FUTURE REPAIR AND MAINTENANCE FOR AEROSPACE INDUSTRY

Deliverable 8.1

SYSTEM ARCHITECTURE DESIGN IT PLATFORM

Function and requirements list, graphical representation of the central node and subsystem; UML representation of the RepAIR central node

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Deliverable 8.1 (summarize)

TITLE: SYSTEM ARCHITECTURE DESIGN IT PLATFORM

Description: Function and requirements list, graphical representation of the central node and subsystem; UML representation of the RepAIR central node

Introduction

The RepAIR IT system design is based on a twofold approach: WP2 analyses requirements from the perspective of end users and scenarios (cp. also deliverable D3.2); WP8 considers these requirements based on existing IT solutions. This deliverable documents the design process for the system architecture and the central node of the RepAIR IT system. It is intended to use the existing product AW Aero Control provided by O'Gayar Consulting (OGA) as a foundation for the central node.

Purpose of this document

The RepAIR project intends to support maintenance, repair and overhaul for aircrafts by applying Additive Manufacturing (AM) technology. For this purpose, Information Technology (IT) provides significant capabilities to support processes and workflows. The purpose of this document is to define the IT system architecture for the RepAIR project, give a vision of the architecture according with the available and/or intended RepAIR functionalities. Proposing a system composed by a central node and distributed subsystems, the document explains how the subsystems work with the IT central node.

Relations to other documents

For this deliverable, the most significant relation to other RepAIR documents is the list of requirements stated in deliverable D2.1:

a. Security Role: each user has a role in the system. The access to the process in the platform and the documents and pieces information will be managed using these roles. (WP7_001, WP7_002, WP7_006, WP2_006)
b. Standard applications: ITPlatform will be done with standard tools (WP2_003, WP2_004, WP2_005):
c. Communication ITPlatform and partners system: webservice (guarantee a failsafe mechanism of the system) (WP7_012, WP2_005)
d. Access: the access to ITPlatform will be done by https (WP2_006)
e. Documents: Repository of all regulations has to be available for users (WP7_001)
f. IT Platform (WP8_002)

In general, relevant RepAIR documents are:

a. [RepAIR-DOW] RepAIR Grant agreement N 605779, Annex I – 'Description of Work'
b. [RepAIR-D2.1] RepAIR Deliverable D2.1: Draft Requirements specification of IT-System
c. [RepAIR-D2.3] RepAIR Deliverable D2.3: Draft Requirements specification of certification processes
d. [RepAIR-D2.5] RepAIR Deliverable D2.5: Draft of production, supply chain and workflow requirements specifications and process control system
e. [RepAIR-D2.9] RepAIR Deliverable D2.9: Draft specification of RepAIR scenarios

f. [RepAIR-D3.2] RepAIR Deliverable D3.2: Defined scenarios that will be considered in the following project steps

General considerations

The definition of the architecture of the system will be the foundation of how it will develop the work process and how it will manage the transfer of information between the partners in the consortium and its subsystems.

Generic requirements

It is therefore necessary to consider how the components that make up the central node will communicate between them, where to store the information on the process so it can be audited and is always available in case of revision or need.

RepAir IT workflows

The RepAIR IT System must support all the possible workflows and should manage many non-defined use-cases considering the project. These use-cases are necessarily to be deployed under real-life conditions (for an overview of processes see RepAIR deliverables D2.3 and D2.5, for scenarios comprising use cases for the IT platform see D2.9).

Therefore the platform considers each process starting as a single event with own processing conditions, which should optimize delivery time and cost while maintaining the reliability of the aircraft and maximizing the flight time.

In each step of the process, as the case of use selected, the platform will manage the communication channel and the information that is transferred to the partner subsystems.

The overall certification process, which is a prerequisite for industry standards, will be done with the highest levels of safety and certified each step of the process, preventing of the process continuation if a step has not completed certification requirements.

