SOFIE - Secure Open Federation for Internet Everywhere

779984

DELIVERABLE D6.7

Initial Report on Communication, Dissemination, and Exploitation

Project title	SOFIE – Secure Open Federation for Internet Everywhere
Contract Number	H2020-IOT-2017-3 – 779984
Duration	1.1.2018 – 31.12.2020
Date of preparation	31.1.2019
Author(s)	Dmitrij Lagutin (Aalto), Mikael Jaatinen (Ericsson), Priit Anton (GT), David Mason (Rovio), George Polyzos (AUEB-RC), Petri Laari (Ericsson), Mirjam Kert (GT)
Responsible person	Mirjam Kert (GT), mirjam.kert@guardtime.com
Target Dissemination Level	Public
Status of the Document	Completed
Version	1.00
Project web-site	https://www.sofie-iot.eu/

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 779984.

Table of Contents

1. Introduction

This deliverable, D6.7 - Initial report on Communication, Dissemination and Exploitation, comprises communication, dissemination, and exploitation activities and results undertaken during the first 13 months on the project. It will be updated by D6.8 - Interim report on Communication, Dissemination, and Exploitation (M25) and D6.11 - Final report on Communication, Dissemination, and Exploitation (M36).

The guidelines for the communication and dissemination activities have been set in D6.6 - Updated Consolidated Communication and Dissemination Plan. The exploitation activities have been introduced by each project partner separately as well as the future plans for the exploitation activities.

2. Communication

This section provides an overview of the activities done in the first 13 months of the project.

2.1 Communication material

2.1.1 Logo

The SOFIE logo was created in the beginning of the project. As SOFIE stands for Secure Open Federation of Internet Everywhere, the circle in the logo is left open to symbolise the notion of openness of the SOFIE federation. The logo has been used on communication materials such as website, flyer, presentations, business card etc.

2.1.2 Flyer

The first SOFIE flyer was produced in March 2018, completing D6.3 on time. The flyer will be updated periodically throughout the project. It has been handed out at events like ICT2018, IoT Week 2018, and Junction hackaton.

2.1.3 Business card

The SOFIE business card was created as an alternative for the flyer. The business card is something that the SOFIE project members can easily take with them and distribute them at events they attend. The business contains the most relevant information such as the website address, social media contacts, and information e-mail.

2.2 Website

The SOFIE website was completed in in February 2018. To provide a visible presence on the internet and serve as one stop shop to receive information about the project and to present its latest achievements. The site was created using Voog.

The SOFIE website has been updated several times with the following news items:

- Junction 2018 - Europe's biggest hackathon
- Decentralized marketplace using smart contracts
- State of the Art in Blockchain Technology and IoT Systems
- A secure blockchain-based energy marketplace for load balancing in Low Voltage distribution grids
- Utilizing blockchain technology for providing product insights from-field-to-fork
- Blockchain technology to secure cross-border data exchange between smart meter platforms
- SOFIE presented at NDSS
- EU research looks into open federated IoT business platforms

2.3 Social networks

We have created accounts in two popular social networks in order to create a channel through which we can publicise our advances and our presence at marketing events and our project results.

Twitter: https://twitter.com/EU_Sofie

2.4 Liaisons

The SOFIE project in collaboration with 5(ENACT, ARMOUR, SMESEC, IoT Crawler, CIPSEC) other IoT projects organised a joint exhibition area at ICT2018.

The SOFIE project also participated in CHARIOT (EU H2020 project) workshop in October 2018, and established liaisons with H2020 projects GHOST, CHARIOT and SEMIoTICS. In addition, in January 2018 the SOFIE project in collaboration with the POINT project were apart of organising the Iothon hackaton.

2.5 Exhibitions

During the first year the SOFIE project was exhibited at two conferences. The first exhibition was in IoT Week 2018 in Bilbao and the second one in ICT2018, Vienna. During both of the exhibitions the SOFIE flyers and business cards were distributed. In addition, the demos for the Estonian energy pilot and Greek from-field-to-fork were introduced.

