POLITECNICO DI MILANO
Computer Science and Engineering

Project of Software Engineering 2: "*myTaxiService*"

Project Plan Document

Author: Andrea Maioli (mat. 852429)
Reference Professor: Mirandola Raffaela

Summary

1. Introduction

This document has the scope of evaluate and identify the time and resources necessary to the development of the myTaxiService application. In order to achieve that, Function Point Analysis and COCOMO model have been applied.

2. Function Points

2.1. Rating Tables

Internal Logic Files			
Record Elements	**Data Elements**		
	1-19	20-50	51+
1	Low (7)	Low (7)	Average (10)
2-5	Low (7)	Average (10)	High (15)
6+	Average (10)	High (15)	High (15)

External Interface Files			
Record Elements	**Data Elements**		
	1-19	20-50	51+
1	Low (5)	Low (5)	Average (7)
2-5	Low (5)	Average (7)	High (10)
6+	Average (7)	High (10)	High (10)

External Inputs			
File Types	**Data Elements**		
	1-4	5-15	16+
0-1	Low (3)	Low (3)	Average (5)
2-3	Low (3)	Average (5)	High (6)
4+	Average (5)	High (6)	High (6)

External Outputs			
File Types	**Data Elements**		
	1-5	6-19	20+
0-1	Low (4)	Low (4)	Average (5)
2-3	Low (4)	Average (5)	High (7)
4+	Average (5)	High (7)	High (7)

External Inquiries			
File Types	**Data Elements**		
	1-5	6-19	20+
0-1	Low (3)	Low (3)	Average (4)
2-3	Low (3)	Average (4)	High (6)
4+	Average (4)	High (6)	High (6)

2.2. Element Analysis

2.2.1. Internal Logic Files

The **Internal Logic Files** (**ILF**) are homogeneous set of data used and managed by the application, and in the **myTaxiService** application are:

ILF	Data Elements	Record Elements
User (Not considered)	first name, last name, email, telephone, password, birthdate, address, city, zipcode, gender	User
Passenger	User's data elements, request_id	User, Passenger
Driver	User's data elements, status, queue position, queue_id, latitude, longitude, maxPassengers, workStartedAt, acceptedRequests, declinedRequests, currentRequestID	User, Driver
Operator	User's data elements	User, Operator
Administrator	User's data elements, special_code	User, Administrator
Queue (Not considered)	containedTaxis	Queue
Area	Queue's Data Elements, name, startingLatitude, startingLongitude, endingLatitude, endingLongitude	Area, Queue
Request	passenger_id, address, city, zipCode, taxi_id, status, eta, numberOfPassengers, isFromACall, endLatitude, endLongitude, operator_id	Request

User and *Queue* are not considered as Internal Logic Files because they does not exists "logically" without being considered with another element. They are reported in this table only for completeness.

2.2.2. External Interface Files

The **External Interface Files** (**EIF**) are homogeneous set of data used by the application but generated and maintained by other applications, and in **myTaxiService** application are:

EIF	Data Elements	Record Elements
Map Data	image	Map Data
Coordinates	Latitude, longitude, address	Coordinates
ETA	arrivalTime, remainingTime	ETA
SMS	sendStatus	SMS

2.2.3. External Inputs

The **External Inputs** (**EI**) are elementary operation to elaborate data coming from the external environment, and in the **myTaxiService** application are:

EI	Data Elements	File Types
Passenger Registration	User data elements, repeat password, activity button, message	Passenger
Call Center Forced User Registration	User data elements (without password), activity button, message	Passenger, Operator
Login	email, password, code + activity button, message	Operator, Administrator, Passenger, Driver
Logout	activity button, message	Operator, Administrator, Passenger, Driver
Call Center Request	address, city, zipCode, numberOfPassengers, driver_id (derived and stored in the request), eta (calculated and stored), activity button, message	Request, Operator, Passenger, Area, Driver, ETA
Passenger Request	numberOfPassengers, driver_id, latitude, longitude, activity button, message	Request, Passenger, Area, Driver
Manage User Profile	User data elements, level, activity button, message	Administrator, Operator, Passenger, Driver
Delete User Profile	user_id, request_id, activity button, message	Administrator, Operator, Passenger, Driver, Request
Create Area	name, startlatitude, startlongitude, endlatitude, endlongitude, activity button, message	Administrator, Area
Manage Area	name, startlatitude, startlongitude, endlatitude, endlongitude, area_id, activity button, message	Administrator, Area
Delete Area	area_id, activity button, message	Administrator, Area
Update Driver Status	tatus, driver_id, queue_id, activity button, message	Driver, Area
End Request	request_id, area_id, queue_id, driver_id, activity button, message	Driver, Request, Area
Report exceptional event	driver_id, request_id, area_id, queue_id, newdriver_id, passenger_id, activity button, message	Driver, Request, Area, Passenger
Accept Request	driver_id, passenger_id, request_id, queue_id, activity button, message	Driver, Request, Passenger
Decline Request	driver_id, request_id, queue_id, queueposition, newdriver_id, status, activity button, message	Driver, Request, Queue

