

## GeoWeb Services Orchestration Based on BPEL or BPMN?

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**Abstract.** Comparison of GeoWeb services orchestration based on BPEL and BPMN became an unplanned task during research project “GeoWeb services orchestration” GA 205/07/0797. The project is solved at the Institute of geoinformatics, VSB-TU of Ostrava. The project is focused on GeoWeb services orchestration and usage of generally used languages for description and design of business processes. There are a lot of languages available at the moment. This paper is focused mainly on comparison of two languages that represents two different levels of abstraction of a business process description. Compared are BPMN (Business Process Modelling Notation) and BPEL (Business Process Execution Language). We have decided to present practical experiences with languages used inside selected modelling software Intalio, Oracle and some other.

**Keywords:** GeoWeb, geoinformatics, web services, orchestration, BPEL, BPMN, Intalio, SOA.

**Název.** Orchestrace geowebových služeb založená na BPEL nebo BPMN?

**Abstrakt.** Srovnání orchestrace služeb s využitím jazyka BPEL a jazyka BPMN vyvstalo neplánovaně v rámci výzkumného projektu „Orchestrace služeb pro GeoWeb“ GA 205/07/0797 řešeného na Institutu geoinformatiky, VŠB-TU Ostrava. Jedná se o výzkum možností orchestrace geowebových služeb a ověření praktických možností dostupných jazyků pro popis a plánování obchodních procesů. Jazyků a standardů souvisejících s orchestrací je v současné době více. Tento článek je zaměřen na srovnání dvou standardů (v podstatě i dvou úrovní orchestrace) prostřednictvím kterých lze definovat orchestraci služeb, jedná se o již zmiňovaný BPMN (Business Process Modelling Notation) a BPEL (Business Process Execution Language). V příspěvku jsou zahrnuty některé praktické zkušenosti a postřehy při práci s volně dostupnými programovými prostředky, jako jsou Intalio, Oracle a některé další.

**Klíčová slova:** GeoWeb, geoinformatika, webové služby, orchestrace, BPEL, BPMN, Intalio, SOA.

### 1 Introduction

Web Services become part of the major part of information systems. A growing number of free available services and payed services brings possibilities to connect services in a scope of a functional system. Simple static services chaining can not use potential of SOA, that is now one of the most popular IS architectures. That's why is necessary to chain services dynamically according to current needs and user possibilities (connection, budget, requested results accuracy, time limits, etc.).

“The standard set of Web Service technologies (XML, SOAP, WSDL) provides the means to describe, locate and invoke a Web Service as an entity in its own right. Although a Web Service may expose many methods, each Web Service Description Language (WSDL) file describes fairly atomic, low-level functions. What the basic technologies do not give us is the rich behavioral detail that describes the role the service plays as part of a larger, more complex collaboration. When these collaborations are collections of activities designed to accomplish a given business objective, they are known as a business process. A business process may extend across one or more organizations. The description of the sequence of activities that make up a business process is called an orchestration”. [THANV].

## 2 BPEL

The paper is based on [PRAGIS], where is described and evaluated example process created in BPEL language. For this purpose is only a brief description included in this chapter. For more detailed information on BPEL see [PRAGIS].

BPEL was originally created by Microsoft and IBM. OASIS made a standard from the specification. Current version of the standard is 2.0. The language allows to specify runnable or abstract processes.

“BPEL defines a model and a grammar for describing the behavior of a business process based on interactions between the process and its partners. The interaction with each partner occurs through Web Service interfaces, and the structure of the relationship at the interface level is encapsulated in what is called a partnerLink. The BPEL process defines how multiple service interactions with these partners are coordinated to achieve a business goal, as well as the state and the logic necessary for this coordination. BPEL also introduces systematic mechanisms for dealing with business exceptions and processing faults. Moreover, BPEL introduces a mechanism to define how individual or composite activities within a unit of work are to be compensated in cases where exceptions occur or a partner requests reversal.” [OASIS\_BPEL].

“BPEL utilizes several XML specifications: WSDL 1.1, XML Schema 1.0, XPath 1.0 and XSLT 1.0. WSDL messages and XML Schema type definitions provide the data model used by BPEL processes. XPath and XSLT provide support for data manipulation. All external resources and partners are represented as WSDL services. BPEL provides extensibility to accommodate future versions of these standards, specifically the XPath and related standards used in XML computation. “ [OASIS\_BPEL].

