Politecnico di Milano
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Project **P**lan **D**ocument (PPD)

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Abstract

Purpose: this document represent the Project Plan Document (PPD) of MyTaxiService project, in order to estimate its size, effort, cost, duration, resources and risks.

Scope: plan the MyTaxiService project.

Brief summary: the main activity concerned with estimate function points, scale drivers and cost drivers, and resource allocation.

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Introduction

0.1 Revision History

Table 1: Detailed history of the document revisions

Name	Date	Note
PPD-version2	05/02/2016	Document completed (chapters 2 and 3 added)
PPD	02/02/2016	Document creation

0.2 Purpose

This document represents the Project Plan Document (PPD) of the MyTaxiService project in order to plan an optimal working path.

0.3 Scope

The Project Planning Document describes a planning of the MyTaxiService project:

- estimating its size through the Function Points (FP) algorithm
- estimating its effort and its cost through the COnstructive COst MOdel (COCOMO) algorithm
- identifying its tasks and their schedule
- allocating its resources
- defining its risks, their relevance and the related recovery actions

0.4 Definitions, acronyms and abbreviations

0.4.1 Definitions

- **System:** the whole MyTaxiService service.

0.4.2 Acronyms

- **DD:** Design Document
- **ETA**: Estimated Time of Arrival
- **FP**: Function Point
- **GUI**: Graphic User Interface
- **LoC**: Line of Code
- **MVC**: Model View Controller
- **OS**: Operating System
- **PPD**: Project Plan Document
- **RASD**: Requirements And Specications Document
- **UML**: Unied Modeling Language
- **ITPD**: Integration Testing Plan Document
- **WRT**: With Respect To

0.4.3 Abbreviations

- **COCOMO**: COnstructive COst MOdel
- **FLEX**: Development Exibility
- **ID**: Identier
- **PMAT**: Process Maturity
- **PREC**: Precedentedness
- **RESL**: Architecture/Risk Resolution
- **TEAM**: Team Cohesion
- **UX**: User Experience

0.5 Overview

This document is composed by four parts:

1. Application of FP and COCOMO II algorithm in order to estimate respectively the project size, effort and cost.

2. Identification of the project tasks and their schedule.
3. Allocatation of the project resources to the various tasks.
4. Definition of the project risks, their relevance and the associated recovery actions.

Chapter 1

Estimation Strategy

1.1 FP Algorithm

«FP allow to estimate LoC depending on the average number of LoC per FP for a given language.» [1]
The following table summarize the factors needed to this estimation:

Table 1.1: Function points express the dimension of the functionalities offered by a software.

Function type	**Multiplier**		
	Simple	**Average**	**Complex**
Internal Logic File	7	10	15
External Logic File	5	7	10
External Input	3	4	6
External Output	4	5	7
External Inquiries	3	4	6

- **Internal Logic FIles (ILFs):** internal data managed used by the application concerns of:
  - users
  - requests
  - rides
  - taxi queues
  - payments
  - sessions

Due to the fact that all of them have a simple structure, it is reasonable to use a simple factor. Therefore:$6 * 7 = 42FPs$

- **External Logic Files (ELFs):** data managed by other systems is about:
  - ETA
  - government checking (payment data, identification cards and taxi licenses).

  All of them have a very simple structure, so:$4 * 5 = 20FPs$
- **External Inputs (EIs):** data coming from users deals with:
  - registration (considered simple operation)
    $1 * 3 = 3FPs$
  - login/logout, which involve also session management (simple)
    $3 * 3 = 9FPs$
  - ride request, wich involves also the ETA and queues management (average)
    $3 * 4 = 12FPs$
  - ride acceptance (average)
    $1 * 4 = 4FPs$
  - taxi driver availability setting (simple)
    $1 * 3 = 3FPs$
  - profile management about personal data, payment data and password management (simple)
    $3 * 3 = 9FPs$
  - payment (simple)
    $1 * 3 = 3FPs$

  Other data regards to initial settings of the backend:

  - timeouts, e.g. the time within which a taxi driver has to answer to a ride request (simple)
    $1 * 3 = 3FPs$
  - map GPS coordinates to be managed for requesting rides and queues management (average):

$2 * 4 = 8FPs$

TOTAL: $\sum EI_i = 54FPs$

- **External Outputs (EOs):**
  - notification system, either through SMS, emails or push notifications (simple)
    $3 * 4 = 12FPs$
- **External Inquiries (EIQs):**
  - request and acceptance of a ride, which involves also management of the zone queues and the ETA (average)
    $3 * 5 = 15FPs$
  - profile management about personal data, payment data and password management (simple)
    $3 * 3 = 9FPs$

TOTAL: $\sum EIQ_i = 24FPs$

After the summation of all the above FPs, it can be estimated the project size in terms of LoC:

$$LoC = A * FP_{total}$$

A is a parameter which depends on the chosen programming language.

