MASHUP APPROACHES FOR IMPROVING SERVICE ORIENTED BUSINESS SCENARIOS

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Abstract: Two kinds of business scenarios are considered: application- and service-oriented. It is shown that the former are more flexible and easier reconfigurable for both traditional (human-oriented) and IT services. Moreover, complex IT services can be created by simple IT services using the modern mashup technology. It is the reason why such business scenarios can be modeled by BPMN in much easier ways. A simple example of a supply chain of a sales company is considered and the available advantages of such technologies are emphasized in the paper.

Keywords: service-oriented scenarios, BPMN approach, complex IT services, mashup technology, general mashup architecture

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1. Introduction

Enterprise Project Management (EPM) [1] supports organizations in their development, according to the assumed goals and strategies describing how the goals can be achieved. Each such strategy involves two major phases: formulation and implementation. The former is related to identifying the situation, and guides the developing policies. The latter refers to suitable actions to achieve the established goals. In the case of IT enterprises, which use the IT infrastructure (hardware and software) to meet the demands of large organizations, we can distinguish an extra maintenance step. The aim of maintenance is to keep the IT infrastructure running reliably, and be less likely to break down, ensuring effective performance and minimizing the risks. Such solutions have become an increasingly important part of modern organizations. It is necessary to describe how an organization can

transform the processes in order to maximize the business value, including economic profits and well-being in the long run. Wide utilization of the SOA (Service Oriented Architecture) technology [2] is the reason why an organization can operate as a service-oriented business. In consequence, changes in the organization are enabled to better govern, manage, and secure IT services offered by, *e.g.* the computing cloud environment [3]. What is important to know is that different kinds of services are required in each phase of the organization's life cycle. For instance, various IT services related to data gathering, transforming and adjusting should be collected for the formulation phase. Different services supporting to develop the functionality are formulated at the implementation phase. At the maintenance phase, monitoring, and recovery services are largely used. All such services can be divided into two categories: manually and automatically performed services. The former will be called services, and the latter – IT services. There is a dilemma, how to choose and use the available set of IT services, and sometimes how to design and implement them to create the required functions of an organization. The organization where IT services play dominant roles can be called an e-organization or service-oriented. The proposed solution differs from the traditional one, however, it is based on mature IT management systems such as ERP (Enterprise Resource Planning), MRP (Manufacturing Resource Planning), and CRM (Costumer Relationship Management). In comparison to a service-oriented approach, the traditional one is rather close-ended, and not able to easily adapt to the changing conditions. In the modern business world, organizations are forced to continually analyze processes within the organization, as well as to analyze external factors. These activities allow proper adaptation and optimization of IT systems in the organization, and the supporting management processes. The innovative project C2NIWA (Center of Competence, Novel Infrastructure for Workable Applications) [4] presented in Figure 1 and offering a set of platforms supports the approach proposed in the paper and offers solutions for complex assistance in the organization's activities through analysis, design, and implementation seeking to promote decision-making process optimization.

The project utilizes three original platforms developed at the Gdansk University of Technology:

1. BeesyCluster – a platform that allows easy execution and management of computations related to data analysis, simulations, and modeling in the large-scale cluster computing environment;
2. KASKADA – a platform dedicated to processing multimedia streams in real time;
3. WikiWS – a platform for building Web Services and applications using an open programming model that enables the reuse of services as well as their cataloging, storage, deployment and execution management.

Among the above platforms, WikiWS is very promising to prepare different kinds of IT services. Having combined this platform with a professional BPEL (Web Service Business Process Execution Language)/BPMN (Business Process

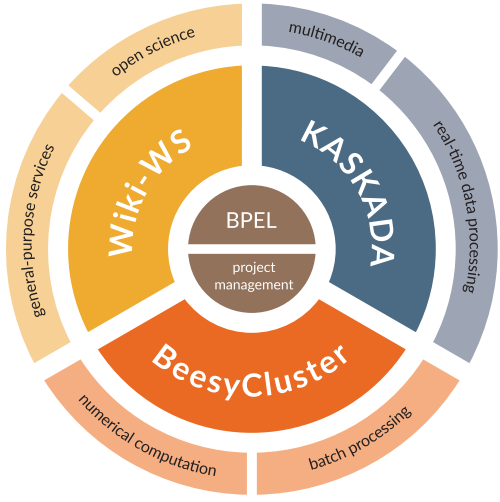

Figure 1. C2NIWA platforms

Model and Notation) environment and modern cloud computing we will be able to offer our users a universal set of tools and services to enable integration of high-level applications and services, needed for creating different business management scenarios.

