Smart and Ageing - healthy life years with internet of things
Proposal Part B, to H2020-IoT-01-2016, pilot 1

Smart&Ageing
healthy life years with internet of things

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2	AALTO	Aalto University	Finland
3	LAUREA	Laurea University of Applied Sciences	Finland
4	PHILIPS	Philips Lighting B.V.	Netherlands
5	WAAG	Waag Society	Netherlands
6	VTT	VTT Technical Research Centre of Finland Ltd	Finland
7	ALBLUND	Municipality of Albertslund	Denmark
8	AMSTERDAM	Municipality of Amsterdam	Netherlands
9	ATHENA	Athena Social Care	Greece
10	HELSINKI	City of Helsinki	Finland
11	LAMIA	Lamia Municipality	Greece
12	MCC	Manchester City Council	United Kingdom
13	REYKJAVIK	City of Reykjavik	Iceland
14	MMU	Manchester Metropolitan University	Manchester
15	HVA	Stichting Hogeschool van Amsterdam	Netherlands
16	DTU	Technical University of Denmark	Denmark
17	NYHERJI	Nýherji hf.	Iceland
18	GLIMWORM	Glimworm Information Technology B.V.	Netherlands
19	GNOSIS	Gnosis Computers (Kon.Mantes-Dim.Tsamis O.E.)	Greece
20	THINGFUL	Thingful Ltd	United Kingdom
21	CHINO	Chino Srls	Italy
22	NSE	Norwegian Centre for E-Health Research	Norway
23	NORDUNET	NORDUnet A/S	Denmark
24	SALUS	Salusfin Oy	Finland
25	ACORN	Acorn Projects Aps	Denmark
26	ROT	Republic of Things Ltd	United Kingdom
27	BSQUARE	MIPSoft Ltd	Finland
28	DEMOS	Demos Helsinki ry	Finland
29	TIETO	Tieto Finland Oyj	Finland

Proposal Sections 1-3. version 1.6 / 10.4.2016 / FVH/RRi

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1. Excellence

Smart&Ageing intensifies and consolidates the European Internet of Things ecosystem to health and wellbeing in ageing. It demonstrates and further enables the deployment of advanced IoT solutions in this domain. Smart&Ageing integrates and deploys four large-scale advanced IoT pilots that demonstrate and define the state-of-the-art in how IoT can increase the independent living of the elderly, and functioning of the care systems in real life. Also, it delivers an ecosystem that integrates the development of the key open IoT technical platforms with the "Northern European" independent living development platforms.

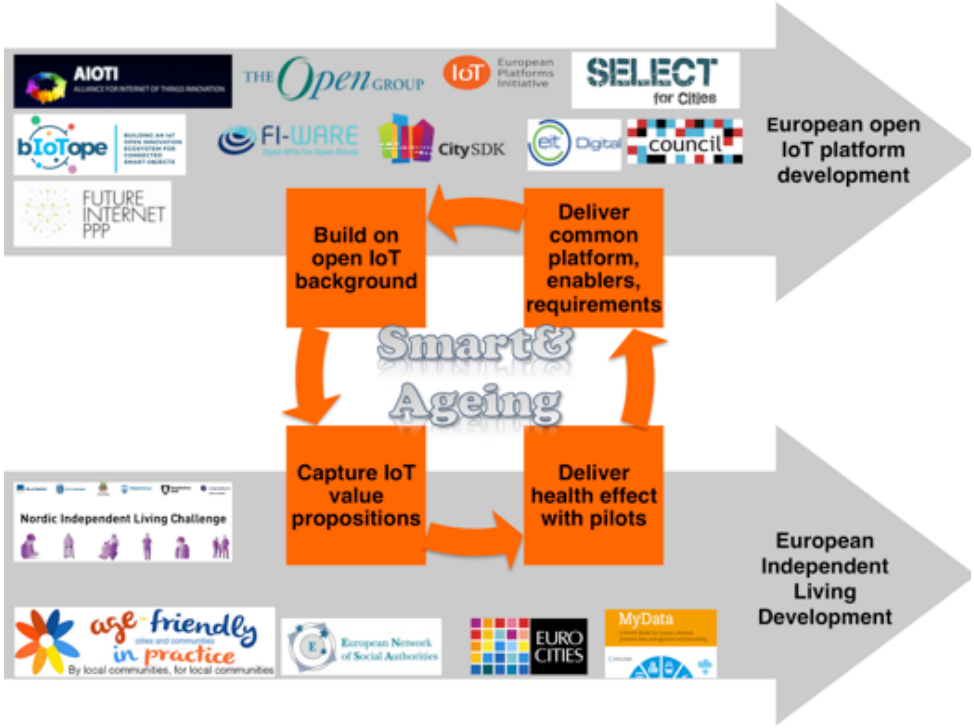


Figure 1 Smart&Ageing integrating European open IoT platforms and Independent living development

1.1 Objectives

The project addresses three European challenges and three objectives:

Challenge #1: Providing future health and welfare services to the ageing population. European countries face substantial challenges in providing future health and welfare services to an increasingly aging population, while at the same time coping with constrained budgets and growing competition for labour. The answer to these challenges is a combination of increased efficiency, increased focus on value-creating services and the implementation of new welfare technologies that enable its users to stay or even become more independent. At the same time, innovative solutions based on new ICT technologies have the potential to increase the quality of life for the people, making the introduction of new technologies and services a win-win scenario. Also, the European wellbeing solution is expected to emerge from the project sites connected in this proposal. Alliance of Internet of Things report (WG05, 2015) frames that as: *"It is clear from the analysis ... that a European solution to health in ageing is possible, a European solution which is well demonstrated in North Europe."* **To address this challenge,** Smart&Ageing integrates, deploys, and replicates four large-scale pilots of advanced IoT-driven services, with comparable pilots in 6 countries. The pilots address such key pre-identified reasons why senior citizens end up losing their independence in real life, in improving which IoT is foreseen to play a key role in future.

Challenge #2: Building European leadership into IoT ecosystems. The first viable IoT ecosystems are currently emerging. There are a large number of competing platforms and technology standards, which are projected in both horizontal and vertical directions. One key objective of the Horizon2020 IoT work programme is to consolidate the future IoT ecosystems within a European leadership. Especially, there is foreseen near future industrial competition between American- and Asian-led *dominant-design* IoT platform

prospects (e.g. Amazon, Google, Samsung - typically horizontal or vertical silos) and European IoT development. As IoT is envisioned to change society at many levels, in addition to the economical success of Europe, platform choices have tremendous implications to society at large, with as obvious examples privacy, security and job creation or loss. **To address this challenge,** Smart&Ageing builds on the leading European open IoT platforms and architectures. It delivers four large-scale pilots with these platforms, with full value chains from demand to supply side in the pilots, in balanced roles from large industry to SMEs. With this "open services, open data" approach, and systems-of-systems type of open platforms, Smart&Ageing will ensure the Health and Wellbeing solutions of the future are aligned with the central European IoT platform development, and are based on *open*, *competitive design ecosystems*, providing opportunities for the European SMEs and nationally diverse ICT ecosystems to thrive in the competition.

Challenge #3: Scaling up IoT wellbeing solutions from research & innovation to real life. There is a large amount of R&D in eHealth, mHealth and connected care solutions, both in public and private spheres. However, pipelines to scale up these innovations in real life at a large scale are missing. Industry-driven product development does not meet the needs of the cities' innovation platforms. Characteristic of this is that non-European markets are often easier to enter for the new innovations supply side, than European markets. The project builds on key European open IoT platform developments, and key European independent living developments. Bringing these together, the project will leverage a large amount of prior background and future traction in both supply and demand, and scale the solutions well beyond research & innovation. **To address this challenge**, the project *integrates* the existing state-of-the-art from the general IoT, with the existing state-of-the-art from specific ICT-based services for the independent living of the elderly and the frail. By taking services and products that are already in the use by the end-users, and improving them with care features (smart home solutions) and IoT features (wellbeing apps), and by ensuring the European IoT open platform compatibility, security and privacy, the project is able foster trajectories of swift piloting and solid further real-life uptake.

These three challenges are met with three key objectives:

1.1.1 Objective 1: Demonstrate the real-life value of IoT-driven services for independent living of elderly

Contributing to the grand societal target of delivering two more healthy life-years of independent living, with the assembly and integration of IoT-enabled service innovations, the project will pilot solutions to four key use cases that together span a wide field of ageing concerns, and will impact the lives of over a thousand people in the project pilots, and millions of people in further uptake:

Use case	Sub-Objectives to be reached in each pilot, within the target group locally
A. Empowering everyday mobility	O1.1: Enable and encourage 25% more independent mobility daily O1.2: Reduce cost of cities social transport services by 5%
B. Independent living at smart home	O1.3: Increase experienced Quality of Life at home by 30% O1.4: Increase experienced independency at home by 20%
C. Connecting Community	O1.5: Increase the experience of quality of social contacts by 20% O1.6: Reduce the experienced loneliness by 10%
D. IoT-enabled Virtual Care	O1.7: Increase experience of health related safety by 75% O1.8: Reduce the cost of care provisioning by 10%

The project will validate European-wide replicability and value of the solutions by creating statistically significant results, by piloting similar solutions in parallel, in large-scale in operational environments at six demosites:

EU eldercare model[1]	Number of end-users taking part actively in the pilot*
Scandinavian	Helsinki, 300 smart home users, additional 200 smart outdoor users Albertslund, 100 smart home users, additional 50 caring home users

[1] Five geographic regions of Europe Union with own characteristics for eldercare funding regimes (TechnolAGE 2013)

Continental	Amsterdam, 50 smart home users, additional 300 smart outdoors users
Anglo-Saxon	Manchester, 50 smart home users, additional 1000 smart outdoors users
Non-EU	Reykjavik, 225 smart home users
Mediterranean	Lamia, 150 smart home users, additional 230 smart outdoors users
Eastern European	(No demosite in the project, but is addressed in ecosystem creation.)

**note: only elderly users are listed here; number of care and other service provisioning users varies*

1.1.2 Objective 2: Intensify and consolidate the European IoT ecosystem for Health and Wellbeing in Ageing

Intensifying collaboration and extracting the potential scale benefits of European level harmonization require a system level view of the European health and wellbeing domain. The ability to ensure that knowledge, generated internally or externally, adds value, depends on how firms and other organisations are linked through business, academic and social networks. The Smart & Aging project acknowledges that the ecosystems are systemic interlinked networks of components that facilitates and generate innovations, and focuses on developing the underlying factors determining innovation capacity in ecosystems. Adopting the 'Absorptive Capacity/Development Capacity' framework, the project focuses on the five key capabilities of ecosystem innovation:

- **Access** (The ability to connect and link to international networks of knowledge)
- **Anchor** (The ability to identify and domesticate external knowledge sources)
- **Diffuse** (The collective ability to adapt and assimilate new innovations, practices and technologies and spread them in the economy)
- **Create** (The ability to generate new knowledge and value)
- **Exploit** (The ability to exploit knowledge for social and commercial purposes)

Smart&Ageing Ecosystem development objectives:	
Access and anchor	O2.1: Ensure access and connections with all relevant constituencies, platforms and pockets of knowledge in Europe for maximised impact and accelerated transition to new dominant designs
Diffuse	O2.2: Articulate collaboration guidelines and orchestration model for ecosystem collaboration
Diffuse	O2.3: Define communication channels and knowledge hierarchy for optimised knowledge transfer and dialogue with impact organisations and end users.
Create	O2.4: Create proof of concept demonstrations of adaptation of new knowledge
Exploit	O2.5: Ensure exploitation through open calls and ecosystem extensions with all relevant stakeholders

1.1.3 Objective 3: Deliver an open, interoperable, IoT platform for the innovations in Health and Wellbeing in Ageing

Smart&Ageing will deliver a common, interoperable IoT platform for developing, implementing and valorising impactful solutions in Health and Wellbeing in Ageing. This platform ensures both technical and business model interoperability and modularity. It is based on the project partners' existing solutions, services, products and standards that are integrated and harmonized. With this integration, and the emergence and development of further advanced IoT features, the project will deliver the Smart&Ageing IoT Platform, that strongly builds on previous European efforts in IoT developments, including Horizon-funded IoT platforms, national IoT spear-head initiatives in the demosites, and the open IoT standardisation already taken:

Smart&Ageing IoT Platform Objectives:	
Open	O3.1: Deliver an open platform based on open APIs, open data and open standards O3.2: Deliver such an open platform where external developers can bring in service- and platform-level components
Interoperable	O3.3: Deliver a functionally interoperable platform, with at least 90% of components technically interoperable O3.4: Deliver selected components into the European open source platforms
Modular business model and technology	O3.5: Deliver 1 common ecosystem business model, that is modular and open, and 2-3 clustered business models of selected partners (e.g. on IoT on Diabetes)

	O3.6: Deliver 1-2 new or improved business models or opportunities for each supply-side partner
Transferable	O3.7: Harmonize the API ecosystem of the platform between each demosite, so that the Service layer solutions are easily transferable from one site to another.
Secure and private	O3.8: Increase the privacy and security levels of the components, and create state-of-the-art privacy for the IoT-enabled services based on MyData (see 1.4.2)
Beyond state-of-the-art in IoT	O3.9: Address the IoT from technically ambitious perspective and deliver such use cases where the technical pilots go far beyond trivial IoT solutions.

1.2 Relation to the work programme

The project deploys, and further fosters deployment of advanced IoT solutions with open platforms, in pilots that consist of all relevant stakeholders and key parts of the IoT supply side value chain. This will lead to validation of the solutions' impact, including acceptability, privacy and security.

The relation of Smart&Ageing to the work programme Horizon2020 IoT-01-2016, pilot 1, is detailed in chapters 1.1 Objectives (directly answering *Challenge*), 1.4 Ambition (directly answering *Scope*), and 2.1 Impact (directly answering *expected Impact*). As a summary and index, a table below is provided to detail how each of the specific requirements of the work programme are addressed and implemented:

Pilots' scope	Implementation in project	See chapter
Propose IoT approach to specific real-life industrial/societal challenge	The project use cases are designed on pre-identified real-life elderly and care system challenges. It builds on the so-called Nordic Health Care Model and adopts IoT solutions in line with its principles.	1.3.3.,1.4.6
Autonomous entity that involve stakeholders from supply to demand side	Pilots are self-sustaining entities with demand- and supply stakeholders (cities, care providers, services providers, technology providers).	1.4.6
Operate under load and close to operational environment	Pilots will be run at operational environments (e.g. real, normal, bus lines, existing care service). They will involve over a thousand users that will use the systems for 20-30 months on a day-to-day basis. Partners have ample experience in delivering mission critical, high load systems and services.	1.4.6
Demonstration to operate across multiple sites	Pilots will be run at 6 countries with a lead-replicate piloting model. Lead pilot integrate the pilot at one site, and replication pilots replicate the solutions at other sites.	3.1.2, 1.4.4
Large amount of heterogenous devices and systems	Pilots consist of various technologies and systems, and multiple end-user devices. We envision the use of mobile phones, various kinds of sensors, tablets, quantified self-measurement devices and self-help applications. They will be linked to the highly modular, cloud based platforms.	1.4.3, 1.4.6
Large amount of real users. Number of users sufficient to ensure statistical significance	The pilots and implementations will involve 875 smart home and 1780 smart outdoor users. This provides enough statistical significance both in specific sites, and between demosites, to ensure statistical significance.	1.4.4
Feedback mechanism to allow adaptation and optimisation of the technology and business approach, which also act as test-bed.	Services are integrated with co-design and service design methods at local labs, iteratively and agile, before large-scale field trials will be performed. The trials will be closely monitored and feedback will be collected to be applied at appropriate intervals Also ecosystem business models are developed with the integration.	1.4.5
Encourage to use open platforms and prior EU IoT investments (FIWARE)	Interoperability with open IoT platforms is taken at the integration stage, and key European and nationally funded open IoT platforms are the basis for this (FIWARE, Biotope, CitySDK, CityVerve, Select4Cities).	1.4.3

Identify where standards are missing or should evolve	Architecture and integration planning and plans are taken in WP2 with a direct link to/from standardisation bodies and communities. Existing standards are taken in, and where they are missing, we will propose tentative new ones in collaboration with standardisation experts and bodies.	WP2, 2.1.4
Capable to support and extend independent living based on IoT	Each pilot has specific KPI's defined that will support and extend independent living at home. These KPI's will be driving the development, implementation and integration activities and will be closely monitored for achievement.	1.4.6
Smart living environments: homes and outside are to be addressed	Pilots A and C address smart outdoors. Pilots B and D address smart homes. Together they span a large field of complementary use cases, in different contexts, that together define the environment of the (prospective) elderly	1.4.6
Integrated system of a range of IoT-based technologies and services	Smart&Ageing is about delivering an integrated system based on the existing partner components, covering a wide range of IoT based technologies and services.	1.3.6
Seamless service while moving	IoT user devices (Blindsquare, Smart Watch, Smart rollator) are already carried with the users and work in homes, outdoors, ensuring a seamless service experience while moving. Outdoor IoT infrastructures (parks, buses) exist in some demosites already and will be integrated with the mobile devices.	1.4.6
Integrate with other relevant application domains as energy, transport or smart cities	Use case B is built on lighting-based smart home solution, and use case D integrates to energy-related smart home solution. Use case A uses public transport (12 connected buses in Helsinki).	1.4.6
Using and extending available open service platforms and open standardised APIs	Smart&Ageing builds on leading open IoT platforms like FIWARE, CitySDK and MyData, and further integrates the components to be harmonized with these platforms. It will use open standardised API's for easy extension and service development and delivery.	1.3.4, 1.4.3
Address innovations on business models for service delivery	Project facilitates development of ecosystem business model, supply-led, but also with care providing partners.	WP2, 1.4.3
Specific requirements for accessibility, usability, cost, personalisation	Solutions and components to be integrated are mostly cost-effective, many in use already, and have awarded usability (e.g. Blindsquare with the blind, and Philips Hue design awards).	1.4.6
Safeguarding ethics and privacy	Providing high standards in ethics and privacy is of key to the consortium partners. Validation of these will be performed the design stage. City partners deliver local health ethic board linkage.	WP3, Section 5
Assess. of impact on QoL and carers, care system efficiency gains, business models. Clear methods for socio-economic impact assessment	A framework to assess impact of pilots is detailed and executed by Laurea, based on method considering health and user value, service experiences, and KPIs defined for each pilot.	1.4.6, 1.3.8., 1.3. 1
Demonstrate benefits of smart living environments based on IoT to prolonged independent and safe living of older adults at home	Project will demonstrate and define state-of-the-art in how IoT will enable better and longer independent living at home, both for care customers and for those in better health conditions.	1.4.6
Specific considerations and pilot implementation		
Mapping of pilot architecture with IoT reference architectures (e.g. IoT-A) enabling interoperability	The project will deliver architecture based on open standards and reference architectures. Partners have direct background from key open IoT standardisation and architecture activities.	1.4.3, WP2, 2.1.4
Common or interoperable object connectivity/functionality/intelligence approaches on various levels.	Project will take up common interoperability measures in the integration: the partner solutions will be integrated with the common architecture and open	1.4.3, WP2, 2.1.4

Pilots to address the elements that provide the basis for interoperability with fields outside pilot.	API approach (e.g. TOG O-DF, O-MI). Also, state-of-the-art commercial IoT cloud services (Thingful, Chino, RoT) are used.	
Exchange on requirements for legal accompanying measures	Legal aspects are planned in WP2 in the definition of the MyData model, with key European data privacy legislation competences (Aalto, Chino, Nordunet)	1.4.2
Involvement of social scientists and representative user groups, in order to design systems that are useful and acceptable for people/citizens and optimise testing and experimentation	S&A is based on existing user need analyses with social sciences and user-centric methods, and project executes integration with multi-disciplinary teams. A number of real end-users take part in service design and integration stage. Also, cities have legal responsibilities to ensure needs of users are met.	1.4.5
Integration of objects, devices and systems in an IoT environment adapted to the expressed needs of the user	Smart&Ageing has a highly ambitious approach in going beyond trivial IoT installations, and is built on state-of-the-art components, and state-of-the-art existing IoT installations.	1.4.1, 1.4.6
Pilots in the selected areas will clearly identify the supply and demand sides. The effort devoted to supply and demand should be balanced for each pilot	Both supply and demand side partners of care are consortium partners, and the project budget is balanced between these, as well as between the pilots, and between the demosites.	3.3
Supply side responsibilities in call text ("this includes: " -list)	Are completely covered. Also, demand side participates in these activities, e.g. the definition of IoT architectures is not the responsibility of only the supply side in European care or transport systems.	WP2
Demand side responsibilities in call text ("this includes: " -list)	Are completely covered. Also, supply side partners participate in the activities as many of the supply partners have interests in European scalability and interoperability, and direct link to the real user needs with existing applications (e.g. Blindsquare)	WP2, WP3

1.3 Concept and methodology

1.3.1 Framework for delivering the value of IoT to independent living of the elderly

How IoT delivers value for independent living is shown in Figure 2. *Value delivery* takes place where the expectations and propositions meet. Optimizing the effectiveness of value extraction has been key driver in designing the Smart&Ageing proposal and consortium. For this, project builds on strong, European, already validated, state-of-the-art background for both *value expectation* (described in 1.3.2.--1.3.3), and *value proposition* (described in 1.3.4--1.3.5). A specific set of state-of-the-art background on methods and facilities is used to ensure quality and effectiveness of the value extraction process (described in 1.3.6--1.3.8). This project design allows Smart&Ageing to ramp up the pilots fast and with minimal operational and acceptance risks. It also allows the project to focus most on specific service innovations in real-life environments, and to contribute to non-trivial IoT solutions, rather than for example battling with technology maturity or being unsure about real user needs or benefits for the pilots. Most importantly, it provides existing direct pathways to further impact, on both the supply and demand side.

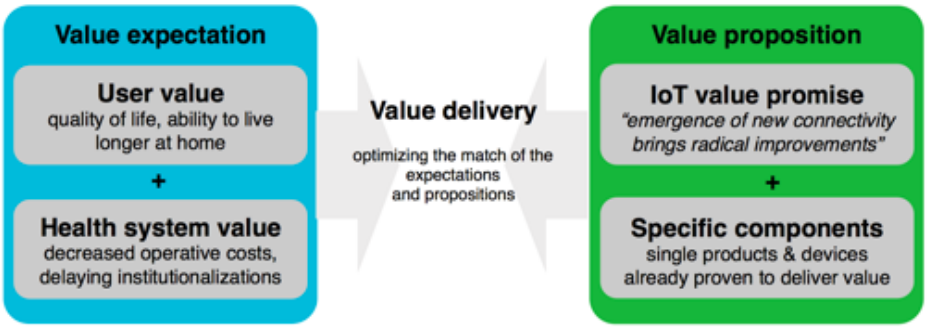


Figure 2 Smart&Ageing value delivery model

1.3.2 Improving the Independent Living of Elderly

The project improves the independent living of the elderly from value-focused perspective. Each use case has specific objectives on how the pilot delivers its value along two main axes:

1. **User value** - Value of the pilot from individual perspectives: quality of life, better services, connectedness to society, ability to live longer at home, empowerment over own wellbeing and health, better working conditions for nurses and family carers
2. **Health system value -** Value of the pilot from health services payer/public sector perspective: decrease in operative costs, delaying institutionalizations of the citizens, better target for interventions, new service innovations, addressing non-optimal use of resources

Also, looking from the preventive health care perspective, the pilots are in the activity levels as follows:

Level	Objective	Target group	Smart&Ageing use cases
Primary prevention	- avoiding adverse events or effects	large	- Connecting Community - Independent living at smart home
Secondary prevention	- act upon early warning signs - prevent negative spiral	strict selection	- Empowering everyday mobility - Independent living at smart home
Tertiary prevention	- ease effect or adverse event - reactive	reactive selected symptoms	- IoT-enabled home care - Connecting Community

1.3.3 Pre-identified, harmonized, high-impact use cases

The project design started from the value expectation side, and four use cases with most impact potential were analysed and selected to become the pilots. Then, supply-side project partners were scouted to match these needs. Here the project is built on previous work that has analysed, designed and validated thematic end-user challenges with detailed descriptions of the user categories, their needs, design drivers and issues to be considered. The pilots integrate and demonstrate solutions to these pre-identified high-impact use cases: detailed definitions of needs that have been already validated with **both the end-users and the health care payers/providers**. In *Nordic Independent Living Challenge (2013-2016)* the needs of the wellbeing service providers (cities) and the needs of the end-users (elderly, frail elderly, disabled) were analysed, documented and validated with a large set of methods, including estimating cities' budget burdens and opportunities, interviews, focus groups and participant observations with professionals and end-user in their daily lives. This was taken in five EU capital cities and the results were *harmonized* to document the common needs and innovation/market opportunities, including demosites Helsinki, Reykjavik and Albertslund (of greater Copenhagen). Similar needs/opportunities validation processes have been taken in project partner cities for example in the Ambient Assisted Living *Express2Connect*-project in Amsterdam, Helsinki and Copenhagen/Albertslund. In Manchester demosite, the project operationalises Age-Friendly Manchester programme, which has objectives to develop age-friendly neighbourhoods, age-friendly services, and innovation and communication engaging the older people actively into the design and delivery of services. Starting from these, Smart&Ageing is able to deliver something the users need and want in real life, able to immediately deliver European solutions, and able to hold a clear vision of the objectives in the process.

A set of 10 user personas representing key challenge groups were identified and detailed through large-scale large interviews, analysis and participant observation of the elderly in Nordic capitals in 2013-2015. The personas include detailed background information on needs and drivers.

1.3.4 European Open IoT Ecosystem Approach

The first viable IoT ecosystems are currently emerging. There are a large number of competing technologies and technology standards, which are projected in both horizontal and vertical directions. One key reason of the Horizon IoT LSP calls is to start to consolidate the future IoT ecosystem, with a European leadership. **Open Ecosystem** is an approach where, by together agreeing on the "common enabling innovation platform" - the open APIs, the data formats, the open, modular, business models, - goal is to foster **competitive design ecosystems** instead of dominant-design ecosystem. In Open Ecosystem the partners together grow and create the common market demand for the IoT solutions (co-ompete). It means that various parts of the IoT ecosystem solutions are interchangeable, and the IoT solutions are interoperable between different countries. Business ambitions are both common and company specific, and the ecosystem business model development in the project follows this with open, modular approach. The project partners are already key actors in the European open ecosystems. The on-going Horizon ICT-30-2015 IoT Platform projects (BIoTope partners: AALTO, FVH) create the European platform basis for IoT (IOT-EPI platform linking these projects). These are however in the first stages. The FIWARE community (partners: Aalto, FVH, BSquare, NSE, WAAG) aims to develop complete future internet ecosystem of which IoT is part, but is still in medium maturity level. The Open Group IoT working group (partners: Aalto) has specified IoT interfaces O-DF; O-MI. The AIOTI working groups WG3, WG5 discuss the architecture issues regarding IoT (partners: FVH, Philips, others). To overcome the risk for ending up with closed, monopolistic, non-private, security-compromised IoT platforms in the future, the project consortium commits to following principles towards open IoT ecosystems:

- Harmonisation of the APIs and the enabling platform (OASC and CitySDK model)
- Using the open IoT standards, stacks and interfaces (The Open Group, FIWARE, CitySDK)
- Using and contributing to the open source platforms 'as much as possible with business interests guaranteed and what is sensible regarding the further use' (FIWARE, CitySDK)
- Public sector being in a key role in delivering the cities' APIs required for care services

The way the global IoT ecosystems will be formed has a great impact on ability of the European industries and European SMEs to capture the value IoT technologies will deliver**.** Many American and Asian large companies are aiming for dominant-design IoT ecosystems, where the most profitable value capturing parts of the ecosystems are monopolized. Amazon IoT and Apple Store are good examples of this approach. More importantly, what IoT ecosystems will thrive will have tremendous impact on the choice, privacy and security of the European citizens in the future.

