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GLOBal Robotic telescopes Intelligent Array for e-Science

Second reviewed software requirement specification report

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1. Introduction

This document is the First Review Software Requirements Specification (SRS) for the GLORIA system. The objective of this document is to collect and analyse all assorted ideas that have come up to define the system, its requirements with respect to final users. In short, the purpose of this SRS document is to provide a detailed overview of the software, its parameters and goals. This document describes the project's target audience and its user interface, hardware and software requirements. It defines how users see the product and its functionality. Furthermore, it helps any developer to collaborate in the software delivery life cycle process.

This document is the revision of a previous one: the deliverable D3.1.

1.1. Glossary

Admin user	See **user**.
ADU	Acronym of Analog-to-digital unit. A number representing a CCD's output. The relationship between the ADUs generated and the number of electrons acquired on the CCD is defined by the system gain. Intensities given in ADUs provide a convenient method for comparing images and data generated by different cameras. Also referred to as *count* and *digital number*.
AP	Acronym for Advisory Panel. Part of GLORIA Steering Board (SB) which will be made up of representatives from each GLORIA partner.
ASCOM	It is a many-to-many and language independent architecture, supported by most astronomical devices which connect to Windows computer. Official site: http://ascom-standards.org/
Camera	Part of a telescope in charge of the image capture.
Captcha	It is a means of automatically generating challenge to ensure that the response is generated by a human, not by a machine.
CCD	Acronym for charge-coupled device. It is an analog electronic device that can be used as the image sensor in place of film in an electronic camera or optical devices like microscopes or telescopes.
Citizen scientist	See **user -> regular user.**
CMS	Acronym for Content Management System. Software for sharing internal documents.
CQ	Acronym for Contribution Equity. The contribution equity measures the contribution of a person to the community. This value is calculated from the information equity of the contributed assets.
Credit	Amount of **glorious** that a **user** has and that can be used for purchasing **RT observing time** according with its **RT price**.
Dome	Closed structure where the telescope is placed.
DoW	Acronym for Document of Work. Technical annex of the consortium agreement signed by all GLORIA partners and the European Commission. The Dow is the business plan of GLORIA project.
EAP	Acronym for External Advisory Panel. The EAP will be made up by members of association in the different countries of GLORI and advice the GLORIA steering board (SB).

FITS	Acronym for Flexible Image Transport System. It is a digital file format used to store, transmit, and manipulate scientific and other images. FITS is the most commonly used digital file format in astronomy.
Focuser	It is the focusing mechanism of a telescope.
Gamma correction	It is the name of a nonlinear operation used to code and decode luminance or tristimulus values in video or still image systems.
GS	Acronym for GLORIA System.
GLORIA	Acronym for GLobal Robotic telescope Intelligent Array for e-science.
GLORIA community	Refers to all the community of **GLORIA users** or citizen scientists.
GLORIA partners	Institutions that participate in GLORIA project, which are the following.
GLORIA Project	FP7 European project for developing GLORIA under contract nº 283783. It is a three years project that started the October 1st of 2011 and will end in September 30th of 2014.
GLORIA Repository	List of links of databases or storage for obtaining images to be used in image library.
GLORIA Resource or Resource	Anything obtained from GLORIA that satisfies user needs and wants. Typical resources are **RT**, **RTDB**, etc. Some GLORIA **resources** are for free, but others have a **price** and users must expend their **credit** in order to use them.
GLORIA System	Web application software which runs in the GLORIA server, available in the URL http://gloria-project.eu
GLORIA System architecture	Set of pieces of software which deals with users and the robotic telescopes.
GLORIA Users	See **user.**
GLORIA Website	URL where all the **GLORIA community** can access to the GLORIA social network. From this site all the resources will be available, like the **RT**, experiments and all content available. This URL is currently http://gloria-project.eu
Glorius	Currency unit which allows an user to purchase **RT observing time**. RT or other **resources** will have an associated **RT price**. Each user will have a **credit.**
GUI	Acronym for Graphical User Interface.
Guess user	See **user.**
HLP	Acronym for *High Level Protocol.* Standard protocol defined for communication among the different RTS and GLORIA System.
HL protocol	See **HLP**.
INDI	Acronym for **I**nstrument **N**eutral **D**istributed **I**nterface. It is a Distributed Control System protocol to enable control, data acquisition and exchange among hardware devices and software front ends, with particular focus on astronomical instrumentation.
Intranet	Private websites (only used by Intranet users).
Intranet user	See **user.**

IQ	Acronym for *Information Equity*. This equity shows the importance and quality (measured by popularity) of the information contained in an asset. It is calculated through social activities related to the information.
Karma	It is a index to measure the participation of a user or telescope a resource (i.e. robotic telescope) in GLORIA. karma in an index of quality associated to each user and resource in GLORIA, like a robotic telescope, an astronomical data base, etc. A high value in the karma means a high quality of the resource or high reputation in case of users. The karma is calculated automatically by GLORIA System everyday as a function of the votes of the users applying specific policies.
LLP	Acronym for Low Level Protocol. Protocol used in the low level layers of the protocol stack.
Meta information	It is information on the information held within a data set.
Mount	It is a mechanical structure which support the telescope and allow for accurate pointing of it.
Owner user	See **user.**
P2P	Acronym for "Peer-to-Peer. In a P2P network, the "peers" are computer systems from users which are connected to each other via the Internet. Files can be shared directly between systems on the network without the need of a central server. In other words, each computer on a P2P network becomes a file server as well as a client.
Pan movement	It refers to the horizontal movement or rotation of a a till or video camera.
PC	Acronym for Project Coordinator. The PC is responsible for the overall project organization, planning and reporting.
PEQ	Acronym for Personal Equity. The ultimate result, that describes a person's achievements and participation in the community. This value is the sum of a person's contribution and participation equities.
PMT	Acronym for Project Management Team. The PMT is delegated by the SB and responsible for monitoring and coordinating the project on a daily basis, assuring the quality of the results, and preparing progress reports. The PMT is delegated by the PM and will meet regularly every three months via phone call or video conferences.
Policy	Reconfigurable set of rules applied in order to take some decision automatically by GLORIA System. This rules will be set by the SB (Steering Board) and redesigned periodically with the aim to foster user's participation focused to increasing the productivity of science. ○ **User admission policy**. It defines the rules for the admission of a new user. ○ **User terms and conditions policy**. Set of rules the user must accept, otherwise he/she can not create and account in GLORIA ○ **RT admission policy**. It defines the rules for the admission a new RT in GLORIA ○ **RT terms and conditions policy**. Set of rules the regular user must accept for becoming a Owner user and register he/she RT in GLORIA. ○ **User Karma calculation policy**. Set of rules defined for calculating the karma of any kind of user.

	○ **RT karma calculation policy**. Set of rules defined for calculating the karma of a RT. ○ **User credit calculation policy**. Set of rules defined for calculating the user's credit ○ **RT price calculation policy**. Set of rules defined for calculating the RT price.
PQ	Acronym for Participation Equity. This equity measures the active participation of a person. It is calculated by measuring the feedback a person has provided to other community contributions (assets). Viewing a contribution can be translated as feedback as well.
Price	See **RT price**.
PS	Acronym for Project Scientist. The PS is the responsible for the overall scientific delivery, on base to planning and reporting, taking care of the activities listed.
Regular user	See **user**.
Resource	See **GLORIA Resource**.
RT	Acronym Robotic Telescope. Facility with all the items necessary for housing a teleoperated robotic telescope. RT refers from a human point of view while RTS refers from a computer point of view.
RT architecture	The Robotic Telescope Architecture is set of software components and the relationships among all of them designed towards controlling a robotic telescope.
RT karma	**RT Karma** and the demand of the **RT**. There could be different prices depending on the date of the year (demand).
RT observing time	Acronym for Robotic Telescope Observing Time. The **user** will be able to make reservation of certain number of hours of **RT Observing time**.
RT price	Price of the observing hour of the telescope. Price will be calculated as a function of the RT Karma and the demand of the RT. There could be different prices depending on the date of the year (demand).
RTC	Acronym for Robotic Telescope Controller. *S*oftware component that controls the different devices of a Robotic Telescope. RTC communicates with RTI at one side and with different RTDs to the other side. RTC has also schedule functionality.
RTD	Acronym for Robotic Telescope Device. Software component that controls and monitorizes any physical device in a Robotic Telescope. There will be several RTD, one for each devices. The RTDs could run all in one computer or can be distributed in different computers.
RTDB	Acronym for Robotic Telescope Data Base. Software component that manages the local data base of the Robotic Telescope. There could be several RTDBs in one RT and they could be running in one computer or distributed in several computers.
RTML	Acronym for Remote Telescope Marckup Language. It is an XML dialect meant to enable the transparent use of remote and/or robotic telescopes
RTS	Acronym for Robotic Telescope System. Set of devices, computers and instrumentation which can be used with Astronomy observation. RTS refers from a computer point of view, while RT refers from a human point of view.
RTS2	Acronym for Remote Telescope System 2nd version. It is an integrated open source package for remote observatory control under the Linux operating system.

RTI	Acronym for *Robotic Telescope Interface*. Software component which runs in RTS and is dedicated to the communication with GLORIA System. RTI will be generated automatically from compiling the HLP defined in a protocol description language.
RTOS	Robotic Telescope Operative System.
SB	Acronym GLORIA Steering board (see Steering Board).
Steering Board (SB)	It is the main management and decision-making body of GLORIA and is comprised of the PC (project coordinator), the PS (project scientists) and the AP (advisory panel). The EAP has a member of each partner of GLORIA. The External Advisory Panel participates in the decision-taking of the SB with voice but no vote.
Surveillance camera	Video camera used to monitorized the state of all the devices inside the dome.
TBC	Acronym for "*To Be Completed*".
Telescope ID	Unique Telescope Identifier in the GLORIA System. It is set when the telescope is registered.
Tilt movement	It refers to the vertical movement or rotation of a a till or video camera.
Time slot	Time interval of using a telescope, defined to specify concrete goals, such as an exchange.
Tool	Software module that brings specific functionality, in terms of application, to certain users. e. g. Exchange calendar.
User	Person who enters in GLORIA website. • **Admin user**: User who has the privileges in order to manage and configure GLORIA web site. • **Guest user**: Any person who see the GLORIA website without logging in. • **Intranet user**: Any authorized user to share internal documents and communication with other authorized users. • **Owner user**: A owner user who owns one or more than one telescope. • **Regular user**: Citizen scientist. They will have different permission depending on their karma.
User ID	Unique User Identifier in the GLORIA System. It is set when the user is registered.
VO	Acronym for Virtual Observatory.
Volunteer P2P storage system	Part of volunteer computing technique. Distributed storage device which uses the hard disc capacity donated by volunteer citizens through the Internet.
Vote	It is the act of voting, which is the method in **GLORIA** for making decisions automatically based in different **policies** and taking into account the interest of **GLORIA community**. The votes could be performed by **GLORIA users**, applying the **voting policy,** on different issues called **VOB** (Votable Object), which could be **content VOB** or **resource VOB**. • The **content VOB** is the **content** added by an **user**, like images uploaded to the **image repository**, comments added by an user, reports made by users, etc. • The **resource VOB** are the different systems available in **GLORIA** by user, like **RT**, **RTDB**, and even different hardware components available in a **RT**, and also the **sky quality**, **weather quality**, **seeing quality**. There could be interdependencies among resource **VOBs** i.e. a RT has different

	resources as **dome**, **mount**, **RTDB, weather quality**, etc.

