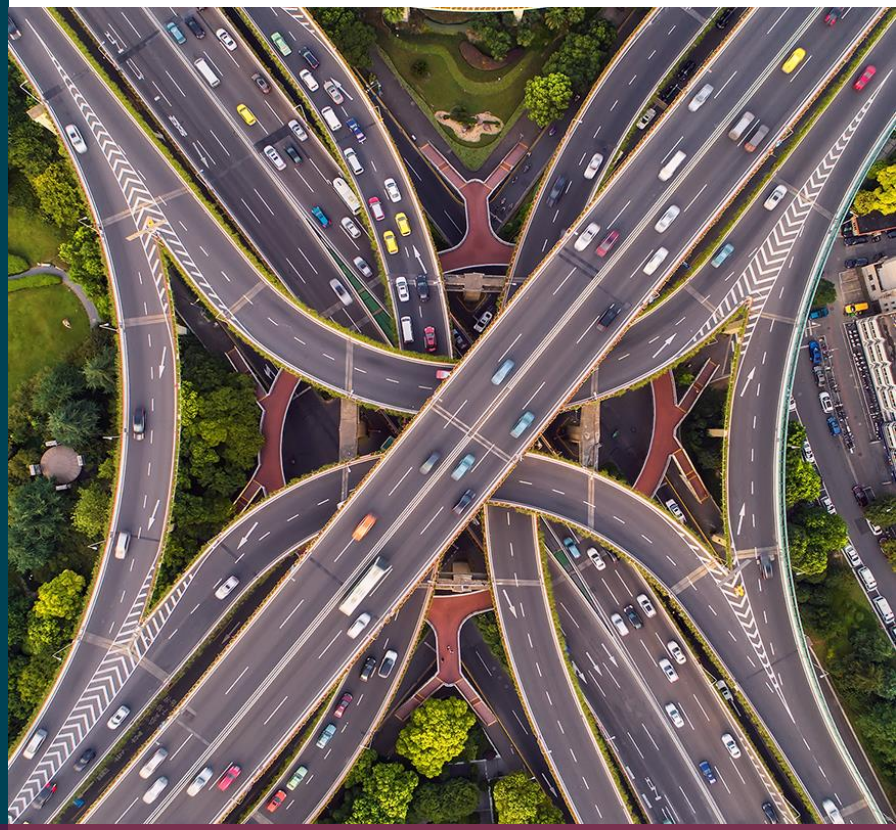
New trends and technologies in smart mobility

Indra Mova Collect



Javier Saralegui Sánchez, PMP- AFC Innovation Manager

in Indra

January 2020

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Ticketing Systems evolution

1

Where are we now?

New transit paradigms

70-2000

Coins

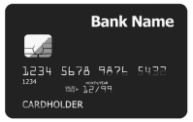
Paper

Magnetic ticket

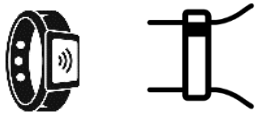
Contactless Card

2014

Contactless EMV Bank Cards



Wearables



Mobile (NFC)

QR

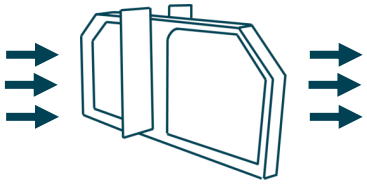
2020?

Pay As You Go

Account based

Travel Partner

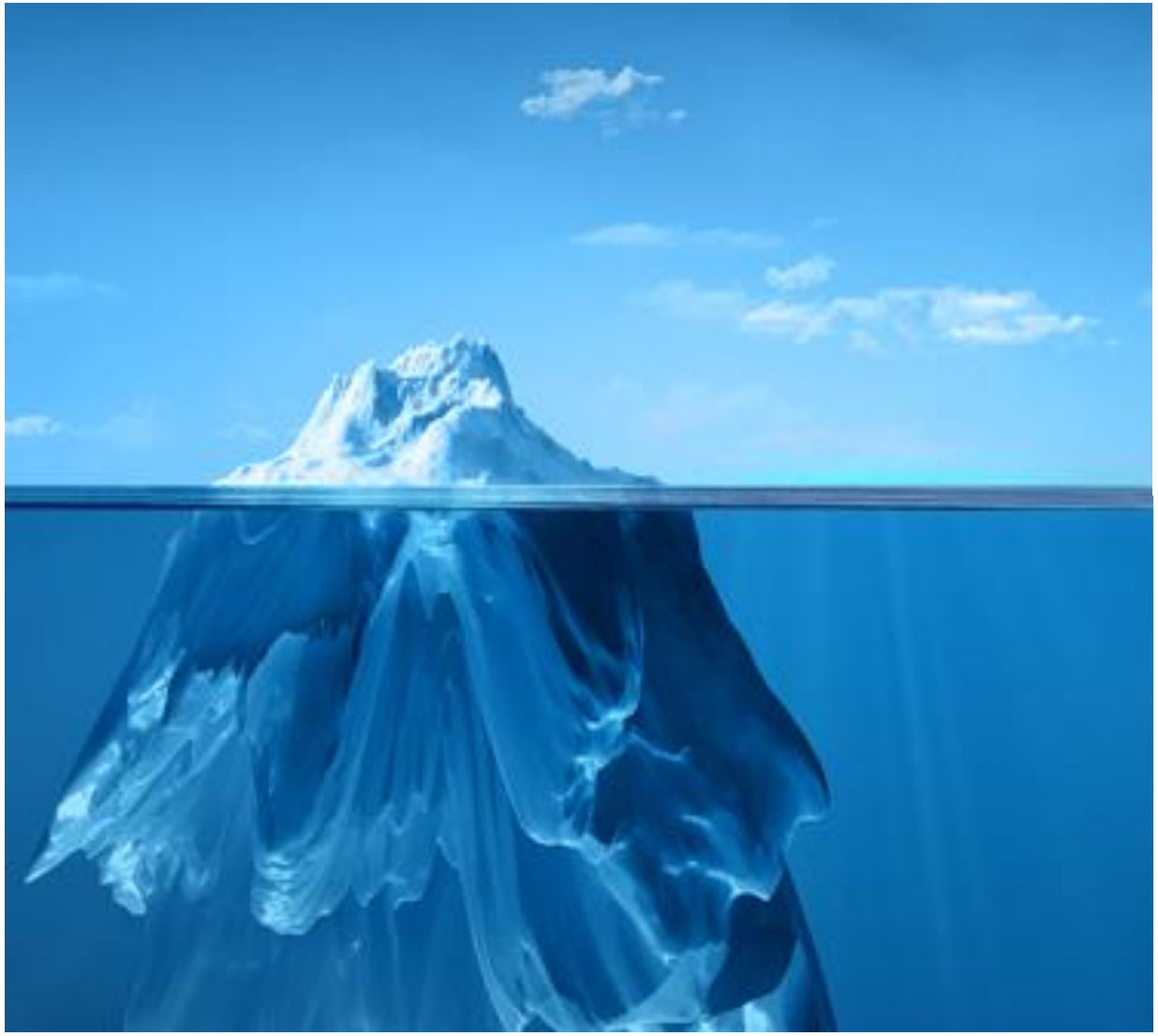
Be-in/Be-out



Ticketing as a Service (TaaS)

Mobility as a Service (MaaS)

Ticketing Projects



Project Management	Systems Integration	Legacy systems and data migration	Integration with external systems
Communications	Security standards (PCI-DSS, GDPR)	Cybersecurity	New payment methods
Financial Reconciliation	Fraud Management	Technological obsolescence	Change Management

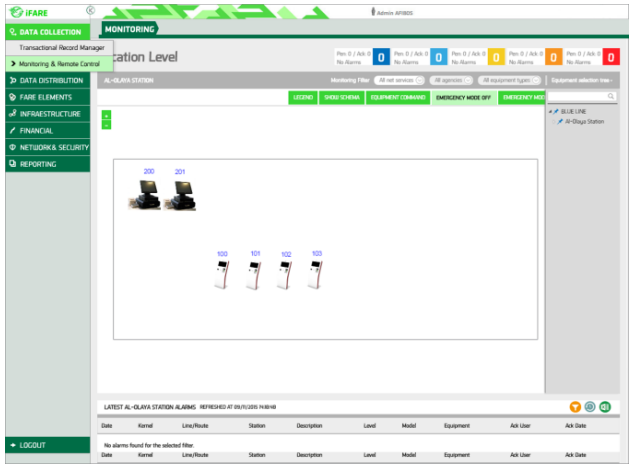
Keys for a successful Ticketing implementation

2

Key points for success in Ticketing Projects

Key points for Ticketing Solutions

360º	Projects and products	Proven & Standardized
Open Architecture	Cost Optimization	Multimodal & Multioperator
Ease of use for traveller	Commercial benefits	Innovation

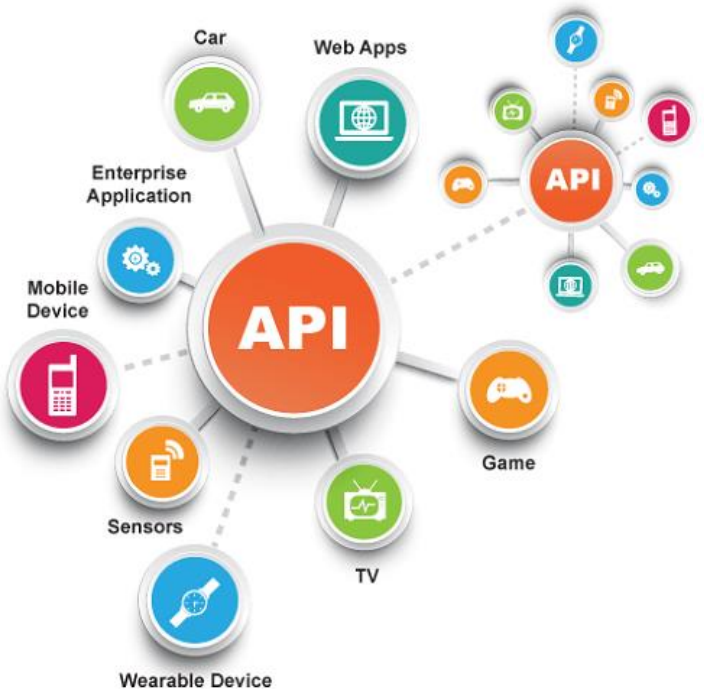


Systems Integration - API First

Three principles of API First Design:

- Your API is the first user interface of your application
- Your API comes first, then the implementation
- Your API is described (and maybe even self-descriptive)

Your implementation will change frequently, your API should not.



