PlatformUptake.eu

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

D2.1

European Open Service Platforms in the AHA Domain – Ecosystem Map

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Institute of science and information technologies, Italy (ISTI)

Frauenhofer Institute For Computer Graphics Research, Germany (IGD)

Universidad Politécnica de Madrid, Spain (UPM)

National Technical University of Athens School of Electrical & Computer Engineering, Greece (ICCS)

Jožef Stefan Institute, Slovenia (JSI)

AFEdemy, Academy on Age-Friendly Environments in Europe BV, Netherlands (AFE)

Cáritas Diocesana de Coimbra, Portugal (CDC)

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Authors: **Andrea Carboni,** ISTI

Dario Russo, ISTI

Davide Moroni, ISTI

Paolo Barsocchi, ISTI

Contributors: **All partners**

Reviewers: **Javier Ganzarain - Willeke van Staalduinen,** AFE

Maria Fernanda Cabrera - Silvia de los Rios - Juan Montalvá, UPM

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EXECUTIVE SUMMARY

Within this document, the activities related to Task T2.1 "Map the ecosystem by collecting existing open-source platforms in the Active and Healthy Aging Domain, their end-users and related stakeholders" are described and discussed.

Initially, the PlatformUptake.eu glossary (which can be consulted in Chapter 3) is presented. The glossary was conceived to meet the need of introducing and describing unambiguously the terminology used in PlatformUptake.eu, with particular attention to the definitions of project, platform and the various types of end-users and stakeholders involved. The analysis focuses on platforms within the AAL/AHA (Active Assisted Living / Active and Healthy Ageing) application domains; nevertheless, more generic platforms that have AHA among their possible application domains have also been included.

The first phase concerned the identification of the platforms which have been the most representative in AAL/AHA research in the last 10 years. From this first group of 48 projects, 18 were selected to be part of the ecosystem map. The selection criteria concerned various factors such as, among others, the impact on research in the AAL / AHA sectors and the European coverage that have led to prefer platforms that have laid the foundations for the subsequent ones.

The ecosystem map is conceived as a set of views belonging to four different domains: geographic, relationship, application and temporal. For each of these domains, a distinct analysis accompanied by a specific graphic representation has been performed and presented. The identification of the domains of interest has therefore made it possible to understand the key characteristics necessary for the correct placement of each platform within the ecosystem, by singling out its main characteristics and relations with the other platforms.

Finally, a platform record containing this information has been created and made available for each platform.

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1. Introduction

The number of people in need of care grows constantly with the increasing of the average age. These changes concern all countries in the world and are of significant impact for Europe. The care sector suffers from a work force shortage due to increased financial straits and bad image. These conditions make older adults dependent on their close relatives for care needs. The main aim of the projects discussed in this document is to provide solutions to improve the quality of life, especially for older people. The progress of the technology in the field of AAL/AHA was possible due to the research work in areas like intelligent building, telematics, computer vision, robotics, artificial intelligence and so on. Moreover, an important contribution to these technological advances is also due to the rise of computational power of systems that become increasingly less expensive. Consequently, new technologies will make it possible to increase the autonomy of older adults and enable them to live longer in their preferred environment without decreasing safety and care they need. These possibilities offered by technology will create more pleasant conditions for the older people at potentially lower costs.

Since AAL solutions always involve a technological aspect, while AHA solutions are more general, in this document the reference to AHA will also contain AAL.

A further consideration is on the habits of the ageing generations. Although some years ago many of the older adults were still reluctant to exploit technology and showed difficulties to use a computer and some of them even sometimes refused to use the mobile phone, in recent years, the percentage of older adults who appreciate technology has significantly increased. In fact, more and more often, they use computers and tablets for work and recreation purposes. This percentage is likely to grow in the coming years and communication technology will surely be increasingly well accepted even by the ageing population.

The European Commission has funded many research projects aimed at using innovative technologies, new philosophies and new rules in order to assist older people to live independently in their home environments as long as possible.

This deliverable describes the activity performed in Task T2.1: “Map the ecosystem by collecting existing open source platforms in the Active and Healthy Ageing Domain, their end-users and related stakeholders“.

2. Methodology

The task involves the collection of existing open sources platforms, that belong to the bigger ecosystem together with universAAL, FIWARE and including too those that are partly open or fully proprietary.

Following the collection of projects and players that will be explored in the next pages, an ecosystem map will be further presented to depict also their networks, subgroups and relationships. This first exercise towards a detailed analysis of the ecosystem will thus seek to provide the overview and pave the way for the analysis to be conducted in consecutive tasks of PlatformUptake.eu.

The first activity to achieve this goal and to ensure a coherent assessment and communication between partners was the definition of a common glossary with the aim of avoiding possible ambiguities in the terminology used. Starting from these definitions, the characteristics that distinguish one platform from another have been identified and from this departing point each platform has been registered. In this way, in the next phase, it is possible to compare the various platforms and create a real multi-dimensional map.

The aspects that were considered most important were:

- Geographical distribution
- Relationships between projects
- Application domains
- Time map

Each of these aspects is discussed in depth later in this document.

The first phase of research of the platforms was broad-based and allowed to identify 48 European projects of interest. The selection concerned three types of projects, those aimed specifically at AAL/AHA issues, projects for general purposes but application guaranteed by the AAL/AHA environment and projects that brought specific integrated development and innovation in the sector.

The identification of the platforms took place both, based on the extensive experience in previous projects of the representatives of the PlatformUptake.eu consortium, but also with an in-depth research through numerous European channels including the "eHealth Hub Platform"[1], the "DHE Catalog"[2] and specific official reports of the European Union[3].

Table 1 lists all the projects identified and selected through this first skimming, accompanied by a brief description. Chapter 5 “Platform description” describes later how the second phase of project selection was carried out.

Table 1: First list of identified projects

Project Name	Main Topic
ACTIVAGE[4]	Build the first European IoT ecosystem across 9 Deployment Sites (DS) in seven European countries
VAALID[5]	New tools and methods for AAL
UNCAP[6]	Open source, scalable and privacy-savvy ecosystem ready to help aging people live independently
ReAAL[7]	Promote standards, guidelines and reference platforms for interoperable solutions in the domain of active and independent living
BEYOND SILOS[8]	Integrated care in 7 European regions
unversAAL[9]	Seamless interoperability of devices, services and applications for IoT enabled smart environments
PERSONA[10]	Sustainable and affordable solutions for the social inclusion and independent living of Senior Citizen
GIRAFF+[11]	Home monitoring solution and telepresence robot
eWALL[12]	Innovative home environment
FI-STAR[13]	Future Internet Social and Technological Alignment Research
m-power [14]	Simplify and speed up the task of developing and deploying services for persons with cognitive disabilities and older people
HAH[15]	Next generation assistive devices for the hearing-impaired
ACCOMPANY[16]	Advanced robotics for rehabilitation
HDIM[17]	Diet assistive monitoring
FIWARE[18]	Curated framework of open source platform components to accelerate the development of smart solutions
AmIVital[19]	ICT technologies and tools for the modelling, design, operation and implementation of Ambient Intelligence devices
CareWell[20]	Integrated care for frail older patients
ehcoBUTLER[21]	ICT technological platform with both leisure and care apps
INNOVAGE[22]	Develop and test social innovations that will have a solid impact on improving the quality of life of older people.
SOPRANO[23]	Service-oriented programmable smart environment for older people
AMIGO[24]	Interoperable middleware and user services for the networked home environment
Mario[25]	Managing active and healthy aging with use of caring servIce robots
Reach2020[26]	Prevent older citizens from loss of function
SmartCare[27]	Define a common set of standard functional specifications for an open ICT platform enabling the delivery of integrated care to older European citizens
CARER+[28]	Equip carers facing new challenges in the digital age
EkoSmart[29]	Smart city ecosystem

DEM@CARE[30]	Dementia monitoring
FARSEEING[31]	Repository enabling research into the nature of falling
FATE[32]	Digital solution for fall detection
GrowMeUp[33]	Smart learning robot and sensors
I-DON'T-FALL[34]	Range of tools for fall prevention
OASIS[35]	Ontology-driven, Open Reference Architecture and Platform in all domains relevant to applications for the older adults and beyond.
INCA[36]	Cloud platform for continuation of care, less hospitalisations and greater efficiency
inCASA[37]	Technologies and a services network that help protect frail older people and prolong the time they can live well in their own homes
iStopFalls[38]	System to predict and prevent falls, including exercise games
I-SUPPORT[39]	Service robotics for bathing tasks
InterIoT[40]	Reuse and integration of existing and future IoT systems
PERSSILAA[41]	Multiple services addressing frailty
IN LIFE[42]	Innovative solutions and services improving elderly care
LONG LASTING MEMORIES[43]	Unified solution for better cognitive and physical health
RADIO[44]	Smart home/assistant robot system
ROBOT-ERA[45]	Advanced robotic systems and intelligent environments in real scenarios fort he ageing population
SILVER[46]	Mobile personal assistant in the shape of a walker that can help with daily routines and housekeeping
SOCIABLE[47]	Cognitive training solution
STOP AND GO[48]	Innovative care and cure solutions

3. Glossary definition

The complete glossary can be found in this chapter under Table 2, it is useful to discuss the main choices made regarding the terms used in order to clarify the general understanding.

Once the meaning of "Platform" and "Project" was defined, it was essential to classify each platform according to its users and its design characteristics, inherent in the activities of the platform developers. As regards to this second aspect, it was decided to follow a similar approach to the layers of a software system, identifying three main operational layers: physical, service and application, in which the physical layer is the building block of the service layer and the service layer is the building block of the application layer. In addition to these three layers there are two other layers, semantic and interoperability, linked to each other, but not always present in each platform.

