

EUROPEAN MIDDLEWARE INITIATIVE

DNA1.3.3 - TECHNICAL DEVELOPMENT PLAN (M23)

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Abstract:

This deliverable provides the details of the technical development plan for all EMI services. DNA1.3.3 represents the final revision of the EMI high level development plan. It contains an initial status assessment, a list of known requirements and their prioritization and a plan with objectives and milestones. The plan contains details for the third year of development and also lists some longer-term high-level objectives for the following years. The preparation of the technical plan is coordinated by the Technical Director, but requires input and active engagement from all WP leaders and Product Team leaders.

I. DELIVERY SLIP

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Approved by	PEB	-	27/05/2012

II. DOCUMENT LOG

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v0.1	16/4/2012	Table of content for review	Balázs Kónya/LU
v0.2	17/4/2012	Completed the Requirements section	Balázs Kónya/LU
v0.3	18/4/2012	Updated the inventory of objectives	Balázs Kónya/LU
v0.4	19/4/2012	Updated the product table	Balázs Kónya/LU
v0.5	20/4/2012	Rewrote the product portfolio text, updated Conclusion	Balázs Kónya/LU
v0.6	3/5/2012	Completed Technical Objectives, Executive Summary and References. Complete document is ready for review	Balázs Kónya/LU
v0.7	20/5/2012	Correcting product table based on release manager feedback, changes as a response to internal reviews	Balázs Kónya/LU
v1.0	27/05/2012	Revision addressing reviewers' comments	Balázs Kónya/LU

III. DOCUMENT CHANGE RECORD

Issue	Item	Reason for Change
1		
2		

IV. DOCUMENT AMENDMENT PROCEDURE

This document can be amended by the EMI Technical Director or people delegated by the TD further to any feedback from other teams or people. Amendments, comments and suggestions should be sent to the PTB (ptb@eu-emi.eu). Minor changes, such as spelling corrections, content formatting or minor text reorganization not affecting the content and meaning of the document can be applied by the document editor, the EMI TD without peer review. Other changes must be submitted to peer review and to the EMI PTB for approval. When the document is modified for any reason, its version number shall be incremented accordingly. The document version number shall follow the standard EMI conventions for document versioning. The document shall be maintained in the CERN CDS repository and be made accessible through the OpenAIRE portal. The EMI Technical Development Plan is revised periodically.

V. GLOSSARY

Acronym	Long Name
API	Application Programming Interface
ARC	The Advanced Resource Connector is general purpose, Open Source, lightweight, portable middleware solution (http://www.nordugrid.org/arc)
GDB	Grid Deployment Board, the main middleware and operations coordination body of the WLCG project
dCache	System for storing and retrieving huge amounts of data, distributed among a large

	number of heterogenous server nodes, under a single virtual filesystem tree with a variety of standard access methods (http://www.dcache.org)
DCI	Distributed Computing Infrastructure
DEISA	The Distributed European Infrastructure for Supercomputing Applications, is a consortium of leading national Supercomputing centres that aims at fostering the pan-European world-leading computational science research (http://www.deisa.eu)
DoW	Description of Work, the contractual document describing the EMI project
EGI	European Grid Infrastructure (http://www.egi.eu)
EGI-InSPIRE	Integrated Sustainable Pan-European Infrastructure for Researchers in Europe (http://www.egi.eu/projects/egi-inspire)
EMI	European Middleware Initiative (http://www.eu-emi.eu)
gLite	The next generation middleware for grid computing born from the collaborative efforts of more than 80 people in 12 different academic and industrial research centers as part of the EGEE Project (http://glite.web.cern.ch/glite)
NorduGrid	A Grid Research and Development collaboration aiming at development, maintenance and support of the free Grid middleware, known as the Advance Resource Connector (ARC) (http://www.nordugrid.org)
PRACE	Partnership for Advanced Computing in Europe, a unique persistent pan-European Research Infrastructure for High Performance Computing (HPC) (http://www.prace-project.eu)
PT	Product Team, the basic working unit of the EMI development structure
PTB	Project Technical Board
TCB	Technology Collaboration Board of EGI
UMD	Unified Middleware Distribution, the EGI middleware distribution
UNICORE	The Uniform Interface to Computing Resources offers a ready-to-run Grid system including client and server software. UNICORE makes distributed computing and data resources available in a seamless and secure way in intranets and the internet (http://www.unicore.eu)
VRC	Virtual Research Community
WLCG	The Worldwide LHC Computing Grid (WLCG) is a global collaboration of more than 140 computing centres in 34 countries, the 4 LHC experiments, and several national and international grid projects (http://lcg.web.cern.ch/lcg)
WP	Work Package

The complete EMI glossary is available at <https://twiki.cern.ch/twiki/bin/view/EMI/EmiGlossary> .

VI. COPYRIGHT NOTICE

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1. INTRODUCTION

1.1. EXECUTIVE SUMMARY

This deliverable, the second and final update of the EMI technical plan, lays down the software development directions for the final year of the EMI project via the specification of set of high level technical development objectives and the updated EMI software portfolio. This document is an update of the previous editions of the DNA1.3.x plans, therefore the document structure is deliberately kept the same while information presented in the various sections has been carefully revised and updated to reflect the project status and view as of the end of the 2nd project year.

The final year of EMI is dedicated to bring to completion development and integration activities that were pursued during the project. By the end of the project, EMI aims to achieve its technical objective which at a high level can be outlined as delivering a production-level consolidated middleware distribution, consisting of modular components with unified interfaces. The components will cover a wide range of functionalities, providing universal building blocks for infrastructures of various complexity and specialization. In short, the final year activities will be focused in hardening of existing products, finalizing new ones, especially those common components that were newly developed during the project, and executing the necessary integration, functionality and usability tests.

This technical development plan is thus not a new plan, but an evolution of its previous versions, taking into account the final year's high-level objectives (see above and Section 4), newly collected requirements (see Section 2) and priorities. Specifically, high priority is assigned to finalizing the common products and finishing implementation of common standards and interfaces, as well as to meeting key functionality requirements collected from user communities. Certain activities have their priority lowered, or got re-scoped, reflecting development of the technology and changes in requirements. New set of requirements that has been submitted to EMI resulted in introduction of several new objectives, reprioritization, adjustment and even discontinuation of some of the previous ones. The software portfolio and the EMI Product Teams have also undergone organizational changes to improve efficiency, and this is reflected in the updated EMI product table.

As an overall assessment of the technical status it can be stated that the project so far delivered most of its planned work. Progress towards achieving objectives defined in the previous revision of the plan is quite satisfactory, with key objectives achieved in due time, as can be seen from the objectives table in Section 4. For a complete status review, please refer to the overall annual report. For details of individual objectives, please refer to specific area work plan reports [R1-R4].

The document starts with the introduction of requirements, followed by the inventory of EMI products and product teams. The EMI software stack currently consists of 62 products, of which 58 have been included into the EMI 2 *Matterhorn* release candidate. The remaining products are scheduled for EMI release number 3 or for an EMI 2 update. The EMI product table (Section 3) serves as a key reference for the entire project. The table identifies and categorizes the products of the EMI software portfolio by specifying their type, area and status. Based on the requirements and the software stack inventory, a technical work plan is formulated through the presentation of a high-level EMI vision (roadmap) that is supported and followed by the table of technical objectives. For each objective a priority, completion due date and status information is given.

To summarize, the objectives that are considered to be of the top priority in the final year are: completion and delivery of the EMI *datalib* and the *STS* products, broad integration with the common EMI products and libraries such as *EMIR* indexing service and *CANL* authentication library, and focus on non-functional developments to improve performance, usability and reliability of EMI products.

