Pushing dynamic and ubiquitous interaction between services **L**everaged in the Future Internet by **A**ppl**Y**ing complex event processing

Project number:	258659		
Instrument:	Collaborative Project		
Thematic Priority:	ICT-2009.1.2: Internet of Services, Software and Virtualisation		
Start Date:	01/10/2010	**Duration:**	36 months

D6.3 - Demo environment for the Nuclear Crisis use case

WP6	Trials

Due date:	M20
Submission Date:	19/06/2012
Organization Responsible for the Deliverable:	ARMINES
Version:	V1.0
Status:	Ready for submission
Abstract:	This deliverable aims at describing the demo environment of the Nuclear crisis use-case: nuclear scenario simulator and connections with the PLAY platform.

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Project co-funded by the European Commission within the Seventh Framework Programme		
Dissemination Level		
PU	Public	**X**
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RE	Restricted to a group specified by the consortium (including the Commission Services)	
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Version History

Version	Date	Comments, Changes, Status	Authors, contributors, reviewers
0.1	21/05/2012	First ToC	ARMINES
0.2	22/05/2012	Added sections 2 and 3	ARMINES
0.3	22/05/2012	Added section 5	ARMINES
0.4	23/05/2012	Added section 4	ARMINES
1.0	23/05/2012	First readable version	ARMINES
2.0	15/06/2012	Final version	ARMINES

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Executive Summary

This deliverable describes the simulation environment for the nuclear crisis use-case. After an introductive section and some restatements concerning the use-case itself (second section), the document is structured according to three main parts. Third section concerns the technical organization of the simulation platform and its links with the crisis behavioural models (BPMN model resulting from the BPM approach). Fourth section describes the connection between the nuclear crisis simulation and the PLAY platform (especially by highlighting the way PLAY components would be used in that scenario. Fifth section introduces some key performance indicators (KPI) to be evaluated during simulation on order to measure PLAY platform performance.

1 Introduction

1.1 Purpose of the document

This deliverable is dedicated to describe the way previous description works concerning the nuclear crisis use-case will be used in the frame of the PLAY platform s(t)imulation. Business description of the nuclear crisis scenario has been performed in order to define business process models (structured according to a business process cartography). The way these models might be exploited and confronted with the technical platform is precisely the subject of this deliverable. Consequently, the present deliverable describes the simulation platform through (i) its links with the nuclear crisis management business process models and (ii) its connections with the PLAY platform.

1.2 Document outline

The document is structured as follows: Section 2 presents the scenario of the nuclear use-case and the mechanism of exploitation of this scenario in the simulation environment. Section 3 focuses on the simulation environment, its technical structure and the way the scenario are exploited (by applying principles describes in section 2). Section 4 makes the links between the simulation environment and the PLAY platform (in terms of expectations and requirements). Section 5 introduces some performance measurement systems in order to evaluate both the PLAY platform and the improvement (provided to the nuclear crisis management).

1.3 List of Acronyms

Acronym	Definition
BPEL	Business Process Execution Language
BPM	Business Process Management
BPMN	Business Process Modelling Notation
CEP	Complex Event Processing
DCEP	Distributed Complex Event Processing
DSB	Distributed Service Bus
ESB	Enterprise service Bus
IRSN	French Institute for Radioprotection and Nuclear Safety
JBI	Java Business Integration
KPI	Key Performance Indicator
PMS	Performance Measurement System
RDF	Resource Description Framework
REE	Relevance Effectiveness Efficiency
RNA	Representative of National Authority
SA	Service Assembly
SU	Service Unit
XML	Extensible Markup Language

WS	Web Service
WSDL	Web Service Description Language
WSN	Web Service Notification

2 Scenario – Nuclear Crisis Management

2.1 Overview

For this use-case, we are considering a situation in which a large quantity of radioactive substance is accidentally released in the atmosphere, due to a critical accident in a French nuclear plant. In this context, heterogeneous actors have to work together in a hurry with the shared aim to solve, or at least reduce, the crisis situation. Moreover the multiplicity and diversity of actors involved, the volume and heterogeneity of information, the critical dependencies between actions as well as the dynamics of the situation make the situation more complex.

The challenge of this use case is to underline the capability of PLAY platform to drive complex situation. To expose the complexity of this situation, a detailed scenario of this use case is described in (Barthe, Carbonnel, Charles, Bénaben, Lauras, and Truptil, 2011), paragraph 4.

So, to deal with this challenge the approach is based on an architecture divided in three parts summarized by figure 1:

- Simulated Environment: WebServices are deployed to simulate on the one hand the evolution of the situation (as the radiation rate in an area), and on the other hand the result of actor's activities on the situation (as the result of the evacuation of a population). The whole of information about the situation is send to the PLAY Platform thanks to events.
- Dynamic of the collaboration: ESB (Entreprise Service Bus) with a BPEL engine are used to simulate interactions between actors, *i.e.* orchestration of the crisis response. An invocation of an operation of WebService could occur after the invocation of another operation or after a receipt of event. The dynamic of the collaboration is described through processes presented in section 2.2.2
- PLAY platform: PLAY platform deals with events and business rules. The reader can see (Stühmer, Stojanovic, Stojanovic, Verginadis, Pellegrino and Hamerling, 2011) to have more information about it.

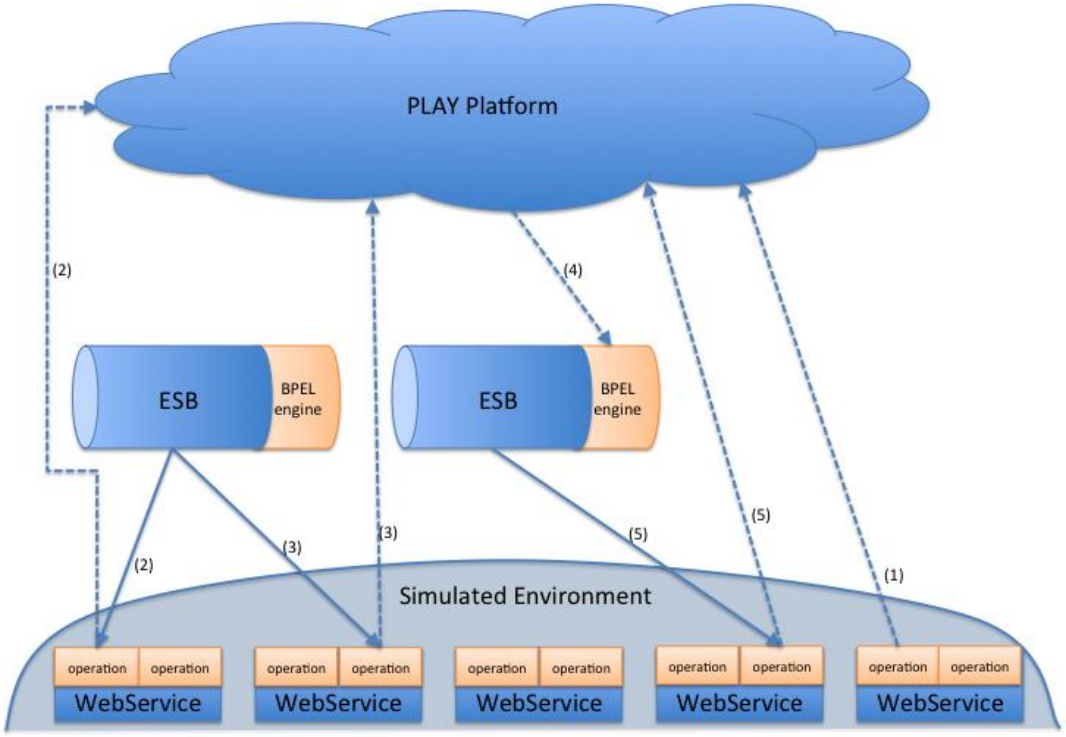

Figure 1: Overview of the simulation architecture

2.2 Behavioral models

We have chosen to follow a Business Process Management approach to implement our research work. The BPMN language has been selected to describe the dynamical layer of models. This formalism is not only strongly aligned with concrete workflows implementation but also structurally event-oriented (events are represented through circles and can be typed). BPMN is so perfect at the intersection between PLAY project specificities (event-based) and technical requirements of the demonstration platform to be provided (proximity between BPMN and workflow language).

Therefore, the set of BPMN models describing the use case, presented in (Barthe, Carbonnel, Charles, Bénaben, Lauras, and Truptil, 2011), are used to configure the simulation of the nuclear crisis management. In this section, we explain how we configure the simulator from a BPMN and then we give an example of BPEL generated from a BPMN.

2.2.1 Overview of the configuration of the simulator

To design the simulator, some steps are needed:

1. List the WebServices that will be used.
2. Design the processes that describe the dynamic of the simulator.
3. Define the events especially content, topics and types of events.

When the processes are designed, it is possible to execute them thanks to different technological solutions like a BPEL engine or BPMN engine. Depending on the solution, transformations could be used to transform the processes in an executable way.

When the events are defined, the DSB component of the PLAY platform could subscribe to the event topics. Then, thanks to business rules PLAY platform could

produce and send events, which can be used by processes. Reader could read deliverable D1.4 for more information.

2.2.2 Specific configuration of the simulator for the Nuclear Crisis use case

For the Nuclear Crisis use case, processes are designed in BPMN language and them transform in BPEL language because BPEL engine are used to execute them.

The section 2.2.2.1 explains the specific transformation for this use case from BPMN processes to BPEL workflow. Then the section 2.2.2.2 shows an example of this transformation.

Finally, the section 2.2.2.3 explains the events used for this specific use case.

2.2.2.1 Matching between business description and technical support

The input of this step is a set of ordered business activities, each under the responsibility of an actor. Nevertheless the business activities could not be directly used by the simulation platform; it is necessary to match these business activities with technical services (as an operation of web-services). In the case of a crisis situation, we can consider that a partner's business activity match with exactly one technical service. For the moment, this matching is done manually.

Based on this choice, the partially automated configuration of the technical platform, represented by figure 2, is divided in eight steps for each business process:

- Step 1: The Manual matching operation consists in extracting from a business process, the set of business activities. Then for each business activity, the user has to make the link with an operation of a web-service. If the link already exists, the user has to provide the WSDL file of this web-service. In other case, the business service is added to the list of services that need to be created.
- Step 2: All services, which need to be created, are grouped according to the actor they depend on. Then a WSDL file is created for each identified actor (a lane in the BPMN diagram). Consequently, a web-service could correspond to several business services.
- Step 3: This step consists in generating the BPEL file corresponding to the business process. This step is based on the result of our research work that defines a model driven engineering to transform a BPMN model in a BPEL file based on the WSDLs files and the matching between business activities and web-services operations.

After this step, two operations are realized. The first one, divided in steps 4 and 5, consists in generating all the artefacts required to configure an ESB based on JBI standard. The second one, divided in steps 6 and 7, consists in creating the web-services.

- Step 4: The aim of this step is to generate some artefacts needed to execute the workflow in a JBI environment. It is necessary to generate service Assemblies (SA) and Service Units (SU) to allow the ESB to communicate with any web-service. A SU is composed of the WSDL of the service and a JBI file that defines, in a unique way for the ESB, the web-service. A SA makes the link between a protocol (SOAP, HTTP,...) and the web-services through the SU. So this step consists in creating all the necessary SAs and SUs
- Step 5: This step consists in deploying all the artefacts on the ESB. These artefacts are composed, on the one hand, of all the SAs and SUs created during the previous step, and, on the other hand, all the binding component

(BC) needed to communicate with the web-services (one BC per protocol) and the potentially requires service engine (for instance a workflow engine).

- Step 6: This step uses an internal tool, named WS-Generator, which allows us to create the skeleton of Java Web Services from the BPEL file and all the WSDL files. However, the main functions of the operations are not created; it is the subject of the following step.

It is important to notice that the operations of the generated web services can generate a start event and an end event (same meaning as in BPMN language).

- Step 7: Our work consists in simulating the execution of a crisis response. Consequently for each operation of a WebService, corresponding to a WSDL file created at step 2, a graphical interface is automatically build. A graphical interface is composed of TextBox for each input and output elements of the operation and the colors of the interface are defined for each actor in a XML file.
- Step 8: At the end of the Step 5 and 7, the simulated crisis response can be launched.

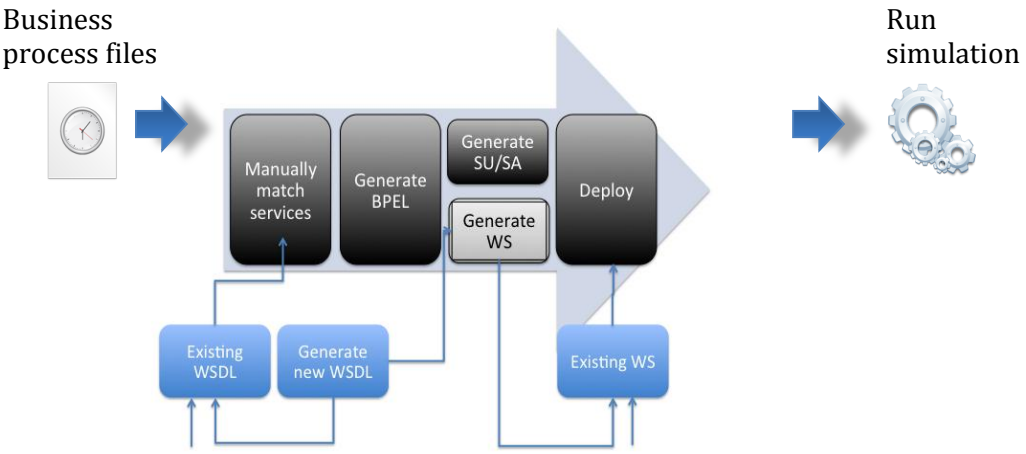

Figure 2: Overview of the configuration of the simulator

2.2.2.2 Example: Situation management process

This section explains the result of the process of simulator configuration through an example based on the situation management process, figure 3. This process is composed of 7 activities under the responsibility of the actor *Representative of the national authority*. Moreover, in this process two kind of event are received (Alert and Report) and several events are generated.