Report Passenger Status	status, passenger_id, activity button, message	Driver, Passenger, Request
Update Driver Location	latitude, longitude, newarea_id, newqueue_id	Driver, Area
Set Request End Point	address, request_id, activity button, message	Driver, Request

2.2.4. External Outputs

The **External Outputs** (**EO**) are elementary operation that generates data for the external environment (usually includes the elaboration of data from logic files), and in the **myTaxiService** application are:

EO	Data Elements	File Types
Request Notification	address, numberOfPassengers, activity button	Request, Driver, Coordinate
Request Update Notification	status, eta, driver_id	Request, Driver, Passenger, ETA
SMS Notification with Admin Code	Code, telephone number	Administrator, SMS
SMS Notification for passenger not found	Message, telephone number, request_id	Passenger, Request, SMS

2.2.5. External Inquiries

The **External Inquiries** (**EQ**) are elementary operation that involves input and output (usually does not include significant elaboration of data from logic files), and in the **myTaxiService** application are:

EQ	File Types	Data Elements
View User Information	User's Data Elements, code	Passenger, Administrator, Operator, Driver
View Area Information	Area's Data Elements	Area
View Active Request Information	Request's Data Elements	Request, Passenger, Driver
View Queue Information	position	Area, Driver

2.3. Function Point Assignment

Internal Logic Files				
ILF	**Record Elements**	**Data Elements**	**Weight**	**Function Points**
Passenger	2	11	Low	7
Driver	2	20	Average	10
Operator	2	10	Low	7
Administrator	2	11	Low	7
Area	2	6	Low	7
Request	1	12	Low	7
			Total:	45

External Interface Files				
EIF	**Record Elements**	**Data Elements**	**Weight**	**Function Points**
Map Data	1	1	Low	5
Coordinate	1	3	Low	5
ETA	1	2	Low	5
SMS	1	1	Low	5
			Total:	20

External Inputs				
EI	**File Types**	**Data Elements**	**Weight**	**Function Points**
Passenger Registration	1	14	Low	3
Call Center Forced User Registration	2	11	Average	5
Login	4	5	High	6
Logout	4	2	Average	5
Call Center Request	6	8	High	6
Passenger Request	4	6	High	6
Manage User Profile	4	13	High	6
Delete User Profile	5	4	Average	5
Create Area	2	7	Average	5
Manage Area	2	8	Average	5
Delete Area	2	3	Low	3
Update Driver Status	2	5	Average	5
End Request	3	6	Average	5
Report exceptional event	4	8	High	6
Accept Request	3	6	Average	5
Decline Request	3	8	Average	5
Report Passenger Status	3	4	Low	3
Update Driver Location	2	4	Low	3
Set Request End Point	2	4	Low	3
			Total:	90

External Outputs				
EO	**File Types**	**Data Elements**	**Weight**	**Function Points**
Request Notification	3	3	Low	4
Request Update Notification	4	3	Average	5
SMS Notification with Admin Code	2	2	Low	4
SMS Notification for passenger not found	3	3	Low	4
			Total:	17

External Inquiries				
EQ	**File Types**	**Data Elements**	**Weight**	**Function Points**
View User Information	4	11	High	6
View Area Information	1	6	Low	3
View Active Request Information	3	12	Average	4
View Queue Information	2	1	Low	3
			Total:	16

2.4. Final Results

FP Type	FP Count
ILF	46
EIF	20
EI	90
EO	17
EQ	16
Total:	189

Considering that the multiplier for Java Code is 53, the total number of **Source Line Of Code** (**SLOC**) is *10017*.

