

**EGI-Engage**

Operational tools development roadmap revised

M3.3

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| **Date** | 13 June 2016 |
| **Activity** | WP3 |
| **Lead Partner** | INFN |
| **Document Status** | DRAFT |
| **Document Link** | https://documents.egi.eu/document/XXX |

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* are possible: the EGI Core Infrastructure platform is the foundation layer of the distributed model of EGI.

The technical development of the 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 Centers 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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**DELIVERY SLIP**

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**DOCUMENT LOG**

|  |  |  |  |
| --- | --- | --- | --- |
| ***Issue*** | ***Date*** | ***Comment*** | ***Author/Partner*** |
| **v.1** |  |  |  |
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**TERMINOLOGY**

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

**Contents**

[1 Introduction 7](#_Toc453606427)

[2 Operations tools roadmap definition 8](#_Toc453606428)

[2.1 Procedure to update the roadmap 9](#_Toc453606429)

[3 Authentication and authorization infrastructure 11](#_Toc453606430)

[3.1 Roadmap summary 11](#_Toc453606431)

[4 Service registry and marketplace 14](#_Toc453606432)

[4.1 Roadmap summary 14](#_Toc453606433)

[5 Accounting 16](#_Toc453606434)

[5.1 Accounting Repository 16](#_Toc453606435)

[5.1.1 Roadmap summary 17](#_Toc453606436)

[5.2 Accounting Portal 18](#_Toc453606437)

[5.2.1 Roadmap summary 19](#_Toc453606438)

[6 Operations tools 21](#_Toc453606439)

[6.1 Operations portal 21](#_Toc453606440)

[6.1.1 Roadmap summary 21](#_Toc453606441)

[6.2 GOCDB 23](#_Toc453606442)

[6.2.1 Roadmap summary 23](#_Toc453606443)

[6.3 Monitoring 26](#_Toc453606444)

[6.3.1 Roadmap summary 26](#_Toc453606445)

[6.4 Messaging 31](#_Toc453606446)

[6.4.1 Roadmap summary 32](#_Toc453606447)

[6.5 Security Monitoring 32](#_Toc453606448)

[6.5.1 Roadmap summary 32](#_Toc453606449)

[7 Resource Allocation – e-Grant 34](#_Toc453606450)

[7.1 Roadmap summary 34](#_Toc453606451)

[8 Summary 36](#_Toc453606452)

**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 composes 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 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, GOCDB, Monitoring, Messaging Infrastructure and Security Monitoring);
* WP3.5: Resource Allocation – e-GRANT.

The technical development of the 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 Centers 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 from all the relevant stakeholders: scientific communities, EGI-Engage competence centers, research infrastructures, NGIs, resource providers, technology providers and European Policy boards as e-IRG.

# Introduction

The document is organised as follows.

Section 2 describe the open process for requirements gathering adopted to define the development roadmap. Furthermore, 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, is depicted.

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

A summary of the document is available in Section 8.

# Operations tools roadmap definition

The 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 centers, 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 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 roadmap, in particular the EGI Operations team, NGIs and Resource Provider needs are collected by this activity. Finally, the requirements from the eight EGI-Engage competence centers 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. e-Infrastructure commons requirement gathering process in EGI-Engage.

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

Before the roadmap definition, all the requirements have been prioritised during the WP3 meetings and in tool specific Operations Tools Advisory Groups (OTAGs)[[1]](#footnote-1) to ensure full participation of the user groups in the process. To date, OTAGs have finished 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 roadmap herein described comprises actions, specific for activities, to collect input from the various stakeholders and, furthermore. A procedure to periodically update the roadmap has been defined to ensure continual service improvement and has been applied during the first year of the project.

## Procedure to update the roadmap

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

Figure 2. Procedure to update the roadmap for a 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.

A procedure to update the WP3 roadmap was defined and agreed with the relevant product teams and is described below. The WP3 roadmap is revised when a certain number of relevant requirements is collected or to explicit request of a product team:

* each product team collects the requirements for its tool between two revisions. All the requirements should be stored in the EGI ticket system;
* 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.

# Authentication and authorization infrastructure

TJRA1.1 – The Authentication and Authorization infrastructure will explore 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. 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.

## Roadmap summary

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, in order 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 center (SA2.3) has been successfully completed and coordination with SA2.2 (Training & User support) has been settled to support other competence centers. 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 eduGAIN as Service Provider supporting the GÉANT Data Protection Code of Conduct and the REFEDS Research & Scholarship entity category. In parallel, we will broaden our collaboration with the EGI Competence Centers 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 Connect 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).

