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Software Engineering 2: MyTaxiService

Project Plan

V2.0

Dimitar Anastasovski, Marco Colombo

Contents

Chapter 1

Introduction

1.1 Purpose

This project plan documents the project planning process and consists of the following basic tasks:

- Defining the sequence of tasks to be performed
- Identifying all deliverables associated with the project
- Defining the dependency relationship between tasks
- Estimating the resources required to perform each task
- Scheduling all tasks to be performed
- Identifying the known project risks
- Defining the process ensuring quality of the project product
- Defining the process specifying and controlling requirements

This plan documents and defines the objectives of the project, the approach to be taken, and the commitment being assumed. This document contains the details required to successfully execute the project. Once project execution begins, this plan will be reviewed, baselined, and updated on a regular basis.

1.2 Definitions

1. *FP:* Function Points
2. *COCOMO:* Constructive Cost Model

3. *ILF:* Internal Logic File
4. *ELF:* External Logic File
5. *EIQ:* External Inquiry
6. *EI:* External Input
7. *EO:* External Output
8. *SLOC:* Source Lines of Code

1.3 Reference documents

- Specification Document: myTaxiService Project
- Example of usage of FP and COCOMO for Assignment 5
- Second example of usage of FP and COCOMO for Assignment 5

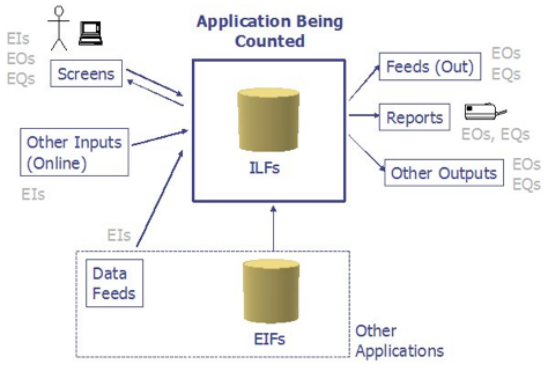
Chapter 2

Functional Points Approach

2.1 Introduction

Frequently the term end user or user is used without specifying what is meant. In this case, the user is a sophisticated user. Someone that would understand the system from a functional perspective — more than likely someone that would provide requirements or does acceptance testing.

Since Function Points measures systems from a functional perspective they are independent of technology. Regardless of language, development method, or hardware platform used, the number of function points for a system will remain constant. The only variable is the amount of effort needed to deliver a given set of function points; therefore, Function Point Analysis can be used to determine whether a tool, an environment, a language is more productive compared with others within an organization or among organizations. This is a critical point and one of the greatest values of Function Point Analysis.



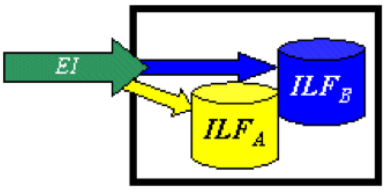
An ILF is a user-identifiable group of logically related data or control information maintained within the boundary of the application. The primary intent of an ILF is to hold data maintained through one or more elementary processes of the

application being counted." Furthermore, for data or control information to be counted as an ILF, both of the following IFPUG counting rules must also apply:

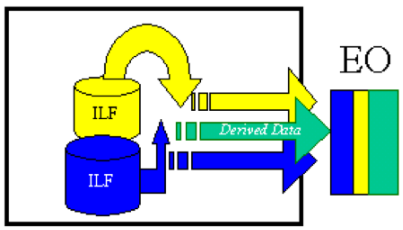
1. The group of data or control information is logical and user identifiable.
2. The group of data is maintained through an elementary process within the application boundary being counted.

