



Progressive Standards Around ICT for Active and Healthy Ageing

WP7 Use Cases and Interoperability in the Context of Different Service Models

Deliverable 7.2

“Report: Interoperability Frameworks for Use Cases in Different ICT and Service Contexts”

v1.0

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Reviewers	Project coordination team (Malcolm Fisk, Nitika Bhalla); the basic concepts of and the need for interoperability have been endorsed by members of the PROGRESSIVE task force (through in-depth interviews).
Abstract	This report introduces the basic concepts of interoperability as well as established interoperability frameworks relevant for information and communication technology (ICT) services in the domain of active and healthy ageing. A provisional (g)ReEIF is proposed and applied on use cases in the fields of smart housing and well-being. Moreover, the rationale for interoperability as an ethical tenet (see Deliverable 2.1) is established and has been validated in interviews with members of the PROGRESSIVE Task Force of (expert) older people.
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List of abbreviations

AAL	Active and Assisted Living Joint Programme
AFCC	Age-Friendly Cities and Communities
AGE	AGE Platform Europe
CE	Conformité Européene (i.e., European Conformity)
CEF	Connecting Europe Facility
DSM	Digital Single Market
DMU	De Montfort University
EC	European Commission
eEIF	eHealth European Interoperability Framework
EHTEL	European Health Telematics Association
EIF	European Interoperability Framework
EIP on AHA	European Innovation Partnership on Active and Healthy Ageing
EIS	European Interoperability Strategy
EU	European Union
GDPR	General Data Protection Regulation (Regulation (EU) 2016/679)
(g)ReEIF	Generalised Refined eHealth European Interoperability Framework
ICT	information and communication technology
ICT for AHA	Information and Communication Technology for Active and Healthy Ageing
IT	Information technology
NIFTE	National Initiative for TeleHealth Framework of Guidelines
QOF	Quality and Outcomes Framework
ReEIF	Refined eHealth European Interoperability Framework
SDO	Standard Developing Organisation
TQG	Telehealth Quality Group
TV	Television
UK	United Kingdom
USA	United States of America
VWiQ	Networked Living in the Neighbourhood (in English)
WHO	World Health Organization
WP	Work Package

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Executive summary

This report introduces the basic concepts of interoperability as well as established interoperability frameworks relevant for information and communication technology services in the domain of active and healthy ageing (ICT for AHA).

An interoperability framework suited for analysing services in the ICT for AHA domain is proposed under the (provisional) name “Generalised Refined eHealth European Interoperability Framework - (g)ReEIF”. The framework has been further developed based on an existing interoperability framework that had been endorsed for just one service domain, i.e. eHealth (hence the name). The main principles and the practical applicability of the generalised framework are demonstrated in this deliverable via the analysis of ICT for AHA use cases in the fields of smart housing and well-being.

Moreover, the rationale for interoperability as an ethical tenet (see Deliverable 2.1) is established and has been validated in interviews with members of the PROGRESSIVE Task Force of (expert) older people.

This report is organised in the following way:

- ⇒ Chapter 1 “Introduction” establishes the scope and continuity of the work of WP7. From there, it explores basic concepts and definitions related to interoperability in ICT for AHA.
- ⇒ Chapter 2 “Interoperability: Ethical challenges and the viewpoint of end-users” explores the interrelationships and synergies of (fulfilment of) ethical tenets identified by WP2. It also reports on the viewpoint of end-users who have been identified by in-depth interviews with members of the PROGRESSIVE Task Force established by WP4.
- ⇒ Chapter 3 “Approach: Interoperability and interoperability frameworks” explores concepts around analysing and enabling interoperability in ICT for AHA. Chapter 3.5 covers the “Generalised Refined eHealth European Interoperability Framework - (g)ReEIF”.
- ⇒ Chapter 4 “Application of the (g)ReEIF on real life Use Cases in smart housing and well-being” demonstrates the applicability of the generic framework to selected use cases.

This document concludes the analysis of ICT for AHA use cases for the aspects of interoperability and standards. In a concurrent process, Work Package 7 is contributing key messages to the “consolidated document” that is jointly produced by all members of the PROGRESSIVE consortium.

