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Pilot Action developed/improved OJP in the pilot area Carinthia-FVG-Northern Slovenia

D.2.3.1 – Report

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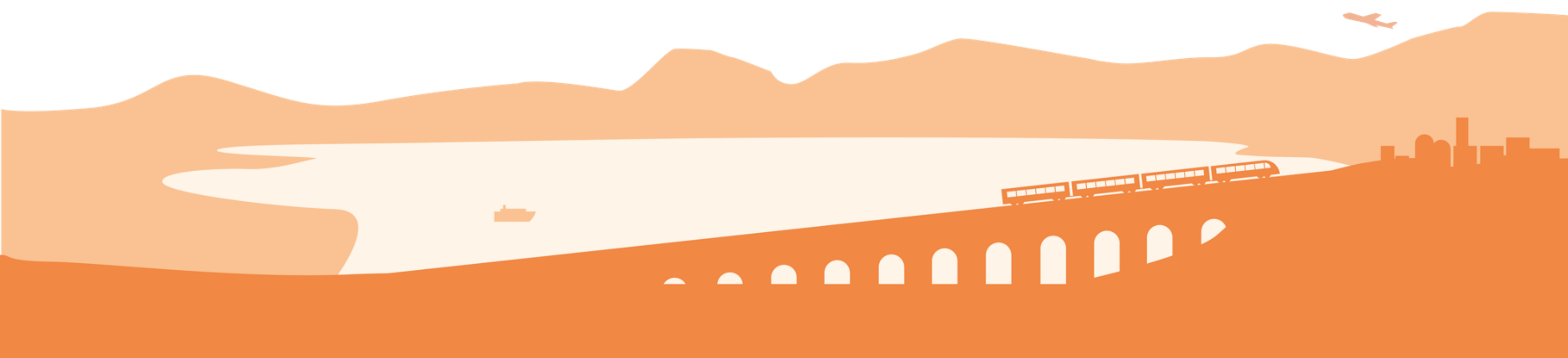


PILOT ACTION DEVELOPED/IMPROVED OJP IN THE PILOT AREA CARINTHIA-FVG-NORTHERN SLOVENIA

Technical Solution and Implementation Report

Content

A. Executive Summary

This report presents the technical solution and implementation of the pilot action developed within the TRANS-BORDERS+ project for the pilot area Carinthia–FVG–Northern Slovenia.

The pilot focuses on improving cross-border journey planning by strengthening the technical interaction and interoperability between journey planning systems in the involved regions, in particular through the interaction between the Slovenian multimodal journey planner SiMO and external journey planning environments supporting routing across system boundaries.

The pilot is presented as an operational use and validation of a distributed journey-planning environment, rather than as the deployment of a new routing engine. It builds on the OJP-based infrastructure developed in previous projects, in particular the LinkingAlps environment, and assesses its capability to support cross-border passenger information in the TRANS-BORDERS+ pilot context.

The report therefore focuses on technical interoperability, the traceability of routing evidence, the quality and availability of the underlying data, and the practical conditions required for sustainable cross-border operation. Static public transport information in the Slovenian ecosystem is based on NeTEx, while dynamic public transport information is supported through SIRI where available, and cross-system routing is handled through OJP interfaces based on underlying static and dynamic data sources.

The report describes the baseline technical environment, the existing system landscape and the target technical setup supporting distributed routing between the involved systems and summarises the technical integration aspects addressed within the pilot together with relevant constraints and dependencies related to data availability and interoperability.

The main contribution of the pilot is the structured validation and documentation of distributed journey planning between interoperating systems, including clearer definition of active and passive system roles, validation through reproducible routing queries, and identification of the technical and data-related conditions required for reliable operation across system boundaries.

B. Introduction

Objective of the Pilot Action

Cross-border public transport between Slovenia and Austria is characterised by the interaction of multiple transport systems, operators and data environments, which are typically managed at national or regional level. As a result, passengers travelling across the border may face challenges related to fragmented journey planning, limited visibility of available cross-border connections and the need to consult multiple journey planning tools in order to obtain a complete travel itinerary. Additional challenges arise from differences in data availability, varying levels of real-time information and the need to ensure consistent interpretation of stops, transfer points and timetables across system boundaries. These factors can affect the completeness, reliability and usability of journey planning results for cross-border travel.