1.2. PURPOSE AND SCOPE

This deliverable (DNA1.3.3) outlines the Technical Development Plan of the EMI project. The document is the last update of the previous versions of the plan presented in DNA1.3.1 and DNA1.3.2 deliverables. The main **purpose of the document** is to complement the EMI Description of Work

[R1], to define the precise scope, to provide more accurately formulated and prioritized goals for the development of the EMI products by presenting:

- **definition of the EMI software portfolio**, the bases of the EMI technical development plan,
- the **high-level vision** of the evolution of the EMI software stack
- a comprehensive, **technical formulation of development objectives** coupled to EMI products and delivery dates.

The DNA1.3.3 document does not provide:

- status of the project, detailed overview of achieved or missed objectives
- extended description and low level, implementation-specific details of the technical objectives, fine-grained, detailed development planning for EMI components and product teams
- standardization and integration plans
- a schedule of the development tasks via a Release Plan
- software quality assurance aspects of the EMI development

These details are found in corresponding dedicated technical reports and the periodic project reports.

The above listed areas are covered in their respective EMI documents:

- DJRA1.1.1, DJRA1.1.2, DJRA1.1.3, DJRA1.1.4 - Compute area work plan and status report
- DJRA1.2.1, DJRA1.2.2, DJRA1.2.3, DJRA1.2.4 - Data area work plan and status report
- DJRA1.3.1, DJRA1.3.2, DJRA1.3.3, DJRA1.3.4 - Security area work plan and status report
- DJRA1.4.1, DJRA1.4.2, DJRA1.4.3, DJRA1.4.4 - Infrastructure area work plan and status report
- DJRA1.5.1, DJRA1.5.2 - Standardization work plan and status report
- DJRA1.6.1, DJRA1.6.2 - Integration work plan and status report
- DSA1.2 - Software Release Plan
- DSA2.1 - Software Quality Assurance Plan
- DNA3.2.1 - Standardization, Integration and Interoperability Plan and Status Report

The Technical Development Plan represents the approved development strategy for the EMI software stack; it contains an overall plan setting the directions and priorities for development. The plan, prepared by the Technical Director (TD) with assistance by the EMI Project Technical Board (PTB), is revised every year (DNA1.3.2, DNA1.3.3). The plan is highly relevant for the entire project and is of interest to all DCI projects, user communities, developers and operation teams.

1.3. DOCUMENT ORGANIZATION

The Technical Development Plan document is organized as follows:

- **Chapter 1 - Introduction:** this section, explaining the purpose, scope and organization of the document. It also contains the executive summary.

- **Chapter 2 - Requirements:** presents the requirements that drove the creation of the EMI technical development plan.
- **Chapter 3 - Products and Product Teams:** an inventory of the EMI products and the Product Teams responsible for them.
- **Chapter 4 - Technical Objectives:** describes the EMI development plan on two levels by presenting both a higher level roadmap and a table with prioritized development objectives.
- **Chapter 5 – Conclusions:** provides recommendations and plans for further work.
- **Chapter 6 - References:** articles, books, papers and other materials cited in this document.
- **Chapter 7 – Annex**

2. REQUIREMENTS

The planning of EMI software development has been governed by the project’s main objective to support efficient, reliable operations of EGI, PRACE and other DCIs.

The initial set of requirements influencing the EMI project setup and the EMI DoW had been already provided during the project preparation phase by the *UMD Operation and user requirements Working Group* [R5]. These initial UMD working group requirements¹ had been taken into account and addressed as early as the project DoW.

During the course of the first project year EMI received requirements from its collaborating partners. After necessary pre-filtering, assessment and prioritization the endorsed first year requirements were taken into account during the preparation of the previous version of this deliverable, the DNA1.3.2 Technical Plan and influenced the developments leading to EMI 2 release.

Naturally, EMI has been continuously receiving requirements during the second project year as well. Our major customers communicate their requests through well-established collaboration channels and procedures [R6]. All the received requirements get submitted to the EMI requirement management tool, the EMI Requirement Tracker. The Annex contains a detailed description of the requirement tracker fields.

As part of the year 3 workplan preparation the EMI technical management (PTB) analysed all the open requirements available in the EMI requirement tracker. Requirements were assessed one by one to check and discuss the status, EMI 2 release progress and relevance of each of them. Relevant and not yet addressed requirements were grouped by areas and products, and translated into prioritized high level technical objectives. Several similar requirements may have resulted in one objective, while some complex single requirements may have lead to a number of inter-connected objectives, such as e.g. implementation of a common information schema in different products. Mapping of requirements to objectives is therefore not straightforward, especially since the level of requirement detail varies from very specific to very generic. What matters is that all the requirements are processed and reflected in the objectives. The overall process is illustrated by the figure below.

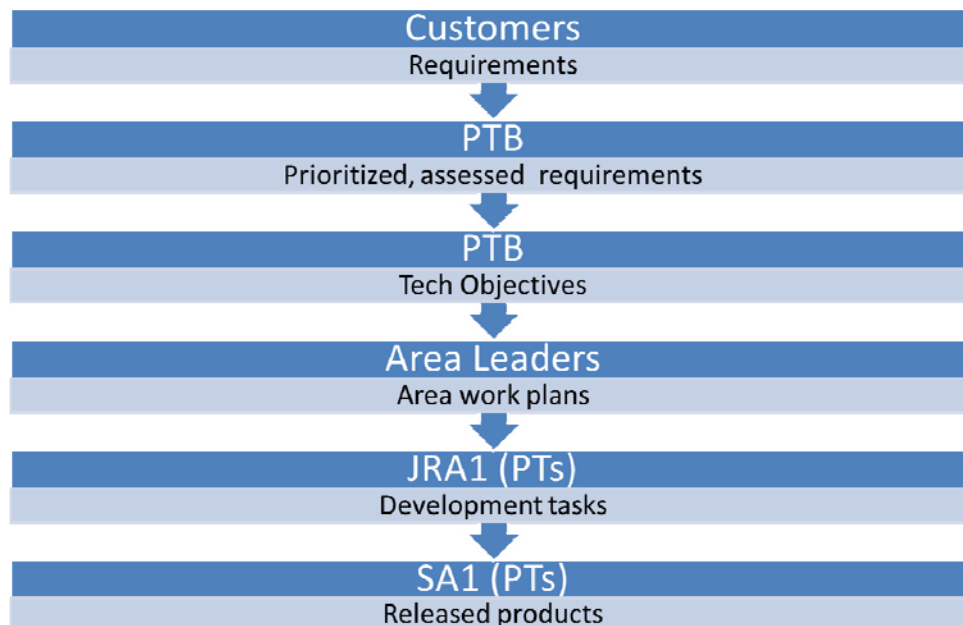


Figure 1: Requirement management

¹ EMI is the main software provider for the Unified Middleware Distribution (UMD) software stack to be deployed within EGI, the flagship European Distributed Computing Infrastructure.

As a very specific example, the request #26574 “*Mandatory variables in configuration files should be clearly identified*” received during year 2 can be used to show how it influenced the EMI workplan of year 3: this request after PTB assessment got accepted, approved and set as a new high level top priority cross-area technical objective, the “*X19 Clear identification of the mandatory configuration variables*“, affecting all technical areas. Then, all the relevant product teams received a very specific development task to address the original community request.

A simplified tabularized snapshot view of the EMI requirement tracker is presented in the table below. This table gives a high level overview of EMI requirements including their status. Please refer to the Annex and the Requirement Tracker [R7] for additional information.