An external interface file (EIF) is a user identifiable group of logically related data or control information referenced by the application, but maintained within the boundary of another application. The primary intent of an EIF is to hold data referenced through one or more elementary processes within the boundary of the application counted. This means an EIF counted for an application must be in an ILF in another application

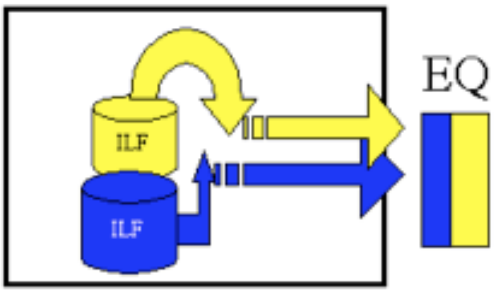
An external input (EI) is an elementary process that processes data or control information that comes from outside the application boundary. The primary intent of an EI is to maintain one or more ILFs and/or to alter the behavior of the system.



An external output (EO) is an elementary process that sends data or control information outside the application boundary. The primary intent of an external output is to present information to a user through processing logic other than, or in addition to, the retrieval of data or control information . The processing logic must contain at least one mathematical formula or calculation, create derived data maintain one or more ILFs or alter the behavior of the system.



An external inquiry (EQ) is an elementary process that sends data or control information outside the application boundary. The primary intent of an external inquiry is to present information to a user through the retrieval of data or control information from an ILF of EIF. The processing logic contains no mathematical formulas or calculations, and creates no derived data. No ILF is maintained during the processing, nor is the behavior of the system altered.



2.2 Function points calculation

The following table outline the number of Functional Point based on functionality and relative complexity: We perform the calculation step by step:

Function Type	Complexity		
	Simple	Medium	Complex
Internal Logic File	7	10	15
External Logic File	5	7	10
External Input	3	4	6
External Output	4	5	7
External Inquiry	3	4	6

- **Internal Logic Files (ILFs):** The application has ILFs, used to store and manage informations about users (Passenger or Taxi Driver), reservation, call and notification. For notification, call and information about users we can use a simple weight for the not so difficult operation involved. Different case for the reservation that we adopt a complex weight.
  So we have: $3 \times 7 + 1 \times 15 =$ **36 FPs**

- **External Logic Files (ELFs):** The application use two ELFs. One to manage the GPS, using the GoogleMap APIs and the second is the phone

company for manage the calls. These are simple operation so in this case we have: $2 \times 5 =$ **10 FPs**

- **External Input:** The application uses these following inputs:
  - Login/Logout: simple operations so we have $2 \times 3 =$ **6 FPs**
  - Sign In: This is a simple operation too so $1 \times 3 =$ **3 FPs**
  - Create a taxi reservation: This is a complex operation because involved more than one entity, so $1 \times 6 =$ **6 FPs**
  - Change a taxi reservation: This is a complex operation because involved more than one entity, so $1 \times 6 =$ **6 FPs**
  - Delete a taxi reservation: This is a complex operation because involved more than one entity, so $1 \times 6 =$ **6 FPs**
  - Call a taxi: This is a simple operation, so $1 \times 3 =$ **3 FPs**
  - Insert taxi availability: This is a simple operation, so $1 \times 3 =$ **3 FPs**
- **External Output:** The application produces the following outputs:
  - Send a notification to the taxi driver for a desired reservation
  - Send a notification to the passenger to confirm the reservation
  - Call the taxi driver for a ride

  The first two outputs can considers as medium weight, but the call we can consider is with a simple weight, so we have: $2 \times 5 + 1 \times 4 =$ **14 FPs**
- **External Inquiry:** The application allows user to:
  - View the available taxi for a reservation
  - Change the status of a taxi driver

  The first can consider as a medium weight, the second as a simple weight. $1 \times 4 + 1 \times 3 =$ **7 FPs**

In conclusion we have: $36 + 10 + 6 + 3 + 6 + 6 + 6 + 3 + 3 + 14 + 7 =$**100 FPs**

Chapter 3

COCOMO II Approach

3.1 Scale Drivers

These values are evaluated according to the following table:

