting Ecosystems with Declarative BPM

Conventionally, business processes have been designed in terms of activities, the order that they are executed in and by whom. This is typically encoded by successor relations between an activity and the activity that is executed consecutively. These process designs are typically created by information analysts that, after carefully considering all requirements, design a flow that meets all these requirements. In the enactment phase, business process support tools assign work to the different actors based on these process designs.

As alternative to imperative, flow oriented business processes, declarative process formalisms have been proposed, such as EM-BRA^{2}CE (Goedertier, Haesen en Vanthienen, 2007), Declare (Pesic and Van der Aalst, 2006) and DPMN (Van Grondelle and Gülpers, 2011). These approaches all try to capture the constraints that the collaboration must meet, rather than the exact order in which activities are to be performed. Although they have different approaches, they use similar techniques (Van Grondelle, Zoet and Vermeer, 2013) to decouple the statements made at specification time from the concrete flows allowed at execution time.

In the context of networked collaboration, the most important feature of declarative process management approaches is the ability to consolidate the requirements and constraints of different stakeholders automatically into a process that all those stakeholders agree with.

This feature helps addressing the first two challenges presented in Sections 2.1 and 2.2. As all participants in the network are able to express their own constraints for the collaboration, including the passive stakeholders, having declarative BPM technology make sure that the different activities across the network are performed within the union of these constraints guarantees that all individual stakeholders are satisfied with the resulting collaboration.

In the context of open ecosystems and highly situational coalitions, we are researching how this scales up when the number of potential participants grows and the number of potential coalitions therefore grows exponentially too. Figure 1 proposes a model for how to support situational collaboration of dynamic coalitions of ecosystem members using declarative process modeling techniques.

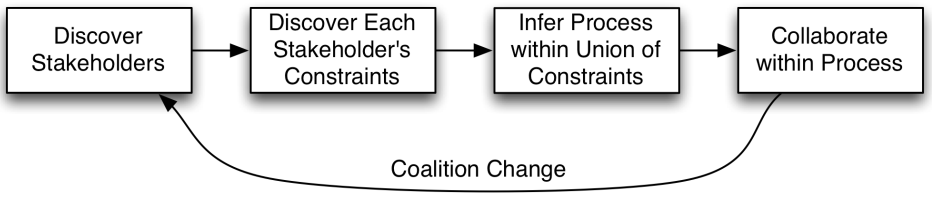

Figure 1: Leveraging declarativity to dynamically creating a collaboration process

To ground the four steps presented in Figure 1 we will describe each steps illustrated by an example. In for instance the case of a claims handling process, depending on customer properties and claims history, in step 1 different departments and/or regimes and external experts, appraisers and auditors may be discovered as stakeholder for an individual claim. In step 2, all the constraints of these stakeholders are retrieved. In step 3, the constraints are consolidated by taking the union and a process is inferred within the combined set of constraints. This process is enacted in step 4 while the set of stakeholders does not change. A coalition change triggers step 1, consequently re-evaluating stakeholders, their constraints and the inferred process.

With respect to the challenges in section 2.3, the fact that constraint sets only need to be merged for a process instance at execution time, prevents the creation of big process designs that can deal with all possible coalitions and situations at once. Having each stakeholder sign off only his own constraints, without asking him to check how those are incorporated into a bigger model, could improve their ability to take ownership of the model. Similarly, constraints map to policy sources better than the impacted flow.

An important question in this context is the ability of non-IT people to understand and work with these formalisms. Existing studies (Fahland et al., 2009) suggest that the intuitive nature of explicitly modeled order is better understandable for users. However, the experiments underpinning this study seem to focus on a conventional setting where analysts have complete information about the requirements of different stakeholders, and create or evaluate process models based on that information. We have conducted initial experiments where growing number of stakeholders, each with individual confidential stakes, have to collectively create or evaluate process models that meet as much of their own stake as possible. The performance of these teams is measured and compared, when using BPMN and a declarative formalism (Van Grondelle and Gülpers, 2011) respectively, in terms of time spent and correctness of the models produced. Although the data is inconclusive at this point, and the experiment is being improved to correct for the effects of unexpected game dynamics, first experiments among groups of students indicate that the combinatoric effects when using BPMN grows very fast when the group size is increased, affecting their ability to converge on shared process models.

