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ASSESSING THE STATE OF THE ART AND SUPPORTING AN EVIDENCE-BASED UPTAKE AND EVOLUTION OF OPEN SERVICE PLATFORMS IN THE ACTIVE AND HEALTHY AGEING DOMAIN

D2.3

European Open Service Platforms in the AHA Domain – Stakeholder Interviews Report

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EXECUTIVE SUMMARY

Within this document, the activities related to Task T2.3 “Run interviews and other types of consultations with platform developers to identify further hidden factors affecting their uptake and evolution “are described and discussed. The activities depart from the final group of eight platforms identified in T2.2: AIOTES, UniversAAL, Fiware, EkoSmart, Onesait, Sensinact, Reach2020 and Uncap.

The work carried out so far within T2.1 and T2.2 has allowed us to better understand the characteristics and differences between the various platforms. The analysis of the existing context and the platforms explored led us to focus on the above-mentioned eight. The purpose of this task is to deepen the knowledge on this poll of platforms by directly questioning the professionals who took part in the creation, management, development and maintenance phases of these platforms, to try to obtain information that is difficult to find in the official documentation.

Starting from the analysis made in T2.2, three dimensions have been defined: Technical, Contextual and Business. The three dimensions have been mapped using two questionnaires: one relating to the technical dimension to be sent to platform developers, the other one relating to the contextual business dimension, to be sent to excutives.

This deliverable aims to provide a complete view of the eight platforms and to acquire more comprehensive understanding on possible success and hindrance factors based on their characteristics, existing networks and stakeholders. Such a view, as to be able to define what could be an ideal platform, highlighting weaknesses and strengths that emerged from the responses to the questionnaires.

After a description of the work carried out to define the questions constituting the surveys and summarize the provided answers, the report concludes by trying to highlight success or hinderance factors seen in a general perspective. This with the aim to create the fundamentals for an ideal platform, taking advantage of the strong points highlighted and trying to avoid errors that may have compromised or slowed down the full development of the platforms under consideration.

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1. Introduction

The main purpose of task 2.3 is to deepen the analysis of T2.1 and T2.2 of the platforms with the contribution of those persons who have participated in their creation.

Against the background of COVID-19 pandemic and its restrictions, the project consortium decided to implement a survey as means of collecting further insights on the hidden factors affecting the uptake of open service platforms in the AHA and AAL domains. In this way, PlatformUptake.eu provides the opportunity to respondents to provide complete and detailed information on critical points regarding the platform development while having the advantage to do it in an anonymous manner. The latter will guarantee the truthfulness and reliability of the provided input needed for the definition of an objective set of KPIs to make the uptake and impact of the platforms under consideration measurable. Last, based on the complexity of some of the questions and teamwork required for the provision of the requested feedback, the survey has been seen by the consortium members as the most effective and appropriate method to tackle these particular challenges.

The analysis performed on the received responses is specific to each individual platform, in the conclusions we tried to collected the strengths and weaknesses of all the platforms analyzed to be able to provide a complete view of all hidden factors involved in the creation of an AHA platform and how they can be addressed in advance. In the same way we analyzed the strengths to understand which steps were fundamental for achieving them.

The purpose of a survey is to deepen some aspects of the history of the considered platforms that are not usually covered by papers, deliverables or documentation. In particular, we aim to understand the reasons behind the success or unsuccess of the considered IoT platform for AHA domain and other information to complete the activities of the next work packages.

We divided the keys for a successful IoT platform in six categories [iotkpis] [iot-manager] [iotkey] [iot-succ]:

- *Security*: it plays an essential role in the success of a platform. Vulnerabilities and points of failure could have a real-life impact on the end-users and people around them. A straightforward example is data flowing. Some of the most used strategies to protect the development and data include end-to-end encryption, access management, secure firmware and provisioning or open network port management. Taking advantage of the improvement of IoT devices equipped with more computing capabilities, the edge computing permits to reduce data transfer to the data-center or use aggregated information. It is essential to pay big attention to resource consumption and requirement.

- *Reliability*: it should be achieved not just in the lab but in real life environments. It is mandatory to have a persistent and high-speed connection that is able to handle a high amount of data and can guarantee the availability of services anytime.

- *Low latency*: it should use the low-latency protocols and technologies to provide the real-time speed necessary to control and monitor IoT devices. Every millisecond counts.

- *Scalability*: it has to be scalable to support a dynamically growing number of new users or services, keeping performance unchanged. It is crucial to determine the needed platform size

that should be sufficient for years. Building an IoT platform on a massively scalable, highly reliable, high-performance platform from the start can avoid speed and scalability challenges that arise with production-scale deployments.

- *Integration*: due to the lack of standards and interoperability, IoT platforms have to integrate several capabilities and features into a solution, essentially enabling to deploy IoT projects and develop applications in a better, faster, more cost-efficient and integrated way, at the same time serving as a bridge, middleware and solution to overcome IoT issues in enabling these applications and ultimately outcomes. Standards, code, certifications, and specifications are keywords.
- *Solve real needs*: while it is necessary to keep up with the latest technologies, trends, and offerings in the IoT domain, it is important to do not fall into the trap of build a novel technology solution without addressing or fixing an existing problem.

2. Methodology

The starting point in T2.3 was the analysis done in D2.1 and D2.2 in order to identify what information was missing and what necessary for gaining a deeper knowledge of the analyzed platforms and their correlations, which is fundamental for the subsequent tasks.

For the analysis carried out in D2.2, three dimensions have been defined: Technical, Contextual and Business. Each of these dimensions is accompanied by a specific analysis.

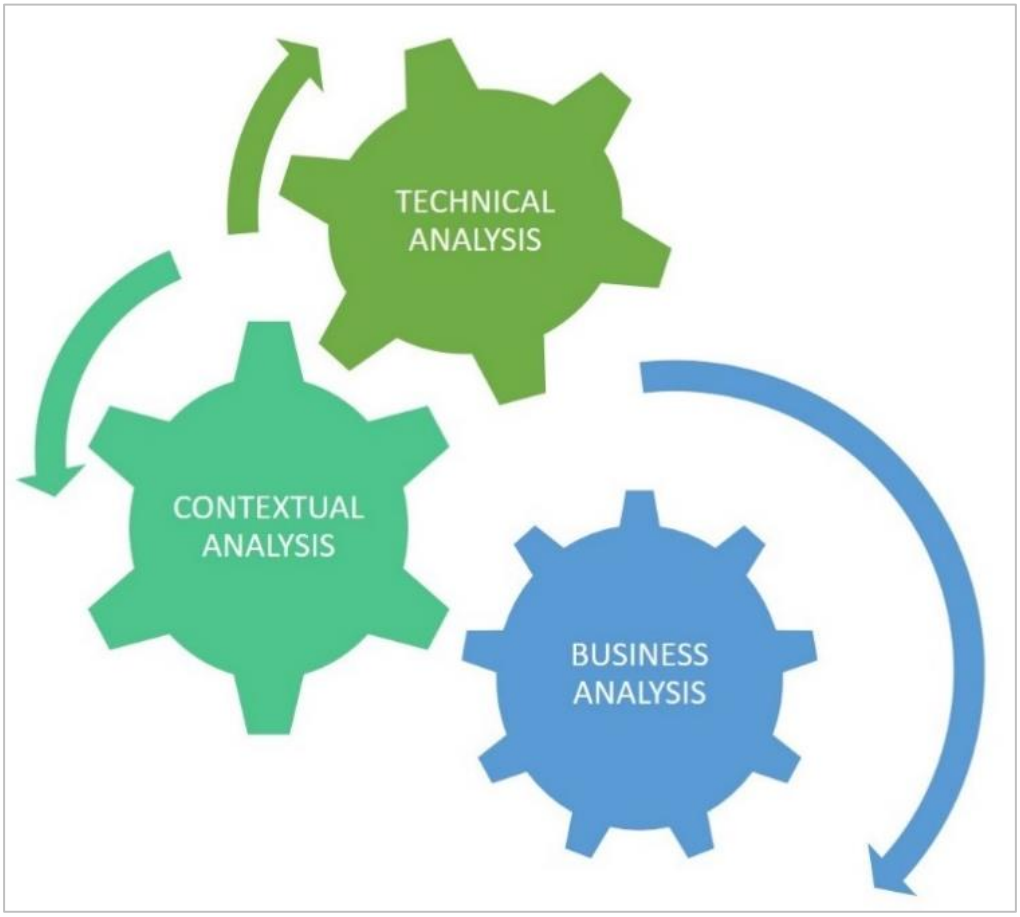

Figure 1: Three layers of in-depth analysis of the open platforms in AHA

For completeness we report the fundamental points relating to the three questionnaires that were the subject of this previous analysis.

Technical analysis

Table 1: Questionnaire for the technical analysis

TECHNICAL ANALYSIS
IN DEPTH PLATFORM ANALYSIS
PHYSICAL LAYER Analysis of the solutions structure and implementation
SERVICE LAYER Analysis of the solutions structure and implementation
APPLICATION LAYER Analysis of the solutions structure and implementation
SEMANTIC LAYER Analysis of the solutions structure and implementation
INTEROPERABILITY LAYER Analysis of the solutions structure and implementation
FEATURES ANALYSIS
DEVICE MANAGEMENT The IoT platform should maintain a list of devices connected to it and track their operation status; it should be able to handle configuration, firmware (or any other software) updates and provide device-level error reporting and error handling. At the end of the day, users of the devices should be able to get individual device level statistics.
INTEGRATION/INTEROPERABILITY The API should provide access to the important operations and data that needs to be exposed from the IoT platform. It's common to use REST APIs to achieve this aim.
INFORMATION SECURITY Measures required to operate an IoT software platform are much higher than general software applications and services. Millions of devices being connected with an IoT platform means we need to anticipate a proportional number of vulnerabilities. Generally, the network connection between the IoT devices and the IoT software platform would need to be encrypted with a strong encryption mechanism to avoid potential eavesdropping.
TYPES OF PROTOCOLS An IoT platform may need to be scaled to several (up to millions or even billions) devices. Lightweight communication protocols should be used to enable low energy use as well as low network bandwidth functionality.
DATA ANALYTICS The data collected from the sensors connected to an IoT platform needs to be analyzed in an intelligent manner in order to obtain meaningful insights. There are four main types of analytics which can be conducted on IoT data: real-time, batch, predictive, and interactive analytics.
SUPPORT FOR VISUALIZATION Typically referred as visual interfaces, they can be simple web portals with some kind of visualization of the system, its components and the data, they can allow for the management of Iot Ecosystems and, in optimal solutions, provide the capabilities of visual data analytics.

