BLEKINGE INSTITUTE OF TECHNOLOGY

Project Specification

TCP Evaluation in Semi-Live Streams

“ Team Enigma”

Anirudh Kodaru

Hemanth Kumar Ravuri

Nandini Chowdary Godavarthi

Naren Naga Pavan Prithvi Tanneedi

Reventh Thiruvallur Vangeepuram

Sasidhar Podapati

Sathvik Katam

Srinand Kona

SriKavya Chavali

Vaibhav Bajaj

Venkata Sathya Sita J S Ravu

Version 1.3
Publication Date: 2015/05/20

Preface

The project proposal document aims at meeting the requirements of the CEO, client and the advancement team of the company.

The current version is v1.2.

If the user is working on a TCP based network, the tool generated with the following project specification gives the user an ability to monitor the traffic between the server and the client. The organizational structure includes glossary and abbreviations, background of the business environment, proposed solution and expected limitations. Progress tracking, quality control and risk management are defined to ensure product quality. Also, system release plans and project organizations are presented.

Release v1.3 on 2015-05-20

- In all the sections of the document figure numbers and table numbers along with captions have been added.

Release v1.2 on 2015-05-14

- The section “preface” has been updated with more details as suggested by the CEO.

Release v1.1 on 2015-05-05

- In the section “Proposed Solution”, required information about RESTful API has been updated.
- In the section “Project Organization”, all team members have been assigned programming tasks.
- In the section “configuration management” system building and release management have been explained with more details.
- In the section “Progress Tracking”, detailed information about group meetings has been added.
- The “Quality Control” section has been changed with proper explanation about the changed quality control process.
- In the section “System Release Plan”, the subsection “Testing Plan” has been updated with detailed information about different tests which will be executed along with the schedule.
- In section “system release plan” the subsection ‘packaging plan’ has been updated with its time schedule.
- In section “system release plan”, subsection “documentation plan” developer documentation has been changed in accordance with the template along with the time plan.

Release v1.0 on 2015-04-27

- Initial release

2. Glossary and Abbreviations

RTT– Round Trip Time
The total time taken for a packet to be sent from source to destination and the acknowledgement to be received from destination to source.

GUI – Graphical User Interface
Allows the user to interact with electronic devices through graphical icons and audio-visual indicators.

API – Application Programming Interface
A set of routines, protocols and tools for building software applications.

TCP – Transmission Control Protocol
Protocol used to exchange data between two communicating hosts through an established connection.

HTTP – Hyper Text Transfer Protocol
This is the underlying protocol used by the World Wide Web which defines how messages are formatted and transmitted.

CM – Configuration Management
It's a systems engineering process which via development and use of standards and procedures, manages and evolves the software system.

CASE tools – Computer Aided Software Engineering tools
Used for designing and implementing software applications

Client: Patrik Arlos

CEO: Dragos Ilie

3. Background

Information sharing in the current scenario revolves around networking. For this sharing to be efficient, the performance of any networking system is of dire concern. In the computing world, performance is one entity which is widely discussed but not really well understood. The client is a Data Centre Company which provides rack space, networking and power to the customers. Recently, the client's company has been receiving complaints regarding TCP performance in networking from their customers.

In this project, a solution tool will be developed to measure the TCP performance of the data streams.

4. Proposed Solution

A tool is to be developed in measuring the TCP performance. The primary aspects measuring the TCP performance of the measurement streams (Data Streams).

- Round Trip Time (RTT)
- Socket Setup Time (three-way handshaking)
- Data Rate per Stream

4.1 RTT

RTT is measured in a particular TCP stream between the client and the server in both the directions by injecting measurement points at different critical points. In the figure below, P_1 is the injected measurement point in the TCP stream.

