Shift2Rail

sprint

CONTENT

FOREWORD / INTRODUCTION

In this 1st newsletter of the project **SPRINT** (Semantics for PerfoRmant and scalable INteroperability of multimodal Transport), you will learn about the latest developments, now that the project has reached its halfway point. Through the various development that are being described, you should also get an idea of what's to come in the following year, until the project concludes in the end of December 2020.

To find out more about **SPRINT**, to get a closer look at the project partners and to access the public deliverables that are already available, please visit our website at **www.sprint-transport.eu**

Enjoy the read!

PROJECT SCOPE & STRUCTURE

SPRINT is building upon the work already initiated in previous projects, by working on enhancing the Interoperability Framework (IF), which is one of the Technology Demonstrators (TD) of the fourth Innovation Program (IP4) of Shift2Rail, dealing with "IT Solutions for Attractive Railway Services". The IF realises its definition by:

- providing travel applications with a uniform abstraction of data and services distributed over the world wide web as a "web of transportation data" in the form of linked data and service descriptors annotated with machine-readable logical statements which describe their semantics;
- providing applications with technical means (i.e., packaged resolvers) to operate on such "web of transportation data" – publishing, querying, etc. – where the semantic annotations are used to automate the process of discovering and matching datasets and service descriptors.

Consistently with its scope, the SPRINT project will pursue the following objectives:

- Define a reference architecture for the IF, which will take into account recent advances in the design and development of distributed systems, and in particular of cloud-based ones;
- Define techniques facilitating, in particular by increasing their level of automation, activities that are central to the concept of the IF, such as the collaborative creation and management of ontologies and of semantic-based mappings between heterogeneous data representations;
- Demonstrate the proposed improvements to the IF through a proof-of-concept implementation that will reach at least TRL 4.

Moreover, SPRINT contributes to the realisation of the IF by:

- masking the complexity of interoperability to travel applications by publishing in the IF's Assets Manager uniform abstractions of services enabling travel applications to know how to communicate with them (e.g., web service/API interfaces, communication protocols);
- providing additional technical means to operate on the "web of transportation data"; for example, the IF will enhance its ability to act as a (distributed) broker to communicate with different services and as a means to dynamically discover, bind and inject data and services, including the Mobility Service Provider (MSP) identification on the basis of their geographical area and offered service capabilities.

The way in which the project is structured is shown in the diagram below:

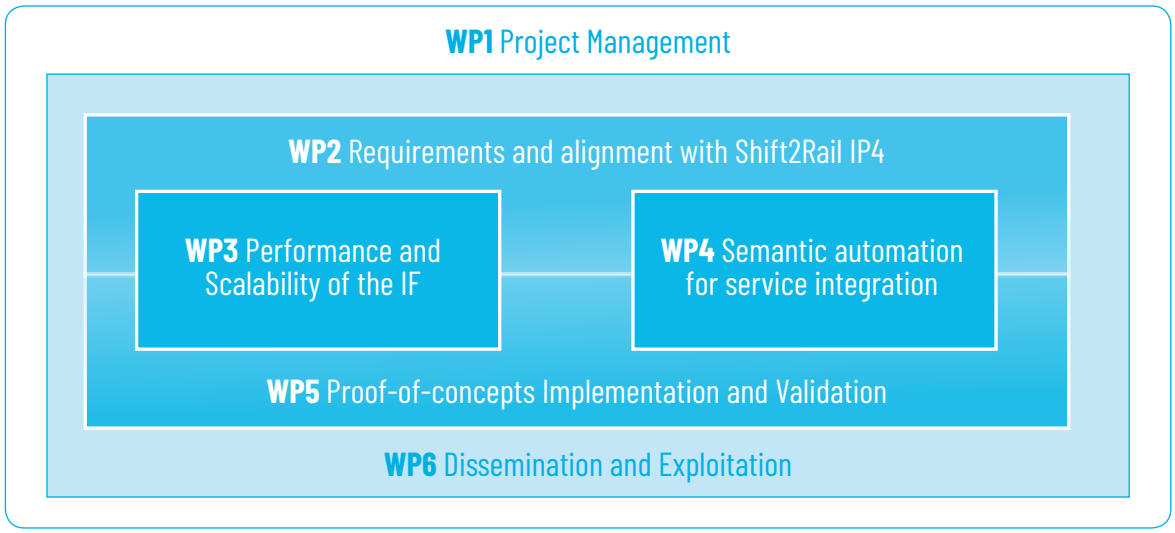
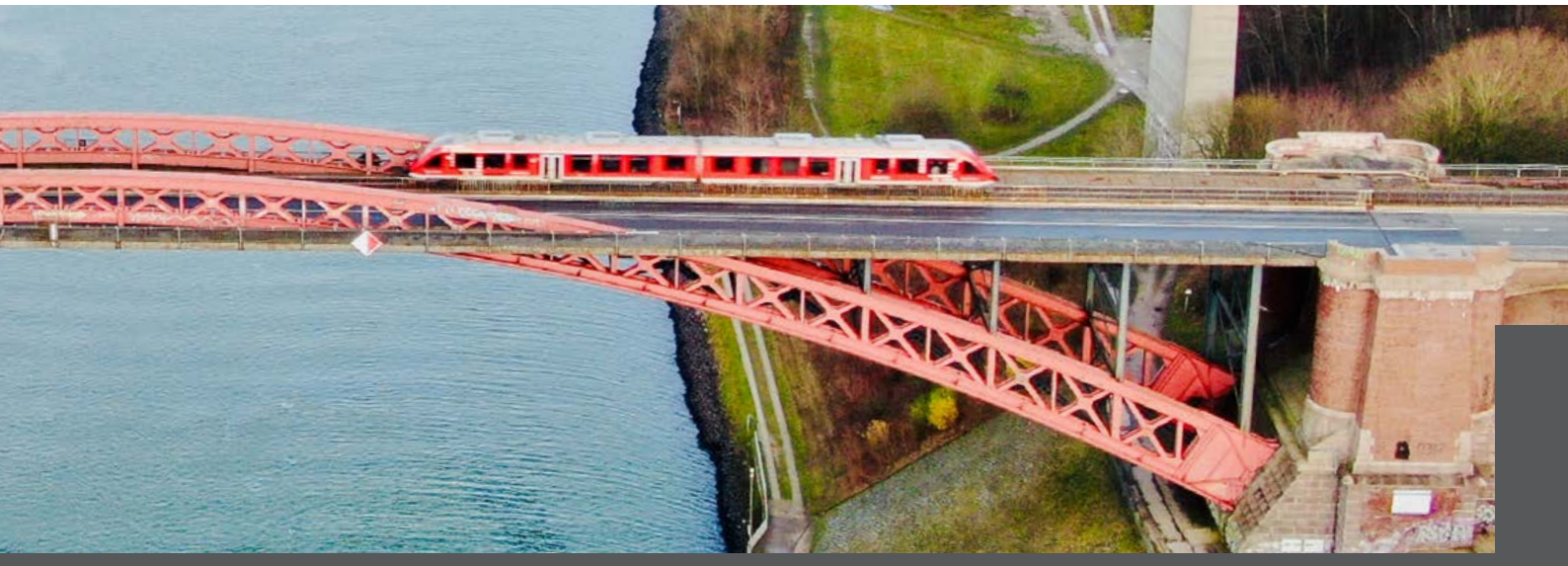


FIGURE 1
SPRINT project structure



REQUIREMENTS AND ALIGNMENT WITH SHIFT2RAIL IP4

One of SPRINT's goals is the definition of requirements for the IF architecture design and the alignment of the IF architecture with Shift2Rail IP4. Besides this, SPRINT accepted the challenge of understanding the needs and requirements of National Access Points (NAPs) and the IF architecture's compatability and complementarity with NAP architecture and data-exchange models.