Most of the new players have a common technology approach:

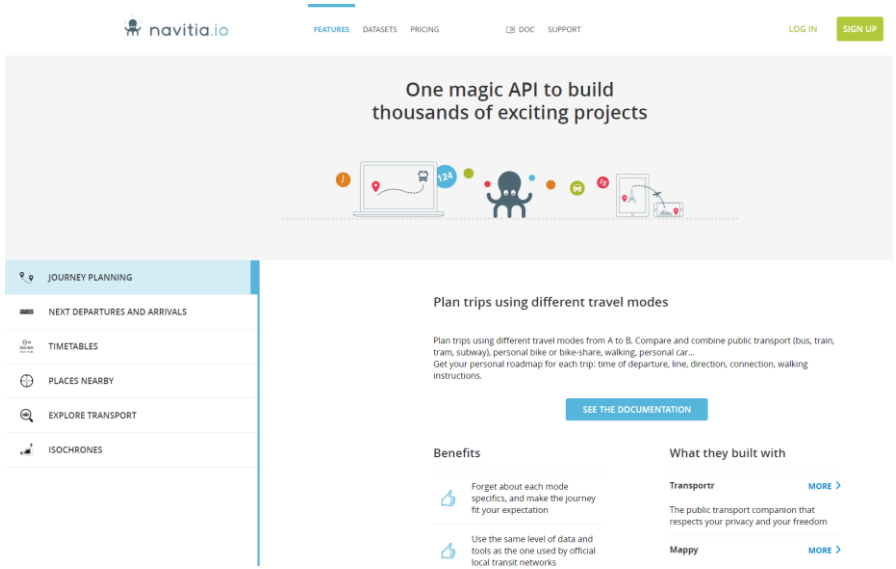
- Open API (usually REST APIs well documented)
- API keys needed for being used
- Simplicity to integrate their services in third-party apps

https://developer.uber.com/docs/riders/ride-requests/introduction
https://lime-go.readme.io/docs
https://github.com/sharenowTech/openAPI
https://dev.blablacar.com/docs/versions/1.0
https://github.com/ubahnverleih/WoBike
https://api.citybik.es/v2/

Systems Integration - Open Data

We are in the era of Open Data:

- Your data belongs to the users
- Usually is a win-win approach
- All players are opening their data



Multiple open data portals and aggregators:

- GTFS and GTFS-RT are de-facto standards
- NeTEx (Network Timetable Exchange) and SIRI (Standard Interface for Real-time information) standards are starting to be adopted
- Transmodel Reference data model for Public Tra

NeTEx Network Timetable Exchange

SIRI

Transmodel

Project Management

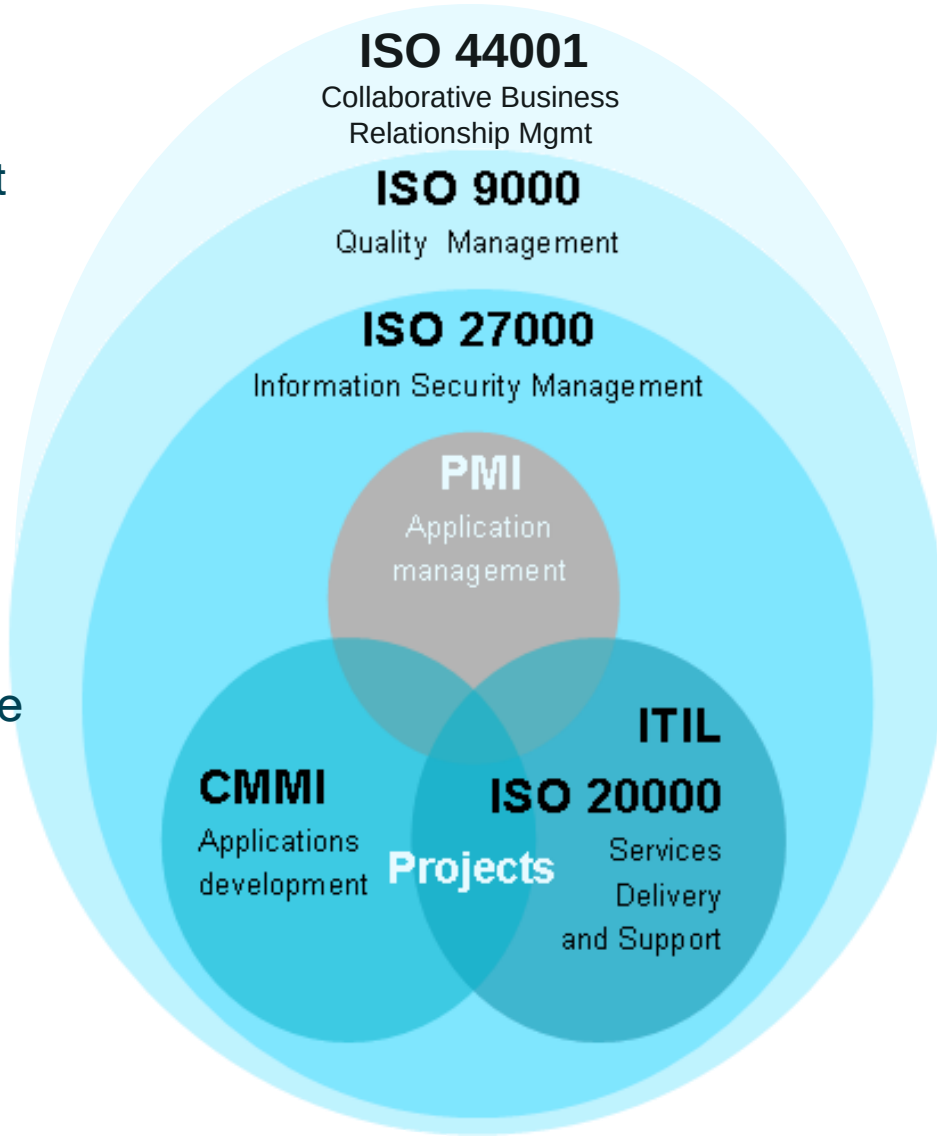
The key to success

Determine what, who, how, when, with what resources and at what cost the project will be carried out.

Define the project organization, the roles and responsibilities of the different participants, the communication processes between the various levels of participation in the project, determine the quality standards required and define the processes for managing changes in the different project areas.

Provide all individuals involved in the project with concrete details on the results to be obtained and the path to be taken to achieve them.

Provide precise guidelines on the monitoring and controlling of the project in order to identify and correct deviations early on.