In this context, the objective of the pilot action is to verify, in an operationally credible manner, whether cross-border passenger information can be delivered through distributed journey planning between existing systems without centralising all underlying source data. In practical terms, the pilot examines whether a journey request initiated in SiMO can be processed across system boundaries by requesting routing results from the competent external responder and returning a coherent itinerary to the user.

The emphasis of the pilot is therefore not on the creation of a new journey-planning core, but on technical interoperability, evidence-based validation of routing results and the robustness of data exchange across organisational and territorial boundaries. Within TRANS-BORDERS+, this is addressed by strengthening the technical interoperability between journey planning systems in the involved regions, in particular through the interaction between the Slovenian multimodal journey planner SiMO and external journey planning environments supporting routing across system boundaries in the pilot area Carinthia–FVG–Northern Slovenia.

From a user perspective, the main added value of the pilot lies in reducing fragmentation in journey planning by enabling a single interface to present results composed from multiple systems.

Scope of the Report

The report describes the technical solution and implementation of the pilot action in the Carinthia–FVG–Northern Slovenia area, focusing on system interaction, data exchange and technical setup supporting cross-border journey planning.

The scope of the report is limited to the technical and operational aspects of distributed journey planning relevant for the pilot, including the existing system landscape, the OJP-based interaction model, the data preconditions and the validation approach. It focuses on what is technically implemented, what is operationally validated, and what remains dependent on data availability and system interaction across participating regions.

Where the pilot area includes multiple territories, the report distinguishes between the territorial scope of the pilot and the operationally evidenced routing scope. Operational functionality is described only where it can be supported by system interaction or routing results.

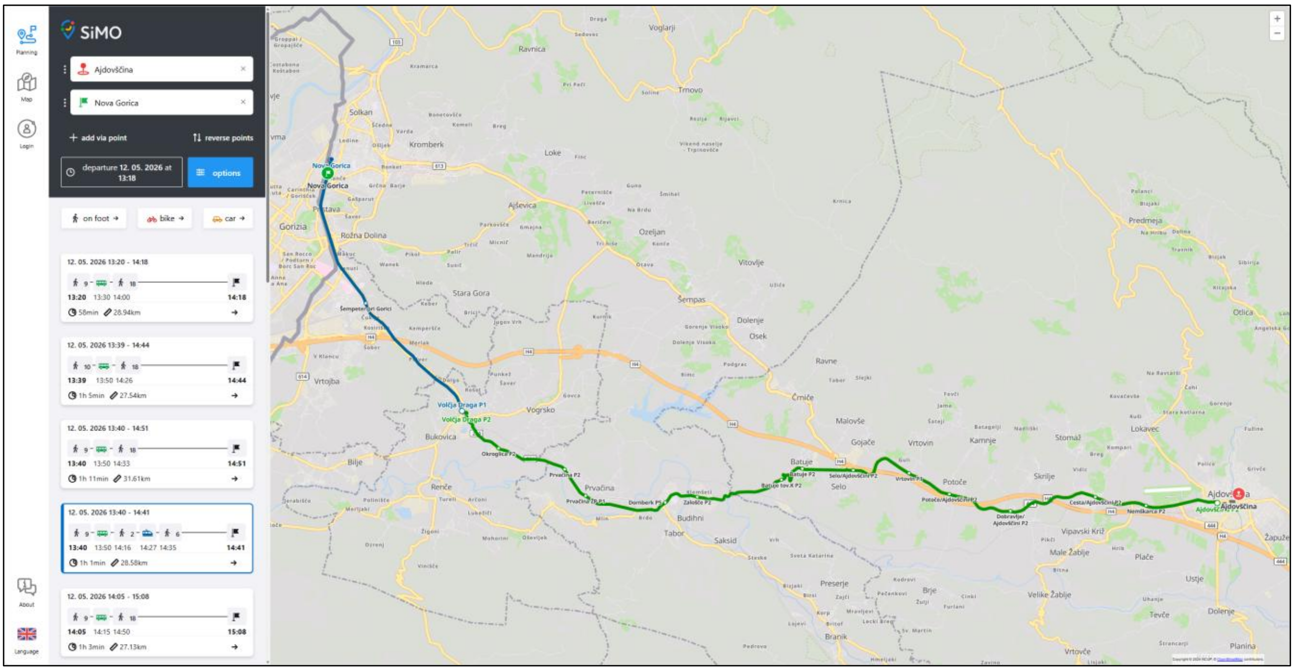
The end result of this approach is the ability to provide cross-border journey results to the user through a single journey-planning interface, based on the aggregation of routing results from multiple systems.

