



IT2Rail



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No: 636078



Welcome and Introduction

Stefanos Gogos
UNIFE

IT2Rail Mid-Term Conference 17/11/2016



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Coordinator



Mainline Operators



Urban Operators



ICT specialists



Universities and Research Centres



SMEs & other



Associations



Consultants



Project Structure

WP9 Project Management

WP8 Dissemination

WP7 Technical Coordination & Pilot

WP1
Interoperability
Framework

WP2
Travel
Shopping

WP3
Booking
& Ticketing

WP4
Trip
Tracker

WP5
Travel
Companion

WP6
Business
Analytics



Current status

IT2Rail project just passed its halfway point.

- 3 major releases:
 - Core release (CREL): delivered end of September 2016
 - Additional release (AREL): planned March 2017
 - Final release (FREL): planned September 2017
- Iterative specifications
 - 6 iterations are planned
 - v3 currently developed



Structure of the Workshop

- ✓ **Morning session (11:15 - 13:00):**
 - WHAT is IT2Rail doing: Concept & Challenges
 - IT2Rail developments explained through an instance of travel experience
- ✓ **Afternoon session (14:00 – 16:45):**
 - How IT2Rail addresses the challenges described in the morning
 - The User-centric experience
 - Ticketing in IT2Rail: the disruptive concepts
 - Interoperability challenge
 - Collaboration Challenge and System Modeling



Project concept & technologies

Riccardo Santoro
Trenitalia

IT2Rail Mid-Term Conference 17/11/2016



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Project Concept

Jane is provided with a personalized, customizable and secure digital "Travel Companion" (TC) environment



Jane plans her trip to attend her fashion show



Jane builds her multimodal travel solutions, manages her booking and shopping through her preferred one-stop shop



Jane uses TC's wallet to validate entitlements



Assistance to navigate at interchanges, taking into account **Jane's** mobility constraints (luggage, reduced mobility)

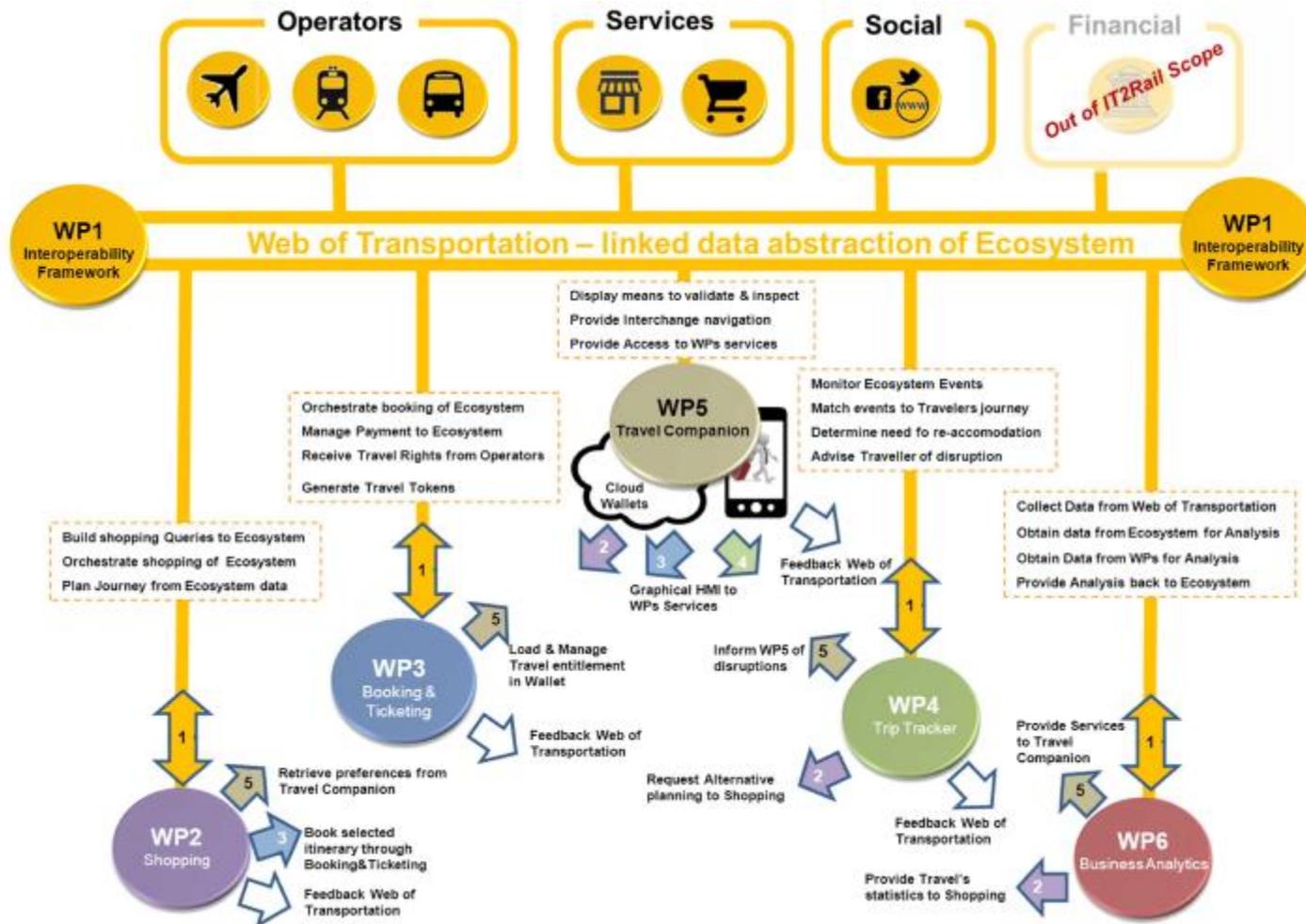


Jane receives notification of significant event affecting her itinerary. She is offered some options for re-routing and re-accommodation

Business Analytics provide relevant feedback of traveler data to operators and service providers, to ensure more robust and responsive operations



Project Technologies



IT2Rail developments explained through an instance of travel experience

Riccardo Santoro
Trenitalia

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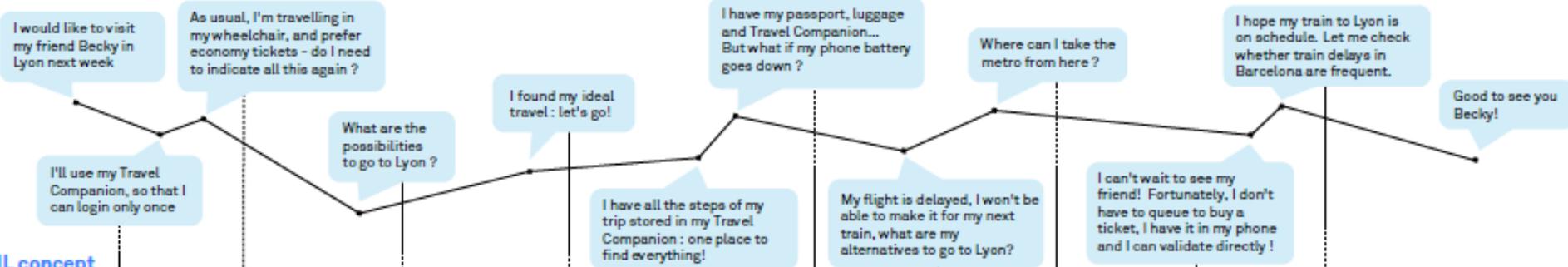


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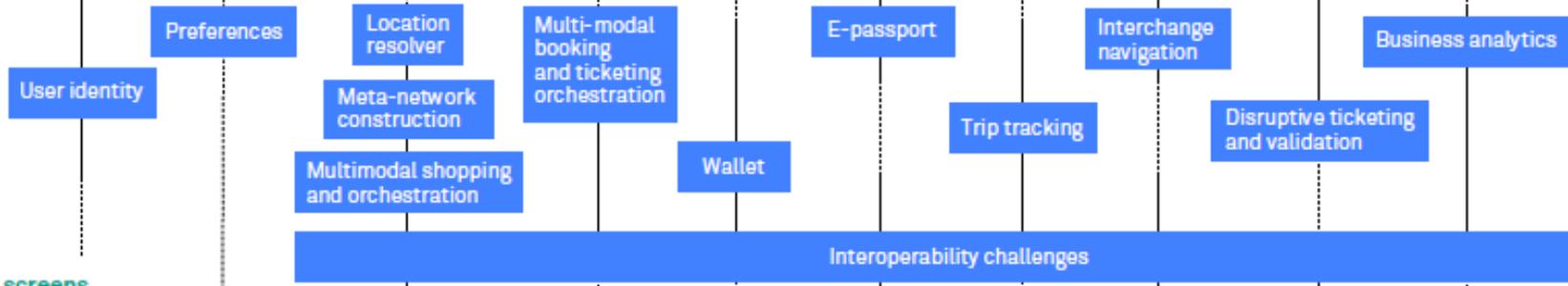
Jane's travel (Prague - Berlin - Barcelone - Lyon)



