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INFORMATION-SENSITIVE AND CUSTOMIZABLE SERVICE CHAINS – VISION AND REQUIREMENTS

Abstract: Nowadays, service-oriented organizations while producing and delivering their products cooperate with a number of entities. Thus, service chains emerge. Although difficult to manage, as single services are under supervision of different entities, service chains, in comparison to typical business processes, are more reactive to changes and may be easily suited to specific needs of customers. Within our research, we target at the development of a next generation application supporting the lifecycle of information-sensitive and customizable service chains meeting customer expectations towards agile business processes and business services, respectively.

Keywords: service chains, business process managements, adaptive workflows.

1. Introduction

Modern companies try to automate as many areas of their activities as possible in order to reduce human effort devoted to perform repetitive, everyday tasks as well as to reduce their operation costs. While focusing on automation, organizations may benefit, inter alia, from the IT-based solutions developed with the Business Process Management (BPM) paradigm in mind [Schmelzer, Sesselmann 2008].

In contemporary implementations of processes, BPM often follows a Service Oriented Architecture (SOA) paradigm [Woods, Mattern 2006]. Simultaneously, the trend towards specialization in core competencies of companies and reduction of other tasks is leading to outsourcing of both services and processes to external parties. In consequence, the transformation towards less vertical integration and increased networking among various providers takes place. Companies undergo significant transformations as they seek partners from around the globe and subsequently dynamic business value networks consisting of service chains are created [Grigoriu 2008]. In addition, many industries shift from offering non-individualized products to developing personalized customer solutions that address people's needs more properly.

Service chains may be defined as collaborative processes consisting of services offered via Internet infrastructure by many participants. The mentioned services if combined together deliver a composite service satisfying needs of a final customer. Such service chains are reactive to changes, e.g., their execution path may change in response to new data acquired. In addition, they support flexibility of an organisation more than typical processes. They are customizable, which means that it is possible to design various service chains realizing the same or similar tasks suited to specific needs of customers.

Although having much to offer, service chains are difficult to manage as single services are under supervision of particular parties and usually information on service characteristics is hard to obtain. The issues related to quality levels of provided services and responsibilities of all parties when it comes to guaranteeing a certain quality level of the entire chain, also need to be taken into account. Thus, a major challenge constitutes the assessment of value of a service in relation to user requirements. This value differs, if looked at from the perspective of a partner, provider or customer.

Nevertheless, considering demands of end users on increased adaptability and availability of customized solutions as well as taking into account the evolution of the Internet in the direction of the Future Internet with the Internet of Services [Nixon et al. 2009], development of the proposed application means that barriers for SMEs will be lowered in respect to their continuous participation in service chains as well as taking advantage of ICT solutions and thus, a proliferation of service chains is envisioned.

Therefore, one of the internationally recognized scientific as well as technical challenges is to develop generic methods, concepts and tools for enabling adaptive processes – e.g., customizable service chains [Guenther et al. 2008; Han et al. 1998; Patel et al. 2004; Siebert 1999]. This necessitates provision of innovative methods for aligning process models with information models capturing real-world information as well as their evaluation from various perspectives. Moreover, service chains need to be monitored so as to allow for dynamic process adaptation.

This position paper introduces a research vision the results of which are to contribute to the proliferation of customizable service chains and development of Internet of Services. Within our research, we target at a next generation application for information-sensitive and customizable service chains, which tackles the mentioned challenges, facilitates the management and interactions with service chains and meets customer expectations of agile business processes. Therefore, in this paper we discuss the underlying motivation and objectives of the carried out research. A discussion on main challenges, requirements for the solution, future work as well as envisioned impact is also included.

The paper is structured as follows. First, the research objectives addressed within our work are shortly mentioned. Then, the overview of the system and its main functionalities follows. The paper concludes with discussion and outlook on the future work.

2. Research vision

The major objective of the research is to develop a next generation application for facilitating usage and management of information-sensitive and customizable service chains. This requires addressing a number of scientific and technical challenges. The developed methods and techniques need to solve the problem of acquiring, filtering and aggregating, in an automated manner, relevant information on process and services in order to support the customization and overall flexibility of service chains. Fulfilling the defined goals would allow making companies more reactive to changes occurring both within and outside an organisation, as well as give users a possibility to create their own service chains meeting their needs.