C. Baseline Technical Environment

Existing Journey Planning Systems in the Pilot Area

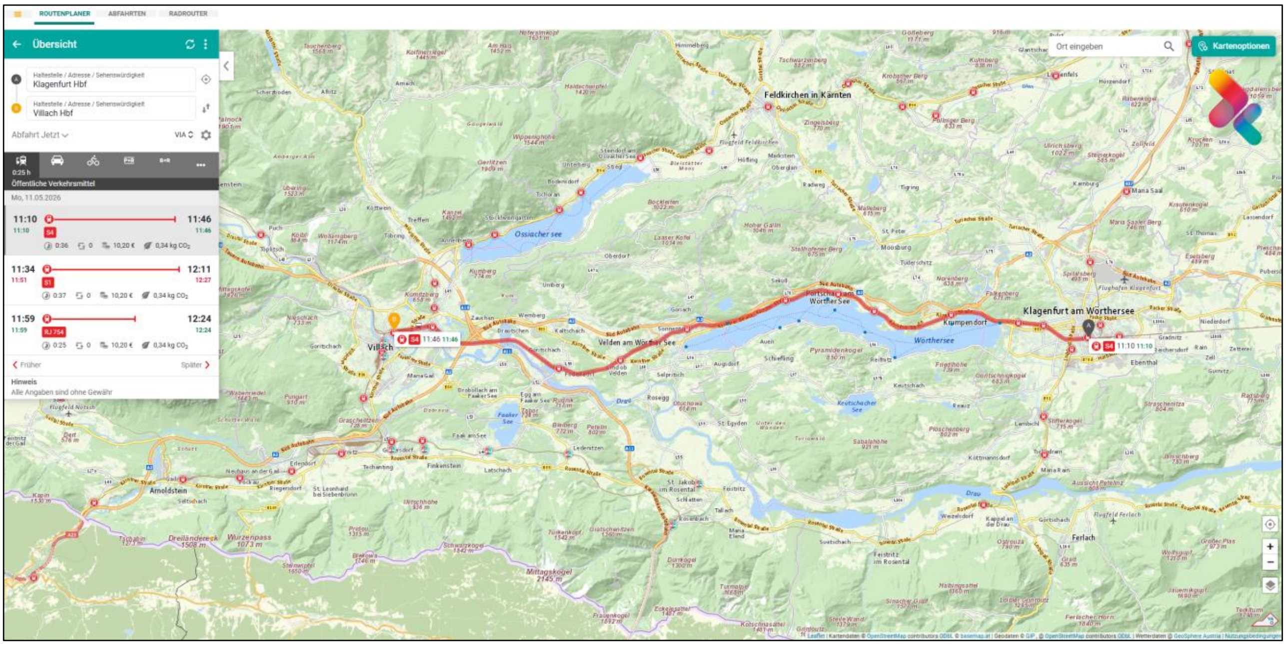
In Slovenia, multimodal journey planning services are provided through the national journey planner SiMO, which supports route planning across different modes of transport and integrates transport information from multiple providers across the national public transport network. SiMO operates within the broader MZI (NCUP) multimodal information environment and is connected to the Slovenian National Access Point data ecosystem, providing the national technical basis for interaction with other journey-planning systems through standardised interfaces.