Traveller experience



IT2RAIL concept



Associated screens



User ID & Preferences

Nora Winninger
SNCF

IT2Rail Mid-Term Conference 17/11/2016



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Identity and Preferences

- Currently a Customer has multiple accounts and credentials, and/or dedicated 'apps', to interact with each of multiple Travel Service Provider they need to complete a European-wide travel.
- The Customer maintains multiple profiles associated with each of her accounts



Before IT2RAIL

User centric



Customer

TSP 1

TSP 2

TSP 3

TSP 4



Identity and Preferences

- With IT2Rail's the Customer will receive a globally unique ID identifying her own Travel Companion
- The Travel Companion will store the Customer's profile, including preferences
- The Customer will use her Travel Companion with the whole Travel and Transportation network



With IT2RAIL

User centric

My trips

My alerts

My tickets

My preferences

My navigation guide

My happenings

My ID

My stats



User

Empowered by his device



Travel Shopping

Taoufik Tazi
Amadeus SAS

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Travel Shopping functionalities

- The Travel Shopping :
 - aims at providing to the customer a list of **Door-to-Door itinerary offers** corresponding to his mobility request.
 - identifies **smartest routes** and **aggregated offers** provided from various Travel Experts to build Door-to-Door itinerary offers.



Travel Shopping functionalities

- IT2Rail Travel Shopping is based on the following modules:
 - Mobility Request Manager (collecting the mobility request and user preferences)
 - Shopping orchestrator (orchestrating shopping exchanges)
 - Location resolver (identifying nearest stop places)
 - Metaroute Explorer (finding smartest routes)
 - Travel Expert resolvers (identifying Travel Experts)
 - Offer Builder (building the list of itinerary offers)

Broker (interacting with Travel Experts to collect offer items)



Focus on the Location Resolver

- Origin and destination specified in the mobility request may be a stop place, but they can also be an **address (customer's home)** or a **point of interest**.
- The Location Resolver is in charge of **converting** these locations (origin and destination) into a list of **stop places located near to these locations**.



Focus on the Location Resolver

Prague Astronomical Clock



INPUTS

- **Reference Point:** Prague Astronomical Clock
- **Radius:** 20 km
- **Preferred infrastructures:** Coach station

OUTPUTS

Coach station: Prague-Florenc
Coach station code: XXX
Geo coordinates :
(48.726449, 2.365290)



Focus on the Metaroute Explorer

- The Metaroute Explorer is in charge of two functions:
 - Building the network resource reference, based on statistical data provided by Travel Experts
 - Exploring the network resource reference to identify smartest routes corresponding to the mobility request
- Resources:
 - Travel Experts publish statistical data on routes they cover
 - Which routes? Validity dates? frequency?
 - A centralized network graph is build based on these data



Focus on the Metaroute Explorer

- **Metaroutes** are divided into **Meta Travel Expert Episodes**, associated to a specific Travel Experts

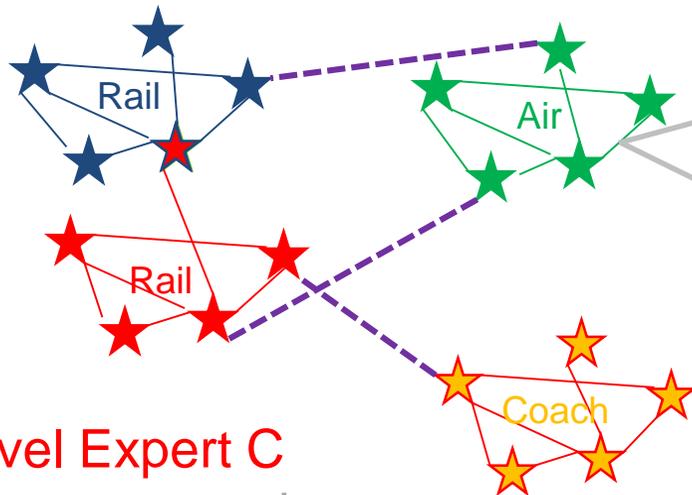


Focus on the Metaroute Explorer

Network illustration

Travel Expert A

Travel Expert B



Travel Expert C

2 transport modes

Statistical data corresponding to the routelink:

01Jun-31Jun

Monday to Friday

Average travel time = 90min

Density = 15 services/day

★ ★ Rail station

★ Airport

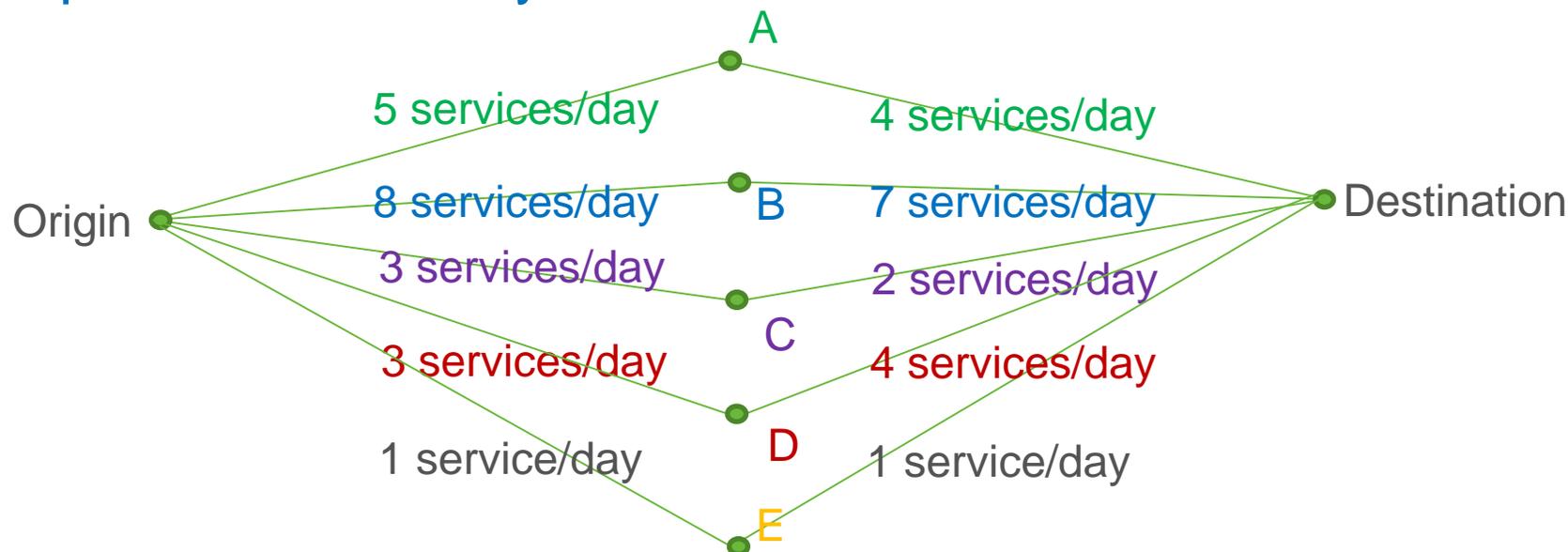
★ Coach station

--- Routelinks between networks (walking ...)



