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CRitical SYSTem Engineering AcceLeration

# Bricks Engineering Process Template D600.010



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# 1 Introduction

## **1.1 Role of deliverable**

The processes and tools described in this deliverable may be applied and if needed adapted by the different SP6 work packages and used as guidelines for their development. The development processes shall on the one hand provide means of management and coordination of a WP but also support the actual development of bricks by technology providers. The process will guarantee clear points of communication through the different development phases of the bricks, but not provide an actual development process or tools to be applied by a brick developer. The main processes are:

**Technical Management Process for Brick Development**: This process model describes how the defined project goals and core requirements are defined as technical requirements and corresponding technical items which represent solutions to be implemented for bricks. This process is complementary to the overall technical management process.

**Interoperability Needs Capturing Process:** Due to the fact that the tool integration and interoperability aspects are crucial in CRYSTAL, a common process has been developed to collect and manage the needs expressed by the users. This process is divided in five steps, which are complementary to the CRYSTAL use case driven approach.

The generic Technical Management Process has been implemented successfully in previous ARTEMIS projects, such as CESAR and MBAT. It has been communicated by the team as part of an effort to harmonize and support efforts in this direction on European level.

This deliverable (i.e. the technical management process for the SP6 Brick Development) will be improved and extended continuously during the projects in order to adapt to new situations and circumstances. Therefore the content is to be observed by the partners during the project life time.

## **1.2 Structure of this document**

Chapter 1 Introduction, gives an introduction to the topic and highlights the purpose and scope of this document.

**Chapter 2 Technical Management Process for Brick Development**, describes a process model which support the development and management of Brick development efforts.

**Chapter 3 Interoperability Needs Capturing Process**, this chapter describes how the Use Case needs are to be captured formally by so called Engineering Methods and how these needs are expressed in corresponding requirements for Interoperability.

**Chapter 4 Integration & Test Team (ITT)**, this chapter elaborates the need for a team of experts which support the other project partners on voluntary bases in their development of interoperability solutions.



# **2** Technical Management Process for Brick Development

As mentioned above, the technical management process for the technology Brick development is complementary to the overall CRYSTAL Technical Management Process. It provides guidelines and tools to develop solutions which satisfy requirements and fulfil user needs, defined by the individual use cases.

A generic and scalable technical management process which provides a framework for projects including:

- Adaptable Basic Process
- Common Vocabulary
- Guidelines & Best Practices
- Tools

A generic technical management process addressed challenges of... and brings value to...:

- Development and Collaboration
- Dissemination and Exploitation

## 2.1 Process Model

#### Top-3 goals of the technical management process

- The Process Model shall allow clear work and information flows supporting partners on all levels to achieve the project goals supported by KPIs
- Clear point of contact respecting responsibilities, interests (i.e. business cases) of partners on all levels
- Reduction of management overhead and noise for all the involved project partners (i.e. separation of concern, modularization of activities with clear interfaces from and to activities)

The basic concepts of the process model support a use case oriented development within the different WPs. Here main concepts are the various phases + mile stones, project goals, innovations and technical items. As illustrated in Figure 2-1.



Figure 2-1 Concepts of the technical management process



The relationship diagram represented in Figure 2-2 show the concepts allocated to corresponding project spaces to ensure clear ownership. There are two main spaces which can be described as follows:

- Problem Space: Dominated, but not exclusive, by end users. Here the project "Goals and Sub-Goals, Engineering Methods, Technical Core Requirements and Technical Refined Requirements" are developed and managed jointly.
- **Solution Space:** Dominated, but not exclusive, by tool and technology providers. Here the "*Project Innovations*" (real innovative outcomes beyond the state of the art) and the actual solutions described as "*Technical Items*" are developed and managed jointly.

Full traceability is achieved by linking the *"Technical Refined Requirements"* to their corresponding implementations/realizations represented as *"Technical Items"*.



Figure 2-2 Relationship between the various concepts

### 2.1.1 Technical Items and Technical Requirements

Whereas the concepts of Goals, Tech. Core Req. and Project Innovations (PI) are mainly used for evaluation and monitoring on project level, the two main concepts used for the actual Brick development are the Technical Items and Technical Refined Requirements, as detailed below.

A Technical Requirement is:

- a refined core requirement, related to a technology Brick
- allowing a technology provider to implement solutions and consequently satisfy requirement and user needs
- expressed in a textual form or as a model (note accessibility issues for others)

A Technical item (TI) is:

- a measurable technical project result
- a solution to a Requirement stated in the project (going to be evaluated by the end user)
- expected to trigger an exploitation strategy
- a contribution to the achievement of the project goals
- is further described by a "Detailed Description".

