Modelling of web services in web information systems using Enhydra JaWE

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Abstract: *This paper aims to present Enhydra JaWE (Java Workflow Editor) which is an open source graphical Java workflow process editor. Using a visual tool, this product allows the user to create, manage and review workflow process definitions. JaWE supporting XPDL (XML Process Definition Language) as its native file format and divides itself into two logical parts: Package Level and Process Level. This paper examines the potential, essence and functional possibilities of Enhydra JaWE and is proposed decision for Web Services in the Web Information Systems (Index for Citations as Web Service).*

Key words: *Information systems, Web service, Workflow management system, Process Definition, XPDL, WfMC, LDAP, E-services, Business process*

Introduction

WfMC provides an interface for defining workflow processes that uses a common meta-model for describing the process definition and XML schema for the interchange of process definitions called XML Process Definition Language (XPDL). This paper is focused on the XPDL Interface and how Enhydra JaWE (Java Workflow Editor) implemented it. Enhydra workflow platform is an Open Source WfMC and OMG compliant Java workflow solution consisting of an editor for XPDL and a powerful and flexible Java XPDL workflow execution engine. JaWE is a graphical Java workflow process editor. It is an open source product. Using a visual tool, this product allows the user to create, manage and review workflow process definitions. JaWE supporting XPDL as its native file format and LDAP connections. XPDL provide a formal model for expressing executable processes that addresses all aspects of enterprise business processes. JaWE divides itself into two logical parts: Package Level and Process Level. The Package level manages entities and attributes within the Package, while Process level manages entities and attributes within Workflow Process Definition. Enhydra workflow platform is used for Integration of Web Services in Internet. In the paper is proposed decision for Web Services in the Web Information Systems (Index for Citations as Web Service) [1], [2].

XML Process Definition Language (XPDL)

The XPDL specification uses XML as the mechanism for process definition interchange. XPDL forms a common interchange standard that enables products to continue to support arbitrary internal representations of process definitions with an import/export function to map to/from the standard at the product boundary.

The XPDL grammar is directly related to these objects and attributes. This approach needs two operations to be provided by a vendor:

- Import a process definition from XPDL
- Export a process definition from the vendor's internal representation to XPDL

An XPDL package corresponds to a Business Process Diagram (BPD) in BPMN, and consists of a set of Process Definitions.

The process definition may contain references to subflows, separately defined, which make up part of the overall process definition. An initial process definition will contain at least the minimal set of objects and attributes necessary to initiate and support process execution. Some of these objects and attributes will be inherited by each created instance of the process.

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The meta-model describes the top-level entities contained within a Process Definition, their relationships and attributes, including some which may be defined for simulation or monitoring purposes rather than for enactment. It also defines various conventions for grouping process definitions into related process models and the use of common definition data across a number of different process definitions or models.

The process model includes various entities whose scope may be wider than a single process definition. In particular, the definitions of participants, applications and relevant data may be referenced from a number of process definitions. The meta-model assumes the use of a common process definition repository to hold the various entity types comprising the process definition. Within the repository itself and to support the efficient transfer of process definition data to/from the repository, the concept of a package is introduced, which acts as a container for the grouping of common data entities from a number of different process definitions, to avoid redefinition within each individual process definition.

The Package provides a container to hold a number of common attributes from the process definition entity like author, version, status, etc. Each process definition contained within the package will automatically inherit any common attributes from the package, unless they are separately re-specified locally within the process definition. An XPDL Package corresponds to a BPMN Business Process Diagram.

Within a package, the scope of the definitions of some entities is global and these entities can be referenced from all process definitions (and associated activities and transitions) contained within the package.

The meta-model for the Package identifies the entities and attributes for the exchange, or storage, of process models. It defines various rules of inheritance to associate an individual process definition with entity definitions for participant specification, application declaration and relevant data field, which may be defined at the package level rather than at the level of individual process definitions.

XPDL is Web services oriented. An activity in a process may invoke a Web service. The ExternalReference, one of elements defined in the XPDL specification, may be used as a reference to applications and data types that are defined in Web service (WSDL) documents. It is also possible to process faults generated by the Web service operation. Messaging in XPDL is based on the WSDL model.

