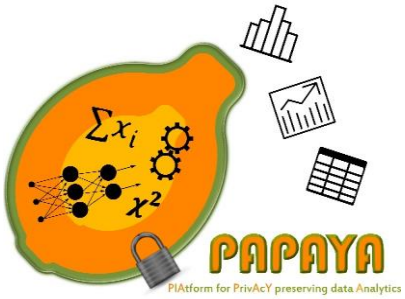

D1.5 – FINAL PROJECT PROGRESS REPORT

Work Package	WP 1, Project Management
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Reviewers	All
Due date	31.07.2021
Date	01.12.2021
Version	2.0
Dissemination Level	Public version

The research leading to these results has received funding from the European Union's Horizon 2020 Research and Innovation Programme, through the PAPAYA project, under Grant Agreement No. 786767. The content and results of this deliverable reflect the view of the consortium only. The Research Executive Agency is not responsible for any use that may be made of the information it contains.

Revision History

Revision	Date	Editor	Notes
0.1	05.07.2021	Melek Önen (EURC), Orhan Ermis (EURC)	First version with todos
0.2	20.07.2021	Melek Önen (EURC), Boris Rozenberg (IBM)	Integration of partners' contributions
0.3	22.07.2021	Melek Önen (EURC), Simone Fisher-Hübner (KAU), Sébastien Canard (ORA), Sara Fumagalli (MCI), Nuria Ituarte, Alberto Crespo	Integration of partners' contributions
0.4	23.07.2021	All	Some updates are applied
0.5	27.07.2021	All	Updates on financial tables
1.0	30.07.2021	All	Final version

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Executive Summary

This deliverable overviews the project's last year activities, namely from May 1st, 2020 to July 30th, 2021. As a reminder, the main goal of PAPAYA is to design and develop a **platform of privacy preserving analytics modules** that allows the outsourcing of analytics operations into untrusted cloud servers while protecting the privacy of the data. Thanks to this newly developed platform, stakeholders will be able to ensure their clients' privacy (and be compliant with the General Data Protection Regulation) while extracting valuable and meaningful information from the analyzed data.

The last-year project activities (including the three additional months) reported in this document can be summarized as follows:

- As planned, WP4 activities on the implementation of the platform and the integration of PETs terminated as expected in M36 and deliverable D4.3 reporting on these activities is submitted on time (M36).
- Regarding the validation of the use cases, **WP5** started in M24. Validation of the PAPAYA framework and related use cases were realized as planned. In connection with the activities in WP4, the implementation of use cases, and their integration with the platform are completed. The integration of the **WP4** services (such as privacy-preserving collaborative training and privacy preserving neural network classification based on 2PC) within **WP5** use cases gave the possibility of identifying minor issues (e.g., on the design of API, or data exchange between modules). Additionally, as suggested by the reviewers during the second review, the PAPAYA consortium identified two new potential use cases that are related to the COVID-19 pandemic: one on privacy preserving contact tracing and one on treating the symptoms caused by the Covid-19 virus in a privacy preserving manner. The second use case consists of a potential integration with another European project, called PoSeID-on, and suggests the use of the PoSeID-on dashboard as a consent approval mechanism to enable the use of PAPAYA's privacy-preserving analytics. Further details about these new use cases are presented in D5.3. Deliverables describing the validation of PAPAYA with the e-health use cases (D5.1) and the telecom use cases (D5.2) are submitted on time. Deliverable D5.4 provides a guide for the use of the platform.
- Regarding activities related to **innovation management and exploitation**, since the development of various PAPAYA components has been completed, identified innovation assets and responses to innovation questionnaires have been updated for the final year. These new responses are reported in section 3. Licensing policies for the solutions, potential patents and contribution to standards are also identified. On M30, the PAPAYA consortium submitted the ANNEX to D6.4 to provide more detailed content based on the following items: i) the stakeholders' maps for the PAPAYA project (and associated use case services); ii) the exploitation plan for the proposed healthcare services. Additionally, in the scope of innovation management and exploitation activities, we prepared and disseminate a questionnaire for IT developers. The results of this questionnaire is presented in deliverable D5.3.

- Finally, the third year's **dissemination and communication activities** consist of the organization of and participation to various virtual events including scientific conferences, workshops and industrial events such as cyberwatchin.eu and GDPR webinars. Furthermore, the consortium organized a workshop to disseminate the use cases and the platform of the PAPAYA project. Due to the COVID19 pandemic, this event was organized as a virtual event. Moreover, the final deliverables D6.5 and D6.6 are also submitted on M39.

Glossary of Terms

ATOS	Atos Spain S.A.
CNIL	Commission Nationale de l'Informatique et des Libertés
DoA	Description of Actions
EURC	EURECOM
GDPR	General Data Protection Regulation
IBM	IBM Israel Science & Technology Ltd.
KAU	Karlstad University
M	Month
MCI	MediaClinics Italia
MS	Milestone
O	Objective
ORA	Orange
PAPAYA	PlAtform for PrivAcY preserving data Analytics
PET	Privacy Enhancing Technology
PIA	Privacy Impact Assessment
SotA	State-of-the Art
UC	Use Case
UI	User Interface
WP	Work Package
Y3	Year 3

1 Introduction

1.1 Purpose and Scope

As a reminder, the goal of the PAPAYA project is to devise and develop a **platform of privacy preserving modules** that protects the **privacy of users** on an end-to-end basis without sacrificing **data analytics functionalities**. The PAPAYA framework will integrate several privacy preserving data analytics modules each of them dedicated to specific analytics operations and to specific settings (single data owner, multiple data owners, etc.). The platform aims to be usable in the sense that it also includes proper transparency and control mechanisms through a dashboard.

During the last year of the project, the major activities consist of (i) the finalization of the integration of privacy enhancing technologies for data analytics including the transparency and control mechanisms within the PAPAYA platform (WP4), (ii) the validation of healthcare and telecom use cases (WP5), (iii) the final dissemination and communication activities to promote the project's objectives, innovation aspects and results (WP6) and (iv) the refinement of the exploitation strategy of each different identified asset, for all partner independently and the consortium as a whole, during the second part of the project but also for the post-project phase (WP6).

1.2 Outline

Similar to deliverable D1.4, the document first summarizes the progress in terms of technical contributions (Section 2) and innovation management (Section 3). The second year's dissemination, communication and exploitation activities are then reported in Section 4. The work carried on by all partners is further described in details in section 5, in a Work Package and Task basis. Section 6 reviews the recommendations provided by the EC and the reviewers during the second review of the project and provides responses to each of them. Finally, Section 7 reviews the status of all project deliverables, milestones and risks relevant to the third year. The document also reports on the use of resources on a WP and partner basis in Section 8.

2 Overall Scientific Progress

2.1 Objectives

As a reminder, the project considers the following objectives:

- **O1:** Design efficient **privacy-preserving data analytics** techniques
- **O2:** Explore **different settings** (single/multiple data sources, …)
- **O3:** Enable **risk management** and **user control** of data disclosure
- **O4:** Design and develop an **integrated platform**
- **O5:** Lead an **end-to-end analysis** for different use cases regrouped in two umbrellas: analytics for **healthcare** and **mobile and phone usage** analytics
- **O6: Disseminate** and **exploit** the project outcomes.

In the sequel of this section, we describe the work carried out during the second year of the project towards the achievement of each scientific objective.

2.2 Design of efficient privacy preserving data analytics techniques (O1)

During the M24-M39 period, the integration of privacy preserving analytics services were completed and these services were deployed to the platform as part of the WP4 activities. Furthermore, the development and the deployment of the Platform Dashboard, the Data Subject Toolbox, and Security and Transparency service were also completed in the scope of WP4. The last deliverable in WP4 is the Final Report on Platform Implementation and PETs Integration, which was submitted on M36.

