SAFETY4RAILS

MID-TERM VALIDATION AND EVALUATION OF THE S4RIS SYSTEM

Deliverable 6.3

Lead Author: UNEW

Contributors: Fraunhofer, IC, NCSRD, MDM

Dissemination level: (PU)

Security Assessment Control: passed



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 883532.

| D6.3 MID-TERM V | ALIDATION AND EVALUATION OF TH | IE S4RIS SYSTEM |
|----------------------|-----------------------------------|-----------------|
| Deliverable number: | 6.3 | |
| Version: | 1.1 | |
| Delivery date: | 07/04/2022 | |
| Dissemination | PU - Public | |
| level: | | |
| Nature: | Report | |
| Main author(s) | Raphael K David; Emmanuel Matsika | UNEW |
| Contributor(s) | Konstantinos Panou | NCSRD |
| | | |
| | | |
| Internal reviewer(s) | Uli Siebold | IC |
| | Antonio De Santiago Laporte | MDM |
| | Stephen Crabbe | Fraunhofer |
| External reviewer(s) | Cristian Ulianov | UNEW |

| Document control | | | |
|------------------|------------|--|--|
| Version | Date | Author(s) | Change(s) |
| 0.1 | 29/07/2021 | UNEW | Initial version. |
| 0.2 | 08/10/2021 | UNEW | Incorporation of S4RIS GUI. |
| 0.3 | 15/12/2021 | UNEW | Inclusion of SECURAIL, RAM ² , CuRIX and CAMS descriptions. |
| 0.4 | 04/01/2022 | UNEW | Inclusion of links to the DMS/KAFKA, SECURAIL, RAM2, CuRIX and CAMS |
| 0.5 | 21/01/2022 | UNEW, NCSRD, STAM, IC and Fraunhofer | Incorporation of live links to DMS/KAFKA, SECURAIL, RAM2, CuRIX and CAMS. |
| 0.6 | 26/01/2022 | UNEW | Start of evaluation section and near completion of Conclusion. |
| 0.7 | 11/02/2022 | UNEW | Incorporated comments from Fraunhofer and updated sections for evaluation and Conclusion. Also added the executive summary. |
| 0.8 | 14/03/2022 | UNEW | Incorporated comments from Fraunhofer (Stephen). |
| 0.9 | 01/04/2022 | UNEW | Incorporating comments from internal reviewers and external reviewer. |
| 1.0 | 06/04/2022 | UNEW | Incorporated comments from Fraunhofer (Stephen), and IC (Uli) following a review meeting. |
| 1.1 | 07/04/2022 | Fraunhofer | Update of V1.0 with minimal formatting and editing. |

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ABOUT SAFETY4RAILS

SAFETY4RAILS is the acronym for the innovation project: Data-based analysis for SAFETY and security protection FOR detection, prevention, mitigation and response in trans-modal metro and RAILway networkS. Railways and Metros are safe, efficient, reliable and environmentally friendly mass carriers, and they are becoming even more important means of transportation given the need to address climate change. However, being such critical infrastructures turns metro and railway operators as well as related intermodal transport operators into attractive targets for cyber and/or physical attacks. The SAFETY4RAILS project delivers methods and systems to increase the safety and recovery of track-based inter-city railway and intracity metro transportation. It addresses both cyber-only attacks (such as impact from WannaCry infections), physical-only attacks (such as the Madrid commuter trains bombing in 2004) and combined cyber-physical attacks, which are important emerging scenarios given increasing IoT infrastructure integration.

SAFETY4RAILS concentrates on rush hour rail transport scenarios where many passengers are using metros and railways to commute to work or attend mass events (e.g., large multi-venue sporting events such as the Olympics). When an incident occurs during heavy usage, metro and railway operators must consider many aspects to ensure passenger safety and security, e.g., carry out a threat analysis, maintain situation awareness, establish crisis communication and response, and they must ensure that mitigation steps are taken and communicated to travellers and other users. SAFETY4RAILS will improve the handling of such events through a holistic approach. It will analyse the cyber-physical resilience of metro and railway systems and deliver mitigation strategies for an efficient response, and, to remain secure given everchanging novel emerging risks, it will facilitate continuous adaptation of the SAFETY4RAILS solution; this will be validated by two rail transport operators and the results will support the re-design of the final prototype.

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Executive summary

The deliverable D6.3 represents the Mid-term validation and evaluation of the S4RIS system. This is an output of T6.3, where the objective is mainly to check if the interfaces provided in tasks T3.4, T4.5 and T5.5 are working properly together to form the overall flexible multi-lingual SAFETY4RAILS Information Platform (S4RIS). The aim of this deliverable is to evaluate and validate the S4RIS system supporting the further development of the S4RIS platform. This is done with consideration of the key issues related to software integration to provide the necessary information and analysis for informed decision-making regarding user interface and interoperability.

One of the objectives of D6.3 is to develop the graphical user interface integrating the existing tools in a user-friendly way that can run on multiple devices (tablets, phones, PCs), different computer platforms and can answer many different questions about railway operations. The main components of the S4RIS platform are integrated in the overall system as a first and preliminary version for testing. These 4 main components are namely:

- Risk assessment tool in WP3 (SecuRail)
- Real-Time Monitoring Tool in WP4 (CuriX)
- Decision Support Tool developed in WP5 (RAM²)
- Central Asset Management System in WP7 (CAMS)

Developed as a web application, the S4RIS GUI platform uses HTML, CSS, PHP and JavaScript technologies. The requirements were obtained from D1.4 (Specification of the overall technical architecture) and D2.3 (System specification and concept architecture).

Four platform representational structures were considered. Based on the project requirements, architecture and usability, two structures were selected and implemented in the iFrame (1) With three layers Infrastructure; Data processing and Decision support. (2) With 5 layers representing the resilience cycle with phases such as: identify, protect, detect, respond, and recover (or similarly named phases). The final structure will be chosen after consultation with end-users, and reported in Deliverable D6.5.