Scale Factors	Very Low	Low	Nominal	High	Very High	Extra High
PREC	thorouhly unprecedented	largely unprecedented	somewhat unprecedented	generally familiar	largely familiar	thoroughly familiar
SF:	6.20	4.96	3.72	2.48	1.24	0.00
FLEX	rigorous	occasional relaxation	some relaxation	general conformity	some conformity	general goals
SF:	5.07	4.05	3.04	2.03	1.01	0.00
RESL	little {20%}	some {40%}	often {60%}	generally {75%}	mostly {90%}	full {100%}
SF:	7.07	5.65	4.24	2.83	1.41	0.00
TEAM	very difficult interactions	some difficult interactions	basically cooperative interactions	largely cooperative	highly cooperative	seamless interactions
SF:	5.46	4.38	3.29	2.19	1.10	0.00
PMAT	SW-CMM Level 1 Lower	SW-CMM Level 1 Upper	SW-CMM Level 2	SW-CMM Level 3	SW-CMM Level 4	SW-CMM Level 5
SF:	7.80	6.24	4.68	3.12	1.56	0.00

- **Precedentedness:** It reflects the teams previous experience with this kind of projects. Since for this team it was the first experience using this frame-

work and these development methodologies, such as J2EE and Android, this value will be low.

- **Development flexibility:** It reflects the degree of flexibility in the development process. The teachers and teaching assistants constructed the assignments giving the general specifications without going too much in details, making this project development very flexible, so, for this reason this value is going to be set to high - general conformity.

- **Risk resolution:** Reflects the extent of risk analysis carried out. This value will be high, considering this project.

- **Team cohesion:** Reflects how well the development team know each other and work together. Let?s assume that this is team's first project and that they didn't know each other previously. Also, let's assume that there are synchronization problems, such as different academic assignments during project for each of the members. So, this driver will be high - largely cooperative.

- **Process maturity:** This was evaluated around the 18 Key Process Area (KPAs) in the SEI Capability Model.

  There are five levels of process maturity, level 1 (lowest half) to level 5 (highest). The CMM specifies "what" should be in the software process rather than "when" or "for how long".

  The CMM level 1 is for organizations that don't focus on processes or documenting lessons learned. The CMM level 1 is for organizations that have implemented most of the requirements that would satisfy CMM level 2. In CMM's published definition, level 1 (lower half) and (Upper half) are grouped into level 1.

Scale Driver	Factor	Value
Precedentedness	Low	4.96
Development Flexibility	High	2.03
Risk Resolution	High	2.83
Team Cohesion	High	2.19
Process Maturity	High	3.12
Total:		15.13

3.2 Cost Drivers

- **Required Software Reliability:** This point is set to Low because in the system occur failures, is possible that some reservation or taxi request are missed.

Table 17. RELY Cost Driver

RELY Descriptors:	slight inconven-ience	low, easily recoverable losses	moderate, easily recoverable losses	high financial loss	risk to human life	
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	0.82	0.92	1.00	1.10	1.26	n/a

- **DataBase Size:** We can suppose that in our case the rating level could be nominal

Table 18. DATA Cost Driver

DATA* Descriptors		Testing DB bytes/Pgm SLOC < 10	10 ≤ D/P < 100	100 ≤ D/P < 1000	D/P ≥ 1000	
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	n/a	0.90	1.00	1.14	1.28	n/a

- **Product Complexity:** Set to high according to the new COCOMO II CPLEX rating scale

Table 20. CPLX Cost Driver

Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	0.73	0.87	1.00	1.17	1.34	1.74

- **Documentation match to life-cycle need:** is set to nominal because all the aspects are described in the documents.