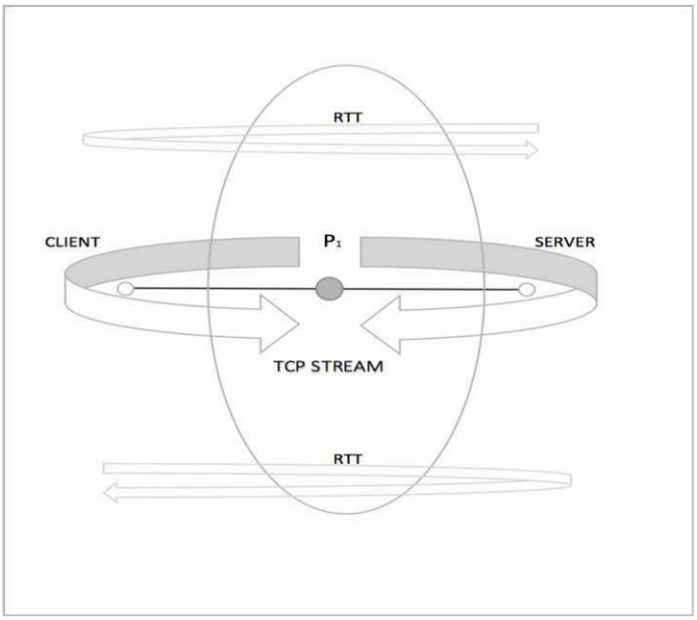

Fig 4.1: RTT calculation

4.2 Socket Setup Time

The time taken to establish a two-way communication link between two communicating entities which helps us to see how responsive those devices are. Socket set up is a three-way handshake.

4.3**Data Rate per stream**

The time series effects on the RTT of the stream as a function of the time.

In association with Data Rate, window size and retransmission have to be found. Also an efficient way of detecting retransmission may be found. All the above mentioned aspects are observed on a single stream. These aspects must also be observed on multiple streams. Hence the aggregate of each aspect can be observed graphically.

Based on the aggregated data, threshold levels of each aspect must be defined namely,

- Normal (expected level)
- Warning
- Critical

For each of these metrics, there would be different threshold levels. When this threshold is achieved or surpassed, notifications are configured/controlled dynamically.

A web interface with a simple user authentication must be created for the client to access the created tool (system).

The client can get the desired TCP performance measurement on the created web interface by real-time/raw-data graphs, time series graphs and aggregated data or historical data graphs (up to 4 weeks).

The tool will be able to export and import data into graphs/tables through a RESTful API; and will also be able to analyze cross correlation with any third party data source.

5. Limitations

- The developed tool limits the measurement of the TCP performance only to the devices within the data center not including the clients of the customer's clients.
- The measurement of performance metrics might be focused only upon a few aspects in this project.
- Time factor and knowledge play an important role.

6. Time Plan

Task	**Date**
Project Proposal	20th April ‘15
Project Specification & SRS	27th April ‘15
Designing a document	4th May ‘15
Acceptance test plan and code generation	11th May ‘15
Project verification	18th May ‘15
Final submission	28th May ‘15