Table 1 - Authentication and authorization infrastructure roadmap

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Task Number** | ***Task*** | ***Start Date (MM/YY)*** | ***Release Date (MM/YY)*** | ***Status*** | ***Dependencies******From other******tasks*** |
| **1.1** | Identification of and liaison with stakeholders:* WP3 F2F and EGI Conference
* Liaise with AARC
* Connections with GN4, EUDAT2020 and PRACE
* Identification of Tools
 | 05/15  | 06/15  | Done  |  |
|  | Requirements capturing: * 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 (GOCDB, Monitoring and Accounting)
 | 05/15  | 08/15  | Done  | 1.1  |
| **1.3**  | Technical architecture and pilot implementation - Phase 1: * Identify which AA services are needed
* Collaboration with the AAI pilot and the user portal activity for the LTOS
* Pilot: Connection of the first set of EGI tools to the EGI IdP proxy
 | 09/15  | 12/15 | Done  | 1.2  |
| **1.4**  | Technical architecture and pilot implementation - Phase 2: * 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**  | Technical architecture and pilot implementation - Phase 3: * Technology reassessment
* Pilot services and best practices to enable federated AAI solutions released
 | 05/16  | 07/16  | On-going  | 1.4  |
| **1.6** | Technical architecture and pilot implementation - Phase 4:* Pilot services and best practices to enable federated AAI solutions released
* Architecture and solution for the production EGI AAI services.
 | 07/16  | 02/17  | Planned  | 1.5  |
| **1.7** | Identity Management for Distributed User Communities report | 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 |

# 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.

## Roadmap summary

The service registry and marketplace roadmap has been changed with respect the original plans to take into account needs 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 outcome of the assessment of the technologies to implement the EGI Service Registry and Marketplace (2.5) Open IRIS is 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 Open IRIS 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 EGI about the sustainability of the solution (2.7). In addition, EGI should deal with FMI (the service provider) to agree on a service agreement that could satisfy the peculiar requirements of a 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 Cloudify 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 is planned 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 * Involvement with Engage participants
* EGI Lisbon conference session
 | 04/2015 | 08/2017 | Done  |  |
| **2.2** | Marketplace strategy * Collaboration with FHNW on paper
 | 04/2015 | 07/2015 | Done |  |
| **2.3**  | Update EGI business development strategy * Discussions with EGI strategy team
* Discussions with potential business partners
 | 04/2015  | 07/2015  | Done  |  |
| **2.4**  | Identify/collect EGI services * Task assigned within the JRA1.2 team
 | 05/2015 | 07/2015  | Done |  |
| **2.5** | Assessment of the technologies to implement the EGI Service Registry and Marketplace | 09/2015 | 02/2016 | Done |  |
| **2.6**  | Design of the EGI Service Registry and Marketplace * Outcome of discussion with stakeholders and JRA 1.2 participants
 | 05/2015  | 02/2016  | Done  | 2.1, 2.2, 2.3, 2.4  |
| **2.7** | Second phase evaluation of the technologies:* terms of use
* compliance to EGI and EU policies and regulations
* trial of a live instance of Open IRIS
* evaluation of costs of ownership, development, operations and support.
 | 02/2016 | 07/2016 | On going | 2.5, 2.6 |
| **2.8** | Design and development of the public facing marketplace. | 02/2016 | 08/2016 | On going | 2.5, 2.6, 2.7 |
| **2.9** | Define technical integration with the EGI core platform* EGI AAI
* Operational Tools (e.g. service registry and AppDB)
 | 02/2016 | 08/2016 | On going | 2.5, 2.6, 2.7 |
| **2.10**  | Populate service catalogue * Tasks assigned to JRA 1.2 participants to gather information
 | 08/2015  | 04/2016  | Postponed | 2.6, 2.7, 2.8  |
| **2.11** | Integrate service catalogue to EGI web site * Tasks assigned to JRA 1.2 participants to gather information
 | 10/2015  | 04/2016  | Postponed  | 2.6 |
| **2.12** | First release of the EGI Service Registry and Prototype  * Leveraging existing tools for prototype
 | 03/2016  | 08/2016  | Planned  | 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. | 09/2016 | 04/2017 | Planned | 2.12 |
| **2.14** | Define the term of reference to publish services into the EGI Service Registry and Marketplace (in collaboration with NA2.2) | 09/2016 | 04/2017 | Planned | 2.12 |
| **2.15** | Second release of the EGI Service Registry and Prototype * Refine based on feedback from first release
 | 08/2016  | 04/2017  | Planned  | 2.12, 2.13, 2.14 |
| **2.16**  | Final report on EGI Service Registry and Marketplace * To be done collectively by participants in JRA 1.2
 | 06/2017  | 06/2017  | 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 |