J2EE accomplish all the requirements and it is known by the project developers.

Hence:

$$LoC = 46 * 152 = 6992LoC$$

The following section uses LoC to estimate the project effort and costs.

Table 1.2: A: programming language parameter

Language	Average	Medium	Low	High
Assembler	119	98	25	320
C	97	99	39	333
C++	50	53	25	80
C#	54	59	29	70
Excel	209	191	131	315
HTML	34	40	14	48
Java	53	53	14	134
Javascript	47	53	31	63
J2EE	46	49	15	67
SQL	21	21	13	37
Visual Basic	42	44	20	60

1.2 COCOMO II Algorithm

1.2.1 Effort

$$Effort = 2.94 * EAF * (KLoC)^E \qquad [person/month]$$

$$E = 0.91 + 0.01 * \sum_{j=1}^{5} SF_j$$

SFs are the scale factors (scale drivers) taken from the following table (the bold numbers are used in MyTaxiService project):

Table 1.3: Scale factors of COCOMO II

Scale Factors	Very Low	Low	Nominal	High	Very High	Extra High
PREC	6.20	**4.96**	3.72	2.48	1.24	0.00
FLEX	5.07	4.05	**3.04**	2.03	1.01	0.00
RESL	7.07	5.65	**4.24**	2.83	1.41	0.00
TEAM	5.48	4.38	**3.29**	2.19	1.10	0.00
PMAT	7.80	**6.24**	4.68	3.12	1.56	0.00

Therefore:

$$E = 0.91 + 0.01 * (4.96 + 3.04 + 4.24 + 3.29 + 6.24) = 1.128$$

While EAF is calculated through this formula:

$$EAF = \prod_{j=1}^{17} EM_j$$

EMs are the effort multipliers (cost drivers) taken from this table (the bold numbers are used in MyTaxiService project):

Table 1.4: Effort multipliers of COCOMO II

Driver	Symbol	Very Low	Low	Nominal	High	Very High	Extra High
RELY	EM1	0.82	0.92	1.00	**1.10**	1.26	n/a
DATA	EM2	n/a	0.90	**1.00**	1.14	1.28	n/a
CPLX	EM3	0.73	0.87	**1.00**	1.17	1.34	1.74
RUSE	EM4	n/a	0.95	1.00	**1.07**	1.15	1.24
DOCU	EM5	0.81	0.91	**1.00**	1.11	1.23	n/a
TIME	EM6	n/a	n/a	**1.00**	1.11	1.29	1.63
STOR	EM7	n/a	n/a	**1.00**	1.05	1.17	1.46
PVOL	EM8	n/a	0.87	**1.00**	1.15	1.30	n/a
ACAP	EM9	1.42	1.19	1.00	**0.85**	0.71	n/a
PCAP	EM10	1.34	1.15	**1.00**	0.88	0.76	n/a
PCON	EM11	1.29	1.12	**1.00**	0.90	0.81	n/a
APEX	EM12	1.22	**1.10**	1.00	0.88	0.81	n/a
PLEX	EM13	1.19	1.09	**1.00**	0.91	0.85	n/a
LTEX	EM14	1.20	1.09	**1.00**	0.91	0.84	n/a
TOOL	EM15	1.17	1.09	**1.00**	0.90	0.78	n/a
SITE	EM16	1.22	1.09	**1.00**	0.93	0.86	0.80
SCED	EM17	1.43	1.14	**1.00**	1.00	1.00	n/a

Therefore:

$$EAF = 1.10 * 1.07 * 0.85 * 1.10 = 1.10$$

$$Effort = 2.94 * 1.10 * (6.992)^{1.128} = 29 person/month$$

1.2.2 Duration

$$\text{Duration} = 3.67 * PM^{[0.28+0.2*(E-0.91)]} * \frac{SCED\%}{100} \quad [months]$$

where PM is the Effort estimation (in person/month) without taking into account the SCED driver value and SCED% is the percentage of SCED taken from the drivers' table.
In this case SCED is equal to 1.00 (nominal), so PM=EAF.
Then:

$$\text{Duration}= 3.67 * 1.10^{[0.28+0.2*(1.128-0.91)]} * \frac{100\%}{100} = 4.92 months$$

1.2.3 Number of people required

$$\text{N}= \frac{Effort}{Duration} = \frac{29}{4.92} = 5.89 \sim 6 persons$$

Chapter 2

Tasks Identification and Scheduling

2.1 Task Identification

The main project activities are the following:

- RASD
  - Goals
  - Constraints
  - Assumption
  - External Dependencies
  - Actors
  - Requirements
    - Functional
    - Non-Functional
  - Scenarios
  - Modelling
    - Use Case Diagram
    - Class Diagram
    - Alloy
- DD
  - Architecture
    - Components View
    - Deployment View

        * Running View
        * Styles and Patterns
    - User Interfaces
    - Requirements Traceability
- Development
    - Client Side
    - Server Side
- CI
- Unit Testing
- Integration Testing
- System Testing

2.2 Task Scheduling

According to the estimation done so far and to the effort distribution (van Vliet 2008), here is the tasks scheduling:

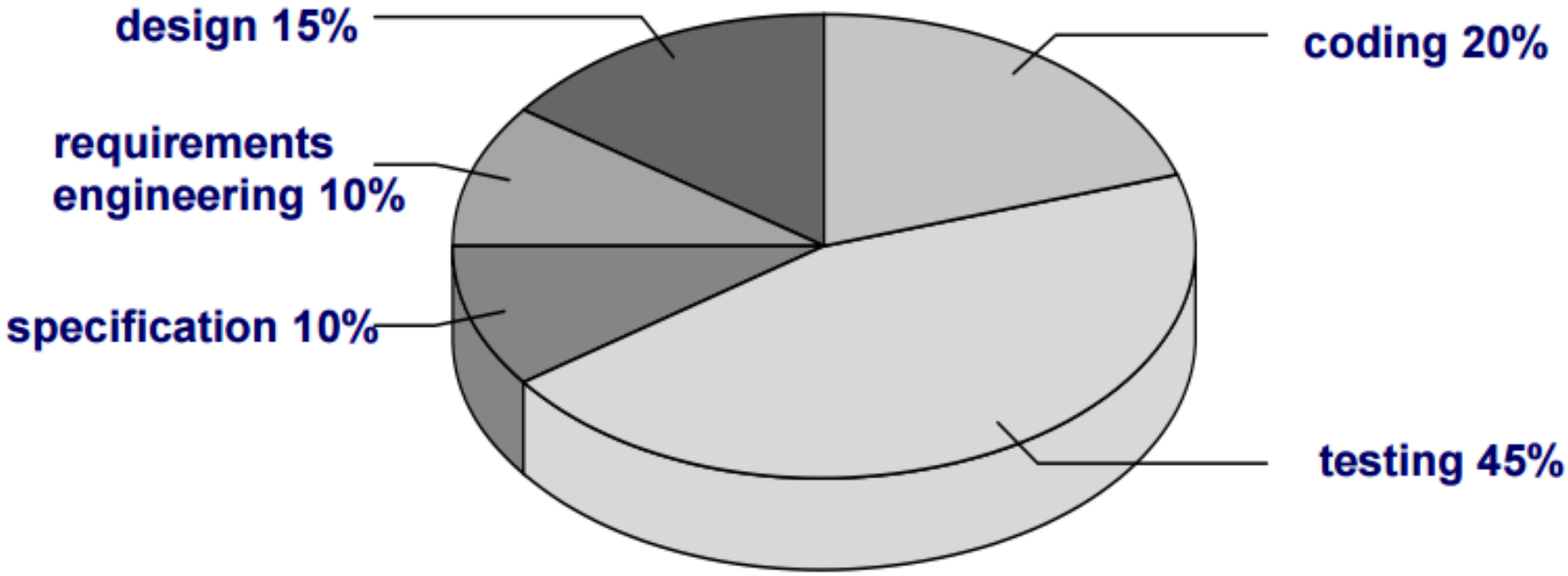

Figure 2.1: General effort distribution (Hans Van Vliet - 2008)

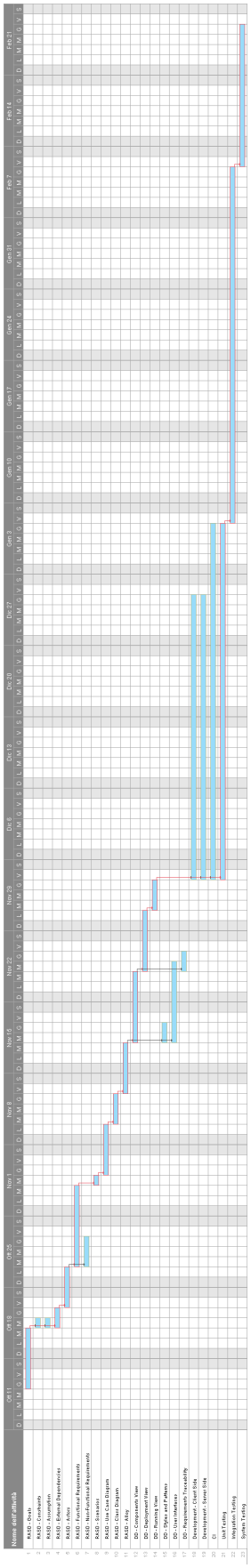

Figure 2.2: MyTaxiService Gantt chart at earliest, calculated using Critical Path Method

