

# Assessment proposal for the Rehearsal framework \*

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## 1. Introduction

Rehearsal [BLK11a] is a framework for the automated testing of web service choreographies. The goal of this tool is to support the Test-Driven Development (TDD) [Bec03, Ast03] of web service choreographies. To achieve this, the Rehearsal features have been developed to support automated unit, integration, and acceptance tests writing, and common TDD practices, such as double object usage [Mes07]. However, for definition, a framework can be considered an incomplete system that must be extended or composed with other classes to create a concrete and executable application [JF88]. Thus, the use of Rehearsal alone does not imply the use of TDD for choreography development. For this reason, we prepared a methodology proposal [BLK11b] that guides the developer to apply TDD in choreographies using Rehearsal.

Our goal is to assess the Rehearsal effectiveness when the proposed TDD methodology is applied during choreography development. To achieve this, we intend to conduct an exploratory study with specialists to assess Rehearsal and the methodology. After this first validation phase, Rehearsal and the TDD methodology will be refined based on the results obtained. Then, a second validation phase consisting of a controlled experiment can be conducted. In this future experiment, we will be able to compare the Rehearsal effectiveness against existing testing tools when performing the experiment tasks.

This document presents our exploratory study proposal. We plan to apply this study in the first semester of 2012. In Section 2, we present all elements belonging to the exploratory study proposed. In Section 3, we present our conclusions and ongoing work.

## 2. The exploratory study

Our methodology [BLK11b] introduces novel concepts, such as the use of a test-driven instead of a contract-driven approach, to guide the choreography development. For this reason, we decided to apply an exploratory study [KPP<sup>+</sup>02] to explore potential benefits and problems arising from the Rehearsal usage to support the TDD methodology. The primary goal of this exploratory study is to investigate qualitatively the benefits and difficulties when Rehearsal is used to support TDD in choreographies. To achieve that, the study subjects, who are Computer Science student-developers with a previous experience in SOA, may apply the proposed TDD methodology to develop a choreography role. After the development, we will collect the subject feedbacks and perception through questionnaires and interviews.

The secondary goal of this study consists on refining and pre-validating the proposed TDD methodology. Since this methodology has been proposed by the Rehearsal authors, we intend to validate and incorporate specialist feedbacks to eliminate possible bias arising from the methodology conception. To achieve these goals, we aim at exploring the following research questions:

**RQ1: Do Rehearsal features help to apply the proposed methodology steps?**

**RQ2: Does the proposed methodology provides adequate guidelines for developing a choreography?**

The exploratory study phases are depicted in Figure 1 and explained in the next sections.

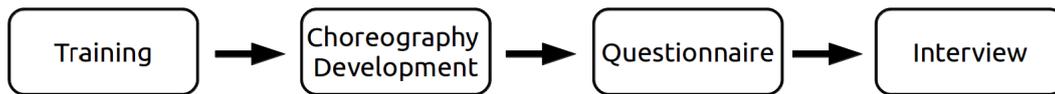


Figure 1. Exploratory study phases

## 2.1. Training

Before the study execution, the students must be trained in the following skills:

- **JUnit and TDD (60 min)**
  - development of a simple test case (20 min)
  - test case preconditions (10 min)
- **BPEL (60 min)**
  - Basic Commands (10 min)
  - Example of orchestration development in Petals Studio (hands on) (30 min)
  - BPEL deployment in Petals ESB (service assemblies) (20 min)
- **Development tasks that must be performed (30 min)**
- **Rehearsal (all features) (60 min)**

Depending of the subject experience and knowledge, this phase may not include the training in all skills presented. We intend to apply a qualifying questionnaire in the selected the subjects. The goal of this questionnaire is to identify the knowledge level of the selected subjects in each one of the skills above. Eventually, If all selected subjects are familiar to the skills mentioned, the training phase will only consists of the Rehearsal features and the tasks the subjects must apply during the development.

## 2.2. Choreography Development

After the training, the subjects will apply the Rehearsal tool to implement a choreography role and to integrate it into a running choreography. To simulate a real choreography development, we will create a business scenario presenting the choreography requirements that must be developed. This scenario will be presented to the students at the beginning of choreography development. In the next subsections we present the running choreography (object) and the business scenario.