## 3 BPMN

BPMN is graphical notation (a set of graphical objects and rules, that can be combined together) standardized by OMG (Object Management Group), that is used for modeling of processes. It comes from BPMI (Business Process Management Initiative), that has one primarily goal to create a notation that is understandable for all participants (users, business analysts, developers, analysts that provide process monitoring, etc.). BPMN fills a communication gap between process design and implementation. BPMN became industrial standard for process modelling, because it is implemented in many software tools [translated from BPMCZ].

Current version of the specification is 1.1. That version was accepted in February of 2008 and commonly is used previous version 1.0. The difference between these two versions are not crucial. A prepared version 2.0 should bring a lot of changes including standardized exchange format.

BPD (Business Process Diagram) is a main result from process modeling with BPMN. It can be constructed from basic types of graphical elements. The figure 1 shows simple process notated according to BPMN specification. Each basic type offers several subtypes. Basic types are following:

- *flow objects* – objects used for process flow modelling (Events, Activities, Gateways),
- *connecting objects* – connect flow objects or artifact together (Sequence Flow, Message Flow, Association),
- *artifacts* – objects not connected with process flow that can hold supplemental information (Data object, Annotation, Group),
- *swim lanes* – allow organize activities according to participants roles.

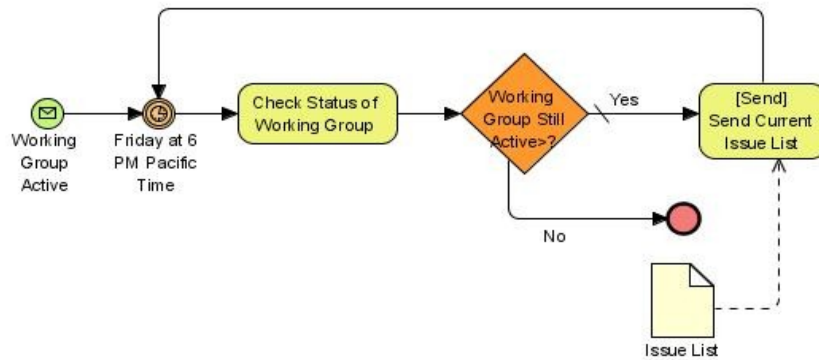


Fig. 1. Example BPMN proces

### 4 BPMN

There are free of charge and charged software available nowadays not only for modelling according to BPMN, but for running processes as well. Selected free of charge software are listed on figure 2.

