

A distributed and scalable architecture for enabling greener multimodal door- to-door travel within the EU

Markus Brachner and Dag Kjenstad, SINTEF Digital

Motivation

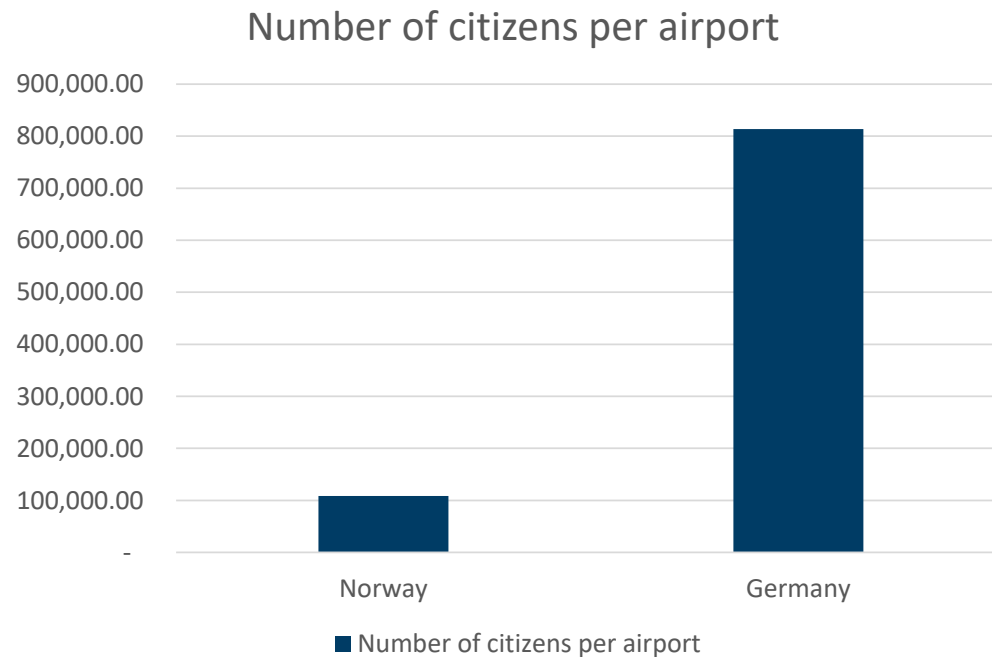
Multimodal solutions that combine air and rail are highly attractive in terms of optimising sustainability and improving connectivity, particularly in dense metropolitan areas where HSR infrastructure is already in place. In this sense, both are complementary ways towards meeting emission reduction goals, making the optimal solution more “plane and train” rather than “plane vs train”.

(Eurocontrol Think paper #11 – 3 June 2021)



How many citizens per airport?

Norway vs. Germany



If you are in a German town with 40.000 inhabitants, you hope to have a train station nearby.

If you are in a Norwegian town of 20.000, you most probably have an airport nearby.

Europe – A smorgasbord of art, history, and culture

[The difference between Austrians and Germans] "...is like the difference between a battleship and a waltz."



Source: Wikipedia

Academy Award-winner Christoph Waltz explains to the US the difference between Germans and Austrians on Conan O'Brien's Late Night Show. <https://youtu.be/F5T2-u5WJH8>

Who plays the music?



Rockstar

VS



Orchestra

From dissonance ...

*Despite the fact that technology and knowledge are mature enough for broader applications, the commission believes that the development has not been as desired, and that **established systems** and services are often **fragmented and without coordination and interoperability**.*

ITS Directive (2010/40/EU)



.... to harmony

Tomorrow's transport network will consist of both small and large actors. Together they will offer their service by means of **smart interoperable digital solutions**. This **decentralized** but still **integrated, continuous, seamless** and **multi-modal** network will allow customers to find and book travels that are **personally adapted** to their own needs and preferences.