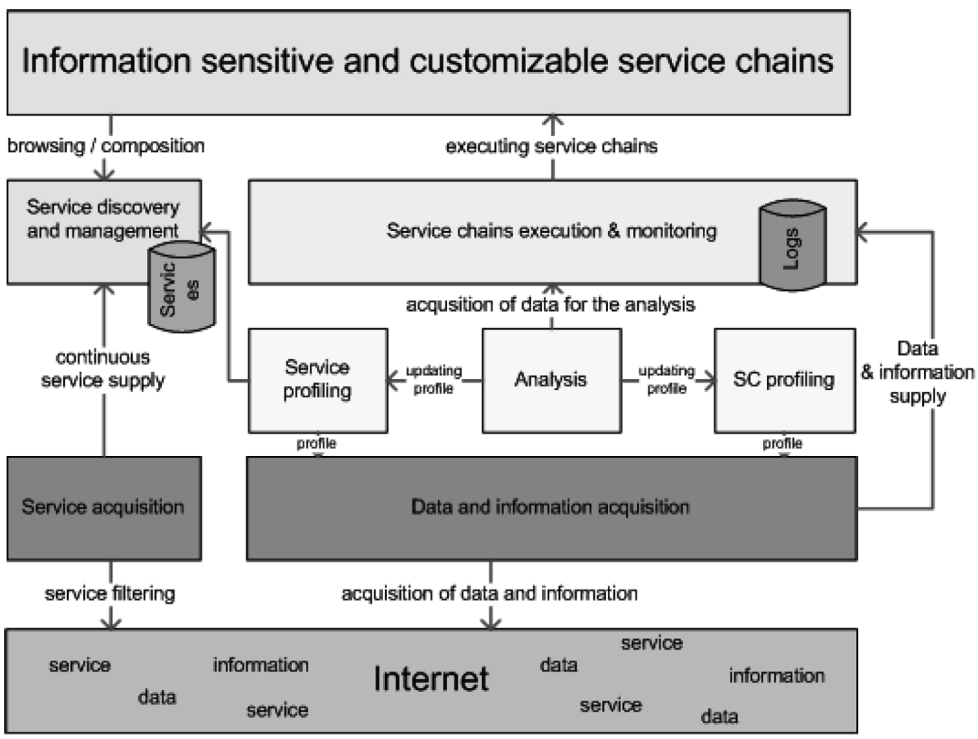

Figure 1. Conceptual model of the developed application

Figure 1 presents the conceptual model of the proposed solution. The application consists of three major building blocks:

– a service, data and information acquisition block encompassing methods and tools for monitoring the Internet taking into account profiles of services and service chains,

– a service and service chain (process) profiling and analysis block: profiles are to be utilised while monitoring and acquiring information, while analysis enables to provide customers with values of quality parameters of services and service chains,
– a service chains execution and monitoring block including, inter alia, execution of service chains taking into account information retrieved from the Internet.

The detailed research objectives, which are derived from the existing scientific challenges and strongly related to the above-mentioned building blocks, are summarized into the following key aspects.

First, a multi-perspective representation model needs to be developed. It should be flexible enough to support description of both functional as well as non-functional aspects of services and their chains. As interactions with service chains may involve various actors, e.g. business analysts, end-users, IT experts, the mentioned model should allow to capture various perspectives on involved artefacts. The developed model should allow providing artefacts characteristics in a form of machine processable profiles, different for description of a service chain and a service. In addition, the model should enable defining process information needs in a formal manner allowing for their automated processing and further usage.

Once the model is developed, the second objective deals with enhanced computation of artefacts characteristics. The evaluation should embrace not only services but support also a multi-perspective computation of service chains' parameters to evaluate their suitability to the user's needs. The evaluation should encompass both the functionality offered by a service (the goal it fulfils) as well as non-functional properties from a user's perspective. Thus, the mentioned method supports personalization of a view on a process (aggregation of different information to suit different information needs of users).

Not only do we need to be able to represent various characteristics of a service and service chains, but also to be able to model service chains themselves. Therefore, an innovative process modelling methodology for information-sensitive customizable service chains needs to be defined on top of the existing process modelling methodologies. The defined modelling methodology should encompass creation of service chains as well as representing their information needs. In addition, it should allow for introducing monitoring rules into the process model. It should also provide support for users in designing valid service chains assuring required level of flexibility.

Information sensitivity means that the developed service chains rely on external information or may be influenced by it. The influence may manifest itself in triggering the process, changing its execution path or stopping its execution. If we represent the information needs of a process in a formal manner, appropriate mechanisms for acquisition of required information may be set in place. Thus, semi-automated acquisition (extraction) of information on services and processes, e.g., from the Internet needs to be implemented. Once the information is acquired, it needs to be integrated in order to allow for further application.

One of the objectives of the conducted research is to make service chains reactive. Supporting this idea requires monitoring of organization-external sources to enable dynamic process adaptation, assessment of the impact of the acquired data on services and a process itself as well as monitoring of the actual process behaviour at runtime including different perspectives required by different users. In order to allow for personalized monitoring, rules with accompanying data need to be developed in order to signal a fault in the execution of a process. This involves extension of process models to declare different monitoring aspects at the design time as well as determination of data needed to assess these aspects during runtime.