Table 22. DOCU Cost Driver

DOCU Descriptors:	Many life-cycle needs uncovered	Some life-cycle needs uncovered.	Right-sized to life-cycle needs	Excessive for life-cycle needs	Very excessive for life-cycle needs	
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	0.81	0.91	1.00	1.11	1.23	n/a

- **Execution Time Constraint:** In our case is set to very low

Table 23. TIME Cost Driver

TIME Descriptors:			≤ 50% use of available execution time	70% use of available execution time	85% use of available execution time	95% use of available execution time
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	n/a	n/a	1.00	1.11	1.29	1.63

- **Main Storage Constraint:** This parameter represents the degree of main storage constraint. In our application this parameter is not relevant so is sets as very low.

Table 24. STOR Cost Driver

STOR Descriptors:			≤ 50% use of available storage	70% use of available storage	85% use of available storage	95% use of available storage
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	n/a	n/a	1.00	1.05	1.17	1.46

- **Platform Volatility:** We think that this value has to be set to Low

Table 25. PVOL Cost Driver

PVOL Descriptors:		Major change every 12 mo.; Minor change every 1 mo.	Major: 6 mo.; Minor: 2 wk.	Major: 2 mo.;Minor: 1 wk.	Major: 2 wk.;Minor: 2 days	
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	n/a	0.87	1.00	1.15	1.30	n/a

- **Analyst Capability:** Design and analysis abilities has to be set to High

Table 26. ACAP Cost Driver

ACAP Descriptors:	15th percentile	35th percentile	55th percentile	75th percentile	90th percentile	
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	1.42	1.19	1.00	0.85	0.71	n/a

- **Programmer Capability:** This parameter is evaluated according to our degree of cooperation, so it is set to high.

Table 27. PCAP Cost Driver

PCAP Descriptors	15th percentile	35th percentile	55th percentile	75th percentile	90th percentile	
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	1.34	1.15	1.00	0.88	0.76	n/a

- **Application Experience:**Since this is our first experience in this typology of project this value is equal to low.

Table 29. APEX Cost Driver

APEX Descriptors:	≤ 2 months	6 months	1 year	3 years	6 years	
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	1.22	1.10	1.00	0.88	0.81	n/a

- **Platform Experience:** This parameter is sets as nominal

Table 30. PLEX Cost Driver

PLEX Descriptors:	≤ 2 months	6 months	1 year	3 years	6 year	
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	1.19	1.09	1.00	0.91	0.85	n/a

- **Language and Tool Experience:** This parameter is sets as nominal

Table 31. LTEX Cost Driver

LTEX Descriptors:	≤ 2 months	6 months	1 year	3 years	6 year	
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	1.20	1.09	1.00	0.91	0.84	

- **Personnel continuity:** We set this parameter has low

Table 28. PCON Cost Driver

PCON Descriptors:	48% / year	24% / year	12% / year	6% / year	3% / year	
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	1.29	1.12	1.00	0.90	0.81	

- **Multisite Development:**This parameter reflects how we handled the distribution of development over distance and multiple platforms. This value is sets to extra high.

Table 33. SITE Cost Driver

SITE: Collocation Descriptors: SITE: Communications Descriptors:	Inter-national Some phone, mail	Multi-city and Multi-company Individual phone, FAX	Multi-city or Multi-company Narrow band email	Same city or metro. area Wideband electronic communicat ion.	Same building or complex Wideband elect. comm., occasional video conf.	Fully collocated Interactive multimedia
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	1.22	1.09	1.00	0.93	0.86	0.80

- **Required Development Schedule:** We set this parament to high

Table 34. SCED Cost Driver

SCED Descriptors	75% of nominal	85% of nominal	100% of nominal	130% of nominal	160% of nominal	
Rating Level	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multiplier	1.43	1.14	1.00	1.00	1.00	n/a

Scale Driver	Factor	Value
RELY	Low	0.92
DATA	Nominal	1.00
CPLX	High	1.17
DOCU	Nominal	1.00
TIME	Low	n/a
STOR	Very Low	n/a
PVOL	Low	0.87
ACAP	High	0.85
PCAP	High	0.88
APEX	Low	1.10
PLEX	Nominal	1.00
LTEX	Nominal	1.00
PCON	Low	1.12
SITE	Extra High	0.80
SCED	High	1.00
Total:		0.69