	Name	Duration	Start	Finish	Predecessors
1	Project Proposal	2.375 days	4/9/15 2:00 PM	4/13/15 5:00 PM	
2	Updated project proposal	5 days	4/14/15 8:00 AM	4/20/15 5:00 PM	1
3	Literature review	7 days	4/14/15 11:00 AM	4/23/15 11:00 AM	
4	**⊟Project specifications**	5 days	**4/21/15 8:00 AM**	**4/27/15 5:00 PM**	
5	Work breakdown structure	5 days	4/21/15 8:00 AM	4/27/15 5:00 PM	
6	**⊞Progress tracking**	29 days	**4/12/15 8:00 AM**	**5/21/15 5:00 PM**	
23	**⊞Quality Control**	5 days	**5/9/15 8:00 AM**	**5/15/15 5:00 PM**	
26	Risk management	27 days	4/20/15 8:00 AM	5/26/15 5:00 PM	
27	Configuration management	35 days	4/20/15 8:00 AM	6/5/15 5:00 PM	
28	**⊟Software Requirement Specifications**	7 days	**4/17/15 8:00 AM**	**4/27/15 5:00 PM**	
29	System architecture	7 days	4/17/15 8:00 AM	4/27/15 5:00 PM	
30	User requirements	3 days	4/17/15 8:00 AM	4/21/15 5:00 PM	
31	System requirements	5 days	4/20/15 8:00 AM	4/24/15 5:00 PM	
32	Updated SRS & Project specifications	2 days	5/2/15 11:00 AM	5/5/15 5:00 PM	
33	Design document	6 days	4/28/15 8:00 AM	5/5/15 5:00 PM	4;28
34	**⊟Acceptance test plan & code impleme**	13 days	**4/23/15 8:00 AM**	**5/11/15 5:00 PM**	
35	Front-end	8.75 days	4/23/15 8:00 AM	5/5/15 3:00 PM	
36	**⊟Back-end**	13 days	**4/23/15 8:00 AM**	**5/11/15 5:00 PM**	
37	Data collection	13 days	4/23/15 8:00 AM	5/11/15 5:00 PM	
38	Performance metrics	13 days	4/23/15 8:00 AM	5/11/15 5:00 PM	
39	Threshold notifications	13 days	4/23/15 8:00 AM	5/11/15 5:00 PM	
40	RESTful API	13 days	4/23/15 8:00 AM	5/11/15 5:00 PM	
41	**⊟Database management**	13 days	**4/23/15 8:00 AM**	**5/11/15 5:00 PM**	
42	MySQL database	13 days	4/23/15 8:00 AM	5/11/15 5:00 PM	
43	RRD	13 days	4/23/15 8:00 AM	5/11/15 5:00 PM	
44	**⊟System release plan**	9 days	**5/6/15 8:00 AM**	**5/18/15 5:00 PM**	
45	**⊟Testing plan**	9 days	**5/6/15 8:00 AM**	**5/18/15 5:00 PM**	
46	Unit tests	8 days	5/6/15 8:00 AM	5/15/15 5:00 PM	
47	Component tests	2 days	5/14/15 8:00 AM	5/15/15 5:00 PM	
48	Release bundle test by other group	1 day	5/15/15 8:00 AM	5/15/15 5:00 PM	
49	Final Release test	1 day	5/16/15 8:00 AM	5/18/15 5:00 PM	
50	Packaging plan	1 day	5/16/15 8:00 AM	5/18/15 5:00 PM	
51	**⊟Documentation plan**	5 days	**5/9/15 8:00 AM**	**5/15/15 5:00 PM**	
52	Installation documentation	5 days	5/9/15 8:00 AM	5/15/15 5:00 PM	
53	User documentation	5 days	5/9/15 8:00 AM	5/15/15 5:00 PM	
54	Developer documentation	5 days	5/9/15 8:00 AM	5/15/15 5:00 PM	
55	Project verification	5 days	5/12/15 8:00 AM	5/18/15 5:00 PM	34
56	**⊟Final submission**	8 days	**5/19/15 8:00 AM**	**5/28/15 5:00 PM**	**55**
57	Final changes with error & bug fixes	5 days	5/19/15 8:00 AM	5/25/15 5:00 PM	
58	Demo to CEO	1 day	5/25/15 8:00 AM	5/25/15 5:00 PM	
59	Final product to customer	1 day	5/28/15 8:00 AM	5/28/15 5:00 PM	

