Abstract

This document describes the user requirements for The Callisto plug-in. Callisto is a plug-in for Jupyter which enables analysis of data from the MIMIC-III database [1]. The MIMIC-III database contains medical information of more than 40,000 critical care patients. With this information, researchers hope to obtain relevant information which can help critical care patients in the future. This document complies with the ESA software standard.
# Contents

1 Introduction 8  
  1.1 Purpose .................................................. 8  
  1.2 Scope .................................................... 8  
  1.3 Definitions and abbreviations ......................... 9  
    1.3.1 Definitions .......................................... 9  
    1.3.2 Abbreviations ....................................... 9  
  1.4 List of references ....................................... 9  
  1.5 Overview .................................................. 11  

2 General description 12  
  2.1 Product perspective .................................. 12  
  2.2 General capabilities .................................. 12  
    2.2.1 Clinical Data Investigations and Insights .......... 12  
    2.2.2 Word Generated report ............................... 12  
    2.2.3 MATLAB Module .................................... 13  
  2.3 General constraints ..................................... 13  
    2.3.1 Security and Privacy ................................. 13  
    2.3.2 Language ............................................ 13  
  2.4 User characteristics .................................... 14  
    2.4.1 Researchers .......................................... 14  
    2.4.2 Database Admin ...................................... 14  
  2.5 Environment description ................................. 15  
    2.5.1 MIMIC-III database ................................ 15  
    2.5.2 Jupyter Notebook ................................... 15  
    2.5.3 JupyterHub .......................................... 15  
    2.5.4 Callisto Cell ........................................ 15  
    2.5.5 MATLAB module ..................................... 15  
    2.5.6 Word generation module ............................... 16  
    2.5.7 Environment model .................................. 16  
  2.6 Assumptions and Dependencies ......................... 17  

3 Specific requirements 18  
  3.1 Capability requirements ............................... 18  
    3.1.1 Clinical Data Investigations and Insights ........ 18  
    3.1.2 Automatic Report Generation ....................... 25  
    3.1.3 MATLAB Module .................................... 25  
  3.2 Constraint requirements ................................ 26
3.2.1 Environment .......................................................... 26
3.2.2 Performance ......................................................... 26
3.2.3 Security and Privacy ............................................... 26

A Appendix - Use Cases .................................................. 28
A.1 General ................................................................. 28
A.1.1 Adding the Jupyter Callisto plug-in to Jupyter Notebook .... 28
A.2 Clinical Data Investigations and Insights .......................... 29
A.2.1 Changing the cell type to a MIMIC cell with the multi-layer menu ... 29
A.2.2 Changing the cell type to a MIMIC cell with the drop-down cell type selector ........................................ 29
A.2.3 Configuring a MIMIC cell to get one of the preset graphs .... 29
A.2.4 Configuring the styling of a graph .............................. 30
A.2.5 Setting a new filter for a MIMIC Cell ......................... 30
A.2.6 Deleting a present filter for a MIMIC Cell .................... 32
A.2.7 Add a new query as a technical user .......................... 32
A.2.8 Change an existing query as a technical user ............... 32
A.3 Automatic Report Generation ...................................... 34
A.3.1 Exporting the document to word format .................... 34
A.3.2 Selecting graph's for the word file ............................ 34
A.4 MATLAB - MathWorks Interface .................................. 35
A.4.1 Exporting a graph to MATLAB ............................... 35
A.5 Security and Privacy ............................................... 36
A.5.1 The admin adds a new user account .......................... 36
A.5.2 The admin deletes a user account ............................ 36
A.5.3 The admin edits a user accounts password .................. 37
## DOCUMENT STATUS SHEET

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1 INTRODUCTION

1.1 PURPOSE

This User Requirements Document (URD) contains the requirements of the product in development for Royal Philips. The requirements defined here were created together with Royal Philips and the development group. The listed requirements will be implemented according to their priorities. Changes later on will require the agreement of both parties.

