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AUTOMATION IN BUSINESS PROCESSES

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Annotation: With the rise of the Web as the major platform for making data and services available for both, humans and applications, a new challenge has become prevalent requiring the support of workflows management. This is a mature technology for automating and controlling business processes. A general task of the development of the workflow system in the current business activities is the implementation of principles of the automatic control for business systems. These systems do not consist of pure technical components, but they integrate both human and human-computer activities and non-automatic interactions. Thus, the implementation of the principles of the automation will benefit the exploitation behaviour of the business systems. This paper presents an implementation of a workflow system applied for the academic practice of a research organization. Illustrations with application of workflow design tools for modeling and execution are given.
Key words: automation of business processes, workflow management, choreography, orchestration

1. INTRODUCTION

The workflow management systems or business process management systems developed in the late 1980s enable the automated coordination of activities, data and resources. This coordination is formalized in a workflow model specified at the build-time stage [1]. The architecture of workflow management systems can be separated in a development environment (modelling with build time component) and an execution environment (run time engine component) [10]. Workflow Management Systems are a mature technology for automating and controlling business processes [4,5]. One widely accepted definition of workflow comes from the Workflow Management Coalition [9]: "Workflow is the computerized facilitation or automation of a business process, in whole or part".

The "workflow management system" becomes important term. *Workflow* can be defined as "the sequence or steps used in business processes" [6]. A general task of the development of the workflow system in the current business activities is the implementation of principles of the automatic control for business systems. These systems do not consist of pure technical components. They integrate both human and human-computer activities and non-automatic interactions. Thus, the implementation of the principles of the automation will benefit the exploitation behaviour of the business systems.

2. WORKFLOW MANAGEMENT

Workflow Management is supporting and controlling the workflow. An important objective in Workflow Management is to automatically route artefacts (documents, messages, e-mails) through a network to actors having predefined roles. The routing is done according to a set of predefined rules, and is often controlled by the state of the artefact (e.g., the price). Business rules are particularly important for routing of artefacts.

Workflow management deals with supporting business processes in organizations and it involves managing the flows of work through an organization [1]. Workflows are a collection of coordinated tasks designed to carry out a well-defined complex process [7]. A workflow management system is a generic information system that supports modelling, execution, management and monitoring of workflow. Many different workflow management systems have been developed that focus on different application domains and provide different functionality [2]. Workflow management lacks a standardized theory that provides a theoretical background for workflows like the relational algebra provide for databases [1]. Despite efforts of standardization bodies, there is no consensus on the representation or conceptual model of workflow processes [8]. In this diverse and complicated landscape, it is a challenge to evaluate and compare the functionality of various workflow management systems and to survey the functional requirements of workflow management systems. A number of approaches attempt to address this situation. In [3] there are described a lot of essential perspectives and aspects of comprehensive workflow management functionality. They provide a structure in the complex environment of workflows. In [2] it is systematically analyzed available functionality in existing workflow management systems, and they are categorized in a number of *workflow patterns*. For the evaluation of the software tools, deploying workflow technologies, an integrated view is applied combining both qualitative and quantitative indicators to assess them for their support in workflow management systems.

In the sixties information systems were built on top of a small operating system with limited functionality. These systems mainly consisted of tailor-made applications. New types of product software added new functionalities since then. Database management systems offer functionality, which used to be in tailor-made applications. This trend leads to the shifted emphasis from programming to assembling of complex software systems. The coding of individual modules is already an old approach. The challenge now is orchestrating and combining pieces of software from the different functional layers. Another trend is the shift from data to processes [2]. The same source points out the seventies and eighties as dominated by data-driven approaches. At that period, the information technology is associated with storing and retrieving information and as a result, data modelling was the starting point for building an information system. The processes had to adapt to information technology and modelling of business processes were often neglected. On the contrary, today the emphasis is on processes, for instance business process reengineering.

3. CHOREOGRAPHY LANGUAGES

A common characteristic of choreography languages is that they concentrate on the specification of the *observable behaviour* of communicating services. They describe which messages are exchanged between services in a specific situation. Therefore they do not prescribe *how* the services have to be *implemented* to be able to exchange the messages. Choreography languages are not executable. The refinement of the specification to executable languages like orchestration languages has to be supported by appropriate mappings and transformations between both kinds of languages.