Why to participate in open ecosystems as businesses then? Recent results from innovation research (Autio 2015, Deschryvere 2015, Burström 2015, Gustafsson 2015, Kortelainen) show that:

- an open approach to ecosystem creation can predict regional economic growth two years in advance
- dominant-design ecosystems tend not to produce socio-economic prosperity

1.3.5 Non-trivial approach to Internet of Things

As general definition, the EU Projects Research Cluster in the Internet of Things (IERC) defines IoT as *"a dynamic global network infrastructure with self-configuring capabilities based on standard and interoperable communication protocols where physical and virtual "things" have identities, physical attributes, and virtual personalities and use intelligent interfaces, and are seamlessly integrated into the information network."* A thorough overview of different IoT definitions and IoT development landscapes is available for example at reports of the AIOTI working groups 1, 3, and 5 from 2015, and is not reviewed here (see www.aioti.eu for more information). For real-life piloting, there are various approaches what each of the definitions of IoT should mean in practice. Independently of one's viewpoint about IoT and IoT technologies, any non-trivial IoT system is expected to comprise of the following elements[2]: 1) Sensors and Actuators; 2) Communication infrastructures; 3) Server/middleware platforms; 4) Data analytics engines; 5) Apps and services. Smart&Ageing deploys non-trivial IoT use cases in large-scale pilots, in a way that all these elements are present in the pilots (see 1.4.6 for details in each use case).

[2] Developing further on "What is IoT" by John Soldatos, the OpenIoT Technical Coordinator

1.3.6 Integration of existing state-of-the-art components to build interoperable IoT- enabled Services

To leap from each of the IoT elements and technologies to the real life of the users, integration of the components is needed. Smart&Ageing focuses on *IoT-enabled Services*. Services are the key interfaces between people and technology, or customers and providers. To go from the technologies to services, the following system-of-systems integration approach is taken:

- integration of various *state-of-the-art components* to provide interoperability of the technical platform
- integration with *open interfaces* to enable on open, modular ecosystem
- generating interoperability by *harmonizing* the interfaces, both between the components, but also towards the European IoT open platforms
- improving the key shortcomings of the IoT platforms, most notably security, privacy and interoperability, by adding layers that address these
- using *service design* as method for integrating the components from end-user perspective

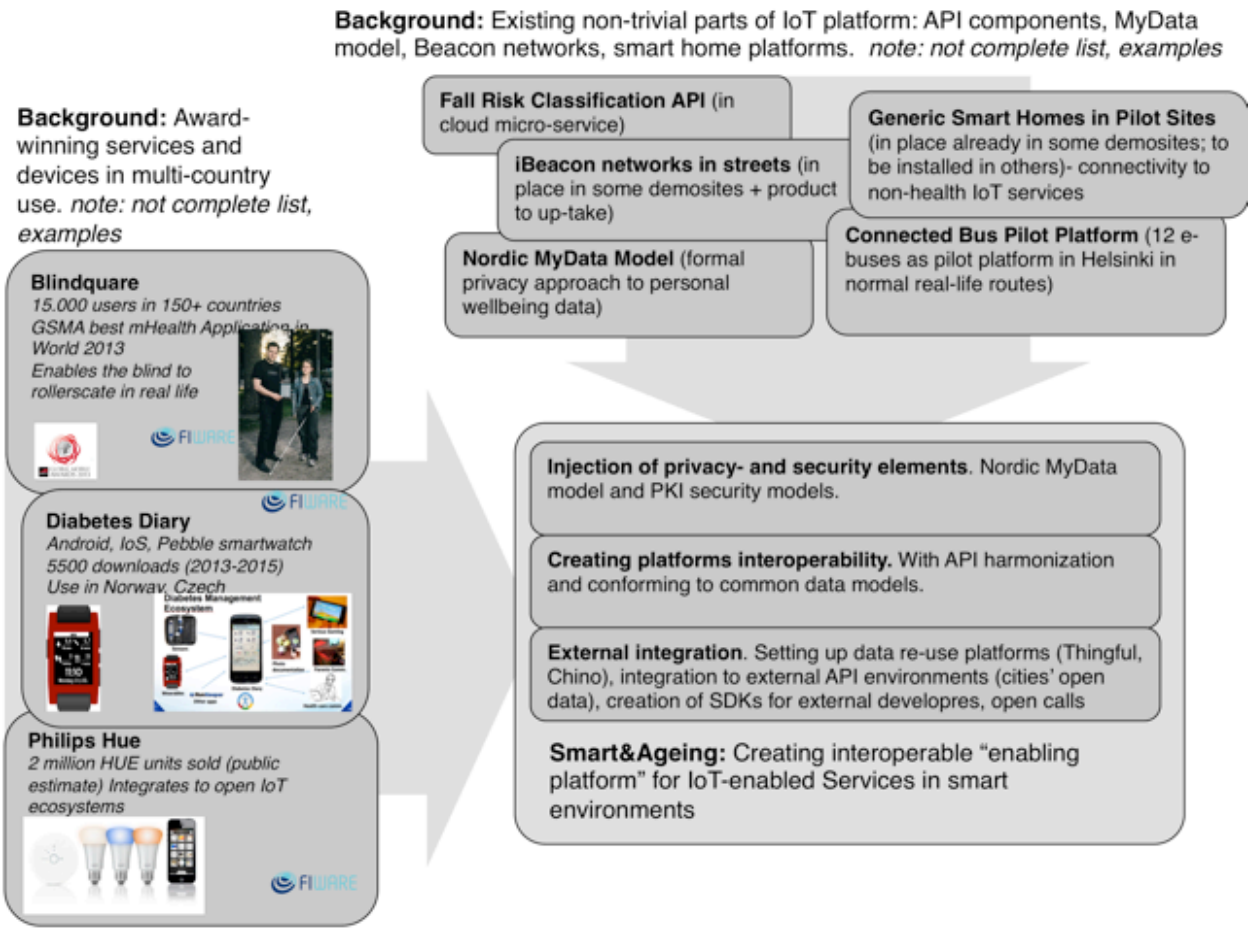


Figure 3 Integration of the technical platforms (WP 2)

1.3.7 Service Design is the user-centric integration method

After the platform components are made interoperable, tested and ready for service-layer integration, each demosite hosts a Service Design&Integration Lab where the user-centric integration of the services is done iteratively with the end-users. Specifically, service design methods are used to:

- assemble the actual pilots, and refine the KPIs and sub-use cases from end-user perspective
- probe and propose the "IoT emergent value"
- refine the user experience - service frontends/service touchpoints of each of the components

Design toolsets (service design, user-centric design, behavioural insights

Figure 4 Value of good user experience design in changing user behaviour

regarding use, human-computer interaction design) are widely used in the development of commercial digital services. In the fields of IoT and other emerging technologies, their application has not yet been as wide. There is a long history of exploiting user-driven open innovation processes in the probing and proposing of the value of new technologies. Too often however end-user involvement in innovation processes is taken in wrong development stages with wrong methods (see e.g. Kommonen et al. 2010[3]). This has often led to shortcomings in the effectiveness and impact of these processes, typical of many of so-called 'living lab' approaches.

> **EXTRA READING** - "*When people talk about innovation in this decade, they really mean design" - Bruce Nussbaum, author of Creative Intelligence, professor of Innovation and Design at Parsons The New School of Design*

1.3.8 Measuring of the results

The measurement of the socio-economical benefit is based on the value model described above. Each of the use cases has specific objectives (KPIs) that cover key aspects of value expectations from user and health care perspective. These objectives will be detailed to more specific site-specific indicators in Work Package 3. First, the indicators are aligned with local measurement frameworks to have the project provide local ecological validity, and with the common framework between the demosites to provide European validity. Then, exact measurement instrument will be designed, based on measurement frameworks listed below. The measurement will be made ex-ante and ex-post with the target group at all pilot sites. Also, reference groups will be measured for control. The key tools are end-user questionnaires, city budget analysis, city service provisioning analyses, and care professional evaluations. Whereas Lead pilot measurement will measure validity of the impact, replication pilots' measurement will provide reliability of the findings. Both the number of users and the lead-replicate model, taking place in various countries, provides enough statistical significance to make strong European hypothesis and reasonable argumentation for the impact of the solutions.

Use case	Sub-Objectives to be reached in each pilot, within the target group locally	Tentative measurement framework
A. Empowering everyday mobility	O1.1: Enable and encourage 25% more independent mobility daily O1.2: Reduce cost of cities social transport services by 5%	- ADL, IADL - City budget use analysis per target group - Use of public transport, mobility survey
B. Independent living at smart home	O1.3: Increase experienced Quality of Life at home by 30% O1.4: Increase experienced independency at home by 20%	- HRQOL - ADL, IADL - UofT QoL - ICF/WHO (International classification of functioning, disability and health) - Product/service satisfaction index
C. Connecting Community	O1.5: Increase the experience of quality of social contacts by 20% O1.6: Reduce the experienced loneliness by 10%	- IADL - Townsend loneliness scale - UofT QoL - ASCOT
D. IoT-enabled Virtual Care	O1.7: Increase experience of health related safety by 75% O1.8: Reduce the cost of care provisioning by 10%	- RAI - IADL - City nurse visit statistics - Service Customer satisfaction questionnaire (CSI) - Service Customer Recommendation Index (CRI) - Medication adherence (indirect, questionnaire)

[3] http://ci-journal.net/index.php/ciej/article/view/746

[redacted]

1.4 Ambition

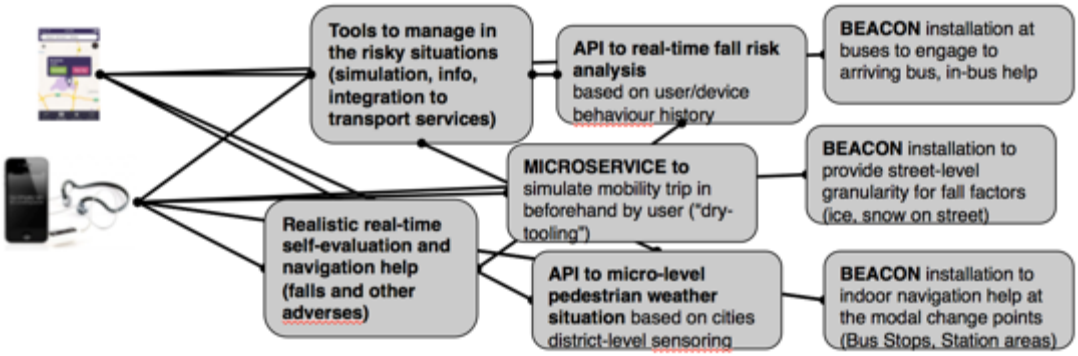
The consortium is based on the existing state-of-the-art in IoT, innovations for ageing, and IoT services for home care. This enables the project integration work to start from this state-of-the-art and progress swiftly further beyond that in service innovations, European single market generation, internet of things-enabled services, and increasing the independent living of the elderly.

1.4.1 To go beyond trivial internet of things installations

Based on existing installations of connected objects in pilot sites ("trivial IoT") the project will integrate these with other key subsystems of the IoT, and enable the pilots to exploit the full value expected from IoT services. For example, there is an existing IoT home care service for elderly in place in Helsinki with 400 customers, where wrist-device alarms, robotic food dispenser, video visits and other devices are connected from smart home directly to the city's elderly care service back-end CRM system and care personnel. While being currently state-of-the-art in Europe regarding IoT and home care, the approach still is based on mindset of automating production and optimizing processes. Also, it has not yet been integrated to the "Smart City" urban IoT environments in place in Helsinki, despite partially same technological solutions. The "non-trivial IoT" in the Helsinki context means adding in new levels of complexity and new sub-systems, like API platforms to fall prediction or and weather forecasts, predictive analytics based on the IoT big data, systems integration to generic smart home appliances like home lights and coffee machines, social integration to real-time information about friends and families, and horizontal integration to smart city IoT platforms. This will lead to new kind of emergent value - "the fourth industrial revolution". It should be noted the existing IoT/virtual home care service is already TRL9 and in large-scale production use 24/7, and available to any Helsinki resident with entitlement to normal home care service, and smart city IoT environments as well as in use. The starting point is similar in most of the other demosites: innovative pilots exist, but in silos.

Background high-lights - State-of-the-Art, on what the project integration builds on		
City of Helsinki IoT home care service	City of Helsinki has been providing virtual home care successfully for years, having impact to care costs and experienced care quality. The current IoT virtual care system includes Azure-based middleware connecting City service center CRM and security center to the smart home with alarm devices, video visits (of care and family), robotic food dispenser, and other devices. In Smart&Ageing, this will be used as baseline onto which to develop IoT ambition in use case D (in for example integration of non-care things, transport services, predictive analytics on big data). TRL9.	
bIoTope (Aalto, FVH)	One of key IoT platform development projects in Europe, bIoTope lays the foundation for open innovation ecosystems, where companies can with minimal investments innovate by creating new Systems-of-Systems (SoS) platforms for connected smart objects. It is funded by EC from H2020-ICT-30-2015 programme. In Smart&Ageing, architectural selections, open components and existing installations from bIoTope will be used. (bIoTope-h2020.eu). Platform integration WP lead Aalto is coordinator of BIoTope.	bIoTope BUILDING AN IoT OPEN INNOVATION ECOSYSTEM FOR CONNECTED SMART OBJECTS
Select4 Cities (FVH)	Select4Cities, Horizon2020 project, is a challenge-driven pre-commercial procurement to develop an open, standardized, data-driven, service-oriented and user-centric IoT platform that enables large-scale co-creation, testing and validation of urban IoT applications and services. In Smart&Ageing, requirements and specifications from	SELECT for Cities

	Select4Cities will be used to prepare for future interoperability.	
CityVerve (MCC)	The CityVerve Project, 12M€ InnovateUK spearhead "IoT Demonstrator" on IoT, which MCC-led consortia won in 2015, aims to test better services using the IoT technology. It includes IoT solutions for management of chronic respiratory conditions, biometric sensor networks, community wellness, talkative bus stop, and others.	cityverve
IoT Living Lab (Amsterdam)	iBeacon and LORA network in place in Amsterdam central areas (streets, selected parks, bus stops; 1500 units), to be used as Amsterdam smart outdoors platform, and model/solution to be replicated to the other pilot cities.	

Comparison of trivial vs. non-trivial IoT	
Trivial IoT: devices connected to cloud back-end	Single threads of connectivity go through a limited amount of layers. Connecting sensor devices to cloud-based data repository and application. Wrist-type health monitors, basic alarms to care and family. Systems deliver incremental innovation that speeds up operations and automates processes. Current state of the art includes use of IoT middleware for data routing in e.g. safety alarms for elderly.
Non-trivial IoT:	 Having all key IoT layers and subsystems involved in service provisioning – sensor/actuators, API-based analytics engines, IoT-middleware ystems, several connectivity platforms. Systems consist of various user interfaces and use cases, and deliver emergence of new kind of value due to the radical improvements of amount of connectivity between the subsystems.

EXTRA READING - *"We stand on the brink of a technological revolution that will fundamentally alter the way we live, work, and relate to one another. In its scale, scope, and complexity, the transformation will be unlike anything humankind has experienced before. We do not yet know just how it will unfold, but one thing is clear: the response to it must be integrated and comprehensive, involving all stakeholders of the global polity, from the public and private sectors to academia and civil society. The First Industrial Revolution used water and steam power to mechanize production. The Second used electric power to create mass production. The Third used electronics and information technology to automate production. Now a Fourth Industrial Revolution is building on the Third, the digital revolution that has been occurring since the middle of the last century. It is characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres.* --World Economic Forum, about internet of things in 2016

1.4.2 To inject "*Nordic-level*" privacy and security to the platforms and services

Current lack of adequate privacy and security implementations is often seen as the key barrier in IoT up-take in domains where these are needed, like health. The project consortium acknowledges this and commits to the uptake of:

1. Committing to up-take of MyData -model for personal data and privacy management. MyData means the user owns the data, and has full rights and technical tools to this ownership, for example to grant or withdraw consent (data access) to various organisations. The reference model is described at:

- POIKOLA, Antti, KUIKKANIEMI, Kai, et al. *MyData - A Nordic Model for human-centred personal data management and processing, Ministry of Transport and Communication Finland, 2015.*

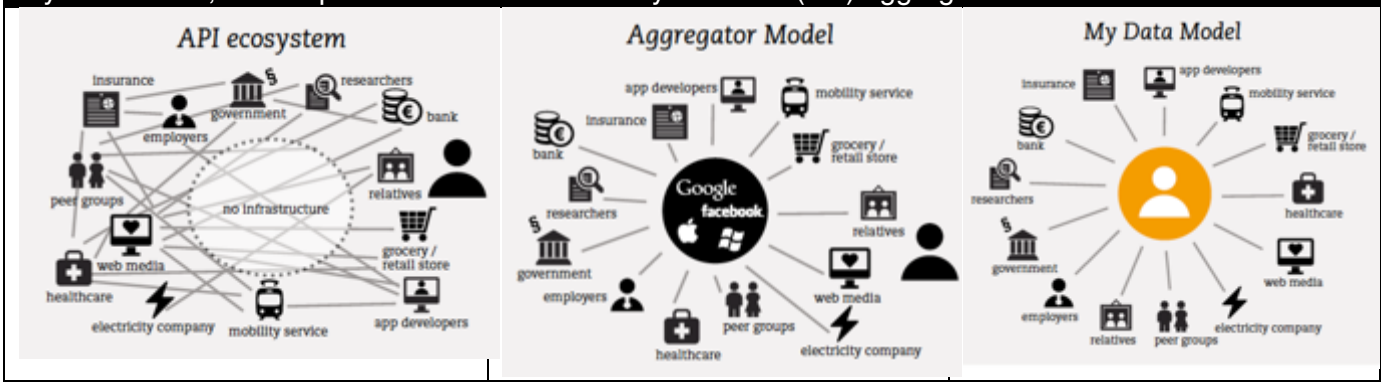
MyData Model is essential for the IoT ecosystems for:

- human-centric management of the big data
- enabling easy data re-use and exploitation horizontally across different domains (e.g. accessibility of smart home data, from health to retail to media to energy)
- providing European alternative approach to non-European commercial platform's aims to monopolise private user data
- leveraging, and/or providing alternatives to the local clinical healthcare repositories (HL7)

2. Committing to up-take of trust-based security systems for the IoT architecture. The security reference model to be applied is based on the security framework of BIoTope Horizon2020 project (ICT-30-2015) (project partners: Aalto, FVH). Trust-based security is based on the use of strong cryptography and trusted certificates. In addition to PKI (Public Key Infrastructure) certificates, BIoTope uses a "white list" notion of trusted nodes, which can be set up in a purely peer-to-peer manner. Such a security model is also a key enabler for privacy management models such as MyData because users, their devices, can set up a trusted, private network where access to information can be based on requesters' identity and role. This requires technical considerations in all pilots and possible addition of security features into existing products. Reference model is described at:

- *KUBLER, Sylvain, FRÄMLING, Kary, BUDA, Andrea. A standardized approach to deal with firewall and mobility policies in the IoT. Pervasive and Mobile Computing, Vol. 20, July 2015. pp. 100-114.*
- *FRÄMLING, Kary, NYMAN, Jan. The compromise between Security and Usability in the Internet of Things. In: Smeds, R. (ed.): Proceedings of Adavanced Production Management Systems (APMS) , Sept. 15-17, 2008, Espoo, Finland.*

MyData Model, as compared to current API ecosystem and (US) aggregatotr model



Background high-lights - State-of-the-Art on what the project integration builds on		
Nordic MyData Model (Aalto:HIIT)	The Nordic MyData Model whitepaper, authored by Aalto project partners, and published by Ministry of Transport and Communication of Finland in 2015, provides framework, requirements and technical model for enabling human-centric control and privacy, essential to health and wellbeing IoT data in the project. (http://bit.ly/1myFTsf, ww.lvm.fi)	MyData – A Nordic Model for human-centered personal data management and processing
bIoTope IoT platform (Aalto, FVH)	bIoTope platform focuses strongly on security by providing identity and certificate management mechanisms based on P2P paradigms, identity-based lookup and authentication, and enables new forms of context-sensitive security and trust management. TRL5-8.	bIoTope BUILDING AN IoT OPEN INNOVATIO ECOSYSTEM FOR CONNECTED SMART OBJECTS

EU privacy laws compliant Digital health Data backend (Chino.io)	Chino.IO provides a secure backend and database for Digital Health businesses that have to store health data in compliance with EU privacy laws. REST API and OAuth 2.0, any kind of data (both JSON, large attachments and BLOBs). TRL9. In project, it is used for all the pilots where there is no existing health data repository that meets the EU privacy laws and Mydata criteria. TRL9.	CHINO.IO
Nordunet secure big data and networks (Nordunet)	Secure and resilient network and cloud infrastructure for big data. Nordunet provides network connectivity and other services for most of the Nordic public research. In project, it provides the big data platforms, cloud services and service labs' repositories in demosites where no local big data platforms exist. TRL9. ISO27001 and ISO9001.	NORDUnet Nordic Infrastructure for Research & Education

1.4.3 To create harmonized, interoperable solutions towards European digital single market

Technological approach to digital single market

Smart&Ageing focuses to consolidate two layers:

- **Smart Environments Platforms**, which are the "enabling platforms" with a harmonized technical environment (APIs) that provides interoperability between the demosites, to let the IoT-enabled services roam and be transferable from one country to another, and open platform for future service innovations. These include smart home, smart outdoors platform, smart mobility platform and smart wearable platform.
- **IoT-Enabled Services**, which are the use case services - what the users experience and use - and that integrate to each other, and to the enabling platform.

These are the layers where most of the added value on IoT for independent living is expected, and thus focus of the project. Network connectivity (4G, 5G; traditionally tele-operator layer in Europe) and smart home set-top-boxes and home appliances (traditionally off-the-shelf equipment manufactured overseas) are seen as bulk and commodity, where the future competition will be based on cost, and interoperable products are expected to arise.

For these, Smart&Ageing will provide interoperability that will lead towards European Digital Single Market for the IoT innovations for independent living. This is taken with two methods:

1. **Harmonization,** which is a technical term, already used by various European Union bodies in for example large-scale CEF infrastructure projects. It means pragmatic hands-on interoperability creation with the "best-value-per-effort". It means agreeing on the common data formats, APIs, interfaces to be used. It is kind of very lightweight standardisation process. It is a reference model in several smart city approaches - "pragmatic harmonization of standards and interfaces, instead of hard top-down hierarchial process". It is both lightweight, and usually precedes the standardisation activities that will follow some years to come after the new technologies up-take. So it should be seen as pragmatic pre-standardisation activity in fields where standardisation lags behind technology uptake.
2. **Integration,** in which the use cases are integrated from various platform and service components, that are made interoperable to provide seamless user experiences as well as emergent new value due to added

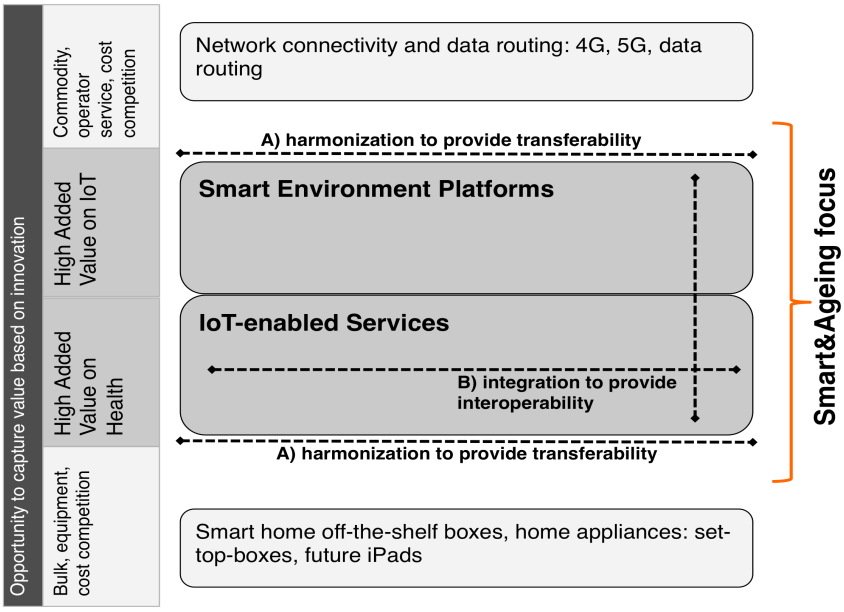


Figure 5 Harmonization and integration

connectivity between the components.

This approach is evident in the project partners' work in developing the European open IoT platform in for example: - Specific H2020 projects developing this platform: Horizon2020 BIoTope, Select4Cities; - Developer ecosystems developing this platform: CitySDK, FIWARE, AIOTI, IOT EPI; - standardisation and pre-standardisation the project partners engage to: The Open Group; -The demand-side technical harmonization collaboration that is taken in Nordic Independent Living (5 EU capital cities), CitySDK (8 EU cities) - where city partners have harmonized the API ecosystems for the IoT innovations

Ecosystem business model approach to digital single market

Globally, whereas the IoT basic technologies and key components are maturing or quite mature, the future IoT ecosystem business models are not. The project begins with the design of ecosystem business model requirements, and how these translate to the technical integration and harmonization planning. The common supply-side offering and the value network / ecosystem business model logic is facilitated throughout the project. This is done with explicit interaction to the key European IoT Ecosystem developments, as enlisted in the section 2 (Impact). For here, the project exploits key methods:

- Ecosystem Business model facilitation, led by Aalto, and based on experiences from various projects, including coordination of the FI-PPP (and strong contributions FIWARE). (For publications, see e.g. *Launonen, Pentti, 2015, "Determinants for orchestrating open innovation networks". In: Lappalainen, Pia. & Markkula, Markku & Kune, Hank (eds.), Orchestrating Regional Innovation Ecosystems - Espoo Innovation Garden. Aalto University and Laurea Applied Sciences, Finland, pp. 199-208.)*
- Pragmatic hands-on/legs-on Ecosystem management, contributed by Rob van Kranenburg (Resonance Design; Sub-Contractor to FVH). Here, the previous ecosystem coordinator work of IoT-A is exploited.
- Active collaboration with the Horizon coordination and support actions IOT-02-2016 and EPI IoT.

Tentative harmonization and integration plan

The architecture consolidation is governed in Work Package 2 as a process that supports, drives and communicates with the pilot integration. It delivers requirements and specifications for the pilot use cases, and further receives inputs from the integration (use case requirements, API catalogues, and so on). It also communicates with the IoT-02-2016 CSA with the respective task leaders responsible for the CSA sub-domain collaboration. The interplay with the architecture and the actual use case pilots is two-fold: both affect each other. The project ambition is pragmatic: as much as need to be harmonized for interoperability and security will be done; and some architecture decisions need to be taken at the IoT-02-2016 CSA level (in order for the IoT LSPs to be able to provide true full-scale European IoT ecosystems). This model also minimises the operative risks on external dependencies: The project can operate successfully in the event of the IoT-02-2016 not being able to succeed, and still provide harmonized IoT ecosystem for the domain of smart environments for ageing well. A harmonized IoT ecosystem signifies the **commitment to uptake universal standards for IoT**, in conjunction with the H2020 ICT-30 project bIoTope. Such IoT standards are identified as a part of The Open Groups Open Platform 3.0 initiative, in collaboration with organizations such as the Industrial Internet Consortium (IIC) and ISO. Cornerstone standards are e.g. the Open Messaging Interface (O-MI) and Open Data Format (O-DF) published by the IoT Work Group of The Open Group. The use of those standards in IoT systems is described for instance in: *FRÄMLING, Kary, KUBLER, Sylvain, BUDA, Andrea. Universal Messaging Standards for the IoT from a Lifecycle Management Perspective. IEEE Internet of Things , Vol. 1, Issue 4, 2014. pp. 319-327.* Prof. Kary Främling from Aalto University is one of the worldwide pioneers in IoT. He is also the main architect of O-MI and O-DF standards, as well as the Chair of the IoT Work Group. In addition to this, the consortium is well aware of standardization activities in ISO and other relevant standardization bodies. Through The Open Group, AIOTI and other channels, the consortium can also propose and influence current and future standards.