SPRINT's ambition is to contribute to the realisation of a Single European Railway Area (SERA) and to the development of Shift2Rail IP4. To do this, SPRINT partners analysed related Shift2Rail IP4 projects results and ongoing developments, as well as EU initiatives and projects related to the IF concept, particularly connected to the public transport sector and semantic technologies. The following organisations and initiatives were taken in consideration: EIF, ERTICO, EU ITS Platform, NAP, STA, MaaSAlliance, ITxPT, MASAI, IDSA, STRIA, as well as the following projects: OASIS, MyCorridor, Data Market Austria.

In the first issue, the project partners published the analysis of relevant initiatives and projects, the high-level requirements and specific requirements to the IF architecture. At this stage, SPRINT is focused on the deep analysis of criteria for the IF architecture as a compliment to NAPs. The following goals were set up:

- Analyse the relationship of the IF architecture with the EU National Access Points;
- Define the requirements for the IF architecture to be aligned with and compatible to NAP architectures.

For this, SPRINT is going to be in contact with relevant NAPs and the projects/initiatives focused on this topic. If you are interested in contributing, please, send an email to the relevant Work Package leader Daria Kuzmina daria.kuzmina@uitp.org

During the second half of the project, SPRINT partners plan to update the requirements' list based on the outcomes of ongoing work and also to provide recommendations to Shift2Rail IP4 for future research opportunities.

SEMANTIC AUTOMATION FOR SERVICE INTEGRATION

SPRINT is working towards easing the development lifecycle of different aspects related to interoperability. Providing a data model as an ontology, mapping the messages used by the IT systems of a Transport Operator onto a common model, sharing all the relevant information allowing other parties to connect to the services offered by a Transport Operator, are all tasks than can benefit from automation enabled by semantics.

In recent years, different methods and systems have been proposed to support teams in the distributed and collaborative development of ontologies. Most of them provide basic web-based ontology editing functionalities, the possibility of exporting the generated ontologies into files that can be further edited offline, and additional features to facilitate collaboration in distributed teams. However, neither of them integrate features for the online publication of the ontology. More recently, systems have also appeared that are inspired by agile software and content development methodologies, using git-based repositories to maintain and control versions of the ontologies, and that allow managing the lifecycle of ontologies in such distributed contexts, including the publication of the different ontology releases.

In the context of SPRINT, one of the latest collaborative lightweight ontology engineering tools (Ontoology) is being adapted in order to automate even more the development lifecycle of ontologies. The SPRINT project is also extending this tool for the definition/revision of ontology-based annotations and mappings, something that has not been dealt with yet appropriately.

Furthermore, we are working at making sure that the development of ontologies will not start each time from scratch, given the existence of many resources that can be used to start and inform of such development. Several frameworks have been proposed to transform XML documents to OWL ontologies, and validation-based approaches (from DTD or XSD to ontology) typically provide rich results. Since XSD schemas were already part of the information lifecycle within the ST4RT project, the SPRINT project selected an already existing validation-based tool for XSD to ontology generation, and is improving it by developing mechanisms to then match and merge the resulting ontologies with the Shift2Rail reference ontology.

Currently, the semantic annotation of data models requires skilled software designers an excessive amount of time in error prone, tedious manual tasks (due to the lack of maturity of semantic interoperability tools) and a not-yet-optimised conversion process. SPRINT is investigating new techniques and mechanisms to increase the automation and the validation of the semantic annotations by lowering the entry-barrier for software and business designers.

PERFORMANCE AND SCALABILITY OF THE IF

After collecting the requirements, the third Work Package of SPRINT is focused on revising and consolidating the architecture of the Shift2Rail IF to make it suitable for deployment in real-life scenarios. This overarching goal is broken down into three sub-goals, which can be summarised as follows:

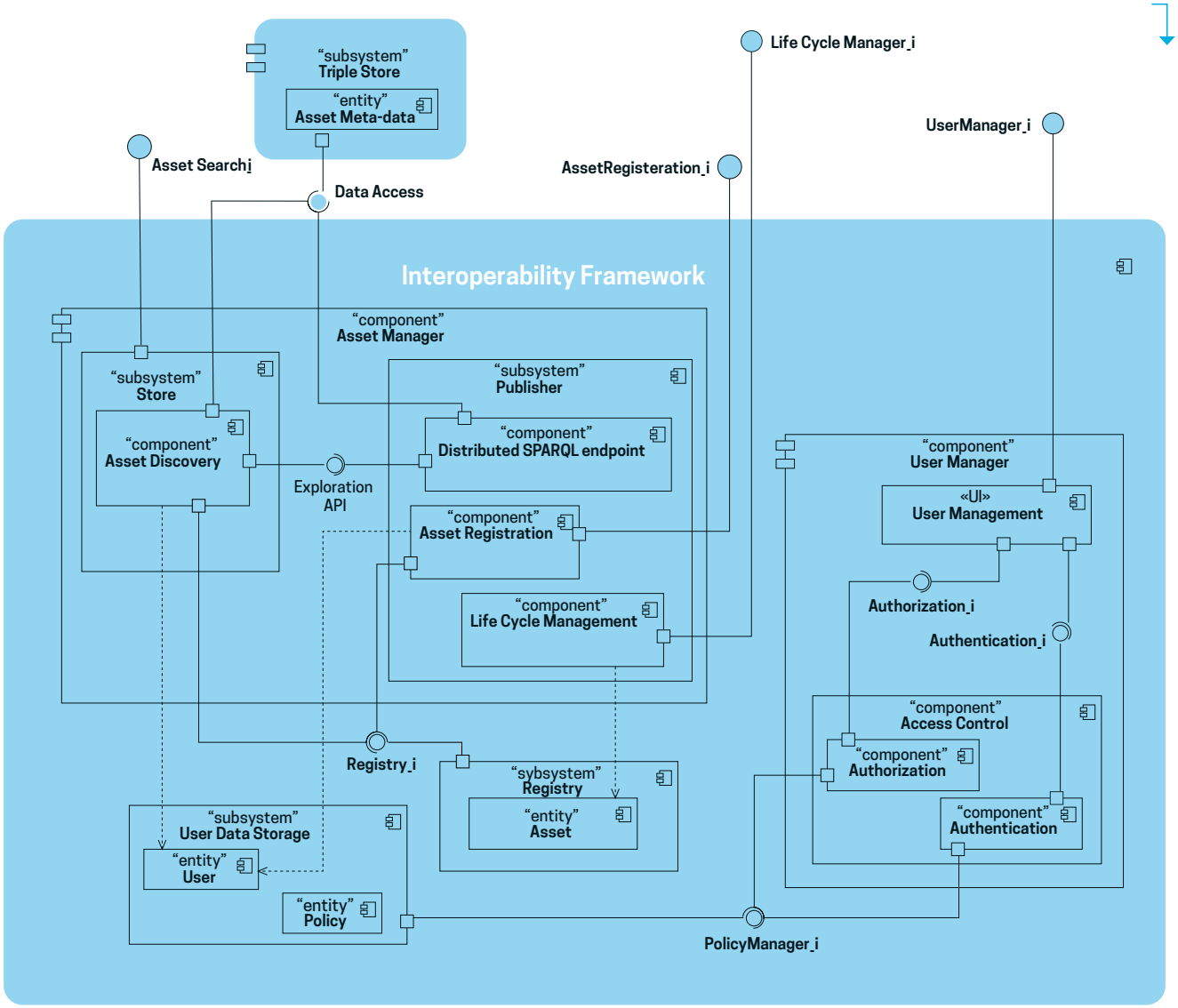
- The technical requirements of the IF need to be identified, in particular those concerning the performance and scalability features of the framework, which need to be fulfilled to ensure that the IF can handle the complexity of the European transportation domain.
- A reference architecture, which identifies the main elements of the IF and their relationships, must be defined.
- The means to verify that an implementation of the defined architecture actually meets the stated requirements must be defined; in particular, the infrastructure to test the IF against its performance and scalability requirements, together with the relevant test cases.

In the first year of the project, the first versions (C-REL) of the artifacts mentioned above were produced. In particular, an initial set of performance and scalability requirements was produced, together with a first consolidated version of the IF architecture and an initial testing infrastructure for the architecture.

