EMBERS

A NEW SMART CITY MOBILITY ECOSYSTEM

# DRIVE SHARP WITH EMBERS

EMBERS OVERVIEW

EMBERS, a Mobility Backend as a Service (commonly referred to as MBaaS), is a robust smart city mobility platform, structured in microservices and deployable in a cloud-based infrastructure, that can be quickly provided for a particular region, to integrate, harmonise and process the existing mobility datasets (e.g., traffic flows, parking occupancy, public transportation schedules, vehicle positioning). On top of this information, third-party developers can leverage open APIs for services such as multimodal routing or complex event processing, while decision makers obtain insights into operational performance. With EMBERS as a piece of a smart city's architecture, not only can city service providers optimise their operational efficiency (through the business intelligence reports and the efficient routing service), but the local ecosystem of application developers can also become engaged into solving the urban mobility challenges of their regions.

EMBERS has been proven through the project of the same name that was financed 2015-2018 through the European Commission's Horizon 2020 programme. The project demonstrated that EMBERS could meet concrete urban mobility challenges posed by real cities. The cities of Porto (Portugal), Cologne (Germany) and Trikala (Greece), proposed challenges in areas spanning parking and bicycle mobility, and three small-to-medium-sized enterprises developed innovative prototype combinations of mobile and web applications that use EMBERS to access mobility data provided by the cities and city service providers in order to meet these challenges. These demonstrators were tested in real-life situations to the readiness of the backend for the market.
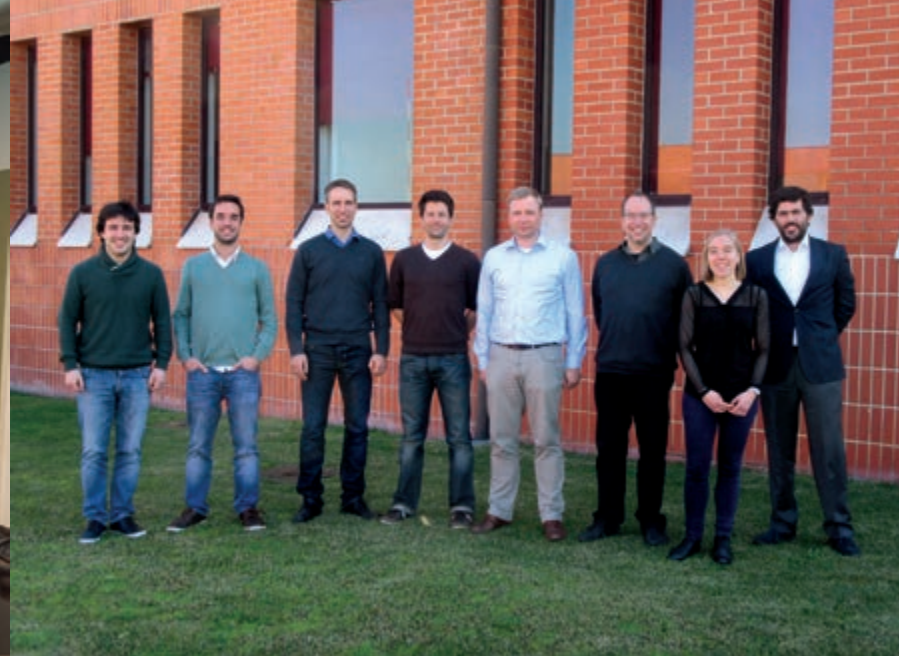
HISTORY

In 2014, collaborators from both industry and research came together at the conference of the European Commission's FIRE initiative, and started to discuss existing mobility challenges that cities were facing, the reasons behind the lack of initiatives undertaken in the area of Smart Mobility, as well as the kind of road blocks that had contributed to that. It became clear that municipalities did have data about their infrastructure and mobility, but simply did not have the right tool to leverage data sources. The typical challenges that cities are confronted with affect the data access and interoperability, facing data silos and vendor lock-in, sometimes together with the lack of technical means to engage developers and startups to create a smart mobility ecosystem of applications. As discussions continued, Ubiwhere, a software development SME from Portugal, emerged with a potential solution for these problems: an interoperable cloud platform aggregating mobility data from multiple sources and making it available for decision-makers, software developers and citizens, the MBaaS. Despite a (modest) number of pilots in Portugal running this solution, the MBaaS would still require the help of core partners for experimentation and validation before reaching the Smart Mobility market. The EMBERS idea was born, and UPMC, now Sorbonne Université, put together a consortium to tackle this challenge, associating key partners Inria Grenoble, Fraunhofer FOKUS, and TU Berlin.