An important part in the process of integration between S4RIS tools is the definition of tools and technologies that allow intra messaging between various tools in the S4RIS platform. During the specification of the overall S4RIS system architecture it was decided that the technology to be utilised for communication between the tools in the S4RIS platform is DMS (Distributed Messaging System). DMS in SAFETY4RAILS is a technology based on Apache Kafka a well-known open-source message broker for building robust streaming applications.

The first step to access the private area of S4RIS GUI platform to access the tools is the registration process. The user must fill a form with login details and an email address. A secure password is required for the process. The S4RIS platform interface was created under WordPress private domain to evaluate the iFrame implementation and login approval process. New users of the system require registration according to the requirements established under D1.4, after which an access request is created for the administrator's approval.

As part of D6.3, 4 tools were integrated in the S4RIS GUI, with communication over the DMS. It was concluded that the web integration using iFrames is a feasible solution for most of the tools.

The communication between the tools through the DMS supported the decision-making process. However, since D6.3 was limited to 4 tools already integrated into the DMS, it was not possible at this stage to assess all the 18 tools. For the next deliverable D6.5, all S4RIS GUI - compatible tools will be fully integrated and tested.

1. Introduction

1.1 Overview

The deliverable D6.3 represents the Mid-term validation and evaluation of the S4RIS system. This is an output of T6.3, where the objective is mainly to check if the interfaces provided in tasks T3.4, T4.5 and T5.5 are working properly together to form the overall flexible multi-lingual SAFETY4RAILS Information Platform (S4RIS).

This Deliverable D6.3 aims at evaluating and validating the S4RIS system. It presents the integration of S4RIS components into the S4RIS platform and system test. It outlines the background and use of S4RIS Integrated platform developed as part of the SAFETYRAILS project. The objective was to guide the development of the graphical user interface (GUI) integrating the existing tools in a user-friendly way that can run on multiple devices (tablets, phones, PCs), different computer platforms and can answer many different questions about railway operations.

The main components of the S4RIS GUI platform are integrated in the overall system as a first and preliminary version for testing. These 4 main components are namely:

- Risk assessment tool in WP3 (SecuRail)
- Real-Time Monitoring Tool in WP4 (CuriX)
- Decision Support Tool in WP5 (RAM²)
- Central Asset Management System in WP7 (CAMS)

The deliverable presents a check that the interfaces provided in tasks T3.4, T4.5 and T5.5 are working properly together to form the overall flexible multi-lingual SAFETY4RAILS Information System (S4RIS) platform. It describes the S4RIS platform and summarises the software tools integration to date.

Developed as a web application, the S4RIS platform uses HTML, CSS, PHP and JavaScript technologies. The platform is still under development and it will be completed in the coming months. Being web-based, the application runs on a web server and can be accessed via web browsers, using any device that supports web browsers.

A comprehensive evaluation and validation of the S4RIS platform would be against all the requirements and specifications detailed in the D1.4 sections 2.2 and 2.3. In this deliverable only the specific requirements connected with the GUI are reproduced and their implementation status reported on. Later deliverables (particularly D6.5) are foreseen to report on the fuller set of requirements and specifications.

The final evaluation and validation of the tools based on the full requirements identified on D1.4 will be reported in Deliverable 6.5 with the complete integration report of all compatible tools.

1.2 Structure of the deliverable

Chapter 1: Introduction

This section seeks to explain the objectives, and development characteristics of the S4RIS platform.

Chapter 2: Requirements and Specifications

The overall aim of this section is to review the requirements for the implementation of the platform's Graphical User Interface (GUI), according to the requirements stated in the D1.4 (Specification of the overall technical architecture) section 2.2 and 2.3.

Chapter 3: Overall Technical Architecture of the S4RIS Platform

The Technical Architecture is described in this section tracing the design, development, and implementation of S4RIS.

Chapter 4: Validation and Technical Evaluation of the S4RIS

This section compares the different ways in which S4RIS can be used by the users and evaluates the effectiveness of the integration into the GUI.

Section 5: Conclusion

Chapter 5 presents a short summary of the deliverable, and what can be inferred or deduced from the integration and testing of the S4RIS platform.

2. Graphical user requirements and specifications

In this section, we reproduce the Graphical User Interface (GUI) requirements and specifications included in the D1.4 and report the implementation status in the last row of each table.

| ReqID | GUI-R01 |
|----------------|--|
| Short name | Web-based interface |
| Key objectives | - to allow easy access to S4RIS |
| Priority rank | Essential |
| Description | S4RIS shall have a web-based interface. |
| Comments | This simplifies the access to the system and avoid installation issues. |
| Specification | The S4RIS GUI shall be accessible over an URL via a standard web browser. |
| Implementation | This is the main requirement for the implementation of the S4RIS platform in the web browser version. Accessible without the need for special apps or installation |

| ReqID | GUI-R02 |
|----------------|--|
| Short name | Login page |
| Key objectives | - to define log-in window |
| Priority rank | Essential |
| Description | When S4RIS interface is opened and the user is not already logged-in, only a log-in page shall be displayed. This page shall be coherent with the authentication method adopted for S4RIS. |
| Comments | if the authentication will be based on username-password only, the username- password fields shall be displayed to the user. If two-factor authentication will be implemented with OTP code (or similar), a page to insert the OTP code (or similar) shall be displayed after the insertion of username-password. |
| Specification | See description. |
| Implementation | Login requirements for accessing S4RIS tools implemented |

| ReqID | GUI-R03 |
|----------------|--|
| Short name | Single point of access to the tools |
| Key objectives | - to have all tools available for use in a single page |
| Priority rank | Essential |
| Description | It shall be possible to launch the tools that need user interaction from a single interface (the home page). |
| Comments | The entry point to all tools shall be unique to have a complete overview on the available tools. |
| Specification | One page of the S4RIS GUI shall provide an overview of all available tools in form of a list or table. Each tool should be depicted by an icon or an example screenshot. |
| Implementation | Multi tools single point in screen implemented |