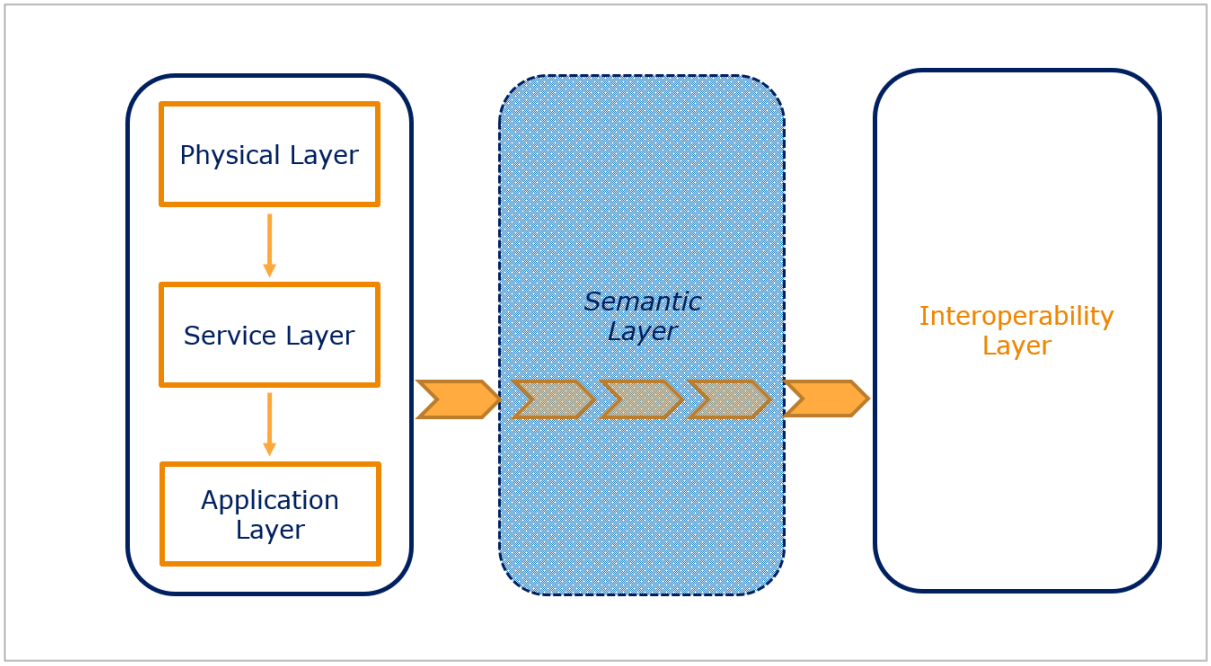

Figure 1: Platform layers from a developers' point of view

The research on the stakeholders started with the identification of the end users. Our analysis focuses on platforms with application in the AAL/AHA (Active Assisted Living / Active and Healthy Ageing) domain so, to ensure a broader and better analysis, more generic platforms (e.g. FIWARE) that have AHA among their possible application domains have also been included. These platforms can therefore have end users outside the AAL/AHA sphere or be dedicated to software developers. Thus, in this document the identified end users have been divided into Platform End Users (all possible end users of the platform, including software developers) and Primary End Users (AHA) (end users relating to the AHA scope only, typically older adults).

Secondary end users (AHA) are defined as the person or organization in direct contact with a primary end user, such as formal and informal care persons, family members, care organizations and their representatives. This group uses a set of applications or services provided by the platform to grant to the Primary End User (AHA) an increase or maintenance of his quality of life. Customer end users are institutions and private or public organizations that are not directly in contact with products and services, but who somehow contribute in organizing, paying or enabling them. This group includes the public sector service organizers, social security systems, insurance companies. In reference to the

stakeholders, it was considered appropriate to include Platform developers in the glossary, responsible for the entire life cycle of the platform's software products.

Figure 2 below shows an example of the relationship between the different users and the Platform developers in a general case scenario.

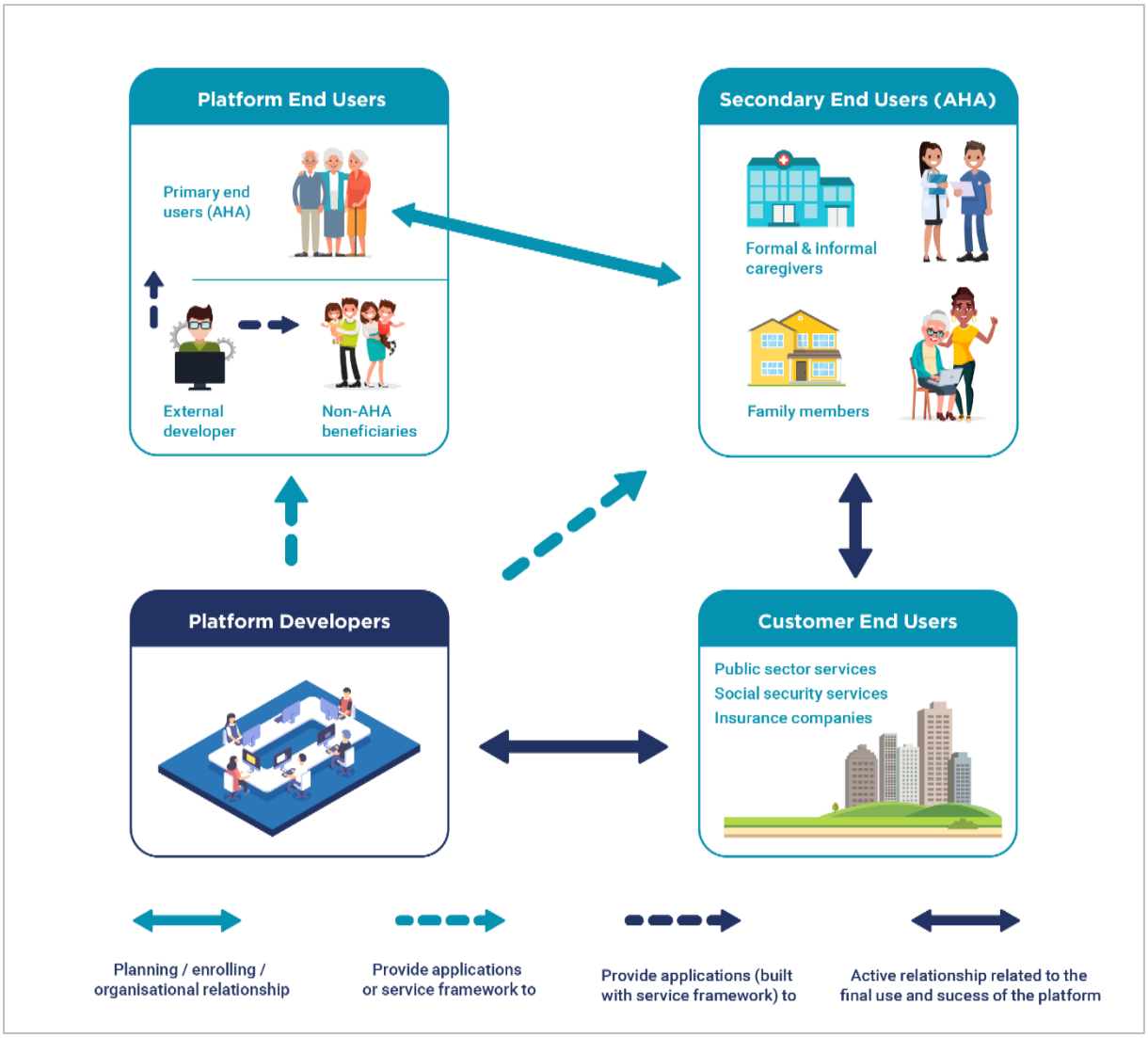

Figure 2: Relations between platform developers and end users

Table 2: The Glossary

Record Name	Definition
Platform	It is an operating environment, under which various applications and service programs from the application layer are designed, implemented, tested, released and maintained.
Project	It is defined as an undertaking that is temporary in nature for the purpose of creating a product, service, or result. A project must have a definite beginning and end (not ongoing), it can be over a very short or very long duration, but must remain a temporary endeavor.
Framework	It is a software providing high-level functionalities through application-specific software. It refers to a collection of libraries/classes with the common goal of providing a scaffold on which to build software and identifies the whole set of services that are part of the service layer. Frameworks might completely alter how you implement your program or they might just speed up common tasks.
Ecosystem	It is a collection of different elements related to a platform and the exploitation of its results. The elements, or parts, can include people, hardware, software, facilities, organizations, policies and documents. Their roles and the way they interact with each other arise from a mutually beneficial purpose, such as commercial gain, innovation or common interest.
Stakeholder	Individual or organization having a right, share, claim, or interest in a platform or in its possession of characteristics that meet their needs and expectations; N.B. Stakeholders include, but are not limited to end users, end user organizations, supporters, developers, producers, trainers, maintainers, disposers, acquirers, customers, operators, supplier organizations and regulatory bodies. (ISO/IEC June 2010).
Platform developer	It is the group of individuals, typically hired by Customer end users, that follow and implement the entire life cycle of the applications, or more generally, of the products, deriving from a given platform.

Platform end user	It is the individual or groups of individuals intended as the main beneficiaries of an application or set of applications provided by the considered platform. It contains Primary end user (AHA) group together with non-AHA beneficiaries and developers.
Primary end user (AHA)	In the AHA domain it is the single individual intended as the main beneficiary of a service or set of services provided by the considered platform. The primary end users directly benefit of these services with an increase of their quality of life.
Secondary end user (AHA)	The person or organisation in direct contact with a primary end user, such as formal and informal care persons, family members, care organisations and their representatives. This group uses a set of applications or services provided by the platform to grant to the primary users an increase or maintenance of their quality of life.
Customer end user	Institutions and private or public organisations that are not directly in contact with products and services, but who somehow contribute in organising, paying or enabling them. This group includes the public sector service organisers, social security systems, insurance companies.
Physical layer	Layer responsible for the recognition and exchange of messages with physical devices and sensors. It implements a high-level communication interface that allows the upper levels easy access to the devices, dealing with raw communication. It is the building block for the service layer.
Service layer	Layer which provides sets of methods that allow access to devices and a first data processing in the context of a specific domain. It is the building block for the Application Layer.
Application layer	Layer in which methods developed in the service layer are combined to create applications.
Semantic layer	Layer in which a knowledge system (e.g. ontology) is defined in order to give a formal representation and provide a natural interface for accessing the

	functionalities of an underlying layer. It usually is the building block of the interoperablity layer.
Interoperability layer	Layer which provides a common interface for accessing and exporting application functionalities from/to different platforms.
Application	It is a software that, by typically combining multiple services, offers to the user a unique, or restricted for a specific purpose, application experience. An application can also include a user interface (graphic, textual, touch). Other important elements of an application are the degree of permissiveness of the license, dependence on the operating system, being standalone or network, to be installed or portable, etc. From a user perspective, elements like accessibility, user-friendliness, look-and-feel, availability, support, maintenance, etc. have to be considered.
Software	Collection of instructions that tell the computer and its related devices how to work.