-

Fig 6.1: Task allocation in ProjectLibre

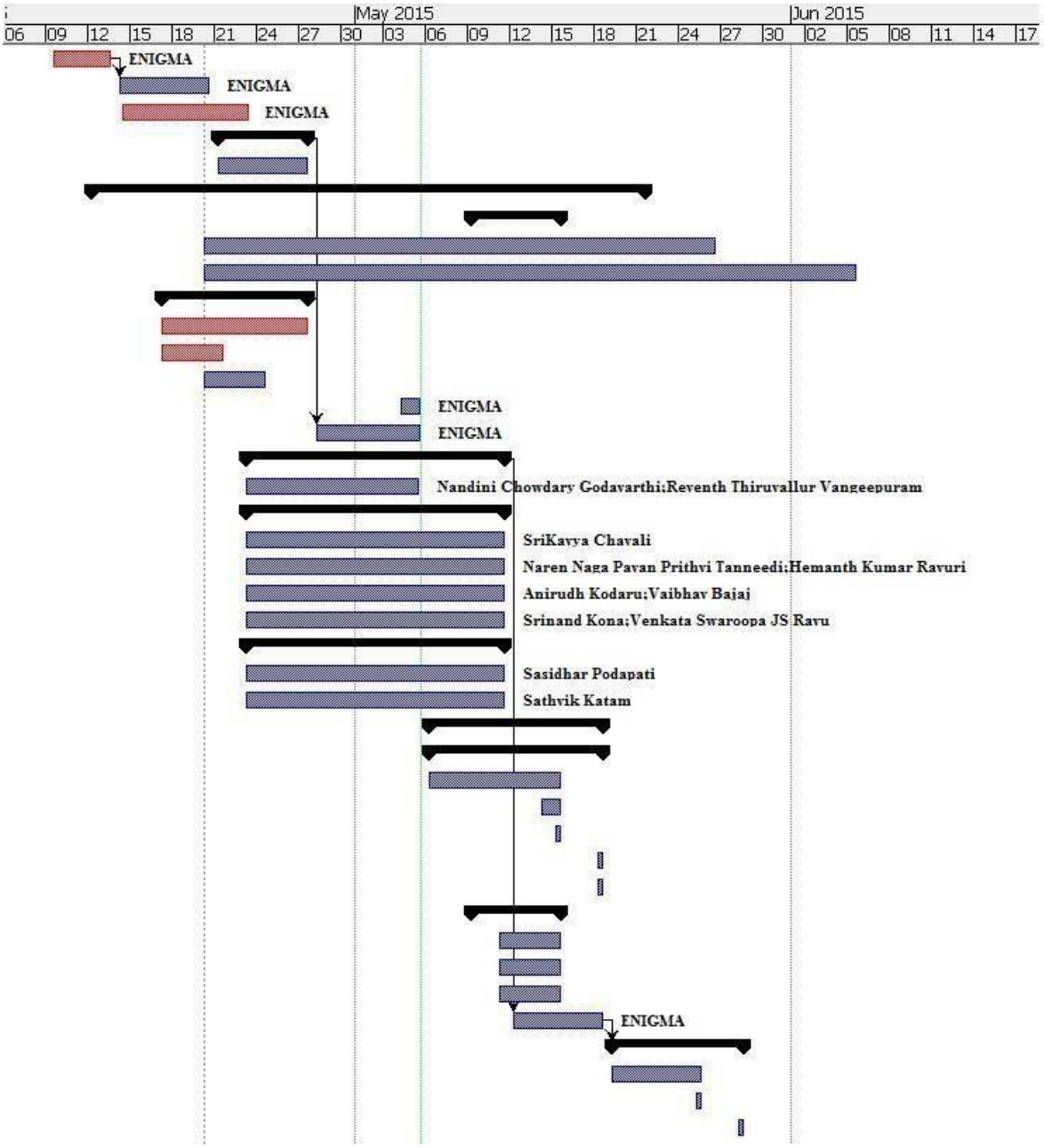

Fig 6.2: Gantt chart in ProjectLibre

7. Project Organization

In this section, the responsibilities of each member of the team are described. Each team has a manager to coordinate the proceedings among team members.

(a) Software development team:

Manager - Hemanth Ravuri

1. **Back-end:**
   Packet capturing-Data acquisition: SriKavya Chavali
   Performance Metrics: Pavan Prithvi, Hemanth Ravuri
   Thresholds and Notifications: Anirudh Kodaru, Vaibhav Bajaj
   RESTful API: Swaroopa Ravu, Srinand Kona
2. **Front-end:** Reventh TV, Nandini Chowdary
3. **Database management:**
   RRD: Sathvik Katam
   MySQL database: Sasidhar Podapati

(b)Testing team: Manager

– Pavan Prithvi Hemanth
Ravuri, Pavan Prithvi

(c) Documentation team:

Manager – Srikavya Chavali
Anirudh Kodaru, Vaibhav Bajaj, Srikavya Chavali

(d) Management team:

Manager – Reventh TV

1. Progress tracking, People management, Quality control: Reventh TV, Sathvik Katam
2. Risk management, Configuration management: Swaroopa Ravu, Nandini Chowdary