2.3 Exploration of different restricted settings and design of dedicated protocols (O2)

As mentioned in the previous interim resource report, WP5 activities started on M24, and MCI and ORA immediately started working on the validation of use cases with the related partners. In connection with the activities in WP4, the implementation of use cases, and their integration with the platform are also completed. The integration in WP5 of the services implemented and deployed in WP4 gave the possibility of identifying minor issues such as the design of API, or data exchange between modules, etc. are the initial steps of validation use cases and hence the PAPAYA platform.

As suggested by the reviewers during the second review, we investigated two new use cases which are related to the COVID-19 pandemic based on the existing PAPAYA primitives. The first one is related to the contact tracing using encrypted Bloom filters and the second one is mainly a specific integration with another H2020 European project called PoSeID-on for using the PoSeID-on dashboard as the consent approval mechanism. Details of these use cases are given in D5.3.

In the scope of WP5 activities, the deliverables D5.2 and D5.4 were submitted on M36, and D5.1 and D5.3 have been submitted on M39.

2.4 Risk management and user-control of data disclosure (O3)

The development and integration of user interfaces (i) presenting risk management artefacts for assessing the privacy risks of privacy-preserving data analytics, and the ones (ii) illustrating the PAPAYA privacy-preserving data analytics modules, have been finalized as part of WP4 activities. Some of these interfaces were also integrated as part of WP5 use cases. Furthermore, the PAPAYA platform also includes the Privacy Engine that help data subjects increase their control on their privacy through the Privacy Preference Manager and the Data Subjects' Right Manager. More specifically, the Privacy Preference Manager was integrated in two PAPAYA use cases.

2.5 Design and development of an integrated platform (O4)

Deliverable D4.3 reporting on final platform implementation and PETS integration activities was submitted on M36. This final deliverable includes detailed instructions about how to use the platform, final updates of APIs of the services and instructions to use deployed PAPAYA services. Furthermore, D5.4 provides a guide for the use of the PAPAYA platform.

2.6 Dissemination and Exploitation of the project outcome (O6)

There have been 20 publications (18 articles, 1 chapter in a book, and 2 posters) in different refereed venues. The last period of the project was also considerably dedicated to various demonstration activities through different events such as industrial forums and seminars organized by the GDPR Cluster meetings. The consortium has also organized a workshop inviting several business units of different companies whereby the PAPAYA platform has been demonstrated together with the PAPAYA use cases. All the dissemination and communication activities are fully reported in D6.6.

The business plan and exploitation strategy of consortium members have been revised in deliverable D6.6. The exploitation activities for each identified PAPAYA asset are also described. As the project is finishing, the way the project outcomes are and will be exploited is now more mature. More specifically, the consortium performed a periodic assessment of the exploitable assets from the PAPAYA framework, also in relationship with T1.3 (Innovation management), that ensured that the assets were in line with market expectations. Deliverable D6.6 reports a description of the identified assets (12), the relationships established among them, their validation status and their sectors of interest. Then, individual exploitation plans and possible joint exploitation strategies (to be enacted during the post-project phase, if partners are interested and according to the Consortium Agreement) were proposed/updated as well. These exploitations (either individual or joint) are based on the definition of the assets, and suppose that partners

could either decide to bring to the market their own components, according to their IPR, or to acquire components from other partners where needed.

3 Innovation

3.1.1 PAPAYA assets

In this section, we present a summary of the analysis done on the marketable assets of the PAPAYA framework. Please notice that further details can be found in Deliverable D6.6 (“Final business plan and exploitation report”).

Table 1 PAPAYA Innovation Assets at M39

Category	Asset	Description
Platform	**Platform for PP Analytics**	The platform will provide to service providers an ability to deploy Privacy Preserving Machine Learning analytics and will provide an ability to data controllers to run Machine Learning models (also in collaborative miner) without revealing their private data to the platform and to each other. The product will include configuration scripts and the platform dashboard.
PP Computation	**PP data analytics modules**	The modules ensure the processing of data while being protected. The processing operations can be Neural Network classification or trajectory clustering.
	PP arrhythmia classifier	This solution aims at classifying arrhythmia disease based on ECG heartbeats in a privacy preserving manner.
	PP collaborative training	A service for Privacy Preserving Collaborative training of Neural Network (NN) which allows multiple participants to perform a NN training collaboratively, while preserving the privacy of the training data.
	PP analytics	A software library for privacy preserving analytics based on homomorphic encryption.
Compliance modules	**Compliance toolbox**	The Compliance Toolbox consists of a number of software tools that ease legal compliance for organisations using privacy-preserving analytics with the GDPR and related privacy and data protection legislation. The tools focus on the rights of natural persons whose personal data is being processed as part of analytics (i.e., data subjects in the GDPR). Each tool in the toolbox is independent and designed with ease of integration in mind.

	Privacy engine	The Privacy Engine provides to the data subject mechanisms to capture his/her privacy preferences on the collection / use of their personal and/or special categories of personal data for processing in privacy-preserving big data analytics tasks. For that purpose, the Privacy Engine transforms high-level descriptions to computer-oriented policies, allowing their enforcement in subsequent processes to only permit the process of the data that the data subject agrees with e.g. filtering and excluding certain personal attributes. In addition the PE provides to the data subject the mechanism to exercise his/her rights derivative from the GDPR (e.g. the right to erasure his/her personal data). In order to do so, the PE, allows, on one hand, to the data controller to choose the communication channel to obtain the subject desire (email, publisher/subscriber pattern, protection orchestrator), and on the other hand provides a user centric GUI to easily exercise his/her rights.
eHealth use cases	**Stress management**	E-health stress management is a service designed for privacy-compliant detection and mitigation of stress-induced anomalies in workers, coming with a device able to collect physiological measures and linked to a mobile app. Whenever the service identifies a stress condition, it suggests a proper action based on psychologists hints.
	Arrhythmia detection	This tool allows an untrusted party to perform the analysis of a person's ECG signal in a privacy-preserving way, leveraging secure platforms such as the PAPAYA one. The tool improves the current MCI software for the analysis of arrhythmias, where a doctor is provided with an ECG signal and looks manually for arrhythmias. The integration with PAPAYA allows the outsourcing of ECG signals for the improvement of analysis performance, while still guaranteeing the preservation of patients' privacy and the protection of data**.**
Mobile And phone usage use cases	**PP mobility analytics service**	The tool is composed of two subparts: - Privacy-preserving statistics on traffic measurement - Privacy-preserving trajectory clustering Those two services rely on a combination of analytics operations with PETs mechanisms.

	WeStat - Privacy preserving mobile usage statistics	This tool detects deviations from normal behaviour in IT systems (leveraging machine learning techniques for anomaly detection), preserving the confidentiality of the data used in training (that are coming from multiple sources) and/or prediction.
	Threat detection for sensitive data	This tool detects deviations from normal behaviour in IT systems (leveraging machine learning techniques for anomaly detection), preserving the confidentiality of the data used in training (that are coming from multiple sources) and/or prediction.

3.1.2 Technology transfer between partners in the consortium

The following figure presents the suggested technology transfers between partners, which would enable the creation of solutions made of components taken from the PAPAYA framework. Notice that these transfers are just suggested, and not mandatory, and can be enabled in case partners (e.g., in the post-project phase) decide to go for joint exploitation, and thus may require the acquisition of a component from another partner in the consortium.