4. The rationale for mapping existing platforms

Before creating an ecosystem map, it is essential to understand both which platforms to analyze and which aspects we are interested in analyzing to provide the most accurate map possible.

Therefore, following first three questions need to be answered:

- What kind of platforms are we interested in?
- What are the common aspects of each platform we are interested in?
- What kind of mapping do we intend to do?

In the following three paragraphs we answer these questions and provide a description of the choices made to best cover these three aspects.

4.1. The Platforms

The aim of the PlatformUptake.eu project is to observe, analyse and understand the whole ecosystem of platforms in the AHA and IoT (Internet of Things) domains and their related networks and depict a picture describing the whole ecosystem with its achievements and potentials targeting all user groups while also generating synergies among them with the ultimate goal of improving the quality of life of older people.

Although it is clear that the main application domains of interest are AAL and AHA, during the analysis it emerged that general purpose platforms used for the creation of AAL / AHA solutions could not be missing. From this it can be therefore deduced that the decision was to include those platforms that are either fully or partially oriented to developers of services or applications for active ageing, as they all are fundamental, especially in recent years.

4.2. Platforms' common aspects

The ecosystem mapping must derive from a set of simple information that allows classifying a platform in a few steps. Therefore, in this phase of the research work, it is not necessary to go into a detailed analysis of each of the platforms, but rather it is fundamental to identify what are the characteristics that allow a clear classification for the creation of the map.

Table 3 below shows all the fields that after a careful analysis have been selected for a correct creation of the ecosystem mapping.

Table 3: The platform record

Platform record
Project
Platform
Short description
Application domain
Physical layer

Service layer
Application layer
Semantic layer
Interoperability layer
Platform end users
Primary end users (AHA)
Secondary end users (AHA)
Customer end users
Project start/end
Project status
Platform status
Maintained
License
Region of diffusion
Relations to other platforms

4.3. The mapping

Once the platform record was established, it was possible to start having a clearer overview of the platforms and their relationships. As we will see in detail in Chapter 6 “Ecosystem map”, the ecosystem map that was created is actually a set of views, or better said, a set of multiple maps, from each of which it is possible to obtain important observations, which joined together will give us a complete vision of all the platforms analysed and their relationships.

The mapping was divided into four main dimensions:

- Geographical dimension
- Relation dimension
- Application dimension
- Temporal dimension

To each of these dimensions, a detailed analysis is associated and accompanied by a specific graphic representation.

5. Platforms description

During an initial analysis phase, 48 platforms were identified and selected. Later on, this initial group was reduced to eighteen (Table 4). The reasons why some platforms have been discarded lie mainly in the following factors:

- Projects with low impact on the development of AAL / AHA technologies,
- projects completed ten years ago or more and are no longer maintained, so are considered obsolete or
- projects without impact or reports on other subsequent projects.

In this phase, however, obsolete platforms that have been fundamental in the development of important subsequent platforms will be analysed. The reason for this choice is to be found in the desire to create an ecosystem map as accurate as possible even from the point of view of relations between projects and time analysis.

Another exclusion criterion for the subsequent analysis phase was not to consider all those projects that aimed at specific solutions, either by type of pathology (e.g. Dem@Care, HDIM, etc.) or by end user (e.g. FATE, I-DON'T-FALL, I-SUPPORT, etc.). The reason for this choice lies in the desire to select projects, that in their vision, have decided to embrace solutions or technologies that over time could converge, as much as possible, among themselves, even if not always with the expected success.

Following these criteria, 18 projects from the initial 48 were selected, as shown in table 4 below.

Table 4: The selected Projects

ID	Project name	Project logo	ID	Project name	Project logo
1	ACTIVAGE		10	m-power	
2	Amigo		11	Oasis	
3	AmIVital		12	Persona	
4	BeyondSios		13	Reach2020	
5	EkoSmart		14	ReAAL	
6	FiWare		15	Soprano	

7	Giraffplus		16	UNCAP	
8	In Life		17	universAAL	
9	interiot		18	VAALID	

In the next paragraphs, the records of each of the selected platforms will be analysed in detail: each platform will have its own specific paragraph, containing the Platform Record together with an introduction containing some of its own specific aspects.

5.1. ACTIVAGE

ACTIVAGE is a European Multi Centric Large Scale Pilot on Smart Living Environments. The main objective is to build the first European IoT ecosystem across 9 pilot sites called Deployment Sites (DS) , in seven European countries, reusing and scaling up underlying open and proprietary IoT platforms, technologies and standards, and integrating new interfaces needed to provide interoperability across these heterogeneous platforms, that will enable the deployment and operation at large scale of Active & Healthy Ageing IoT based solutions and services, supporting and extending the independent living of older adults in their living environments, and responding to real needs of caregivers, service providers and public authorities.

The solutions offered by the ACTIVAGE IoT Ecosystem Suite (AIOTES) are all oriented towards AHA-type issues, but end users are not only the older people. In fact, the AIOTES platform is also intended for developers of AHA solutions, therefore they are themselves being considered end users, concretely platform end users.

From the point of view of interoperability, ACTIVAGE is the only project of those analysed that aims to achieve interoperability between platforms, for example, to make communication possible between a FIWARE product and one of universAAL. This is done through the creation of an appropriate semantic layer, according to the model described in Figure 1.

Table 5: Platform record of ACTIVEAGE

ACTIVAGE	
Project	ACTIVAGE
Platform	AIOTES (ACTIVAGE IoT Ecosystem Suite)
Short description	The AIoTES framework consists of a set of techniques, tools and methodologies for interoperability between heterogeneous

	IoT platforms and an open framework for providing semantic interoperability of IoT platforms for AHA while addressing trustworthiness, privacy, data protection and security.
Application domain	AHA
Physical layer	External (FIWARE, universAAL)
Service layer	Yes
Application layer	Yes
Semantic layer	Yes
Interoperability layer	Semantic interoperability, inter platform interoperability
Platform end users	Developers / Older people
Primary end users (AHA)	Older people
Secondary end users (AHA)	Formal and informal care persons, family members, care organisations and their representatives
Customer end users	Care organisations
Project start/end	Start 01/01/2017 End 30/06/2020
Project status	Active
Platform status	Under development since 01/01/2017
Maintained	Yes
License	Not applicable
Regions of diffusion	Italy, Spain, France, UK, Germany, Finland, Grece
Relations to other platforms	Integrates other platforms for physical layer implementation

5.2. AMIGO

The project has created a system, with the same name, that can support the activities of all family members, whether in home, out and about or abroad. The system can keep track of family members or alert the appropriate person if someone suddenly falls ill. It can also plan a family meal and order the ingredients from the local grocer. It is so sophisticated that it can even tell you if you have forgotten your wallet before you leave the house.

The AMIGO platform focused on three thematic areas dealing with the intelligent home: care and safety, information and entertainment, and extended support for linking family members and friends as they go about their daily routines.

AMIGO project offers solutions that are oriented to solve AAL issues. The end users are persons with physical limits or mental disorders and their families and caregivers. However, the platform is also suitable for other people without any specific health problem. Developers of application can also be considered end users as the creators of new home services for the platform exploiting the furnished designer tools. The platform can be installed by care organizations that want the independence and the monitoring of their patients.

The AMIGO platform further supports interoperability between equipment and services within the networked home environment by using standard technology when possible and by making the basic middleware (components and infrastructure) and intelligent user services available as open-source software together with architectural rules for everyone to use.

Table 6: Platform record of AMIGO

AMIGO	
Project	AMIGO
Platform	AMIGO
Short description	The Amigo project developed open, standardized, interoperable middleware and attractive user services for the networked home environment. Fifteen of Europe's leading companies and research organizations in mobile and home networking, software development, consumer electronics and domestic appliances had joined together in the Amigo project to develop an integrated interoperable home networking framework. Amigo was an IST-funded IP project.
Application domain	AAL
Physical layer	Yes
Service layer	Yes
Application layer	Yes
Semantic layer	Yes
Interoperability layer	Intra, semantic interoperability
Platform end users	People in home / developers
Primary end users (AHA)	People in home
Secondary end users (AHA)	Family members, friends
Customer end users	Care organisations
Project start/end	Start 01/09/2004 - End 29/02/2008

Project status	Closed
Platform status	Not operational
Maintained	No
License	Open source
Regions of diffusion	Germany, Spain, Finland, France, Greece, Netherlands
Relations to other platforms	Used as input for universAAL

5.3. AmIVITAL

AmIVITAL project developed a new generation of ICT technologies and tools for the modelling, design, operation and implementation of Ambient Intelligence (AmI) devices and systems to be used for providing services and personal support for independent living, wellbeing and health of older people, with special emphasis on those with chronic illness, people with disabilities or reduced mobility. Likewise, it also helped formal and informal caregivers.

The AmIVITAL project involved the construction of a technological space to facilitate the development of the European concept of AAL (Ambient Assisted Living) through the design and application of business models aimed at covering primary social necessities. This meant to contribute to the economic objectives of promoting industrial competitiveness, jobs and general economic welfare; placing industry and AAL service providers as stakeholders of AmIVITAL.

AmIVital set up a technological platform comprising device, network and computer programme standardized components allowing for a simple creation of services adapted to different needs and environments. However, no interoperability layer was contemplated in the implementation.