Finally, the appropriate application operating on the above-mentioned artefacts and supporting the discussed interactions needs to be provided. The application needs to support the design and development of dynamic service chains lowering the traditional technology and information barriers to enable non-IT knowledge workers to participate in a flexible process orchestration.

The proposed application builds upon the state-of-the-art technologies and paradigms while striving for enhancements and new solutions. To realize the vision, more thorough research must be conducted in the relevant fields. The progress is summarized within the following table.

Table 1. Progress beyond state-of-the-art in specified research areas

State-of-the-art	Planned progress
1	2
Research area: Business process management methods for the Internet of Services	
– still a technology challenge and paradigm shift to provide a BPM solution as platform-as-a-service – limited access of processes being executed to process-external information in an automated manner – limited discovery of appropriate services with respect to a modelling context, hindering potential reuse of services – missing support during process modelling: design patterns, auto-completion, restructuring algorithms – orchestrated processes are too rigid to allow for any context-based adaptations, thus design of business processes disregards end users – business models cannot automatically be checked for compliance with trust and security requirements nor users are supported in modelling thereof – missing link between process execution and real-world events	– design and development of a prototypical application aligned with platform-as-a-service paradigm – innovative modelling methodology for integrating real-world information into business process models – intuitive methods for supporting users in building correct processes assuring the required level of flexibility and trust with the focus on their adaptability – extension of existing modelling methodologies, languages and tools to accommodate new methods and artefacts required while execution of service chains

1	2
Research area: Distributed data capturing, filtering and consolidation for business-related events	
– insufficient event correlation and pattern recognition mechanisms – template-based extraction from multiple sources with precision and recall under expectations	– flexible integration of information from multiple (but predefined) Internet sources that may be used for process implementation and execution – enhancement of data capturing and filtering with a novel unified real world event model that enables consistent aggregation of business relevant event data
Research area: Automated evaluation and selection of services	
– missing dynamic methods of establishing trust in adaptive and dynamic services	– enabling semi-automatic judgement of quality of services from the user's point of view – development of rules enabling for monitoring of a process that would notify the user on any potential problems – aggregation of quality parameters on different levels depending on the user's information needs
Research area: End user enablement & interaction	
– service delivery requires complex user interaction – end users required to remember relevant patterns/forms for querying system – end user query processing does not involve domain ontology – service front end does not take end user relevant context information into account	– integrating user context information into the interactions between the end-user and the system to improve the end user experience – creating visual environment to ease cooperation of a user with the system

3. System model

To fulfil the vision of the information-sensitive and customizable service chains, an application supporting users in developing and managing these chains needs to be developed. This application is to provide a user with the following functionalities (divided in three areas from the BPM point of view):

1) Business Process Modelling using services:

– modelling of a business process (a service chain) using services available in a dedicated service repository,
– browsing the repository, suggesting services matching initial activity description,
– displaying information on substitution possibilities tailored to preferences of a user (preferred service providers, business partners, payment options, etc.),
– continuous acquisition of services from the Internet.

2) Business Process Execution:
- information acquisition from the Internet based on profiles of process information needs,
- supplying adequate process instances with acquired information,
- execution monitoring and logging the execution data.

3) Business Process Analysis:
- analysis of services and processes with regard to their qualitative and functional aspects,
- displaying aggregated information on functional and non-functional characteristics of a process tailored to the information needs of an actor (KPI or more technical details) (analysis option, analysis is to take into account user preferences, process structure, etc.),