Another question is how stakeholders respond to the new form of control they get in this way of working. Instead of having detailed knowledge and influence on the precise way how the collaboration will be performed, the stakeholder gets strong guarantees that his personal constraints will be met, regardless of the requirements and constraints of others. There intuitively is a parallel to different leadership styles, where directive leaders control how employees do their work, while in modern leadership, setting goals and boundaries and allowing for professional autonomy are valued.

4 Discussion and Further Research

In this paper we have explored what the challenges are in supporting the collaboration between dynamic coalitions of service providers in an ecosystem. The main challenge, certainly from a conventional BPM perspective, is the ad hoc, situational composition of coalitions of stakeholders on a per case basis. The emerging field of declarative BPM addresses this, as it does not depend on up front, integral process design, but computes acceptable flows within the constraints of all stakeholders that participate in an individual case. This way, composite products and services can be supplied by ecosystems with high numbers of providers, where the collaboration process needed for every possible coalition is supported.

Further research is needed for the field of declarative BPM to address the challenges introduced by collaboration of large networks of stakeholders in ecosystems.

To move stakeholder identification out of the process model and into the cycle introduced in Figure 1, advanced stakeholder models are needed that support stakeholder identification in ecosystems, but also allow for establishing stakeholders in individual cases.

There seems to be a performance trade-off between better understandability of flow-based formalisms, compared to declarative formalisms, and the inherent complexity when they are applied to exhaustively prescribe the collaboration of large numbers of autonomous stakeholders. Additional research is needed to establish at what network scale there is a tipping point and declarative BPM outperforms conventional BPM.

The relation between BPM paradigms and leadership and influencing styles should be studied further, as it may help understand and overcome the sometimes-perceived lack of control when BPM stops prescribing collaboration explicitly at design time.

References

Camarinha-Matos, L. M., Afsarmanesh, H., Galeano, N., & Molina, A. (2009). Collaborative networked organizations–Concepts and practice in manufacturing enterprises. Computers & Industrial Engineering, 57(1), 46-60.

Demirkan, H., Kauffman, R. J., Vayghan, J. A., Fill, H. G., Karagiannis, D., & Maglio, P. P. (2009). Service-oriented technology and management: Perspectives on research and practice for the coming decade. Electronic Commerce Research and Applications, 7(4), 356-376

Fahland, D., Mendling, J., Reijers, H. A., Weber, B., Weidlich, M., & Zugal, S. (2009). Declarative versus Imperative Process Modeling Languages: The Issue of Understandability. In *Intl Workshop on Enterprise Business Process and Information Systems Modeling BPMDS* (Vol. 29, pp. 353–366).

Goedertier, S., Haesen, R., & Vanthienen, J. (2007). EM-BrA^{2}CE v0. 1: A vocabulary and execution model for declarative business process modeling. Available at SSRN 1086027, 0–74.

Iansiti, M., & Levien, R. (2004). The keystone advantage: what the new dynamics of business ecosystems mean for strategy, innovation, and sustainability.

Kortuem, G., Kawsar, F., Fitton, D., and Sundramoorthy, V. 2010. "Smart Objects as Building Blocks for the Internet of Things," *Internet Computing, IEEE* (14:1), pp. 44-51.

Lusch, R. F., Vargo, S. L., & Tanniru, M. (2010). Service, value networks and learning. Journal of the Academy of Marketing Science, 38(1), 19-31.

Pateli, A., & Giaglis, G. (2003). A framework for understanding and analysing e-business models. Bled Electronic Commerce Conference.

Pesic, M., & Van Der Aalst, W. M. P. (2006). A Declarative Approach for Flexible Business Processes Management. In J. Eder & S. Dustdar (Eds.), Business Process Management Workshops (Vol. 4103, pp. 169–180). Springer Berlin Heidelberg.

Van Grondelle, J., & Gülpers, M. (2011). Specifying Flexible Business Processes using Pre and Post Conditions. In P. Johannesson, J. Krogstie, & A. L. Opdahl (Eds.), Practice of Enterprise Modeling (Vol. 92, pp. 38–51). Springer.

Van Grondelle, J., Zoet, M., & Vermeer, F. (2013). Characterizing Declarativity across Business Process Formalisms. In Proceedings of IIMA 2013.

Vargo, S. L., & Akaka, M. A. (2009). Service-dominant logic as a foundation for service science: clarifications. Service Science, 1(1), 32-41.

Williamson, O. E. (1975). Markets and hierarchies, analysis and antitrust implications: a study in the economics of internal organization. New York.