### 2.2.1. Object: Future Market Choreography

Our study object is the Future Market choreography which implements a distributed shopping service consisting of the following workflow:

1. A customer provides to the choreography a shopping list;
2. The price of each list item is queried in multiple supermarket services to find which one has the lowest price;
3. The choreography returns to the customer the total cheapest price of its list and provides features for purchasing and delivering the items from the multiple supermarkets that are selected by the choreography.

This workflow is implemented by the following roles:

- **Registry:** The service playing this role must store a list of services that implements the supermarket role.
- **Supermarket:** Services playing this role must provide functionalities for searching and purchasing products.
- **Customer:** This role represents the choreography “trigger”. Through the service playing this role, real human customers can interact with the choreography by shopping for products and retrieving the delivery information for their orders;
- **Shipper:** The service playing this role is in charge of storing information about the delivery of products to a postal addresses.

Figure 2 illustrates the interaction among these roles. In this figure, the services are deployed on a cloud infrastructure with each service playing a specific role. The communication among the services is made through the Petals Distributed Service Bus (DSB)<sup>1</sup>.

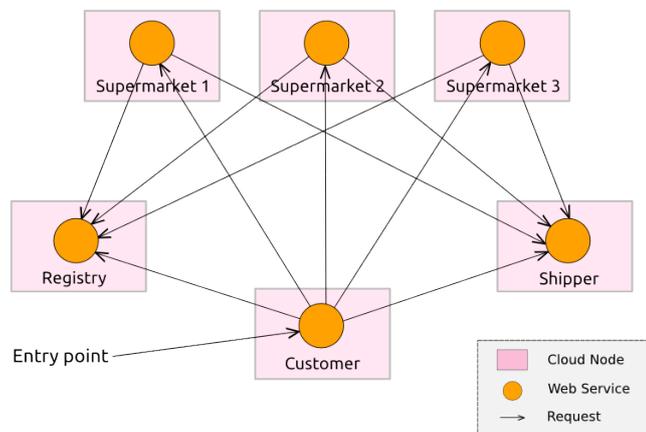


Figure 2. Choreography Roles Interaction

In the development phase of the proposed study the object choreography as well Petals DSD will be already up and running in a cloud infrastructure. The subjects must extend the choreography by implementing a new role called the Supplier. The service playing this role will be responsible for supplying products to the services playing the supermarket role. To achieve that, this service must interact to services playing the Shipper role to deliver the supermarket orders. The Supplier role contract and its requirements will be presented to the subject at the training phase of the proposed study.

### 2.2.2. Business Scenario

A new partner (e.g., a company) will join the choreography by playing the Supplier role. To achieve that, the company must implement the predefined contract (WSDL) for playing this role. This company has 2 existing services that must be integrated to play this role:

- **Inventory Service:** a real SOAP web service that controls the product inventory of this company;

<sup>1</sup>Petals DSB: <http://research.petalslink.org/display/petalsdsb/>

- **Customer database system:** a legacy system (not a web service) that contains company client information, including their address.

Based on a BPMN2 diagram that describes the choreography global model, the subjects must implement the Supplier role by following the tasks presented below. These tasks were elaborated based on the proposed TDD methodology phases.

#### **Task 01 - Wrap the customer database system into a web service**

In this task, a new web service encapsulating the customer database system must be developed by using TDD. Thus, the following steps must be performed:

1. Writing test cases for the web service operations to be developed
2. Coding the new web service

#### **Task 02 - Integrate the two services to provide the Supplier Role Contract**

This task contains the more complex development steps. To implement the Supplier role following the contract defined in the choreography model, the company services must be integrated in to a business process. The following steps must be performed for composing the business process:

1. Mocking the Inventory Service: Since the Inventory Service is not available in a development environment (offline), this service will be mocked.
2. Writing test cases to validate the message exchange within the business process
3. Writing test cases to validate the service integration
4. Implement the business process using Business Process Execution Language (BPEL)<sup>2</sup>
5. Applying predefined compliance tests (we will provide these test cases)

#### **Task 03 - Integrate the developed role into the choreography**

In this task, the developed services must be deployed on the Petals DSB. To validate the integration the following steps must be performed:

1. Writing test cases to validate the service message exchange
2. Deploying the services on the Petals DSB
3. Invoking the choreography which is running on a development/testing environment

#### **Task 04 Apply acceptance tests**

In this task, the subjects must apply acceptance tests using predefined input and output parameters to validate the correct choreography functional behavior. We will provide the expected input an output parameters.