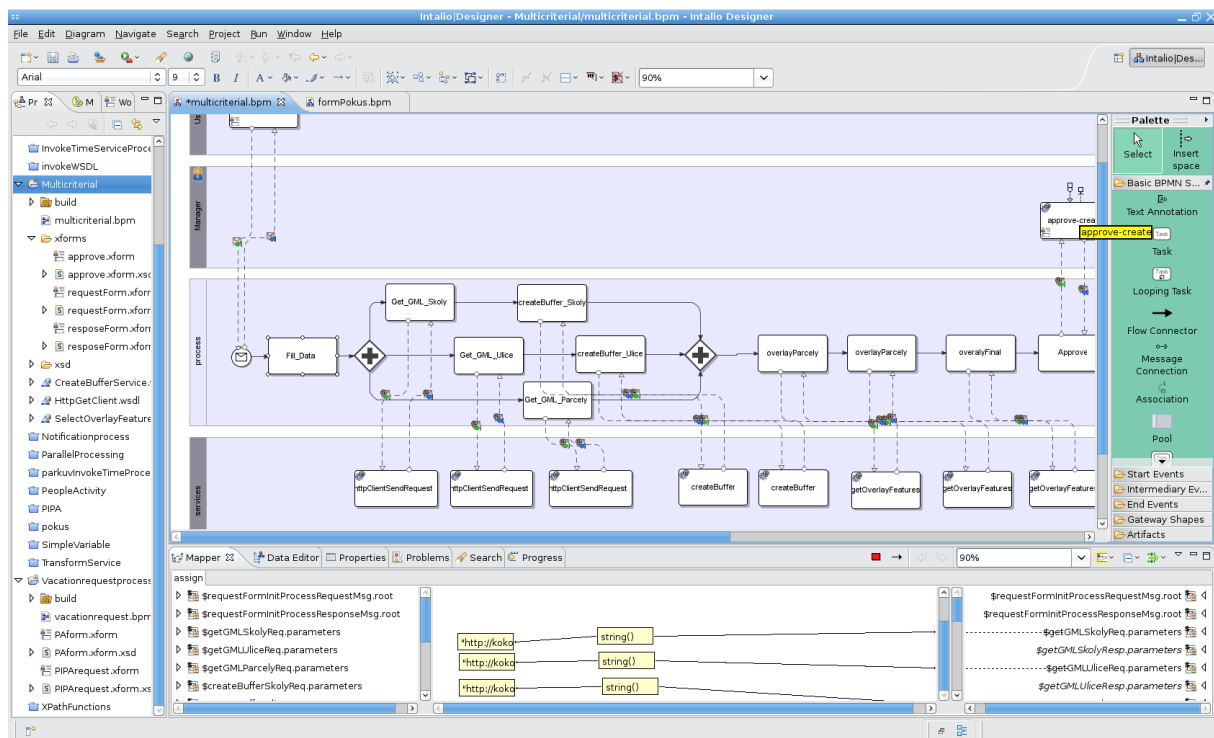
Product	Lombardi Blueprint	ADONIS BPM Toolkit CE	TIBCO Business Studio	BizAgi Process Modeler	Savvion Process Modeler	Intalio Designer	Active Modeler Avantage
Platform	SaaS	xxx	Eclipse	xxx	Eclipse	Eclipse	.NET
BPMN	1.0 reduced	1.0 reduced	1.0 full	1.1	1.0 reduced	1.0 full	1.0 full
Other models	matrice	9 types	1 type	no	no	BPEL	2 types
Easiness	***	*	**	***	**	*	**
Performance	*	***	***	*	*	***	**

Fig. 2. BPMN modelers [BPMMOD]

“If you are searching for modeller as a substitute for charged version of the professional tools and for serious work choose TIBCO Business Studio, if you are IT professional used to experiment and if you need the most opened environment choose Intalio Designer. If you are beginner with BPM or you need process models only for documentation or communication with management choose BizAgi or ActiveModeler.” [BPMMOD]  
 Most of the free available tools are focused on the process modelling only, but when we are deciding between BPEL and BPMN we need runtime engine as well. From the available tools this functionality covers only Intalio Desginer. TIBCO offers runtime engine as well, but this part of the tool is not available free of charge.

#### 4.1 Intalio Designer & Server

*Intalio Designer & Server* are developed in Intalio software company, that is one of the top companies in the area of BPM and SOA. Both products are available for OS GNU/Linux, MS Windows and Mac OS. Figure 3 shows GUI of the designer. Diagrams are more technically oriented than in *BizAgi* or *ActiveModeler*, that are focused on presentation more than on modelling.



**Fig. 3.** Intalio Designer GUI

Intalio server runs as a web service and application that can be run inside application server Apache Geronimo. The Intalio server installation is simple and in default configuration runs without any problem. Changing a configuration of the server can be tricky. We need to change listening port, but unfortunately some parts of the server use different configuration sources. Some of them are well documented and available on predicted places, but some of them are not probably available on predicted places. We were not able to set up port correctly for all parts of the server. Processes that use XForms 2.0 did not run correctly after port change.

## 5 Example of BPMN usage

Following example is basic multicriterial decision making process. A user wants to find suitable site for constructing a building. The decision is based on two criteria. The first one is a distance from a road and the second one is a distance from elementary school. We will use two participant roles to demonstrate possibilities of BPMN in 1.0 version. The first role is a general user (named User). The second role is a privileged user (named Manager), that evaluates the result before returning it to a user.