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### 2.1.2 Tool support for the management and organization of the elements

The implantation of the elements has been done in the online platform provided by AVL Microsoft SharePoint. Partners can login to the project environment and will find the various lists of elements by clicking on the elements listed at the left side under "Technical Management", as illustrated in the screenshot below.

🖉 Goals / Sub Goals - Al	l Items - Windows	s Internet Explorer	BX
💽 🕞 🔻 🔣 https://pr	rojects.avl.com/11/015	54/Lists/Sub%20Goals/Allitems.aspx 💽 🔒 🤧 🗴 👂 Google	<b>P</b> -
🚖 Favorites 🛛 🛞 Goals / 1	5ub Goals - All Items	🛅 🔹 👼 🔹 Dage + Safety + Tools +	<b>?</b> • "
Site Actions 😰 Brow	List Tools rse Items List	t Parham Vasaiely AVL	9% 9%
New New View Item	Edit Manage	History missions em Attach Alet em Attach Alet Hite Vorkflows Approve/Reject I Like Tags & Workflows Approve/Reject I Like Tags & I Like Tags & I to read Materia	
Calendar			~
Dissemination activities	∃ Goal : G_02 M	Manage increasing embedded system complexity (by 25%) (5)	
Reviews	SG_02.01	Evolve interoperability specification towards a European standard and improve the RTP (in order to manage increasing embedded system complexity (by 25%))	
Project Structure	SG_02.02	Strengthen the seamless use of model-based systems engineering techniques (in order to manage increasing embedded system complexity (by 25%))	
List of Deliverables	SG_02.03	Improve the requirement management and development process, providing a standard - common - systematic approach featuring traceability	
Member list	SG_02.04	Manage complexity increase of 25% with 10% effort reduction	
Publications	SG_02.05	Improve the configuration management process in the preliminary design phases	
Patents, Trademarks etc.	∃ Goal : G 03 S	Support cross-domain reusability, re-certification, re-qualification, and design variability (5)	
Exploitable Foreground	SG 03.01	Improve and foster cross-domain reusability and variability management	
FAQ's	SG 03.02	Improve collaboration among engineering disciplines involved in embedded system development	
	56,03,03	Inprese exception and another and toole minimize accordination code a year of opping.	=
l echnical Management	SG_03.03	notesse revisionny or design and doos imminizing re-derindration costs. Revision effect and line consider fact or uplications and the consideration of extension shares by 10.158/	
Technology Bricks	SG_03.04	Require error and ume required for re-variadition and re-certaincation or systems after making changes by 10-15%	
Goals / Sub Goals	56_05.05	mansier procedures and tools between different domains, e.g. between aeronautics and space business	
Project Innovations	∃ Goal : G_04 R	Reduce development & design costs and time-to-market (10-15%) (3)	
Engineering Methods	SG 04.01	Reduce development and development life cycle costs by 15-20% depending on application domain	
Technical Core Requirements	SG_04.02	20% fewer design iterations	
Technical Refined Requirements	SG_04.03	Reduce the cost of integration, configuration, deployment, and maintenance of appropriate tool chains for all major actors in the supply chain involved in the project by 50%.	
Technical Items	🖯 Goal : G_05 R	Reduce validation and test effort (by 15%) (4)	
L	SG_05.01	Opportunity to adapt a proprietary test suite to a real multi-provider interoperable environment without manually rewriting each test	~
		🔷 Tokonot 🖉 - 🖗 1000	0/ -

#### Figure 2-3 CRYSTAL SharePoint Screenshot with lists of artefacts for technial management

### 2.1.3 Key Performance Indicator (KPI)

KPIs within CRYSTAL shall support a level of management and transparency without influencing or disturbing the individual "Technology Brick Groups" in their development of solutions to meet the projects goals and address the UC needs.

### 2.1.3.1 KPIs for WP 6.1 (IOS Evolution & Development, Standardization)

- Development of Interoperability specification
  - Per "Technology Brick Group"
- Disseminate of IOS within Project
- Standardization of IOS

### 2.1.3.2 KPIs for WP6.2 (Platform Builder and Meta-Model)

- Development of solution (TI) to meet the use case needs and requirements
- Definition of Engineering Domain specific concepts and services for the IOS
  - Defined based on UCs needs

### 2.1.3.3 KPIs for WP6.3-13 (Technology Bricks)

- Development of solution (TI) to meet the use case needs and requirements
- Definition of Engineering Domain specific concepts and services for the IOS
  - Defined based on UCs needs

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- To be collected and consolidated by 6.1



Figure 2-4 CRYSTAL SP6 KPIs

## 2.2 CRYSTAL Development Strategy for Bricks

The Brick development can be summarized in two main aspects, general development and interoperability related development. Again, these technical solutions are represented as "Technical Items" for management purposes within the technical management process.

