D2.3 – Initial GOEASY Synergies and ESG workshop report

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Table of Contents

1 Introduction

This document will provide an overview of the activities that have been conducted within *'Task 2.2: Synergies with on-going initiatives, technology roadmaps and the ESG'*, particularly focusing on the exploitation of past/ongoing European projects and a brief summary of the workshop that has been organized as part of the Task.

1.1 Scope

Within the GOEASY work package structure, Work Package 2 (Agile Requirements and Architecture Engineering) is responsible for specifying the system architecture design. Having completed the previous steps in WP2, i.e. an initial set of requirements (MS1), this deliverable defines the work carried out in order to fulfil the task *'Task 2.2: Synergies with on-going initiatives, technology roadmaps and the ESG'*, whose purpose is the continuous monitoring of state-of-the-art research, policy and commercial initiatives delivering tangible results, standards, regulations or lessons learned which are relevant for GOEASY development and further business exploitation.

The main purpose of the task within this period (M1-M13) has been the creation of the ESG, creating a network of partners and project for which GOEASY outcomes could be relevant and, on the other hand, whose opportunities could be exploited to improve the GOEASY platform.

Document sections are presented as follows.

- In Section 2 the initial synergies with past and ongoing European projects are described.
- Section 3 describes the methodology for finding and creating the ESG, with a report of the workshop [1]that has been organized.
- In Section 4 the list of ESG is presented, providing a more detailed overview of the exploitation plan of GOEASY.
- Finally, Section 5 provides the conclusions of the work.

1.2 Related documents

ID	Title	Reference	Version	Date
[RD.1]				

[1] In the following, the term Workshop will be also used to indicate telcos or physical meetings

2 Synergies with European Projects

This section will provide a short overview on some of the past/ongoing European projects experiences, focusing on how such experience have provided benefit to GOEASY or, on the other hand, might obtain benefits from it.

2.1 ALMANAC

2.1.1 Project Description Summary

The ALMANAC[2] project has developed a Smart City Platform which creates synergies between existing resources and services in the city for a more efficient and sustainable urban living.
The platform follows an integrated approach, enabling real-time data connection, management and sharing in a complex urban ecosystem with multiple and heterogeneous devices, systems and services.
Particularly, ALMANAC project has developed a service delivery platform with corresponding technology solutions that integrated Internet of Things (IoT) edge networks (termed capillary networks) with Telco's metro access networks thus enabling an integrated Smart City Information System for green and sustainable Smart City applications.
Such system collects, aggregates, and analyses real-time or near real- time data from heterogeneous sensors and actuators to support Smart City processes. The support to various Smart City applications has been given by leveraging on a communication network built associated dynamically by federating private and public networks
The Smart City Platform has been tested and evaluated in the City of Torino, providing solutions for waste and water management and for citizen engagement.

2.1.2 Exploitation

ALMANAC project has provided two main outcomes useful for GOEASY:

- Experience with a platform delivering and supporting Smart City applications "at large";
- A security framework scalable on such platform, supporting heterogenous scenario:
  With ALMANAC it is easy to configure which Federated Identity Managers (FIM) it trusts to authenticate users. This allows the entities operating on the platform to define their own users with their own FIM. But it also allows the platform to accept requests from users which are registered at another FIM from a federated entity. By the use of the Access Manager (AM) it is possible to have fine-grained access control for all interactions within the platform. In combination with the user attributes (user role, FIM ID, log in time, ...) the policies of the AM become quite a powerful feature, because the platform gets full control on whom it trusts how.

2.2 FANTASTIC

2.2.1 Project Description Summary

The FANTASTIC project[3] aims to develop key components in professional positioning and timing applications. Based on an innovative "field aware" antenna technology combined with a multi-frequency receiver, leveraging on Galileo-specific features, such as the Commercial Service, pilot channels and frequency diversity, it will substantially broaden the scope of professional GNSS applications, making them work in harsher conditions, where they cannot today. The fundamental aspect of the FANTASTIC solution is the system dependability, which include anti-spoofing capability. The exploitation of this feature has been thought in particular for the timing applications where the likelihood of a spoofing attack is higher and more detrimental.
The project investigates and implements different anti spoofing techniques including the OS-NMA, which is a distinguishing feature of Galileo.

2.2.2 Exploitation

FANTASTIC has provided a base for the threat analysis related to GNSS-spoofing.