PLATFORM OVERVIEW

EMBERS is a web platform focused on the urban mobility domain (i.e. parking, traffic, public transportation, logistics, routing, pollution, reporting). With one of its foundations being interoperability, EMBERS is capable of integrating IoT devices and information systems, in compliance with Open Standards (NGSI, oneM2M, LwM2M), Protocols (HTTP, CoAP, MQTT) and Harmonised Data Models, making the data and services available through standardized open interfaces for third-party applications.

ROADMAP

KICK-OFF
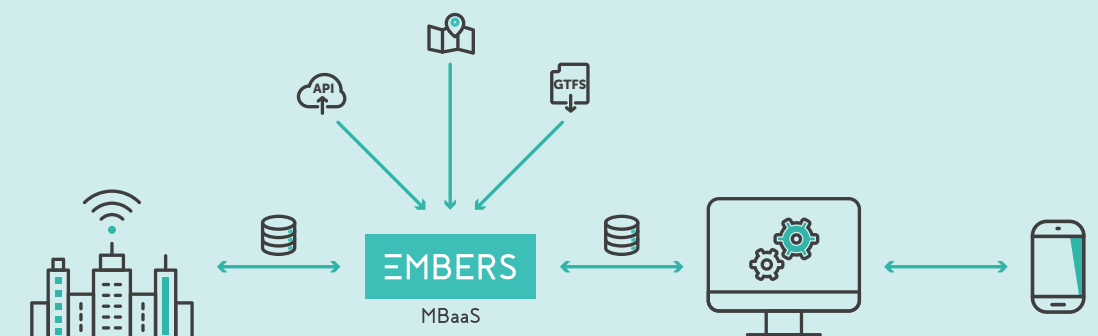
PILOTS & TRIALS
Pilots & Trials is distribution mechanism akin to a freemium model and allowed us to gather early requirements and establish the viability, desirability and feasibility of the solutions. EMBERS provided municipalities, communities of end-users, transportation providers and application developers access to its platform in order to receive first-hand feedback. All this valuable input allowed us to assess technical and business model risks at a manageable scale.

JUNCTION HACKATHON
EMBERS challenged developers to build innovative applications by using its APIs at Junction Hackathon - a converging point for over a thousand developers, designers, and entrepreneurs from around the world, where one of the solutions even won the Junction Grant Prize of 2000€.

OPEN CALL:
EMBERS organized an Open Call for finding three highly motivated and competent SMEs to develop a minimum of three demonstrations of applications that make use of EMBERS in order to solve specific urban mobility challenges posed by the cities of Porto in Portugal, Cologne in Germany and Trikala in Greece.

APP CHALLENGE @ HACKACITY:
EMBERS participated in Hackacity, a 24-hour hackathon that promotes the usage of innovative technology to develop solutions based on open data and open standards to address mobility challenges. EMBERS challenged participants with actual requests provided by smart cities actively willing to solve major problems related to mobility in their urban areas.

PROTOTYPE SOLUTIONS
After having tested the developed solution in real-life situations, Porto, Cologne and Trikala have now working prototype solutions and are now able to integrate them in their services' portfolio, evaluate the added-value to their citizens and also eventually extend the solutions' functionalities.

CITIES, CHALLENGES, SOLUTIONS
AND SOLUTION PROVIDERS

DRIVING SHARP THROUGH CITY CHALLENGES!
See how cities are solving challenges with us turning problems into challenges

PORTO & PORTO DIGITAL

The smart and digital city strategy and policies date back to 2004, when the Municipality of Porto created the Porto Digital Association, a private non-profit association, aiming at creating and promoting ICT projects within the context of the city.

In 2014, the municipality proposed a broader and more ambitious strategy. This new strategy aims at developing citizen driven services with high impact in increasing the city attractiveness for entrepreneurs, reducing social exclusion and increasing the city sustainability. The municipality strong commitment in this new strategy and the results already achieved are being fundamental to attract new players from the ecosystem.