Part of this report may also become instrumental for the STAIR-AHA platform that has been initiated to continue the work of PROGRESSIVE and to support in particular the expression of the voices of older adults.

The Consortium expects to further concretise and refine the “Generalised Refined eHealth European Interoperability Framework - (g)ReEIF” in ongoing steps like the activities mentioned above.

1 Introduction

This report (D7.2) concludes the analysis of use cases of ICT for AHA for the aspects of interoperability and standards. This document serves also as foundation for the interoperability-related sections of the PROGRESSIVE “consolidated document” under preparation by the Consortium. It may also become instrumental for the STAIR-AHA platform that is currently initiated to continue the work of PROGRESSIVE in the long run and to support in particular the expression of the voices of older adults.

The content and emphasis of this report respond to the guidance received from the reviewers of the European Commission towards a short, tangible document that sufficiently reflects the needs and voices of (expert) older people. One important conclusion has been to update the title of this deliverable to mention “interoperability frameworks” instead of “interoperability profiles”, i.e. the focus is on principles, recommendations and practices rather than on detailed specifications (see Annex for an exemplary overview on interoperability profiles). WP7 has contributed and participated to the consultations with the Advisory Board and with the PROGRESSIVE Task Force of older people (organised by AGE for WP4) to obtain feedback on the needs and perceptions for interoperability in the field of ICT for AHA. Summaries of two dedicated in-depth interviews have been included in this document (see chapter 2).

The focus of the PROGRESSIVE project is to explore standards in the context of information and communication technology (ICT) products and services that empower older people in fields that relate to their active and healthy ageing. These fields include aspects of older people’s lifestyles or work, digital literacy, use of telehealth and telecare, general health, and concordance with medication-taking and treatments.

WP 7 is dedicated to considering use cases in different ICT and service contexts and to build upon this exploration to identify Interoperability frameworks for service provision that fit within broader European Interoperability Strategies.

According to the PROGRESSIVE Glossary (see D1.3 Glossary) **Interoperability** is defined as: Ability of two or more devices or systems to interact with one another and exchange information in order to achieve predictable results (NIFTE)¹. Under a service perspective it is important to understand “systems” as also comprising human actors, i.e. the exchange of information must enable service providers and service users to access the information and to interpret the information in the correct context, otherwise the communication is meaningless.

Deliverable D7.1² defined the PROGRESSIVE approach for identifying suitable use cases and provides definitions on the basic concepts around active and healthy ageing as well as for ICT for AHA. The exploration of use cases started from the four domains and 22 fields as descri-

¹ NIFTE is the (Canadian) National Initiative for TeleHealth Framework of Guidelines, whose guidelines date from 2003. https://www.isfteh.org/files/work_groups/FrameworkofGuidelines2003eng.pdf, last accessed 30 July 2018.

² Deliverable 7.1 “Use Cases Defined” (Revision following annual technical review, 9/10 January 2018)

bed in the PROGRESSIVE Description of Action. Jointly with the consortium³, WP7 identified the “Age Friendly Flower”, i.e. the presentation of eight domains that impact age-friendliness in the format of eight petals of a flower as developed by the World Health Organization (WHO) Age-Friendly Cities and Communities (AFCC) programme (WHO 2007⁴), as a suitable format to organise the exploration of ICT for AHA use cases in the different service contexts.