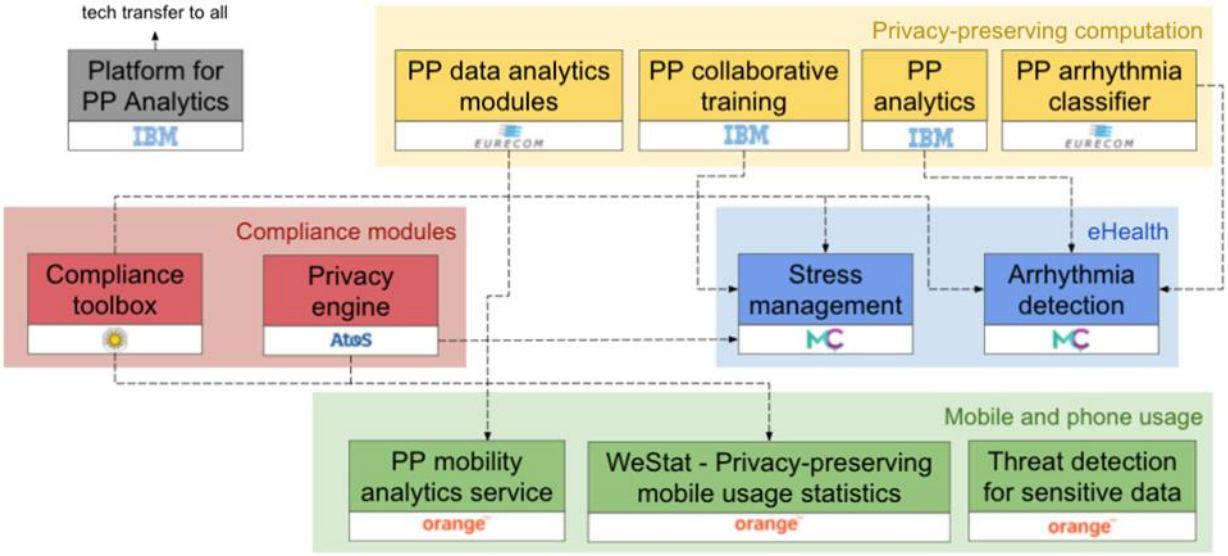

Figure 1 PAPAYA assets at M36

3.1.3 Relevant sectors

The identified assets are distributed among the sectors indicated in Figure 2. Notice that most of the assets are identified as belonging to the “Knowledge and digital economy” sector (48.9%) and to the “Social infrastructure” sector (29.8%). Then we find 8.5% of assets belonging to the

"Resource and environment" sector, 10.6% of assets belonging to the "Transport sector" and finally 2.1% of assets belonging to the "Financing for the SMEs" sector.

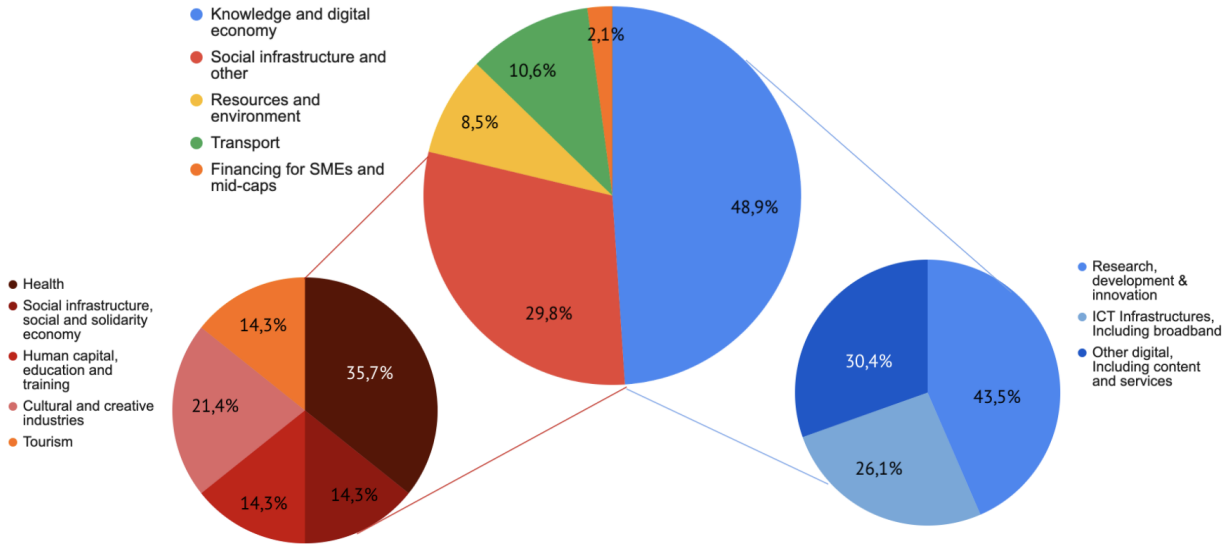

Figure 2 Relevant sectors for the PAPAYA assets

4 Dissemination, Communication and Exploitation Activities

4.1 Scientific Publications

We report in this section, the new scientific publications we have obtained during the last period. This corresponds to 13 additional publications related to the PAPAYA project.

Type of scientific publication	Article
Title of scientific publication	SwaNN: Switching among cryptographic tools for privacy-preserving neural network predictions
DOI	10.5220/0009890704970504
Authors	G. Tillem, B. Bozdemir, M. Onen
Title of journal or equivalent	SECRYPT 2020
Year of publication	July 2020
Peer-review	Yes
Is/Will open access provided to this publication	Yes

Publication #2

Type of scientific publication	Article
Title of scientific publication	ProteiNN: Privacy-preserving one-to-many Neural Network classifications
DOI	10.5220/0009829603970404
Authors	B. Bozdemir, O. Ermis, M. Önen
Title of journal or equivalent	SECRYPT 2020
Year of publication	July 2020
Peer-review	Yes
Is/Will open access provided to this publication	Yes

Publication #3

Type of scientific publication	Article
Title of scientific publication	Protecting citizens' personal data and privacy: a joint effort from GDPR EU cluster research projects
DOI	10.1007/s42979-020-00218-8
Authors	R.M. de Carvalho, C. Del Prete, Y.S. Martin, R.M. Araujo Rivero, M. Önen, F.P. Schiavo, Á.C. Rumín, H. Mouratidis, J.C. Yelmo, & M.N. Koukovini
Title of journal or equivalent	SN Computer Science 2020
Year of publication	2020
Peer-review	Yes
Is/Will open access provided to this publication	Yes

Publication #4

Type of scientific publication	Article
Title of scientific publication	Using PAPAYA for eHealth – Use Case Analysis and Requirements
DOI	10.1109/CBMS49503.2020.00089
Authors	A.S. Alaqra, E. Ciceri, S. Fischer-Hübner, B. Kane, M. Mosconi, S. Vicini
Title of journal or equivalent	CBMS 2020

Year of publication	July 2020
Peer-review	Yes
Is/Will open access provided to this publication	Yes

Publication #5

Type of scientific publication	Article
Title of scientific publication	Wearable Devices and Measurement Data: An Empirical Study on eHealth and Data Sharing
DOI	10.1109/CBMS49503.2020.00090
Authors	A.S. Alaqra, B. Kane
Title of journal or equivalent	CBMS 2020
Year of publication	July 2020
Peer-review	Yes
Is/Will open access provided to this publication	Yes

Publication #6

Type of scientific publication	Article
Title of scientific publication	Blind Functional Encryption
DOI	10.1007/978-3-030-61078-4_11
Authors	S. Canard, A. Hamdi, F. Laguillaumie
Title of journal or equivalent	ICICS 2020
Year of publication	August 2020
Peer-review	Yes
Is/Will open access provided to this publication	Yes

Publication #7

Type of scientific publication	Article
Title of scientific publication	Data Protection: New data analytics platform eases privacy concerns for owners

Authors	M. Onen
Title of journal or equivalent	EU Magazine Special Feature
Year of publication	January 2021
Peer-review	Yes
Is/Will open access provided to this publication	Yes

Publication #8

Type of scientific publication	Article
Title of scientific publication	Privacy-preserving Density-based Clustering
DOI	10.1145/3433210.3453104
Authors	B. Bozdemir, S. Canard, O. Ermis, H. Möllering, M. Önen, T. Schneider
Title of journal or equivalent	AsiaCCS 2021
Year of publication	June 2021
Peer-review	Yes
Is/Will open access provided to this publication	Yes

Publication #9

Type of scientific publication	Article
Title of scientific publication	WeStat: a Privacy-Preserving Mobile Data Usage Statistics System
DOI	10.1145/3445970.3451151
Authors	S. Canard, N. Desmoulins, S. Hallay, A. Hamdi, D. Le Hello
Title of journal or equivalent	IWSPA 2021
Year of publication	April 2021
Peer-review	Yes
Is/Will open access provided to this publication	Yes