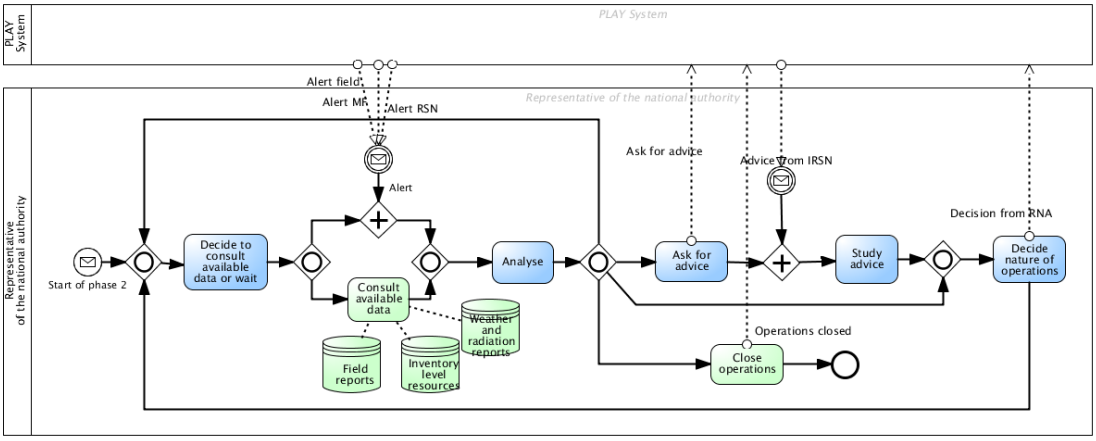

Figure 3: situation management process

The configuration of the simulator creates a BPEL and a WebService (dedicated to the considered process). The generated WebService is composed of 7 operations, one per activity of the process. And the BPEL, represented by figure 4, is generated. See Appendix A for the concrete BPEL file (in XML).

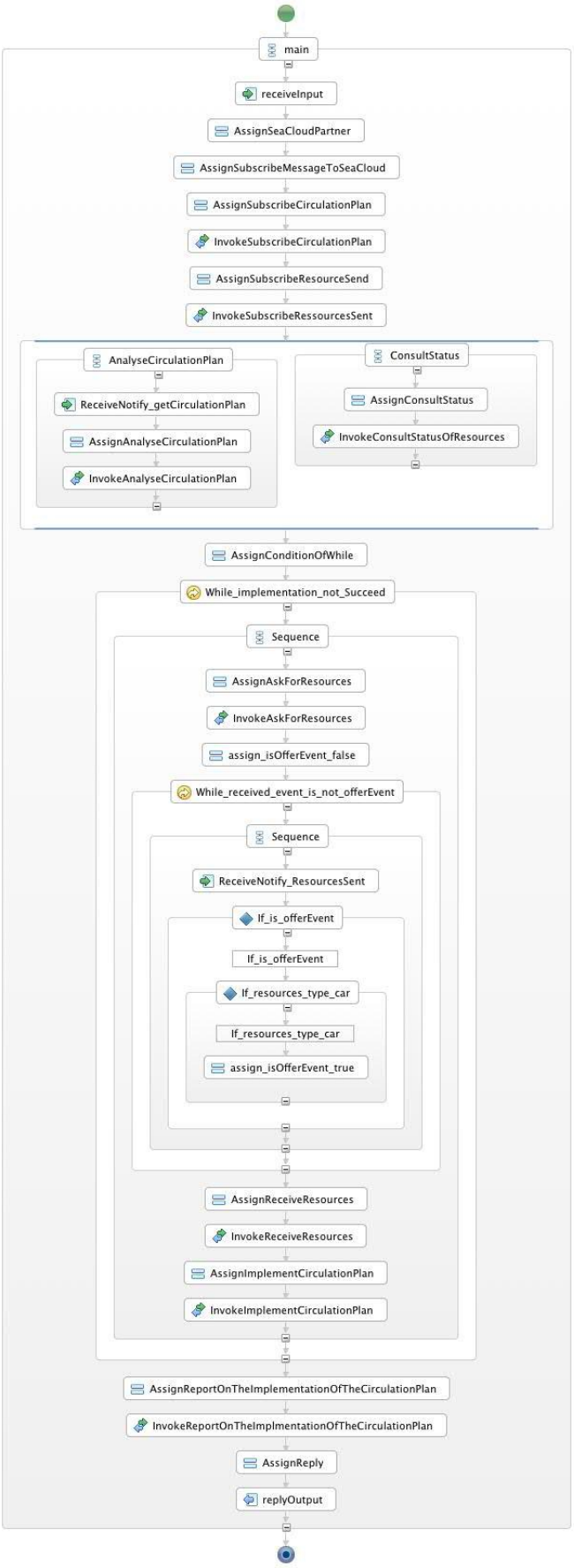

Figure 4: BPEL of situation management process

2.2.2.3 Use case events

The Nuclear Crisis Use Case is implemented through WebServices. In this context, WebServices are considered as Event Sources. Nevertheless, the WebServices provide event instances in WS Notification format. Consequently, event instances are translated in RDF format before being sent to the PLAY platform through the DSB.

Events come from both the simulated evolution of the studied system (the crisis situation) and the dynamics of the crisis response. Events can also be grouped in two categories: continuous events, punctual events.

For example, the weather forecast service of Meteo France publishes events about the weather (temperature, weather condition, wind speed, wind direction) continuously. The radiation sensors of IRSN also publish events about the radiation rate in determined geographical area continuously. Other services publish only punctual events, to signal the successful end of an activity of the workflow, or the availability of a resource for instance.

Events generated from the PLAY platform are pushed towards BPEL engine. They are classified as *Events Out* from the platform point of view (Event Consumers).

In spite of the origin of event, all events of the use case could correspond to the 8 types of events. The 8 kinds of events are the following:

- Measure: event about a measurement of the situation as the radiation rate.
- Alert: event produced when a problem occurs.
- Demand: event produced when an actor asks for resources.
- Offer: event produced when an actor answers about a demand.
- Resources Status: event about the status of resources.
- Activity Status: event about the status of activities.
- Instruction: event produced when a decision is made.
- Report: event produced at the end of some activities.

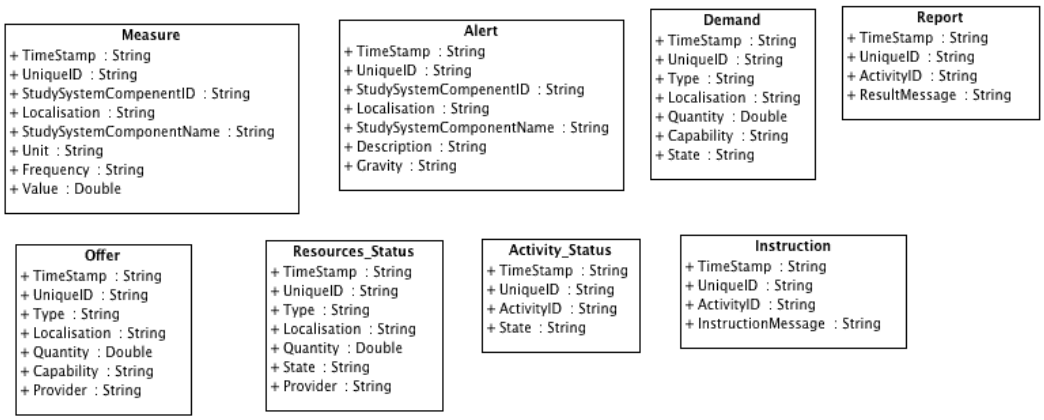

Figure 5: description of the attribute of each kind of event.

The table below (Table 1) shows an example of mapping between events and event type

event name	event type
running	activity_status
done	activity_status
Alert Field	Alert
Alert CEP	Alert

survey	**Measure**
Present	**Report**
Info Sub.	**Instruction**
Team ready	**Report**
Info	**Report**
Decision RNA	**Instruction**
Ask4Advice	**Report**
Op. Closed	**Report**
AdviceIRSN	**Report**
Plan	**Instruction**
Security measures	**Instruction**
status	**Report**
Trends	**Report**
buses deployed	**Report**
Release resources	**resouces_status**
Request resources	**Demand**
Resource received	**resources_status**
Resource sent	**resources_status**
Inventory level resources	**Offer**

Table 1: example of mapping between event and event type.

For example, there is an instance of the DemandEvent with the previous properties:

```
<?xml version="1.0" encoding="UTF-8"?>
<ns14:Notify xmlns:ns10="http://com.petalslink.easyesb/data/admin/1.0"
xmlns:ns11="http://com.petalslink.esstar/admin/model/datatype/1.0"
xmlns:ns12="http://com.petalslink.easyesb/admin/model/datatype/1.0"
xmlns:ns13="http://www.w3.org/2005/08/addressing" xmlns:ns14="http://docs.oasis-
open.org/wsn/b-2" xmlns:ns15="http://docs.oasis-open.org/wsrf/bf-2"
xmlns:ns16="http://docs.oasis-open.org/wsn/t-1" xmlns:ns17="http://docs.oasis-
open.org/wsrf/rp-2" xmlns:ns18="http://com.petalslink.esstar/data/management/user/1.0"
xmlns:ns19="http://com.petalslink.esstar/data/management/admin/1.0"
xmlns:ns2="http://com.ebmwebsourcing.easyesb/soa/model/endpoint"
xmlns:ns20="http://com.petalslink.easyesb/component/bpel/data/1.0"
xmlns:ns3="http://com.petalslink.easyesb/soa/model/datatype/1.0"
xmlns:ns4="http://com.ebmwebsourcing.easyesb/soa/model/service"
xmlns:ns5="http://com.ebmwebsourcing.easyesb/soa/model/component"
xmlns:ns6="http://com.ebmwebsourcing.easyesb/soa/model/node"
xmlns:ns7="http://com.ebmwebsourcing.easyesb/soa/model/registry"
xmlns:ns8="http://com.petalslink.easyesb/exchange/1.0"
xmlns:ns9="http://com.petalslink.easyesb/transporter/1.0">
<ns14:NotificationMessage>
<ns14:SubscriptionReference>
<ns13:Address>http://localhost:9803/OfficeOfInfrastructureEventProducersSOAPEndpoint</ns1
3:Address>
<ns13:ReferenceParameters/>
</ns14:SubscriptionReference>
<ns14:Topic Dialect="http://www.w3.org/TR/1999/REC-xpath-
19991116">top:resourcesEvent</ns14:Topic>
<ns14:ProducerReference>
<ns13:Address>http://localhost:9300/OfficeOfInfrastructureSOAPEndpoint</ns13:Address>
<ns13:ReferenceParameters/>
```

```
</ns14:ProducerReference>
<ns14:Message>
<ns2:demandEvent xmlns:ns2="http://www.mines-albi.fr/nuclearcrisisevent"
xmlns:ns3="http://www.petalslink.org/OfficeOfInfrastructure/"
xmlns:ns4="http://www.petalslink.org/SimulatedEventProducers/" xmlns:ns5="http://docs.oasis-
open.org/wsrf/rp-2" xmlns:ns6="http://docs.oasis-open.org/wsrf/bf-2"
xmlns:ns7="http://www.w3.org/2005/08/addressing" xmlns:ns8="http://docs.oasis-
open.org/wsn/b-2" xmlns:ns9="http://docs.oasis-open.org/wsn/t-1"
xmlns:wsnt="http://docs.oasis-open.org/wsn/b-2">
<ns2:uid>DemandEvent-0</ns2:uid>
<ns2:timestamp>2012-02-23T09:46:24.399+01:00</ns2:timestamp>
<ns2:capability/>
<ns2:state/>
<ns2:uncertainty>
<ns2:unit/>
<ns2:value/>
<ns2:origin/>
</ns2:uncertainty>
<ns2:resources>
<ns2:type>car</ns2:type>
<ns2:localisation/>
<ns2:quantity>10.0</ns2:quantity>
</ns2:resources>
</ns2:demandEvent>
</ns14:Message>
</ns14:NotificationMessage>
<ebm:emissionDate xmlns:ebm="http://wwww.petalslink.com/wsoui/wsnotification"
xmlns:wsnt="http://docs.oasis-open.org/wsn/b-2"/>
</ns14:Notify>
```

Figure 6: Example of DemandEvent in WS-Notification

3 Simulation Environment

3.1 Global Description

The simulation environment is implemented through WebServices deployed on several ESBs (Entreprise Service Bus). The interactions between operations of Web services are written in BPEL (Business Process Execution Language) and executed through a BPEL engine.