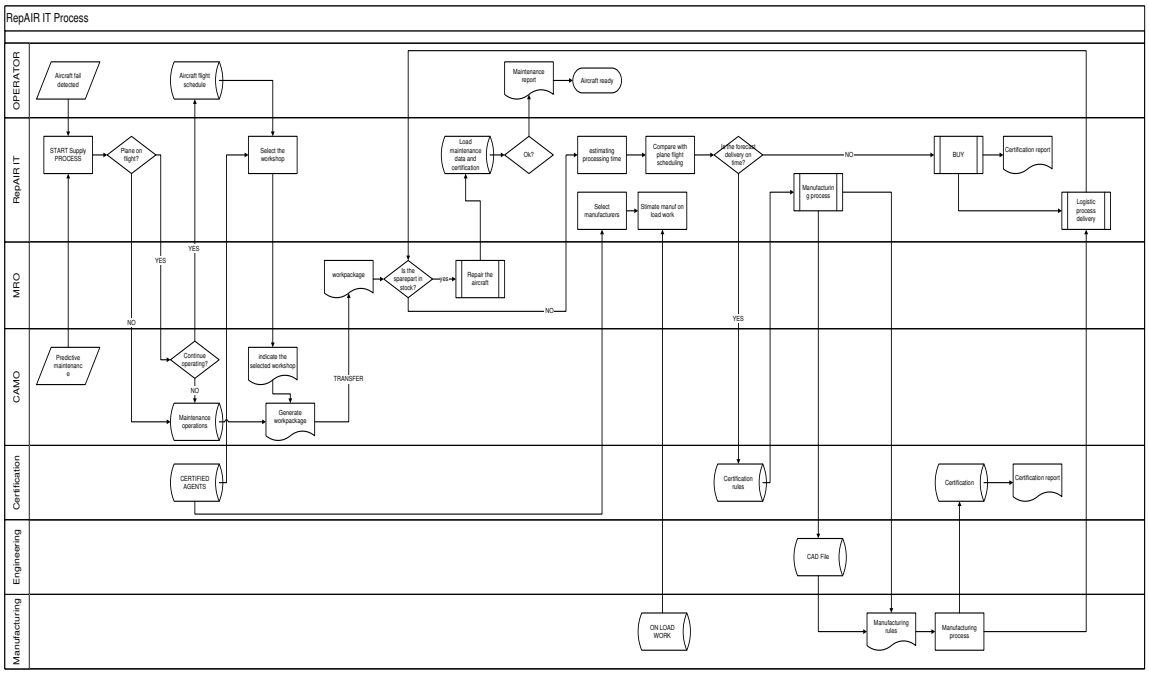

Figure 1: Workflow sample

RepAir system architecture

The system architecture will be developed for a distributed working environment based on the service-oriented paradigm using the most advanced IT available.

The core of the Platform will be a Central Node which will support the supervision of the overall supply chain process and the organization of the information exchange between all subsystems.

The Central Node will provide to each agent the necessary information and files to develop its work in the Supply Chain.

To interact with the partner's existing solutions the Central Node will be provided with a file exchange interface supported by a web service and using an encryption algorithm to assure the information integrity, developing a collaborative environment.

The next picture represents, in a diagram, the RepAIR IT Platform structure and how the users (i.e. human users or computers) interact with the RepAIR IT central node:

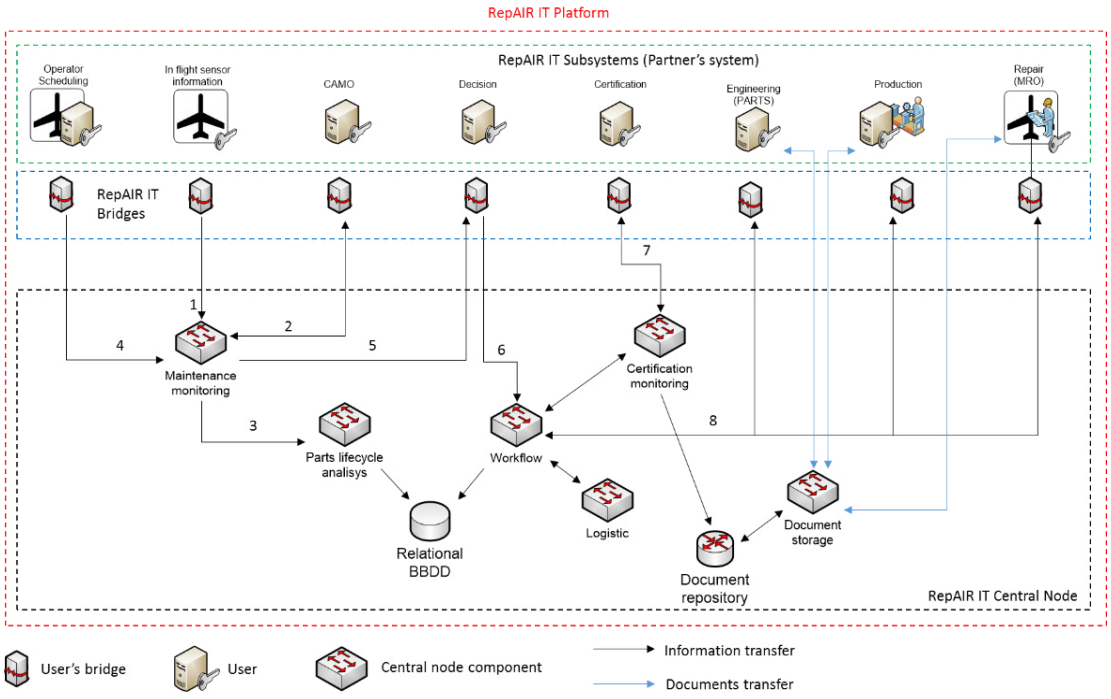

Figure 2: RepAIR Platform representation and interaction between users and central node components

RepAIR system architecture

We have opted for a centralized architecture for all functionalities assigned to the central node, with the goal of ensuring the robustness of the process and information security.