Comparing choreography languages with programming languages shows many similarities. The definition of data types has to be supported, either explicit or implicit. The definition of control structures has to be supported. Calls to existing functions/services have to be supported. Newer standards are based on formal calculi like Petri nets or the Πi-calculus.

4. ORCHESTRATION LANGUAGES

The term "orchestration" was introduced to describe the flow of communication as multi-step, long-lived business process from one party's view. Languages used to write these processes in a way that software systems (i.e. workflow engines) can execute them are called orchestration

languages. There has been much effort invested in orchestration languages area in the last 15 years. The early work included XLANG designed by Microsoft for their BizTalk Server and WSDL proposed by IBM. These two languages have been superseded by BPELWS created by Microsoft, IBM and BEA. Another effort was made by the WfMC and resulted in the publication of XPDL in version 1.0 in 2002. In order to reach full compliance with BPMN work, XPDL has been further developed into version 2.0. The third important initiative in the orchestration standards area was created by OASIS, UN/CEFACT, and commercial organizations such as Intel or SAP. As a result of these efforts, the ebXML family of standards has been published (with CPPA as an orchestration language). Version 2.0 has been approved as an ISO standard.

5. A NETWORKED WORKFLOW INTEGRATION EXAMPLE

To illustrate the possible integration of networked workflow components here are introduced examples of services. It is examined the possible integration, applying the methodology of the workflow management. These services are propriety ones, developed and used by an academic institution like Institute of computer and communication systems, Bulgarian Academy of Sciences. Using their integration, it is illustrated the operational rules applied with the workflow tools for design and execution. The services applied here origin from the academic practice. They are called service for "Scientific Citation" and service "Paper Submission". The idea behind the examples is to integrate these services. When a paper is accepted for publication by the service Submission, the appropriate references from the paper have to be copied and included in the database of the service Citation. Thus all actual and newly published and accepted papers will be referred by the service Citation.

A choreography approach for the creation of workflow "Request for a service scientific citation". A customer contacts the service provider to obtain an offer for a **S**cientific **C**itation (SC). The architecture of the service "Scientific Citations" is designed by Enhydra Java Workflow Editor (JaWE) and it contains three hierarchical tiers.

The first functional tier defines the clients (User) of the workflow system. The user is assumed to apply web browser for the invocation of the SC service. The service is performed by the main server side application. The communication between the User and the SC service is implemented by HTTP protocol.

The second tier consists in a Web server. After a User's request for SC service, the server starts to process the SC request.

The third level is constituted by database engine. The server side applications using the input object of the SC service processes the request from the database and constitutes the LISTS of the output object of the SC service.

The general functional scheme of the SC service with the main architecture blocks, performing the service, is given in Fig.1.

To get experience with the workflow standards applied for workflow modeling and management the Citation Service has been specified with the workflow software suite Enhydra Java Workflow Editor (JaWE). This product supports the XPDL standard for workflow modelling. The core functions related to searching and retrieving functionalities are implemented as:
- Specification of the structure of the objects exchanged between the client machine and the database on the server machine.
- Specification of the results set (definition of the LIST objects).
- Application of modelling and execution objects of Enhydra workflow platform.
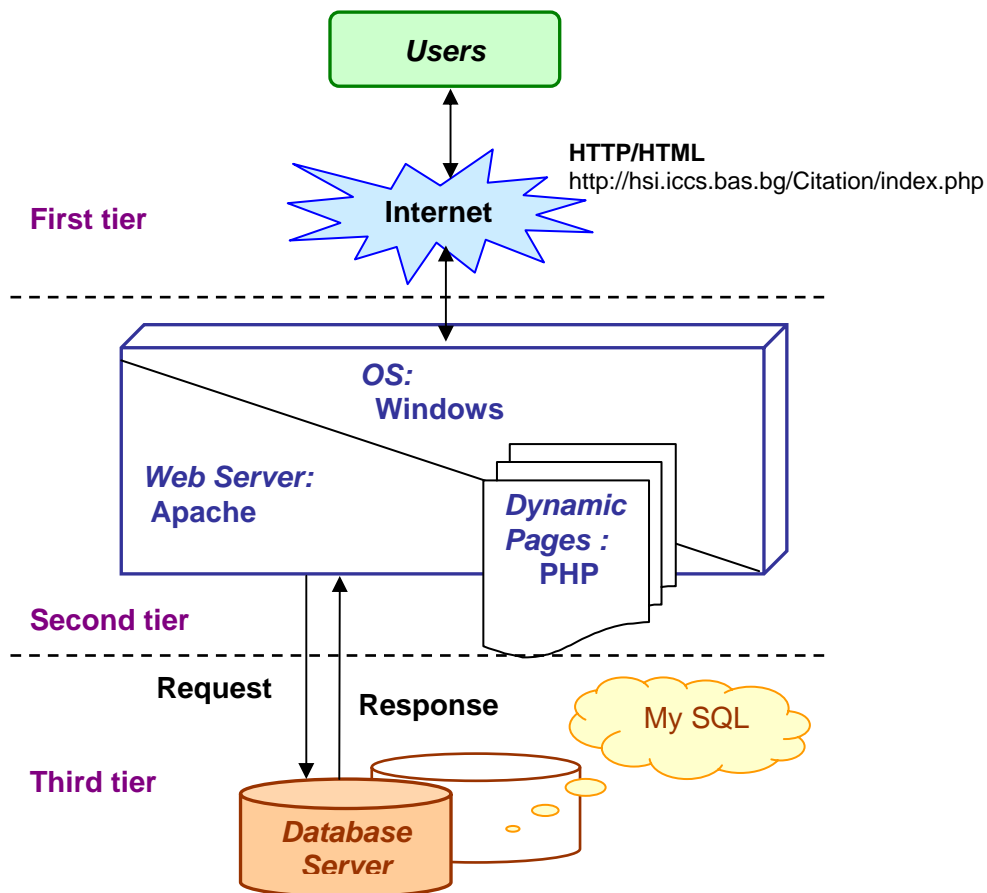- Formal presentation in XPDL standard of the SC service.