# 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 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.

## 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/WLCG 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.

### Roadmap summary

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 are being defined to create an initial prototype (3.1.9). This will allow us to report on the design of the data accounting system (3.1.4) 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 | Open | 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 | Open |  |
| **3.1.4** | ARC Parser | 04/15 | 07/16 | Open |  |
| **3.1.5** | Data Accounting: proof of concept | 06/15 | 01/16 | Done |  |
| **3.1.6** | Storage Accounting: Usage Record V2.0  | 07/15 | 10/16 | Planned | 3.1.2 |
| **3.1.7** | XML Parser | 12/15 | 07/16 | Planned |  |
| **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 | Planned | 3.1.5 |
| **3.1.10** | Storage Accounting: support new storage systems  | 03/16 | 10/16 | Planned | 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 | 3.15 |
| **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 |

## 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 a integrated view of accounting data on the EGI Infrastructure.

### Roadmap summary

We have arrived at the first release of the new Portal, which will be effective in 04/16 including the covered tasks and a great number of additional requirements collected by EGI RT and several meetings.

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  | Done | 3.1.1, 3.1.3  |
| **3.2.6**  | EGI Federated AAI Integration  | 04/16  | 04/16  | On hold | Depends on outcome of AAI TF and EGI policy  |
| **3.2.7**  | D3.5: First release of the new Accounting Portal deployed in production  | 04/16  | 04/16  | On Going | 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  | 01/16  | 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  |

# Operations tools

The evolution of these 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.

## Operations portal

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. Further information have been added to the VO ID card and proper interfaces are available to retrieve the data stored in the portal.

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

### Roadmap summary

For the coming year the aim is to enforce the features of Vapor by adding key features of Gstat . 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.

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  | 05/2015 | 02/2016 | Done |  |
| **4.1.2** | LavGlue Replace Glue1.3 queries by Glue 2 | 05/2015 | 02/2016 | Done | 4.1.1 |
| **4.1.3**  | LavCloud Capture Cloud Resources in Lavoisier  | 06/2015  | 02/2016  | Done  |  |
| **4.1.4** | RBExtensionExtend the resource browser to cloud resources | 06/2015 | 02/2016  | Done | 4.1.3 |
| **4.1.5** | VaporExtension Extend Vapor views to cloud resources | 06/2015  | 02/2016  | Done | 4.1.3 |
| **4.1.6** | DashboardExtension Extend dashboard views to cloud resources  | 10/2015 | 02/2016  | Done | 4.1.3 |
| **4.1.7** | ReplaceGstat Replace Gstat Main Features | 11/2015 | 02/2017 | On Going |  |
| **4.1.8**  | ExtendAPI1 Extend dashboard API  | 04/2016  | 02/2017  | Planned  |  |
| **4.1.9**  | ExtendAPI2 Extend Vapor API | 04/2016  | 02/2017  | Done  |  |
| **4.1.10**  | ExtendAPI3 Extend Gstat API  | 04/2016  | 02/2017  | Done  | 4.1.7  |
| **4.1.11** | MonitorVM1 monitor running/creation requests VM | 06/2016 | 02/2017  | Planned |  |
| **4.1.12** | MonitorVM2 monitor success/error/time-out rates for cloud sites | 06/2016  | 02/2017  | Planned | 4.1.11 |
| **4.1.13**  | ExtendVoDataManagement Support cloud storage solutions / File catalog  | 01/2017  | 08/2017  | Planned  |  |
| **4.1.14** | OpsPortalEgiMetricsExtends the current metrics and add new ones  | 05/2016  | 09/2016  | Done |  |
| **4.1.15** | OpsPortalVoAcknowledgement Add Vo Acknowledgement section in VO ID card  | 10/2015  | 11/2015  | Done |  |
| **4.1.16** | OpsPortalVoRobotCertificate Add certificate robot section  | 11/2015 | 12/2015  | Done |  |
| **4.1.17** | OpsPortalAAIAdd Operations Portal into AAI infrastructure | 06/2016 | 12/2016 | Planned |  |
| **4.1.18** | OpsPortalPerunSupportSupport Perun and its usage into VO ID cards and VO Metrics | 05/2016 | 09/2016 | On Going |  |

## GOCDB

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 project. 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.