Contextual analysis

Table 2: Questionnaire for the Contextual Analysis

CONTEXTUAL ANALYSIS
REGULATORY FRAMEWORK
In which country is it based
Is there information available on the regulations it complies with? (e.g. link to deliverables)
Is it a medical device? Is it certified? CE mark? Other?
Is there information available on how it was funded? If the services are reimbursed, if it was funded through procurement, projects, etc.?
ETHICS AND PRIVACY
Type of data collected
Information provided to the user on data collection, storage, processing and transfer
Is there an informed consent?
DATA SHARING GOVERNANCE
Which model of data sharing does it use?
How is data management ensured?
IPR
Is the platform registered - brand, trademark, patent, etc.
What is the access model? Open access, open source, close access

Business analysis

Table 3: Questionnaire for the business analysis

BUSINESS ANALYSIS
KEY PARTNERS
Suppliers, financiers, contractors, and marketing firms. Here it is important to mention if the creators of the open source platforms have used resources from external parties or outsourced certain activities. A list of key partners can be also added
KEY ACTIVITIES
Activities needed to create value, achieve benefits for the customers/end users and deliver successful services. The key activities are linked to the value proposition and key resources. Some sample activities might be marketing, distribution, research and development, customer service, revenue streams etc.
KEY RESOURCES
Key Resources looks at the staff, the processes, available money and equipment or applications needed to create the value for the customers/ end users of the open source platforms in AHA and AAL domains.
VALUE PROPOSITION
It defines the services supplied to the customers/ end users. The term “value” refers to the newness, performance, design, accessibility, etc. that the customer perceives.
CUSTOMER SEGMENT
All the important (paying) customers /end-users or organizations for which the business model wants to create value need to be defined.
CHANNELS
Channels look at how the offerings/services/products can get to the customers and through what preferred channels.
CUSTOMER RELATIONSHIP

Customer Relationship focuses on getting, keeping, and growing the customer base (marketing communications, sales support, technical assistance and customer service).
COSTS
The costs for the creation of an open source platform need to be estimated and the money needed to get the business to a stage where it's providing the desired profit.
REVENUE STREAMS
Revenue streams, one focuses on how the customer pays for the provided value. Some examples are subscriptions, rentals, service sale, and asset sale.

The above mentioned three dimensions have been mapped into two questionnaires: one relating to the technical dimension and one relating to the contextual business dimension. Each questionnaire is therefore aimed at specific target groups: the technical questionnaire was designed to be sent to platform developers, while the contextual business questionnaire to executives.

In this chapter we will see a brief analysis of the European platform used for the realization of this survey and we will see the criteria that led to the selection of the professionals responsible for answering the questions.

2.1. Setup of the survey

To implement the survey, we used the *EUSurvey* [eusurvey] tool. *EUSurvey* is the *European Commission*'s official online survey management platform to create, manage, and publish forms for public consultations. *EuSurvey* was created in 2013 for internal communication and staff management, e.g., staff opinion surveys and forms for evaluation or registration.

Like other survey platforms, *EUSurvey* provides most of the elements usually used in forms like text questions and multiple-choice questions, editable spreadsheets, and multimedia elements.

Other features of *EUSurvey* are:

- *languages*: the user interface is available in 23 EU languages, and it is possible to translate forms;
- *security*: its infrastructure secures the online forms;
- *sending invitations*: from the application, it is possible sending to single contacts individual access links;
- *advanced privacy*: the possibility to guarantee participant's privacy by creating anonymous forms;
- *analysis of results*: the availability of basic result analysis capabilities and visualization of data in histograms and chart views. Moreover, the system can export data in spreadsheet format;
- *publishing results*: it can show submitted answers on the application's internal pages with automatic calculated charts and statistics.

To login to the EUSurvey service as a survey creator/manager, it is necessary to have a EULogin account [eulogin]. EuLogin account is the Commission's Authentication Service for logging on to a whole range of websites and online services run by the Commission. After login, the system presents the Dashboard summarizing information about current surveys, and a set of actions to do with them like opening, editing, copying, exporting, archiving, deleting, viewing results. Moreover, it is possible to create a new survey (Figure 2).

Figure 3 shows the editing page of a survey. In particular, on the left side, there are the types of supported forms; on the centre, there is the page containing the questions that we are building; on the right the properties of the selected form in the page to personalize it.

In our case, the questionnaires contain four types of forms:

- *Section* of the *Structure* submenu: to divide the surveys into sections and sub-section. It permits to group the questions according to their subjects and to show them in different pages (e.g. informed consent, the platform, end-users and privacy);
- *Text* of the *Text and Media* submenu: to write free text presenting the survey in the first part of the surveys;
- *Single Choice* of the *Question* submenu: used as *Select box* to choose the platform name that is the subject of the responses; as *Radio button* to respond with a simple *yes* or *no*.
- *Free text* of *Question* submenu: used to permit to respond to open questions. The open questions can be always visible or shown only when the previous question was of a single choice type, and the response was yes. In this case, it is useful to deepen the previous response.

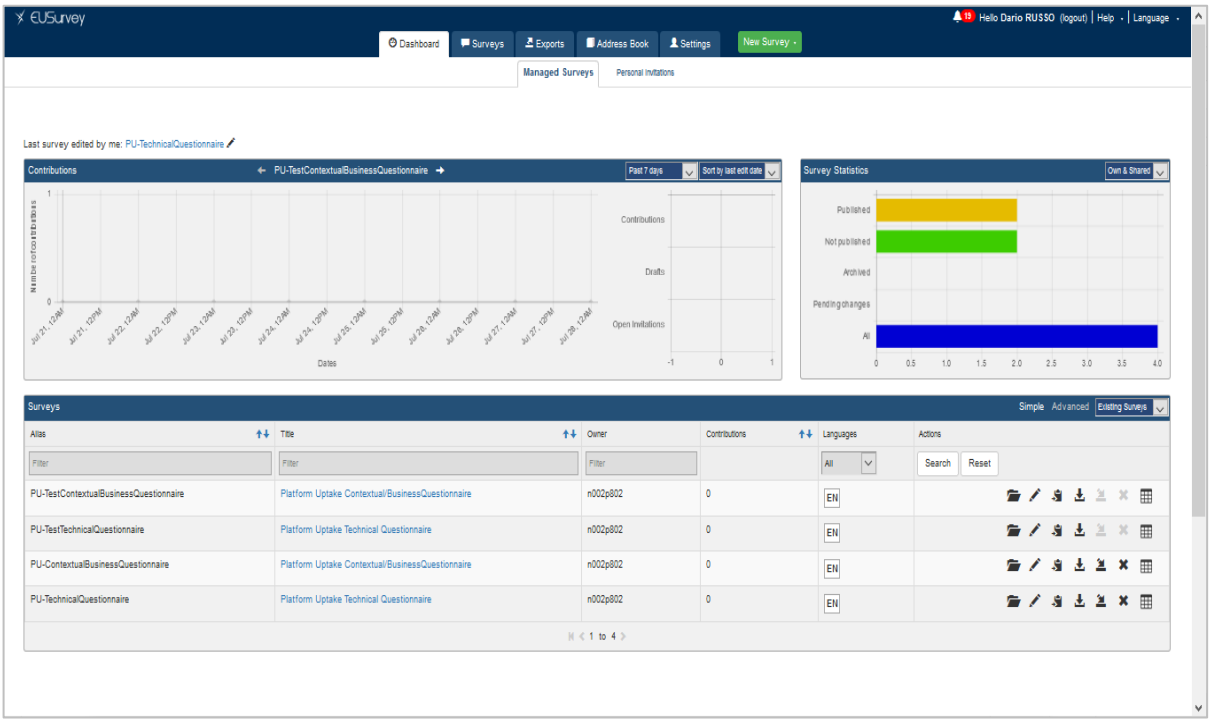

Figure 2: Dashboard of the EUSurvey system

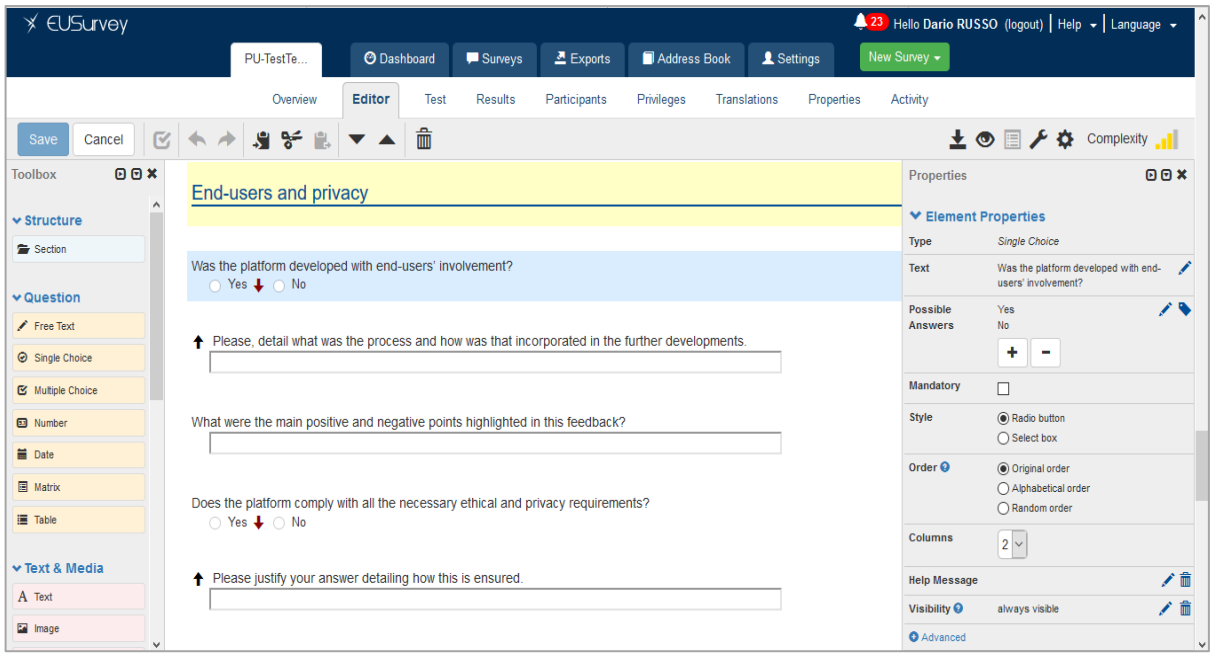

Figure 3: Editing survey page

Recruitment

This paragraph describes the survey invitation and distribution processes. We thank the respondents who agreed to answer the questionnaire in a public way, in no particular order: Primož Kocuvan (Ekosmart Platform), Matjaz Gams (Ekosmart Platform), Alejandro Medrano Gil (UniversAAL and AIOTES Platforms), Mohammad-Reza (Saied) Tazari (UniversAAL Platform), Stefano Nunziata (AIOTES Platform), Ulrich Ahle (FIWARE Platform), Fabio Roncato (Uncap platform).

Invitation

The members of the project consortium created an effective invitation, encouraging participation. As such, it was designed to be short, not complex and to the point. It included important information about the PlatformUptake.eu project and the challenges it aims to address. Furthermore, the invitation delivered information on the purpose of the survey and highlighted the importance of the participants to the achievement of the project's overall goal. Since shorter is always better in feedback survey terms, a realistic and specific estimate of the time to finish the survey was provided.

Distribution

In order to achieve a higher response rate a multichannel distribution strategy was applied by utilizing online and offline communication channels to target and engage survey participants. At first, the profiles and the relevant channels for each group of relevant stakeholders were identified. Then various communication channels were utilized, across multiple platforms and devices, in order to attract and engage survey recipients. The survey was widely distributed among members of the project teams responsible for the development and implementation of the platforms under consideration using social media sites such as Twitter and LinkedIn as well as more conventional means of communication such as via email.