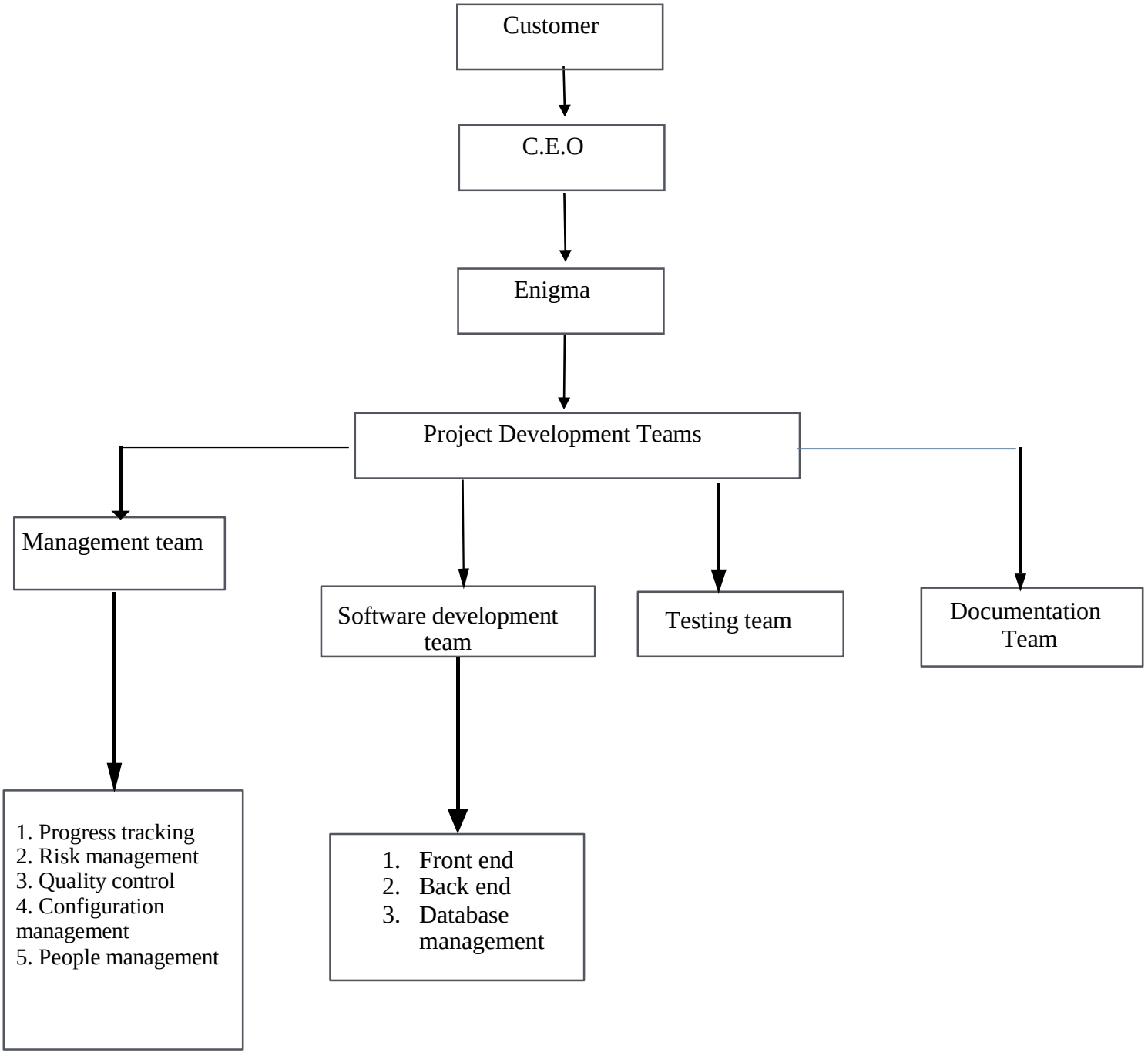

Fig 7.1: Project organization

8. Configuration Management

The purpose of Configuration Management is to establish and maintain the integrity of the software products throughout the project's software cycle. CM involves policies, processes and tools for managing changing software systems. As software changes regularly, we need a set of versions to maintain and manage it. CM involves the following activities:

Version Management: This helps in tracking different versions of software components and systems using these components. We use Git management tool for managing our systems. The GitLab server used here features version management, issue tracking, milestone management, etc. The documents and source code files are managed using GitLab server. The customer and CEO cankeep track of the changes and request changes through issue tracking system. It also ensures that changes made by our development team-mates do not interfere with each other. The initial version release is 1.0 and subsequently incremented by changes requested by the customer or CEO.