Tracker ID	Requirement	Category	Status	Release	Requestor
#20334	WMS should provide better feedback about jobs, automated resubmission of stuck jobs	component requirement	Resolved	EMI 1	Various User Communities via EGI-UCB
#20335	Release EMI clients on SL5/32	general requirement	Resolved	EMI 2	EGI-TCB, WLCG
#20339	CEs should support a set of LRMS	general requirement	Resolved	EMI 2	EGI-OMB
#20340	Provide optimized semi-automated configuration of service backends	general requirement	Resolved	EMI 2	EGI-OMB
#20342	Better WMS configuration tools and monitoring	component requirement	Resolved	EMI 1 update	EGI-OMB
#20349	Various MPI-Start improvements	component requirement	Resolved	EMI 1 update	EGI-OMB
#20350	CREAM: better GLUE 1.3 cluster information	component requirement	Resolved	EMI 1 update	EGI-OMB
#20357	Unicore site infosystem enhancement	component requirement	Resolved	EMI 1 update	NGI_PL, EGI-OMB
#20359	Provide Nagios probes for EMI services	general requirement	Resolved	EMI 2	EGI-OMB
#20478	Support for SL6	general requirement	Resolved	EMI 2	EGI-TCB, WLCG
#26581	Automate VO membership renewal by VOMS	component requirement	Resolved	EMI 2	EGI-TCB, NGI_IBERGRID
#26591	Support drop-in trust anchor distribution	general requirement	Resolved	EMI 2	David Groep
#26408	Support for three additional JDL attributes: SMPGranularity, HostNumber, Wwholenodes	component requirement	Duplicate	none	EGI-TCB, NGI_PL
#26617	Possibility to throttle job submission rate via CREAM	component requirement	Duplicate	none	EGI-TCB
#26572	Top-BDII must scale with the number of sites	component requirement	Need Info	none	EGI-TCB
#26610	CE should "secure" jobs with special memory requirements	general requirement	Need Info	none	WLCG TEG
#22854	EMI appliances for KVM	general requirement	under discussion	none	WeNMR project
#20329	High Availability (HA) CREAM	component requirement	endorsed	EMI 3	came via several mails, WLCG ?
#20331	Better error messages (more verbose, informative)	general requirement	endorsed	EMI 2 update	Various User Communities, received via EGI-UCB
#20337	Ubuntu support at least for EMI clients	general requirement	endorsed	EMI 3	NGI_FRANCE, received via EGI-

					OMB; EMI survey
#20344	support for VO renaming and migration in the SEs and LFC	general requirement	endorsed	post EMI	EGI-OMB
#20348	Simple (and automatic) way of forcing users to choose a group during VO registration	component requirement	endorsed	EMI 3	EGI-OMB
#20352	Protection against DOS attacks	general requirement	endorsed	EMI 3	EGI-OMB
#26415	automagical migration of files among SEs to prevent filling up disk space	general requirement	endorsed	post EMI	EGI-TCB, Life Sciences Grid Community
#26458	Data lifetime management	general requirement	endorsed	post EMI	EGI-TCB, WeNMR
#26573	Top-BDII should be able to handle multiple info sources per site	component requirement	endorsed	EMI 3	EGI-TCB, COO
#26575	Support for local jobs in the accounting system	general requirement	endorsed	EMI 3	EGI-TCB
#26584	The accounting layer should treat sites with more than one CE installed correctly	general requirement	endorsed	EMI 3	EGI-TCB
#26585	short-lived anonymous HTTP TURL on Storage Elements	general requirement	endorsed	post EMI	EGI-TCB, NGI_IT
#26589	Support for SHA2 proxies	general requirement	endorsed	EMI 3	EGI
#26590	Support the Online Certificates Status Protocol	general requirement	endorsed	EMI 3	EGI
#26592	Authorization based on the accepted proxy lifetime	general requirement	endorsed	EMI 3	EGI
#26593	CRL refresh	general requirement	endorsed	EMI 3	EGI
#26602	CE should support jobs requiring whole nodes or multiple cores	general requirement	endorsed	EMI 3	WLCG TEG
#26614	CE interface extension for "job streams"	general requirement	endorsed	post EMI	WLCG TEG
#26618	Replace gsoap	general requirement	endorsed	post EMI	EGI-TCB
#26824	Tarball for the EMI-UI	component requirement	endorsed	EMI 3	WLCG, ATLAS VO
#27010	Reduce WMS memory usage	component requirement	endorsed	EMI 3	CMS
#27011	Enable logging from CEs in LB	component requirement	endorsed	EMI 3	WLCG
#27082	Provide transparent HTTP access to distributed storage composed of different SEs	general requirement	endorsed	EMI 3	WLCG
#20333	Coherency of APIs	general requirement	endorsed with	EMI 3	Various User Communities,

			modification		received via EGI-UCB
#26574	Mandatory variables in configuration files should be clearly identified	documentation requirement	endorsed with modification	EMI 3	EGI-TCB, NGI_NL
#20345	Increase of LB WS interface performance	component requirement	Returned	none	EGI-OMB
#20346	Reduce memory consumption of CREAM	component requirement	Returned	none	EGI-OMB
#26411	Stability and scalability of data area services	general requirement	Returned	none	EGI-TCB, LSGC VRC
#26414	'rsync' style file updates including automatic update of all its replicas	general requirement	Returned	none	EGI-TCB, Life Sciences Grid Community
#26417	Set the same default SRMv2.2 port on all SEs	general requirement	Returned	none	EGI-TCB, NGI_HR
#26578	Publish accurate HEP SPEC06 benchmark	general requirement	Returned	none	EGI-TCB, COO
#26579	Identify users affected by an SE intervention	general requirement	Returned	none	EGI-TCB, Asia Pacific NGI
#26580	WMS to support multiple Top-BDII's	component requirement	Returned	none	NGI_IT
#20330	Increased stability and scalability for gLite WMS	component requirement	ongoing	EMI 2 update	Various User Communities, received via EGI-UCB
#20332	Coherency of command line commands parameters	general requirement	ongoing	EMI 3	Various User Communities, received via EGI-UCB
#20336	Debian 6 support	general requirement	ongoing	post EMI	received via various surveys
#20338	Standard file locations for logs and temporary files	general requirement	ongoing	EMI 2 update	EGI-OMB
#20343	Publish mw service version	general requirement	ongoing	EMI 2 update	EGI-OMB
#20351	monitoring interactive jobs	general requirement	ongoing	EMI 3	EGI-OMB
#20353	common way of controlling services	general requirement	ongoing	EMI 2 update	EGI-OMB
#20354	Service comparison documentation	documentation requirement	ongoing	EMI 2 update	EGI-OMB
#20355	New features for Unicore Target System	component requirement	ongoing	EMI 3	EGI-OMB
#20356	Unicore server-side management tools	component requirement	ongoing	EMI 2 update	NGI_PL
#20358	WebDav interface to LFC/SE	general requirement	ongoing	EMI 3	Grid in Ireland

#20360	EMI Data clients should be able to offer the file:// protocol to SRM services	general requirement	ongoing	EMI 2 update	EGI-OMB
#22849	Load balancing for CREAM, WMS and LFC	component requirement	ongoing	EMI 3	EGI-TCB
#22851	documentation for service migration and hot swapping	documentation requirement	ongoing	EMI 2 update	EGI-TCB
#22853	Coherency of storages and catalog	general requirement	ongoing	EMI 3	EGI-TCB
#26407	VOMS Admin supports group selection at registration time	component requirement	ongoing	EMI 2	EGI-TCB, NGI_IT
#26447	High Availability (HA) ARGUS	component requirement	ongoing	EMI 3	EGI-TCB
#26577	Accounting of parallel jobs	general requirement	ongoing	EMI 3	EGI-TCB
#26587	Enforce Relying-Party Defined Namespace constraints	general requirement	ongoing	EMI 3	David Groep
#26588	Default key size for any generated proxy	general requirement	ongoing	EMI 3	David Groep

3. PRODUCTS AND PRODUCT TEAMS

The EMI software stack originates from four middleware providers thus consists of selected components provided by the ARC, gLite, UNICORE and dCache middleware consortia. The first definition and composition planning of the EMI software stack was presented in the DNA1.3.1 “Technical development plan” document. The first plan envisioned an EMI distribution containing 98 components.