However, based on the fact that some of the teams responsible for the development of the platforms were already dissolved and hardly reachable within the months of the coronavirus crisis, the consortium has not yet received any additional input on REACH2020 and on SENSINACT Technical dimension. Nevertheless, the project will tackle this issue by organizing virtual events and other types of consultations within the coming months seeking to engage more consistently in knowledge exchange with those stakeholders capable of providing the missing insights.

3. The questionnaires

The produced questionnaires, which we will describe in this chapter, mainly contain open questions in ordert o give the interviewee so much freedom as possible. As seen in chapter 2, the questionnaires concern two dimensions: the technical dimension and the contextual/business dimension. Each questionnaire is divided into macro sections. The subsequent analysis of the responses received, which we will see in chapter 4, will further elaborate on this subdivision. Given the professional flexibility of the persons involved in the research projects, we also aimed to create questions able to understand the involvement of the individual interviewees at 360 degrees within the project. This is to focus mainly on relationships with end-users in the design or test phases and how these and other interactions have contributed to the resolution of issues and the final implementation of the platform. It is necessary to keep in mind that we wanted to keep some questions similar in the two surveys in order to have different points of view on the same themes in order to have an in-depth bilateral vision.

3.1. The technical questionnaire

The technical questionnaire is aimed primarily at platform developers and is divided into three main parts:

- Development, services and devices
- End-users and privacy
- Other questions

3.1.1 Development, services and devices

This part of the questionnaire asks for an overview of the platform and focuses on interoperability and how it is achieved. Other relevant questions are about monitoring capabilities, real-time diagnostic, usage analytics and some detail about the minimum resource requirements (computing, storage, memory, VMs) needed to deploy the platforms. As a broader question, which in addition to technical skills also includes the correct communication processes between all those taking part in the project, the interviewee was asked for an opinion on the difficulty relating to solving problems with the platform.

3.1.2 End-users and privacy

This part of the questionnaire is made up of two main parts, one concerning the involvement of end-users and the other concerning privacy and security issues in the processing and transmission of sensitive data. As regards the first part, it is important to underline the questions regarding the possible involvement of end-users in the development phases of the platform, in order to adapt some services to specific needs or even to create new ones to deal with problems that were not initially foreseen.

3.1.3 Other questions

This section seeks to address issues not strictly related to the specific role assumed in the development of the platform: these may concern management or recruiting assignments, difficulties and problems encountered during development, including at the communicative level, and general knowledge of other AAL-oriented platforms / AHA.

3.2. The contextual/business questionnaire

The Contextual/Business questionnaire is primarily aimed at platform executives and is divided into three main parts:

- The Platform
- End-users and privacy
- Other questions

3.2.1 The Platform

This part of the questionnaire focuses on an overview of the platform from a higher level point of view, asking for competitive advantages and weaknesses of the platform taken into consideration and then addresses the aspects which are considered as fundamental for a successful AHA platform. The other questions refer to the impact of the services in the various aha domains and the costs related to the installation and maintenance of all the services offered.

3.2.2 End-users and privacy

This section focuses mainly on the relationship with end users and the treatment of the feedback received, trying to bring out the positive and negative points that emerged in these phases of the project. In the second part of this section, a specific reference is requested regarding security and data processing, also as regards the methods of access and sharing, trying to understand possible vulnerabilities of the platform.

3.2.3 Other questions

This section focuses on the request for statistical data regarding the actual use of the platform (active or passive users, registrations, growth rates, earnings, etc.) and possible success stories related to its use.

4. Analysis of the technical questionnaire

In this chapter the answers given by the interviewees to the Technical Questionnaire are analyzed. From a first division into three sections seen in chapter 3, based on the responses, we were able to create a more in-depth vision by collecting the answers we received in these five sections:

- Platform introduction
- End-users
- Privacy and security
- Deployment
- Other

Below follows the analysis of the Technical questionnaire of each of the eight selected platforms.

4.1. AIOTES

AIOTES is an IoT interoperability framework putting in relation different IoT frameworks. It permits to support different AHA devices belonging to different technologies. The supported technologies depend on the frameworks that AIOTES includes. It will be related as open-source code in a GitHub repository. To implement interoperability, AIOTES uses JSON-LD and a standard based data model (including SAREF, among other ontologies applicable to AHA-IoT Domain, as well as some specific pre-normative definitions for AHA not defined elsewhere).

Designers and developers have structured AIOTES framework exploiting a set of technologies. For the development of the framework, In particular:

- *Microservices*: a service-oriented and distributed architecture that can be considered an evolution of SOA architecture. What most characterizes microservices is the structure of the applications that are made up of a number of independent services, each focused on a particular aspect of the business (i.e. "micro" services, as the name suggests), which communicate with each other to realize more complex businesses;
- *Express Gateway*: Express Gateway is an open-source API Gateway written in JavaScript and running on NodeJS. It is a centralized middleware that can be shaped based on real client needs (i.e. managing authentication, monitoring, load balancing, caching, request shaping and management, and static response handling) rather than merely returning what the particular microservice is sending you back. These gateways are effectively implementing the facade pattern in the microservices world;
- *Keycloak*: open-source software to allow single sign-on with Identity Management and Access Management aimed at applications and services;
- *InterMW*: an Inter-IoT framework component providing core functionalities related to facilitation of interoperability among IoT Middleware platforms, as well as the provision of a common abstraction layer to provide access to platform features and information. It provides some features, i.e. common ontology, middleware abstraction, Rest API, security features.

AIOTES can integrate different services, systems and platforms without having an in-depth knowledge of it, exploiting the microservice architecture. However, it requires some burdens developing the semantic part.

Moreover, AIOTES offers IoT monitoring capabilities, real-time diagnostics and usage analytics.

4.1.1 End-users

End-users can take advantage of documentation. The participants in the ACTIVAGE project (including third party applicants through open calls) can have technical support. This kind of support is available beyond the end of the research project. A foundation called "ACTIVAGE.ORG" is being set up also to promote project results.

End-users participated in the development of the platform. In particular, they provided support in the collection and management of the requirements. This phase has included the creation of working groups, interviews, mockups and focus groups. Feedback from end-users was collected but not formally analyzed or replied: specific focus groups to collect impressions from the elderly (carried out by informal caregivers and professionals) and continuous human to human relationship.

End-users' feedback highlighted that older people were not bothered by the proposed solutions, and instead, they felt stimulated to perform physical activities. Moreover, informal caregivers were reassured by monitoring the correct behaviour of patients. However, feedback highlighted too many questions during the required questionnaire submitted to older people, and the difficulty for them to consult their data because they were not familiar with using the digital resources.

4.1.2 Privacy and security

The platform complies with all the necessary ethical and privacy requirements, according to 2016/679 EU GDPR. For this purpose, each Deployment Sites (DSs) designed and implemented solutions to be GDPR compliant as possible. Each DS issues its privacy statement rather than the platform itself. DSs are responsible for the definition of modalities and transparency related to the collection and the management of the required consents from the end-users, according to 2016/679 EU GDPR. The end-user's consents concern the collection, treatment, processing and sharing of their data. Each application manages personal data portability and now is under development the possibility to migrate data between apps.

All communications between services and between devices are secured and GDPR compliant. Any AIOTES deployment communicates using a ciphered channel with the best certificate available. All endpoints are protected by a role-based authorization scheme, although it is under development a dynamic approach which could also consider consent for accessing endpoints and data.

The platform was developed with end-users' involvement, and their feedbacks are collected, treated and replied to, through the project individual deployers of the framework (Deployment Sites). When needed, DSs send feedback to the development team. Github Issue tracking is also used for more technical issues.

4.1.3 Deployment

The deployment of the platform takes at least 2 hours, including downloading (from docker registry) configuration and customization (adding specific platform connectors and components). The minimum resource requirements are 1 Virtual Machine with 16Gb RAM and 30GB of Diskspace, but may be larger if more components are installed (e.g. Data Lake and Data analytics require up to 32GB and as much disk space as you can provide).

4.1.4 Other

The identification of problems with the platform and their resolution can be challenging. There are many microservices involved, each with its log and approach on reporting. In general, the platform is too complex. End-users do not perceive the platform, as they interact with "traditional" IoT-AHA platforms.

The main difficulties encountered during the planning, development and implementation were the communication between partners, from agreeing on a concept, through design and integration of different technologies. Documentation is essential, and a considerable effort is going into properly organizing all the documentation.

UniversAAL is the first platform that comes to the reviewer's mind if asked about other AHA/AAL platforms.

4.2 FIWARE

FIWARE is an open-source platform that utilises diverse technologies. The main programming languages and runtime environments based on which FIWARE has been developed are the following (detailed descriptions stem from Wikipedia[1]):

- C: a general-purpose, procedural computer programming language supporting structured programming, lexical variable scope, and recursion, with a static type system. By design, C provides constructs that map efficiently to typical machine instructions.
- Java: a class-based, object-oriented programming language that is designed to have as few implementation dependencies as possible. It is a general-purpose programming language intended to let application developers write once, run anywhere (WORA), meaning that compiled Java code can run on all platforms that support Java without the need for recompilation.
- node.JS: an open-source, cross-platform, JavaScript runtime environment (Framework) that executes JavaScript code outside a web browser. Node.js lets developers use JavaScript to write command line tools and for server-side scripting—running scripts server-side to produce dynamic web page content before the page is sent to the user's web browser. Consequently, Node.js represents a "JavaScript everywhere" paradigm, unifying web-application development around a single programming language, rather than different languages for server- and client-side scripts.
- python: an interpreted, high-level, general-purpose programming language. Python's design philosophy emphasizes code readability with its notable use of significant whitespace. Its language constructs and object-oriented approach aim to help programmers write clear, logical code for small and large-scale projects.

The FIWARE platform is interoperable via using the NGSI protocol to connect all internal elements as well as to external platforms. Hence it can be integrated in other systems or platforms. However, integration is not straight forward without some deeper technical knowledge. One should have a deeper understanding of what they are doing. There are connections available to:

[1] https://www.wikipedia.org

- Apache Flink: a framework and distributed processing engine for stateful computations over unbounded and bounded data streams. Flink has been designed to run in all common cluster environments, perform computations at in-memory speed and at any scale.
- Apache Spark: a unified analytics engine for large-scale data processing. It provides high-level APIs in Java, Scala, Python and R, and an optimized engine that supports general execution graphs. It also supports a rich set of higher-level tools including Spark SQL for SQL and structured data processing, MLlib for machine learning, GraphX for graph processing, and Structured Streaming for incremental computation and stream processing.
- Node-RED: a programming tool for wiring together hardware devices, APIs and online services in new and interesting ways. It provides a browser-based editor that makes it easy to wire together flows using the wide range of nodes in the palette that can be deployed to its runtime in a single-click.

Internal communications within FIWARE are all based on the NGSI over HTTP protocol. IoT Device protocols are supported via the various available IoT Agents, including agents for SigFox, LoRaWAN, OPC-UA, ROS, ROS-2, MQTT, HTTP etc. Connectors to other device standards and protocols can be created by developers. Hence, FIWARE could connect indirectly to any class/ type of device including eHealth devices. eHealth data has context and FIWARE deals with context.

FIWARE does not directly offer IoT monitoring capabilities or real-time diagnostics and usage analytics. However, developers can select and mix different parts of software based on their own desired functionalities from a list of available ones. These could have been developed by third parties, as long as they are FIWARE-compatible.