Such scenarios integrate people, information and appropriate applications (IT services). What is important, according to the SOA, the required IT services are self-governing, and may call other services to implement complex tasks. We limit our deliberations to the formulation phase where suitable implementation scenarios consisting of services and IT services are considered. It is shown how to model such scenarios using the BPMN. In addition to this, a popular kind of integration of IT services is described, based on mashup technologies. It allows building complex suitable scenarios consisting of simple IT services in order to support the execution of different kinds of complex business enterprises. In Section 2, service-oriented scenarios of different supply chain management are considered, and using them for the implementation of such activities. In Section 3, modeling of some activities of a sales organization using the BPMN is analyzed. Transformation of classical supply chains into virtual ones is discussed. Section 4 describes the integration problems of services into enterprise scenarios, and presents promising technologies called mashup. In conclusion, the results of the paper are summarized, and some propositions for future investigations are suggested.

2. Service-oriented business scenarios

Let us consider a model of supply chain management shown in Figure 2 oriented on a sales organization. It can be implemented by a traditional closed system management using ERP, MRP, CRM platforms [5]. An alternative solution is to use a service-oriented system, where management is across organizational

boundaries. The progress of running services can be monitored by extra services, performing within their operational organization environment. In such cases, some information about services, and their characteristics is required. In other words, services should be more measurable and manageable. Several standard management frameworks are currently used, such as SNMP (Simple Network Management Protocol), WBEM (Web-Based Enterprise Management), WSMF (Web Service Management Framework) [6]. The latter provides support for discovering, inspecting, securing and invoking resources, management functions, infrastructure services and tool sets. The standard management interfaces enable higher-value utility functions, processes or applications. They concern aspects such as availability and performance management, optimization, capacity, planning, billing, configuration management, asset protection, problem determination and business analysis. However, in order to investigate exactly what the possibilities of IT technology bring in terms of the supply chain, it is necessary to define business scenarios for which they can be used. Referring to Figure 2 the business scenario can be as follows.

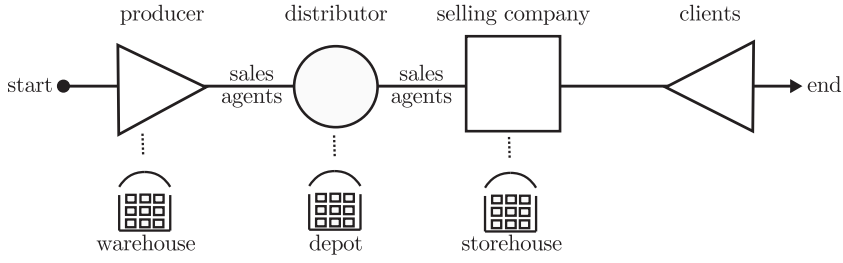

Figure 2. Model of supply chain management typical for sales company

The supply process begins when a sales company reports the product demand. It starts from the manufacturer, the place where products are manufactured, and transferred to a warehouse. Next, products are transported by the distributor to depots; and then, depending on the type of order, delivered to the sales company's storehouse [7]. It is worth noting that it is usually sales agents that mediate in the sales of goods between organizations. Numerous processes take place in a typical supply chain. One of such processes is preparation and negotiation of the product purchase offer, presented in Figure 3. Let us consider a scenario of a sales transaction, where the client (customer) wants to place an order for a given product, and communicates with the seller (sales company) for this purpose to obtain a suitable offer.

The communication between the customer and the seller is effected by typical human activities which may be direct (meeting) or indirect (phone call). However, if the sales company wished to check the profitability of the planned transaction they should use the IT support *e.g.* a recommendation system and forecasting. A good example of forecasting is the use of predictive models (*e.g.* the Holt model), which predicts future values based on historical data.

