



EGI-Engage

Operational tools development roadmap revised

M3.3

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Abstract

This document revises the development plans of the EGI operational tools foreseen until the end of the EGI-Engage project. The EGI tools discussed in this document are components of the EGI Core Infrastructure platform, which enables the federation of High Throughput Computing and Cloud services worldwide. Through these tools the *e-Infrastructure Commons* is made possible: the EGI Core Infrastructure platform is the foundation layer of the distributed model of EGI.

The technical development of the EGI e-Infrastructure Commons services is user-driven to satisfy the needs of research communities, the Research Infrastructures contributing to EGI-Engage via the EGI Competence Centres and the Resource Providers who contribute infrastructure services to the federation. The development plan will ensure interoperability with other e-Infrastructures and research infrastructures. The development roadmap presented in this document has been updated according to the requirements collected during the first year of the project.



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TERMINOLOGY

A complete project glossary is provided at the following page: <http://www.egi.eu/about/glossary/>

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Executive summary

This document revises the development plans of the EGI operational tools until the end of the EGI-Engage project. The whole set of EGI tools is a substantial part of the *e-Infrastructure Commons*, an ecosystem of services that constitute the foundation layer of any distributed e-Infrastructure. The e-Infrastructure Commons is one of the three pillars of the *Open Science Commons* vision, where researchers from all disciplines have easy and open access to the innovative digital services, data, knowledge and expertise they need for collaborative and excellent research.

The e-Infrastructure common services evolution is coordinated by the Work Package 3, which is organised in five tasks covering the following themes:

- WP3.1: Authentication and Authorisation Infrastructure;
- WP3.2: Service Registry and Marketplace;
- WP3.3: Accounting (repository & portal);
- WP3.4: Operations Tools (Operations portal, GOCD, Monitoring, Messaging Infrastructure and Security Monitoring);
- WP3.5: Resource Allocation – e-GRANT.

The technical development of the EGI e-Infrastructure Commons services is user-driven to satisfy the needs of research communities, the Research Infrastructures contributing to EGI-Engage via the EGI Competence Centres and the Resource Providers who contribute infrastructure services to the federation. The development plan ensures interoperability with other e-Infrastructures and research infrastructures.

The development roadmap presented in this document has been updated according to the requirements collected during the first year of the project from all the relevant stakeholders: scientific communities, EGI-Engage competence centres, research infrastructures, NGIs, resource providers, technology providers and European Policy boards as e-IRG.

1 Introduction

The document is organised as follows.

Section 2 describes the open process for requirements gathering adopted to define the development roadmap. Furthermore, it is depicted a well-defined procedure to periodically revise this roadmap, according to the new user needs that will be collected and identified during the project lifetime.

Sections 3 to 7 outline the development plans for each tool in the e-Infrastructure commons. Each section includes the done, on-going and planned activities for one of the above listed WP3 tasks. Changes with respect to the original development roadmap have been highlighted and justified. The roadmap is also available in the WP3 wiki page¹.

A summary of the document is available in Section 8.

¹ <https://wiki.egi.eu/wiki/EGI-Engage:WP3>

2 Operations tools development roadmap definition

The development roadmap presented in this document has been defined and updated by taking into account the requirements collected from different actors, including scientific communities, EGI-Engage competence centres, research infrastructures, NGIs, resource providers, technology providers and European Policy boards as e-IRG. The planned activities will allow us to extend the current capabilities of the existing EGI core infrastructure services and adapt them to the needs of new user communities and research infrastructures, and to ensure interoperability according to the EGI-Engage Objective 3 (O3) - *Offer and expand an e-Infrastructure Commons solution*.

The requirement gathering process has been accomplished in collaboration with the other EGI-Engage WPs, which are in charge of the communication with users and key stakeholders. WP2/NA2 is exploring business models and policies to enable access to services via pay-for-use, along with the more traditional resource procurement processes. This activity within the project will source new requirements for the support pay-for-use access. Furthermore, closely linked to this activity, NA2 is developing the Marketplace concept that is being implemented in WP3/JRA1. WP4/JRA2 is taking care of the technical infrastructure of EGI by expanding the capabilities of the current platforms, and by integrating new ones. The development roadmap of the EGI tools includes activities to extend their capabilities to support the new technology introduced by WP4/JRA2 in the EGI infrastructure. WP5/SA1 is another source of requirements for the tool development roadmap; in particular the EGI Operations team, NGIs and Resource Provider needs

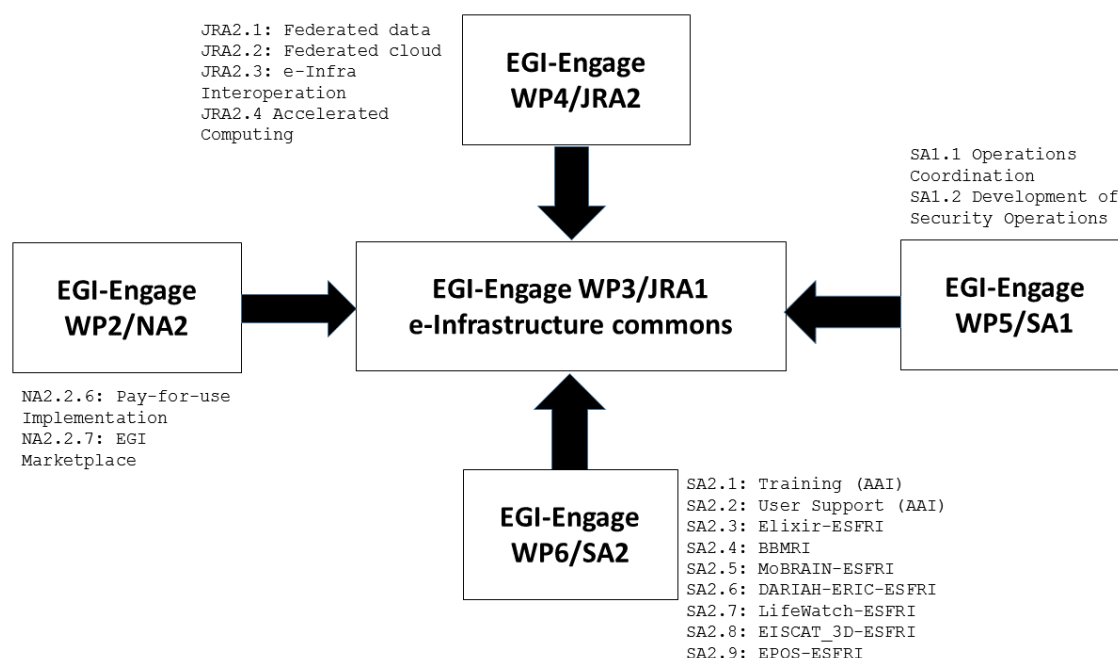


Figure 1. e-Infrastructure commons requirement gathering process in EGI-Engage.

are collected by this activity. Finally, the requirements from the eight EGI-Engage competence centres and, in general, from the EGI users are gathered in WP6/SA2, which coordinates the provisioning of services for scientific communities. The communication channel with WP6/SA2 is of critical importance in order to successfully identify the most relevant e-Infrastructure Commons requirements for users.

