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D1.1: Kick-off progress report

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Abstract:

Report on the KoM outcomes and actions undertaken on its basis.

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1. Executive Summary

This document is a follow-up of the kick-off meetings and reports the status of the project in the first three months. It theoretically involves all the three tasks of WP1, even though we did not select yet the members of the Advisory Board (AB). Therefore, Task 1.3 is not active yet. This activity will be however completed in the next month in order to appoint the AB at the next General Assembly (GA) meeting and to start also this activity before the first review meeting at M10 (as agreed with the Program Officer M9 review is going to be shifted at M10).

1.1. Structure of Document

This document is organized as follow

- Summary of the kick-off meeting briefly describes the main outcome and action plans that resulted from the KoM.
- Management achievements reports the most important decisions taken in the first GA meeting, organized on the very first KoM day.
- Technical achievements reports the preliminary technical discussions we had in the KoM. Methodological decisions have been taken primarily, and the action plans for the first 4 months have been defined.
- Dissemination achievements reports on the primary communication and dissemination achievements of the project.

2. Kick off Meeting Summary

CERBERO Kick of Meeting (KoM) took place at the Università degli Studi di Sassari from the 11th to the 13th of January 2017. It was a highly participated KoM, there were 27 participants from 11 out of 12 beneficiaries:

- IBM Israel: Michael Masin, Evgeny Shindin
- Università degli Studi di Sassari: Francesca Palumbo, Luca Pulina, Rosario Cecaro
- Thales Alenia Space Espana: Manuel Sanchez, Antonio Lopez
- Università degli Studi di Cagliari: Luigi Raffo, Carlo Sau, Tiziana Fanni
- Institut National des Sciences Appliquees de Rennes: Daniel Menard, Maxime Pelcat, Karol Desnos
- Universidad Politecnica de Madrid: Eduardo de la Torre, Eduardo Juarez, Ruben Salvador, Alfonso Rodriguez
- Università della Svizzera italiana: Francesco Regazzoni, Christian Pilato
- Abinsula SRL: Katiuscia Zedda, Antonio Solinas, Gasser Ayad
- Ambiesense LTD: Hans Myrhaug
- Nederlandse Organisatie Voor Toegepast Natuurwetenschappelijk Ondeerzoek TNO: Joost Adriaanse, Andreea Balau
- Centro Ricerche FIAT: Antonella Toffetti, Alessandro Petrera

S&T was the only missing beneficiary due to internal reasons. However, IBM, UNISS TNO and TASE had a teleconference call right after the end of the meeting (on January 19th) to update S&T on the KoM achievements and to start discussing their involvement in the space exploration (TASE) and in the electric vehicle (TNO) use cases.

2.1. KoM goals and plans

The main goal of KoM, besides introducing to each other, was to start establishing a project common ground starting from its keywords and the preliminary workplan defined in the proposal and the DoA. All the KoM technical discussions, either related to the use cases or to the methods and tools have been centred on the following CERBERO terms. For each of them you may find the questions that have driven our discussions and that are driving the work of the work packages has have already started.

- Cross-Layer: Computational, physical and communication layers are going to be cross-optimized, taking into consideration that they are intrinsically concurrent, among each other and internally. *We tried to answer the question: what are the environment and the physical aspect each use-case has to interact with?*
 - We planned all the road-map to use cases definition that included several face-to-face and remote meetings (see Section 4.1) to discuss each single use-case composition and characteristics to be taken into account to properly design the cyber part of the system and how the physical and the computation layer interact with each other. This activity is part of WP2,

which is the only R&D WP active right from the project start.