Figure 1: SiMO multimodal journey planning application used within the Slovenian Ministry of Infrastructure (MZI/NCUP) environment



In Austria, multimodal journey planning services are provided through the national journey planner VAO – Verkehrsauskunft Österreich. Like SiMO in Slovenia, VAO also supports route planning across different modes of transport, including real-time information for scheduled public transport services. For Carinthia, VKG in its role as regional transport association, is responsible for collecting static and dynamic mobility data from different service providers and supplying it to VAO.

Figure 2: VAO – Verkehrsauskunft Österreich, national routing system in Austria



Within the context of cross-border journey planning, the interaction between SiMO and external systems in neighbouring regions, such as VAO, represents a key technical element. The baseline situation is characterised by the existence of mature national or regional journey-planning environments, combined with the need to ensure that cross-border routing requests can be exchanged, interpreted and combined in a consistent manner. The quality of the final passenger-facing result therefore depends not only on the technical interface, but also on the completeness, freshness and harmonisation of the data maintained by each participating system.

The baseline environment therefore already includes relevant technical components for cross-border journey planning. However, their practical value for passengers depends on whether routing results can be exchanged, interpreted and presented consistently across system boundaries. This is the specific gap addressed by the pilot: not the creation of a new planning system, but the operational use and validation of existing distributed journey-planning capabilities.

Cross-Border Journey Planning Setup

An OJP-based cross-border journey planning infrastructure has been developed and implemented within the Alpine Space project "LinkingAlps". Within this infrastructure, the Slovenian SiMO system acts as an active system (active node), while the Austrian VAO is connected as a passive system (passive node).

Within the TRANS-BORDERS+ project, this existing OJP infrastructure is used as the basis for demonstration activities. This approach allows TB+ to build on an already established technical basis and to focus on operational validation, data quality and the usability of cross-border routing results.

To ensure synergies between different projects and support the testing phase of the OJP-based journey planning solution, it has been decided to use the OJP-infrastructure of LinkingAlps for the demonstrations of TB+. The focus of activities in TB+ was on continuously improving data quality and availability as key inputs for the OJP system, described in D.2.2.1 Report on improvements in data quality in the involved regions.

Within this architecture, the active system receives the end-user request, identifies the relevant adjacent or remote systems, distributes journey-part requests to the competent responders and composes the returned partial results into one seamless route. The active system can therefore be understood as the OJP Router, while the passive system provides local routing results as an OJP Responder. In the pilot context, SiMO fulfils the role of the active system for the Slovenian environment, while VAO provides the Austrian responder environment for cross-border interaction. This separation of roles is important because each system remains responsible for the accuracy and completeness of data within its own domain, while the active system provides the combined passenger-facing result.

Data Availability and Technical Preconditions

Transport data availability is a core precondition for cross-border journey planning. In the pilot area, relevant data include static public transport data, stop and station information, timetable information, transfer points, and where available dynamic or real-time information.

Within the Slovenian NCUP environment, multimodal services are based on the Transmodel family of standards. NeTEx is used as the basis for static public transport exchange, while SIRI is used for dynamic public transport information where available. These data standards are relevant because OJP-based routing can only deliver reliable cross-border results if the underlying national and regional data are sufficiently complete, structured and interoperable.

The Slovenian multimodal journey planner SiMO uses data made available through the national data ecosystem and supports route planning across different modes, including public transport and access/egress modes such as walking, cycling and park-and-ride where available. This is relevant for cross-border journey planning because passenger journeys rarely start and end exactly at border stations; they often require access, transfer and continuation legs.

On the Austrian side, VAO provides an intermodal journey-planning environment and receives relevant static and dynamic mobility data from regional and national data providers. For Carinthia, VKG supplies static and dynamic mobility data from mobility service providers to VAO.

The pilot therefore depends not only on the availability of data, but also on their consistent interpretation across systems. This includes the harmonised identification of stops, locations and exchange points, the consistent representation of timetable and transfer information across system boundaries, the availability of routing services in the participating systems, and stable OJP-based request-response interaction between active and passive systems.

Differences in data completeness, update frequency, semantic alignment and real-time coverage directly affect the quality, consistency and reliability of cross-border journey results.