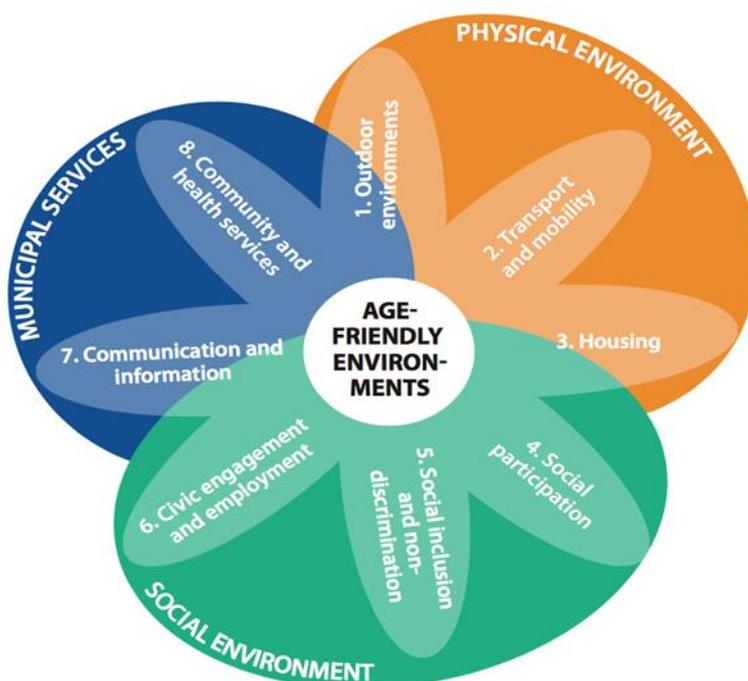


Figure 1: The Age-friendly Cities and Communities (AFCC) programme project “flower”

By combining the eight domains of the WHO flower with the three important fields for AHA application identified by the 2012 European Year of Active Ageing and Intergenerational Solidarity, i.e. **Employment**, **Participation in Society** and **Independent Living**, a matrix of 24 fields has been defined (see Annex 1) that guided the collection and selection of ICT for AHA use cases (see D7.1 Use Cases Defined) and assisted in the mapping of standards, guides and/or initiatives in support of AHA (see D8.2 Establishing the Position on Standards around ICT for AHA for Age Friendly Communities). NB, for consistency: The flower above is the latest release with additional grouping – the matrix lines (see Annex 1) have been derived from an earlier version.

Continuing from this preparatory work, two use cases have been selected for interoperability related analysis (chapter 4). These represent both the field of Independent Living and belong to the fields included in the matrix (Annex 1) 1C/2C (Smart Housing Use Case) and 6C (Self-Management Use Case).

³ See also the reference to the WHO AFCC model in Deliverable 8.2

⁴ World Health Organization (WHO) (2007) *Global Age-friendly Cities: A Guide*. WHO: Geneva http://www.who.int/ageing/age_friendly_cities_guide/en/, p9, last accessed 30 July 2018.

2 Interoperability: Ethical challenges and the viewpoint of end-users

This section highlights both the ethical challenges relevant to the field of active and healthy ageing in relation to interoperability, and draws on the voices of older people and the views of end-users explored by the PROGRESSIVE consortium.

2.1 Ethical challenges

The PROGRESSIVE consortium has identified nine ethical tenets that should be observed for ICT in the field of active and healthy ageing. For the purpose of this report, the most important ethical tenet is interoperability (in bold); however, also of importance and highly interdependent are those tenets which have been underlined in the list (below):

- Accessibility and usability;
- Affordability;
- Autonomy and empowerment;
- Beneficence and non-maleficence;
- Care, protection and support;
- Equality, equity, justice;
- Inclusion, non-discrimination, social impact;
- **Interoperability;**
- Privacy, safety, security.

These tenets are described in detail in the subsections of chapter 4 “Key Ethical Tenets” from Deliverable 2.1 “Ethical Framework for Standardisation in the Context of ICT for AHA”.

Interoperability, as one of those categories of tenets, implies that “[...] *the user doesn’t need to worry about the correct functioning of, and interaction between, different devices or software when used together, [it] is important to secure safety, quality and intended outcomes of the use of ICT technology. It is about user-friendliness (usability), user safety, choice and affordability. It may, furthermore, guard against manufacturer or supplier ‘lock-in’ and help stimulate competition (thereby reducing prices). This makes interoperability an ethical imperative*”⁵.

This citation underlines the strong interdependency of interoperability with other categories of ethical tenet, especially “Accessibility and usability” (D2.1–4.1), “Affordability” (D2.1–4.2) and “Privacy, safety, security”⁶ (D2.1–4.9):

⁵ PROGRESSIVE D2.1 “Ethical Framework for Standardisation in the Context of ICT for AHA”, p.16

⁶ For the aspect of security, it seems fair to mention an ongoing debate within the PROGRESSIVE Consortium on the relationship of interoperability and cybersecurity: On the one hand, a fully proprietary system with no defined interface (or API) to the outside world (Internet) would be protected against attacks by not being accessible at all; on the other hand, networked systems built on the principles of interoperability can more easily support uniform protection policies and automatic, regular updates for security flaws.

