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Data Modeling of Workflow-XML Resource Model

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Abstract. Workflow has an important role, which is that it provides back-end services to respond to front-end requirements. The workflow technique reduces the process time, allocates resources effectively and improves the performance of enterprises. Workflow-XML(workflow-XML) is the language defining an XML-based protocol suggested for the mutual interoperability of a workflow engine, as an asynchronous web service protocol. We define a rule that changes a Workflow-XML document to a UML class diagram and a collaboration diagram. And each entity that comprises a Workflow-XML resource model is modeled in a class diagram, and interoperability between entities verifies the proposed method mapped by the collaboration diagram. For this, this paper defines the mapping rule to convert a Workflow-XML document to a UML class diagram and collaboration diagram, and suggests a technique to model each entity of a Workflow-XML resource model to a class diagram and the interaction between entities to a collaboration diagram.

Keywords: Asynchronous Web Service, Modeling, UML, Workflow-XML, XML, XML-based protocol

1. Introduction

'Workflow' is the representative technique to standardize the above business process, and the standard for the 'workflow' is presented as the reference workflow model by the 'Workflow Management Coalition' so that part of the process between and among services executing homogeneous or different workflows can be delivered to a different workflow service, providing collaborative work[1]. Workflow-related providers have developed and used Workflow-XML, a XML-based protocol language in order to allow inter-working between workflow engines.

Therefore, this paper suggests a modeling method facilitating business partners to comprehend the workflow for their interlinking of workflow engines. It also supports cooperation by modeling the resource model provided by Workflow-XML through a UML(Unified Modeling Language)[2, 3] diagram.

2. Related Studies

This chapter compares and analyzes the previous studies relating to XML schema and Workflow-XML document modeling. Firstly, [2-4] are related by modeling an XML schema to a UML class diagram. In [2], a method of modeling an XML schema structure to a UML class diagram is suggested.

Based on the expression of [5], this study includes the correlation between classes and establishes the rule to convert an XML schema to a UML class diagram. In addition, [3] and [4] describe the modeling procedure of an XML schema for major objects. Especially, they suggest a modeling procedure such as stereo-type, number of repeats, inherited class attributes and others in detail.

Surveying the several studies about XPDL document modeling, [5] expresses the business process in a production system using the workflow concept as a UML activity diagram and [6] designs a distributed

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collaborative work flow as a UML diagram. In [5], the entities of a production system applying the workflow concept are expressed as a UML class diagram, and the detailed process activities are modeled as a UML activity diagram. Since the study models the work flow of a specific stream mainly with an activity diagram, the mapping technique is not mentioned in detail.

3. Asynchronous Web Service Protocol

A web service interface can be classified into two types; synchronous web service and asynchronous web service. These two architectures can be distinguished by the request-response process method. While in synchronous service a client makes a request for service and waits for the response, in asynchronous service (check) a client makes a request for service and continues the previous work, instead of waiting for the response.

3.1. Workflow-XML Resource Model and Method

The workflow system using an asynchronous web service provides asynchronous service based on the workflow system resource model suggested by the Workflow-XML standard, as the major components are interoperating with each resource. Workflow-XML defines 5 types of resources according to the roles of operation, as presented in Fig. 1.

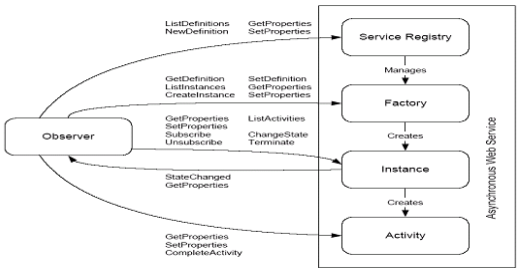

Fig. 1: Workflow-XML resource model

4. Workflow-XML Resource Type Entity Modeling

The entities of the Workflow-XML resource model are expressed with a Workflow-XML schema. The following shows the definition to map the Workflow-XML schema as a UML class diagram.

> **[Definition 1]** To execute a web service, the Workflow-XML schema for each entity of the Workflow-XML resource model is mapped as a UML class diagram.

4.1. Observer Resource Entity

The Observer resource entity is expressed as <<observerPropertiesGroup>> in the Workflow-XML, and the modeling rule is as follows.

> **[Rule 1]** The observerPropertiesGroup element is expressed in the <<Group>> stereotype and the sub-element is expressed as a grouping relation(◆).

The following figure shows the results when [Rule 1] is applied to the observer resource element.

```
<xsd:group
  name="observerPropertiesGroup">
 <xsd:sequence>
   <xsd:element name="Key" type="xsd:anyURI"/>
 </xsd:sequence>
</xsd:group>
```

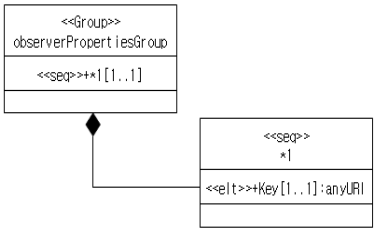

Fig. 2: <observerPropertiesGroup> Example of an element and the modeling results

4.2. ServiceRegistry Resource Type Entity

ServiceRegistry entity is expressed as <<serviceRegistryPropertiesGroup>> and the modeling rule is as follows.