2. Gloria system web requirement

2.1. User management

REQUIREMENTS

Code	**USRMGT-001**
Associated Requirements	
Description	Any **user** could register themselves, by accepting the GLORIA terms and conditions, indicating the following information: alias, e-mail (mandatory fields), and other useful personal data (birthday, gender, full name) and must solve a *captcha* validation. The user will be identified by an **User ID**. No private information is required.
Business Rules	• BR-1 The alias and the e-mail must be unique in the system. • BR-2 The user must introduce the alias and the email as mandatory fields. • BR-3 The system sends a password to her/his e-mail account and the registration must be confirmed through an email. • BR-4 When the user enters the first time, he/she will have to accept the terms and conditions of using GLORIA and set the a new password.
Validation Rules	• VR-1 Password must be at least 8 characters. • VR-2 Password must have at least one non alpha numeric letter, one upper case, and one number.
Observations	

Code	**USRMGT-002**
Associated Requirements	-
Description	Any user could update their profile, with the chance to add or modify his/her information: alias, e-mail, full name, avatar, location, language, time zone, address, links, etc. The only data that is unchangeable is the User ID.
Business Rules	• BR-1 The alias and the e-mail must be unique in the system. • BR-2 The user must enter the alias and the email as mandatory fields.
Validation Rules	• VR-1 Password must be at least 8 characters. • VR-2 Password must have at least one non alpha numeric letter, one upper case, and one number. • VR-3 When changing the password, the user can not use the (n) previous passwords.
Observations	-

Code	USRMGT-003
Associated Requirements	USRMGT-001
Description	Any user can log into the GS indicating the e-mail and the password of its account. If its data are correct, the user will access to the GS.
Business Rules	• BR-1 A user with the alias and e-mail must exit in the system. • BR-2 The user is active in the system. That is, user did not deactivate or delete his/her account.
Validation Rules	-
Observations	-

Code	USRMGT-004
Associated Requirements	USRMGT-007
Description	Users could have four different **user roles**: **admin**, **guest, owner, regular**.
Business Rules	• BR-1 The **admin** role will let users to carry out administration tasks in the **GLORIA Portal**. • BR-2 The **guest user:** Any person who see the GLORIA website without logging in. • BR-3 The **owner** role is for indicating that this user owns some robotic telescope or database. The owner role will let them configure their own robotic telescopes or databases. • BR-4 The **regular role** will let users do citizen science activities. All users will become regular user during the first registration.
Validation Rules	• VR-1 Each user can carry out the actions defined by his/her **roles**.
Observations	-

Code	USRMGT-005
Associated Requirements	-
Description	Any **user** who forgot their **password**, could request to receive a link by email to enter into a web and could change it.
Business Rules	
Validation	• VR-1 The email is sent to the personal address email which is defined by the

Rules	user in his/her profile. • VR-2 The process to reset the password requires a **captcha** validation.
Observations	

Code	**USRMGT-006**
Associated Requirements	-
Description	Any **user** could see the **public profiles** of the rest of the users.
Business Rules	• BR-1 Any **user** can decide which information will be public for the rest of the users.
Validation Rules	• VR-1 No private information will be shown.
Observations	-

Code	**USRMGT-007**
Associated Requirements	-
Description	The administrator will be able to create new **roles**, modify or delete roles. A role is a set of permissions. The administrator will be able to modify the permissions related to a role.
Business Rules	-
Validation Rules	-
Observations	-

Code	**USRMGT-008**
Associated Requirements	**RTMGT-005**
Description	The **administrator** could **deactivate** (temporally removed) any user account. Any user can **deactivate** his/her own account. That is, the user will be not able to enter into the GS.
Business Rules	• BR-1 The data of the user deactivated, will be preserved in GS, both personal information and content generated in GS, like photos, posts, statistics, etc. • BR-2 The admin could only **restore** a previous deactivated user. • BR-3 If the user is an **owner** must deactivate/delete out their telescopes firstly to be deactivated from the system.

Validation Rules	• VR-1 A confirmation process will be requested to fulfill this action.
Observations	-

Code	**USRMGT-009**
Associated Requirements	
Description	The **administrator** could **delete** (permanently deleted) any user. Or any user can **delete** himself/herself.
Business Rules	• BR-1 The personal information of this user will be deleted from GS, but content generated in GS, like photos, posts, etc., will remain in the system. • BR-2 If the user is an **owner** must deactivate/delete out their telescopes firstly to be deleted from the system.
Validation Rules	• VR-1 A confirmation process will be requested to fulfill this action.
Observations	-

Code	**USRMGT-010**
Associated Requirements	
Description	The administrator could assign new **roles** to the users or modify the existing roles.
Business Rules	
Validation Rules	
Observations	

USE CASES

UC-USRMGT-001	**Register**
Associated Requirements	**USRMGT-001**
Actors	GUEST
Description	Register a new user account.
Main Flow (MF)	1. The user introduces all their personal information as explained in BR-4. 2. The system checks the data as explained in VR-1, VR-2, VR-3. 3. The system stores the user and sends an e-mail with the password

	assigned and a link to confirm the registration. 4. The user clicks in the link, introduces the user and password. 5. The user accepts the terms and conditions. 6. The user chooses the password.
Alternative flow (AF1)	3a. The email address is already taken. 1. The system displays the error and requests another e-mail. 2. Go to MF step 1.
Alternative flow (AF2)	3b. The alias is already taken. 1. The system displays the error and requests another alias. 2. Go to MF step 1.
Alternative flow (AF3)	*a. At any time, the user decides to cancel the process. 1. The system cancels the operation and the user is not registered.
Postconditions	The new user is registered in GS with an unique User ID and regular role.
Observations	

UC-USRGMT-002	**Deactivate user account**
Associated Requirements	**USRMGT-008**
Actors	REGULAR, OWNER
Description	An existing user deactivates her/his account.
Action / Workflow	1. The user requests to deactivate the account. 2. The system asks confirmation before deactivating. 3. The user agrees. 4. The system deactivates the user.
Alternative flow (AF1)	1a. The user is **owner** of some active **RT**. 1. The system cancels the operation.
Alternative flow (AF2)	3a. The user disagrees. 1. The system cancels the operation.
Postcondition	The user is deactivated temporally.
Observations	-

UC-USRGMT-003	**Deactivate any user account**
Associated Requirements	**USRMGT-008**
Actors	ADMIN
Description	An administrator deactivates any account. The administrator can deactivate a user by an unapproved use of the system resources according to terms and services defined by GLORIA.

Action / Workflow	1. The system shows the list of the users. 2. The admin selects an user. 3. Go to **UC-USRGMT-002** step 1.
Postcondition	The user is deactivated temporally.
Observations	-

UC-USRGMT-004	**Delete user account**
Associated Requirements	**USRMGT-009**
Actors	USER
Description	An existing user deletes her/his account.
Action / Workflow	1. The user requests to delete his/her account. 2. The system asks confirmation before deleting. 3. The user agrees. 4. The system deletes the user.
Alternative flow (AF1)	1a. The user is **owner** of some active **RT**. 1. The system cancels the operation.
Alternative flow (AF2)	3a. The user disagrees. 1. The system cancels the operation.
Postcondition	The user is deleted permanently from the GS.
Observations	-

UC-USRGMT-005	**Delete any user account**
Associated Requirements	**USRMGT-009**
Actors	ADMIN
Description	An administrator deletes any account. The administrator can delete an user by an unapproved use of the system resources according to terms and services defined by GLORIA.
Action / Workflow	1. The system shows the list of the users. 2. The admin selects an user. 3. Go to **UC-USRGMT-004** step 1.
Postconditions	The user is deleted permanently from the GS.
Observations	-

UC-USERGMT-006	**Update user profile**

Associated Requirements	**USRMGT-001**
Actors	ADMIN, OWNER, REGULAR
Description	Update personal user information.
Action / Workflow	1. The system shows the current personal information about the user. 2. The user modifies the information what he/she wishes. 3. The user submits the changes. 4. The system stores the new information.
Alternative flow	● 3a. The user does not submit the changes. 1. The system finishes the operation and the data are not changed. ● 3b. The user enters an e-mail which is already taken. 1. The system shows the error and request new data. ● 3c. The user enters an alias which is already taken. 1. The system shows the error and request new data.
Postconditions	The personal user information is changed.
Observations	

UC-USERGMT-007	**Password forgotten**
Associated Requirements	**USRMGT-005**
Actors	GUEST
Description	The user forgot their password and requests a process to sets another new one.
Action / Workflow	1. The user requests the password reset indicating his/her email address. 2. The system sends him/her a link by email to set another new password. 3. The user logs into their account with the link and changes their password. 4. The system stores the new password.
Alternative flow (AF1)	1a. The email address does not exist in GS. ● 1. The system asks another email address.
Postconditions	The system changes the **user** password.
Observations	Maybe there will be a limit time to the link is available. TBD!

UC-USERGMT-008	**Manage roles**
Associated Requirements	**USRMGT-007**
Actors	ADMIN
Description	The **admin** will be able to manage the roles, so could create new **roles**, modify or delete roles. The **admin** will be able to modify the permissions related to a role.

Action / Workflow	1. The system shows the available roles in GS. 2. The admin sets the roles and permissions associated. 3. The system stores the changes.
Alternative flow (AF1)	*a. The admin cancels the operation. 1. The system finishes the operation and the data are not changed.
Postconditions	The roles are changed.
Observations	-

UC-USERGMT-009	**Read user profile**
Associated Requirements	
Actors	USER
Description	Read the information of the user.
Action / Workflow	1. A user requests the public information about any user. 2. The system shows the user information. If the user is admin, the admin can see the private information as well.
Postcondition	The user's public information is shown.
Observations	-

UC-USERGMT-010	**Login**
Associated Requirements	**USRMGT-003**
Actors	GUEST
Description	The user logs into the GS.
Main Flow (MF)	1. The system requests that the actor enter e-mail and password. 2. The actor enters the e-mail and password. 3. The system validates the entered name and password and logs the actor into the system.
Alternative flow (AF)	The actor enters an invalid name and/or password, the system displays an error message.
Postcondition	If the use case was successful, the actor is now logged into the system.
Observations	-

UC-USERGMT-011	**Change user roles**
Associated Requirements	**USRMGT-010**

Actors	ADMIN
Description	The **admin** will be able to manage the roles of any user, so could assign new **roles** or delete roles.
Action / Workflow	1. The system shows the list of the users. 2. The admin selects a user and choose the option “Permissions”. 3. The system shows the available roles and permissions related to this user. 4. The admin modifies the roles and permissions associated. 5. The system stores the changes.
Alternative flow (AF1)	*a. The admin cancels the operation. 1. The system finishes the operation and the data are not changed.
Postconditions	The user’s roles are changed.
Observations	-

2.2. Karma

REQUIREMENTS

Code	**KRM-001**
Associated Requirem	-
Description	The **RT** will have its own karma as a function of its quality.
Business Rules	• BR-1 The **karma** in an index of quality associated to each user and **resource** in GLORIA, like a **RT** robotic telescope or a **RTDB** robotic telescope data base, etc. A high value in the **karma** means a high quality of the **resource** or high **reputation** in case of users. • BR-2 The **karma** of all users and resources will be calculated automatically by **GLORIA system** periodically according to the corresponding **policy**, taking into account the positive or negatives **votes** of the rest of users and applying the corresponding **policy.** • BR-3 The **karma** depends on a defined **policy**. The **policy** is composed by **rules**, like quality of the **RT**, observing conditions and geographical situation and an associated weights to increase or reduce its relevancy. Weights and rules can be changed, modified or deleted.
Validation Rules	• VR-1 Karma is a real number in the range [0,10]
Observ.	**TBC** with the specific information.