3. COCOMO II

Until now, only one person has developed the project. In order to have a more realistic situation that corresponds to the reality, two developers with the same level of knowledge of the currently employed developer will be hired to help the development phase.

3.1. Software Scale Drivers

3.1.1. Scale Driver Weights Table

Scale Factors	Very Low	Low	Nominal	High	Very High	Extra High
PREC	thoroughly unprecedented	largely unprecedented	somewhat unprecedented	generally familiar	largely familiar	thoroughly familiar
SF$_j$:	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$_j$:	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$_j$:	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$_j$:	5.48	4.38	3.29	2.19	1.10	0.00
PMAT	The estimated Equivalent Process Maturity Level (EPML) or					
	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$_j$:	7.80	6.24	4.68	3.12	1.56	0.00

3.1.2. Scale Driver Information

Precedentedness (**PREC**): Reflects the previous experience of the organization with this type of project. Very low means no previous experience, extra high means that the organization is completely familiar with this application domain.
It is set to "Low" because there is no enough experience with the used technology and the design skills achieved until now are not enough. Also, the most of the notions and technology used for this project are new.

Development Flexibility (**FLEX**): Reflects the degree of flexibility in the development process. Very low means a prescribed process is set; Extra high means that the client only sets general goals.
It is set to "High" because there are some goals and some general key-point defined, but there is also a good level of flexibility.

Architecture / Risk Resolution (**RESL**): Reflects the extent of risk analysis carried out. Very low means little analysis, extra high means a complete a thorough risk analysis.
Due to the analysis done in the Risks chapter, it is set to "High".

Team Cohesion (**TEAM**): Reflects how well the development team know each other and work together. Very low means very difficult interactions, extra high means an integrated and effective team with no communication problems.
The hired developers will have a good level of experience in working in team, so it can be considered "very high".

Process Maturity (**PMAT**): Reflects the process maturity of the organization. The computation of this value depends on the CMM Maturity Questionnaire but an estimate can be achieved by subtracting the CMM process maturity level from 5.
By analyzing the description of each CMM level, the CMM level is 3 and the PMAT is set to "high".

- ➔ ***CMM level 3: "defined".*** It is characteristic of processes at this level that there are sets of defined and documented standard processes established and subject to some degree of improvement over time. These standard processes are in place (i.e., they are the AS-IS processes) and used to establish consistency of process performance across the organization.

3.1.3. Scale Driver Values

Code	Name	Factor	Value
PREC	Precedentedness	Low	4.96
FLEX	Development Flexibility	High	2.03
RESL	Architecture / Risk Resolution	High	2.83
TEAM	Team Cohesion	Very High	1.10
PMAT	Process Maturity	High	3.12
		$\boldsymbol{E = 0.91 + 0.01 * \sum_i SD(i)}$	1.0504

3.2. Software Cost Drivers

3.2.1. Product Cost Driver

Required Software Reliability (**RELY**): This is the measure of the extent to which the software must perform its intended function over a period of time. If the effect of a software failure is only slight inconvenience then RELY is very low. If a failure would risk human life, then RELY is very high.
Due to the easily recoverable losses, it is set to "Nominal".

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

Data Base Size (**DATA**): This cost driver attempts to capture the effect large test data requirements have on product development. The rating is determined by calculating D/P, the ratio of bytes in the testing database to SLOC in the program. The reason the size of the database is important to consider, is because of the effort required to generate the test data that will be used to exercise the program.
The database size can be estimated with a value between 10 and 100 D/P, so it is set to "Nominal"

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 (**CPLX**): Complexity is divided into five areas: control operations, computational operations, device-dependent operations, data management operations, and user interface management operations. Using the following table, select the area or combination of areas that characterize the product or the component of the product you are rating. The complexity rating is the subjective weighted average of the selected area ratings. *Considering all the areas and the selected effort for each area, the final rating is set to "Nominal".*