Table 7: Platform record of AmIVITAL

AmIVITAL	
Project	AmIVITAL
Platform	AmIVITAL
Short description	The general objective of the AmIVITAL project was the development of a new generation of ICT technologies and tools for the modelling, design, operation and implementation of Ambient Intelligence (AmI) devices and systems to be used for providing services and personal support for independent living, wellbeing and health. This involved the construction of a technological space to facilitate the development of the European concept of AAL (Ambient Assisted Living) through the design and application of business models for an emerging

	sector with good future prospects aimed at covering primary social necessities.
Application domain	AAL
Physical layer	Yes
Service layer	Yes
Application layer	Yes
Semantic layer	Yes
Interoperability layer	No
Platform end users	Older adults / developers
Primary end users (AHA)	Older adults
Secondary end users (AHA)	Formal and informal caregivers
Customer end users	Informal caregivers' and caregivers associations
Project start/end	Start 01/01/2007 - End 31/12/2010
Project status	Closed
Platform status	Not operational
Maintained	No
License	Not licensed
Regions of diffusion	National (Spain)
Relations to other platforms	None

5.4. BeyondSilos

BeyondSilos was co-funded by the European Commission under the framework of its Competitiveness and Innovation Programme (CIP, grant agreement no. 621069). Its goal was to deliver truly integrated care which meets people's needs.

This goal was achieved by offering a solution for two identified pathways: Integrated short-term home support after an acute episode; and Integrated long-term home support. BeyondSilos developed and piloted integrated care services delivered with the help of suitable ICT systems. These services were based on care pathways cutting across boundaries which typically separate healthcare from social care – delivering "horizontal integration". In practice, a telemonitoring platform, called SmartLiving was offered, which bridged gaps identified in the different pilot sites.

This telemonitoring solution brought together different stakeholders such as older adults, formal and informal caregivers. It offered vital signs measurements and alerts for the older adults, managing the

task assignments of caregivers, schedules of medical professionals and building reports based on the system data.

These services were implemented and piloted in the regions of Northern Ireland, Sofia in Bulgaria, Badalona and Valencia in Spain, Campania in Italy, Amadora in Portugal and the Kinzigtal in Germany.

Table 8: Platform record of BeyondSilos

BeyondSilos	
Project	BeyondSilos
Platform	SmartLiving telemonitoring
Short description	BeyondSilos aimed at further spreading ICT-enabled, joined-up health and social care for older people by developing, piloting and evaluating integrated services based on two generic pathways in a multicentric approach, making extensive use of knowledge and experience gained among early adopters of integrated eCare in Europe. Third sector organisations and family/informal carers, where appropriate, were included in the information loop in order to facilitate service users to self-care and live independently.
Application domain	AHA
Physical layer	No. Devices are used to connect through Bluetooth and automatically add their data to the web service
Service layer	No
Application layer	Yes
Semantic layer	No
Interoperability layer	No
Platform end users	Older adults / developers
Primary end users (AHA)	Older adults
Secondary end users (AHA)	Formal and informal caregivers
Customer end users	Informal caregivers and caregivers associations
Project start/end	Start 01/01/2007 - End 31/12/2010
Project status	Closed
Platform status	Not operational

Maintained	No
License	Not licensed
Regions of diffusion	National (Spain)
Relations to other platforms	None

5.5. EkoSMART

The purpose of the EkoSmart program was to develop a smart city ecosystem with all the support mechanisms necessary for efficient, optimized and gradual integration of individual areas into a unified and coherent system of value chains. The program focused on three key domains of smart cities: health, active living and mobility; and formed strategic relationships with municipalities and other areas of smart cities, such as energy, smart buildings, involvement of citizens, smart communities, etc.

EkoSMART introduced the universal architecture of a smart city, based on the combination of self-learning and self-optimizing agents able to find a common Nash equilibrium even between inhomogeneous sources; this architecture enabled the realization of all the concepts of smart cities, such as interoperability, self-adaptivity and self-configurability, open data, semantic interoperability, and integration of social capital.

In terms of economy, the vision of the EkoSmart program was to launch Slovenian solutions in the field of smart cities on the world market. The realization of this vision was based on several major approaches: concentration of knowledge and experience, focus on the user, evolutionary development, and flexible architecture.

Points of excellence:

Emphasis is placed on electronic and mobile health as one of the pillars of smart cities.

- Introduction of self-configurable, self-integrating, self-optimizing, flexible and adaptable universal architecture with simple addition of modules.
- Intensive development and implementation of new ICT methods and concepts, such as IoT and methods of artificial intelligence as a backbone of technology and human society development.
- Founded on high quality and varied consortium of the most advanced partners in these areas, with strategic links to smart home and health programs.
- Emphasis on the concept of smart specialization – the introduction of interconnected comprehensive chains, and markets.

The primary stakeholders of the system had been identified as tele-medicine service providers, municipalities and elder-care institutions. With the use of the platform, they can greatly extend the services they provide, allowing users better, easier and more personalized care, compared to existing solutions.

The EkoSmart platforms acts as a meta platform for connecting and combining services and data gathered from IoT devices and other platforms. The communication with the platform is done through specified REST API through different channels and allows other services and users to subscribe to the specific channel. The main advantage of the EcoSmart is the ability to easily connect different service

providers and users, extending individual's service functionalities and allowing building new services with the combination of information provided by other services connected to the platform.

Table 9: Platform record of EKoSmart

EKoSmart	
Project	EkoSmart
Platform	EkoSmart
Short description	The purpose of the EkoSmart program is to develop a smart city ecosystem with all the support mechanisms necessary for efficient, optimized and gradual integration of individual areas into a unified and coherent system of value chains. The program focuses on three key domains of smart cities: health, active living and mobility; and forms strategic relationships with municipalities and other areas of smart cities, such as energy, smart buildings, involvement of citizens, smart communities, etc.
Application domain	General Purpose
Physical layer	Yes
Service layer	Yes
Application layer	Yes
Semantic layer	Yes
Interoperability layer	Intra, semantic interoperability
Platform end users	Everyone, older people (eHealth - part)
Primary end users (AHA)	Everyone, older people (eHealth - part)
Secondary end users (AHA)	Formal and informal carers, family members, healthcare organisations
Customer end users	Muncipalities
Project start/end	Start 01/08/2016 End 31/07/2019
Project status	Closed
Platform status	Operational
Maintained	No
License	Not licensed

Regions of diffusion	National (Slovenia)
Relations to other platforms	None

5.6. FIWARE

FIWARE is a curated framework of open source platform components; its main scope is to maintain and promote an open sustainable ecosystem around public, royalty-free and implementation-driven software platform standards, which will ease and accelerate the development of smart applications and solutions in multiple sectors. The FIWARE platform combines components that enable the connection to IoT with Context Information Management and Big Data services in the cloud, and allows for smart and easy usage of data by employing standard APIs for data management and exchange, as well as harmonised data models. The FIWARE framework further involves a marketplace which accommodates FIWARE-based solutions and services for enabling the automation of processes across the entire value chain and allowing easy integration with other solutions and services.

Supported by the modular approach followed in the FIWARE platform, the solutions enabled via its usage are targeted towards multiple sectors, such as smart cities, smart industry, smart agrifood, smart energy, and of course smart health, including AHA. Hence, both the developers utilising FIWARE to create such solutions as well as all the people who benefit from these developments can be considered its end users.

FIWARE can be used as a middleware platform to create an interoperable layer among various data/information providers and consumers, covering the need to gather and manage context information, processing that information and informing external actors, enabling them to actuate and therefore alter or enrich the current context. The FIWARE Context Broker, one of the core components of FIWARE-based solutions, enables the system to access the current state of context and perform updates to it. The Context Broker can be, in turn, integrated with a number of additional components, which may be supplying context data (from diverse sources such as a CRM system, social networks, mobile apps or IoT sensors for example), supporting processing, analysis and visualization of data or bringing support to data access control, publication or monetization. All interactions among applications or components and the Context Broker take place using the FIWARE NGSI v2 open standard. The Industry Specification Group for cross-cutting Context Information Management (ISG CIM) of ETSI, one of the three official European Standards Organisations, has recently built upon FIWARE's NGSI v2 specification, to create and ratify the expanded NGSI-LD standard as a full-featured API specification for context information management. This updated standard has already been incorporated back in FIWARE. By adhering to industry-leading standards, FIWARE can be used for enabling cross-domain interoperability, facilitating the development of portable applications and avoiding vendor lock-in.

There is a large active open community around FIWARE consisting of contributors to the associated technology (the FIWARE platform), but also of all those who contribute to the real-life usage, spread and sustainability of the FIWARE framework. These include individuals and organisations committing relevant resources in FIWARE-based solutions, activities and programmes, including municipalities utilising FIWARE technologies, investors hubs and various accelerator programmes, amongst others. There are also strategic partnerships with the GSM Association (GSMA), the telecommunications industry (TM) Forum, the Connecting Europe Facility (CEF), and ETSI. In addition to the above there are

stakeholders who offer FIWARE-related added-value services, such as training/coaching and consultancy, integration and support.

Table 10: Platform record of FIWARE

FIWARE	
Project	FIWARE
Platform	FIWARE
Short description	FIWARE is a curated framework of open source platform components with its main scope being to maintain and promote an open sustainable ecosystem around public, royalty-free and implementation-driven software platform standards that will ease and accelerate the development of smart applications and solutions in multiple sectors.
Application domain	General purpose (common, collaborative and interoperable data sharing)
Physical layer	Yes
Service layer	Yes
Application layer	Yes
Semantic layer	No, but there is an optional feature which brings some semantic capabilities to the IoT Broker, which is a physical-layer GE for enabling communication with IoT devices
Interoperability layer	Intra, standards-based (and limited semantic) interoperability
Platform end users	Developers of interoperable data sharing solutions in various sectors (including Smart Cities, AgriFood, eHealth, Transport, Energy & Environment, Media & Content, Manufacturing & Logistics, Social & Learning, etc.) / End users who benefit from these developments
Primary end users (AHA)	Older people
Secondary end users (AHA)	Formal and informal care persons, family members, care organisations and their representatives
Customer end users	Public organisations with focus on policy making and care
Project start/end	Start: 01/05/2011 - End: 31/12/2014
Project status	Closed

Platform status	Operational
Maintained	Yes
License	Open Source (various open source licenses depending on the GE)
Regions of diffusion	Europe, global (Belgium, Brazil, Switzerland, Germany, Spain, Finland, France, Hungary, Italy, Netherlands, Portugal, Sweden, United Kingdom, Colombia)
Relations to other platforms	None

5.7. GIRAFFplus

The GIRAFFplus project aims to combine social interaction and long-term monitoring to help people live independently taking advanced also of a robot using a Skype-like interface to implement a virtual visit to the older from family members, friends, and health professionals. To these purposes, it was developed a system implementing:

- a networked system in the home consisting of environmental and physiological sensors;
- intelligent services that can extract high-level activities based on sensor data and provide a robust system;
- services such as alarms which via the Giraff plus will allow healthcare professionals and family to enable timely involvement.