4.2.1 End-users

Detailed and well structured documentation about all FIWARE components (aka Generic Enabler - GE) as well as numerous tutorials are freely available for end users through Read the Docs[2] site. There further is technical support service available mainly through Stack Overflow[3] site.

4.2.2 Privacy and security

Not all communications between services and between devices are secured and GDPR compliant.

4.2.3 Deployment

The time needed for FIWARE deployment, as well as the resources required (computing, storage, memory or number and specifications of VMs) depend on the specific needs and hence the complexity of the platform to be deployed. In the simplest case, running a Docker-compose file would be enough and would start-up almost immediately.

4.2.4 Other

There was no further information provided in the questionnaire.

4.3 UniversAAL

UniversAAL IoT is a semantic interoperability platform, which permits integrating different devices belonging to different technologies and AHA services. It provides connections to different AHA devices

[2] https://www.readthedocs.org
[3] https://stackoverflow.com/

by being plug-gable to different technologies. It is open-source and its core components such as source code and distributions are in a GitHub repository under Apache Software License 2.0. To implement semantic interoperability, universAAL uses different serializations such as Turtle or JSON-LD.

The main technologies used by the platform are Java, J-groups, OSGi, Karaf, RDF and OWL. In terms of device protocols supported, standard protocols such as Bluetooth-continua, fs20, KNX, Zigbee, Zwave and everything which can be connected through Eclipse Smarthome (OpenHAB) can be integrated with the universAAL IoT platform.

Depending on the level of technical knowledge, universAAL offers different levels of integration: dealing with data, micro-service interoperation and java interface, REST API etc. integration – adapting to the level of the integrator. UniversAAL is also a representative of semantic interoperability, which serves as the basic inter-system interoperability, which requires a specific set of skills.

UniversAAL offers in terms of IoT monitoring capabilities, real-time diagnostics and usage analytics in its basic form as a platform without solutions designed on top of it, only basic logging functionality, which however could be extended.

Depending on the level of familiarity with the platform it is more easy or difficult to identify and resolve problems with the platform. The log system identifies the module where the problem is, but very often the errors refer to problems in other components, which requires some experience to identify (not much), despite documentation and messages. E.g: even though the error messages explain the issue in detail (maybe too technical), novel users tend to focus on the module issuing the error rather than at the pointed problem. This is a common human factor, especially in java-like exceptions. Documentation and technical support services which are available, help solve many problems.

4.3.1 End-users

The platform was developed with end-users' involvement by applying user centered design. This resulted in an extensive UI framework with which users could engage directly in order to interact with the platform. Github Issue tracking is used for more technical issues.

4.3.2 Privacy and security

The platform itself as an enabler for solutions built on top does not comply with all the necessary ethical and privacy requirements, according to 2016/679 EU GDPR, but the implemented solutions on top can be considered as GDPR compliant as possible. Thus, the platform itself does not have a consent form for end-users to accept, since the end-users of the platform are mostly developers. However, it does explain what data is collected and how it is used. The logged information inside the platform shows the usage of the data and the semantic interfaces force components to “explain” the usage of data. The user can access and share his/her data via a SPARQL query from the database as collected by the platform. universAAL was developed before GDPR regulations, but can be adapted to better enforce it.

4.3.3 Deployment

Depending on the requirements, the deployment of a simple deployment distribution is downloaded and ready for use within 10 minutes. Deploying a distribution and customizing it can take between 1 hour to several days. This depends on the complexity.

The minimum resource requirements are a machine with JDK1.5+ such as the Raspberry PI, on which it has been successfully tested. The needed machine requirements are 512MB RAM and 200MB of disk space, but may be larger if more components and applications are installed.

4.3.4 Other

As part of the sustainability process of the universAAL IoT platform an entity was founded within the universAAL Coalition. Here several services were analysed for different stakeholders, including end-users even though end-users' needs are typically addressed by a solution on top of the platform.

The main difficulties encountered during the design, development and implementation phase was the creation and maintenance of documentation. Proper documentation is essential for any platform. Since during development of universAAL many technologies and parties were involved, without proper protocol and definition of documentation the access to development components could have been lost. UniversAAL has lots of documentation, however finding the needed content is an issue related to structure and focus of documentation.

4.4 UNCAP

UNCAP is an open-source, scalable and privacy-savvy ecosystem platform based on open industrial standards able to create new care and assistance paradigms permitting ageing people to live independently.

From a technical standpoint, the five pillars of UNCAP are:

- *Interoperability and use of open standard*: through support for a range of open standards from the Geospatial Consortium (OGC) from the European SDOs (CEN, CENELEC and ETSI) for all its key services (e.g. position, sensors, building automation systems, clinical assessment, storage of clinical data) allowing for future extensions in terms of hardware and software;
- *Openness*: through the release of open specifications and open software components;
- *Scalability*: through use of cloud-centric approaches;
- *User-friendliness:* ensuring compliance with all most common usability standards (e.g. Web Accessibility Initiative - WAI or ISO/TR 16982:2002);
- *Privacy and security*: through attention to all related privacy and security aspects.

The UNCAP Architecture consists of 3 main groups of components: the UNCAP Box, the UNCAP User GUI and the UNCAP Cloud.

The UNCAP end-users can interact with UNCAP either through the Box "at home" and "on the go" (i.e. if they are outside their place of residence) or through the UNCAP Web Application, that is the UNCAP Webapp whose Graphical User Interface (GUI) has been designed to be accessible from a PC.

The platform permits the connection of different AHA devices including video cameras, glucometer, heart rate monitor with a pulse oximeter, blood pressure monitor and weight scale. Some examples of standards and protocols supported by platform devices are Bluetooth and MQTT.

The platform is interoperable, and itself or some of the services it provides can be integrated into other systems. The platform offers IoT monitoring capabilities, real-time diagnostics and usage analytics.

4.4.1 End-users

Target users and general needs addressed by UNCAP:

- *Ageing citizens with minor cognitive impairments*: to re-acquire an autonomous life with high quality, be this at their homes or within formal care environments; to reduce the number of visits to the health care system;
- *Caregivers and family members*: to ensure safety and high quality of life for their family member; to reduce the physical and psychological burden of care activities; to be updated continuously about the state of patients and promptly contacted in case of emergency; to facilitate the empowerment of patients and their families, becoming more active in the decision regarding their health;
- *Nursing Homes*: to control the night activity of the patient affected by mobility and/or behavioural problems; to monitor the daily activities in the common spaces (i.e. ambulation, posture, possible falls or exit from the safe areas);
- *General practitioners*: to be able to monitor "sentinel events" of a patient at home through automatic recording of relevant data based on specific test scales (InterRAI™) to help them improve monitoring of patients' health or effects of therapies;
- Clinical staff (in general): to access patient's health records via interoperable standards; to accurately monitor patients' physical and cognitive state; to promote a healthy lifestyle among patients;
- *Medical helpdesk*: to remotely assess patients' conditions/vital signs and needs; to deliver high-quality, low-cost services based on remote and reliable monitoring of patient's habit patterns and vital signals.

The platform was developed with end-users' involvement during the development phase. Feedback from users was collected, treated and replied using through the bimonthly report to monitor the pilot sites.

The main negative highlighted point in feedback was that the used technology was not simply to be used directly with older people. Technologies have to be invisible to be accepted.

4.4.2 Privacy and security

All communications between services and between devices are secured and GDPR compliant. Data collected will pass via the IoT Data Broker and will be made available in "real-time" mode for all intended subscribers or via a separate database supporting historical queries. In particular, UNCAP is relying on an external database technology (as a service), provided as a third party application by Chino (http://chino.io/), a company specialising in secure storage for health data according to EU privacy laws.

The platform complies with all the necessary ethical and privacy requirements, according to 2016/679 EU GDPR and a privacy statement was provided to the user.

4.4.3 Deployment

The setup and deployment of the main UNCAP components in the pilot site were as follows:

- Smartphone/Tablet running the UNCAP App: it provides an interface between third party devices (e.g. glucometer, heart rate monitors) and the UNCAP platform;
- The UNCAP Box: an Android device connected to the TV. Similarly to the UNCAP App, it provides an interface between devices and the UNCAP platform;
- "Smarter" Devices: devices that are able to directly connect to the Data broker and upload measurements and alarms (e.g. SensFloor); The data broker Server is the component redirecting messages coming from the various devices to the most appropriate modules on the main UNCAP Cloud server;
- The UNCAP Cloud: is the main server of the architecture where most of the modules are deployed. Every pilot will have their machine specifically configured. Trilogis hosted the server but, if required by the pilot site, it may also be deployed at the pilot premises.
- The Atl@nte server: it manages data collected from the assessment campaigns, was hosted and managed by Social-IT. A secure connection will be established with the UNCAP Cloud.
- Log server: it has been deployed at Trilogis premises, but to guarantee better performances, the logging server will be on a separate machine.
- DB Server: it was managed by Chino.io and provided compliance with EU regulations to guarantee privacy and security of the data stored.
- Clients: those are web clients (please note that also the UNCAP App/Box act as web clients when the user wants to access data on the server) that are connected directly with the UNCAP Cloud (no need to go through the Data Broker).

4.4.4 Other

The main difficulty encountered during design, development and implementation, was the use of too many different technologies involved.

4.5 ONESAIT

ONESAIT is an open-source platform for the agile development of IoT oriented solutions. ONESAIT enables the accelerated development and efficient operation taking advantage of cutting-edge technologies such as microservices, IoT Big data and AI. Being also a service integrator, it allows the consumption of services from any manufacturer avoiding vendor lock-in.

The engine implements a set of features exploiting technologies such as:

- *OpenAPI*: to implement an API Manager allowing to interact with ontologies and digital flows;
- *Node-red*: to implement an execution engine for the business logic and process flows between components;
- *Drools*: to create rules on the platform using the DRL (Drools Rule Language) working on JSON format;
- *oAuth2*: as security standard to implement Realms, Single Sign-On, integration with LDAP and Active Directory and encryption of data and communications;

- *GIS*: based on Cesium representing GeoJson, to store longitude and latitude of a point;
- *JSON-LD*: to implement semantics using ontologies permitting the integration and information exchange with other systems;
- *Microservices*: for the management of the service life cycles;
- *MQTT, REST, Web Sockets and different client APIs*: permitting the communication with the platform as simple as possible.

The platform offers monitoring capabilities, real-time diagnostics and usage analytics. However, depending on the need, the user can use external tools.

4.5.1 End-users

The platform was developed without end-users' involvement, and no feedback from them was collected.

4.5.2 Privacy and security

Communications between services and between devices are secured and GDPR compliant.

According to the EU regulation 2016/679 for the data protection (GDPR), the platform has proceeded to adopt the requirements in the design and software development to ensure the privacy, the ethical and personal data protection for the user.

From the beginning of the Onesait Platform, the design focused on full compliance with the standard, adopting the necessary measures in all processes that involve data processing. The platform provides mechanisms for authentication, authorization (by roles) and encryption (encrypted information), both in the transfer of information from systems and devices to the platform each other and in the consumption of stored information. This process guarantees the confidentiality and integrity of the information stored, complying at all times with data protection by design and anonymization.