	Control Operations	**Computational Operations**	**Device-dependent Operations**	**Data Management Operations**	**User Interface Management Operations**
Very Low	Straight-line code with a few non-nested structured programming operators: DOs, CASEs, IF- THEN-ELSEs. Simple module composition via procedure calls or simple scripts.	Evaluation of simple expressions: e.g., A=B+C*(D- E)	Simple read, write statements with simple formats.	Simple arrays in main memory. Simple COTS-DB queries, updates.	Simple input forms, report generators.
Low	Straightforward nesting of structured programming operators. Mostly simple predicates	Evaluation of moderate-level expressions: e.g., D=SQRT(B**2- 4.*A*C)	No cognizance needed of particular processor or I/O device characteristics. I/O done at GET/PUT level.	Single file subsetting with no data structure changes, no edits, no intermediate files. Moderately complex COTS- DB queries, updates.	Use of simple graphic user interface (GUI) builders.
Nominal	Mostly simple nesting. Some intermodule control. Decision tables. Simple callbacks or message passing, including middleware- supported distributed processing	Use of standard math and statistical routines. Basic matrix/vector operations.	I/O processing includes device selection, status checking and error processing.	Multi-file input and single file output. Simple structural changes, simple edits. Complex COTS-DB queries, updates.	Simple use of widget set.
High	Highly nested structured programming operators with many compound predicates. Queue and stack control. Homogeneous, distributed processing. Single processor soft real-time control.	Basic numerical analysis: multivariate interpolation, ordinary differential equations. Basic truncation, round-off concerns.	Operations at physical I/O level (physical storage address translations; seeks, reads, etc.). Optimized I/O overlap.	Simple triggers activated by data stream contents. Complex data restructuring.	Widget set development and extension. Simple voice I/O, multimedia.
Very High	Reentrant and recursive coding. Fixed-priority interrupt handling. Task synchronization, complex callbacks, heterogeneous distributed processing. Single- processor hard real-time control.	Difficult but structured numerical analysis: near- singular matrix equations, partial differential equations. Simple parallelization.	Routines for interrupt diagnosis, servicing, masking. Communication line handling. Performance- intensive embedded systems.	Distributed database coordination. Complex triggers. Search optimization.	Moderately complex 2D/3D, dynamic graphics, multimedia.
Extra High	Multiple resource scheduling with dynamically changing priorities. Microcode-level control. Distributed hard real-time control.	Difficult and unstructured numerical analysis: highly accurate analysis of noisy, stochastic data. Complex parallelization.	Device timing-dependent coding, micro- programmed operations. Performance- critical embedded systems.	Highly coupled, dynamic relational and object structures. Natural language data management.	Complex multimedia, virtual reality, natural language interface.

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

Developed for Reusability (**RUSE**): This cost driver accounts for the additional effort needed to construct components intended for reuse on current or future projects. This effort is consumed with creating more generic design of software, more elaborate documentation, and more extensive testing to ensure components are ready for use in other applications.
The reusability will be applied only to reuse components across the modules in this project, so it is set to "Nominal".

RUSE Descriptors:		none	across project	across program	across product line	across multiple product lines
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	n/a	0.95	1.00	1.07	1.15	1.24

Documentation Match to Lifecycle Needs (**DOCU**): this cost driver is evaluated in terms of the suitability of the project's documentation to its life-cycle needs. The rating scale goes from Very Low (many life-cycle needs uncovered) to Very High (very excessive for life-cycle needs).
The suitability of the project's documentation to its life-cycle needs is the right-sized, so it is set to "Nominal".

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

3.2.2. Platform Cost Driver

Execution Time Constraint (**TIME**): This is a measure of the execution time constraint imposed upon a software system. The rating is expressed in terms of the percentage of available execution time expected to be used by the system or subsystem consuming the execution time resource. The rating ranges from nominal, less than 50% of the execution time resource used, to extra high, 95% of the execution time resource is consumed.
The estimated use of the execution time is below 50% of the available execution time, so it is set to "Nominal".

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

Storage Constraint (**STOR**): This rating represents the degree of main storage constraint imposed on a software system or subsystem.
It is set to "Nominal" because the application will store only information in the database and the data usage will be very low.

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 (**PVOL**): "Platform" is used here to mean the complex of hardware and software (OS, DBMS, etc.) the software product calls on to perform its tasks.
It is set to "Low" because, for now, no changes to the platform are planned.