Code	**KRM-002**
Associated Requirem	-
Description	A user will have its own **karma**.
Business Rules	• BR-1 The **karma** depends of parameters like participation in social network or experiments. • BR-2 Participation on experiments includes design new experiments or participate in offline experiments • BR-2 These parameters can be added or deleted from the **karma** calculation dynamically. • BR-3 Each parameter has a weight associated to increase or reduce their relevancy. Can be change. • BR-4 The **karma** will be calculated from time to time
Validation Rules	• VR-1 Karma is a real number.
Observations	-

USE CASES

Code	**UC-KRM-001**
Associated Requirements	**KRM-001**
Actors	ADMIN
Description	The **karma** is calculated through a **policy** defined by the administrator. The formula is composed by several information sources (**TBD**) and an associated weight.
Main Flow	1. The system shows a list with the different parameters and weights. 2. The user modifies the parameters and weight 3. The user accepts the modification
Alternative Flow (AF1)	3a The weight is not a valid number 1. The system cancel the operation
	There is a new **policy** defined
Observations	

Code	**UC-KRM-002**
Associated Requirements	**KRM-001, KRM-002**
Actors	ADMIN, OWNER, REGULAR
Description	Get karma value.
Main Flow	1. The user requests its karma value. 2. The system shows the karma value
Alternative Flow (AF1)	-
Postcondition	The value of the karma
Observations	

Code	**UC-KRM-003**
Title	Calculate karma
Associated Requirements	**KRM-001, KRM-002**
Actors	GS
Description	The karma value will calculate through a formula defined by the system administrator. This will execute periodically.

Action / Workflow	1. Get the old karma 2. Calculate the new karma (using the defined policy) 3. Save the new karma
Alternative flow (AF2)	
Postcondition	The new values of the karma associated to users or telescopes
Observations	

2.3. Tools

REQUIREMENTS

Code	**TOOLS-001**
Associated Requirements	**TOOLS-003**
Description	The **admin** can manage the set of **tools** available to users by adding or deleting as appropriate.
Business Rules	• BR-1 All the **tools** to be added to the set of available, must be previously registered in the system. • BR-2 Each **tool** must be unique in the system. • BR-3 Each **tool** must have a name or title, so we can be uniquely identified in the system.
Validation Rules	• VR-1 In the process of addition, the new **tool** (name) should not belong to the set of available **tools**. • VR-2 In the process of deletion, the selected **tool** (name) should belong to the set of available **tools** previously. • VR-3 When deleting an existing **tool**, it only be necessary to identify the **tool** by its name or title. • VR-4 When adding a new **tool**, its assigned title must not be registered in reference to another existing **tool**. • VR-5 The **tool** name must meet the format specifications. (**TBC**)
Observations	

Code	**TOOLS-002**
Associated Requirements	
Description	The **admin** can setup and modify the access capabilities of available **tools**, linking them to concrete **user roles**.
Business Rules	• BR-1 It must be possible to link any **tool** with one or more **user roles**. • BR-2 When the link setup is completed, the affected users will automatically be updated with the new state.
Validation Rules	• VR-1 The **tool** is included in the set of available.
Observations	The consequences of deleting a linked role are **TBD**.

Code	**TOOLS-003**
Associated Requirements	

Description	The **admin** can register a new software component to be later included as a tool. Also, this user can do the reverse process (unregistered).
Business Rules	• BR-1 Each **tool** must have a software component associated. The cardinality must be 1-1.
Validation Rules	• VR-1 Each software component must have a valid and unique file name. • VR.2 The file name of a software component must have a valid (recognized) extension (**TBD**). • VR-3 Each software component must always be accessible to the system (non-functional requirement). • VR-4 Before removing a software component, its possible available tool associated must be deleted from the set.
Observations	Storing software components procedure and location are **TBD**.

USE CASES

UC-TOOLS-001	**Manage tools**
Associated Requirements	**TOOLS-001**
Actors	**ADMIN**
Description	Manage the available **tools**.
Main Flow (MF)	1. The system requests the tool name and software component. 2. The user introduces the requested information: **tool** name and software component. 3. The system validates the data as explained in VR-x. 4. The system enables the software component associated and includes it in the set of available **tools**.
Alternative flow (AF1)	3a. Adding: The system detects that the name of the new tool already exists in the set of available. 1. The system notifies this error to the user and requests a correction. 2. Go to MF step 1.
Postcondition	• PC1: The tool is added to the set of available (Adding). • PC2: The tool is removed from the set of available (Delete).
Observations	

UC-TOOLS-002	**Manage software components**
Associated Requirements	**TOOLS-003**
Actors	**ADMIN**
Description	Manage the software components.
Main Flow	1. The system requests the path of the software component.

(MF)	2. The user introduces the requested information. 3. The system validates the data as explained in VR-1 and VR-2. 4. The system removes the reference to the software component.
Alternative flow (AF1)	4a. Adding: The system detects that the path of the new component is already registered. 1. The system notifies this error to the user and requests a correction. 2. Go to MF step 1.
Postcondition	• PC1: The component is added to the set of registered (Adding). • PC2: The component is removed from the set of registered (Delete).
Observations	

2.3.1. Exchange

REQUIREMENTS

Code	**EXCHANGE-001**
Associated Requirements	
Description	Any **owner user** can choose any **time slot** in their calendar as a proposal of sharing with others.
Business Rules	• BR-1 All **time slots** must be defined as an interval. • BR-2 By this, the owner is able to offer its telescope to others interested in exchanging time.
Validation Rules	• VR-1 The end date for a **time slot** should always be greater than the start date. • VR-2 The total time proposed for exchange can not be greater than the total available to the user himself.
Observations	

Code	**EXCHANGE-002**
Associated Requirements	
Description	Any **owner user** can navigate through the calendar of all exchange offers.
Business Rules	• BR-1 All the correctly proposed exchanges will be included in the corresponding calendar. • BR-2 The user can specify the time interval to focus on visualization. • BR-3 The user can apply some search criteria, e.g. location or user karma.
Validation Rules	• VR-1 The focusing time interval must be well defined: end date always before start date.

Observations	

Code	**EXCHANGE-003**
Associated Requirements	
Description	Any **owner user** can select an offer, i.e. other's **time slot**, and retrieve its information associated.
Business Rules	• BR-1 The information attached to a **time slot** will be: owner user, telescope location and **karma** associated. (**TBC**)
Validation Rules	
Observations	

Code	**EXCHANGE-004**
Associated Requirements	**EXCHANGE-003**
Description	Any **owner user** can select an other's offer and propose an exchange.
Business Rules	• BR-1 The **user** that receives the proposal will be notified through the system, and also will receive an email. • BR-2 An exchange is always a proposal for transfer two time intervals, each of them belonging to different users.
Validation Rules	• VR-1 The proposal will be allowed only if the issuer has any available **time slot**.
Observations	

Code	**EXCHANGE-005**
Associated Requirements	**EXCHANGE-004**
Description	Any **owner user** can visualize their pending proposals for exchanging time slots.
Business Rules	• BR-1 All those proposals that are previous in time to the moment of visualizing will be removed (ignored). It only will be considered the proposals made for future times. • BR-2 The user will be able to organize the proposals following a certain criteria (**TBD**).
Validation Rules	
Observations	

Code	**EXCHANGE-006**
Associated Requirements	**EXCHANGE-005**
Description	Any **owner user** should be able to accept a proposal, while selecting a time slot available from the issuer as an offering response. Also, this user should be able to dismiss it.
Business Rules	• BR-1 Any user that receives a proposal will be able to navigate through the calendar of available time slots of the issuer. • BR-2 If the proposal receiver is not interested in any available time slot of the issuer, may dismiss the offering and the issuer will be notified.
Validation Rules	
Observations	

Code	**EXCHANGE-007**
Associated Requirements	**EXCHANGE-004, EXCHANGE-005, EXCHANGE-006**
Description	Any **owner user** that was the issuer of a proposal, can accept or dismiss an offering response for the exchange.
Business Rules	• BR-1 In any case, the proposal receiver user will be notified with the resulting decision.
Validation Rules	
Observations	

USE CASES

UC-EXCHANGE-001	**Visualize exchange time slots**
Associated Requirements	**EXCHANGE-002**
Actors	**OWNER USER**
Description	The **owner user** watches its set of exchange time slots.
Main Flow (MF)	• The user asks to visualize its **time slots** for exchange. • The system offers the user to entry additional information before starting the search, so that the results are filtered. • The user does not apply any filter and request to start the visualizing of its **time slots**. • The system retrieves all the data related to the **owner user time slots** and shows it in the predefined organising model (First the nearest

	time).
Alternative flow (AF1)	3a. The user accepts the system offering: 1. The user selects the desired filter criteria and specify the matching conditions. 2. The system retrieves all the filtered data related to the **owner user time slots** and shows it in the selected organising model.
Postcondition	
Observations	

UC-EXCHANGE-002	**Manage exchange time slots**
Associated Requirements	**EXCHANGE-001**
Actors	**OWNER USER**
Description	The **owner user** adds a **time slot** for exchanging.
Main Flow (MF)	• The user asks to add a new **time slot** for exchanging. • The system request the information needed to proceed with the operation. • The user introduces the start and end date/time of the **time slot**. • The system validates the new **time slot** according to the defined rules. • The system creates and reserves the new **time slot** and marks it for exchange.
Alternative flow (AF1)	5a. The system detects that the **time slot** is incorrect: 1. The system notifies the user that the **time slot** is invalid and request to correct it. 2. Goto MF step 2.
Alternative flow (AF2)	5a. The system detects that including the **time slot** the available time for the user would be exceeded: 1. The system notifies the user with the problem and request to correct it. 2. Goto MF step 2.
Postcondition	• The set of **time slots** for exchange related to the user contains the new interval.
Observations	

UC-EXCHANGE-003	**Accept a time slot for exchange**
Associated Requirements	**EXCHANGE-007**

Actors	**OWNER USER**
Description	The **owner user** accepts a time slot offered by another user for exchange.
Main Flow (MF)	• The user selects an other's **time slot** and accepts the exchange. • The system requests the user an own time slot to offer. • The user selects a **time slot** of his own to offer. • The system collects all the required information about the user and register the application. • The system sends an email to the owner of the selected **time slot** requesting its confirmation. • The user gets a notification indicating that its operation is accepted.
Alternative flow (AF1)	3a. The user cancels the operation.
Postcondition	• The set of exchange applications of the user contains the new one, including both time slots (own and others).
Observations	

2.3.2. Image Library

REQUIREMENTS

Code	**IMAGELIB-001**
Associated Requirements	
Description	Any logged in **user** could vote any image.
Business Rules	• BR-1 A **user** must vote according to **voting policy.** • BR-2 The rating and the number of votes must be showed near the image.
Validation Rules	• VR-1 Images are evaluated between 1 and 10 points.
Observations	

Code	**IMAGELIB-002**
Associated Requirements	
Description	Any logged in **user** could report an image or comment as inappropriate.
Business Rules	• BR-1 If an image exceeds a threshold of complaints, the system will lock the image and the **karma** of the owner of the image will be negatively affected.
Validation Rules	

Observations	

Code	**IMAGELIB-003**
Associated Requirements	
Description	Any **user** could sort the list of images by rating, visits, name, category, etc.
Business Rules	• BR-1 System must show a list of images sorted by date (default).
Validation Rules	
Observations	

Code	**IMAGELIB-004**
Associated Requirements	
Description	Any **user** could download any images.
Business Rules	• BR-1 Without download limits
Validation Rules	
Observations	

Code	**IMAGELIB-005**
Associated Requirements	
Description	Any **user** could search for images from a search panel.

Business Rules	• BR-1 The search results will be displayed on screen and sorted by date.
	• BR-2 Search fields are:
	  ○ By name
	  ○ By owner
	  ○ By date
	  ○ By telescope
	  ○ By category
	  ○ By rated
	  ○ By hits

Validation Rules	

Observations	

Code	**IMAGELIB-006**
Associated Requirements	
Description	Any logged in **user** could comment any image.
Business Rules	• BR-1 Comments must be related with the astronomy.
Validation Rules	
Observations	

Code	**IMAGELIB-007**
Associated Requirements	
Description	When accessing the image library, the system must show three lists of images (by default).
Business Rules	• BR-1 The three lists are as follows: • most newer list • top 5 of most rated • top5 of most visited.
Validation Rules	
Observations	

Code	**IMAGELIB-008**
Associated Requirements	
Description	When clicking on an image, it must show on full screen with all its information and with share options and “Like it” button.