Figure 2 shows the current version of the IF architecture described through a UML Component Diagram. It shows that at the core of the IF is the Asset Manager, which itself has a number of components dealing with various issues, such as asset registration and asset discovery. Additionally, the IF relies on asset meta-data (created at the moment of asset registration) for various tasks, including the asset discovery. The asset meta-data is then stored in a triple store, which is another core element of the IF.

For the upcoming developments, WP3 will focus on consolidating the final version of the requirements, the architecture, and the testing infrastructure, based also on the experience gathered with the first (C-REL) demonstrator, which will be based on the outcomes of the first half of the project.

FIGURE 2
Component Diagram of the IF



PROOF-OF-CONCEPTS IMPLEMENTATION AND VALIDATION

The main objectives of this part of the SPRINT project are to implement the proof-of-concepts designed in WP3 (Performance and Scalability of the IF) and WP4 (Semantic Automation for Service Integration), to set up the technical environment defined in WP3, to test its performance and scalability and to validate the technological solutions identified in the project. To achieve these objectives, it is necessary to define the scenarios and use cases for the proof-of-concept, in terms of functionalities, stakeholder analysis, components, services, execution workflows and framework conditions.

Specifically, in-depth analysis of the use cases and demo scenarios was performed. In particular, they comprise Asset Manager, Converter components and Resolver components. The technical environment for proper testing of suggested concepts has been set up and configured as defined by WP3. The Asset Manager is already installed in this environment. Other applications, e.g. mapping tools, will be deployed in the next phase of the project. Evaluation of the capabilities of the implemented solutions will follow as the next step.

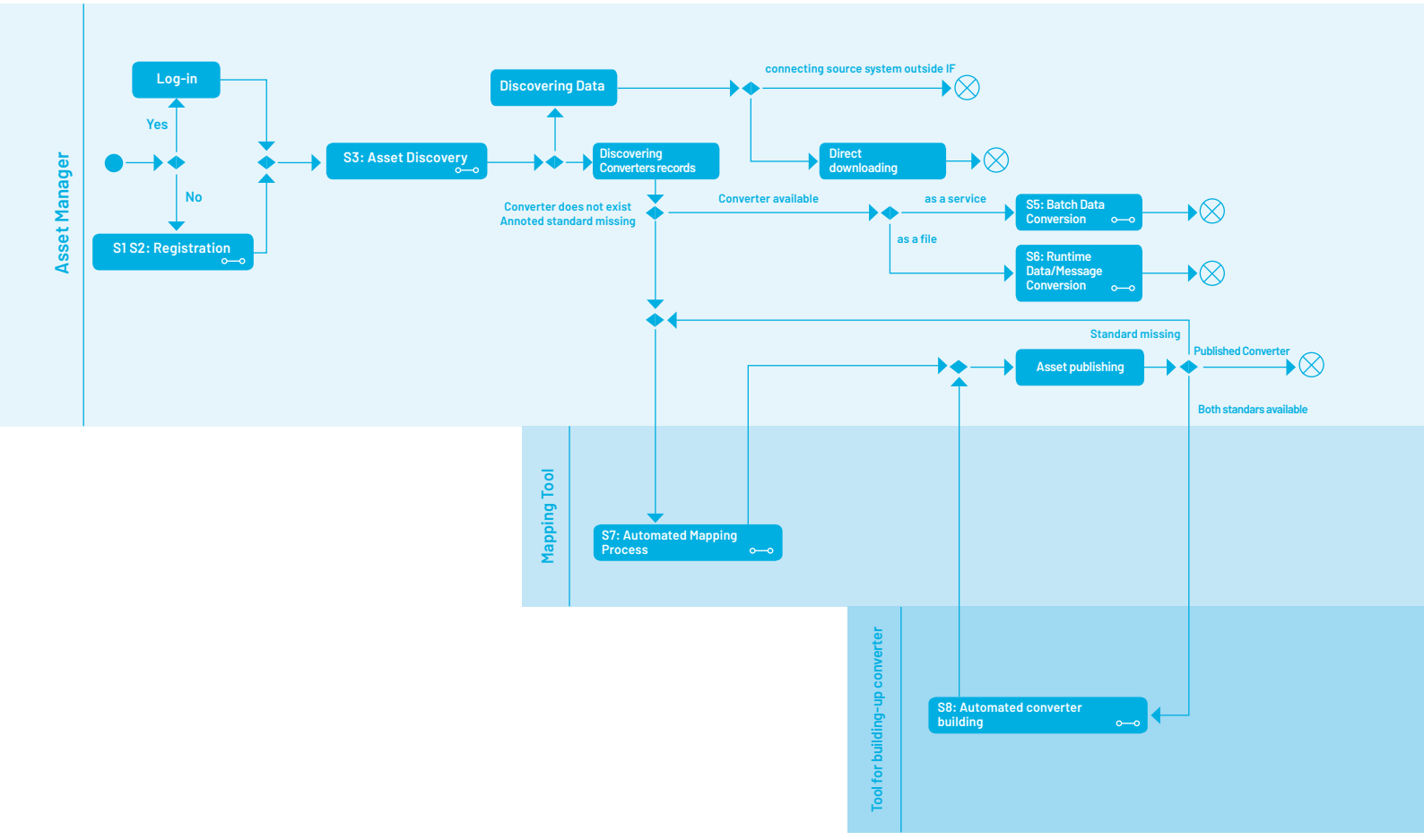
The entire asset management process is depicted in the diagram below.