- ⇒ Interoperability is an enabler for “Accessibility and usability” since uniform software interfaces and the “plug and play” principle provide the infrastructure and support for user-friendly interface designs and service provisions;
- ⇒ Interoperability is an enabler for “Affordability” since open, uniform interfaces enable more economic software development and also competition in an open market;
- ⇒ Interoperability is an enabler for “Privacy, safety, security” since uniform software interfaces provide the infrastructure and IT services for state-of-the-art privacy and safety policies and procedures as well as they support uniform protection policies and automatic, regular updates for security flaws (see however footnote 7).

2.2 Viewpoint of end-users

The PROGRESSIVE project team is convinced that older people possess expertise and experience about their own lives, and that products, services and environments need to be tailored by end-users’ perceptions, needs and preferences.

Therefore, the project consortium set up a task force of older persons’ representatives to comment and advise on the main project activities⁷. The task force is composed of people of various nationalities, genders and expertise, but all its members have an interest in digitalisation and the challenges related to ageing well with technologies. The task force supported the work in this report by providing feedback on interoperability-related concepts and observations via interviews.

In contrast to “standards”, “interoperability” is a term usually not known to lay persons who have no background in ICT. However, after having received an explanation about interoperability in lay language, the need for interoperability was strongly endorsed from the viewpoint of older people⁸.

This statement of endorsement has three caveats, however:

- 1) In real-life examples it may difficult to decide what is the contribution of available standards vs. the “orchestration” of interoperability.
- 2) From an end-user perspective, there may be a strong interdependence (see 2.1 above) between usability and accessibility, affordability, and safety and security.

⁷ cf. PROGRESSIVE Consolidated Document (under preparation) and upcoming editions of the PROGRESSIVE Newsletter for more information on the proceedings and membership of the Task Force.

⁸ Interview questions were provided in advance for the preparation of the interview. Those questions that highlight Interoperability as one element are provided here below:

3. What are, to your opinion, the main priorities for standardization in the coming years to sustain active and healthy ageing? (Try to limit the focus to ICT-based products, services, solutions and **how they are interworking - interoperable - towards a smooth user experience and interaction**. Also your opinions or experiences on how to organize the standardization process and on how to involve end users/older citizens would be very interesting to hear.).

4. (If you have a specific interest in interoperability issues) **How do you see in particular the importance of interoperability, i.e. smoothly interworking services, given the rapid spread of digitalisation and interactive service platforms?**

3) Only two interviews could be conducted with members of the task force⁹. Hence, the results are understood as providing “face validity”. The interviews are referred to as interview a) and interview b). One was with a person with no prior knowledge of interoperability; the other was with a person with prior knowledge.

Interview a) was with a person with no prior knowledge of “interoperability”. It is summarised in these statements:

- ⇒ Digitalisation proceeds with incredible complexity and speed. While it delivers enormous and impressive improvements, it also implies that that a large group of people cannot follow (the developments and the implied changes in daily living) and is excluded from certain services.
- ⇒ Setting standards is important and it should serve to make technology accessible and understandable for a certain group of people (older generations not belonging to the digital natives), i.e. technology that is easier to handle and to read.
- ⇒ For the time being, it is also needed to maintain “old” processes – familiar to most older people – for certain applications.
- ⇒ The proceedings of daily living imply increasingly – and often exclusively – the use of digital processes and make the use of a computer obligatory. Examples are making payments to the municipality, applying for passports or a driver’s licence etc. (in the concrete example offered by the interviewee, the conventional process – on site service at the municipality - was continued after a citizens’ lobbying intervention).
- ⇒ Overall, people who do not know digital technologies well are increasingly excluded from daily experiences and cultural or organisational events, for example caused by organising online payments and difficulties ordering e.g., theatre tickets online.
- ⇒ The need for education and courses in how to use digital services is well-accepted. The education must include aspects of cybersecurity, so as to support elderly in a realistic assessment of the risks of connected systems, to make end-users more confident in their use of technology and less vulnerable to e.g. Phishing attacks.
- ⇒ On the provider side, more collaboration is needed so as to avoid that each and every digital service has its own, different logic and screen layout. Using instead more widely uniform digital processes and harmonised, screen layouts could help to avoid confusion in older people when using digital services.
- ⇒ User needs seem to be less important to providers than the economic benefits; hence, the understanding of interoperability as an ethical principle is endorsed.