| ReqID | GUI-R04 |
|----------------|---|
| Short name | Grouping of tools |
| Key objectives | - to group tools based on their area of use |
| Priority rank | Essential |
| Description | The tools shall be visually grouped into at least four areas: risk assessment, prevention and mitigation, detection and response, planning and investments. |
| Comments | This requirement ensures that tools related to an area of use are visually grouped together. This allows the operator to focus more easily on its current task (e.g., when an operator needs to use the "detection" capabilities of S4RIS, all tools related to this capability will be shown grouped and therefore it will be easier for him to focus on these tools). |
| | Other orders of displaying the tools (e.g., all the tools simply in alphabetic order) are considered less user-friendly and more confuse. |
| | Additional areas could be present if needed. |
| Specification | See also GUI-R03; the depicted list of tools shall also contain the group name of each tool so that it is possible to sort them according the group. |
| Implementation | Grouping guidelines for S4RIS is discussed in this document in section 3 |

| ReqID | GUI-R05 |
|----------------|--|
| Short name | How to launch tools |
| Key objectives | - to define how each tool will be accessed by the operator |
| Priority rank | Essential |
| Description | To launch each tool, an icon button shall be used. The icon button shall include: |
| | - the icon of the tool. |
| | If the tool does not come with an icon from the tool provider, another icon could be defined. |
| Comments | This requirement ensures that it is easy for the operator to identify the different tools. |
| Specification | For each tool there should be a clickable link that opens the tool in one of the following possibilities: |
| | Navigate to the web GUI of the selected tool (within the S4RIS GUI or open another tab / browser window) |
| | Open the respective tool on the client machine via an executable file Open a web page that provides access to a remote machine in which the tool can be executed |
| | Tools that are used in a one-shot manner and are not meant to run permanently need to assure that required data is available. One of the following three possibilities can be followed by each tool: |
| | request manual input of required data (via upload possibilities or forms) retrieve data over parameters provided via the open link within S4RIS |

| | having a permanently running program that observes KAFKA and stores relevant files in an accessible folder of the respective tool | |
|----------------|---|--|
| | Results of stand-alone tools shall be sent over KAFKA if those results will be processed by other tools within S4RIS; if results are meant to be directly communicated to the user they will be provided by standard means (e.g. own GUI of tool, result file, email, etc.) | |
| Implementation | Navigation guidelines for S4RIS is discussed in this document in section 3 | |

| ReqID | GUI-R06 |
|----------------|---|
| Short name | Display of tools based on user role |
| Key objectives | - to guarantee that only authorized users can launch the tools |
| Priority rank | Essential |
| Description | To launch each tool, an icon button shall be used. The icon button shall include: the name or acronym of the tool, and; the icon of the tool. If the tool does not come with an icon from the tool provider, another icon could be defined. |
| Comments | This requirement ensures that it is easy for the operator to identify the different tools. |
| Specification | This requirement ensures that only authorized users can launch the tools. For example, an operator dealing with "detection" could be not authorized to access tools dealing with "recovery". In this case, only tools related to "detection" should be shown and clickable by the operator" Note: defining the criteria for granting access to the operators to the tools is out of scope. See also GUI-R03; The list shall only display tools which are accessible to the user, |
| | or his/her respective role. |
| Implementation | For better user experience the tools functionalities and tools guidelines are presented in the tools section |

| ReqID | GUI-R07 |
|----------------|---|
| Short name | Tools keywords and short descriptions |
| Key objectives | - to help users to easily understand what a tool is used for |
| Priority rank | Essential |
| Description | A set of keywords and/or a short description, aimed to describe the tool main functionalities, shall be displayed for each tool. |
| Comments | Due to large number of tools included in S4RIS, it seems reasonable that for each tool a short description and/or keywords are shown to help the operator to understand what the tools do. Keywords should be provided by the tool providers. Note: other implementations are allowed. |

| | Proposed implementation: |
|----------------|--|
| | - near the icon button to launch the tool, a text box with the keywords is displayed; |
| | - when the cursor hovers over the icon button to launch the tool and/or the keywords, a tooltip is shown with the short description. |
| Specification | See also GUI-R03; The list shall contain keywords and/or a short description of the accessible tool. |
| Implementation | For better user experience the tools functionalities and tools guidelines are presented in the tools section |

| ReqID | GUI-R08 |
|----------------|--|
| Short name | Log-out button |
| Key objectives | - to defined log-out position |
| Priority rank | Essential |
| Description | A log-out button shall be present in the right-top angle of each page (login page is excluded). |
| Comments | - |
| Specification | See description; When the log-out button is clicked, the user shall be navigated to the login page. All other pages shall not be accessible any longer after being logged out. |
| Implementation | Logout option implemented |

| ReqID | GUI-R09 |
|----------------|--|
| Short name | Home page button |
| Key objectives | - to define position of home page button |
| Priority rank | Conditional |
| Description | S4RIS logo shall be displayed in the left-top angle of each page and shall work as a "home" button (login page is excluded). |
| Comments | - |
| Specification | See description |
| Implementation | Home button implemented |

| ReqID | GUI-R10 |
|----------------|---|
| Short name | Account management |
| Key objectives | - to allow the user to manage its account and change its own password |
| Priority rank | Essential |

| Description | It shall be possible for the user to manage its account and change its password in a dedicated page, accessible from the home page. |
|----------------|---|
| Comments | - |
| Specification | A link to the user account page shall be visible at least on the home page of the S4RIS GUI. If a menu for accessing other pages will be implemented, the link to the user account page shall appear there and shall be permanently present in that menu bar. |
| Implementation | Account management system implemented |