Project Management Institute

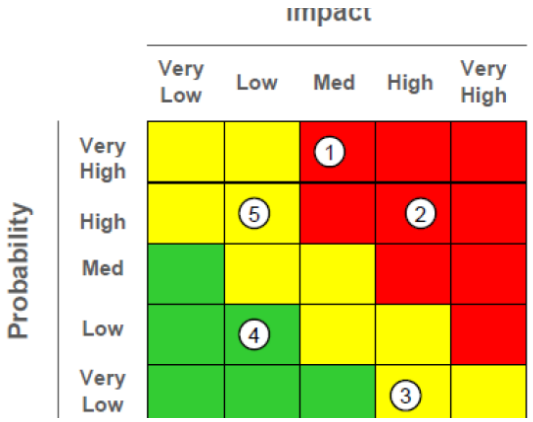
Institute for Collaborative Working

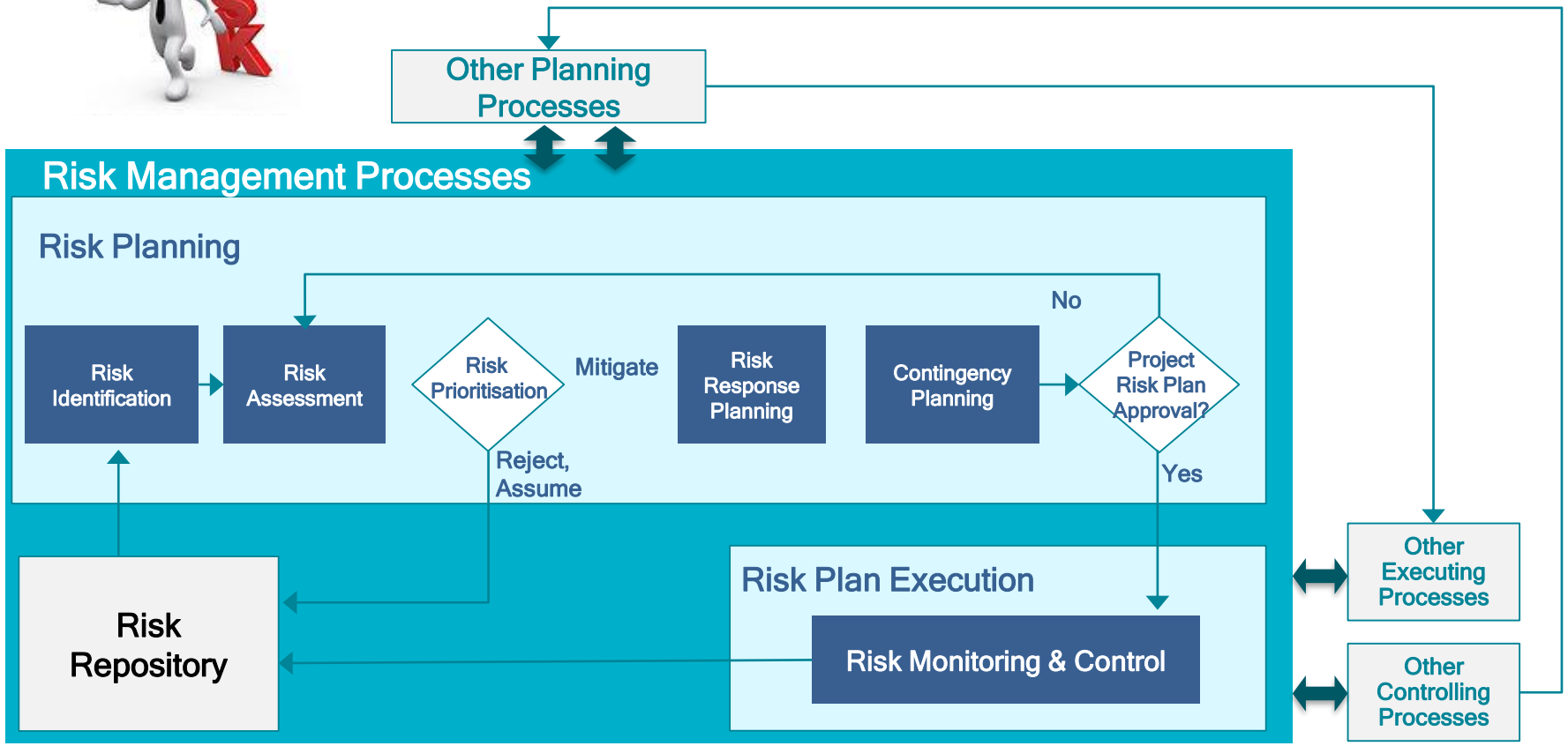
ISO International Organization for Standardization

Risk Management

A process carried-out throughout the entire project life cycle

Effective Risk Management can only be achieved with a comprehensive study of all aspects of the project to identify possible risks.





Change Management

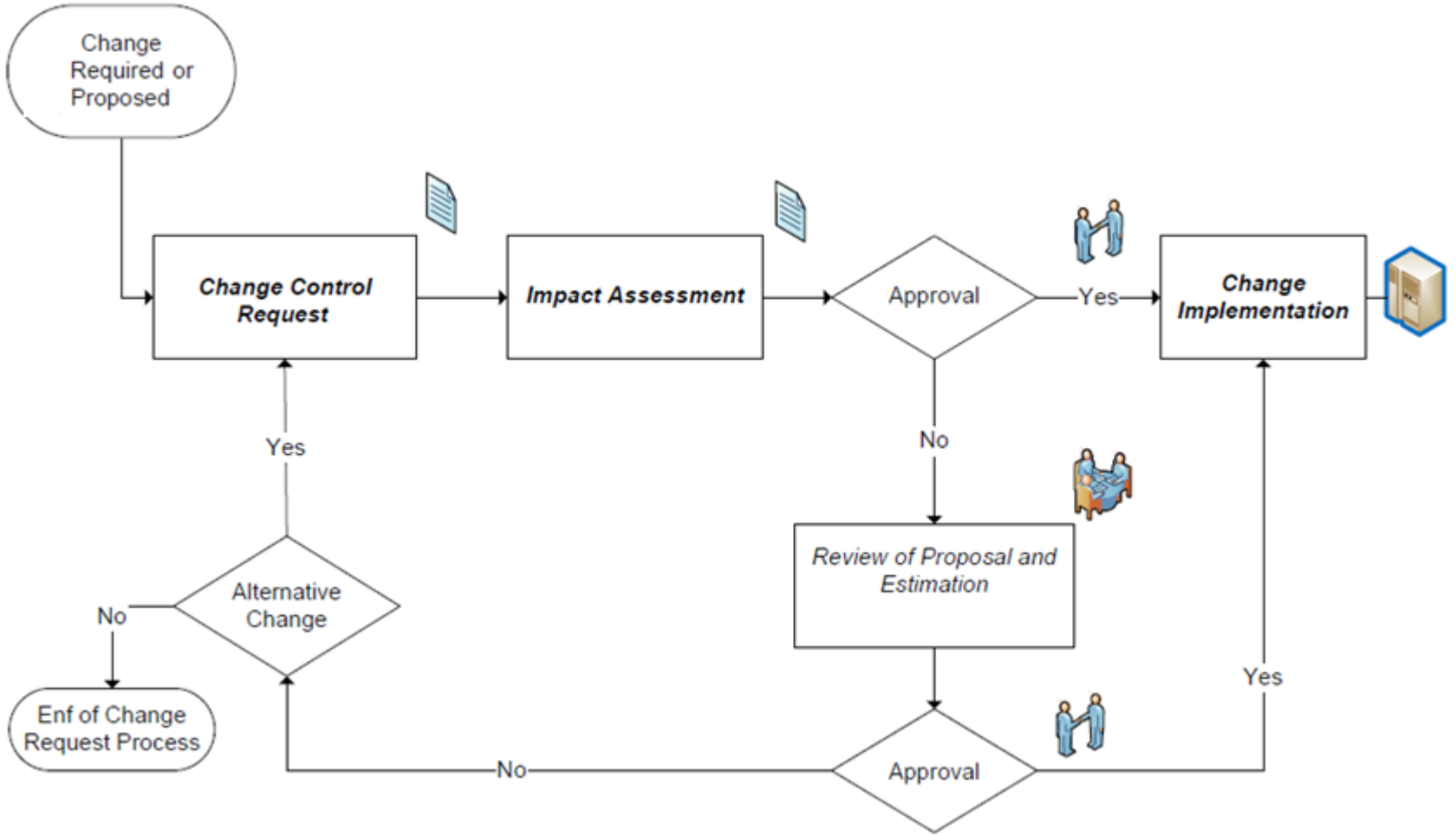
Effective Change Management increases the likelihood of success

Changes are inevitable.

Effective change management processes rely on supporting activities and tools.

It must also cover:

- Releases Management
- Configuration Management
- Security Management



Indra Mova Collect

End-to-end solution for Ticketing projects

Station Devices

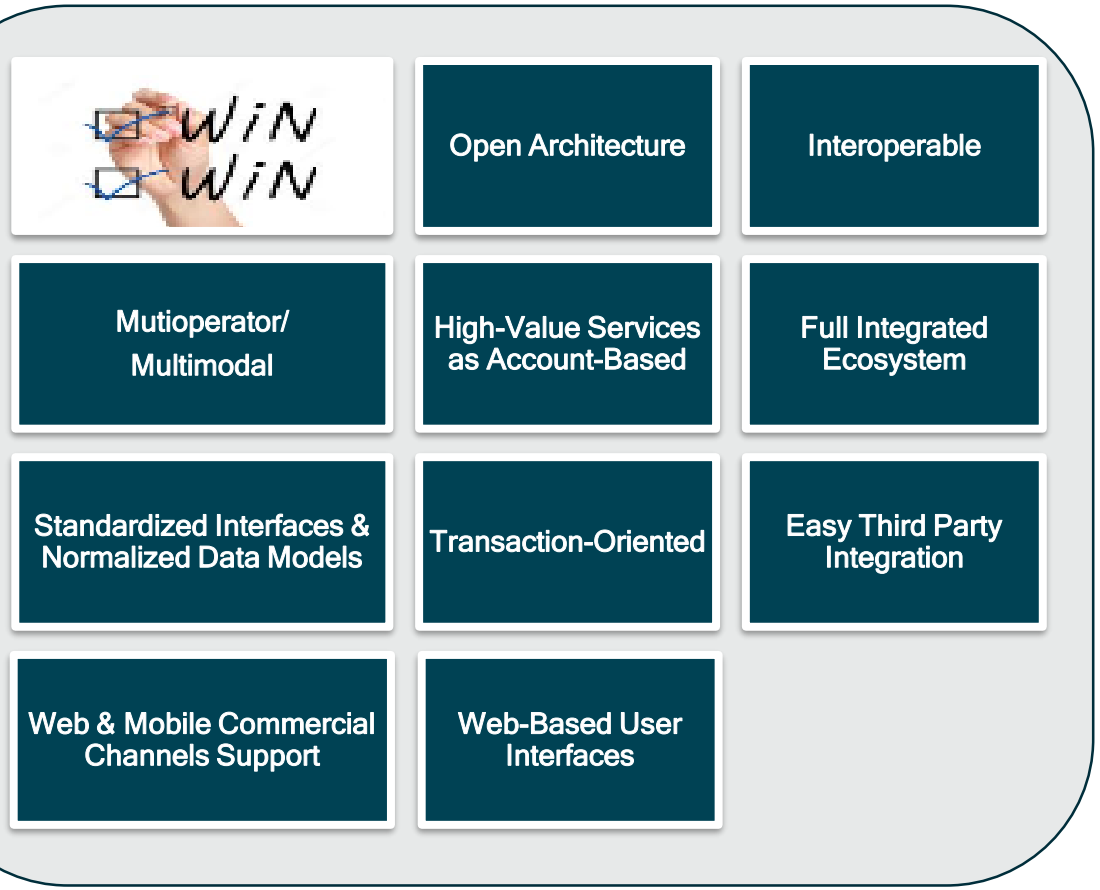
On-board Devices

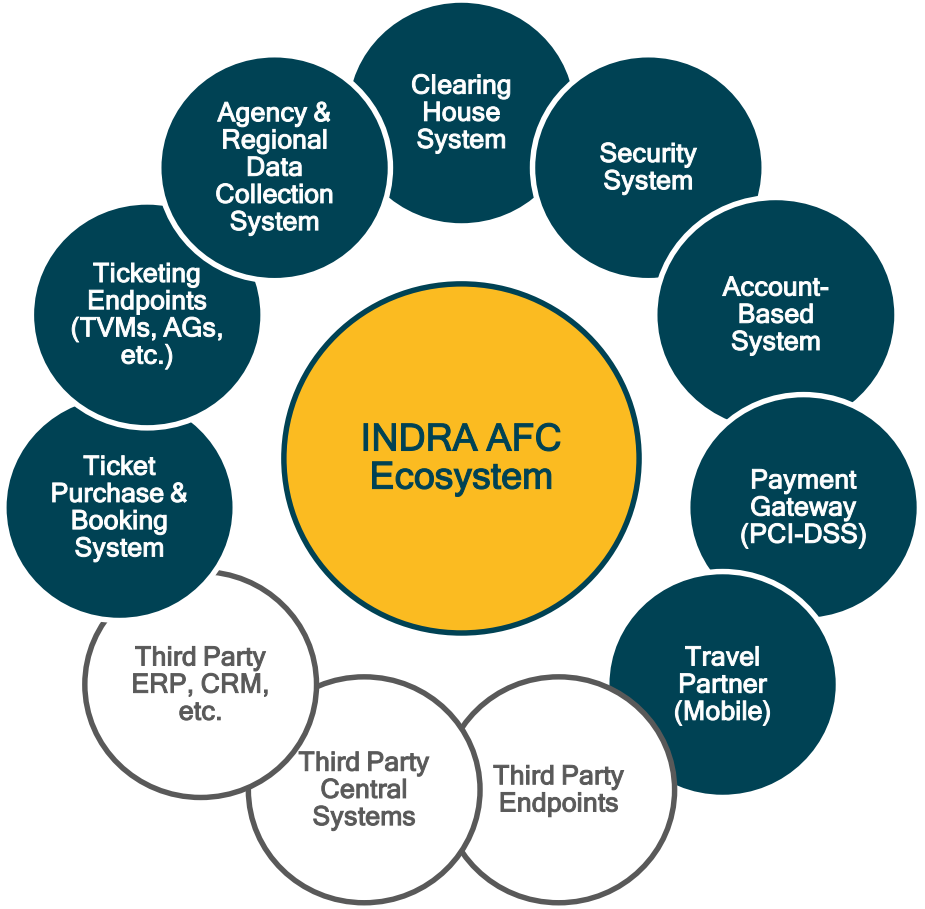
Travel Partner

Back-office

Online Sales and Booking System

AFC Ecosystem powered by Indra

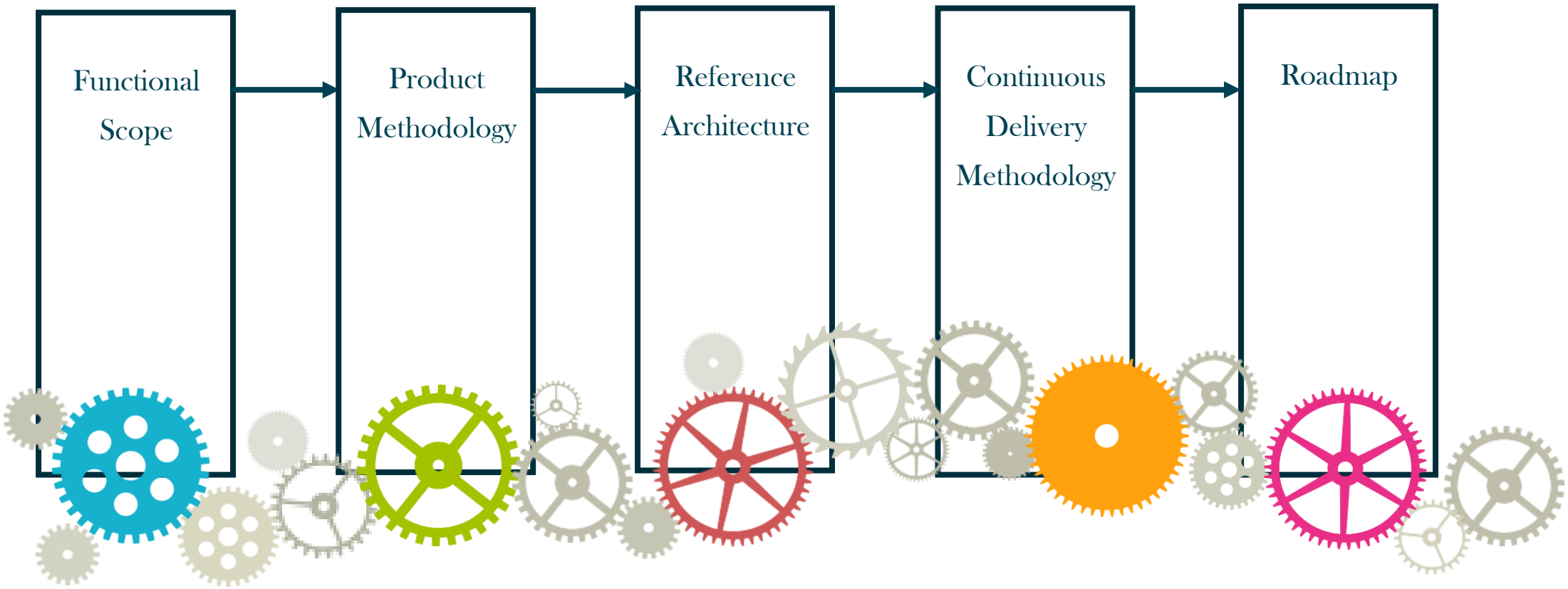




Indra's Ticketing solution key points

- Compliance with the ISO-24014 standard "Public Transport - Interoperable Fare Management System"
- Data model based on Transmodel
- NeTEx standard for distributing fare tables and topology
- Open Architecture to cover the main requirements of an interoperable System:
  - ❑ Interoperable: Multi-operator/Multi-modal
  - ❑ Modular
  - ❑ Multi-client
  - ❑ Scalable (Architecture based on Microservices)
  - ❑ Expandable