### Roadmap summary

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**  | * Extend Data Model
 | 03/15  | 08/17  | Done / ongoing  |  |
| **4.2.1**  | v5.4 * 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 * Multi-tenant (apply different rules/roles on a per-project basis)
* SAML/FIM authentication, Elixir
 | 06/15  | 12/15  | Done  |  |
| **4.2.3**  | D3.4: First release of the Operational tools - GOCDB | 02/16  | 02/16  | Done  |  |
| **4.2.4**  | V5.6* 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 ProxyIdp - Allow access for users without client certificate.

  | 11/15  | 03/16  | Done  |  |
| **4.2.4.1** | v5.6.1* 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** | v5.7* Writable REST API to post updates to sites/services. Will require Site's to manage their own API keys per site required to post updates for a site/service.
 | 03/16 | 09/16 | Planned |  |
| **4.2.6** | v5.8* 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  |  |

## 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 that will compose monitoring services tailored to specific user/administrator profiles and which will improve EGI’s infrastructure utilization.

### Roadmap summary

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 VOs (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 1. 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: * automatic recomputation triggers
* multi-tenant support

stability and performance improvements  | 04/15  | 06/15  | Done  |  |
| **4.3.2**  | ARGO Monitoring Engine: * probe framework
* support documentation (Guides)

stability and performance improvements  | 04/15  | 06/15  | Done  |  |
| **4.3.3**  | ARGO EGI Web UI * ACL mechanism (support groups/roles)

UI Enhancements  | 04/15  | 06/15  | Done  |  |
| **4.3.4**  | ARGO EGI Connectors & Consumer: * improved support for VOs

stability and performance improvements  | 04/15  | 06/15  | Done  |  |
| **4.3.5**  | ARGO POEM: * ACL mechanism (support groups/roles)

stability and performance improvements  | 04/15  | 06/15  | Done  |  |
| **4.3.6**  | ARGO Compute Engine & Web API: * API for data ingestion specification
* separation of A/R and Metric stores
* APIv2 Specification

stability and performance improvements  | 07/15  | 09/15  | Done  | 4.3.1  |
| **4.3.7**  | ARGO Monitoring Engine: * FedCloud probes

stability and performance improvements  | 07/15  | 09/15  | Done  | 4.3.2  |
| **4.3.8**  | ARGO EGI Web UI: * UI Enhancements

initial support for federated logins using SAML  | 07/15  | 09/15  | Done  | 4.3.3  |
| **4.3.9**  | ARGO EGI Connectors & Consumer: * use of CE ingestion API

stability and performance improvements  | 07/15  | 09/15  | Postponed  | 4.3.4  |
| **4.3.10**  | ARGO POEM * initial support for federated logins using SAML
* support for probe management

stability and performance improvements  | 07/15  | 09/15  | Postponed  | 4.3.5  |
| **4.3.11**  | ARGO Compute Engine & Web API: * API for data ingestion specification
* APIv2

stability and performance improvements  | 09/15  | 12/15  | Done  | 4.3.6  |
| **4.3.12**  | ARGO Monitoring Engine: * fedcloud probes update

stability and performance improvements  | 09/15  | 12/15  | Done  | 4.3.7  |
| **4.3.13**  | ARGO EGI Web UI: * UI Enhancements

support for federated logins with IdP Discovery  | 09/15  | 12/15  | Done  | 4.3.8  |
| **4.3.14**  | ARGO EGI Connectors & Consumer: stability and performance improvements  | 09/15  | 12/15  | Done  | 4.3.9  |
| **4.3.15**  | ARGO POEM: * support for federated logins with IdP Discovery

stability and performance improvements  | 09/15  | 12/15  | Deprecated  | 4.3.10  |
| **4.3.16** | First release of the Operational tools - ARGO (D3.4)   | 03/15 | 02/16 | Done | 4.3.1 – 4.3.15 |
| **4.3.17**  | ARGO Compute Engine & Web API: stability and performance improvements  | 01/16  | 03/16  | Done  | 4.3.11  |
| **4.3.18**  | ARGO Monitoring Engine: * FedCloud probes update