| r | |
|----------------|---|
| ReqID | GUI-R11 |
| Short name | Settings and configuration |
| Key objectives | - to allow editing of setting and configuration |
| Priority rank | Essential |
| Description | If settings will be present for S4RIS, it shall be possible for the user to change settings in a dedicated page, accessible from the home page. |
| Comments | This requirement shall be implemented only if the users can modify any setting. |
| Specification | A link to the settings page shall be visible at least on the home page of the S4RIS GUI. If a menu for accessing other pages will be implemented, the link to the settings page shall appear there and shall be permanently present in that menu bar. |
| Implementation | Settings and configuration to be implemented in the next version |

| ReqID | GUI-R12 |
|----------------|--|
| Short name | Language |
| Key objectives | - to allow changing of the displayed language |
| Priority rank | Essential |
| Description | It shall be possible to change the displayed language. At least the following languages should be supported: |
| | - English; - Italian; - Spanish; - Dutch; - Turkish. - French |
| Comments | Proposed alternative implementations: - change language in a dedicated page accessible from home page: |
| | - change language in the setting page, if present; |
| | - change language using a drop-down menu in the home page. |
| | Note: other implementations are allowed. |

| | Within the project not all tools and the S4RIS GUI will provide all mentioned languages for all the texts. Selection of different languages shall be prepared in the S4RIS GUI and each individual tool and shall be demonstrated for at least two different languages. If a specific language is not prepared yet, fallback language shall be English. |
|----------------|---|
| Specification | Texts shall appear in the selected language, except the tool names or user inputted data items, e.g. asset names. |
| Implementation | Multi language support to be implemented in the next version under settings and configuration button |

| ReqID | GUI-R13 |
|----------------|---|
| Short name | Bar with additional functions |
| Key objectives | - to quickly and easily find additional S4RIS functions and menus. |
| Priority rank | Conditional |
| Description | A side-bar (preferred) or a top-bar should be present in the home page and should provide buttons to access the followings: |
| | - password management (GUI-R10); |
| | - settings and configuration (GUI-R11), if implemented. |
| | - language selection (GUI-R12); |
| | - help, if implemented (GUI-R21). |
| Comments | Allowing the user to choose between side-bar or top-bar would be a plus. |
| Specification | See description. |
| Implementation | To be implemented in the next version |

| ReqID | GUI-R14 |
|----------------|--|
| Short name | Opening web-based tools |
| Key objectives | - to define how to open tools with web-based interface |
| Priority rank | Essential |
| Description | When tools with web-based GUI are launched, they shall be opened in another tab or window of the browser. |
| Comments | - |
| Specification | See GUI-R05 |
| Implementation | For better user experience the tools functionalities and tools guidelines are presented in the tools section |

| ReqID | GUI-R15 |
|------------|-----------------------|
| Short name | Opening desktop tools |

| Key objectives | - to define how to open tools with desktop application |
|----------------|--|
| Priority rank | Essential |
| Description | When tools with desktop application are launched, the desktop application itself shall be launched. |
| Comments | - |
| Specification | See GUI-R05 |
| Implementation | For better user experience the tools functionalities and tools guidelines are presented in the tools section |

| ReqID | GUI-R16 |
|----------------|---|
| Short name | Opening CLI tools |
| Key objectives | - to define how to open tools with Command Line Interface only |
| Priority rank | Conditional |
| Description | When tools with Command Line Interface only are launched, one (or more) page(s) specific for dealing with that tool should be opened. |
| Comments | - |
| Specification | See GUI-R05 |
| Implementation | For better user experience the tools functionalities and tools guidelines are presented in the tools section |

| ReqID | GUI-R16a |
|----------------|---|
| Short name | Opening CLI tools - BB3d |
| Key objectives | - to define how to deal with BB3d |
| Priority rank | Conditional |
| Description | When BB3d icon button is pressed, the following features should be displayed (in one or more pages): |
| | 1) area for functionalities and parameters' value assignment |
| | 2) area for solution progress / warning / errors monitoring |
| | 3) area for 3d plot and ASCII results files visualization |
| Comments | This requirement provides information on how to manage BB3d tool, that does not have a GUI. The guidelines are shown below: |
| | 1) the first area will allow the user to create/edit input file(s) and to set parameters; |
| | 2) the second area will show the solution progress (e.g., with progress bar) and will display warnings and errors; |
| | 3) the third area will allow to show 3D plots and ASCII results (maybe using external viewer) |
| Specification | See Description. |

| Implementation | For better user experience the tools functionalities and tools guidelines are presented in the tools section |
|----------------|--|
| | |

| ReqID | GUI-R16b |
|----------------|---|
| Short name | Opening CLI tools - CaESAR |
| Key objectives | - to define how to deal with CaESAR |
| Priority rank | Conditional |
| Description | When CaESAR icon button is pressed, the following features should be displayed (in one or more pages): |
| | 1) area for creation/selection/editing of input file(s) and parameters |
| | 2) area for launching; monitoring the processing/showing warnings and errors |
| | 3) area to view the generated outputs and open already generated results |
| Comments | This requirement provides information on how to manage CaESAR tool, that does not have a GUI. Below are the guidelines: |
| | 1) the first area will allow the user to create/edit input file(s) and to set parameters; |
| | 2) the second area will show the processing progress (e.g., with progress bar) and will display warnings and errors; |
| | 3) the third area (or page) will allow to show the generated plots and outputs |
| Specification | See Description. |
| Implementation | For better user experience the tools functionalities and tools guidelines are presented in the tools section |