Ticketing solution based on the following pillars



New Transit Paradigms

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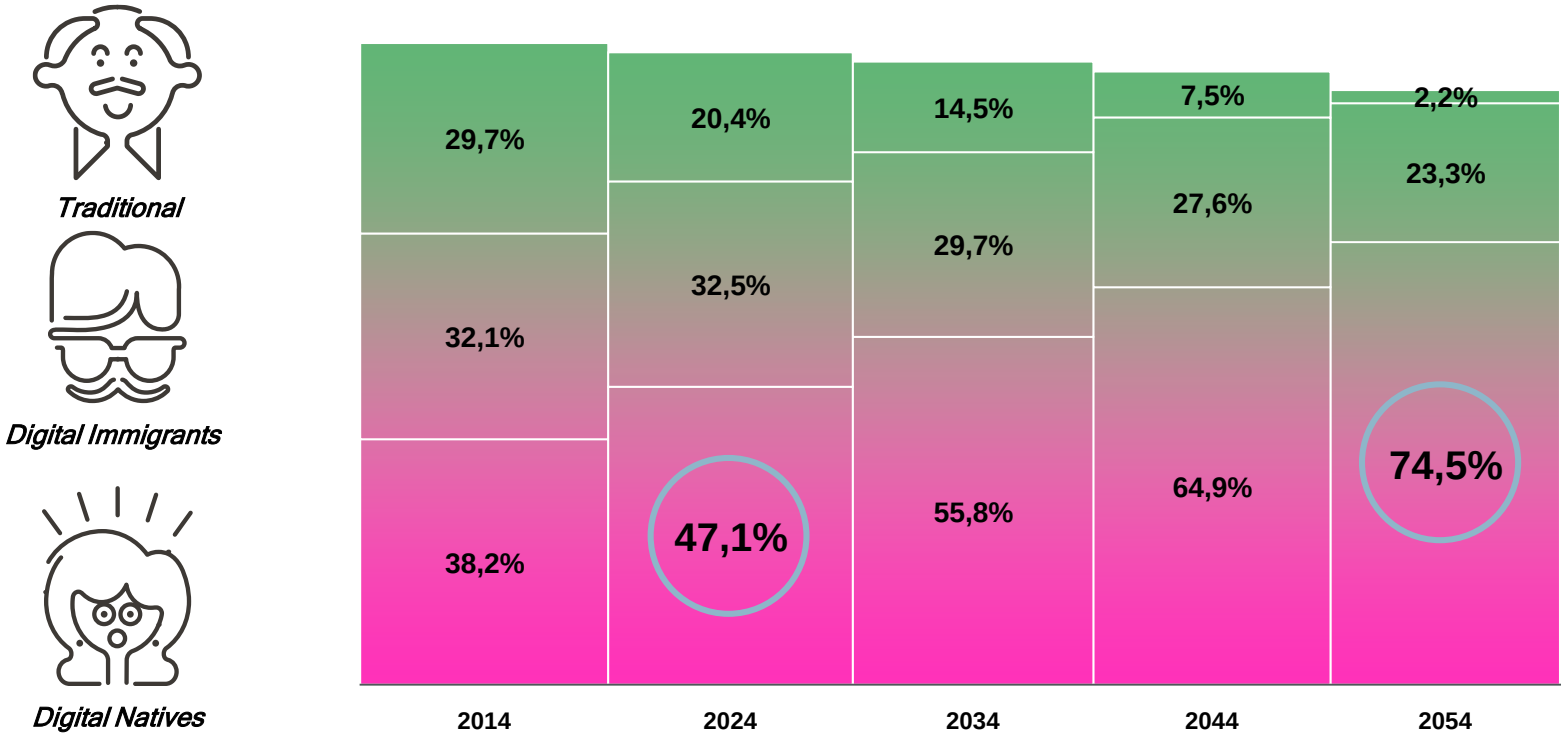
Focus on our customers

Our customers are Digital Natives

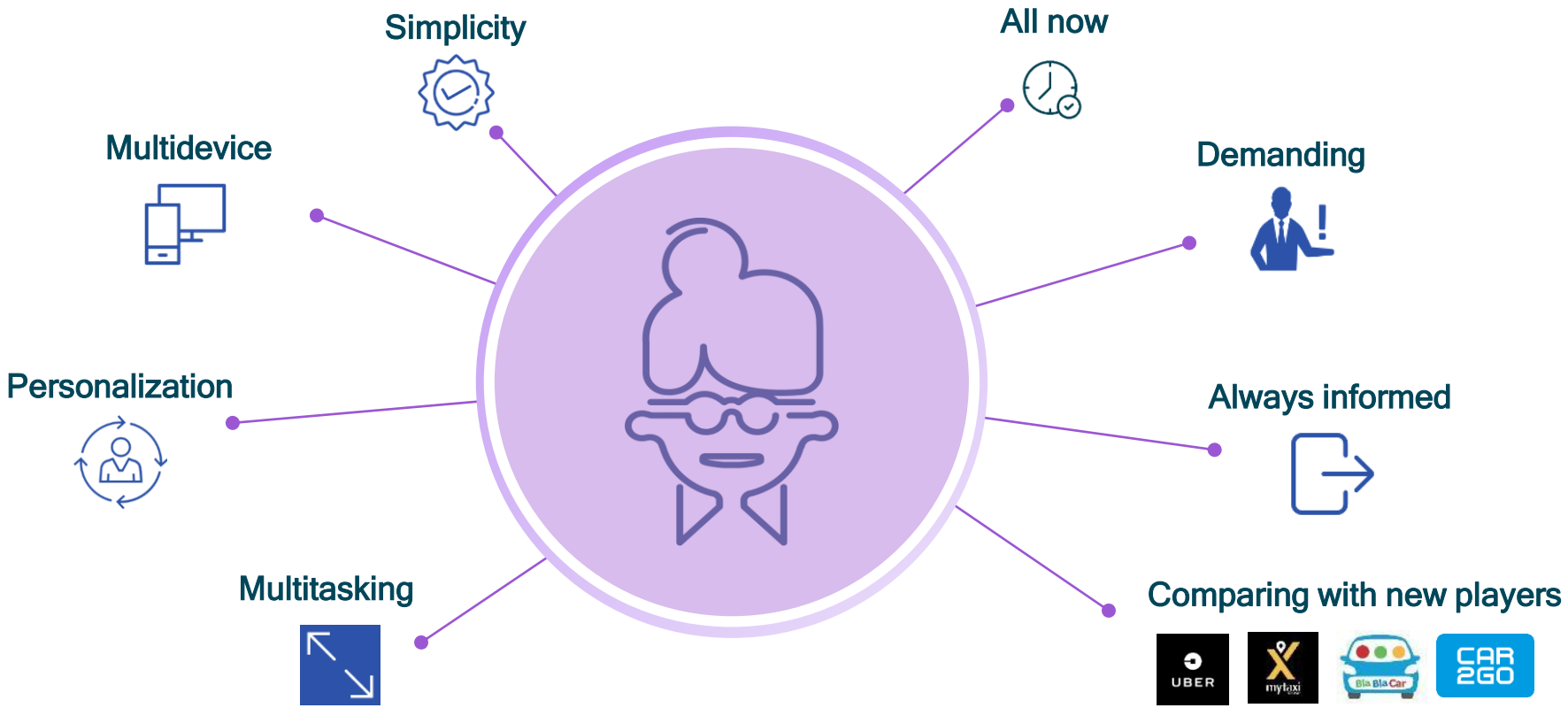
In 4 years time, almost half of the population will be Digital Natives



Source: Euromonitor

Customer Experience

Traveller in the digital era, new habits and needs



Customer Experience

Main friction points of the digital traveller

- Flexibility in the payment methods
- Lack of personalization
- Multimodal journeys calculation
- Added-value services
- Lack of real-time information
- Occupancy and comfort levels

Metro de Madrid, we have a problem: astronaut Pedro Duque also complains about the transport card

Pedro Duque
@astro_duque

Metro of Madrid @metro_madrid: - I have the red card - I have put enough money - I try to enter the airport and the machine tells me that I have to put money again for the supplement? You don't like the other money I put in? What joke is this?

