



Do Process-based Systems Support Emergent, Collaborative and Flexible Processes? Comparative Analysis of Current Systems

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Abstract

Advanced process-based applications such as crisis and risk management require Emergent, Collaborative and Flexible (ECF) processes. These three features correspond to specific real-world requirements. Firstly, to face unpredictable situations, emergent processes are needed, *i.e.* processes whose model/schema is (partially) unknown at design-time and gradually defined/refined at run-time. Secondly, the complexity of the application domain being addressed requires collaborative processes, *i.e.* processes whose definition and enactment require interactions between groups of actors using their skills and experiences to make the process convergence towards their common goal. Thirdly, to adapt to the frequent changes that occur in their operating environment, flexible processes are needed, *i.e.* processes whose model/schema can be modified in real time. The objective of this paper is to present a literature review to study the state of the art of process-based systems with a focus on the three above mentioned properties. Our approach is to specify real world requirements, then to discuss the adequacy of current systems to these requirements and finally to provide advices for their improvement. Examined systems fall within the following areas: Business Process Management (BPM), Adaptive Case Management (ACM), Computer Supported Collaborative Work (CSCW) and Knowledge Management (KM). The paper concludes on the insufficiency of existing systems and the need for designing and implementing a specific process-based system that integrates these three properties in a coherent framework.

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1. Introduction

Advanced process-based applications falling within crisis and risk management, virtual organizations, or factory of the future, manage processes with specific features. In particular, such applications help companies to coordinate the different actors involved in their processes by automating repetitive tasks and facilitating the distribution of

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information and control in distributed settings. Firstly these processes are *emergent*, as their model/schema is (partially) unknown at the beginning and gradually defined/refined during execution: process definition and execution intertwine. Secondly, these processes are *collaborative* as they require skills and experiences from several groups of actors both for their modelling and execution: each group of actors is responsible for modelling parts of the process according to its skill area and the whole group is responsible for the synchronization of each group contributions. To sum up, both process modelling and execution are actor-driven, these actors focusing on a common goal and the modelled and executed process being the result of a consensus between them. Thirdly, we can mention that such processes operate in dynamic environments and are subject to frequent changes. As a consequence, they should be *flexible i.e.* able to respond to changes occurring in their operating environment.

For example, let us consider a crisis management application [1]. In this application, several participating actors (experts) have to act simultaneously and urgently to reduce the crisis and its impacts on the real world. To achieve this common goal efficiently, these actors must collaborate, or at least act in a coordinated way in order to make their activities as efficient as possible. Designing this coordination is a difficult task. It requires the use of business skills of the involved groups of actors, who are responsible for defining actions to be undertaken on the ground and their coordination according to their areas of expertise, and the process driving crisis resolution merges the defined actions from all relevant actors. Thus a crisis resolution process schema is the result of a collective and consensual modelling work between actors involved in crisis resolution. On the other hand, such processes are subject to frequent changes to meet the evolving requirements of the crisis. In addition, these changes may be performed while there are ongoing process actions on the ground. This means that design and execution of such processes are strongly intertwined: actors are allowed to design the schema, *i.e.* the actions and their coordination, of the considered process while executing it.

Advanced process-based applications should benefit from existing process-based systems relevant from the four following complementary areas: Business Process Management (BPM), Adaptive Case Management (ACM), Knowledge Management (KM) and CSCW (Computer-supported Collaborative Work). However process-based systems from these areas lack in meeting the following requirements, derived from the three above mentioned properties:

- need for process flexibility as well as a strong intertwining of process design and process execution,
- need for human and collective dimension integration in order to support collaborative design and execution of the process driving these applications (*e.g.*, the crisis resolution process),
- need for context and knowledge support to both describe the current situation (*e.g.*, the impacted ground and its evolution in a crisis application) and the already existing or created knowledge to deal with such a situation (*e.g.*, reusing part of past experiences in a crisis application) in order to provide actors involved in this collaborative design and execution with the relevant information and data.

The objective of this paper is to present a literature review to study the state of the art of process-based systems with a focus on the three above mentioned properties. Our approach is to specify real world requirements, then to discuss the adequacy of current systems to these requirements and finally to provide advices for their improvement. More precisely, the contribution of the paper is a critical and comparative analysis of the main process-based systems in BPM, ACM, CSCW and KM areas, considering the above mentioned requirements. We have carried out this analysis in three steps answering the three main following questions: (i) do examined process-based systems support the required flexible dimension, *i.e.*, process flexibility, as well as process design and execution intertwining, (ii) do examined process-based systems support the required collaborative dimension and finally (iii) do examined process-based systems support the modelling of the required context and knowledge dimension, so that decision-making is make easier.

Accordingly, the paper is organized as follows. The next three sections give an overview of the examined process-based systems addressing respectively the flexible, the collaborative, and the context and knowledge dimensions support in processes. Section 5 presents a comparative analysis highlighting the benefits of examined process-based systems to support collaborative and emergent processes with respect to the previous requirements but also highlighting their lacks within a comparison grid. This section also positions collaborative and emergent processes with respect to examined process-based systems areas, thus underlying that none of the examined systems

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