In this context, BPEL are considered as Event consumer and WebServices are considered as Event Sources. Nevertheless, our BPEL engine, which is a consumer of events, can only interpret event in WS-Notification format contrary to the PLAY Platform that interpret event in RDF format. Therefore, our simulation environment is divided into two sub-environments:

- WS-Notif environment: each event is written on WS-N format. This sub-environment is composed of the whole WebService and the Whole BPEL executed by the BPEL engine of an ESB.
- RDF environment: each event is written on RDF format. This sub-environment corresponding to the connection between the PLAY platform and the WS-Notif environment.

To make the link between these sub-environment, we decided to build a Web service, the WS-Notif ←→ RDF translator. The Figure 7 illustrates these points.

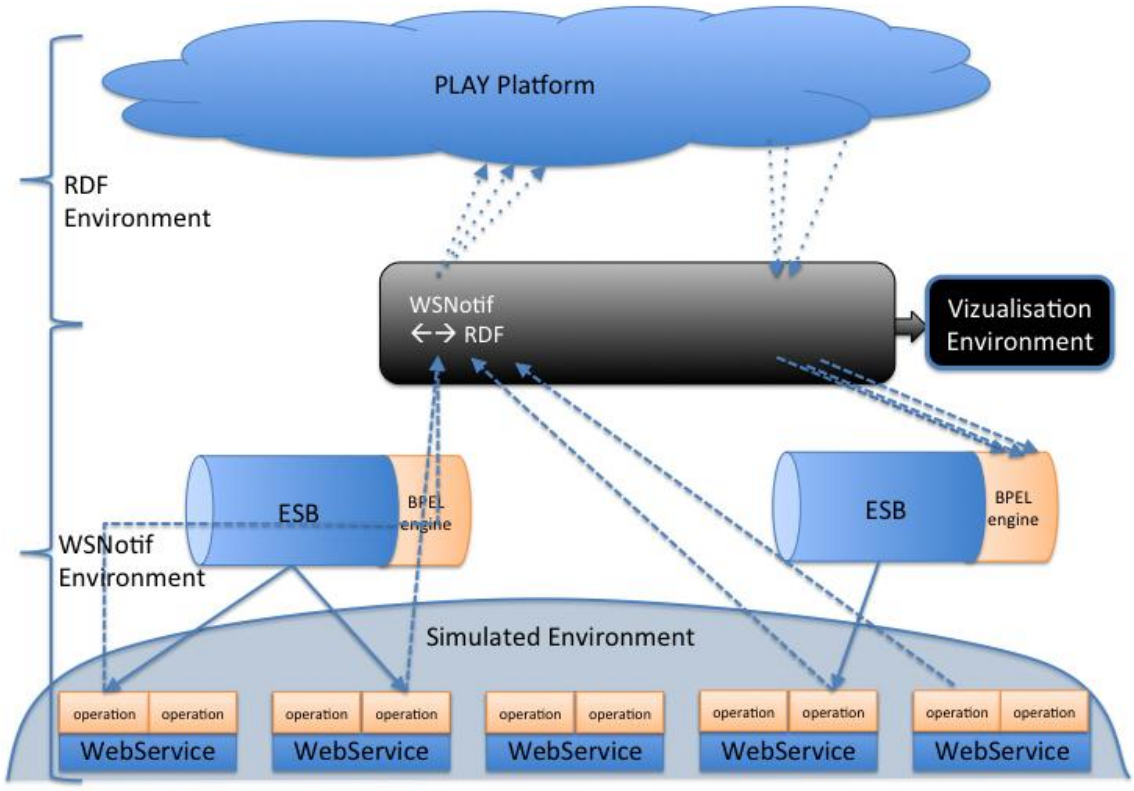

Figure 7: overview of the simulation platform.

The multiplicity and diversity of actors involved, the volume and heterogeneity of information, the critical dependencies between actions as well as the dynamics of the situation do not allow us to have a clear vision of the situation at each moment. Consequently, we propose to design a tool named Visualization Environment. This tool provides the user to have information about the situation, the dynamic of the crisis

response, the resources engaged in the crisis response and the report of actors' activities. This tool is a consumer of event.

3.2 Events schemas

The eight kinds of events of the Nuclear Crisis Use-Case are specified below in the table 2:

DSB Topic	Event Type
SituationalTopic	MeasureEvent
	AlertEvent
ActivityTopic	ActivityStatusEvent
ResourcesTopic	DemandEvent
	OfferEvent
	ResourcesStatusEvent
ConsequenceTopic	InstructionEvent
	ReportEvent

Table 2: Nuclear Crisis event types

3.3 Implementation of workflows

Our simulated environment is based on 61 workflows. These workflows could be merged in 18 types of processes. Indeed, because of scalability objectives, lots of processes are realized by several actors at the same times.

Therefore, in the following, we will present processes by type. The implementation of processes is divided in three steps. Each step corresponds to a subpart of the scenario. The table below presents the type of processes and the steps.

		N°	Type	Name	Sub-processes	Part
Step 1		1	O	Alert and deploy	8	8/61
		2	S	Assess situation	2	10/61
		3	D	Manage situation	1	11/61
		4	D	Protect	5	16/61
		5	O	Assist victims	3	19/61
	Step 2	6	S	Manage resources	5	24/61
		7	S	Manage data	3	27/61
		8	O	Evacuate population	2	29/61
Step 3		9	O	Confine population	1	30/61
		10	O	Distribute iodine	1	31/61
		11	O	Implement security	1	32/61

			measures		
	12	O	Implement circulation plan	1	33/61
	13	D	Scientific support	1	34/61
	14	O	Communication media	2	36/61
	15	D	Dynamic subscribe	6	42/61
	16	D	Recover and wrap-up	7	49/61
	17	O	Withdraw back	5	54/61
	18	D	Initiate	7	61/61

Table 3: type of processes and the three steps

3.3.1 Implementation of WebServices

In the whole of the simulated environment, 253 operations of WebServices have to be used. To remind, each operation simulated an activity of an actor and a WebService is composed of one or several operation.

Based on the three step of workflow implementation, to develop the WebServices we decide that one WebService will be design for each actor at each step. Therefore, for each actor, the number of WebServices is between 1 and 3.

The table below summarizes the number of operations and WebServices by actor.

Actors	Number of WebServices	Number of operation step 1	Number of operation step 2	Number of operation step 3
CommunicationOfficer	2	0	3	10
IRSN Scientific experts	3	2	1	1
Media	3	10	9	3
Representative of the Army	3	1	2	6
Representative of the Firemen	3	1	2	6
Representative of the National Authority	3	7	2	6
Representative of the Office Of Infrastructure	1	0	0	3
Representative of the Office of Infrastructure	3	1	2	3
Representative of the Police	3	2	2	6
Police	2	0	40	1
LocalAuthority	2	4	6	0
Firemen	3	3	26	1
Army	2	5	20	0
OfficeOfInfrastructures	2	3	13	0
MEMS	3	3	11	1
Hospitals	2	2	4	0
MeteoFrance	1	0	2	0
RadiationSurveyNetwork	2	1	2	0
DataWarehouse	1	0	6	0
OfficeOfInfrastructure	1	0	8	0

Total	**45**	**45**	**161**	**47**

Table 4: Webservices and number of operation by actors

3.3.2 Alert and deploy, associated events

Paragraphs 3.3.2 to 3.3.19 present the events used for each type of processes by a table. Each kind of event used in the process is presented in column; the three first lines of the table describe first the topic, then the type and finally the name of the event.

The lines after describe if this event is used for an actor. There are two kind of utilization of an event:

- **out**: means that this event is generated during the actor's process.
- **in:**means that this event is needed to launch an actor's activity, *i.e.* process is stopping until the event is received.

event topic	activity	activity	consequence
event type	activity_status	activity_status	report
event name	running	done	Team ready
Firemen	out	out	out
Police	out	out	out
Army	out	out	out
Office InfraS	out	out	out
MEMS	out	out	out
Hospitals	out	out	out
Locals	out	out	out
Media	out	out	out

Table 5. Alert and deploy, associated events

3.3.3 Assess situation, associated events

event topic	activity	activity	situation	consequence
event type	activity_status	activity_status	measure	instruction
event name	running	done	survey	Decision RNA
Meteo France	out	out	out	
RSN	out	out	out	in (reinforce RSN)

Table 6. Assess situation, associated events

3.3.4 Manage situation, associated events

event topic	activity	activity	consequence	situation	situation	consequence	consequence	consequence
event type	activity _status	activity _status	instruction	alert	alert	report	report	report
event name	runnin g	done	Decision RNA	Alert Field	Alert CEP	Ask4Advice	Op. Closed	AdviceIRSN
R.NA	out	out	out (all types)	in	in	out	out	in

Table 7. Manage situation, associated events

3.3.5 Protect, associated events

event topic	activity	activity	consequence	consequence	consequence
event type	activity_status	activity_status	instruction	instruction	instruction
event name	running	done	Decision RNA	Plan	Security measures
R.Office.InfraS.	out	out		in (evacuation)	
R.Office.InfraS.	out	out		out (circulation)	in
R.Firemen	out	out	in (distribute iodin)	out (distribution)	
R.Police	out	out	in (confine)	out (evacuation)	
R.Police	out	out	in (evacuate)	out (confinement)	
R.Army	out	out	in (all types)		out

Table 8. Protect, associated events

3.3.6 Assist victims, associated events

event topic	activity	activity	situation	consequence	consequence
event type	activity_status	activity_status	alert	instruction	report
event name	running	done	Alert Field	Plan	status
Firemen	out	out	in	out (assistance)	out (victims)
MEMS	out	out	in	out (assistance)	out (victims)
Hospitals	out	out			out (victims)
Hospitals	out	out			in (victims)

Table 9. Assist victims, associated events

3.3.7 Manage resources, associated events

event topic	activity	activity	consequence	resource	resource	resource	resource	resource
event type	activity_ status	activity _status	instruction	resouces_ status	demand	resources_ status	resources_ status	offer
event name	running	done	Info Sub.	Release resources	Request resources	Resource received	Resource sent	Inventory level resources
Firemen	out	out	in	in	in	out	out	out
Police	out	out	in	in	in	out	out	out
Army	out	out	in	in	in	out	out	out
Office InfraS	out	out	in	in	in	out	out	out

Table 10. Manage resources, associated events

3.3.8 Manage data, associated events

event topic	activity	activity	consequence	situation	situation	consequence	consequence	resource	consequence
event type	activity _status	activity _status	report	alert	alert	report	report	offer	report
event name	running	done	Info	Alert Field	Alert CEP	Op. Closed	status	Inventory level resources	Trends
Data Warehouse	out	out	in (all types)	in (all types)	in (all types)	in	in (victims)	in	out

Table 11. Manage data, associated events

3.3.9 Evacuate population, associated events

event topic	activity	activity	consequence	consequence	situation	consequence	resource	resource	consequence
event type	activity_status	activity_status	report	instruction	alert	instruction	demand	resources_status	report
event name	running	done	Info	Decision RNA	Alert Field	Plan	Request resources	Resource sent	buses deployed
Police	out	out	out (report)	in (evacuate)	out	in (evacuation)	out	in	in
Local Authority	out	out		in (evacuate)		in (evacuation)			out

Table 12. Evacuate population, associated events

3.3.10 Confine population, associated events

event topic	activity	activity	consequence	consequence	situation	consequence	resource	resource
event type	activity_status	activity_status	report	instruction	alert	instruction	demand	resources_status
event name	running	done	Info	Decision RNA	Alert Field	Plan	Request resources	Resource sent
Police	out	out	out (Op final report)	in (confine)	out	in (confinement)	out	in

Table 13. Confine population, associated events

3.3.11 Distribute iodine, associated events

event topic	activity	activity	consequence	consequence	situation	consequence	resource	resource
event type	activity_status	activity_status	report	instruction	alert	instruction	demand	resources_status
event name	running	done	Info	Decision RNA	Alert Field	Plan	Request resources	Resource sent
Firemen	out	out	out (report)	in (distribute iodin)	out	in (distribution)	out	in

Table 14. Distribute iodine, associated events

3.3.12 Implement security measures, associated events

event topic	activity	activity	consequence	consequence	situation	consequence	resource	resource
event type	activity_status	activity_status	report	instruction	alert	instruction	demand	resources_status
event name	running	done	Info	Decision RNA	Alert Field	Security measures	Request resources	Resource sent
Army	out	out	out (report)	in (all types)	out	in	out	in
Army	out	out	out (Op final report)					

Table 15. D Implement security measures, associated events

3.3.13 Implement circulation plan, associated events

event topic	activity	activity	consequence	consequence	situation	consequence	resource	resource
event type	activity_status	activity_status	report	instruction	alert	instruction	demand	resources_status
event name	running	done	Info	Decision RNA	Alert Field	Plan	Request resources	Resource sent
Office InfraS	out	out	out (Op final report)	in (all types)	out	in (circulation)	out	in