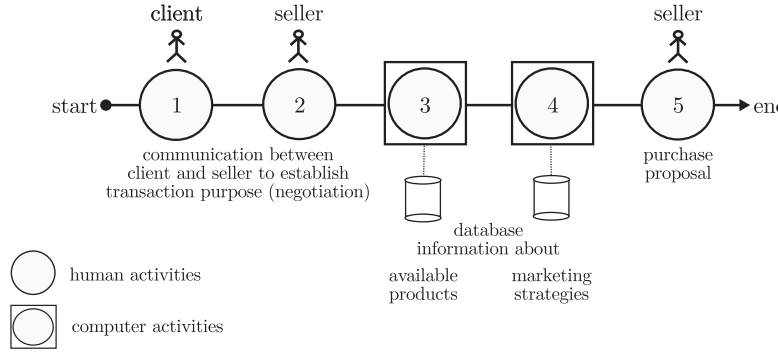

Figure 3. Purchase offer preparation scenario, including two types of activities: human and computer-based

The appropriate algorithm and model are adapted depending on the type and characteristics of the data [8]. Despite using artificial intelligence, the final decision is made by a human, who sets the terms of sales. Referring to Figure 4, IT support may also apply to warehouse management processes in the sales company.

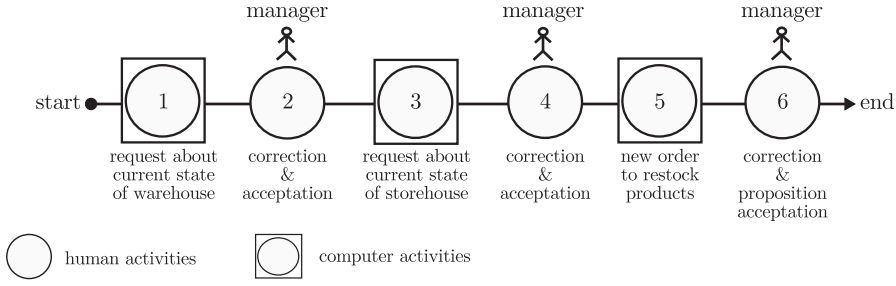

Figure 4. Stock replenishment management scenario

The manager responsible for warehouse management, depending on the needs, has various types of IT services supporting the decision making process. They can be used freely at any time, without the need to preserve the order of their application. Figure 4 shows a situation in which the manager wants to check whether it is necessary to order goods for maintaining optimal stock levels. The manager uses IT services and checks the current warehouse level (quantity of specific goods). Then, the IT system recommends the action. The manager, basing on the artificial intelligence of the IT system, but also on his/her practical knowledge and experience, makes the best possible decision. What is important, as far as possible, the manager should monitor and control the IT system operation in order to avoid potential errors. In such a case the manager performs the only management functions, others belong to IT services.

3. Modeling service-based workflow of business scenarios

To generate higher profits from the organization of business activities, it is necessary to identify the processes taking place in the organization, and to

understand them. These processes are often cross-functional so they could be used alternately, including both human services, and computer activities (IT services). Their proper relations can affect the organization's ability to succeed. Generally, a business process is a sequence of actions designed to produce a product or service that is of value to the customer, whereas business process modeling is simply representing the process in a graphical form. Obviously, it is important to maintain the sequence logic, without it the model could be misinterpretive or incomprehensible. We can distinguish the most popular and official process modeling notations UML (Unified Modeling Language) and BPMN (Business Process Modeling Notation). An alternative way is not to use notation, but standards, such as BABOK (Business Analysis Body of Knowledge) [9], which is a guide for correct process modeling, including different knowledge and various techniques, published by the International Institute of Business Analysis (IIBA).

As shown above, each decision carrying on from the supply chain execution can be solved in two different ways, using: a classical or service-oriented approach. Figure 5 presents two approaches, one based on the well-known system management such as ERP, CRM, or MRP, and another based on soft access, where functions of classic systems are replaced by a suitable set of services, which can be flexibly used by users. Moreover, services can be provided in distributed ways, parallel in time, which changes the imagination about sequences of activities. In consequence, a traditional supply chain is transformed into a virtual one [10].