3. Dissemination

During the first 13 months of the project there were 6 publications published. In addition, 9 external presentations have been made.

3.1 Code Releases

SOFIE has planned for 3 main software releases. The first main release code has been made available in December 2018. The code is downloadable at GitHub: https://github.com/SOFIE-project.

Between main releases, the code base is improved through a continuous integration and deployment process.

3.2 Publications

During the first 13 months of the project there were 6 publications published. In addition, 9 external presentations have been made. All the scientific publications are also published on the project's website.

1. Secure Open Federation for Internet Everywhere. A. Karila, Y. Kortesniemi, D. Lagutin, P. Nikander, S. Paavolainen, N. Fotiou, G.C. Polyzos, V.A. Siris and T. Zahariadis. Workshop on "Decentralized IoT Security and Standards" (DISS) in conjunction with the 25th "Network and Distributed System Security Symposium" (NDSS 2018). Published 18.2.2018. https://dx.doi.org/10.14722/diss.2018.23001
2. Security and Privacy Challenges and Potential Solutions for DLT based IoT Systems. Santeri Paavolainen, Pekka Nikander. 2018 Global Internet of Things Summit (GioTS). Published 4.6.2018.
3. Smart Contracts for the Internet of Things: Opportunities and Challenges. N. Fotiou and G.C. Polyzos. European Conference on Networks and Communications (EuCNC). Published: 18.6.2018.
4. Interacting with the Internet of Things Using Smart Contracts and Blockchain Technologies. N. Fotiou, V. A. Siris, G.C. Polyzos. Proc. of Security, Privacy, and Anonymity in Computation, Communication, and Storage 2018 (SpaCCS 2018), Melbourne, Australia, 2018.
5. Turning the Trust Around: Smart contract-assisted Public Key Infrastructure. A. Ahmed, T. Aura. IEEE International Conference on Trust, Security and Privacy in Computing and Communications 2018.Published: 31.07.2018.
6. Risks from Spam Attacks on Blockchains for Internet-of-Things Devices. S. Paavolainen, T. Elo, P. Nikander. IEEE IEMCON 2018. Published: 02.11.2018.

3.3 Open data

As outlined in D6.5 - Data Management Plan, data that can compromise commercialization prospects or has inadequate protection of, e.g., personal information, shall not be published. The rest of the data will be deposited in an open access repository such as Zenodo (https://www.zenodo.org). When the data is related to a publication, it will be linked to it via OpenAIRE (https://www.openaire.eu).

Data available at Zenondo:

- Electric Vehicle (EV) data collected by Emotion. This data was collected using a particular OBD device connected to each EV. The dataset can be found here: https://www.zenodo.org/record/1410857#.XFBkLc8zau4 .

4. Exploitation

This chapter covers the knowledge advancement activities by academic partners, as well as the status the status of commercial exploitation and standardization efforts.

4.1 Exploitable Foreground

Interledger

There exists large number of DLTs each offering different tradeoffs in terms of latency, throughput, consensus algorithm, etc. Therefore, in complex systems it is not feasible to use a single DLT, hence the *interledger* approach that allows different DLTs to exchange data with each other is necessary in most situations. Using multiple ledgers is also necessary for privacy reasons, which affect both individuals and companies. By default, all participants within DLT can access all the data stored in DLT, therefore the participant may use private ledger, and store only a subset of his data to main ledger used for collaboration with others. Multiple ledgers are also necessary to enable crypto-agility, cryptographic algorithms used by DLTs such as SHA-256 will not stay safe forever, therefore it is necessary to have a mechanism to transfer data from one ledger to another.

Decentralized identifiers and Verifiable Credentials

Decentralized identifiers (DIDs) are a privacy promoting self-sovereign type of identifier, where the owner of the identifier is free to create, use, modify or revoke the identifier at will and free of any controlling central entity. A related technology, verifiable credentials (VCs), allows one to make reliable attestations about the owner of the identifier. In SOFIE, DIDs will be used in co-operation with legacy identifiers to support privacy-preserving cross-ledger operations, and VCs will be used to authenticate and authorise the users of the services.