Chapter 3

Resources Allocation

3.1 Resources Allocation

Following the estimation in chapter 1, it is required to hire 5 employees in order to have a team composed by 6 persons.
The activities are assigned to the employees, according to the Gantt Chart, in the following way:

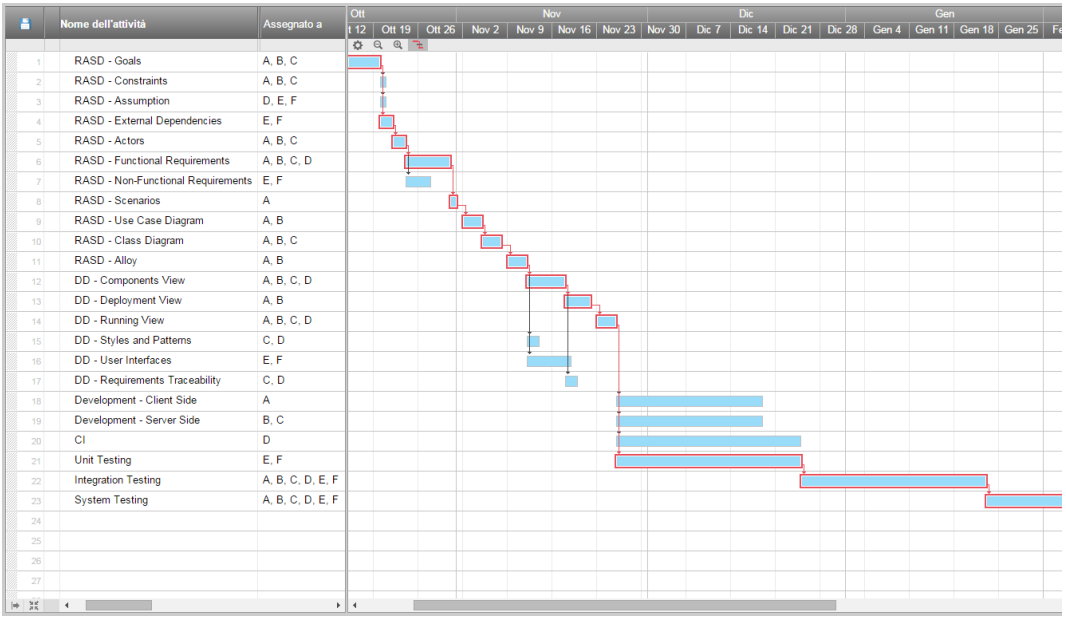

Figure 3.1: Resources (employee) allocated to every task

Chapter 4

Project Risks

4.1 Project Risks

There are many risks:

- RISK 1:
  - Description: capability shortfalls (junior personnel)
  - Relevance: high
  - Solution: the task scheduling is calculated in order to have a duration less than estimated one through COCOMO, in order to have a slack to expolit it in case of emergency
- RISK 2:
  - Description: requirements volatility
  - Relevance: medium
  - Solution: ask to the customer to sign the RASD in order to make it legally binded. The requirements changement causes a project process replanning, which includes dealines and cost replanning.
- RISK 3:
  - Description: bad external components
  - Relevance: high
  - Solution: sign a contract, which includes penalty clauses, with the external software houses
- RISK 4:
  - Description: overstimated durantion and personnel number

  - Relevance: high
  - Solution: hire consultants with flexible duration contracts. Also the solution related to the RISK 1 can face off this problem.

- RISK 5:

  - Description: goldplating
  - Relevance: low
  - Solution: don't develop more features than the requested in RASD and DD.

- RISK 6:

  - Description: real-time shortfalls
  - Relevance: low
  - Solution: using cluod servers whose power can be incremented dynamically, the probability of a shortfall of this type is very low

Appendix A

Document Information

A.1 Effort

Approximately **20 hours** have been spent making this document.

A.2 Tool Used

- **LyX**: www.lyx.org
- **SmartSheet**: https://www.smartsheet.com

Appendix B

References

- [1] Function Points Languages Table:
https://dl.dropboxusercontent.com/u/79082424/Function%20Points.pdf
- [2] COCOMO II Model Definition Manual:
https://dl.dropboxusercontent.com/u/79082424/cocomo%202.pdf
- [3] Project Plan assignment
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