The overall technical objective of EMI, as outlined in Section 4, is to deliver a consolidated and unified software stack, consisting of variety of products providing Grid services using unified interfaces, and complete with utilities and tools necessary to build a Grid infrastructure of any size and complexity. To meet this objective, the original pre-EMI components had to be re-engineered to offer common interfaces, re-packaged to provide unified deployment, and several new products, such as common libraries and an information indexing service, needed to be added in order to provide the desired consolidation.

It is important to understand that EMI does not impose a specific architecture; rather, it offers services and tools that allow federating existing computing and storage resources into various distributed infrastructures. The ultimate goal of EMI is to make sure that all its components are fully interchangeable, allowing all kinds of architectural solutions, depending on specific customer requirements.

The concrete realization of the EMI software stack started with the preparation of the EMI 0 “Zugspitze” internal test release. The **EMI 0** was an ‘exercise’ release designed to understand how to apply the agreed procedures, find any problem about tools and processes and in general fine tune the EMI software engineering process. The outcome of EMI 0 was not expected to be released externally. The resulting EMI 0 packages, making up the first EMI product list, were described in the milestone report [R8].

The **EMI 1** release preparation had further influenced the way EMI software stack is structured in terms of products and components. To keep granularity as uniform as possible, the initial 98 “DNA1.3.1 components” were logically grouped into 61 products.

The current EMI software portfolio, as of the final stage preparation of the Matterhorn release is going on, consists of 62 products. 4 products² out of the 62 have not yet been released in EMI 1 and not ready for EMI 2 either. The other 58 products constitute the **EMI 2** release stack.

The EMI **software portfolio** has undergone **some organisational changes during the second year**: new products were defined as the result of the common development (EMIR, CANL, EMI datalib), or by community request (CREAM LSF module, CREAM SGE module, CREAM SLURM, EMI-Nagios, WNoDeS). Two UNICORE products, the USE and the UNICORE/X got merged into one product. A couple of UNICORE products undergone minor name change. Finally, one product, the DGAS accounting sensors, has been removed from the stack as a result of the accounting functionality consolidation. These changes are not caused by unexpected activities: they are in line with the previous technical plan, and took place with the PTB approval in order to accommodate the planned new developments into the existing organisational structure.

These changes in products also lead to corresponding **changes in the product teams**. The formation of three new PTs (EMI Common, WNoDeS, EMI CANL) and a discontinuation of one Product Team (DGAS) have been approved by the EMI Project Technical Board.

During the year 3 no new product addition is foreseen while it is expected that the 4 planned or alpha state products will become mature enough to be released as part of an EMI 2 update or **the final EMI release**, the Monte Bianco.

² CREAM SLURM module, EMI datalib, Hydra, Messaging library

In what follows, the latest official **inventory of the EMI software stack** is presented via the **EMI product table**. The table lists all the EMI software products regardless their current status (e.g. planned or already released). The maintenance and development of the EMI products is carried out by their respective Product Teams under the coordination of SA1 and JRA1 and under the governance of well-defined policies. The product table provides the organization of the EMI products into product teams as well, reflecting changes outlined above.

This EMI component table serves as an key reference not only for the software development activities but also for the entire EMI project.

The products are listed in alphabetic order, and for each, the area (compute, data, infrastructure or security) and type (service, client or internal non-exposed component) are indicated. One can see that the EMI software portfolio covers all the areas, and offers a large variety of functionalities.

	Product	Element	PT	Area	Type	Release Status
1.	AMGA	AMGA server	AMGA	D	service	v2.1.2 in EMI 1 v2.3.0 in EMI 2
		AMGA client		D	client	
2.	APEL parsers	none	APEL Client	I	internal	v1.0.1 in EMI 1 v1.1.0 in EMI 2
3.	APEL publisher	none		I	client	
4.	ARC CE	A-REX	ARC Compute Element	C	service	v1.1.0 in EMI 1 v2.0.0 in EMI 2
		ARC gridftp jobplugin interface		C	service	
		Infoproviders		I	internal	
		ARC CE-Cache		D	internal	
		ARC CE-staging		D	internal	
		ARC LRMS modules		C	internal	
		JANITOR		C	internal	
		JURA accounting hook		I	internal	
		nordugridmap		S	internal	
5.	ARC Clients	pre-WS compute CLI (ng*)	ARC Clients	C,I	client	v1.1.0 in EMI 1 v2.0.0 in EMI 2
		WS compute CLI (arc*)		C,I	client	
		libarcclient		C,I	library	
		libarcdata2		D	library	
		pre-WS data CLI (ng*)		D	client	
		WS data CLI (arc*)		D	client	
		arc-proxy		S	client	
6.	ARC Core	HED	ARC Container	I	service	v1.1.0 in EMI 1 v2.0.0 in EMI 2
		HED Security		S	internal	
		HED LIDI		I	internal	
		HED language bindings		I	internal	
		DMCs		D	internal	

	Product	Element	PT	Area	Type	Release Status
7.	ARC GridFtp server	none	ARC Classic SE	D	service	v1.1.0 in EMI 1 v2.0.0 in EMI 2
8.	ARC InfoSys	ARIS	ARC Infosys	I	service	v1.1.0 in EMI 1 v2.0.0 in EMI 2
		EGIIS		I	service	
		ARC Grid Monitor		I	client	
9.	ARGUS	Argus server	ARGUS	S	service	v1.4.0 in EMI 1 v1.5.0 in EMI 2
		Argus client		S	library	
10.	ARGUS-EES	none	ARGUS	S	service	v0.0.10 in EMI 1 v0.1.3 alpha for EMI 2
11.	BDII core	BDII resource	gLite Infosys	I	service	v1.3.0 in EMI 1 and in EMI 2
		GLUE model		I	internal	
		GLUE validator		I	internal	
12.	BDII site	none	gLite Infosys	I	service	v1.1.0 in EMI 1 and in EMI 2
13.	BDII top	none	gLite Infosys	I	service	v1.0.1 in EMI 1 and in EMI 2
14.	BLAH	none	gLite Compute	C	internal	v1.16.4 in EMI 1 v1.18.0 in EMI 2
15.	CEMon	none		C	service,client	v1.13.3 in EMI 1 v1.14.0 in EMI 2
16.	CREAM LSF module	none		C	internal	v1.0.0 in EMI 1 v2.0.0 in EMI 2
17.	CREAM SGE module	none		C	internal	v1.0.0 in EMI 1 v2.0.0 in EMI 2
18.	CREAM Torque module	none		C	internal	v1.0.0 in EMI 1 v2.0.0 in EMI 2
19.	CREAM SLURM module	none		C	internal	planned
20.	CREAM	CREAM service		C	service	v1.13.3 in EMI 1 v1.14.0 in EMI 2
		CREAM client		C	client	
21.	dCache	dCache server		dCache	D	service
		dCache client	D		client	
22.	Delegation Java	none	gLite sec.	S	library	v2.0.1 in EMI 1 v2.2.4 in EMI 2