stability and performance improvements  | 01/16  | 03/16  | Done | 4.3.12  |
| **4.3.19** | ARGO EGI Web UI: join as a SP to eduGAIN  | 01/16  | 03/16  | Deprecated | 4.3.13  |
| **4.3.20**  | ARGO EGI Connectors & Consumer stability and performance improvements  | 01/16  | 03/16  | Done  | 4.3.14  |
| **4.3.21**  | ARGO POEM * join as a SP to eduGAIN

stability and performance improvements  | 01/16  | 03/16  | Deprecated | 4.3.15  |
| **4.3.22**  | ARGO Compute Engine & Web API: * API for data ingestion
* stability and performance improvements
 | 03/16  | 09/16  | On Going  | None |
| **4.3.23**  | ARGO Monitoring Engine: * FedCloud probes update
* stability and performance improvements
 | 03/16  | 09/16  | Planned (On demand ) | None  |
| **4.3.24** | ARGO EGI Web UI: * join as a SP to EGI AAI
 | 03/16  | 09/16  | Planned  | None |
| **4.3.25**  | ARGO EGI Connectors & Consumer * stability and performance improvements
 | 03/16  | 09/16  | On Going  | None |
| **4.3.26**  | ARGO POEM * join as a SP to the EGI AAI
* stability and performance improvements
 | 03/16  | 09/16  | On Going  | None |
| **4.3.27**  | ARGO Compute Engine & Web API: * Support for stream processing
* stability and performance improvements
 | 10/16  | 02/17  | Planned  | 4.3.22  |
| **4.3.28**  | ARGO Monitoring Engine: * FedCloud probes update
* stability and performance improvements
 | 10/16  | 02/17  | Planned  | None |
| **4.3.29** | ARGO EGI Web UI: * UI Enhancements
 | 10/16  | 02/17  | Planned  | None |
| **4.3.30**  | ARGO EGI Connectors & Consumer * stability and performance improvements
 | 10/16  | 02/17 | Planned  | None |
| **4.3.31**  | ARGO POEM * Probe management interface
* stability and performance improvements
 | 10/16  | 02/17  | Planned  | None |
| **4.3.32** | Second release of the Operational tools - ARGO (D3.11) | 10/16 | 02/17 | Planned | 4.3.22– 4.3.31 |
| **4.3.33** | D3.18: Final release of the Operational tools – ARGO (D3.18)  | 03/17 | 08/18 | Planned | 4.3.32 |

## 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.

### Roadmap summary

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 STOMP interfaces for direct usage of the Message Broker Network. Still, we believe after consulting with the major users of the Messaging Service, 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 |

## 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. 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.

### Roadmap summary

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 images to detect know 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 | Ongoing |  |  |
| **4.5.3** | Cloud resources monitoring | 10/16 | 06/17 | Planned |  |  |

# Resource Allocation – e-Grant

e-GRANT is a platform that enables EGI customers to apply 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 coherent and fully-integrated platform supporting different types of resources, numerous infrastructures and diverse processess connected with them.

## Roadmap summary

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

Main area of development was focused on integration of pay-for-use resources in Resource Allocation 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 price and amount of them. Existing platform supports the majority of pay-for-use SLA life-cycle and is being supported by EGI Pay-for-Use team.

Finalization of some of the integrational task were postponed due to the continous improvement and development of given tools: EGI LTOS platform anf authorization platform.

The updated 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  | In progress  | 5.1  |
| **5.3**  | Alignment with EGI SLA framework for existing process  | 04/15  | 06/15  | In progress | 5.1  |
| **5.4**  | Implementing support for tracing site configuration for allocated SLA  | 07/15  | 06/16  | Planned  | 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  | In progress | 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 prototype 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  | In progress  | 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  |

# 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 overall objective of this roadmap is to steer the evolution of the EGI tools towards the e-Infrastructure Commons, an ecosystem of services that constitute the foundation layer of any distributed e-Infrastructures, which is one of the three pillars of the *Open Science Commons* vision.

The roadmap definition has been steered by requirements gathered from different actors as scientific communities, EGI-Engage competence centers, 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 requirement gathering process will be continuously carried out during the whole project lifetime and beyond, and the roadmap will be revised accordingly. A well-defined procedure has been adopted to periodically update the roadmap of each tool.

1. 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. [↑](#footnote-ref-1)