Publication #10

Type of scientific publication	Article

Title of scientific publication	From Design Requirements to Effective Privacy Notifications: Empowering Users of Online Services to Make Informed Decisions
DOI	10.1080/10447318.2021.1913859
Authors	P. Murmann, F. Karegar
Title of journal or equivalent	International Journal of Human–Computer Interaction
Year of publication	2021
Peer-review	Yes
Is/Will open access provided to this publication	Yes

Publication #11

Type of scientific publication	Article
Title of scientific publication	Machine Learning Based Analysis of Encrypted Medical Data In The Cloud: A Qualitative Study of Expert Stakeholders' Perspectives
DOI	10.2196/10954
Authors	A.S, Alaqra, B. Kane, S. Fischer-Hübner
Title of journal or equivalent	Journal of Medical Internet Research - JMIR Human Factors. 07/06/2021:21810.
Year of publication	2021
Peer-review	Yes
Is/Will open access provided to this publication	Yes

Publication #12

Type of scientific publication	Article
Title of scientific publication	Vision: A Noisy Picture or a Picker Wheel to Spin? Exploring Suitable Metaphors for Differentially Private Data Analyses
Authors	F. Karegar, S. Fischer-Hübner
Title of journal or equivalent	EuroUSEC 2021
Year of publication	October 2021
Peer-review	Yes
Is/Will open access provided to this publication	Yes

Publication #13

Type of scientific publication	Chapter in a book
Title of scientific publication	Traiter des données multimédia chiffréesgrâce au chiffrement homomorphe (Chapter 6)
Authors	S. Canard, S. Carpov, C. Fontaine, R. Sirdey
Title of journal or equivalent	Sécurité multimédia 2, Biométrie, protection et chiffrement multimédia
Year of publication	July 2021
Peer-review	No
Is/Will open access provided to this publication	Yes

4.2 Conferences, workshops and other events

4.2.1 Scientific conferences, workshops

Participation.

PAPAYA members have been actively promoting the project in many and diverse events listed in Table 2. During the lifetime of the project, we gave a total of 15 new presentations for the last period of the project. As previously, those events include scientific conferences and workshops (a third of the presentations), researchers' seminars from academia (a third of the presentations), and exhibitions targeting industry in different disciplines including ICT, security, law, social sciences, companies and organizations from public and private sectors, the EU commission, law makers and data protection authorities (the last third of the presentations).

Organization.

The PAPAYA consortium has organized a workshop on demonstration of the PAPAYA components and use cases to various business units of different stakeholders including the PAPAYA consortium members, namely IBM, Orange, MediaClinics Italia and ATOS, and other companies such as the Maria Negri health institute, ReplyLaife, Ericsson and Sandvine. The EU commission as well as one of the EC reviewers also participated to this workshop.

Table 3 provides an overview of all the events attended by PAPAYA members.

Table 2 Events attended by PAPAYA

Name of Event	Date	Place	Partner	Audience	Comment
International Conference on Information and Communications Security (ICICS 2020)	August 24-27, 2020	Online	ORA	Scientific audience	Adel Hamdi gave a presentation of the paper "Blind Functional Encryption"
EBDV Forum 2020	November 4, 2020	Online	ATOS	Scientific audience	Juan Carlos Perez and Alberto Crespo gave a talk on "Towards robust privacy preserving of data and digital sovereignty in European data spaces: examples from EU research projects" presentation the PAPAYA vision.
GDPR Cluster Technical Meeting	November 19, 2020	Online	EURC	Technical audience	EURC gave a technical presentation
3IA event, "AI & Security"	November 25, 2020	Online	EURC	Technical audience	EURC gave a technical presentation
Atos Digital Show 2020	November 23-26, 2020	Online	ATOS	ATOS business units	ATOS presented the PAPAYA project and its vision.
Security and Privacy by Design for Healthcare: New solutions from EU H2020 Projects to comply with GDPR webinar	December 10, 2020	Online	EURC	Technical audience	Presentation by EURC of the eHealth Use Cases of PAPAYA project
COSIC Seminar	December 11, 2020	Online	EURC	Technical audience	EURC gave a presentation entitled "Privacy Preserving NN Classification"

EPFL Seminar	January 26, 2021	Online	EURC	Technical audience	EURC gave a presentation entitled "Privacy Preserving NN Classification"
German Innovationskonferenz – Cybersicherheit	February, 2021	Online	KAU	Scientific audience	Simone Fischer-Hübner gave a talk presenting work from PAPAYA on the topic "Privacy als Enabler für Maschinelles Lernen"
Orange Research Exhibition	March, 2021	Online	ORA	ICT researchers and professionals. Orange business partners	ORA presented the PP counting using Bloom filters demonstrator
ISBI 2021, International Symposium on Biomedical Imaging	April 13-16, 2021	Online	EURC	Technical audience	EURC gave a technical presentation
ACM International Workshop on Security and Privacy Analytics	April 28, 2021	Online	ORA	Scientific audience	Adel Hamdi presented the paper describing the WeStat application.
Privacy Studies Journal Inaugural online Workshop 26-28 April 2021, University of Copenhagen	April 28, 2021	Online	KAU	Scientific audience	Simone Fischer-Hübner gave a talk on End User Perspectives on "Privacy Enhancing Technologies (PETs) – User studies from PRISMACLOUD & PAPAYA"
Privacy and Security for Emerging Technologies, TU Darmstadt	June 24, 2021	Online	EURC	Scientific audience	EURC gave a lecture on PAPAYA PP techniques
Cyber Week, Tel Aviv University, Israel	July 22, 2021	Online	KAU	Scientific audience	Simone Fischer-Hübner presents HCI work related to PAPAYA in a panel session

4.3 Collaboration with other research projects

Our collaborations with other research projects have continued during the last year of the project.

These collaborations helped the consortium establish synergies. In particular, during 2020 and 2021 the PAPAYA consortium cooperated actively with the PoSeID-on consortium, with the objective of evaluating the feasibility of integration between the two frameworks. Specifically, the PoSeID-on data subject dashboard has been evaluated of interest for the healthcare scenarios, as it allows to check data subjects' consent before sharing data, and to check the types of data exchanged between applications. The two teams then set the objective of building a new use case inspired by the COVID-19 scenario. A design of a possible solution that allowed data sharing through the PoSeID-on dashboard and a tentative integration between the PAPAYA assets and the PoSeID-on dashboard have been performed. Unfortunately, the integration required more time than expected and the PoSeID-on project came to an end before the integration was fully working. Hence, we reported the designed use case as an additional one that could be better and fully developed in the future (see Deliverable D5.3 for further details).

4.4 Web presence

4.4.1 PAPAYA website

Table 3 PAPAYA Web Statistics

	M24-M39	Target Y3
Sessions	11398	6000
Users	6458	4000
Average Session Duration	70 seconds	2 min
New visitors	78.9%	86%

4.4.2 PAPAYA Twitter

Table 4 Twitter statistics

	M24-M39	Target Y3
Number of Followers	63	0
Number of Tweets	8	50

4.4.3 PAPAYA LinkedIn

Table 5 LinkedIn statistics

	M24-M39	Target Y3
Number of Followers	6	100
Number of Updates	10	20

5 Progress Overview at each WP

This section describes the activities of each partner on a per Work Package, per Task basis. For the sake of clarity, the tables depicting the resources per partner and per Task for each WP correspond to the M25-M39 period.

5.1 Work Package 1: Project Management

WP Leader: EURC

Contributors: All partners.

5.1.1 Progress towards the objectives

This work package aims at coordinating project management activities through regular monitoring of the work carried out at each work package and following the allocated budget. In the third year of the project, we had our second review meeting towards the end of M26. We prepared the related reports. Based on the feedback of our reviewers, we have also prepared a report on the clarification of end-users of each component of the PAPAYA platform. Furthermore, we organized two more online GA meetings on M29 and M36. Finally, the current deliverable reports on the Y3 activities.