The platform offers solutions oriented to the AHA domain. End users are older people, their families, and their caregivers. Health professionals verify the health status of the patients in the distance using also an audio/video telecommunication system.

Giraff plus doesn't implement any interoperability mechanism.

Table 11: Platform record of GIRAFFplus

GIRAFFplus	
Project	GIRAFFplus
Platform	GIRAFFplus
Short description	Social interaction and monitoring, Giraffplus is a complex system that can monitor activities in the home using a network of sensors, both in and around the home as well as on the body. The sensors can measure, e.g. blood pressure or detect e.g. whether somebody falls. Different services, depending on the individual's needs, can be pre-selected and tailored to the requirements of both the older adults and health care professionals. At the heart of the system is a unique

	telepresence robot, Giraff, which lends its name to the project. The robot uses a Skype-like interface to allow e.g. relatives or caregivers to virtually visit an older person in the home. Special emphasis in the project is given to evaluations and input from the users so that the system can have empathetic user interaction and address the actual needs and capabilities of the users.
Application domain	AHA
Physical layer	Yes
Service layer	Yes
Application layer	Yes
Semantic layer	No
Interoperability layer	No
Platform end users	Older people
Primary end users (AHA)	Older People
Secondary end users (AHA)	Family, friends, informal and formal care givers and health professionals.
Customer end users	Individuals and families, care organizations and other payers such as insurance companies
Project start/end	Start: 01/01/2012 - End: 31/12/2014
Project status	Closed
Platform status	Last update February 2015
Maintained	Yes
License	Apache 2.0
Regions of diffusion	Sweden, Spain, Italy, Portugal, UK, Slovenia
Relations to other platforms	None

5.8. inLIFE

inLIFE was an Innovation Action large scale multi-country pilot project, funded by the European Union's Horizon 2020 programme. inLIFE aimed to prolong and support the independent living of seniors with cognitive impairments (i.e. early dementia, moderate dementia, etc.), through ICT solutions that support home activities, communication, health maintenance, travel, mobility and socialisation tasks.

In addition to people with cognitive impairments, IN LIFE also addressed formal and informal caregivers, including family members, care organisations, and developers of third-party applications.

It was tested Europewide in large-scale and multi-country pilot applications through pilots in 6 sites (North: UK, Sweden; Central: The Netherlands; South: Spain, Greece; East: Slovenia) with 1200 older people with cognitive impairments, 600 formal and informal caregivers, and 60 other stakeholders.

Regarding interoperability, inLIFE's architecture took advantage of the semantic interoperability features of previous projects, in order to enable semantics-aware seamless integration of existing Web services and hardware devices. Moreover, the project investigated and contributed to existing and on-going standards activities under the interoperability perspective.

Table 12: Platform record of inLIFE

inLIFE	
Project	inLIFE
Platform	inLIFE
Short description	IN LIFE aims to prolong and support independent living for older people with cognitive impairments, through interoperable, open, personalized and seamless ICT services that support home activities, communication, health maintenance, travel, mobility and socialization, with novel, scalable and viable business models, based on feedback from large-scale, multi-country pilots. These interoperable services are integrated into an open, cloud-based, reference architecture.
Application domain	AAL
Physical layer	Yes
Service layer	Yes
Application layer	Yes
Semantic layer	Yes
Interoperability layer	Intra, semantic interoperability
Platform end users	Developers / Older people/ Caregivers
Primary end users (AHA)	Older people
Secondary end users (AHA)	Formal and informal care persons, family members, care organisations
Customer end users	Older adults, caregivers, care organisations

Project start/end	Start 01/02/2015 - End 31/01/2018
Project status	Closed
Platform status	Not operational
Maintained	No
License	Not licensed
Regions of diffusion	Europe (United Kingdom, Slovenia, Ireland, Austria, Netherlands, Spain, Sweden, Greece)
Relations to other platforms	None

5.9. interiot

interiot project is aiming at the design, implementation, and experimentation of an open cross-layer framework and associated methodology to provide voluntary interoperability among heterogeneous Internet of Things (IoT) platforms. interiot implements smart IoT applications, atop different heterogeneous IoT platforms, spanning single and/or multiple application domains.

The overall goal of the interiot project is to provide an interoperable framework architecture for seamless integration of different IoT architectures present in different application domains. Interoperability was provided at different levels: device, network, middleware, services, and data. The two application domains and use cases addressed in the project and in which the IoT framework was applied were m-health and port transportation and logistics.

interiot is a general-purpose platform and its end users are the developer that creates solutions suitable for this platform, people in general. At the moment, there are applications for ill and older people and all subjects involved in logistics and port environments.

The project may deal with interoperability at different layers. In particular, it can integrate different IoT devices, networks, platforms, services and applications allowing a global continuum of data, infrastructures, and services that can enable different IoT scenarios. As well, reuse and integration of existing and future IoT systems will be facilitated, creating a de-facto global ecosystem of interoperable IoT platforms. [49]

Table 13: Platform record of interiot

interiot	
Project	interiot
Platform	interiot
Short description	Most current existing IoT developments are based on “closed-loop” concepts, focusing on a specific purpose and being isolated from the rest of the world. Integration between heterogeneous elements is usually done at device or network

	level, and is just limited to data gathering. A multi-layered approach integrating different IoT devices, networks, platforms, services and applications will allow a global continuum of data, infrastructures and services that can enable different IoT scenarios. As well, reuse and integration of existing and future IoT systems will be facilitated, creating a de-facto global ecosystem of interoperable IoT platforms. In the absence of global IoT standards, the INTER-IoT results will allow any company to design and develop new IoT devices or services, leveraging on the existing ecosystem, and bring them to market quickly.
Application domain	General Purpose
Physical layer	Yes
Service layer	Yes
Application layer	Yes
Semantic layer	Yes
Interoperability layer	Intra, semantic interoperability
Platform end users	Developer, older people, transportation and logistics involved people in a port environment
Primary end users (AHA)	Older people
Secondary end users (AHA)	None
Customer end users	Universities, Companies, Public Institutions
Project start/end	Start 01/01/2016 - End 31/12/2018
Project status	Closed
Platform status	Last update December 2019
Maintained	Yes
License	Apache 2.0
Regions of diffusion	Europe (Spain, Italy, Netherland, UK, Slovenia, Poland, France)
Relations to other platforms	None

5.10. m-power

MPOWER is a middleware platform that enables the rapid development of novel smart house systems, applications, and services for persons with cognitive disabilities and the older people. MPOWER is an AAL oriented platform and its end users are older people with cognitive diseases at home to be monitored and formal and informal care persons, family members, care organizations and their representatives to verify the state of health of patients.

Provided services are, for example, security services, database management service (with initial data), patient manager service, calendar service with a reminder (HL7v3), patient information message board service, localization service, frame sensor service (ISO/IEEE 11073), as well as alarming and notification services and many others. Documentation is provided for these services and the overall architecture. The services presented are freely available as open-source under the MIT license.

The MPOWER project has designed and implemented interoperability services based on patterns, service-oriented architectures, web services, and XSDL transformations. In this way, MPOWER provides a standard means of interoperating between different software applications, running on a variety of platforms and/or frameworks. Any AAL application can communicate with MPOWER services using HTTP and SOAP. MPOWER service interfaces are defined using WSDLs to easily exchange an internal service with other external web services that are found more suitable. This provides developers with choice and flexibility. MPOWER further implemented a UDDI service and a message bus to achieve the fundamental SOA concept of loose coupling.

Table 14: Platform record of m-power

m-power	
Project	m-power
Platform	m-power
	MPOWER defines and implements an open platform to simplify and speed up the task of developing and deploying services for persons with cognitive disabilities and older people. The platform supports integration of SMART HOUSE and sensor technology; interoperability between professionals and institution-specific systems (e.g. Hospital Information System); secure and safe information management, including both social and medical information; and mobile users which often change context and tools. The project researches and develops the platform as a suite of independent building blocks.
Application domain	AAL
Physical layer	Yes
Service layer	Yes
Application layer	Yes

Semantic layer	No
Interoperability layer	No
Platform end users	Older people with cognitive diseases at home
Primary end users (AHA)	Older people with cognitive diseases at home
Secondary end users (AHA)	Formal and informal care persons, family members, care organisations and their representatives
Customer end users	Care organisations
Project start/end	Start 01/10/2006 - End 31/03/2009
Project status	Closed
Platform status	Not operational
Maintained	No
License	Open source
Regions of diffusion	Austria, Spain, Norway, Croatia, Cyprus, Poland
Relations to other platforms	Used as input for universAAL

5.11. OASIS

OASIS was a Large Scale Integrated Project from the 7th Framework Programme of the European Union with the aim to develop an open and innovative reference architecture, based upon ontologies and semantic services, that allows plug and play and cost-effective interconnection of existing and newly developed services in all domains required for the independent and autonomous living of older people and their quality of life enhancement. Concretely, target user groups were older people who experience mild cognitive and physical impairments due to ageing.

OASIS was also oriented to developers, who can be considered end users of the project as well. Other relevant stakeholders were informal caregivers and caregivers' associations.

OASIS developed a reference architecture that supported interoperability between different web services from the same or different application domains. Its results were later incorporated in the universAAL IoT platform.