Focus on the Metaroute Explorer

Impact of the density:



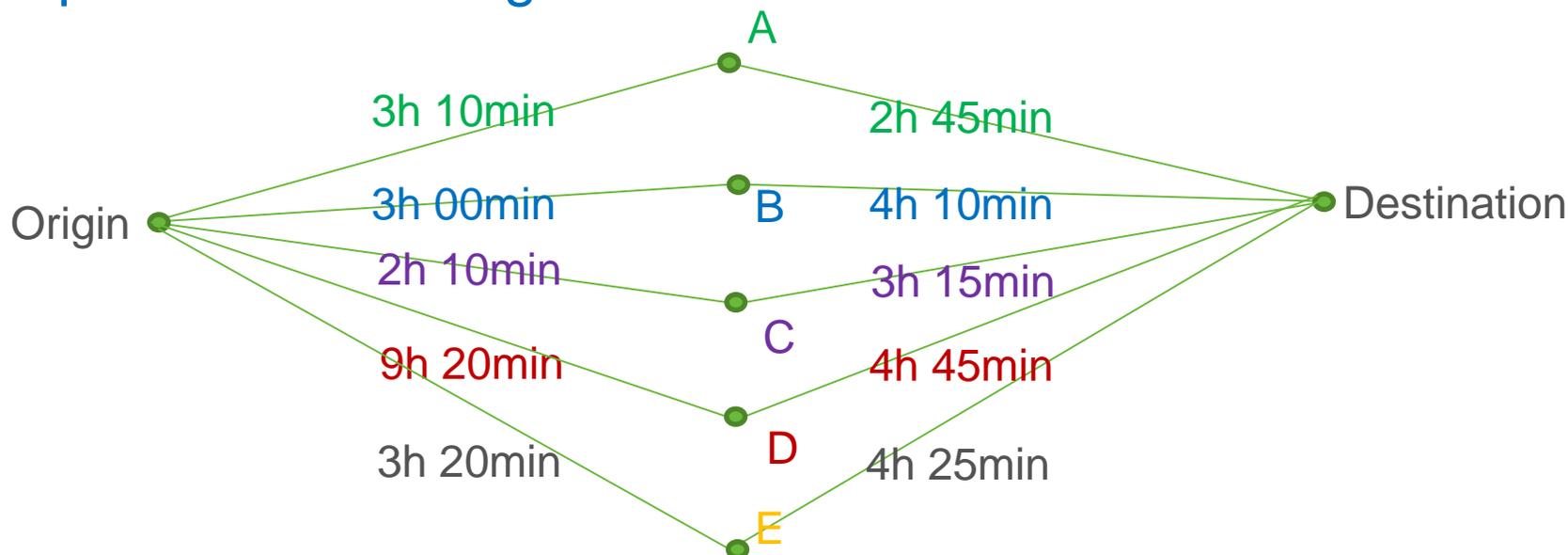
Five Metaroutes are possible.

Metaroutes with highest density (B and A) are selected, because the probability to build an itinerary offer with them is higher.



Focus on the Metaroute Explorer

Impact of the average travel time:



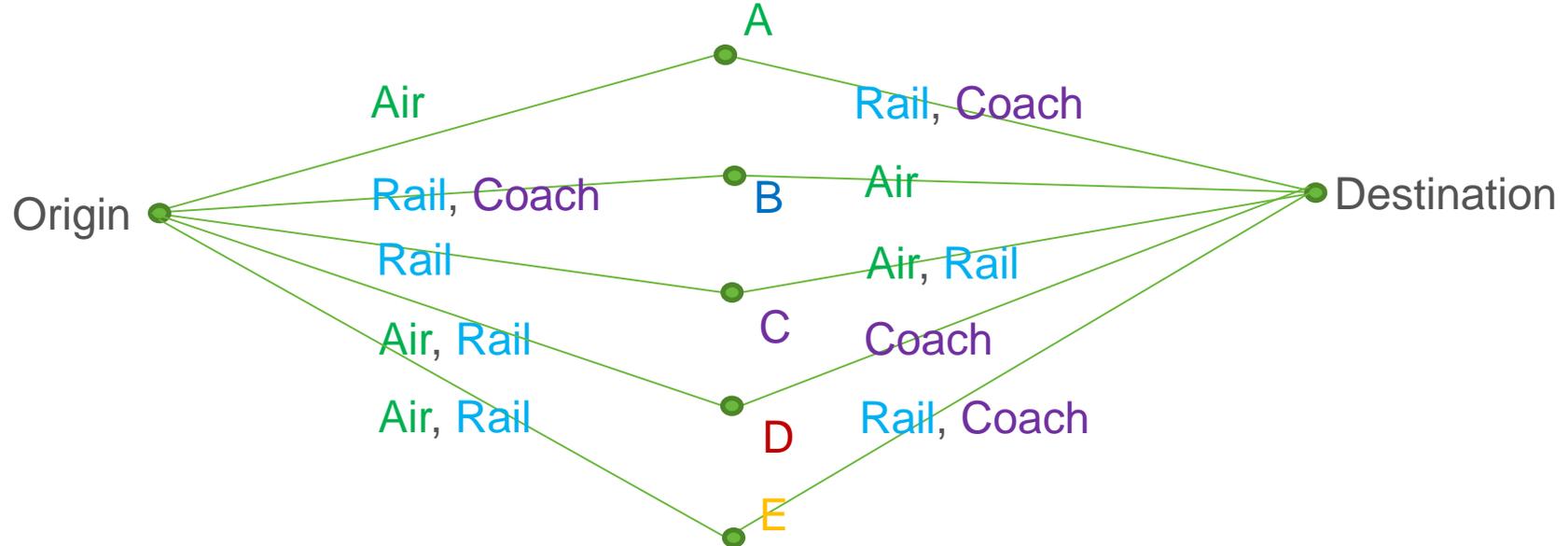
Five Metaroutes are possible.

Shortest Metaroutes (C and A) are selected, other Metaroutes are ignored.



Focus on the Metaroute Explorer

Impact of the user preferences:



Five Metaroutes are possible. The customer specifies “rail only” in the mobility request.

The smartest Metaroutes are through C and E because the “rail” mode is available on the whole Metaroute. Other Metaroutes are ignored.



Focus on the Offer Builder

- **The Offer Builder** is in charge of two functions:
 - **Calling Travel Experts** to collect itinerary offer items (corresponding to each Meta Travel Expert Episode)
 - **Aggregating itinerary offer items** to build a list of Itinerary Offers.
- Calls to Travel Experts are **parallelized** and managed by the interoperability Broker.
- **The Broker** is in charge of **converting shopping requests** and of **routing them** to the appropriate Travel Expert.



Booking & Ticketing Orchestrators

Tom Jones
Amadeus SAS

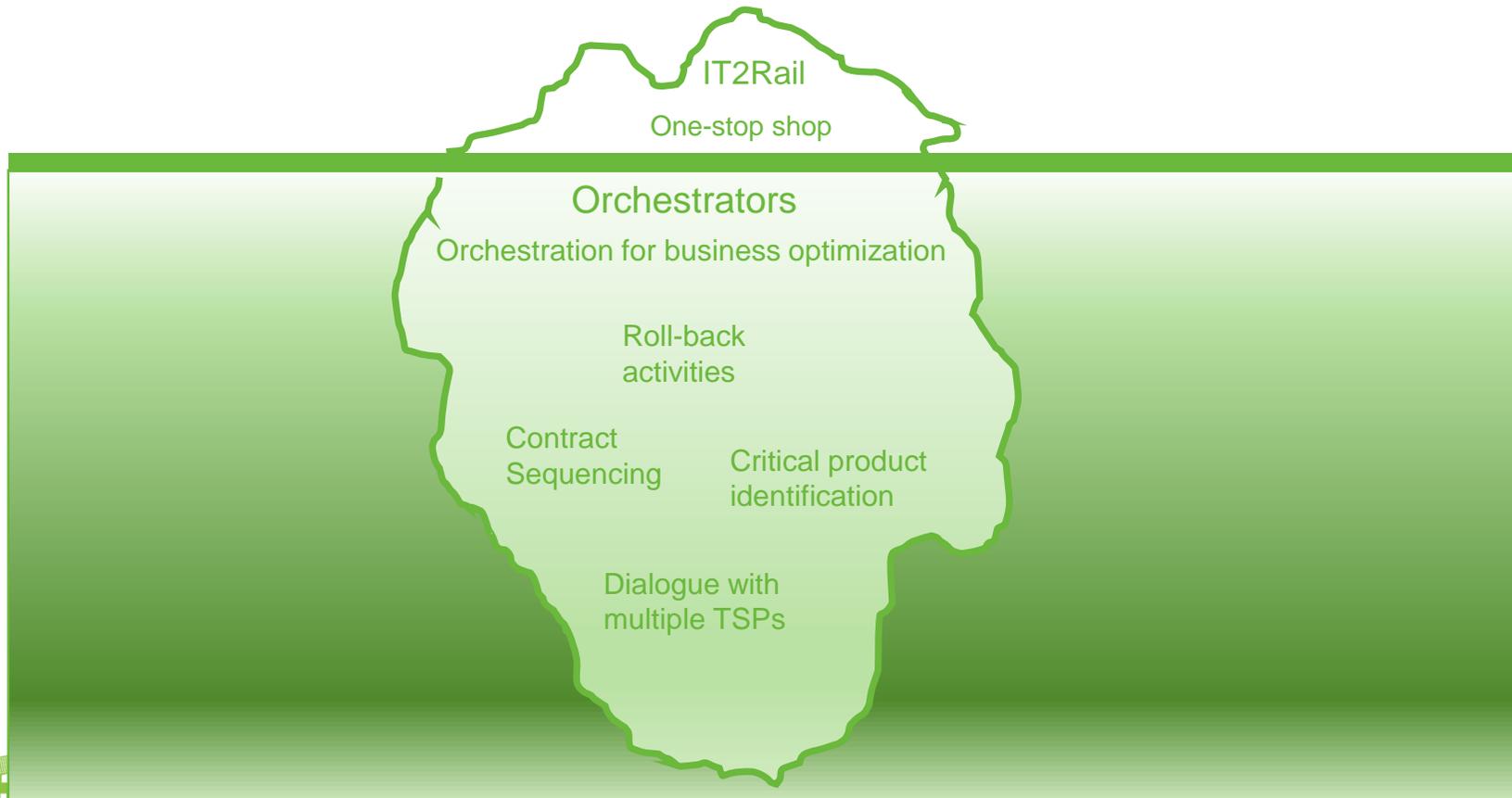
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Booking & Ticketing mission