Interview b) was conducted with a person with prior knowledge of the term “interoperability”. It is summarised in these statements:

⁹ Three other interviews were conducted with task force and advisory group members, but these focused less on the issue of interoperability.

- ⇒ Standardisation can help to support interoperability, data protection, affordability, and IT security and to lower costs. Standards make systems usable and affordable.
- ⇒ The field of ICT for AHA represents a large sector of products and services. Benefits in the home: these range from helping to make people secure at home, to preventing and monitoring medical problems like high blood pressure, and to supporting health promotion.
- ⇒ In hospitals, interoperability is key for enabling the exchange of data between different institutions, avoiding occurrences like double testing.
- ⇒ Digitalisation is affecting many daily activities while the access to public services via the Internet is developing very fast. For example, the payment of income taxes is an online process.
- ⇒ Interoperability helps to improve the performance of service platforms. It also lowers costs in developing applications, since there is no need to redevelop the interfaces, based on technical standards.
- ⇒ On the one hand, initiatives to reduce the complexity of systems in favour of older people to support their use of online services are underway; e.g. providing tweaks for Windows to display always visible links for email and internet access.
- ⇒ On the other hand, ICT for AHA is an opportunity for and exercise in intergenerational collaboration.

The interviews provide “anecdotal” evidence from opinion leaders in the ICT for AHA domain in support of the statement that interoperability contributes to improving ICT-based services and also making them usable for longer by older people who do not belong to the “digital natives” generation.

The importance of these statements underlines the real-life experience of older people that daily living is impaired by enforcement of the use of digital services and communication channels for essential aspects of daily living. Examples of domains where this use is being enforced include the use of municipal services like municipal tax payments; online banking; and payment for cultural events (e.g., through online ordering and payment of theatre tickets): this use of technology can restrict the participation of older adults in events and activities. All these statements and examples underline the importance of interoperability (and standards overall) as ethical principle(s).

3 Approach: Interoperability and interoperability frameworks

This section explores Interoperability Frameworks - and embedded in these frameworks - interoperability concepts and interoperability profiles. Interoperability concepts in health are used as a starting point to analyse some concepts on a more detailed level.

From this starting point, the perspective is widened to establish a generalised interoperability framework that can be used to support the wider domain of ICT for AHA.

3.1 Concept of interoperability

To re-iterate information from the introduction of this report, the definition of interoperability referenced by the PROGRESSIVE glossary is:

*The ability of two or more devices or systems to interact with one another and exchange information in order to achieve predictable results.*¹⁰

This definition reflects mainly the context of technical device to device communication and does not make reference to the concept of “human understandable data and knowledge”. To account for the widest range of ICT for AHA services, a definition embracing the human factor would seem to be a good starting point, i.e. a text inspired by the health-related definition (see below).

The understanding of interoperability in the health and social care domain is guided by the idea of enabling **collaboration** between the relevant actors and organisations. Hence, a more pragmatic definition – developed by a series of European projects in the eHealth domain – gives:

*“Interoperability” [in eHealth] means the ability of two or more [eHealth] systems to use and exchange both computer interpretable data and human understandable data and knowledge*¹¹

Interoperability strategies are e.g. defined and exemplified in the wider eGovernment and eBusiness domains as covered by the Digital Single Market Strategy and other EC Communications.

The *Digital Single Market (DSM) Strategy* builds on interoperability-related work initiated within the Digital Agenda for Europe where interoperability has been established as one of the key concepts. Interoperability has as well been recognised as a success factor in various sectors, in particular, in the eGovernment and Health-IT industry domains.