The asset management process is divided into several steps. The first step is to register with the Asset Manager. The Asset Manager registration process needs to be flexible enough to be easily reconfigurable in a production environment with various user registration policies. The registration can be done in two ways. Either the user registers through the Asset Manager Web interface and both the user and the Asset Manager administrator are notified about the registration progress by email messages, or the user registers through the Web interface provided by the Asset Manager, but the configured user roles are modified by adding the "service consumer" role and granting other rights than the "service publisher". A user with the "service consumer" role cannot access the Asset Manager Publisher Web interface nor its Web API.

The next step is to search for the convenient source/asset. The procedure depends on the asset type. If it is necessary to discover data, there are two possible flows: either connecting the source system outside the IF or its direct downloading. When it comes to the converter, if there is no annotated standard, the process continues with the automatic mapping that ends with an annotated standard published in the Asset Manager. If both annotated standards are available, the process continues with the automatic building of the converter and its republishing. If the second standard is missing, it is automatically annotated, republished and the converter is built. If the published asset is a converter, this part of the process is complete.

Once a converter of a required standards is available, the converter is either called as a service outside the IF or downloaded as a file. In this case, the converter can be used outside the IF at the user's discretion.

FIGURE 3
Asset management process



SPRINT INTERACTION WITH SHIFT2RAIL

As explained in this newsletter, SPRINT is building upon the work already initiated in previous projects, by working on enhancing the IF, which has first been released by the IT2Rail project (2015-2018), by enabling the technical interoperability of all multimodal services by relieving consumer applications from the task of locating, harmonising and understanding multiple and independent sources of data, events, and service resources, which are consequently made available "as a service".