### **2.3. Questionnaire**

At the end of the development phase, the students will be invited to answer a questionnaire. Through this questionnaire, we want to explore the RQ1 (“Do the Rehearsal features help to apply the proposed methodology steps?”) by studying issues related to usability, ease of learning, and effectiveness of Rehearsal. Then, to cover these issues, the following questions are proposed:

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<sup>2</sup>BPEL: <http://www.oasis-open.org/committees/wsbpel>

ID	Question
QR1	I experienced no difficulty in learning Rehearsal features. (1–5)
QR2	I experienced no difficulty in writing test cases. (1–5)
QR3	I experienced no difficulty in changing existing test cases. (1–5)
QR4	Did you think WSClient is useful for invoking web services in the test cases? (a–e)
QR5	Did you think WSMock is easy for mocking real web services? (a–e)
QR6	Did you think Message Interceptor is suitable for validating the message exchange? (a–e)
QR7	Did you think the Abstraction Choreography feature helps to use other Rehearsal features? (a–e)
	1 = strongly disagree, 2 = partially disagree, 3 = indifferent, 4 = partially agree, 5 = strongly agree a = definitely not, b = little, c = undecided, d = enough, e = very much

In the case of the TDD methodology, we want to explore the RQ2 (“Does the proposed methodology provides adequate guidelines for developing a choreography?”) by studying issues related to its suitability and acceptance in the development of choreography. Then, to cover these issues, the following questions are proposed:

ID	Question
QM1	I experienced no difficulty in following the steps from Task 01. (1–5)
QM2	I experienced no difficulty in following the steps from Task 02. (1–5)
QM3	I experienced no difficulty in following the steps from Task 03. (1–5)
QM4	I experienced no difficulty in following the steps from Task 04. (1–5)
QM5	Did you think the methodology phases are adequate for the proposed scenario? (a–e)
	1 = strongly disagree, 2 = partially disagree, 3 = indifferent, 4 = partially agree, 5 = strongly agree a = definitely not, b = little, c = undecided, d = enough, e = very much

## 2.4. Interview

The goals of the interviews is to collect the subject criticisms, suggestions and perceptions about Rehearsal and the proposal methodology. Then, the questions below are proposed. For some questions, such as QI2, if the answer is affirmative, questions such “Which one” and “Why” can also be applied.

ID	Question
QI1	What are your overall perceptions about Rehearsal?
QI2	Would you change any Rehearsal feature?
QI3	What are your overall perceptions about the proposed methodology?
QI4	Do you think Rehearsal is suitable for applying the methodology steps?
QI5	Would you change any step in the proposed methodology?
QI6	In our opinion, what are the advantages and disadvantages in applying TDD in choreographies?
QI7	Is there any comment you would like to add ?

The interview questions QI1, QI2 and QI7 aim at extending the questionnaire about Rehearsal by identifying perceptions that cannot be covered in the questionnaire. In the case of the questionnaire about the methodology, the questions QI3, QI4, QI5, QI6 and QI7 complement this questionnaire.

## 3. Conclusion and ongoing work

This document corresponds to our first exploratory study proposal for assessing Rehearsal tool. Based on evaluation methods, such as DEMET [Kit96], a definitive exploratory study protocol may be developed in the beginning of the next year. In particular, we must include in the definitive protocol how we intend to analyze, present and interpret the results obtained from the questionnaire and interview. Based on the definitive study protocol, the development phase

of this study will be executed and all results obtained will be analyzed and reported in scientific contributions.

In addition, based on these results, we may apply a second and more concrete assessment which consists in a controlled experiment. The goal of this experiment is to study the Rehearsal benefits when the proposed TDD methodology is applied during the development of an entire choreography. In this experiment, we intend to compare Rehearsal with existing tools in terms of needed effort (development time) and effectiveness (requirements implemented correctly) during the choreography development.

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