- Model-Based: Address the current lack of a comprehensive modelling strategy for heterogeneous CPS supporting model-to-model (e.g. from computational to communication view) mapping and synchronization (e.g. from time-continuum and event-driven) interfaces with feedback loops. *We tried to answer the questions: Which models have already been used in the given scenarios? Which others could be adopted? How do we combine their semantics?*
 - We planned the activities that will characterize WP3, stating with a survey on models already used in the consortium coupled with a specific activity on state-of-the-art and best practices to be completed before the first planned review at M10. See Section 4.3 for more details.
- Multi-Objective: Continuous guarantees and analysis of functional and nonfunctional requirements by means of a library of reusable Key Performance Indicators (KPIs). *We tried to answer the questions: Which are the constraints to be taken into account? What are the scenario specific challenges and what are the system related constraints?*
 - As for the cross-layer activities, we planned the road-map for feature extraction from use cases and requirements definition. This activity is part of WP2, which is the only R&D WP active right from the project start.
- Reconfigurable: Address the current lack in adaptivity modelling and support. CPS should autonomously adapt to rapid changes in the environment and in the system itself. *We tried to answer the questions: Which are the real changes to be considered? Which are the triggers for reconfigurations? Are they internal or external?*
 - Following the industry-driven approach that characterizes CERBERO, we planned to discuss all the use-case executions scenarios in details. This will enable, as soon as WP4 starts, to define the optimal strategies on this matter. We planned the activities that will characterize WP4, stating with a survey hardware and software reconfiguration support already implementable by consortium members coupled with a specific activity on state-of-the-art and best practices to be completed before the first planned review at M10.
- Uncertain Hybrid Environments: Optimization of dynamic systems described by differential and algebraic equations and inequalities, and characterized by uncertain parameters belonging to uncertainty sets of different uncertainty sources. *We tried to answer the questions: Which parameters will characterize*

each single scenario? How do we take into consideration this uncertainty?

• As for the cross-layer activities, we planned the road-map for features extraction from use cases and requirements definition. This activity is part of WP2, which is the only R&D WP active right from the project start.

Apart from the technical discussions, we also set the operative goals that we want to achieve before the mid-term review, that are:

- Reach a successful beta version of the CERBERO framework for M15.
- Start assembling partial and incremental demonstrators of some features of the use cases.
- Achieve the maximum visibility for CERBERO technologies, by means of communication and dissemination activities.

We have discussed also the fact that we will have a first review earlier M10 and we have planned to be able to:

- Provide a demonstration of the basic tool features and, possibly, the integration of a certain subsets of them.
- Provide gaps from the-of-the-art and a concrete plan for the integration of the beta version.

3. Management Achievements

3.1. General Assembly

We had a GA meeting, where we appointed the Innovation Manager of the project, Dr. Katiuscia Zedda from Abinsula, and the Dissemination and Communication Manager, Dr. Francesco Regazzoni from Università della Svizzera Italiana.

During the GA, we discussed project management procedures, roles and responsibilities of the Project Coordinator, Technical Coordinator, WP and Tasks leaders; summarizing the responsibility chain as explained in the Consortium Agreement (CA). Project and Technical Coordinators will constantly cooperate to track the project big picture. GA face to face meetings will be held twice a year, but we decided to organize a monthly progress meeting involving all the consortium partners; when required, GA phone meetings will be organized by the Coordinators. The Project Management and Innovation Board (PMIB) will be held every four months or when required by any PMIB member. WP and Task leaders manage subgroups of work. To enable a faster and direct communication with WP members we decided to have a one mailing list per WP, use cases and integration platform (involving also the Coordinators to keep trace of all the running activities and effectively manage potential pitfalls as soon as they show up).

3.2. Project Management and Innovation Board

We had a PMIB meeting where, due to the additional review at M10 not originally present in the proposal, we decided upon some additional project activities that will allow us to meet the planned goals. Here is the list of activities we agreed on

- Survey on Tools (M1) → Which tools are already available in the consortium? What is their status? What do they offer/support? [Abinsula]
- Survey on Models (M5) → Which models are we already using? What are they capable of representing? [TNO]
- Project Glossary (M5) \rightarrow Public glossary of the project [USI]
- Technology/Tools to Scenarios Mapping (M3 and M9) → Technology and tools have to match the need of the Use-Case. Discussions on this aspect are included in the D2.2 and will have to be revised before the short term review. [TASE]
- State of the Art on tools and on models (M9) → Informal state-of-the-art to be discussed, if needed, in the short term review and to be updated/included in the deliverable at M15. [TNO-INSA-IBM]

4. Technical Achievements

In the CERBERO design approach different levels of abstraction are going to be used. Normally, at the state of the art view separation is used, which leads to the classical V model. In the CERBERO model-based approach the idea is providing a ladder approach, as depicted in Figure 1. To achieve it several design cycles in a continuous and incremental manner in order to refine the models and the corresponding prototypes are necessary.