Domain of harmonization	Key candidate(s) for common selection, based on partner background
General API type	RESTful (http, https)
General primary protocol	IP (IPv6, IPv4)
Wellbeing data privacy	Nordic MyData Model

model	HL7 and HL7/FHIR interoperability and integration (various national and local repositories)
The general standards framework	The Open Group Open Platform, possibly FIWARE framework if its maturisation proceeds (project partners have lot of experience in FIWARE).
Low-level data models and messaging format	O-DF, O-MI (The Open Group)
Security model	public-private-key trust-based model (BIoTope-h2020, TOG)
IoT data routing engines	Platforms in use include Microsoft Azure IoT, Thingworx, IFTTT. European platforms in the project (Thingful.com. Select4Cities and BIoTope, FIWARE) are providing European IoT middleware that mature along the project timeframe towards TRL9. However, currently many EU-initiatives, which consider themselves platforms, (FIWARE, UniversAAL, ReAAL) lack in maturity and realistic commercial scale-up pathways.
Smart home connectivity	BLE (several), ANT+ (ACorn), Zigbee (Philips), LORA (Salus,Glimworm). Wifi. 5G connectivity options are evaluated at the integration stage (Aalto coordinates industry-agnostic Take5G test network and project).
Smart outdoors connectivity	LORA and iBeacon (several partners), Wifi. 5G connectivity options are evaluated at the specification stage.
IoT Discoverability	Thingful, RoT, TOG
Context awareness	FIWARE NGSI where applicable, URI
Integration to PHR, EHR	epSOS, HL7/FHIR
End-user authentication	OAuth
Open services	SOA and TOGAF
Smart city API family	CitySDK harmonization package (GTFS, Open311, LOD). Possibly FIWARE if its maturisation proceeds parallel in e.g. LSP pilot 4. CKAN for static open data repositories.

EXTRA READING - *The Open Group Internet of Things (IoT) Standards have been developed to fill an interoperability gap identified in the context of the IoT, as explained in the White Paper: An Introduction to Quantum Lifecycle Management (QLM). A great number of useful standards exist on the level of communications within a local network, within a specific domain, or for a limited purpose such as remote management of computers. However, at the moment of writing this specification, we have not been able to identify an appropriate standard that would address the higher-level requirements of the IoT. Such requirements are notably the need for any data sources (devices, machines, server-based systems, etc.) to be able to publish their available data and provide access to it in an easy and secure way, which includes the possibility to filter the data provided depending on the requester's identity, the context, etc. The O-DF can be used for publishing the available data using ordinary URL (Uniform Resource Locator) addresses. O-DF structures can also be used for requesting and sending published data between systems, notably when used together with the O-MI standard.*

1.4.4 To provide evidence of the value of IoT at a statistically significant scale

The use cases are piloted with the following number and location of end-users. The end-users are actively using the solutions in their daily lives.

	A. Empowe-ring everyday mobility	**B.** Independent Living at Smart Home	**C.** Communi-ty as Care	**D.** IoT-enabled virtual home care
Helsinki, Finland (total 300 smart home users, 200 other users)				
Helsinki IoT eldercare customers (and care personnel providing care). 200 smart homes for pilot (existing).				
Smart Homes for seniors at Smart Kalasatama, not having city care (new installation), 100 flats (new city district with regulated smart homes with open APIs, 1600 residents)				
Recreation and service center for the elderly, 200 persons				
Albertslund (greater Copenhagen region), Denmark (100 smart home users, 50 other users)				
Elderly receiving caring and nursing services in private homes, with some degree of health enabling IoT solutions				

in place already. 100 homes.				
Public nursing centre with 50 elderly receiving caring and nursing services. Some degree of health enabling IoT solutions in place already.				
Amsterdam, Netherlands (50 smart home users, 300 other users)				
Age Friendly City - neighbourhoods (200 persons)				
Health Lab (several locations, smart homes to be installed, n=50-100)				
Elderly citizen (n=100) with special transportation needs (visually impaired, cognitive disabilities, mobility limitations)				
Manchester, UK (50 smart homes, 1000 other users)				
Age Friendly Manchester – primarily working in 4 neighbourhoods: Burnage, Moss Side and Hulme, and Moston.				
Lamia, Greece (150 smart home users, 230 other users)				
Help at Home Service for elderly (294 beneficiaries), total of 100 smart homes (new installation)				
Athena-Social Care's Mental Health and Rehabilitation units, 30 smart home patients users at assisted living facilities and 200 community users, 50 smart homes (new installation)				
Centers for Daily Care for elderly (30 users)				
Reykjavik, Iceland (total 225 smart home users)				
Smart Homes for city service flats, 375 flats at Felagsbustadir (new smart home installation) - 100 care customers at Felagsbustadir service flats				
The Society for the Elderly in Reykjavik own apartments in 6 buildings for senior citizens and sell it to its members. The only service is home care services provided by the City. Homes of 125 elderly people to be set up as pilot site				

Smart&Ageing provides an almost complete coverage of various eldercare models in Europe, with user groups large enough to provide statistically significant evidence of results both in pilot sites but also comparatively between eldercare models.

1.4.5 User-led agile and interactive design and integration at Service Integration Labs

Service design is a facilitative approach that brings together the technical developers, end-users, care professionals and the social scientists. In Smart&Ageing, the use cases are integrated with two, separate, service design approaches. These are taken simultaneously when assembling the pilot:

1. Service design as method to integrate pre-selected components into a seamless user experience. The pilot is assembled towards the pre-defined use case described below, towards the specific KPIs and objectives. Here the integration is co-designed with a test user group at Service Design&Integration Labs, and validated before going into the large-scale field trials. The aim of this approach is to create a seamless, localized user experience, and to ensure the quality and interoperability of the components and the pilot. The exploitable partner background is TRL7-9. Specific methods to be used: Service blueprints, Business Model Canvas, People Value Canvas, Service Design, Prototypes, Scrum, A/B Testing of user experience. This activity builds the parts of pilot where there is very strong evidence of the benefit of the solution in beforehand. Open calls are used to integrate additional components that have emerged from the user trials to complement the pilot activities.

2. Probing for additional, radical opportunities that emerge from the nature of IoT, especially when connected to external sources and non-evident project partner background. The pilot is strengthened with features and integration where the value is not pre-evident, and that only can be identified and tested during the design and exploration process. This part of the pilot design and integration is partly planned,

partly ad hoc. The exploitable TRLs vary. Specific methods to be used: Prototyping, integration prototyping, WIBGI with end-users, "just doing it", A/B testing of concepts, People Value Canvas. Open calls are used to probe for "wild card" type of solution components. The activity builds the parts of pilot that are 'the extraordinary IoT value promise': fast, cheap integration of systems of systems and new interoperable tools into the production services will create new kind of emergence and use cases that could have not been planned in beforehand: For example: *"integrating a Flic-'Please Find Me'-button at home door when leaving out might or might not lead to radical improvements in overcoming loneliness" or "combining grocery lists in smart fridges that enables neighbours to cook together"*. This part of pilot design partly is foreseen to continue during the pilot operation stage due to fact that it is not possible to stop the end-users exploit the new technologies in new ways, if that is easy.

Exact design methods to be used will be specified at the beginning of the WP3 by the method partners, and a method toolkit and guidelines will be developed for the project use. **Key method background** of the partners, from which the method toolkit development starts, is:

- **Design for Government (Demos).** Design for Government project proposed a new, quick-to-implement model for including experiments and behavioural approaches into Nordic policy design. The use of behavioural approaches as part of governmental steering has been shown to make policy more user-orientated, targeted and efficient. This same approach is applicable to different settings that aim at utilizing expert insight and designing experiments, such as the proposed multi-stakeholder integration.
- **Smart Hospital – Living Lab (Laurea).** Smart Hospital - Living Lab was a development environment, in which new products and services were tested and further developed in co-operation with users such as health care professionals, patients and their significant others. The purpose of the project was to create a functional and open environment for testing and further developing technology based innovations for health care and wellbeing. The project promoted the effectiveness of everyday work, improved the quality of care, as well as involved patients and their significant others to participate in their care.
- **People Value Canvas (Waag).** The People Value Canvas is a unique tool to support designers and stakeholders in a systematic manner to gain insight into what people actually consider to be valuable. This helps to describe critical aspects of a concept, leading to a value proposition for the user and using empathy as a tool for social impact
- **Lab-as-a-Tool (Waag).** Waag Society has long experience and methodology in using Labs as deliberate tools in innovation processes, at various domains and various stages of the innovation. This Lab model is used as basis for the Labs. Some Waag Labs are more focused on open innovation and some for more field test. Current Waag Labs include Creative Care Lab, Creating Learning Lab, Future Heritage Lab, Future Internet Lab, Open Design Lab and Open Wetlab.
- **"Internet of No Things" (Demos).** The Naked Approach -project by Demos Helsinki and IoT research partners develops a path towards a significant paradigm shift: a change from gadget-centric to user centric, gadget-free -Naked- digital interface. Companies that utilize smart technologies and business models are one of the key enablers of huge Internet of Everything markets. In 10 to 15 years, what is the potential of smart solutions to nudge us to do the right things? Design, technology and business solutions are created and studied from the user perspective in order to realize new digital interaction paradigms. While developing business models and ecosystems, the Nordic values – respectful co-living and trust – are emphasized as a part of new services and products; on our way towards the hyperconnected world of the future. The insights like 10 principles for hyperconnected Nordic societies are especially valuable for this project. We will also utilize the scenario work that investigates 5 most important tensions in the future of hyperconnected society in designing for the service pilots and their integration
- **Health 2050 and human-centric health approach (Demos).** Health 2050 research project on the freedom of choice in healthcare and the future of health and wellbeing examined healthcare from the individual´s perspective as a citizen and consumer and focused on how new policies and services can better support individual health choices. In the project Demos Helsinki produced model of human-centric health. The model describes health as something that is focusing on capability that to a large extent is built outside the scope of current social and health-care services: at home, through other services and peer-to-peer.
- **Nudge theory (Laurea).** Nudge theory approach utilizes accumulating empirical and theoretical knowledge on choice behaviour to solve practical behavioural challenges, such as promoting healthy living styles. Very low-cost changes in communication, environmental signals, or choice architecture have been shown to change the behavioural patterns in a significant manner towards more positive and

productive behaviours. Positive impacts can be reached e.g. with MINDSPACE and EAST tools developed by the Behavioural Insights Team in the UK. Here we utilize the nudge theory approach to designing the environments so that it helps the elderly to use the IoT solutions appropriately and productively.

Service Design&Integration Labs

The design and integration of the use cases is taken at local Service Design&Integration Labs. The Labs are existing facilities and homes of the test-users, where technical IoT "lab" setting is set up to simulate the operational environment for the integration stage. The design&integration is taken together with the users (elderly and care personnel). The Labs connect to the localized needs, languages, culture and ecosystem. For example, whereas the local mobility challenge in Helsinki is the winter pedestrian street conditions, in Amsterdam this is the pedestrian congestion at urban areas. For both needs existing API and IoT systems are in place by the cities. Also, the language localisation is taken at local lab level. A small number of dedicated local test users of elderly and care professional are central to the service integration stage. The service integration is executed with agile methods) with several iterations of the use case.

- The Integration Labs work in lead-replicate model described in Section 3.This facilitate learning and provides the interoperability between the use cases and demosites.
- The use cases have been planned to have overlapping components (platforms or services used in multiple use-cases), ensure connectivity and exploitability between use cases, and this exploitation of the common components between the use cases is one key role of the labs.
- Each of the local labs provides early stage end-user review and validation (of prototypes, concepts and prototype A/B tests) of all of the lead pilots in integration, to provide European-wide insights into all integration tasks.

	Current local Lab facility	The Smart&Ageing Lab facility specific issues and improvements
Amsterdam (operator: Waag)	- Health-Lab, Future Internet Lab and Creative Care Lab (Waag). Health-Lab aimed at stimulating and accelerating innovation in health care. Existing smart home clients for health lab. - IoT Living Lab (Glimworm, Amsterdam), a large public installation of iBeacon network in the streets and specific parks in Amsterdam	- Test-users with smart homes (HealthLab) - IoT living lab as iBeacon outdoor infra - Physical co-design and test room at Waag - Collaboration with other Waag Labs - Local design method support - Amsterdam city recruits the elderly - Age-friendly city infra for large scale pilot
Helsinki (operator: Laurea)	- Smart Kalasatama Living Lab (FVH) - formal co-design and piloting district of City of Helsinki with large amount of Smart Homes regulated into the district, and new also health&wellbeing center opening 2017 - Living Lab Bus (VTT), a set of 12 electric buses in normal bus-line operations in the City as a test environment	- test-users with smart homes at Kalasatama - Physical co-design and test room at Laurea - selected test users with Helsinki city home care - Living Lab Bus as public transport innovation platform
Reykjavik (operator: Reykjavik)	-Apartments for the elderly. Real life services as a platform for piloting and testing IoT services. - Test lab building, where home care and nursing are operated from the house. Hot meals are cooked there and delivered to the elderly in Reykjavik who can not cooked themslves	- Test lab to be located in a building where there are 94 appartments for elderly people, both owned by the City of Reykjavik and private owners. - Reykjavik is the "virgin demosite" for Smart&Ageing, enabling wide piloting without historical system burdens, combining use cases
Albertslund (operator: Alblund, DTU)	- Patient@home (DTU) is Denmark's largest welfare-technological research and innovation initiative - DOLL (Danish Outdoor Living Lab) is a national Green Lab and form Europe's largest Urban Living Lab encompassing 12 kilometers of 1:1 tests and demonstration of intelligent outdoor systems and smart city technologies. - SigFox Lab (DTU) Integrated Sigfox base	- Test lab to transfer the methods and knowhow of DOLL to the work in healthcare. - Test lab is to be located in private homes as well as in public care homes. - Test lab to build on existing welfare technologies and IoT solutions within healthcare - Albertslund is living lab for human centric lighting in the Capital Region of Copenhagen.

	station solution with LAN and 3G/4G backhauling for IoT experimentation.	
Manchester (operator: MCC)	- Centre for Spatial Inclusion Design-Research - a community-engaged research and design partnership - CityVerve project (led by MCC) will have a city IoT infrastructure which Republic of Things and MCC will develop applications on top of.	- Ambition for Ageing project led by GMCVO (Greater Manchester Centre for Voluntary Organisations) and Manchester City Council's Age Friendly Manchester team, will provide links to the local community organisations in each of 4 neighbourhoods
Lamia (operator: Gnosis)	- Facility for assisted living (Center for Daily care for Elderly) with 4 rooms are to be equipped as demosite. - 50 senior citizens through Athena NGO initiatives are set up as demosite.	- 10 senior citizens of Help at Home are set up as demosite. Facility for assisted living (Center for Daily care for Elderly) with 4 rooms are to be equipped as demosite. - 50 senior citizens through Athena NGO initiatives are set up as demosite.

1.4.6 To demonstrate and define state-of-the-art in Internet of Things for independent living

The application of information and communication technologies in personal healthcare is still in its' infancy, and a lot of work needs to be done in terms of interoperability and interfaces' standards. Personalized, adaptive, and anticipatory requirements, necessitating high quality-of-service to achieve interoperability, usability, security, and accuracy need to be defined. Current solutions usually include a limited set of features and are costly for public service domain. IoT systems rely on sensors with wireless capability, actuators, cloud based "intelligent" systems and a mobile, geographic independent, human interface, whether a tablet, phone or other device. In the context of independent living, the hardware design must be given specific focus due to user related safety risks, usability and use context related considerations. The design and development process is highly regulated, involving safety standards and regulatory testing requirements that limit the number of companies entering the field. Recent studies have found that more inter-organizational collaboration, user-centered studies, increased standardization efforts, and a focus on open systems is needed to achieve more interoperable and synergetic solutions[4] (Memon, et al 2014). In Smart&Aging, the user driven development process will create a valuable data bank of user preferences, perceived quality attributes and experiences for involved partners and communities the future reference.

The project will demonstrate and define the future state-of-the-art for Internet of Things in four use cases:

A. Empowering everyday mobility

Immobility leads to a downward spiral that drives towards further immobility, increasing health problems, loss of freedom and independence. The decisions on whether to go outside on your own, or ask for help, or not go out at all, are taken based on heuristics and guesses rather than on facts - for example assumptions about congestion at buses and at the shopping center, feeling of personal ability, or assumptions of winter pavement conditions. For the frail elderly, the trips outdoor, especially with public transport, contain specific "high risk" points (for falling, for getting lost), like entering the buses or negotiating ice-free walking route or just getting real-time information about the transport fleet locations, bus and indoor congestion, pavement road conditions. Smart City solutions in place in the demosites provide fast IoT integration to the needs of and services for the elderly. Enabling the use of public transport and urban pedestrian trips also increases the inclusiveness to the society by not marginalizing the users.

Figure 6 piloting IoT-walker

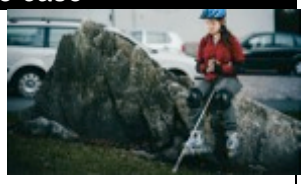
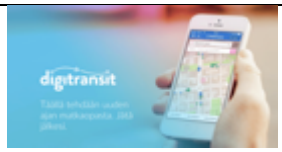
[4] Memon, M.; Wagner, S.R.; Pedersen, C.F.; Beevi, F.H.A.; Hansen, F.O. Ambient Assisted Living Healthcare Frameworks, Platforms, Standards, and Quality Attributes. *Sensors* **2014**, *14*, 4312-4341.

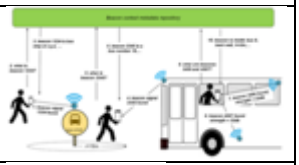
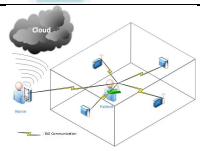
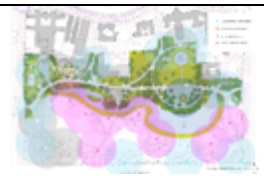
A. Empowering everyday mobility	
Sub-objectives	O1.1: Enable and encourage 25% more independent mobility daily O1.2: Reduce cost of cities social transport services by 5%
Target user groups	1. Medium-to-high risk of fall, but no other serious health issues 2. Serious adverses that affect mobility, especially visual impairment or cognitive problems (memory or attention) 3. Seniors that experience difficulty in using public transportation and are currently heavily dependant on special municipality transportation like city taxis/minivans (Amsterdam and Helsinki only)
Scalability / Business model after pilot	- Scalability via existing commercial components: Blindsquare commercial product in use in 150 countries already. Public transport navigation app open source, works in Helsinki, Amsterdam, Manchester already. Commercial iBeacon infrastructure product Glimworm (IoT Living Lab in place in Amsterdam). - Further commercialization of research partner background (Smart walker, reflector, fall risk APIs), with already commercial approach in place. - Further shared offering business model developed in project
Progress beyond state-of-the-art	Whereas there is a large body of research and several commercial solutions in specific IoT components for ageing (fall indicators, prediction, indoor positioning), a user-centric real-life service model for IoT-enabled mobility for elderly is mostly missing. Most of the mobility related IoT-technology research for elderly focus on beacon/indoor positioning (e.g. NOTECASE), where project partner BSquare is the awarded state-of-the-art solution provider. Also there is lot of technical tool development (VTT smart walkers being the SoTA, google glass-type pilots), but the integration to the IoT ecosystems is mostly missing or trivial from these. On the Smart City domain on mobility for elderly, in addition to BSquare, City of Helsinki's open API with all accessibility data for all points of interest and public transport data is often evaluated to be the state-of-the-art API environment. Also, Helsinki and FVH developments on Mobility-as-a-Service have been recognized as one of the global innovation leads in future of urban smart mobility, and featured in global media from Foreign Policy to Guardian. Also, the existing Living Lab Bus platform (using real buses as technology test bed) and Smart City reference districts with regulated smart homes provide state-of-the-art from the demand side.

Detailed use cases	
Use cases to be implemented (known benefit; known solution)	- Decision-support to enable and nudge to use public transport at home: information of outdoor conditions; personal fall risk indication; simulation of the route in beforehand; navigation plan and contextual guidance - Increase the experience of safety of the public transport - Pedestrian routefinding outside in bad weather and road conditions (Helsinki, Reykjavik) - slipperiness of the street, snow plow route info - Clean air walking, public transport routes (open environment sensor data) - Modality change hubs: Entering and exiting the bus (bus-stop and in-bus), ticketing, alerts in bus - Interfacing to the professional user interface of the features to the cities' care transport service center (Helsinki City) => use case D - Integrate city care transport service ordering function into the public transport navigator, to promote use of public transport, and enable elderly use primarily normal transport navigation tool (to avoid marginalisation), provide information about real-time location of the fleets => use case D? - Indoor navigation at the specified end-point in each demosite (close-by commercial center, health center, service center) - Smart reflector as signalling and an ID tool - Pedestrian mobility management at pedestrian congestion (events in center) - Personalised maps, wayfinding and personal fitness applications utilising city

	data and sensors (Manchester only)
Explorative questions (possible use case implementation; service lab innovation)	- What happens if mobility aids are integrated to smart home appliances like the coffee machine? (remind to turn off -- prepare for trip) - How to optimize the accessibility and usability? - How can the smart home support the decision-making to move? - How the smart home can prepare for the trip (smart lights, coffee machine, etc). - Can the IoT outdoor infrastructure also stimulate outdoor exercise / physical exercise by providing smart walking routes? - Smart walkers and smart reflectors as risk analysis instruments? - If you have memory problems, can the mobility app help you, your family or the care personnel detect you in a way that you can still retain privacy and dignity? - Integration of the care-specific tools to "real life" - coffee shops advertisements, events around, community?

Smart Environments	
User interfaces	The personal mobility management is integrated into normal end-user services in each demosite. For target group 1 this is the public transport (and pedestrian) navigation service, in personal mobile app, or the Acorn smart watch in some pilot sites. For target group 2 the interfaces are the Blindsquare application and the smart walker. Seamless user interface with he walker, apps, watch, connected to outdoors and indoor environments.
Smart homes	Smart homes in use ase B and D act as the smart home platform.
Public transport	In Helsinki, Manchester and Reykjavik, a public transport leg with bus is central part of the use case. In Helsinki there are 12 pilot buses (VTT Living Lab Bus) on normal (specific) routes that are part of the pilot providing in-bus and out-bus smart environment. In Helsinki, Amsterdam and Manchester many urban APIs were harmonized in CitySDK, including real-time location of the public transport fleet.
Streets	In Amsterdam, existing IoT Living Lab in central areas and parks (existing iBeacon /LoRaWAN installation at the center, 1500 units) will be used, and similar platform is uptaken in other demosites. CityVerve biometric sensor network (MCC) and Smart Kalasatama sensored environments (Helsinki), and smart lampposts in most sites provide street IoT platform. In Helsinki and Reykjavik a pedestrian walking weather (slipperiness of the streets, snow-plowing situation) is set up for the mobility information (with existing snow-plowing API in Helsinki; new sensors slipperiness) In Lamia, existing traffic and environment monitoring sensor network that entails five traffic and five environmental monitoring stations is used, and outdoor beacon infrastructure in place near major public buildings is used.

Key components - State-of-the-Art partner background to integrate into the use case		
Blindsquare (BSquare)	Augmented reality mobility navigator, currently targeted for visually impaired. Blindsquare won the GSMA Award for Best eHealth Application in World (2013). 15000 users in 150 countries. (TRL9, partly 6-8). Mobile device App that can be purchased from Appstore. Outdoor navigation with audio information of locations around and routes to take (from e.g. Foursquare). Indoor navigation in sites where iBeacon installations in place. Enables blind people e.g. to rollerskate in real life.	
Public transport and pedestrian navigator app (FVH)	Open source public transport navigator developed by Helsinki City, FVH and region, available at github (TRL7-9). The official public transport navigator of the city. Currently works in Helsinki, Amsterdam and Manchester with local public transports. Anyone can develop new features. Uses GTFS and other standard APIs. Strong developer community. In Lamia, existing mobile Transport	

	Assistant is integrated.	
Blindsquare audio menu with bluetooth remote (BSquare)	Universal hierarchial user-interface, multi-lingual with audio (25 languages supported). Tiny remote control to help navigate in real life with audio, connecting to bluetooth device. Based on acting as music player Bluetooth device for the mobile phone/ipad.	
Connected Buses (VTT)	12 connected buses up-take in Helsinki in 2016 that act as platform for new service trials (TRL 7-9). Buses travel in normal bus routes in Helsinki.	
Smart Rollator/Walker (VTT)	Rollator equipped with motion sensors for monitoring health related issues. Can be used for physical and mental health monitoring and communication to care. Mobile app gives feedback.	
Slippery pavement warning solution (Salus)	-Weather analysis and pavement sensors (LoRa) for ice formation -Data delivered to mobile app / integration platforms	
Personal fall risk classification API (VTT)	Fall risk classification system (AIB AAL-project). Algorithms for detection of physical motion with embedded sensors (including all smartphones), state-of-the-art accuracy	
Fall detector (DTU)	Bluetooth Low Energy (BLE) fall detector. Following resources are used: -Four BLE devices, which all act as a BLE-broadcaster; -A BLE device with an integrated accelerometer and a Central/Peripheral switching capability (It must support both roles and be able to switch between them). -A Smartphone with a BLE- and WiFi antenna.	
BAMBEA (HvA)	An IoT system for nudging people outdoor to exercise and move more. The system consists of an app that receives localized information from iBeacons, and can give personalized messages to end users. Because the beacons communicate (via Lora) to a central server, the ID's (and thus the messages) can be controlled.	
IoT Living Lab (Glimworm)	iBeacon network in place in Amsterdam central areas (streets, selected parks), to be extended to the other pilot cities.	GLIMWORM Beacons
CityVerve (MCC)	Biometric sensor network, talkative bus stop, smart lighting, and smart air-quality monitoring parts of demonstrators from CityVerve act as platform into which Smart&Ageing is integrated.	
Other project background to integration	Smart Reflector (VTT). Indoor positioning systems (Glimworm, DTU). Smart home appliances (Philips, Salus). Smart Watches (Acorn, DTU). Several digital (exer- and rehabilitation-) games (Waag). Outdoor sensor discovery (Thingful), and others, are explored for integration at the service integration stage.	

B. Independent Living in Smart Home

How can the smart home best support independent living of those not yet requiring extensive care or clinical interventions? With age, being able to self manage minor health & wellbeing disturbances, lower stress, and increase home comfort, will lead to increase in (health related) quality of life and delay the onset

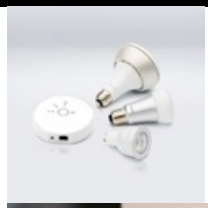
of age-related wellbeing issues. The change from adulthood to elderhood is not a single step, but a smooth shift starting long before retirement age. For today's elderly, smart homes should be compelling and comfortable and part of their normal technology environments with FaceBook, iPads and Roombas, and technologies could and should support the user in connecting them to the rest of the society. As people spend substantial amount of their time in their homes, the home-as-technology could and should be seen as a primary prevention technology for many age-related issues (stress, sleep, slowing cognition) in a person-centered approach of health.

B. Independent living in smart home	
Sub-objectives	O1.3: Increase experienced Quality of Life at home by 30% O1.4: Increase experienced independency at home by 20%
Target user group	People living at home, at housing for seniors, or communal housing, but not yet receiving medical care services. The target group excludes service houses, service apartments as well as nursing homes. The target user group is such that it is identified by the care professionals to be in risk of becoming the city social and health services clients in near-term future.
Scalability / Business model after pilot	The use case is strongly based on a commercial generic smart lighting solution that will provide the key further up-take and commercialisation path.
Progress beyond state-of-the-art	The solution is based in Philips research and a set of patents described in the partner profile (research SoTA), as well as the awarded Hue smart lighting commercial solution (innovation SoTA).