Porto aims at becoming a true living lab, a catalyst of innovation, which works in a close cooperation with the academia, along with reference entrepreneurs from Porto's vibrant innovative businesses ecosystem.

The main priorities are to use ICT, sensing, communications and data to improve municipal services and urban processes; combine data on the municipal level (across all departments) and subsidiary institutions to enhance transparency and efficiency; invest into organizational development in order to better manage a smart and digital city across the responsible units; and to use an intelligent and integrated approach to create entrepreneurship and ICT focused companies.

BITMAKER

Bitmaker was founded in 2012, holds around 20 employees, and is specialized in the conception and implementation of complex software systems. Bitmaker also serves clients from different industries and domains by developing customer-based solutions. As a small- and medium-sized custom software company, Bitmaker proved to have vast experiences in the development of mobile solutions, and therefore had all the expertise to set up the software development process for this particular challenge. The development team consisted of software architects, software engineers, product owners, as well as UX/UI specialists. The mix of these key individuals with relevant competences ensured a successful outcome of the project.

SMART PARKING SOLUTION

Several times considered Best Touristic Destination, the city of Porto has experience on what is called "Smart City" technologies and is very ambitious to improve the situation around their parking spaces, to give users the most seamless way of using their available parking spaces, and to simply provide better services for its citizens. Considering its fast growth and aspiration for a better traffic management, Smart Parking is the challenge to be solved in the Portuguese city. Bitmaker took on the challenge and developed a solution that not only gives a better overview on parking spaces available throughout the city, but ultimately improves the driver's experience and city traffic.
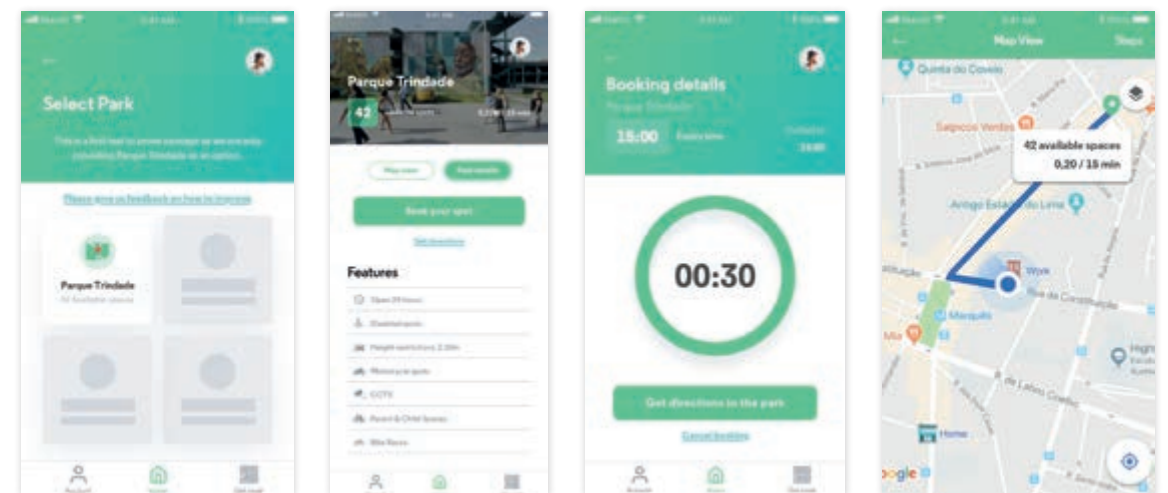
MOBILE APP

COLOGNE

Situated on the banks of the river Rhine, Cologne is the fourth largest city in Germany and home to key players in business and industry. As a 2,000-year-old city spanning along the river, Cologne does not fall short on landmarks of its history, for example its wonderful architecture set amid reconstructed old town or, of course, the twin-spired Cologne Cathedral which is known for its gilded medieval reliquary and sweeping river views. An exciting contrast to this is posed by the ultramodern Rheinauhafen riverfront complex or the Rhine Boulevard, which allows sweeping river views. As it hosts a population of about 1 million inhabitants, the city is committed to the European Union's goal of achieving reduction in greenhouse gas emissions, an increase in the share of renewable energy and an increase in energy efficiency. Cologne is active in collaborating with research and industry with a focus on sustainable mobility and ensuring an integrated infrastructure as the city expands.