Another concept defined in the XPDL specification is *Partner Link*. Partner links define a communication link between two parties, each assuming a role in the communication. From a modelling perspective the roles are normally, but not always, given by the name of a pool or lane. If used this way, the message flow between two pools will correspond to a partner link with each role corresponding to the name of the corresponding pool. The relation between supplier (one role/pool) and buyer (second role/pool) in a supply chain protocol can be a good example of such a partner link.

Partner links are optional and normally used to model the communication at an abstract level using WSDL and port types. A *WebServiceOperation,* one XPDL element, can use a partner link for abstract modelling of a service when a concrete Web service is used and the port name is used instead of the port type. Partner links are defined at two levels:

- The *package level*: the partner link type defines a partner link name and one or two roles. The basic information about the partner link is defined at this level.
- The *process level*: the partner link itself is defined using the partner link type. This allows partner link types to be reusable at the package level.

Enhydra Java Workflow Editor (JaWE)

Enhydra JaWE (Java Workflow Editor) [3] is an open source graphical Java workflow system. Using a visual tool, this product allows the user to create, manage and review workflow process definitions. As its native file format JaWE support XPDL (XML Process Definition Language) and also LDAP connections.

JaWE accomplished three main goals:

- Graphical representation of process definition
- Export of process definitions to XPDL
- Import of any valid XPDL and its graphical representation

The workflow process definition interface defines a common interchange format, which supports the transfer of workflow process definitions between different products. A workflow process definition, generated by JaWE, is capable of interpretation in different workflow run-time products. The principles of Process Definition Interchange are based on Meta-Model framework. The Meta-Model identifies commonly used entities within a process definition, their relationships and attributes. A variety of attributes describe the characteristics of this limited set of entities. Using this Meta-Model, JaWE can transfer models using a XPDL as a common exchange format. Beside this interchange, JaWE is also used for internal representation of process definitions. The whole concept is shown on Figure 1.

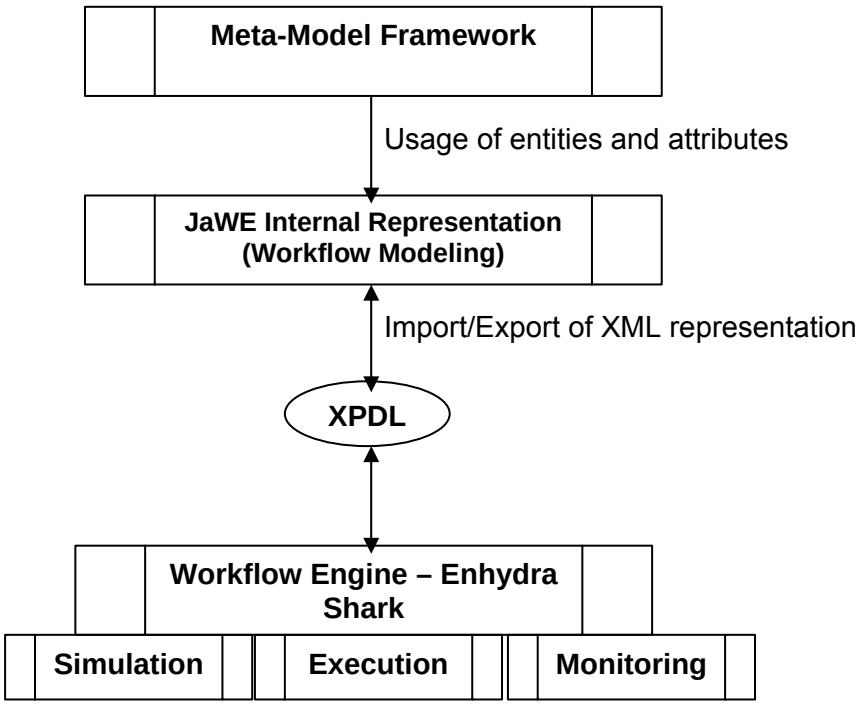

Figure 1. Concept of the Process Definition Interchange based on Enhydra platform

The meta-model identifies the basic set of entities used in the exchange of process definitions. The top-level entities are as follows [4], [5]:

- *Workflow Process Definition* - The Process Definition entity provides contextual information that applies to other entities within the process. It is a container for the process itself and provides information associated with administration or to be used during process execution.
- *Workflow Process Activity* - A process definition consists of one or more activities, each comprising a logical, self-contained unit of work within the process. An activity represents work, which will be processed by a combination of resource and/or computer applications.