	Product	Element	PT	Area	Type	Release Status
23.	DPM	DPM server	CERN Data	D	service	v1.8.2 in EMI 1 v1.8.3 in EMI 2
		DPM client		D	client, library	
24.	EMI-UI	none	EMI Common	C,D,S ,I	client	v1.0.0 in EMI 1 v2.0.0 in EMI 2
25.	EMI-NAGIOS	none		C,D,S ,I	client	v1.0.0 alpha for EMI 2
26.	EMI-WN	none		C,D,S ,I	client	v1.0.0 in EMI 1 v2.0.0 in EMI 2
27.	EMI CANL	JAVA part C part C++ part	EMI CANL	S	library	v1.0.0 in EMI 2
28.	FTS	FTS service and agents	CERN Data	D	service	v2.2.8 in EMI 1 and in EMI 2
		FTS cli		D	client	
29.	GFAL/lcg_util	GFAL		D	library	v1.11.19 in EMI 1 v1.12.1 in EMI 2
		lcg_util		D	client	
30.	<i>EMI datalib</i>	<i>none</i>		<i>D</i>	<i>library</i>	<i>planned</i>
31.	gLExec-wn	gLExec	gLite security	S	internal	v1.0.1 in EMI 1 v1.1.1 in EMI 2
		LCAS		S	internal	
		LCMAPS		S	internal	
		LCMAPS- plugins-c-pep		S	internal	
32.	gLite CLUSTER	none	gLite Compute	C,I	service	v1.0.0 in EMI 1 v2.0.0 in EMI 2
33.	gLite-gsoap/gss	emi-lbjp- common-gsoap- plugin	CESNET security	S	internal	v3.0.2 in EMI 1 v3.1.3 in EMI 2
		emi-lbjp- common-gss		S	internal	
34.	gLite- proxyrenewal	emi-px- proxyrenewal		S	internal	v1.3.21 in EMI 1 v1.3.25 in EMI 2
35.	gLite-MPI	MPI-start		gLite MPI	C	internal
		MPI-utils	C		internal	

	Product	Element	PT	Area	Type	Release Status
36.	gLite-yaim-core	none	EMI common	all	internal	v5.0.0 in EMI 1 v5.1.0 in EMI 2
37.	gridsite	org.gridsite	CESNET sec.	S	internal	v1.7.19 in EMI 1 v1.7.21 in EMI 2
38.	Hydra	none	gLite sec.	S,D	service	<i>not yet released, not yet ready for EMI 2</i>
39.	L&B	LB server	L&B	C	service	v3.1.0 in EMI 1 v3.2.6 in EMI 2
		LB client		C	client	
40.	lcg-info-clients	lcg-info, lcg-infosites	gLite Infosys	I	client	v1.0.0 in EMI 1 v1.0.1 in EMI 2
41.	LFC	LFC server	CERN Data	D	service	v1.8.2 in EMI 1 v1.8.3 in EMI 2
		LFC client		D	client, library	
42.	RAL-SAGA-SD	SAGA-SD	SAGA-SD- RAL	I	library	v1.0.0 in EMI 1 v1.0.0-4 in EMI 2
		SAGA-ISN		I	library	
43.	StoRM SE	none	StoRM	D	service	v1.8.2 in EMI 1 v1.9.0 in EMI 2
44.	TORQUE server config	yaim-torque- server	EMI Common	C	internal	v1.0.0 in EMI 1 v1.0.0-2 in EMI 2
45.	TORQUE WN config	yaim-torque- client lcg-pbs-utils		C	internal	v1.0.0 in EMI 1 v2.0.0 in EMI 2

	Product	Element	PT	Area	Type	Release Status
46.	Trustmanager	Trustmanager	gLite sec	S	library	v3.0.5 in EMI 1 v3.1.3 in EMI 2
47.	UNICORE Client6	U. client libs	UNICORE Clients	C	library	v4.1 in EMI 1 v5.0.0 in EMI 2
		ucc		C	client	
48.	UNICORE HILA	none		C	library	v2.2 in EMI 1 v2.3.0 in EMI 2
49.	UNICORE Gateway6	none	UNICORE sec.	S	service	v2.2 in EMI 1 v4.3.0 in EMI 2
50.	UNICORE XUADB	none		S	service	v1.3.2-3 in EM 1 v1.3.2-4 in EMI 2
51.	UNICORE Registry6	none	U. Services	I	service	v4.0 in EMI 1 v5.0.0 in EMI 2
52.	UNICORE TSI6	none	U. Services	C	internal	v4.0 in EMI 1 v5.0.0 in EMI 2
53.	UNICORE UVOS	UVOS service	U. sec	S	service	v1.5.0-1 in EMI 1 v1.5.1-1 in EMI 2
		UVOS client		S	client	
54.	UNICORE/X6	XNJS	UNICORE Services	C	internal	v4.0 in EMI 1 v5.0.0 in EMI 2
		WSRFLite		I	internal	
		Security libs		S	library	
		XACML PDP		S	internal	
		AIP		S	internal	
		UAS-C		C	service	
		U-BES		C	service	

	Product	Element	PT	Area	Type	Release Status
		U-EMIEX		C	service	
		U-CIP		I	service	
		UAS-D		D	service	
55.	VOMS	VOMS server	VOMS	S	service	v2.0.6 in EMI 1 v2.0.8 in EMI 2
		VOMS client		S	client, library	v2.0.7 in EMI 1 v2.0.8 in EMI 2
56.	VOMS-Admin	none		S	service	v2.6.1 in EMI 1 v2.7.0 in EMI 2
57.	WMS	WMS server	gLite Compute	C	service	v3.3.4 in EMI 1 v3.4 not yet ready for EM 2
		WMS client		C	client, library	
		jobwrapper		C	internal	
58.	STS	<i>none</i>	gLite sec.	S	service	<i>alpha not ready for EMI 2</i>
59.	Pseudonymity	none		S	service	v1.0.0 in EMI 2
60.	EMIR	none	Registry	I	service	v1.1.1 in EMI 2
61.	WNoDES	none	WNoDES	C	service	v2.0.0-2 in EMI 2
62.	<i>EMI messaging layer</i>	<i>none</i>	Messaging	I	library	<i>planned</i>

EMI Product Table Legend:

- **Product:** name of the product
- **Element:** in case the product consists of well-identifiable modules/components/units with separate characteristics, the Element column lists those sub units. Alternatively, “none” is set.
- **PT:** name of the product team responsible for the product.
- **Area:** the technical area addressed by the product or element. Multiple values are allowed:
 - C: compute
 - D: data
 - S: security
 - I: infrastructure

- **Type:** the type of the product or element. Multiple values of “service”, “client”, “library” or “internal” are allowed.
- **Release Status:** The product version and the EMI release in which the product is made available. “Planned” means at least a design exists while “alpha” indicates that the product has not yet reached a production-ready status and should be considered as a technology/feature preview.

Products listed in *italics* are not yet ready for the EMI 2 release, as of the time of writing.

4. TECHNICAL OBJECTIVES

This chapter defines the EMI development strategy: the presentation of the three pillars of the EMI development is followed by a high-level time-line view of the overall development plan. Finally, a table with the concrete technical objectives is provided.

The EMI software development is organized around the following three pillars:

Support existing DCI infrastructures by providing re-active and pro-active maintenance for software components used in production. Implement best-practice service-oriented procedures based on clear Service Level Agreements. Work out transition and phase out plans.

Harmonize and consolidate the software portfolio originating from the middleware consortia by removing duplications and simplifying usage and maintenance. The EMI software stack must be consolidated and streamlined by removing unnecessary duplication, replacing proprietary technologies with off-the-shelf and community supported technologies wherever possible. The harmonization should be carried out via the adoption of either standard interfaces from well-established international collaborations or interfaces defined via EMI agreements reflecting de-facto standards used by the majority of implementations.

Evolve the middleware by addressing the requirements of the growing infrastructures as they become more stable and pervasive. The focus is more on hardening the reliability of existing services, evolving their operational capabilities, implementing new requested features and addressing clear and present needs, rather than producing new prototypal technology to be deployed in a few years' time. The development preferably should be based on existing code or off-the-shelf 3rd party solutions, this way avoiding the creation of yet another prototype-level solution.

