FR8RAIL

Contract No. H2020 – 730617

Development of Functional Requirements for Sustainable and Attractive European Rail Freight

D2.1 – Overall developed high-level architecture

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PU	Public	X
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EXECUTIVE SUMMARY

This high-level architecture focuses on continuously combining all developed procedures, data flows and functional/technical processes. Important is the feedback loop to optimize and constantly improve the status and the current solution/pattern/maintenance regime. The aim is to be flexible to be able to integrate new technologies/solutions which came to market during the project phase.

Before we developed this high-level architecture, we analysed in accordance with the CBM Proposal the prevailing maintenance processes. In addition, we defined and developed in several discussions the CBM use cases (equalized maintenance, condition monitoring, condition based maintenance, predictive maintenance) and the CBM go-to-market Strategy which describes how we want to implement the defined use cases. These tasks are not part of this deliverable in accordance with the DoA.

ABBREVIATIONS AND ACRONYMS

OBU = Onboard Unit

LCC = Life Cycle Cost

MBSE = Model Based System Engineering

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

To implement the CBM strategy it is important to design a high level overall condition based and predictive maintenance architecture which focuses on process, functional and technical requirements and dependencies. The development focuses on locomotives but is universal and ensures scalability for the integration of freight wagons. Several pillars where considered:

a. Data handling such as: data input (e.g. on board unit, sensors), locomotive diagnostic box, data transfer (e.g. transfer to landsite), data storage (long-term, short-term) in alignment with WP 3 (Telematics)

b. Algorithms' such as: data analytics, monitoring/reporting (for corrective maintenance), predictive suites (for predictive maintenance),

c. Maintenance scheduling and planning algorithms such as: maintenance planning (e.g. task bundling for preventive maintenance), the operational controlling (e.g. technical field support, fleet steering/ECM 3 and Asset Management)

This high-level architecture is setting the guideline and the priority for the implementation roadmap. The developed architecture will be aligned with the overall architecture from Work package 6 (Systems integration procedures and guidelines).

1. WP 2 HIGH LEVEL ARCHITECTURE

The "overall developed condition based and predictive maintenance high-level architecture" is divided into two main components, which interact via a common process step - transfer of data. Figure 1 shows the CBM's overall developed condition based and predictive maintenance high-level architecture.

The main point Knowledge Management/Rules Definition is termed ''Offline'' and is made up of six steps and is designed offline, this means regardless of the current production and maintenance to improve the existing maintenance program and its rules iteratively (e.g. by Analytics/Big Data). The result of the process can be

d. an enriched knowledge store,

e. an adapted maintenance program (preventive) or

f. identified patterns.

These results are further processed in the second main component. The second main component is termed ''Online'' and is the application of the maintenance program optimized in the offline process and consists of 6 core elements:

1. Vehicle (relating to WP3),
2. Real-time Database,
3. Rule Engine,
4. Support,
5. Maintenance Planning & Preparation and
6. Maintenance Workshop