5.1.2 Deviations

The project has been extended by three months due to the COVID19 pandemic.

5.1.3 Task 1.1: Project Management and Reporting

Task Leader	EURC
Contributors	All
Overall task progress	The task has been progressed successfully as planned. Due to the COVID-19 pandemic, all physical meetings including the second review meeting were replaced with the online events. Deliverable D1.6, namely the Interim Resource Report (required by the EC when the project was extended) and deliverable D1.5 reporting on the last year activities were submitted on time (M31 and M39, respectively).
Work carried out by beneficiaries (M25-M31)	**EURC**: EURC prepared the second review meeting together with the consortium. EURC also monitored the activities for the second review meeting. Finally, EURECOM organized the online review meeting together with the consortium. EURC organized the fifth online GA meeting, which was held on M29. **IBM**: Preparation and participation to the review meetings. **KAU**: KAU contributed with the required reporting, participation to the review meeting.

	MCI: Support during management aspects and reporting steps **ORA**: Preparation and participation to the review meetings. **ATOS**: Reporting effort and participation to the review meetings.
Work carried out by beneficiaries (M32-M39)	**EURC:** EURC organized the last GA meeting which was held on M35 continued monitoring the activities until the end of the project. **IBM:** Participation to the last GA meeting **KAU:** KAU participated in the last GA meeting and contributed to the reporting **MCI:** Participation to meetings, reporting and project management activities **ORA:** Internal management and interaction with EURC for project management and reporting. **ATOS:** Reporting and participation to the review meetings.

5.1.4 Task 1.2: Quality Assurance and Risk Management

Task Leader	EURC
Contributors	All
Overall task progress	The task has progressed successfully as planned.
Work carried out by beneficiaries (M25-M31)	**EURC**: monitored the production of Y3 deliverables, updated version of the risk (for Covid-19 related risks) and TRL tables (as requested by the reviewers in the second review report). EURC monitored and submitted the Annex to D6.4 on M30 as part of the response for the first review report and D1.6 Interim Resource Report on M31. **MCI**: Support in quality assurance and contributed to the new version of the risk table. **ORA:** Contributed to the new version of the risk table **KAU:** Contributed to the new version of the risk table **ATOS:** Contributed to the new version of the risk table
Work carried out by beneficiaries (M32-M39)	**EURC:** EURC monitored M39 deliverables and edited D1.5. **IBM:** Contribution to D1.5 **KAU:** Contribution to D1.5 **MCI:** Contribution to D1.5 **ORA:** Contributed to the evaluation of the identified risks and D1.5. **ATOS:** Contributed to D1.5

5.1.5 Task 1.3: Innovation Management

Task Leader	MCI
Contributors	MCI, EURC

Overall task progress	This task has successfully ended.
Work carried out by beneficiaries (M25-M31)	**EURC**: EURC contributed to the new version of the innovation questionnaire. EURC together with MCI is monitoring the innovation activities in PAPAYA. **IBM**: Contribution to the innovation management activities **MCI**: Following the first review of the PAPAYA project, MCI supported the preparation, summarisation and submission phases of the innovation questionnaires (due to M24). Periodic check on exploitable components in preparation to the next round of questionnaires. Preparation of stakeholders maps for each of the use cases. **ORA**: Redaction of the new version of the innovation questionnaire for Orange. Interaction with MCI about the innovation questionnaire. Update of D6.4 related to such questionnaire. **ATOS:** Contributed to the innovation questionnaire.
Work carried out by beneficiaries (M32-M39)	**EURC:** No major activities were carried out under this Task in this period. **IBM:** No major activities were carried out under this Task in this period. **KAU:** Minor contributions to innovation questionnaire. **MCI:** Preparation, summarization and submission of the innovation questionnaires (due to M36). Periodic check on exploitable components. **ORA:** Working on the innovation in order to integrate inputs to deliverable D6.6 on the exploitation. **ATOS:** No major activities were carried out under this Task in this period.

5.1.6 Meetings/calls in WP1

Date	Location	Reason
16 Jue 2020	Conference call	WP1 meeting on review preparation activities
22 June 2020	Conference call	PAPAYA review meeting
10 November 2020	Conference Call	WP1 meeting on PAPAYA extension
13 April 2021	Conference call	WP1 slot at the remote GA meeting

5.2 Work Package 4: Platform Design and Development

WP Leader: IBM

Contributors: ATOS, EURC, KAU, IBM, ORA

5.2.1 Progress towards the objectives

In this period, we setup PAPAYA framework environment, completed implementation of the platform dashboard and deployed/integrated the services developed in the course of WP3, including the core services, security and transparency services and the data subject tools.

5.2.2 Deviations

No deviation is identified

5.2.3 Task 4.1: Design models and architecture

This task completed on M24.

5.2.4 Task 4.2: Development of the platform and integration of PETs

Task Leader	IBM
Contributors	ATOS, EURC, IBM, KAU, MCI, ORA
Overall task progress	The task progressed as scheduled: the partners completed development of the platform, including security and transparency mechanisms, deployed it on the IBM cloud, and integrated all the PETs developed in WP3. D4.3 documents this work.
Work carried out by beneficiaries (M25-M31)	**EURC**: Deployment and integration evaluation of pp arrhythmia detection service. EURC worked on the integration of the following 2 PETs: PP Trajectory Clustering and PP NN Classification based on PHE. These modules were deployed in the PAPAYA platform. EURC also participated to the integration of ORA's pp trajectory clustering based on MinHash service. **IBM**: Setup PAPAYA framework environment (Kubernetes service); dockerization, deployment and integration evaluation of PP classification and PP Collaborative Training services; implementation and deployment of the PAPAYA platform, leading D4.2. **KAU**: Development of auditing mechanisms; contribution to D4.2. **MCI**: T4.1, MCI supported the technical partners in what concerns the design and implementation of the platform, ensuring that the implementation follows the expected behavior as for the use cases **ORA**: Development and first tests of the encrypted Bloom filters, and the trajectory clustering on encrypted data; contribution to D4.2.
Work carried out by beneficiaries (M32-M39)	**EURC:** EURC finalized its contributions to D4.3 **IBM:** Final implementation of the PAPAYA platform, leading D4.3 **KAU:** Contributions to D4.3. **MCI:** participation as auditor to the final phases of the activity. **ORA:** Modification of the PETS related to our use cases, specifically for WeStat, but also for the new COVID-19 use case (wih EURC).

	ATOS: Finishing of the development of the Privacy Engine and IAM and preparation for integration

5.2.5 Task 4.3: Dashboard for the platform

Task Leader	KAU
Contributors	ATOS, EURC, IBM, KAU, MCI, ORA
Overall task progress	The task progressed as scheduled: the partners completed implementation of the Platform Dashboard and deployed it on IBM cloud, and completed implementation of Data Subject tools. D4.3 documents this work.
Work carried out by beneficiaries (M25-M31)	**IBM**: We implemented and deployed the 1st version of the platform dashboard **KAU**: KAU implemented data subject user interfaces as part of the data subject toolbox. These include data subject tools for explaining risks and privacy-preserving data analytics (DST1) and data subject tools for enhancing transparency by visualising data flows (DST2). KAU also discussed cooperation with the H2020 Poseidon and Defend projects. **MCI**: MCI offered support to technical partners for what is expected from dashboards, specifically from the point of view of end users. **ORA**: Interaction with partners to better understand the platform dashboard. **ATOS**: Adapting the Privacy Engine tools developed for an easy integration and deployment within the Papaya framework and contributing with the corresponding deliverables. Development of the different PE modules
Work carried out by beneficiaries (M32-M39)	**IBM:** Final implementation and deployment of the Platform Dashboard **KAU:** Production of demonstration videos for data subject tools and clickable demo versions. Contributions to D4.3 **MCI:** Participation as auditor to the final phases of the activity **ORA:** Working on the way to integrate the Data Subject Tools to our WeStat demonstrator. **ATOS:** ATOS contributed with the integration of IAM and to Deliverable D4.3 for the integration of Privacy Engine and IAM. Also ATOS performed the internal review of this document.