### 5.1 Input data

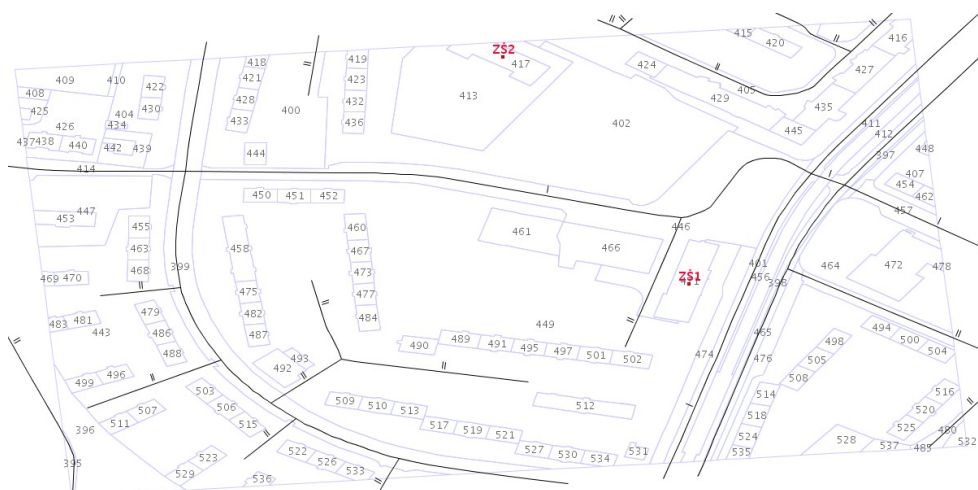
Data from Ostrava-Poruba were used for this example. The process uses six web services (see Table 1).

**Table 1.** Used web services.

Type	URL	Description
WFS	http://kokos.vsb.cz/cgi-bin/mapserv?map=/var/mapservdata/mapfiles/ostravawfs.map&VERSION=1.0.0&SERVICE=wfs&REQUEST=getfeature&TYPENAME=ulice	Serving street lines
WFS	http://kokos.vsb.cz/cgi-bin/mapserv?map=/var/mapservdata/	Serving location of schools as a point layer

WFS	mapfiles/ostravawfs.map&VERSION=1.0.0&SERVICE=wfs&REQUEST=getfeature&TYPENAME=skoly http://kokos.vsb.cz/cgi-bin/mapserv?map=/var/mapservdata/mapfiles/ostravawfs.map&VERSION=1.0.0&SERVICE=wfs&REQUEST=getfeature&TYPENAME=parcely	Serving parcels as a polygon layer
WSDL	http://kokos.vsb.cz:8081/axis2/services/HttpGetClient?wsdl	Proxy service between HTTP/GET based service and HTTP/SOAP service.
WSDL	http://kokos.vsb.cz:8080/jGWS/CreateBufferService?wsdl	Returns buffer around defined geometry
WSDL	http://kokos.vsb.cz:8080/jGWS/SelectOverlayFeaturesService?wsdl	Overlay service for two geometries

Figure 4 shows all three layers used for the process. Schools are labelled by their name, parcels are labelled by their id and streets are labelled by their category (type).



