

## INFORMATION TECHNOLOGIES FOR SHIFT TO RAIL

### D7.10 - Development Readiness Review Pack (FREL)

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## REPORT CONTRIBUTORS

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## EXECUTIVE SUMMARY

This document provides the IT2Rail specifications, through an overall and a consolidated view integrating each functional area (WP1 to 6 in the project) and providing additional transversal end-to-end specification elements (WP7).

These specifications are made of three parts:

- Glossary: compiles all the IT2Rail key terms used by all the contributors and through all the produced IT2Rail documents. It is listing and describing the common principles pursued to address the traveller's perspective;
- Requirements: defines the IT2Rail key concepts and system requirements, shared between WP1 to 6 as the foundation for the IT2Rail pilot. It is describing the high-level functional components required to deliver the solution;
- Concepts and services interfaces: defines the external IT2Rail interfaces and associated services, shared between WP1 to 6 as the foundation for the IT2Rail pilot. It is describing the common architecture based on the requirements of individual work packages and the common interfaces between the work packages.

This document has been produced by consolidating specifications elements coming from WP1 to 6 and by reviewing, organizing and integrating interfaces and services architecture elements proposed by WP1 to 6 components.

This document is targeting the following audience:

- WP1- 6 leaders;
- WP8 and WP9 leaders;
- Shift2Rail Joint Undertaking;
- European Commission;
- Other IT2Rail participants, to give them a view of the specifications pursued in IT2Rail.

Beside the main objective of this document which is to provide a complete view of the project specifications, compiling the work performed by the different work packages of the project. As a consequence, along the documents it's common to have references between different functional areas of the project, including various diagrams describing functional exchanges. Those functional areas are normally identified as:

- WP1 : "Interoperability framework";
- WP2 : "Travel shopping";
- WP3 : "Booking and ticketing";
- WP4 : "Trip tracker";
- WP5 : "Travel companion";
- WP6 : "Business analytics".

These specifications were subject to various definitions and adjustments throughout the entire project life-cycle and the present edition is the final consolidated version of the IT2Rail overall specifications. This is the foundation for the IT2Rail pilot which shall be demonstrated in the project. All the editions of these documents were shared and maintained under the COOPERATION TOOL by applying the engineering guidelines defined for the project in the document [1]. So it was guaranteed the document management, keeping the history of each version of the document.

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## 1. INTRODUCTION

The IT2Rail project is supporting the seamless multimodal (air, rail, coach and urban) traveller experience across Europe. IT2Rail is a so called “lighthouse IP4” project of the Shift2Rail initiative. Shift2Rail IP4 aims at delivering a complete multimodal travel solution door-to-door connecting the first and last mile to long distance journeys combining air, rail, coach and other services. This initiative includes a semantic interoperability framework, business analytics platforms, a one-stop shop (travel shopper), a European scale trip tracker, multiple ticketing system (one for air, rail and urban), and a customer centric application and device. These proposals will be demonstrated in a selected conceptual corridor.

The objectives pursued by IT2Rail are:

- Enable/enrich the traveller experience by providing applications and access to seamless door-to-door multimodal services (shopping, tracking,...);
- Design an interoperability framework to enable multimodal multi-standard distributed data management, to serve as a foundation for the implementation of multimodal seamless services.

The IT2Rail technical activity has been broken down as follow:

- WP1 – Interoperability Framework: tools and standards supporting interoperability between systems;
- WP2 – Travel Shopping: a system integrating transportation offers of multiple (including travel experts) to compose a purchasable offer;
- WP3 – Booking and ticketing: a set of ticketing system for air, rail, coach and urban transportation;
- WP4 – Trip Tracker: a European-scale trip tracking system aggregating data from multiple sub-systems;
- WP5 – Travel Companion: a system presenting the only HMI front-end to the customer for the IT2Rail systems. This system is also presenting the business operators with a single access to the customer data under the form of a cloud space;
- WP6 – Business Analytics: a platform providing business analytics processing on multiple data source;
- WP7 – Technical Coordination & Pilot: this item is the specifications elements reference and also the pilot basis (considered not as system but as the definition of acceptance scenario, the corridor, as well as the reference platform integrating all the above-mentioned systems).