> **[Rule 2]** The serviceRegistryPropertiesGroup is expressed in <<Group>> stereotype, the sub-element is expressed as a grouping relation(◆) and the external reference element is expressed as a <<elt>> stereotype.

The following figure shows the results when [Rule 2] is applied to the service registry element.

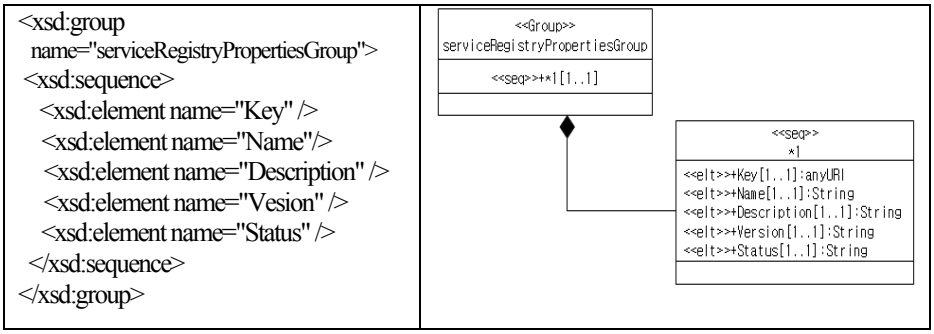

Fig. 3: Example of <serviceRegistryPropertiesGroup> element and the modeling results

4.3. Factory Resource Entity

The Factory resource entity is expressed as <<factoryPropertiesGroup>> in the Workflow-XML and the modeling rule is as follows.

> **[Rule 3]** The factoryPropertiesGroup is expressed in <<Group>> stereotype, the sub-element is expressed as a grouping relation(◆) and the external reference element is expressed as a <<elt>> stereotype.

The following figure shows the results when [Rule 3] is applied to the service registry element.

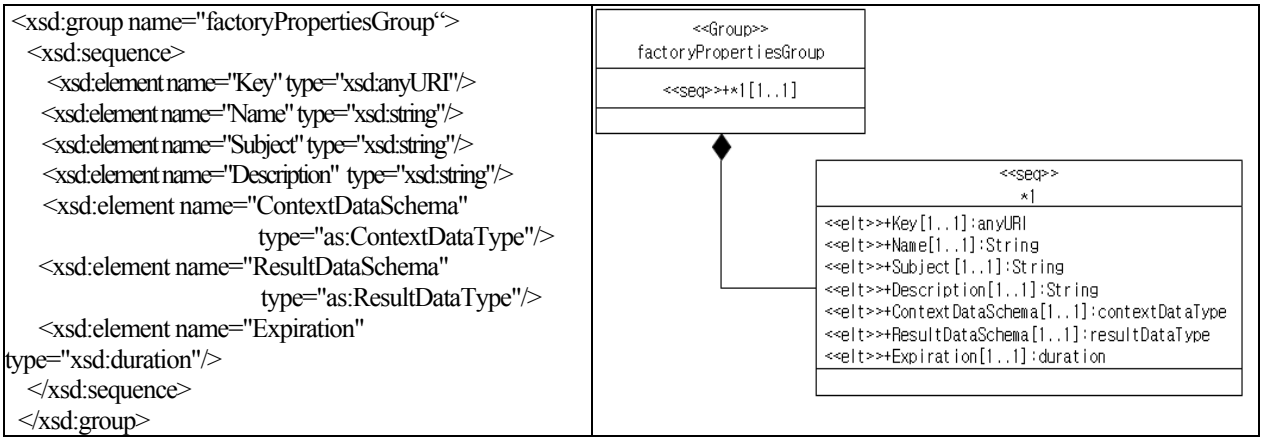

Fig. 4: Example of a <Factory> element and the modeling results

4.4. Instance Resource Type Entity

The Instance resource entity is expressed as <<InstancePropertiesGroup>> in the Workflow-XML and the modeling rule is as follows.

> **[Rule 4]** The instancePropertiesGroup is expressed as a <<Group>> stereotype, the sub-element is expressed as a grouping relation(◆) and the external reference element is expressed as a <<elt>> stereotype. In addition, the composite data type of Observers, ContextData and ResultData is expressed as a <<ComplexType>> stereotype.