- ⇒ COM (2016) 179 final: EU eGovernment Action Plan 2016-2020: Accelerating the digital transformation of government¹²
- ⇒ COM(2016) 176 final: ICT Standardisation Priorities for the Digital Single Market¹³.

¹⁰ PROGRESSIVE Project D1.3 KEY TERMS AND PHRASES, File reference “T1.3 Key Concepts, Terms and Phrases.docx”

¹¹ Communication (2008)3282 “Commission Recommendation of 2 July 2008 on cross-border interoperability of electronic health record systems, <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32008H0594>, last accessed 30 July 2018.

¹² <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52016AE2741>, last accessed 30 July 2018

¹³ <https://ec.europa.eu/digital-single-market/en/news/communication-ict-standardisation-priorities-digital-single-market>, last accessed 30 July 2018

A definition of interoperability frameworks also exists: “An interoperability framework is an agreed approach to interoperability for organisations that wish to work together towards the joint delivery of public services. Within its scope of applicability, it specifies a set of common elements such as vocabulary, concepts, principles, policies, guidelines, recommendations, standards, specifications and practices.”¹⁴

3.2 eGovernment policies and the European Interoperability Framework (EIF)

Several European policy documents published over the past 15 years, but especially in the 2015-2017 time-period, state the importance of interoperability for eGovernment and other public services.

The European Interoperability Framework (EIF) is a set of recommendations which specify how Administrations, Businesses and Citizens communicate with each other within the European Union (EU) and across Member States borders. The first version was published in 2004.

The generic EIF has been further developed through various policy documents like the *EU Decision 2015/2240* that is focused on “establishing a programme on interoperability solutions and common frameworks for European public administrations, businesses and citizens as a means for modernising the public sector”. The document references as implementation instruments the European Interoperability Strategy (EIS) and the European Interoperability Framework (EIF). It also points to the merits of ‘an interoperable e-society’ and states that ‘the principle of user-centricity applies, in particular, to the end-users of interoperability solutions.’ Because of the crucial nature of many public sector services to older people, and the emphasis on citizens, this Decision provides an important foundation for PROGRESSIVE activities.

The 2017 (edition of the) *European Interoperability Framework* includes guidance to public administrations when delivering public services. This guidance is provided to ensure that the public sector will not only be digital but also **interoperable**. This European framework aims to help Member States to follow a common approach when making their public services available online across both countries and policy areas. Examples will assist in reducing bureaucracy for both citizens and businesses when they request certificates, enrol in services, or submit tax declarations.

The 2017 *Rolling Plan for ICT Standardisation* outlines that interoperability is a consistent, generic issue mentioned in several of the topic areas addressed – including the Internet of Things, eGovernment, smart metering and robots. The Rolling Plan affirms that “one of the main aims of European and global standardisation is to enable interoperability in a multi-vendor, multi-network, multi-service environment. Interoperability gives users a much greater choice of products and services. It also enables manufacturers and service providers to benefit from economies of scale in a wider market”. Added to this aspiration is the intention to “look at the full spectrum of available instruments for promoting awareness about standardisation

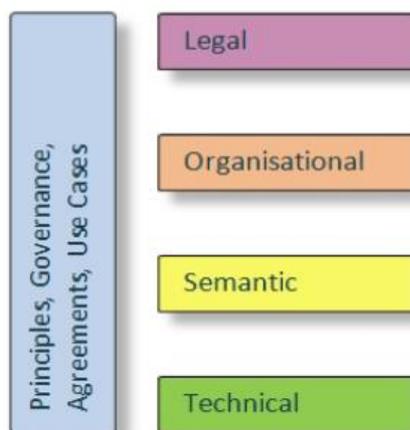
¹⁴ Definition taken from Annex II - EIF (European Interoperability Framework) of the Communication “Towards interoperability for European public services” on the 16th of December 2010.

and standards; for identifying and mapping standards, finding standardisation gaps and kicking off new activities in ICT standardisation; and for making use of standardisation, standards and technical specifications in policies.”