[2] Reliable Smart Secure Internet Of Things For Smart Cities
[3] Field Aware Navigation and Timing Authentication Sensor for Timing Infrastructure and Centimeter level positioning. http://gnss-fantastic.eu/

The in-lab spoofing attacks generated in the frame of the FANTASTIC project helped in a better understanding of the GNSS receivers' vulnerabilities. The hardware and software framework and the test methodology can be also exploited in the frame of GOEASY in order to test projects developments with particular reference to GNSS spoofing threats.
Furthermore, FANTASTIC provided theoretical directions for the implementation of the algorithm based on the Galileo OS-NMA authentication service.

2.3 frontierCities

2.3.1 Project Description Summary

Project partner greenApes participated to several European Projects, with two specifically related to sustainable mobility, leveraging on FIWARE technologies:

- frontierCities – European Cities driving the Future Internet (FP7)[4] - this project allowed the greenApes platform to integrate third party apps for the detection of mobility actions of users in pilot European Cities (Florence and Essen);
- frontierCities2 - Another Level of Impact Accelerator (Horizon 2020)[5] – this project focused on the consolidation of the usage of FIWARE Enablers as well as the integration with additional third-party apps and supported the efforts of greenApes towards reaching a larger market.

2.3.2 Exploitation

Both projects, gave greenApes the opportunity to:

- Adopt FIWARE technology, in particular the Orion Context Broker, that represents an asset for its privacy-oriented features, especially in relation with the exchange of information in between services, but also towards public databases;
- Work on the validation of mobility actions via third party apps (e.g. carsharing services, health-oriented activity trackers). Such experience highlighted the need for a privacy-friendly tracker that could certify a variety of mobility behaviors, which then lead to the decision of developing ApesMobility in GOEASY;
- Mature an experience in engaging citizens for their sustainable mobility choices;
- Design and deploy solutions that create value also for municipalities and additional stakeholders (such as public transport companies).

2.4 BRAIN-IOT

2.4.1 Project Description Summary

The BRAIN-IoT (model-Based fRamework for dependable sensing and Actuation in INtelligent decentralized IoT systems) project focuses on complex scenarios, where actuation and control are cooperatively supported by populations of heterogeneous IoT systems. In such a complex context, many initiatives fall into the temptation of developing new IoT platforms, protocols, models or tools aiming to deliver the ultimate solution that will solve all the IoT challenges and become "the" reference IoT platform or standard. Instead, usually they result in the creation of "yet-another" IoT solution or standard.
BRAIN-IOT will establish the principle that future IoT applications should *never* be supported by a single, unique, irreplaceable IoT platform. Rather future IoT services should exist within a federated / evolving environment that not only leverages current Industry Standards, but it is also capable of adapting to embrace future unforeseen industry developments. BRAIN-IoT aims at demonstrating that the lack of a single IoT standard and platform, which is generally recognized as the most notable weakness of IoT, can be turned into a strength and a guarantee for market competitiveness and user protection – if the proper framework for IoT dynamism, security and privacy is in place.

[4] http://www.fi-frontiercities.eu/go-apes
[5] https://www.frontiercities2.com/fc2-mag-fitech-gallery/

2.4.2 Exploitation

BRAIN-IoT builds on model-based approaches and open industry standards and aims at supporting rapid development and deployment of applications and services in professional usage scenarios characterized by strict constraints in terms of dependability, safety, security and privacy.

The BRAIN-IoT vision is realized through seven Technical Objectives:

1. Enforce interoperability across heterogeneous IoT devices autonomously cooperating in complex tasks;
2. Enable dynamic smart autonomous behavior involving actuation in IoT scenarios;
3. Enable the emergence of highly dynamic federations of heterogeneous IoT platforms able to support secure and scalable operations for future IoT use cases;
4. Establish Authentication, Authorization and Accounting in dynamic, distributed IoT scenarios;
5. Provide solutions to embed privacy-awareness and privacy control features in IoT solutions;
6. Facilitate rapid model-based development and integration of interoperable IoT solutions supporting smart cooperative behavior;
7. Enable commissioning and reconfiguration of decentralized IoT-based applications

2.5 MONICA

2.5.1 Project Description Summary

MONICA[6] is a European project that focuses on security, noise prevention and managing streams of visitors to big events. It utilizes sensor technologies and wearable devices in order to create "participating systems" that are immediately linked to the visitors. The MONICA project demonstrates how cities can use IoT technologies to manage sound and security at large, open-air cultural and sporting events taking place in the city.

Based on several devices such as smart wristbands, video cameras, loudspeakers, mobile phones and smart glasses, MONICA offers a portfolio of applications for enhanced city services, demonstrated in six different European cities (i.e., Bonn, Copenhagen, Hamburg, Leeds, Turin and Lyon), involving more than 100,000 application users.