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

3.2.3. Personnel Cost Driver

Analyst Capability (**ACAP**): Analysts are personnel who work on requirements, high-level design and detailed design. The major attributes that should be considered in this rating are analysis and design ability, efficiency and thoroughness, and the ability to communicate and cooperate. The rating should not consider the level of experience of the analyst; that is rated with APEX, LTEX, and PLEX. Analyst teams that fall in the fifteenth percentile are rated very low and those that fall in the ninetieth percentile are rated as very high.

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 (**PCAP**): Evaluation should be based on the capability of the programmers as a team rather than as individuals. Major factors which should be considered in the rating are ability, efficiency and thoroughness, and the ability to communicate and cooperate. The experience of the programmer should not be considered here; it is rated with APEX, LTEX, and PLEX. A very low rated programmer team is in the fifteenth percentile and a very high rated programmer team is in the ninetieth percentile.

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

Personnel Continuity (**PCON**): The rating scale for PCON is in terms of the project's annual personnel turnover: from 3%, very high continuity, to 48%, very low continuity.

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	

Application Experience (**APEX**): The rating for this cost driver (formerly labeled AEXP) is dependent on the level of applications experience of the project team developing the software system or subsystem. The ratings are defined in terms of the project team's equivalent level of experience with this type of application. A very low rating is for application experience of less than 2 months. A very high rating is for experience of 6 years or more. *It is set to "Low" due to a low level of experience for this kind of application.*

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 (**PLEX**): The Post-Architecture model broadens the productivity influence of platform experience by recognizing the importance of understanding the use of more powerful platforms, including more graphic user interface, database, networking, and distributed middleware capabilities.
It is set to "Low" due to a low level of experience for this kind of platform.

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 Toolset Experience (**LTEX**): This is a measure of the level of programming language and software tool experience of the project team developing the software system or subsystem. Software development includes the use of tools that perform requirements and design representation and analysis, configuration management, document extraction, library management, program style and formatting, consistency checking, planning and control, etc. In addition to experience in the project's programming language, experience on the project's supporting tool set also affects development effort. A low rating is given for experience of less than 2 months. A very high rating is given for experience of 6 or more years.
It is set to "Low" because there is a bit of experience with the Language and Toolset that have been grown during other java projects.

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	

3.2.4. Project Cost Driver

Use of Software Tools (**TOOL**): The tool rating ranges from simple edit and code, very low, to integrated life-cycle management tools, very high.
The tool to be used corresponds to the descriptor of the rating level "Low".

TOOL Descriptors	edit, code, debug	simple, frontend, backend CASE, little integration	basic life-cycle tools, moderately integrated	strong, mature life-cycle tools, moderately integrated	strong, mature, proactive life-cycle tools, well integrated with processes, methods, reuse	
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Effort Multipliers	1.17	1.09	1.00	0.90	0.78	n/a

Multisite Development (**SITE**): Determining its cost driver rating involves the assessment and judgement-based averaging of two factors: site collocation (from fully collocated to international distribution) and communication support (from surface mail and some phone access to full interactive multimedia).

SITE: Collocation Descriptors:	Inter-national	Multi-city and Multi-company	Multi-city or Multi-company	Same city or metro. area	Same building or complex	Fully collocated
SITE: Communications Descriptors:	Some phone, mail	Individual phone, FAX	Narrow band email	Wideband electronic communicat ion.	Wideband elect. comm., occasional video conf.	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 (**SCED**): This rating measures the schedule constraint imposed on the project team developing the software. The ratings are defined in terms of the percentage of schedule stretch-out or acceleration with respect to a nominal schedule for a project requiring a given amount of effort. Accelerated schedules tend to produce more effort in the earlier phases to eliminate risks and refine the architecture, more effort in the later phases to accomplish more testing and documentation in parallel.