Figure 1 – CERBERO development approach: from V to ladder.

Figure 2 depicts the development approach that will be followed, which will include all the R&D work packages and it is characterized by the fact that:

- model-based continuous engineering (MBCE) is adopted also for tool development in WP5;
- WP5 intends to develop tools and methods integrating results of WP3 and WP4.
- Maintenance and runtime system optimization will be guaranteed by formal simulation, analysis and verification.

MBCE approach is based on a lot of cycles that, leveraging on models, create a virtual/real environment continuously evolving. Models are used by tools but also to update the same tools. The aim is to build an initial integrated framework (interfaces and connections) and maintain it throughout the whole project duration. The starting point is then using the tools within the integrated framework with their actual capabilities.

Figure 3 provides a snapshot of the framework, derived from the results of the discussion on tools we already have available. Right after the KoM, Abinsula has distributed a survey on tools, which results are summarized in Section 4.4.

Please note that the user of the CERBERO primary outcome, the modelling, optimization and deploying toolchain for CPS depicted in Figure 3, is meant to be a designer. The use case providers of the consortium are, therefore, possible users.



Figure 2 – CERBERO model-based approach.



Figure 3 – CERBERO framework 1.0

4.1. Cooperations and Interactions after the KoM

Strong cooperation and continuous interaction among partners have been identified as the recipe of success. Therefore we have established:

• *Monthly Progress Meetings*: to report to the entire consortium the project advances (the first Thursday of each month at 10:00am Brussels Time)

- *WP and Task Meetings* (for the active technical WPs): In particular, from mid-February till the beginning of April we had:
 - weekly conference calls for Task 2.1 of WP2 (each Tuesday at 10:00 Brussels Time), to align all the use-case definition and to make sure that the use-cases demonstration activities and their final goals are sustainable with technologies available within the consortium, with the projects goals and the preliminary framework definition
 - o dedicated use-case specific meetings:
 - Space 7th of February in Madrid. Participants: TASE (Manuel Sanchez and Cesar Castañares) – UPM (Eduardo Juarez, Eduardo de la Torre, Ruben Salvador, Andres Otero, Raquel Lazcano, Daniel Madroñal, Leonardo Suriano, Alfonso Rodriguez) – – INSA (Maxime Pelcat) – UNICA (Carlo Sau) – UNISS (Francesca Palumbo)
 - Ocean Monitoring Several remote meetings have been organized among the Project and the Scientific Coordinators and AS team to fully specify the demonstration activities of the Ocean Monitoring use case (i.e. 06/03, 13/03, 16/03, 20/03)
 - Smart Travelling Several remote regular meetings and one face to face meeting on .28th-29th of March in CRF (Orbassano -TORINO). Participants: CRF (Antonella Toffetti, Francesco Palma, Giovanni Turi, Alessandro Petrera), TNO (Andreea Balau, Julio Oliveira Filho, Joost Adriaanse) and S&T (Yunyun Ni, Peter Novak)

4.2. Work Package 2: Use Cases

During the KoM we have converged on the idea that we are going to use two levels of requirements that will contribute to provide the big picture of the scenarios in terms of functionalities and performance. Low-level specifications will be used by technology and tools developers. Their specification is the main concern of CERBERO WP2.



Figure 4 – CERBERO focus on low-level requirements.

Task 2.1 is currently finished and its activities led to the complete definition of the use cases as described in Deliverable 2.1. Since discussions on the use-cases took longer than expected, as agreed with the Program Officer we shifted to M4 such deliverable, and

consequently those on technical requirements (Deliverable 2.2 that is going to include use-case related requirements and technical specification for the CERBERO toolchain, models, methods and architectures) to M5.

4.3. Work Package 3: Models

The activities on WP3 are about to start. Basically, during the KoM we decided that to achieve model to model transformation and to provide models cross-optimization we need to generalize the available models and to find a way to smoothly go from one level of abstractions to another. Preliminarily, we decided that we should try to:

- Define standard interfaces in order to make models compatible, which means that we will have to standardize the outputs of tools.
- Provide methods (where possible) to map one system view (computation, communication and physic) to another.

The definition of the proper semantic connecting all the views could be useful to allow cross-analysis of the system and its properties, favouring consistency check.

These transformations have to be supported by tools that are partially developed in WP3, but aggregated with the rest of the CERBERO toolchain in WP5.