Business Rules	• BR-1 Share option are as follows:
	  ○ By email
	  ○ To a specific **user**
	  ○ By linking images
	  ○ By social network share buttons (Facebook, Twitter, etc.)

Validation Rules	

Observations	

Code	**IMAGELIB-009**
Associated Requirements	
Description	Image library must have a tag cloud of images.
Business Rules	
Validation Rules	
Observations	

USE CASES

UC-IMAGELIB-001	**Advance Image Search**
Associated Requirements	
Actors	OWNER, GUEST, REGULAR, ADMIN
Description	Search any image from search panel.
Main Flow (MF)	1. The user enters the search parameters in the search panel. 2. The user clicks the search button. 3. The system shows a list of images sorted by date according to search parameters.
Alternative flow (AF)	a*. The admin cancels the operation.
Postcondition	The image library website has changed
Observations	

UC-IMAGELIB-002	**Comment on image**
Associated Requirements	
Actors	OWNER, REGULAR, ADMIN
Description	Comment on any image
Main Flow (MF)	1. The user selects an image to comment. 2. The user enters a comment about the image. 3. The system saves the comment and shows it on display.

Alternative flow (AF)	a*. The admin cancels the operation.
Postcondition	The system saves the comment in the databases
Observations	

UC-IMAGELIB-003	**Voting an image**
Associated Requirements	
Actors	OWNER, REGULAR, ADMIN
Description	Voting an image
Main Flow (MF)	1. The user selects an image to vote. 2. The user evaluate the image. 3. The system saves the vote and shows summary of voting on display.
Alternative flow (AF)	a*. The admin cancels the operation.
Postcondition	The system saves the vote in the databases
Observations	

UC-IMAGELIB-004	**Download an image**
Associated Requirements	
Actors	OWNER, GUEST, REGULAR, ADMIN
Description	Download an image on user computer.
Main Flow (MF)	1. The user selects an image to download. 2. The user saves the image on his/her computer
Alternative flow (AF)	a*. The admin cancels the operation.
Postcondition	The user gets the image.
Observations	

UC-IMAGELIB-005	**Sharing an image**
Associated Requirements	
Actors	OWNER, GUEST, REGULAR, ADMIN
Description	Sharing an image on social networks or other users

Main Flow (MF)	1. The user selects an image to share. 2. The user selects a share option 3. The system notifies the receiver that he/she has a shared image. 4. The system notifies the user of the success of sharing.
Alternative flow (AF)	a*. The admin cancels the operation. 3a. Sharing in social networks, the system doesn't notified.
Postcondition	An image is shared.
Observations	

UC-IMAGELIB-006	**Reporting an image**
Associated Requirements	
Actors	OWNER, REGULAR, ADMIN
Description	Reporting an image as inappropriate
Main Flow (MF)	1. The user selects an image to report. 2. The user uses the report button. 3. The user writes the subject if the complaint and then clicks the send button. 4. The system notifies the user of the success of reporting.
Alternative flow (AF)	a*. The admin cancels the operation.
Postcondition	The system saves the report to be reviewed by an administrator.
Observations	

UC-IMAGELIB-007	**Image on full screen**
Associated Requirements	
Actors	OWNER, GUEST, REGULAR, ADMIN
Description	Display an image and its information on full screen.
Main Flow (MF)	1. The user selects an image to display on full screen. 2. The system displays the image on full screen
Alternative flow (AF)	a*. The admin cancels the operation.
Postcondition	The image library website has changed.
Observations	

2.3.2.1. Virtual Observatory

REQUIREMENTS

Code	**VO-001**
Associated Requirements	
Description	**Gloria system** must obtain images of **virtual observatories** of open-access network.
Business Rules	
Validation Rules	
Observations	

Code	**VO-002**
Associated Requirements	
Description	An **admin user** must be able manage **virtual observatories** within of the **GLORIA repository**.
Business Rules	• BR-1 An interface web should be used.
Validation Rules	
Observations	

2.3.2.2. Owner telescope

REQUIREMENTS

Code	**OWNERREP-001**
Associated Requirements	
Description	**Owner user** must allow to **Gloria system** to access to the images of his/her repository.
Business Rules	• BR-1 **RTI** should be used.
Validation Rules	
Observations	

Code	**OWNERREP-002**
Associated Requirements	
Description	An **admin user** must be able manage repositories of **owner telescope** within of the **GLORIA repository**.
Business Rules	• BR-1 An interface web should be used.
Validation Rules	
Observations	

2.3.2.3. P2P storage

REQUIREMENTS

Code	**P2P-001**
Associated Requirements	-
Description	Since the amount of data generated by a telescope is huge, it could even reach several terabytes per night, a volunteer P2P storage system will be needed in GLORIA system, in order to preserve the most valuable data. The peer-to-peer network has to support large amounts of media content, whereas data refers to images, videos or related information.
Business Rules	• BR-1 A user could search and retrieve data from the peer-to-peer network. • BR-2 Given the name of the desired data, a user could only search for one piece of data at a time. No regular expressions are allowed. • BR-3 The network must reply with the latest version of the desired data.
Validation Rules	• VR-1: The name of the data has to be alphanumeric, with the exception of the underscore (“_”) and dash (“-”) characters. • VR-2: The given name has to be the exact match of the desired data.
Observ.	

Code	**P2P-002**
Associated Requirements	-
Description	Data has to be accessible regardless of the network disruptions that may occur such as partial system breakdowns or network overhead, featuring high availability.

Business Rules	• BR-1 A user could retrieve the desired data at any time.
Validation Rules	
Observ.	

Code	**P2P-003**
Associated Requirements	P2P-002
Description	Data in the network has to be replicated to multiple locations for fault-tolerance.
Business Rules	• BR-1 A user could retrieve the desired data at any time.
Validation Rules	
Observ.	

Code	**P2P-004**
Associated Requirements	-
Description	A user within the system participates sharing her own resources, improving the scalability of the system.
Business Rules	• BR-1 A user has to share at least computational or storage resources. • BR-2 A user has to share her network bandwidth as a member of the system. • BR-3 A user has to store pieces of data replicated through the whole system. • BR-4 The system has to check the user capabilities in terms of resources.
Validation Rules	• VR-1 A user must provide a certain amount of resources to contribute. • VR-2 The system validates periodically the user resources being shared.
Observ.	The user can share computational (CPU), memory (storage) or network (bandwidth) resources.

Code	**P2P-005**
Associated Requirements	P2P-004
Description	The peer-to-peer network is managed in a decentralized way, where nodes such as users collaborate with each other to maintain the system, avoiding network bottlenecks and single points of failure.
Business Rules	• BR-1 The system must not depend on particular network nodes. • BR-2 The network has to be self-managed. • BR-3 The network has to treat equally the users within the system. • BR-4 The network has to scale dynamically based on the system workload.

Validation Rules	• VR-1 The system has to monitor and log the status of the network to adapt itself accordingly, providing a homogeneous interface for users.
Observ.	

2.3.3. Report

REQUIREMENTS

Code	**REPORT-001**
Associated Requirements	
Description	A user can publish a report. A report has the following fields: • Authors • Subject • Description • Categories • Associated image Another field is the identificator but this parameter is filled automatically by the system and is unique
Business Rules	BR-1 There is no limits to publish reports BR-2 All fields are required. BR-3 The author must be an existing user BR-4 The category must exist in the system BR-5 Only one image can be attached BR-6 The image has a limit size
Validation Rules	
Observations	

Code	**REPORT-002**
Associated Requirements	
Description	A report can be read by an specific user.
Business Rules	BR-1 The report belongs to one category
Validation Rules	
Observations	

Code	REPORT-003
Associated Requirements	
Description	A user can evaluate a report throw a voting method
Business Rules	BR-1 The value of the vote is defined BR-2 An user only can vote for a report once. BR-3 The weight of the vote depends of the user's karma
Validation Rules	V-1 Vote can be [0..10]
Observations	

USE CASES

UC-REPORT-001	Publish a report
Associated Requirements	**REPORT-001**
Actors	USER
Description	A user publish a report on a category. The fields of the report are: ● Authors ● Subject ● Description ● Category ● Associated image
Main flow (MF)	1. The system requests a report 2. The user sends a report completing all required fields 3. The system publishes the report
Alternative flow (AF1)	2a. The report contains incorrect fields. ● The system cancels the operation and shows a message
Postcondition	The report is published
Observations	

UC-REPORT-002	Read report
Associated Requirements	**REPORT-001**
Actors	USER
Description	A user read a report
Main Flow (MF)	1. The user request a report 2. The system shows the report

Alternative Flow (AF1)	1a. The report doesn´t exist. ● Show an error message ● Goto MF 1
Postcondition	The report is showed.
Observations	

UC-REPORT-003	**Create category**
Associated Requirements	**REPORT-002**
Actors	ADMIN
Description	An administrator creates a new category
Main Flow (MF)	1. The administrator introduces a new category 2. The system registers the category
Alternative Flow (AF1)	1a. The category exist ● The system shows a message indicating this problem ● Goto MF1
Postcondition	The category is created
Observations	

UC-REPORT-004	**Vote report**
Associated Requirements	**REPORT-003**
Actors	USER
Description	A user can vote a report
Main Flow (MF)	1. The user introduces the value of the vote 2. The system assign this vote to a report
Alternative Flow (AF1)	1a. The value is not valid ● Show an error message ● Goto MF1
Postcondition	The report is scored
Observations	

2.4. Experiments

2.4.1. Experiment Management

REQUIREMENTS

Code	**EXPMGT-001**
Associated Requirements	**A Authoring tool - Web Administration Tool - Online experiments** This application will provide the following modules: ● **Target List Management Module**. ○ Add/Remove/Modify targets (name and coordinates). ● **O.P.** (Observing Plan) **Management Module**. This module allows administrator to manage whatever O.P in the GLORIA System. The functionality will be: ○ O.P. searching by: ■ Target. ■ User. ○ Create/Modify/Remove/Clone an O.P. using these submodules: ■ **Constraints Editor**. It allows a user to set, at least, this information in the edited O.P. ● Specific time window. ● Specific telescope (or selection from a set). ● Specific filters. ● Height above horizon (degrees). ● Zenith separation (degrees). ● Moon separation (degrees). ● Moon down (boolean). ● Time after dusk/before dawn. ■ **Scripts Editor**. It allows a user to set what the O.P. has to do. The script language must be defined previously. ■ **O.P validator.** Before to make an O.P persistent, a validator must check its total integrity.
Description	
Business Rules	
Validation Rules	
Observations	

Code	**EXPMGT-002**

Associated Requirements	GLORIA-SRS-Online experiment (ONEXP-003)
Description	**Authoring tool - Web User Tool - Online experiments** This application is similar to the Administration Tool, but is limited. The user only could modify his own Object Plans. It will provide the following modules: ● **O.P.** (Observing Plan) **Management Module**. This module allows administrator to manage his Object Plans. The functionality will be: ○ O.P. searching by: ■ Target. ■ User. ○ Modify/Remove his Object Plans and Create/Clone whatever Object Plan using these submodules: ■ **Constraints Editor**. It allows a user to set, at least, this information in the edited O.P. ● Specific time window. ● Specific telescope (or selection from a set). ● Specific filters. ● Height above horizon (degrees). ● Zenith separation (degrees). ● Moon separation (degrees). ● Moon down (boolean). ● Time after dusk/before dawn. ■ **Scripts Editor**. It allows a user to set what the O.P. has to do. The script language must be defined previously. ■ **O.P validator.** Before to make an O.P persistent, a validator must check its total integrity.
Business Rules	
Validation Rules	
Observations	