4:15 pm 2018 · Twitter for iPhone

1.5 thousand Retweets **3.2 thousand** I like

Pay as you go with an EMV system

Mains concepts

Access with your own card bank

Multi-brand

Highest security Standards

Online and Offline Validation

Universal access to transport

Tourism

First use validation risk

Fraud and Debt management

Coexist with traditional travel supports

Calculation of the best rate and post-payment

Account-based systems

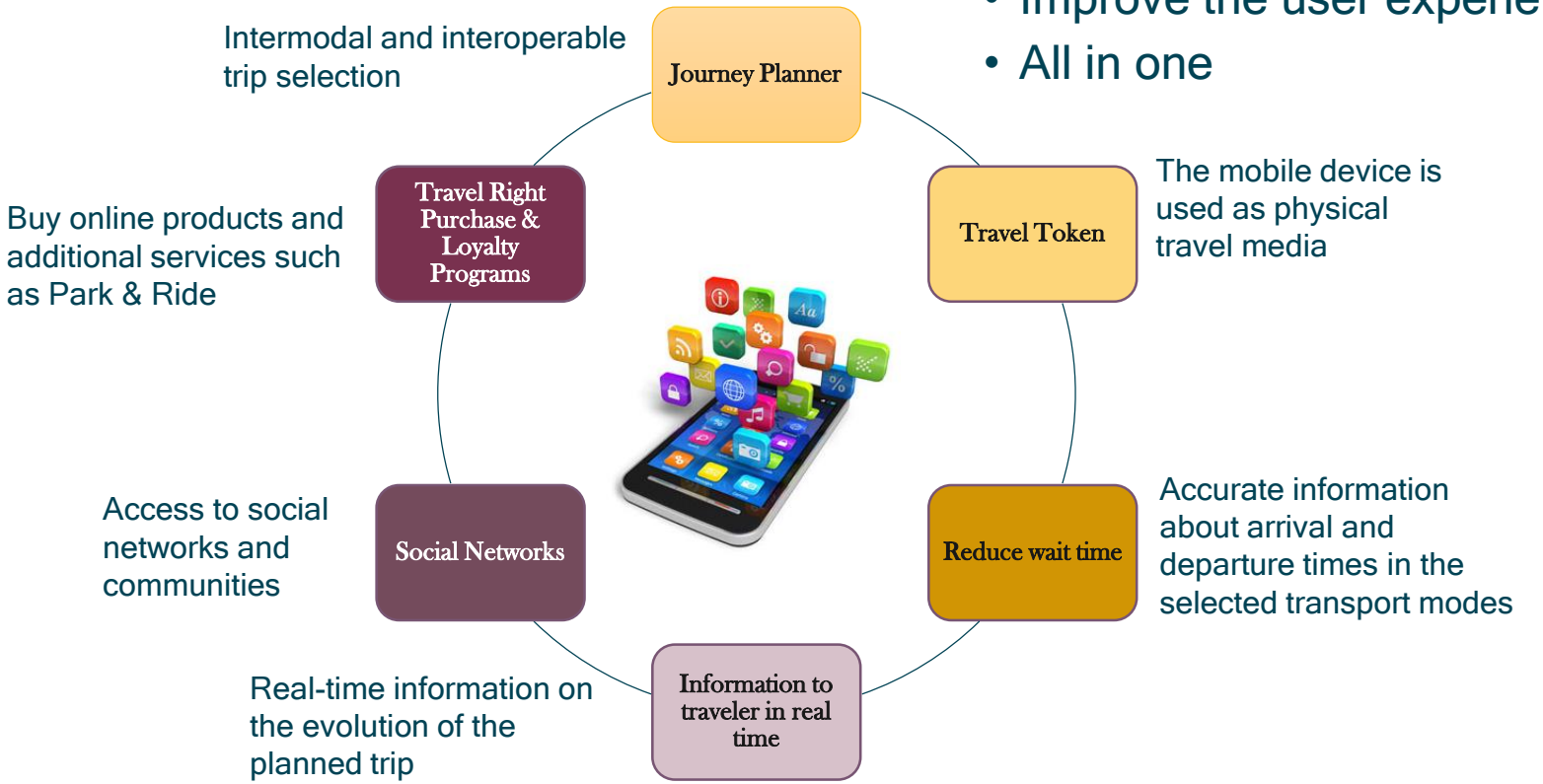
Main features and benefits

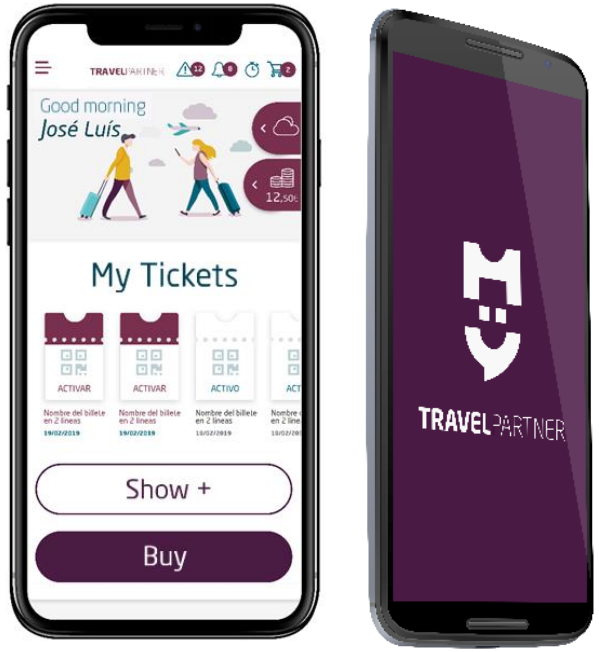
- Calculation of the most cost-effective fare for the passenger at back office.
- Single account with multiple travel tokens (smartcards, bank cards, etc.).
- Multiple account types support (single account, families, institutions, etc.).
- Customizable user-friendly website for online account management.
- Validation rules implemented in back office for full flexibility and scalability.
- Multiple capping options (single day, weekly, monthly, etc.).
- Integration with multiple transit modes (Park&Ride, taxi, tolling, bikes, etc.).
- Post-billing via bank account and/or financial card.
- Loyalty programs and added-value services such as volume discounts.
- Access to institutions to create new transport cards using a secure identifier

Bring your Own Device - Travel Partner

Single point of contact with the traveller

- Multi-channel Solution
- Improve the user experience
- All in one





Shopping, tracking, and tapping (NFC & QR)

Travel Partner

New horizons

Business Analytics, Machine Learning and Big Data

Business Analytics at three levels:

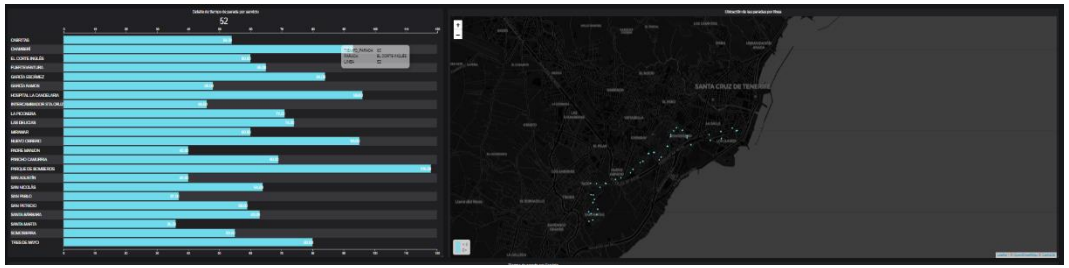
1. **Descriptive** Analysis
   Use data aggregation and data mining to provide insight into the past and answer: **"What has happened?"**
2. **Predictive** Analysis
   Use statistical models and forecasts techniques to understand the future and answer: **"What could happen?"**
3. **Prescriptive** Analysis
   Use optimization and simulation algorithms to advice on possible outcomes and answer: **"What should we do?"**

TRANSFORMING TRANSPORT

Shift2Rail CONNECTIVE

Use Cases

- Passengers flow in large & high capacity stations
- Passengers Demand previsions
- Predictive and Prescriptive Ticketing Assets Maintenance
- What-if scenario analysis to make smarter decisions
- Smart Stations – Station 4.0



Be-in/Be-out

Access without barriers

BLE- Bluetooth Low Energy

- Access without traveller interaction
- Mobile and barrier communicate directly via Bluetooth
- Reduced hardware requirement
- Low energy consumption

Be-in/Be-out

Next Steps

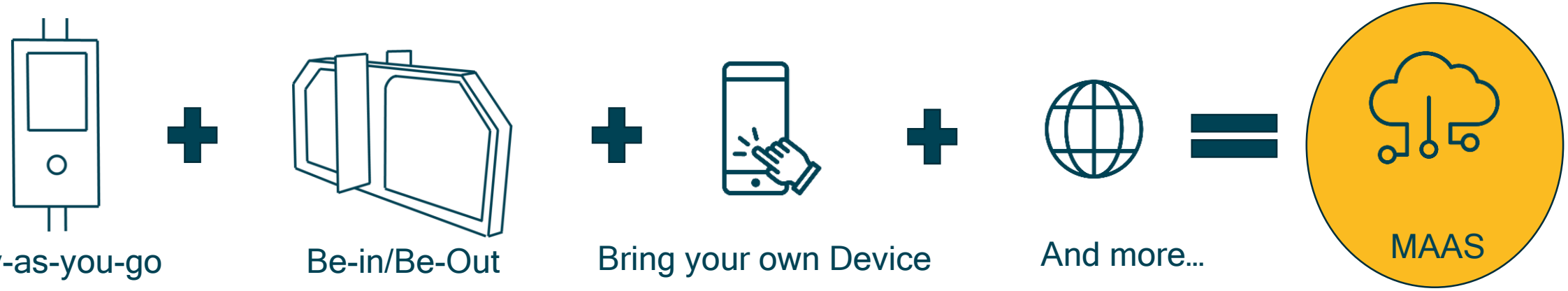
Biometric recognition

- Barrier-free steps that identify users through their biometric features. The token is your face.
- Simplification of validation equipment and greater convenience for users

Technology Evolution

The transportation sector is undergoing a major transformation in recent times, thanks to the incorporation of new technologies such as mobile devices, NFC, QR or EMV.