1.2 SCOPE

The Pyoneers is a Bachelor End Project group working for the TU/e and Royal Philips. The software product is a plug-in for Jupyter which is created by The Pyoneers for the collaborative initiative lead by the Research of Chronic Disease Management department at Royal Philips, and the department of Mathematics and Computer Science Flagship Data Science of Eindhoven University of Technology. The goal of the application is to develop a data science environment in which the researchers can use the data in the MIMIC-III database. The application will allow the user to generate graphs from the MIMIC-III data in an easy and user friendly manner. Text can be added to the graph to clarify the results that the graph represents. This will help researchers in gaining insights into relevant correlations. In the end this will all contribute to making it easier for the scientists to do research using the MIMIC-III database [1] to find insights in health care and treatment processes. When the researcher feels that the document is finished, they can export the document to Microsoft Word (.docx) format to easily share their findings. They are also able to export the charts, with the underlying settings, to MATLAB code. Furthermore, Callisto will allow scientists to save and resume their work.
## 1.3 DEFINITIONS AND ABBREVIATIONS

### 1.3.1 DEFINITIONS

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tr>
<td>Callisto Cell</td>
<td>A Jupyter cell which contains the graphical user interface for the creation of the graph and the graph itself. Furthermore it contains options for exporting to Microsoft Word and MATLAB.</td>
</tr>
<tr>
<td>Disease class</td>
<td>All diseases which would be in the same category, is called a disease class.</td>
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<tr>
<td>Jupyter Notebook</td>
<td>A web application that allows the creation of live code, visualisations and text.</td>
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<tr>
<td>Jupyter Project</td>
<td>A document in the Jupyter Notebook which can contain a set of cells.</td>
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<tr>
<td>JupyterHub</td>
<td>An application which enables an instance of Jupyter Notebook for every user which logs in.</td>
</tr>
<tr>
<td>MATLAB</td>
<td>A multi-paradigm computing environment for numerical data.</td>
</tr>
<tr>
<td>MIMIC Graph</td>
<td>A graph created with the data of the MIMIC-III database.</td>
</tr>
<tr>
<td>Philips</td>
<td>A company focused on improving people’s lifestyle with meaningful innovations in healthcare, consumers lifestyles and lighting.</td>
</tr>
<tr>
<td>Python</td>
<td>Python is a widely used high-level, general-purpose, interpreted, dynamic programming language.</td>
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<td>Top 6 disease classes</td>
<td>Cardiovascular disease, chronic lung disease, chronic kidney disease, cancer, diabetes, injuries.</td>
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### 1.3.2 ABBREVIATIONS

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tr>
<td>ESA</td>
<td>European Space Agency</td>
</tr>
<tr>
<td>GUI</td>
<td>Graphical User Interface</td>
</tr>
<tr>
<td>MIT</td>
<td>Massachusetts Institute of Technology</td>
</tr>
<tr>
<td>TU/e</td>
<td>Eindhoven University of Technology</td>
</tr>
<tr>
<td>URD</td>
<td>User Requirements Document</td>
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</table>

## 1.4 LIST OF REFERENCES

1.5 OVERVIEW

The remainder of the document is organized as follows. Chapter 2 will give a general description of the product, starting with the product perspective. The product perspective is followed by the general capabilities and constraints. User characteristics, environment description, and assumptions and dependencies are also included in this chapter. In Chapter 3 the specific requirements will be provided along with their priorities, including capability requirements and constraint requirements. Finally in Appendix A, use cases relevant to the project will be provided.
2 GENERAL DESCRIPTION

2.1 PRODUCT PERSPECTIVE

In the world of health care it is desirable to gain insights into how patients health evolves over time. In order to gain high quality insights it is very important to look at the treatments patients receive based on their symptoms and to compare this information to relevant past cases. Additionally, it is also favourable to keep the billing for treatment affordable, without undue sacrifice to the quality of care given. Hence, it would be ideal to see how patients in the past have responded to certain treatments, and at what cost. The MIMIC-III database keeps track of how the health of patients evolved over time with certain treatments. Unfortunately it is hard to use the raw data to gain any real insight without proper tooling. Moreover, displaying the results of the research organised in a quick manner also proves to be quite difficult. Therefore the product requested by the customer is a plug-in for a web application where one can easily add relevant information to the document in the form of text, illustrations, and figures created from the data of the MIMIC-III database. Furthermore the product should have a word conversion plug-in, such that the created text and graphs can easily be shared with other people. Lastly, the customer requested an export capability to MATLAB, such that the graphs can easily be adapted with MATLAB code.

2.2 GENERAL CAPABILITIES

The Callisto plug-in will have the capabilities described below. These capabilities are divided by scope.

2.2.1 CLINICAL DATA INVESTIGATIONS AND INSIGHTS

Clinical scientists want an easy way of interacting with the MIMIC-III database. The user will be able to generate a graph by choosing one of the predetermined kind of graphs. There are a couple of options that can be set for the predetermined graphs. First of all filters can be added to those predetermined graphs. Secondly the user will be able to change the graph type. Lastly, the colour of the graph can be altered. To clarify the results found in a particular graph, the user will be able to add a description to the graph. This is default behavior of the Jupyter Notebook.

