

# Final Presentation

## Software Engineering 2 Project

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## Tasks Scheduling

# Outline - Introduction

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The project we have been assigned is called *PowerEnjoy* and it is a complex software system that should implement a car sharing service. In order to rationalize, clarify, and put in structured and standardized documents all the relevant concepts and informations, we designed and delivered several documents such as the **RASD**, the **DD**, the **ITPD**, and the **PPD**. These slides will only present an overview of the concepts thoroughly described in the above mentioned documents.

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We composed the documents we had to using some tools such as:

- **TexStudio:** to compile  $\text{\LaTeX}$  document.
- **StarUML:** to draw UML diagrams.
- **Alloy Analyzer 4.2:** to checking model consistency.
- **Draw.io:** to build mockups.
- **GitHub:** for storing the project.
- **Skype:** for team collaboration

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The aim of the software is to provide a new digital management system for car-sharing service that exclusively uses electrical cars. It can be applied to different small and big city and even in a large urban area.



This new service pretends to achieve various goals, such as:

- **G4:** Allow user logged in to book a car in a certain location.
- **G6:** A user who request a rent can abort the process whenever he/she wants.
- **G9:** A non registered users can only register once to the service.
- **G10:** A user can get discount or overtaxes from his/her last rent.

## Actors - Users, Cars and Customer Service

Below are listed the four main actors that will interact with the application once deployed:

- **Registered User:** A person who subscribed to the system and can access to all functionalities of the application.
- **Visitors:** A person that needs to move from a position to another one among the city and wants to use *PowerEnJoy* in order to do so, but has not registered yet to the service.
- **Car:** The car reserved / rented / Parked that communicates with the system.
- **External Customer Service:** A team that provide technical support in case of problems related to the car.

# Product Perspective

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Our *PowerEnJoy* is a **completely new product**, not based on previous ones.

It relies on **location data** received via **Internet** from each user application and car system: all the involved smartphones already have a **GPS antenna** installed inside, that communicates their position to the service.

Being a partially **distributed application**, *PowerEnJoy* requires a fully operative **Internet** connection in order to work properly, both on server and client side: **no service is intended to be provided offline**.

All the data generated by this software are stored in a database, accordingly to current normative and laws about privacy and personal data management.

In addition, several **APIs** are provided in order to allow further improvements and expansions of the software: for instance, the payment will be managed from an external entity (we supposed **PayPal**) and the map will be provided by **Google**.

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# UML Diagrams

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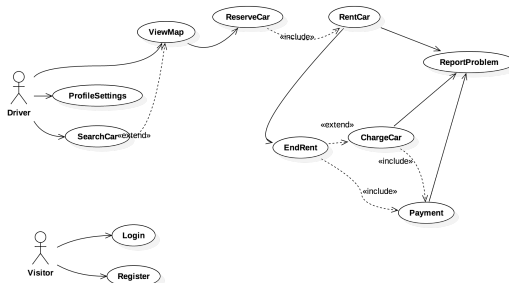
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We provided a variety of UML diagrams, each type having a different purpose.

- **UML Use Case**
- **UML Sequence Diagram**
- **UML Class diagram**

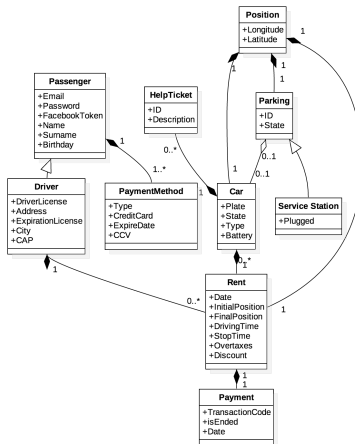
# UML Use Case Diagram

This is perhaps the most useful diagram that can be designed in the early phase of the development of a software project.



# UML Class Diagram

Furthermore we designed a class diagram for an early evaluation of the basic software components that consists in a sort of **Model** for *PowerEnJoy*.





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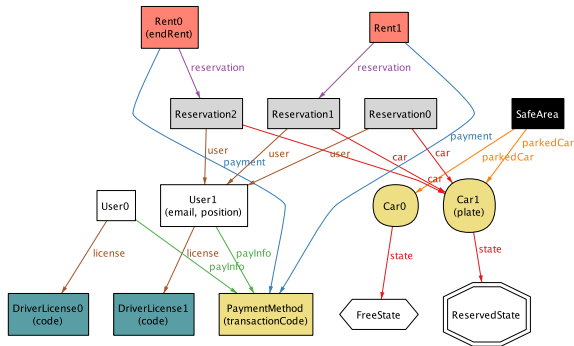
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Alongside the **UML Class Diagram** we built **Alloy Models** using the **Alloy** modeling language with the help of **Alloy Analyzer 4.2**.