3.3 COCOMO II calculation

To pass from FP(Function Points) to SLOC(Source Lines of Code) we use an average conversion factor of 46 lines of code for each function point:

$$100FPs * 46 = 4600SLOC$$

EAF: Effort Adjustment Factor derived from Cost Drivers. EAF=0.69
E:Exponent derived from Scale Drivers. E=0.91 + 0.01*Scale Drivers = 1.0613

The formula to calculate the effort is the following:

$$effort = 2.94 * EAF * (KSLOC)^E$$

so we have

$$effort = 2.94 * (0.69) * (4600)^{1.0613} = 10.24 \text{ Person-Months}$$

Now we try to calculate the schedule (duration) of project in month with the following formula

$$Duration = 3.67 * (effort)^{E-0.91}$$

we use a new value for E, that is 0.1513. So we have

$$Duration = 3.67 * (10.24)^{0.1513} = 5.21 \text{ Months}$$

Now we can estimate the number of people needed to complete the project with the following formula:

$$N_{people} = effort/Duration$$

$$N_{people} = 10.24/5.21 = 1.96 \rightarrow 2 \text{ people}$$

3.4 Risk

A risk is an event or condition that, if it occurs, could have a positive or negative effect on a project's objectives. Risk Management is the process of identifying, assessing, responding to, monitoring and controlling, and reporting risks. This Risk Management Plan defines how risks associated with the MyTaxiService project will be identified, analyzed, and managed. It outlines how risk management activities will be performed, recorded, and monitored throughout the lifecycle of the project and provides templates and practices for recording and prioritizing risks by the Risk Manager and/or Risk Management Team.

Risk Assessment

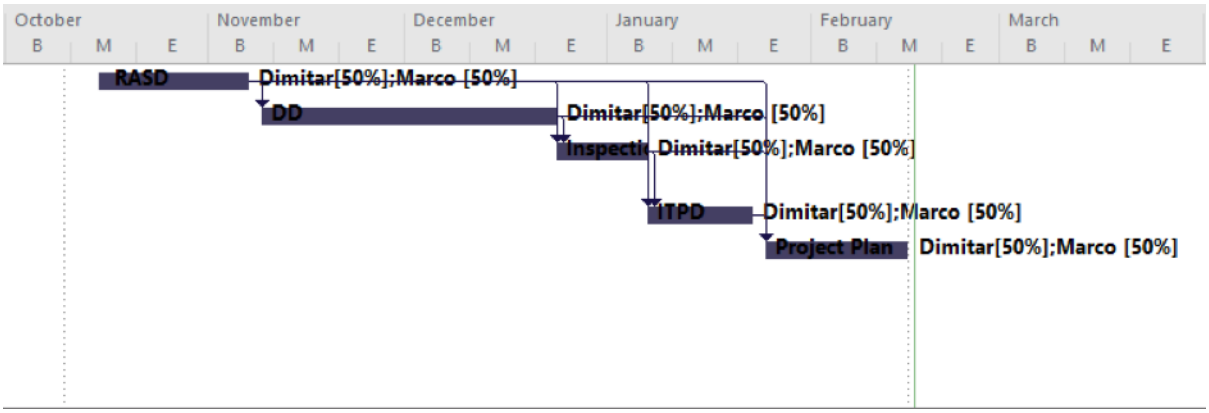
Risk assessment is the act of determining the probability that a risk will occur and the impact that event would have, should it occur. This is basically a "cause and effect" analysis. The "cause" is the event that might occur, while the "effect" is the potential impact to a project, should the event occur. Assessment of a risk involves two factors. First is the probability which is the measure of certainty that an event, or risk, will occur. This can be measured in a number of ways, but for the MyTaxiService project will be assigned a probability as defined in the table below.