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

3.2.5. Cost Driver Values

Code	Name	Factor	Value
Product			
RELY	Required Software Reliability	Nominal	1.00
DATA	Data Base Size	Nominal	1.00
CPLX	Product Complexity	Nominal	1.00
RUSE	Developed for Reusability	Nominal	1.00
DOCU	Documentation Match to Lifecycle Needs	Nominal	1.00
Platform			
TIME	Execution Time Constraint	Nominal	1.00
STOR	Storage Constraint	Nominal	1.00
PVOL	Platform Volatility	Low	0.87
Personnel			
ACAP	Analyst Capability	Nominal	1.00
PCAP	Programmer Capability	High	0.88
PCON	Personnel Continuity	Very High	0.81
APEX	Application Experience	Very Low	1.22
PLEX	Platform Experience	Very Low	1.19
LTEX	Language and Toolset Experience	Low	1.09
Project			
TOOL	Use of Software Tools	Low	1.09
SITE	Multisite Development	Extra High	0.80
SCED	Required Development Schedule	Nominal	1.00
		$\boldsymbol{EAF = \prod_i CD(i)}$:	0.8557

3.3. Results

$\boldsymbol{KSLOC = 10.017}$
(KSLOC: *Kilo Source Line Of Code*; lines of code estimated with the FP analysis, expressed in multiple of 10^3)
$\boldsymbol{EAF} = \prod_i CD(i) = \mathbf{0.8557}$
(EAF: *effort adjustment factor*)
$\boldsymbol{E} = 0.91 + 0.01 * \sum_i SD(i) = 0.91 + 0.01 * 14.04 = \mathbf{1.0504}$
(E: *Effort Applied*)
$\boldsymbol{SE} = 0.28 + 0.2 * (E - 0.91) = 0.28 + 0.2 * (1.0504 - 0.91) = 0.28 + 0.02808 = \mathbf{0.30808}$
(SE: *Schedule Equation Exponent*)
$\boldsymbol{Effort} = 2.94 * EAF * KSLOC^E = 2.94 * 0.8557 * 10.017^{1.0504} = \boldsymbol{28.3037\ person/months}$
$\boldsymbol{Duration} = 3.67 * Effort^{SE} = 3.67 * 27.3412^{0.30808} = \boldsymbol{10.279\ months}$

$$\boldsymbol{N_{people}} = \frac{Effort}{Duration} = \frac{28.3037}{10.279} = \boldsymbol{2.7535\ people}$$

$$\boldsymbol{EffettiveDuration} = \frac{Effort}{Actual\ Memebrs} = \frac{28.3037}{3} = \boldsymbol{9.4346\ months = 284\ days}$$

3. Tasks and Schedule

4.1. Project Tasks

Even considering the various changes made to the provided documentation, it is useful to present the project to the stakeholders in order to verify that all their requests have been fulfilled. This will prevent modifications to the project documents (and project structure, too) during the implementation phase.
Considering that, the tasks of the project are:

Task ID	Task Description
T.01	Creation of the Requirement Analysis and Specification Document (RASD)
T.02	Creation of the Design Document (DD)
T.03	Creation of the Integration Testing Plan Document (ITPD)
T.04	Creation of the Project Plan Document (PPD)
T.05	Creation of the slides for the Project Presentation
T.06	Presentation of the slides to the stakeholders
T.07	Apply changes to the project documentation, if required
T.08	Implementation
T.09	Integration Testing
T.10	Deployment