Figure 1, above, shows the e-Infrastructure Commons requirement-gathering process involving other WPs in the project.

Before the development roadmap definition, all the requirements have been prioritised during the WP3 meetings and in tool-specific Operations Tools Advisory Groups (OTAGs)² to ensure full participation of the user groups in the process. To date, OTAGs have been established for three WP3 tools: Operations Portal, Accounting Portal and e-Grant. New OTAGs will be (re)created if the number of requirements to be prioritised will require this.

However, the requirement-gathering process will continuously run during the whole project lifetime and beyond. The development roadmap herein described comprises actions, specific for activities, to collect input from the various stakeholders. Furthermore, a procedure for periodically updating the roadmap has been defined to ensure continual service improvement and has, already, been applied during the first year of the project.

The e-Infrastructure commons development roadmap is updated during the project lifetime according to the requirements gathered through the identified communication channels involving both internal and external stakeholder groups through a procedure agreed with the product teams.

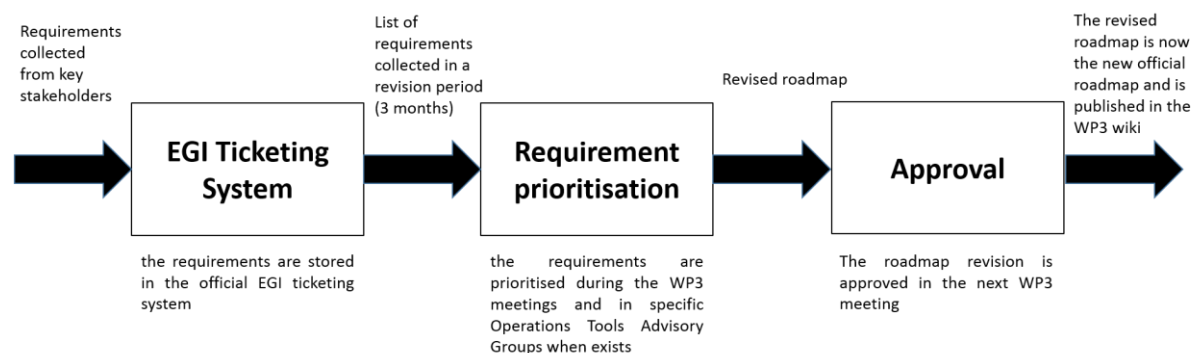


Figure 2. Procedure to update the development roadmap for a tool.

² The OTAG mandate is to help developers in requirement prioritization and releasing process of operational tools. OTAG provide forums to discuss the tools evolution that meet the expressed needs of the EGI community. It has representation from the all end users groups depending on the tool.

The process is necessary to ensure innovation management within the project and specifically to allow the project to swiftly address new emerging needs and update the activity plans accordingly. The procedure is described below.

The WP3 development roadmap is revised when a certain number of relevant requirements is collected or by explicit request of a product team, the relevant OTAG or the work-package manager:

- each product team collects the requirements for its tool between two revisions. All the requirements should be stored in the EGI ticket system³;
- the requirements are prioritised during the WP3 periodic meetings and in specific Operations Tools Advisory Groups;
- after the priority for each requirement has been agreed, each product team defines a roadmap revision which is presented it in the next WP3 meeting for approval;
- the approved roadmap revision is published in the WP3 wiki pages.

³ <https://rt.egi.eu/rt/index.html>

3 Authentication and authorization infrastructure

TJRA1.1 – The Authentication and Authorization infrastructure is exploring how to integrate suggested AA methods with current middleware and community services, guaranteeing a sufficient Level of Assurance, and supporting the use of credentials issued by other infrastructures and services (e.g. eduGAIN). TJRA1.1 will:

- enable users to access the EGI Federated Services (web and non-web);
- enable Scientific Communities and the Long Tail of Science to organize themselves and collaborate on top of the EGI infrastructure;
- allow seamless access to and from other e-Infrastructures through interoperable services
- work together with AARC, eduGAIN and Identity Federations in order to maximize the number of IdPs “connected” to the EGI platform.

Task JRA1.1 started its activity in May 2015 focussing on collecting requirements from EGI users and key stakeholders, in order to understand their short-term and medium-term requirements, and establishing relationships with AARC, GN4, EUDAT2020 and PRACE, with the aim to work together towards an interoperable AAI. The outcome of this process has been a list of core requirements that drove the design of new EGI AAI (1.1, 1.2).

By the end of the first year of the JRA1.1 activity in the EGI-Engage project, the EGI AAI is fully functional in terms of core features and EGI has started on-boarding scientific communities. The first pilot with the ELIXIR competence centre (SA2.3) has been successfully completed and coordination with SA2.2 (Training & User support) has been settled to support other competence centres. The recent introduction of the pilot CILogon service enables all users to access even the legacy non-web EGI Services through the EGI AAI (1.3, 1.4).

By the end of Q2 2016, it is expected that the EGI AAI will join eduGAIN⁴ as Service Provider supporting the GÉANT Data Protection Code of Conduct and the REFEDS⁵ Research & Scholarship entity category. In parallel, we will broaden our collaboration with the EGI Competence Centres in order to connect them to the EGI AAI. This is an interactive process, which allows us to shape the EGI AAI exactly to the needs of our customer base (1.5).

Later this year, we will continue with the second phase of the pilot, by the end of which we expect to have all the EGI scientific communities on-board the EGI AAI. In addition, we will be introducing the new OpenID Connect⁶ interface, which will enable us to introduce new services to the EGI platform in a faster and friendlier way. Finally, we will depict the architecture and solution to move into production the new EGI AAI services (1.6).

⁴ <http://services.geant.net/edugain/Pages/Home.aspx>

⁵ <https://refeds.org/>

⁶ <http://openid.net/connect/>

During the third year of the project, JRA1.1 will focus its effort on final reporting (1.7) and on refinements of the architecture (1.8).

Table 1 - Authentication and authorisation infrastructure roadmap

Task Number	Task	Start Date (MM/YY)	Release Date (MM/YY)	Status ⁷	Dependencies From other tasks
1.1	Identification of and liaison with stakeholders: <ul style="list-style-type: none"> • WP3 F2F and EGI Conference • Liaise with AARC • Connections with GN4, EUDAT2020 and PRACE • Identification of Tools 	05/15	06/15	Done	
1.2	Requirements capturing: <ul style="list-style-type: none"> • Use FIM4R as the starting point • Align with AARC DJRA1.1 • Identify the most important use cases (EGI-Engage CCs) • Technical guidelines for enabling federated access in an initial set of tools (GOCD, Monitoring and Accounting) 	05/15	08/15	Done	1.1
1.3	Technical architecture and pilot implementation - Phase 1: <ul style="list-style-type: none"> • Identify which AA services are needed • Collaboration with the AAI pilot and the user 	09/15	12/15	Done	1.2

⁷ Status can be Done, Ongoing, Planned or Postponed:

- Done: task successfully completed
- Ongoing: task already started but not completed yet
- Planned: task is scheduled but not started yet
- Postponed: task has been postponed with respect the previous version of the development roadmap. New "Start Date" and "Foreseen Date" are showed in the table.

