

Proof of Concept (POC) for a dynamic consistency management (TOP document)

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Summary

This document aims at introducing the results that concern the proof of concept of what can be done in terms of traceability, configuration and change request, to support consistency.

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Evolutions

| Version | Date | Modified § | Modification summary | Modified by |
|---------|------------|------------|--------------------------|--------------|
| V1 | 03/04/2023 | all | Creation of the Document | Anouk Dubois |
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1 Introduction

1.1 Purpose of document

This document aims at introducing the results that concern the proof of concept of what can be done in terms of traceability, configuration and change request, to support consistency.

This deliverable is a top document and lists the different documents that have been produced to address this topic (POC for traceability, configuration and change request tools and services). These documents are listed in section 1.2.1 and the following sections give an overview of each of them.

1.2 Referenced documents

1.2.1 S2C referenced documents

| Title | Reference |
|--|-----------------------------------|
| Stage « cohérence dynamique » (pré étude du POC) Internship dynamic consistency (pre-study for POC) | NT-S085L01-048 ISX-S2C-DOC-472 |
| POC Dynamic Consistency Management : code + video « L1.3_POC Dynamic Consistency Management_video » | NT-S085L01-047 ISX-S2C-DOC-471 |
| Notice d'utilisation du POC / POC operating Instructions | NT-S085L01-050 ISX-S2C-DOC-474 |
| S2C_Cotation_Impact_S03_2023 | NT-S085L01-049 ISX-S2C-DOC-473 |

1.2.2 External referenced documents

| Title | Reference |
|-------|-----------|
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2 Internship « dynamic consistency» (POC pre-study)

Refer to file ISX-S2C-DOC-472 Stage « cohérence dynamique » (pré étude du POC) / Internship “dynamic consistency” (pre-study for POC).

This file contains the different results provided during the internship on “dynamic consistency”. Dynamic consistency refers to the idea that a consistency status obtained at a given time can be questioned when an artefact has changed, possibly impacting the global consistency of the artefact chain to which this artefact belongs. This internship produced a first elementary POC based on a metamodel of SE/SA data relationships and on a generic evolution scenarios database. Each scenario described the possible relationship between data and gave a generic and pre-defined impact quotation for the change of one of the artefacts involved in the scenario. The bases of this internship have not been reused for the POC in section 3 (because to “generic”) but this internship allowed to frame what had to be done in terms of dynamic consistency and with which interest.

3 POC Dynamic Consistency Management

Refer to deliverable ISX-S2C-DOC-471 “POC Dynamic Consistency Management”. This POC is a tooling demonstration (code sources). A short video has been produced to illustrate how it works.

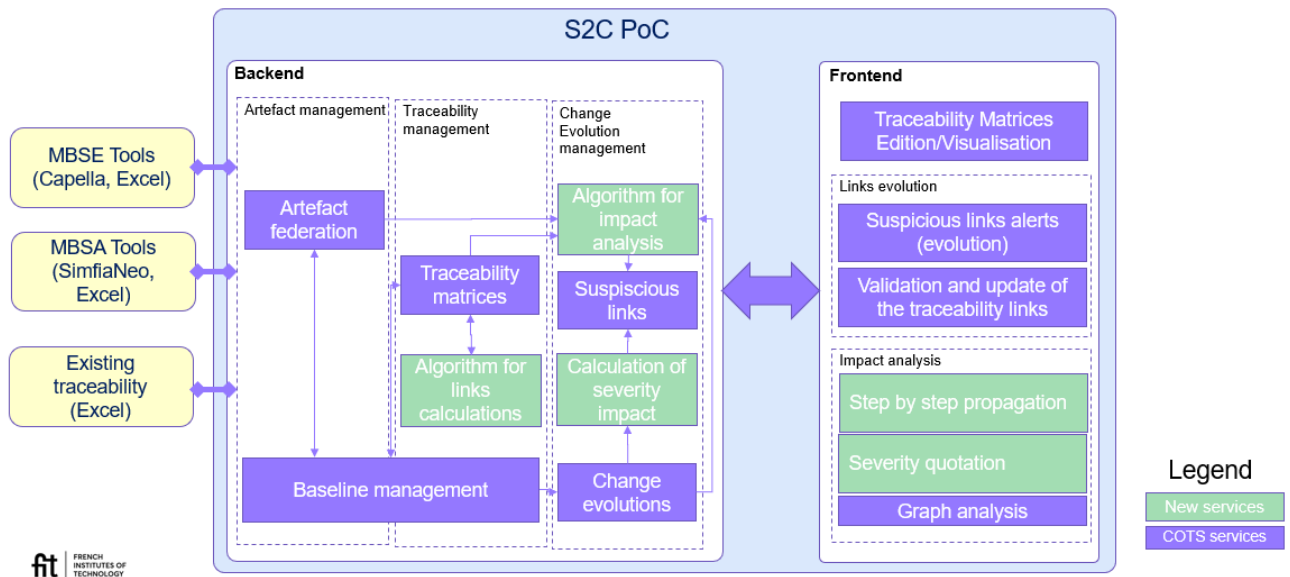
For more details, refer to document ISX-S2C-DOC-474 “Notice d'utilisation du POC / POC Operating Instructions for use”. A video of this POC that illustrates the functioning of the POC, is also proposed; see “L1.3_POC Dynamic Consistency Management_video”.