**General –** Extensions, enhancements, improvements of Bricks developed in CRYSTAL to meet the UC needs, except from Interoperability

Example 1: MATLAB is the Brick and a new ToolBox developed for this tool would be a Technical Item

Example 2: OMG SysML is the Brick and a new or modified concept for "Block" would be a Technical Item

Example 4: V-Model is the Brick and an additional Layer between Component and System Level would be a Technical Item

**Interoperability** – Development activities which are related to interoperability of Bricks. This aspect again, can be divided in "<u>Basic Interoperability</u>", Linked Data for Traceability and sharing of basic engineering data (e.g. IOS - Reference Architecture, Linked Data, REST, RDF). <u>"Extended Interoperability</u>" Exchange of Data and Files (e.g. HTML Delegated User Interface (see OSLC), Files of any format can be exchanged between tools, given that previously a link as been established to ensure traceability.

Example 3: FaultTree+ is the Brick and an IOS adapter to link Requirements to Fault Trees would be a Technical Item

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The development strategy therefore sees the following activities as crucial for the successful implementation of CRYSTAL Bricks.

The development of "General" Brick aspects is not actively supported by guidelines, workshops and therefore also not restricted, however any development needs to be relevant and therefore fulfil one or more "Technical Refined Requirements". For the development, the SP6 recommends the use of the work plan template for development teams, see chapter 7.

The development of "Interoperability" related aspects of a Brick is actively supported by the SP6 leaders with workshops, guidelines (i.e. IOS, SDKs, Test Suits) and prepared work plans.

We recommend starting the development for all Bricks by implementing the "Basic Interoperability" using OSLC SDK for OSLC-RM, OSLC-QM, OSLC-CM, OSLC-AM (see <u>http://open-services.net</u>). After this step the interoperability can be extended by implementing other OSLC specifications and/or other standards for interoperability as part of the "Extended Interoperability".



Figure 2-5 Visualization of the proposed Brick development Strategy



# **3 Interoperability Needs Capturing Process**

Due to the fact that the tool integration and interoperability aspects are crucial in CRYSTAL, a common process has been developed to collect and manage the needs expressed by the users. This process is divided in five steps, which are complementary to the CRYSTAL use case driven approach. The illustration below, describes the steps, whereas this chapter focuses on step 4 and its use in the SP6.



The "Step 4 - Detailed Descriptions of the Engineering Methods" has been implemented to ensure a common way to express the use cases from a process/technical point of view. The purpose of the so called "Engineering Methods" is to describe in a common way, and step-by-step, the desired solution for each activity. The descriptions of the "Engineering Methods" are provided by SP2-5 partners, with support from SP6. The methods may be processed by WP6.1 to be used for interacting with SP6 work packages (for identifying cross-use-case and cross-domain commonalities regarding Interoperability Needs). However also WP6.2-13 will process this information in order to identify needs for technical solutions, i.e. define Technical Requirements and Technical Items.

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# 3.1 Use of the Engineering Methods to derive IOS Core Requirements

As mentioned above, the information provided by the "Engineering Methods" may be used by WP6.1 to understand the needs to interoperability and consequently derive Technical Requirements related to these challenges. It is important to realize that the so called Interoperability Specification (IOS) is developed by analysis commonalities (common challenges) identified across multiple "Engineering Methods" rather than focusing on too specific or individual needs. Figure 3-2 illustrated the definition of commonalities based on an example.



Figure 3-2 Process to create common IOS Requirements

The steps to collect the requirements can be summarized as follows:

- Evaluate the IOS Needs capture forms for each industrial domain based on requirements types
- Compile to a set of common requirements and [later] a set of industrial domain specific requirements
- Divide the common requirements in non-functional and functional requirements (i.e. purpose of IOS for CRYSTAL) see Figure 3-3.
- Reuse of existing (non-project specific) requirements from other projects careful selection!