	<p>portal activity for the LTOS</p> <ul style="list-style-type: none"> • Pilot: Connection of the first set of EGI tools to the EGI IdP proxy 				
1.4	<p>Technical architecture and pilot implementation - Phase 2:</p> <ul style="list-style-type: none"> • Expansion to EGI Tools and selected CCs • Interaction with SA2.1 and SA2.2 (Training & User support) 	01/16	04/16	Done	1.3
1.5	<p>Technical architecture and pilot implementation - Phase 3:</p> <ul style="list-style-type: none"> • Technology reassessment • EGI AAI will join eduGAIN as Service Provider • Pilot services and best practices to enable federated AAI solutions released 	05/16	07/16	On going	1.4
1.6	<p>Technical architecture and pilot implementation - Phase 4:</p> <ul style="list-style-type: none"> • Pilot services and best practices to enable federated AAI solutions released • OpenID Connect interface towards EGI service providers • Architecture and solution for the production EGI AAI services. 	07/16	02/17	Planned	1.5
1.7	<p>Identity Management for Distributed User Communities report</p>	02/17	02/17	Planned	1.6

1.8	Refinements to the architecture and pilot wrap-up	03/17	08/17	Planned	1.6, 1.7
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4 Service registry and marketplace

Sharing and discovering research resources (instruments, computing, software, data, etc.) and services (consulting, sample preparation, etc.) is essential for helping researchers to be competitive. It is envisioned this can be done by developing a “marketplace” concept where free and paid resources can be listed and discovered. The goal of this activity is to put together a marketplace concept and demonstrate the ideas via a proof-of-concept (POC). This will be done with the involvement of the relevant stakeholders and demonstrated via real cases, which will be used to develop the POC.

The service registry and marketplace roadmap has been changed with respect to the original plans to take into account needs that emerged during the first year of the project. Actions related to the assessment of the technologies to implement the demonstrators have been added (2.5 and 2.7) and some actions were postponed (2.10 and 2.11).

At this stage, all the preparatory actions and the first design of the demonstrator have been completed (2.1, 2.2, 2.3, 2.4, 2.5, 2.6).

As an outcome of the assessment of the technologies to implement the EGI Service Registry and Marketplace (2.5), OpenIRIS has been identified as the most promising solution to implement the EGI marketplace demonstrator. According to this conclusion, the EGI marketplace technical architecture has been based (2.6) on OpenIRIS and short-term development roadmap has been defined (2.8, 2.9, 2.10, 2.11), to release the demonstrator in August 2016 (2.12). Anyway, it is necessary to further analyse the tool and discuss with the Swiss NGI about the sustainability of the solution (2.7). In addition, EGI should deal with FMI (Friedrich Miescher Institute for Biomedical Research, the service provider) to arrange a service agreement that could satisfy the peculiar requirements of an European e-infrastructure (2.12).

After the release of the demonstrator, an analysis of specific cloud marketplace enablement tools such as AppCara, App Marketplace, Juju, Alien4Cloud and Cloudfify will be done to understand if they could be integrated within the marketplace (2.13).

In parallel with the technical implementation of the demonstrator, the analysis and development of a legal, policy and business framework for a marketplace capability will continue within the task NA2.2. In this context, the activity to define the term of reference to publish service into the tool has been planned (2.14). Indeed, EGI has to guarantee that services advertised via its marketplace guarantee an adequate quality of service satisfying the defined requirements.

A second release of the EGI Service Registry and Prototype is planned for April 2017 (2.15) and a final report on this activity for the end of the project (2.16).

Table 2 - Service registry and marketplace

Task Number	Task	Start Date (MM/YY)	Release Date (MM/YY)	Status	Dependencies From other tasks
2.1	Stakeholder involvement <ul style="list-style-type: none"> • Involvement with Engage participants • EGI Lisbon conference session 	04/15	08/15	Done	
2.2	Marketplace strategy <ul style="list-style-type: none"> • Collaboration with FHNW on paper 	04/15	07/15	Done	
2.3	Update EGI business development strategy <ul style="list-style-type: none"> • Discussions with EGI strategy team • Discussions with potential business partners 	04/15	07/15	Done	
2.4	Identify/collect EGI services <ul style="list-style-type: none"> • Task assigned within the JRA1.2 team 	05/15	07/15	Done	
2.5	Assessment of the technologies to implement the EGI Service Registry and Marketplace	09/15	02/16	Done	
2.6	Design of the EGI Service Registry and Marketplace <ul style="list-style-type: none"> • Outcome of discussion with stakeholders and JRA 1.2 participants 	05/15	02/16	Done	2.1, 2.2, 2.3, 2.4
2.7	Second phase evaluation of the technologies: <ul style="list-style-type: none"> • terms of use • compliance to EGI and 	02/16	07/16	On going	2.5, 2.6

	<p>EU policies and regulations</p> <ul style="list-style-type: none"> • trial of a live instance of Open IRIS • evaluation of costs of ownership, development, operations and support. 				
2.8	Design and development of the public facing marketplace.	02/16	08/16	On going	2.5, 2.6, 2.7
2.9	<p>Define technical integration with the EGI core platform</p> <ul style="list-style-type: none"> • EGI AAI • Operational Tools (e.g. service registry and AppDB) 	02/16	08/16	On going	2.5, 2.6, 2.7
2.10	<p>Populate service catalogue</p> <ul style="list-style-type: none"> • Tasks assigned to JRA 1.2 participants to gather information 	08/15 07/16	04/16 09/16 ⁸	Postponed	2.6, 2.7, 2.8
2.11	<p>Integrate service catalogue to EGI web site</p> <ul style="list-style-type: none"> • Tasks assigned to JRA 1.2 participants to gather information 	10/15 09/16	04/16 02/17	Postponed	2.6
2.12	<p>First release of the EGI Service Registry and Prototype</p> <ul style="list-style-type: none"> • Leveraging existing tools for prototype 	03/16	08/16	On going	2.6, 2.7, 2.8, 2.9
2.13	Analysis of specific cloud marketplace enablement tools such as AppCara, App Marketplace, Juju, Alien4Cloud and Cloudify.	09/16	04/17	Planned	2.12

⁸ A higher priority has been assigned to this task to be completed in a shorter time and reduce the delay. This statement is valid also for other postponed tasks which duration has been decreased.