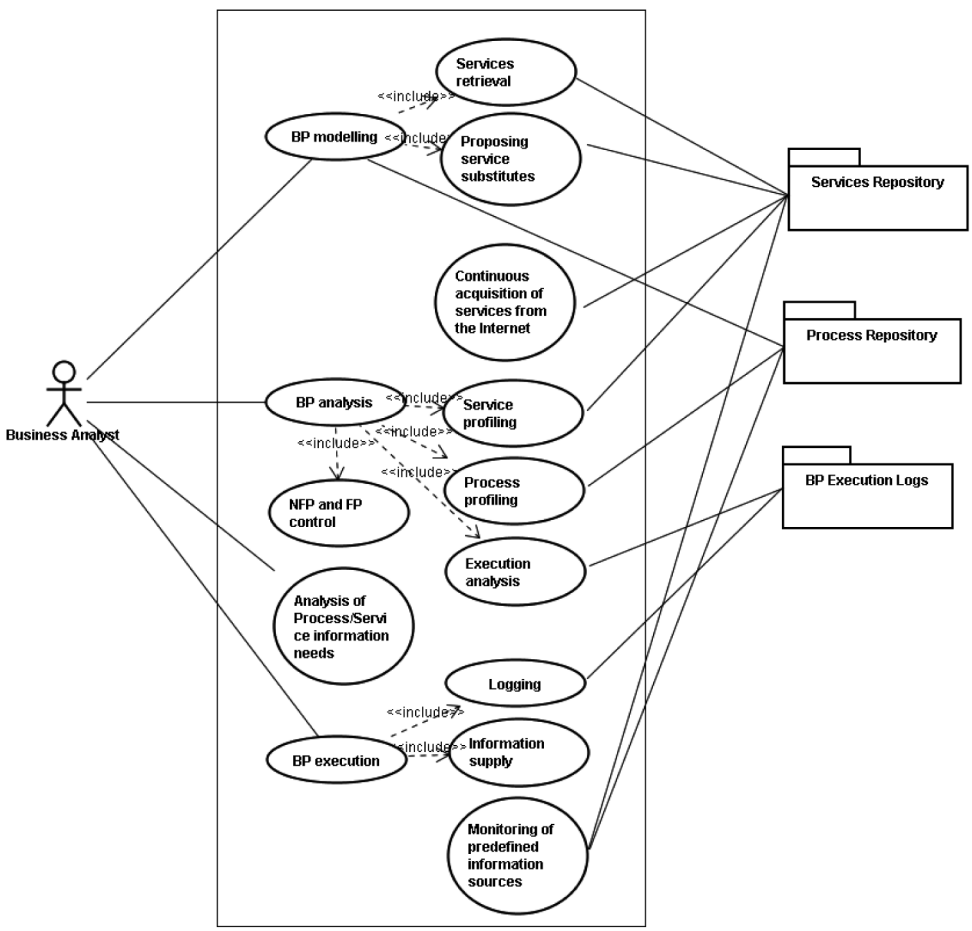

Figure 2. System functionalities. UML Use Case Diagram

– analysis of information needs of process elements and the entire process, i.e., user assisted creation of process information needs: information required by a process itself, process and service profiling.

The detailed list of functionalities to be offered is presented in Figure 2.

4. Discussion and conclusions

The discussed research idea investigates both scientific as well as technical challenges promising to deliver innovative solutions. It offers clear advantage over state-of-the-art in the area of Business Process Management and Information Systems. By provision of novel approaches, modelling methodologies and tools allowing for creation and usage of real-time information within service chains, it is to support the vision of adaptive processes being a topic of an on-going research all over the world. By taking into account a wide range of non-functional properties, not considered till now, it allows for complex evaluation of service chains as well as services from a user perspective.

The research is multidisciplinary being built on two pillars: BPM and techniques for information extraction and aggregation, exploiting synergies of both fields. The developed application should empower both companies and their end users to dynamically compose, adapt or evolve their business processes, i.e., service chains to fit the actual needs and constraints of the situation in hand and to fulfil the overall goals of the involved business partners in the best possible way. Furthermore, easy-to-use application front-ends will facilitate user involvement in changing dynamic service chains as well as value assessment from various perspectives (end-user, offering company, business partner).

The fulfilment of the idea in the long term will facilitate utilization of service chains by business making them more flexible and adjustable to the changing conditions as well as will allow for customization of business offer for end-users. By supporting utilization of business value chains, we will also contribute greatly to the proliferation of services being an integral part of the Future Internet. We are convinced that ultimately, such a service infrastructure will enable assessments of collaborating partners to dynamically adjust partnerships and operations as new trends take shape.

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STEROWANE INFORMACJĄ ŁAŃCUCHY USŁUG – WIZJA I WYMAGANIA DLA NARZĘDZI

Streszczenie: Współczesne przedsiębiorstwa coraz częściej współpracują z zewnętrznymi partnerami, tworząc dynamiczne łańcuchy wartości dodanej składające się, zgodnie z paradygmatem architektury usługowej, z powiązanych usług dostarczających wspólnie pewną funkcjonalność odpowiadającą potrzebom klienta końcowego. Chociaż takie dynamiczne łańcuchy usług są trudne do zarządzania, to ich konstrukcja umożliwia większą reaktywność na zmiany w porównaniu z typowymi procesami biznesowymi, co powoduje, że oferowane usługi mogą być łatwo dostosowane do zmieniających się potrzeb klientów. Celem badań opisanych w artykule jest analiza wymagań dla aplikacji informatycznej nowej generacji wspierającej cykl życia konfigurowalnych i reaktywnych łańcuchów usług spełniających oczekiwania klientów.