Fig. 1. Graphical representation of the components of the workflow "Science Citation"

The SC service in the Enhydra platform is constituted by four functional packages: Citation Process, General Search Citation, Search Citations members only, Edit New Data. The workflow network for the Citation Service is presented in Fig. 2, [11]. It includes four main packages: Citation Process, General Search Citation, Search Citations members only, Edit New Data processes. This scheme presents the workflows and the appropriate logical rules, which take place during the SC service invocation.
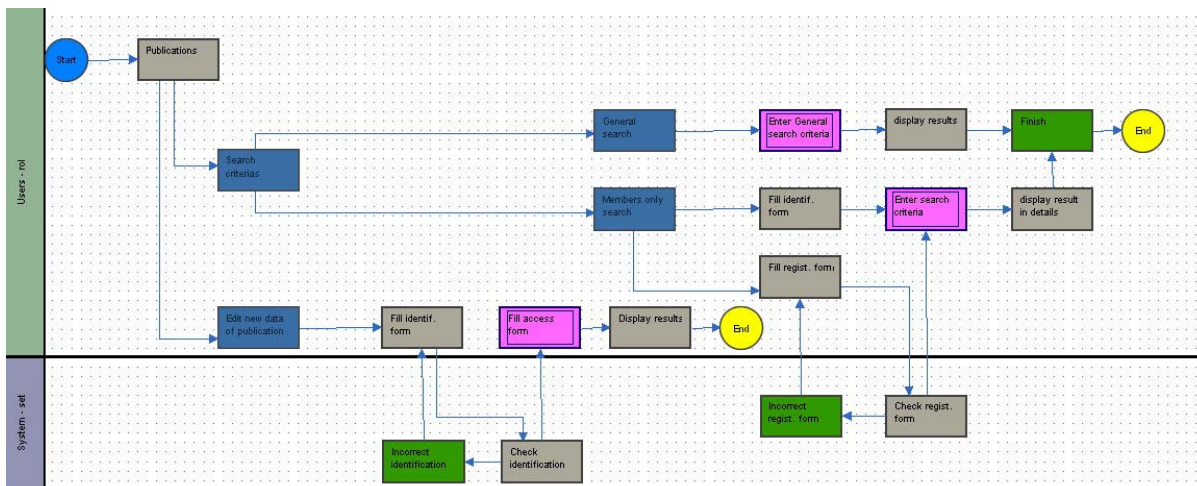

Fig. 2. Science Citations as Workflow Service - basic model, Process level.