Code	**EXPMGT-003**
Associated Requirements	GLORIA-SRS-Offline experiment (**OFFEXP-002**)
Description	● **Authoring tool - Web User Tool - Offline experiments** ● This application will provide the following modules: ● **Management Module of Offline Experiment Kinds (for administrators).** ○ Add/Remove/Modify kinds of offline experiments. ○ It must be scalable. It is necessary to take into account that an offline experiment has got two types of agents to execute the

	experiment: ■ Automatic process (images processors or comparators, Solar Objects locator, etc.). ■ Interactive process. The administrator must maintain a list of possible automatic processes that a common user may include into his offline experiment. So, a standard interface for these processes must be defined on the server side. ● **Offline Experiment (templates) Management Module**. ○ Offline experiment searching by. ■ User. ■ Offline experiment kind. ■ Offline experiment identifier (name). ○ Add/Remove/Modify offline experiments. Only the administrator or experiment owner can modify/remove it. ○ **Offline experiment editor**. This editor allows user to create/modify an offline experiment. This is the information the editor allows to maintain a sort list of online experiments and processes. ■ Online experiments (see **OFFEXP-002 requirement**). It may be necessary to obtain actual images executing online experiments. ■ Automatic processes (see previous module). For each process, it's necessary: ● Input. ○ Images from the global repository of GLORIA. ○ Output of previous automatic or interactive processes in this same offline experiment. ○ Other types of available resources that can be needed. ● Output. An identifier can be set, allowing other process to use it as input. ■ Interactive processes (see previous module). ● Input. ○ Images from the global repository of GLORIA. ○ Output of previous automatic or interactive processes in this same offline experiment. ○ Other types of available resources that can be needed. ● Output. An identifier can be set, allowing other process to use it as input.
Business Rules	

Validation Rules	
Observations	

USE CASES

UC-EXPMGT-001	**Offline experiments - Steps to create an experiment**
Associated Requirements	
Actors	USER, GS (Global System)
Description	These are the execution steps that define an ordinary offline experiment: 1. User logins to GLORIA System. 2. User selects the offline experiment type. 3. User introduces the needed input for the selected experiment type. 4. User creates the offline experiment in Gloria System. 5. The Gloria dispatcher executes step by step each online experiment (see **OFFEXP-002 requirement**) and process (automatic or interactive).
Preconditions	
Presentation	
Main Flow (MF)	
Alternative flow (AF)	
Postcondition	
Observations	

2.4.2. Online experiments

REQUIREMENTS

Code	**ONEXP-001**
Associated Requirements	http://bit.ly/Kv4VCI
Description	**Online Experiments** ● Online experiments are how the users access GLORIA's telescopes. ● There are six kinds of online experiments supported by GLORIA. ○ **Interactive-Fixed**. Context: classroom demonstration, maintenance & testing ○ **Interactive-Scheduled**. Context: smart monitoring of variable stars.

	○ **Interactive-Alert**. Context: supernova observation by a human or expert system. ○ **Batch-Fixed**. Context: planetary transit. ○ **Batch-Scheduled**. Context: deep image of a galaxy. ○ **Batch-Alert.** Context: supernova response by a predefined observing script. Keys: ○ **Interactive**. Direct low-level remote control of the telescope functions. ○ **Batch**. The telescope receives an Object Plan (OP), and executes it autonomously. ○ **Fixed**. At a time chosen by the user. ○ **Scheduled**. At a time chosen by the system. ○ **Alert**. When triggered by an external event.
Business Rules	
Validation Rules	
Observations	

Code	**ONEXP-002**
Associated Requirements	http://bit.ly/Kv4VCI
Description	**RTS - Mandatory/Optional online experiments** ● The online interactive experiments must be optional. The telescope owner decides if it can be teleoperated by a GLORIA user. ● The online batch experiments must be mandatory.
Business Rules	
Validation Rules	
Observations	

Code	**ONEXP-003**
Associated Requirements	http://bit.ly/Kv4VCI

Description	**Observing Plan** In order to allow the execution of online experiments, GLORIA manages Observing Plans (**O.P.**). The O.P. entity is a package containing everything GLORIA needs to know to carry out the observation. O.P. sections: ● **Constraints**. The observing constraints list must be established in order to maintain a set of known constraints. Some of these constraints may be: ○ Specific time window. ○ Specific telescope (or selection from a set). ○ Specific filters. ○ Height above horizon (degrees). ○ Zenith separation (degrees). ○ Moon separation (degrees). ○ Moon down (boolean). ○ Time after dusk/before dawn. ● **Instructions**. An O.P. has associated a list of instructions that must be executed by a RTS. This section can contain: ○ A sequence of instructions. ○ A simple statement indicating that the observation will be run manually. Therefore, there is a scripting language. This language can describe exposure times, filter settings, camera modes, repetitions, etc., and could be extended quite readily to include telescope pointing and constraints. An advance of what must provided by this language may be: ○ **Target**. Identified by name (registered previously) or coordinates. ○ **Camera**. Some of the telescopes have cameras with multiple readout speeds, amplifier gain settings, etc., which may permit better science, although the resulting script is likely to be telescope specific. Technically this information belongs with exposure, but this information is far more likely to be kept constant, and the expose command already has many parameters attached to it. ○ **Expose**. Take one or more identical exposures, defined by timing, repetitions, filters. Note that filters and camera settings (if used) constitute implicit constraints – not all telescopes have all filters, not all cameras possess the same features. Iteration is defined here for compactness and because some cameras can take sequences more efficiently than single frames, and this notation makes it easy to recognise the opportunity. ■ Timing parameters. ● Fixed depth (specified by limiting magnitude)

	● Fixed depth, max. duration (as above, but subject to a maximum exposure time) ● Fixed duration (the traditional version) ■ Repetition parameters. ● Once (default) ● Repeat N times ● Repeat for T seconds ■ Filters: Once filters are selected for any exposure, this creates a constraint that probably reduces the range of telescopes available. Subsequent filter drop-downs should only show those filters on the surviving telescopes. ○ **Label**. Free-form text entry. ○ **Repeat**. Has a repetitions-or-duration field identical to the Exposure one.
Business Rules	
Validation Rules	
Observations	

Code	**ONEXP-005**
Associated Requirements	http://bit.ly/Kv4VCI
Description	**Authoring Tool** The Authoring Tool will be mainly a palette of web components organized by categories. There are two different categories for experiments, one for for the on-line, and the other category for the off-line experiments. The web components will be added to any page of the platform through the drag-and-drop feature (or other mechanism).
Business Rules	
Validation Rules	
Observations	● Must GLORIA allow somebody to develop a new component for the Authoring Tool?

Code	**ONEXP-006**

Associated Requirements	http://bit.ly/Kv4VCI
Description	**Remote Control** GLORIA provides a set of web components to allow a user to control the RTS during the execution of an online interactive experiment. The set of web components is: ● Component to control the mount. ● Component to control the focuser. ● Component to control the dome. ● Component to control the camera. ● Component to control the filters.
Business Rules	
Validation Rules	
Observations	

Code	**ONEXP-007**
Associated Requirements	http://bit.ly/Kv4VCI

Description	**Global-Scheduler**
	● The global scheduler is located at GLORIA System.
	● Th global scheduler will do the following tasks:
	  ● Accept a telescope-neutral Observing Plan as input.
	  ● Choose a set of telescopes, candidates to execute the Observing Plan, taking into account the user capabilities, the available telescopes time-slots and the constraints of the Observing Plan (specific time window, specific telescope/s, specific filters, height above horizon, Zenith separation, Moon separation, Moon down, Time after dusk/before dawn).
	  ● Make execution proposals to each chosen telescope. The local scheduler of the telescope will evaluate the observing plan and it will return an execution offer.
	  ● Choose the best execution offer for the Observing Plan among all available ones, assigning it to the telescope which made the offer.
	● It can receive alert notices and determine the affected telescopes and the O.P which will interrupt the current telescope execution as long as is capable..

Business Rules	
Validation	

Rules	
Observations	• The Scheduler has to manage an alert-online-experiment using a registered O.P. This O.P. is associated to this kind of alert. Depending on the priorities, the Scheduler could interrupt a robotic telescope registered to this alert and launch the execution of a new O.P.

Code	**ONEXP-008**
Associated Requirements	http://bit.ly/Kv4VCI
Description	**RTS** • RTS provides to GLORIA System a device-level control interface for remote control **RTS – Local Scheduler** • Maintains a list of time-slots in a proper time window (N days, N months ahead) and its associated Observing Plan, attending alerts and cancelling scheduled Observing Plans if it's needed. All changes in the time-slots must be communicated to the global scheduler • Evaluates the execution proposal sent by the global scheduler. This evaluation is a score which indicates how good the telescope satisfies the constraints of the Observing Plan.
Business Rules	
Validation Rules	
Observations	

USE CASES

UC-ONEXP-001	**Creation of an on-line experiment: Interactive-Fixed.**
Associated Requirements	http://bit.ly/Kv4VCI
Actors	USER, GS (Global System)
Description	• 1. The OP will be empty in order to not interfere with the scheduler. • 2. The user could use in realtime the devices defined by the experiment designer.
Main Flow (MF)	
Alternative flow (AF)	
Postcondition	

Observations	

UC-ONEXP-002	**Creation of an on-line experiment: Interactive-Scheduled.**
Associated Requirements	http://bit.ly/Kv4VCI
Actors	USER, GS (Global System)
Description	
Main Flow (MF)	
Alternative flow (AF)	
Postcondition	
Observations	

UC-ONEXP-003	**Creation of an on-line experiment: Interactive-Alert.**
Associated Requirements	http://bit.ly/Kv4VCI
Actors	USER, OWNER, GS (Global System)
Description	**1) User - Alert creation phase** ● A registered user accesses to GLORIA System. ● The user creates a new alert in GLORIA, using a web module for this purpose. The alert has the following properties: ○ It has associated an O.P. This O.P. is really the handler of the alert and consists in a telescope manual control. ○ The user (operator) who can control the telescope. **2) Telescope - Registration phase** ● A telescope owner registers his telescope in an alert. ● GLORIA System checks compatibility of the O.P constraints associated to the alert and registers the telescope in this alert. **3) User/System - Alert launch phase** ● An alert can be launched using the GLORIA web application (the source is a user) or a web service provided for this purpose (the source is an automatic system). **4) GLORIA System - Alert management phase** ● GLORIA System detects the alert and interrupts the normal behaviour of all telescopes registered on it, scheduling the O.P. associated to the alert in each telescope.

	5) User - Manual control phase ● A registered user accesses to GLORIA System. ● The user can view a list of all telescopes attending the alert. ● The user selects a telescope and starts to teleoperate the telescope.
Main Flow (MF)	
Alternative flow (AF)	
Postcondition	
Observations	● I could be interesting to consider the alert creator user and the telescope owner as the users who can teleoperate the telescope.

UC-ONEXP-004	**Creation of an on-line experiment: Batch-Fixed.**
Associated Requirements	http://bit.ly/Kv4VCI
Actors	USER, GS (Global System)
Description	● A registered user accesses to GLORIA System. ● The user accesses to the Observing Plan Tool in order to create a new O.P. with the following data: ○ The proper constraints, including a SPECIFIC TIME WINDOW. ○ The instructions script (a sequence). ● The user requests the execution of the O.P. to the GLORIA System. ● The global and local schedulers works together to schedule the O.P request a posteriori (in order to make the implementation easier) and notifies user about the O.P. planning. ● GLORIA System could change the planning of the O.P. in any time due to several reasons: ○ An new O.P. with more priority appears. ○ An alert is launched. ○ The telescope owner changes its availability. ○ The user must be notified of any planning change as soon as possible. ● GLORIA System sends the O.P. planning to the RTS (N days/months ahead). It's necessary to take into account that GLORIA System can modify the planning, at any time, in the RTS.
Main Flow (MF)	
Alternative flow (AF)	
Postcondition	
Observations	

UC-ONEXP-005	Creation of an on-line experiment: Batch-Scheduled.
Associated Requirements	http://bit.ly/Kv4VCI
Actors	USER, GS (Global System)
Description	It's similar to the use case UC-ONEXP-004, but the constraint TIME WINDOW is not set.
Main Flow (MF)	
Alternative flow (AF)	
Postcondition	
Observations	

UC-ONEXP-006	Creation of an on-line experiment: Batch-Alert.
Associated Requirements	http://bit.ly/Kv4VCI
Actors	USER, OWNER, GS (Global System)
Description	**1) User - Alert creation phase** ● A user accesses to GLORIA System. ● The user creates a new alert in GLORIA, using a web module for this purpose. The alert has the following property: ○ It has associated an O.P. This O.P. is really the handler of the alert and consists in a instructions script (a sequence). **2) Telescope - Registration phase** ● A telescope owner registers his telescope in an alert. ● GLORIA System checks compatibility of the O.P constraints associated to the alert and registers the telescope in this alert. **3) User/System - Alert launch phase** ● An alert can be launched using the GLORIA web application (the source is a user) or a web service provided for this purpose (the source is an automatic system). **4) GLORIA System - Alert management phase** ● GLORIA System detects the alert and interrupts the normal behaviour of all telescopes registered on it, scheduling the O.P. associated to the alert in each telescope. **5) RTS - Batch execution.** ● RTS executes the O.P.