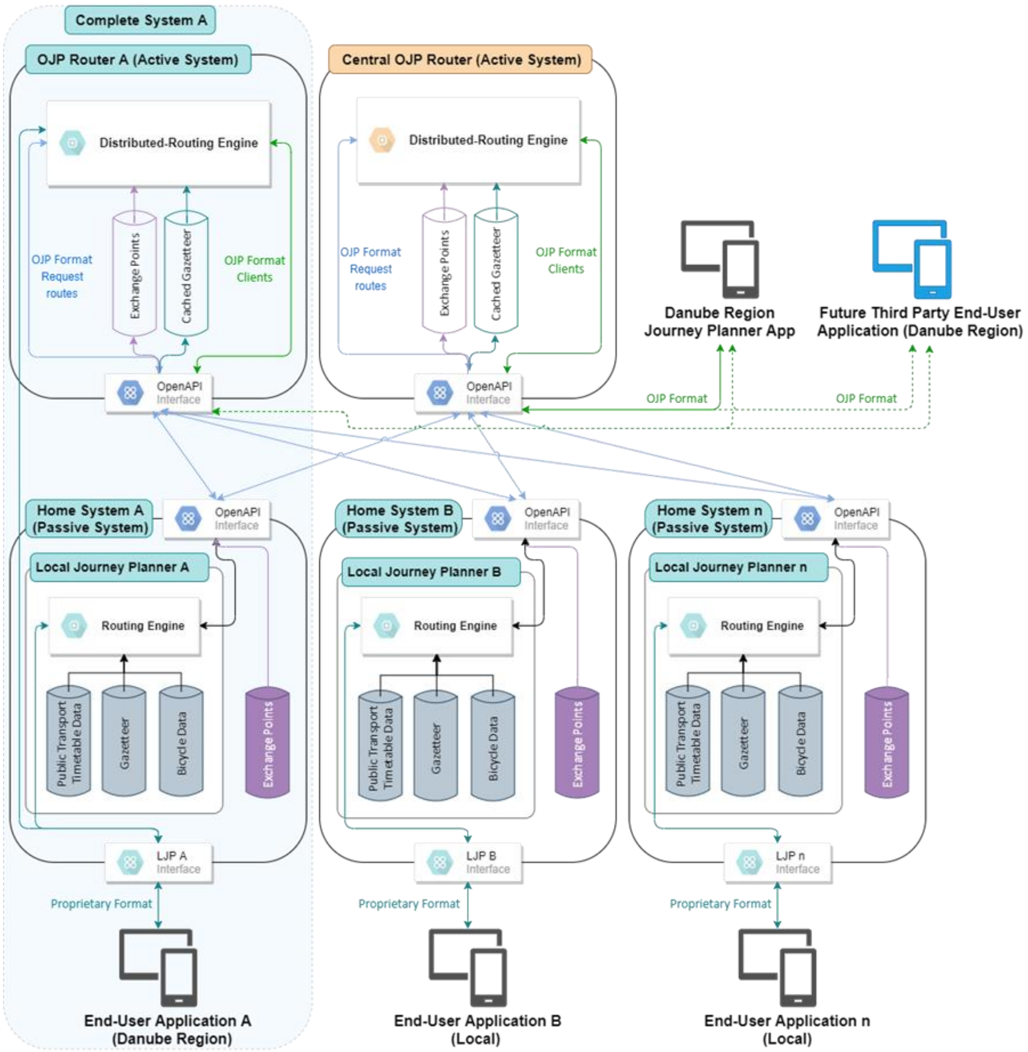
D. Target Technical Setup and Data Architecture

Overall System Architecture

The pilot builds on the interaction between existing journey planning systems in the participating regions. In the pilot area Carinthia–FVG–Northern Slovenia, the technical setup focuses on the interaction between the Slovenian multimodal journey planner SiMO and external journey planning environments supporting cross-border routing. The architecture follows the concept of distributed journey planning, where routing requests and responses can be exchanged between systems in different regions, while each system remains responsible for its own data and routing logic, enabling cross-border results without centralising underlying data sources.