### 1.1 REFERENCE DOCUMENTS

- [1] ITR-T7.1-W-THA-006-04 IT2RAIL PROJECT INITIATION REVIEW PACK

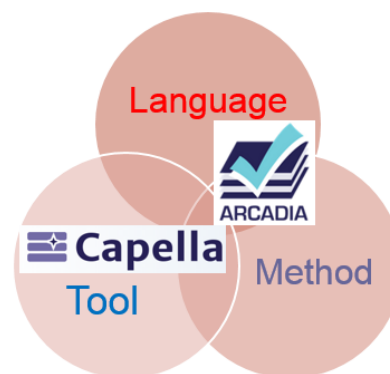
## 1.2 METHODOLOGY

Throughout the whole project, Capella was the engineering model tool of choice. It is an Open Source solution developed by Thales providing a process and tooling for graphical modelling of systems, hardware or software architectures, in accordance with the principles and recommendations defined by the Arcadia method.

Much more than just yet another modelling tool, Capella is a model-based engineering solution that has been deployed in a wide variety of industrial contexts. Based on a graphical modelling workbench, it provides systems, software and hardware architects with rich methodological guidance relying on ARCADIA, a comprehensive model-based engineering method:

- Ensure engineering-wide collaboration by sharing the same reference architecture;
- Master the complexity of systems and architectures;
- Define the best optimal architectures through trade-off analysis;
- Master different engineering levels and traceability with automated transition and information refinement.

Referring to the well-known three pillars of MBSE, presented on Figure 1, ARCADIA provides both a modelling language and a modelling approach, and Capella knows perfectly the language and the method to be applied.

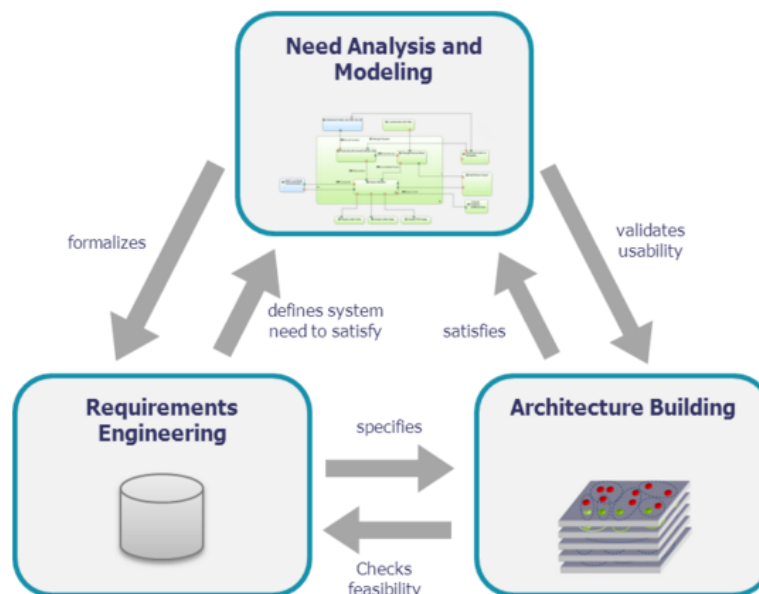


**Figure 1 - The three pillars of MBSE with ARCADIA/Capella (Roques, 2016)**

ARCADIA (ARChitecture Analysis and Design Integrated Approach) is a Model-Based engineering method for systems, hardware and software architectural design. It was developed by Thales between 2005 and 2010 through an iterative process involving operational architects from all Thales business domains (transportation, avionics, space, radar, etc.). It enforces an approach structured on successive engineering phases which establishes clear separation between needs (operational need analysis and system need analysis) and solutions (logical and physical architectures), in accordance with the IEEE 1220 standard.

ARCADIA recommends three mandatory interrelated activities, at the same level of importance (Figure 2):

- Need Analysis and Modelling;
- Architecture Building and Validation;
- Requirements Engineering.



**Figure 2 - ARCADIA three mandatory interrelated activities (Roques, 2016)**

On IT2Rail the main diagrams developed were:

- System Analysis level
  - [SAB] with system, actors, main functions and interactions;
  - [MCB] missions and capabilities of the system;
  - [ES] for high level scenarios.
- Logical Architecture level
  - [LAB] Definition of components and sub-components;
  - [IDB] interfaces between components with content of interfaces (exchange items);
  - [ES] interaction between components illustrated by scenarios with component and functions.



An example of the graphical modelling created through Capella is the following diagram on Figure 3, showing the relationships between the Interoperability Framework components.



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## 2. GLOSSARY



IT2Rail\_WP7\_Glossary\_iteration2.docx

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## 3. REQUIREMENTS

<WP7 requirement doc to be inserted here>

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## 4. INTERFACES AND SERVICES ARCHITECTURE

<WP7 interface doc to be inserted here>