The Callisto plug-in allows a technical user to modify the predetermined graphs. A new query to generate a graph can be created and an existing graph query can be modified or deleted.

2.2.2 WORD GENERATED REPORT

The customer wants to be able to easily share their findings with others. Therefore there has to be an option to export the data of the online document to a local document. The client re-
quested that the online document can be exported to a Microsoft Word document (.docx). The user can select what graphs should be included in the conversion and what graphs should not. The Microsoft Word document includes all the selected graphs and the explanatory text beneath the selected graphs.

2.2.3 MATLAB MODULE

The customer specified that they want to be able to export the graphs created from the MIMIC-III database, to MATLAB. This means that in the Jupyter interface, one should be able to export a specific graph to MATLAB code. This MATLAB code can then be used in MATLAB to further analyze the data. When the user selects the export to MATLAB button, a MATLAB script is generated. The script can then be opened with the MATLAB software to generate the graph.

2.3 GENERAL CONSTRAINTS

The Callisto plug-in is intended to be used by researchers at Philips and the TU/e. The researchers will have a technical background, but will not necessarily be programmers, so there should be a simple graphical user interface.

2.3.1 SECURITY AND PRIVACY

To make sure the MIMIC-III database is only used by people licenced by MIT, the database is only accessible with the right user credentials. Moreover, all Internet connections are encrypted to prevent eavesdropping and therefore preventing unauthorized people to get insight in the MIMIC-III database.

2.3.2 LANGUAGE

The Callisto plug-in is written in English, since most clinical scientists will be able to understand the English language.
2.4 USER CHARACTERISTICS

2.4.1 RESEARCHERS

The Callisto plug-in will mainly be used by clinical researchers trying to gain insights with the help of the MIMIC-III database. We expect the researchers to have no previous experiences with the Jupyter notebook. These users will use The Callisto plug-in to get information from the MIMIC-III database and help them to gain insights into relevant correlations. To achieve this, The Callisto plug-in will enable them to filter data from the database and create graphs. Researchers would also like to be able to easily share their findings with their colleagues. They are able to share by means of exporting their Jupyter file to word. Since word documents are widely used all over the world, almost everyone will be able to open the document.

2.4.2 DATABASE ADMIN

To make sure that only the people with the right credentials are able to access the MIMIC-III database, the database should be user account protected. The database admin checks if the person who applies for the password has obtained the MIMIC-III MIT certificate and is therefore allowed to use the database.
2.5 ENVIRONMENT DESCRIPTION

In this section the environment description will be given. First all the components will be described. After that the environment model will be described.

2.5.1 MIMIC-III DATABASE

The main goal of the Callisto plug-in is to have a tool to enable simple interaction with the MIMIC-III database. This database is supposed to be stored on the server. This database is open for the general public with permission of MIT and free of charge. It does however require that the user acquires a certificate to ensure the data is used for the right purposes and without endangering the privacy of the patients. The database is therefore not supposed to be stored on an insecure server, as there is a risk that the data will be breached by people without the required certificate.

2.5.2 JUPYTER NOTEBOOK

The Callisto plug-in has to be an extension upon Jupyter Notebook. Jupyter Notebook is a web based application. It allows you to create documents which contain live code, figures and explanatory text. It is often used for data analyses, simulations or statistical models. The goal of the Callisto plug-in is to improve Clinical Data Investigations and Insight by providing a good extension to Jupyter.

2.5.3 JUPYTERHUB

JupyterHub is used for instantiating a new Jupyter Notebook for every user that is logged in. JupyterHub requires a user to log-in and is assessable by the web. By using JupyterHub the user only needs one of the accepted browsers. JupyterHub is also responsible for allowing the admin to manage the user accounts. JupyterHub works in a way that it creates a Jupyter Notebook instance for every user logging in, therefore it requires Jupyter Notebook. JupyterHub will also be stored on the server together with Jupyter Notebook and it's plug-ins.

2.5.4 CALLISTO CELL

The Callisto cell is the part of the plug-in for Jupyter Notebook that is responsible for generating a graph based on the MIMIC-III data. The Callisto cells connect to the MIMIC-III database to get the data required for the specific graphs that the user requested.

2.5.5 MATLAB MODULE

The MATLAB module is the part of the plug-in for the Jupyter Notebook which enables the user to export the graph into MATLAB. The MATLAB module will be displayed inside the Callisto Cell and is thereby part of it.
2.5.6 WORD GENERATION MODULE

This is the part of the Callisto plug-in for Jupyter Notebook which enables users to export the Jupyter project to Microsoft Word. It also interacts with the Callisto Cell, as one can select which of the Callisto cells with notes underneath it, should be exported to the Microsoft Word document.