2.14	Define the term of reference to publish services into the EGI Service Registry and Marketplace (in collaboration with NA2.2)	09/16	04/17	Planned	2.12
2.15	Second release of the EGI Service Registry and Prototype <ul style="list-style-type: none"> Refine based on feedback from first release 	08/16	04/17	Planned	2.12, 2.13, 2.14
2.16	Final report on EGI Service Registry and Marketplace <ul style="list-style-type: none"> To be done collectively by participants in JRA 1.2 	06/17	06/17	Planned	2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10, 2.11, 2.12, 2.13, 2.14, 2.15

5 Accounting

The target of this task is the evolution of the EGI accounting system. Its main components are the Accounting Repository and the Accounting Portal. The development guidelines will be:

- Evolve the accounting system to be able to manage larger volumes of data: the accounting team will investigate techniques to manage huge amounts of data, such as Apache Hadoop or Cassandra;
- Add support for data set usage accounting to record who accesses data, how often, how much is transferred, and where to;
- Extend the current accounting measurements:
 - Cloud accounting: the current system will be extended adding features to normalise the CPU usage on different kinds of cloud resources and to account for the usage of the cloud storages supported in the EGI Federated Cloud;
 - Storage accounting: the number of the supported storage systems will be increased;
 - GPU accounting: increase the number of systems supported;
- Improve the portal, designing new and easier ways to access and visualise data for the end users;
- Develop unified views in the portal for different kinds of resources (e.g. CPU usage for grid and cloud resources);
- Create new views to show the new types of data available in the accounting repository (e.g. data set usage accounting);
- Expose an API allowing third parties to gather accounting data from the system;
- Create new views of the Accounting Portal adapted to the particular needs of user communities.

This task will collaborate with the OGF Usage Record Working Group, in particular to agree a schema for a data usage record. Moreover, support for the OGF standard UR2 will be improved.

5.1 Accounting Repository

APEL is an accounting tool that collects accounting data from sites participating in the EGI and WLCG infrastructures as well as from sites belonging to other Grid organisations that are collaborating with EGI, including OSG, NorduGrid and INFN.

The accounting information is gathered from different sensors into a central Accounting Repository where it is processed to generate statistical summaries that are available through the EGI Accounting Portal.

Statistics are available for view in different detail by Users, VO Managers, Site Administrators and anonymous users according to well-defined access rights.

The main target of this task is the evolution of the EGI accounting system. The development themes identified are:

- re-design the accounting repository to be ready to manage increasing volumes of data with lower latency;
- create more generic parsers to enable faster integration of other accounting data sources;
- including new types of accounting measurement (e.g. data set usage accounting) and extend the current ones (e.g. cloud (3.1.1, 3.1.3) and storage (3.1.2, 3.1.6, 3.1.10));

The re-design of the accounting repository to manage large volumes of data started with an analysis of the tools available (3.1.11). Following this, the tools analysed will be tested to see which one is most suitable for application to the Accounting Repository while allowing for greater throughput and lower latency (3.1.12).

The creation of more generic parsers will run in three development cycles (3.1.4, 3.1.7, 3.1.13) where a new parser will be developed in each. A parser for the ARC batch system to increase the number of batch systems supported, an 'XML' parser which will allow input from a standard XML format, and an 'SQL' parser which will allow extraction of data directly from a client database.

Data set usage accounting will be developed over three development cycles. An initial proof of concept has been developed based on a user questionnaire and interviews (3.1.5). Currently, a set of minimum requirements is being defined to create an initial prototype (3.1.9). This will allow us to report on the design of the data accounting system (3.1.14) and implement this by the end of the project (3.1.15).

Table 3 - Accounting repository

Task Number	Task	Start Date (MM/YY)	Release Date (MM/YY)	Status	Dependencies From other tasks
3.1.1	Cloud Accounting: Usage Record V0.4 (Benchmarks etc.)	03/15	07/16	On going	3.1.3
3.1.2	Storage Accounting: Contact sites and test of the current solution	03/15	10/15	Done	
3.1.3	Cloud Accounting: Long running VMs	03/15	07/16	On going	
3.1.4	ARC Parser	04/15	07/16	On going	
3.1.5	Data Accounting: proof of concept	06/15	01/16	Done	
3.1.6	Storage Accounting: Usage Record V2.0	07/15 07/16	02/16 10/16	Postponed	3.1.2
3.1.7	XML Parser	12/15	07/16	Postponed	

		07/16	11/16		
3.1.8	D3.3: Accounting Repository Release	02/16	02/16	Done	3.1.2, 3.1.5
3.1.9	Data Accounting: minimal requirements implemented	02/16	09/16	On going	3.1.5
3.1.10	Storage Accounting: support new storage systems	03/16 09/16	10/16 02/17	Postponed	3.1.6
3.1.11	D3.6: Analysis on techniques to manage big data on the EGI accounting system	02/16	02/16	Done	
3.1.12	Investigating Big Data tools to improve accounting repository	07/16	02/17	Planned	3.1.11
3.1.13	SQL Parser	08/16	03/17	Planned	
3.1.14	D3.8: First data accounting prototype	10/16	10/16	Planned	3.1.9
3.1.15	Data Accounting: production requirements	10/16	05/17	Planned	3.1.14
3.1.16	GPGPU Accounting	10/16	05/17	Planned	
3.1.17	Support AAI evolution	01/17	08/17	Planned	
3.1.18	D3.12: Second release of the Accounting Repository	02/17	02/17	Planned	3.1.1, 3.1.4, 3.1.6, 3.1.8, 3.1.9, 3.1.10, 3.1.12, 3.1.14
3.1.19	D3.13: Report on Data Accounting	02/17	02/17	Planned	3.1.15
3.1.20	D3.15: Second data accounting prototype	06/17	06/17	Planned	3.1.15
3.1.21	D3.17: Final release of the Accounting Repository	08/17	08/17	Planned	3.1.13, 3.1.15, 3.1.16, 3.1.17, 3.1.18

5.2 Accounting Portal

The EGI Accounting Portal receives data from APEL and ultimately from sites participating in the EGI and WLCG infrastructures as well as from sites belonging to other Grid organisations that are collaborating with EGI. This is crossed with metadata from other sources to offer an integrated view of accounting data on the EGI Infrastructure.

We have arrived at the first release of the new Portal, which is in production since 05/16 including the covered tasks and a great number of additional requirements collected by EGI RT and several meetings (3.2.1, 3.2.2, 3.2.3, 3.2.4, 3.2.7).

Other two releases are foreseen by the end of the project. The second release (3.2.11) will include a complete API to get accounting data directly from the accounting portal (3.2.8) and data in maps for a graphical distribution of the information (3.2.9). The third release (3.2.15) will comprise analytics to extract intelligence operation from the data (3.2.10) and the support for Data Accounting (3.2.12), GPGPU Accounting (3.2.13) and Big Data tools (3.2.14).

