Power EnJoy
Integration Test Plan Document

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Software Engineering 2 Course Project

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1 Introduction

1.1 Revision History

Version	Date	Author(s)	Summary
1.0	06/01/2016	Niccolo' Raspa, Matteo Marinelli	Initial Release

1.2 Purpose and Scope

This document represents the Integration Testing Plan Document for PowerEnJoy. The main purpose of this document is to outline, in a clear and comprehensive way, the main aspects concerning the organization of the integration testing activity for all the components that make up the system.

This process is essential because it not only guarantees that every component behaves as expected but also that all the components interoperate correctly together to fullfil all the functionalities expected from the system.

We will focus deeply on the Application Layer since it implements all the core of our business. This component is divided in different services which provides great benefits but the implicit granularity of a service oriented approach must be fully tested to guarantee that all the subcomponents behave as one cohesive layer.

This document is structured as follows:

Chapter 1 Provides general information about the ITPD document.

Chapter 2 Explains in details the chosen integration strategy. In more details:

- Lists of the subsystems and their subcomponents involved in this process
- Specifies the criteria that must be met before integration testing begins
- Describes the integration testing approach and the rationale behind it
- Outlines the order in which components and subcomponents will be integrated

Chapter 3 Describes the type of tests that will be used to verify that every step of the integration process above perform as expected.

Chapter 4 Identifies all tools and test equipment needed to accomplish the integration.

Chapter 5 Identifies any program stubs or special test data required for each integration step

1.3 List of Definitions and Abbreviations

DD: Design Document

RASD: Requirement Analysis and Specification Document

ITPD: Integration Test Plan Document

EJB: Enterprise JavaBeans

SOA: Service Oriented Architecture

Component: One of the four tier of the system (Client, Web, Application, Database)

Subcomponent: Usually refers to the Application Layer, and refers to a EJB that encapsulates a specific part of the business logic of the module

Layer: synonim of *Component*

Service: synonim of *Subcomponent*

Power User: Registered user of the application

1.4 List of Reference Documents

Please refer to the following documents, for additional informations on the Power Enjoy System:

- Project rules of the Software Engineering 2 project
- Power Enjoy - Requirement Analysis and Specification Document
- Power Enjoy - Design Document
- **Documentation of any tool you plan to use for testing**

2 Integration Strategy

2.1 Entry Criteria

This section describes the prerequisites that need to be met before integration testing can be started.

Stakeholder Approval First of all, the Requirements Analysis and Specification Document and the Design Document must have been presented to the stakeholders for approval even before the coding phase can begin, this will ensure that they're satisfied with the development.

Website and Mobile App The presentation layer to the user might not be completed but communication between the Application Server and Clients, both via the Mobile App and via the Web Server, must have clearly structured and coded via RESTful APIs using JAX-RS.