There is a consent form where the end-user accepts the collection, treatment, processing and sharing of personal data, according to 2016/679 EU GDPR.

4.5.3 Deployment

The minimum resources requirements for deploying the platform are an Octa-core processor and 64GB RAM. 2 virtual machines with 4 cores and 32GB RAM, HDD 512 GB.

4.5.4 Other

The main difficulties encountered during design, development and implementation was the communication with the other parties involved in the creation of the platform. Moreover, documentation for different audiences requires different information with different details.

4.6 EKOSMART

The platform is divided into different aspects/sub-platforms, one of them is electronic and mobile health. The platform itself doesn't provide any direct services for the end users, but gives the ability for different service providers to add their services on the platform. The platform primarily uses HTTP-REST protocols for communication. The main technologies that the platform is based on are open

source frameworks such as Rocketchat communication platform, Flask framework, reldi-tagger and intent-expert.

The platform itself is not open source, but some services provided on the platform are. It is easy to integrate other services into the platform and connect with other platforms or devices via API specifications.

For the services connected platform offers real time IoT monitoring, diagnostics and usage analytics.

4.6.1 End-users

The platform was developed with end-users in mind. Depending on the service the users were asked to input their ideas and recommendations for the platform and the services provided on it. The channels for communication were different from emails, phone calls to feedback gathered from different dissemination events.

The negative points that users highlighted were mainly concerning technical difficulties regarding the connected devices to the platform and difficulty of use. The positive points were primarily targeted at the platform as a whole, since users felt safer/better when using the system.

4.6.2 Privacy

The actual service providers were tasked to store and protect the data for their users. As it is, GDPR is not observed with all the services that are present on the platform, while the platform at its core follows GDPR principles.

4.6.3 Costs / Deployment

The costs of running the platform are solely based on the hardware (server) used. The system requirements are low: *50 GB disk capacity, 10 GB of RAM, 6 CPU Intel i7, 20 % idle,* and the deployment process is rather easy and fast (1 hour).

The above statement is only correct for the main principle platform. The costs of running and deploying different services to the platform varies from service to service.

4.6.4 Other

The platform is currently not online, due to some maintenance/upgrade to a new version. It is not stated how long it will remain offline.

The number of active users before seemed to be small, or rather more connected to the specific service rather than the whole platform.

4.7 Comparative analysis

From a technical point of view, the use of microservice technology for the development of service-oriented platforms is increasingly emerging (e.g. in AIOTES and ONESAIT). Microservice technology facilitates the creation of service-oriented and distributed architecture (it can be considered like a SOA architecture evolution) permitting to structure applications as independent services, each focused on a particular aspect of the business (i.e. "micro" services, as the name suggests), which communicate with each other to realize more complex businesses. Most of the projects release the platforms under an open-source licence, and the most used programming language are Java and Python. All platforms permit to integrate new AHA devices according to platform features. AIOTES exploits its ability to

integrate new platforms permitting to include their devices. Other platforms like ONESAIT, FIWARE, EKOSMART and UNCAP furnish in their core the support of some protocols like MQTT, HTTP based standards and expose APIs to interface them. The new trend to implement interoperability is using semantics, especially using JSON-LD approach. JSON-LD is a method permitting encoding linked data using JSON. JSON-LD is designed around the concept of a "context" to provide additional mappings from JSON to an RDF model. The context links object properties in a JSON document to concepts in an ontology. Platforms like AIOTES, ONESAIT and UNIVERSAAL use the semantic approach. FIWARE instead uses a JSON-LD based language named NGSI. Most of the platforms permit a real-time diagnostic except for UNIVERSAAL that has only a logging system.

The main problems encountered in the development of platforms concern communication with project partners. The weak aspects, however, mainly concern the complexity in the use of the tool and the documentation being not always completed or not well structured. GDPR is essentially supported by all platforms conserning ethics and privacy. Only AIOTES, ONESAIT and UNCAP support GDPR also for the communication part.

5. Analysis of the contextual/business questionnaire

In this chapter the answers given by the interviewees to the Contextual/Business questionnaire will be analysed and discussed. From a first division into three sections highlighted in chapter 4, based on the responses we were able to create a more in-depth vision by collecting the answers received in these six sections:

- Platform introduction
- Real case examples
- End-users
- Privacy
- Costs
- Other

Below follows the analysis of the Contextual/Business questionnaire of each of the eight selected platforms.

5.1 AIOTES

By representing a whole ecosystem AIOTES facilitates the interoperability of existing open service platforms in the AHA and AAL domains. This feature is perceived by the survey respondents as its main competitive advantage. However, according to the participants, its integration requires specific skills and extra efforts.

The platform has been used/piloted/tested in these 11 AHA domains:

- Daily activity monitoring
- Integrated care
- Health parameter monitoring
- Emergency trigger
- Exercise promotion
- Cognitive stimulation
- Prevention of social isolation
- Safety, comfort and safety at home
- Mobility monitoring and advice for active mobility
- Notification of abnormal situation
- Support for caregivers

With reference to the Italian region Emilia Romagna Deployment Site (DS RER), platform services, apps and solutions don't contribute significantly to the individual end-user's empowerment, side activities are in place to reach these goals.

The most important aspects to be considered when evaluating and comparing platforms for AHA are:

- Learning curve
- Long term savings
- Compatibility with company strategies

UniversAAL is the first platform that comes to the reviewer's mind if asked about other AHA/AAL platforms.

5.1.1 Real case examples

Positive incidence was found in the cases of seniors, post stroke, users: the presence of a device stimulates seniors psychologically, because for some of them, having sensors installed, is an incentive to movement and interaction. Further on the monitoring of drug intake and adherence to the therapy therefore becomes a decisive factor for the tranquillity of the caregiver, so the technologies in this area have a good level of acceptability and represent a possible field on which to focus investments.

The negative incidence on both seniors and caregivers are related to the initial diffidence as they fear to be spied on in their private space.

5.1.2 End-users

The platform was developed with users's involvement. This was achieved with co-creation activities and an iterative approach to collection and management of the requirements. In this phase working groups, interviews, mockups and focus groups were created. Feedback from end-users was collected but not formally analysed or replied. Specific focus groups were asked to collect impressions from the older adults (carried out by informal caregivers and professionals) on the continuous human to human relationship. A french partner made interviews for qualitative evaluation.

In general there was a positive feedback by the older people who have highlighted the fact that they were stimulated to move without having the feeling of being bothered by technology. Informal caregivers felt reassured by monitoring the correct behaviour of patients.

Critique was wreaked on the too many questions during questionnaire submission and that older people generally could not make use of the digital resources available to consult their data.

5.1.3 Privacy

The platform implements a Privacy by Design model and includes a privacy statement to the user as well as a consent form about the collection, treatment and processing of personal data according to 2016/679 EU GDPR. The platform explains what data is collected and how it is used and can raise ethical or privacy or security issues, but they are treated.

5.1.4 Costs

Regarding the costs related to the setup of the platform, a typical installation (consisting of few local HW resources for back end, back end deployment and installation, sensor kit and communication devices) costs around 1500 euros per user. All the software is free of charge.

The costs to maintain the platform active and up-to-date are (per user) internet connection, support and professional care costs. These are not specified but are not considered to be high especially scaling up the number of users.

5.1.5 Other

Considering only Italy, the number of active registration on the platform in 2019 was 22 end-users and 15 GPs with a 20% drop out. There is still no data about the decrease of hospitalization/improvement of care, but the target is 25%.

5.2 FIWARE

The main competitive advantages of FIWARE platform are that it is Open Source, utilizing standard APIs and standard data models, and hence there is no vendor lock-in associated with developing and using a FIWARE-based solution.

The main weaknesses include that market adoption is mainly in the domain of Smart Cities but not yet that strong in Agriculture, Energy and Industry.

The platform has been tested on AHA services within the frame of the EU project ACTIVAGE[4], where it was used to pilot services in various relevant domains (see below).

According to the questionnaire respondent, the platform services, apps, solutions, etc. significantly contribute to the individual end-user's empowerment, for example by supporting and training the individual end-user to better understand and express their own current and future wishes, needs and preferences.

The most important aspects to be considered when evaluating and comparing platforms for AHA are Open Source and Open Standards.

5.2.1 Real case examples

Real case examples about the usability and acceptance of the services offered by FIWARE in the domain of AHA/AAL stem from its usage in ACTIVAGE project. In specific, it was used and validated in the following EU regions (Deployment Sites-DS) and AHA/AAL-specific domains:

- In DS Valencia (Spain), for daily activity monitoring at home and monitoring of assisted persons outside of home.
- In DS Region Emilia Romagna (Italy), for daily activity monitoring at home, integrated care for chronic conditions, exercise promotion and prevention of social isolation.
- In DS Greece, for support of transportation and mobility services for elderly persons

5.2.2 End-users

The platform was developed with end users' involvement. For example, the standard data models used by FIWARE are developed together with end users. While developing the platform, feedback from end users was collected, treated and replied to. This was achieved by means of the FIWARE helpdesk and questionnaires. Diverse positive and negative points were highlighted in this feedback. Feedback from end users is still collected, treated and replied to.

The platform services, apps, solutions, etc. are accessible, especially considering the user experience of people with disabilities and of older age.

5.2.3 Privacy

FIWARE complies with all the necessary ethical and privacy requirements by using up to date technologies. There is a privacy statement to the user as well as a consent form about the collection, treatment and processing of personal data according to 2016/679 EU GDPR. These are not fixed but depend/ can be modified by the platform provider. The platform further explains what data is collected and how it is used, which is also platform provider dependent. The user can also access and share

[4] https://www.activageproject.eu

his/her data as collected by the platform, according to 2016/679 EU GDPR in a platform provider dependent manner.

5.2.4 Costs

The FIWARE platform is free of charge. There are no subscription or pay-per-use fees neither for end users nor for service providers.

The costs related to setting up the platform, including hardware, other software royalties, installation and configuration depend on the size of the installation. Pilots and testbeds can be set up free of charge on the FIWARE Lab network.

The costs related to maintaining the platform active and up-to-date also depend on the installation size.

Overall, the costs for setting up and maintaining a FIWARE platform are kept at the minimum level.

5.2.5 Other

Figures including the number of active registrations on the platform last year, the number of registrations on the platform last year by country, the proportion of subscribers/ registered members who abandoned the platform during the last year, the proportion of active end users of the platform during the last year, the growth rate of the platform users or membership during the last year, the growth rate of platform developed apps based on platform, the number of visits from different end users to the website platform per year, the number of downloads of items at platform per year, the average duration time visiting the website platform per visitor, the percentage of active producers/ developers from the total number of registrations, the amount of decrease of hospitalization/ improvement of care of end users using the platform solutions, products, services, etc., the amount of certifications of apps/ solutions based on the platform contents, the amount of use-cases based on the platform contents over a year, the amount of Customer Success Stories known, the revenue of the platform in euros, all depend on the platform provider.

5.3 UniversAAL

In the view of the respondents the competitive advantages of universAAL IoT are that it opens a truly flexible world in terms of arbitrary constellations and interconnections to developers, solution providers and consumers. The Semantic Interoperability is based on offers the access to these flexible interconnections and is at the same time a weakness, since due to the shift of programming paradigm one has to tackle a steep learning curve in the beginning.