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Figure 3-3 Define common requirements in non-functional and functional requirements



# 4 Integration & Test Team (ITT)

Due to the fact that the integration and interoperability is a crucial aspect of the project, a team will be established to support partners in the overall IOS implementation (no actual development support just advice and review). This team is further called "Integration & Test Team (ITT)". The mandate of the team is not time limited, however since this group is established on a voluntary basis, it is not mandatory for the members to be available at all time or attend all workshops. The main tasks can be summarised as follows:

- Monitor and Validate the Development progress constantly during the project
  - o Check against KPIs
- Verification of the...
  - o Developed IOS based Adapters to be correct and compliant with specification
- Support for deployment and deployment of Bricks
  - o Support to build, establish and maintain a project internal IOS community
  - Check quality of Brick Documentation, Training... etc.
  - Organize development workshops, both online and physical
  - o Identify resources such as SDKs, Test Suites to support the development of Bricks

## 4.1 Areas of support

**Common IOS Vision:** Support partners to develop a business case for the IOS. A *real-world* business case may ensure that the developed solutions are valuable also outside CRYSTAL, and that partners get support from their non-research product management team inside their own organization.

**Development Support:** OSLC Concepts, Service Development, SDKs (Eclipse Lyo, C# and .NET). They will for example provide links to resources, present related solutions online and at workshops. Note: no actual development support just advice and review.

**Platforms and Integration:** Support development of the "Integration Platform" approach, focusing on the ModelBus, PTC Windchill, PTC Integrity, Siemens Teamcenter, IBM Jazz platform. Integration shall be done based on the IOS principles. Provide links to resources, support partners to develop OSLC/MM concepts.



# 5 Terms, Abbreviations and Definitions

Please add additional terms, abbreviations and definitions for your deliverable.

CRYSTAL	CRitical SYSTem Engineering AcceLeration
R	Report
Р	Prototype
D	Demonstrator
0	Other
PU	Public
PP	Restricted to other program participants (including the JU).
RE	Restricted to a group specified by the consortium (including the JU).
СО	Confidential, only for members of the consortium (including the JU).
WP	Work Package
SP	Subproject
IOS	Interoperability Specification
RQ	Requirement
ІТТ	Integration & Test Team
KPI	Key Performance Indicator
ТІ	Technical Item

Table 5-1: Terms, Abbreviations and Definitions



# 6 References

Please add citations in this section.

[Author, Year]	Authors; <i>Title</i> ; Publication data (document reference)



# 7 Annex

## Annex I: Work Plan Template for Technology Brick Development per WP

The generic "Technology Brick" development work plan is divided into five phases, as described below. The phases go from the planning and organization through to the deployment and verification of the Bricks. Please note that this verification is not to be confused by the validation/evaluation of end users but is the technology providers own technical verification of the developed solution.

Template for MS Visio - Gantt chart (please adapt dates and descriptions)

6	Task Name	<b>C</b> 1 <b>1</b>	Finish	Duration	Aug 2013	Sep 2013				Oct 2013					Nov 2013				Dec 2013		
		Start	FINISN		28/7 4/8 11/8 18/8 25/8	1/9	8/9	15/9	22/9	29/9	6/10	13/10	20/10	27/10	3/11	10/11	17/11	24/11	1/12 8,	/12	15/12
1	Phase 1	8/1/2013	8/9/2013	7d	Planning and Organization																
2	Phase 2	8/12/2013	8/22/2013	9d	Sel	Selection Process															
3	Final Scenarios and Components	8/23/2013	8/23/2013	1d	Final Use Cases and Scenarios to be realized by the Brick																
4	Phase 3	8/26/2013	10/11/ 201313	35d	Implementation																
5	Phase 4	10/14/2013	10/18/2013	5d																	
6	Phase 5	10/21/2013	10/25/2013	5d	Validation																
7	Final Brick	10/28/2013	10/28/2013	1d											F	inal I	Brick				

Figure 7-1 General Work Plan as Gantt (MS Visio File)

Phase	Name	Short Description	ption Result/Milestone		Start	End
P1	Planning and Organization	This phase includes the planning and organization of the backup solution, as well as the allocation of resources.	Work Plan and Communications Document	WP6.x Leader	MX DATE	<b>MX</b> DATE
P2	Selection Process	In this phase the industrial use cases and scenarios are selected. Based this selection and the filter process the RTP components are selected.	M1: Final use case and Technical Requirements to be covered by the Brick. Final Technical Items to be implemented.		MX DATE	MX DATE
P3	Implementati on	Implementation of Technical Items	General solutions and enhancements of Brick. IOS based adapter implementation		MX DATE	MX DATE
P4	Integration	After developing the IOS/OSLC adapters, the different components will be integrated to an overall Brick or Tool-Chain prototype. After an integration test the first version of the solution is available for validation.	Brick(s) available for validation.		MX DATE	MX DATE
P5	Verification	The first version of the Brick will be validated using the selected industrial use cases and scenario from the first phase.	M2: Validated and Final Brick	WP6.x Leader with support of ITT*	MX DATE	MX DATE

Table 2 EXAMPLE Template Development Phases for Bricks