BIKE CITIZENS

Bike Citizens was founded 2011 in Graz by former bike messengers Daniel Kofler and Andreas Stückl and currently has a second office located in Berlin. The aim of Bike Citizens is to make urban cycling more attractive in order to contribute to the improvement of the quality of life in cities. In order to reach this goal, Bike Citizens develops products that offer urban cyclists a platform for information and exchange. Together with cities, companies and organisations, Bike Citizens works on software solutions and communication and marketing concepts to promote cycling.

SMART BICYCLE TRAFFIC SOLUTION

Known as the fourth largest city of Germany and Carnival's capital, promoting new means of transport is a main priority for Cologne's local authorities. A strong focus lies on integrating new technologies into efforts to improve bicycle traffic and the experience for local cyclists. The city therefore wanted an innovative mobility solution that promotes city center cycling and allows to share and report encountered road hazards with the cycling community and the city. This results in improved route navigation and visualization of key insights on the bicycle traffic on a map that supports city representatives in developing new bicycle concepts. Bike Citizens enhanced their existing mobile and web solutions with new features built upon EMBERS which now provides great cycling experience for Cologne's citizens.

WEB DASHBOARD

MOBILE APP

TRIKALA

Trikala is a typical medium-sized European city and the capital of the Trikala region, located in the center of the mainland of Greece. Trikala is one of the oldest cities in Europe with a long history that goes back in 3,000 BC, while today it hosts a population of about 81,000 inhabitants. The municipality of Trikala governs the city and follows an approach that combines innovation and culture, with a respect to the local history and the implementation of numerous smart solutions for its residents and visitors that makes it a famous smart city. Moreover, Trikala is friendly and offers special local flavors and spirits of high quality (i.e., feta cheese and pies, wine and tsipouro accordingly), while it makes citizens and visitors happy and encourages them to explore the city with bicycles and boats in Litheos river or walk in its open spaces and museums.

GRIDNET

GridNet is an IT and Networking company that builds cutting-edge technology solutions in the fields of wireless communications, software-defined networking, sensor networks and energy management.GridNet offers a comprehensive portfolio of software and hardware solutions in the IT industry. Their product range comprises of Custom Made Solutions for Communication and Management, Web-based Systems, Sensor Platforms, PCB Design and Development with the usage of open source microcontrollers, web applications, cloud computing applications, software-defined networks and so on.

PARKING ANALYTICS SOLUTION

Don't let its size fool you, this Greek city - one of the oldest in Europe, with a history that goes back to 3,000 BC - has been several times shortlisted by the Intelligent Community Forum as one of the top 21 smart cities in the world. Trikala has a strong focus on expanding their current offering on services for citizens using new technologies to improve their lives. In order to improve the parking situation in and around the city, the city wanted an innovative mobile solution that utilizes integrated parking data of their parking facilities to not only guide drivers to a chosen available parking space throughout the city, but also allow city representatives to extract relevant insights on the actual usage of available parking spaces in order to make strategic decisions in their urban planning. GridNet developed a mobile solution that uses real time information to provide the best parking service for Trikala's citizens and tourists.

WEB DASHBOARD

MOBILE APP

CONSORTIUM

EMBERS is brought to you by a reliable consortium of partners from research and industry who are fully aware of the importance of openness in smart city ecosystems.

SORBONNE UNIVERSITÉ

Sorbonne Université (SU) is one of France's foremost public research universities. Prominent among the 125 laboratories of its Faculty of Science is the LIP6 computer science laboratory at SU's Pierre et Marie Curie campus in Paris. LIP6 faculty member Timur Friedman has been active in leading projects from the European Commission's FP6 multi-year research and innovation funding program, through FP7, and into the current H2020. These projects have focused on experimental platforms for information and communication technology research and development, smart cities, and, most recently, cloud computing.

TIMUR FRIEDMAN
Timur Friedman leads EMBERS. Lecturer at UPMC, president of the PlanetLab Europe testbed, his PhD in computer science is from UMass Amherst, MS in technology management from Stevens Tech, and BA from Harvard.