Main Flow (MF)	
Alternative flow (AF)	
Postcondition	
Observations	

2.4.3. Offline experiment

REQUIREMENTS

Code	**OFFEXP-001**
Associated Requirements	http://bit.ly/JJYtnA
Description	**Offline experiments - Scalability** GLORIA System must be able to increase the number of offline experiment kinds easily.
Business Rules	
Validation Rules	
Observations	• Who can develop new offline experiments (user, administrators or both of them)?

Code	**OFFEXP-002**
Associated Requirements	
Description	**Offline experiments - Execution dependencies** • **No dependence**. The off-line experiments use the archival images obtained by the telescopes. GLORIA System must allow a user (during the offline experiment creation time) to choose the kind of the offline experiment and, in any way, the images that will be the input of the experiment. • **With dependence**. Additionally, an offline experiment may require the execution of online experiments because the offline experiment needs to take images (present). So, GLORIA System must provide this kind of dependencies. In other words, the offline experiment must wait for the output of the online experiments.
Business Rules	
Validation Rules	
Observations	• The dependency can be avoided following these steps: a. First, to create the needed online experiments and Let them finish. b. A posteriori, to create the offline experiment. This observation affects to the SRS - Experiment management document.

2.5. Robotic telescope management

REQUIREMENTS

Code	**RTMGT-001**
Associated Requirement	-
Description	Register a Robotic Telescope. Any user logged in could request to add a RT to the GLORIA System. This user will have to fill the information about the RT: ● RT name. ● Address. ● City. ● Country. ● GPS location coordinates. ● IP or DNS name server. ● Time Zone. To complete the registration is needed to validate the RT according to the Validation Rules. If the validation process would be completed, the RT will belong to GS and will be identified by an unique **Telescope ID**. The GS will register all the information obtained through the communication with the RT in order to make an inventory (set of operations and .
Business Rules	● BR1. The RT name must be unique in the system. ● BR2. The RT has an unique status in GS of the following ones:, **error**, **inactive, maintenance, pending_validation**, and **running**. ● BR3. The Telescope ID is unique and unchangeable. ● BR4. If the validation process is completed, the RT will be in “running” status. ● BR5. If the validation process fails or is not completed, the RT will be in “pending acceptation” status. ● BR6. The user who completes her/his first RT registration process, automatically will get the **owner** role.
Validation Rules	● VR-1. The validation process requires that the RT fulfills the HL protocol. That is, for each operation defined into the High Level protocol, the GS will interact with RT and will check that GS receives a valid response for each HL operation. If some operation fail, the process validation is aborted and the RT must be rejected.
Observations	

Code	**RTMGT-002**
Associated Requirement	
Description	Get the Robotics Telescopes List. An administrator could obtain the list of the all the RTs included in GLORIA. However, an owner could get only the list of its own

	RT which the owner registered previously.
Business Rules	• BR-1. The information shown will be the data entered by the owner during the registration. • BR-2. The RT karma will be shown. • BR-3. Statistics about its number of reservations, observing time used, etc., will be shown. • BR-4. The current status will be shown. When a user click on the RT listed, all the RT information will be shown. This information must be at least: • Robotic Telescope Name. • Location Name. • Location Map (Using Google Maps). • Name server or IP. • Change RTI username and password option. • Average Observing Time. • Shared Time Configuration (in order to change this information) • Karma
Validation Rules	-
Observations	-

Code	**RTMGT-003**
Associated Requirement	-
Description	An owner could update a RT. After the registration, an **owner** could decide to update the RT because its configuration has changed. The owner could update its information, i.e. IP or GPS coordinates, or its internal configuration. To modify the information the owner will have to fill the new fields and accept the changes. To complete the updating of the internal configuration is needed to validate the telescope according to the Validation Rules. If the validation is completed, the GS will register all the devices information in order to make an inventory.
Business Rules	• BR1. If the validation process for updating is completed, the RT will be in an “running” status. • BR2. If the validation process is not completed, the RT will be in an “pending acceptation” status.
Validation Rules	• VR-1. The validation process requires that the RT fulfills the HL protocol. That is, for each operation defined into the High Level protocol, the GS will interact with RT and will check that GS receives a valid response for each HL operation. If some operation fail, the process validation is aborted and the RT must be rejected.

Observations	-

Code	**RTMGT-004**
Associated Requirement	-
Description	An owner deactivates one of his/her RT from GS, or an admin deactivates any RT. That indicates that the RT will not be possible to control it temporally.
Business Rules	• BR1. The RT will change to “inactive” status.
Validation Rules	• VR-1. The actor has to accept a confirmation.
Observations	-

Code	**RTMGT-005**
Associated Requirement	-
Description	An owner could delete one of his/her RT from GS, or an admin could delete any RT. That indicates that the RT will disappear from the GS network.
Business Rules	• BR-1. The RT will change to “delete” status. • BR-2. The information and statistics about the RT will remain in the GS but not public. • BR-3. As optional, the owner could indicate a reason to delete it.
Validation Rules	• VR-1. The actor has to confirm the action before doing it. As optional, the actor could indicate a reason to abandon GS. • VR-2. If it is the last RT who has the owner, then the owner role will delete from her/his.
Observations	-

Code	**RTMGT-006**
Associated Requirement	-
Description	An owner, who wants to carry out maintenance tasks while the RT is running, can change the status of the RT to “maintenance”, so users can know that the RT is unavailable temporarily.
Business Rules	• BR1. The RT will change to “maintenance” status.
Validation	• VR-1. The actor has to accept a confirmation.

Rules	
Observations	-

Code	**RTMGT-007**
Associated Requirement	-
Description	If a RT fails while is being used (running status), the RT will change to status "error" and the RT will be unavailable temporarily, until the owner solves the problems and check the validation process.
Business Rules	• The RT's owner must be informed by email indicating the error detected: operation failed, time, etc. • The
Validation Rules	• GS is notified when a communication problem with RTS occurs, i.e., when the RT is disconnected, returns an invalid response, etc.
Observations	

Code	**RTMGT-008**
Associated Requirements	**RTMGT-004**, **RTMGT-006**, **RTMGT-007**
Description	An owner who has a RT in inactive, maintenance or error status, could decide to validate it again. And then, the RT will have to test the process validation again.
Business Rules	• BR1. If the validation process is completed, the RT will be in "running" status. • BR2. If the validation process fails or is not completed, the RT will be in "pending acceptation" status.
Validation Rules	• VR-1. The validation process requires that the RT fulfills the HL protocol. That is, for each operation defined into the High Level protocol, the GS will interact with RT and will check that GS receives a valid response for each HL operation. If some operation fail, the process validation is aborted immediately.
Observations	-

USE CASES

UC-RTMGT-001	**Register a RT**
Associated Requirements	RTMGT-001

Actors	USER, RT OWNER
Description	Register a new RT into the GS.
Main Flow (MF)	1. User select “Add Robotic Telescope” option in the user menu. 2. A new RT form is shown to the user. 3. User fills all the information. 4. User press Accept buttom. 5. The GS check all the information 6. The GS check if the RT is correct.
Alternative flow (AF)	4a. Information is not complete or wrong. 1. The form will be shown again to the user with the wrong fields in red and a text explain the error. 5a. This RT has been added before. 1. An error message will be shown to the user. 5b. The IP address or DNS name already exist in the GS. 6a. The GS detect an error in the RT interface 1. The GS will show the errors and help about how to resolve.
Postcondition	The RT will be added to the GS.
Observations	

UC-RTMGT-002	**Get the RTs List**
Associated Requirements	RTMGT-002
Actors	User, RT Owner
Description	A RT List will be shown to the user.
Main Flow (MF)	1. User select “My Robotics Telescopes” option. 2. The RT List will be shown to the user.
Alternative flow (AF)	2a. There isn’t any telescope. 1. A message will be shown and an invitation to add a RT.
Postcondition	
Observations	

3. Robotic telescope architecture

3.1. Robotic telescope interface

REQUIREMENTS

Code	**RTI – 001 Get remote Telescope Device List**
Associated Requirements	

Description	The RTI will return the device inventory to the GS.
	The RTOS will access to all devices, or database with this information, and this information will be sent.
	A list of devices information with its own id. Each RT device will have a unique id (at a RT level), which will be used in order to identify the devices for further requests.
	Device: [AstronomicalCamera, SurveillanceCamera, FilterGrismPrimsWheel, Focuser, Mount, Enclosure, CloudDetector, WindSpeed, RainDetector, StormSensor, Humidity, WeatherVane, Photometer]
	Id=(Integer)
	i.e.
	device=RTOS,id=0;
	device=Camera,id=1;
	device=Mount,id=2;
	device=CloudDetector,id=3;
	...

Observ.	Each device will have a property list, the whole list will be defined in the High Level Interface document. i.e. The id=0 belongs to the Robotics Telescope OS, it'll be used for OS parameters like RTID, etc.

Code	**RTI – 002 Get Device Status**
Associated Requirements	
Description	The RT will return the device status to GS. A connection between Global System and remote Telescope must be established. The RT returns the status to the GS using a network connection. The RTOS will access to the device in order to check the status. Device status: READY, BUSY, OFF, MAINTENANCE, ERROR, etc.
Observ.	

Code	**RTI – 003 Get Device Property List**
Associated Requirements	
Description	The Remote Telescope will return a device property list.

	A connection between Global System and remote Telescope must be established. The device id must be defined in a parameter. The RTOS has to check if the id belongs to any device in the RT, if not it'll return an error. The RT will access to the device information in order to send it.
Observ.	A Property Device will be only for read or read/write. This information will be defined in the High Level Interface Document

Code	**RTI – 004 Get Device Property Value**
Associated Requirements	
Description	The Remote Telescope will return a device property value. A connection between Global System and remote Telescope must be established. The RT has to check if the id and the property name belong to any device, if not it'll return an error. The RT will access to the device information in order to send the property value.
Observ.	

Code	**RTI – 005 Set Device Property Value**
Associated Requirements	
Description	The RTI will establish a device property value. A connection between Global System and remote Telescope must be established. The RT has to check if the id and the property name belong to any device, if not it'll return an error. The RT returns all the information to the GS using a network connection. The RTI will establish the property value in the device.
Observ.	

Code	**RTI – 006 Alarm Notification**
Associated Requirements	
Description	The RTI will notify an Alarm about any device or the whole RT. A device or the RTOS has generated an error state. The RTI connects to the GS in order to notify the alarm, using a network connection. Output: Alarm Code: MALFUNCTION_ALARM, HW_ALARM, SW_ALARM, etc., any description text?, RTID and Device ID. The GS should modify the device or RT availability.
Observ.	Each RT will have its own RTID. It'll be defined by the Global System.

Code	**RTI -007 Event Notification**
Associated Requirements	

Description	The RTI will notify an Event about any device or the whole RT. A device or the RTOS has generated an event. The RT connect to the GS in order to notify the event, using a network connection. The RTI detect an error and transmit it to the GS. Event Code: READY, BUSY, etc., any description text, RTID and Device ID.
Observ.	