2.5.2 Exploitation

Because MONICA uses a smartphone app tailored to the specific event, the LBS services implemented in the GOEASY project could be brought as added values to visitors. By doing so:

- Visitors can get information about pollution level in the location where the event takes place;
- Visitors with similar interests can use GOEASY services to locate each other;
- GOEASY team utilize experiences gathered by MONICA team during the course of project implementation

2.6 MUV

2.6.1 Project Description Summary

MUV – Mobility Urban Values – is a Research and Innovation Action funded by the European Commission under the call Horizon2020 MG-4.5-2016. Rather than focus on infrastructures, it raises citizen awareness on the quality of the urban environment where they live in order to promote a shift towards more sustainable and healthy mobility choices.

The MUV system will result from the combination of behavioral change techniques, new technologies, data science and co-design approaches. The solution will include a mobile app tracking users' daily routes and assigning points for sustainable behaviors and a network of sensing stations designed by the makers' community. Urban commuters, from a set of six diverse urban neighborhoods spread across Europe, will co-

[6] https://www.monica-project.eu/

create and then test different game dynamics and their achievements will be rewarded by a network of local businesses that will benefit from the advertising provided by the MUV platform.

Mobility and environmental data gathered via the mobile app and the monitoring stations, all released as Open Data, will allow policymakers to enhance planning processes and civic hackers to build new services able to improve cities' quality of life in a more effective way.

The MUV solution will be open, co-created with a strong learning community of users and stakeholders and piloted in six different European neighborhoods: Buitenveldert in Amsterdam, Sant Andreu in Barcelona, the historic district of the Portuguese county of Fundao, Muide-Meulestede in the harbor of Ghent, the new area of Jätkäsaari in Helsinki and the area of Centro Storico in Palermo.

MUV builds on the experience of trafficO2, an Italian research-action project co-founded in 2012 by a grant from the Italian Ministry of Education, University and Research and carried out by PUSH – MUV's Project Coordinator – in the city of Palermo in the last three years. The trafficO2 experimentation, involving 2.000 students of the University of Palermo and a network of 100 local businesses, showed a reduction of the carbon emissions associated to the active users of more than 40%.[7]

2.6.2 Exploitation

A first explorative telco has taken place with PUSH[8] representatives.
As described in Section 3.1.2, a brief introduction of the GOEASY project has been given, with less focus on GALILEO since it was already known to them.
At the time of writing, MUV is only based on GPS signal, therefore they would be interested in having the possibility of exploiting GALILEO signal. At the beginning, the use of GALILEO would provide a mean for comparison between MUV users having smartphones equipped with GPS and MUV users running the app on GALILEO enabled smartphones.
Since there is a strong interest in collaborating in both parties, soon more detailed technical telcos will take place and MUV representatives will be invited to a more formal workshop to be prepared.

[7] www.muv2020.eu
[8] https://www.wepush.org

3 Workshop Report

This section will provide an overview on the ESG workshop that has been organized, including:

- A brief description about how the workshop has been organized
- What have been the main criteria driving the choice of the platforms/companies to be involved
- The list of involved platforms/companies (which will be described with better details in Section 0)

3.1 Workshop organization

In order to organize a physical meeting with the interested companies, an initial survey has been done within ISMB, in order to define the point of interests for GOEASY.

It has been established that possible synergies with external companies or platform should help and drive the platform development towards a product that is close to what the business world is looking for.
In such a way, the work carried out in this task could also help the future platform exploitation.

3.1.1 Platform exploitable

GOEASY platform offers several modules that are combined in order to define a comprehensive platform structure[9]:

- Position alteration detection library
- Trusted collection and exchange of position information
- End to end position authentication
- LBS data processing library
- LBS proxy
- Mobility behaviour detection module
- Federation services
- Condition modeler module
- Data access manager
- Data aggregator
- Data anonymizer
- Public data storage
- Encrypted storage

Since many of these components will expose APIs that are de-coupled from the other components, it has been decided to introduce, to interested companies, the possibility of exploiting single components and not being forced to use the platform as a whole.

3.1.2 First Telco

The typical structure of the first telco, to introduce the platform, has been as follows:

- General GOEASY introduction;
- Introduction to GALILEO;
- Description of GOEASY added value, as being the first platform to provide and integrate GALILEO authenticated signal;
- Hardware and battery requirements for integrating GALILEO;
- Description of security and privacy problems addressed by GOEASY.