Probability of Occurrences		
Definition	**Meaning**	**Value**
Frequent	- Occurs frequently - Will be continuosly experienced unless action is taken to change event	5
Likely	- Occur less frequently if process is corrected - Issues identified with minimal audit activity - Process performance failures evident to trained auditors or regulators	4
Occasional	- Occurs sporadically -Potential issues discovered during focused review	3
Seldom	- Unlikely to occur - Minimal issue identification during focused review	2
Improbable	Highly unlikely to occur	1

Risk	Probability	Effects	Strategy
Requirements change	Moderate	Serious	Derive traceability information to access requirements to change impact; work on software flexibility
Requirements have compliance issues (conflicts) with law and legal regulations - as this software deals with personal data which need to be authentic)	Low	Serious	Mention in the beginning what could be legal issues related to requirements and try to reformulate them in order to avoid conflicts with law and legal regulations
Requirements fail to align with strategy - Requirements conflict with the firm's strategy (fair taxi managment)	Moderate	Serious	Involve stakeholders as much as possible during requirements analysis and formulation
Design lacks flexibility - A poor design makes change requests difficult and costly.	Moderate	Serious	Work on training and improving less experienced team members but, in general, let only the most experienced members do this job, as design is critical part of the project and is heavily base on experiene with similar projects.
Technology components aren't scalable - Components that can't be scaled to meet performance demands	High	Serious	Consider different technlogies (as alternatives) and start performance testing as soon as possible
Technology components aren't compliant with standards and best practites - Non-standard components that violate best practices	Moderate	Marginal	Use technology that is already has been approved as suitable for similar systems.

Project team lack authority to complete	Low	Catastrophic	Make clear in the beginning what is the authority needed (access to government databases in this case) to complete the project and work on achieving it as early as possible
Database perfomance	Moderate	Serious	Consider using higher perfomance database or cloud
Junior member not able to work on mobile app	Moderate	Catastrophic	Consider switching other team member to this task(either expert or project manager who is not so experienced in mobile apps development but is experienced and educated enough as an engineer to accept such challenge)

3.5 Task Allocations



TASK USAGE

	Task Mode	Task Name	Work	Duration	Start	Finish	Add New Column	Details
1		**Summary #3**	**720 hrs**	**90 days**	**Thu 15/10/15**	**Mon 15/02/16**		Work
2		RASD	136 hrs	17 days	Thu 15/10/15	Fri 06/11/15		Work
		Dimitar	*68 hrs*		*Thu 15/10/15*	*Fri 06/11/15*		Work
		Marco	*68 hrs*		*Thu 15/10/15*	*Fri 06/11/15*		Work
3		DD	272 hrs	34 days	Mon 09/11/15	Wed 23/12/15		Work
		Dimitar	*136 hrs*		*Mon 09/11/15*	*Wed 23/12/15*		Work
		Marco	*136 hrs*		*Mon 09/11/15*	*Wed 23/12/15*		Work
4		Inspection docum	80 hrs	10 days	Thu 24/12/15	Wed 06/01/16		Work
		Dimitar	*40 hrs*		*Thu 24/12/15*	*Wed 06/01/16*		Work
		Marco	*40 hrs*		*Thu 24/12/15*	*Wed 06/01/16*		Work
5		ITPD	104 hrs	13 days	Thu 07/01/16	Fri 22/01/16		Work
		Dimitar	*52 hrs*		*Thu 07/01/16*	*Fri 22/01/16*		Work
		Marco	*52 hrs*		*Thu 07/01/16*	*Fri 22/01/16*		Work
6		Project Plan	128 hrs	16 days	Mon 25/01/16	Mon 15/02/16		Work
		Dimitar	*64 hrs*		*Mon 25/01/16*	*Mon 15/02/16*		Work
		Marco	*64 hrs*		*Mon 25/01/16*	*Mon 15/02/16*		Work
								Work

3.6 Changelog

We performed a different calculation for the COCOMO II with the right scale drivers