Table 15: Platform record of OASIS

OASIS	
Project	OASIS
Platform	OASIS

Short description	OASIS introduced an innovative, Ontology-driven, Open Reference Architecture and Platform, which enabled and facilitated interoperability, seamless connectivity and sharing of content between different services and ontologies in all application domains relevant to applications for the older people and beyond.
Application domain	AAL
Physical layer	Yes
Service layer	Yes
Application layer	Yes
Semantic layer	Yes
Interoperability layer	Intra, semantic interoperability
Platform end users	Developers / Older adults
Primary end users (AHA)	Older adults
Secondary end users (AHA)	Formal and informal caregivers
Customer end users	Informal caregivers and caregivers' associations
Project start/end	Start 01/01/2008 - End 31/12/2011
Project status	Closed
Platform status	Not operational as OASIS but its results were incorporated in universAAL IoT platform
Maintained	No
License	Not licensed
Regions of diffusion	Worldwide (Italy, Austria, Belgium, Bulgaria, Switzerland, China, Greece, Spain, Germany, Netherlands, Mexico, Romania, United Kingdom)
Relations to other platforms	Its results were incorporated in universAAL IoT platform

5.12. PERSONA

PERSONA was a European research project funded in the 6th Framework Programme of the European Union, aimed at advancing the paradigm of AmI through the harmonization of AAL technologies and concepts for the development of sustainable and affordable solutions that promote the social inclusion and independent living of older people. It was evaluated and validated in extensive testbeds and trials in three sites in Spain, Italy, and Denmark, with older adults.

PERSONA provided a common semantic framework that comprises a scalable open standard AAL technological platform and a broad range of AAL services; involving developers also as end users.

The PERSONA architecture framework provided a middleware layer that guaranteed interoperability across the different spaces, devices, applications and services which conform to the AAL Environment. Its results were incorporated into the universAAL IoT platform.

Table 16: Platform record of PERSONA

PERSONA	
Project	PERSONA
Platform	PERSONA
Short description	PERSONA aimed at advancing the paradigm of Ambient Intelligence through the harmonisation of Ambient Assisted Living (AAL) technologies and concepts for the development of sustainable and affordable solutions for the social inclusion and independent living of Senior Citizens, integrated into a common semantic framework.
Application domain	AAL
Physical layer	Yes
Service layer	Yes
Application layer	Yes
Semantic layer	Yes
Interoperability layer	No
Platform end users	Developers / Older adults
Primary end users (AHA)	Older adults
Secondary end users (AHA)	Formal and informal caregivers
Customer end users	Informal caregivers and caregivers' associations
Project start/end	Start 01/01/2007 - End 30/06/2010
Project status	Closed
Platform status	Not operational as PERSONA but its results were incorporated in universAAL IoT platform
Maintained	No

License	Not licensed
Regions of diffusion	Europe (Italy, Greece, Spain, Germany, Denmark, Norway)
Relations to other platforms	Its results were incorporated in universAAL IoT platform

5.13. REACH2020

REACH2020 developed a service system that provides Long Term Care (LTC) by serving personalized modular sensing, prevention and intervention systems for promoting and monitoring the activity of older adults in order to reduce their risk of loss of function and associated morbidities (e.g., cardiovascular and neurological disorders/diseases, depression, falls due to motor disabilities, etc.).

The REACH platform targets not only older citizens, but also formal and informal caregivers, hospitals and other healthcare organizations, insurance companies and care professionals. Moreover, it provides an interface for system administrators and third-party developers.

Regarding interoperability, REACH is an open solution that remains compatible with existing sensing systems and technologies. This is demonstrated by REACH's cross-compatibility and integration of Philips' Health Suite Digital Platform (HSDP).

Table 17: Platform record of REACH2020

REACH2020	
Project	REACH2020
Platform	REACH2020
Short description	REACH represents a solution that seeks to prevent older adults from loss of function and a decline of being able to perform Activities of Daily Living (ADLs) independently leading ultimately to entering Long Term Care (LTC). REACH is a personalized prevention and intervention system that promotes the activity of the older people by monitoring and evaluating their daily habits. REACH is an open solution that proposes its own innovative systems while remaining compatible with existing sensing systems and technologies. This is demonstrated by REACH's cross-compatibility and integration of Philips' HealthSuite Digital Platform (HSDP).
Application domain	AHA
Physical layer	Yes
Service layer	Yes
Application layer	Yes

Semantic layer	No
Interoperability layer	No
Platform end users	3 types: older adults / doctors, care professionals, relatives / system administrators, 3rd party application developers
Primary end users (AHA)	Older adults
Secondary end users (AHA)	Formal and informal caregivers (doctors, care professionals, relatives)
Customer end users	Hospital, insurance companies, care organizations / Philips through its HSDP
Project start/end	Start 01/02/2016 - End 31/01/2020
Project status	Closed
Platform status	Operational
Maintained	Yes, launch of REACH-based start-up company
License	Not licensed
Regions of diffusion	Europe (Germany, Netherlands, Switzerland, Denmark, Poland, Sweden)
Relations to other platforms	Its results will be integrated with the Philips' HealthSuite Digital Platform (HSDP)

5.14. ReAAL

ReAAL was a large scale pilot project, funded by the 7th Framework Programme of the European Union that deployed a critical mass of Ambient Assisted Living applications and services for 7000 users in 7 EU countries, based upon the universAAL platform, previously developed with EC support, with the intent of kick-starting the market for interoperable AAL services, applications and devices. Main end users were older people who wish to avoid dependence on nursing homes, and who prefer to continue living autonomously in their own homes. Moreover, the targeted end users in ReAAL were the stakeholders in the AAL ecosystem: citizens, formal and informal givers, service providers, technology providers and policy makers. The ReAAL project demonstrated that universAAL open platform could be used by service providers to deploy interoperable services avoiding vendors-locks.

Table 18: Platform record of ReAAL

ReAAL	
Project	ReAAL (make it ReAAL)
Platform	universAAL (named afterwards universAAL IoT)
Short description	ReAAL aims to demonstrate the advantages of using open and flexible ICT solutions as basis for flexible and personalised delivery of a range of services needed for independent and active living of older people. Building on the universAAL research project which was launched in 2010, the headline objective of ReAAL is to promote standards, guidelines and reference platforms for interoperable solutions in the domain of active and independent living and to demonstrate by 2015 an ICT ecosystem that uses them in pilot sites involving at least 7000 users in at least seven countries. In this context, ReAAL will validate the role of common open platforms in putting interoperability standards in place and measure the related socio-economic impact.
Application domain	AHA
Physical layer	Yes
Service layer	Yes
Application layer	Yes
Semantic layer	Yes
Interoperability layer	Intra, semantic operability
Platform end users	Developers / Older People
Primary end users (AHA)	Older adults
Secondary end users (AHA)	Formal and informal care persons, family members, care organisations and their representatives
Customer end users	Care organisations
Project start/end	Start 16/01/2013 - End 30/06/2016
Project status	Closed
Platform status	Operational since 31/01/2014

Maintained	Yes
License	Open source
Regions of diffusion	Europe (Italy, Slovenia, Denmark, Netherlands, United Kingdom, Spain, France, Norway, Germany, Grece)
Relations to other platforms	Incorporates results from these previous AAL Project: AMIGO, SOPRANO, MPOWER, OASIS, PERSONA

5.15. SOPRANO

SOPRANO aims to create a new AAL architecture to support pro-active assistance based on situational analysis fed by user input and local monitoring, with interfaces that are easy to use for older people and their family members in their home environment. Responses are to follow agreed rules and seamless access provided to external professionals. Safety and security are strongly enhanced with adherence to stringent reliability standards. Multiple modalities and dialogue adaptations to cognitive ageing help meet special accessibility and usability needs.

SOPRANO integrates (i) stand-alone assistive technology: products designed to compensate for motor, sensory and cognitive difficulties frequently experienced by older adults; (ii) smart home technology: networking of ICT in the home environment, with the integration of appliances and devices to provide control of the entire living space; (iii) telecare services: applications addressing care-related needs prevalent among older people, with ICT utilized to enable support from professionals and informal carers.

SOPRANO is an AAL oriented platform. Its end users are older people to be monitored in the house, formal and informal care persons, care organizations and their representatives to verify the status of the older people. The platform doesn't implement interoperability features.

Table 19: Platform record of SOPRANO

SOPRANO	
Project	SOPRANO (Service Oriented Programmable smart environments for older Europeans)
Platform	Soprano
Short description	Soprano project aims to develop a service-oriented programmable smart environment for older people. SOPRANO designs and develops highly innovative, context-aware, smart services with natural and comfortable interfaces for older people at affordable cost, meeting requirements of users, family and care providers and significantly extending the time we can live independently in our homes when growing older. User-friendliness and acceptability are a top priority for the project - a zero-slope learning curve is to be achieved and

	interfaces are to "vanish" into domestic settings. Large-scale viability in real homes is demonstrated with 600 users to raise public awareness and accelerate AAL exploitation
Application domain	AAL
Physical layer	Yes
Service layer	Yes
Application layer	Yes
Semantic layer	Yes
Interoperability layer	No
Platform end users	older people in house
Primary end users (AHA)	older people in house
Secondary end users (AHA)	Formal and informal care persons, family members, care organisations and their representatives
Customer end users	Care organisations
Project start/end	Start 01/01/2007 - End 30/04/2010
Project status	Closed
Platform status	Not operational
Maintained	No
License	Not confirmed
Regions of diffusion	Spain, Netherlands, Germany, Greece, United Kingdom, Slovenia, Ireland
Relations to other platforms	Used as input for universAAL

5.16. UNCAP

UNCAP is co-financed by the EU through the Horizon 2020 program. The goals of UNCAP are to enhance the effectiveness of the process during hospital-hospice recovery, enhance home care treatment and support independent living. These objectives are supported by offering interoperability and the use of open standards and open specifications. Uncap aims at achieving scalability by use of cloud-centric approaches, being user friendly and draws attention to privacy and security aspects.

In practice, UNCAP offers a system of 4 components: UNCAP Box, Cloud, Webapp and the Certification suite, with the help of which identified use-cases of older adults are implemented for usage at home

and on the go. UNCAP integrates third-party technologies by providing software modules to help hardware or sensor manufacturers develop compliant solutions to the standards supported by UNCAP.

The services delivered by UNCAP at the different piloting sites reach a multitude of stakeholders. By offering a straight solution, the data gets directly there where it is needed. Caregivers, nurses, professionals and relatives save time and cost by interacting through UNCAP with the person who needs care. By expanding the use of the UNCAP system pharmacists could profit from more online sales and insurance companies from outsourcing the data administration to UNCAP.