Mask the complexity to the customer



Comodal Vs Intermodal business models

- **Comodal** is where the passenger selected travel solution consists of a concatenation of Transport Service Provider (TSP) products/services, performed in the distribution link of the supply chain. None of the contributing TSPs are aware of the contribution of the others: **multiple payments and 'tickets'** (transport contracts) are established between the passenger and each contributing TSP, **each guaranteeing arrival only at the destination of the service provided by each TSP.**
- **Intermodal** is where the passenger selected travel solution consists of an aggregation of TSP products/services performed by the contributing TSPs themselves at the start of the supply chain: commercial agreements between contributing TSPs define a single 'thru-fare' and the apportionment of ticket revenues between them: **a single payment and 'ticket'** or transport contract is established **which guarantees arrival of the passenger at the final destination**



How to orchestrate multiple TSP products/services?



IT2Rail objectives and scope

Integrate and demonstrate **multimodal booking & ticketing functions** integrating air, rail, coach, and urban services

- Interoperability : **limit the integration costs** of multiple service providers using **existing but different standards** and **legacy systems**
- Orchestrate the booking and purchase of co-modally retailed travel products/services
- Out of scope:
 - After-sales and Reaccommodation
 - Back-office accounting and clearing/settlement services
 - Intermodal business model



Current status

Business need: Orchestration of multiple dialogues with booking, and payment/ticketing engines

Main challenges faced so far:

- **1 step Vs 2 steps**
 - Not all TSPs require booking step
 - Some TSPs booking and ticketing is in a single step
 - Some TSPs have separate booking and ticketing steps
- **Roll-back activities (Comodal use-case):**
 - How to manage the case where a transaction (booking, payment, or ticketing) fails with one of the TSPs
 - Concept of critical products – no roll-back if no critical product (e.g. long distance segment) has failed
 - Concept of Sequencing – if contract establishment (ticketing) must succeed for the entire itinerary or cancel the entire trip, we look at sequencing e.g. non-refundable segments to the end of the multiple dialogues



Wallet & e-passport

Nora Winninger
SNCF

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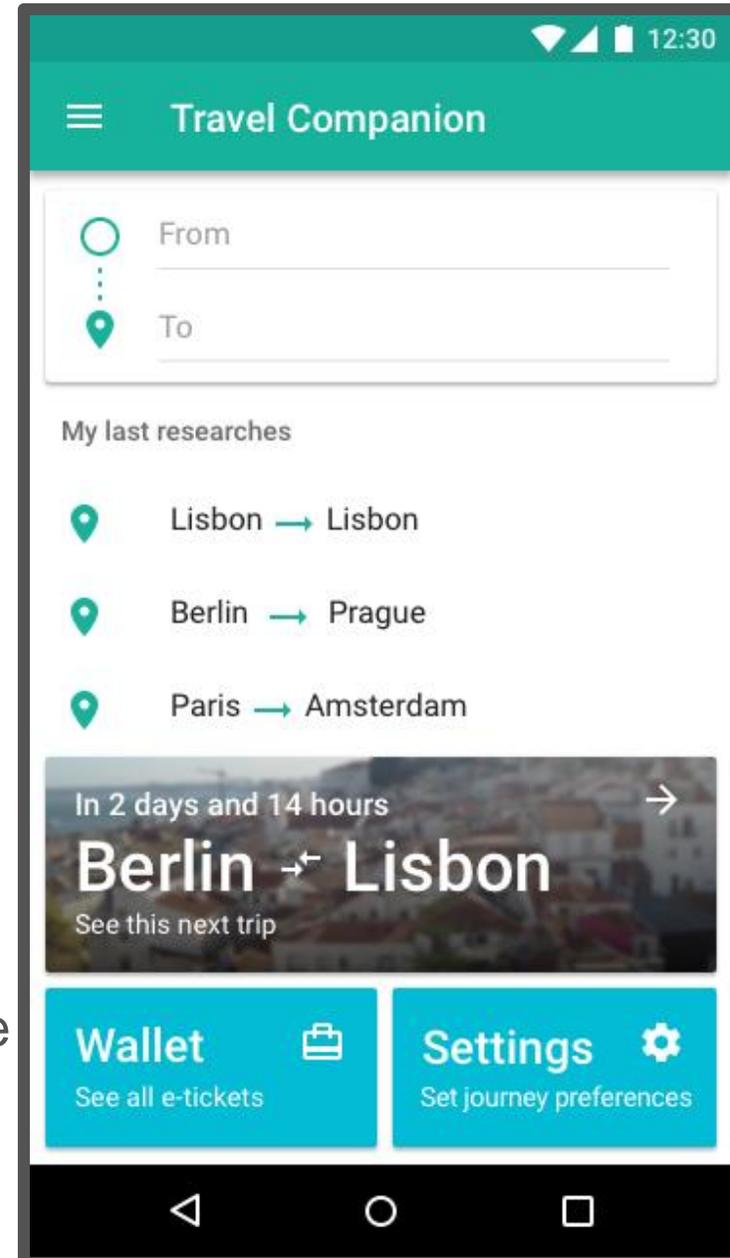
With IT2RAIL

Cloud

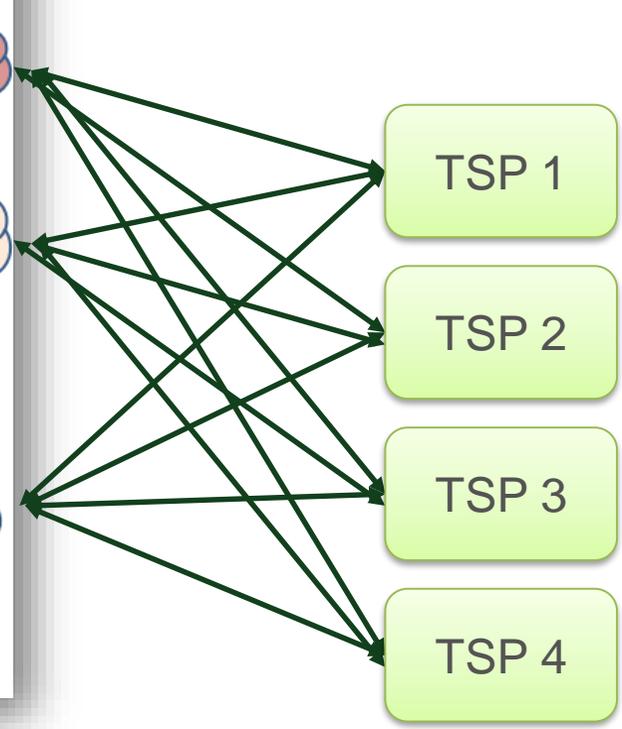
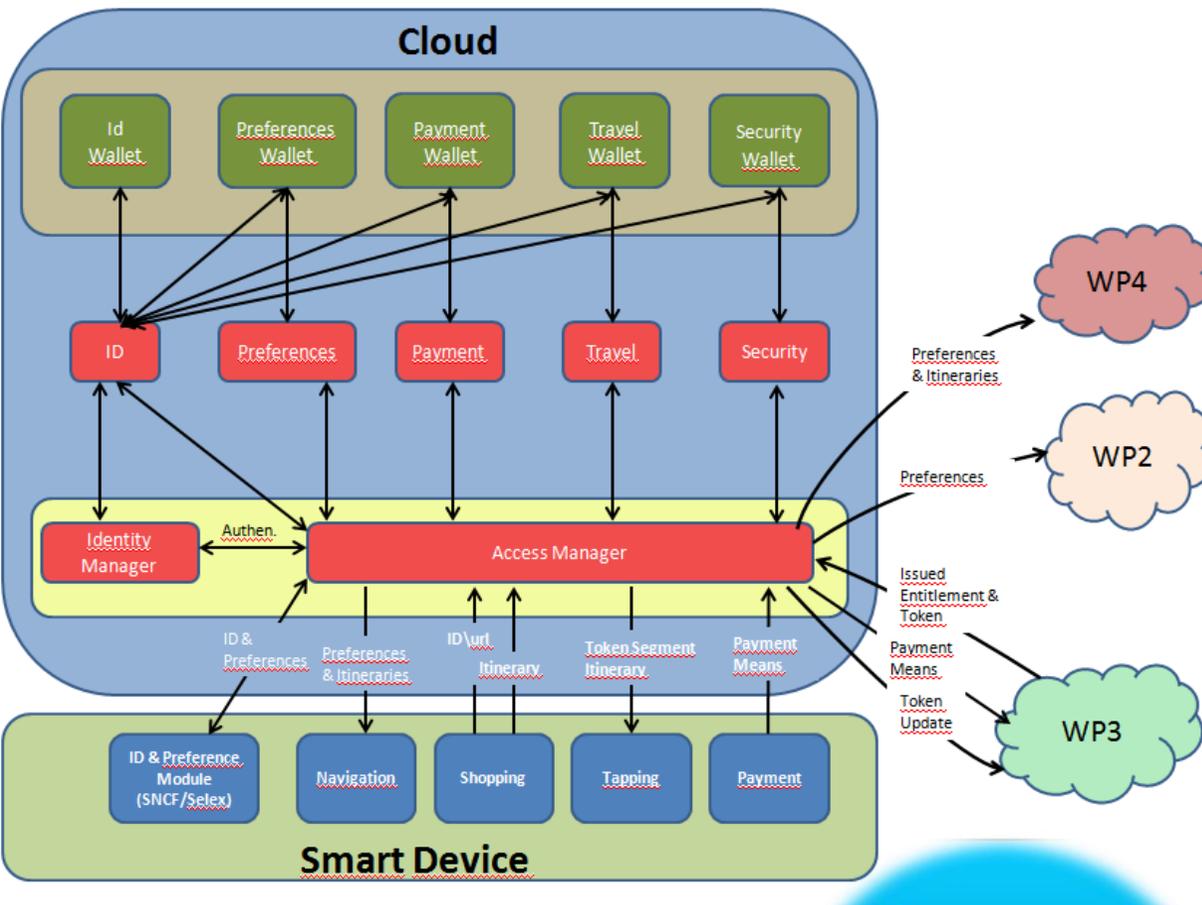