The tool didn't find a proof of the inconsistency of our **Alloy Models**, and that along with the **Automatic Generation** (and **Manual Verification**) of interesting worlds, made us aware of the **Consistency** of those **Models** within a reasonable level of confidence.

# Alloy Simple World

Here is an example of one among the **simplest world** we generated and double checked using both **Alloy Analyzer 4.2** and **manual checking**.





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The system is composed of many **distributed** components: those will communicate with a **Client-Server** style and through **Point to Point** messaging system.

- The **Client-Server** style is used to give the many Clients connected to the Server the opportunity of sending different requests (e.g. a **Car Reservation** or **Open Car Request**).
- The **Point to Point** bidirectional communication channel is made necessary to enable the Server the delivery of various messages and requests to the Clients and the Car:
  - Generic notifications
  - Service messages
  - Internal message to the car as Open or Check the status

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The selected software architecture follows the principles of the **Model View Controller** architectural pattern, therefore three main software components have been identified and those are:

- The **View**, the user application View that is designed to perform comfortable user experience

- The **Controller**, in charge of leading the communication between views and process either **synchronous responses** or **asynchronous events**.
- The **Model** that guarantees a high level interface to store and manage all the *PowerEnJoy* relevant data and an abstraction of **Relational Database** in a software component that is in direct connection with the **Controller**



The selected software architecture follows the principles of the **3-Tiers** architecture. Therefore our structure expands this concept by adding 1 additional tiers to interact with the external world

In particular the tiers are:

- The **Client**, the mobile application designed and projected
- The **Application Server**, the main core of the system that include **Controller** and **Model** into it
- The **DB Server**, the data storage of the *PowerEnJoy*' data.
- The **Car System**, that is the interface between the physical system and the software, furnished by sensor and display in order to communicate with the user.

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Several components has been designed to provide all the functionalities needed for *PowerEnJoy* to work. Many subsystems have been identified:

- Ride Manager,Bill Manager,Zone Manager...
- Database ...
- External API ...

# Component View - UML Component Diagram

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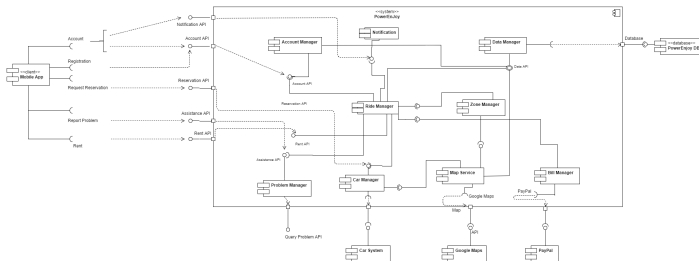
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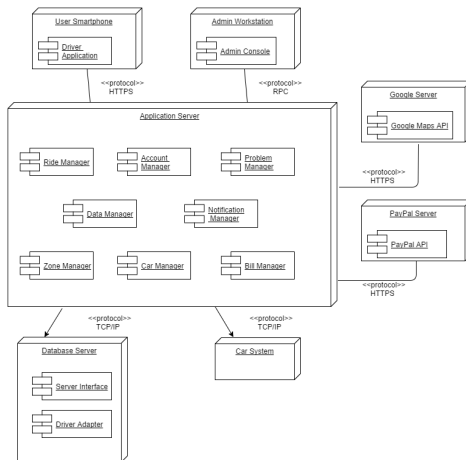
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The best way found to deploy the software components identified, is to consider 5 different nodes (7 if considering the Google Server and the PayPal server) that correspond with the **Tiers** with in addition the **External Extentions**

# Deployment View - UML Deployment Diagram

The following diagram shows how **software components** are mapped into the **physical system**.



- Find a FreeCar
- Make a Reservation

There are other functionalities whose **UML Sequence Diagram** is not reported here for space and time constraints:

# Find a FreeCar

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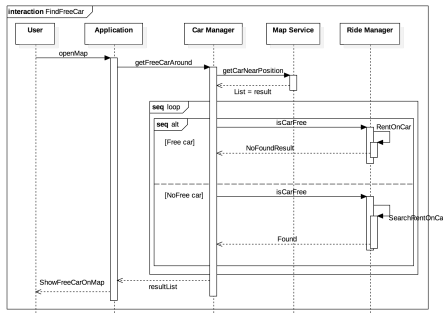
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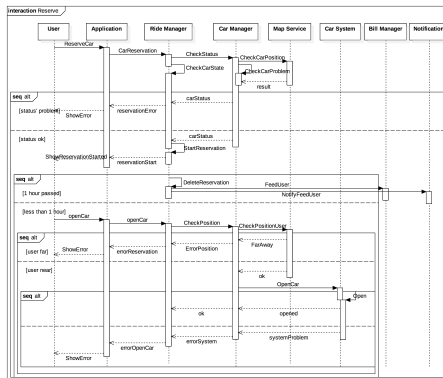
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- **Open the car:**
- **Count the Passenger:**
- **Display Message through a navigator' LCD:**
- **Check car' position:**
- ...