Detailed use cases	
Use cases to be implemented (known benefit; known solution)	Wellbeing management (non-medication related) - Delivering better general home comfort - Managing sleep (smart lighting for natural wakeup/wind down at evening, other solutions) - Avoiding seasonal affective disorder (especially Nordics) - Improving well-being based on circadian rhythm - Managing alertness/relaxation (smart lighting, other solutions) Functional light - Light that supports activities - Home alerts (lights, other actuators; e.g. medication reminders, mild memory problems) - Light alerts for people with hearing impairments Analysis and support Monitoring of the sensors and lighting usage, and interpretation of this data for alerts and recommendations for users, family and caregivers Interfacing component with use case A is the mobility management: how to support the motility and mobility with generic smart home solutions. Interfacing component with use case C is the communication: how could the lighting be used to deliver use case C services (messages, nudges, others) to home? Interfacing component with use case D is the tools for self-management of health: how to enable the smart home act as interface to these tools, and how the smart home can enhance the self-management of health, for example management of diabetes.
Explorative questions (possible use case implementation)	- What kind of interactions connecting with other smart home appliances can provide? - What is the interaction between health management and wellbeing? - Can the compelling smart home also deliver components of "hard-core" care?

Smart Environments

User interfaces	The user interface is the smart home (lights, buttons, actuators at home, connected home appliances), plus the services/apps that integrate to it (e.g. Diabetes Diary). Also the care-oriented interfaces (e.g. Acorn smart watches, Blindsquare navigator; menumat Smart food dispenser in Helsinki pilots) are integrated to the smart home.
Smart homes	The pilot is integrated on Hue connected lighting solution, with integration to other key background (devices at home, apps and services for wellbeing management). Smart homes include existing sites like Smart Kalasatama, new residential district in Helsinki with existing regulation to uptake smart homes (1600 residents) and new installations.
Wellbeing equipment for pilots	The following equipment is optionally to be integrated, but considered market solutions and thus are not project partners. The devices are targeted only to sub-user groups that are on related medication or control. Open call will be targeted to these, if specific integration needs arise at the service integration stage. - physical sensors (e.g. motion, temperature, light) - physiological sensors (e.g. heart rate, heart variability, galvanic skin conductance, skin temperature) - utility monitoring (e.g. electricity, water consumption) - cameras - open/close sensors, electronic locks - daylight control (e.g. sun screen - connected medication dispensers (medication reminders; Addoz, Pilloxa) - blood pressure meters - connected scales, indoor air quality meters - appliances to control home electricity lines (remote control of oven, etc)

Key components - State-of-the-Art partner background to integrate into the use case		
Hue: personal wireless lighting (Philips)	"Philips Hue lets you control your lights from your bedroom to your backyard. You can automate your lights completely to make it seem like you're home when you're not. With geofencing technology, your lights can even welcome you home or switch off automatically when you leave your home. Philips Hue can wake you up and help you energize, read, concentrate and relax. Customize your daily routines into moments you can enjoy." It works with open APIs (IFTTT), 3rd party appliances and bulbs, and Apple HomeKit, Nest, and others.	
Interfaces to other use cases	See other use case details on how the solutions in these use cases interact with this pilot. The Pilot B will be the smart home approach for several users in use case A and B who are not involved in use case D (e.g. are not cities' are customers). This is designed in the service integration stage.	

C. Connecting Community

Healthy ageing is strongly linked to the environment in which the ageing is taking place. One important component of wellbeing is to connect with the people around us: With family, friends and neighbours in the local community (New Economics Foundation, 2008). Having social relations and experience the feeling of being connected to people or places are essential to the quality of life. Viewed from a health-related perspective, social connectedness is seen as a precondition for (social) wellbeing. A societal challenge nowadays for European cities is to develop age-friendly environments that support social participation and inclusion. Connectedness in respect to healthy ageing incorporates a number of elements, including social support, social networks, social engagement. This can be supported through IoT environments and contribute to age-friendly communities and cities. The pilot provides products and services, which enable elderly to consolidate social connectedness at home or outdoors. Despite limitations of physical or mental decline, the

IoT community networks provide ways that stimulate senior citizens to stay active and connected. This pilot aims to activate elderly (socially) by providing technology that supports the human-to-human interaction.

C. Connecting Community	
Sub-objectives	O1.5: Increase the experience of quality of social contacts by 20% O1.6: Reduce the experienced loneliness by 10%
Target user group	- Active seniors in Age Friendly City neighbourhoods - Targeting both the groups of the ageing population, as well as the local community around them - 200 active seniors in Age Friendly City neighbourhoods (Amsterdam) - 50-100 elderly living within locations of Health-lab (Amsterdam) - 500-1000 seniors in 4 neighbourhoods within Manchester, co-creating solutions to combat social isolation
Progress beyond state-of-the-art	Various tablet-based social media and TV-based community systems for elderly have been a topic of applied research (e.g. Vanhat ketut, VTT 2012; Care TV). Also, there are commercial products for video communication between elderly, care and family (videovisit.com, pienipiiri.fi) that are used. However, addressing loneliness and social connectedness with IoT has very little innovation or research background that would be comparable. Adding IoT components, like sensor data, to existing services to will increase the possibilities of supporting social connectedness and decrease loneliness. Integrating accepted technology ensures the commercial uptake instead of delivering through additional hardware.

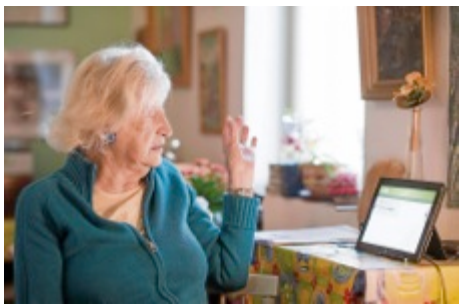
Detailed use cases	
Use cases to be implemented (known benefit; known solution)	Support social participation outdoors (Amsterdam, Manchester): - Create connectedness at specific smart places (iBeacon network, Oosterpark) - Nudge people in parks to exercise more (Bambea) - Develop IoT enabled community services for personalised wayfinding - Provide peer-to-peer support and support community networks (helping neighbours/city villages, like Wehelpen, mijnbuurtje, BUUV, Nifty neighbours and city's data and sensor infrastructure) Support social connectedness indoors: - Expand the quality of social relations (Storyville games) - Provide a feeling of being thought of by improving implicit communication with family and relatives (ambient connectedness with smart lights, Internet of Touch, Scottie)
Explorative questions (possible use case implementation; service lab innovation)	- Integration into the city villages: how can IoT support existing offline social network and involve new community members? - How can IoT services and beacons support elderly in spontaneous contacts and encounters? How to embed serendipity into IoT services and products? - What kind of "IoT-nudging" with appliances like Flic button can be arranged? - Can virtual or augmented reality enhance the feeling of social connectedness? And provide an environment where social activities can take place without the barriers of physical limitations?

Smart Environments	
User interfaces	The user interface is the smart home (lights, buttons, actuators at home, connected home appliances), plus the specific services and apps (digital games, smart home mobile Apps, mobility Apps - see use cases A, B)
Smart homes	Health-lab (several locations in Amsterdam, independent living with care services in the building - technology needs to be installed). See use case B, D.
Smart places	- IoT living lab at Oosterpark, beacon mile, bus-stops in Amsterdam (see use case A) - Concept of Thermal Winter Garden in Reykjavik - CityVerve in Manchester (See use case A)

Key components - State-of-the-Art partner background to integrate into the use case

Storyville games (Waag)	The games are designed to stimulate social connectedness among elderly and their families and friends. The games are played on the iPad as a game board. Each game can be played with 2 - 6 players. The games are on the market and will be validated in a large pilot. TRL 9	
Scottie (Waag)	The project Scottie researched the possibilities of using information and communication technology to create virtual intimacy between long-stay absentees and their primary social contact group. Non-verbal, implicit forms of communication are essential in keeping intimate relationships. The widespread technology for distant communication like SMS, chat, e-mail and telephony are all less of use as substitute for implicit and tactile real life communication within intimate relations.	
Internet of Touch (HvA)	An IoT system for enabling touch at a distance. Based on a special developed combination of layers of different fabric and a layer of vibramotors, wearable sleeves are made with which human touch can be communicated between users. The system is tested in lab situations. A variant is tested fro communication with deaf-blind persons. A small set of robust prototypes will be available summer 2016.	
IoT Living Lab (Glimworm, Amsterdam, Waag)	iBeacon network in place in Amsterdam central areas (streets, selected parks). The IoTLL Open API publishes and maintains ALL open IoT data in the city of Amsterdam. All Beacon, LoRa Beacon, Sensors and other IoT object data available on an open RESTful API. Connects to multiple IoT Cloud services creating newly linked open data. Uses state of the art IoT protocols (MQTT, others)	GLIMWORM Beacons
Other project background to integration	Bambea (see pilot A), SmartWatch (Acorn), Smart Walker (VTT), Smart Reflector (VTT), Social network platform (Gnosis), Living Lab Bus in Helsinki (VTT), Philips HUE (Philips), and other interfaces from other use cases are to be explored at service integration stage for the pilots, either locally or for all demosites.	

D. IoT-enabled virtual home care



In many European countries there is a strong drive to lower the cost of care. Substantial amount of professional eldercare could be delivered and managed remotely with the correct tools. From the user perspective, the process of non-connected care is not very user friendly, often requiring e.g. repeated visits to laboratories. On non-connected home care, substantial amount of care provisioning time goes to transport. From user perspective, the personal wellbeing/health data is rarely available and usable when in doubt, and the results of measurements are kept too often with the clinical practitioners. The emerging "Quantified Self" movement usually targets young professionals and not the elderly, and sharing of wellbeing data with friends and family is not usually technically possible in eldercare. Safe, secure and working communication between the elderly, the family and the professional caregivers is mostly missing. However, some state-of-the-art pilots like IoT-enabled home care service in Helsinki have the started to deliver the truly connected eldercare. This will be use as the baseline for the pilot.

D. IoT-enabled virtual home care	
Sub-objectives	O1.7: Increase experience of health related safety by 75% O1.8: Reduce the cost of care provisioning by 10%
Target user group	- Cities' home care customers with diagnoses that require continuous controls (either

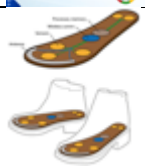
	at home, or at communal housing) - Care providers: Home care professional (nurses, social workers, alarm centers), the home care administration (improving home care but also e.g. transport services linked to care)
Scalability / Business model after pilot	The home care services piloted and ramped up in the pilot continue to be used after the project and scaled up to larger user bases in pilot cities. Also, with the replication in the local settings, and the replication sites' contribution to common planning, provide a tool for further replication after the project. The care services development in Europe is very demand-led, with strong local solution providers typically of "generic ICT company" nature, thus the key scalability for the solution will be through dissemination with the care development networks and promotion of the company partners to the other care providers in Europe.
Progress beyond state-of-the-art	There are several commercial products in specific vertical silos, for example safety alarms, fall alarms, activity trackers, pillbox controls, video visits (e.g.Philips Lifeline, Tunstall). Many of these are also using term IoT in marketing / research whereas there is very little non-trivial IoT ecosystem involved. Helsinki IoT-enabled home care service is considered to be the state-of-the-art in integrating a variety of these vertical devices into a real-life IoT service and the care processes for real life care provisioning (instead of e.g. test-bed of trial). The progress beyond state of the consist of integration of the predictive analytics (INaaS), the smart mobility components (use case A), non-care related wellbeing components (use case B), further development of MyData for the elderly, and exploration in the opportunities what the connectivity of the "normal" smart home components and wrist-based smart devices will bring.

Detailed use cases	
Use cases to be implemented (known benefit; known solution)	**The existing Helsinki IoT care solution, that will be the basis for integration & replication:** - videovisit (nurses, family carers) - remote physiotherapist (hipper, rehabilitation after hip surgery, others via video) - note: self measurement of health best practice is to have a 5 minute video visit of the nurse to discuss the results (blood glucose, blood pressure) with the normal day visit, as opposed direct connectivity of the measurement device to back-end (the care evaluation is more holistic and produces less total cost for system) - health and wellbeing data platform - safety alarms - connectivity of home care appliances (e.g. food dispensers) - generation of user profiles based on IoT data **Smart&Ageing integration to be taken:** **Smart Wearables** - Integrating the connected footpads to detect/measure charcot foot (DTU,100 users in all pilot sites) - Integrating blood oxygen level sensor to smart watch, primary target COPD patients (DTU, Acorn, 200 users) - Integrating the Smart watch, Diabetes Diary and the connected footpad to specific diabetes target group (N=200), with integration to care backend IoT **Connecting care** - self-measurement of health at home with sharing of the wellbeing data with family, friends, caretakers (Chino) - integration of the fall alarm systems (Smart rollator, DTU sensors, Smart watch, others) **Improving transport** - integration of the city's care transport service to the public transport navigator (use case A), to encourage elderly primarily use public transport instead of dial-in to city transport service (FVH), and provide real-time info of the location of the

	fleet - IoT-enabled transport service automation (interface to transport staff) - integration of frontdoor smart locks (exists) with transport driver device **Home helping coping** - visual alarms for users with hearing problems (Hue) - fall prevention with automatic, smart home lighting (Hue) - smart home helping with memory problems (going outdoor, IADL activity list including groceries, cleaning, etc) - wrist device alerts for addressing memory problems - connected pillboxes (also managing memory problems) - diabetes management in IoT environment - wrist device alerts for medical reminders **Predictive IoT-based analytics** - predictive analytics of the IoT- and smart home -based big data (Tieto INaaS), and development of use cases on analysing medication adherence, relapses, other issues
Explorative questions (possible use case implementation; service lab innovation)	- How can the smart home learn to support daily living? - How can the smart home / wellbeing big data be used for predictive analytics - What kind of interplay and smart interactions between care professionals, family carers and the elderly can take place in IoT-enabled virtual care (e.g. using Flic-type smart button devices, appliance integration, etc) - What is the role of clinical PHR/EHR systems in European wellbeing data? - How could existing rehabilitation and mental health games (digital and physical) be integrated into IoT-enabled care procedures? (Waag, Athena)

Smart Environments	
User interfaces	Smart home (sensors and actuators); Tablet-type interface for care service provisioning and specific Apps; Wrist devices (Acorn), home appliances. Care professionals' interfaces with web- and mobile-based interfaces.
Smart homes	Smart home indoor connectivity with care devices, smart home appliances. Smart watch connectivity with wellbeing sensors and the smart home. Connecting the devices with the Care back-end (Cities existing wellbeing data repositories, or Chino system where city CRM does not exist)
Wellbeing equipment for pilots	The following equipment is to be integrated, but considered market solutions and thus are not project partners. The devices are targeted only to sub-user groups that are on related medication or control. Open call will be targeted to these, if specific integration needs arise at the service integration stage. - connected medication dispensers (medication reminders; Addoz, Pilloxa) - blood glucose meters (type 2 diabetes; Mendor, Modz) - blood pressure meters - food therapeutic on-line services (Mealtracker etc) - connected scales, fridges, indoor air quality meters - appliances to control home electricity lines (remote control of oven, etc)

Key components - State-of-the-Art partner background to integrate into the use case		
Helsinki IoT virtual care (Helsinki)	In Helsinki, IoT care is already provisioned with integration of City service center CRM and care processes (providing security and home care) to smart homes of the home care customers. Integration consists of wrist device (Tunstall), robotic food dispenser (Menumat), videovisit (Videovisit). The middleware is Azure-based. In Smart&Ageing, this is used as baseline. TRL 9.	

SmartWatch (DTU, Acorn)	SmartWatch technology currently targeted applications with integrated galvanic skin response sensors and pulse sensor, to measure stress etc. Calendar function to support patients with Alzheimer's, autism spectrum disorder (asd), elderly people. Standalone solution with integrated Wi-Fi.	
Home automation solution for senior citizens (Salus)	Home automation solution with -security and safety features; -remote surveillance and controlling capability; -electricity appliance controls; -heating controls. Mobile and web clients. Open API's for integrations	
Diabetes Diary (NSE)	Personal diabetes management ecosystem (Apps, Smartwatch, iPad). 2300 downloads, 9 languages. TRL9. Apps and serious games (games currently targeted for children).	
Foot wearables to detect charcot foot, monitor activity levels (DTU)	Foot wearable integrated sensor solutions to measure pressure and temperature. Target health applications are: -diabetes: detection of charcot foot condition. -training and monitoring of elderly people: monitoring of activity level and walking patterns.	
INaaS Intelligence-as-a-Service (Tieto)	Tieto has started to develop the Intelligence as a Service concept by cooperation with its customers. The company wants to find out what the main challenges needed to be predicted based on big data and how can machine-learning technologies respond to these needs.	
Other integrations to the pilot	Fall risk analysis (VTT), Fall detector (DTU), Blindsquare (BSquare), Smart Rollator (VTT), Internet of Touch - trial (Hva) and Smart home lighting - trial (Philips) will be integrated to the use case. Each of these is described above in use case A, B or C.	

1.4.7 To enhance Cloud ecosystem and open further services around independent living

In addition to direct end-user pilots, the project will develop the digital ecosystem in the cloud for innovations for and about independent living. This will provide direct exploitability of the project data results to new services, innovations and markets beyond those addressed in the specific pilots. These include for example innovations on insurance businesses, exploitation of the personal wellbeing data on other use cases (e.g. fitness, food), exploitation of the projects smart environments - urban sensor networks for non-care purposes, and developing the big data to be available for further research purposes. Also, engaging the developer communities to further innovation on the APIs and data provides new opportunities for innovation.

These activities in the project consist of integrating the use case pilots, and the Smart&Ageing platform:

- **Thingful** (thingful.com) is a search engine for the IoT and a decentralised access service. A decentralised cloud based service for discovery and access of private and public IoT data. The architecture allows the use of a transparent client (Thingful Interchange) with open source code that acts as an equivalent of a browser in web search to search, find and request access to IoT data on the fly on a dynamic real-time basis. The Interchange client borrows data repository parser maps, access credentials and access entitlements from Thingful's search engine to dynamically request IoT data. **In Smart&Ageing**, Thingful pilots and develops a commercial grade service that will be enacted across the various use cases in the proposed pilots. The core commercial offering of Thingful will be making private and public (but not necessarily open) IoT data discoverable and accessible by managing a system of access entitlements and semantic ontologies in a decentralised cloud services architecture. Data in general and IoT data specifically is at the heart of emerging business models that are based on acquiring and utilising data from diverse and dynamic sources to power new service and product algorithms for a range of autonomous capabilities. Thingful will act as a data discovery layer for commercial external parties that have interest in the various domains of IoT data covered by the proposed use cases and pilot programmes. Data/device owners (whether individuals, service delivery organisations, commercial enterprises or cities) are also likely to be consumers of external IoT data. A many-to-many IoT data

search and access service will be provided with clear path to monetisation supported by a cloud services model for Thingful predicated on enabling data access which in certain instances will be based on exchange of economic value from the acquiring party to the data provider. This capability to potentially monetise IoT data in a highly scalable decentralised service architecture is a market leading innovation that will be developed and implemented in the project supporting use cases and pilots.

- **Chino** provides to health application developers services and tools to help them in solving security and privacy law compliance issues. It offers to developers a set of API to store, share and manage sensitive data securely. Chino API are used also to manage application users, their identity and authentication and access control. In other words Chino provides a secure Backend as a Service and Database**. In Smart&Ageing**, Chino integrates its services and provides expertise to the pilots and helps the service operators in delivering their service. Also it will develop new sets of API that satisfy the requirements in the IoT-specific service delivery, including interoperability with MyData model.
- **NORDunet big data platform and analysis tools will be developed in Smart&Ageing.** The concept of Big Data is to collect and store data from a multitude of data sources that may present little information individually. With it, observations and patterns may be found that is not seen in the individual observations, for example multiple inputs and tracking patient data over a longer time will give new insights to the health and wellbeing of users carrying e.g. a smart watch. Measuring blood oxygen levels and heart rate combined with GPS data might be enough to predict if the elderly is just changing motion behaviour or is suffering from a serious illness. Smart&Ageing investigates different methods from machine learning/AI to evaluate their usefulness in real life applications in predicting short and long-term medical conditions. Methods will be developed that raise an alert when real time data indicates that something is not right, alerting elder care or doctors to take a decision based on the severity of the data. Also, methods will be developed that estimates the wellbeing of the elderly, potentially forecasting illness and sicknesses before any ordinary consultation can conclude this.
- **Tieto** has started to develop the Intelligence as a Service (INaaS) concept by cooperation with its customers. This is a service that aggregates various data analytics to a single service point (e.g. of IBM Watson -type analytics engines). **In Smart&Ageing,** Tieto wants to find out what the main challenges needed to be predicted based on big data and how can machine-learning technologies respond to these needs. Additionally, Tieto INaaS will be integrated in the use case D smart homes and use cases will be developed together with the care providing organisations.

1.4.8 Additional reviews of the State-of-the-Art

In addition to what is described above, there are good recent reviews of state-of-the-art innovation and research projects in the domain of smart ageing: AIOTI WG5 report from 15.10.2015 (www.aioti.eu) and review of the EU-funded projects in ICT for Ageing Well (European Commission, March 2016). These are not repeated here for brevity. From the EU-funded project catalogue, internet of things is specifically addressed only in RADIO (robots in assisted living environments) and I-Prognosis (addressing Parkinson's disease), however many of the EU projects address some IoT components (wireless insoles or fall detectors). From the EU-funded projects, Smart&Ageing exploits the state-of-the-art (VTT Smart Walker, BSquare, DTU/Acorn Smartwatch, Diabetes Diary), or solutions comparable to state-of-the-art (DTU Fall detector). The AIOTI report has substantial merit in developing a holistic approach to define the field of IoT and ageing, but it lacks in analysis and identification of most of the innovation and research taken in the Northern and German-speaking Europe, as well as identification of the state-of-the-art that already exists and is in use in the public sector in Nordics. Also, some of its suggestions are more suitable for the large health-tech industry organisations than for the ecosystem as a whole, and the absence of participation of the end-users and care providers from the analysis is explicit.

2. Impact

2.1 Expected impacts

The expected impact of the work programme Horizon2020 IoT-1-2016, pilot 1, is high on several levels: on citizens, on business and on the public sector. How the project delivers the expected impacts are specified in 2.1.1--2.1.6. The expected contribution to the work programme details, is as follows:

Expected impact	Contribution	See chapter
High impact on citizens	Ambitious objectives for target groups, O1.1--O1.8, with pilot of 875 smart home, 1780 other users	1.1.1, 2.1.1
High impact on industry and businesses	Delivery of common business ecosystem that has ambitions towards Silver Economy global markets	1.1.3, 1.4.3
High impact on public services	Ambitions objectives for target groups from health care provider/payer perspective, further scale-up paths identified and committed to	1.1.1, 1.3, 2.1.1
KPIs should be identified	Each use case defines specific KPIs regarding user and health system value. IoT KPIs are defined in 1.1.2--1.1.3	1.4.6; 1.1.1--1.1.3
Impact should go beyond involved partners, aim at influencing external communities	Project focus is linking two central European platforms: open IoT development, and independent living development, and with aim to contribute to changes in these communities (care services, IoT standards)	2.1.4., 2.1.5
Validation of technological choices, architectures, interoperability, security, privacy	Validation of choices in Integration stage with smaller batch of end-users and then in field trials, in total of 6 countries covering most of European eldercare models.	1.1.1, 1.4.4, 1.4.5
Exploration and validation of new industry and business models	Developing and delivering of the ecosystem business model for the solution.	1.4.3, WP2, WP8
User acceptance validation addressing privacy, security, identification of user needs	Validation of choices in Integration stage with smaller batch of end-users and then in field trials, in total of 6 countries covering most of European eldercare models. Having design-driven approach with integrating the end-users, technology developers, care personnel, social scientists.	1.1.1, 1.4.4, 1.4.5
Significant, measurable contribution to standards or pre-normative activities via open platforms	Strong contribution and direct link to standardisation in The Open Group, FIWARE, OASC, and pre-standardisation through Select4Cities, BIoTope, and other.	2.1.4
Improvement of citizen's quality of life, in public and private spheres	Ambitious objectives for each of the use cases, with all use case pilots addressing improvement of the quality of life from the citizen perspective.	1.4.6, 1.1.1
Creation of opportunities for entrepreneurs	Consortium consists of 8 start-ups, and open calls activate further start-ups. Open platform approach enables easy further entrepreneurship activation into the platform.	3.3, WP1, 1.3.4
Development of secure and sustainable European IoT ecosystems	Strong contribution through up-take of state-of-the-art privacy and security models.	1.4.2
Contribution to IoT infrastructures viable beyond duration of pilot	Project builds heavily on existing IoT infrastructures where the IoT infra sustainability already exists (e.g. existing smart home, existing IoT infra at outside). Project will strengthen the sustainability of these by bringing in specific added value use for these infrastructures.	use case A, D
Show clear evidence of benefits of the solutions for active and independent living and QoL of older persons	The project was designed from benefit perspective, starting from benefit expectations already defined and identified (1.3.3), and scouting on solution partners to answer these. KPIs are identified (1.4.6) and measured (1.3.8)	1.3.3, 1.4.6 (define), 1.3.8 (measure)

2.1 Impact delivery (tentative dissemination and exploitation plan)

2.1.1 Impact to life quality of populations at the demosites

Within the target groups, compared to the local control demographics in the pilot sites, the pilots will lead to reaching the following impact. The tentative measurement of the impact is taken at ex-ante and ex-post pilot evaluation. The specific aims for post-project impact are:

- Increase in the days in home of the users before moving into care facility
- Increase the evaluated independence and quality of life
- Reduction of the home care provisioning costs
- Reduction the costs of special transport targeted for the frail elderly

The project builds on leveraging existing investments in age-friendly cities, IoT infrastructures and virtual care. This provides key sustainability and up-take path for the project results, as the integrated pilots land directly on real life. As examples, Helsinki Smart Kalasatama smart homes investment size is 20M€ by 2035 and CityVerve is 12M€ investment 2016-2017 into IoT demonstration in Manchester. Cities total investments to development of virtual care and age-friendly programmes these pilots will be part of, are much larger.

Partner	Exploitable result	Planned further use of the exploitable result
AMSTERDAM	Connecting community pilot	Embed the project operations into service delivery and integration of results into policy and municipality departments and care/welfare organisations (as contracted by municipality)
FVH	Mobility navigator	Up-take for all residents in Helsinki, and beyond (currently works in 6 cities)
HELSINKI	IoT home care pilot	Establish the project results and solutions into normal remote home care processes of all population receiving the virtual home care.
MANCHESTER	Personal wellbeing platform	Currently being developed for the general population, it will be adapted for the needs of seniors, providing a new service/application that can be “prescribed” widely as part of the Greater Manchester Health/Social Care devolution and then adapted in other cities.
MANCHESTER	Personalised Wayfinding	Developing the community-based care solutions by adding a technology layer, which can provide easy scaling of solutions and can improve delivery of services within communities.
REYKJAVIK	IoT home care pilot	Set up remote home care service for the elderly residents. Permanent fully functional test lab. IoT solution in all City’s service apartments and apartments owned by the Society of the Elderly. As the largest and leading municipality in Iceland regarding developing of welfare services the remote home care service will be multiplied in other Icelandic municipalities.
LAMIA	Beacon network	Extension and enhancement of the existing outdoor beacon network to augment the quality of provided transportation services and cover the mobility needs of all citizens of the Municipality.
LAMIA	Help at Home	Enhancement of the Help at Home service to achieve long-term sustainability and to adequately fulfil the needs of more beneficiaries
LAMIA	Center for the Daily Care	Gamification of care services to achieve greater participation and eventual impact. Modernization of services towards mitigating loneliness and support social inclusiveness for the elderly.
ATHENA	Play&Learn	Adjustment of the board game as a tool for cognitive assessment of the elderly and for implementing brain exercises. The game will be utilized to increase public awareness on mental health and social care issues by collaborating with other entities on a national level.
ALBERTSLUND	IoT home care pilot	Implement the project results and solutions into normal remote care processes of all population receiving the virtual home care. Also implementing the full IoT solution in the municipality’s own public nursing centre.

2.1.2 Packaging the project results a joint offering for global markets

One key objective of the project is to create a "joint offering" of the supply side - a modular, ecosystem business model that enables the partners together and separately engage into further commercial activities. Here the target is the global Silver Economy market: 1) 85 million consumers over 65 that together have 3000B€ of wealth currently, which is addressed in use case B and A; and 2) the care market, with European care costs over 1.000B€ annually, which is addressed in use case D and C.