Code	**RTI – 008 Get Image from RT**
Associated Requirements	
Description	The GS will get an image path from RT. The images will be stored in the RTOS file system.
Observ.	When you set StartExposure, the status will change to EXPOSING, and when the devices will have been finished, status will change to READY. An event (RTI-007) will be sent to the GS when the image will be ready. The image format is given i.e. by ImageFormat property.

Code	**RTI – 009 Get Video from RT**
Associated Requirements	
Description	The GS system need to show a real time video from the surveillance cameras. This video will be transmitted using a RT local URL.
Observ.	The surveillance camera will be activated using a Set Property command (RTI-005), and the URL will be fixed in a Property.

Code	**RTI -010 Configure RTI Security Layer**
Associated Requirements	RTMGT-002
Description	In order to connect the GS with the RTI, the security layer parameters must be fixed. This configuration will be done using a GUI.
Observ.	

Code	**RTI – 011 Configure RTOS**
Associated Requirements	
Description	In order to manage the RTOS by the RTI, the RT owner must configure all the RTOS parameters in the RTI GUI. Once the RTOS has been configure, the RTI GUI must show if there is any error.

Observ.	

Code	**RTI – 012 Test RTI**
Associated Requirements	
Description	The RTI GUI will have the test functionality. This one will check the Internet and GS connection, and if the RTOS is running and ready. If there is any problem, the GUI will show the error/s and how to solve.
Observ.	

Code	**RTI – 013 Configure RTI Network Parameters**
Associated Requirements	
Description	This option in the GUI will configure the network connection.
Observ.	The main parameter is the GS hostname.

Code	**RTI – 014 RTI Log**
Associated Requirements	
Description	All the events and errors will be stored in a log file. This one will be shown in the GUI using the “View Log file” option.
Observ.	

Code	**RTI – 015 RTI restart**
Associated Requirements	
Description	RTI will be restart and all the connections (GS and RTOS) will be established
Observ.	

USE CASES

UC-RTI-001	**Get Remote Telescope Devices List**
Associated Requirements	RTI-001
Actors	GS (Global System)
Description	The GS will get the devices list from a RT.
Main Flow (MF)	1. The GS connects to the RT. 2. GS-RT Authentication (Security Layer) 3. GS Telescope Devices List request 4. The RT returns the Devices List.
Alternative flow (AF)	1a. GS can't connect to the RT. 1. GS will show an error message to the user. 2a. Authentication Error 1. The RT returns an authentication error 2. The GS could retry.
Postcondition	
Observations	

UC-RTI-002	**Get Device Status**
Associated Requirements	RTI-002
Actors	GS
Description	The GS will get a device status
Main Flow (MF)	1. The GS connects to the RT. 2. GS-RT Authentication (Security Layer) 3. GS Get Device Status request 4. The RT returns the Device Status.
Alternative flow (AF)	1a. GS can't connect to the RT. 1. GS will show an error message to the user. 2a. Authentication Error 1. The RT returns an authentication error 2. The GS could retry. 4a. The device doesn't exist in the Robotic Telescope. 1. The RT returns an error.
Postcondition	
Observations	
UC-RTI-003	**Get Device Properties List**
Associated Requirements	RTI-003

Actors	GS
Description	The GS will get all the Device Properties.
Main Flow (MF)	1. The GS connects to the RT. 2. GS-RT Authentication (Security Layer) 3. GS Get Device Properties List request 4. The RT returns the Device Properties List
Alternative flow (AF)	1a. GS can't connect to the RT. 1. GS will show an error message to the user. 2a. Authentication Error 1. The RT returns an authentication error 2. The GS could retry. 4a. The device doesn't exist in the Robotic Telescope. 1. The RT returns an error.
Postcondition	
Observations	

UC-RTI-004	**Get Device Property Value**
Associated Requirements	RTI-004
Actors	GS
Description	The GS will get a device property value
Main Flow (MF)	1. The GS connects to the RT. 2. GS-RT Authentication (Security Layer) 3. GS Get Device Property Value request 4. The RT returns the Device Property Value
Alternative flow (AF)	1a. GS can't connect to the RT. 1. GS will show an error message to the user. 2a. Authentication Error 1. The RT returns an authentication error 2. The GS could retry. 4a. The device doesn't exist in the Robotic Telescope device. 1. The RT returns an error.
Postcondition	
Observations	

UC-RTI-005	**Set Device Property Value**
Associated Requirements	RTI-005
Actors	GS

Description	The GS will set a device property value
Main Flow (MF)	1. The GS connects to the RT. 2. GS-RT Authentication (Security Layer) 3. GS Set Device Property Value request with the value to be set 4. The RT returns a confirmation
Alternative flow (AF)	1a. GS can't connect to the RT. 1. GS will show an error message to the user. 2a. Authentication Error 1. The RT returns an authentication error 2. The GS could retry. 3a. The device doesn't exist in the Robotic Telescope. 1. The RT returns an error. 3b. The property doesn't exist in the Robotic Telescope device. 1. The RT returns an error.
Postcondition	The property value has been set. If this value implies any action, the device will execute the action. i.e. Open the dome.
Observations	

UC-RTI-006	**Alarm Notification**
Associated Requirements	RTI-006
Actors	RT
Description	The RT will notify an alarm to the GS.
Main Flow (MF)	1. The RT connects to the GS. 2. RT-GS Authentication (Security Layer) 3. Alarm notification request with Alarm code, device id and RT id. 4. The GS returns an ack
Alternative flow (AF)	1a. RT can't connect to the GS. 1. RT will write an error message in the RT log file. 2a. Authentication Error 1. The GS returns an authentication error 2. The RT could retry. 4a. The RT doesn't exist in the GS. 1. The GS returns an error.
Postcondition	The GS executes all the actions needed in order to manage this alarm.
Observations	

UC-RTI-007	**Event Notification**
Associated Requirements	RTI-007

Actors	RT
Description	The RT will send an event to the GS.
Main Flow (MF)	1. The RT connects to the GS. 2. RT-GS Authentication (Security Layer) 3. Event notification request with Alarm code, device id and RT id. 4. The GS returns an ack
Alternative flow (AF)	1a. RT can't connect to the GS. 1. RT will write an error message in the RT log file 2a. Authentication Error 1. The GS returns an authentication error 2. The RT could retry. 4a. The RT doesn't exist in the GS. 1. The GS returns an error.
Postcondition	The GS executes all the actions needed in order to manage this Event.
Observations	

UC-RTI-008	**Get Image From RT**
Associated Requirements	RTI-0018
Actors	GS
Description	The GS will get an image from the RT.
Main Flow (MF)	1. The RT connects to the GS. 2. RT-GS Authentication (Security Layer) 3. Set StartExposure device property in order to start the camera exposure. 3. Wait until get the IMAGEREADY event in the GS. 4. Get the image format using the ImageFormat device Property. 3. Get the image from the RT device. 4. The RT will return the image url. 5. The GS will access to the given url in order to get the image file.
Alternative flow (AF)	1a. GS can't connect to the RT. 1. GS will show an error message to the user. 2a. Authentication Error 1. The RT returns an authentication error 2. The GS could retry. 3a. The device doesn't exist in the RT. 1. The RT returns an error. 3b. The device doesn't support this property. 1. The RT returns an error. 5a. The GS can't access to the url. 1. The GS will show an error to the user.
Postcondition	The image will be shown to the user.
Observations	

UC-RTI-009	**Get Video from RT**
Associated Requirements	RTI-009
Actors	GS
Description	The GS will access to a real-time video.
Main Flow (MF)	1. The RT connects to the GS. 2. RT-GS Authentication (Security Layer) 3. Set StartVideo device property in order to start the video transmission. 4. Get the video url using Get Device Property. 5. The RT will return the video url. 6. The GS will access to the given url in order to get the video steaming.
Alternative flow (AF)	1a. GS can't connect to the RT. 1. GS will show an error message to the user. 2a. Authentication Error 1. The RT returns an authentication error 2. The GS could retry. 3a. The device doesn't exist in the RT. 1. The RT returns an error. 3b. The device doesn't support this property. 1. The RT returns an error. 6a. The GS can't access to the url. 1. The GS will show an error to the user.
Postcondition	The video steaming will be shown to the user.
Observations	

UC-RTI-010	**Configure RTI Security Layer**
Associated Requirements	RTI-010
Actors	RT User Administrator
Description	Configure the security parameters for a RT.
Main Flow (MF)	1. The Administrator open the RTI Interface. 2. The Administrator configure all the security parameters. 4. The Administrator User restart the RTI software using the RTI GUI.
Alternative flow (AF)	2a. Error in the security parameters 1. RTI GUI will show the error and how to resolve it.
Postcondition	The RTI will use the new security configuration.
Observations	

UC-RTI-011	Configure RTOS
Associated Requirements	RTI-011
Actors	RT User Administrator
Description	Configure all the RTOS Parameters.
Main Flow (MF)	1. The Administrator open the RTI Interface. 2. The Administrator configure all the RTOS Parameters. 3. The RTI will try to connect to RTOS and it will check all the RTOS functionalities. 4. RTI GUI will show all the information about RTOS. 4. The Administrator User restart the RTI software using the RTI GUI.
Alternative flow (AF)	2a. Any parameter is wrong. 1. RTI GUI will show the error and how to resolve it. 3a. There is an error in the RTOS. 1. The RTI GUI will show the error/s and how to resolve it.
Postcondition	The RTI will be connected to the RTOS.
Observations	

UC-RTI-012	Test RTI
Associated Requirements	RTI-012
Actors	RT User Administrator
Description	Test the RTI Configuration.
Main Flow (MF)	1. The Administrator open the RTI Interface. 2. The Administrator will select the Test RTI option. 3. RTI will try to connect to the GS. 4. RTI will try to connect to RTOS and it will check all the devices. 5. The Test report will be shown to the user by RTI GUI.
Alternative flow (AF)	3a. RTI cannot connect to GS. 1. RTI GUI will show the error and how to resolve it. 4a. There is an error trying to connect to RTOS. 1. The RTI GUI will show the error and how to resolve it. 4b. There is error/s with any device/s. 1. The RTI GUI will show all the errors and how to resolve it.
Postcondition	
Observations	

UC-RTI-013	Configure RTI Network Parameters
Associated Requirements	RTI-013

Actors	RT User Administrator
Description	Configure the Network parameters.
Main Flow (MF)	1. The Administrator open the RTI Interface. 2. The Administrator configure all the network Parameters. 3. The RTI will try to connect to GS. 4. RTI GUI will show a confirmation.
Alternative flow (AF)	2a. Any parameter is wrong. 1. RTI GUI will show the error and how to resolve it. 3a. There is an error in the connection. 1. The RTI GUI will show the error and how to resolve it.
Postcondition	The RTI will be connected to the GS.
Observations	

UC-RTI-014	**Show RTI Log**
Associated Requirements	RTI-014
Actors	RT User Administrator
Description	The RTI GUI will show the log.
Main Flow (MF)	1. The Administrator open the RTI Interface. 2. The Administrator select “Show Log” option. 3. The RTI GUI will show all the log.
Alternative flow (AF)	
Postcondition	
Observations	

UC-RTI-015	**RTI Restart**
Associated Requirements	RTI-014
Actors	RT User Administrator
Description	The RTI will restart.
Main Flow (MF)	1. The Administrator open the RTI Interface. 2. The Administrator select “Restart” option. 3. The RTI will notify disconnect from GS. 4. The RTI will disconnect from RTOS. 5. The RTI will connect to GS and notify it. 6. The RTI will connect to RTOS and check all the devices.
Alternative	5a. RTI cannot connect to GS.

flow (AF)	1. RTI GUI will show the error and how to resolve it. 6a. RTI cannot connect to RTOS. 1. RTI GUI will show the error and how to resolve it.
Postcondition	RTI will be connected and online.
Observations	