Table 16. Implement circulation plan, associated events

3.3.14 Scientific support, associated events

event topic	activity	activity	situation	consequence	consequence
event type	activity_status	activity_status	alert	report	report
event name	running	done	Alert CEP	Ask4Advice	AdviceIRSN
IRSN	out	out	in	in	out

Table 17. Scientific support, associated events

3.3.15 Communication media, associated events

event topic	activity	activity	consequence	consequence	situation	situation	consequence	consequence
event type	activity_status	activity_status	report	instruction	alert	alert	report	report
event name	running	done	Info	Decision RNA	Alert Field	Alert CEP	Op. Closed	status
Media	out	out	in (official report)			in (start P2)		
Com.Officer	out	out	in (all reports)	in (all types)	in (all types)	in (all types)	in	in (all types)
Com.Officer	out	out	out (official report)					

Table 18. Communication media, associated events

3.3.16 Dynamic subscribe, associated events

event topic	activity	activity	consequence	situation
event type	activity_status	activity_status	instruction	alert
event name	running	done	Info Sub.	Alert CEP
R.NA	out	out	out	in (advice sub)
R.Firemen	out	out	out	in (advice sub)
R.Army	out	out	out	in (advice sub)
R.Office.InfraS.	out	out	out	in (advice sub)
R.Police	out	out	out	in (advice sub)
Com.Officer	out	out	out	in (advice sub)

Table 19. Dynamic subscribe, associated events

3.3.17 Recover and wrap-up, associated events

event topic	activity	activity	consequence	consequence	consequence
event type	activity_status	activity_status	report	instruction	report
event name	running	done	Info	Decision RNA	Op. Closed
R.NA	out	out	in (all final reports)	out (directives)	
R.Firemen	out	out	out (final report)		in
R.Army	out	out	out (final report)		in
R.Office.InfraS.	out	out	out (final report)		in
R.Police	out	out	out (final report)		in
Com.Officer	out	out	out (Last report)	in (directives)	
Media	out	out	in (Last Report)		

Table 20. Recover and wrap-up, associated events

3.3.18 Withdraw back, associated events

event topic	activity	activity	consequence	consequence
event type	activity_status	activity_status	report	report
event name	running	done	Info	Op. Closed
Firemen	out	out	out (over)	in
Police	out	out	out (over)	in
Army	out	out	out (over)	in
MEMS	out	out	out (over)	in
Office InfraS	out	out	out (over)	in

Table 21. Withdraw back, associated events

3.3.19 Initiate, associated events

event topic	activity	activity	consequence	consequence	consequence
event type	activity_status	activity_status	report	instruction	report
event name	running	done	Present	Info Sub.	Info
R.NA	out	out	out	out	
R.Firemen	out	out	out	out	
R.Army	out	out	out	out	
Com.Officer	out	out	out	out	out (1st of. Report)
R.Police	out	out	out	out	
R.Office.InfraS.	out	out	out	out	
Media	out	out			in (1st of. Report)

Table 22. Initiate, associated events

3.4 WS-Notif to RDF translator

This translator is divided in two parts: WS-Notif → RDF and RDF→WS-Notif. Each of these parts is also divided in a consumer part and a provider part. Indeed, the consumer part keeps information of an event in a format and the provider part sends an event with the information in the other format.

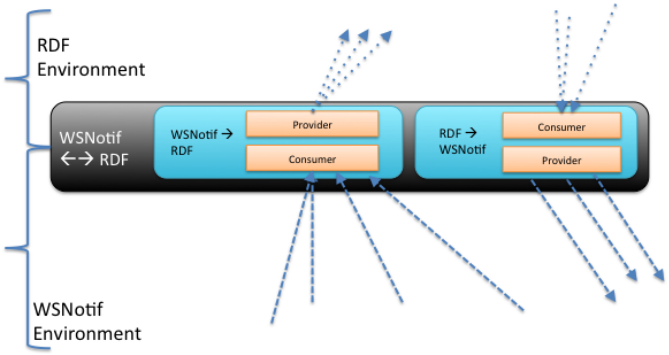

Figure 8: overview of the WSN2RDF translator

The following example shows a transformation from an event in WSNotif to an event in RDF. The event is a measure event, this topic is situationalEvent and it brings some information. The radiation value of the nuclear plant is 95 mSv.

In WSNotif the following information are written like this:

```
<?xml version="1.0" encoding="UTF-8"?>
<ns14:Notify xmlns:ns10="http://com.petalslink.easyesb/data/admin/1.0"
xmlns:ns11="http://com.petalslink.esstar/admin/model/datatype/1.0"
xmlns:ns12="http://com.petalslink.easyesb/admin/model/datatype/1.0"
xmlns:ns13="http://www.w3.org/2005/08/addressing" xmlns:ns14="http://docs.oasis-open.org/wsn/b-2"
xmlns:ns15="http://docs.oasis-open.org/wsrf/bf-2" xmlns:ns16="http://docs.oasis-open.org/wsn/t-1"
xmlns:ns17="http://docs.oasis-open.org/wsrf/rp-2"
xmlns:ns18="http://com.petalslink.esstar/data/management/user/1.0"
xmlns:ns19="http://com.petalslink.esstar/data/management/admin/1.0"
xmlns:ns2="http://com.ebmwebsourcing.easyesb/soa/model/endpoint"
xmlns:ns20="http://com.petalslink.easyesb/component/bpel/data/1.0"
xmlns:ns3="http://com.petalslink.easyesb/soa/model/datatype/1.0"
xmlns:ns4="http://com.ebmwebsourcing.easyesb/soa/model/service"
xmlns:ns5="http://com.ebmwebsourcing.easyesb/soa/model/component"
xmlns:ns6="http://com.ebmwebsourcing.easyesb/soa/model/node"
xmlns:ns7="http://com.ebmwebsourcing.easyesb/soa/model/registry"
xmlns:ns8="http://com.petalslink.easyesb/exchange/1.0" xmlns:ns9="http://com.petalslink.easyesb/transporter/1.0">
 <ns14:NotificationMessage>
  <ns14:SubscriptionReference>
   <ns13:Address>http://localhost:9807/MeasureRadioactivityPort</ns13:Address>
   <ns13:ReferenceParameters/>
  </ns14:SubscriptionReference>
  <ns14:Topic Dialect="http://www.w3.org/TR/1999/REC-xpath-19991116">top:situationalEvent</ns14:Topic>
  <ns14:ProducerReference>
   <ns13:Address>http://localhost:7518/MeasureRadioactivityPort</ns13:Address>
   <ns13:ReferenceParameters/>
  </ns14:ProducerReference>
  <ns14:Message>
   <measureEvent:measureEvent xmlns="http://www.mines-albi.fr/nuclearcrisisevent"
xmlns:measureEvent="http://www.mines-albi.fr/nuclearcrisisevent" xmlns:ns2="http://docs.oasis-open.org/wsrf/rp-2"
xmlns:ns3="http://docs.oasis-open.org/wsrf/bf-2" xmlns:ns4="http://www.w3.org/2005/08/addressing"
xmlns:ns5="http://docs.oasis-open.org/wsn/b-2" xmlns:ns6="http://docs.oasis-open.org/wsn/t-1"
xmlns:wsnt="http://docs.oasis-open.org/wsn/b-2">
    <uid>RadioactivityMeasure-27</uid>
    <timestamp>2012-06-18T10:48:22.439+02:00</timestamp>
    <unit>mSv</unit>
    <frequency>10s</frequency>
    <value>95.0</value>
    <uncertainty>
     <unit>?</unit>
     <value>?</value>
     <origin>?</origin>
    </uncertainty>
    <situation>
     <localisation>FR</localisation>
     <componentSEID>nuclearplant</componentSEID>
     <componentName>nuclearplant</componentName>
    </situation>
   </measureEvent:measureEvent>
  </ns14:Message>
 </ns14:NotificationMessage>
 <ebm:emissionDate xmlns:ebm="http://wwww.petalslink.com/wsoui/wsnotification" xmlns:wsnt="http://docs.oasis-
open.org/wsn/b-2"/>
</ns14:Notify>
```

Figure 5: measure event in WSNotif

When this event was produced, the consumer, which had subscribe to the topic situationalEvent, catch it, all the information of the event are saved in java variable (the value, the unit, the location, the studied system component, the timestamp, …). Then an event in RDF are created with the saved values. This event was created thanks to an library produce with Topbraid composer.

The following figure show the event in RDF format.

<?xml version="1.0" encoding="UTF-8"?><wsnt:Notify xmlns:wsnt="http://docs.oasis-open.org/wsn/b-2"><wsnt:NotificationMessage><wsnt:SubscriptionReference><wsa:Address xmlns:wsa="http://www.w3.org/2005/08/addressing">http://localhost:9998/foo/Endpoint</wsa:Address><wsa:ReferenceParameters xmlns:wsa="http://www.w3.org/2005/08/addressing"/></wsnt:SubscriptionReference><wsnt:Topic xmlns:tns1="http://radiationsurveynetwork/" Dialect="http://docs.oasis-open.org/wsn/t-1/TopicExpression/Concrete">tns1:situationalEvent</wsnt:Topic><wsnt:ProducerReference><wsa:Address xmlns:wsa="http://www.w3.org/2005/08/addressing">http://localhost:9998/foo/AbstractSender</wsa:Address><wsa:ReferenceParameters xmlns:wsa="http://www.w3.org/2005/08/addressing"/></wsnt:ProducerReference><wsnt:Message><mt:nativeMessage xmlns:mt="http://www.event-processing.org/wsn/msgtype/" mt:syntax="application/x-trig">@prefix : <http://events.event-processing.org/types/> .
@prefix tns1: <http://radiationsurveynetwork/> .
@prefix uctelco: <http://events.event-processing.org/uc/telco/> .
@prefix geo: <http://www.w3.org/2003/01/geo/wgs84_pos#> .
@prefix e: <http://events.event-processing.org/ids/> .
@prefix uccrisis: <http://www.mines-albi.fr/nuclearcrisisevent#> .
@prefix sioc: <http://rdfs.org/sioc/ns#> .
@prefix gn: <http://www.geonames.org/ontology#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix s: <http://streams.event-processing.org/ids/> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
@prefix owl: <http://www.w3.org/2002/07/owl#> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix src: <http://sources.event-processing.org/ids/> .
@prefix types: <http://events.event-processing.org/types/> .
@prefix user: <http://graph.facebook.com/schema/user#> .
{
}

e:RadioactivityMeasure-221384 {
<http://events.event-processing.org/ids/RadioactivityMeasure-221384#event>
:stream <http://radiationsurveynetwork/situationalEvent#stream> ;
uccrisis:uid "http://events.event-processing.org/ids/RadioactivityMeasure-221384" ;
uccrisis:componentName
"nuclearplant" ;
uccrisis:frequency "10s" ;
uccrisis:localisation
"fr" ;
uccrisis:componentSeid
"nuclearplant" ;
rdf:type uccrisis:MeasureEvent ;
uccrisis:unit "mSv" ;
uccrisis:value "95.0" ;
:endTime "2012-06-18T10:48:22.552Z"^^xsd:dateTime .

}
</mt:nativeMessage></wsnt:Message></wsnt:NotificationMessage></wsnt:Notify>

Figure 6: measure event in RDF

3.5 Business rules

The following business-rules are expressed in natural language and refer to the events and processes as described previously in this document.

1. IF t = *Activity is running*.time + A.length x 1.1 AND Not(*Activity is done*) ➔ *Alert-Delay*

If one activity takes more than 110% of expected time, then send a DELAY alert

2. IF t = *Activity is running*.time + A.length x 2 AND Not(*Activity is done*) ➔ *Alert-Warning*

If one activity takes more than 200% of expected time, then send a WARNING alert

3. IF *radiation measure > V+* OR (*radiation measure > V-* AND *dRM/dt > s)* ➔ *Alert-RSN*

If radiation measure exceeds V+ or if radiation measure exceed V- and increase to strongly, then send an alert concerning radiation survey network (nota: V+>V-)

4. IF *dWindDirection/dt > dWD* OR *dWindIntensity/dt > dWI measure > V-*➔ *Alert-MF*

If the wind change too drastically in intensity or in direction, then send an alert concerning meteo france

5. IF *confine* received AND *distribute iodine* NOT received ➔ *distribute iodine*

If the "confine" decision has been taken without asking for iodine distribution, then send an event concerning the need for iodine distribution

6. IF *evacuate* received OR *confine* received AND *security measures* NOT received ➔ *security measures*

If the "evacuate" decision or the "confine" decision has been taken without asking security measures to be defined, then send an event concerning the need for security measures to be defined

7. IF *confine* received ➔ *input for circulation plan = security measures + confine*

If the "confine" decision has been taken, then the event concerning inputs to define circulation plan should contain data concerning the confine decision and associated security measures

8. IF *evacuate* received ➔ *input for circulation plan = security measures + evacuate*

If the "evacuate" decision has been taken, then the event concerning inputs to define circulation plan should contain data concerning the evacuate decision and associated security measures

9. IF (*Assistance plan*.Nb people to decontaminate > Limit) AND (*dRM/dt > 0*) ➔ *Risk of "over crisis"*

If the number of people to be decontaminated exceeds a limit and the radiation measure still increases, then send an event concerning the risk of crisis worsening

10. IF *confine* AND *Alert-delay(decontaminate)* ➔ *Risk of "panic"*

If the "confine" decision has been taken and the decontaminate activity is late (delay), then send an event concerning the risk of panic

11. IF *Alert-warning(decontaminate)* ➔ *Risk of "large amount of victims"*

If decontaminate activity is very late (warning), then send an event concerning the risk of victims

12. Every *X* minutes ➔ Draw graph with last *X* minutes *RSN* measures + *RSN measure graph*

Every X minutes, draw the graph describing last X minutes RSN measures and send it as an event

13. If *Ask for Activity Report (Activity, Partner, T_{min}, T_{max})* ➔ Send list of running periods of *Activity* (from *Partner*) between T_{min} and T_{max}

If the request for an activity report is received, then define a list of running periods concerning the requested activity from the requested partner during the requested period

14. IF *Alert-warning(decontaminate)* ➔ *Risk of "large amount of victims"*

If decontaminate activity is very late (warning), then send an event concerning the risk of victims

4 Connections with the PLAY platform

In this part, we will present the PLAY platform requirements regarding the nuclear crisis use case and the nuclear crisis use case expectations regarding the PLAY platform abilities.