4.1. HIGH LEVEL VIEW

As the ultimate result of the EMI software development activity, by the end of the project, EMI will deliver a high quality **consolidated middleware distribution** of modular inter-compatible components with **unified interfaces** offering advanced functionalities that can be swapped depending on what kind of feature set is needed. The *EMI-Final* software stack will consist of reliable **interoperable solutions** for the core capabilities needed to operate and manage a distributed computing infrastructure. In particular, EMI will provide services within the compute, data, security and infrastructure functionality areas. The EMI services will form **an integrated ecosystem** via the common security mechanisms and the information system backbone. On the user-side simplified management of security credentials will hide the complexity of Grid security and considerably lower the entry level barrier. The EMI products, many of them to be available as grid appliances deployable in **cloud environments**, will benefit from advanced technologies such as **messaging and virtualization**. *EMI-Final* will also bring **simplification and streamlining** into the current middleware landscape due to harmonization and consolidation efforts.

The high level view of the EMI development roadmap is shown in Figure 2. The workplan is divided into three phases (years):

- The first phase of the development is marked as EMI 1. This phase was completed with the *Kebnekaise release* delivered on 12 May 2011. During the first EMI development phase important technical agreements, component design and early implementations were delivered in addition to the enormous integration efforts that had been deployed for EMI 1 release preparation. Furthermore, most of the *Kebnekaise* products come with numerous improvements as a result of individual component evolution.
- The second development phase, leading to the soon-to-be released EMI 2 release, completed the work on the four area consolidation plans (data, security, compute and infrastructure) that

already had started back in year 1. The second phase constituted the most development intensive period of the EMI project. This was the phase that delivered harmonized solutions based on the first year agreements, products such as the EMI Execution Service Interface implementations or the EMIR service and the CANL security library are highlights of the Matthehorn release. Some Year 2 product developments have not yet become ready for public release and their completion is due during the third year (STS and the EMI datalib are such products).

- During the third, final phase the work will focus on completing all the open development tasks thus bringing the three-year EMI developments to production level. Not yet released products such as STS and the EMI datalib will be the new product highlights of the third release. Apart from these, the final phase development objectives, which are detailed in next Section, are mostly targeting hardening of existing EMI features, improving non-functional aspects such as reliability, usability and interoperability. Another important objective is the integration of common libraries and EMI products with the rest of the EMI software portfolio. The broad usage of the EMIR information index service and the migration to the CANL EMI security library are such planned activities. The phase will result with the *Monte Bianco* release due February 2013.

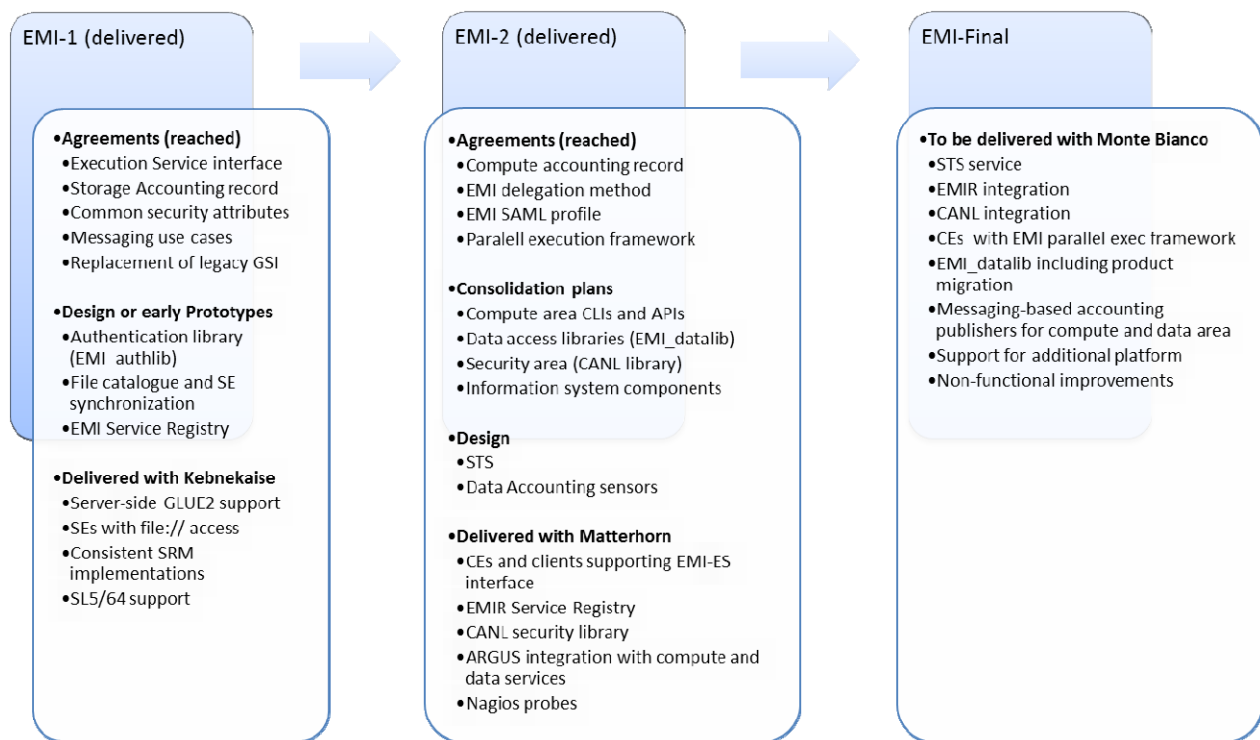


Figure 2: High level overview of the most important EMI development objectives. Please note not all the objectives are displayed, the figure is not a comprehensive graphical presentation of all the objectives.

4.2. INVENTORY OF OBJECTIVES

The updated table presents the technical objectives of the EMI development plan as a result of the year 3 workplan preparation. For each objective, priority (highest 5, lowest 1), implementation due date (expressed in project months) and status information is provided. When due date is yet to be defined precisely, “N/D” is inserted. Objectives that has been achieved already have “-” for both priority and due date. More detailed description of the objectives, including the specification of affected products and also an extended progress report is given in the respective specific technical area work plans (see Section 1.2).

During the year 3 workplan preparation, the relevance, priority and due date of every not yet completed objective have been revised by the PTB. This revision was based on the following principle: the focus of the year 3 development is set on completing the ongoing work, making sure high quality, production ready features are delivered and that the common EMI agreements, products and libraries are taken up, integrated and used within a broad set of EMI components.

In addition to the existing objectives, 12 new ones have been defined in order to address new requirements (see Section 2) received during year 2. These new objectives do not represent new strategies; rather, they are complementary to the existing EMI plans and visions, adapting to the newly emerging requirements. Conversely, 9 existing objectives were de-prioritized, with the associated ongoing or not yet started development removed from the scope of the project. These changes reflect the changing requirements and technology landscape, and enable the project to allocate resources efficiently. The “status” column of the inventory table below briefly explains such decisions, while a more detailed justification of the discontinuation of a development objective can be found in each respective dedicated technical area workplan document.

It should also be noted here that objectives with the priority value 1 are categorized as lowest priority development targets. These lowest priority tasks still have the attention of the project but most likely will not be fully carried out during the lifetime of the EMI project due to non-available resources. However, if there are collaborating parties that plan to address these objectives, EMI will be keen on promoting some of them and working with them on the implementation. Alternatively, the priority 1 tasks can be worked on after EMI 1 as part of a post-EMI Product Team development work.