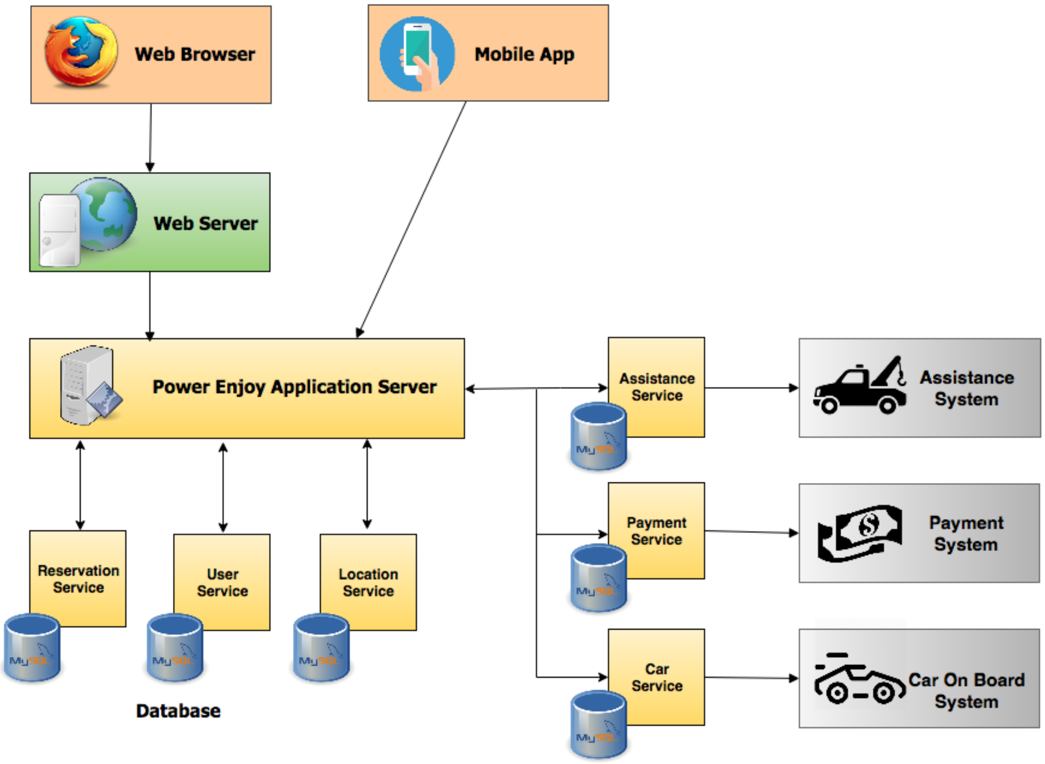
Coding and Testing Application Layer

- All the classes and methods of the Entity Beans must be coded and must pass thorough **Unit tests**. Unit tests should have a minimum coverage of 90% of the lines of code and should be run automatically at each build using JUnit.
- **Code inspection** has to be performed on all the code in order to ensure maintainability, respect of conventions and find possible issues which could increase the testers' effort in next testing phases. Code inspection should be performed using automated tools when possible.
- **Documentation** of all classes and functions should be well written using JavaDoc. The public interfaces of each Entity Bean shoud be clearly stated.
- **Object relational mapping** of each service to its corresponding database should be implemented with automated tools to avoid errors (such as Hibernate) and fully tested.

2.2 Elements to be Integrated

In this section we're going to provide a list of all the components that need to be integrated together. The figure below corrispond to the system architecture already discussed in the Design Document.

The system is built upon the interactions of many tiers, each one implementing a specific set of functionalities. Every tier is also obtained by the combination of several lower-level components. This modularity causes that the integration phase will involve the integration of components at different levels of abstraction. In addition our system is in relation with External Systems, which are crucial for our application to work. It's important that they're correctly integrated to the system in a way in which everything is trasparent to the user.



In summary, the elements to integrate are:

1. Integration of the different services inside the Application Layer.
2. Integration of different tiers (Client - Web - Application)
3. Integration and configuration with third party systems (Payment System, Assistance System)

2.3 Integration Testing Strategy

The approach we're going to use to perform integration testing is based on a mixture of the bottom-up and functional-grouping integration strategies. This choice is due to the fact that if the entry criteria is met, it's reasonable to assume that we have different small services, indipendent from one other, that implement correctly a small part of the application logic and by integrating them we're able to create a more and more complex system that will eventually satisfy all the requirements. In a pure bottom-up strategy we would start from the lowest layers of the system, testing the basic functionalities, then moving forward the most abstract layers but in our case this approach would be unefficient. Since every service is dedicated to one part of the business logic we can parallelize this testing, focusing on different logic groups at the same time, giving more priority to the critical components first and then integrating secondary functionalities. Moreover, we also need to keep in mind that we're dealing with external systems and if we discover some bugs or problems on their side, fixes might take time and this would create a time gap in which we're not able to move the integration forward.

For all these reasons we believe that the best integration strategy is the following:

PHASE 1: Assure that services in relations with external systems works as expected.

As stated earlier, in order to avoid wasting time we start from the boundary of the system. This process should be fairly quick if everything was implemented as mutually agreed and should immediatly discover issues that we can notify early on to external parties. In this phase we'll test the communication between *Assistance Service - Assistance System* and *Payment Service - Payment System.*

PHASE 2: Assure that we have control over the Car

This phase is similar to the previous, and can be carried in parallel. In this phase we're also in relation with an external system which is the *Car On Board System* but due to the relevance of this process we've decided to outline it and dedicated a whole phase. We can't move the integration forward if we're lacking the foundations. In a digital management system for a car-sharing service the control over the car must be treated as a first class citizen. This will avoid a big bang scenario, where we have implemented high level functionalities that not reflect the concrete situation of the car in the real world. These two inital phases will also allow us to "forget" of external systems in the next phases, and only focus on the relation among different services.