The platform has been used/piloted/tested in these 8 AHA domains:

- home/outdoors activity monitoring;
- fall/frailty/nutrition abnormalities prevention/detection;
- mobility;
- communication.

The Spanish solution MAHA[5] (Madrid Active Aging Network) on top of universAAL claims to address platform services, apps and solutions and contribute significantly to the individual end-user's empowerment. Side activities are in place to reach these goals.

The most important aspects to be considered when evaluating and comparing platforms for AHA are:

- The openness of the platform[6] especially in the sense of remaining extensible by third-party components and solutions;
- The technical potential to become a mainstream enabler for integrating complex systems of systems across domains, devices, brands & vendors, locations, and deployment strategies

The respondents take all IoT platforms seriously, but does not have experience with another one. If asked, AIOTES is the first platform that comes to the reviewer's mind if asked about other AHA/AAL platforms.

5.3.1 Real case examples

The two examples MAHA in Spain and the uCORE controller in Germany started as experiment

during 2013-2016 in the ReAAL project and now the corresponding solution providers have successful products on the market, continuing with universAAL as the underlying technology.

5.3.2 End-users

The platform was developed with users's involvement and based on their feedback. It is still ongoing for MAHA and uCORE. However, However, it does not affect universAAL per se directly as the end users see and talk about the solutions. The users of universAAL itself are not the end users, but the developers and the solution providers, such as Tercera Edad in Spain and the start-up "uCORE" in Germany and their respective developers. For the relationship between universAAL and the developers, the issue tracking of the open source project is the mainly used channel. Otherwise, feedback is collected through dialog with the management level. Additionally, a better organized dialog between the universAAL users and the universAAL open source community is established by the launched open international association called "The universAAL IoT Coalition -- uIC". However, it has not been very active so far, as real universAAL-based business is just emerging; it is expected that the existence of uIC will be appreciated more soon, when businesses increasingly become dependent on the maintenance of universAAL.

5.3.3 Privacy

UniversAAL IoT complies with the ethical and privacy requirements in the context of concrete deployments of concrete solutions. With regard to privacy, universAAL actually promotes the paradigm of Edge Computing, where for AHA domain, each home / care room is expected to have its own private "controller" device that processes data locally. The benefit is that data remains in the hand of its owner and is only shared to external entities if the data owner has a service contract with them based on which s/he configures his/her controller to share selected data with a given external entity. This is a straightforward guarantee for "informational self-determination" (being in control of your own private data). It also reduces the risk of misuse, hidden business with the data, etc. However, universAAL can

[5] https://www.terceraedadactiva.es/en/mahamadrid-active-aging-network/
[6] https://www.universaal.info/blog/post/4717/Assessing-the-openness-of-universAAL-IoT/

be deployed in other ways, like in a centralized way in the Cloud, that would directly expose all raw data directly to the servers of the solution providers.

Both of the above strategies are practiced in the actual business of the two examples so far: MAHA is following a centralized Cloud-based deployment strategy and uCORE is following a distributed private deployment strategy. Both MAHA and uCORE have already obtained the ethical approval of their local authorities. The privacy statement for MAHA is included in their solution, uCore does not need such a privacy statement at all.

The solutions based on the universAAL IoT platform explain what data is collected and how it is used. In case of uCORE, it is part of the contract that data from sensors used in the given constellation is stored on the controller locally for at most 6 months, where the live data is archived on the same device on a monthly basis and archived files older than six months are deleted. No data is sent to any external entity, unless the buyer configures the system differently. The only data transferred over the internet is the audio streams used in alarming logic over IP telephony to the contact persons / call centers of their trust. This setup enables the user to access and share his/her data collected by the solution based on the universAAL IoT platform.

As an enabler for AHA applications and solutions, universAAL provides different mechanisms that can be used for data sharing[7]. As an example, uCORE makes use of the universAAL "uSpace Gateway (uG)[8]" concept and mechanism so that if third parties reach a service contract with several uCORE users, they will have to deploy their own universAAL instance including a multi-tenant version of the uG; then each contracted uCORE user can configure its own uG to connect to the uG of the service provider based on certain security and data sharing policies.

Each uCORE user can also access the data stored on his/her own controller via a Web application accessible in the local network of the controller itself, which is protected by login/password.

UniversAAL IoT per se cannot raise any ethical, privacy or security issues. Indeed, as an enabler, universAAL provides several different security mechanisms related to different aspects of the operation of the platform itself.

5.3.4 Costs

Regarding the costs related to setting up the platform, there are ready to use distributions of universAAL IoT that simply run on any hosting machine that has a Java Virtual Machine pre-installed. The software is royalty-free based on the Apache Software License v2.0. Solutions on top will need an additional configuration. For instance, the uCORE controller of the WoQuaZ Deployment Site in the ACTIVAGE project[9] is based on a Raspberry Pi for 40 €. uCORE comes with a system image in which a simple text file is edited for the concrete installation at hand and then it re-configures itself and is then ready for operation. The whole process takes 15 minutes at most, if you already know which values you want to set in the configuration file. Depending on what you want to achieve with the uCORE controller, you will have to pay for other devices (mostly sensors) and also spend time to bind them to the system according to devices' original specifications.

[7] https://github.com/universAAL/remote/wiki
[8] https://github.com/universAAL/remote/wiki/uSpace-Gateway#Configuration
[9]https://www.activageproject.eu/blog/2017/09/28/The-Position-Paper-of-the-ACTIVAGEDeployment-Site-in-Germany/

There is no centralized instance of the platform that would need to be kept active. The maintenance of the universAAL IoT source code has been financed so far through public funding, but as businesses start to emerge on top of universAAL, we expect that can start to switch to getting financial support from the providers of universAAL-based solutions.

On the side of the solution providers, there will certainly be specific costs for keeping their solutions up-to-date. The uCORE controller, for example, is being sold based on a private VPN infrastructure that makes it possible to update the online controllers with the latest versions of the delivered application; as part of this process, there has been only one universAAL-related update in one year. The cost of keeping the private VPN infrastructure up and running is estimated at 10000 € p.a. The infrastructure has a capacity of serving 650000 controllers. With the targeted 10000 online controllers within two years, uCORE is calculating 1 € p.a. for each controller. The controllers are sold on a per home / per care room basis. The respondent does not think that these costs are too high.

5.3.5 Other

Regarding the active registrations, channels such as GitHub, own hosting with registration possibility and the Website analytics are used to evaluate this.

Before 2015, universAAL software was hosted in own facilities with obligation to create an account, where the site had reached over 1000 relatively active accounts of which ca. 200 were belonging to the organizations directly involved in the development and maintenance of universAAL.

universAAL has migrated to GitHub in 2015. Here one can see the most recent statistic e.g. that 5 downloads have been done within the last 2 weeks. Now that the software has reached a higher maturity level, the number of involved developers on GitHub is 16.

According to Google Analytics, access to the Website universaal.info in 2019 can be summarized in the following way:

- Users: 4,722
- New Users: 4,708
- Sessions: 5,741
- Number of Sessions per User: 1.22
- Pageviews: 10,633
- Pages / Session: 1.85
- Avg. Session Duration: 00:01:55
- Bounce Rate: 69.55%

The website also provides information on the registrations per country via Google Analytics, where the first 10 countries are:

#	Country	Users	% Users
1.	Australia	760	16.01%
2.	United States	697	14.69%
3.	Germany	324	6.83%
4.	Spain	296	6.24%
5.	India	260	5.48%
6.	United Kingdom	164	3.46%
7.	Italy	162	3.41%
8.	China	104	2.19%
9.	France	100	2.11%
10.	Greece	100	2.11%

Figure 4: Registrations per country via Google Analytics

About 11% of the users are returning users, the remaining are a one-time user.

According to ACTIVAGE reports in September 2019, MAHA had ca. 840 active users and uCORE had ca. 235 active users. In the case of uCORE, ca. 150 new installations were acquired within the last three months.

There are no certifications of apps/solutions based on the platform contents.

The number of use-cases based on universAAL are available from the ReAAL project, where more than 100 use cases were implemented in real life.

There are only MAHA and uCORE as Customer Success Stories known to the respondent. After REAAL two further sites were continuing with their deployments, but no updates are known.

Since there is no direct platform business yet, there is no revenue of the platform in euros.

5.4 UNCAP

Uncap is an interoperable platform based on open industrial standards that leverages on existing technologies for biosensor, indoor/outdoor localization and home automation. The platform has a good usability and high level of intrusiveness. Its services are physically, emotionally as well as environmentally accepted by care givers, medical personnel and patients.

The platform has been used/piloted/tested in these domains:

- Home/outdoor monitoring
- Mobility
- Communication
- Falls detection

The platform services allow the development of customized solutions for the empowerment of patients with cognitive decline and disorders, enabling the location of older users and detection of sudden falls. The solution developed over Uncap motivates the patients to regularly measure biodata

using easy-to-use smart sensors (e.g., glucometer, smart scale), take medication and attend scheduled video workouts.

FIWARE is the first platform that comes to the respondent's mind if asked about other AHA/AAL platforms.

5.4.1 Real case examples

As a real case example can be considered the implementation of the platform services at the pilot sites. In all the cases, the Social return was visible and in general improvements have been made in the quality of life, acquisition of new skills, improvements in the organization, achieving lower levels of stress, feeling of security, less isolation and in general greater overall satisfaction. This also affected a decrease in hospitalization expenses and general expenses, which is the category where the return of these benefits was best reflected.

5.4.2 End-users

The platform was developed with end-users' involvement. While developing the platform, feedback from end users was collected, treated and replied to. The feedback is collected at the pilot sides through Quality of life questionnaires and data is treated immediately in order to improve platform functionalities. Privacy statements and content forms are provided to the users and are available online.

5.4.3 Privacy

The platform is in compliance with GDPR. Promoters of the platform as well as developers of solutions are provided with inform consent ensuring the compliance with ethical regulations and clearance by local ethical committees. Data collection, sharing and analysis are always conducted in full respect of dignity, privacy and confidentiality of personal information of the involved subjects. The presence of legal representatives is always required in the case of patients who are unable to give consent. Data transmission security is ensured by channel level encryption using cryptographic protocol TLS (Transport Layer Security). Each operation over data is securely audited to ensure accountability. To optimize collection and management of the informed consents, Trilogis has created and operates an Intenent Central Web site (ICW), which allows collecting and archiving in a central repository the personal data of the patients along with the signed consents. The doctor responsible for enrolling the patient and distributing and managing the informed consent in the pilot organization (pilot site responsible from now on) can access the site if he/she possesses the authentication credentials (Login and password). The data collected are stored in a database (PostgreSQL) that is backed up every 24 hours. Access to the database is granted to those registered, but the functionalities are limited: the user can create new entries but cannot remove an entry once it is uploaded (minor edits are permitted in case of misspelled entries).

5.4.4 Costs

Regarding the costs related to the setup of the platform, a typical installation (consisting of few local HW resources for back end, back end deployment and installation, sensor kit and communication devices) costs around 1500 euros per user. All the software is free of charge but there are subscribing prices or fee for acquiring licenses.

5.4.5 Other

The patients who have participated in the test phases at the pilot sites felt more secure and have perceived an overall improvement in the relationship with the medical staff as they could establish an immediate contact with them. They have also received more attention from the caregivers.