| ReqID | GUI-R16c |
|----------------|---|
| Short name | Opening CLI tools - SARA |
| Key objectives | - to define how to deal with SARA |
| Priority rank | Conditional |
| Description | When SARA icon button is pressed, the following features should be displayed (in one or more pages): |
| | 1) area for creation/selection/editing of input file(s) and parameters |
| | 2) area for launching and monitoring the processing / showing warnings and errors |
| | 3) area to view the generated outputs and open already generated results |
| Comments | This requirement provides information on how to manage SARA tool, that does not have a GUI. Below are the guidelines: |
| | 1) the first area will allow the user to create/edit input file(s) and to set parameters; |
| | 2) the second area will show the processing progress (e.g., with progress bar) and will display warnings and errors; |
| | 3) the third area (or page) will allow to show the generated plots and outputs |
| Specification | See Description. |

| Implementation | For better user experience the tools functionalities and tools guidelines are presented |
|----------------|---|
| | in the tools section |

| ReqID | GUI-R17 |
|----------------|--|
| Short name | User confirmation on certain actions |
| Key objectives | - to let the user correct some unwanted actions |
| Priority rank | Essential |
| Description | When the button to launch a tool or the log-out button are pressed, a confirmation pop- up shall be displayed to let the user confirm or cancel the action. |
| Comments | This requirement allow the user to cancel actions when a button is pressed in error |
| Specification | See Description. |
| Implementation | To be implemented in the next version |

| ReqID | GUI-R18 |
|----------------|--|
| Short name | Font type and size |
| Key objectives | - to ensure readability |
| Priority rank | Conditional |
| Description | The used font shall be clearly readable (e.g., Arial, Helvetica, Calibri, etc.). The font size shall never be smaller than 12pt. |
| Comments | This requirement ensure that used font is readable and not too small. |
| Specification | See Description. |
| Implementation | Font size/ colour support to be implemented in the next version under settings and configuration button |

| ReqID | GUI-R19 |
|----------------|---|
| Short name | Error display |
| Key objectives | - to inform the user of errors |
| Priority rank | Essential |
| Description | When an error occurs, a pop-up to inform the user shall be displayed. |
| Comments | The pop-up should contain a description of the error, not only a code. |
| Specification | See Description. During development and pilots also stacktrace information shall be displayed in the error information. Due to security issues the stacktrace information shall be hidden in the product version. |
| Implementation | No comment in this deliverable |

| Requirement ID | GUI-R20 |
|----------------|--|
| Short name | S4RIS account creation |
| Key objectives | - to allow operators to request the creation of an account |
| Priority rank | Optional |
| Description | A button to request the creation a new account could be present in the login page. Pressing this button, a form should be displayed to collect user information (such as name, surname, email, ID, qualification, etc.). Then, the user should be able to cancel the process or to submit the form for the creation of the account. |
| Comments | This feature would allow new operators to request the creation of a new account. Depending on the provided information, the administrator can decide the level of access that the user might have. |
| Specification | See Description. After submitting the form an email will be sent by S4RIS automatically to the administrator account's email address containing the request information. |
| Implementation | Administrator control implemented |

| ReqID | GUI-R21 |
|----------------|--|
| Short name | Help and documentation |
| Key objectives | - to provide access to provide tutorials and/or documentation |
| Priority rank | Conditional |
| Description | A button should be present in the home page to provide access to tutorials and user manuals. |
| Comments | This feature allows the operators to get information on S4RIS and on the tools |
| Specification | See also P-15. |
| Implementation | For better user experience the tools functionalities and tools guidelines are presented in the tools section |

| ReqID | GUI-R22 |
|----------------|---|
| Short name | Frequently/recently used tools |
| Key objectives | - to collect the tools frequently/recently used |
| Priority rank | Optional |
| Description | The homepage could include an area where the most frequently/recently used tools are displayed, to simplify the access to those tools |
| Comments | This feature allows to have in a single place the most frequently/recently used tools, so that the operator can access them easily. |
| Specification | See Description. The area should contain the three most frequently/recently used tools, not more than three. |
| Implementation | To be implemented in the next version |

| ReqID | GUI-R23 |
|----------------|--|
| Short name | Dashboard |
| Key objectives | - to display information to the user |
| Priority rank | Conditional |
| Description | A dashboard displaying relevant and useful information to the user should be present in the home page. |
| Comments | If possible, a dashboard should be present in the home page. The type of displayed information will depend on the actual implementation of the tools |
| Specification | See Description. |
| Implementation | Not feasible under current UX guidelines |

| ReqID | GUI-R24 |
|----------------|--|
| Short name | Mobile interface |
| Key objectives | - to allow usage of S4RIS from mobile devices |
| Priority rank | Conditional |
| Description | S4RIS GUI should be compatible for displaying on mobile devices such as tablets or phones. In this case, it should be possible to launch only the tools compatible with usage from mobile devices. |
| Comments | In the long run, the support for using S4RIS from mobile devices will be a plus. |
| Specification | See Description. |
| Implementation | Implemented in the current version |

| ReqID | GUI-25 (derived from DoA, in addition to what is included in the D2.3) | | |
|---------------------------|---|--|--|
| Short name | S4RIS publicly accessible part optimized for mobile devices | | |
| Key objectives | - to allow public access with mobile devices | | |
| Priority rank | Conditional | | |
| Description | The platform will contain a part accessible for the public. This part will be optimized for mobile devices. | | |
| | | | |
| Comments | Will partially covered within SAFETY4RAILS. Source: DoA Part A – Page 37 (T6.1 Description) Invalid source specified. . | | |
| Comments Specification | Will partially covered within SAFETY4RAILS. Source: DoA Part A – Page 37 (T6.1 Description) Invalid source specified Within the project the S4RIS GUI and all the tools that provide their own GUIs will make use of state-of-the-art visualization and GUI technologies. Those results that are appropriate to show to the public (e.g. text-based instructions or information) will be provided in a way that it will be able to access them via mobile devices in particular in the product version after the project. (See also P | | |

3. Overall technical architecture of the S4RIS system

3.1 S4RIS GUI Structure

This deliverable tested the feasibility of using an intuitive Graphic User Interface (GUI) to create an interoperable model for several rail analytical software to simplify user experience, reduce human error and enable (in the future) integration of third-party software within a GUI framework with high performance computing capabilities. The interface was developed considering multiple devices including mobile devices. This aimed at enabling access to the S4RIS platform and computational tools, wherever the user is, regardless of their location. A main benefit of this integration is the ability to enable users with little or no expertise access and use of different tools to perform operational analyses. The conceptual design for the integration of the tools on the S4RIS GUI platform considered initially 4 different structures for organising the tools. The first structure is based on three layers shown in **Figure 1**:

- Infrastructure
- Data processing
- Decision support

The first structure is based on the three stages of the data lifecycle: Collection, Processing and Analysis, which is shown in FIGURE 2. The tools would be grouped based on this structure discussed in D2.3. This creates the structure, Option 1 (FIGURE 2).