- *Transition Information* - Activities are related to one another via flow control conditions (transition information). Each individual transition has three elementary properties, the from-activity, the to-activity and the condition under which the transition is made. Transition from one activity to another may be conditional or unconditional. The transitions within a process may result in the sequential or parallel operation of individual activities within the process.
- *Workflow Participant Declaration* - This provides descriptions of resources that can act as the performer of the various activities in the process definition. The particular resources, which can be assigned to perform a specific activity, are specified as an attribute of the activity, participant assignment, which links the activity to the set of resources which may be allocated to it.
- *Workflow Application Declaration* - Workflow application declaration is a list of all applications or tools required and invoked by the workflow processes. Such applications may be generic industry tools, specific departmental or enterprise services, or localized procedures implemented within the framework of the workflow management system.
- *Workflow Relevant Data* - This defines the data that is created and used within each process instance during process execution. The data is made available to activities or applications executed during the workflow and may be used to pass persistent information or intermediate results between activities and/or for evaluation in conditional expressions such as in transitions or participant assignment.
- *System & Environmental Data* – It is maintained by the workflow management system or the local system environment, so it is not implemented in JaWE.
- *Resource Repository or Organizational Model* - Resource Repository is external to the workflow process definitions. In some complex processes, participant declaration may refer to a resource repository, which may be on Organizational Model (OM). WfMC Meta-Model specification defines a simple in-built (Minimal) Organizational Model or permits access to an externally defined OM.
- *Data Types and Expressions* - The meta-model (and associated XPDL) assumes a number of standard data types (string, reference, integer, float, etc.); such data types are relevant to workflow relevant data, system or environmental data or participant data. Expressions may be formed using such data types to support conditional evaluations. JaWE has possibility to declare its own types.

All of these entities are maintained by JaWE, except "System & Environmental Data".

JaWE divides itself into two logical parts: Package Level and Process Level. As will be explained in detail below, the Package level manages entities and attributes within the Package, while Process level manages entities and attributes within Workflow Process Definition.

1. Package level

At the Package level, the user is allowed to choose among several XPDL views such as graphical, text, and xpdl view which represent the XPDL as it will be saved into file. Graphical view of package level is divided into some parts. Left side of the main window shows Package Hierarchy Tree. Right side of the main window displays workflow processes defined in package which is selected on the hierarchy tree. Processes are presented only symbolic with not many information about process and with no graphical layout of process elements (activities and transitions). All details about process are provided in 'Property' menu item from context menu of a selected process.

On the Figure 2 below are shown several workflow processes defined within one package. The package acts as a container for grouping together a number of individual process definitions and associated entity data, which is applicable to all the contained process definitions.