UNCAP was perceived by the medical staff as a very efficient tool facilitating the record of data and thus providing them with a great support in their daily tasks.

5.5 SENSINACT

The respondent highlighted that being open and evolutive, modular, easy to use and scalable represent the competitive advantages of the platform. Its robustness and the fact that the deployment might be not so plug and play, are the weaknesses of the platform.

The respondent did not understand the question “Are platform services, apps, solutions, etc. accessible, especially considering the user experience of people with disabilities and older people?” and agrees that the platform supports out of the box (…)

That platform has been used/piloted/tested in these 4 AHA domains:

- older adults homes with ACTIVAGE,
- mobility with ClouT and BigClouT
- smart cities with festival and outsmart

The respondent considers that the platform significantly contributes to the individual end-user’s empowerment. The most important aspect to be considered when evaluating and comparing platforms for AHA “Interoperability”.

When asked to provide some real case examples about the usability and acceptance of the services offered by the platform by stakeholders, the respondent mentioned the “The Star of Europe” Award, delivered by the French Ministry of High Education and Research.

No platform comes to the respondent’s mind when asked about other AHA/AAL platforms.

5.5.1 Real case examples

The questionnaire has no available information to fill in this topic.

5.5.2 End-users

The platform was developed with users’ involvement. This was achieved with EU projects involving end-users like ACTIVAGE. Feedback from the end-users was collected but the respondent has no information on whether the Sensinact team engaged or not with a follow-up

5.5.3 Privacy

The respondent indicates that the platform complies with all the necessary ethical and privacy requirements. When asked about how this is ensured, the respondent stated that the AAA process was followed. However, no other information is provided and there is no privacy statement provided to the user.

5.5.4 Costs

Regarding the costs related to the setup of the platform (e.g. hardware, software royalties, installation and configuration), as well as the platform's maintenance costs, the answer was the same: it depends on the project size. The respondent does not think the costs are too high and states that there are subscribing prices or fee per service for end-users or service providers.

The following were described as the subscribing prices or fees being applied:

- Licensing a customized version of the platform including added-value tools for data analysis and visualization;
- necessary connection bridges "à la carte";
- specific developments for integration with the existing infrastructure and specific needs per city division;
- end-to-end applications for the current challenges of cities (security, environment, mobility)

5.5.5 Other

The questionnaire has no available information to fill in this topic.

5.6 ONESAIT

First the questionnaires' participants were asked to outline the competitive advantages of Onsite. As a result they stated that the free use of services as well as agile development and deployment of solutions are among the major strengths of the platform. However, when asked to indicate the weaknesses of the platform, the respondents claimed that there is a need by external developers for additional support from the provider which hinder their autonomous use of the platform's functionalities. Further, it was highlighted by the respondents that the platform's apps are accessible for anybody whereas the main barrier appeared to be the knowledge of IoT capabilities to take advantage of the solutions.

Next the participants were asked to answer with yes or no to whether Onsite supports out of the box or has been used/piloted/tested on AHA services. Here the questionnaire showed that the platform supports the development of solutions for mainly home/outdoors activity monitoring, mobility and communication.

With reference to the contribution of the platform to individual end-user's empowerment, the questionnaires' recipients added that its services facilitate the development of customized solutions which enable the inclusion and implementation of the end-users' preferences.

When considering important aspects for evaluating and comparing platforms the participants highlighted the easy to use and technical capabilities of Onsite claiming a wide range of real case examples. These can be consulted in the testimonials section (https://www.onesait.com /testimonials/) of the platform's website.

On the question which is the first AHA/AAL platform that comes to their mind, the respondents stated that Fiware is the most prominent example.

5.6.1 Real case examples

Some of the real case examples demonstrating the applicability and wide acceptance across sectors of Onsite as an open service platform are the Bogota Digital Health success story and the Bidafarma's innovative consultation service for citizens tested for skin cancer.

Based on the solution developed in collaboration with Onsite, Bogota District Health organisation managed to unify information of all the patients cared for in the public hospital network of the district and thus consequently upload the medical records of over 8 million people, schedule more that 7.5 million appointments a year and store over 2.6 million medical forms.[10]

Bidafarma, a drug distribution cooperative with headquarter in Sevilla, Spain, managed to develop a solution providing 9,200 Spanish pharmacies with remote consultation services for the early detection of skin cancer. The service is enabled by filling out a questionnaire and obtaining two photographs with a dermatoscope, which are sent securely and anonymously to medical professionals, so that they can issue an assessment that will be given to the patient by his or her pharmacist.[11]

5.6.2 End-users

The platform was not developed with the end-users' involvement. Nevertheless, there is feedback collected from the end users in punctual events like meetups or in the scope of some projects where the treatment of the data is defined within each case.

5.6.3 Privacy

The platform's data privacy practices are based on GitHub's Standard Contractual Clauses as a legally provided mechanism to lawfully transfer data from the European Economic Area, the United Kingdom, and Switzerland to the United States. In addition, GitHub is certified to the EU-US and Swiss-US Privacy Shield Frameworks. Onsite handles personal data by including a consent form about its collection, treatment and processing according to 2016/679 EU GDPR.

5.6.4 Costs

Important aspects to be considered in the evaluation of the business models of open service platforms are the costs needed for their development and running the platform's components. In this context the questionaries' recipients were asked to specify the costs related to the setup of Onsite. As such, the participants answered that one can use the cloud-lab for test projects at no costs under the condition of reduced requirements. Further on, the respondents claimed that the costs depend on each use case according to the expected hardware consumption and the need of technical support. The prices are available upon request sent to the commercial department. Since Onsite is an open service platform, there are no costs for its maintenance where the latter is an exclusive responsibility of the end user.

5.6.5 Other

Lastly the questionnairies' respondents indicated that there were 800 active registrations on the platform last year. 50% of those belonged to solution providers and platform developers who actively use the services of Onsite.

[10] Onsite, The Bogotá Digital Health success story, https://www.onesait.com/testimonials/el-caso-de-bogota-salud-digital/, retrieved on 31.08.2020

[11] Onsite, The Bidafarma success story, https://www.onesait.com/testimonials/el-caso-de-bidafarma/, retrieved on 31.08.2020

5.7 EKOSMART

The platform is part of the smart city platform, consisting of several prototype sub-platforms. Electronic and mobile health (EMH) is one of them. The platform at the moment is mostly used as a research/pilot project, but some sub-platforms are being redeveloped or used by the end users. The EMH platform is currently being redesigned/modified as a Slovenian/Italian platform for EMH. The platform is not only focused on elderly users alone, but about 50% of the services are meant for a wider audience.

The platform is free for the users, but some services might get a separate charge in the future. Cost of operating is not clearly defined, as is at the moment it falls down to the cost of running infrastructure (servers). The whole cost of the platform is hard to establish as each service-provider carries his own costs of running the service.

5.7.1 Real case examples

An example of searching for information about a disease is provided. Where otherwise users would usually go on the internet to look for information about the disease, if he had done the same on the platform, instead of links to the articles and similar, the platform would provide him with the list of services that can help inform and or manage the disease.

5.7.2 End-users

The platform was developed with end-users in mind. Several thousands of users were involved in development of the platform as pilot testers of different services provided on the platform. The feedback from the users was gathered and used to improve specific services they were testing and not the platform as whole.

Currently some services have more than a thousand users but others have non or close to none. As the platform is so defragmented into smaller services with separate service providers it is hard to determine the actual number of active users at the moment.

The services were only provided in Slovenia.

5.7.3 Privacy

The platform's solution to privacy was to store as little personal information as possible. The actual service providers were tasked to store and protect the data for their users. As it is the services provided on the platforms are not compliant with the principles set out in GDPR

5.7.4 Costs

The costs of running the platform falls back on infrastructure of the server, electricity and internet. Since the costs of the acquisition of the platform was covered by the project, the current running costs are minimal.

The costs for each individual service provided on the platform range from service to service. If the service only provides some online tool / help the costs are minimal, however if the service provides home-care or telemedicine, the costs per user is much higher.

5.7.5 Other

The platform was developed as a conglomerate of different services and products provided by service providers. It was designed and developed under research national project, but after the project was

finished, not many companies decided to support and continue to provide their services on the platform. Some of the sub-platforms / services such as EMH are currently being redeveloped/redesigned under new projects and extended into Italy as well.

5.8 Comparative analysis

From a Contextual/Business point of view, the analyzed platforms have all the advantage to be free and released under an open-source licence. ONESAIT highlighted its facility to develop solutions while others pointed the attention on technical aspect like modularity, scalability, use of standard techniques. As weakness point, most of the platforms suffer from difficulties in learning their functioning and the need for specific skills to exploit all their features. All platforms have been tested in AHA domain, and their services and solutions are mainly studied for the in/out door contexts, principally for monitoring purposes. However, being platforms permitting the creation of applications to extend their services, in general, they can offer solutions for different domains. All platforms furnished concrete contribution in the end-user empowerment, and each of them has documented it with examples. Accessibility is an important aspect that is, in most cases, left to the applications of the platforms because the platforms meant as infrastructure, in general, have not direct interaction with end-users. The emerged important aspects to take into consideration when evaluating platforms are mainly their ease of use and technical capabilities, the interoperability features, to be open and based on open standards.

For all platforms, deployment costs are mainly related to the hardware needed for running the platform, the purchase of devices, and the use of cloud services at runtime. SENSINACT and UNCAP requires a licence for its use.

6. Conclusion

Within this deliverable we have analyzed the platforms examined in even more detail, placing an important piece that will contribute to the achievement of the objectives of the PlatformUptake.eu project. This was possible by shifting the point of view of the analysis from that of the observer to that of those who actually conceived, developed and made each platform operational. The two surveys have allowed to understand aspects of the platform that are difficult to find in the official documentation and above all to understand what may have worked and what not throughout the entire life cycle of these platforms. It is important to remember that what has been achieved so far is not a point of arrival but a solid basis that in the following months will be continuously enriched with new information. This will be achieved by organizing virtual events and other types of consultations seeking to engage more consistently in knowledge exchange stakeholders, both those who completed the surveys and those who could not, based on the fact that some of the teams responsible for the development of the platforms were already dissolved and hardly reachable within the months of the coronavirus crisis.

The analysis of the information collected in this document therefore allows us to imagine what the essential characteristics of an ideal platform could be from an insider point of view, and what are the main points towards which it is necessary to pay particular attention as they are critical and capable of compromising functionality and purposes.