FIGURE 1: S4RIS CONCEPT SYSTEM ARCHITECTURE DIAGRAM





From the cluster model developed in Task 4.4 (FIGURE 3), which groups tools into 8 areas, the second conceptual design structure (FIGURE 4) was created. Grouping the tools on so many levels proved less user friendly than Option 2 because of the space taken by the 8 clusters (option2).



FIGURE 3: CLUSTERING OF TOOLS UNDER T4.4

Option 2

| Home | Tools | Partners | Profile | Login |
|-------------------|-------|-----------|------------|-----------------|
| Inframed Alert | I | nframed / | Applicatio | on |
| | | | Intercont | octod Studios |
| | _ | | Interconr | lected Studies |
| | | | Ca | scating effecs |
| | | | Phy | sical Security |
| | | | c | yber Security |
| | | | Ca | ascating effecs |
| | | | | Anomaly |
| | | | Adi | tional Aspects |
| | | | | End User |

FIGURE 4: SECOND S4RIS STRUCTURE

The third model organised the tools according to the grouping of tools in the different work packages as shown **FIGURE 5** (i.e., 5 groups: Risk Assessment, monitoring, simulation and decision support, policy and observation solution).

| Option 3 | Home | Tools | Partners | Profile | Login |
|----------|-------------------|-------|-----------|---------------|-----------------|
| | Inframed Alert | I | nframed / | Applicatio | n |
| | | | | Ri | sk Assessment |
| | | | | | Monitoring |
| | | | Sim | ulation and D | ecision support |
| | | | | | Policy |
| | | | | Observa | tion Solutions |

FIGURE 5: THIRD S4RIS STRUCTURE

In preparation of this report, a further fourth option (**FIGURE 6**) was considered which would align with resilience cycles.¹ This would follow the sequences of actions typically taken by the users e.g., modelling the system, adding information about assets, performing actions for prevention and simulation.



FIGURE 6: FOURTH S4RIS STRUCTURE

3.2 Intuitive Interface for S4RIS

The implementation of S4RIS visual hierarchy is applied to the intuitive interface to:

- Communicate messages: Visually dominant images elements have been placed in key positions to get noticed most.
- Illuminate actions: Distinct visual weight in the sections have been used to guide the user through the different sections.
- Organise information: The main screen including open access area and private area using visual weight elements.
- The approach to S4RIS interface is to represent the information in a way that is familiar to the user. Keeping the design has been simple and intuitive. The information in the screen aim to represents all aspects of the software.

¹ In D8.2 it is noted on page 8: "Prevention phase covering identification of vulnerabilities and gaps, and implementation of protection measures. Therefore, covering IDENTIFICATION and PROTECTION phases mentioned in previous project documents".

The first step to access the private area S4RIS platform in the registration process (see **FIGURE 7**). The user must fill a form with login details and a cooperative email. A secure password is required for the process.

| SAFETY4RAILS | Home | Т | ools | Register | Login |
|--------------|------|----------|-------------------------------------|----------|----------|
| | | | | 0 | <u> </u> |
| | | | | | |
| | | S | AFETYARAILS | | |
| | | Name | | | |
| | | Usemam | | _ | |
| | | * | | _ | |
| | | First | | | |
| | | Name | | | |
| | | Last | | | |
| | | Name | | | |
| | | Contact | Info | | |
| | | E-mail* | | _ | |
| | | Password | | | |
| | | * | | _ | |
| | | | Minimum length of 8 | | |
| | | | characters. The password must ha | ve a | |
| | | | minimum strength of S | itrong | |
| | | Repeat | Strength | _ | |
| | | Password | 1 | | |
| | | * | | | |
| | | Addition | | | |
| | | Add User | | | |
| | | | | | |

FIGURE 7: S4RIS PLATFORM SECURE LOGIN

The form generates a request for email confirmation and the admin must approve the user registration process (FIGURE 8).



FIGURE 8: APPROVAL PROCESS

After the approval the user can access the S4RIS platform and manage the login details (e.g., change of password), as shown in **FIGURE 9**.

| Home | Tools | Partners | Register | Login |
|------|-------|----------------------|----------|-------|
| | | | | |
| | | | | |
| | | | | |
| | 100 | est month in a local | | |
| | Une | Super Proves | | |
| | Paul | ewil word | | |
| | | In the later | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

FIGURE 9: S4RIS LOGIN PROCESS

3.3 Intra Messaging in S4RIS

An important part in the process of integration between S4RIS tools is the definition of tools and technologies that allow intra messaging between various tools in the S4RIS platform. During the specification of the overall S4RIS system architecture it was decided that the technology to be utilized for communication between the tools in the S4RIS platform is Distributed Messaging System (DMS). DMS is a technology based on Apache Kafka a well-known open-source message broker for building robust streaming applications. Apache Kafka is a messaging platform that allows participants to intercommunicate using the publish and subscribe pattern enabling efficient relaying of messages to all participants while avoiding traffic duplication. A more detailed analysis of how DMS operates will be further outlined in D6.2 Technical Interoperability and Interfaces, due in March 2022.