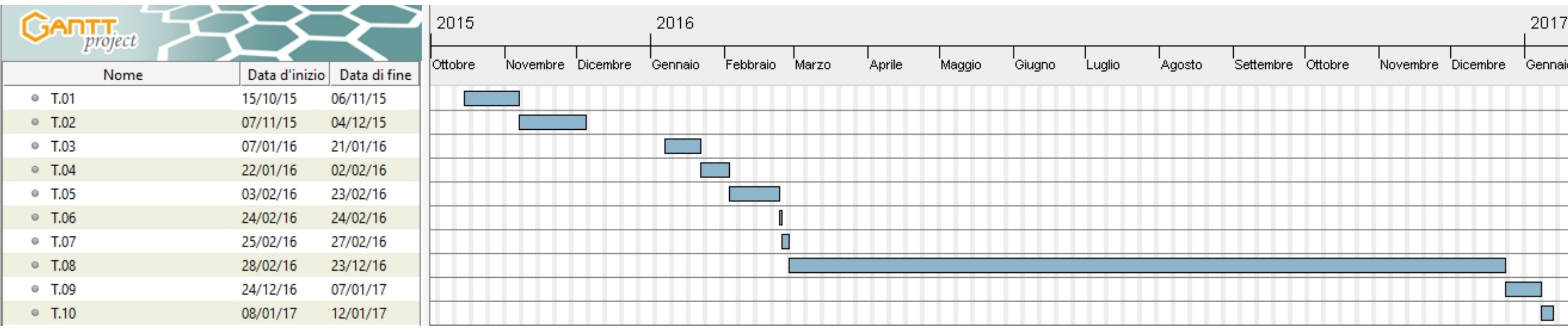
4.2. Project Schedule

Given the results of the COCOMO analysis, the development phase should last 284 days. In order to be a little bit more flexible with the deadline, the development phase can last maximum 300 days. For the integration testing phase will be used 15 days and 5 more days will be used to deploy the entire system.

The deadline of the project are shown in this table:

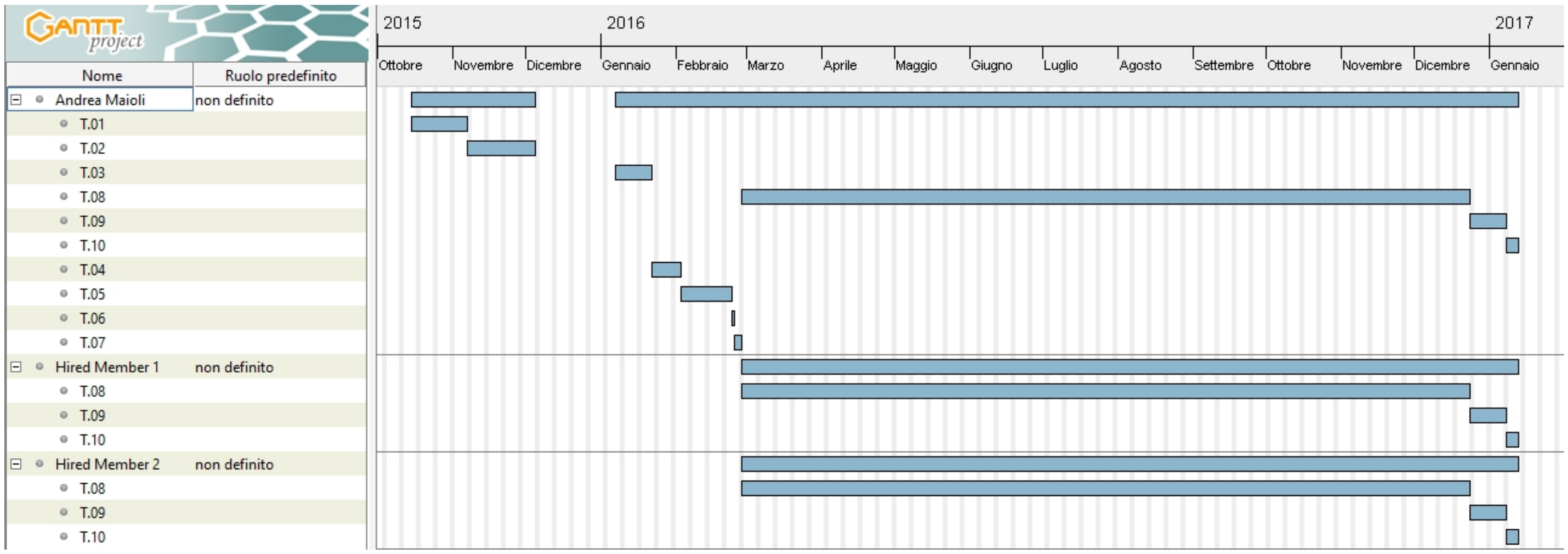
Task ID	Starting Date	Deadline	Duration	Status
T.01	15/10/2015	06/11/2015	23 Days	Done
T.02	07/11/2015	04/12/2015	28 Days	Done
T.03	07/01/2016	21/01/2016	15 Days	Done
T.04	22/01/2016	02/02/2016	12 Days	Done
T.05	03/02/2016	23/02/2016	21 Days	To Be Done
T.06	24/02/2016	24/02/2016	1 Days	To Be Done
T.07	25/02/2016	27/02/2016	3 Days	To Be Done
T.08	28/02/2016	23/12/2016	300 Days	To Be Done
T.09	24/12/2016	7/01/2017	15 Days	To Be Done
T.10	8/01/2017	12/01/2017	5 Days	To Be Done