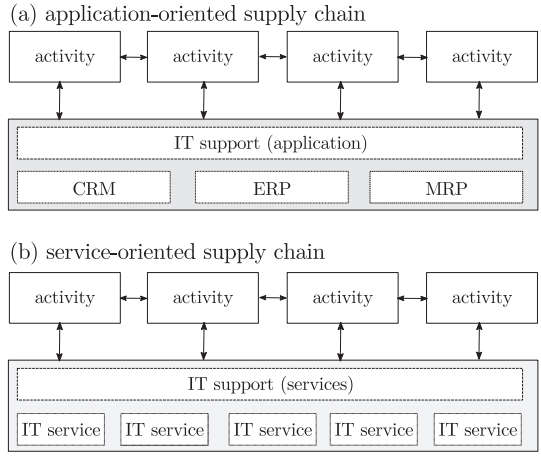

Figure 5. Two concepts of IT support of supply chain management by: traditional system (a), and service-oriented system (b)

Composition IT services can also be conducted on both management and service levels, which is presented in Figure 6. The management level would address composition, including user preferences to integrate into IT services, which are required to assess their performance, and to decide when to track the execution progress of IT services. Such services should satisfy some additional requirements:

- how to exchange comprehensive information among services;
- how to deal with service unreliability;
- how to substitute IT services with other peers without disrupting the execution flow;
- how to suspend the IT service execution.

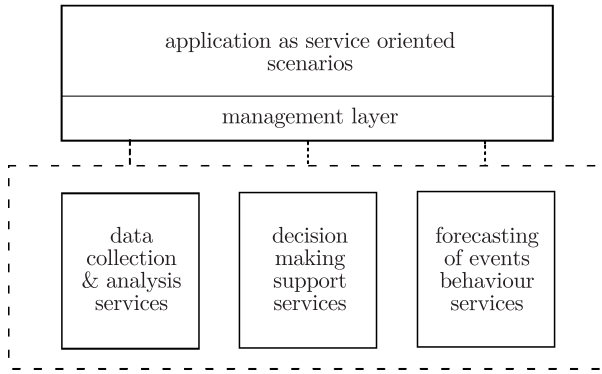

Figure 6. Architecture of a service-based supply chain management

Currently, many specialized, external services providers can offer various IT services, which can be used to create diverse, much more complex business scenarios for different organizations. Moreover, they can be created in computing clouds [10] and then they are more flexible, making them able to procure, integrate, useful and adaptive. Organizations decide which parts of their processes can be made by themselves, and which parts can be made by external providers. Then, new methods to manage multi-supplier IT services can be defined. Problems, such as the consistency of standards (interfaces), run on-demand, security achievement, could then be solved. Different services can be used to realize SLA (Service Level Agreement) and provide the suitable service management. An interactive monitoring and reporting can also be organized in that way.

Conducting a relationship analysis of current operations is an essential step in building a process model. Figure 7 shows a model of the sales company presented in Section 2, created in the BPMN standard. The BPMN describes a workflow with a set of graphical tools, and rules for their use (semantics and syntax notation), it allows us to see a visual representation of the process, and related artifacts. Standard BPMN 2.0 was published by OMG (Object Management Group) in 2011. It is currently the most popular standard for describing business processes, used to accurately describe business processes at a technical level. Three areas of the organization: processes, procedures, policies (3P approach) can be described using the BPMN. Let us consider one scenario to create supply streams of products in a sales company. The process presented in Figure 7 consists of five lines within a pool, where communication and goods flow between management, IT services, the storehouse, the manufacturer and the distributor.