This is supported by

- The EU ITS Action Plan 2009-2014
- The EU ITS Directive (2010/40/EU)
- The ITS-strategy of the Norwegian Transport Ministry
- The National Transport Plan of Norway (NTP) 2018-2029



We stand for a European approach to intermodal digital services: A "No Rockstar" architecture

- Distributed travel planning by means of an *"orchestrator service"* and *"soloist services"*.
- Each soloist can be a specialised travel planner who handles one or more modalities in a possibly confined geographical area.
- The orchestrator utilizes optimization and machine learning algorithms to determine which soloists can be included in the planning of a given travel.





Bon
voy
age

From Bilbao to Oslo, intermodal mobility solutions and interfaces for people and goods, supported by an innovative communication network.

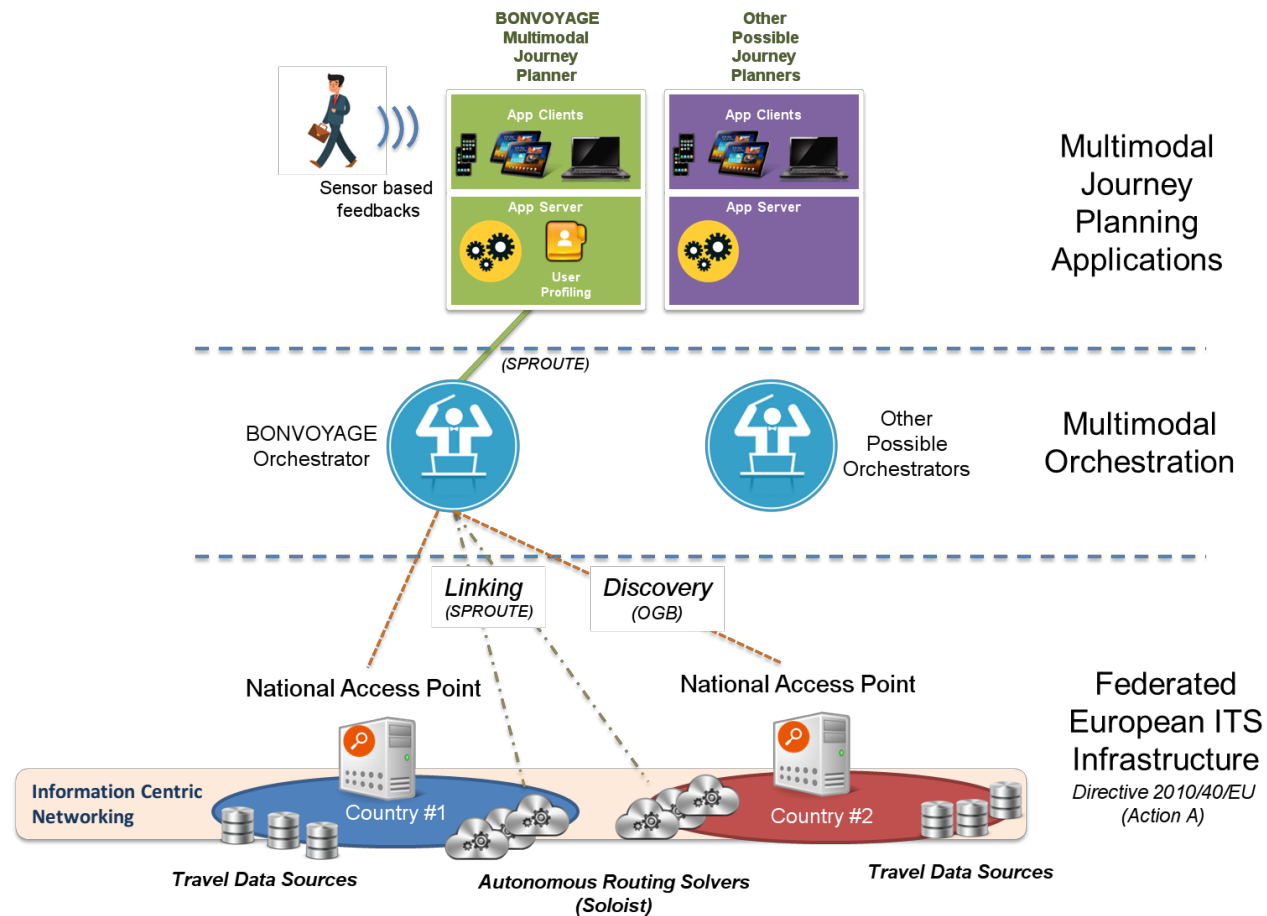
EU-project - HORIZON2020, 2015-2018

Call: Mobility for Growth

Topic: MG.7.2-2014. Towards seamless mobility addressing fragmentation in ITS deployment in Europe

Project participants from Italy, France, Spain, Austria and Norway

The BONVOYAGE vision



Soloist covering selected modes and areas

Coverage:

Oslo county

Population: 673 000

Akershus county

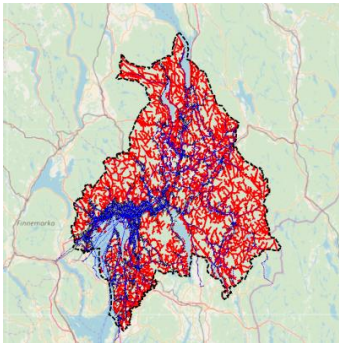
Population: 614 000

Modalities:

Car, Walk

Public transport

Bus, Tram, Subway, Ferry, Airport Express train



Coverage:

Flights serving selected airports in Europe

Oslo

Bergen

Lyon

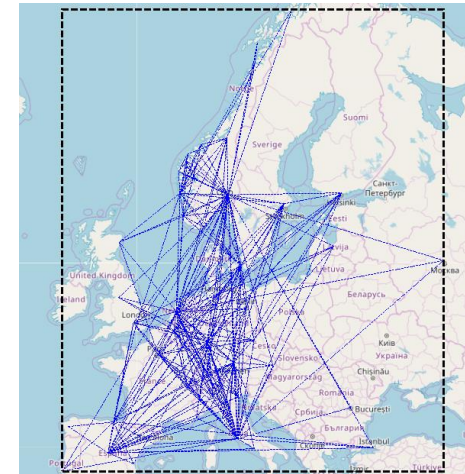
Bilbao

Rome

and connecting airports

Modalities:

Airplane



Coverage:

Bilbao city and airport

Population: 350 000

Modalities:

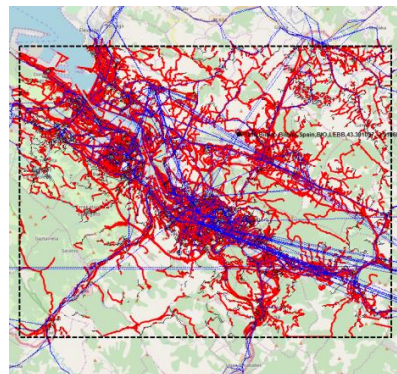
Car, Walk

Public

Bus: Bilbobus, Bizkaibus

Train: Euskotren

Subway: Metro Bilbao



Unfinished Symphony

- Real-time planning of door-to-door transport
- Real-time support in carrying out the journey
- New modalities – from Hyperloop to autonomous vehicles and airtaxis
- (Belly-)Freight



Franz Schubert, composer of the "Unfinished Symphony" (Source: Wikipedia)

Ode to Joy!

- Aviation as the backbone of a European multimodal system will have positive knock-on effects on other modalities, if well integrated.
- Strengths and weaknesses of modalities need to be better reflected in the digital services. A distributed and federated architecture may better support this.
- A concerted effort of industry and the scientific community is needed.
- Multimodal travel within Europe needs to take into account a heterogeneous environment of culture, infrastructure, geography and topology.



Ludwig van Beethoven (Source: Wikipedia)

For further reading

- BONVOYAGE project page
 - <http://bonvoyage2020.eu/>
- Publication in Sustainability (journal)
 - <https://www.mdpi.com/2071-1050/11/7/1888>





Technology for a better society