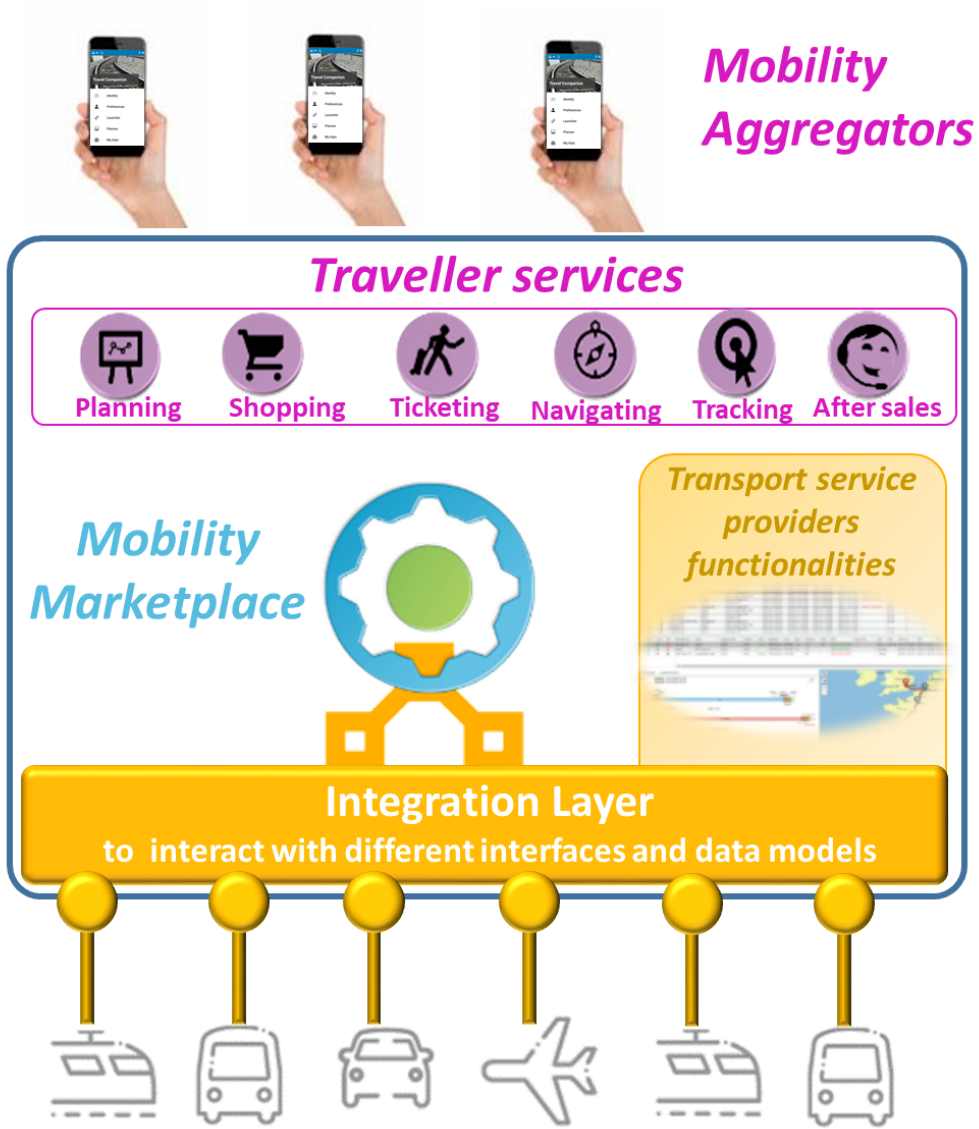
This is allowing new paradigms to emerge that converge into a final one. :



Mobility Marketplace

Providers must be able to “publish” their services in mobility marketplaces to compete with the rest of the providers, ensuring that the traveller can have the most complete information to solve their mobility needs.

Great experience as partner of the Shift2Rail projects Connective and MaaSive.



Augmented Reality

Use of new technologies for business processes

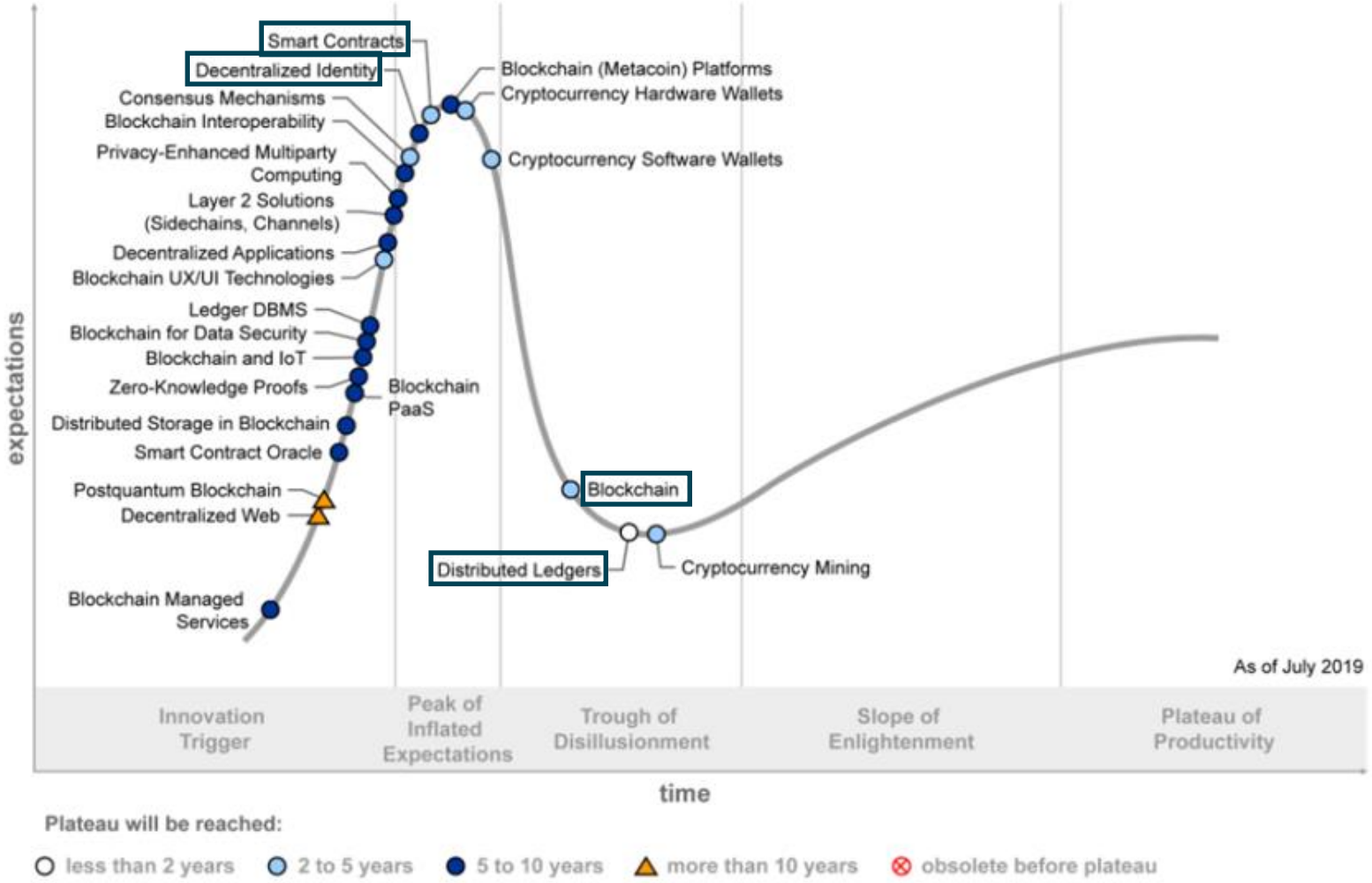
Interaction with AFC devices for maintenance tasks

- Augmented reality techniques overlaps information provided by the system to the physical world (maintenance manuals, alarms)
- Applicable for training and maintenance tasks (i.e. TVM with a paper jam)

Blockchain in transportation

Technology for the present and the future

- Distributed ledger: Inalterable record of the sales and validations processed by the operators. Used for clearing and settlement processes.
- Security: Tickets issued and controlled through blockchain to reduce fraud.
- Smart Contracts: Agreements between operators and authorities. Common business rules for interoperable systems.
- Digital Identity: Single token for travelling.



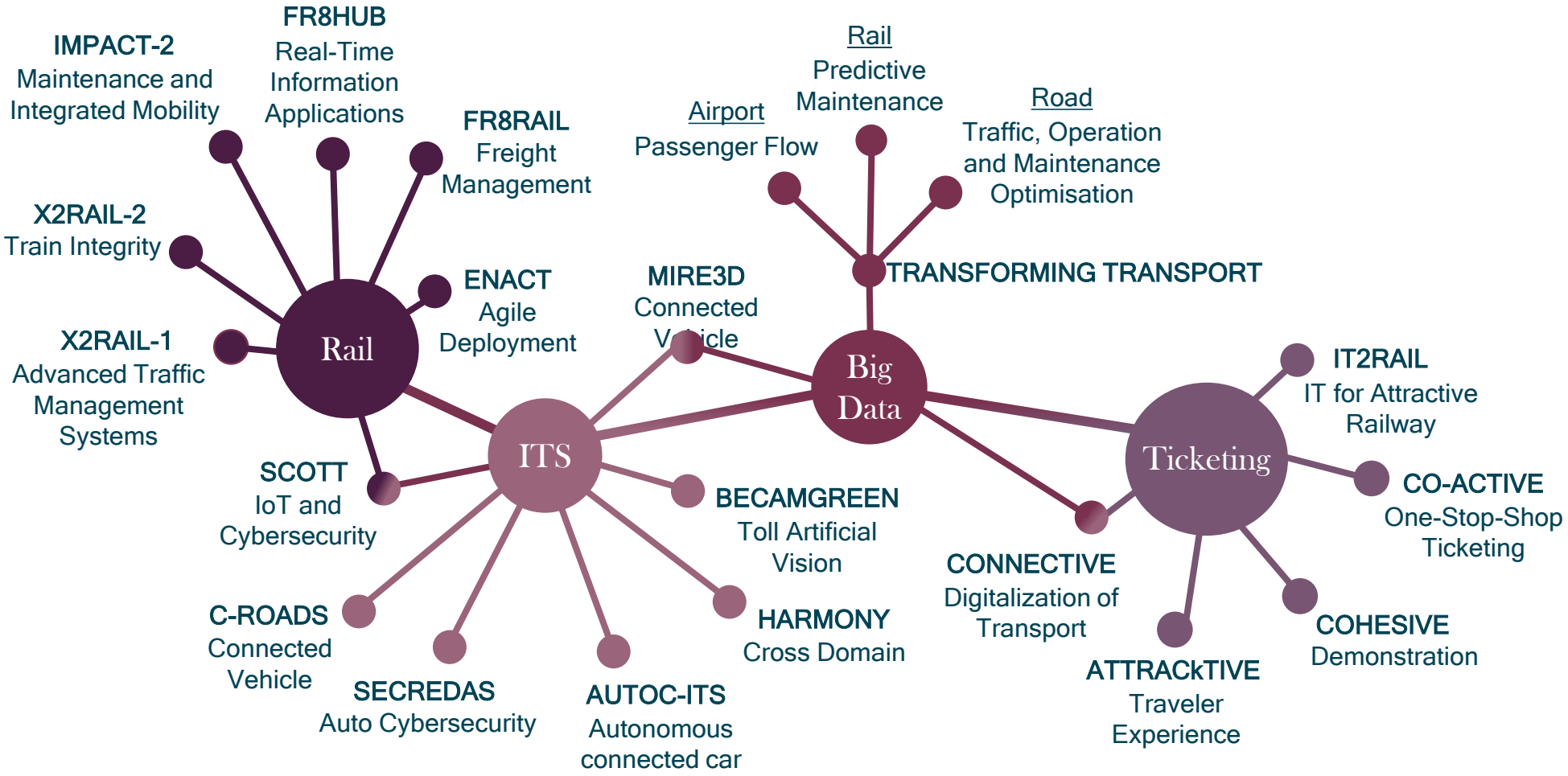
Source: Gartner (October 2019)