The target setup builds on a distributed OJP-based architecture, where journey planning systems interact through standardised interfaces. The figure below illustrates the general system context and interaction logic relevant for the pilot.

Figure 3: OJP-based distributed journey planning architecture showing interaction between active and passive systems



Source: OJP-based system architecture (OJP4Danube / LinkingAlps)

Roles of the Involved Systems

Within the pilot setup, the participating journey planning systems retain their respective technical roles while enabling cross-border interaction. In the Slovenian context, SiMO acts as the national multimodal journey planner providing routing services for the Slovenian network, while external systems in neighbouring regions, such as the Austrian journey planning environment VAO, enable the processing of routing requests that extend across regional and national system boundaries. In this context, SiMO performs the role of the active system receiving and orchestrating routing queries, while external systems act as passive responders providing routing results for their respective domains, which are then combined into a single passenger-facing itinerary.

System and Data Interface Interaction

Cross-border journey planning requires the exchange of routing requests and responses between the involved systems, supported through technical interfaces that enable distributed routing across system boundaries. In the pilot area Carinthia–FVG–Northern Slovenia, this interaction focuses on the exchange of routing information between SiMO and external journey planning environments in neighbouring regions, where routing results are requested, returned and aggregated in a structured request-response process that ensures consistency of timing, locations and transfer points across the composed journey.

E. Technical Integration and Implementation

Routing Request Processing

Routing requests within the pilot environment are processed by the participating journey planning systems according to their respective system logic and data availability. In the case of the Northern Slovenia pilot area, routing requests can involve interactions between the Slovenian journey planner SiMO and external journey planning environments in neighbouring regions, allowing cross-border travel options to be considered during route calculation.

Where external coverage is required, the active system evaluates the request, distributes routing requests to the relevant systems and aggregates the returned journey parts into a coherent passenger-facing result.

Cross-Border Data Exchange and Interoperability

Cross-border journey planning requires the exchange of routing requests and responses between systems operating in different regions. Within the pilot action, this interaction focuses on enabling interoperable system communication supporting distributed journey planning across regional and national system boundaries, with interoperability relying not only on technical connectivity but also on consistent interpretation of data such as stops, identifiers and transfer points across systems.

Improvements Introduced During the Pilot

The pilot action explores improvements in the technical interaction between journey planning systems involved in cross-border routing. Compared to the baseline situation, the pilot aims to improve the ability of the systems to exchange routing information and support cross-border journey planning for passengers travelling between the involved regions, with the main contribution being improved operational use, validation and traceability of distributed routing rather than the development of new routing functionality.

F. Technical Constraints and Dependencies

The pilot remains dependent on the quality, availability and scope of the participating source systems. Differences in data completeness, update frequency and real-time coverage can directly affect the quality and reliability of returned journey results. Some journey parts may therefore rely primarily on scheduled data, while others may include dynamic information where available.

A further dependency concerns the consistent identification and interpretation of stops, locations, exchange points and transfer information across systems. If these elements are not sufficiently harmonised, the resulting journey may be incomplete, inconsistent or difficult to reproduce. Stable system interfaces and continued cooperation between the participating organisations are therefore essential for reliable cross-border operation.

G. Conclusion

The pilot confirms that distributed journey planning based on existing systems and standardised OJP interfaces is a technically credible approach for supporting cross-border passenger information in the pilot area. The key result is not the creation of a new centralised routing system, but the operational use and validation of existing journey planning systems connected through standardised interfaces.

The quality of the final passenger-facing result depends on data availability, semantic consistency of stops and exchange points, stable active/passive system interaction, and the ability to document routing results in a reproducible way. These factors determine whether the technical capability can be translated into reliable and understandable information for passengers and commuters.

From a project perspective, the main added value lies in strengthening the practical use, validation and documentation of the existing OJP-based environment. Future work should therefore focus on maintaining data quality, ensuring stable interfaces, improving harmonisation of stops and exchange points, and preserving operational cooperation between the participating systems beyond the project context, in order to ensure sustained and reproducible operation of distributed journey planning services.