Timur and his team initiated and coordinated the EMBERS project in order to advance the mobility platform, and to pilot EMBERS in real cities solving real mobility challenges. In addition to managing the financial, administrative, and legal aspects of the project, SU led the open call, partnering with the cities of Cologne, Porto, and Trikala to define their challenges, and contracting with SMEs Bike Citizens, Bitmaker, and Gridnet to produce demonstrators that showcase the capabilities of EMBERS' backend for solving these challenges. Dr. Friedman's team at SU remains on the lookout for new opportunities to offer its expertise, network, and managerial competencies to help develop new technologies and to accompany smart city pilots.

UBIWHERE

Ubiwhere (UW) wants to be an international reference in smart cities and Future Internet. This vision led to an investment in the smart cities and IoT sector – Together with other two Portuguese companies, they had founded Citibrain as a joint venture in order to launch, sell and implement smart cities solutions to improve mobility and environment of the urban environment. Today, the Citibrain brand not only is fully owned by Ubiwhere but also includes in its portfolio the MBaaS, brought to market thanks to the EMBERS project.

RICARDO VITORINO
Ricardo is a project manager at Ubiwhere leading the technical team who works on the Smart Cities field, namely the Mobility solution exploited in EMBERS. He has been working in the field of Urban Mobility since 2010.

Ricardo and his team from Ubiwhere have a central role in EMBERS, as the leader of the development, improvement and validation (both technically and business-wise) of the Mobility Backend. As the owner of the product, Ubiwhere leveraged the experience of its partners to truly validate the solution while approaching the smart mobility market.

FRAUNHOFER FOKUS

Fraunhofer FOKUS, develops solutions for the communication infrastructure of the future. The research institute explores how information and communication will contribute to a more secure and convenient living. Fraunhofer FOKUS supports the identification and implementation of research and development projects, while promoting standards and technologies of communication infrastructures and platforms targeting different application domains.

THOMAS GÜNTHER
Thomas Günther is responsible for the coordination of events and evaluation of the EMBERS Mobility Backend throughout 3rd parties. He is working as Solutions Architect at Fraunhofer FOKUS and leads the international industry and research projects covering Industrial IoT and Smart City projects.

Thomas and his team provided OpenMTC as the reference implementation of a oneM2M compliant middleware, and implemented a load generator to emulate sensors with configurable patterns to run performance and scalability test against EMBERS. Fraunhofer FOKUS extended its network with forerunner cities and innovative mobility service providers, improved and extended the OpenMTC within the duration of the project. Furthermore OpenMTC was launched as open source software and has become a software component of the FIWARE catalog.

TECHNISCHE UNIVERSITÄT BERLIN

The Technische Universität Berlin (TUB) is one of the largest technical universities in Germany and member of TU9, a network of the leading Institutes of Technology in Germany. TUB has participated in many previous projects in the field related to testbed experimentation and federation.

ZAHOOR AHMED
Zahoor is one of the developers, responsible for experimentation and testing in EMBERS. He is a researcher at Technical University Berlin in the field of Industrial Internet of Things (IIoT) and currently pursuing his PhD.