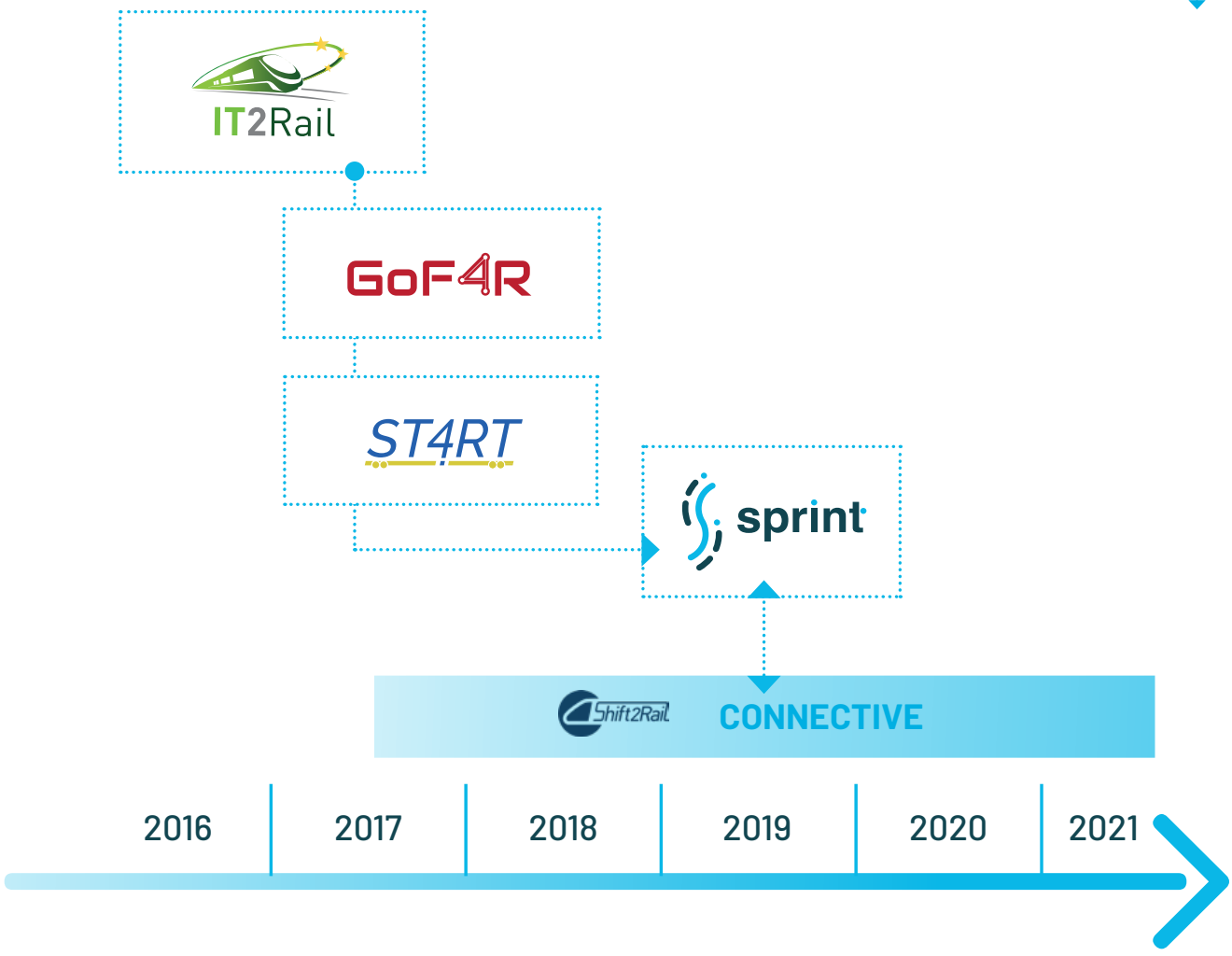
IT2Rail has laid the foundations for the achievement of the objectives of TD4.1 - Interoperability Framework - described in the Shift2Rail Joint Undertaking Multi-Annual Action Plan (MAAP). The improvement and enhancement of IT2Rail's results has been and is under development in the IP4 TD4.1 projects (GoF4R, ST4RT, SPRINT and CONNECTIVE).

SPRINT will therefore make steps towards the uptake of the IP4 multimodal transport ecosystem by addressing the following specific challenges arising from TD4.1's objectives and explicitly addressed in the work programme topic **S2R-OC-IP4-01-2018 Semantic framework for multimodal transport services:**

- Improve IF performance and scalability to sustain a large deployment.
- Simplify/automate all the necessary steps needed to integrate new services and sub-systems in the IP4 ecosystem.

In the figure below you can see the evolution of the IF through the various Shift2Rail IP4 projects that have been funded.

FIGURE 4
Projects linked to the IF and interactions with SPRINT



FACTS AND FIGURES

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1 999 500
100%
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8 Partners

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2018

Project End Date
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2020

Duration
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