Furthermore, users' requirement will be continuously collected to refine the new portal according to their needs.

Table 4 - Accounting portal

Task Number	Task	Start Date (MM/YY)	Release Date (MM/YY)	Status	Dependencies From other tasks
3.2.1	Requirements collection	03/15	08/15	Done	
3.2.2	D3.1: Technical design of the new Accounting Portal and implementation plan	03/15	08/15	Done	3.2.1
3.2.3	Modernize the accounting Portal with the adoption of technologies easier to maintain	06/15	01/16	Done	3.2.1
3.2.4	Simplify access to some basic functionality. Avoid the use of complex forms for common statistics and get accounting information for some common queries	07/15	04/16	Done	
3.2.5	Support Cloud Usage Record V0.4 and accounting of long running VMs	07/15	04/16	On going	3.1.1, 3.1.3
3.2.6	EGI Federated AAI Integration	04/16 10/16	04/16 02/17	Postponed	1.5
3.2.7	D3.5: First release of the new Accounting Portal deployed in production	04/16	04/16	Done	3.2.2, 3.2.3, 3.2.4, 3.2.5
3.2.8	Define a complete API to get accounting data directly from the accounting portal	05/16	12/16	Planned	

3.2.9	Integrate data in maps for a graphical distribution of the information	07/16	01/17	Planned	
3.2.10	Integrate analytics to extract intelligence operation from the data	08/16	05/17	Planned	
3.2.11	D3.10: Second release of the new Accounting Portal deployed in production	02/17	02/17	Planned	3.2.7, 3.2.8, 3.2.9, 3.2.10
3.2.12	Support Data Accounting	01/17	08/17	Planned	3.1.5, 3.1.8, 3.1.9, 3.1.15, 3.1.18
3.2.13	Support GPGPU Accounting	01/17	08/17	Planned	3.1.16, 3.1.18
3.2.14	Support Big Data tools	01/17	08/17	Planned	3.1.12, 3.1.18
3.2.15	D3.19: Final release of the new Accounting Portal deployed in production	08/17	08/17	Planned	3.2.11, 3.2.12, 3.2.13, 3.2.14

6 Operations tools

The evolution of the EGI operational tools has been driven by the need to support new technologies (e.g. cloud) and to satisfy new requirements emerging from service providers and user communities, in particular from the Research Infrastructures contributing to EGI-Engage via the EGI Competence Centres and the Resource Providers (RP) who contribute infrastructure services to the federation. The development roadmap has been defined according to a requirement gathering process, which has been accomplished in collaboration with the other EGI Engage WPs in charge of the communication with users and key stakeholders.

6.1 Operations portal

The EGI Operations Portal is developed and hosted into the IN2P3 Computing Centre since November 2004. This service is used by different actors of the EGI area: regional operators, regional managers, resource centre administrators, virtual community managers or any end users linked to this infrastructure.

The main features provided by the Operations Portal are:

- registration / update / consultation of the virtual community information;
- communication tools to contact and inform the different actors of the project;
- the access of multiple information sources on synoptic views (dashboards);
- the tracking and follow-up of operational/security problems detected on the resource centres;
- metrics and indicators related to the user distribution or the VO disciplines.

The Operations Portal features have been broadened with the integration of the VO Administration and operations PORTal (VAPOR), which now supports cloud technology and has been extended with a GLUE2 based resource browser (4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.1.5, 4.1.9, 4.1.10). Further information has been added to the VO ID card and proper interfaces are available to retrieve the data stored in the portal (4.1.15, 4.1.16).

A new module has been developed in order to provide metrics for the EGI reports (4.1.14).

For the coming year the aim is to extend VAPOR by adding key features of Gstat (4.1.7). Then we will work on the integration of Cloud monitoring information. This part will be dependent from the progress of the monitoring group and the possibilities offered by the current technologies (tasks 4.1.11, 4.1.12 and 4.1.13).

In parallel, we will work on the integration of the Operations Portal into the AAI ecosystem and the use of Perun as alternative solution to the VOMS servers (4.1.17, 4.1.18).

Table 5 - Operations portal

Task Number	Task	Start Date (MM/YY)	Release Date (MM/YY)	Status	Dependencies From other tasks
4.1.1	LavUpgrade Upgrade Vapor configuration for lavoisier	05/15	02/16	Done	
4.1.2	LavGlue Replace Glue1.3 queries by Glue 2	05/15	02/16	Done	4.1.1
4.1.3	LavCloud Capture Cloud Resources in Lavoisier	06/15	02/16	Done	
4.1.4	RBExtension Extend the resource browser to cloud resources	06/15	02/16	Done	4.1.3
4.1.5	VaporExtension Extend Vapor views to cloud resources	06/15	02/16	Done	4.1.3
4.1.6	DashboardExtension Extend dashboard views to cloud resources	10/15	02/16	Done	4.1.3
4.1.7	ReplaceGstat Replace Gstat Main Features	11/15	02/17	On going	
4.1.8	ExtendAPI1 Extend dashboard API	04/16	02/17	Planned	
4.1.9	ExtendAPI2 Extend Vapor API	04/16	02/17	Done	
4.1.10	ExtendAPI3 Extend Gstat API	04/16	02/17	Done	4.1.7
4.1.11	MonitorVM1 monitor running/creation requests VM	06/16	02/17	Planned	

4.1.12	MonitorVM2 monitor success/error/time-out rates for cloud sites	06/16	02/17	Planned	4.1.11
4.1.13	ExtendVoDataManagement Support cloud storage solutions / File catalog	01/17	08/17	Planned	
4.1.14	OpsPortalEgiMetrics Extends the current metrics and add new ones	05/16	09/16	Done	
4.1.15	OpsPortalVoAcknowledgement Add Vo Acknowledgement section in VO ID card	10/15	11/15	Done	
4.1.16	OpsPortalVoRobotCertificate Add certificate robot section	11/15	12/15	Done	
4.1.17	OpsPortalAAI Add Operations Portal into AAI infrastructure	06/16	12/16	Planned	
4.1.18	OpsPortalPerunSupport Support Perun and its usage into VO ID cards and VO Metrics	05/16	09/16	On going	

6.2 GOCDB

GOCDB is a central registry used to define the topology of an e-Infrastructure. This includes core-object definitions and their inter-relationships such as operations centres, resource centres, service endpoints and their downtimes, contact information and roles of users responsible for operations at different levels. The service enforces a number of business rules and defines different grouping mechanisms and object-tagging for the purposes of fine-grained resource filtering.