Table 20: Platform record of UNCAP

UNCAP	
Project	UNCAP - Ubiquitous iNteroperable Care for Ageing People
Platform	UNCAP certification suite
Short description	UNCAP made use of solutions and technologies developed in previous research projects to develop an open, scalable and privacy-savvy ICT infrastructure designed to help aging people live independently while maintaining and improving their lifestyle. The final solution will consist of real products that will be made available on the market.
Application domain	AAL
Physical layer	Yes
Service layer	Yes
Application layer	Yes
Semantic layer	Yes
Interoperability layer	No
Platform end users	Older adults
Primary end users (AHA)	Older adults
Secondary end users (AHA)	Informal carers, formal carers
Customer end users	Hardware or sensor manufacturers
Project start/end	Start 01/01/2015 - End 31/05/2018
Project status	Closed
Platform status	Operational
Maintained	No

License	Not confirmed
Regions of diffusion	Europe (Italy, United Kingdom, Slovenia, Romania, Greece, Germany, Sweden, Spain, North Macedonia)
Relations to other platforms	None

5.17. universAAL

The main goal of the universAAL project is to make it easier for the ICT industry in Europe to develop and successfully deploy AAL solutions. To achieve this, the project is developing an open standardized platform/specification on which the AAL service providers can quickly and cheaply build AAL services. UniversAAL helps to further expand the AAL market by providing an application store, called uStore, through which developers, service providers, and end-users can offer and obtain AAL applications. The platform is produced by a mixture of new development and consolidation of state-of-the-art results from existing initiatives.

UniversAAL is an AAL oriented platform and its end users are older people in the house, formal and informal care members and organizations. Developers are also end users and the project assists them by providing development tools to further decrease the costs.

UniversAAL implements semantic interoperability avoiding domain-specific APIs and reducing syntactical dependencies to one single brokerage API. In this way, universAAL can hide distribution and heterogeneity within the device ensemble, and facilitate the integration of components as well as the communication among them at a semantic level. [3]

Table 21: Platform record of universAAL

universAAL	
Project	universAAL
Platform	universAAL IoT
Short description	universAAL enables seamless interoperability of devices, services and applications for IoT enabled smart environments. The platform provides the framework for communication, connectivity and compatibility between otherwise disparate products, services and devices.
Application domain	AAL
Physical layer	Yes
Service layer	Yes
Application layer	Yes
Semantic layer	Yes

Interoperability layer	Intra, semantic interoperability
Platform end users	Developers / Older People
Primary end users (AHA)	Older adults
Secondary end users (AHA)	Formal and informal care persons, family members, care organisations and their representatives
Customer end users	Care organisations
Project start/end	Start 01/02/2010 - End 31/01/2014
Project status	Closed
Platform status	Operational since 31/01/2014
Maintained	Yes
License	Open source
Regions of diffusion	Europe (Italy, Austria, Denmark, Netherlands, Croatia, Israel, Spain, Germany, Greece, Poland)
Relations to other platforms	Incorporates results from these previous AAL Project: AMIGO, SOPRANO, MPOWER, OASIS, PERSONA

5.18. VAALID

VAALID was a research project, funded by the 7th Framework Programme of the European Union, provided a set of accessible technological solutions for Ambient Intelligence to face the problem of an aging population in Europe, where older people can increase their life independence. It was evaluated during 6 months in three pilot sites in Spain, Germany and Italy.

The project aimed at creating new tools and methods that facilitate and streamline the process of creation, design, construction and deployment of these accessible solutions, turning also developers as end users of VAALID.

No interoperability layer was contemplated.

Table 22: Platform record of VAALID

VAALID	
Project	VAALID
Platform	VAALID Platform
Short description	The objective of the VAALID project is to develop new tools and methods which will facilitate and make more dynamic the creative, design, construction, implementation and evaluation

	processes for technological solutions, within the context of 'Vida Cotidiana Asistida por el Entorno' (literally Daily Life Assistance through Surroundings in Spanish) or AAL (Ambient Assisted Living), thereby assuring the accessibility and usability of the said environment for the older people. In order to achieve the proposed objectives, VAALID has concentrated on the creation of an Integrated Platform of Development, (IDE being the acronym in English), for the assisted design by computer, the simulation, and the validation of the interaction components between the user and the AAL solution.
Application domain	AAL
Physical layer	Yes
Service layer	Yes
Application layer	Yes
Semantic layer	Yes
Interoperability layer	No
Platform end users	Developers
Primary end users (AHA)	Older adults
Secondary end users (AHA)	None
Customer end users	Developers
Project start/end	Start 01/05/2008 - End 30/04/2011
Project status	Closed
Platform status	Not operational
Maintained	No
License	Not licensed
Regions of diffusion	Europe (Spain, Germany, Greece, Italy)
Relations to other platforms	None

6. Ecosystem map

In this chapter the ecosystem map will be described, that is a set of views, each accompanied by its own analysis, capable of giving a complete general view of all the platforms examined and their inter-relationships. As already mentioned in paragraph 4.3, the dimensions considered are four: geographic, relationship, application and temporal.

- Geographical dimension
- Relational dimension
- Application dimension
- Temporal dimension

6.1. Geographical mapping

This section points out the European continent nations involved in the different projects we are analyzing. Figure 3 below shows a map of Europe. Each country involved in projects shows a list of IDs corresponding to the different platforms, as catalogued in Table 4. The nations colored in white belong to the European Union, while those in grey do not. The figure shows that there are some nations which, although not belonging to the European community, have nevertheless participated as partners in some EU projects presumably as Associated Countries[4]. They are North Macedonia, Switzerland, and Norway. Some projects involved other nations not belonging to the European continent.

Figure 3: Geographical mapping of projects in AHA and AAL domains

Table 23 shows, for each country, the number of projects in which they participated as a partner. Spain, Germany and Italy appear to be the most active in the development of AAL-IoT platforms. Cyprus, Hungary and North Macedonia are the less active.

Table 23: Total number of projects for each nation.

European Nation	Projects	European Nation	Projects	European Nation	Projects
Spain	16	Sweden	5	Finland	3
Germany	12	Austria	4	Belgium	3
Italy	11	Denmark	4	Bulgaria	2
Greece	10	Poland	4	Croatia	2
Netherlands	9	Ireland	4	Romania	2
United Kingdom	9	Switzerland	4	Cyprus	1
Slovenia	7	Norway	3	Hungary	1
France	5	Portugal	3	North Macedonia	1

Table 24 below shows the number of nations involved in each project. FIWARE, Oasis and universAAL involved most nations. AmIVital and EKoSmart involved fewer nations because they are national projects.

Table 24: Projects with the number of involved nations.

Project	Nations	Project	Nations	Project	Nations
FIWARE	14	IN LIFE	8	m-power	6
Oasis	13	InterIoT	7	Persona	6
universAAL IoT	10	SOPRANO/ OpenAAL	7	Reach2020	6
ReAAL	10	Amigo	6	VAALID	4
UNCAP	9	BeyondSilos	6	AmIVITAL	1
ACTIVAGE	9	Giraff Plus	6	EKoSmart	1

6.2. Platforms relational mapping

In this paragraph we will analyze, whenever applicable, the main dependencies between the platforms examined. As can be seen in Figure 4, three main relationships between projects have been identified:

- "Derived from" indicates that the receiving platform was partially created using a previous platform as a basis, typically inheriting some characteristics. These features can be both design or actual implementation.
- "Allow interoperability" indicates that the indicated platform allows inter-platform interoperability between the platforms from which the arrow starts. In our analysis, the only platform that allows this level of interoperability is ACTIVAGE.

- "Physical layer from" indicates that the receiving platform inherits the design and implementation of the layer indicated by the source platform

"Standalone platforms" are those that have no relationship with other platforms examined. In our analysis, half of the analyzed platforms belong to this category.

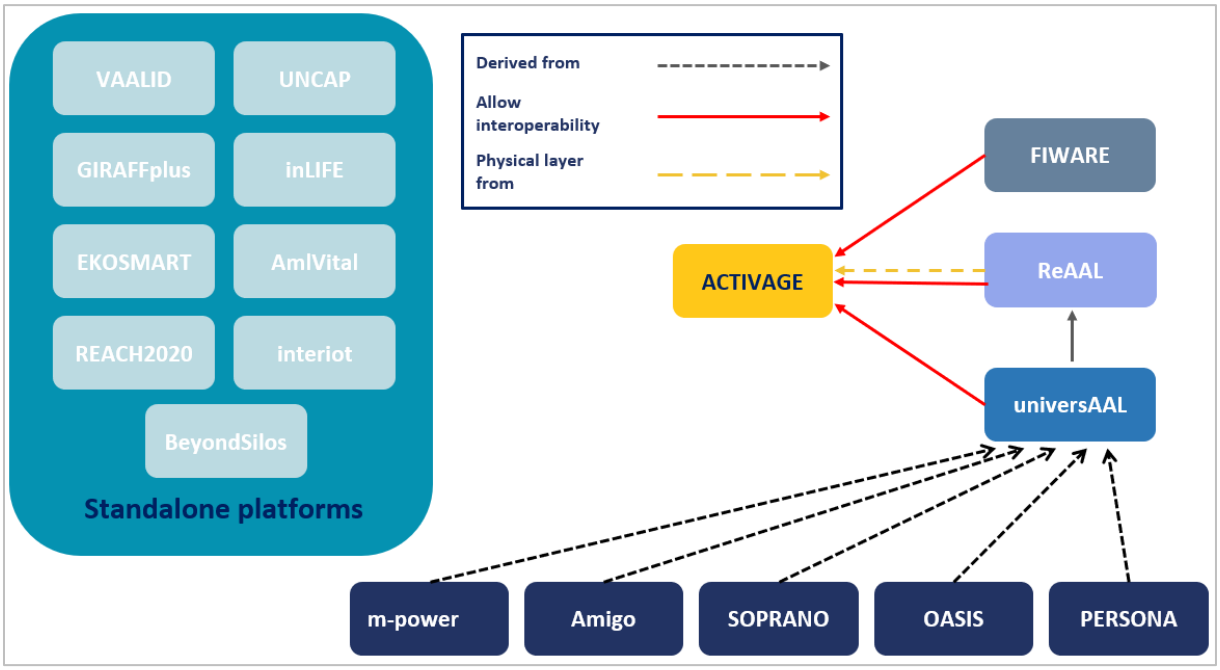

Figure 4: Relationships between platforms

"Standalone platforms" are those that have no relationship with other platforms examined. In our analysis, half of the analyzed platforms belong to this category.