The following figure shows the results when [Rule 4] is applied to the service registry element.

```
<xsd:group name="InstancePropertiesGroup">
  <xsd:sequence>
    <xsd:element name="key" type = "xsd:anyURI"/>
    <xsd:element name="state" type="stateType"/>
    <xsd:element name="Name" type="xsd:string"/>
    <xsd:element name="Subject" type="xsd:string"/>
    <xsd:element name="Description" type="xsd:string"/>
    <xsd:element name="FactoryKey" type="xsd:anyURI"/>
    <xsd:element name="Observers">
</xsd:group>
```

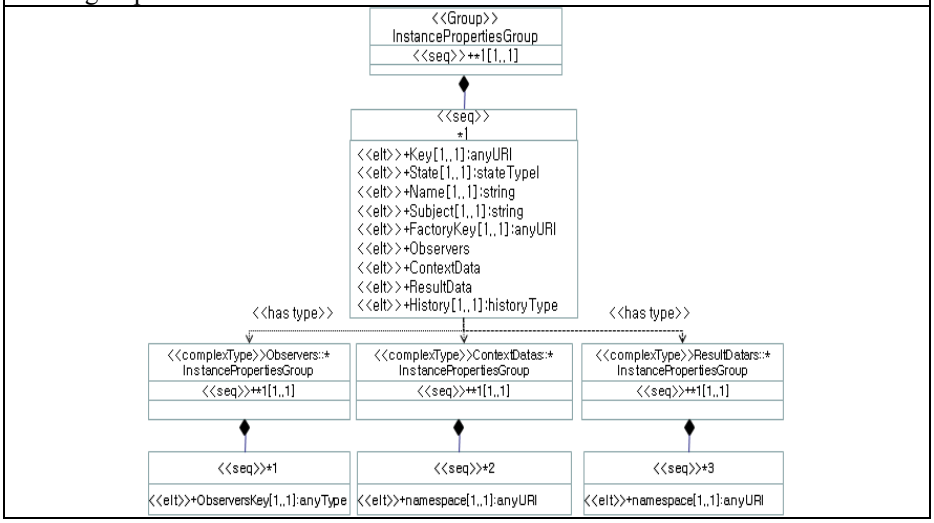

Fig. 5: Example of <InstancePropertiesGroup> element and the modeling results

4.5. Activity Resource Type Entity

The activity resource entity is expressed as <<activityPropertiesGroup>> in Workflow-XML and the modeling rule is as follows.

[Rule 5] The activityPropertiesGroup expressed in <<Group>> stereotype, the sub-element is expressed as a grouping relation(◆) and the composite data type of external reference elements is expressed in the <<ComplexType>> stereotype.

The following figure shows the results when [Rule 5] is applied to the service registry element.

```
<xsd:group name="activityPropertiesGroup">
<xsd:sequence>
   <xsd:element name="Key" type="xsd:anyURI"/>
   <xsd:element name="State" type="as:stateType"/>
   <xsd:element name="Name" type="xsd:string"/>
   <xsd:element name="Description"
type="xsd:string"/>
   <xsd:element name="ValidStates">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="ValidState" type="as:stateType"
minOccurs="0"
                        maxOccurs="unbounded"/>
    </xsd:sequence>
  </xsd:complexType>
 </xsd:element>
   <xsd:element name="InstanceKey" type="xsd:anyURI"/>
   <xsd:element name="RemoteInstance" type="xsd:anyURI"/>
   <xsd:element name="StartedDate" type="xsd:dateTime"/>
   <xsd:element name="DueDate" type="xsd:dateTime"/>
  <xsd:element name="LastModified" type="xsd:dateTime"/>
 </xsd:sequence>
</xsd:group>
```

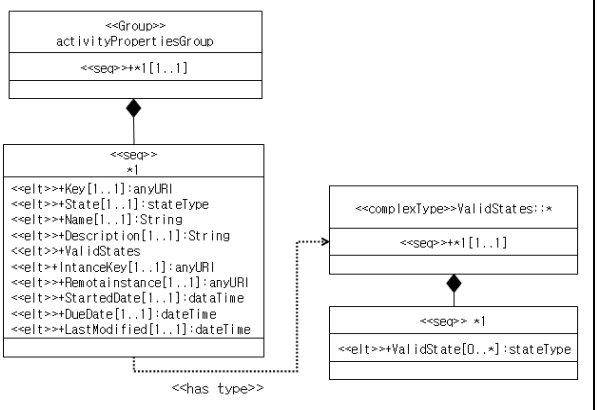

Fig. 6: Example and modeling result of <activityPropertiesGroup>

5. Conclusion and Further Works

In the age of e-commerce, workflow has an important role, which is to provide back-end services to respond to front-end requirements. The workflow technique reduces the process time, allocates resources effectively and improves the performance of enterprises.

The process definition in the workflow contains all of the necessary information related to the business process and is executed by the workflow management system.

The resource model that is offered in the Workflow-XML for interoperability of different workflow engines in this paper performs modeling using an UML diagram. Also, we a propose model that improves the ease of analysis for business flow for interoperability and cooperation. So, we define a rule that changes a Workflow-XML document to a UML Class Diagram and Collaboration Diagram. Each entity that comprises a Workflow-XML resource model is modeled in a Class Diagram, and interoperability between entities verifies that the proposed method is mapped by a Collaboration Diagram.

The contribution of this works is as follows: (1) standardization that proposes new modeling techniques and applies a mapping rule historically with UML notation. (2) basis technology for internal and external workflow integration in a corporation. (3) system design and implementation method for workflow integration.

Future works will apply an actuality situation about a business process that is achieved by a web service and embodied by a Workflow-XML. Also, the research result can be obtained by using a standard workflow process internal and external to a national corporation, because modeling is performed in a normalized manner.

6. References

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