2.5.7 ENVIRONMENT MODEL

Now that all components are explained, the model can be discussed. First of all there are 2 users. The admin can interact with the user administration, to manage the user accounts, and do all the actions a researcher can. The JupyterHub launches a Jupyter Notebook instance for every user and the user only interacts with the Jupyter Notebook. The Jupyter Notebook is extended by the Callisto Cell and the Word Generation module. These are part of the Callisto plugin. The Callisto Cell includes a MATLAB module and it interacts with the Word Generation module, such that the user can select which graph to export. The Callisto Cell finally interacts with the MIMIC-III database to get the information required for the graphs to be generated.
2.6 ASSUMPTIONS AND DEPENDENCIES

Callisto requires the following assumptions and dependencies in order to function correctly.

- The Pyoneers is approved to use the MIMIC-III database.
- Jupyter development version (5.0) is a stable version.
- The server hosting the MIMIC-III database is accessible at all time.
- The Internet connection is not an obstructive factor when trying to access the database.
3 SPECIFIC REQUIREMENTS

Listed in this section are all the requirements for the software project. All these requirements are agreed upon by both The Pyoneers and the customer. If one of the two parties want to change a requirement, full consent of both parties is required. All requirements are prioritised with the MoSCoW model [2]. The model works as follows:

- **M Must have**: These requirements are essential and must therefore be included in the product.
- **S Should have**: These requirements are important, but not as important as the must have requirements. Hence, they can be left out if there is no other choice.
- **C Could have**: These requirements are good to have in the product, but only when there is time left or if it is easy to implement.
- **W Won’t have**: These requirements will not be implemented into the project, but can be realised at a later version of the product.

3.1 CAPABILITY REQUIREMENTS

3.1.1 CLINICAL DATA INVESTIGATIONS AND INSIGHTS

3.1.1.1 General

**URF - 1**

The Callisto plug-in allows the user to output an arbitrary number of graphs in each Jupyter project.

**URF - 2**

The Callisto plug-in creates graphs using data from the MIMIC-III database.

**URF - 3**

The Callisto plug-in allows the user to remove graphs from a Jupyter project.

**URF - 4**

The Callisto plug-in allows the user to input a graph title.

**URF - 5**

The Callisto plug-in allows the user to edit the graph title.

**URF - 6**

The Callisto plug-in allows the user to input a graph description.

**URF - 7**

The Callisto plug-in allows the user to edit the graph description.
The Callisto plug-in allows the user to create notes under a graph.

The Callisto plug-in allows the user to edit notes under a graph.

The Callisto plug-in allows the user to delete notes under a graph.

The Callisto plug-in allows the user to save the document.

**3.1.1.2 Graph types and styles**

Line graphs can be generated.

Scatter plots can be generated.

Bar charts can be generated.

Pie charts can be generated.

3D charts can be generated.

The Callisto plug-in allows the user to change the graph type.

The Callisto plug-in allows the user to change the color of the data visualisation.

The Callisto plug-in allows the user to change the type of marker.

**3.1.1.3 Predetermined combinations**

The Callisto plug-in allows the user to select the x, y and optionally z-axis, from views of the database, which are named predetermined combinations.

The following 2D-graph is a pre-determined combination:

- Description: The number of (re)admissions per month.
• X-axis: Number of months.
• Y-axis: Number of (re)admissions.

**URF - 22**

The following 2D-graph is a pre-determined combination:

• Description: The number of patients with a certain number of (re)admissions
• X-axis: Number of (re)admissions.
• Y-axis: Number of patients

**URF - 23**

The following 2D composite graph is a pre-determined combination:

• Description: Percentage of patients with a given number of (re)admissions, for which the majority of the (re)admissions are due to the same/not the same disease class.
• X-axis: Number of (re)admissions.
• Y-axis: Percentage of patients, where a majority of (re)admissions are due to the same disease class.

**URF - 24**

The following 3D graph is a pre-determined combination:

• Description: The number of (re)admissions for the top 6 disease classes with the number of patients that had (re)admissions due to that disease class.
• X-axis: Top six disease classes.
• Y-axis: Number of (re)admissions.
• Z-axis: The number of patients that had (re)admissions due to the disease class.

**URF - 25**

The following 2D-graph is a pre-determined combination:

• Description: The number of patient deaths for patients who were admitted a certain number of months ago.
• X-axis: Number of days from admission until death.
• Y-axis: Number of patient deaths.