System building: System building starts from building the source code. It deals with the creation of a complete, compiled and executable system. We don't use any existing system builder. We use our own scripts to build our system. There is no IDE that generates the scripts, we develop our own scripts for front-end and back-end, and are run parallel for evaluation of the TCP streams. The software development team is working on the generation of basic pieces of code which are later linked, compiled and built into an executable system. Then the testing team tests each component as well as the system to verify and validate the code. The initial version of the product is released and later updated based on the changes requested by the customer or CEO.

Release management: Release management deals with the release of a version of the system that is distributed to the customer. The release bundle includes an executable code of the system, installation programs, configuration files, data files needed for successful system operation and documentation describing the system. Before the release, these are given to a group of people, not related to project, to use the tool with the help of documentation provided; to ensure the release bundle is understandable. As planned, this will be done on the date given in the ProjectLibre plan. Based on the feedback from the customer, the changes (if any) are made by the software development team and tested before its next release. Different versions of release are managed using the GitLab server as described in the Version management section.

9. Progress Tracking

Progress tracking is implemented using ProjectLibre. Initially, the milestones, toll gates and resources are specified in ProjectLibre. Once in every three days, a group meeting is held to discuss the progress and problems regarding the project. The project plan is periodically updated ensuring that milestones and tollgates are met. The updated plan is uploaded in the GitLab server for the CEO to track the progress of the project. For every checkpoint, the project status is updated to the customer. The management team keeps track of the progress against the actual time plan defined.

	Name	RBS	Type	E-mail Address	Material Label	Initials	Group	Max. Units	Standard Rate	Overtime Rate	Cost Per Use	Accrue At	Base Calendar
1	ENIGMA		Work			ENIGMA		100%	$0.00/hour	$0.00/hour	$0.00	Prorated	Standard
2	Anirudh Kodaru	Documentation, Back-end script	Work	anirudhkodaru15@gma...		ANKO	ENIGMA	100%	$0.00/hour	$0.00/hour	$6000.00	Prorated	Standard
3	Hemanth Kumar Ravuri	Back-end script, Testing	Work	hemanth.ravuri33@gm...		HERA	ENIGMA	100%	$0.00/hour	$0.00/hour	$6000.00	Prorated	Standard
4	Nandini Chowdary Godavarthi	Front-end script, Risk management	Work	nandini94.chowdary@g...		NAGO	ENIGMA	100%	$0.00/hour	$0.00/hour	$6000.00	Prorated	Standard
5	Naren Naga Pavan Prithvi Tanneedi	Back-end script, Testing	Work	pavanprithvi27@yahoo....		NATA	ENIGMA	100%	$0.00/hour	$0.00/hour	$6000.00	Prorated	Standard
6	Reventh Thiruvallur Vangeepuram	Front-end script, Progress tracking	Work	revanth.tv@gmail.com		RETH	ENIGMA	100%	$0.00/hour	$0.00/hour	$6000.00	Prorated	Standard
7	Sasidhar Podapati	Database management	Work	sasidhar.podapati93@g...		SAPO	ENIGMA	100%	$0.00/hour	$0.00/hour	$6000.00	Prorated	Standard
8	Sathvik Katam	Database management, Quality control	Work	katam.sathvik@gmail.c...		SAKA	ENIGMA	100%	$0.00/hour	$0.00/hour	$6000.00	Prorated	Standard
9	SriKavya Chavali	Back-end script, Documentation	Work	srikavyac93@gmail.com		SRCH	ENIGMA	100%	$0.00/hour	$0.00/hour	$6000.00	Prorated	Standard
10	Srinand Kona	Back-end script	Work	srinand567@gmail.com		SRKO	ENIGMA	100%	$0.00/hour	$0.00/hour	$6000.00	Prorated	Standard
11	Vaibhav Bajaj	Documentation, Back-end script	Work	vaibhav.bajaj92@gmail...		VABA	ENIGMA	100%	$0.00/hour	$0.00/hour	$6000.00	Prorated	Standard
12	Venkata Swaroopa JS Ravu	Back-end script, Configuration management	Work	swaroopa.ravu@gmail....		VERA	ENIGMA	100%	$0.00/hour	$0.00/hour	$6000.00	Prorated	Standard

Fig 9.1: Resource allocation in ProjectLibre

10. Quality Control

Quality control ensures that the services performed, meet the requirements of the customer. It emphasizes on monitoring the product to ensure that the quality standards are met. The product standards are set with respect to the requirements of the customer, as accepted in the SRS. The deliverables of the product are checked against these standards. In order to do so, quality reviews of the software along with the documentation are done by the quality management team. In the reviews, the attributes such as security, reliability, testability, usability and efficiency are expected to be checked. The conclusions of the review are presented to the software development team and documentation team to correct the errors, problems or inconsistencies. These reviews are conducted at different points of time during the project development process. This has been scheduled in the ProjectLibre plan with respect to the planned implementation and documentation processes.