4.3. Gantt Diagram



Nome	Data d'inizio	Data di fine
T.01	15/10/15	06/11/15
T.02	07/11/15	04/12/15
T.03	07/01/16	21/01/16
T.04	22/01/16	02/02/16
T.05	03/02/16	23/02/16
T.06	24/02/16	24/02/16
T.07	25/02/16	27/02/16
T.08	28/02/16	23/12/16
T.09	24/12/16	07/01/17
T.10	08/01/17	12/01/17

5. Resources allocation



Nome	Ruolo predefinito
Andrea Maioli	non definito
T.01	
T.02	
T.03	
T.08	
T.09	
T.10	
T.04	
T.05	
T.06	
T.07	
Hired Member 1	non definito
T.08	
T.09	
T.10	
Hired Member 2	non definito
T.08	
T.09	
T.10	

Due to the team composition, all the tasks involving the creation of the documents will be done by only the real member of the team (Andrea Maioli).
Starting from the task T.08 (that is the implementation) two more members will help the task execution.
In order to increase the speed of the development phase, an accurate analysis of the provided documentation will be done with all the three members of the team.
All the dependencies among components are identified in the ITPD and this information can be used to increase the speed of the development phase, by developing in parallel components that doesn't have any dependencies.

6. Risks

6.1. Project Risks

- **Delays over the planned deadlines**
  - *Explanation*: due to the dimension of the project to be implemented, is it possible that the planned deadlines are not respected.
  - *Probability*: High
  - *Effect*: Medium
  - *Possible countermeasure*: release a version of the application that doesn't include the less essential features (Administration, Mobile Application) and release them in a future version.

- **Requirements Change**
  - *Explanation*: even if the entire project documentation will be discussed with the stakeholder, it is possible that the requirements changes.
  - *Probability*: Very Low
  - *Effect*: Medium
  - *Possible countermeasure*: the developed code must be easily reusable and extensible.

- **Lack of experience**
  - *Explanation*: The team have no experience with Java EE.
  - *Probability*: High
  - *Effect*: Medium

- **Temporary unavailability of personnel involved in critical tasks**
  - *Explanation*: due to university commitment, it is possible that one of the team members is unavailable for a critical task.
  - *Probability*: Medium
  - *Effect*: Medium
  - *Possible countermeasure*: reorganize the resource allocation.

6.2. Technical Risks

- **Data loss**
  - *Explanation:* even with the cloud architecture of this project, is possible to experience data loss (e.g.: for misconfiguration of a service).
  - *Probability*: Very Low
  - *Effect*: Very High
  - *Possible countermeasure*: it is important to have a backup of all the data into another region, in order to avoid data loss (even if the loss is caused by catastrophic events).
- **Data leaks and security problems:**
  - *Explanation:* due to misconfiguration of a service or a bad implementation, is possible to have security issues or data leaks.
  - *Probability*: Very Low
  - *Effect*: Very High
  - *Possible countermeasure*: verify the configuration of a service (https) and test the implementation of the code that can cause data leaks.

- **Spaghetti code:**
  - *Explanation:* with the increase of the development phase, the code can be bad-structured and difficult to read.
  - *Probability*: Medium
  - *Effect*: Medium
  - *Possible countermeasure*: perform code inspection periodically.

6.3. Business Risk

- **Bad Estimation of the Project's Costs**
  - *Probability*: Medium
  - *Effect*: Medium
  - *Possible countermeasure*: allocate more economical resources to the project or, if not possible, downscale the project size.

7. Appendix

7.1. Software and Tools Used

- Gantt Project: http://www.ganttproject.biz/

7.2. Reference Documents

- Function Points Training Booklet:
  - http://www.softwaremetrics.com/Function%20Point%20Training%20Booklet%20New.pdf
- Function Points Analysis Tutorial:
  - http://alvinalexander.com/FunctionPoints/FunctionPoints.shtml
- COCOMO II Model Definition Manual:
  - http://csse.usc.edu/csse/research/COCOMOII/cocomo2000.0/CII_modelman2000.0.pdf
- Requirements Analysis and Specification Document
- Design Document
- Integration Test Plan Document
- “Project Plan Assignment”