[9] As the component development is an ongoing project, the complete list is available at https://confluence.fit.fraunhofer.de/confluence/display/GOEAS/Components+specification

3.2 Involved platforms and companies

In this section, the list of the companies with which GOEASY has had intereaction, besides initial contact only, is provided. For some of those companies a more advanced interaction has happened, and is reported in Section 4, while for the others a brief description is provided in this section.

1. BOSCH
2. Satispay
3. Push (refer to section 2.6 as well)
4. Phoops srl (MUV-App City) - Among the several talks held by greenApes with mobility-related applications (i.e. potentially relevant LBS) the most interesting advancements have been registered with Phoops srl. Phoops launched MUV-app[10], a FIWARE-based solution that was also part for the frontierCities acceleration program (FP7) with greenApes in the past years. In particular, MUV-app developed mobility detection algorithms that could be integrated with the GOEASY platform for the ApesMobility pilot but is also carrying out projects for cities and organizations in which the use of the GOEASY planned services could be beneficial.
5. Ruuvi – Ruuvi is a startup from Finland. With their passion for electronics and new innovations, they are disrupting the IoT market with open-source products, trying to address the needs of both companies and private users. Their aim is to change the world together with their user. The continuously growing Ruuvi Community is a significant power resource not only for hackers but also for business customers who benefit from ready-made projects and extended support. They are planning to launch a completely new IoT open-source device with a GNSS receiver in order to offer geolocation with some environmental data. Some ISMB representatives have been in touch with Ruuvi team explaining them the advantages offered by the GALILEO authenticated signal together with the reliability of the GOEASY platform. The Ruuvi team was very impressed by the many advantages of the GOEASY platform and they are very interested in future developments, but currently their prototype is based on a nRF9160 chip (Nordic Semiconductor) that does not support the GALILEO signal.

As the work of the Task proceeds, more details will come and, eventually, interested companies will be invited for a new workshop session.

[10] https://muv-app.io/

4 Synergies with private platforms

4.1 Bosch

4.1.1 Company Description Summary

Robert Bosch GmbH, or Bosch, is a world leading multinational engineering and electronics company headquartered in Gerlingen, near Stuttgart, Germany. The company was founded by Robert Bosch in Stuttgart in 1886[11]. As described on the company website[12], Bosch has always been very active in the innovation, especially related to the IoT domain, applied to five main industries:

- **Sustainable mobility**: Bosch offers cutting-edge solutions ranging from connected electric-vehicle charging networks through connected vehicles to connected intermodal mobility services.
  Manufacturing: Bosch Industry 4.0 solutions help optimizing production and logistics processes. The collection, visualization, and analysis of data from machines, processes, and sensors leads to entirely new opportunities for the businesses exploiting them.
- **Energy**: Bosch energy solutions digitalize and connect the energy industry. They are also the basis for new business models and services for metering point operators, direct marketers, energy traders, and grid operators.
- **City**: Bosch is transforming the cities of today into vibrant, attractive, and sustainable cities of tomorrow by providing connected solutions for urbanites – in turn making life easy and efficient.
- **Home and Building**: Bosch solutions for connected buildings and our IoT platform enable smart-home solution providers, building managers, and manufacturers of building technology to provide new business models based on connectivity.

4.1.2 Meetings

4.1.2.1 Workshop Nov 23, 2018

The workshop has taken place at Bosch premises in Turin, Strada del Drosso 37.
At first, a comprehensive presentation about GOEASY has been given, followed by a Q/A session:

- Q: What is the competitive advantage this might bring to them?
  A: GOEASY will provide authenticated GALILEO signal to federated platform.
- Q: Is GOEASY the first platform providing authenticated position signal?
  A: Yes, to be verified.
- Q: How does the position authentication takes place?
  A: GALILEO signal comes with 40-authentication bits, that are verified by GOEASY-enabled app on the phone. After this phase, if network is available, further verification is performed on the cloud by the GOEASY platform. In the end, the signal is returned to the app requiring the position.
- Q: Are storage solutions foreseen?
  A: Yes, a privacy aware DBMS is part of GOEASY.

4.1.3 Advantages offered by GALILEO signal and GOEASY platform together

We need to distinguish 2 levels of integrity:

- Signal integrity;
- Integrity of use.

Exploiting the 40-authentication bits from the GALILEO signal it is possible, for the first time, to obtain an authenticated position (signal integrity). Combining the signal integrity with the GOEASY platform it is also possible to obtain the integrity of use offering a new and complete, more secure service.