Ecosystem business development is taken in the project, in which for example additional foreground and background IP sharing or licensing is negotiated. The aim of the consortium is to produce joint future business offerings, where licensing models for the IP of both foreground and background plays a key role. A modular open business model is an easy market opener- both as a holistic package, and through single solutions that act as market entry spearheads for other components as well. The specific impact objectives are:

- Joint declaration of shared vision for the European health care IoT made with 20 relevant health and wellbeing platforms and communities
- Development of scalable model for health and wellbeing related IoT ecosystem management and IPR management
- Generate a user manual/ handbook for organizing health and wellbeing IoT pilots and demonstrations

2.1.3 Further results exploitation by each supply side partner

The market delivery of the solutions is as follows:

1. The integration of the use cases contains components that exist in the market with the end-users. Both the existing users, and the existing sales channels for these products, act as direct market uptake pathway.
    a. By adding IoT features to some services, these services become more compelling to the end-users and attract also new user bases (examples: Blindsquare, Diabetes Diary).
    b. By developing features for the elderly and the care, some general IoT products become more compelling to these user groups, and allow for production of specific value added versions of the products for these user groups (examples: Hue, Glimworm)
2. Emerging markets for IoT Care
3. Emerging IoT markets that come via alignment of the future European IoT ecosystems
4. Commercialization of the close-to-market research results

Partner	Exploitable result	Planned further use of the exploitable result
FVH	Mobility navigator for elderly	Up-take for all residents in Helsinki, and beyond (currently works in 6 cities including Amsterdam and Manchester). The Helsinki mobility navigator is open source and at github for anyone to exploit.
GLIMWORM	iBeacon Street Network	Validation of urban connectivity platform in 4 cities provides references for scalability and replicability of the solution in further markets
BSQUARE	Blindsquare new IoT features	Deliver the new features to the full Blindsquare user base (currently 15000 users in 150 countries) (visually impaired). New user target groups (elderly) for Blindsquare app in the existing Blindsquare countries.
SALUS	Interoperability of the smart home solution	Further uptake of the interoperable smart home system, also to the existing non-care customer base, where for example mobility and wellbeing features of the project would also be compelling.
SALUS	Slipperiness sensor system	Commercialization of the results to further markets in the Nordic
NSE	Diabetes Diary IoT features	Deliver the new features to Diabetes Diary user base (4600 downloads in Norway and Czech in App stores, 480 downloads in Pebble store).

		New language support (Greek and Dutch) for Diabetes Diary.
VTT	Fall risk identification	Provide evidence of reliability of the algorithm, and negotiate with interested parties about commercialization.
VTT	Smart reflector	Maturation of the business concept for the elderly target group
VTT	Smart rollator	Create evidence of the rollator as health monitoring tool, and support the commercialisation process with project results.
VTT	Living Lab Bus solutions for elderly	Conceptualize smart technological framework for public transportation, and create evidence of replicability and market potential of the IoT bus solution.
DTU	Connected footpad	Integration and commercialization of the smart footpad, oxygen measure, fall sensing technologies
PHILIPS	Independent living innovations	Deliver the results to international markets via the uptake pathway of several million already sold Hue units and existing market channels.
WAAG	Smart community network	Advanced commercialization of the connected community services and under take further unrolling of the pilots to other cities/regions.
WAAG	Sensor data routing platform	Expand the products and service to the (open) platform
GNOSIS	IoT4All for ADL monitoring	Increase in the TRL level, validation of value, exploration of commercialization opportunities
GNOSIS	Smart Safe&Sound alerting system	Extension of features to the current user base, adjustment for new vertical target audiences (seniors) and further internationalization.
GNOSIS	Social networking platform	Adjustment and replication for new vertical target audiences (seniors) and use cases and further internationalization.
THINGFUL	Project data integration and common business models	Business models to potentially monetise IoT data in a highly scalable decentralised service architecture is a market leading innovation that will be developed and implemented in the project supporting use cases and pilots.
ACORN	Blood oxygen level sensor into smart watch	Exploit the new sensor i) in further care and health markets, where this can be used, and ii) in the professional sports and wellbeing markets where the Acorn device has specific user groups
NYHERJI	Home care services and solutions	Develop product offering for existing and new clients in Nordic countries.
CHINO	Chino health vault with IOT features	Integration of the IoT features into products
TIETO	INaaS for home care	Validate the value of predictive analytics engine and service in the context of home care of the elderly. Package product for further markets.
RoT	Personalised Wayfinding	Full service solution for improving mobility in local communities, enabling testing of different technology solutions and roll out to a wider population.

2.1.4 Advancing the development and consolidation of IoT architectures, beyond of the project

Smart&Ageing delivers impact to the European open IoT ecosystems, platforms and architectures development with the following direct channels. For all of these, this means:

- Aligning the on-going and future European IoT development to the needs of the elderly and care providers, and requirements and ambitions laid out in this project

- With the alignment of the Smart&Ageing solutions to these ecosystems, ensure the long-term viability of the project partners' solutions in the emerging IoT landscapes
- With the harmonization of the enabling platforms provide good kick-off for the European digital single market for IoT-enabled health and ageing solutions
- Ensure the interoperability of non-care oriented European IoT solutions to the Smart&Ageing solutions (e.g. energy-related smart home APIs)

Community, in which future IoT architectures are developed in practice	**Partners**, in key roles in these communities	Specific dissemination and impact
FUTURE INTERNET PPP	Future-Internet PPP: Aalto CKIR is the Coordinator of FI-PPP collaboration platform project CONCORDE.	Delivery of ecosystem, platform, architecture to FI-PPP; alignment; ensuring two-way connections from FIWARE health activities.
OPEN & AGILE SMART CITIES	OASC: FVH is a founding member of Open and Agile Smart Cities.	OASC Harmonizes APIs between smart cities. Contribution to OASC on API harmonization and further uptake path of platform, architectures in other cities.
FI-WARE Open APIs for Open Minds	FIWARE: Several FIWARE developers (NSE, BSquare, Philips) and FIWARE Accelerator (FVH), companies from FI-STAR, CREATI-FI	Integration of relevant results into FIWARE, providing substantial contribution to FIWARE Health components, *based on realistic hands-on understanding of FIWARE opportunities and technology maturity issues.*
CitySDK	CitySDK: FVH (coordinator and founder of CitySDK), Waag (technology lead on CitySDK LD platform).	CitySDK Harmonizes APIs between cities and provides tools for multi-city developers. Delivery of API specifications to CitySDK.
AIOTI ALLIANCE FOR INTERNET OF THINGS INNOVATION	AIOTI: Members Philips, FVH (WG2, WG3, WG5)	Providing experiences and project selections to the AIOTI collaboration.
bIoTope BUILDING AN IoT OPEN INNOVATION ECOSYSTEM FOR CONNECTED SMART OBJECTS	Aalto (coordinator of BIoTope project), FVH (partner of BIoTope).	Delivering use cases for the platform development of the ICT-30-2015 projects (BIoTope). Integrating BIoTope smart home pilots in Helsinki.
IoT European Platforms Initiative	IoT EPI, the initiative linking the ICT-30-2015 projects (BIoTope: Aalto, FVH).	Deliver architecture, components, and solution partners to the IoT EPI community for further exploitation.
eit Digital	EIT Digital: VTT, Aalto, Philips, FVH are partners and have common EIT projects.	Providing further piloting platforms for EIT community, new products and collaboration. Aligning future EIT actions and collaboration.
THE Open GROUP	The Open Group: Aalto/Kary Främling is chair of The Open Group IoT Work group.	Contributions to, and leveraging from O-DF, O-MI, other work in The Open Group IoT WG.
council	The IoT Council: founder RvK (is FVH subcontractor to ecosystem task).	Contribution to IoT Council developments, and direct linkage to IoT-A ecosystem RvK is managing.
CITY keys	CITYKeys is coordination and support action to Smart City Lighthouse (SCC-1) projects, for which it develops and validates KPIs for smart cities. VTT is	Ensure the alignment of KPIs and architecture between energy- and living quality-related coordination of smart cities in EU, and KPIs (e.g. smart homes is central topic in SCC-1 Lighthouse

	coordinator of CITYkeys.	projects).
cityverve	CityVerve is a 12M€ InnovateUK-funded "UK IoT Demonstrator" spearhead programme for the IoT in Manchester.	Integrating the CityVerve technologies to the pilots. Delivering components for independent living to the CityVerve IoT ecosystem.

2.1.5 To advance the development of smart independent living in Europe

Smart&Ageing will provide impact to the development platforms that are around independent living and care development in the Europe. For all of these direct channels of dissemination, this means

- introducing the IoT as viable, cost-effective and innovative solution to improving care
- aligning the on-going and future European development of the independent living to the needs, requirements and opportunities laid out in this project
- providing direct further market opportunities for the supply side partners

Community, in which future IoT architectures are developed in practice	**Partners**, in key roles in these communities	Specific dissemination and impact
age friendly cities and communities in practice By local communities, for local communities	Amsterdam, Copenhagen, Manchester, Reykjavik are WHO Age-Friendly Cities.	Parallel development of WHO Age-Friendly Cities procedures and best practices; integration of IoT into Age-Friendly Cities
European Network of Social Authorities	Helsinki project partners are active member at ENSA.	Direct dissemination of project results to the ENSA community.
EURO CITIES	Amsterdam, Helsinki, Manchester. Helsinki is the chair of Innovation working group. Manchester project partner is the chair of Smart Cities working group.	Direct dissemination of results into the working groups. Alignment of Eurocities further collaboration.
Nordic Independent Living Challenge	Copenhagen, Helsinki, Oslo, Reykjavik and Stockholm.	Through the competition new solutions are being developed for the elderly and disabled people in the Nordic countries order to make it possible for them to live independently in their home.
norden	Various Nordic Health and Wellbeing collaboration projects between the cities within Nordic framework, for example CONNECT project with 10 Nordic municipalities and 7 national authorities.	CONNECT identifies a complete process on how to work with welfare technology. It creates a complete toolkit, equipped with "Best Practice" tools for each identified step in the process.
EIP AHA	Albertslund (2015), Amsterdam, Helsinki and Laurea (2016).	Contribution of results to EIP AHA Action groups.

In addition, there is a vast amount of local, national and regional networks, including Copenhagen Healthtech Cluster (DTU and Albertlund members), 6Aika Finland (FVH coordinates), FinEst Twins Smart Twin City Helsinki-Tallinn (FVH partner), Smart Citizen lab community, Make Health Meetup community (Waag) and others.

2.1.6 Barriers and obstacles to impact

The challenge facing IoT is not so much the technology and hardware itself, but the interoperability of IoT solutions. To integrate the various IoT-solutions for independent living seamlessly with one another, openness is one of the key challenges. Commitment to open solutions is necessary to gather critical mass. However, this requires high-level decisions for inter-organizational collaboration to achieve open standards. Engineers and developers need to design beyond their own device, application or infrastructure. One of the potential obstacles is that likely not all suppliers are able to take this step. The project approach to mitigate this risk is the use of open standards and commonly agreed interfaces, and build the business and technology ecosystem in a modular way. This means that no single supplier becomes crucial for project impact. Open calls in the project, and ecosystem development parallel and after the project, can bring in competing and complementing suppliers.

Another key challenge is to deliver synergetic and inclusive solutions to create value and optimize adaptation by the users. To ensure inclusiveness, co-designing solutions with the end-users is relevant. So, a person-centred approach to developing and engineering IoT-solutions is required. If not, ill-designed, unappealing user interfaces, security threats and deployment complexity are the result. Reviews have shown that these require significant technical support from IT personnel to keep the home based systems operational for daily use. The project approach to mitigate the usability risk is the use of design methods in the integration stage, and have the pilot interfaces based on "commercial-grade", and awarded, user interfaces of suppliers.

One key specific barrier is the real and experienced privacy and security. Part of the problem is that IoT devices tend to be relatively basic. In trivial installations this is not an issue, but after connecting to the internet and production systems, both privacy and security are become targets of unintended and intended breaches. This is especially true in the context of health and wellbeing. The project approach to this is pragmatic: On technical level, "Injecting" a layer of state-of-the-art privacy and security features to the integrated platform, and the components it consists of. On processes level, using the experiences and practices of the current IoT-enabled virtual home care in Helsinki, where some of the issues are solved in practice (e.g. monitoring screens displaying status of IP-link to each care customer home) and some of the issues to be are identified (e.g. missing technical security of some layers that enables easy "hackability").

2.2 Tentative communication plan

In addition to the specific dissemination channels and targets detailed above, Smart&Ageing will provide various types of communication and dissemination materials, ranging from traditional project brochures and reports to blogs, social media posts and videos. Table below provides greater emphasis on what types of channels will be developed and tailored to different target audiences (six Categories A to F being targeted). Greater details about each dissemination channel is provided below:

	Category A *Industry stakeholders*	**Category B** *Regulation authorities*	**Category C** *Academia*	**Category D** *Cities & Municipalities*	**Category E** *Citizens/ General public*	**Category F** *Standardization bodies*
Website	x	x	x	x	x	x
e-Newsletters	x	x	x	x	x	
Social media	x	x	x	x	x	
Flyers/Posters	x	x	x	x	x	
Scientific articles; white papers	x		x			x
Workshops, Hackathons	x		x	x		x
Study visits and training	x	x	x	x	x	
Videos				x	x	

- **Website**: a website dedicated to the project will be designed and developed. This work amongst others requires the initial content collection from all the partners in the consortium, the creation of additional

content related to the project, the regular content update, based on the communication, interaction and feedback provided by the other partners

- **e-Newsletter**: A newsletter in electronic format will be regularly sent out to interested stakeholders on a subscription basis, which will be managed through the Smart&Ageing website. This newsletter will summarise and report on significant intermediate results, press releases, and others.
- **Study visits for external experts:** A study visit programme will be arranged, that arranges two 2-day demosite field visit at each demosite, each field visit targeting 15 external experts on IoT and ageing. The study visits are promoted with the channels above and are available for limited numbers of external experts only.
- **Social media**: Smart&Ageing will exploit national and international media to disseminate the project results and progress to a wider range of public awareness and impact. For instance, different types of social networking websites to target distinct end-user communities will be used, e.g. Linkedin, Twitter
- **Flyers/Posters**: This dissemination material will be used in large events or public events in order to communicate about the overall Smart&Ageing goal, consortium and scheduled events
- **Scientific articles and white papers**: Smart&Ageing partners, academic and industrial, will pursue dissemination activities in international refereed scientific & technical international journals (IEEE Internet of Things Journal...) and conferences (IEEE Conference on Future Internet of Things & Cloud, International Smart Cities Conference, IEEE World Forum on Internet of Things, ...)
- **Workshops, Hackathons**: Smart&Ageing partners will participate to public and industry exhibitions and demonstrations, including hackathons, Apps challenges, and major EU workshops. Furthermore, Smart&Ageing will organise its own workshops and events, as well as panel discussions;
- **Videos**: Video editing will be carried out and posted on website such as Youtube in order to exhibit Smart&Ageing objectives, demo-site pilot activities and the demonstrators/pilots

Effectiveness of the dissemination activities will be continuously monitored and adjusted based on both the project KPIs, but also based on the dissemination KPIs. A DCM (Dissemination and Communication Manager) is appointed, who will manage and coordinate the dissemination activities within different work packages. We have chosen this approach so that communication takes place in the work packages immediately by the people who do the innovation work. At the beginning of the action, the DCM will create a dissemination plan in collaboration with all beneficiaries to identify different audiences and means to dissemination tasks. The plan will be compatible with the protection of IPR of IoT solutions providers/developers, and in respect with the ethics and privacy regulations in order to ensure the protection and security of citizens data, and overall confidentiality obligations. Smart&Ageing will develop a dissemination calendar, which will be regularly updated. This includes European level workshops and events of relevance, local events to mobilise communities and industry in the pilot demo-site cities, and the scientific community involved in IoT and related fields.

The channels detailed in 2.1.4 and 2.1.5 provide the key channel and target of the dissemination, with the events, workshops and publications from these forums. These include for example EIP IOT, FIWARE, OASC, The Open Group, Nordic Innovation, EIP AHA, ENSA, EIT Digital events, workshops, seminars, publications and meetings. In addition, the following of already identified additional targets:

Market-oriented dissemination channels	Academic-oriented dissemination channels
- IoT Council (theinternetofthings.eu), FVH/RvK/IoT Council, founder - The Internet of Things Linked in (8000+ users), FVH/RvK/IoT Council, group founder - Over 60 IoT conference partnerships with IoT Council - Smart City World Expo and Congress 2018, 2019, 2020 (Helsinki stand, FVH typically has 2-3 presentations at the congress programme) - Panhellenic Exposition at Lamia (Gnosis) - Several / Mobile Word Congress 2018, 2019, 2020 (Several) - 4YFN 2017, 2018, 2019, 2020 (Gnosis) - Gate21 Global Smart City Conference (DTU)	- HICCS Conference on computer systems, January 2017 (Aalto) - ECIS, European Conference for Information Systems, June 2017 (Aalto) - ITS Europe, ITS World Congress, 2017, 2018, 2019, 2020 (VTT) - Patient@home conferences. (DTU) - Med@Tel (DTU) - Special sessions in the ISPIM and ENoLL conferences 2018, 2019, 2020 (Laurea) - INTED (International Technology, Education and Development conference) (Laurea) - Finnish Telemedicine and eHealth association conference. (Laurea)

- DOLL Conference: Greater Copenhagen Smart Solutions (DTU) - Special issue(s) in the domain of business (marketing, management) and innovation) e.g. Technology Innovation Management Review with the theme of Ecosystem business models and value designs in IoT (Laurea) - Technology Innovation Management Review, Journal of Business Industrial Marketing, Industrial Marketing Management, International Journal of marketing, Service Management Journal etc. (Laurea) and others	- EMBC conference: Annual International Conference of the IEEE Engineering in Medicine and Biology Society, http://embc.embs.org/2016/ (VTT) - Publication targets at IEEE Internet of Things Journal (IoT-J) (DTU, VTT, Aalto) - IEEE International Smart Cities Conference (ISC2) Proceedings (DTU) - Paper for Design and Emotion conference (Waag) - Paper for Design + Research + Society conference (Waag) - Paper for Medicine 2.0 (Waag) and others

3. Implementation

3.1 Work plan

3.1.1 Project stages

Project consists of the following stages: **Initiation**, which is pre-proposal stage and will be completed with the signature of Grant Agreement and Consortium agreement. **Then starts the Work Package 2 with Platforms integration and harmonization**, which consolidates and integrates the IoT platform and facilitates the harmonization from business and technical perspective. WP2 is the focus of this work, and it will deliver the technical platforms interoperable for service design and integration. **Following, Work Package 3, Services Design and Integration**, in which each use case pilot is assembled and integrated; first with lead pilot in each demosite, and then with replication pilots in each demosite. The integration is taken in local Service Integration labs with a small patch of lead users, and iterative, agile process is used. The work package 3 ends with services and their components ready-to-ramp-up at each demosite. All of the technical and development work at the WP3, and there is a technical gate that evaluates the operational capability.

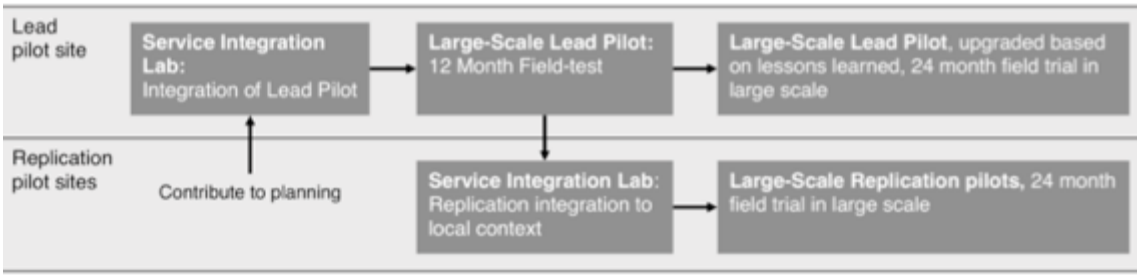
Pilot are in operative stage in Work Packages 4 to7, in which the use cases are piloted with large-scale end-user group, and the results are measured and monitored. Lead pilots start the pilots in each demosite, and replication pilots follow them. During pilot stage no major feature improvements to the services are made. As the work responsibilities turn to piloting organisations, the supply-side partners begin **Impact Management at Work Package 8**, in order to develop further the joint and specific business opportunities.

Finally, the results are evaluated, pilots are either shut down or transformed to normal operations, and the lessons learned are gathered and communicated. The ecosystem facilitation is visited, and further exploitation opportunities are identified.

3.1.2 Lead-Replicate piloting model

In order to demonstrate and ensure the transferability of the innovations, a lead-replicate model is used. The model was originally developed by FVH for the awarded CitySDK ICT PSP CIP-project, and later has become a de-facto requirement for many EU smart city programmes. It is a structure that drives towards thinking about replicability in the pilot planning, both from the supply and the demand side perspectives. It is also a framework for explicitly learning from the pilots and differences between the pilot sites. First, the use case is developed to an up-take ready condition at one demosite in "Lead Integration". Then, the Lead pilot field trial starts in this demosite. Parallel to this, and collecting learnings from the Lead pilot, Replication pilot sites start to integrate the use case towards the local context (languages, local API environment, local service system, possible changes of component suppliers). With this process also the Lead pilot is upgraded. Finally, both the upgraded Lead pilot and the Replication pilots are run, all parallel, in both Lead and Replication sites. From health effect perspective, the lead pilot provides the validity measurement of the intervention, and the replication pilots provide the reliability measurement of the intervention. The use case work package leaders are responsible for leading the service integration in both Lead and Replication sites, providing knowledge transfer. Also, the serial scheduling of pilots in integration labs means the same local

project persons accumulate knowledge of the separate pilots, providing maximum exploitation of common components, accumulated user knowledge, interoperability and overlapping areas. Also, it provides means to link the use cases on their overlapping parts.



Smart&Ageing	Lead	M1	M4	M7	M10	M13	M16	M19	M22	M25	M28	M31	M34	M37	M40	M43	M46	M49	M52	M55	M58	M60
WP1: Coordination, management, communication	**FVH**																					
T1.1: Project management and administration	FVH	D1.1	D1.2			D1.3				D1.3				D1.3				D1.3				D1.3
T1.2: Quality and performance monitorng	FVH		D1.4																			
T1.3 Open call to integrate additional components and services	FVH				D1.6				D1.6					D1.6								
T1.4: Financial management and extender partner budget	FVH											D1.5										D1.5
T1.5: Communication	FVH		D1.7			D1.8				D1.8		D1.7		D1.8				D1.8				D1.8
WP2: IoT Ecosystem and Platform Harmonization	**Aalto**																					
T2.1: Ecosystem business model development	Aalto		D2.1	D2.1				D2.1														
T2.2: IoT Architecture and integration specification	Aalto		D2.2	D2.2				D2.2														
T2.3: Hands-on IoT developer ecosystem mgmt	FVH/RD							D2.3														
T2.4: Specification and integration of IoT MyData Model	Aalto		D2.4			D2.4		D2.4														
T2.5: Harmonization and interoperability toolkit	Waag		D2.5			D2.5		D2.5														
T2.6: Interoperability development and governance	Aalto					D2.6		D2.6														
T2.7: Functional features development	DTU				D2.7			D2.7														
WP3: Services Design and Integration	**Laurea**																					
T3.1: Preparing for service design	Laurea			D3.1..	D3.4																	
T3.2: Lab operations	Laurea										D3.10											
T3.3: Design&Integration of Empowering Eveday Mobility	VTT							D3.5			D3.5											
T3.4: Design&Integration of Independent Living at Smart Home	Philips							D3.6			D3.6											
T3.5: Design&Integration of Connecting Community	Waag							D3.7			D3.7											
T3.6: Design&Integration of IoT-Enabled home care	FVH							D3.8			D3.8											
T3.7: Design&Integration of cloud based services	Thingful										D3.9											
T3.8: Ethics evaluation of the pilots	Laurea							D3.11			D3.11											
WP4: Empowering Everyday Mobility	**VTT**																					
T4.1: Ex ante and ex post evaluations	Laurea								D4.1											D4.7		
T4.2: Lead pilot in Helsinki	VTT									D4.2										D4.2		
T4.3: Replication pilot in Amsterdam	Amsterdam												D4.3							D4.3		
T4.4: Replication pilot in Manchester	MCC												D4.4							D4.4		
T4.5: Replication pilot in Reykjavik	Reykjiavk												D4.5							D4.5		
T4.6: Replication pilot in Lamia	Gnosis												D4.6							D4.6		
WP5: Independent Living in Smart Home	**Philips**																					
T5.1: Ex ante and ex post evaluations	Laurea								D5.1											D5.6		
T5.2: Lead pilot in Reykjavik	Reykjavik									D5.2										D5.2		
T5.3: Replication pilot in Amsterdam	Waag												D5.3							D5.3		
T5.4: Replication pilot in Helsinki	FVH												D5.4							D5.4		
T5.5: Replication pilot in Lamia	Gnosis												D5.5							D5.5		
WP6: Connecting the Community	**Waag**																					
T6.1: Ex ante and ex post evaluations	Laurea								D6.1											D6.6		
T6.2: Lead pilot in Amsterdam	Waag									D6.2										D6.2		
T6.3: Co-lead pilot in Manchester	MCC									D6.3										D6.3		
T6.4: Replication pilot in Reykjavik	Reykjavik												D6.4							D6.4		
T6.5: Replication pilot in Lamia	Gnosis												D6.5							D6.5		
WP7: IoT-Enabled Home Care	**FVH**																					
T7.1: Ex ante and ex post evaluations	Laurea								D7.1											D7.6		
T7.2: Lead pilot in Helsinki	FVH									D7.2										D7.2		
T7.3: Replication pilot in Reykjavik	Reykjavik												D7.3							D7.3		
T7.4: Replication pilot in Albertslund	Alblund												D7.4							D7.4		
T7.5: Replication pilot in Lamia and Athena	Lamia												D7.5							D7.5		
WP8: Impact management	**Aalto**																					
T8.1: Ecosystem business model consolidation	Aalto										D8.1		D8.1								D8.1	
T8.2: Commercialization and integration by each partner	Philips										D8.2				D8.2							
T8.3: Dissemination to IoT ecosystems and platforms	Aalto										D8.3				D8.3							
T8.4: Lessons learned by project partners	Demos																		D8.4		D8.4	
T8.5: Impact analysis	Laurea																		D8.5		D8.5	
T8.6: Dissemination to academic and research communities	Laurea																			D8.6	D8.6	
T8.7: Dissemination to independent living development	Reykjavik																					
T8.8: Futures landscapes for IoT and ageing	Demos																			D8.7	D8.7	

WP n:o	1		Lead partner:	FVH	Start date:	M1	End date:	M60
Title	Coordination, management and communication							

N:o	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Short name	FVH	Aalto	Laurea	Philips	Waag	VTT	Alblund	Amsterdam	Athena	Helsinki	Lamia	MCC	Reykjavik	MMU	HVA	DTU	Nyherji	Glimworm	Gnosis	Thingful	Chino	NSE	Nordunet	Salus	Acorn	RoT	BSquare	Demos	Tieto
PM	72	12	6	6	9	6	6	9	2	6	6	2	6	2	2	2	6	8	2	5	2	2	8	2	2	2	2	8	2

Objective(s) of this work package

WP1 overall defines the project vision, quality procedures and management actions for resource-efficient and timely management of Smart&Ageing activities. WP1 produces regular financial and operation reports on the project progress, and ensure the project activities conform to the EC requirements, the Grant Agreement (GA), the Consortium Agreement (CA) and best practices. WP1 goals include: - enabling the committed partnership of all consortium partners to the common activities and decision-making; - provide leadership regarding the project execution; - enable the content implementation WPs to deliver their results, all things considered and all risks managed; - ensure all activities conform with the highest ethics, security and privacy standards; - manage all communications between the EC and the Consortium; - provide quality control for all project partners in their reporting;- manage the processes of start up and closing of the project. WP1 also defines and implements good general communication about the project.