5.2.6 Meetings/calls in WP4

Date	Location	Reason
12 August 2020	Conference call	WP4 monthly call
21 October 2020	Conference call	Online GA meeting
9 December 2020	Conference call	WP4 monthly call
21 October 2020	Conference call	WP4 slot at the remote GA meeting

10 February 2021	Conference call	WP4 monthly call
12 April 2021	Conference call	WP4 slot at the remote GA meeting

5.3 Work Package 5: Platform Validation

WP Leader: MCI

Contributors: ATOS, EURC, KAU, IBM, ORA

5.3.1 Progress towards the objectives

The consortium worked together towards the achievement of three objectives: i) the validation of eHealth use cases; ii) the validation of telecom use cases; iii) the validation of the PAPAYA framework and the preparation of a guide for the PAPAYA platform.

The validation of use cases (points 1 and 2 cited above) involved the verification of requirements (as in Deliverables D2.1 and D2.2) and the validation via end users. The validation of the PAPAYA framework (point 3 cited above) has been done with respect to Deliverable D2.2 and with IT users, and reported in Deliverable D5.3. Finally, Deliverable D5.4 has been prepared to instruct potential users of the PAPAYA platform to use it and its dashboard.

5.3.2 Deviations

No major deviations in activities are identified.

5.3.3 Task 5.1: Validation through e-health UC

Task Leader	MCI
Contributors	ATOS, EURC, IBM, KAU, ORA
Overall task progress	The task has been finalized, with a full validation of the eHealth use cases. The validation has been done on solutions that integrated eHealth services and components from the PAPAYA framework. The validation involved the review of requirements coverage and the validation via end users
Work carried out by beneficiaries (M25-31)	**MCI**: MCI prepared a plan for integration and validation; then, started with the implementation of use cases and their integration with the PAPAYA platform. **EURC:** EURECOM worked on the validation through e-health UC together with MCI using the PP Arrhythmia Detection solution. **KAU:** Participated in telcos, provided feedback to the validation plan and started to plan the evaluation of user interfaces. **IBM:** Integration of PP-Colaborative training service with stress detection e-health UC **ORA:** Interaction with MCI related to their use case. **ATOS**: Atos contributed on integration of Privacy Engine

Work carried out by beneficiaries (M32-M39)	**MCI:** Implementation of the solutions for UC1 and UC2. Integration with the technologies of the project. Validation of the implemented solution. Redaction of D5.1. Integration with PoSeID-on technologies in a new use case. **EURC:** EURC finalized its contributions to UC1 with the integration of the privacy preserving arrhythmia detection tool. EURC also participated to the integration with PoseID-ON together with MCI. **IBM:** Changes to the platform and PP collaborative training service after receiving feedback from the use cases **KAU:** KAU evaluated the data subject tools for explaining DP through interviews. KAU contributed to D5.1. **ORA:** Interaction with Orange BU on e-health. **ATOS:** ATOS worked on the adaptation and integration of the PE, specifically in Privacy Preferences Manager (PPM) for UC4.

5.3.4 Task 5.2: Validation through web analytics UC

Task Leader	ORA
Contributors	ATOS, EURC, IBM, KAU,
Overall task progress	During this period, this task has seen the integration of all the components to UC4 and UC5, and the study on the way to integrate UC3 in the current Orange architecture. This task as been more or less concluded by the submission of Deliverable D5.2.
Work carried out by beneficiaries (M25-M31)	**ATOS**: Initial work on the integration of the different tools developed by Atos. Providing PE modules for each use case, adapting them for each specific requirements. **KAU:** Participated in telcos started to plan the evaluation of user interfaces. **EURC:** EURC worked with ORA on the validation of UC3 on trajectory clustering. EURC completed benchmarks on the trajectory clustering solution developed in WP4 using ORA's synthetic dataset. **ORA:** ORA are deeply working on our use case prototypes: mobility statistics, WeStat and threats detection. First versions of each prototype are now finished and we are continuing the work on the integration part. ORA has also take the lead, with EURC, on the definition of the new COVID-19 use case.
Work carried out by beneficiaries (M32-M39)	**ORA:** Integration of the PETS and Data Subject Tool to the WeStat demonstrator, working with Orange BU for the integration of the mobility data analytics, redaction of D5.2. **EURC:** EURC collaborated with ORA on the definition and initial development of a new Covid-19 use case. **IBM:** Participation in telcos **KAU:** KAU validated the use case through user interface walkthroughs and focus group and contributed to D5.2.

	ATOS: ATOS worked on the adaptation and integration of the PE, specifically in Privacy Preferences Manager (PPM) for UC4.

5.3.5 Task 5.3: Technology assessment and recommendations

Task Leader	MCI
Contributors	All
Overall task progress	The task achieved the objective of evaluating the current implementation of the PAPAYA framework and making it accessible to external users with a guide (proposed in Deliverable D5.4). The evaluation of the PAPAYA framework has been done with respect to the requirements traced at the beginning of the project (Deliverable D2.2), the recommendations coming from partners and external parties, and the opinion of IT users.
Work carried out by beneficiaries (M25-M31)	**MCI**: Contribution to the collection of recommendations and feedback for the platform; this collection has been performed while integrating components from the use case apps and components from the PAPAYA platform in T5.1. **ATOS**: Establishing the initial lines of work on detailing the technology assets and recommendations. Contributing to the early stage analysis performed by these tasks. **ORA:** We have work on the technology assessment and recommendations related to the PAPAYA techniques, especially related to our use cases.
Work carried out by beneficiaries (M32-M39)	**MCI:** Redaction of D5.3. Preparation of new use case based on COVID-19 pandemic scenario. Interviews conducted with IT users, to assess the interest in the technologies of the PAPAYA framework. Assessment of coverage of requirement. **EURC:** EURC contributed to deliverable D5.3 with several recommendations in particular for privacy preserving NN classification components. **IBM:** Leading D5.4 and contribution to D5.3, including internal reviews **KAU:** KAU contributed to D5.3. and D5.4. **ORA:** Working on the new COVID-19 use case with EURC, working on the recommendations to use PAPAYA components for Orange needs, participation to the redaction of D5.3, internal review of D5.1. **ATOS:** ATOS contributed to deliverable D5.3 with validation of requirements and recommendations regarding Privacy Engine and IAM, moreover with questionnaires for helping the validation. Atos also contributed to D5.4 providing the guide for deploying of the components Privacy Engine, Key manager and IAM, and also performing the review of this deliverable.

5.3.6 Meetings/calls in WP5

Date	Location	Reason

18 May 2020	Conference call	WP5 call
15 June 2020	Conference call	WP5 call
8 July 2020	Conference call	Call on PAPAYA – PoSeID-on integration
21 July 2020	Conference call	Call on PAPAYA – PoSeID-on integration
6 August 2020	Conference call	Call on PAPAYA – PoSeID-on integration
7 September 2020	Conference call	WP5 call
20-21 October 2020	Conference call	WP5 slot during the GA meeting
16 February 2021	Conference call	WP5 bi-weekly call
2 March 2021	Conference call	WP5 bi-weekly call
16 March 2021	Conference call	WP5 bi-weekly call
30 March 2021	Conference call	WP5 bi-weekly call
13 April 2021	Conference call	WP5 slot during the GA meeting
27 April 2021	Conference call	WP5 bi-weekly call
11 May 2021	Conference call	WP5 bi-weekly call
25 May 2021	Conference call	WP5 bi-weekly call
8 June 2021	Conference call	WP5 bi-weekly call
22 June 2021	Conference call	WP5 bi-weekly call

5.4 Work Package 6: Dissemination and Exploitation

WP Leader: ORA

Contributors: All

5.4.1 Progress towards the objectives

Within WP6, the objectives related to dissemination and communication are considered achieved. We have published papers, participated to conferences, workshops and industrial events, we have organized some of them, especially the PAPAYA Business workshop, and we have promoted the project through our website and our Twitter/LinkedIn accounts. Even if the pandemic situation have transformed most of the event to online ones, we have continued to participate to them. All the detailed results are now given in Deliverable D6.5.