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In this section we provide the **most important and meaningful mockups** for every class of screens we have designed.

# Car Info Mockups

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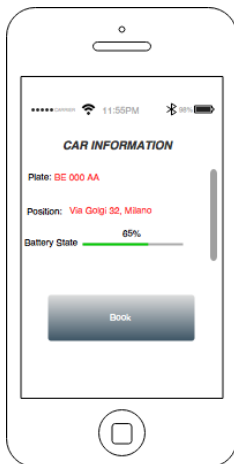
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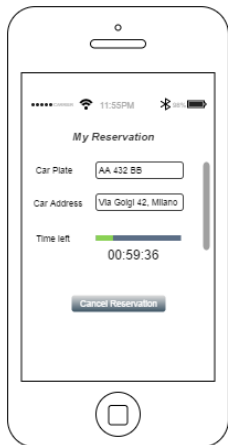
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# Reservation Mockups



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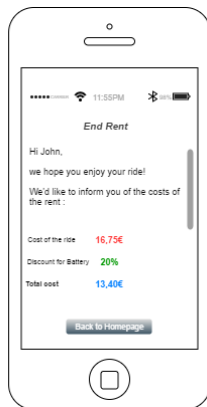
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# End Rent Mockups





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# Scope and Approach

This project phase is highly based on the **Design** one.

We will clearly state the order in which the software components identified in the **Component View** of the **Design** part have to be integrated one with each other in order to guarantee a well tested final software.

The **bottom-up integration testing approach** has been chosen, because for a medium sized project like *PowerEnjoy*, it is best to proceed step by step in a careful yet coherent integration strategy.

Before starting the integration testing of any software component that has been designed for *PowerEnJoy* system, few points have to be underlined:

- The **internal functions** of the considered component must be **unit tested** using an appropriate framework.
- We suppose that **Google Maps API and PayPal API** are well tested by **Google and PayPal** and thus we can use them without testing any further.

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We have considered all the **Subsystems**. and we had divided into 3 different categories, in particular we divided the system in part based on the drivers' number. Trying to minimize the number of drivers to use in a **bottom-up** strategy.

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# Convention adopted - Blocks

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- **Green:** This block is not dependent on any lower level component in *PowerEnJoy* and therefore it is integrated as a starting point in the current diagram.
- **Red:** This block is going to use some Drivers in order to perform a complete test on all its functionalities
- **Yellow:** This block is going to be tested without Drivers because it's at the end of the process.
- **Blue:** This block will be not tested.

# System Integration Sequence

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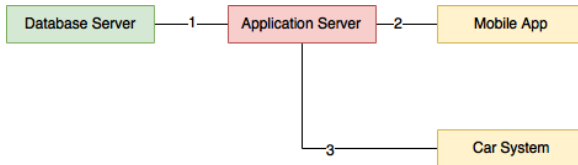
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# Subsystem Integration Sequence

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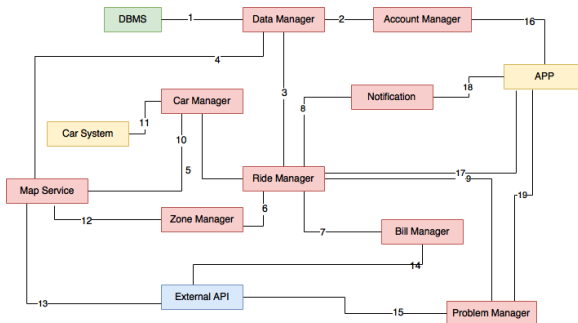
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# Program Stubs And Data Required

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In conclusion there is the need for some sample data to be in the **Database** and some sample **GPS data** are needed.



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In order to estimate the project effort, we followed the assumption that the **dimension of the software** can be characterized by correlating **the kind of functionalities offered** with **the source lines of code (SLOC) of the software itself**

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The **Function Points approach**, defined in 1975 by Allan Albrecht:

- Consists in a technique to assess the effort needed to design and develop custom software applications.
- Correlates the kind of functionalities offered with the source lines of code of the software itself.