System dynamic models of business platform network effects

System dynamic models are causal loop diagrams, which include simulation equations and real world data as inputs to the model. Simulation results and scenarios can thus be produced by using standard tools such as Vensim[1]. In the future, we plan to model SOFIE IoT platforms with System Dynamics. These models can be used to simulate the data markets, the economic sensitivity, and economic sustainability of the platform businesses.

IoT federation adapters for open and commercial IoT platforms

IoT federation adapters enable interoperability of legacy IoT platforms with SOFIE business platforms and interledger operations. Each IoT federation adapter should be able to proactively adapt and reconfigure data from devices to align with semantics, service discover, access control, security and privacy specifications dictated by SOFIE architecture. In SOFIE, a common framework for secure adaptation of IoT platforms and devices will be released on top of which specific implementations will be implemented for each integrated IoT platform.

Decentralized marketplace, DSO congestion detection and EV flexibility provision

The *decentralized marketplace* will be applied in the Italian Energy pilot in conjunction with the *DSO congestion detection dashboard* used by the DSO to detect potential congestion points

[1] https://vensim.com/

and the *EV flexibility provision dashboard* used by the Fleet Manager to monitor and manage the electric vehicles and the charging stations and to provide flexibility to DSO.

The components will be used to create specific Demand Response (DR) campaigns leveraging distributed ledger technologies and smart contracts capabilities.

Blockchain federation

Sofie project is relevant to ASM in terms of new tools and services to make the distribution power network stable and secure. The high penetration of DER in the Terni's area has led to a significant increase of the reverse power flow in the substations and number of congestions. Matching consumption with production through secure and efficient DR strategies using blockchain technology represents nowadays one of the most promising approach for the DSO's grid management. Thanks to the blockchain driven federated IoT business platform developed under the SOFIE project, smart micro-contracts and micro-payments will enable the emerging neighbourhood market of energy and energy services.

4.2 Academic Knowledge Advancement

4.2.1 Aalto University

Foreground to be exploited: interledger, decentralized identifiers, system dynamic models of business platform network effects, decentralized marketplace.

Measures taken so far: Two PhD students are working on SOFIE project. A graduate course "Postgraduate Seminar in Communications Engineering on Data Economics" was held in Autumn 2018 at Aalto university.

Future work: SOFIE results will be utilized in several EU- and national-level research projects, accepted projects include H2020 PHOENIX, EMPIR SmartCom, and EIT Climate-KIC GOWOOD (provisionally accepted).

Aalto will also offer master thesis topics, guest lectures, seminars, and/or special courses related to the SOFIE project. A course related to SOFIE, "Microservice architectures and serverless computing", will be held in Spring 2019.

4.2.2 Athens University of Economics and Business

Foreground to be exploited: Interledger mechanisms, design of smart contracts encoding payment and authorization policies.

Measures taken so far: One PhD student is working on topics related to SOFIE. Furthermore, two master students are working on master theses related to SOFIE, entitled "Creating a 'Store of Value' platform for cryptocurrencies" and "Interacting with Web of Things gateways using blockchains". Finally, laboratory seminars on distributed ledger technology, programming of smart contracts, and blockchain security have been offered.

Future work: AUEB will offer master thesis topics and seminars related to the SOFIE project. A graduate course on 'Blockchains and Smart Contracts' is scheduled for the Spring 2019 semester. Two additional PhD dissertations related to IoT, WoT and blockchains are expected to start during the Spring 2019 semester.

4.3 Commercial Exploitation

4.3.1 ASM Terni SPA

Foreground to be exploited: ASM Terni is a municipal undertaking, aiming at offering specialized and public services to citizens, including water and electricity grid management through cutting-edge technologies such as a potential federation composed of different platforms connected to each other. ASM Terni as responsible for the distribution power network has the potential to offer a significant change in terms of energy availability by providing safe and secure operation and management of the Distribution Network. In this case, renewable energy has the paramount benefit to meet the local green economy.