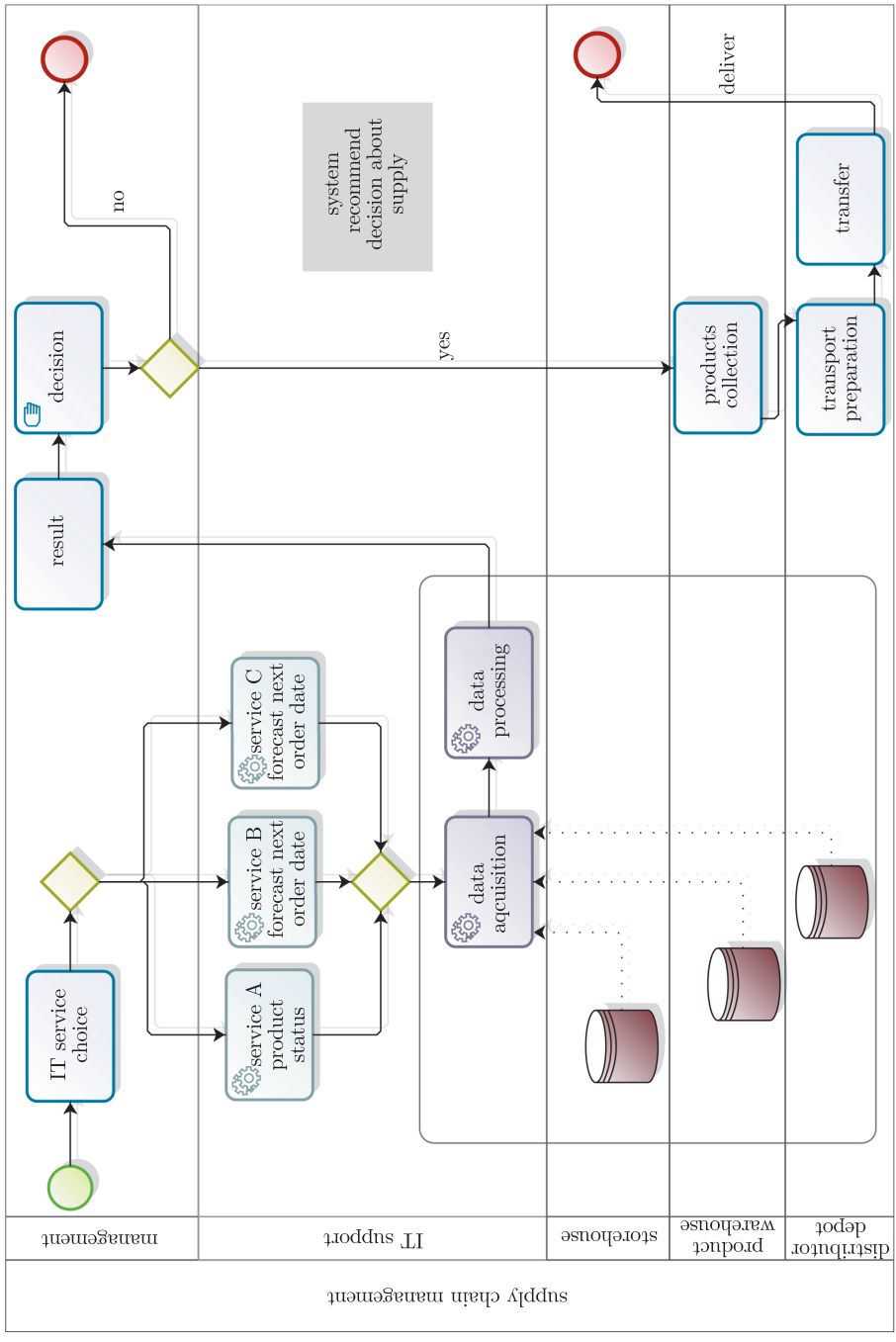

Figure 7. Workflow of product supply in a sales company expressed in BPMN

The process presented in Figure 7 initiates the need for a stock refill, and forecasts the future demand for products offered in the store by the sales company. In the next step, with the support of IT systems, a parallel analysis of supply is taking place. Well prepared IT services determine the storehouse status, and also show the sales historical data (transaction statistics). They collect and analyze them, so that IT system algorithms are able to predict the future demand for products, and then the manager is able to undertake the most optimal supply decision. If the manager makes an order, the information is dispatched to the manufacturers warehouse. When the product is ready to move, products are sent to the distributor, whose task is to deliver goods to the storehouse. By supporting the logistics process of IT systems, entrepreneurs do not have to worry about the lack of the product range in the store. Such scenarios can be followed when more than one product is sold. This approach is the Just In Time (JIT) methodology, which assumes that stocks should be available when the company needs them, and not earlier or later. Generally, the aim of using the IT technology in logistics processes is to manage the inventory, eliminate waste, and ensure timely delivery of orders to the customer. In practice, it is much more complicated, and many IT subsystems can be employed in such scenarios [11].