[11] Source: Wikipedia
[12] https://www.bosch-si.com/corporate/about-us/bosch-software-innovations.html

4.1.4 Use cases

Since by 2020 every device produced by Bosch will be connected, several possible use-cases have been drawn from the round-table discussion at the workshop, according to Bosch main area of business:

- Anti-Jammer techniques;
- Highway tolls based on location tracking;
- Outdoor location tracking for assets;
- Incidents (such as landslide or avalanche) response;
- Cargo monitoring;
- Dongle for automotive positioning;
- Use in autonomous driving for certification of position;

4.1.5 Requirements

Some requirements have emerged from the discussion:

- GOEASY API should support several transport protocols (HTTP, MQTT, AMQP among the others);
- Possibility to store/retrieve anonymized data for different applications;
- Possibility to store/retrieve data with different levels of privacy;
- The power consumption should be reduced as much as possible.

4.1.6 Future activities and Exploitation

Two main exploitation possibilities have been identified:

1. Integration of available GOEASY technology into innovative Bosch products;
2. Possibility of conjunct participation in future EU-calls of the GOEASY consortium and Bosch.

In the near future ISMB will provide Bosch with further details regarding the position authentication phases and database operations that might be performed on collected data. After that, more telcos will take place in order to better define such possibilities.

4.2 Satispay

4.2.1 Company Description Summary

Satispay is a new payment system that allows you to send money to friends and pay in stores from your smartphone. The app is completely independent from traditional payment circuits and is available for iPhone and Android. Satispay makes moving money easier, more secure and completely free for private users while extremely inexpensive for businesses[13].

4.2.2 Meetings

4.2.2.1 Technical telcos

A series of technical telcos has taken place with Satispay representatives, following the structure described in Section 3.1.2.
In the near future, and as soon as more demos will be ready, Satispay representatives will be invited to the workshop to be organized.

4.2.3 Advantages offered by GALILEO signal and GOEASY platform together

We need to distinguish 2 levels of integrity:

- Signal integrity;
- Integrity of use.

[13] https://support.satispay.com/en/articles/what-is-satispay

Exploiting the 40-authentication bits from the GALILEO signal it is possible, for the first time, to obtain an authenticated position (signal integrity). Combining the signal integrity with the GOEASY platform it is also possible to obtain the integrity of use offering a new and complete, more secure service.

4.2.4 Use cases

Satispay is currently using the position information to locate the closest stores for which a payment might be made. Starting from that, new use cases have been introduced:

- Given the authenticated GALILEO signal, a user would have much more trust in making a payment, knowing that the store he is about to pay is the intended one, and not a fake store that is trying to spoof the position;
- Possibility of storing anonymized payment info, on top of which it would be possible to apply machine learning algorithms (e.g. for improving user experience)

4.2.5 Future activities and Exploitation

In the near future GOEASY consortium will provide Satispay with further details regarding the position authentication phases and database operations that might be performed on collected data. After that, more telcos will take place in order to better define such possibilities. Therefore, when the GOEASY platform will be ready to provide first tangible demos, Satispay members will be interested in trying them out.

5 Conclusions

GNSS signal is widely used for positioning and time synchronization for mobile devices. However, since time and position data of mobile devices aren't authenticated and seldom verified by most vendors and developers, it provides a huge attack surface for potential attackers (Position Spoofing).
Time and position data of mobile devices can be easily cheated using open source tools, and neither physical touch with mobile devices nor jailbreak/root process is necessary. It is able to interfere all the position and time of cellphones in the surrounding area. Several years ago, it was still very expensive for personal potential attackers to obtain SDR devices.
Given the advent of more and more devices that need reliable location data, this is the main reason why, nowadays, signal integrity and integrity of use, offered by GALILEO and GOEASY, are needed in the use of position data.

GOEASY has proven to have gained experience, in the above-mentioned scenario, also thanks to the past/ongoing European project (as described in Section 2).

Thanks to the interaction and possible partnership with BOSCH, it has been verified the added value that GOEASY can bring to the research community and, in the meanwhile, new scenarios for its exploitation have been identified.

When the GOEASY platform will be in a more advanced status of development, with the possibility of having more live demos and hands-on session, a more formal workshop will be organized.

Acronym

Acronym	Explanation
ESG	External Stakeholder Group
ALMANAC	Reliable Smart Secure Internet Of Things For Smart Cities
FIM	Federated Identity Manager
AM	Access Manager
LBS	Location Based Services
WPx	Work Package x
IoT	Internet Of Things
MSx	MileStone x
OS-NMA	Open Service – Navigation Message Authentication
GNSS	Global Navigation Satellite System
API	Application Programming Interface
SDR	Software-defined radio

List of figures

No table of figures entries found.

List of tables

No table of figures entries found.

References