Moreover, the knowledge acquired in SOFIE will be exploited in other projects ASM Terni is already part of, such as: NRG-5 (http://www.nrg5.eu/), eDREAM (https://edream-h2020.eu/), Defender (http://defender-project.eu/) and Phoenix that will be granted in 2019. Thanks to the exploitation of SOFIE there will be many ways to use energy and the ASM Terni Smart Grid will allow to upgrade European platforms.

Whatismore, ASM Terni is interested in exploiting the blockchain technology, smart micro-contracts and micro-payments, as well as in the P2P approach considering an end-to-end scenario from electricity production to distribution, storage and consumption. However, since legal barriers currently exist in Italy, the exploitation of SOFIE results will be strongly affected by the decision of the national government.

Measures taken so far:

1. Evaluation of flexibility focusing on renewable energy production (e.g. PV arrays) and electric mobility in the city of Terni,

Future work:

1. Electric Infrastructure improvement for real-time measurements,
2. Block Chain installation for Smart contracts, if legally applicable, at ASM headquarters

4.3.2 Emotion SRL

Foreground to be exploited: Emotion will be part of the Italian Energy pilot providing monitoring and management services for electric vehicles and charging stations. Collaboration with the other partners of the SOFIE project for the development of the demand response campaigns based on micro contracts and micro payments and the implementation of a monitoring and management service for electric vehicles and charging stations using blockchain technology will allow Emotion to refine their skills and enrich their knowledge, being able to take advantage of this learning after the end of the project. Furthermore, Emotion will use the involvement in the SOFIE project to improve the ability of its employees and to increase the ability to provide contribution to the European projects in which it participates, such as WiseGRID (http://www.wisegrid.eu/), NRG-5 (http://www.nrg5.eu/), eDREAM (http://edream-h2020.eu/), and those to which it will participate. In addition, the acquired knowledge will be exploited to increase its business, offering to the market products and services enhanced during the project, with the aim of giving strength to electric mobility, for a cleaner mobility, allowing an increasingly massive deployment of electric vehicles and charging stations and an increasingly intense use of renewable photovoltaic energy that is mainly produced at lunchtime, when consumption is lower and when the vehicle could be parked in charge.

Measures taken so far: An EV fleet dashboard was developed and a DR campaign based on micro contract and micro payment was performed at the laboratory level.

Future work: The following actions are being planned for in relation to SOFIE:

1. Improving Emotion platform of car sharing;

2. Improving Emotion sevices by exploiting blockchain technology.

4.3.3 Engineering Ingegneria Informatica SPA

Foreground to be exploited: Engineering is involved in the Italian Energy pilot, implementing the Decentralized Marketplace that enables the demand response campaigns via smart contracts.

The results of the project, in particular the components related to the Decentralized Marketplace and the DSO forecast and congestions detection dashboard, will be exploited in several European research projects exploring the usage of distributed ledger solutions in the Energy field; moreover these technologies will be made available to the related ENG business unit.

In fact Engineering addresses the specific market with its Business unit Energy & Utility to provide its own value proposition as complete solution for its customers.

In the Engineering innovation model, the R&I activity goal is to contribute to the change in markets and companies via solutions that can create innovative experiences for the users, in order to encourage a safe and aware use of information technology. The process is composed by three macros steps:

1. Develop and consolidate the results of research projects

2. Define and execute experimental checks of developed solutions –or components- including the activity to assure the replicability of processes.

3. Capitalize the investment providing -via ENG Business Unit- Business Offer to the clients according to a specific business plan. Part of this step is the actual commercialization process, it includes the work of the business unit to extend the company offer portfolio and address the worldwide market with a proper marketing strategy.

Measures taken so far: Involvement of Energy & Utility Business Unit for the scenarios identification, preliminary pilot use cases design and first requirement analysis.