The idea is to survey the consortium to understand which models are already available around and to define, as a first outcome of WP3 (before the second GA), what are the best practices.

As soon as the results of the survey are available, a WP3 meeting will be organized to check whether the definition of a common Intermediate Representation could be a solution to be able to allow achieve models integration and to be capable of providing easier and modular extensions.

Models and semantics considered in WP3 will have to be capable of supporting runtime configuration and uncertain environments. This aspect will have to be included in the survey.

4.4. Work Package 5: Tools

Theoretically, WP5 has not started yet. Nevertheless, to be able to map CERBERO technologies/tools and use cases Abinsula (tool integrator together with IBM) prepared and collected back a survey on the already available tools. As shown in Figure 3 the consortium already agreed upon an array of tools spanning all different layers of the CERBERO framework. Proposed tools for application architecture and runtime development widely support Eclipse and are already available as eclipse plug-in. High-level systems modelling in UML/SysML is currently done through popular commercial tools such as Matlab or IBM Rhapsody. However, Eclipse can also be used for modelling and some commercial plug-in, such as MetaEdit+, already exist to serve that purpose. Proposed tools vary in their level of maturity, though they currently assume TRL "3" as an overall minimum, which would allow CERBERO to progress smoothly focusing on tool interfacing and integration to fulfil the target use cases. Some of the tools are fully developed and already released while others are the outcome of completed EU research projects. The outcome of this survey will guide WP5 leaders and members in defining a straightforward integration plan and to specify the interfaces for newly

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designed tools. Besides, it has been used in these first months to start matching the usecase needs to the already available features of the components in Figure 3.

Tool integration is meant to be cross-layer in such a way that consistency is maintained between individual layers (high-level system model, application architecture, runtime manager, and low-level implementation) through collaborating with respective partners for development of code interfaces that map the functionality of each block or tool in the toolchain and wrap it for integration with other blocks or tools accordingly. The idea is to use intermediate semantics, rather than directly jumping to the implementation job. This will allow requirements analysis and verification at the model level, without any preliminary implementation step.

From the integration point of view we have decided that Eclipse could be the right option. Currently, though WP5 has not started yet, tool providers are working on code polishing to make available the source code as soon as possible.

The toolchain integration will be based on methods and interfaces in agile cycles performing cross-layer integration and combining modelling, simulation, verification and code generation activities.

5. Dissemination and Communication Activities

5.1. Website

• Website @ M2: http://www.cerbero-h2020.eu/

5.2. Communication Activities

- Press releases (http://www.cerbero-h2020.eu/press/)
 - CERBERO kick-off: CERBERO KoM received larger press coverage by Italian media, with articles on the several newspapers: La Stampa, L'Unione Sarda, and La Nuova Sardegna. Moreover, the Technical Coordinator given a short live interview right after the KoM to Radio 24
- The Twitter account is already active and has 18 followers.
- Events/Conferences Participation:
 - Road2CPS CPS concentration meeting 30/01 Brussels: The scientific coordinator (Francesca Palumbo, UNISS) and the Innovation Manager (Katiuscia Zedda, Abinsula) participated to this event. The goal was to start establishing contact with the CPS community that has been building in the last few years by the Road2CPS team.
 - ICT1 Cluster Kick-Off 15/02 Brussels: All the CERBERO Core Team (Michael Masin, Francesca Palumbo, Katiuscia Zedda and Francesco Regazzoni) participated to this event. The goal was to start establishing contact with the other CPS related projects founded in the ICT1 call. The general aim of this group of people is start planning cross-fertilization actions among projects to maximize the impact of each single project and meet the expectation of the EU Commission.
 - DATE paper presentation: Michael Masin has presented the "Cross-layer Design of Reconfigurable Cyber-Physical Systems" at the Design Automation and Test in Europe Conference that has been held in Lausanne from the 27th to the 31st March 2017.

6. List of Acronyms

AB	Advisory Board
CA	Consortium Agreement
CPS	Cyber-Physical Systems
GA	General Assembly
KoM	Kick off Meeting
MBCE	Model Based Continuous Engineering
PMIB	Project Management and Innovation Board
WP	Work Package

7. References

[CERBERO 2017] <u>http://www.cerbero-h2020.eu</u>