4.1 Requirements from the PLAY platform concerning the use case

4.1.1 Scalability

One of the major constraints regarding the nuclear crisis use case is the scalability. It has to publish a lot of various events.

From the use case point of view, the scalability is verified by the use of a certain amount of heterogeneous event producers (heterogeneous actors, heterogeneous devices).

The nuclear crisis use case is a typical example of a situation implying numerous heterogeneous actors (police, army, firemen, scientists, local authority, national authority, office of infrastructure, media, IRSN –the French radiation survey network-, Meteo France –the French weather survey network-, medical emergency service, hospitals, etc.) and so their heterogeneous information systems. The stakeholders' information systems provide a set of services, which execution is called by the crisis response workflows. For the moment (Step 2), the nuclear crisis use case provides a set of 61 response workflows (see Figure 10), calling the services (implemented as web service) of all the actors of the crisis cell.

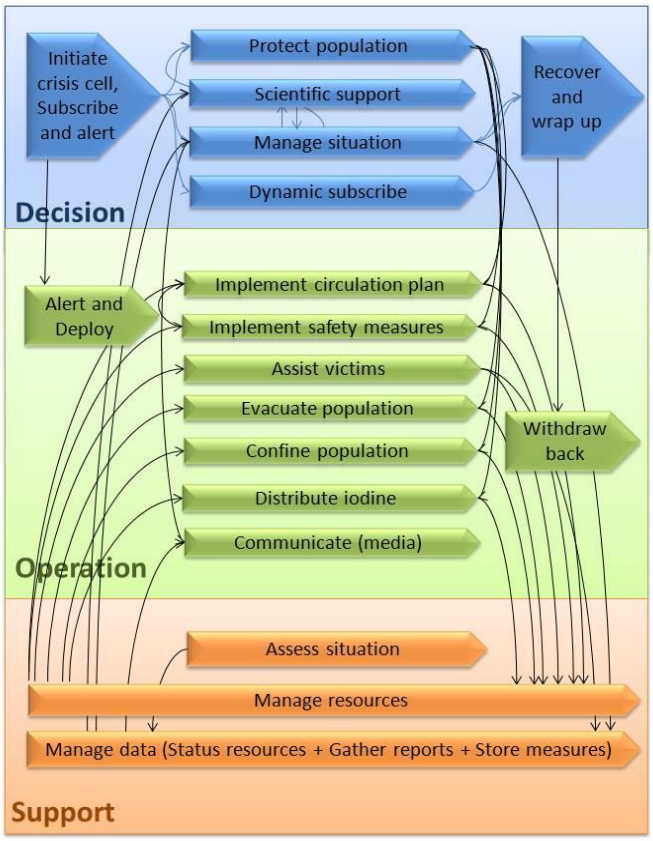

Figure 9. Overview of the process cartography of the nuclear crisis use-case.

Each web service is able to publish its own events and to subscribe to events provided by the PLAY Platform. Events come from both the simulated evolution of the studied system (the crisis situation) and the dynamics of the crisis response. Events can also be grouped in two categories: continuous events, punctual events.

For example, the weather forecast service of Meteo France publishes events about the weather (temperature, weather condition, wind speed, wind direction) continuously. The radiation sensors of IRSN also publish events about the radiation rate in determined geographical area continuously. Other services publish only punctual events, to signal the successful end of an activity of the workflow, or the availability of a resource for instance.

The nuclear crisis use case does not only publish events: it also subscribes events coming from the PLAY Platform.

The execution of the response workflows is driven by events: they allow information exchange between the several workflows composing the crisis response. Events are the core of the communication between the workflows. In other words, the processes are driven by the PLAY Platform, because of the event management made by the PLAY Platform. Therefore, the PLAY Platform ensures the consistency between processes. For example, the civilian population evacuation can begin if and only if the event containing the evacuation plan is published (on the PLAY Platform) and received by the “evacuate population” workflow.

4.1.2 Adaptation

The SAN service of the PLAY platform manages the adaptation of the process. So one of the PLAY Platform requirements regarding the use case is to provide a dynamical context to generate adaptation needs

By nature and by the effects of the collaborative processes to solve or reduce the crisis, a crisis situation is an unstable and evolutionary phenomenon. So, we can consider that as the crisis situation evolves, the crisis response may be not relevant after a while. Two kinds of evolutions of such collaborative situations exist:

- The evolution of the crisis situation itself: the perceived characteristics of the crisis, in particular the issues to solve, are not the same at the beginning of the crisis and need a new response to the crisis.
- The evolution of the response to the crisis: the management of the response to the crisis situation may evolve due to (i) an evolution of the structure of the crisis cell (e.g. arrival or leaving of stakeholders, lack of resources), (ii) a dysfunction of the execution of a service (leading to the interruption of the workflow of the response), or (iii) due to a partial initial definition of the process of the response.

A crisis situation meets perfectly this requirement.

4.1.3 Security

Obviously, the nuclear crisis use-case required a high level of security concerning the information exchange through the events.

Everybody must not have a full access at any time to certain of the events and event topics related to the nuclear crisis: if anybody can get a weather forecast from Meteo France service, some piece of information like the evacuation plan, the progress of the population evacuation, or the average radiation rate in the last 20 minutes must be kept confidential and for the eyes of authorized people.

This is necessary to avoid the misunderstanding of information by people not trained, the use of information by malicious people (e.g. activists, or worse, terrorists), the risk of panic and the risk of riots (especially in the civilian population), so in few words to avoid the risk of an over-crisis situation.

4.2 Expectations about the PLAY platform

4.2.1 Easy subscription + efficient publication: DSB

A new stakeholder arriving in the crisis cell could connect his information system to the DSB in a very easy way.

4.2.2 Management of historical events: Event clouds

In the nuclear crisis use case, we need to collect events during the entire crisis: first to allow the dCEP to apply business rules that need the calculus of average rates (for instance), secondly to gather knowledge about the crisis in order to prepare and train the actors for the future crisis and improve future crisis responses (feedback). The PLAY Platform provides Event Clouds to store a huge amount of events that will allow us to execute business rules on a set of events (average / min / max calculus, etc.) and to retrieve the timeline of the events from both the field and the response workflows during the crisis response.

4.2.3 Management of rights: Governance

As described in 4.1.3, security and more precisely access rights to event subscriptions is a huge constraint in our use case. The Governance component of the PLAY Platform has to manage access rights to event topics: only authorized users can subscribe to certain event topics.

4.2.4 Dynamic subscription and adaptation: ESR, SAR

During the response step of the crisis lifecycle, it is really crucial to quickly adapt the response workflows to the current situation when, for instance:

- A new service (and new events) is provided: regarding its relevancy, it may be useful for the crisis cell (dynamic subscription to the event topics)
- An evolution occurs on the field or in the crisis cell (see 4.1.2): redo an activity, redefine a part of the response workflows or the complete workflow cartography.

4.2.5 Definition of business rules: DCEP

In the context of a crisis situation, and particularly of a nuclear crisis situation, emergency plans exist and business rules are defined far before a crisis breaks out. Even they do not cover all the possibilities, these rules allow the detection of a lot of critical situations to avoid an over-crisis or a failure in the crisis response. These business rules are based on the detection of events, their filtering and management.

The use of Complex Event Processing principles and of a Complex Event Processing engine allows instantiate theses business rules: they are based on event patterns. An example of such a business rule using events is given below:

IF (*Assistance plan*.Nb_people to decontaminate > Limit) AND (*dRM/dt > 0*) ➔ *Risk of "over crisis"*

I.e. *"If the number of people to be decontaminated exceeds a limit and the radiation measure still increases, then send an event concerning the risk of crisis worsening"*.

The following Figure 10 summarizes these points:

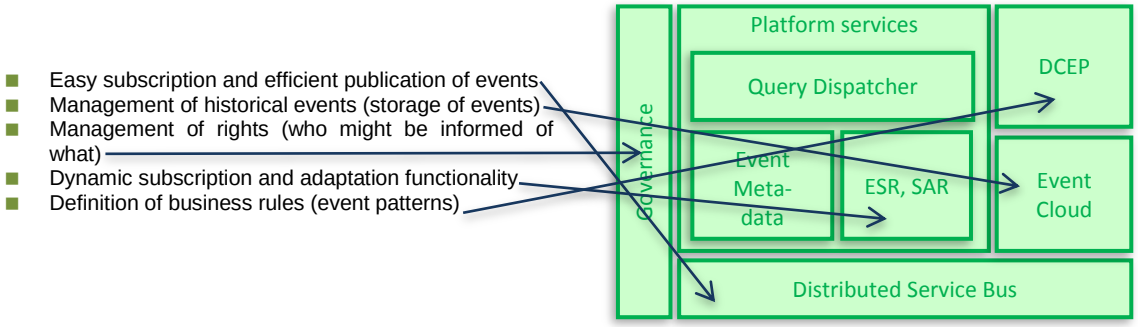

Figure 10. Requirements and PLAY Platform architecture.

4.3 Expected benefits

A SOA architecture provides native orchestration. But, this kind of architecture doesn't allow the choreography of workflows, nor the adaptation of the workflows regarding the received events.

We expect that the PLAY Platform provides us choreography facilities, and adaptation facilities (for both orchestration point of view and choreography point of view) (see Table 23).

Table 23. Expected benefits from the PLAY Platform.

Natively	Nominal	Adaptation
Orchestration	✓	✗
Choreography	✗	✗
PLAY Platform	Nominal	Adaptation
Orchestration	✓	✓
Choreography	✓	✓

5 Performance measurement

The PLAY project can be summarized as:

“The PLAY platform is a Web-oriented structure to combine events from many sources with the goal of connecting and orchestrating services, devices and people. The platform has emerged as an event marketplace, a place that brings together the senders and receivers of events and provides numerous services on top of them. To that end PLAY combines several technologies to deal with delivery, processing and storage of events as real-time information”.

To ensure that these goals are really reached, our developments must be monitored. Our contribution is basically twofold:

- Designing a Performance Measurement System (PMS) able to control the performance of processes supported by the platform in one hand, and the performance of the platform in the other hand;
- Instantiating this PMS on the current nuclear use case in order to underline the added value of the PLAY platform in such a situation.

5.1 Key Performance Indicators

Regarding the first objective, we use workflow representation to support PMS that will able to prove the added value of the PLAY platform.

Business processes are a foundation of management activities. They deliver the control information that the operational activities need (when the execution will start, what the objectives are). But they are also in charge of selecting, booking and monitoring resources for the predicted executions. (Folan and Browne, 2005) specify two kinds of requirements for managing performance with business processes:

- A procedural performance measurement framework shall evaluate the performance of each activity and process;
- A structural performance measurement framework shall evaluate the performance at each level of the organization (internal and external).

In the PLAY project we focus only on procedural performance measurement. It is commonly agreed that a four step approach has to be followed to control a system (Smith and Goddard, 2002): Define the set of KPIs; Measure performance; Analyze responses with respect to objectives; Act to satisfy the objectives. If the principle seems intuitively obvious, the access to pertinent information in order to implement the method is frequently a limitation. In practice, the large volume of information processed by the workflows and the platform should be controlled by the definition of Key Performance Indicators (KPI), which are supposed to be meaningful for stakeholders.

A KPI is a piece of input information to the diagnosis activity that the decision maker has to carry out. Performance management is regularly fed, and decision-making triggered, by KPIs. One problem remains to be solved in order to complete the definition of the PMS architecture: the distributed nature of processes is a source of difficulties. The approach to tackle this problem was based on the idea that the use case is a set of interrelation intended both for web-services that must be performed to reach the main objective of the collaboration, and for PLAY platform that should support this execution. Using a Business Process Modelling approach to represent services (functional process representation), we proposed a systematic rule to structure KPI definitions. The rule uses concepts of Relevance, Effectiveness and Efficiency (REE) introduced by (Jacot, 1990) (Figure 11). REE is based on comparison

between the objectives / results / resources, a triptych that basically aims to discuss the performance of an activity. Despite its simplicity, it is surprising that this kind of analysis has received little attention in the past.