Currently in the S4RIS platform DMS has been successfully deployed as a secure service (using TLS) under a REST (Representational State Transfer) interface allowing the integration of tools of heterogenous nature in diverse environments. Only authenticated parties can access the platform and tool providers have received dedicated accounts for accessing the service. Our original and remaining goal is to connect all relevant tools over KAFKA. However, at this stage we identified those tools for which the communication between the tools brings the most added value to the end-user. At the time of writing 7 technical providers have connected to the platform having successfully carried out initial tests and are proceeding with further integration considering the upcoming field tests. The server currently processes about 150 requests per day although this is expected to increase marginally as we approach the first field test, and a considerable volume of traffic is expected throughout the field test period.

The final goal of S4RIS deployment is to serve as basis for our demos and can be a blueprint for customer deployments later more than a "singleton" application, that exists only once.

3.4 Front end Integration

To implement the S4RIS platform, a software framework for the development of S4RIS tools has been developed. The software framework is based on a simple concept of "plug-and-play" allowing the different tools to be easily integrated into the platform through the iFrame application. This entails that an HTML document is embedded inside another HTML document on a website. It was decided that for the purposes of the S4RIS project this interface provides a good support for the software developers from both the hardware and software perspective. The software framework provides a set of basic tools that allow a user to navigate and test the functionalities of an S4RIS tool. This initial set is expected to increase as the project progresses.

At this stage of the S4RIS platform development, depending on how the individual tools manage the credentials, there may be need for double registration.

Example of tools integration in iFrame is shown in FIGURE 10, and FIGURE 11.



FIGURE 10: INTEGRATION IFRAME

| C SECURAIL |
|--|
| STAM srl is in charge of the development of SECURAIL, a Risk Assessment web-based application dedicated to Railways. SECURAILS should allow users to model their own railway network, perform risk analysis towards cyber, physical and natural threats and even perform cost-benefit analysis to find optimal countermeasure setup within budget constraints. |
| Decision Support - Wingspark Sara Osinit DataFan Bomblast3D CAMs Curix Securail iCrowd RAM ² |
| Data Processing - Curix DataFan Tisais Ganimede RAM ² Securail WingsPark |
| Infrastructure Sensation PRIGm UNIMis Saecas SISC2 Wibas |

FIGURE 11: EXAMPLE OF EXECUTION OF SECURAL

3.5 S4RIS Web Implementation

Choosing to implement the S4RIS platform in an online tool based on WordPress allowed the operation on multiple devices (phone, tables and pc) and easily integrate with visual components. **FIGURE 12** shows the S4RIS home page.



FIGURE 12: S4RIS HOME PAGE

The provisional implementation of S4RIS in the web version (FIGURE 12) allows users to customise the organisation of tools according with their own needs. The 4 options discussed in Chapter 3 will be

implemented for all the tools as part of D6.5. Nevertheless, for the purposes of the MDM simulation exercise, a version of the S4RIS with the 4 initially selected tools was implemented.

3.6 S4RIS Data, Input and Provision

User interfaces require visual hierarchies, and visual hierarchies must stem from user requirements. Task 6.3 as part of the D6.5 will create user profiles based on the access level required.

Understanding the data inputs required for the tools and applying them into the visual hierarchy was fundamental for the S4RIS. Prioritising the user interface based on how users scan for information from the different tools will allow the creation of comprehensive tutorials for multi tool usage.

The current version of S4RIS have two main "streams" of inputs and outputs, one stream directly on the GUI where the users interact with the tools and other one over the technical data-provision through APIs (e.g., real-time monitoring) where the data are exchanged, and the information displayed as an alert via DMS.

4. Validation and Technical Evaluation of the S4RIS

4.1 Testing / validation

Prior to official S4RIS platform creation, a test environment was created for the web version. The interface was created under WordPress private domain to evaluate the iFrame implementation and login approval process. New users of the system require registration according to the requirements established under D1.4, after which an access request is created for the administrator's approval.

| ReqID | Priority | Implementation |
|---------|-------------|---------------------------------------|
| GUI-R01 | Essential | Implemented |
| GUI-R02 | Essential | Implemented |
| GUI-R03 | Essential | Implemented |
| GUI-R06 | Essential | Implemented |
| GUI-R08 | Essential | Implemented |
| GUI-R09 | Conditional | Implemented |
| GUI-R10 | Essential | Implemented |
| GUI-R20 | Optional | Implemented |
| GUI-R21 | Conditional | Implemented |
| GUI-R22 | Optional | To be implemented in the next version |
| GUI-R23 | Conditional | Not feasible |
| GUI-R24 | Conditional | Implemented |
| GUI-25 | Conditional | Implemented |
| GUI-R04 | Essential | Implemented |
| GUI-R05 | Essential | Implemented |

| ReqID | Priority | Implementation |
|----------|-------------|---------------------------------------|
| GUI-R07 | Essential | Implemented |
| GUI-R11 | Essential | To be implemented in the next version |
| GUI-R12 | Essential | To be implemented in the next version |
| GUI-R13 | Conditional | To be implemented in the next version |
| GUI-R14 | Essential | To be implemented in the next version |
| GUI-R15 | Essential | To be implemented in the next version |
| GUI-R16 | Conditional | To be implemented in the next version |
| GUI-R16a | Conditional | To be implemented in the next version |
| GUI-R16b | Conditional | To be implemented in the next version |
| GUI-R16c | Conditional | To be implemented in the next version |
| GUI-R17 | Essential | To be implemented in the next version |
| GUI-R18 | Conditional | To be implemented in the next version |

4.2 Evaluation

For the Metro de Madrid simulation exercise, a version of the S4RIS GUI platform was presented and demonstrated using 4 tools namely CAMS, Curix, SECURAIL and RAM².

After the integration the main limitation for the usage in S4RIS was the requirements for login and password.