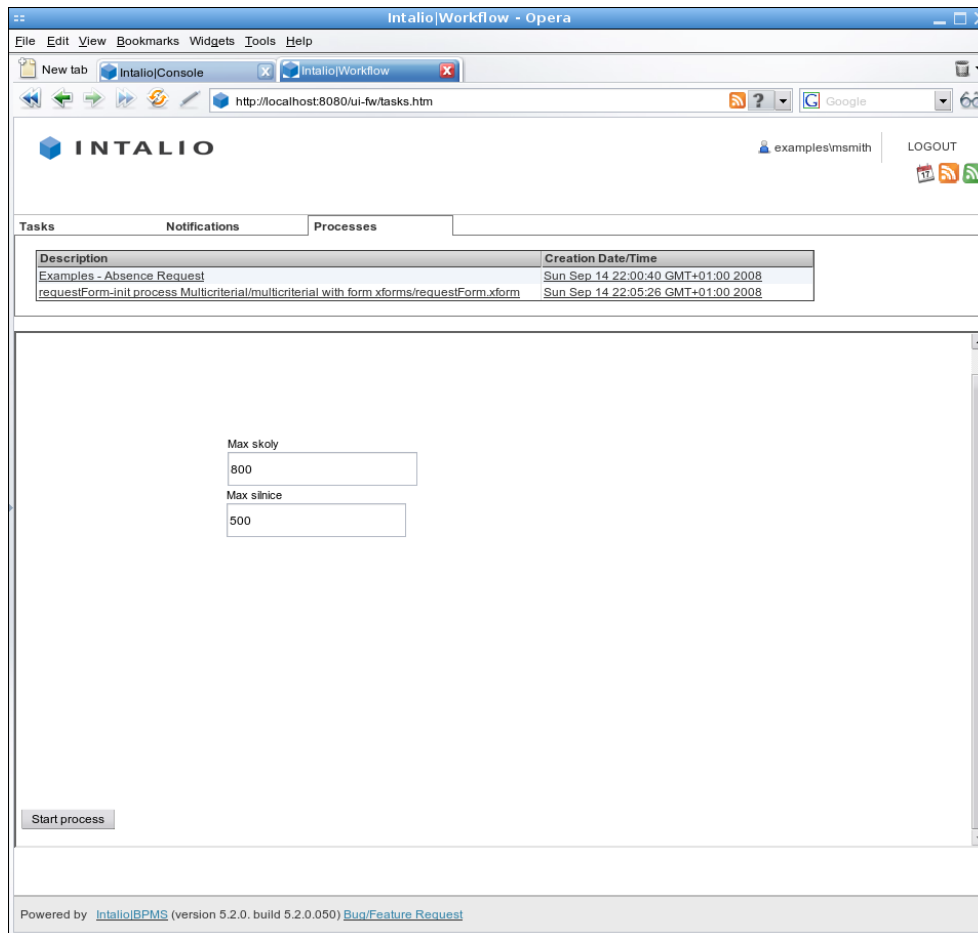
**Fig. 4.** Used geodata

## 5.2 Implementation of the process

Process modelling has been done in Intalio Designer (for full model see Figure 8). The process is constructed in four swim lanes (*User, Manager, Process, Services*). The *User* and the *Manager* represents user participants in the process. The *Process* contains process logic and the *Services* contains used web services for the process.

The process is divided into several parts, for purposes of this paper.

- **Process initialization** (swim lane User) – input is covered by two parameters, maximum distance of a street from a parcel (500 m) and maximum distance of a school from a parcel (800 m). The user enters this two parameters (see Figure 5). Process has been initialized.



**Fig. 5.** Process initialization (Intalio Server)

- **Process logic** (swim lane Process):
  - Insert URL of WFS services. URLs are statically bounded to the process. They could be a part of process initialization.
  - Parallel requests on all WFS services using Proxy service (HTTPGetClient).
  - Parallel requests on creating buffers around streets and schools.
  - Two parallel request on overlaying
  - One request on overlaying
- **Evaluating of the results** (swim lane Manager) - in a case of wrong results, there is role of the Manager, that can disable return of the results to the user, that initialized the process (see Figure 6).

Intalio|Workflow - Opera

File Edit View Bookmarks Widgets Tools Help

IntalioConsole IntalioWorkflow

http://localhost:8080/ui-fw/tasks.htm

examples@williams LOGOUT

Tasks Notifications Processes

Task State	Description	Creation Date/Time	Due Date	Priority
READY		Mon Sep 15 21:09:18 GMT+01:00 2008		

```
<?xml version="1.0" encoding="utf-8" ?><ogr:FeatureCollection
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://ogr.maptools.org/
fsc1_tmppgws_0bba456e0eba9dba81460f0937f53d21ce64e17c.xsd"
xmlns:ogr="http://ogr.maptools.org" xmlns:gml="http://www.opengis.net/
gml"> <gml:boundedBy> <gml:Box>
<gml:coord><gml:X>18.22696161739813</gml:X><gml:Y>49.78850819064565</
gml:Y></gml:coord> <gml:coord><gml:X>18.227925</
gml:X><gml:Y>49.78948800000001</gml:Y></gml:coord> </gml:Box> </
gml:boundedBy>
<ogr:sql_statement
fid="FO"> <ogr:geometryProperty><gml:Polygon><gml:outerBoundaryIs><gml:L
18.227028,49.788747 18.227070999999999,49.788851
18.227076,49.788873000000002 18.227070999999999,49.788896
18.227056,49.788919 18.227039999999999,49.788936
18.227024954753677,49.788944662414551
18.227081211075092,49.789072243714891 18.227119999999999,49.789065
18.227122999999999,49.789078000000003
18.227132999999998,49.789101000000002
18.227143999999999,49.789126000000003 18.227228,49.789323000000003
18.227193391130101,49.789329346481423
18.227223981387137,49.789399649740498
18.227243000986628,49.78945277384426
18.227327454838928,49.789478392640191
18.227424999999933,49.789488000000006
18.227462308191903,49.789484325463825
18.227461897152789,49.789476189423695
18.227457107471629,49.789457180127378
18.227411107471628,49.789329180127382
18.227408737112899,49.789323196707215
18.227303737112901,49.789081196707215
18.227303499603956,49.789080653717939