Description of work

Roles:

- FVH is the project coordinator and this WP Leader. It is responsible for the overall quality of the management procedures and people.
- Demos is responsible for the communication planning, project material, digital communication during the project, and events
- WP Leaders are responsible for the management of the WPs: the internal communications, controls of task execution, synchronization of activities, the quality of the deliverables, the communication between the common steering structures and the WP, and creating detailed activity plans (stage plans) for each project stage.
- Task Leaders are responsible for managing the execution of the task: the internal communications, breaking down of the tasks, delivery of sub-tasks to execution, controls, synchronization, issue solving, quality of deliverables and communication within the work package between the tasks.
- Each partner is responsible for executing the work as planned and reporting according to the GA and CA.

Task 1.1 Project Management and Administration, M1-M60 (FVH) (all partners contribute)

This task is based on the DESCA project management model (presented more exhaustively in section 3.2.1) and will consists of a series of tasks including: a) Managing project meetings (preparation, coordination, documentation); b) Controlling deadlines and delivery dates; c) Producing management documentation; d) Performing quality control and risk management; e) Resolving issues and conflicts; f) Acting as the liaison point of contact with EU; g) Managing partner and stakeholder enquiries. To implement the trusted project management methodology, the PM will deliver a project management plan in a form of handbook for the project partners. The workflows of the different WPs and their interdependences will be designed during the first month of the project. FVH will set up an online workspace using the collaboration platform PODIO.

The project manager will organize twice a year a general meeting with all partners, including the Executive

board, and the Ethics Expert Advisory Board (EEAB). Monthly conference calls with the WP leaders and ad-hoc conference calls will be conducted. This task includes the preparation of any modifications to the Description of Work required due to changes to the project as a result of annual reviews, partnership changes, or external factors.

Task 1.2 Quality and Performance Monitoring, M1-M60 (FVH) (all partners contribute)

Quality and Performance monitoring controls performance in the fundamental areas of budget, schedule, and quality, and addresses the monitoring, measurement and management of the project's scope, partner satisfaction, and the interdependent team relationships. Quality Assurance is the joint responsibility of all partners and will be applied at all levels of the project activities. To ensure the high quality of the project results, the Project Manager will deliver and implement a quality and risk-monitoring plan for the time of the project. Performance indicator monitoring will be defined to measure project's operational performance, as well as project's progress towards its objectives. The detailed risk analysis for each WP will be conducted in the early stage of the project in close collaboration with all WP leads. Based on the risk analysis, risk mitigation actions will be proposed. The risk assessment will be regularly updated.

Task: 1.3 Open Call to integrate additional components to the services, M3-M29 (FVH) (local support Amsterdam, Gnosis, MCC, Alblund, Reykjavik)

The objective of the open calls is to extend the service integration use cases in WP3, with new partners that either, (a) provide wellbeing measurement appliances like blood glucose level meters and weight scales where no functional open API is identified in market products, OR (b) extend the use cases with specific services/Apps that have emerged from the Service integration planning stage, and are capable of provide new exceptional features for the use cases (hypothetical examples being Warfarin INR self-measurement at home, or 5G real-life pilot partners). Allocated budget of 550.000€ for open calls. Estimated for support up to 15 external partners.

Subtask 1.3.1 Open Call Methodology, Management and Support

This task will detail the methodology, management procedures, selection criteria, administrative instructions, support mechanisms, etc., for the Open Calls tenderers. The open calls methodology draft, presented in §1, will be enhanced during this subtask based on feedback and success stories from earlier projects and consultations (e.g. how to Non-IoT-developers into the platform).

Subtask 1.3.2 Open Call Publication, Evaluation, Negotiation, Continuous monitoring and Evaluation

This task involves publishing the Open Calls, organizing evaluation panels, and leading supporting the negotiations for the shortlisted candidates. The process will be based upon the enhanced methodology defined in sub-task above. After the tenderers selection the tenderers work will be monitored and evaluated by local project partners, to be selected based on the tenderer targeted domains. Open Calls aim to bring extended project partners in WP3.

Task 1.4 Financial Management and Extended Project Partners Budget Management, M1-M60 (FVH) (all partners contribute)

This task covers all areas of financial planning, budgeting, accounting, auditing (including audit certification where required), administering project resources, monitoring project expenses, submission of cost statements, receipt of funds from the Commission, financial transfers between the coordinator and partners, and the handling of income and expenditure for any items that are centrally managed on behalf of the group as a whole. This task contains the collecting of cost statements and explanation of the use of resources from the consortium partners. The periodical financial report, detailing also the explanation of the partner's use of resources, will be included in the periodical progress reports. This task also involves planning, management, contracting, administration, and transfer of the budget designated for the financial support to external project partners (through Open Calls). FVH as task leader is responsible for budget distribution towards the partners and the Open Call budget.

Task 1.5 Project communication, M1-M60, (FVH) (Demos, all partners)

This task comprises of coordination of communication and dissemination, and all typical activities relating to general communication of the project's activities and results (website, twitter, etc.), which are detailed at the 'Tentative communication plan' in §2.2. Concrete dissemination plans will be developed for project as a whole, but also for individual partners. The plans will be regularly updated and reported. Task objective and responsibility is to provide professional level general communication of the project activities and WP 8 is responsible for dissemination of the project results to the specific impact channels.

N:o	Deliverable	Month(s)	Type	Responsible
D1.1	Consortium Agreement	M1	R,CO	FVH
D1.2	Project Management Handbook	M3	R,CO	FVH
D1.3	Progress Report and Financial Statements Periods 1-5	M13,25,37,49,60	R,CO	FVH
D1.4	Quality Plan	M3	R,CO	FVH
D1.5	Report on the Use of External Project Partners Budget	M31,60	R,CO	FVH
D1.6	Open Calls: methodology, management and support (M9), Publication, evaluation and negotiation report (M20), implementation results report (M36)	M9, 20, 36	R,CO	FVH
D1.7	Communication and Dissemination Plan	M3, 30	R,CO	FVH
D1.8	Communication and Dissemination Report	M12,24,36,48,60	R,CO	FVH

* * * * *

WP n:o	2	Lead partner:	AALTO	Start date:	M1	End date:	M20
Title	IoT Ecosystem and Platforms integration and harmonization						

N:o	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Short name	FVH	Aalto	Laurea	Philips	Waag	VTT	Alblund	Amsterdam	Athena	Helsinki	Lamia	MCC	Reykjavik	MMU	HVA	DTU	Nyherji	Glimworm	Gnosis	Thingful	Chino	NSE	Nordunet	Salus	Acorn	RoT	BSquare	Demos	Tieto
PM	4	56	8	48	24	12	2	3	2	2	2	8	2	4	6	28	30	13	25	15	20	8	16	10	16	10	10	1	1

Objective(s) of this work package
To deliver an integrated, interoperable technological platform, related components, processes, interface descriptions and business models. This includes open interfaces and open ecosystem model, horizontal improvement of the components security, privacy and interoperability, and financial and operational requirements. The WP will deliver the technical platform for WP3 service-level design and integration, and govern the platform architecture and its' relations with the open standards and the IoT-02 CSA. It will deliver an ecosystem of supply-side providers with opportunities and ambitions for future joint exploitation of the interoperable platform, demand side institutions and external developers on an open, scalable technology platform.

Description of work
Roles: Aalto is the work package lead of this work package, and responsible for management and coordination of the activities. Aalto also facilitates the ecosystem business model and architecture development with partners. All supply-side solution partners are responsible for the interoperability and harmonization work needed to take in their solutions, with the domain- and task responsibilities described below. The solution partners are also responsible for the privacy and security features upgrade in their components/solutions. All partners are further responsible for taking part in the ecosystem business model development. **Task 2.1: Ecosystem business model development, M1-M20 (Aalto:CKIR)** (all supply-side partners) *Identification of joint business model opportunities for different ecosystem actors, facilitation and design of the ecosystem business model and the ecosystem strategy, and optimizing the value delivery and capture opportunities. Identification of licensing frameworks (service, software, open/closed source), and*

development of future revenue sharing models. The strategy and requirements consider aspects common to all independent living domains, clustered (e.g. diabetes; mobility), and partner-specific aspects.
Subtask 2.1.1: Ecosystem business model elements, M1-M3
Subtask 2.1.2: Ecosystem business strategy and integration model specification M4-M8
Subtask 2.1.3: Ecosystem business model development M9-M20

Task 2.2: IoT Architectures and integration Governance, M1-M20 (Aalto:CS) (all partners with technology stakeholder position from supply side and demand side)

Design of technical architecture that enables the ecosystem business model requirements, and management of the decision-making regarding the IoT architecture and it's various sub-components. Facilitating joint decision-making required for the common use, and sub-component and use-case specific activities, and providing governance linkage to the IoT-02-2016 CSA, IoT EPI, The Open Group IOT working group, and where relevant AIOTI and FIWARE communities. Specification of the integration model and selection of the standards, interfaces, and other interoperability issues for harmonization.

Subtask 2.2.1: Architecture master plan and requirements, M1-M6, -M20

Subtask 2.2.2: Technical integration model specification, M4-M8, -M20

Task 2.3: Hands-on IoT developer ecosystem management, M1-M20 (FVH, with subcontractor Rob van Kranenburg/RD) (all partners with technology stakeholder position, Aalto and Waag key contributions)
Pragmatic hands-on bootstrapping and extension of the ecosystem based on model from IoT ecosystem management and coordination from IoT-A (and other) by RvK. Facilitation of the IoT ecosystem development around the project specifications. Development of the community of technology providers, users, facilitators and benefitters, by leveraging on the existing communities and ecosystems of developers, and engaging with associations of relevant stakeholders through a series of meetups and presentations.
Task 2.4: Specification and integration of MyData Model, M1-M20 (Aalto) (key contributions from Chino.io, Nordunet, Waag, Thingful, and City partners from their wellbeing data/CRM perspective)
The integrations starts from the specification and implementation of the Nordic MyData Model for IoT environment. This includes reference architecture, functional requirements, legislative analysis in the partner countries, and creation of open source components for the integrators. This is followed by implementation of the model for the wellbeing data repositories, and ramping up wellbeing data repositories in each demosite. Local data repositories in each demosite consist of the cities health care CRM systems complemented with Chino health data repository (and Nordunet big data repository).
Subtasks 2.4.1 - 2.4.9: The following partners have specific sub-task (implementation/integration of MyData model) and specific sub-deliverable (successful integration test report): Chino, Nordunet, Helsinki, Amsterdam, MCC, Gnosis, Nyherji, Alblund, Thingful.
Task 2.5: Harmonization and interoperability toolkit, M1-M12, -M20 (Aalto) (all supply-side partners)
Subtask 2.5.1: Tools and open source components for O-DF and O-MI uptake, M1-M4, Aalto
Subtask 2.5.2: Tools and open source components for security model, M1-M12, Aalto, (key contributions Nordunet, Waag, Chino, and other supply-side partners)
Subtask 2.5.3: Creation of interoperability model for IoT sensor data routing platforms, M1-M20, Waag
A model and open source components for the integration of the services of the selected external IoT sensor data routing platforms (these are to be selected at task 2.2 - they include project partner platforms (Thingful), and external candidates include Azure IoT, IFTTT, Thingworx, possibly UniverSAAL and FIWARE)
Subtask 2.5.4: API Catalogue and external API harmonization, M1-M20, Waag (key contributions FVH, Gnosis, Thingful, ROT, all city partners)
An inventory of project-partner APIs and relevant external APIs for the project pilots is made. API SLA planning and negotiations are taken (both project internal and external), and the API catalogue is prepared for the platform and service developers in the project.
Subtask 2.5.5: Creation of Smart&Ageing SDK for developers, M1-M20, Waag (key contributions Aalto, Nordunet, Chino, Acorn, Thingful, ROT, Salus, Philips)
The open source SDK and library components are developed for the service integration stage as well as for external exploitation of the project ecosystem (open calls, external developers). SDK is service development kit for software developers, and the model is based on prior successful model at CitySDK and hardware-oriented SDK projects (Smart Citizen Kit, Fairphone). The SDK encompasses APIs and open source components relevant to the project and pilots, as well as security, privacy and entitlements features. The

scale and scope of the SDK is initially dictated by the pilot's needs; taking future broadening of services into account. Interoperability with legacy systems, with API's without semantic annotation, across domains and across geographic borders is achieved using thin layers of semantics enhancing bridges or glue. For example, it makes easy for all service developers to create a feature to send control messages to he smart watch or the smart lighting.

Subtask 2.5.6: Big Data Platform integration and set-up, M4-M20, Nordunet

Task integrates existing backend infrastructure platforms with various open and closed source tools into a high availability and secure back end big data platform. The integration and design work will take the use cases into consideration in order to find the optimum choices of storage technologies and data analytics. The work will look at requirements to real-time processing and data driven decision, in order to ensure fast reaction time for events triggered on the client side.

Task 2.6: Interoperability development and governance, M1-M12, -M20 (Aalto) (all supply-side partners)

Analyse needs and requirements from other integrated wellbeing services (what data shall be provided to integration layer, format, real-time vs non-realtime, personal data protection). Select or design specific data models. Implement integration functionality at all relevant partner products to be used in the use cases.

All subtasks deliver a partner-specific integration test report. Each partner is responsible for the implementation of interoperability and harmonization for it's own technologies, platforms and services.

Subtask 2.6.1: Connectivity interoperability development, M5-M12, VTT

Implement interoperability and harmonization at Glimworm, VTT, Philips, Salus, DTU, Gnosis, BSquare, Acorn use case technologies and services (Bluetooth, iBeacon, Zigbee, Wifi layers).

Subtask 2.6.2: Personal Mobility: Interoperability development, M5-M12

Implement interoperability and harmonization at VTT (Smart walker, reflector, Living lab Bus), BSquare, Thingful, Gnosis, FVH, use case technologies and services.

Subtask 2.6.3: Diabetes and IoT: Interoperability development, M5-M12

Implement interoperability and harmonization at NSE, DTU, Acorn, Chino, Helsinki, Nyherji, Salus technologies, apps and services (Diabetes Diary, foot wearables, smart watch, wellbeing data, and generic smart home solution), integration to the city care back-ends at pilot sites.

Subtask 2.6.4: Fall risks and IoT: Interoperability development, M5-M12

Implement interoperability and harmonization at VTT, DTU, BSquare, Chino, Helsinki services, apps and components

Subtask 2.6.5: People2People IoT communications: Interoperability development, M5-M12

Implement interoperability and harmonization at Waag, Glimworm, BSquare, VTT, Gnosis, Nyherji apps, technologies and services.

Subtask 2.6.6: Smart Home: Interoperability development, M5-M12, Salus (Philips, FVH, DTU, Nyherji, Gnosis, VTT)

Implement interoperability and harmonization at Philips, Salus, Nyherji, Gnosis, VTT, DTU services and technologies, including the existing smart home solutions in use in cities pilot sites (e.g. Helsinki IoT care off-the-shelf smart home device)

Subtask 2.6.7: Smart Outside: Interoperability development, M5-M12, VTT (Glimworm, Salus)

Implement interoperability and harmonization at VTT, Glimworm, BSquare, Salus, Thingful technologies and services.

Subtask 2.6.8: Wearables and walkables: Interoperability development, M5-M12, VTT (Acorn, DTU, BSquare, HVA)

Implement interoperability and harmonization at Acorn, VTT, DTU, BSquare,HVA technologies and services

Subtask 2.6.9: Data Platforms: Interoperability development, M5-M12, Thingful (all data-producing partners contribute)

Implement interoperability and harmonization at Thingful, Nordunet, ROT and Chino technologies and services not yet covered at MyData

Subtask 2.6.10: Games and other apps: Interoperability development, M5-M12, Waag

Implement interoperability and harmonization at web- or tablet-based Apps and Services used in pilots

Subtask 2.6.11: Integration of the predictive analytics service platform, M1-M12, Tieto

Implement interoperability of the INaaS Intelligence-as-a-service predictive analytics service with the use case D home care services.

Subtask 2.6.12: Measures to govern and manage risk of non-interoperability issues, M1-M20, Aalto

Task 2.7: Functional features development and implementation, M1-M20, DTU

With the extended new interoperability and connectivity between the components, new IoT-emergent feature development is made possible. Along the use case plans, the following features are developed to enable the service design stage start swiftly.

Task 2.7.1: Street slipperiness sensor system implementation, M1-M20, Salus, Thingful (Helsinki, Reykjavik)

Task 2.7.2: Enhancing of the predictability of the fall risk, based on new integrations from smart watch, smart walker, connected insoles, M1-M20, DTU, key contributions VTT

Task 2.7.3: Development and integration of the sensored foot wearables, M1-M20, DTU

Task 2.7.4: Integration of the blood oxygen sensoring capabilities for COPD for the smart watch, M1-M20, Acorn

Task 2.7.5: Develop care-related predictive analytics features for the INaaS platform for the smart home big data, M1-M20, Tieto

N:o	Deliverable	Month(s)	Type	Responsible
D2.1	Smart&Ageing Ecosystem Business Plan	M3, M8, M20	R,PU	Aalto
D2.2	IoT Architecture. Master Plan (M3) and Detailed Plans: current pilot architectures and harmonization target architectures (ISO/IEC/IEEEE 42010 format) and integration requirements (M8). Final architecture (M20). All plans including decision-making meetings minutes	M3, M8, M20	R,PU	Aalto
D2.3	Report on ecosystem bootstrapping activities (M12). Report on the Smart&Ageing ecosystem status, exploitation and sustainability plans (M20)	M12, M20	R,CO	FVH (RD)
D2.4	IoT MyData model, reference and tools for pilots	M6, M12, M20	R,PU	Aalto
D2.5	Harmonization and interoperability toolkit. (Subdeliverable responsibilities: each sub-task lead)	M6, M12, M20	R,PU	Aalto
D2.6	Summary of integration test reports and measures to improve integration. Each sub-task lead is responsible for producing integration test reports, and plan of measures to improve integration if reports have issues.	M12, M20	R,CO	Aalto
D2.7	Features in use in specific components; Report of new integrated features' integration tests. (Subdeliverable responsibilities: each sub-task lead)	M10, M20	Other	DTU

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WP n:o	3	Lead partner:	LAUREA	Start date:	M1	End date:	M30
Title	Services integration and design						

N:o	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Short name	FVH	Aalto	Laurea	Philips	Waag	VTT	Alblund	Amsterdam	Athena	Helsinki	Lamia	MCC	Reykjavik	MMU	HVA	DTU	Nyherji	Glimworm	Gnosis	Thingful	Chino	NSE	Nordunet	Salus	Acorn	RoT	BSquare	Demos	Tieto
PM	12	10	**66**	72	33	24	6	3	10	18	8	16	10	16	6	22	10	40	25	85	12	16	22	12	16	16	14	6	3

Objective(s) of this work package

To integrate and design the services, starting from the use-cases and solution components, to a state where the services and service providers are ready for up-take in the pilot sites (WP4-7). The work in this WP is based on the interoperability generation and emerging IoT opportunities from the technical platform integration at the work package 2. To deliver such service designs that are compelling to the end-users targeted, and that have been co-designed and validated in each of the demosite Labs, both with elderly and professional care end-users. To ensure the needs and opportunities of the local contexts have been encoded into the service designs (European-level shared use case, and the local variations), and to ensure there has been knowledge sharing between the developing partners in the service design stage. To detail the KPIs and the evaluation method for the pilots. To ensure the designed services conform to all ethics requirements and local field trial procedures.

Description of work

Roles: Laurea is the work package leader and responsible for coordinating the tasks and the activities. Laurea is also the design method lead, supported by method partners Waag and Demos. The work package is very horizontal, and there are substantial task-level coordination responsibilities for each integration task lead, and service lab lead.

Local **Service Integration Lab** operator partners in each demosite (Helsinki:Laurea, Amsterdam:Waag, Albertslund:DTU, Reykjavik:Reykjavik, Lamia:Gnosis, Manchester:MMU) are responsible for the local service design and local facilitation of the integration of the pilots, with the local users in local contexts, including translations. Local Labs facilitate the local co-design, acquire and manage the local test user pools, set up the local technical co-design/test facility (smart home/smart outdoor lab-site). The local labs provide the local design competences, but are supported by both material and design-expertise person-work from the common method partners (Laurea, Demos, Waag).

The **pilot service design and integration tasks** are led by the Pilot WP4--WP7 lead partners, and they are responsible for driving and defining the pilot content (to the local context) in the service labs. They support the local Labs and integration partners with material, equipment and substantial lab site travel and person-months.

The work package is very horizontal: most supply and demand side partners participate, especially in the design tasks. The aim of having the pilot design stage before (and outside) the actual pilot WPs is to enable better emergence of new opportunities between the project partners, and provide more common interfaces between the specific use cases. This is the WP where IoT service-level serendipity and "IoT magic" happens.

Tasks:

Task 3.1: Preparing for the Service Design, M1-M12 (Laurea) (with contribution from all partners, and major role for local Lab partners)

Task creates foundation and guideline for the Labs by creating a common vision of inspiring systemic understanding of future possibilities and probabilities, and develops a methodology and knowledge in the use of the methodology for the lab partners.

Subtask 3.1.1: Envisioning the IoT-Enabled Services, M1-M9 (Demos) (all project partners)

Common criteria and guidelines are created in Envisioning workshop with all the partners. Based on the understanding the future studies bring into the technological development, it creates knowledge and understanding how can we support positive change by using new technologies. In the envisioning workshop the conditions, vision and methods of the labs. Internet of Things and other hyperconnected technologies and new practises can be used to create a more user friendly and prospere society but they don't automatically do. This can be called Nordic perspective towards Internet of Things. Envisioning create a link between future understanding and practical pilots and help in building capabilities for all the demand partners.

Subtask 3.1.2: Harmonization of the use cases and refining of the value expectations, M1-M12 (Laurea) (Waag, all care provider partners, other partners)

All pilot use cases are refined and harmonized, together with the value expectation "owners": the health care providers and a set of end-users or their representatives (M1-M9). The aim of the task is to ensure the qualitative and quantitative ambition of each of the pilots from user/health system perspective, and facilitate the selection of both common and complementing parts of the use cases. The work builds on validated user needs from the project background, and entails in detailed specification of the needs and motivations of the elderly and the care providers. The task delivers detailed KPIs and the framework for the impact assessment, and the measurement tool (M10-M12).

Task 3.2: Service Design & Integration Lab operations, M1-M29 (Laurea) (Waag, Reykjavik, DTU, Gnosis, MCC)

The Service Design & Integration Labs are set up are set up in demosite cities. This includes setting up the physical testing facilities (2-10 smart homes, limited smart outdoor site), acquiring test user pool that take part in the service design stage (elderly test users, case professionals and other key user groups), and acquisition and activation of local stakeholders including 3rd sector, care providers, elderly unions, social scientists into the Service Lab operations. Methodologies are learned and co-designed together with the method partners, and localized for local context. All named test users and stakeholders will receive training and support material. All local partners participate in the lab operations.

Subtask 3.2.1: Lab Guidebook, Method toolkit and Manual, M1-M9 (Laurea, Waag, Demos, all lab partners)
Subtask 3.2.2: Service Design & Integration Lab in Albertslund, M9-M29 (DTU)
Subtask 3.2.3: Service Design & Integration Lab in Amsterdam, M9-M29 (Waag)
Subtask 3.2.4: Service Design & Integration Lab in Lamia, M9-M29 (Gnosis)
Subtask 3.2.5: Service Design & Integration Lab in Helsinki, M9-M29 (Laurea)
Subtask 3.2.6: Service Design & Integration Lab in Manchester, M9-M29 (MMU)
Subtask 3.2.7: Service Design & Integration Lab in Reykjavik, M9-M29 (Reykjavik)
Subtask 3.2.8: Service lab Methodology Support and lab-to-lab knowledge exchange, M9-M29 (Laurea, Demos, Waag)

Task 3.3: Service Design and Integration: Empowering Everyday Mobility, M12-M29 (VTT) (BSquare, Glimworm, FVH, Helsinki, Amsterdam, HvA, Waag, Reykjavik, Nyherji, Gnosis, DTU, Salus, MCC)

Service design and integration of the pilot A is executed in the local Labs, with test end-users, in an agile way, with methods and tools defined in Task 3.2.1 and described tentatively in chapter 1.4. The task assembles the service from the components, and designs the IoT-enabled service experience from the user perspective. The task delivers the ready service concept, all its components, all necessary service operations and support functions integrated, ready to ramp-up the pilot in large-scale field trials.

Subtask 3.3.1: Lead pilot service design and integration at Helsinki, M12-M20 (VTT, BSquare, FVH, Helsinki, Laurea)
Subtask 3.3.2: Replication pilot service design and integration at replication site Labs, M21-M29 (local labs lead, VTT supports)

Task 3.4: Service Design and Integration: Independent Living at Smart Home, M12-M29 (Philips) (Reykjavik, Nyherji, FVH, Helsinki, Gnosis, Lamia, MCC, Waag)

Service design and integration of the pilot B (see above).

Subtask 3.4.1: Lead service design and integration at Reykjavik Lab M12-M20 (Philips, Reykjavik, Nyherji)
Subtask 3.4.2: Replication service design and integration at replication site Labs, M21-M29 (local labs lead, Philips supports)

Task 3.5: Service Design and Integration: Connecting Community, M12-M29 (Waag) (HvA, Amsterdam, Glimworm, MCC, MMU, ROT, Reyjkavik, Nyherji, Gnosis, Athena)

Service design and integration of the pilot C (see above). Pilot C has a lead design stage simultaneously in Amsterdam and Manchester.

Subtask 3.5.1: Lead service design and integration at Amsterdam Lab M12-M20 (Waag, HvA, Amsterdam, Glimworm)
Subtask 3.5.2: Lead service design and integration at Manchester Lab M12-M20 (MCC, MMU, ROT, Waag)
Subtask 3.5.3: Replication service design and integration at replication site Labs, M21-M29 (local labs lead, Waag supports)

Task 3.6: Service Design and Integration: IoT-enabled Virtual Home Care, M12-M29 (FVH) (Helsinki, Tieto, Salus, Alblund, DTU, VTT, BSquare, Reykjavik, Nyherji, Gnosis, Lamia)

Service design and integration of the pilot D (see above).

Subtask 3.6.1: Lead service design and integration at Helsinki Lab M12-M20 (FVH, Helsinki, Tieto, Salus, DTU, BSquare, Laurea)
Subtask 3.6.2: Replication service design and integration at replication site Labs, M21-M29 (local labs lead, FVH supports)

Task 3.7: Service Design and Integration: Cloud-based IoT Ecosystems, M12-M29 (Thingful)

Subtask 3.7.1: Service integration and development of other pilots data opportunities into Thingful use case

with an insurance provider M12-M29 (Thingful)
Subtask 3.7.2: Service Integration of other pilots into CitySDK Linked open data Platform M12-M29 (Waag)
Subtask 3.7.3: Service Integration of other pilots into Nordunet big data service M12-M29 (Nordunet)
Subtask 3.7.4: Chino.io MyData service integration and development M12-M29 (Chino)
Task 3.8 Ethics governance and evaluations of pilots (M13-M29) (Laurea) (contributing: all care providing partners provide linkage to local ethics assessment model and method)
Laurea will facilitate the ethics evaluation of the pilot designs, through the EEAB, and with local research and project procedures (managed by city partners) where needed. Two evaluations are made: mid-way in the service design stage, and close at the end of the service design stage. A brief manual about practises on issues including privacy and informed consent is made for the pilots.