Future work: After the prototype realization:

- Business Unit involvement to evaluate the SOFIE platform to identify potential extensions of the company solutions offer;
- Preparation of a potential technology transfer preparatory for engineering phases to address a product

4.3.4 LMF Ericsson

Foreground to be exploited: Ericsson is very interested in the interledger model that is being researched and developed in SOFIE. We are planning to evaluate these capabilities as part of Ericsson's early product/concept development once there is a more mature SOFIE SW baseline available.

Ericsson is also interested in the research and development in SOFIE around Distributed Identifiers, on similar terms and conditions as stated for interledger above.

Measures taken so far: One Master's Thesis student working on Distributed Identifiers. Generally, SOFIE is on the map as a potential platform for IoT related early product/concept development during 2019.

Future work: The following research areas are being planned for in relation to SOFIE. In addition, Ericsson may also offer Master's Thesis topics related to SOFIE.

1. Research on transparency for centralized identity system. Centralized system including identity e.g, PKI, Remote SIM provisioning (RSP) system are centralized in nature. Recent state nation attack shows transparency for such systems are critical. This work

uses decentralized and immutable structure of ledger and smart contract for transparency of identity data.

2. Security analysis of identity systems. Security analysis of blockchain and non-blockchain identity systems, considering e.g. PKI, Remote SIM provisioning and Ethererum name service.
3. Automated device provisioning with use of blockchain. Evaluate the feasibility of blockchain for automated device provisioning.

4.3.5 Guardtime AS

Foreground to be exploited: During the first year of SOFIE, Guardtime has defined the use-cases on how data exchange between Transmission System Operators (TSO) and smart meter platforms could be handled. These use-cases can be exploited in a horizontal way to support the business case of a TSO and to protect them from legal problems when opening up the data to third parties. From technical perspective the foreground component to be used is divided into four main pillars:

1) The authorisation and access between systems;
2) The hardware, mainly smart meters, opt in to the existing platform;
3) Data exchange and sharing;
4) Security module.

The foreground component is using Guardtime KSI API and combining this with the SOFIE federated framework. In Addition to SOFIE's components the methodology how to evaluate existing TSO legacy platforms is developed and will be used for future exploitation of the SOFIE federated platform.

Measures taken so far: The structure of Guardtime's exploitation plan is divided into two main blocks: the activities related to the industry side and the work towards the EU legislation, regulatory side with organisations that group together different interest groups. Guardtime interest is to bring novel technologies to the market that would directly affect the challenges that Energy sector (TSOs, DSOs, flexibility service providers) have. For this purpose, there is direct connection to Guardtime's energy sector marketing and sales force and results and exploitation plan in SOFIE. In the industry side the starting point for Guardtime, is to have synergy between our existing networks, customers and projects in Energy sector. We see that there is much benefit to use the existing customers like the TSOs (TenneT, Elering, AKKA, ESO) to discuss and evaluate the value that could be brought through Sofie Estonian Energy project as well as technology components described in previous section in exploitation plan. In EU and policy maker level Guardtime has approached Entso-E and attended in a couple of workshops to map the existing challenges with the tasks defined in SOFIE. Additionally, Guardtime presented the key components of SOFIE federated framework related to using distributed ledger and KSI Blockchain combination. The results of the EU energy policy indicate that the stand-alone data hubs and legacy systems that the current TSOs and DSOs are operating cannot achieve the overall goals of reaching 50% of Renewable energy production by 2030. This is a clear indication that the technology developed in SOFIE is needed and should be supported by exploitation activities. In parallel to enabling the technology in business perspective there has also been activities related to comply with GDPR in regards to existing and new energy services. Exploitation activities so far have been to define the key points where SOFIE federated architecture could help the industry side comply with GDPR and handle personal identifiable information accordingly.