```

Approve  
 deny  
 submit

Claim Save Complete

Powered by Intalio|BPMS (version 5.2.0. build 5.2.0.050) Bug/Feature Request

Fig. 6. Results evaluation (Intalio Server)

- **Response to the user** (swim lane User) - according to the Manager decision the user obtains vector layer coded in GML (Figure 7) or information about denying results delivery.

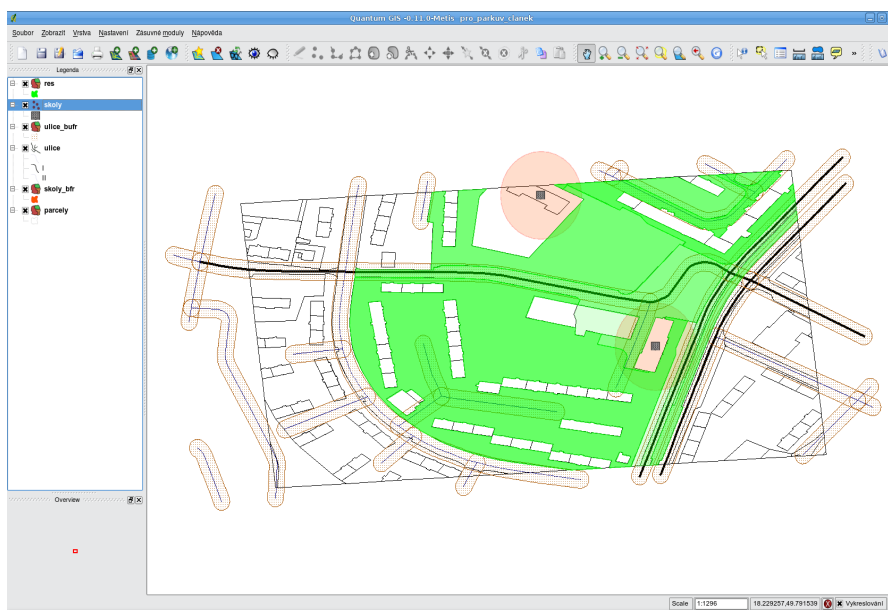
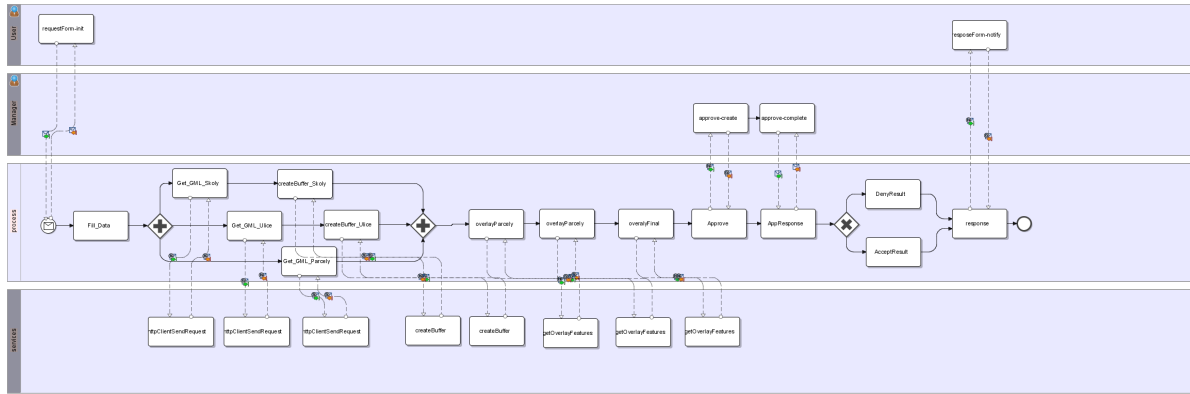


Fig. 7. Results coded in GML (displayed in a green color)



**Fig. 8.** BPMN diagram of the modelled process (Intalio Designer). Vector version of this figure is available at <http://gis.vsb.cz/ruzicka/down/multicriterial.svg>.