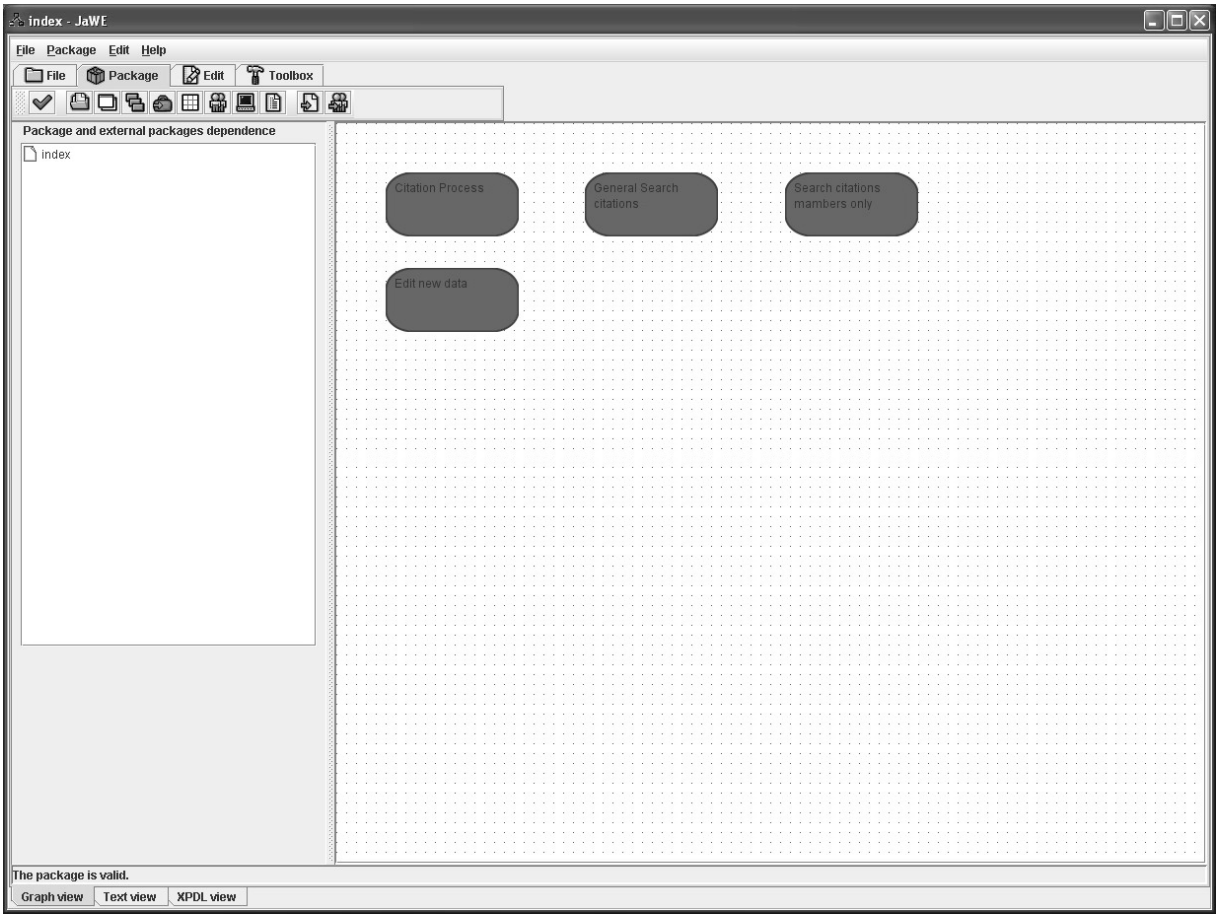

Figure 2. Package level

2. Process level

The second part of JaWE is Process level. This part of JaWE is used for graphical representation of process definition and for defining attributes of entities on that level. In the visible working area, the user inserts visible objects and adjusts them. The first thing drawn must be a participant, after which the user may insert other elements such as Activities and Transitions.

In JaWE are defined four kinds of Activities as follows:

- Generic Activity - Most activities are atomic (generic activity), the smallest units of work, although even atomic activity may produce more than one work item for a performer, or may invoke more than one application.
- Sub-Flow Activity - Subflow is another activity type that implements a whole new workflow process. Process definitions within the subflow are entirely independent of the first one (where the subflow activity resides). Each subflow has its own set of activities, internal transitions, participants, application definitions, and other workflow relevant data. Participants, application definitions, and other workflow relevant data may be inherited from the model that is common for both workflow process definitions.
- Block Activity - An activity may be a block activity that executes an activity set or a map of activities and transitions. The work-around is to create a separate process with a set of activities.
- Route Activity - A dummy (route) activity does nothing on its own. This type of activity is used for synchronization and constructing complex and sophisticated transitional conditions (i.e., activity pre- and post- conditions).

The link between two activities is established by transitions. Transitions are more

than just link between activities. They describe possible transitions between activities and the conditions that enable or disable them during workflow execution. JaWE has three types of transition - simple, self-routed and circular. Simple transition is link between two activities, represented graphically with one straight line. Self-routed transition is link between two activities which is graphically 'broken' in three parts, and circular transition is transition from activity to itself, and is graphically represented as a circle with an arrow.

On the Figure 3 below is shown graphical representation (model) of web service for citations includes participants, activities and transitions.