Two main sub-processes: "Enter General Search criteria" and the sub-process "Enter search criteria Members only" are derived explicitly for the workflow modelling. The sub-processes functional architecture is given in Fig 3, [11].
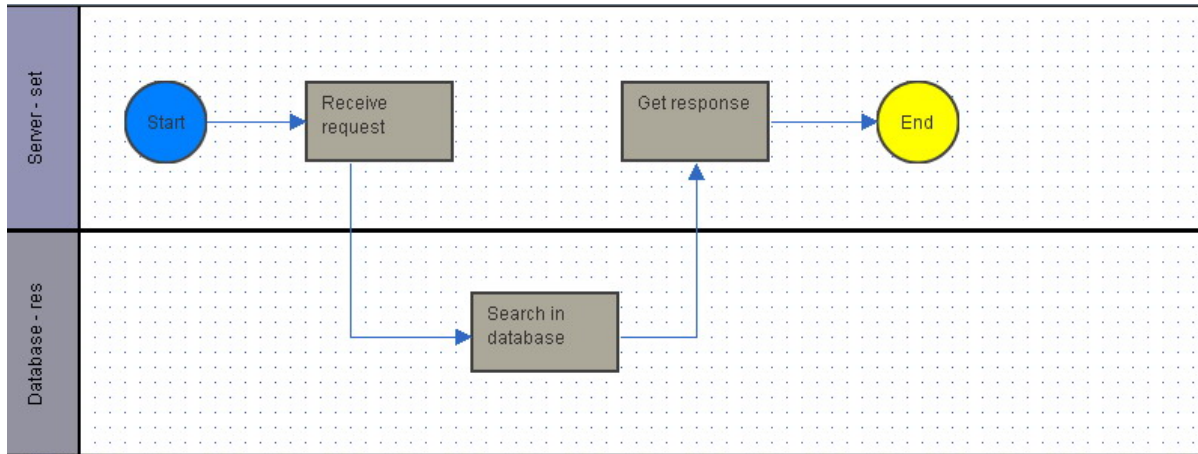

Fig. 3. Workflow sub-process "Search"

Thus, the modelling of the SC services by Enhydra platform starts with building a Meta-Model Framework, which describes the functional architecture of the services. This meta-data model identifies commonly used entities and sub-processes within the Package, their relationships and attributes. A variety of attributes describe the characteristics of the SC sub-processes. The tool Enhydra Java Workflow Editor allows the designer to create, manage and review workflow process definitions and formalize them in XPDL standard. An XPDL file is created and used for the execution at runtime by a workflow engine. In particular Enhydra Shark engine supports both model simulation, model execution and model monitoring workflow functionalities, Fig. 4.
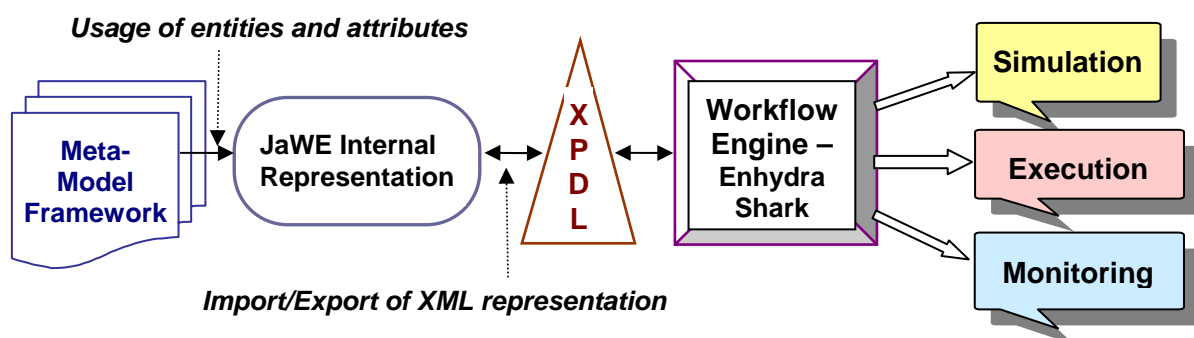

Fig. 4. The workflow SC service execution with Enhydra platform

6. CONCLUSIONS

For the implementation of workflow mangement, it is necessary to keep a common standard for the workflow service specification and modelling. The orchestration tools, which perform execution of the workflow services, have to support the compatibility with the Designer workflow tools. Particularly, the SC service has been modelled with tools, supporting XPDL workflow standard. The implementation of the service will have different instances according to the workflow engine invocation. The general idea is to integrate the output of the Paper Submission service for the accepted papers with the databases of Science Citation service. Thus, in an automatic way the references of the new accepted papers can be transmitted to the repositories of the Science Citation service. This integration can be implemented in a common workflow management system, negotiating two workflow services.

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