User

Empowered by his device



User centric



E-passport technology

- **LDS2' management**

- About LDS2
 - a specific memory zone into the chip of the ePassport
 - access (read/write/delete) **standardized by ICAO**
- LDS2 will store the travel companion data as a mirror of the ones stored into the cloud. This will guarantee a full interoperability at worldwide level for all travelers



E-passport concepts

- It is planned to store some data inside the traveller biometric Passport. These data will be stored inside the NFC chip of the passport, through the application.
- *Travel Companion* needs an internet connection to access data stored into the cloud
- **ePassport/LDS2** could also be used as a backup of the *Travel Companion* when internet connection is down
- **ePassport/LDS2** stores the key data (trip data) linked with the current citizen' trip, as a mirror of the ones stored into the cloud



Trip Tracker

Petr Buchníček
OLTIS Group

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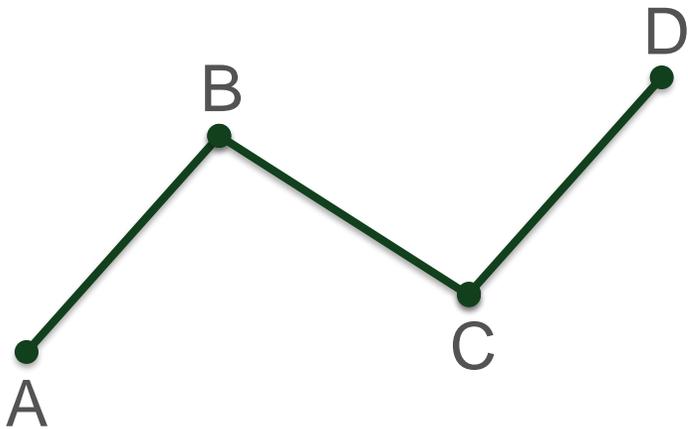
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Activate „push messages“ receiving

„My flight is delayed...“

- Concepts

- Journey tracking: activated on user's request, takes user's preferences into account
- Events listening: after tracking activation, the Traveller is kept informed on all known travel conflicts that may affect the planned journey

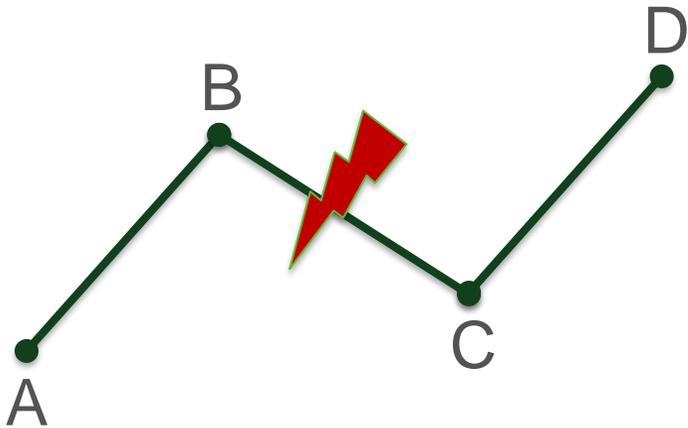


Evaluate disruption impact

„... I won't be able to catch my train...“

- Concepts

- Complex Event Processing: impacts evaluated in 2 steps (generic vs. user-dependent rules matching)
- Alerting Travellers: based on individual impact, 3 different types of messages are sent (information, warning alert)

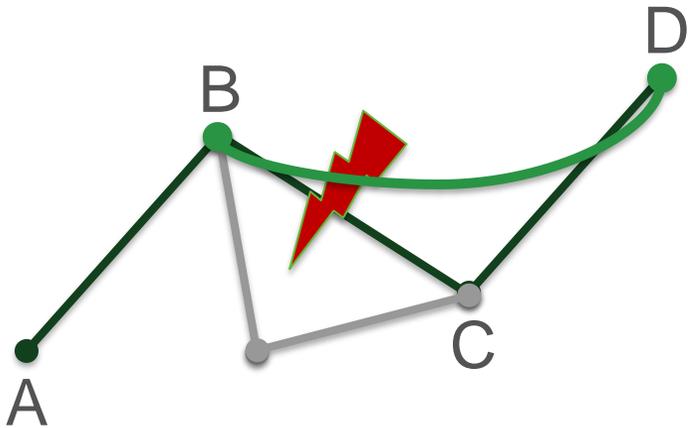


Propose alternatives

„... what are my alternatives to get to my destination?“

- Concepts

- Alternatives Manager: a Traveller is provided with suggested alternatives through the Travel Companion app in accordance with his/her preferences
- Alternatives validation: before offered to the Traveller, each alternative is checked for its correctness first



Navigation

Daniel Schmidt
HaCon

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Navigation – Motivation

Car



Public Transport



Navigation – Functions

1. show Position
 - Positioning
 - display position
2. show Route(s)
 - calculate route(s)
 - display route(s)
3. Guidance
 - display instructions
4. Deviation Recognition
 - Positioning
 - compare position with the route
 - Recalculation



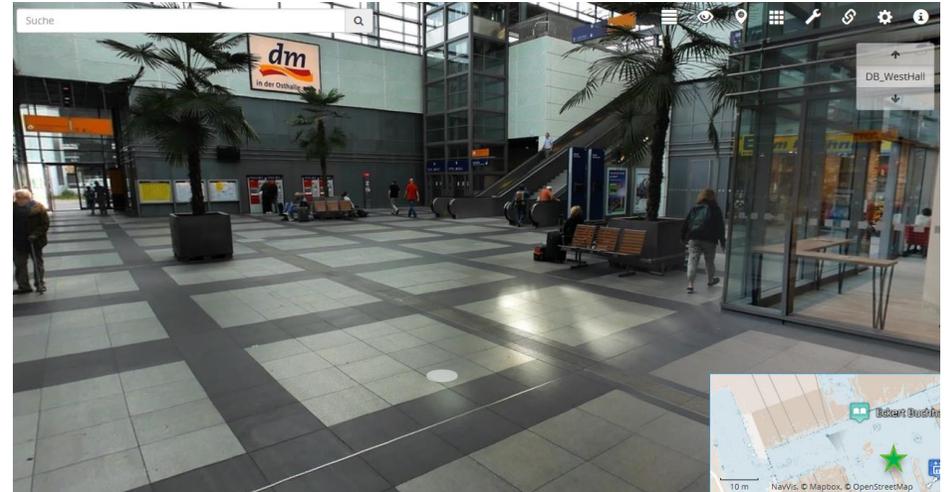
Navigation – Intermodal Itinerary

- General question
 - Will I catch my next travel episode?
- Public transport
 - When and where to enter, leave or change vehicles
- Personal or shared transport
 - Like car navigation
- Interchanges
 - Like car navigation, but indoor and outdoor