Essential characteristics

- **Micro services:** service-oriented and distributed architecture (it can be considered like a SOA architecture evolution) permitting to structure applications as independent services, each focused on a particular aspect of the business (i.e. "micro" services), which communicate with each other to realize more complex businesses
- **Open source:** inherently guarantees advantages such as reliability, transparency, cost savings and collaboration, without having to depend on licenses
- **Support standards:** since these are systems intended for large segments of the population, it is necessary to support, especially at the communication level, the main existing standards in order to guarantee full compatibility with most of the devices on the market
- **Object oriented:** provides natural support for software modeling of real-world objects or the abstract model to be reproduced and allows easier management and maintenance of large projects
- **Interoperability through semantic:** expresses the meaning of terms and concepts and finds the right relationships between them
- **Correct dimensions definition:** it is important that the three dimensions, technical, contextual and business, are thought of as separate modules but dependent on each other. The design of a platform should start from the setting of these three dimensions and their dependencies.
- **Focused documentation:** when developing a big platform many technologies and parties are involved, without proper protocol and definition of documentation the components may be lost.
- **Tools for diagnostics and usage analytics:** the monitoring of software components and their use is fundamental both as regards maintenance aspects and as regards the extraction of

metrics that allow the creation of new fundamental metadata to understand the interactions with the systems

- **End-users engagement and feedback**: for the success of a platform it is necessary, especially in the experimentation phases, to make the end-users an active part by making them perceive that the functionalities of the platform are really useful for improving their lives. For this task it would be necessary to involve professionals and not to underestimate it.
- **Full GDPR compliance:** improves the protection of European data subjects' rights and clarifies what companies that process personal data must do to safeguard these rights.

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Appendix A - Questionnaires

Contextual/Business Questionnaire

PlatformUptake.eu

PlatformUptake Contextual/Business Questionnaire

Fields marked with * are mandatory.

Informed consent

INFORMED CONSENT FORM for participants in PlatformUptake.eu research survey

PlatformUptake.eu

Project description

PlatformUptake.eu is delivering an inventory and analysis of open service platforms in the active and healthy ageing (AHA) and active assisted living (AAL) domains. To measure the impacts of such platforms and enhance their uptake, the project presents a methodology for monitoring open platform development, adoption and spread across Europe, by listing key factors that determine success or hindrance in their uptake by end-user groups. PlatformUptake.eu assesses the societal impact of these existing platforms, collects successful user stories and best practices, promotes interoperability and defines guidelines for a common evolution of open service platforms, in order to support their large-scale uptake and increase the number of AHA and AAL solutions available to end-users.

Consortium members

SYNYO GMBH (SYNYO), Austria; ISTI-CNR (CNR), Italy; FRAUNHOFER INSTITUTE FOR COMPUTER GRAPHICS RESEARCH IGD (FH-IGD), Germany; UNIVERSIDAD POLITÉCNICA DE MADRID (UPM), Spain; NATIONAL TECHNICAL UNIVERSITY OF ATHENS SCHOOL OF ELECTRICAL & COMPUTER ENGINEERING (ICCSS), Greece; JOŽEF STEFANO INSTITUTE (JSI), Slovenia; AFEDEMY (AFE), Netherlands; CÁRITAS DIOCESANA DE COIMBRA (CDC), Portugal; LINKÖPING UNIVERSITY (LIU), Sweden; UNIVERSITAT DE LES ILES BALEARS (UIB), Spain; STICHTING SMART HOMES (SMH), Netherlands; ETABLISSEMENTS A. LIEVENS LANCKMAN (LL), Belgium.

The project is funded by the European Union's Horizon 2020 coordination and support action under grant agreement No 875452. More information may be found at www.platformuptake.eu.

1

Why You have been chosen

You have been invited to participate in the survey, because of your expertise and participation in the development of one of the eight main European AAL/AHA oriented Platforms selected for our analysis.

Your participation

Your participation is entirely voluntarily. You are free to leave at any time, without giving reason and without any consequences on you or your future participation in the project. See below section "Right to withdraw" for further information on what happens to your data if you decide to leave.

Privacy and confidentiality

The analysis of the results will be anonymous. The information will be processed during the analysis of the data obtained and will appear in the project deliverables - but again, only in a way that will not allow anybody to identify from whom we received the information.

The results of this research can be published in scientific magazines or be presented at conferences, always guaranteeing the complete anonymity. The authorization for the use and access of the information for the aim of the research is totally voluntary. This authorization will apply until the end of the project unless you cancel it before. In this case we will stop using your data.

Right to withdraw

Data Protection Officer: Caty Pou
Organisation: UIB
Address: Carretera de Valldemossa, km 7.5, 07122 Palma, SPAIN
E-mail address: dpo@uib.es

From the moment of your withdrawal, your data will not be newly processed in any further phases of the research project. However, it will not be possible to extract information you provided once all data has been anonymised, alter already existing, published documents or completed project deliverables. Feel free to also contact our Data Protection Officer for further information about your rights as a survey participant.

Data Subject Rights

You have the right to information regarding what is collected and processed, to access your data being processed, to delete or make any changes to this information, and to restrict processing. You have the right to receive requested information in a time-limited fashion.

If you have any further questions regarding this topic, feel free to contact us via email at h2020@synyo.com.

Confidentiality preferences

2

* I agree to be quoted directly
  - Yes
  - No

* My name

* My e-mail

* My data may be used in the promotion of PlatformUptake.eu in general
  - Yes
  - No

- [ ] I have read the outlined terms and understand them

Contextual/Business dimension questionnaire

* Name of the platform
  - AIOTES
  - EKOSMART
  - FIWARE
  - ONESAIT
  - REACH2020
  - SENSINACT
  - UNCAP
  - UNIVERSAAL

The platform

Which are the competitive advantages of the platform?

Which are the weaknesses of the platform?

Are platform services, apps, solutions, etc. accessible, especially considering the user experience of people with disabilities and older people?

Does the platform support out of the box or has been used/piloted/tested on AHA services?

3

Yes No

In which AHA domains (e.g. home/outdoors activity monitoring, fall/frailty/nutrition abnormalities prevention /detection, mobility, communication, leisure, etc.)?

Do platform services, apps, solutions, etc. significantly contribute to the individual end-user's empowerment (for example by supporting and training the individual end-user to better understand and express their own current and future wishes, needs and preferences)?

Which are the costs related to the setup of the platform (e.g. hardware, software royalties, installation and configuration)?

Which are the costs to maintain the platform active and up-to-date?

Do you think these costs are too high?

Is the platform free of charge or there are subscribing prices or fee per service for end-users or service providers?

Free of charge Subscribing prices or fee

In case of subscribing prices or fees being applied, please describe them.

Which aspects of a platform do you consider most important when evaluating and comparing platforms for AHA?

Can you provide some real case examples about the usability and acceptance of the services offered by the platform by stakeholders?

If asked about other AHA/AAL platforms, which is the first that comes to your mind?

4

End-users and privacy

Was the platform developed with end-users' involvement?

Yes No

Please detail what was the process and how was that incorporated in the further developments.

Have you had any feedback from end-users?

Yes No

Is feedback from end users collected?

Yes No

Is it treated and replied to?

Can you explain the mechanism you use to this end?

What were the main positive and negative points highlighted in this feedback?

Does the platform comply with all the necessary ethical and privacy requirements?

Yes No

Please justify your answer detailing how this is ensured.

Is there a privacy statement provided to the user?

Yes No

Can you please include below a link to the statement?

5

Is there a consent form where the user accepts the collection, treatment and processing of personal data, according to 2016/679 EU GDPR?

Yes No

Can you please include below a link to the statement?

Does the Platform explain what data is collected and how it is used?

Yes No

Can you please provide the link to that explanation?

Can the user access and share his/her data as collected by the platform, according to 2016/679 EU GDPR?

Yes No

Can you describe the access and sharing model?

Is feedback from end users collected?

Yes No

Is it treated and replied to?

Can the platform raise ethical or privacy or security issues?

Other questions

Which is the number of active registrations on the platform last year?

Which is the number of registrations on the platform last year by country?

Which is the proportion of subscribers/members/registered/... who abandoned the platform during last year?

6

Which is the proportion of active end-users of the Platform during last year?

Which is the growth rate of platform users or membership during last year?

Which is the growth rate of platform developed apps based on platform?

Which is the number of visits from different end-users to the website platform per year?

Which is the number of downloads of items at platform per year?

Which is the average duration time visiting the website platform per visitor?

Which is the percentage of active producers/developers from the total number of registrations?

How much decrease of hospitalization/improvement of care of end-user using the platform solutions, products, services, etc.?

Has the platform any scoring from any stakeholder type?

Which is the amount of certifications of apps/solutions based on the platform contents?

Which is the amount of use-cases based on the platform contents over a year?

7

Which is the amount of Customer Success Stories known?

Which is the revenue of the platform in euros?

8

Technical Questionnaire

PlatformUptake.eu

PlatformUptake Technical Questionnaire

Fields marked with * are mandatory.

Informed consent

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PlatformUptake.eu

Confidentiality preferences

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The results of this research can be published in scientific magazines or be presented at conferences, always guaranteeing the complete anonymity. The authorization for the use and access of the information for the aim of the research is totally voluntary. This authorization will apply until the end of the study unless you cancel it before. In this case we will stop using your data.

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If you have any further questions regarding this topic, feel free to contact us via email at h2020@synyo.com.

* I agree to be quoted directly
( ) Yes ( ) No

2

* My data may be used in the promotion of PlatformUptake.eu in general
  - ○ Yes ○ No

* My name

* My e-mail

☐ I have read the outlined terms and understand them

Technical dimension questionnaire

* Name of the platform
  - ○ AIOTES
  - ○ EKOSMART
  - ○ FIWARE
  - ○ ONESAIT
  - ○ REACH2020
  - ○ SENSINACT
  - ○ UNCAP
  - ○ UNIVERSAAL

Development, services and devices

Which are the main technologies used by the platform?

Does the platform provide the connection of different AHA devices?

Which standards and/or protocols are supported by the platform for devices?

Is the code open source?

3

Can the Platform itself or some of the services it provides be integrated in other systems or platforms without deep technical knowledge?

Is the platform interoperable?

Does the platform offer IoT monitoring capabilities, real-time diagnostics and usage analytics?

Are all communications between services and between devices secured and GDPR complaint?

Yes No

Can you detail how this is ensured?

How easy or difficult is it to identify and resolve problems with the platform?

Is there documentation and a (technical) support service available?

Yes No

Can you detail conditions of usage?

How many hours are needed for the deployment of the platform?

What are the minimum resources requirements (computing, storage, memory) for deploying the platform?

How many VMs are required?

End-users and privacy

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Was the platform developed with end-users' involvement?

Yes No

Please specify which kind of involvement and detail what was the process and level of involvement of end-users; at what point of the design or development where they being involved and how their feedback was incorporated in the further developments.

Is feedback from end users collected?

Yes No

Is it treated and replied to?

Can you explain the mechanism you use to this end?

What were the main positive and negative points highlighted in this feedback?

Does the platform comply with all the necessary ethical and privacy requirements, according to 2016/679 EU GDPR?

Yes No

Please justify your answer detailing how this is ensured.

Is there a privacy statement provided to the user, according to 2016/679 EU GDPR?

Yes No

Can you please include below a link to the statement?

Is there a consent form where the end-user accepts the collection, treatment and processing of personal data, according to 2016/679 EU GDPR?

Yes No

Can you please include below a link to the statement?

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Does the Platform explain what data is collected and how it is used, according to 2016/679 EU GDPR?

Yes No

Can you please provide the link to that explanation?

Can the user access and share his/her data as collected by the platform, according to 2016/679 EU GDPR??

Yes No

Can you describe the access and sharing model?

Other questions

Have you been involved in aspects not strictly related to development such as understanding what kind of services can be offered to end-users?

What were the main difficulties, if any, encountered during design, development and implementation, also in terms of communication with the other parties involved in the creation of the platform?

If asked about AHA/AAL, which is the first platform that comes to your mind?

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