N:o	Deliverable	Month(s)	Type	Responsible
D3.1	Criteria and guidelines for Hyperconnected Independent Living	M9	R,PU	Demos
D3.2	Refined use case descriptions and common and site-specific indicators for each pilot	M9	R,PU	Laurea
D3.3	Lab Guidebook and Lab Operations plan	M9	R,PU	Laurea
D3.4	Tool and framework for ex-ante and ex-post impact assessment at demosite	M12	R,PU	Laurea
D3.5	Pilot A: Service concept and components ready for ramp-up, field-trial operations manual	M20, M28	R,Other	VTT
D3.6	Pilot B: Service concept and components ready for ramp-up, field-trial operations manual	M20, M28	R,Other	Philips
D3.7	Pilot C: Service concept and components ready for ramp-up, field-trial operations manual,	M20, M28	R,Other	Waag
D3.8	Pilot D: Service concept and components ready for ramp-up, field-trial operations manual	M20, M28	R,Other	FVH
D3.9	Service concept and components complete for cloud services, report of integration tests	M29	R,PU	Thingful
D3.10	Lab Operations report (users, workshops, new innovations, results)	M29	R,PU	Laurea
D3.11	Ethics manual, evaluations and field trial permission	M19, M29	R,PU	Laurea

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WP n:o	4	Lead partner:	VTT	Start date:	M21	End date:	M56
Title	Pilot: Empowering Everyday Mobility						

N:o	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Short name	FVH	Aalto	Laurea	Philips	Waag	VTT	Alblund	Amsterdam	Athena	Helsinki	Lamia	MCC	Reykjavik	MMU	HVA	DTU	Nyherji	Glimworm	Gnosis	Thingful	Chino	NSE	Nordunet	Salus	Acorn	RoT	BSquare	Demos	Tieto
PM	16		6		2	**50**		15		6	16	16	12		10		6	14	10								22		

Objectives

To ramp up, prepare and execute the large-scale pilot on Empowering Everyday Mobility (see 1.4. for pilot use case description). To deliver replicable and validated solution for IoT-enabled services for Empowering Everyday Mobility. To deliver specific health effects on independent living in demosites, as detailed in Objectives 1.1. To ensure the continuation of the pilot experiences after the field trial in each demosite.

Description of work

Roles: VTT is the work package lead and responsible for directing the content of the pilot, lead pilot management in Helsinki, and coordination of the replication pilots. Replication pilots are locally led by Amsterdam, Reykjavik, Gnosis and MCC, with the support and knowledge transfer from VTT. The specific solution providers take part in delivering the pilot content, as described in use case descriptions.

Task 4.1: Ex-ante and ex-post assessment in pilot sites, (Laurea) (Amsterdam, MCC, Reykjavik, Lamia)

Baseline assessment is made before the pilot in demosites, and a complementing assessment of change is made near the end of the pilot period. Each local integration lab executes the assessment locally under coordination of the task lead. Some Labs subcontract this work locally (see partner profile for details).

Task 4.2: Lead pilot in Helsinki M21-M56 (VTT) (FVH, BSquare, Helsinki, Salus, Glimworm)
Large-scale field trial for the pilot is set up and executed in Helsinki. First, the ramp-up of the pilot: user management and stakeholder communication, training, and ramp up of the infrastructure. Then, executing the pilot and supporting the pilot operations. Finally, transformation of the pilot after piloting period, either integration into normal operations or ramp down of the pilot.
Subtask 4.2.1: Ramp-up of service infrastructure, M21-M24
Subtask 4.2.2: Training of the staff and users, M21-M24
Subtask 4.2.3: Pilot Execution in Helsinki, M25-M56
Subtask 4.2.4: Upgrade of lead pilot, M30
Subtask 4.2.5: Transformation of pilot after field trial, M52-M56

Task 4.3: Replication pilot in Amsterdam (M30-M56) (Amsterdam) (Waag, HvA, VTT, BSquare, Glimworm)
The replication pilot is set up and executed in Amsterdam.
Subtask 4.3.1: Ramp-up of service infrastructure in Amsterdam M30-M33
Subtask 4.3.2: Pilot Execution in Amsterdam M34-M56
Subtask 4.3.3: Transformation of pilot after field trial, M52-M56

Task 4.4: Replication pilot in Manchester (M30-M56) (MCC) (MMU, ROT, BSquare, Glimworm, VTT)
The replication pilot is set up and executed in Manchester
Subtask 4.4.1: Ramp-up of service infrastructure in Manchester M30-M33
Subtask 4.4.2: Pilot Execution in Manchester M34-M56
Subtask 4.4.3: Transformation of pilot after field trial, M52-M56

Task 4.5: Replication pilot in Reykjavik (M30-M56) (Reykjavik) (Nyherji, BSquare, Salus, Glimworm, VTT)
The replication pilot is set up and executed in Reykjavik
Subtask 4.5.1: Ramp-up of service infrastructure in Reykjavik M30-M33
Subtask 4.5.2: Pilot Execution in Reykjavik M34-M56
Subtask 4.5.3: Transformation of pilot after field trial, M52-M56

Task 4.6: Replication pilot in Lamia (M30-M56) (Gnosis) (Lamia, BSquare, Glimworm, VTT)
The replication pilot is set up and executed in Lamia
Subtask 4.6.1: Ramp-up of service infrastructure in Lamia M30-M33
Subtask 4.6.2: Pilot Execution in Lamia M34-M56
Subtask 4.6.3: Transformation of pilot after field trial, M52-M56

N:o	Deliverable	Months	Type	Responsible
D4.1	Baseline report at the demosites	M21	R,PU	Laurea
D4.2	Helsinki pilot deployment and report	M24,M56	R,DEM,PU	VTT
D4.3	Amsterdam pilot deployment and report	M33,M56	R,DEM,PU	Waag
D4.4	Manchester pilot deployment and report	M33,M56	R,DEM,PU	MCC

D4.5	Reykjavik pilot deployment and report	M33,M56	R,DEM,PU	Reykjavik
D4.6	Lamia pilot deployment and report	M33,M56	R,DEM,PU	Gnosis
D4.7	Ex-post report of results at demosites	M56	R,PU	Laurea

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WP n:o	5		Lead partner:	Philips	Start date:	M21	End date:	M56
Title	Pilot: Independent Living at Smart Home							

N:o	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Short name	FVH	Aalto	Laurea	Philips	Waag	VTT	Alblund	Amsterdam	Athena	Helsinki	Lamia	MCC	Reykjavik	MMU	HVA	DTU	Nyherji	Glimworm	Gnosis	Thingful	Chino	NSE	Nordunet	Salus	Acorn	RoT	BSquare	Demos	Tieto
PM	6		6	**68**	8				8	6	8		28			10	10		10										

Objective(s) of this work package

To ramp up, prepare and execute the large-scale pilot on Independent Living at Smart Home (see 1.4. for pilot use case description). To deliver replicable and validated solution for IoT-enabled services for Independent Living at Smart Home. To deliver specific wellbeing effects on independent living in demosites, as detailed in Objectives 1.1. To ensure the continuation of the pilot experiences after the field trial in each demosite.

Description of work

Roles: Philips is the work package lead and responsible for directing the content of the pilot. Pilots are locally executed by Reykjavik, FVH, Waag and Gnosis, with the support and knowledge transfer from Philips. The specific solution providers take part in delivering the pilot content, as described in use case descriptions.

Task 5.1: Ex-ante and ex-post assessment in pilot sites (Laurea) (Reykjavik, Waag, Lamia)

Baseline assessment is made before the pilot in demosites, and a complementing assessment of change is made near the end of the pilot period. Each local integration lab executes the assessment locally under coordination of the task lead. Some Labs subcontract this work locally (see partner profile for details).

Task 5.2: Lead pilot in Reykjavik M21-M56 (Philips) (Reykjavik, Nyherji)

Large-scale field trial for the pilot is set up and executed in Reykjavik. First, the ramp-up of the pilot: user management and stakeholder communication, training, and ramp up of the infrastructure. Then, executing the pilot and supporting the pilot operations. Finally, transformation of the pilot after piloting period, either integration into normal operations or ramp down of the pilot.

Subtask 5.2.1: Ramp-up of service infrastructure, M21-M24
Subtask 5.2.2: Training of the staff and users, M21-M24
Subtask 5.2.3: Pilot Execution in Reykjavik, M25-M56
Subtask 5.2.4: Upgrade of lead pilot, M30
Subtask 5.2.5: Transformation of pilot after field trial, M52-M56

Task 5.3: Replication pilot in Amsterdam (M30-M56) (Waag) (Amsterdam, Philips)

The replication pilot is set up and executed in Amsterdam.

Subtask 5.3.1: Ramp-up of service infrastructure in Amsterdam M30-M33
Subtask 5.3.2: Pilot Execution in Amsterdam M34-M56
Subtask 5.3.3: Transformation of pilot after field trial, M52-M56

Task 5.4: Replication pilot in Helsinki (M30-M56) (FVH) (Helsinki, Laurea, Philips)

The replication pilot is set up and executed in Helsinki, with partial integration to the use case D.
Subtask 5.4.1: Ramp-up of service infrastructure in Helsinki M30-M33
Subtask 5.4.2: Pilot Execution in Helsinki M34-M56
Subtask 5.4.3: Transformation of pilot after field trial, M52-M56
Task 5.5: Replication pilot in Lamia (M30-M56) (Gnosis) (Lamia, Philips)
The replication pilot is set up and executed in Lamia
Subtask 5.5.1: Ramp-up of service infrastructure in Lamia M30-M33
Subtask 5.5.2: Pilot Execution in Lamia M34-M56
Subtask 5.5.3: Transformation of pilot after field trial, M52-M56

N:o	Deliverable	Months	Type	Responsible
D5.1	Baseline report at the demosites	M21	R,PU	Laurea
D5.2	Reykjavik pilot deployment and report	M24,M56	R,DEM,PU	Philips
D5.3	Amsterdam pilot deployment and report	M33,M56	R,DEM,PU	Waag
D5.4	Helsinki pilot deployment and report	M33,M56	R,DEM,PU	FVH
D5.5	Lamia pilot deployment and report	M33,M56	R,DEM,PU	Gnosis
D5.6	Ex-post report of results at demosites	M56	R,PU	Laurea

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WP n:o	6	Lead partner:	Waag	Start date:	M21	End date:	M56
Title	Pilot: Connecting Community						

N:o	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Short name	FVH	Aalto	Laurea	Philips	Waag	VTT	Alblund	Amsterdam	Athena	Helsinki	Lamia	MCC	Reykjavik	MMU	HVA	DTU	Nyherji	Glimworm	Gnosis	Thingful	Chino	NSE	Nordunet	Salus	Acorn	RoT	BSquare	Demos	Tieto
PM			6		**42**			32			16	36	12	22	12		6		10										

Objective(s) of this work package

To ramp up, prepare and execute the large-scale pilot on Connecting Community (see 1.4. for pilot use case description). To deliver replicable and validated solution for IoT-enabled services for Connecting Community. To deliver specific wellbeing effects on independent living in demosites, as detailed in Objectives 1.1. To ensure the continuation of the pilot experiences after the field trial in each demosite.

Description of work

Roles: Waag is the work package lead and responsible for directing the content of the pilot, and management of the lead pilot in Amsterdam. Replication pilots are locally executed by MCC, Reykjavik and Gnosis, with the support and knowledge transfer from Waag. The specific solution providers take part in delivering the pilot content, as described in use case descriptions.

Task 6.1: Ex-ante and ex-post assessment in pilot sites (Laurea) (Amsterdam, Reykjavik, MCC, Lamia)

Baseline assessment is made before the pilot in demosites, and a complementing assessment of change is made near the end of the pilot period. Each local integration lab executes the assessment locally under coordination of the task lead. Some Labs subcontract this work locally (see partner profile for details).

Task 6.2: Lead pilot in Amsterdam M21-M56 (Waag) (Amsterdam, HvA)

Large-scale field trial for the pilot is set up and executed in Amsterdam. First, the ramp-up of the pilot: user management and stakeholder communication, training, and ramp up of the infrastructure. Then, executing the pilot and supporting the pilot operations. Finally, transformation of the pilot after piloting period, either integration into normal operations or ramp down of the pilot.
Subtask 6.2.1: Ramp-up of service infrastructure, M21-M24
Subtask 6.2.2: Training of the staff and users, M21-M24
Subtask 6.2.3: Pilot Execution in Amsterdam, M25-M56
Subtask 6.2.4: Upgrade of lead pilot, M30
Subtask 6.2.5: Transformation of pilot after field trial, M52-M56
Task 6.3: Parallel lead pilot in Manchester (M21-M56) (MCC) (MMU, ROT, Waag)
The replication pilot is set up and executed in Manchester.
Subtask 6.3.1: Ramp-up of service infrastructure in Manchester M30-M33
Subtask 6.3.2: Pilot Execution in Manchester M34-M56
Subtask 6.3.3: Transformation of pilot after field trial, M52-M56
Task 6.4: Replication pilot in Reykjavik (M30-M56) (Reykjavik) (Nyherji, Waag)
The replication pilot is set up and executed in Reykjavik.
Subtask 6.4.1: Ramp-up of service infrastructure in Reykjavik M30-M33
Subtask 6.4.2: Pilot Execution in Reykjavik M34-M56
Subtask 6.4.3: Transformation of pilot after field trial, M52-M56
Task 6.5: Replication pilot in Lamia (M30-M56) (Gnosis) (Lamia, Waag)
The replication pilot is set up and executed in Lamia
Subtask 6.5.1: Ramp-up of service infrastructure in Lamia M30-M33
Subtask 6.5.2: Pilot Execution in Lamia M34-M56
Subtask 6.5.3: Transformation of pilot after field trial, M52-M56

N:o	Deliverable	Months	Type	Responsible
D6.1	Baseline report at the demosites	M21	R,PU	Laurea
D6.2	Amsterdam pilot deployment and report	M24,M56	R,DEM,PU	Waag
D6.3	Manchester pilot deployment and report	M33,M56	R,DEM,PU	MCC
D6.4	Reykjavik pilot deployment and report	M33,M56	R,DEM,PU	Reykjavik
D6.5	Lamia pilot deployment and report	M33,M56	R,DEM,PU	Gnosis
D6.6	Ex-post report of results at demosites	M56	R,PU	Laurea

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WP n:o	7	Lead partner:	FVH	Start date:	M21	End date:	M56
Title	Pilot: IoT-Enabled Virtual Care						

N:o	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Short name	FVH	Aalto	Laurea	Philips	Waag	VTT	Alblund	Amsterdam	Athena	Helsinki	Lamia	MCC	Reykjavik	MMU	HVA	DTU	Nyherji	Glimworm	Gnosis	Thingful	Chino	NSE	Nordunet	Salus	Acorn	RoT	BSquare	Demos	Tieto
PM	38		6	8			42		22	46	8		28			18	10		10					4	6				4

Objective(s) of this work package
To ramp up, prepare and execute the large-scale pilot on IoT-Enabled Virtual Care (see 1.4. for pilot use case description). To deliver replicable and validated solution for IoT-enabled services for virtual care. To deliver

specific wellbeing effects on independent living in demosites, as detailed in Objectives 1.1. To ensure the continuation of the pilot experiences after the field trial in each demosite.

Description of work

Roles: FVH is the work package lead and responsible for directing the content of the pilot, and management of the lead pilot in Helsinki. Replication pilots are locally executed by DTU, Reykjavik and Gnosis, with the support and knowledge transfer from FVH. The specific solution providers take part in delivering the pilot content, as described in use case descriptions.

Task 7.1: Ex-ante and ex-post assessment in pilot sites (Laurea) (Albertslund, Reykjavik, Lamia)

Baseline assessment is made before the pilot in demosites, and a complementing assessment of change is made near the end of the pilot period. Each local integration lab executes the assessment locally under coordination of the task lead. Some Labs subcontract this work locally (see partner profile for details).

Task 7.2: Lead pilot in Helsinki M21-M56 (FVH) (Helsinki, Salus, Acorn, NSE, Tieto, Laurea)
Large-scale field trial for the pilot is set up and executed in Helsinki. First, the ramp-up of the pilot: user management and stakeholder communication, training, and ramp up of the infrastructure. Then, executing the pilot and supporting the pilot operations. Finally, transformation of the pilot after piloting period, either integration into normal operations or ramp down of the pilot.
Subtask 7.2.1: Ramp-up of service infrastructure, M21-M24
Subtask 7.2.2: Training of the staff and users, M21-M24
Subtask 7.2.3: Pilot Execution in Helsinki, M25-M56
Subtask 7.2.4: Upgrade of lead pilot, M30
Subtask 7.2.5: Transformation of pilot after field trial, M52-M56

Task 7.3: Replication pilot in Reykjavik (M30-M56) (Reykjavik) (Nyherji, Helsinki, Tieto, DTU, Salus, Acorn, NSE, FVH)
The replication pilot is set up and executed in Reykjavik.
Subtask 7.3.1: Ramp-up of service infrastructure in Reykjavik M30-M33
Subtask 7.3.2: Pilot Execution in Reykjavik M34-M56
Subtask 7.3.3: Transformation of pilot after field trial, M52-M56

Task 7.4: Replication pilot in Albertslund (M30-M56) (DTU) (Acorn, NSE, Tieto, FVH)
The replication pilot is set up and executed in Albertslund.
Subtask 7.4.1: Ramp-up of service infrastructure in Albertslund M30-M33
Subtask 7.4.2: Pilot Execution in Albertslund M34-M56
Subtask 7.4.3: Transformation of pilot after field trial, M52-M56

Task 7.5: Replication pilot in Lamia and Athena care (M30-M56) (Gnosis) (Athena, NSE, DTU, Acorn, Lamia, FVH)
The replication pilot is set up and executed in Lamia City and Athena care
Subtask 7.5.1: Ramp-up of service infrastructure in Lamia City and Athena care M30-M33
Subtask 7.5.2: Pilot Execution in Lamia City and Athena Care M34-M56
Subtask 7.5.3: Transformation of pilot after field trial, M52-M56

N:o	Deliverable	Months	Type	Responsible
D7.1	Baseline report at the demosites	M21	R,PU	Laurea
D7.2	Helsinki pilot deployment and report	M24,M56	R,DEM,PU	FVH
D7.3	Reykjavik pilot deployment and report	M33,M56	R,DEM,PU	Reykjavik
D7.4	Albertslund pilot deployment and report	M33,M56	R,DEM,PU	DTU
D7.5	Lamia and Athena Care pilot deployment and report	M33,M56	R,DEM,PU	Gnosis
D7.6	Ex-post report of results at demosites	M56	R,PU	Laurea

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WP n:o	8		Lead partner:	Aalto	Start date:	M20	End date:	M57

Title	Impact management

N:o	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Short name	FVH	Aalto	Laurea	Philips	Waag	VTT	Alblund	Amsterdam	Athena	Helsinki	Lamia	MCC	Reykjavik	MMU	HVA	DTU	Nyherji	Glimworm	Gnosis	Thingful	Chino	NSE	Nordunet	Salus	Acorn	RoT	BSquare	Demos	Tieto
PM	3	28	8	20	10	10	8	6	19	4	8	8	8	4	2	6	4	12	6	5	2	2	6	2	2	6	6	11	2

Objective(s) of this work package

To optimize the valorisation and exploitation of the project results. This is done through integrating the results into the existing European development platforms and user communities, and developing the ecosystem business model's long-term sustainability and short-term applicability. The ecosystem business model is built open and modular for scalability. The WP will ensure that supply-side results are integrated into companies' ongoing business activities and future roadmaps where feasible. The WP will start the commercialisation process for the research organisations' results, disseminate the lessons learned, results, and knowledge about the benefits of IoT into European platforms on the development of care and technology innovation regarding independent living. It goes to ensure the project's technical results, architecture selections, and business models are integrated into the European open IoT platform development, and ensures high media visibility for the pilots, the solutions, and the results of the pilots.

Description of work

Roles: Aalto is the work package leader and responsible for coordination of the tasks. The work exceeds typical dissemination activities with focus on direct economic, societal and technical impact. Thus each supply-side partner is involved in the WP. Each company is responsible for it's own commercial valorisation as well as engaging into the common ecosystem business model development and adaptation. The specific impact channels and responsible actors are detailed in Section 2. Impact will be created on European, cluster and national levels, and the partners will play a role on each level.

Tasks:

Task 8.1 Ecosystem business model consolidation, M20-M36 (Aalto) (All supply-side partners)

Continuing from the ecosystem approach from WP2, the ecosystem business model development is taken forward after the pilots enter large-scale field trial stage. This is when the solutions and services are integrated and in use, and pragmatic lessons from the service design and integration stage are learned. The task considers the common future business opportunities, the modularity of the ecosystem, the strategies of how to engage external actors into the ecosystem, develop joint offering, organize partner licensing, and tap on joint commercialisation prospects. The work is a facilitative approach, with support from business development, negotiations with the open IoT platforms (FIWARE, AIOTI), and key external stakeholders.

Task 8.2: Commercialization and integration into partners' product lines, M20-M36 (Philips) (VTT, FVH, DTU, Nyherji, Glimworm, Gnosis, Thingful, Chino, Salus, Acorn, BSquare, Tieto, RoT)

Commercialization of the supply-side results begins immediately after the service integration stage, while large-scale pilots are running (M20 onward). Each supply side partner is responsible for the exploitation of the project results within its own business development and business lines. The tasks begin these valorisation processes; for some partners, the work is plan of business integration, for some partners, the work is a plan for commercialization, and for some partners the pilot features are already developed into the production service. All task partners are responsible for their own reporting and internal procedures, and each sub-task will produce a report. Each of the abovementioned task partners will lead a sub-task, and will deliver a report of the partner-specific activities. These are enlisted in Section 2.1.3 (examples: VTT: commercialisation of Smart Walker, Philips: Integration of results into product lines, BSquare: Up-take of project pilot features for all users, FVH: Integration of features into city's normal public transport navigator

for all).

Task 8.3: Dissemination of technical results to open IoT Ecosystems development, M20-M36 (Aalto) (FVH, Waag, Philips, VTT, FVH/RvK)

Project results are disseminated to- and exploited in the selected established open IoT ecosystems, as detailed in Section 2.1.4. The aim of this task is to ensure the requirements, architecture, and technical selections, use cases and ecosystem partners' future interests are delivered into the key IoT platform, architecture and ecosystem procedures. These include The Open Group IoT Working group, AIOTI, IoT Council, FIWARE Foundation, CitySDK, Open&Agile Smart Cities, IoT EPI, 6Aika, FinEst Twins, and projects: Select4Cities, BIoTope (and others). A plan and a report of activities will be delivered. (examples: Waag: delivery of results into CitySDK platform, FVH: delivery of results into OASC and Select4Cities, Aalto: delivery of results into ToG and FI-PPP).

Task 8.4 Lessons Learned, M40-M57 (Demos) (all partners)

Case-stories & internal field-test learnings workshop. Collecting and sharing best practices and identifying key issues for the dissemination workshop, both form care providing and IoT supply partners

Task 8.5 Impact assessment analysis, M42-M57 (Laurea)

Based on results of ex-ante and ex-post evaluations taken in pilot work packages, the results are document and real life impact is analysed. The results are documented in academic format, policy format and care innovation format.

Task 8.6: Dissemination of results into academic research and innovation communities, M42-M57 (Laurea) (DTU, Laurea, Aalto, MMU, HVA, NSE)

Project results, lessons learned, analyses and future research questions are disseminated into the research targets as detailed in tentative dissemination and communication plan at Section 2.2.

Task 8.7 Dissemination of wellbeing results to European independent living development, M50-M57 (Reykjavik) (Manchester, Amsterdam, Helsinki, Lamia, Albertslund, FVH, Laurea, DTU)

Project results are disseminated to- and exploited in the European, Nordic and national platforms where the independent living of Europe is developed. These, and the partners responsible for each, are detailed in Section 2.2.4.

Task 8.8 Future landscapes for IoT and ageing, M50-58 (Demos) (all partners)

The foresight co-creation workshop within the consortium partners aiming to envision the scalable impact of the research findings and their potential impact to societies & business according to Nordic hyperconnected planet principles. This workshop is used to conclude research findings in a shape that is easily digestible, actionable and holistic. The Hyperconnected Impact Forum with all the relevant stakeholders such as cities, IoT-forerunners, health sector employers and employees and service users. Forum is a critical debate regarding the findings from the labs. It is also a feedback session. A large part of the high-level stakeholder forum will be devoted to updating & summarizing visions for IoT and ageing.