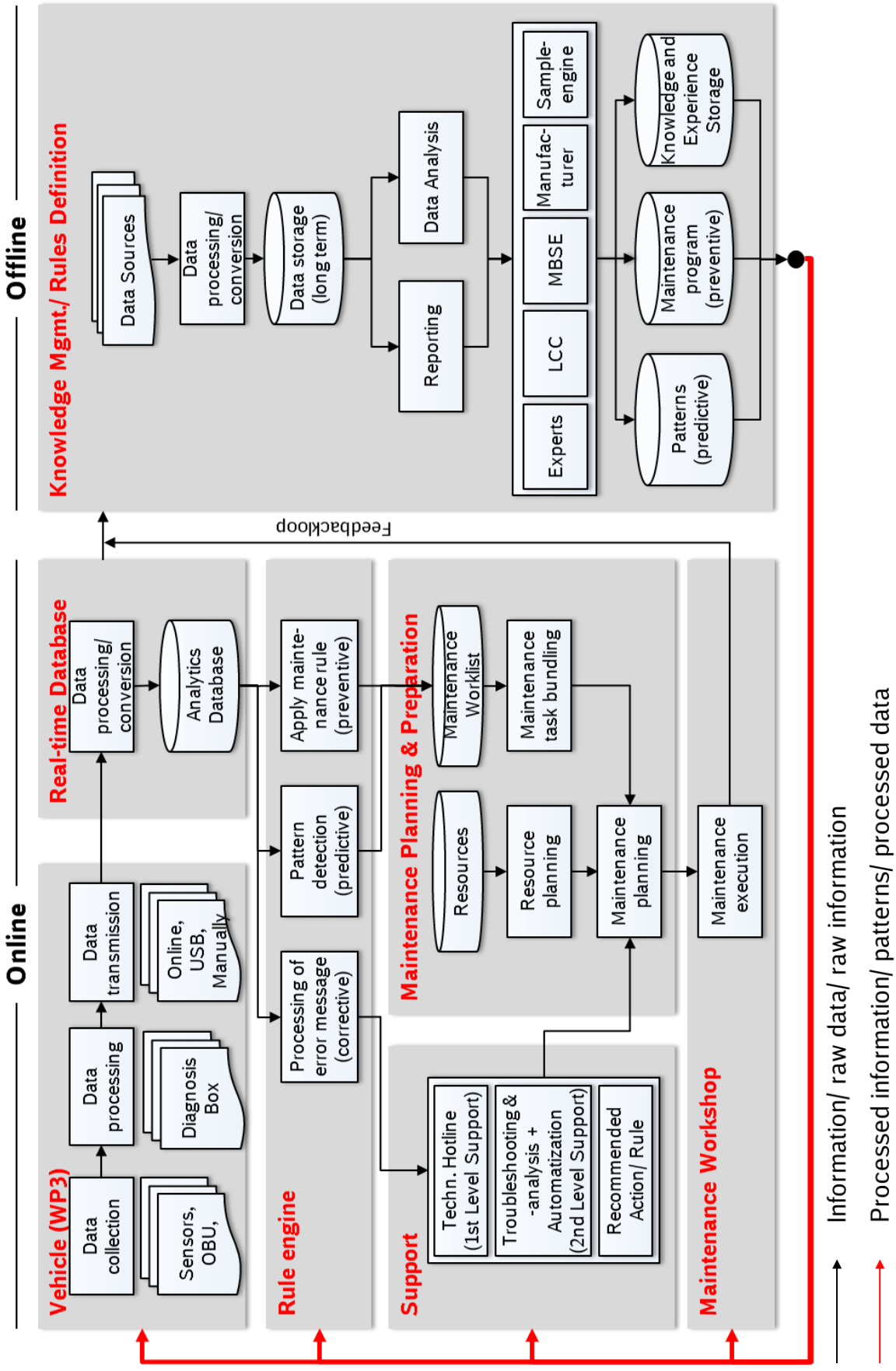

Figure 1: WP 2 CBM High-level architecture

The application or control of these core areas is carried out using current and new technologies for recording and processing data on the vehicle condition (e.g. OBUs, sensors, etc.) and for bundling maintenance measures with the aim of carrying out maintenance under economic aspects and increasing availability of the locomotives.

It becomes clear that there are many stakeholders and different user groups at the CBM Overall developed condition based and predictive maintenance high-level architecture and thereby also many interest groups of the CBM tools in the CBM process. This circumstance must be paid particular attention with regard to the integration into existing ERP systems, user rights, approval processes, system stability, achievability, documentation security, data quality, device management, etc.

In regards to the overall FR8RAIL focus which is related to locomotives and cargo wagon the CBM high-level architecture can be extended to wagon by replacing or adding the vehicle part by specific wagon characteristics (e.g. transferring data from wagon to the locomotive or transferring data directly to the landsite, power supply etc.)

In the further development of the S2R FR8RAIL project and especially in WP2, the individual core elements are further elaborated und underpinned by appropriate technologies. For example, the core element references 1.) Vehicle on the WP3 Telematics & electrification within FR8RAIL. The interaction of these two work packages is also clearly shown in WP6 High-level System architecture and integration.