	Compute area objectives	Priority	Due	Status
C1	Glue 2.0 support in job management services (LDAP and/or XML rendering).	-	-	delivered with EMI 2
C2	Agreements over an EMI compute accounting record (UR).	-	-	delivered with EMI 2
C3	Investigate solutions to improve interactive access capability of at least one EMI CE.	1	N/D	could be done depending on available effort
C4	Proposal for a common parallel execution framework, a “backend” across the different computing services to allow users to execute parallel applications in a uniform way.	-	-	delivered with EMI 2
C5	Implementation of the agreed common job submission and management methods (EMI-ES	5	M27	partially (70%) delivered with EMI 2

	Compute area objectives	Priority	Due	Status
	interface) in all the CEs.			
C6	Implementation of the agreed common job submission and management methods (EMI-ES interface) in compute clients.	4	M27	partially (40%) delivered with EMI 2
C7	EMI compute area services should provide fully integrated solutions to interface with identified set of batch systems.	-	-	delivered with EMI 2
C8	Glue 2.0 support in matchmaking modules and client tools.	5	M26	partially (80%) delivered with EMI 2
C9	Support for the EMI compute accounting record (UR) by compute area services.	3	M27	ongoing
C10	Consolidation and harmonization of compute area clients/APIs.	5	M25	ongoing
C11	Implement the EMI cloud strategy within compute area.			ongoing, partially delivered with WNoDeS
C12	Implementation of the common parallel execution framework across the EMI computing services.	3	M32	starts in Y3
C13	Extend the parallel computing capabilities to better address multi-core jobs on emerging architecture resources; multi-node execution on interconnected clusters; and special scenarios like advanced topologies, FPGAs, GPGPUs.	-	-	delivered with EMI 2
C14	Provide better support for jobs requiring exclusive node and/or multiple core allocation	3	M32	new
C15	Ability to process job with different characteristics in a suitable environment	3	M32	new
C* ³	EMI-ES interface extension for job streams	1	N/D	new, could be done depending on available effort

	Data area objectives	Priority	Due	Status
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³ * denotes an objective with no number assigned yet, or which has been already achieved earlier

	Data area objectives	Priority	Due	Status
D*	All storage elements publishing initial GLUE 2.0 storage information.	-	-	delivered with EMI 1
D*	Using https instead of httpg for the SRM protocol as a prototype implementation in one storage element and client (library).	-	-	delivered with EMI 1
D*	All storage elements offering at least a prototype-level support for the "file://" access protocol.	-	-	delivered with EMI 1
D*	Overall consolidation of data area by adopting a consistent interpretation of SRM.	-	-	delivered with EMI 1
D*	Agreement over a common storage accounting record including the refinement, definition and adoption (if/when applicable) of relevant standards.	-	-	delivered with EMI 1
D1	A storage client is capable consuming GLUE 2.0 information published by storage elements.	5	M27	ongoing
D2	Investigate the possibility to support http/webdav for LFC in order to provide a standard user-friendly access method to catalogues.	-	-	delivered with EMI 2
D3	SRM-capable clients and services should add "file://" to the already supported access protocols.	3	M26	ongoing
D4	File Catalogue Access from UNICORE data.	3	M29	ongoing
D5	Providing a common set of data access libraries at least between gLite and ARC (EMI_datalib).	4	M29	ongoing
D6	All storage elements publishing full set of GLUE 2.0 storage information and the EMI data client is capable consuming that.	-	-	delivered with EMI 2
D7	Integration of SRM-based access into UNICORE storage management	3	M32	ongoing
D8	All storage elements offering support for the http(s) protocol.	-	-	delivered with EMI 2
D9	Investigate solutions to work with EMI data services in the context of persistent data Ids.	1	N/D	could be done depending on available effort
D10	Solve the synchronization problem of the storage elements and the file catalogue.	-	-	Delivered with EMI 2 for LFC and DPM

	Data area objectives	Priority	Due	Status
D11	Storage elements offering support for the WebDav protocol.	4	M30	partially (70%) delivered with EMI 2
D12	Using https instead of http for the SRM protocol as a production implementation in all the storage elements and clients utilizing the EMI delegation.			discontinued
D13	Integration of AMGA-based access to UNICORE storage management.	-	-	delivered with EMI 2
D14	Design and implement the next generation FTS, a distributed next generation file transfer service that among others utilizes the common messaging system.	4	M32	ongoing
D15	Completed migration to the common EMI_datalib data access libraries.	3	M32	starts in Y3
D16	Add support for storage space usage accounting to SEs based on the agreed record.	5	M29	ongoing
D17	Implement the EMI cloud strategy within data area.			Waiting for definition of cloud strategy in this area
D18	Provide transparent HTTP access to distributed storage composed of different SEs	3	M32	new
D*	Basic data lifetime management in the SEs	1	N/D	new, could be done depending on available effort
D*	Supporting short-lived anonymous HTTP transfer URLs on Storage Elements	1	N.D	new, could be done depending on available effort

	Security area objectives	Priority	Due	Status
S0	Agreement on a minimal common set of security attributes to be used in policies.	3	M29	ongoing
S1	Plan for substantial simplification and reduction in the number of security area CLIs, libraries, internal components and services: security area consolidation plan.	-	-	delivered with EMI 2

	Security area objectives	Priority	Due	Status
S2	Simplified management of security credentials by reducing the complexity of handling certificates and integrating different security mechanisms like Shibboleth and Kerberos across the EMI stack that allows users to use their own authentication system to access a ``Grid".	5	M32	ongoing
S3	Provide common authentication libraries supporting X.509 and optionally SAML (EMI_authlib).	-	-	delivered with EMI 2
S4	Agreement and full support for a common single X.509 and SAML based Attribute Authority Service integrated with all EMI components.			re-scoped to a limited set of use-cases
S5	Implementation of the security area consolidation plan.			discontinued (duplicate of X17)
S6	Provide a transparent solution for encrypted storage utilizing ordinary EMI SEs.	-	-	delivered with EMI 2
S7	Proxy handling features to address sha2, default keysize and ocsf requests	4	M28	new
S*	Apply the available ARGUS-based authorization framework to support the proxy-lifetime restriction use case.	1	N/D	new, could be done depending on available effort

	Infrastructure area objectives	Priority	Due	Status
I*	Provide early internal guidelines for integrating messaging into potential EMI target components.	-	-	delivered with EMI 1
I*	Design a common EMI Service Registry that is required in order to discover all the service endpoints of the different middleware components.	-	-	delivered with EMI 1
I*	Investigate possible use cases for a common standard messaging system for the information services and L&B.	-	-	delivered with EMI 1
I1	Investigate possible use cases for a common standard messaging system in the accounting area.	-	-	delivered with EMI 2
I2	Investigate possible use cases for a common standard messaging system for the service monitoring and management.	-	-	delivered with EMI 2

	Infrastructure area objectives	Priority	Due	Status
I3	Devise a plan for substantial simplification and reduction in the number of infrastructure area CLIs, libraries, internal components and services.	-	-	delivered with EMI 2
I4	Deliver the EMI cloud architecture and strategy.	-	-	delivered by NA3
I5	Fully utilize and support the GLUE2 model in information components including the development of validation tools.	-	-	delivered with EMI 2
I6	Implement the EMI Service Registry.	-	-	delivered with EMI 2
I7	Provide guidelines for 3 rd parties to integrate messaging into their services or applications based on the EMI experience.	-	-	delivered with EMI 2
I8	Investigate service remote management interface for the compute, data, security and infrastructure area services, including remote configuration change and service management, utilizing the messaging system.			Discontinued by requests of infrastructure managers (replaced by implementation of Nagios probes)
I9	Implement or adapt the accounting record publishers of compute and data area services to use the common messaging system.	5	M28	ongoing
I10	Implementation of the infrastructure area consolidation plan.	3	M32	ongoing