Regarding exploitation, market analysis and business plan, we have met our objectives, evaluating the PAPAYA assets that can be commercialized, and, based on the market analysis we have done, proposing a way to exploit them, both from a consortium point of view and from

an individual one. We have also studied the way PAPAYA results can be further exploited by the consortium after the end of the project. All our conclusions are given in Deliverable D6.6.

5.4.2 Deviations

No major deviation was identified.

5.4.3 Task 6.1: Dissemination & Communication

Task Leader	ORA
Contributors	All
Overall task progress	During this period, we have mainly finalized most of the communication and dissemination activities we have started, publishing papers and presenting the PAPAYA vision outside the consortium, both to the research and the industrial communities. One main work we have done is the organization of the PAPAYA Business workshop.
Work carried out by beneficiaries (M25-M31)	**EURC**: EURC has contributed to several dissemination activities (GDPR cluster webinar and technical meeting about the scientific outcomes of PAPAYA services). EURC has been involved into writing 3 scientific papers (2 of them are accepted and presented at SECRYPT2020 conference and the last one is accepted and presented at AsiaCCS conference). **IBM**: Presenting PAPAYA technologies at Privacy & Security Seminar in Haifa **KAU**: KAU has been involved in writing 3 papers for disseminating project results (2 accepted and 1 submitted). Besides, KAU presented PAPAYA at a ENISA-ULD workshop on pseudonymity, and at a panel discussion organized by the CyberSec4Europe project and at the NECS winter school. KAU also organised a special privacy track at the IEEE CBMS conference, at which PAPAYA research related to the medical use cases was presented. **MCI** provided contributions on use cases for the publications released in the considered period. **ORA**: Dissemination activities related to Twitter account and web site. Creation of a proposal that will be submitted to the next Orange Research Show in March 2021, based on Orange use cases. ORA has also worked on the definition of the Business meeting in April 2021. **ATOS:** Managing the project Website, contributing on the general dissemination of the project, participating in different events disseminating the main results of the project
Work carried out by beneficiaries (M32-M39)	**ORA:** Finalization of dissemination and communication activities, redaction of D6.5. **EURC:** EURC contributed to D6.5 and D6.6. **IBM:** Contribution to D6.5. **KAU:** KAU contributed to D6.5 and disseminated results via publications and presentations. **MCI:** Contribution do D6.5.

	ATOS: Managing and updating the project Website (enabling theupload of project Demos) stats generation and follow up Additionally to this, Atos continued with its participation in different events (e.g. BDVA Privacy Work Group) disseminating the main results of the project.

5.4.4 Task 6.2: Exploitation

Task Leader	ORA
Contributors	EURC, IBM, MCI, ATOS
Overall task progress	During this period, we have continued to work on the exploitation strategy, as a whole, and for each partner independently. We have some refined the market analysis, especially related to the studied use cases. Eventually, we have worked on the post-project phase. The final step is the redaction and submission of the final report on exploitation D6.6.
Work carried out by beneficiaries (M25-M31)	**EURC:** EURC proposed several semester projects whose topics are PAPAYA related particularly for the potential candidate of joint use case with PoSeID-on project, privacy preserving clustering based on MinHash and the new privacy preserving contact tracing use case. **IBM:** Meetings with different bodies within/outside the IBM to exploit technologies being developed in PAPAYA. Presentation of PAPAYA technologies to IBM BUs and IBM customers **MCI:** In line with T1.3, MCI identified exploitable assets and their interactions (through the usage of the innovation questionnaires), which forms the needed basis to understand the possible exploitation plans (individual and of the consortium) to be presented as an outcome for this task. Revision of eHealth exploitation plan to include larger clients and markets **ORA:** Interaction with the Flux Vision team at Orange Business Service to integrate PAPAYA's work on Bloom filters and trajectory clustering into their service. Interaction with different services inside Orange for the exploitation of the use case related to statistics on mobile apps. **ATOS:** Contributing to the corresponding deliverables, especially on the description of the Privacy Engine Exploitation
Work carried out by beneficiaries (M32-M39)	**ORA:** Interaction with Orange BU and Orange legal department for the exploitation of PAPAYA results, redaction and internal review of D6.6. **EURC:** EURC contributed to D6.6 **IBM:** Platform presentation at the PAPAYA workshop **KAU:** KAU participated in Telcos and exploited results in a Master course. **MCI:** redaction of D6.6, contribution to D6.5. Summary of assets description and details, also in relation with T1.3. Exploitation strategy extracted from assets definition. Participation to business workshop. **ATOS:** Atos participated actively in the exploitation strategy and specially involved in the potential options of the joint exploitation (generation of draft version of an IPR agreement and commercial agreement)

5.4.5 Task 6.3: Market Analysis and Business Plan

Task Leader	MCI
Contributors	All
Overall task progress	The task conducted a work of analysis of the current market, in line with the activities conducted with the exploitation task.
Work carried out by beneficiaries (M25-M31)	**IBM:** Contribution to D6.4. Presentation of PAPAYA technologies to IBM BUs and IBM customers. **MCI:** in line with T1.3, MCI coordinated the analysis of existing market and products through the usage of the innovation questionnaires. Market analysis in view of the updated for the eHealth exploitation plan. Revision of MCI business plan **ORA:** Participation to the market analysis and business plan. **ATOS:** Contributing to the corresponding deliverables
Work carried out by beneficiaries (M32-M39)	**MCI:** Redaction of D6.6 with aspects related to market analysis. **IBM:** Contribution to D6.6 including the internal review **ORA:** Interaction with Orange BU and regarding market analysis and business plan related to PAPAYA results, redaction and internal review of D6.6. **ATOS:** Atos reviewed and updated its individual exploitation plan and the business plan approach (business model canvas reviewed)

5.4.6 Meetings/calls in WP6

Date	Location	Reason
October 20, 2020	Conference call	WP6 meeting during the GA meeting
March 15, 2021	Conference call	PAPAYA Workshop with Business Units
April 13, 2021	Conference call	WP6 meeting during the GA meeting
June 22, 2021	Conference call	WP6 meeting
July 6, 2021	Conference call	WP6 meeting
Juy 20, 2021	Conference call	WP6 meeting

6 Deliverables, Milestones & Risk Management

6.1 Deliverables

Table 6 shows the status of all year 3 deliverables. As shown in this table, all year 3 deliverables are submitted. Due to the extension of the project by 3 more months, the submission of deliverables D1.5, D5.1, D5.3, D6.5 and D6.6 are postponed to M39.

Table 6 PAPAYA Year 3 deliverables

Del. No.	Deliverable Name	WP No.	Editor	Type	Diss. Level	Due Date	Actual Delivery Date	Status	Comments
Annex to D6.4	Annex to Intermediate Business Plan and Exploitation Report	WP6	MCI	R	CO	-	M30	Submitted	No further comments
D1.6	Interim Resource Report	WP1	EURC	R	CO	-	M31	Submitted	No further comments
D4.3	Final report on platform implementation and PETs integration	WP4	IBM	D	PU	M36	M36	Submitted	No further comments
D5.2	Web analytics use case validation	WP5	ORA	R	PU	M36	M36	Submitted	No further comments
D5.4	Platform Guide	WP5	IBM	R	PU	M36	M36	Submitted	No further comments
D1.5	Final Project Progress Report	WP1	EURC	R	PU	M39	M39	Submitted	No further comments
D5.1	E-health use case validation	WP5	MCI	R	PU	M39	M39	Submitted	No further comments
D5.3	Refinement Recommendations for the Platform	WP5	MCI	R	PU	M39	M39	Submitted	No further comments
D6.5	Final Dissemination and Communication Report	WP6	ORA	R	PU	M39	M39	Submitted	No further comments
D6.6	Final Business Plan and Exploitation Report	WP6	MCI	R	CO	M39	M39	Submitted	No further comments

6.2 Milestones

Table 79 describes the status of the project with respect to the project's milestones corresponding to year 2, as defined in the DoA and the internal milestones as defined in deliverable D1.1.