11. Risk Management

Risk management deals with having knowledge about the risks that might have an impact on the project development process or the quality of the product. It is also concerned with the actions to be taken to avoid these risks. The following are the risks which might affect the project.

Name of Risk	Probability	Effect on Project	Type of Risk	Risk Identification	Risk Analysis	Risk Planning	Risk Monitoring
Time delay	Very High	Catastrophic	Project	Delay in time affects the schedule of the project	Analyzed from Progress tracking	By assigning more resources & working hours for each checkpoint	Constantly assessed from progress of configuration management
Staff Change	Moderate	Serious	Project	1. Team members not showing up. 2. Decrease in confidence levels.	1. Falling ill 2. External help, motivation in group meetings	Each member of the group should participate in more than one event i.e., by reorganising the	Determined from the progress tracking
CASE Tools	High	Tolerable	Product	1. CASE tools which support the project do not perform as anticipated	1. Inefficient generation of code by CASE tools. 2.Complaints about tools	1. Selection of proper tools and keeping track of efficient alternatives to the tools in use.	Progress tracking & Quality control
Change in require-ments	Very low	Serious	Project & Product	1. Customer gives new set of requirements.	1. Major re- work on the initially proposed design.	1. Deriving traceable information to assess impact of change in requiremen-ts.	Increase in the number of requirements, change requests and complaints from customers.

Table 11.1: Risk Management. [1]

12. System Release Plan:

12.1 Testing Plan:

The product developed is tested by the testing personnel who facilitate the ease of accessibility of the tool by the users. Module interaction issues are checked and resolved after performing the tests on the tool. Validation of the tool is prepared by making a note of exceptional cases and also, all scripts are checked for execution. This involves verification of the tool too, both of which involve dependency on software inspection and reviews. Different types of tests are conducted at different points of time during the project development process. Unit tests are to be conducted throughout the code evolution process i.e. whenever a functionality is modified due to various reasons such as bug fixing or natural incremental development. Hence these are scheduled along with the implementation process. Component tests which deal with testing individual components of the system are to be performed once different pieces of the system are built. These have been planned accordingly. Release testing deals with testing release of the system that will be distributed to consumers. This is usually a black-box testing process, where system is treated as black box whose behavior is explained by the inputs and their corresponding outputs. After the release tests, the product deliverables are handed over to the costumer as per the release plan. Then based on the feedback from the customer, the bugs are fixed and the product is tested before releasing it on 28th May 2015.

Testing plan as scheduled in the ProjectLibre:

	Name	Duration	Start	Finish	Predecessors
1	Project Proposal	2.375 days	4/9/15 2:00 PM	4/13/15 5:00 PM	
2	Updated project proposal	5 days	4/14/15 8:00 AM	4/20/15 5:00 PM	1
3	Literature review	7 days	4/14/15 11:00 AM	4/23/15 11:00 AM	
4	**Project specifications**	5 days	**4/21/15 8:00 AM**	**4/27/15 5:00 PM**	
6	**Progress tracking**	29 days	**4/12/15 8:00 AM**	**5/21/15 5:00 PM**	
23	**Quality Control**	5 days	**5/9/15 8:00 AM**	**5/15/15 5:00 PM**	
26	Risk management	27 days	4/20/15 8:00 AM	5/26/15 5:00 PM	
27	Configuration management	35 days	4/20/15 8:00 AM	6/5/15 5:00 PM	
28	**Software Requirement Specifications**	7 days	**4/17/15 8:00 AM**	**4/27/15 5:00 PM**	
32	Updated SRS & Project specifications	2 days	5/2/15 11:00 AM	5/5/15 5:00 PM	
33	Design document	6 days	4/28/15 8:00 AM	5/5/15 5:00 PM	4;28
34	**Acceptance test plan & code impleme**	13 days	**4/23/15 8:00 AM**	**5/11/15 5:00 PM**	
44	**System release plan**	9 days	**5/6/15 8:00 AM**	**5/18/15 5:00 PM**	
45	**Testing plan**	9 days	**5/6/15 8:00 AM**	**5/18/15 5:00 PM**	
46	Unit tests	8 days	5/6/15 8:00 AM	5/15/15 5:00 PM	
47	Component tests	2 days	5/14/15 8:00 AM	5/15/15 5:00 PM	
48	Release bundle test by other group	1 day	5/15/15 8:00 AM	5/15/15 5:00 PM	
49	Final Release test	1 day	5/16/15 8:00 AM	5/18/15 5:00 PM	
50	Packaging plan	1 day	5/16/15 8:00 AM	5/18/15 5:00 PM	
51	**Documentation plan**	5 days	**5/9/15 8:00 AM**	**5/15/15 5:00 PM**	
55	Project verification	5 days	5/12/15 8:00 AM	5/18/15 5:00 PM	34
56	**Final submission**	8 days	**5/19/15 8:00 AM**	**5/28/15 5:00 PM**	**55**