The central node is responsible of transferring information between partners and regulating access to information according to the profiles of each partner. Within a partner may be multiple users with different profiles and therefore with different allocation levels. The central node, by means of user validation functionality, will manage and prevent the unauthorized access to information or to the process.

Each subsystem (partner's systems) will be fully autonomous, taking care of processing the calculations and be responsible of storing information relating to its role in the process.

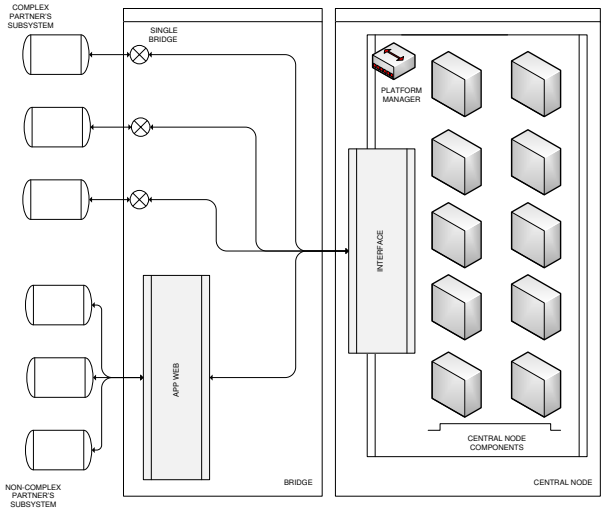

Figure 3: conceptual RepAIR architecture and distribution of subsystems

In the figure 3 we can see:

1. Central node
    a. Systems components
        i. Profiles and skills management
        ii. Information transfer log
        iii. General documentation store
        iv. Parts lifecycle analysis (airworthiness and reliability)
        v. Supply Chain management and monitoring
            1. Production analysis and planning
            2. Logistic process
            3. Maintenance scheduling
        vi. SOP and workflow management (SeMS requirements)
        vii. Certification monitoring
    b. Interface with the bridge
    c. Manager central node
2. Bridge
    a. Web application to communicate the non-complex subsystems (for example: excel sheets) with the central node interface
    b. Ad-Hoc applications to communicate the complex subsystems (for example an ERP) with the central node interface
3. Partner's subsystems

RepAir IT Platform technology

Central node:

To implement the architecture described above we will use J2EE (Java Enterprise Edition). J2EE allows differentiation between logical layers:

a. first layer of view
b. second layer of business logic
c. third layer data modelling

In this project we will implement the business layer using EJB (enterprise java beans). For data storage we will use a relational database.

To communicate the central node with the external applications the system will use REST Web Service, these web service can be deployed using EJB. To communicate with the application web the use of RMS is possible; with RMS we can invoke remotely the EJB.

Communication Bridges between central node and subsystems

To ensure communication between systems and platform partners we have defined two types of bridge, bridges ad-hoc and web application. These types of bridges should support the functionalities described in these document (D.8.1 and D.8.2), as well the potential functionalities that could arise during the project.

Ad-hoc bridges

The ad-hoc bridges are proxies between the RepAIR IT Platform and the partner's systems, this small application will run on the partner's computers. This applications would be developed to each partner with a complex system, and procure an automatic data transfer.

Its mission is to collect the necessary information from the partners systems, according to the central node component that made the request, and work as liaise data transmission to and from the IT Platform.

Web Application Bridge

To support those partners that do not have a complex system (for example an excel file) or these partners that would not be able / desire to integrate the platform between the ad-hoc bridges, it would be necessary to develop a web application to interact with the platform.

This web application should be adaptable to the partner role and to the user skill, showing and asking for the relevant information.

Bridges buffer

In the case that the central node becomes inoperable temporarily, the communication bridges should store the output of the partner systems until the central node would be restored.

When the central node will restore the operation, the bridges will start to send information to the central node. The central node will need to reconstruct the process, so when the RepAIR system send the requirements to the partners systems it will add information about the numerator of the event and its place in the supply chain. This location information must be added to the systems partners outputs.