Table 7 PAPAYA Year 3 milestones

MS No	Milestone title	Related WP(s) & Due Date	Means of achieved verification	Status	Comments
MS5	Intermediate version of the PAPAYA platform	WP3, WP4, WP5, M30	**MS5-1, M24** Analysis of PAPAYA PETS and integration of one module at least	Achieved	No further comments.
			MS5-2, M30 PAPAYA platform v1 (D4.2)	Achieved	This version of the platform contains (1) PP NN classification based on 2PC, PHE, FHE and hybrid approaches; (2) PP collaborative training of DNN; (3) PP Trajectory Clustering based on MinHash and 2PC (4) IAM and Key Manager; (5) 1st version of Platform Dashboard including auditing; (6) 1st version of Data Subject tools including data disclosure view, annotated log view, first integrated versions of views for explaining privacy-preserving data analytics, and Privacy Engine. The rest of the services described in D4.2 will be integrated till M39
MS6	PAPAYA Platform Implementation	WP3, WP4, WP5, M36	**MS6-1 M36** PAPAYA platform v2 (D4.3), PAPAYA Platform Guide (D5.4)	Achieved	The final version of the platform contains (1) PP NN classification based on 2PC, PHE, FHE and hybrid approaches; (2) PP collaborative training of DNN; (3) PP Trajectory Clustering based on MinHash and 2PC (4) IAM and Key Manager; (5) Final version of the Platform Dashboard including auditing; (6) Finnal version of Data Subject tools including data disclosure view, annotated log view, first integrated versions of views for explaining privacy-preserving data analytics, and Privacy Engine. Furthermore, the PAPAYA Platform Guide (D5.4) was submitted on M36.

MS7	PAPAYA use case final validation	WP5 M39	**MS5-1 M36** Web analytics use case validation (D5.2), **MS5-2 M39,** E-Health use case validation (D5.1), Refinement Recommendations for the platform (D5.3)	Achieved	(1) Deliverable D5.2 Web analytics use case validation was submitted on M36. This deliverable reports the validation process of the three telecom use cases, namely, Privacy-preserving mobility analytics (UC3), Privacy-preserving mobile usage statistics (UC4), and Threat detection (UC5). (2) Deliverable D5.1, namely the e-Health use case validation was submitted on M39 and it reports the validation process of privacy-preserving arrhythmia detection and privacy-preserving stress detection use cases. (3) Deliverable D5.3 is also submitted on M39. This deliverable overviews the recommendations for the platform for future enhancements, summarizes the recommendations in the validation period. Moreover, detailed definitions of COVID19 related new use cases of PAPAYA project are reported in this deliverable. Demonstrations of all use cases are disseminated through PAPAYA's website.

6.3 Risk Management

Table 10 overviews the identified risks and their status at year 3.

Table 8 PAPAYA status on risk management

Risk No	Risk Description & Initial level of Likelihood	Related WP(s)	Proposed mitigation measures (DoA)	Risk Status	Comments
RT1	Requirements are too ambitious and cannot be met. (*Low)*	**WP2, WP3, WP4, WP5**	The project will keep requirements in line with the objectives, and leaders of WP3 and WP4 will constantly review the requirements.	*Low*	D5.3 reviewed the requirements defined in D2.2 and demonstrates their validation.

RT2	Some use cases are discovered to be limited. *(Low).*	**WP2, WP5**	All partners will take part in the definition and the review of the use cases. Complementary adjustments can be made continuously during the project and reviewed at the WP5 start time. Interaction with operational team by industrial use case partners will additionally be done all along the project	*Low*	All use cases are operational and demonstrated. More information can be found in D5.1 and D5.2
RT3	Failure to implement one or more primitives in a real setting *(Medium).*	**WP3, WP4, WP5**	WP3 partners will focus on most important requirements and innovative aspects and define a two-phase validation procedure in order to early detect any possible difficulties	*Low*	The complete specification and implementation of the PAPAYA privacy preserving data analytics has been provided and described in D3.3
RT4	Delay in the development of the platform (*Low).*	**WP4**	The work by WP3 and WP4 will continuously be monitored which will allow identifying any possible delays and hence taking the necessary corrective measures such as focusing on key primitives that can be validated by case studies.	*Low*	The development of the PAPAYA platform is finalized. D4.3 reports on the final integration and implementation activities and D5.4 provides a guide for the platform.
RT5	Time for development is underestimated (*Medium).*	**All WPs**	The project will focus on the core functionalities that can illustrate the key innovations of PAPAYA.	*Low*	All components and use cases were developed.
RM1	Some potential conflicts regarding authorship or exploitation (*Low)*	**WP1**	The IPR strategy is defined in WP1 and provides a framework for managing authorship and results exploitation involving	*Low*	The project did not witness any conflict regarding authorship and exploitation.

			all partners. An early detection of such an issue will be done thanks to close and good contacts and frequent meetings.		
RM2	Allocated resources are not sufficient (*Medium)*	**WP1**	Depending on shortage e.g. skills, expertise, etc. redistribution of the effort/costs can be proposed	*Low*	MCI needed more resources in terms of PM then expected. Nevertheless the budget was not exceeded.
RI1	Project objectives lose relevance (*Low)*	**WP1, WP6**	T1.3 will produce an innovation strategy at the early stage to evaluate market trends. Industrial partners will bring their competences and will monitor and adapt the results in order to ensure the relevance of the solutions.	*Low*	Relevance of recognized assets (as an outcome to the project) has been tracked with the questionnaires (see Section 3), which monitored the adherence of the assets to the market. Furthermore feedback from the business workshop also demonstrated that project objectives are still relevant.
RI2	Results produced by PAPAYA are not well exploitable (*Low).*	**WP6**	T1.3 on innovation management will continuously monitor the market trends to influence WP action plans on time to redesign or incorporate new requirements. The presence of major industrials as well as partners that are key stakeholders allows PAPAYA to cover the complete value chain which in turn guarantees a variety of exploitation tracks.	*Low*	Exploitation of recognized assets, as well as their adherence to market expectations, has been evaluated, in particular while compiling the questionnaires mentioned in Section 3, every year. Even if a real exploitation is not yet recorded, each industrial partner has clear plans on its own exploitation, in terms of platform components and/or use cases. More details can be found in D6.6.

RI3	Less opportunities to reach relevant stakeholders.	**WP6**	Within the plans of the consortium is the realization of a workshop at the headquarters of Orange to show the final results to relevant stakeholders. It is planned that the other industrial partners will also collaborate and be able to provide their contacts to attend the presentation.	*Low*	A workshop gathering business units of different stakeholders (internal to the consortium and external) was organized on March 15th
RI4	Less opportunities to have dissemination at industrial event (Medium/High)	**WP6**	The consortium has planned to have some of its industrial partners to partecipate at events, relevant in their technological sectors, where to showcase the PAPAYA project.	*Medium/ High*	Due to the COVID a lot of the industrial events have been postponed or canceled. We have however been able to present the project at several online events, in particular the one we have managed.
RV1	Availability of healthcare end users for interviews may be reduced	**WP5**	We plan to include other users not previously included for health use-cases validation, such as third party companies that wants to resell the services etc. We'll also try to schedule remote telco with the nursing homes and healthcare IT departments, but their availability will vary a lot according to the evolution of pandemic	*Low*	Healthcare system developers were contacted via questionnaires. Interviewees in the patient role for evaluating the data subject tools explaining differential privacy were recruited by KAU via the Prolific platform.