Navigation (1/3) – IT2Rail

- Navigation at interchanges
 - Infrastructureless Positioning
 - Calculate route
 - Display route
 - Map
 - List
 - Guidance
 - Instruction
 - Map/Pictures



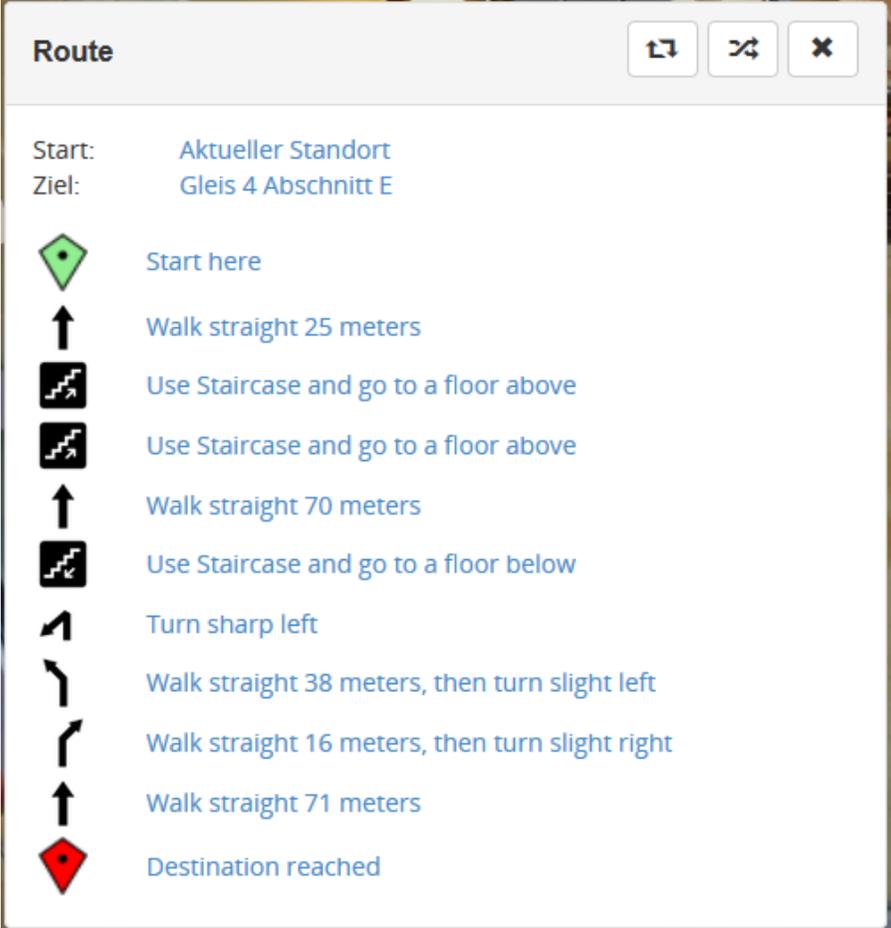
Navigation (2/3) – IT2Rail

- Navigation at interchanges
 - Infrastructureless Positioning
 - Calculate route
 - Display route
 - Map
 - List
 - Guidance
 - Instruction
 - Map/Pictures



Navigation (3/3) – IT2Rail

- Navigation at interchanges
 - Infrastructureless Positioning
 - Calculate route
 - Display route
 - Map
 - List
 - Guidance
 - Instruction
 - Map/Pictures

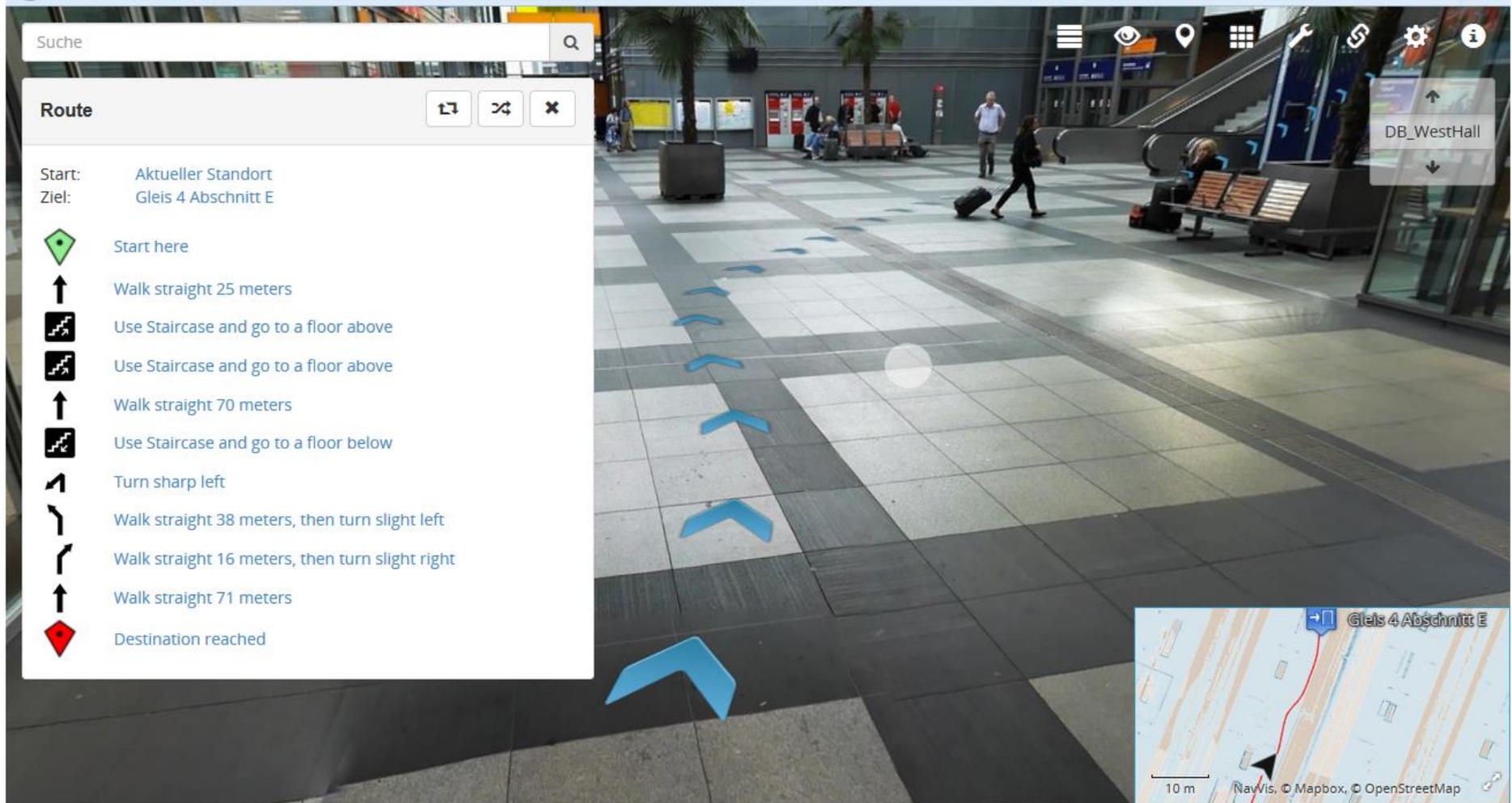


The screenshot shows a navigation window titled "Route" with three control buttons (back, forward, close) in the top right corner. The route details are as follows:

Icon	Instruction
Green diamond with a dot	Start here
Upward arrow	Walk straight 25 meters
Staircase icon	Use Staircase and go to a floor above
Staircase icon	Use Staircase and go to a floor above
Upward arrow	Walk straight 70 meters
Staircase icon	Use Staircase and go to a floor below
Sharp left turn arrow	Turn sharp left
Slight left turn arrow	Walk straight 38 meters, then turn slight left
Slight right turn arrow	Walk straight 16 meters, then turn slight right
Upward arrow	Walk straight 71 meters
Red diamond with a dot	Destination reached



Navigation – Guidance



IT2Rail – Status

- Data acquisition at Berlin-Südkreuz
- AREL
 - Positioning: indoor, infrastructureless
- FREL
 - Calculate route
 - Display route
 - Guidance



Disruptive ticketing and validation

Edouard Carpentier de Changy

THALES

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IT2Rail ticketing challenge

- Keep legacy equipment
- Keep existing infrastructure.
- Scale horizontally
- Near zero cost of acquisition for small operators



IT2Rail ticketing solution

- Entitlement
 - Decouple user's "contract" from the "ticket"
- Token
 - Generate user's "travelling means" from the Entitlement
- Embodiment
 - Generate a physical version of the Token



IT2Rail disruptive concepts

- Allow existing systems to remain fully functional
- Scale horizontally and allows small actors to participate
- IT2Rail adoption is driven by market forces only



Business Analytics

Catherine Minciotti
LEONARDO

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Business Analytics at first glance

- The Business Analytics module aims at enriching the IT2Rail platform by providing Travel & Transport Analytics.
- The module combines data from various sources (internal and external to the system) in order to provide meaningful information for all IT2Rail users.