Zahoor was responsible, on behalf of TUB, for the experimentation and testing of EMBERS, and in the course of that leveraged on tools and test facilities provided by other partners in order to design, execute and analyse different experiments on the North- and Southbound APIs of EMBERS.
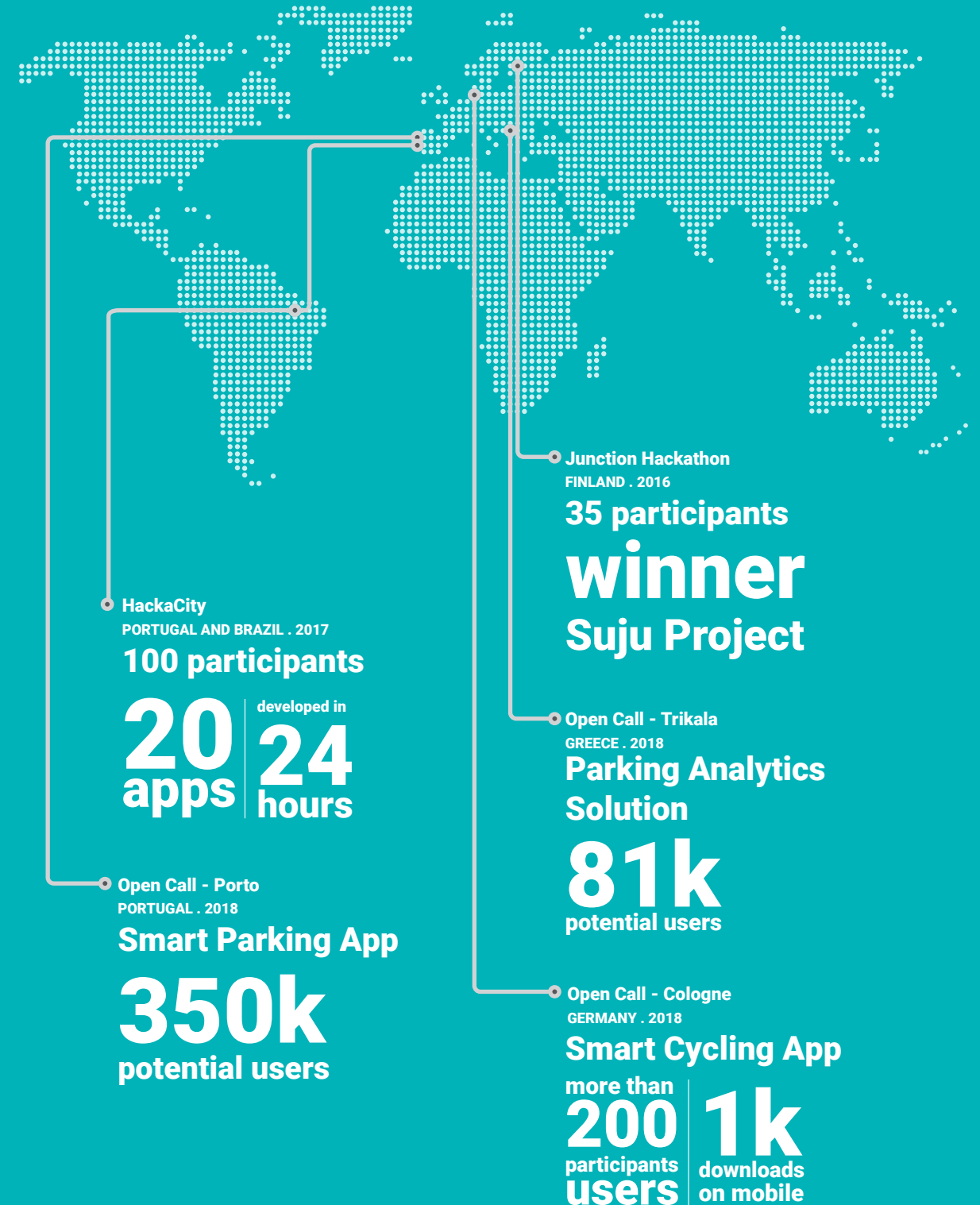
INRIA

Inria, the French research institute for computer science, promotes scientific excellence and technology transfer to maximise its impact. Its scope is to find a path for the future of Internet as a communication structure, as well as a computing infrastructure in the broad sense. Its researchers are interested in developing innovative communication protocols as much as in the modelling of existing networks, in order to achieve a better performance and needs' fulfillment.

FREDERIC SAINT-MARCEL
Frederic is a senior research engineer at INRIA. Since 2012, he is the technical leader of a research and innovation team focusing on Internet of Things and the research testbed named FIT IoT-LAB exploited for experimentation and testing in EMBERS.

Frédéric and his team were responsible of the experiment facility set-up. They provided FIT IoT-LAb testbed, a very large scale open testbed built to help foster the development, tuning and experimentation of protocols and applications for Internet of Things and wireless sensor networks. Also, INRIA delivered SDK tools to test scalability and performance of EMBERS broker implementation. In this way they have generated sensors values with IoT-LAB nodes (parking, light, temperature, among others) and support several IoT protocols (eg. CoAP, LwM2M, HTTP) to communicate with Southbound APIs of EMBERS middleware.

HackaCity
PORTUGAL AND BRAZIL . 2017
100 participants
20 apps
developed in
24 hours

Open Call - Porto
PORTUGAL . 2018
Smart Parking App
350k
potential users

Junction Hackathon
FINLAND . 2016
35 participants
winner
Suju Project

Open Call - Trikala
GREECE . 2018
Parking Analytics Solution
81k
potential users

Open Call - Cologne
GERMANY . 2018
Smart Cycling App
more than
200 participants users
1k
downloads on mobile

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