## 6 Example of BPEL usage

Several possibilities how to use BPEL are described in [PRAGIS]. The process described here requires additional tools, because we have to include user interaction as well. That part of the process modelling is named *workflow*. BPEL example has been prepared in *Oracle jDeveloper 10g*. Oracle covers this part of modelling (running) with other software named *Oracle BPM Worklist* (see Figure 9). That software is a part of an application server. BPM Worklist can cover asynchronous processes and its user interface is based on JSP (Java Server Pages).

**Fig. 9.** Oracle BPM Worklist – result verification



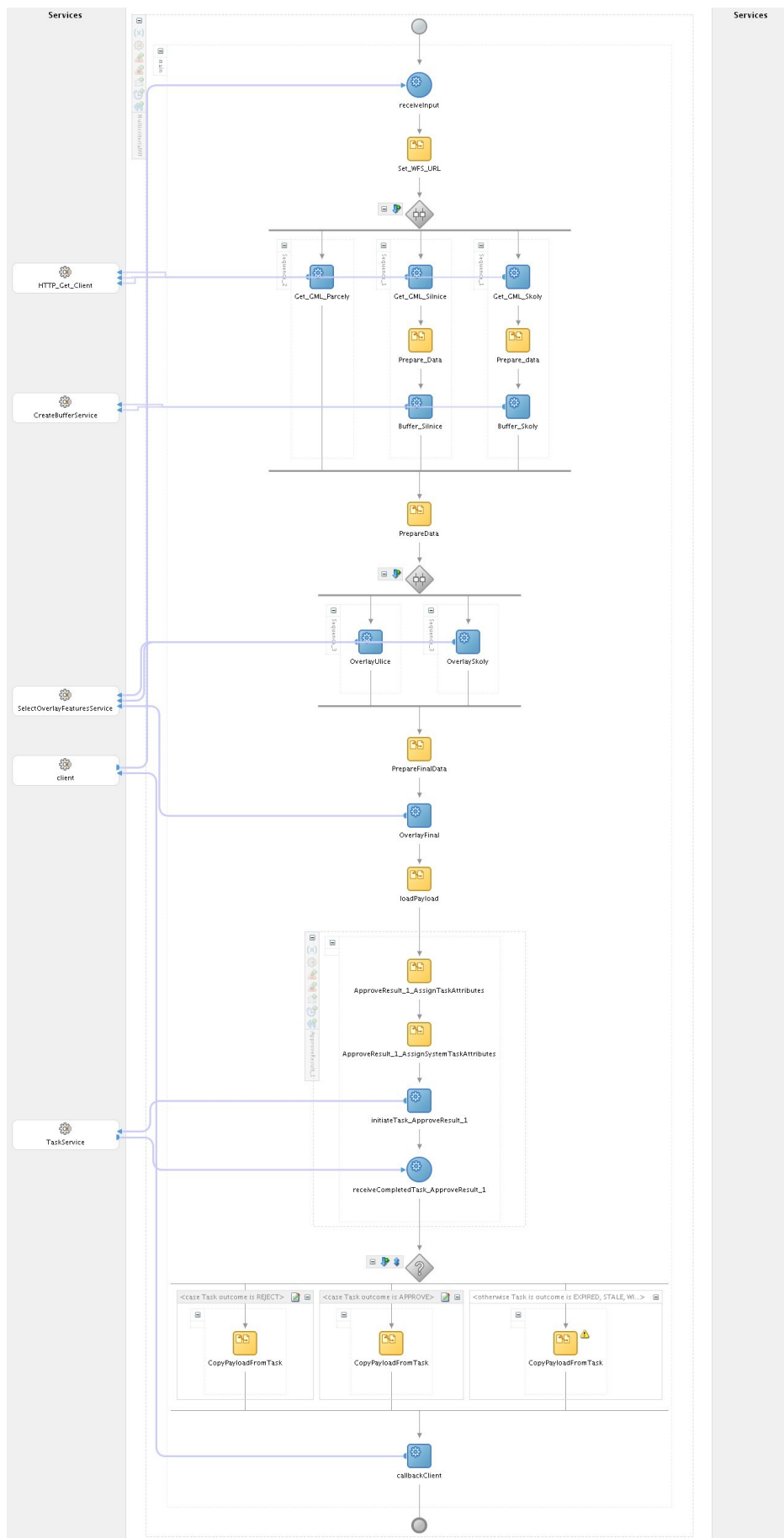


Fig. 10. BPEL example (Oracle jDeveloper 10g)

## 7 Conclusion

Web services orchestration using BPMN notation is one of the possible ways how to orchestrate. There is available a open source and free of charge software, that covers most of the necessary features for BPMN usage. This software is *Intalio Designer and Server*.

Beginning with Intalio Designer is a little bit problematic even for user experienced in the area of orchestration. There are some technical problems with this software such as not-refreshing of dependencies in a case of model changes or not-documented errors. Some of the problems have been solved, but usually not efficiently enough. For example some problematic parts of the model had to be deleted and modelled again. After some time the user was able to find rules how to use designer without running into this problems.

Intalio offers a lot of technologies to handle any process. A user can use all basic tools for XML data manipulation (such as XPath or XSLT). A user can include program code in Java language to handle parts of a process that are difficult to model in BPMN or BPEL. There are available tools for building user interface in a form of xForms technology and support for multiuser software development.

Work flow modelling in Intalio or ActiveBPEL designers is based on extension of BPEL named BPEL4People (WS-HumanTask) and can include user interaction. Oracle jDeveloper does not use such specifications and offers its own solution for such modelling named TaskService that is connected as an additional PartnerLink.