Implementation of the CAMS tool into the S4RIS GUI platform was successful (FIGURE 13). However, the user still needs to login to the partner (RMIT) platform to access the tool. SECURAIL was also successfully implemented (FIGURE 14) and needs login to the partner STAM's platform to access the tool. Future deployment will require the single login via S4RIS platform.

| Home | Tools | Register | S4RIS | Madrid |
|------|-------|----------|-------|------------------|
| | | Login | 1 | () Нер |
| | | | | CAMS2 V1.9.0 (1) |

FIGURE 13: IMPLEMENTATION OF THE CAMS TOOL

| Home | Tools | Register | S4RIS | Madrid |
|---------------------|---|--|---|--------|
| | | | | |
| | | | | |
| | C SECURAIL | | | |
| | STAM srl is in charge of the develo to Railways. SECURAILS should all cyber, physical and natural threats setup within budget constraints. | pment of SECURAIL, a Risk Assess ow users to model their own railway and even perform cost-benefit and | ment web-based application dedicated y network, perform risk analysis towards alysis to find optimal countermeasure | |
| | Get Started | | | |
| | | | | |
| | | | | |
| Implemented tools - | CAMs Curix Securail RA | AM2 | | |

FIGURE 14: IMPLEMENTATION OF THE SECURAIL TOOL

For Curix implementation (FIGURE 15) the platform was able to handle multiple sections and windows moving around. However, to perform zoom into the different sections, the iFrame implementation is not ideal. The user interface can be improved in size to match the original tool.



Implemented tools - CAMs Curix Securail RAM2

FIGURE 15: IMPLEMENTATION OF THE CURIX TOOL

Finally, for the RAM² implementation into the S4RIS platform with the iFrame, a special connection was required from the tool developer linking the IP address from the user to connect with the platform. The approval of the IP address was still pending at the time of submission of this deliverable. Hence, unlike the other three tools, the S4RIS output is blank (**FIGURE 16**). Reporting on RAM² is expected in the next deliverable, D6.5.



FIGURE 16: IMPLEMENTATION OF THE RAM² TOOL

4.3 Recommendations for final version

For the next phase of the project, a single login for all tools is advised. Further testing to match the user interface of the tool to the GUI will be implemented in S4RIS, ideally through the whole workflow between the tools. It is also suggested that there will be a customisation guideline to allow the end user to organise the tools according with their own needs and preferences.

4.4 Implementation matrix

For the initial version of the S4RIS platform, 4 tools were integrated into the S4RIS GUI. **TABLE 2** shows the implementation matrix for the tools that had confirmed thus far (tools that have been implemented in the S4RIS GUI), and those that are operational and tested. It also shows the level of access, in terms of whether they are on the S4RIS GUI/screen and/or DMS Kafka.

| ΤοοΙ | Implemented in S4RIS GUI | Tested | Access |
|------------------|-----------------------------|--------|---------------------|
| CAMS | Yes | Yes | In screen/DMS Kafka |
| RAM ² | Yes | No | In screen/DMS Kafka |
| WINGS | No | No | DMS Kafka |
| CURIX | Yes | Yes | In screen/DMS Kafka |
| ICROWD | No | No | In screen/DMS Kafka |
| SECURAIL | Yes | Yes | In screen |
| Tree | No | No | In screen/DMS Kafka |

TABLE 2: IMPLEMENTATION MATRIX - S4RIS v1.0

5. Conclusion

5.1 Conclusion

This deliverable was set out to present the tools integration into the S4RIS platform and assess the feasibility of creating a web version of the S4RIS platform assessing the interoperability between the tools and the communication with the distributed message system.

In general, therefore, it seems that the web integration using iFrames is a feasible solution for most of the tools providing an empirical confirmation that the intercommunication between the tools provides and useful decision-making support

Since this Deliverable D6.3 is limited to 4 tools already integrated into the DMS, it was not possible at this stage to assess the S4RIS GUI platform with all the 18 tools. With addition of all the compatible tools to the GUI in the next months, the next deliverable D6.5 will present an evaluation of the fully integrated and tested platform.

It will be interesting to assess the user experience during the tests in Madrid to collect more evidence before a large randomised controlled trial.

6. Bibliography

- 1. IC, et al (2021): Deliverable D1.4 Specification of the Overall Technical Architecture. EU SAFETY4RAILS Project.
- 2. NCSRD, et al (2021): D2.3 System Specifications and Concept Architecture. EU SAFETY4RAILS Project.

7. Annexes

7.1 ANNEX I. GLOSSARY AND ACRONYMS

TABLE 3: GLOSSARY AND ACRONYMS

| Term | Definition/description |
|---------|--|
| AB | Advisory Board |
| CC | Crisis Communication |
| CCP | Crisis Communication Plan |
| ССТ | Crisis Communication Team |
| CCTV | Closed-circuit television |
| СО | Confidential |
| D | Deliverable |
| DC | Data controller |
| DoA | Description of the Action (Annex 1 to the Grant Agreement) |
| EC | European Commission |
| ENISA | European Union Agency for Cybersecurity |
| ERS | Emergency Response Services |
| ERTMS | European Rail Traffic Management System |
| IDS/IPS | Intrusion Detection / Prevention System |
| IM | Infrastructure Manager |
| IMOC | Infrastructure Managers Operations Control |
| IPR | Intellectual Property Rights |
| ISO | International Standardisation Organisation |
| ITS | Intelligent Transportation System |
| ITU | International Telecommunications Union |
| LEA | Law Enforcement Agency |
| S4RIS | SAFETY4RAILS Information System |
| ТС | Technical Committee |
| тос | Train Operating Company |

| TSI | Technical Specification for Interoperability |
|-----|--|
| UC | Use-Case |
| UR | User Requirement |
| WG | Working Group |
| WP | Work-Package |
| WS | Workshop |



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 883532.