**URF - 26**

The following 2D-graph is a pre-determined combination:

• Description: The number of patients who died after a certain number of (re)admissions.
• X-axis: Number of (re)admissions.

• Y-axis: Number of patients who died.

URF - 27

The following 3D graph is a pre-determined combination:

• Description: The number of days since the last (re)admission for the top 6 disease classes with the number of patients that died within that time.

• X-axis: Top six disease classes.

• Y-axis: Number of days since the last (re)admission.

• Z-axis: The number of patients died.

URF - 28

The following 2D-graph is a pre-determined combination:

• Description: The number of patients admitted previously a certain number of months ago and who are still alive.

• X-axis: Number of months since the last admission.

• Y-axis: Number of patients who are still alive.

URF - 29

The following 3D graph is a pre-determined combination:

• Description: The length of stay for the top 6 disease classes within a certain age group.

• X-axis: Top six disease classes.

• Y-axis: Age group.

• Z-axis: Length of stay.

URF - 30

The following 3D graph is a pre-determined combination:

• Description: The average Intensive Care Unit length of stay for the top 6 disease classes within a certain age group.

• X-axis: Top six disease classes.

• Y-axis: Age group.

• Z-axis: Average Intensive Care Unit length of stay.
The following 3D-graph is a pre-determined combination:

- Description: Top six disease classes in each age group with the average number of patient transfers from the Intensive Care unit.
- X-axis: Top six disease classes.
- Y-axis: Age group.
- Z-axis: Average number of patient transfers from the Intensive Care unit.

The following 3D-graph is a pre-determined combination:

- Description: Top six disease classes in each age group with the average number of patient transfers to the Intensive Care unit.
- X-axis: Top six disease classes.
- Y-axis: Age group.
- Z-axis: Average number of patient transfers to the Intensive Care unit.

The following 3D-graph is a pre-determined combination:

- Description: Top six disease classes in each age group with the average billing.
- X-axis: Top six disease classes.
- Y-axis: Age group.
- Z-axis: Billing rating.

The Callisto plug-in allows the clinical scientist to select another pre-determined combination of the graph.

3.1.1.4 Filters

The Callisto plug-in allows the clinical scientist to filter the graph data on Diagnosis.

The Callisto plug-in allows the clinical scientist to filter the graph data on Age.
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<tr>
<td>The Callisto plug-in allows the clinical scientist to filter the graph data on Gender.</td>
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<th>URF - 38</th>
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<tr>
<td>The Callisto plug-in allows the clinical scientist to filter the graph data on Ethnicity.</td>
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<th>URF - 40</th>
<th>must have</th>
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<td>The Callisto plug-in allows the clinical scientist to change the filters of a graph.</td>
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<tr>
<th>URF - 41</th>
<th>could have</th>
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<tbody>
<tr>
<td>The Callisto plug-in allows the clinical scientist to add their own filters for the data.</td>
<td></td>
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3.1.1.5 Correlation analyses

**URF - 42**
The Callisto plug-in allows for correlation analysis between two diagnoses. *won't have*

**URF - 43**
The Callisto plug-in allows for correlation analysis on age versus length of stay. *must have*

**URF - 44**
The Callisto plug-in allows for correlation analysis on age versus ICU length of stay. *must have*

**URF - 45**
The Callisto plug-in allows for correlation analysis on length of stay versus number of transitions. *must have*

**URF - 46**
The Callisto plug-in allows for correlation analysis on has diagnosis X got treatment Y versus number of staff. *won't have*

**URF - 47**
The Callisto plug-in allows for correlation analysis on has diagnosis X got treatment Y versus length of stay. *won't have*

3.1.1.6 User Account control

**URF - 48**
The Callisto plug-in allows the user to enter their credentials for the use of the database. *must have*

**URF - 49**
The admin is able to create a new user account. *must have*

**URF - 50**
The admin is able to disable or remove a user account. *must have*

**URF - 51**
The admin is able to create a password for a user. *must have*

**URF - 52**
The admin is able to change a password for a user. *must have*

**URF - 53**
A user is able to request a new password if he forgot it. *could have*

3.1.1.7 Control over predetermined combinations

**URF - 54**
The admin is able to create new presets by providing an SQL query. *should have*
URF - 55
The admin is able to edit existing predetermined combinations.

URF - 56
The admin is able to remove predetermined combinations.

3.1.2 AUTOMATIC REPORT GENERATION

URF - 57
The Callisto plug-in allows the user to download the Jupyter project, with all the MIMIC-III graphs, as a Microsoft Word compatible (.docx) file.

URF - 58
The Callisto plug-in allows the user to select which graphs will be downloaded as a Microsoft Word compatible (.docx) file.