	Common or Cross area objectives	Priority	Due	Status
X*	Define the Information Flow architecture describing messaging and non-messaging based information exchange of the EMI components (e.g. service registry, information system, accounting, monitoring, and instrumentation).	-	-	delivered with EMI 1
X*	Investigate possible use cases for a common standard messaging system in the computing area.	-	-	delivered with EMI 1
X*	Investigate possible use cases for a common standard messaging system in the data area.	-	-	delivered with EMI 1
X1	Publish coherent GLUE2-based version information as part of service description in order to facilitate service discovery and monitoring.	3	M26	partially (80%) delivered with EMI 2

	Common or Cross area objectives	Priority	Due	Status
X2	Definition of a common SAML profile all over the middleware stacks.	-	-	delivered with EMI 2
X3	Agreement on common EMI delegation method.	4	M32	ongoing
X4	Provide and support monitoring probes for EMI services (e.g. Nagios).	3	M26	partially (90%) delivered with EMI 2
X5	Integration of the compute area services with the ARGUS authorization framework.	-	-	delivered with EMI 2
X6	Adhere to operating system standards for service operation and control regarding configuration, log and temporary file location and service start/status/stop.	3	M26	partially (90%) delivered with EMI 2
X7	Port, release and support EMI components on identified platforms (full distribution on SL6 and Debian 6, UI on SL5/32 and latest Ubuntu).	2	M34	partially (40%) delivered with EMI 2
X8	Improve usability of client tools based on customer feedback by ensuring a) better more informative, less contradictory error messages b) coherency of commands line parameters.	4	M32	ongoing
X9	Initial integration of the storage elements with the ARGUS authorization framework.	-	-	delivered with EMI 2
X10	Introduce minimal DOS protection for EMI services via configurable resource limits.	1	N/D	could be done depending on available effort
X11	Implementation of the EMI SAML profile all over the middleware stack.	-	-	delivered with EMI 2
X12	The legacy Globus security infrastructure (GSI) will be replaced with a common security solution based on TLS/SSL and EMI delegation method.	4	M32	partially delivered with EMI-2
X13	Provide optimized semi-automated configuration of service backends (e.g. databases) for standard deployment.	-	-	delivered with EMI 2
X14	Adapt or implement monitoring interfaces, sensors, providers for compute, data, security and infrastructure services to allow the use of standard monitoring tools preferably based on the common EMI messaging system.			discontinued by requests of infrastructure managers (replaced by implementation)

	Common or Cross area objectives	Priority	Due	Status
				of Nagios probes)
X15	Increase performance of EMI services.	3	M32	ongoing
X16	Evolve EMI components to meet specific user requests.	3	M32	ongoing
X17	Complete the rewrite of components utilizing the new emi_authlib libraries.	4	M32	starts in Y3
X18	EMIR rollout: service and consumer-side integration	5	M30	new
X19	Clear identification of the mandatory configuration variables	5	M28	new
X20	Make EMI products installable as a non-privileged user	4	M26	new
X21	Verify the standard support of CRL handling of EMI services	3	M29	new
X22	Support service migration and hot swapping	3	M32	new
X23	Define a consolidated EMI API set	3	M29	new
X24	EMI appliances for the most popular virtualization platforms	2	M35	new

5. CONCLUSIONS

The EMI Technical Development Plan is the main reference document providing the identification of requirements, EMI software portfolio and the planning of the technical work to be performed by the various Product Teams and task forces. This reference document may also be useful for users of the EMI middleware to understand how the EMI middleware distribution is composed and evolves. The EMI Technical Development plan also allow users of the EMI middleware, infrastructure administrators and application developers to plan in advance their work and provide feedback as early as possible in the development cycle.

The second and final update of the plan outlined in this deliverable now gives a complete view of the remaining development directions and also presents the foreseen final EMI software portfolio. The last year development has the emphasis on integration along the common EMI agreements and products and completion of ongoing development. The Year 3 plan also addresses many of the community requests received during the second year. Regarding the software portfolio, the current plan already lists the most possible content of the final EMI release.

Even though this document will not have further update, user requirements and technology change very rapidly especially in the distributed computing and data management fields as infrastructures and applications evolve and become more complex. The collection and analysis of requirements is one of the major activities of the software engineering process in EMI and it is performed continuously by the Technical Director and the Technical Area leaders via several channels, most notably the regular collaboration with the major European infrastructures like EGI, PRACE and WLCG. The result of the requirement analysis and the progress on the EMI technical objectives will be recorded and followed up in the corresponding EMI trackers [R7, R] until the very end of the project, thus inheriting an up-to-date and still relevant requirement and development task list for the Product Teams for post-EMI planning.

6. REFERENCES

R1	DJRA1.1.3 - Compute area work plan and status report <i>http://cdsweb.cern.ch/record/1277612?ln=en</i>
R2	DJRA1.2.3 - Data area work plan and status report <i>http://cdsweb.cern.ch/record/1277617?ln=en</i>
R3	DJRA1.3.3 - Security area work plan and status report <i>http://cdsweb.cern.ch/record/1277571?ln=en</i>
R4	DJRA1.4.3 - Infrastructure area work plan and status report <i>http://cdsweb.cern.ch/record/1277585?ln=en</i>
R5	UMD User and Operation Working Group Recommendations (2009), <i>https://twiki.cern.ch/twiki/pub/EMI/DeliverableDNA131/UMD-User-Operation-Req_draft.pdf</i>
R6	TCB Requirements Management, <i>https://documents.egi.eu/public/ShowDocument?docid=440</i>
R7	The EMI requirement tracker, <i>https://savannah.cern.ch/task/?group=emi-req</i>
R8	EMI-0 Reference release (MSA1.2.1), <i>http://cdsweb.cern.ch/record/1277546/files/EMI_MS18_v1.0.pdf</i>
R9	The EMI development tracker, <i>https://savannah.cern.ch/task/?group=emi-dev</i>

7. ANNEX

7.1. REQUIREMENTS TRACKER

A dedicated tracker, the EMI Requirement tracker is used to monitor requirements received from the EMI customers. The tracker contains **all requests** submitted or communicated to EMI via various channels. The content of the tracker is publicly available at [R7]. This Annex lists and gives definition of the fields used in the tracker and serves as a legend.

EMI Requirements Tracker legend:

- **Tracker ID:** The ID and URL pointing to the actual record in the EMI requirement tracker.
- **Requirement:** A short textual description of the requirement. The tracker entry contains more detailed description.
- **Planned Release:** The release in which the request is initially planned to be addressed
- **Requestor:** The origin of the requirement.
- **Related ticket:** Related ticket(s) (in other tracker) describing the same/similar requirement.
- **Components:** Affected products or components.
- **Category:** The type/scope of the request
 - general: The request is applicable as a general request covering multiple areas and products.
 - component: The request addresses only a specific component.
 - documentation: The request relates to documentation
 - bug report: The request is a bug report, not a requirement
 - non-emi (out-of-scope) : The request targets non-emi components or out-of-scope development objectives
 - other: everything else not fitting the previous categories
- **Priority:**
 - 0 – unknown (not assigned)
 - 1 – lowest
 - 2 – lower
 - 3 - medium
 - 4 - high
 - 5 - top
- **Status:** The state of the requirement.
 - submitted: The requirement has been recorded in the tracker.
 - need info: The requirement is not sufficiently defined.
 - under discussion: The request is being discussed by the EMI technical management (PTB).
 - endorsed: The requirement is accepted as a valid EMI requirement
 - endorsed with modification: A modified version of the original requirement is accepted as a valid EMI requirement.

- ongoing: some activity is already going on in order to address the endorsed requirement. E.g. code is being written, documentation/report is being updated/prepared
- postponed: The requirement will be processed later (no date given)
- duplicate: the request is already covered by another item
- resolved: The requirement has been implemented and released with an EMI component release.
- returned: The requirement is rejected in its current form.