During the year a number of new features were introduced without introducing backward compatibility issues or loss of service (details given below). The internal GOCDB release procedure served as template for the new EGI core operations tool release procedure. Time was spent engaging with the WLCG Information-Systems Task Force to provide input into their information system review, designed to inform the future evolution of the WLCG information system. Given the successful delivery of WLCG feature-requests, WLCG have since decided to prototype GOCDB (and OIM in the US) as a candidate system to replace the BDII (currently under review). Effort was

also spent researching Federated Identity Management (FIM) solutions for EGI and the ELIXIR Competence Centre. The GOCDB test system was used to test/develop the ProxyIdP as an attribute provider and service provider. All findings/recommendations were disseminated on the GOCDB wiki. During the year, time was also spent on operational support and service delivery.

Existing tasks: three major GOCDB updates (v5.4, 5.5, 5.6) were released during the period which addressed a number of core tasks. Version 5.4 addressed tasks 4.2.0 and 4.2.1. This included extending the data model, role action logging, fine-grained content rendering and refactoring the downtime time-zone logic. Version 5.5 completed task 4.2.2 for multi-tenant/multi-project support and also integrated the task for Federated AAI and integration with the EGI ProxyIdP (formerly listed as task 4.2.6). Task 4.2.3 was completed for the first release of the operational tools.

New tasks: A number of new high-priority tasks were added to the roadmap during the year to address the requirements of the WLCG user community. These were addressed in the v5.6 release (now listed as task 4.2.4). This included the introduction of reserved scope tags for WLCG, a new downtime calendar with fine grained downtime filtering, and bulk edit/upload of custom property files. A new/ongoing task was introduced to apply forced paging on a number of core API methods to address server loading issues (4.2.4.1). A new/ongoing task (4.2.5) was introduced to develop a writeable rest API as requested by WLCG and the EGI Federated Cloud.

Previously documented tasks for object diff auditing of core objects and for new NGI Certification/Suspension rules were de-prioritised (now under task 4.2.6). The remaining task to refactor the UI (4.2.7) is currently less well-defined and new tasks will undoubtedly emerge. The updated roadmap is given below.

Table 6 – GOCDB

Task Number	Task	Start Date (MM/YY)	Release Date (MM/YY)	Status	Dependencies From other tasks
4.2.0	<ul style="list-style-type: none"> Extend Data Model 	03/15	08/17	On going	
4.2.1	v5.4 <ul style="list-style-type: none"> Role action logging Finer grained content rendering (PermitAll and Protected pages) Downtime declaration in local timezone 	04/15	07/15	Done	
4.2.2	v5.5 <ul style="list-style-type: none"> Multi-tenant (apply 	06/15	12/15	Done	

	<p>different rules/roles on a per-project basis)</p> <ul style="list-style-type: none"> • SAML/FIM authentication, Elixir 				
4.2.3	D3.4: First release of the Operational tools - GOCDB	02/16	02/16	Done	
4.2.4	<p>V5.6</p> <ul style="list-style-type: none"> • Reserved Scope Tags - Restrict user tagging of resources using reserved/protected scope tags. Will allow WLCG/Elixir sites to apply tags only to their resources and prevent other sites from using same tags. • Downtime Calendar with fine grained filtering by scopes and other params. • Bulk addition/upload of multiple custom properties. • Integration with EGI Proxyldp - Allow access for users without client certificate. 	11/15	03/16	Done	
4.2.4.1	<p>v5.6.1</p> <ul style="list-style-type: none"> • Forced Paging on PI - Selected PI queries should page by default. If the 'page' URL parameter is not provided, then query will return the first page by default. Apply to get_downtime*, get_service* methods and review others for paging. 	05/16	07/16	Planned	
4.2.5	<p>v5.7</p> <ul style="list-style-type: none"> • Writable REST API to post 	03/16	09/16	Planned	

	updates to sites/services. Will require Site's to manage their own API keys per site required to post updates for a site/service.				
4.2.6	v5.8 <ul style="list-style-type: none"> • NGI certification / suspension rules • Object diff auditing • Review/clarify automatic freshness of data check task 	10/16	02/17	Planned	
4.2.7	MVC GUI refactoring Replace proprietary MVC with e.g. Symfony3	01/17	06/17	Planned	
4.2.8	D3.11: Second release of the Operational tools - GOCDB	02/17	02/17	Planned	
4.2.9	D3.18: Final release of the Operational tools - GOCDB	08/17	08/17	Planned	

6.3 Monitoring

The ARGO platform is the continuation and evolution of the SAM monitoring framework. ARGO has been re-architected in order to provide a flexible and powerful solution, which can meet the requirements and challenges of the emerging e-Science platforms across Europe.

Monitoring in a complex federated cloud infrastructure presents a number of interesting challenges. Firstly, to provide a monitoring solution that integrates and enriches the existing cloud ecosystem. Secondly, to deploy a monitoring framework with constraints posed by a multi-cloud large scale environment and the timing and synchronization requirements of any delivery service. Finally, to provide a modular monitoring framework, scalable, extensible and adoptable by different users utilizing the EGI infrastructure facilities. All these challenges imply that an appropriate orchestration engine will be deployed. This engine will compose monitoring services tailored to specific user/administrator profiles and which will improve EGI's infrastructure utilization.

ARGO development activities are grouped in five main sets:

- ARGO Compute Engine & Web API: to compute (engine) and retrieve (Web API) metrics for Services, Sites, NGIs and VO's (4.3.1, 4.3.6, 4.3.11, 4.3.17, 4.3.22, 4.3.27);
- ARGO Monitoring Engine: to run the monitoring tests (NAGIOS) (4.3.2, 4.3.7, 4.3.12, 4.3.18, 4.3.23, 4.3.28);
- ARGO EGI Web UI: the ARGO user interface (4.3.3, 4.3.8, 4.3.13, 4.3.19, 4.3.24, 4.3.29);
- ARGO EGI Connectors & Consumer: to retrieve raw data from the monitored services (4.3.4, 4.3.9, 4.3.14, 4.3.20, 4.3.25, 4.3.30);
- ARGO POEM: module where the metrics are defined (4.3.5, 4.3.10, 4.3.15, 4.3.21, 4.3.26, 4.3.81).

The roadmap is organised in three months period for these activity sets, repeated until the end of project year 2. A detailed roadmap for project year 3 is not defined yet.

The first release of ARGO (4.3.16) offers the multi-tenants support (4.3.1). This new functionality allows offering a Monitoring as a service to communities within the EGI collaboration. The set of probes, to monitor the EGI Federated Cloud resources, have been expanded to validate more functionality (4.3.2, 4.3.7, 4.3.12, 4.3.18). A centralised architecture for the EGI infrastructure monitoring has been designed and will be deployed in production in the first half of 2016. It will allow a more agile management of the whole EGI monitoring system.

The recent evolution of the EGI AAI (see section 2) affected the ARGO roadmap with some activities that now can be considered deprecated (4.3.15, 4.3.19, 4.3.21) and new ones that have been added to the roadmap (4.3.24, 4.3.26). UI enhancements (4.3.29), stability and performance improvements (4.3.22, 4.3.23, 4.3.25, 4.3.26, 4.3.27, 4.3.28, 4.3.29, 4.3.30, 4.3.31) and the creation of a probe management interface (4.3.31) will be also part of the second year roadmap.