URF - 59
Notes are only exported if the graph it is considered part of, is exported too.

3.1.3 MATLAB MODULE

URF - 60
The Callisto plug-in allows the user to export a graph to a MATLAB script, such that the graph can be recreated in MATLAB.

URF - 61
The Callisto plug-in allows the user to export the SQL query to a MATLAB script.

URF - 62
The Callisto plug-in allows the user to export the MATLAB script which connects to the database within MATLAB.

URF - 63
The MATLAB script is able to regenerate the graphs with the help of the database connection.

URF - 64
The MATLAB script generated by the Callisto plug-in can be saved.
3.2 CONSTRAINT REQUIREMENTS

3.2.1 ENVIRONMENT

**URC - 1**  
Callisto is built on top of Jupyter Notebook.  
*must have*

**URC - 2**  
The Callisto plug-in is available in the English language.  
*must have*

**URC - 3**  
The MIMIC-III database has to be stored on a server.  
*must have*

**URC - 4**  
The Callisto plug-in requires the server with the MIMIC-III database to be accessible from the computer using the Callisto plug-in.  
*must have*

3.2.2 PERFORMANCE

**URC - 5**  
The generation of a graph takes at most 5 second per accessed table in the Database.  
*must have*

**URC - 6**  
The generation of a graph takes at most 3 seconds per accessed table in the Database.  
*should have*

**URC - 7**  
The generation of a graph takes at most 1 seconds per accessed table in the Database.  
*could have*

**URC - 8**  
The generation of the .docx file with n pages takes at most 5+n seconds.  
*must have*

**URC - 9**  
The generation of the .docx file with n pages takes at most 5+0.5n seconds.  
*should have*

**URC - 10**  
The generation of the .docx file with n pages takes at most 5+0.1n seconds.  
*could have*

3.2.3 SECURITY AND PRIVACY

**URC - 11**  
User credentials should consists of a username and password.  
*must have*

**URC - 12**  
The admin should create a user account for the MIMIC-III database only to people who have the required the MIT certificate for the database.  
*must have*

**URC - 13**  
The database is inaccessible by users who do not fill in the correct user credentials.  
*must have*
URC - 14

The data sent over the internet is encrypted.
APPENDIX - USE CASES

In appendix A we will describe some use cases for the Jupyter Callisto plug-in. These use cases will describe how the Callisto plug-in responds to requests coming from an actor. Our use cases consist of a list of actions or events detailing the interaction between an actor and the Callisto plug-in. The use cases should give a clear idea of which users can do what with the Callisto plug-in.

A.1 GENERAL

A.1.1 ADDING THE JUPYTER CALLISTO PLUG-IN TO JUPYTER NOTEBOOK

Goals: To add the Jupyter Callisto plug-in to Jupyter Notebook.
Summary: The Jupyter Callisto plug-in is added to Jupyter Notebook.
Preconditions: Jupyter Notebook is already installed.
Priority: Must have.
Steps:

<table>
<thead>
<tr>
<th>Actor actions</th>
<th>The Callisto plug-in response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Open up the installation script for the Jupyter Callisto plug-in.</td>
<td>2. The installation will install the plug-in for Jupyter.</td>
</tr>
</tbody>
</table>

Alternatives:

2. A An error message is shown.
A.2 CLINICAL DATA INVESTIGATIONS AND INSIGHTS

A.2.1 CHANGING THE CELL TYPE TO A MIMIC CELL WITH THE MULTI-LAYER MENU

**Goals:** To change the cell type to a MIMIC cell.

**Summary:** Changing the cell type to a MIMIC cell with the multi-layer menu.

**Preconditions:** There is an project open in Jupyter with a cell in it.

**Priority:** Must have.

**Steps:**

<table>
<thead>
<tr>
<th>Actor actions</th>
<th>The Callisto plug-in response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Select the cell in the Jupyter interface in which you want the graph.</td>
<td></td>
</tr>
<tr>
<td>2. In the menu select Cell.</td>
<td></td>
</tr>
<tr>
<td>3. Hover over Cell Type with the mouse.</td>
<td></td>
</tr>
<tr>
<td>4. Select 'MIMIC graph'.</td>
<td></td>
</tr>
<tr>
<td>5. The MIMIC cell with the option to select which preset you want to choose appears.</td>
<td></td>
</tr>
</tbody>
</table>