3.2. Robotic Telescope Controller

REQUIREMENTS

Code	**RTC-001**
Associated Requirements	
Description	There will be one **RTC** for each robotic telescope server (**RTS**).
Business Rules	• BR-1 This robotic telescope controller (**RTC**) will manage the communication with all the robotic telescope devices (**RTD**), its monitoring and control sequences. • BR-2 Although there is only one **RTC**, the implemented control system may be distributed in more than one machine.
Validation Rules	
Observations	

Code	**RTC-002**
Associated Requirements	
Description	To include a telescope device on the server, it must first be registered on the **RTC**.
Business Rules	• BR-1 The registering task must be like a discovering process from the **RTC** point of view. • BR-2 The **RTC** will never be modified to be able to manage a new device or to remove an existing one. • BR-3 All the devices (**RTD**) that wants to be included on the server must have the ability to communicate its characteristics and specific interface. (**TBC**) • BR-4 Although there is only one **RTC**, the implemented control system may be distributed in more than one machine.
Validation Rules	• VR-1 Each of the devices, must have implemented at least a set of predefined commands, specific and mandatory to be a part of the system.
Observations	

Code	**RTC-003**

Associated Requirements	**RTC-001**
Description	Any **user** could retrieve the list of devices registered on the **RTS** and its associated information or description.
Business Rules	
Validation Rules	
Observations	

Code	**RTC-004**
Associated Requirements	
Description	RTC will receive requests from RTI through a unique port. All the requests will be managed concurrently (if possible) and will start a communication to the specific RTD/RTDB or to the scheduler.
Business Rules	
Validation Rules	
Observations	

Code	**RTC-005**
Associated Requirements	
Description	RTC will also receive events and alarms from the RTDs through a unique port. These notifications will be managed and sent to the RTI. In order to receive these notifications, the RTC has to be previously registered.
Business Rules	
Validation Rules	
Observations	

Code	**RTC-006**
Associated Requirements	

Description	RTC will include a scheduler to program tasks to the devices.
Business Rules	
Validation Rules	
Observations	

USE CASES

UC-RTC-001	**Get the device list**
Associated Requirements	**RTC-003**
Actors	**USER**
Description	A user in GS ask for the device list of a RTS
Main Flow (MF)	1. GS connects to a RTS via RTI 2. RT-GS Authentication (Security Layer) 3. GS request the device list 4. RTC connects to the RTDs and retrieve the device list. 5. RTC send to GS via RTI the device list
Alternative flow (AF)	1a. GS can't connect to the RT. 1. GS will show an error message to the user. 2a. Authentication Error 1. The RT returns an authentication error 2. The GS could retry. 3a. RTC can't connect to RTDs 1. Notification to GS 2. GS will show an error message to the user.
Postcondition	
Observations	

3.3. Robotic Telescope Devices

REQUIREMENTS

Code	**RTD-001**
Associated Requirements	
Description	Any robotic telescope device (**RTD**) must implement a predefined set of interface commands.
Business Rules	
Validation Rules	
Observations	

Code	**RTD-002**
Associated Requirements	
Description	Any robotic telescope device (**RTD**) must belong to a predefined type of device (**TBD**).
Business Rules	• BR-1 The system provides a specific set of device categories. • BR-2 Each type of device imposes another additional set of operations that the interface device must meet (**TBD**).
Validation Rules	
Observations	

Code	**RTD-003**
Associated Requirements	
Description	Any robotic telescope device (**RTD**) must implement a predefined set of interface commands.
Business Rules	
Validation Rules	
Observations	

Code	RTD-004
Associated Requirements	
Description	RTD will receive requests from RTC through a unique Low Level Protocol (LLP) port.
Business Rules	
Validation Rules	
Observations	

Code	RTD-005
Associated Requirements	
Description	RTD will notify events and alarms to the RTC. This notification will be made if RTC has previously registered to receive this kind of event/alarm.
Business Rules	
Validation Rules	
Observations	

USE CASES

UC-RTD-001	Requests from RTC
Associated Requirements	RTD-004
Actors	RTC
Description	A request is made by RTC
Main Flow (MF)	1. RTC connects to RTD 2. RTC make a request to RTD 3. RTD recovers the information 4. RTD sends the information back to RTC
Alternative flow (AF)	1a. RTC can't connect to the RTD. 1. If request has been made due to a RTI-RTC communication, the error is transmitted to the RTI.

Postcondition	
Observations	

UC-RTD-001	**Events and alarms notification**
Associated Requirements	**RTD-005**
Actors	**RTC**
Description	The events and alarms are sent to the RTC
Main Flow (MF)	1. RTD connects to RTC 2. RTD sends the event or alarm
Alternative flow (AF)	
Postcondition	
Observations	

4. GLORIA intranet

REQUIREMENTS

Code	**INTRA-001**
Associated Requirements	
Description	Any **Intranet user** will be able to register itself in the **Intranet**.
Business Rules	• BR.1 Any **Intranet user** could access to **Intranet**, using an alias and password given. • BR-2 The alias and the e-mail must be unique in the system. • BR-3 The **Intranet user** must introduce the alias and the email as mandatory fields. • BR-4 The system sends a password to her/his e-mail account and the registration must be confirmed through an email. • BR-5 When the **Intranet user** enters the first time, he/she will have to accept the terms and conditions of using GLORIA and set the a new password.
Validation Rules	• VR-1 Password must be at least 8 characters. • VR-2 Password must contain at least one one lower case letter, one upper case letter, one digit and one special character • VR-3 When changing the password the user can't use the (n) previous passwords.
Observ.	Valid special characters are - @#$%^&+=

Code	**INTRA-002**
Associated Requirements	
Description	**Intranet** must be hidden to public user and not reachable by any web crawlers (bots, robots, spiders...).
Business Rules	• BR-1 Users that are not **Intranet user**s are not allowed to register, login, or even see the Intranet. • BR-2 The **Intranet** will be accessible through Internet, but the system will be hidden for regular Internet Users and web crawlers
Validation Rules	
Observ.	This can be done 2 ways: 1.- Using a alias/password share by all the team members to access to a private area in the server, where the website will be accessible.(this will be the default, until a decision is taken) 2.- Avoiding bots, robots, spiders,.. by the robots.txt file configuration. This solution

	will avoid to be indexed in search engines, but anybody who knows the URL will access the website. Even this way, non authorized user won't be able to access the private area of the web site, due to the registration of a new user account, is checked by the administrator before it becomes active a usable.

Code	**INTRA-003**
Associated Requirements	
Description	**Intranet** will be meant to be a communication tool between **Intranet users**, using forums.
Business Rules	• BR-1 The Intranet user of the portal will be the same for the forum. The CMS and the FORUM will be integrated between them. • BR-2 Intranet user will be capable of subscribe any category or thread so they will be notified by email of any update in them. • BR-3 Intranet user will be capable of update them profile in the forum. • BR-4 Intranet user will be capable of create new threads. • BR-5 Intranet user will NOT be capable of create new categories. • BR-6 Intranet user will NOT be capable of delete own posts.
Validation Rules	
Observ.	Possible candidate for this solution could be Kunena Forum.

Code	**INTRA-004**
Associated Requirements	
Description	**Intranet** will be storage of files for sharing between **Intranet user**, using a files container.
Business Rules	• BR-1.- The system will create a document repository • BR-2.- A search engine will be accessible for user in order to search for a document. • BR-3.- Files will be uploaded through a web interface • BR-4.- Main file extensions will be allowed to be uploaded (zip, rar, odt, pdf, txt, gif, jpg, png, doc, xls, rtf, ppt, pps)
Validation Rules	
Observ.	It will be implemented with the component JDownloads.

Code	**INTRA-005**
Associated	INTRA-001

Requirements	
Description	An **Intranet user** could update his profile, with the chance to modify the following information: full name, avatar, location, etc. Alias and e-mail can not be changed.
Business Rules	
Validation Rules	
Observ.	

Code	**INTRA-006**
Associated Requirements	**USRMGT-001**
Description	An **Intranet user** can log into the **intranet** indicating the e-mail and the password of its account. If its data are correct, the user will access to the **intranet**.
Business Rules	
Validation Rules	
Observations	-

Code	**INTRA-007**
Associated Requirements	
Description	**Intranet** will notify each user about next events and deliverable that are close to be closed.
Business Rules	• BR-1.- A calendar will be accessible to include/import it in most popular calendar clients. • BR-2.- The calendar will NOT be updatable by users. It will be only read mode.
Validation Rules	
Observ.	This could be implemented through the Gmail calendar

USE CASES

UC-INTRA-001	**Update user profile**

Associated Requirements	**INTRA-005**
Actors	User (member of GLORIA)
Description	Update personal user information
Main Flow (MF)	1. The system shows a form with the information 2. The user modifies the information 3. The system stores the new information
Alternative flow (AF1)	2a. The user doesn't change the information
Alternative flow (AF2)	3a. The system doesn't store the information 1. Operation aborted
Postcondition	The personal user information is changed
Observations	Information: full name, avatar, location, password and language.

UC-INTRA-002	**Register**
Associated Requirements	**INTRA-001**
Actors	User
Description	User registers itself in the site
Main Flow (MF)	1. The system shows a form to fill in 2. The user fills in the form with its data 3. The system validates the data 4. The system stores the new information 5. Email is sent to user 6. User replies to the email to confirm the registration 7. The administrator receives a notification to approve or decline the registration
Alternative flow (AF1)	3a. Some of the data is not valid 1. Asking again for the correct data
Alternative flow (AF2)	4a. The system doesn't store the information 1. Operation aborted
Postcondition	The user is registered
Observations	

UC-INTRA-003	**Post in forum**
Associated Requirements	**INTRA-003**

Actors	User (GLORIA member)
Description	User replies in a thread in the forum
Main Flow (MF)	1. The system shows a form to fill in 2. The user fills in the form with its data 3. The system validates the data 4. The system stores the new information 5. New post is shown in the thread 6. Email is sent to all subscribed users to the category or thread
Alternative flow (AF1)	3a. Some of the data is not valid 1. Asking again for the correct data
Alternative flow (AF2)	4a. The system doesn't store the information 1. Operation aborted
Postcondition	The post is published in the forum
Observations	

UC-INTRA-004	**Create a thread in forum**
Associated Requirements	**INTRA-003**
Actors	User (GLORIA member)
Description	User creates a thread in the forum
Main Flow (MF)	1. The system shows a form to fill in 2. The user fills in the form with its data 3. The system validates the data 4. The system stores the new information 5. New thread is shown in the category 6. Email is sent to all subscribed users to the category
Alternative flow (AF1)	3a. Some of the data is not valid 1. Asking again for the correct data
Alternative flow (AF2)	4a. The system doesn't store the information 1. Operation aborted
Postcondition	The post is published in the forum
Observations	

UC-INTRA-005	**Upload a file to the document repository**
Associated Requirements	**INTRA-004**
Actors	User (GLORIA member)

Description	User uploads a file/document to the system
Main Flow (MF)	1. The system shows a form to fill in 2. The user fills in the form with its data 3. The system validates the data 4. The system stores the new information and file 5. New file/document its shown in the category, available to be downloaded
Alternative flow (AF1)	3a. Some of the data is not valid 1. Asking again for the correct data
Alternative flow (AF2)	4a. The system doesn't store the information 1. Operation aborted
Postcondition	The file/document is available to all GLORIA members to be downloaded
Observations	

5. Non-functional Requirements

REQUIREMENTS

Code	**NFR-001**
Associated Requirement	-
Description	Multi-language Capability. The web interfaces must be translated at least into the languages of the **GLORIA Consortium**: English (default language), Spanish, Italian, Polish, Czech, Russian, and also into the languages of the **DISCOSMOS Consortium**.
Business Rules	• BR-1 Any user can select the language in which wants to watch the website.
Validation Rules	-
Observations	

GLORIA Partners

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CZECH REPUBLIC

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