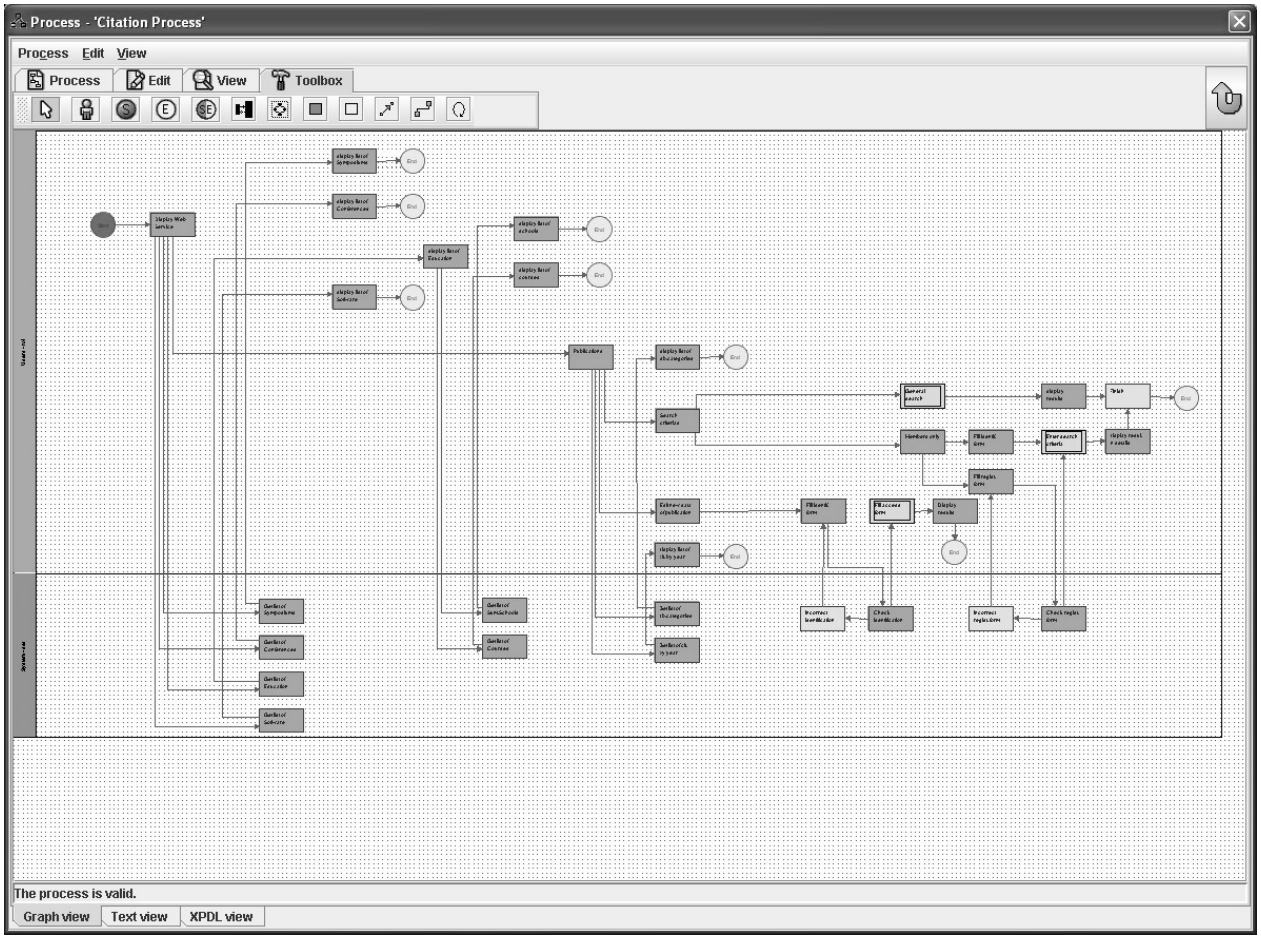

Figure 3. Process level

Conclusions and future work

This paper defines in essence XML Process Definition Language (XPDL) standard and examines the potential, essence and functional possibilities of Enhydra Java Workflow Eeditor. Special features of modelling on Web Services and their application in the Web Information Systems are outlined. Proposed is a decision for Web Service - Index for Citations in the Web Information Systems. Software components of the product are described. The product is platform and software independent. As a future work is the problem for optimization of Index for Citation as Web Service in Internet.

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