A.2.2 CHANGING THE CELL TYPE TO A MIMIC CELL WITH THE DROP-DOWN CELL TYPE SELECTOR

**Goals:** To change the cell type to a MIMIC cell.

**Summary:** Changing the cell type to a MIMIC cell with the multi-layer menu.

**Preconditions:** There is an project open in Jupyter with a cell in it.

**Priority:** Must have.

**Steps:**

<table>
<thead>
<tr>
<th>Actor actions</th>
<th>The Callisto plug-in response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Select the cell in the Jupyter interface in which you want the graph.</td>
<td></td>
</tr>
<tr>
<td>2. In the dropdown list in the menu, select MIMIC graph.</td>
<td></td>
</tr>
<tr>
<td>3. The MIMIC cell with the option to select which preset you want to choose appears.</td>
<td></td>
</tr>
</tbody>
</table>

A.2.3 CONFIGURING A MIMIC CELL TO GET ONE OF THE PRESET GRAPHS

**Goals:** To get one of the preset graphs.

**Summary:** Configuring a MIMIC cell to get one of the preset graphs.

**Preconditions:** The MIMIC cell where the graph should come is already selected.

**Priority:** Must have.

**Steps:**
Actor actions
1. Click on the dropdown list of the preset.

3. You select the preset you are looking for.

### A.2.4 CONFIGURING THE STYLING OF A GRAPH

**Goals:** To change the styling of a graph.

**Summary:** The user changes the graph by means of changing color, graph type or kind of marker.

**Preconditions:** The graph that the user wants to edit is already selected.

**Priority:** Should have.

**Steps:**

<table>
<thead>
<tr>
<th>Actor actions</th>
<th>The Callisto plug-in response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Click on the dropdown list of the available styling categories.</td>
<td>2. A dropdown list appears with all the possible styling categories.</td>
</tr>
<tr>
<td>3. You select the styling categories that you are looking for.</td>
<td>4. The options for that styling category appear.</td>
</tr>
<tr>
<td>5. The user sets the styling for that particular category.</td>
<td>6. The graph updates according to the new styling settings.</td>
</tr>
</tbody>
</table>

### A.2.5 SETTING A NEW FILTER FOR A MIMIC CELL

**Goals:** To set up a new filter for the data of the MIMIC-III database.

**Summary:** Setting a new filter for a MIMIC Cell.

**Preconditions:** The MIMIC cell already has a preset set.

**Priority:** Must have.

**Steps:**
Actor actions
1. Click on the ‘+ Add filter’ button.


3. The user now has to select what he wants to filter.

4. The options to select parameters for these filters are given.

5. The user should set the filter to how they want.

6. The graph will be regenerated now with the filtered data.

Alternatives:
6.A. An error is generated that there were no results.
A.2.6  DELETING A PRESENT FILTER FOR A MIMIC CELL

Goals: To delete a filter for the data of the MIMIC-III database.
Summary: Deleting a filter for a MIMIC Cell.
Preconditions: The MIMIC cell already has a preset and at least one filter set.
Priority: Must have.
Steps:

<table>
<thead>
<tr>
<th>Actor actions</th>
<th>The Callisto plug-in response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Click on the ‘×’ symbol.</td>
<td>2. The filter will be removed.</td>
</tr>
<tr>
<td></td>
<td>3. The graph will be regenerated now with the filtered data.</td>
</tr>
</tbody>
</table>

Alternatives:
3.A. The graph could not be regenerated and gives an error.

A.2.7  ADD A NEW QUERY AS A TECHNICAL USER

Goals: Add a new query to the system.
Summary: The technical user adds a new query to the system enabling the clinical users to use it afterwards.
Preconditions: Jupyter Notebook including the Callisto plug-in is already installed.
Priority: Must have.
Steps:

<table>
<thead>
<tr>
<th>Actor actions</th>
<th>The Callisto plug-in response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Go to the configuration directory.</td>
<td></td>
</tr>
<tr>
<td>2. Copy and past one of the existing query files.</td>
<td></td>
</tr>
<tr>
<td>3. Edit the newly pasted query file to the users preference.</td>
<td></td>
</tr>
<tr>
<td>4. Save the new file.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. The Callisto plug-in now allows you to use the new query.</td>
</tr>
</tbody>
</table>

A.2.8  CHANGE AN EXISTING QUERY AS A TECHNICAL USER

Goals: Change an existing query in the system.
Summary: The technical user changes an existing query to the system enabling the clinical users to use the updated query afterwards.
Preconditions: Jupyter Notebook including the Callisto plug-in is already installed.
Priority: Must have.

Steps:

**Actor actions**

1. Go to the configuration directory.
2. Open the query file that needs to be modified.
3. Edit the opened query file to the users preference.
4. Save the new file.