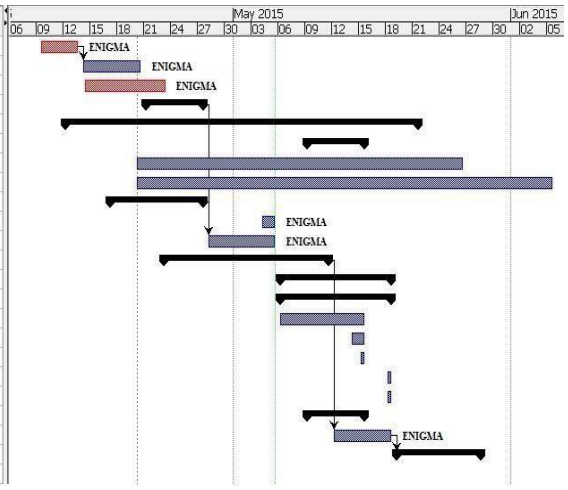

Fig 12.1: Testing plan scheduled in Project Libre

12.2 Packaging Plan:

The user will be provided with a Zip or Tar archive which will contain the product as well as the entire project documentation including an updated ProjectLibre plan. Project packaging is done on 17th May 2015 after all the tests, quality reviews and the test of Release bundle are completed.

12.3 Documentation Plan:

12.3.1 Installation Documentation:
A PDF format document will be provided, which will involve the installation and configuration information related to the product. This will help the user in the installation of the product. Installation documentation process will start on 9th May 2015 and is expected to complete on 14th May 2015. A quality review will be done 14th May 2015 and the outcome of the review will be used to make changes accordingly. Release bundle test as described in release management section will be performed on 16th May 2015 and the final documentation is prepared for submission on 18th May 2015. Based on the feedback from the customer and the CEO, changes are made (if any) before the final release on 28th May 2015.

12.3.2 User Documentation:
A PDF format document will be provided to help the user with the usage of the product and its operation. This will involve information regarding the required basic knowledge of the user. User documentation process will start on 9th May 2015 and is expected to complete on 14th May 2015. A quality review will be done on 14th May 2015 and the outcome of the review will be used to make changes accordingly. Release bundle test as described in release management section is performed on 16th May 2015 and final documentation is prepared for submission on 18th May 2015. Based on the feedback from the customer and the CEO, changes are made (if any) before the final release on 28th May 2015.

12.3.3 Developer Documentation:
A PDF document will be provided, which will contain specific versions of source code components used for the development of executable code. It also includes data format used for communication with the system, format of database tables and a description about the RESTful API. These are useful to extend the system or to build on top of it. Installation documentation process will start on 9th May 2015 and is expected to be completed on 14th May 2015. A quality review will be done 14th May 2015 and the outcome of the review will be used to make changes accordingly. The final documentation will be prepared for submission on 18th May 2015. Based on the feedback from the customer and CEO, changes if any are made before the final release on 28th May 2015.

13. References:

---

[1] Ian Sommerville, *SOFTWARE ENGINEERING*, 9th ed. Pearson Publications, 2011.