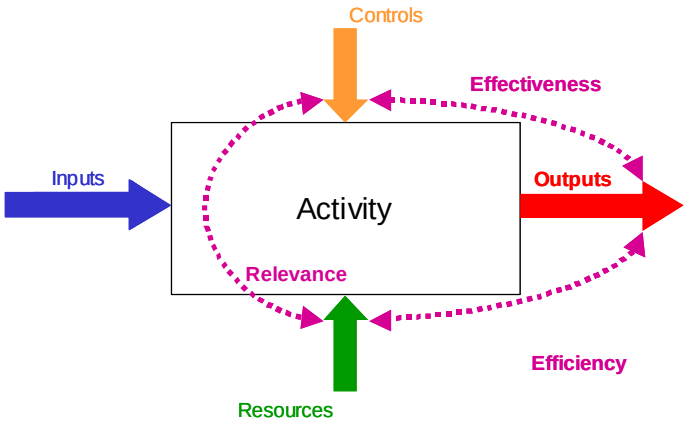

Figure 11: Performance dimensions: Relevance, Effectiveness and Efficiency

Regarding the PLAY project, Activity has to be considered as a systemic view and should contain:

- The simulation Platform including workflows and their web-services;
- The PLAY platform including services provided by its components (Distributed CEP, Platform Services, Distributed Service Bus and Event Cloud).

5.1.1 Effectiveness

Effectiveness measures whether the results of the activity meet its objectives. In other words, effectiveness is doing the right things. In our case, the objective is to check whether the activation of the services produces the expected results. We measure here the cause-effect relationship of the services on the results. Specifically, this point of view assesses whether the decisions that are supposed to control the activity and its results are adapted or not.

One other component of effectiveness is the responsiveness. Responsiveness is doing things quickly and this can be defined as the speed at which services could send or receive events in order to achieve their own mission in a good way.

A consequence of a bad result on this point of view might be an important delay or an deficiency that should impose a change in the orchestration (internal business process) or the choreography (interactions between actors).

Effectiveness KPIs could measure reactivity (time between two events) or frequency of updating (between two versions of a document for instance). In our use case, such a KPI could monitor time between the event that asks for a relief operation and the event that confirms the good execution of this operation. This kind of indicator can give information – through the PLAY Platform – about the capacity of the business process to run quickly.

5.1.2 Efficiency

Efficiency expresses whether the resources were well used to reach the results. In our case, the objective is to identify what the impact of the services is on the means used by the execution of the operational activity. This information allows the detection of insufficient or oversize resources. We measure here the cause-effect relation of the use of resources due to the services. In other words, this point of view measures the quantity of energy (human resources, costs, machines, etc.) the service has to use in

order to produce the activity's results. A consequence of a bad result on this point of view might be important delays and requisitioning of complementary capabilities.

A typical example of efficiency KPIs is the productivity (how many things a single resource can do at a same time). In our use case for instance, efficiency KPI measures the filling rate of the buses that are used to evacuate people of the contaminated zone. This indicator gives important information – through the PLAY Platform – about the capacity of stakeholders to use resources (probably limited) correctly.

5.1.3 Relevance

Relevance measures the appropriateness of the means to the objectives. The objective is to evaluate the feasibility of the controls assigned to the activity. In other words, does the activity have the means to match its ambition? This information allows the detection of unexpected controls or services unsuited to the mission. Here we are measuring the distance from the means to the instructions. It is important to notice that the controls are not some decision variables but only the objective or the constraint the activity has to reach. A consequence of a bad result on this point of view might be a modification of the objectives assigned to the activity or the implementation of a more effective process (re-design of orchestration or choreography).

Relevance KPIs classically concern the feasibility of requests (if some cannot be executed by stakeholders) or the freshness of the data. In our case, such a KPI can follow the number of alert field without commitments under 5 minutes. This indicator is representative of the overall capacity of the system to find quickly a stakeholder able to respond to an alert.

5.2 Concrete KPI of the nuclear use-case

Regarding the nuclear use case, we propose a set of KPIs following the good practices describe in section 5.1. and adapted to the different workflows included into the simulated scenarios. These workflows and scenarios were described in the deliverable D6.2.1 (Barthe, Carbonnel, Charles, Bénaben, Lauras, and Truptil, 2011).

Practically we distinguish KPIs able to monitor the performance of the PLAY platform to KPIs able to control the performance of the business processes. For each KPI, we propose:

- A performance formula (called Perf. Formula in Figure 12) that explains how the measure should be obtained (i.e. this is the mathematical formula that allows to calculate the KPI value based on several state measures);
- A value of reference (called Perf. Objective in Figure 12), which constitutes the performance objective that the system should attain.

Based on these elements, it should be possible to assess and above all, to explain, the performance of the system. This will allow identifying potential deficiencies in order to improve the overall performance of the use case and/or the performance of the PLAY platform.

Concerning the PLAY platform KPIs, we propose to measure the performance as followed:

- Effectiveness:
    - *Speed (N°A)*: [Date of output event from the web-service – Date of input event to the web-service];
    - *Reliability (N°B)*: [Number of requests processed by the platform / Number of requests emitted by the web-services];
    - *Completeness (N°C)*: [Number of events unusable / Number of events sent by the platform].

- Efficiency:
  - *Workload (N°D)*: [Number of events processed simultaneously (max)];
  - *Productivity (N°E)*: [Amount of events processed / Period of time].
- Relevance:
  - *Feasibility (N°F)*: [Maximum expected number of events manageable / Period of time].

Concerning the Workflows KPIs, we propose to measure the performance as presented in the table of the following Figure 12. This table just includes KPIs from the first twelve business processes of the use case. The complementary KPIs will be defined, as the new business processes will be instantiated.

In this table the performance objectives are indicative and experts must confirm their suitability. This validation / adjustment is ongoing.

Business Process	Perf. Dimension	N°	KPI	Perf. Formula	Perf. Objective
Alert and Deploy	Effectiveness	1	Reactivity of setting up	[Date of the Last Event - Date of the First Event]	5 minutes
	Efficiency	2	N/A		
	Relevance	3	N/A		
Assess Situation	Effectiveness	4	Periodicity MF	[Time between the two last events sent to PLAY Platform]	10 secondes
		5	Periodicity RSN	[Time between the two last events sent to PLAY Platform]	10 secondes
		6	Reactivity RSN	[Date of setting up new measurement mean - Date of instruction from RNA]	30 minutes
	Efficiency	7	N/A		
	Relevance	8	N/A		
Assist Victims	Effectiveness	9	Reactivity of relief	[Time between alert field event and assistance plan event]	10 minutes
		10	Relief tracking	[Time between two "status of victims" events]	5 minutes
	Efficiency	11	Committed means	[Number of web-services "ongoing" at a same time]	2
	Relevance	12	Rejection ratio	[Number of Alert field without committment under 5 minutes]	0
Manage Situation	Effectiveness	13	RNA Decision reactivity	[Time between Alert event and Decision from RNA event]	2 minutes
		14	Non quality ratio	[Number of unusable events received / Total of events received]	1%
		15	IRSN Advice reactivity	[Time between Alert event and Advice event]	5 minutes
	Efficiency	16	Advice ratio	[Number of "ask for advice" event / Number of "decision from RNA" events]	20%
	Relevance	17	Unfeasibility	[Number of unfeasible request (unvailable contente)]	5%
Protect Population	Effectiveness	18	ROI Instruction Reactivity	[Time between decision from RNA event and instruction event]	4 minutes
		19	RF Instruction Reactivity	[Time between decision from RNA event and instruction event]	5 minutes
		20	RA Instruction Reactivity	[Time between decision from RNA event and instruction event]	2 minutes
		21	RP1 Instruction Reactivity	[Time between decision from RNA event and instruction event]	2 minutes
		22	RP2 Instruction Reactivity	[Time between decision from RNA event and instruction event]	3 minutes
	Efficiency	23	ROI Instruction update	[Number of version (events) of instruction sent following a unique decision]	3
		24	RF Instruction update	[Number of version (events) of instruction sent following a unique decision]	5
		25	RA Instruction update	[Number of version (events) of instruction sent following a unique decision]	10
		26	RP1 Instruction update	[Number of version (events) of instruction sent following a unique decision]	1
		27	RP2 Instruction update	[Number of version (events) of instruction sent following a unique decision]	3
	Relevance	28	N/A		
Manages resources	Effectiveness	29	F Setting up reactivity	[Time between request event and resource sent event]	2 minutes
		30	P Setting up reactivity	[Time between request event and resource sent event]	8 minutes
		31	A Setting up reactivity	[Time between request event and resource sent event]	10 minutes
		32	OI Setting up reactivity	[Time between request event and resource sent event]	15 minutes
	Efficiency	33	F Recovery reactivity	[Time between release resource event and resource received event]	5 minutes
		34	P Recovery reactivity	[Time between release resource event and resource received event]	15 minutes
		35	A Recovery reactivity	[Time between release resource event and resource received event]	20 minutes
		36	OI Recovery reactivity	[Time between release resource event and resource received event]	60 minutes
	Relevance	37	F Update frequency	[Number of update of inventory level / Number of event received (request, release)]	100%
		38	P Update frequency	[Number of update of inventory level / Number of event received (request, release)]	100%
		39	A Update frequency	[Number of update of inventory level / Number of event received (request, release)]	100%
		40	OI Update frequency	[Number of update of inventory level / Number of event received (request, release)]	100%
Manage data	Effectiveness	41	Analysis frequency	[Time between the two last analysis reports]	20 minutes
	Efficiency	42	N/A		
	Relevance	43	N/A		
Evacuate population	Effectiveness	44	Evacuation reactivity	[Time between decision from RNA event and start of evacuation web service]	45 minutes
		45	Report frequency	[Time between two reports on evacuation]	20 minutes
		46	Bus reactivity	[Time between evacuation plan event reception and buses deployed event]	30 minutes
	Efficiency	47	Filling rate	[number of people to evacuate / capacity of buses mobilized]	70%
		48	Supervisory rate	[Number of policemen (human resources) / number of people to evacuate]	0,2
	Relevance	49	Unfeasibility	[Number of unfeasible instructions received / total number of instructions received]	5%
Confine population	Effectiveness	50	Confinement reactivity	[Time between decision from RNA event and start of confinment web service]	30 minutes
		51	Confinement cycletime	[Time between start of confinement and end of confinement]	60 minutes
	Efficiency	52	Supervisory rate	[Number of policemen (human resources) / number of people to confine]	0,1
	Relevance	53	Unfeasibility	[Number of unfeasible instructions received / total number of instructions received]	5%
Distribute iodine	Effectiveness	54	Evacuation reactivity	[Time between decision from RNA event and start of iodine distribution web service]	15 minutes
		55	Report frequency	[Time between two reports on distribution]	20 minutes
	Efficiency	56	Supervisory rate	[Number of firemen (human resources) / number of people to supply]	0,01
	Relevance	57	Unfeasibility	[Number of unfeasible instructions received / total number of instructions received]	10%
Implement security measures	Effectiveness	58	Security reactivity	[Time between decision from RNA event and start of implementation]	15 minutes
		59	Report frequency	[Time between two reports on security measure]	20 minutes
	Efficiency	60	Supervisory rate	[Number of military (human resources) / number of people to control]	0,05
	Relevance	61	Unfeasibility	[Number of unfeasible instructions received / total number of instructions received]	1%
Implement circulation plan	Effectiveness	62	Circulation reactivity	[Time between decision from RNA event and start of implementation]	30 minutes
		63	Report frequency	[Time between two reports on implementation of circulation plan]	20 minutes
	Efficiency	64	Supervisory rate	[Number of people / km2]	2
	Relevance	65	Unfeasibility	[Number of unfeasible instructions received / total number of instructions received]	25%

Gloassary : F = Firemen; P = Police; A = Army; OI = Ofiice of Infrastructure; RF = Representative of Firemen; RP = Representative of Police; ROI = Representative of Office Infrastructure RA = Representative of Army; RNA = Radio Network Authority; IRSN = Institut de Radioprotection et de Sûreté Nucléaire; MF = Meteo France

Figure 12: List of Workflows' KPIs for the nuclear use case.

Regarding "genericity" of the previous KPIs, it is possible to consider the PLAY Platform KPIs (N° A to F) can be considered as generic and should be applicable to any application case. The Workflow KPIs (N°1 to 65) are specific to the nuclear use

case because they are representative of the concrete business implemented on the field. Nevertheless, generic workflow KPI's typology could be defined to support the implementation of the PLAY platform for any business case. This research work is ongoing.