The advantage of a BPMN modelling is mainly a fact that the modelling is more abstract and produced diagrams are simpler to understand for many users (compare Fig. 8 and Fig. 10) and their basic graphical representation is standardized. The main disadvantage of BPEL diagrams could be an absence of possibilities to include participants roles that are in BPMN represented by swim lanes.

Finally we must say that does not matter which language is used for orchestration of web services. BPMN is for run purposes transformed into BPEL, but this kind of BPEL is not suitable for diagram visualisation. A choice should be based on potential readers of diagrams. Possibilities of the premium software (Intalio, ActiveBPEL, Oracle, TIBCO) are close to equal, they differ mainly on GUI. A lot of BPMN design tools allow to export models in XPD (XML Processing Description Language), that is a candidate on exchange format for BPMN. On the other hand, exchange of full featured BPMN models will probably stay problematic similar to exchange of BPEL.

## Reference

- [BPMMOD] BPM-CZ. <http://bpms-cz.blogspot.com/search/label/BPMN%20Free%20Modelery>
- [BPM CZ] BPM-CZ. <http://bpm-cz.blogspot.com/>
- [OASIS\_BPEL] OASIS. [http://www.oasis-open.org/committees/tc\\_home.php?wg\\_abbrev=wsbpel](http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=wsbpel)
- [PRAGIS] PRAGER, M; MARŠÍK, V. Využití orchestrace služeb pro řešení úloh v rámci ISKŘ. Sborník symposia GIS Ostrava 2008. VŠB-TUO, Ostrava 2008. Dostupný z WWW: [http://gis.vsb.cz/GIS\\_Ostrava/GIS\\_Ova\\_2008/sbornik/Lists/Papers/093.pdf](http://gis.vsb.cz/GIS_Ostrava/GIS_Ova_2008/sbornik/Lists/Papers/093.pdf)
- [THANV] THAN, V. [http://www.eurescom.de/message/messagejun2003/Web\\_Service\\_Orchestration.asp](http://www.eurescom.de/message/messagejun2003/Web_Service_Orchestration.asp) Web Service Orchestration - An open and standardised approach for creating advanced services.

## Support

The article is supported by Grant agency of the Czech republic GACR as a part of the project **GA 205/07/0797 GeoWeb services orchestration**.