**The Callisto plug-in response**

5. The Callisto plug-in now allows you to use the updated query.
A.3 AUTOMATIC REPORT GENERATION

A.3.1 EXPORTING THE DOCUMENT TO WORD FORMAT

Goals: The document exported as word document.
Summary: Exporting the document to word format.
Preconditions: Jupyter has a project open with MIMIC cells in it.
Priority: Must have.
Steps:

<table>
<thead>
<tr>
<th>Actor actions</th>
<th>The Callisto plug-in response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Select 'file' in the menu of the Jupyter interface.</td>
<td></td>
</tr>
<tr>
<td>2. Select 'Download as '▶':</td>
<td></td>
</tr>
</tbody>
</table>

Alternatives:

4.A An error of not being able to convert to .docx appears.

A.3.2 SELECTING GRAPH’S FOR THE WORD FILE

Goals: To select which graph’s with descriptions are going to be present in the exported word document.
Summary: Selecting which graph’s with descriptions are going to be present in the word document when exported.
Preconditions: A Project is open in Jupyter with only MIMIC and text cells in it.
Priority: Should have.
Steps:

<table>
<thead>
<tr>
<th>Actor actions</th>
<th>The Callisto plug-in response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Select a MIMIC cells.</td>
<td></td>
</tr>
<tr>
<td>2. In the 'export to word' checkbox, select it if you want it to be exported</td>
<td>4. A download will be started with only the selected graphs with descriptions in it.</td>
</tr>
<tr>
<td>3. Export the document to word format.</td>
<td></td>
</tr>
</tbody>
</table>

Alternatives:

2.A In the 'export to word' checkbox, deselect the checkbox if you don't want it to be exported.

4.B An error of not being able to convert to .docx appears.
A.4 MATLAB - MATHWORKS INTERFACE

A.4.1 EXPORTING A GRAPH TO MATLAB

Goals: To export the data and contents of the graph to a MATLAB usable graph.
Summary: Exporting the graph’s data and contents to a MATLAB graph.
Preconditions: A MIMIC cell is already present with a graph to be exported to MATLAB. MATLAB is already installed.
Priority: Should have.
Steps:

<table>
<thead>
<tr>
<th>Actor actions</th>
<th>The Callisto plug-in response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Select a MIMIC cell.</td>
<td>3. A MATLAB script is created and downloaded.</td>
</tr>
<tr>
<td>2. Select 'export to MATLAB'.</td>
<td>4. The user opens up the MATLAB script.</td>
</tr>
<tr>
<td></td>
<td>5. A graph will appear with the same contents and data as the one selected in Jupyter.</td>
</tr>
</tbody>
</table>

Alternatives:

3.A An error of not being able to create the MATLAB script will appear.
A.5 SECURITY AND PRIVACY

A.5.1 THE ADMIN ADDS A NEW USER ACCOUNT

Goals: To add a new user.
Summary: The admin adds a new user account.
Preconditions: The admin is logged in into Jupyter hub.
Priority: Must have.
Steps:

Actor actions
1. The admin goes to the home page.
2. At the top right, selects 'terminal'.
3. A terminal opened.
4. In the terminal a command should be entered and user will be created.
5. The user will be created.
6. In the terminal a command should be entered to create a password for the user.
7. The password will be edited.

Alternatives:
3. An error of not being able to open up the terminal is shown.

A.5.2 THE ADMIN DELETES A USER ACCOUNT

Goals: To delete a user.
Summary: The admin deletes a user account.
Preconditions: The admin is logged in into Jupyter hub.
Priority: Must have.
Steps:

Actor actions
1. The admin goes to the home page.
2. At the top right, selects 'terminal'.
3. A terminal opened.
4. In the terminal a command should be entered to remove the user.
5. A confirmation message will be shown.
6. The user confirms.
7. The user will be deleted.

Alternatives:
3.A An error of not being able to open up the terminal is shown.

6.A The user denies the confirmation.

A.5.3 THE ADMIN EDITS A USER ACCOUNTS PASSWORD

Goals: To edit a users password.
Summary: The admin edits a user accounts password.
Preconditions: The admin is logged in into Jupyter hub.
Priority: Must have.
Steps:

**Actor actions**
1. The admin goes to the home page.
2. At the top right, selects ‘terminal’.
3. A terminal opened.
4. In the terminal a command should be entered to change the password of the user.
5. The user gets a confirmation message where he can enter the password.
6. The admin enters the new password for the user.

**The Callisto plug-in response**
3. A terminal opened.
5. The user gets a confirmation message where he can enter the password.
7. The password will be edited.