Future work: The exploitation plan is to carry on with the three main topics. - Work related to legal and regulatory side. Both GDPR and flexible open energy market activities, with Entso-E and EU commission bodies related to Energy sector. – - The future use of Guardtime's business network in energy sector (information exchange, joint events, cross usage of sales/marketing force). Thus, making sure that the approach towards industry is constantly and widely targeted. - Efforts to combine the different components, developed in SOFIE federated platform, and matching them to the legal and business-related challenges to find best steps forward for long term exploitation of the results.

4.3.6 Optimum Anonimi Etairia Technologies Pliroforikis

Foreground to be exploited: IoT service/device description, data description

Measures taken so far: Presentation of the SOFIE business platform to partners and commercial customers to inform them about new business opportunities towards integrating end-to-end secure traceability in logistics and warehouse management.

Future work: the following actions are planned in relation to SOFIE

- Improving IoT semantics of Aberon IoT platform

- Improving Aberon services tailored to the needs of logistic chain with blockchain technology

4.3.7 Rovio Entertainment Corporation

Foreground to be exploited: Rovio leads the Sofie Gaming Pilot. We aim to seek and identify where data platforms using DLTs can have significant impact in gaming industry. We will also build prototypes for leading use cases and validate game experience and business potential for DLTs and IoT in gaming.

Measures taken so far: One Blockchain research developer (PhD student) working on to identify use cases, current challenges to implement those use cases and their possible solutions. A publication is being prepared for this purpose.

A wider team is involved in prototype development. To date, we have developed one prototype to understand the use of DLTs for content ownership by players in games enabling buying and selling of in-game assets. Furthermore, system requirement and architecture of a a scavenger hunt game is also being prepared which will seek to understand the potential for DLT and IoT in a gaming context.

Future work:

1. Paper submission for review "SOFIE Gaming - Use Cases, Challenges and Solutions" - planned for first week of March (IEEE TrustCom '19).
2. Implementation of the scavenger hunt game testing DLT and IoT gaming use case.
3. Play testing and business requirement assessments for use case for the gaming pilot.
4. Define requirements for SOFIE platform integration with the gaming pilot use cases.

4.3.8 Synelixis Solutions SA

Foreground to be exploited: Synelixis is interested in the semantics schema developed in the scope of SOFIE to support supply chain management, especially that part that matches processing of data from farming system (as it is managed by SynField IoT platform) to the rest segments of the chain. Also, we are planning to evaluate SOFIE IoT Federation adaptations as an extension of our SynField platform that enhances its secure integration capabilities in Smart City applications

Measures taken so far: Within the food supply business environment, the first measure taken by Synelixis was to present SOFIE technological and business views to 7GRAPES- Pegasus (http://www.7grapes.gr/) in order to use this entity with employees and facilities in the food-chain pilot.

Future work: Future exploitation will result through main research, development and dissemination activities of SOFIE in which Synelixis is actively involved and interested. In this scope, the following priorities are planned for the next period:

- Security analysis of IoT platforms deployed in the segments of the food chain pilot.

- Evaluation and development of the semantics reference model for web services discovery and provision in the food-chain supply system.

- Investigation and determination of the social/business context (e.g. structural properties of collaboration, business routines, governance issues etc.) in which the food-chain pilot will be deployed and operate.

- Exploitation of SOFIE advances within other EU H2020 research and development projects, e.g. PHOENIX.

5. Conclusion

It is natural that the communication and exploitation activities advance and grow as the project evolves. The SOFIE project has already made some good progress in the first year.

In communication all the necessary materials have been completed, the website has been built and updated. The project has set up social networks and is actively using Twitter. We also have been actively building liaisons with other projects as well as exhibiting at conferences.

As for dissemination, two open-source codes were released in the end of 2018 and the codes are publicly downloadable at GitHub. During the first 13 months of the project already 6 papers have been published. SOFIE is also participating in the Horizon 2020 Pilot on Open Research Data and the data related to publications and deliverables has been made available via the project's website.

In the area of exploitation, the academic partners have already been providing education related to the SOFIE project and the industrial partners are taking first steps towards commercial exploitation.