This POC is a tooling demonstration of what can be done in terms of change and impact analysis of SE or SA artefacts, based on a traceability plan. This POC is intended to help the safety analyst in the impact analysis of his perimeter, when any inputs data has changed.

S2C Dynamic consistency management PoC

Additional services of the PoC (vs COTS) :

- Suggestion of traceability links when artefact change;
- Impact analysis;
- Severity quotation of the impact



PoC example, with Capella, SimfiaNeo and Excel for illustration purpose

This POC offers some current services (in purple), already proposed by other COTS tools, but makes also a focus on new services (in green), not yet implemented in COTS:

- Suggestion of traceability links when artefact change;
- Impact analysis;
- Severity quotation of the impact

The architecture of this POC is divided in a backend and a frontend.

The backend proposes first an artefact management service that allows to import different kind of data :

- Data coming from MBSE Tools (implementation of the Capella connector in POC) or in an Excel format,
- Data coming from MBSA Tools (implementation of the SimfiaNeo connector in POC) or in an Excel format.
- Existing traceability plan (in an excel format)

The POC manages these data in baseline for the purpose of the change evolution management service.

Then, the POC proposes a traceability management service where traceability matrix can be performed and modified. It also proposes a first version of a links calculation algorithm, based on the analysis of the traceability matrix and the content of the previous baseline. It suggests new traceability links between artefacts when artefacts have changed. This algorithm is used to help the safety analyst in its analysis, during step by step propagation process (see frontend).

The service "change evolution management" is composed of different functionalities, as suspicious link or change evolution management, but proposes also a mechanism to calculate the impact severity of a change (minor, major, critical). This mechanism is displayed during the step by step propagation process. It is based on the decision trees available in deliverable "S2C_Cotation_Impact_S03_2023" (see section 4).

Concerning the frontend, it proposes functionalities to visualize traceability matrix, also with graph representation, but more specifically a step by step propagation process, where the safety analyst gets an evolution alert with potential impacts on his safety analysis and can have an understanding of the context and rationale that motivates the change. He gets also a good overview of the artefacts linked to his analysis so that he can perform his impact analysis and quotes the impact severity if needed (see section 4), and then decide to propagate the impact analysis to the next level (next impacted artefact).

4 Quotation of the impact Severity

Refer to document ISX-S2C-DOC-473 "S2C_Cotation_Impact_S03_2023".

This document presents the different decision trees produced to guide the safety analyst in his analysis of the impact induced by different possible triggering (and change) event.

3 decision trees are available, one for each triggering event:

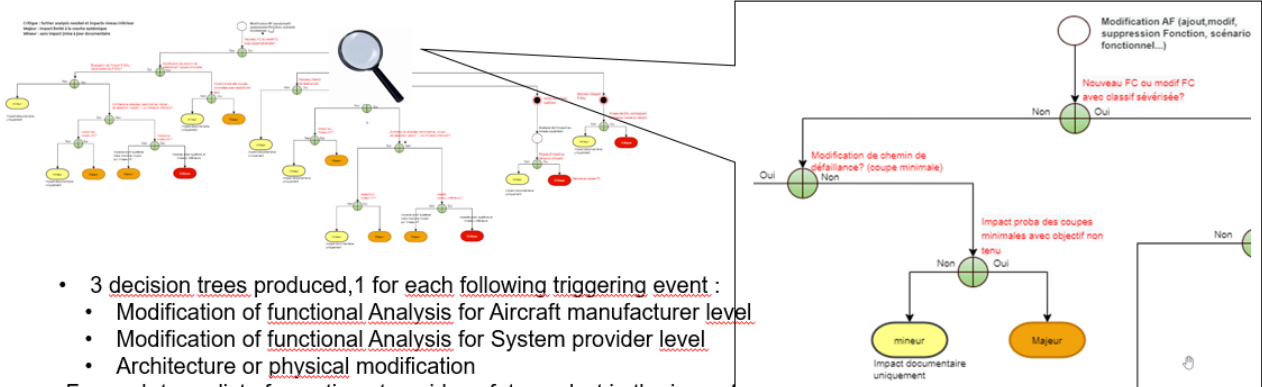
- Modification of functional Analysis for Aircraft manufacturer level
- Modification of functional Analysis for System provider level
- Architecture or physical modification

For each tree, the document lists the questions the safety analyst has to ask to well evaluate the impact of the considered evolution.

S2C Traceability PoC : Impact Analysis / Decision tree



- Realization of decision tree to guide the safety analyst in the evaluation of the impact of an evolution



- 3 decision trees produced, 1 for each following triggering event :
 - Modification of functional Analysis for Aircraft manufacturer level
 - Modification of functional Analysis for System provider level
 - Architecture or physical modification
- For each tree : list of questions to guide safety analyst in the impact evaluation of the evolution.
- 3 criticality levels considered
 - Critical** : further analysis needed et impact on lower level
 - Major** : Impact limited to system level
 - Minor** : without impact (except documentary update)

Decision trees available in the POC