Other two ARGO releases are foreseen in the project at M24 (4.3.32) and M30 (4.3.33).

Table 7 – Monitoring

Task Number	Task	Start Date (MM/YY)	Release Date (MM/YY)	Status	Dependencies From other tasks
4.3.1	ARGO Compute Engine & Web API: <ul style="list-style-type: none"> • automatic recomputation triggers • multi-tenant support stability and performance improvements	04/15	06/15	Done	
4.3.2	ARGO Monitoring Engine: <ul style="list-style-type: none"> • probe framework 	04/15	06/15	Done	

	<ul style="list-style-type: none"> support documentation (Guides) <p>stability and performance improvements</p>				
4.3.3	<p>ARGO EGI Web UI</p> <ul style="list-style-type: none"> ACL mechanism (support groups/roles) <p>UI Enhancements</p>	04/15	06/15	Done	
4.3.4	<p>ARGO EGI Connectors & Consumer:</p> <ul style="list-style-type: none"> improved support for VOs <p>stability and performance improvements</p>	04/15	06/15	Done	
4.3.5	<p>ARGO POEM:</p> <ul style="list-style-type: none"> ACL mechanism (support groups/roles) <p>stability and performance improvements</p>	04/15	06/15	Done	
4.3.6	<p>ARGO Compute Engine & Web API:</p> <ul style="list-style-type: none"> API for data ingestion specification separation of A/R and Metric stores APIv2 Specification <p>stability and performance improvements</p>	07/15	09/15	Done	4.3.1
4.3.7	<p>ARGO Monitoring Engine:</p> <ul style="list-style-type: none"> FedCloud probes <p>stability and performance</p>	07/15	09/15	Done	4.3.2

	improvements				
4.3.8	<p>ARGO EGI Web UI:</p> <ul style="list-style-type: none"> • UI Enhancements <p>initial support for federated logins using SAML</p>	07/15	09/15	Done	4.3.3
4.3.9	<p>ARGO EGI Connectors & Consumer:</p> <ul style="list-style-type: none"> • use of CE ingestion API <p>stability and performance improvements</p>	07/15 11/16	09/15 02/17	Postponed	4.3.4
4.3.10	<p>ARGO POEM</p> <ul style="list-style-type: none"> • initial support for federated logins using SAML • support for probe management <p>stability and performance improvements</p>	07/15 09/16	09/15 02/17 ⁹	Postponed	4.3.5
4.3.11	<p>ARGO Compute Engine & Web API:</p> <ul style="list-style-type: none"> • API for data ingestion specification • APIv2 <p>stability and performance improvements</p>	09/15	12/15	Done	4.3.6
4.3.12	<p>ARGO Monitoring Engine:</p> <ul style="list-style-type: none"> • fedcloud probes update <p>stability and performance improvements</p>	09/15	12/15	Done	4.3.7

⁹ The priority of this task has been decreased. The feature will be made available with the ARGO release foreseen for the end of PY2.

4.3.13	<p>ARGO EGI Web UI:</p> <ul style="list-style-type: none"> • UI Enhancements <p>support for federated logins with IdP Discovery</p>	09/15	12/15	Done	4.3.8
4.3.14	<p>ARGO EGI Connectors & Consumer:</p> <p>stability and performance improvements</p>	09/15	12/15	Done	4.3.9
4.3.15	<p>ARGO POEM:</p> <ul style="list-style-type: none"> • support for federated logins with IdP Discovery <p>stability and performance improvements</p>	09/15	12/15	Deprecated	4.3.10
4.3.16	<p>First release of the Operational tools - ARGO (D3.4)</p>	03/15	02/16	Done	4.3.1 – 4.3.15
4.3.17	<p>ARGO Compute Engine & Web API:</p> <p>stability and performance improvements</p>	01/16	03/16	Done	4.3.11
4.3.18	<p>ARGO Monitoring Engine:</p> <ul style="list-style-type: none"> • FedCloud probes update <p>stability and performance improvements</p>	01/16	03/16	Done	4.3.12
4.3.19	<p>ARGO EGI Web UI:</p> <p>join as a SP to eduGAIN</p>	01/16	03/16	Deprecated	4.3.13
4.3.20	<p>ARGO EGI Connectors & Consumer</p> <p>stability and performance improvements</p>	01/16	03/16	Done	4.3.14
4.3.21	<p>ARGO POEM</p>	01/16	03/16	Deprecated	4.3.15

	<ul style="list-style-type: none"> • join as a SP to eduGAIN <p>stability and performance improvements</p>				
4.3.22	<p>ARGO Compute Engine & Web API:</p> <ul style="list-style-type: none"> • API for data ingestion • stability and performance improvements 	03/16	09/16	On going	None
4.3.23	<p>ARGO Monitoring Engine:</p> <ul style="list-style-type: none"> • FedCloud probes update • stability and performance improvements 	03/16	09/16	Planned (On demand)	None
4.3.24	<p>ARGO EGI Web UI:</p> <ul style="list-style-type: none"> • join as a SP to EGI AAI 	09/16	02/17	Planned	None
4.3.25	<p>ARGO EGI Connectors & Consumer</p> <ul style="list-style-type: none"> • stability and performance improvements 	03/16	09/16	On going	None
4.3.26	<p>ARGO POEM</p> <ul style="list-style-type: none"> • join as a SP to the EGI AAI • stability and performance improvements 	03/16	09/16	On going	None
4.3.27	<p>ARGO Compute Engine & Web API:</p> <ul style="list-style-type: none"> • Support for stream processing 	10/16	02/17	Planned	4.3.22

	<ul style="list-style-type: none"> stability and performance improvements 				
4.3.28	ARGO Monitoring Engine: <ul style="list-style-type: none"> FedCloud probes update stability and performance improvements 	10/16	02/17	Planned	None
4.3.29	ARGO EGI Web UI: <ul style="list-style-type: none"> UI Enhancements 	10/16	02/17	Planned	None
4.3.30	ARGO EGI Connectors & Consumer <ul style="list-style-type: none"> stability and performance improvements 	10/16	02/17	Planned	None
4.3.31	ARGO POEM <ul style="list-style-type: none"> Probe management interface stability and performance improvements 	10/16	02/17	Planned	None
4.3.32	Second release of the Operational tools - ARG0 (D3.11)	10/16	02/17	Planned	4.3.22– 4.3.31
4.3.33	D3.18: Final release of the Operational tools – ARG0 (D3.18)	03/17	08/18	Planned	4.3.32

6.4 Messaging

The production EGI Operations Message Broker Network is used in order to facilitate the message exchange between the operational tools of EGI. This broker network consists of two

geographically separated brokers, which are operated by two geographically separated institutes, AUTH and SRCE, to increase the reliability of the system.