PHASE 3: Integration of Services

In this part the bottom-up approach would be used to build complex functionalities integrating different services. Since subsystems are fairly independent from one another, the order in which they're integrated together to obtain the full system follows the critical-module-first approach. This strategy allows us to concentrate our testing efforts on the riskiest components first that represent the core functionalities of the whole system. By proceeding this way, we are able to discover bugs earlier in the integration progress and take the necessary measures to correct them on time.

The most critical service to integrate is the *Reservation Component* which manages all active reservation made by Power Users, we will ensure that it integrates correctly both with the *User Component* and the *Car Service.* This will ensure that we have a stable prototype of the actual software that implements the core functionalities. From this prototype we will spread like wildfire, integrating other Components that implements all the secondary functionalities.

In this phase, it is only necessary to use drivers to simulate the top layers during the testing, which are a lot easier to produce than stubs.

PHASE 4: Integration with top layers

In this phase we will remove the drivers and connect the Application Side to the top tiers. We must ensure that the Application Layer works with real inputs from the "external word" and not only in a simulated and controlled environment. The integration should proceed smoothly since the communication via RESTful APIs was clearly structured at the beginning of the integration but we should focus deeply on errors and expection handling.

PHASE 5: Alpha Test

In this phase we'll test the Power Enjoy System as a whole. This phase will provide a confirmation of the correctness of the integration process and will ensure that we haven't overlooked possible error scenarios.

2.4 Sequence of Component/Function Integration

NOTE: The structure of this section may vary depending on the integration strategy you select in Section 2.3; use the structure proposed below as a non mandatory guide

2.4.1 Software Integration Sequence

For each subsystem, identify the sequence in which the software components will be integrated within the subsystem; relate this sequence to any product features that are being built up.

2.4.2 Subsystem Integration Sequence

Identify the order in which subsystems will be integrated; if you have a single subsystem, 2.4.1 and 2.4.2 are to be merged in a single section. You can refer to Section 2.2 of the test plan example [1] as an example

3 Individual Steps and Test Description

For each step of the integration process above, describe the type of tests that will be used to verify that the elements integrated in this step perform as expected. Describe in general the expected results of the test set. You may refer to Chapter 3 and Chapter 4 of the test plan example [1] as an example of what we expect. (NOTE: This is not a detailed description of test protocols. Think of this as the test design phase. Specific protocols will be written to fulfill the goals of the tests in this section.

4 Tools and Test Equipment Required

Identify all tools and test equipment needed to accomplish the integration. Refer to the tools presented during the lectures. Explain why and how you are going to use them. Note that you may also use manual testing for some part. Consider manual testing as one of the possible tools you have available.

JUnit Before integration testing, tests on single components is necessary. This first part of testing is not covered in this document. Anyway, the main issue is to check the absence of bugs and problem in each part of the system, from the application to the all the Application Server components. JUnit is the most used framework for single components testing in java. In particular, we are going to use it in order to verify that the correct objects are returned after a method invocation, that appropriate exceptions are raised when invalid parameters are passed to a method and other issues that may arise when components interact with each other.

Mockito Mockito is an open-source test framework useful to generate mock objects, stubs and drivers. Since the entire system interacts with external and real objects, is necessary to use a framework to reproduce this kind of entities. In unit testing, mock objects can simulate the behavior of complex, real objects: they are useful when a real object is impractical or impossible to incorporate into a unit test. They are also useful for the developers, who have to focus their tests on the behavior of the system without worrying about its dependencies and having predictable results.

Arquillian Arquillian is an integration testing framework for business objects that are executed inside a container or that interact with the container as a client. We choose it as framework because is widely used and is quite simple to work on. It combines a unit testing framework (JUnit), and one or more sup- ported target containers (Java EE container, etc) to provide a simple, flexible and pluggable integration testing environment. Arquillian makes integration testing no more difficult than the bins testing. Specifically, we are going to use Arquillian to verify that the right components are injected when dependency injection is specified, that the connections with the database are properly managed and similar containerlevel tests.

Devices The application run on two types of operative systems (Android and IOs). This fact make necessary testing on the direct tools that allow users to exploit power enjoy system. Power Enjoy service was tested on two groups of mobile devices (non necessarly phones), one for each type of operative system. Web page is available on the web and a group of computers were used to test the page. Test were made on every combination of Operative system and browser.

5 Program Stubs and Test Data Required

Based on the testing strategy and test design, identify any program stubs or special test data required for each integration step.

6 Effort Spent

The approximate number of hours of work for each member of the group is the following:

Niccolo' Raspa 5 Hours

Matteo Marinelli y Hours