N:o	Deliverable	Month(s)	Type	Responsible
D8.1	Ecosystem business plan, draft M26; signed by partners M34; upgraded M58. Tentative title: "Overtaking the Silver Economy with joint Smart&Ageing Solutions"	M26,34,58	R, CO	Aalto
D8.2	Organisation-specific commercialization plan by each-subtask lead (M26), and report of success (M38). No summary is made; only catalogue of all plans. Company confidential.	M26, M38	R,CO	Philips (Coordination)
D8.3	Plan (M26) and report of dissemination of results into IoT ecosystems (M38)	M26, M38	R,PU	Aalto
D8.4	Case stories (M50). Case stories updated with results of analysis (M57).	M50, M57	R, PU	Demos
D8.5	Analysis of impact of the pilots after field trials, tentative (M52), deep analysis (M58)	M52, M58	R,PU	Laurea
D8.6	Plan (M50) and report of impact to independent living development platforms	M50, M57	R,PU	Reykjavik
D8.7	Futures landscape for IoT and Ageing (M50 internal, M57 external)	M57	R,Other, PU	Demos

Table 3.1c: List of Deliverables

N:o	Deliverable	Month(s)	Type	Responsible
D1.1	Consortium Agreement	M1	R,CO	FVH
D1.2	Project Management Handbook	M3	R,CO	FVH
D1.4	Quality Plan	M3	R,CO	FVH
D1.7	Communication and Dissemination Plan	M3, M30	R,CO	FVH
D2.1	Smart&Ageing Ecosystem Business Plan	M3, M8, M20	R,PU	Aalto
D2.2	IoT Architecture. Master Plan (M3),Detailed Plans	M3, M8, M20	R,PU	Aalto
D2.4	IoT MyData model, reference and tools for pilots	M6, M12, M20	R,PU	Aalto
D2.5	Harmonization and interoperability toolkit	M6, M12, M20	R,PU	Aalto
D3.1	Criterias and guidelines for Hyperconnected Independent Living	M9	R,PU	Demos
D3.2	Refined use case descriptions and common and site-specific indicators for each pilot	M9	R,PU	Laurea
D3.3	Lab Guidebook and Lab Operations plan	M9	R,PU	Laurea
D2.7	Features in use in specific components	M10, M20	Other	DTU
D1.8	Communication and Dissemination Report	M12, 24, 36, 60	R,CO	FVH
D3.4	Tool and framework for impact assessment	M12	R,PU	Laurea
D2.3	Report on ecosystem bootstrapping activities	M12, M36	R,CO	FVH (RD)
D2.6	Summary of integration test reports	M12, M20	R,CO	Aalto
D1.3	Progress Report and Financial Statements Periods 1-5	M13,25,37,49,60	R,CO	FVH
D2.1	Smart&Ageing Ecosystem Business Plan	M3, M8, M20	R,PU	Aalto
D2.2	IoT Architecture. Master Plan (M3),Detailed Plans	M3, M8, M20	R,PU	Aalto
D2.4	IoT MyData model, reference and tools for pilots	M6, M12, M20	R,PU	Aalto
D2.5	Harmonization and interoperability toolkit	M6, M12, M20	R,PU	Aalto
D2.7	Features in use in specific components	M10, M20	Other	DTU
D3.11	Ethics manual, evaluations and field trial permission	M19, M29	R,PU	Laurea
D3.5	Pilot A: Service concept and components ready for ramp-up, field-trial operations manual	M20, M28	R,Other	VTT
D3.6	Pilot B: Service concept and components ready for ramp-up, field-trial operations manual	M20, M28	R,Other	Philips
D3.7	Pilot C: Service concept and components ready for ramp-up, field-trial operations manual,	M20, M28	R,Other	Waag
D3.8	Pilot D: Service concept and components ready for ramp-up, field-trial operations manual	M20, M28	R,Other	FVH
D2.6	Summary of integration test reports and measures to improve integration.	M12, M20	R,CO	Aalto
D4-7.1	D4.1, D5.1, D6.1, D7.1 - Baseline report at the demosites for impact evaluation	M21	R,PU	Laurea
D4.2	Helsinki lead pilot A deployment	M24,M56	R,DEM,PU	VTT
D5.2	Reykjavik lead pilot B deployment	M24,M56	R,DEM,PU	Philips

D6.2	Amsterdam lead pilot C deployment	M24,M56	R,DEM,PU	Waag
D6.3	Manchester lead pilot C deployment	M24,M56	R,DEM,PU	MCC
D7.2	Helsinki lead pilot D deployment	M24,M56	R,DEM,PU	FVH
D1.6	Open Calls: methodology, managment and support (M9), Publication, evaluation and negotiation report (M20), implementation results report (M36)	M9, M20, M36	R,CO	FVH
D1.8	Communication and Dissemination Report	M12, 24, 36, 60	R,CO	FVH
D1.3	Progress Report and Financial Statements Periods 1-5	M13,25,37,49,60	R,CO	FVH
D8.1	Ecosystem business plan, draft	M26,34,58	R, CO	Aalto
D8.2	Organisation-specific commercialization plan	M26, M34	R,CO	Philips (Coord.)
D8.3	Plan, dissemination to IoT ecosystems	M26, M38	R,PU	Aalto
D3.9	Services ready: cloud services	M29	R,PU	Thingful
D3.10	Lab Operations report (labs close)	M29	R,PU	Laurea
D3.5	Pilot A: replication service integration ready	M20, M28	R,Other	VTT
D3.6	Pilot B: replication service integration ready	M20, M28	R,Other	Philips
D3.7	Pilot C: replication service integration ready	M20, M28	R,Other	Waag
D3.8	Pilot D: replication service integration ready	M20, M28	R,Other	FVH
D3.11	Ethics manual, evaluations,field trial permission	M19, M29	R,PU	Laurea
D1.5	Report, Use of External Project Partners Budget	M31,60	R,CO	FVH
D1.7	Communication and Dissemination Plan	M3, M30	R,CO	FVH
D4.3-.6	Pilot A: Replication deployment at replication sites	M33,M56	R,DEM,PU	See WP4
D5.3-.4	Pilot B: Replication deployment at replication sites	M33,M56	R,DEM,PU	See WP5
D6.4-.5	Pilot C: Replication deployment at replication sites	M33,M56	R,DEM,PU	See WP6
D7.3-.5	Pilot D: Replication deployment at replication sites	M33,M56	R,DEM,PU	See WP7
D8.1	Ecosystem business plan signed by partners	M26,34,58	R, CO	Aalto
D1.8	Communication and Dissemination Report	M12, 24, 36, 60	R,CO	FVH
D1.3	Progress Report and Financial Statements Periods 1-5	M13,25,37,49,60	R,CO	FVH
D8.3	Report of dissemination to IoT ecosystems	M26, M38	R,PU	Aalto
D1.3	Progress Report and Financial Statements Periods 1-5	M13,25,37,49,60	R,CO	FVH
D8.6	Plan and report of dissemination to independent living development platforms	M50, M57	R,PU	Reykjavik
D4.2-.5	Pilot A: Reports of pilot tasks at all sites	M24,M56	R, PU	See WP4
D5.2-.5	Pilot B: Reports of pilot tasks at all sites	M33,M56	R, PU	See WP5
D6.2.5	Pilot C: Reports of pilot tasks at all sites	M33,M56	R,DEM,PU	See WP6
D7.2-.5	Pilot D: Reports of pilot tasks at all sites	M33,M56	R,DEM,PU	See WP7
D4-7.6	Ex-post evaluation report of results at demosites	M56	R,PU	Laurea
D8.4	Case stories; Case stories updated with results of analysis	M50, M57	R, PU	Demos
D8.5	Analysis of impact of the pilots after field trials, tentative (M52), deep analysis (M58)	M52, M58	R,PU	Laurea

D8.6	Plan and report of dissemination to independent living development platforms	M50, M57	R,PU	Reykjavik
D8.7	Futures landscape for IoT and Ageing (M50 internal), M57 (public)	M50, M57	R,Other, PU	Demos
D8.1	Ecosystem business plan, upgraded	M26,34,58	R, CO	Aalto
D1.8	Communication and Dissemination Report	M12, 24, 36, 60	R,CO	FVH
D1.3	Progress Report and Financial Statements Periods 1-5	M13,25,37,49,60	R,CO	FVH

**the number of the deliverable contains the work package number where it is delivered*

3.2 Management structure, milestones and procedures

Consortium Agreement will be made based on Medium and Large Projects of the DESCA - Horizon 2020 Model Consortium Agreement, version 1.2, March 2016, with options detailed below.

3.2.1 Organizational and decision-making structure

The management structure of Smart&Ageing will implement the Governance structure for Medium and Large Projects of the DESCA - Horizon 2020 Model Consortium Agreement, version 1.2, March 2016 (www.DESCA-2020.eu). This ensures a credible and efficient delivery of project outputs as well as the protection and effective utilisation of the knowledge that is being generated. The management of the project will be implemented by a group of highly qualified and experienced programme and project managers with sound project management methodologies and tools. Project management ensures that all involved Partners understand each other's roles and responsibilities appreciating the internal and external deadlines and ensuring smooth cooperation. Although key partners have been identified for each role, the complete structure will be finalised and implemented within D1.1 (Project Management Handbook) where also the methodologies, processes and tools for Project management will be laid out. The organisational structure of the Consortium consists of the following Consortium bodies, in accordance to the DESCA medium and large-scale projects model (Section6, March 2016 version):

1. **General Assembly** as the ultimate decision-making body of the consortium
2. **Executive Board** as the supervisory body for the execution of the Project, which shall report to and be accountable to the General Assembly
3. **The Coordinator** is the legal entity acting as the intermediary between the Parties and the Funding Authority
4. **The Ethics Expert Advisory Board (EEAB)** shall assist and facilitate the decisions made by the General Assembly, and help the Coordinator in their implementation, with regards to Ethics, Privacy and Security issues (as described in section 5 'Ethics'.

In addition the **European Commission will appoint independent experts** to assist with the monitoring and evaluation of the project.

Smart & Ageing project will follow the *General operational procedures for all Consortium Bodies*:

- Representation in meetings
  Any Party which is a member of a Consortium Body (hereinafter referred to as "Member"):
  - should be present or represented at any CB meeting;
  - may appoint a substitute or a proxy to attend and vote at any meeting;
  - and shall participate in a cooperative manner in the meetings.
- Preparation and organisation of meetings:
  - General Assembly: once a year
  - Executive board: quarterly
  - Extraordinary meetings can be set at any time upon reques

The meetings convening, notices, setting and sending agendas, meeting performances, and decision making procedures, meeting minutes, etc, are to be followed as described in DESCA, section 6.2.

Project General Assembly

As described in DESCA, the General Assembly consist from one representative of each partner. Each General Assembly Member shall be deemed to be duly authorised to deliberate, negotiate and decide on all matters. The Coordinator shall chair all meetings of the General Assembly.

The following decisions shall be taken by the General Assembly:

- Content, finances and intellectual property rights
    - Proposals for changes to DoW, Grant and Consortium Agreement, and all related annexes (Background, Third parties, etc.). To be agreed by the Funding Authority
    - Changes to the Consortium Plan
- Evolution of the consortium
    - Entry of a new Party to the consortium and approval of the settlement on the conditions of the accession of such a new Party
    - Withdrawal of a Party from the consortium and the approval of the settlement on the conditions of the withdrawal
    - Identification of a breach by a Party of its obligations under this Consortium Agreement or the Grant Agreement
    - Declaration of a Party to be a Defaulting Party - Remedies to be performed by a Defaulting Party
    - Termination of a Defaulting Party's participation in the consortium and measures relating thereto
    - Proposal to the Funding Authority for a change of the Coordinator
    - Proposal to the Funding Authority for suspension of all or part of the Project
    - Proposal to the Funding Authority for termination of the Project and the Consortium Agreement
- Appointment
    - Executive Board Members

Project Executive Board

As described in DESCA, the Executive Board consists of the Coordinator and one representative of each project WP lead (to be appointed by the General Assembly). The Coordinator shall chair all meetings of the Executive Board. The Executive Board supports the Coordinator in preparing meetings with the Funding Authority and in preparing related data and deliverables. It prepares the content and timing of press releases and joint publications by the consortium or proposed by the Funding Authority in respect of the procedures of the Grant Agreement. In the case of abolished tasks as a result of a decision of the General Assembly, the Executive Board shall advise the General Assembly on ways to rearrange tasks and budgets of the Parties concerned. Such rearrangement shall take into consideration the legitimate commitments taken prior to the decisions, which cannot be cancelled.

Coordinator

The coordinator (FVH) is the intermediary between the Parties and the Funding Authority and shall perform all tasks assigned to it as described in the Grant Agreement and in this Consortium Agreement.
In particular, the Coordinator shall be responsible for:

- monitoring compliance by the Parties with their obligations
- keeping the address list of Members and other contact persons updated and available
- collecting, reviewing to verify consistency and submitting reports, other deliverables (including financial statements and related certifications) and specific requested documents to the Funding Authority
- transmitting documents and information connected with the Project to any other Parties concerned
- administering the financial contribution of the Funding Authority and fulfilling the financial tasks
- providing, upon request, the Parties with official copies or originals of documents that are in the sole possession of the Coordinator when such copies or originals are necessary for the Parties to present claims.

Work Package Leads

The WP Leader's prime responsibility is to ensure that the WP succeeds in providing the expected outputs in high-quality, timely delivery and within the dedicated budget. The WP Leads report to, and take direction from the Coordinator and Project Executive Board to:

- Direct, motivate, plan and monitor the team's work;
- Inform and negotiate with the Project Coordinator of any foreseen deviations to the plan;
- Ensure all WP matters are properly reported; and
- Ensure quality controls of the team's work are performed and planned correctly

Ethics Expert Advisory Board (EEAB)

In addition to DESCA, An Ethics Expert Advisory Board (EEAB) will be appointed and steered by the Executive Board. The EEAB shall assist and facilitate the decisions made by the General Assembly with regards to Ethics, Privacy and Security issues (as described in section 5 'Ethics'. The EEAB, will include internal and external experts, playing a key role in ensuring that local regulations and guidelines are adopted

together with all relevant European and national level regulation and best practices are followed, and that additional best practices resulting from Smart&Ageing pilot implementation will be disseminated and up-taken within the field.

Dissemination and Communications Coordinator

To ensure that the project results are disseminated and communicated as effectively as possible, a Dissemination and Communications Coordinator (DCC) will be nominated. The project has organized coordination of communication and dissemination activities and general communication under the Management Work Package in order to ensure the best working efficiency and avoid any overlaps between these two functions. Both day-to-day management and strategic level control are seamlessly integrated to internal and external communications actions. This is done by FVH who has a successful track record in large scale pilots implementation and in the innovative management of communication and dissemination actitivies.

3.2.2 List of Milestones

The following list of Milestones have been defined for controlling the project progess and as decision points in the project. Table 3.2.2 shows for each milestone, the related WPs, the expected date, and means of verification.

Table 3.2.2 List of Milestones

N:o	Milestone name	Related WP(s)	Due date	Means of verification
1	Kick-off	WP1	M0	GA, CA
2	Technical platform interoperable and working	WP2	M12	All unit and integration test reports done
3	All Lead Pilots ready for up-take	WP3	M20	Field test permission for all lead pilots received
4	All Replication Pilots ready for up-take	WP3	M28	Field test permission for all replication pilots received
5	All pilots in field test stage	WP4-WP7	M34	All pilots ramp-up tasks finalized
6	All pilots' results measured	WP4-WP7	M56	Pilot results measured
7	All impact delivered into impact pathways	WP8	M60	Product integration reports and transform plans ready

3.2.3 Consortium Agreement. Consortium Agreement (CA) will be negotiated between all partners, settling among other things the internal organization of the consortium, reflecting what has been described about the project management structure below. The DESCA 2020 version 1.2 for large will be signed as the Consortium Agreement, with following options:

- access rights to foreground under "fair and reasonable conditions" (9.4.1 option 1)
- transfer of EC contribution with model "forwarding of all"

3.2.4 Quality management. Quality management will be carried out to ensure that the quality expected by the EC is achieved. Progress of the work within the project will be monitored against the deliverables, milestones, and the defined objectives and performance indicators. Criteria, based on the EC's expectations for the project, will be defined at the beginning of the project, to ensure that all work is carried out in reference to them. To help ensure the project meets its objectives, all the quality procedures to be implemented during the project life cycle will be formalized in a quality plan to be produced at the start of the project (D1.4). The Project and Quality Assurance role will be taken by the coordinator. It's main job will be to review and approve (sub-)quality plans customized for each project stage, and ensuring the creation of a structured internal peer-review of each deliverable produced in a planned, documented and organized fashion. **Document management.** A project intranet will be hosted to centralize all information related to the project. Coordinator has existing custom-made solution for this purpose, already used in Horizon2020 projects, including Select4Cities, to manage documents and other project documentation issues (reviews, validations). The Coordinator, Workpackage Leaders and document editors will provide and

maintain all information at their respective levels. All project documentation will be normalized in a common format according to well-defined templates to maintain homogeneity in the project. The deliverables will be managed and released under the responsibility of the Work-package leader, after a well-defined review procedure. A deliverable owner is identified for all documents. All developed software will be centralized using a common repository based on CVS (Concurrent Versions System) or SVN (Sub Version Number) Open Source software tools.

3.2.5 Critical risk management. A detailed risk management plan will be created at the start of the project to review the critical risks for implementation table (3.2b), in order to reflect any recent developments, and to clearly define how the Smart&Ageing consortium will manage risks throughout the life of the project. This plan will include the creation of a risk log where risks will be identified by all WP leaders, through a facilitation by the Project Coordinator. It will also include the layout of the steps required to mitigate these risks. The risk exposure will be assessed for each of the identified risks, being derived from a calculation based on the effect/impact coupled with the probability of the risk. Specific mitigation strategies will be put in place and acted upon for risks the project is highly exposed to. The Project Coordinator will review each risk (based upon the risk's impact and its likelihood) and define a mitigation and contingency plan that is aimed at preventing the risk from materializing or taking corrective action if the former fails. The mitigation plan will include the preventive actions to be performed, responsibilities to be assigned, and tentative dates by which the plan will be implemented. A contingency plan will also be defined in order to counter any risks that eventually materialize further on down the road.

Risk Monitoring. A mitigation plan for all identified risks will be defined and closely monitored by the Project Executive Board. Issue resolution and escalation will be defined for the project as per this mechanism. Risk will be analysed at project and/or engagement level. Once a risk is identified, it will be tracked and monitored during the course of the project in order to minimize its potential damage. This will be done via status reports and periodic management reviews of the project. A risk log outlining potential issues and contingency actions will be created at the start of the project. An initial list of key project risks for each WP has been identified and reported in the Table given on the next two pages.

Table 3.2b: Critical risks for implementation

Risk	Likelihood	Consequence level	WP	Risk-mitigation measure
Integration does not succeed enough (interoperability remains under 75%)	Medium	Moderate	WP2	Active governance of integration. Start integration with planning and identifying common business ambitions to provide incentives. Use of open standards for integration (other value than project results only). Open call to replace "non-integrateable" supply partners
Technical success risks (integrated services do not work)	Low	Major	WP3, WP4-7	Service Integration stage (WP3) is built long to fix technical challenges before going into actual field trial. The local Labs at each site that have the full technology lab act as integration test sites for local contexts. Consortium was built on high TRL components and partners with proven track record of providing commercial solutions. Pilots only start after services tested at labs.
Project execution risk (large consortium of various stakeholder types)	Low	Moderate	WP1	Coordinator's and all WP lead's prior experience of coordinating large EU projects, which excellent project final reviews by EC (of the past projects). Use of combining existing business interests and care interests (project incentives).
"Start-up risk". There are 8 SMEs involved, which sometimes is seen as a risk (performance and from 'economic	Low	Minor	WP2, WP3	Open call will be used replace specific solution component providers, if a use-case critical SME is unable to perform. (Coordinator experience is that usually the SMEs carry less operative risk than large companies in EU projects).

continuity' perspective).				

3.2.6 Intellectual property and innovation management. Management of IP and innovation is central to the development of the common ecosystem business model. This is managed in WP2 and WP8 with the business model ecosystem facilitation, including all relevant business, legal, technical and other aspects that need to be considered. These are detailed more in the WP2.

3.2.7 Intellectual Property prior to consortium agreement, and participation in open research data
The Consortium Agreement provides framework for IP management (access rights, licensing, other). Any result generated before the effective date of the CA (i.e. background) shall remain with the respective party bringing such background to the project. The project does not participate in the open access to research data pilot of article 29.3 of the model grant agreement as there are legitimate reasons not to participate in such pilot as set forth in the present proposal document.

3.3 Consortium as a whole

Consortium consists of a balance of supply- and demand-side partners representing some of the key actors responsible for European IoT and independent living development. It is based on "Nordic innovation model", which means that the PPP and non-profit innovation organisations are in key enabling roles: facilitating the industry development and balancing the dialogue between big and large companies, and also having strong supply components from close-to-market publicly-owned research partners who typically deliver a large amount of for-profit spin-offs based on the research results. This is typical especially in the sector of the health and wellbeing in the Nordics and Netherlands, and, often argued, one key success factor for the better health and wellbeing in these countries. In a way this drives the European replicability of this wellbeing model to the rest of the Europe as well, in addition to scaling up "just the IoT technologies".

Many of the partners have previous working experience together.

The project is coordinated by FVH, which as a public-private partnership company is well positioned for the coordination between supply and demand. As fully owned and guaranteed by City of Helsinki it provides secure and safe coordination function, yet with having part of it's basic funding and formal steering coming from the industry it is focused strongly towards the interests of the industry and economic development. Also, FVH has strong coordination competences and successful merits from coordination of larger programmes (6Aika, 80M€ ERDF) as well as from wide European Horizon2020 and ICT PSP CIP IoT-projects. For example, CitySDK, 7M€ ICT PCP CIP for European API harmonization in Smart Cities, coordinated by FVH, received full scoring at its the final review. The IoT platform and ecosystem consolidation is led by CKIR in Aalto. Aalto CKIR is the coordinator of Future-Internet PPP and key actors in founding of the FIWARE Foundations, the industry-driven initiative to develop the future of the internet in Europe. As a unit of university, it provides neutral forum for facilitating the industry interests, and is proven to be successful industry ecosystem facilitator at FI-PPP. Also importantly, Aalto:CS IoT architecture expertise and positions in the standardisation of open IoT architectures is crucial in laying out the European open IoT approach.

Demand side: Care providers. The demand-side on the consortium consist of the care providing partners (cities of Albertslund, Amsterdam, Helsinki, Lamia, Manchester, Reykjavik and Athena social and mental care), and local care innovation organisations, who have had often roles in piloting the new innovations with the city care personnel (FVH, Laurea, MMU, HvA, Waag). The city units responsible are the eldercare providing departments. **The elderly.** The elderly are represented i) through the cities care developers and personnel, based on their knowledge and access to the users (e.g. Nordic Independent Living user personas); ii) by engaging a part of the elderly target group in the service design & integration stage into the actual service design of the pilots, and iii) existing user-centric findings and knowledge of the facilitating partners (Laurea, Demos, Waag), who have both material and method background regarding the needs and expectations of the elderly (e.g. People Value Canvas, Health 2050).

Supply side: The core parts of the supply-side value chain are covered with high-profile supply side organisations. **Smart homes.** Project partners Philips, Salus, FVH, Nyherji have specific services, products

or technologies regarding the smart home. **Smart outdoors.** Project partners Glimworm, Salus, VTT, HvA, Gnosis have specific products and technologies regarding the IoT-connected outdoors. **Analytics and data engines.** Projects partners VTT, Tieto, Nordunet, Gnosis, Philips have IoT data analytic engine service, products and technologies. **Connected care technologies.** Project partners Philips, DTU, VTT, Chino, Waag, NSE, Acorn have specific product, services and technologies target for connected care. **Mobility and accessibility**. Project partners BSquare, VTT, FVH, Glimworm, Gnosis have specific technologies, services and products for smart urban mobility. Also, many of the cities have lot of accessibility data infrastructures. **Middleware.** Project partners using IoT data routing cloud services include VTT, Helsinki, Nyherji, Tieto, Alblund, Gnosis. **Wearable and walkable technologies.** Project partners Acorn, VTT and BSquare have specific products and technologies that are either worn or carried. **Cloud and big data.** Project partners Thingful, Chino, Nordunet, Tieto, VTT and ROT have existing cloud-based big data products, services and technologies. **Apps and services.** Project partners BSquare, NSE, FVH, Philips, Thingful, ROT, Helsinki, Gnosis, Waag have Apps and Services that act as one user interface to the project's non-trivial IoT use cases.

Of the project budget, 77% goes to the supply-side and 23% to the demand side. On supply-side, the for-profit budget share is 55% and the non-profit budget share is 45%. Most of the non-profit partners are research institutions that aim to commercialize the piloted products within the project, and have previous success in these commercialization activities. There are 8 start-up companies involved in addition to the larger industry players, all of which have previous market validation. The demosite costs are aligned with about similar budget shares for all sites, besides Lamia, which is half smaller budget than the rest (mainly due to substantially lower personnel costs in Greece). Sustainable success of the internet-age IoT ecosystems is also about the evangelists. The project consist of key work contributions from for example WIRED-featured Rob van Kranenburg (e.g. IoT-A Ecosystem coordinator) and Usman Haque (Thingful, earlier Pachube), Mobile World Congress' World's best e-Health solution award winner Ilkka Pirttimaa (Blindsquare), and chairs of key European IoT development, Ilkka Lakaniemi, chair of Future Internet PPP and Kary Främling, chair of The Open Group IoT working group. Also, Philips Hue has won several awards internationally on design and innovation, with the outputs and patents of the research team involved. On the Smart City domain, previous innovation activities of FVH have been awarded several times (EU Prize for Innovation in Public Administration; World e-Government award) and have been featured several times in international magazines including the Guardian and the Foreign Policy.

3.4 Resources to be committed

The project resources consist of 2243 person-months distributed to 60 calendar months. The division of resources between partner types is elaborated in 3.3.

3.4a: Summary of staff efforts

The person months are distributed in a meaningful way and are justified. Each WP has a distinct leader. Most of the supply-side efforts take place in WP2, WP3 (integration and design). Most of the demand-side efforts take place in WP4-7 (piloting). There is a clear continuum of lead responsibilities from design to pilot. All four pilot work packages are aligned in the amount of work, and all piloting sites are aligned in the amount of work.

N:o	PARTNER	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	Total
1	FVH	**72**	4	12	16	6		**38**	3	**151**
2	AALTO	12	**56**	10					**28**	**106**
3	LAUREA	6	8	**66**	6	6	6	6	8	**112**
4	PHILIPS	6	48	70		**68**		8	20	**220**
5	WAAG	9	24	33	2	8	**42**		10	**128**
6	VTT	6	12	24	**50**				10	**102**
7	ALBLUND	6	2	6				42	8	**64**
8	AMSTERDAM	9	3	3	15		32		6	**68**
9	ATHENA	2	2	10		8		22	19	**63**
10	HELSINKI	6	2	18	6	6		46	4	**88**

11	LAMIA	6	2	8	16	8	16	8	8	**72**
12	MCC	2	8	16	16		36		8	**86**
13	REYKJAVIK	6	2	10	12	28	12	28	8	**106**
14	MMU	2	4	16			22		4	**48**
15	HVA	2	6	6	10		12		2	**38**
16	DTU	2	28	22		10		18	6	**86**
17	NYHERJI	6	30	10	6	10	6	10	4	**82**
18	GLIMWORM	8	13	40	14				12	**87**
19	GNOSIS	2	25	25	10	10	10	10	6	**98**
20	THINGFUL	5	15	85					5	**110**
21	CHINO	2	20	10				2	2	**36**
22	NSE	2	8	10				6	2	**28**
23	NORDUNET	8	16	22					6	**52**
24	SALUS	2	10	12				4	2	**30**
25	ACORN	2	16	16				6	2	**42**
26	ROT	2	10	16			14		6	**48**
27	BSQUARE	2	10	14	22				6	**54**
28	DEMOS	8	1	6					11	**26**
29	TIETO	2	1	3				4	2	**12**
	TOTAL	**205**	**386**	**607**	**201**	**168**	**208**	**250**	**218**	**2243**

3.4b. Other direct cost items

Table 3.4b: Other direct cost items. Note: only for partners, whose other direct costs exceed 15% of person-month costs.

Partner	Cost	Type	Justification
VTT	20000€	Other goods /services	A kit and components to develop connected reflector for active use in use case A and D (TinyNode kit), 200 units,
VTT	20000€	Other goods /services	Kit to make existing walkers/rollators connected. Sub-usergroup of use case A,D (existing walker users). (TinyNode kit). 200 units. Note: Does not include rollators.
VTT	25000€	Other goods/ services	Kit needed for in-bus and bus-stop (sensors, actuators, becons). Helsinki 15 units; replication pilots total 10 units (2-3 per city)
VTT	2000€	Other gds/srv	Transport cost of equipment to replication sites
VTT	3000€	Other gds/srv	Communication material
VTT	46000€	Travel	WP Lead to replication pilot sites requires travel
VTT	3500€	Audit cost	
Alblund	45000€	Other gds/srv	Pilot kit for the smart homes (100 units)
Alblund	12000€	Travel	Travel to project meetings
Alblund	3500€	Audit cost	
Amsterdam	67000€	Other gds/srv	Travel kit for pilot A users (includes public transport costs)
Amsterdam	5000€	Other gds/srv	Communication costs
Amsterdam	24000€	Travel	Travel to project meetings
Athena	12221€	Other gds/srv	Pilot goods and services to use case D
Athena	12000€	Travel	Travel to project meetings
Lamia	40700€	Equipment	Pilot equipment and components to use case D
Lamia	5000€	Other gds//srv	Connectivity costs
Lamia	12000€	Travel	Travel to project meetings
Reykjavik	81400€	Other goods/service	Pilot kits and equipment to use case D, best-value-for money off-the shelf components for smart homes and bus pilot in A.
Reykjavik	39000€	Other gds/srv	IoT Connectivity costs, pilots A and D

Reykjavik	12000€	Other gds/srv	Communication material
Reykjavik	36000€	Travel	Travel to project meetings (Iceland travel expensive).
Reykjavik	5000€	Audit	
DTU	30000€	Other gds/srv	100 units of sensor-equipped insoles, components, use case D
DTU	27000€	Other goods/services	Fall detection system components, use case D, 100 units. Four BLE devices, which all act as a BLE-broadcaster- A BLE device with an integrated accelerometer and a Central/Peripheral
DTU	34000€	Travel	Travel to project meetings, use case D development
DTU	8000€	Other goods/service	Licenses required for fall detection components, use case D
DTU	3500	Audit	
Glimworm	48500€	Other goods/service	iBeacon production and installation costs, use case A, C
Glimworm	2000€	Other goods/service	Platform maintenance costs
Glimworm	9500€	Other	Event production costs, 1 event
Glimworm	75000€	Subcontract.	Subcontracting of project management and communication work
Glimworm	28400€	Travel	Travel to project meetings, use case A in several cities
Glimworm	3500€	Audit	
Gnosis	75000€	Other goods/service	Pilot components hardware to Lamia pilots of use case A and C
Gnosis	24000€	Travel	Travel to project meetings, use case A and D development
Gnosis	3500€	Audit	
NSE	38410€	Travel	Travel to project meetings, use case D development
NSE	3500€	Audit	
Salus	45000€	Other goods/service	Lora and Zwave components to pilot A, including outdoor slipperiness sensor system
Salus	18000€	Travel	Travel to project meetings, use case A development
Salus	3500€	Audit	
Salus	92500€	Other goods/service	Subcontracting of software programmer from existing software coder service contract (bulk programming parts on web UX)
Acorn	26000€	Other goods/services	Smart watch component cost, 200 units of Leikr-type watch, with sensor integrations (see use case D), use case D (and A)
Acorn	19000€	Other goods/services	Production costs for watch (17000€ mechanical tools, 2000€ electronic production set-up fee), 200 units
Demos	30000€	Travel	Support work and of service integration and design stage at all local demosites and labs