Innovation at Indra

Mapping the way to the future of mobility

4

We lead 18 R & D projects of the major European programs



Innovation is in our DNA

Associated Member since December 2015
Governing Board member since February 2016
Projects in IP2, IP4, IP5, cross cutting activities

Associated Member since December 2015
Governing Board member since February 2016

Steering Board member.
Projects with European and Ministry funding

Indra is a member of the Big Data Value Association (BDVA), that leads the European research in the field of big data and defines the strategic research and innovation agenda in this field

Involved in projects within other European programs:

We are at the head of the major European programs and working groups

Present in the great programs

Indra in Shift2Rail

IP4 – IT Solutions for Attractive Railway Services

1. Interoperability Framework: facilitate multimodal travel in a highly diverse environment and with many transport modes
2. Travel Shopping: provide a comprehensive shopping application enabler which combines all modes of transport
3. Booking & Ticketing: Provide booking and ticketing functionalities integrating multiple modes of transport
4. Trip-tracker: give travellers in-trip assistance when navigating transport nodes
5. Travel Companion: Provide mobile application for travelers that allows information and functions Shift2Rail, including search for travel options, booking, ticketing and tracking of incidents
6. Business Analytics: Enrich ecosystem with analytical capacity
7. Integration and Demonstration: Integrate/demonstrate the rest of TDs

- Leads **Interoperability** Framework
- Cloud services for bid generation services
- Orchestrator of **ticketing and issuing** services among multiple operators
- **Compensation solution and web portal** for agreements between operators
- Urban planner integrating park& ride
- Notification of events that might affect the itinerary
- Creation of a Virtual User Wallet in the Cloud, storing traveler information, preferences, trips, tickets, etc.
- Development of modules and functionalities for the user's app
- Business analytics: processing and generation of indicators and dashboards

IT2Rail

Shift2Rail ATTRACkTIVE

Shift2Rail Co-Active

Shift2Rail CONNECTIVE

COHESIVE

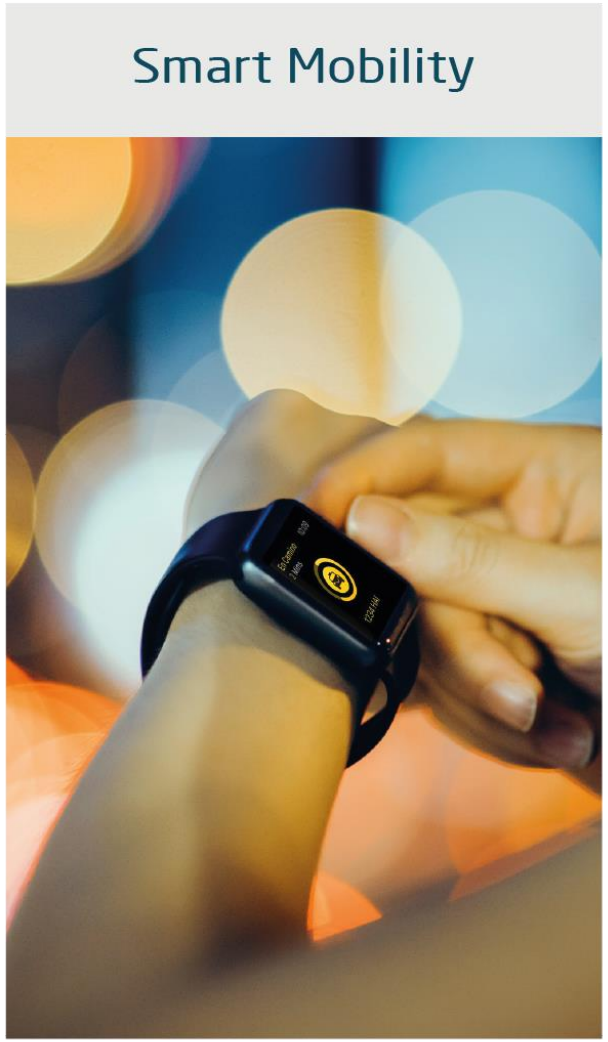
Complementary in other programs

HARMONY

Trends

Development of the four major trends that are transforming the sector, and that are driving new mobility solutions for the future.

- Virtual Me (User - Focused)
- Integrate, Share & Collaborate
- Security & Sustainability
- Person / Machine Collaboration



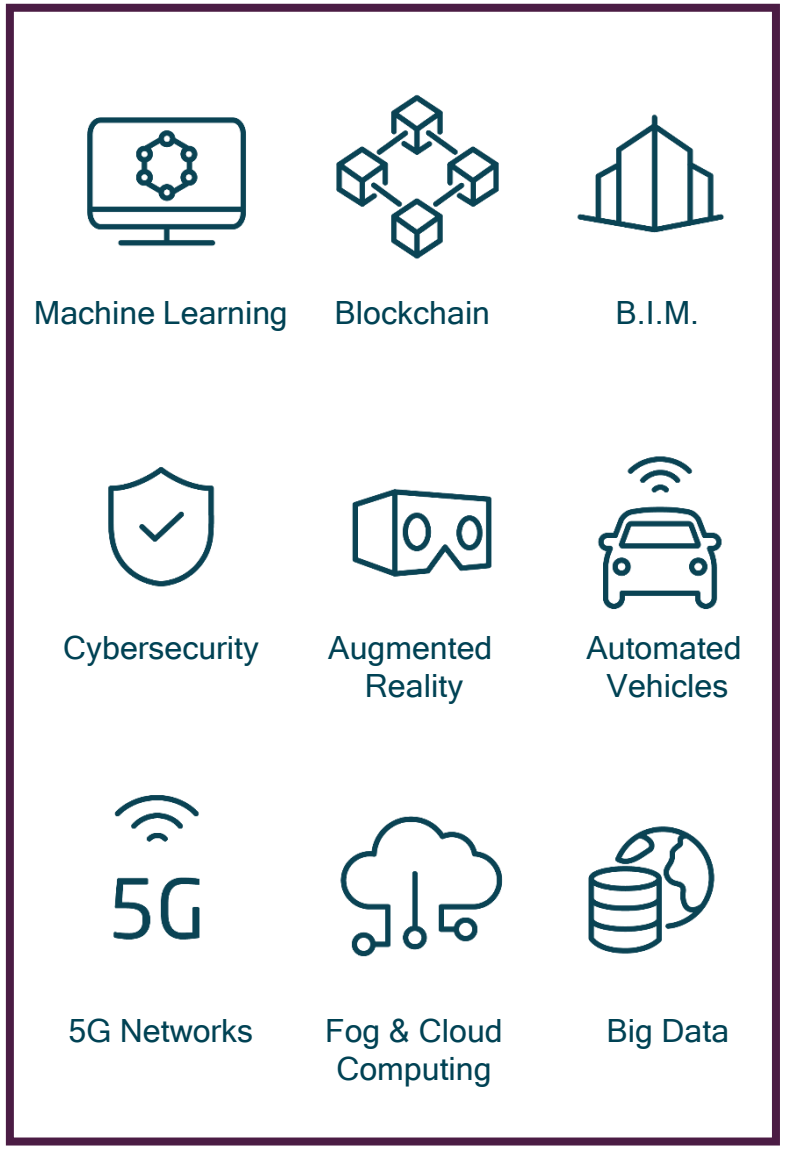
https://www.indracompany.com/en/ittreport2018

Technologies

Main disruptive innovations that shape the new mobility scenarios. We are just considering non-consolidated technologies, those which have high potential for transforming the industry.

Within this Report, we explain each technology with the scenario where it can have a higher impact.

https://www.indracompany.com/en/ittreport2018



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in Indra

January 2020

Thank you!

Come visit us at Booth A40