5.3 Connections with the requirements and constraints

In (Barthe, Carbonnel, Charles, Bénaben, Lauras, and Truptil, 2011), the list of PLAY requirements were confronted to the several use case processes in order to ensure that they would be attained. In this section, we propose to control that these requirements might be objectively validated through the previous set of KPIs (independently of the content relevance of data). The following table 13 presents this association:

Requirements (from D6.2.1, section 4.4.)	**Related KPI**
Ability to connect services in a highly distributed context (i.e. to link various processes, which are running on separate ESB (choreography)).	A, D, E
Ability to identify exceptional situations where expected interactions or events were not achieved or not received.	C + 1, 4, 5, 6, 9, 13, 15, 18, 19, 20, 21, 22, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 44, 45, 46, 54, 55, 58, 59, 62, 63.
Ability to manage events coming from heterogeneous (from external environment or from different stakeholders of the system).	B, C, F + 12, 17, 49, 53, 57, 61, 65.
Ability to define the privacy of events.	Not yet instantiated.
Ability to recommend or to take into account changes in the normal process to circumvent an exceptional situation (agility in orchestration)	11, 12, 16, 17, 23, 24, 25, 26, 27, 33, 34, 35, 36, 37, 38, 39, 40, 47, 48, 49, 52, 53, 56, 57, 60, 61, 64, 65.
Ability to run efficiently independent internal business processes (orchestration).	1, 11, 12, 17, 49, 53, 57, 61, 65.
Ability to secure the privacy of events.	Not yet instantiated.
Ability to exchange high volumes of heteregenous and fluctuated information (elasticity and scalability).	D, E + 4, 5.
Ability to deal with some delays.	1, 4, 5, 6, 9, 13, 15, 18, 19, 20, 21, 22, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 44, 45, 46, 54, 55, 58, 59, 62, 63.
Ability to be responsive in the event dissemination.	A + 1, 4, 5, 6, 9, 13, 15, 18, 19, 20, 21, 22, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 44, 45, 46, 54, 55, 58, 59, 62, 63.
Ability to record events properly.	37, 38, 39, 40
Ability to define her/his own requirements for the "quality" of processing.	C + 12, 16, 17, 49, 57, 61, 65
Ability to combine real-time data with stored information.	C + 15, 41
Ability to recommend subscription to additional event sources as a response to exceptional situations	Not yet instantiated.

Figure 13: Validation of PLAY requirements through the use of KPIs.

6 Conclusion

The way the scenario described in (Stühmer Stojanovic, Stojanovic, Verginadis, Pellegrino, and Hamerling, 2011) may be used in order to define the technical structure of the s(t)imulation platform dedicated to the nuclear crisis use-case has been described in section 2. The way this mechanism has been applied and the obtained results (concerning the technical description of the simulation Platform) have been described in section 3. The connections, in terms of requirements and expected benefits, between the s(t)imulation environment and the PLAY platform have been presented in section 4. Principles and metrics to evaluate the PLAY platform and the profits for the crisis management context have finally been described in section 5.

Current and next steps concern the final implementation and experimentation of the simulation environment, especially concerning connections with ESR (in order to ensure concrete agility of the system).

References

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Smith, P. and Goddard, M. 2002, 'Performance management and operational research: a marriage made in heaven?', Journal of the Operational Research Society, No. 53, pp. 247–255

Appendix A:

BPEL file

```
<bpel:process name="Decision_sc1_Situation_management"
        targetNamespace="http://www.petalslink.org/" suppressJoinFailure="yes"
        xmlns:tns="http://www.petalslink.org/" xmlns:bpel="http://docs.oasis-
open.org/wsbpel/2.0/process/executable"
        xmlns:wsnt="http://docs.oasis-open.org/wsn/b-2"
xmlns:wsn="http://www.petalslink.com/wsn/service/WsnProducer"
        xmlns:ns="http://www.petalslink.org/OfficeOfInfrastructure/"
xmlns:ns0="http://docs.oasis-open.org/wsn/bw-2"
        xmlns:ns1="http://www.w3.org/2001/XMLSchema"
        xmlns:event="http://www.mines-albi.fr/nuclearcrisisevent"
xmlns:ns2="http://nuclearcrisisevent/firemen"
xmlns:ns3="http://nuclearcrisisevent/representativeNationalAuthoritySet1Service">

<!-- Import the client WSDL -->
<bpel:import
namespace="http://nuclearcrisisevent/representativeNationalAuthoritySet1Service"
location="representativeNationalAuthoritySet1.wsdl"
importType="http://schemas.xmlsoap.org/wsdl/"></bpel:import>
<bpel:import location="SeaCloud.wsdl" namespace="http://www.petalslink.org/SeaCloud/"
         importType="http://schemas.xmlsoap.org/wsdl/" />
<bpel:import location="SimulatedEventProducers.wsdl"
         namespace="http://www.petalslink.org/SimulatedEventProducers/"
         importType="http://schemas.xmlsoap.org/wsdl/" />
 <bpel:import location="Decision_sc1_Situation_managementArtifacts.wsdl"
         namespace="http://www.petalslink.org/"
importType="http://schemas.xmlsoap.org/wsdl/" />
<bpel:import location="./eventservice/wsn-producer.wsdl"
         namespace="http://www.petalslink.com/wsn/service/WsnProducer"
         importType="http://schemas.xmlsoap.org/wsdl/" />
<bpel:import location="./eventservice/standard/wsn/b-2.xsd"
         namespace="http://docs.oasis-open.org/wsn/b-2"
importType="http://www.w3.org/2001/XMLSchema" />

<!-- ================================================================= -->
<!-- PARTNERLINKS -->
<!-- List of services participating in this BPEL process -->
<!-- ================================================================= -->
<bpel:partnerLinks>
<!-- The 'client' role represents the requester of this service. -->
<bpel:partnerLink name="client" partnerLinkType="tns:Decision_sc1_Situation_management"
               myRole="Decision_sc1_Situation_managementProvider" />
<bpel:partnerLink name="SeaCloudPartnerLink"
               partnerLinkType="tns:SeaCloudPLT"
partnerRole="SeaCloudRole"></bpel:partnerLink>
<bpel:partnerLink name="WSNProducerPartnerLink"
               partnerLinkType="tns:WSNProducerPLT"
partnerRole="WSNProducerRole"></bpel:partnerLink>

<bpel:partnerLink name="RepOfNationalAuthority" partnerLinkType="tns:RepOfNatAutho_PLT"
partnerRole="RepOfNatAutho_Role"></bpel:partnerLink>
</bpel:partnerLinks>

<!-- ================================================================= -->
<!-- VARIABLES -->
<!-- List of messages and XML documents used within this BPEL process -->
<!-- ================================================================= -->
<bpel:variables>
<!-- Reference to the message passed as input during initiation -->
<bpel:variable name="input"
               messageType="tns:Decision_sc1_Situation_managementRequestMessage" />

<!-- Reference to the message that will be returned to the requester -->
<bpel:variable name="output"
               messageType="tns:Decision_sc1_Situation_managementResponseMessage" />


<bpel:variable name="subscribeInstructionEventRequest"
```

```
                element="wsnt:Subscribe"></bpel:variable>
<bpel:variable name="subscribeInstructionEventResponse"
                element="wsnt:SubscribeResponse"></bpel:variable>
 <bpel:variable name="subscribeAlertEventRequest"
                element="wsnt:Subscribe"></bpel:variable>
<bpel:variable name="subscribeAlertEventResponse"
                element="wsnt:SubscribeResponse"></bpel:variable>
 <bpel:variable name="subscribeReportEventRequest"
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<bpel:variable name="subscribeReportEventResponse"
                element="wsnt:SubscribeResponse"></bpel:variable>



<bpel:variable name="subscribeMessageToSeaCloud"
                element="wsnt:Subscribe"></bpel:variable>

<bpel:variable name="notificationOnGetInstructionEventRequest"
                element="wsnt:Notify"></bpel:variable>
 <bpel:variable name="notificationOnGetAlertEventRequest"
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 <bpel:variable name="notificationOnGetReportEventAdviceRequest"
                element="wsnt:Notify"></bpel:variable>
 <bpel:variable name="notificationOnGetReportEventActivityRequest"
                element="wsnt:Notify"></bpel:variable>

<bpel:variable name="address" type="ns1:string"></bpel:variable>
<bpel:variable name="isInstructionEvent" type="ns1:boolean"></bpel:variable>
<bpel:variable name="isAlertEvent" type="ns1:boolean"></bpel:variable>
<bpel:variable name="isReportEvent" type="ns1:boolean"></bpel:variable>
<bpel:variable name="isReportEventAdvice" type="ns1:boolean"></bpel:variable>

<bpel:variable name="RepOfNationalAuthorityResponse"
messageType="ns3:consultOrWaitResponse"></bpel:variable>
<bpel:variable name="RepOfNationalAuthorityRequest"
messageType="ns3:consultOrWait"></bpel:variable>
<bpel:variable name="RepOfNationalAuthorityResponse1"
messageType="ns3:consultDataResponse"></bpel:variable>
<bpel:variable name="RepOfNationalAuthorityRequest1"
messageType="ns3:consultData"></bpel:variable>

 <bpel:variable name="RepOfNationalAuthorityResponse2"
messageType="ns3:analyseDataResponse"></bpel:variable>
<bpel:variable name="RepOfNationalAuthorityRequest2"
messageType="ns3:analyseData"></bpel:variable>
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messageType="ns3:studyAdviceResponse"></bpel:variable>
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messageType="ns3:studyAdvice"></bpel:variable>
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messageType="ns3:closeOperationsResponse"></bpel:variable>
<bpel:variable name="RepOfNationalAuthorityRequest7"
messageType="ns3:closeOperations"></bpel:variable>
<bpel:variable name="RepOfNationalAuthorityResponse8"
messageType="ns3:decideNatureOpResponse"></bpel:variable>
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messageType="ns3:decideNatureOp"></bpel:variable>

</bpel:variables>

<bpel:correlationSets>
<bpel:correlationSet name="InstructionEventCorrelationSet" properties="tns:consumerEPR
tns:topic"/>
<bpel:correlationSet name="AlertEventCorrelationSet" properties="tns:consumerEPR
```

```
tns:topic"/>
<bpel:correlationSet name="ReportEventCorrelationSet" properties="tns:consumerEPR
tns:topic"/>
</bpel:correlationSets>

<!-- ================================================================= -->
<!-- ORCHESTRATION LOGIC -->
<!-- Set of activities coordinating the flow of messages across the -->
<!-- services integrated within this business process -->
<!-- ================================================================= -->
<bpel:sequence name="main">

<!-- Receive input from requester. Note: This maps to operation defined
        in Decision_sc1_Situation_management.wsdl -->
<bpel:receive name="receiveInput" partnerLink="client"
              portType="tns:Decision_sc1_Situation_management" operation="process"
variable="input"
              createInstance="yes" />

<bpel:assign validate="no" name="AssignSeaCloudPartner">
<bpel:copy>
       <bpel:from>
       <bpel:literal xml:space="preserve">
       <sref:service-ref
              xmlns:sref="http://docs.oasis-open.org/wsbpel/2.0/serviceref">
       <ns1:EndpointReference
              xmlns:ns1="http://j2ee.netbeans.org/wsdl/echo">
              <wsa:Address
              xmlns:wsa="http://www.w3.org/2005/08/addressing">
              {http://www.petalslink.org/SeaCloud/}SeaCloud::SeaCloudSOAPEndpoint
              </wsa:Address>
       </ns1:EndpointReference>
       </sref:service-ref>
       </bpel:literal>
       </bpel:from>
       <bpel:to partnerLink="SeaCloudPartnerLink"></bpel:to>
</bpel:copy>
</bpel:assign>
<bpel:assign validate="no" name="AssignSubscribeMessageToSeaCloud">
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       <![CDATA[concat("http://", bpel:getVariableProperty("env", "host"), ":",
bpel:getVariableProperty("env", "port"),
"/services/Decision_sc1_Situation_managementPort_proxy", "?",
bpel:getVariableProperty("process", "name"))]]>
       </bpel:from>
       <bpel:to variable="address"></bpel:to>
</bpel:copy>
<bpel:copy>
       <bpel:from>
       <bpel:literal xml:space="preserve">
       <ns2:Subscribe
              xmlns:ns3="http://docs.oasis-open.org/wsrf/bf-2"
xmlns:ns2="http://docs.oasis-open.org/wsn/b-2"
              xmlns:ns4="http://docs.oasis-open.org/wsn/t-1"
xmlns:ns5="http://www.w3.org/2005/08/addressing"
              xmlns:ns6="http://com.petalslink.esstar/admin/model/datatype/1.0"
              xmlns:ns7="http://com.petalslink.esstar/data/management/user/1.0"
              xmlns:ns8="http://docs.oasis-open.org/wsrf/rp-2"
xmlns:ns9="http://docs.oasis-open.org/wsrf/r-2"
              xmlns:tns="http://www.petalslink.org/"
              xmlns:bpel="http://docs.oasis-open.org/wsbpel/2.0/process/executable"
              xmlns:wsnt="http://docs.oasis-open.org/wsn/b-2"
xmlns:wsn="http://www.petalslink.com/wsn/service/WsnProducer"
              xmlns:ns="http://www.petalslink.org/OfficeOfInfrastructure/"
              xmlns:ns0="http://docs.oasis-open.org/wsn/bw-2">
       <ns2:ConsumerReference>
              <ns5:Address>$address</ns5:Address>
              <ns5:ReferenceParameters />
       </ns2:ConsumerReference>
       <ns2:Filter>
              <ns2:TopicExpression xmlns:res="http://www.soceda.org/crisis"
                           Dialect="http://www.w3.org/TR/1999/REC-xpath-
19991116">$topic</ns2:TopicExpression>
       </ns2:Filter>
       </ns2:Subscribe>
```

```
        </bpel:literal>
        </bpel:from>
        <bpel:to variable="subscribeMessageToSeaCloud"></bpel:to>
</bpel:copy>
</bpel:assign>

<bpel:assign validate="no" name="AssignSubscribeAlertEvent">
<bpel:copy>
        <bpel:from>
        <![CDATA[bpel:doXslTransform("expand_variable.xsl", $subscribeMessageToSeaCloud,
"address", $address, "topic", "res:situationalEvent")]]>
        </bpel:from>
        <bpel:to variable="subscribeAlertEventRequest"></bpel:to>
</bpel:copy>
</bpel:assign>
<bpel:invoke name="InvokeSubscribeAlertEvent"
                partnerLink="SeaCloudPartnerLink" portType="wsn:NotificationProducer"
                operation="Subscribe" inputVariable="subscribeAlertEventRequest"
                outputVariable="subscribeAlertEventResponse">
<bpel:correlations>
        <bpel:correlation initiate="yes"
                        set="AlertEventCorrelationSet" />
</bpel:correlations>
</bpel:invoke>

<bpel:assign validate="no" name="AssignSubscribeReportEvent">
<bpel:copy>
        <bpel:from>
        <![CDATA[bpel:doXslTransform("expand_variable.xsl", $subscribeMessageToSeaCloud,
"address", $address, "topic", "res:consequenceEvent")]]>
        </bpel:from>
        <bpel:to variable="subscribeReportEventRequest"></bpel:to>
</bpel:copy>
</bpel:assign>
<bpel:invoke name="InvokeSubscribeReportEvent"
                partnerLink="SeaCloudPartnerLink" portType="wsn:NotificationProducer"
                operation="Subscribe" inputVariable="subscribeReportEventRequest"
                outputVariable="subscribeReportEventResponse">
<bpel:correlations>
        <bpel:correlation initiate="yes"
                        set="ReportEventCorrelationSet" />
</bpel:correlations>
</bpel:invoke>


 <bpel:while name="While">
<bpel:condition
expressionLanguage="urn:oasis:names:tc:wsbpel:2.0:sublang:xpath1.0"><![CDATA[not(contain
s(string($RepOfNationalAuthorityResponse7.parameters/out),"close"))]]></bpel:condition>
<bpel:sequence>
<bpel:invoke name="Decideconsultorwait" partnerLink="RepOfNationalAuthority"
operation="consultOrWait" portType="ns3:representativeNationalAuthoritySet1"
inputVariable="RepOfNationalAuthorityRequest"
outputVariable="RepOfNationalAuthorityResponse"></bpel:invoke>
<bpel:if name="If">
<bpel:condition
expressionLanguage="urn:oasis:names:tc:wsbpel:2.0:sublang:xpath1.0"><![CDATA[contains($R
epOfNationalAuthorityResponse.parameters/out,"consult")]]></bpel:condition>

<bpel:invoke name="consult" partnerLink="RepOfNationalAuthority" operation="consultData"
portType="ns3:representativeNationalAuthoritySet1"
inputVariable="RepOfNationalAuthorityRequest1"
outputVariable="RepOfNationalAuthorityResponse1"></bpel:invoke>
<bpel:else>
 <bpel:sequence name="Sequencet">
<bpel:assign validate="no" name="assign_isAlertEvent_false">
        <bpel:copy>
        <bpel:from><![CDATA[false]]></bpel:from>
        <bpel:to variable="isAlertEvent"></bpel:to>
        </bpel:copy>
        </bpel:assign>

        <bpel:while name="While_received_event_is_not_alertEvent">
        <bpel:condition><![CDATA[$isAlertEvent = false()]]></bpel:condition>
        <bpel:sequence name="Sequence">
```

```
<bpel:receive name="ReceiveNotify_AlertEventSent"
                        partnerLink="client" operation="Notify"
portType="tns:Decision_sc1_Situation_management"
                        variable="notificationOnGetAlertEventRequest">
        <bpel:correlations>
                <bpel:correlation initiate="no"
                                set="AlertEventCorrelationSet" />
        </bpel:correlations>
        </bpel:receive>

        <bpel:if name="If_is_AlertEvent">
        <bpel:condition><![CDATA[exists($notificationOnGetAlertEventRequest/wsnt:Notifica
tionMessage/wsnt:Message/event:alertEvent)]]></bpel:condition>
                        <bpel:assign validate="no" name="assign_isAlertEvent_true">
                <bpel:copy>
                <bpel:from><![CDATA[true]]></bpel:from>
                <bpel:to variable="isAlertEvent"></bpel:to>
                </bpel:copy>
                </bpel:assign>
        </bpel:if>
         </bpel:sequence>
        </bpel:while>
        </bpel:sequence>
        </bpel:else>
</bpel:if>

        <bpel:invoke name="Analyse" partnerLink="RepOfNationalAuthority"
operation="analyseData" portType="ns3:representativeNationalAuthoritySet1"
inputVariable="RepOfNationalAuthorityRequest2"
outputVariable="RepOfNationalAuthorityResponse2"></bpel:invoke>
<bpel:if name="If3">
<bpel:condition
expressionLanguage="urn:oasis:names:tc:wsbpel:2.0:sublang:xpath1.0"><![CDATA[not(contain
s($RepOfNationalAuthorityResponse2.parameters/out,"boucle"))]]></bpel:condition>
<bpel:if name="If5">
<bpel:condition
expressionLanguage="urn:oasis:names:tc:wsbpel:2.0:sublang:xpath1.0"><![CDATA[contains($R
epOfNationalAuthorityResponse2.parameters/out,"close")]]></bpel:condition>
<bpel:invoke name="closeOperation" partnerLink="RepOfNationalAuthority"
operation="closeOperations" portType="ns3:representativeNationalAuthoritySet1"
inputVariable="RepOfNationalAuthorityRequest7"
outputVariable="RepOfNationalAuthorityResponse7"></bpel:invoke><bpel:else>
<bpel:sequence>
<bpel:if name="If1">
<bpel:condition
expressionLanguage="urn:oasis:names:tc:wsbpel:2.0:sublang:xpath1.0"><![CDATA[contains($R
epOfNationalAuthorityResponse2.parameters/out,"activity")]]></bpel:condition>
<bpel:sequence>
<bpel:invoke name="Askfor activityreport" partnerLink="RepOfNationalAuthority"
operation="askForActivityReprot" portType="ns3:representativeNationalAuthoritySet1"
inputVariable="RepOfNationalAuthorityRequest3"
outputVariable="RepOfNationalAuthorityResponse3"></bpel:invoke>

 <bpel:assign validate="no" name="assign_isReportEvent_false">
        <bpel:copy>
        <bpel:from><![CDATA[false]]></bpel:from>
        <bpel:to variable="isReportEvent"></bpel:to>
        </bpel:copy>
        </bpel:assign>

        <bpel:while name="While_received_event_is_not_reportEvent">
        <bpel:condition><![CDATA[$isReportEvent = false()]]></bpel:condition>
        <bpel:sequence name="Sequence">
 <bpel:receive name="ReceiveNotify_ReportEventSent"
                        partnerLink="client" operation="Notify"
portType="tns:Decision_sc1_Situation_management"
                        variable="notificationOnGetReportEventActivityRequest">
        <bpel:correlations>
                <bpel:correlation initiate="no"
                                set="ReportEventCorrelationSet" />
        </bpel:correlations>
        </bpel:receive>

        <bpel:if name="If_is_ReportEvent">
        <bpel:condition><![CDATA[exists($notificationOnGetReportEventActivityRequest/wsnt
:NotificationMessage/wsnt:Message/event:reportEvent)]]></bpel:condition>
```

```
        <bpel:if name="If_resources_type_car">

        <bpel:condition><![CDATA[$notificationOnGetReportEventActivityRequest/wsnt:Notifi
cationMessage/wsnt:Message/event:reportEvent/event:resultMessage = "activity"]]>
                </bpel:condition>
                <bpel:assign validate="no" name="assign_isReportEvent_true">
                <bpel:copy>
                <bpel:from><![CDATA[true]]></bpel:from>
                <bpel:to variable="isReportEvent"></bpel:to>
                </bpel:copy>
                </bpel:assign>
        </bpel:if>
        </bpel:if>
        </bpel:sequence>
        </bpel:while>


         <bpel:invoke name="studyreport" partnerLink="RepOfNationalAuthority"
operation="studyReprot" portType="ns3:representativeNationalAuthoritySet1"
inputVariable="RepOfNationalAuthorityRequest4"
outputVariable="RepOfNationalAuthorityResponse4"></bpel:invoke>
</bpel:sequence><bpel:else>
<bpel:if name="If2">
<bpel:condition
expressionLanguage="urn:oasis:names:tc:wsbpel:2.0:sublang:xpath1.0"><![CDATA[contains($R
epOfNationalAuthorityResponse2.parameters/out,"advice")]]></bpel:condition>
<bpel:sequence name="Sequence">
<bpel:invoke name="askforadvice" partnerLink="RepOfNationalAuthority"
operation="askForAdvice" portType="ns3:representativeNationalAuthoritySet1"
inputVariable="RepOfNationalAuthorityRequest5"
outputVariable="RepOfNationalAuthorityResponse5"></bpel:invoke>

        <bpel:assign validate="no" name="assign_isReportEvent_false">
        <bpel:copy>
        <bpel:from><![CDATA[false]]></bpel:from>
        <bpel:to variable="isReportEventAdvice"></bpel:to>
        </bpel:copy>
        </bpel:assign>

        <bpel:while name="While_received_event_is_not_reportEvent">
        <bpel:condition><![CDATA[$isReportEventAdvice = false()]]></bpel:condition>
        <bpel:sequence name="Sequence">
         <bpel:receive name="ReceiveNotify_ReportadviceEventSent"
                        partnerLink="client" operation="Notify"
portType="tns:Decision_sc1_Situation_management"
                        variable="notificationOnGetReportEventAdviceRequest">
        <bpel:correlations>
                <bpel:correlation initiate="no"
                                set="ReportEventCorrelationSet" />
        </bpel:correlations>
        </bpel:receive>

        <bpel:if name="If_is_ReportEvent">
        <bpel:condition><![CDATA[exists($notificationOnGetReportEventAdviceRequest/wsnt:N
otificationMessage/wsnt:Message/event:reportEvent)]]></bpel:condition>
        <bpel:if name="If_resources_type_car">

        <bpel:condition><![CDATA[$notificationOnGetReportEventAdviceRequest/wsnt:Notifica
tionMessage/wsnt:Message/event:reportEvent/event:resultMessage = "advice" ]]>
                </bpel:condition>
                <bpel:assign validate="no" name="assign_isReportEvent_true">
                <bpel:copy>
                <bpel:from><![CDATA[true]]></bpel:from>
                <bpel:to variable="isReportEventAdvice"></bpel:to>
                </bpel:copy>
                </bpel:assign>
        </bpel:if>
        </bpel:if>
        </bpel:sequence>
        </bpel:while>
<bpel:invoke name="studyadvice" partnerLink="RepOfNationalAuthority"
operation="studyAdvice" portType="ns3:representativeNationalAuthoritySet1"
inputVariable="RepOfNationalAuthorityRequest6"
outputVariable="RepOfNationalAuthorityResponse6"></bpel:invoke>
</bpel:sequence>
<bpel:else>
```

```
<bpel:assign validate="no" name="Assign1">
<bpel:copy>
<bpel:from>
<bpel:literal xml:space="preserve"><tns:decideNatureOpRequest
xmlns:tns="http://nuclearcrisisevent/representativeNationalAuthoritySet1Service"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
<in></in>
</tns:decideNatureOpRequest>
</bpel:literal>
</bpel:from>
<bpel:to variable="RepOfNationalAuthorityRequest8" part="parameters"></bpel:to>
</bpel:copy>
<bpel:copy>
<bpel:from part="parameters" variable="RepOfNationalAuthorityResponse2">
<bpel:query
queryLanguage="urn:oasis:names:tc:wsbpel:2.0:sublang:xpath1.0"><![CDATA[out]]></bpel:que
ry>
</bpel:from>
<bpel:to part="parameters" variable="RepOfNationalAuthorityRequest8">
<bpel:query
queryLanguage="urn:oasis:names:tc:wsbpel:2.0:sublang:xpath1.0"><![CDATA[in]]></bpel:quer
y>
</bpel:to>
</bpel:copy>
</bpel:assign>
</bpel:else>
</bpel:if>
</bpel:else>
</bpel:if>
<bpel:invoke name="decidenatureofoperation" partnerLink="RepOfNationalAuthority"
operation="decideNatureOp" inputVariable="RepOfNationalAuthorityRequest8"
outputVariable="RepOfNationalAuthorityResponse8"></bpel:invoke>
</bpel:sequence>
</bpel:else>
</bpel:if>
<bpel:else>
<bpel:assign validate="no" name="Assign">
<bpel:copy>
<bpel:from>

<![CDATA[$RepOfNationalAuthorityResponse2.parameters/out]]>
</bpel:from>
<bpel:to>

<![CDATA[$RepOfNationalAuthorityResponse7.parameters/out]]>
</bpel:to>
</bpel:copy>
</bpel:assign>
</bpel:else>
</bpel:if>
</bpel:sequence>
</bpel:while>
</bpel:sequence>
</bpel:process>
```