4. Implementation of complex it services by mashup approaches

To create service-oriented enterprises, we should use different kinds of IT services altogether, in contrast to human-oriented services (services), and point out the available data sources for processing. There are two different approaches to composite IT services: orchestration and choreography. The orchestration refers to business scenarios that can interact with both the interface and external IT services. It determines service execution under the message transfer level. In general, it is managed by one extra unit that coordinates the work of others. The specification called BPEL, following from BPMN, models the behavior of services in a business process interaction, very often by using workflows. First of all, it allows handling, receiving, replying, invoking of IT services. The choreography refers to peer-to-peer models without any coordinator. Collaborative protocols are described by the WSCI (Web Services Choreography Interface) that allows defining message exchanges between services. It supports message correlation, sequence rules, exception handling, transaction and dynamic collaboration which will be considered as orchestrating the IT services.

A representative case study can be a system scenario in a sales company which builds its sales offers using lists of the available supplier offers. It is likely that such a list is defined by managers who, by watching over business operations, can identify all opportunities (and serious problems) as they occur. Thus, they can ensure that there are IT services supporting such business scenarios, which are performing in accordance with the service level objectives. Of course, the buyer will decide about accepting or refusing the suggested proposals (list of

products). Another shopping scenario is that the seller automatically informs suppliers about the most popular products for buyers. Then, suppliers can adapt their product-gathering strategies. It is possible to model the above-considered scenarios by the BPMN (Section 3) and analyze their behavior the BPEL. Besides, special languages can be offered, *e.g.* the WS-CDL (Web Service Choreography Description Language), to describe such scenarios [12].

Management of such a distributed environment requires reliable and efficient extra services for both scenarios, business development and management. Configuring services into discrete logical components aligned directly with business execution and management functions can create a new architecture of the organization. We can orchestrate various services into many different configurations to support business processes. Management services, similarly to execution services, involve collections of services that communicate with each other in order to pass the same data on, to coordinate the same activities. A mashup is an approach that uses content from more than one source to create new services displayed in a single graphical interface [13]. For example, a seller could combine supplier offers with opinions of buyers to create new services belonging to the recommendation group. In brief, services of a proper kind can be prepared. Moreover, the mashup makes the existing data more useful, using it to communicate, for visualizations and execution. What is important, mashup composition tools are usually simple enough to be used by an end-user without programming skills. It is only some choice of GUI (Graphical User Interface) widgets and access to various services that are required.

We can distinguish three kinds of mashups: enterprise (business scenarios), consumer (behavior) and data (collection). The enterprise mashup defines scenarios that integrate the service and data resources with the externally available services, focusing data into a unique representation. In such a way they allow collaboration among businesses and developers. A data mashup focuses on transformation of similar types of data, and transforms it into a single representation. Changing the decision into appropriate services requires a business mashup approach. The customer mashup combines data from multiple public access thereto by browsers. Figure 8 shows three mashup types.

The architecture of mashup is also divided into three levels (Figure 9). The presentation layer supports the user's interaction with the technology such as HTML (HyperText Markup Language), CSS (Cascading Style Sheets), JavaScript. The service level represents the main functionality by using API services: XML-RPC, SOAP (Simple Object Access Protocol), REST (Representational State Transfer). The data level manages orders, receiving and storing information using the XML (Extensible Markup Language) technologies. Three high-level categories of items can be mashed together: user interfaces, artifacts, data and/or application functionalists. No service coding or deployment is required to integrate user interfaces for new applications. The opportunities take their descriptions from multiple sites and unite them in a new form that will be useful to these applications. A data-oriented mashup involves combing data in the XML form from one