Business Analytics functionalities

- IT2Rail Business Analytics functionalities are:
 - KPIs computation of rail transport performances
 - Advice on happenings
 - Display of weather data
 - KPIs computation based on social network messages.

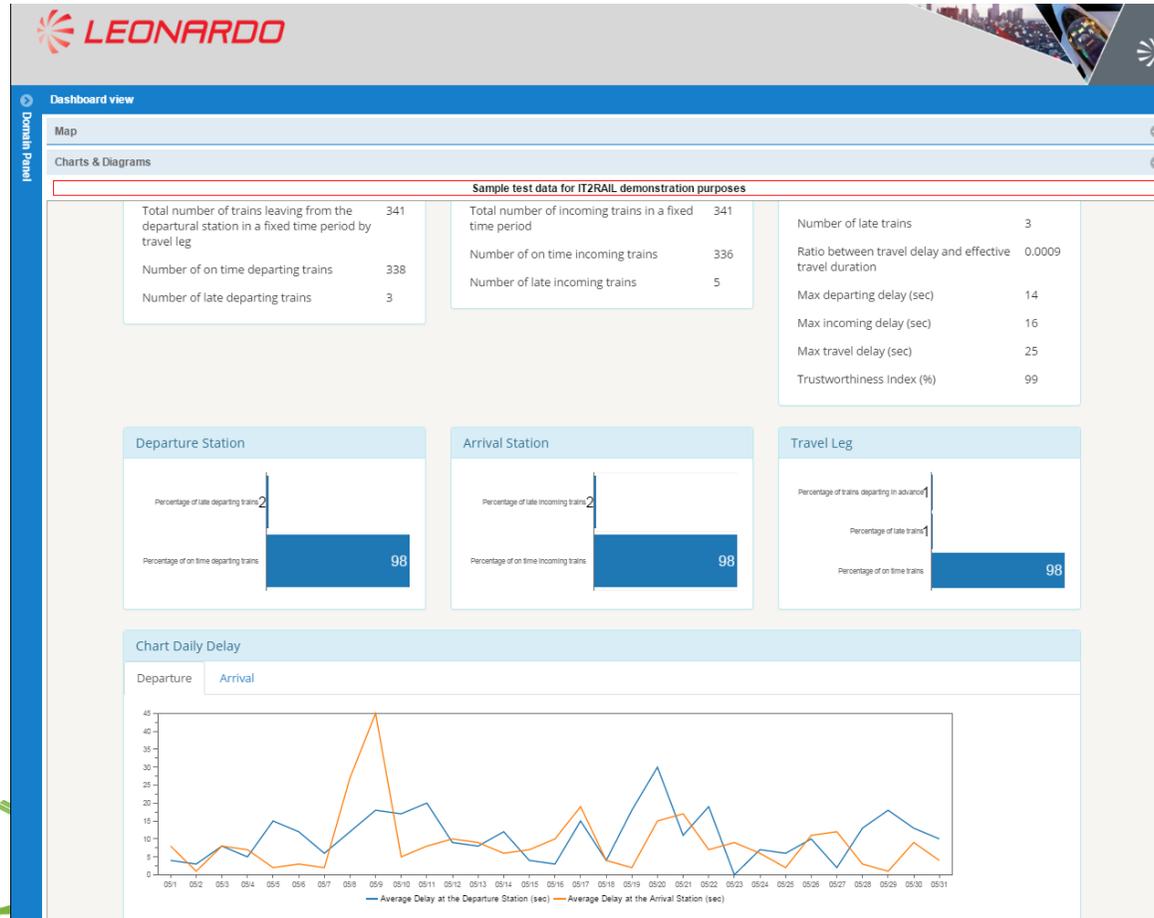


BA functionalities: KPIs computation

- IT2Rail Business Analytics provides a list of KPIs for a generic travel episode.
- These indicators measure the performances of a multimodal transportation system.
- A dashboard containing indicators, charts and graphs eases KPI visualization for IT2Rail actors.



BA functionalities: KPIs computation



BA functionalities: Advice on Happenings

- Knowing which happenings will take place at a location can help travellers plan their journey.
- During a journey, Business Analytics can provide:
 - advice on what to do at a potential travel stop
 - recommendations on locations with more things to do.



BA functionalities: Display of Happenings

The screenshot displays the LEONARDO web application interface. The top left features the LEONARDO logo. Below it is a 'Domain Panel' with a 'Dashboard view' button. The main area is a map of Paris, showing various districts and landmarks. The map is overlaid with numerous circular markers, each containing a different icon representing an event or happening. The sidebar on the left is divided into sections: 'GEO' with 'Layers' (Base Layers and Weather Forecasting), 'RAIL', and 'EVENTS'. The 'EVENTS' section includes filters for 'Cities' (Paris), 'Categories' (All), 'Start Date' (05-09-2016), and 'End Date' (07-09-2016), along with a 'Search events' button. The bottom of the interface shows 'Charts & Diagrams'.



BA functionalities: Providing Weather Data

- Weather data is useful to travellers in order to know the current weather situation in a specific place.
- Weather layers have been retrieved from Open Data sources and are displayed within the webGIS.
- Business Analytics also provides weather information and forecasts in tables and charts.



BA functionalities: Display of Weather Layers

The screenshot displays the LEONARDO web interface. At the top left is the LEONARDO logo. Below it is a 'Domain Panel' with a 'Dashboard view' button. The main area is divided into a 'GEO' sidebar and a 'Map' area. The 'GEO' sidebar contains a 'Layers' section with 'Base Layers' (Google Satellite, Google Hybrid, Google Physical, Google Streets, OpenStreetMap) and 'Forecasting' (Weather Forecasting, Rain, Snow, Cloud, Sea, Temperature, Wind). The 'Map' area shows a map of Europe with weather layers overlaid, including rain precipitation (green and blue areas) and snow (white areas). The map includes a 'Center' button and a 'Max Extent' button. The bottom of the interface has a 'Legend' section, a 'RAIL' section with a plus sign, and an 'EVENTS' section with a plus sign. The map data is attributed to ©2016 GeoBasis-DE/BKG (©2009), Google, Inst. Geogr. Nacional, Mapa GISrael, ORION-ME.



BA functionalities for KPI computation based on Twitter

- Collecting messages from social network platforms:
 - Definition of a list of terms specified in the IT2Rail Ontology
 - Data retrieval from Twitter filtering out messages containing the terms defined previously.
- KPI computation based on messages retrieved from social network platforms:
 - Number of tweets crawled per day
 - Words more used (removing stop words)
 - Users who tweeted more about the terms in the configuration
 - Users with more followers who tweeted more about the terms in the configuration.