The development activity on the EGI messaging infrastructure foresees the provision of a Restful HTTP API as a layer on top of the existing Message Broker Network. The change will be backwards compatible as we will continue the operation of the STOMP¹⁰ interfaces for direct usage of the Message Broker Network. Still, after consulting with the major users of the Messaging Service, we believe that everybody will be eager to move to the new Restful Service layer and simplify the maintenance of their client implementations.

First project year has been devoted to define the Restful API specification (4.4.1, 4.4.2, 4.4.3, 4.4.4). A beta implementation will be completed by M19 (4.4.5), three months earlier of the original schedule. The first production level release will be ready by the end of project year 2 (4.4.6, 4.4.7) and a further version will be released at M30 (4.4.8).

Table 8 – Messaging

Task Number	Task	Start Date (MM/YY)	Release Date (MM/YY)	Status	Dependencies From other tasks
4.4.1	Preparatory phase	04/05	06/05	Done	
4.4.2	APIv1 alpha specification	07/05	09/05	Done	4.4.1
4.4.3	APIv1 test implementation APIv1 final draft specification (ready for external party review)	09/05	12/05	Done	4.4.2
4.4.4	APIv1 final specification	01/06	03/06	Done	4.4.3
4.4.5	APIv1 beta implementation	03/16	9/16	On going	4.4.4
4.4.6	APIv1 production implementation	9/16	2/17	Planned	4.4.5
4.4.7	Second release of the Operational tools - ARGO (D3.11)	01/17	02/17	Planned	4.4.1 – 4.4.6
4.4.8	D3.18: Final release of the Operational tools – ARGO (D3.18)	03/17	08/18	Planned	4.4.8

6.5 Security Monitoring

Security incidents may cause significant problems for users, service providers and infrastructure operators. Security monitoring tools try to identify weaknesses that lead to a security incident.

¹⁰ <https://stomp.github.io/>

Current technologies, namely federated clouds, bring new security challenges that must be addressed by new approaches. In this task, we will identify the new areas and provide solutions for proper monitoring of them.

The goal of the activity is to develop a framework for security assessment of cloud services. Over the first project year, we explored areas that play crucial role in cloud security. Resilience of virtual machines against known and common Internet threats manifested as the key functionality. The main attention is paid to assessment of images of virtual machines to detect known vulnerabilities that could lead to a security incident. In order to cover the needs identified, we started developing a framework for automated assessment of images of virtual machines. We plan to verify the approach in the context of EGI cloud services.

Table 9 - Security Monitoring

Task Number	Task	Start Date (MM/YY)	Release Date (MM/YY)	Status (Planned /Done)	Dependencies From other tasks	Issues
4.5.1	Gap analysis	04/15	11/15	Done		
4.5.2	VM Image assessment	12/15	09/16	On going		
4.5.3	Cloud resources monitoring	10/16	06/17	Planned		

7 Resource Allocation – e-Grant

e-GRANT is a platform that enables EGI customers to apply for and get allocation of compute and storage resources. Task's main goal is to enable EGI Customers to apply for both free and paid resources available in the Infrastructure in a consistent matter reflected in a complete SLA life cycle. The two types of available resources (paid are free) are supported by different SLA life cycles, which concludes in e-GRANT's main activity: creation of a coherent and fully-integrated platform supporting different types of resources, numerous infrastructures and diverse processes connected with them.

During last period, no new tasks were added to e-GRANT's development roadmap as the development was focused on existing ones and no new requirements from other teams were expressed.

The main area of development focused on the integration of pay-for-use resources in the platform. As a result, the first prototype of a platform is available under e-grant.egi.eu/v2 link, where EGI Customer can apply for paid resources and negotiate the quantity of resources and their associated price. Existing platform supports the majority of pay-for-use SLA life-cycle and is being supported by EGI Pay-for-Use team (5.12, 5.13, 5.14).

The work to implement the needed improvements for the resources allocation process and the alignment with EGI SLA framework is progressing (5.2, 5.3).

Finalization of some of the integration tasks were postponed due to the continuous improvement and development of given tools: EGI LTOS platform and authorization platform (5.7).

The updated development roadmap is given below.

Table 10 - Resource Allocation – e-Grant

Task Number	Task Name	Start Date (MM/YY)	Release Date (MM/YY)	Status	Dependencies From other tasks
5.1	Defining extensions and interface with other tools and processes.	04/15	12/15	Done	
5.2	Continual implementation of improvement needed for resources allocation process	04/15	08/17	On going	5.1
5.3	Alignment with EGI SLA framework for existing process	04/15 07/16	06/15 09/16	On going	5.1
5.4	Implementing support for tracing site configuration for allocated SLA	07/15 09/16	06/16 02/17	Postponed	5.1, 5.2
5.5	Integration with market-place	10/16	03/17	Planned	5.1

5.6	Integration with EGI monitoring framework	01/16	12/16	Planned	5.1
5.7	Integration with LTOS portal	04/15	12/16	On going	5.1
5.8	Integration with EGI Accounting system	02/16	12/16	Planned	5.1, 5.2
5.9	Integration with EGI Accounting Portal	02/16	12/16	Planned	5.1, 5.2
5.10	Integration with EGI authorization platform	10/16	12/16	Planned	5.1, 5.2
5.11	Further integration with GOCDB	06/16	06/16	Planned	5.1, 5.2
5.12	Pilot execution of pay-for-use process in e-GRANT	08/15	11/15	Done	
5.13	First release of pay-for-use process in production	01/16	03/16	Done	5.1
5.14	Extending support for pay-for-use process	03/16	12/16	On going	5.1
5.15	Extensions needed for including new types of EGI services	10/16	07/17	Planned	5.1
5.16	Final release of e-GRANT	08/17	08/17	Planned	5.2-5.11, 5.14, 5.15

8 Summary

The development roadmap of the EGI tools is revised in this document. Details are provided for each product and changes with respect to the original plan have been highlighted and justified.

The roadmap definition has been steered by requirements gathered from different actors as scientific communities, EGI-Engage competence centres, research infrastructures, NGIs, resource providers, technology providers and European Policy boards. The requirements have been collected in collaboration with the other EGI-Engage work packages and prioritised during the WP3 periodic meetings or in tool specific Operations Tools Advisory Groups (OTAGs).

The resulting development roadmap will enable the evolution of EGI tools to better satisfy user needs and to enhance the interoperability with other e-/research infrastructures. Furthermore, the improved support of new technologies (e.g. cloud) and the introduction of new features (e.g. the data accounting) will enrich the EGI core platform making it able to satisfy emerging requirements and support the most innovative use cases (e.g. dealing with big data).

In addition, this roadmap will also allow to pursue the final aim of the WP3, improving EGI tools integration and, then, providing users with a seamless user experience coherently with the e-Infrastructure Commons concept.

The requirement gathering process will be continuously carried out during the whole project lifetime and beyond, and the roadmap will be further revised accordingly.