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This technique consists in combining the following program characteristics to obtain a final result:

- **Internal Logic Files**
- **External Logic Files**
- **External Input**
- **External Output**
- **External Inquiry**

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All the calculated  $FP_i$  sums up to  $FP$ , which is the total Function Points value:

$$\begin{aligned} FP &= FP_{ILF} + FP_{ELF} + FP_{EI} + FP_{EO} + FP_{EIQ} \\ &= 80 + 10 + 35 + 16 + 8 \\ &= 149 \end{aligned}$$

# COCOMO II - Parameters



## COCOMO II - Constructive Cost Model

**Software Size**      Sizing Method

Unadjusted            Language

Points

### Software Scale Drivers

Precedentedness	<input type="text" value="Nominal"/>	Architecture / Risk Resolution	<input type="text" value="Nominal"/>	Process Maturity	<input type="text" value="High"/>
Development Flexibility	<input type="text" value="High"/>	Team Cohesion	<input type="text" value="Very High"/>		

### Software Cost Drivers

#### Product

Required Software Reliability	<input type="text" value="Nominal"/>
Data Base Size	<input type="text" value="Low"/>
Product Complexity	<input type="text" value="High"/>
Developed for Reusability	<input type="text" value="High"/>
Documentation Match to Lifecycle Needs	<input type="text" value="Nominal"/>

#### Personnel

Analyst Capability	<input type="text" value="Nominal"/>
Programmer Capability	<input type="text" value="High"/>
Personnel Continuity	<input type="text" value="High"/>
Application Experience	<input type="text" value="Nominal"/>
Platform Experience	<input type="text" value="Nominal"/>
Language and Toolset Experience	<input type="text" value="High"/>

#### Platform

Time Constraint	<input type="text" value="Nominal"/>
Storage Constraint	<input type="text" value="Nominal"/>
Platform Volatility	<input type="text" value="Low"/>

#### Project

Use of Software Tools	<input type="text" value="High"/>
Multisite Development	<input type="text" value="Nominal"/>
Required Development Schedule	<input type="text" value="Nominal"/>

**Maintenance**

### Software Labor Rates

Cost per Person-Month (Dollars)



# COCOMO II - Results

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### Results

#### Software Development (Elaboration and Construction)

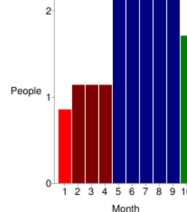
Effort = 16.4 Person-months  
Schedule = 9.2 Months  
Cost = \$24660

Total Equivalent Size = 7897 SLOC

#### Acquisition Phase Distribution

Phase	Effort (Person- months)	Schedule (Months)	Average Staff	Cost (Dollars)
Inception	1.0	1.2	0.9	\$1480
Elaboration	3.9	3.5	1.1	\$5918
Construction	12.5	5.8	2.2	\$18742
Transition	2.0	1.2	1.7	\$2959

#### Staffing Profile



#### Software Effort Distribution for RUP/MBASE (Person-Months)

Phase/Activity	Inception	Elaboration	Construction	Transition
Management	0.1	0.5	1.2	0.3
Environment/CM	0.1	0.3	0.6	0.1
Requirements	0.4	0.7	1.0	0.1
Design	0.2	1.4	2.0	0.1
Implementation	0.1	0.5	4.2	0.4
Assessment	0.1	0.4	3.0	0.5
Deployment	0.0	0.1	0.4	0.6

Your output file is [http://csse.usc.edu/tools/data/COCOMO\\_January\\_20\\_2017\\_16\\_05\\_48\\_617569.txt](http://csse.usc.edu/tools/data/COCOMO_January_20_2017_16_05_48_617569.txt)

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- ① Introduction
- ② Requirement Analysis and Specification
  - Overview
  - UML Diagrams
  - Alloy
- ③ Design
  - Architectural Design
  - User Interface Design
- ④ Integration Test Plan
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## Introduction

## Requirement Analysis and Specification

Overview  
UML Diagrams  
Alloy

## Design

Architectural  
Design  
User Interface  
Design

## Integration Test Plan

Overview  
Integration  
Sequence  
Diagrams

## Project Plan

Plan Contents  
Cost Models  
Tasks  
Scheduling

Task	Description	Completed?
T1a	RASD - Writing	Yes
T1b	RASD - Presentation	Yes
T2a	DD - Writing	Yes
T2b	DD - Presentation	Yes
T3a	ITPD - Writing	Yes
T3b	ITPD - Presentation	Yes
T4a	PPD - Writing	Yes
T4b	Final Presentation	Yes
T5	Implementation	No
T6	Unit Testing	No
T7	Integration Testing	No
T8	System Testing	No
T9	User Acceptance - Alpha Testing	No
T10	User Acceptance - Beta Testing	No

# Gantt Diagram