Interoperability Challenge

Riccardo Santoro
Trenitalia

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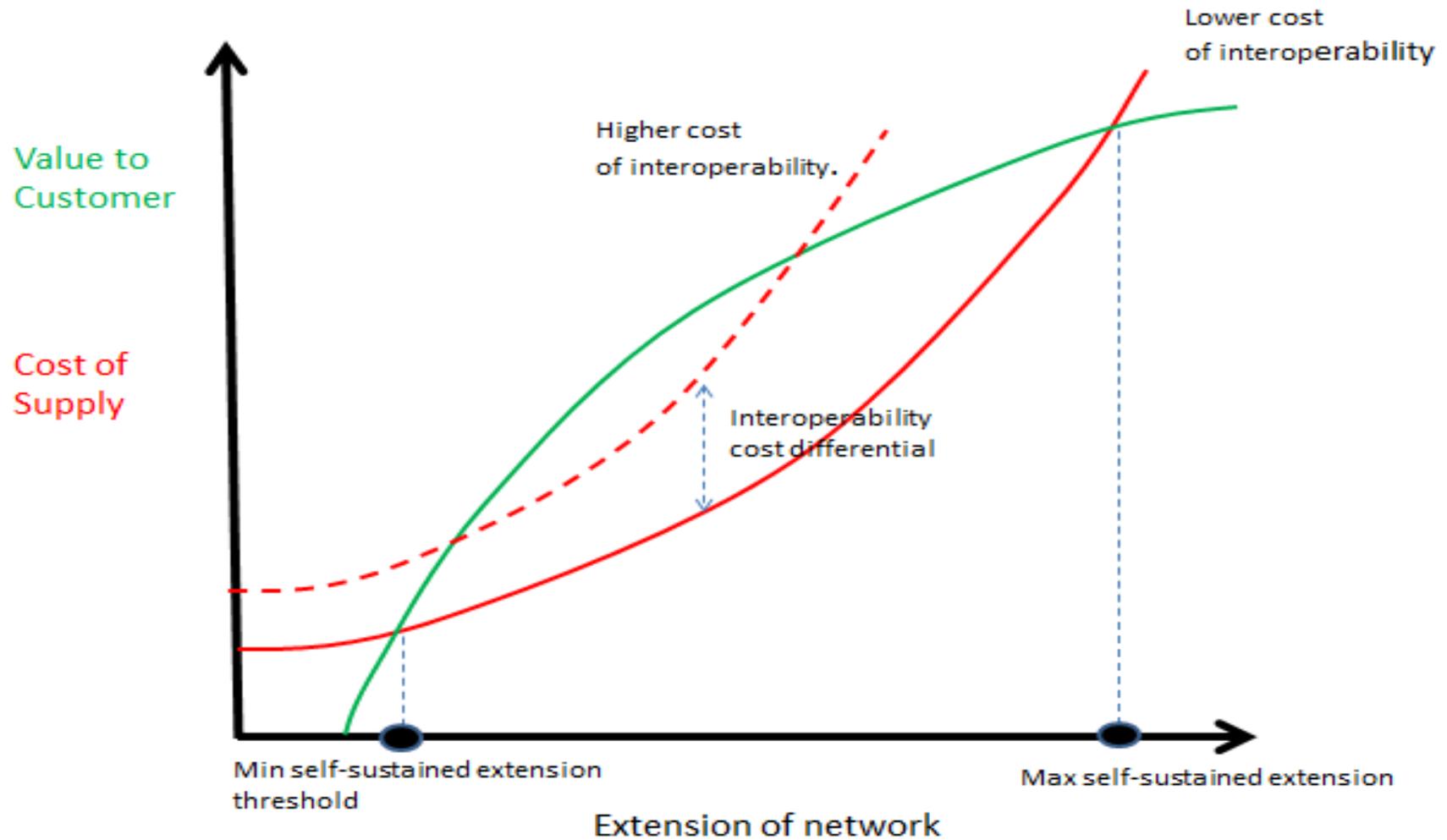


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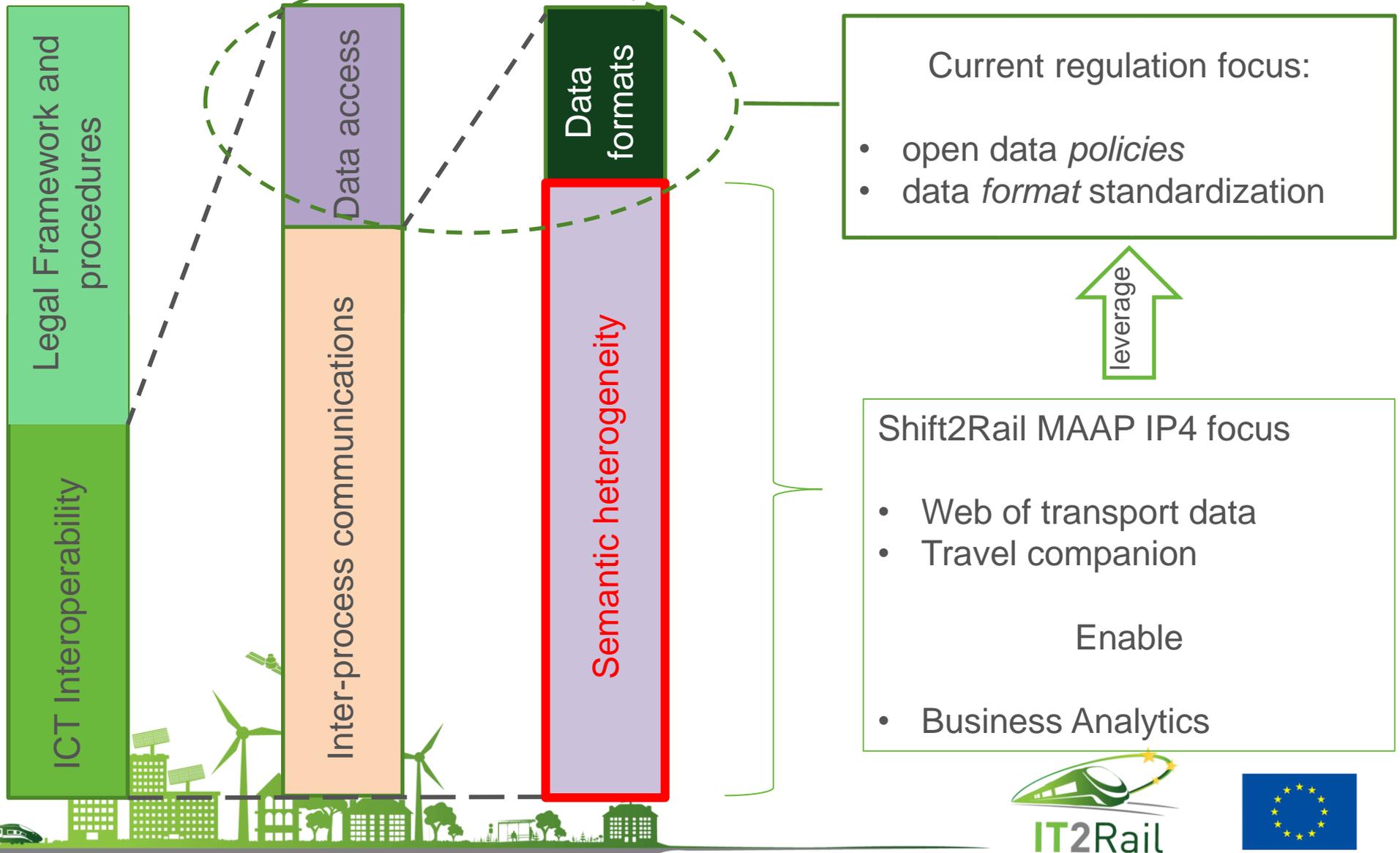
- The value (demand) of mobility products increases with their ability to *complement* other *compatible* products the Customer can combine to solve 'life experience' problems
- Customer-centric means the ability of the rail system to supply mobility as a *network product*,
- i.e. a product participating in a network of other *complementary, compatible* services that can be integrated to solve a problem



Network dynamics of a market of network products



Breakdown of the costs of service compatibility



Semantic Heterogeneity

- Occurs when parties at the end of a 'data exchange' differ in the *interpretation* of data values
- In conventional approaches interpretation is based on analysts and programmers sharing *assumptions* on what the data *means*



Sharing «assumptions» in the SERA

- *Multiple* data standards are here to stay, and more will be developed/introduced, *particularly in the Customer's digital environment*
- Customers and Operators in the *digital market* are autonomous agents, they join and leave at will



Interoperability Framework principles

- Insulate applications from interoperability ‘machinery’
- *Automate* interoperability ‘machinery’
 - discovery, matching, binding, conversion *across* data formats and protocols
- *Link* data/services *across* the web, providing applications with a ‘web of transport data’ abstraction of distributed resources
- Minimal *centralized* architecture, system, governance, or *anything*. Allow for multiple concurrent implementations on any architecture and toolset by anyone



Interoperability Framework Concepts

- Represent knowledge of the domain as a set of formal, explicit machine-readable *logical axioms* that can be shared over networks and are *independent* from the representation of facts
- Applications exchange *logical propositions* about facts
- Discovery, matching, binding and conversion are *inference tasks performed by machines* on the stated facts based on the domain's theory



Interoperability Framework Research topics

- Knowledge representation in a formal logical system
 - Can we actually axiomize all of the domain knowledge for *machine* reasoning?
- Engineering issues
 - *Machine processing* of the above
 - Tooling (reasoners, utilities, frameworks, etc)
 - Scalability, performance
 - Security, auditing, etc.





Shopping
Real time

Innovation
Open Interfaces
Door to Door
Seamless Travel
Business Analytics

Digital

Multimodal
Ticketing
Tracking
Web of Transportation
Travel Companion
One-stop Shop

Connectivity

Technical Enabler Cloud

Re-accommodation
Attractive Railway
Services

Interoperability



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