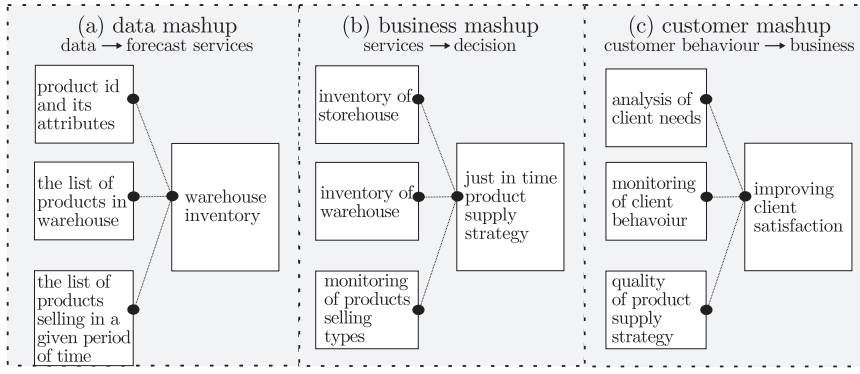

Figure 8. Service oriented scenarios for: data mashup (a), business mashup (b), customer mashup (c)

or more externally hosted sites together with applications typically using scripting techniques and languages. Much of such data is presented as DaaS (Data as a Service), *i.e.* a data-oriented service API (Application Programming Interface). It can be called without recycling to third-party processes or components between the service provider and the service consumer.

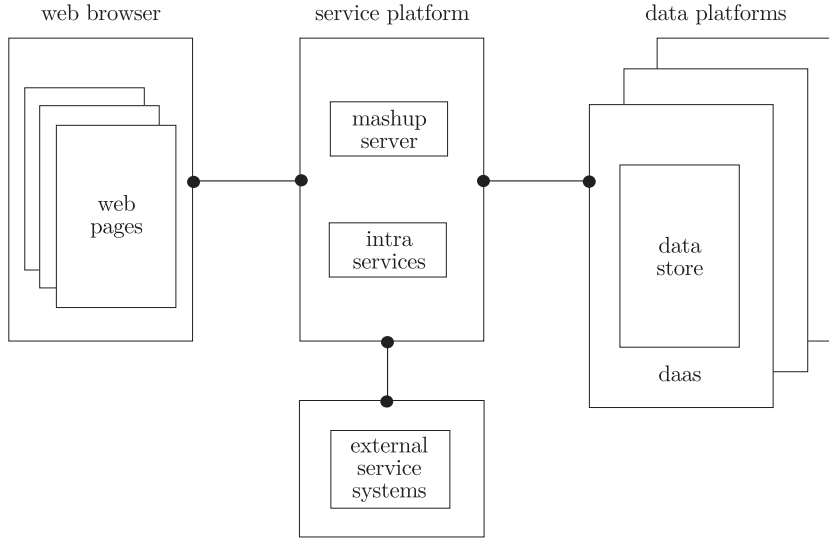

Figure 9. General mashup architecture

Due to the mashup technology, different services can be reused within other services to provide higher business flexibility. Moreover, the supported data services can also be unified and integrated. Then, management tasks are needed to coordinate and manage execution of all services supporting the organization activities. It corresponds to the service-oriented scenario shown in Figure 7. Due to the use of IT services, all decisions can be taken in a shorter time, and can be more efficient, because the inventory maintenance cost will be significantly decreased.

In a similar way, we can improve other different organizational activities. However, we need to create new IT services which support or execute the currently required human tasks.

5. Conclusions

Service-oriented processing for business organizations is presented in the paper. Furthermore, it is shown how to model and implement such structures. A new flexible service-oriented architecture is proposed, and it is shown how to describe and manage it using the Web technology. Moreover, mashup approach propositions are also discussed to create complex IT services and interpret them into service-oriented scenarios, which can also be easily modified and managed. It allows creating business-oriented systems on the basis of cloud computing technologies. The need for modeling has also been emphasized, an example of using a standard BPMN is presented and described. The proposed modeling approach gives an opportunity for better understanding of processes in the whole organization, and formulating chosen activities as IT services. In the case of complex services (consisting of other services) a mashup approach can be successfully used. It allows facilitating BPMN modeling and taking more details into account. In the paper, we focus on the technological aspects which allow adopting a general approach for description and implementation in various kinds of organizations. Additionally, implementation details of the proposed solution can be analyzed and evaluated. Moreover, other aspects of the enterprise project management, related to human and computer activities (briefly, services) can be taken into consideration.

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