6.3. Application domain mapping

As previously seen, the application domains to which the platforms examined refers to are three: general-purpose, AAL and AHA. As shown in Figure 5, only FIWARE and InterIoT platforms have a general-purpose application domain while all the others belong to AAL / AHA domains.

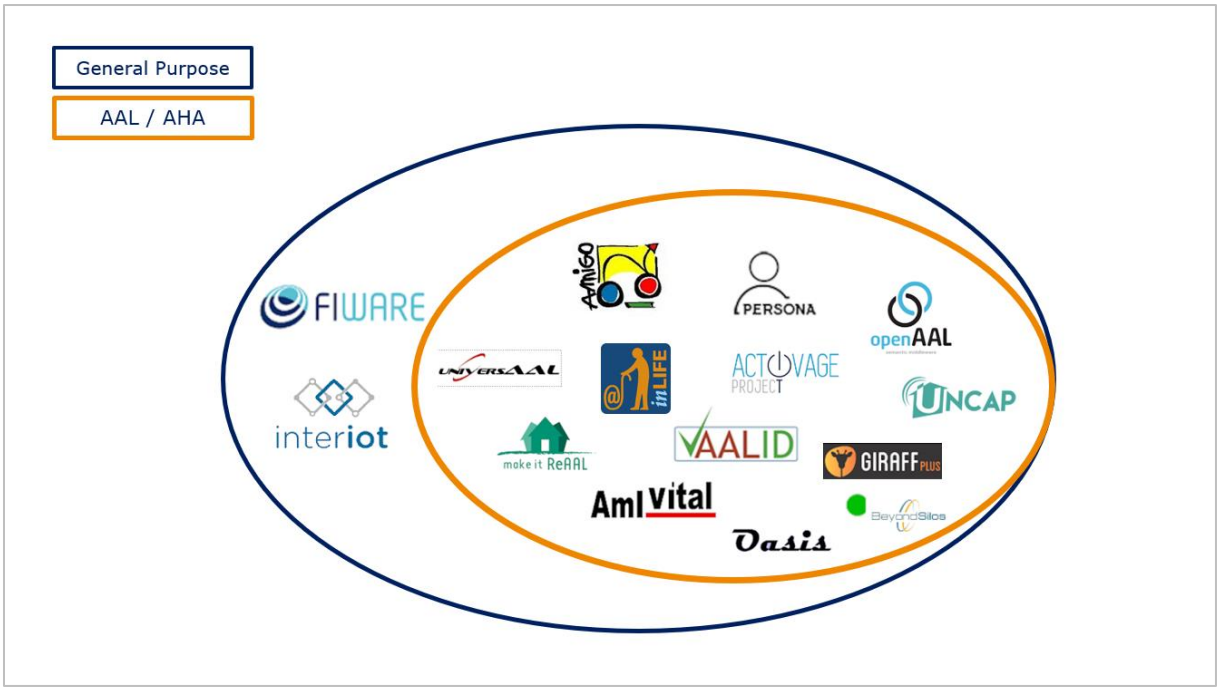

Figure 5: Application domain mapping

6.4. Time mapping

The temporal analysis covers a period of 16 years and brings out some interesting data. It is, in fact, possible to identify three macro time cycles, the first from 2004 to 2010, the second from 2010 to 2015 and the third from 2015 to 2020 (See figure 6).

It should be noted that in the first period there have been various projects that have started to address AAL / AHA issues in various aspects. In 2010, first with UniversAAL and then with FIWARE and ReAAL, there was a first attempt to converge previous experiences into a single platform. Indeed, it has already been seen in previous paragraph 6.2 how the Amigo, Soprano, MPower, Oasis platforms and Persona contributed to the birth of universAAL, which in turn contributed to that of ReAAL. The third band includes projects such as ACTIVAGE, which seeks to further raise the concept of interoperability by focusing on the integration between the already established platforms and other projects.

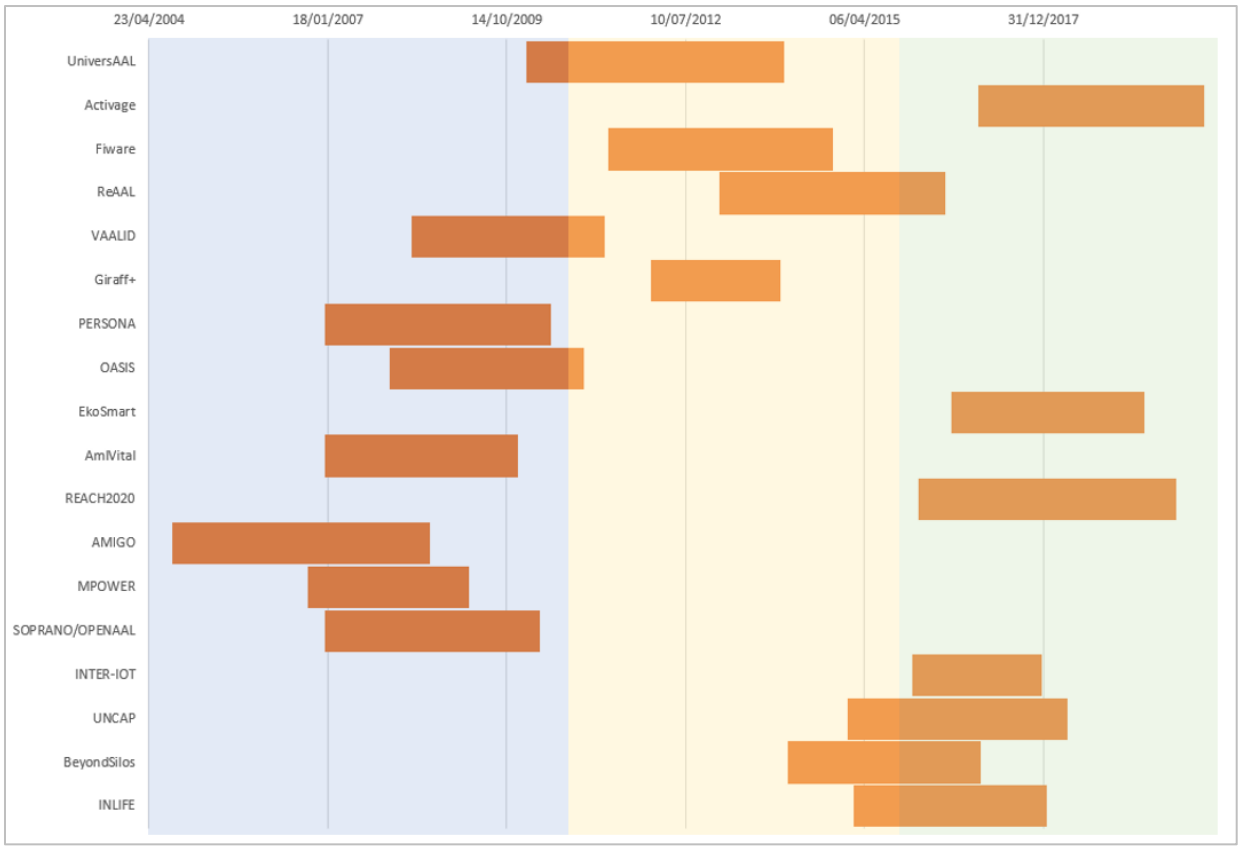

Figure 6: Time mapping

7. Conclusion

All the activities related to Task T2.1 "Map the ecosystem by collecting existing open-source platforms in the Active and Healthy Aging Domain, their end-users and related stakeholders" have been described in this document. The analysis started with a large group of 48 projects, then concentrated on the 18 most significant, each of which has been described in detail in chapter 5, accompanied by a platform record, which summarizes all the main features used in classification. Four main dimensions of interest have been identified: geographic, relation, application and temporal. The resulting ecosystem map is represented by a set of views corresponding to one of the dimension.

The geographical map showed that in the last sixteen years the AAL / AHA projects have been involved by almost all European countries, with Malta, the Czech Republic and Slovakia being the only exceptions and involving North Macedonia, Switzerland and Norway as associated countries. Spain proved to be the most active nation regarding participation in the projects examined, followed by Germany, Italy, Greece, Netherlands and United Kingdom.

The platform's relational mapping has shown how the analyzed platforms can be divided into two main groups: one consisting of standalone platforms and a second group in which platforms are all related to each other (ACTIVAGE, FIWARE, ReAAL, UniversAAL, MPOWER, AMIGO, SOPRANO, OASIS, PERSON). In the latter, ACTIVAGE stands out and is the only one that currently tries to develop an interoperability layer between heterogeneous platforms.

The application domain mapping shows us that only two of the platforms analyzed, FIWARE and interIoT, are not specific for AAL / AHA applications.

The Time mapping has made it possible to identify three main time bands that have represented the evolution in AAL / AHA research: from 2004 to 2010, from 2010 to 2015 and from 2015 to 2020. In particular, it has been noted that, starting from 2010, the trend has been to exploit past knowledge to bring it together in a single platform, also to date there is still no standard that has been established.

The analysis reported in this document represents the basis of all the activities of subsequent tasks within which it will be deepened and completed to lay a solid basis for dealing with the upcoming work packages.

To set the path for future developments, some experiments were carried out during the analysis regarding an automated approach based on machine learning-natural language processing and organizing platforms with taxonomies, ontologies and clustering. In simple words: clustering organizes platforms according to their similarity; taxonomy presents a tree separating ontologies based on descriptions and ontology tries to present an overall knowledge and overview of ontologies. The performance of the automated procedure in its core relies on recognizing key words from the description of the platform. This can be done either automatically with text mining, manually by providing a list of key words (e.g. programming language, license type, etc.) or combination of both. The algorithm then automatically builds a cluster/taxonomy/ontology based on the frequency (weight) of the words for each particular platform.

This procedure will be applied in Task 2.2, where the various platforms will be analyzed in detail and related to each other.

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