3.3 European eHealth Interoperability Framework (eEIF)

The *eHealth European Interoperability Framework (eEIF)* has been established as a domain-specific framework for health and social care: “The eHealth EIF is positioned as an operational tool kit for implementers and purchasers to deploy eHealth systems. It is intended to be used as a reference guide in calls for proposals and tenders for the Connecting Europe Facility (CEF) deployment, but possibly also for deployment at the national and regional levels. The vision is that the eHealth EIF will be leveraged by the eHealth Network for eHealth deployment that takes place in Member States. The high-level concepts are its governance, principles, agreements, interoperability levels, and high-level use cases.”¹⁵

Commission Recommendation of 2 July 2008 on cross-border interoperability of electronic health record systems (2008/594/EC) marked a milestone in the work on interoperability and is still an established reference for the healthcare domain: It is the starting point of the agreements between the Member States that has been endorsed by the eHealth Network of the EU



Member States. The recommendation provides an instantiation of the more generic interoperability definition, used above, for Electronic Health Care Records, i.e. “ ‘interoperability of electronic health record systems’ means the ability of two or more electronic health record systems to exchange both computer interpretable data and human interpretable information and knowledge”¹⁶ and it establishes the understanding for the layers/levels of interoperability now referenced as the LOST concept (legal, organisational, semantic and technical interoperability, cf. also the extended version in the *Revised eHealth European Interoperability framework – ReEIF* – see section 3.4 (below)).

Member States. The recommendation provides an instantiation of the more generic interoperability definition, used above, for Electronic Health Care Records, i.e. “ ‘interoperability of electronic health record systems’ means the ability of two or more electronic health record systems to exchange both computer interpretable data and human interpretable information and knowledge”¹⁶ and it establishes the understanding for the layers/levels of interoperability now referenced as the LOST concept (legal, organisational, semantic and technical interoperability, cf. also the extended version in the *Revised eHealth European Interoperability framework – ReEIF* – see section 3.4 (below)).

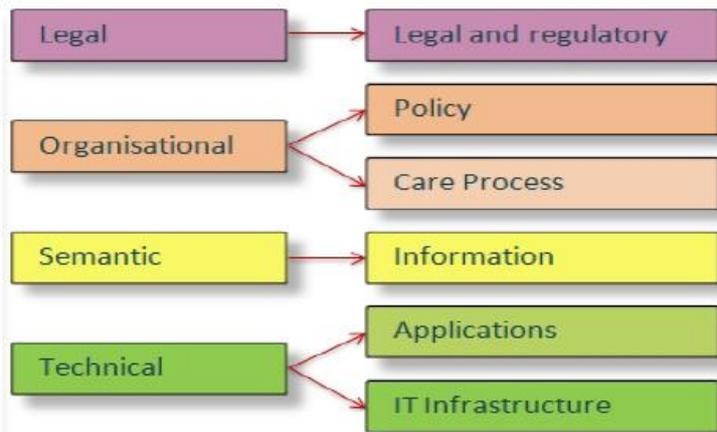
3.4 Revised eHealth European Interoperability framework (ReEIF)

The high-level concepts of the Revised eHealth European Interoperability Framework (ReEIF)¹⁷ are its governance, principles, agreements, interoperability levels, and high-level use cases.

¹⁵ https://ec.europa.eu/health/sites/health/files/ehealth/docs/ev_20151123_co03_en.pdf, last accessed 30 July 2018.

¹⁶ Official Journal of the European Union, 18.7.2008, L190/39 - recital 3(g)

¹⁷ https://www.antilope-project.eu/wp-content/uploads/2013/05/D1.1-Refinement_of_Antilope_Use_Cases_v1.2.pdf, last accessed 30 July 2018.



The ReEIF is the most recent version of the eEIF. It has been developed by the EU-funded Antilope project on eHealth interoperability as a refinement of the eEIF. This framework provides, among other things, an overview of possibly relevant use cases and appropriate links to the existing and available profiles from the major international consortia in the area of

standardisation and interoperability. The refined model splits two of the original levels into two (i.e., the organisational and the technical levels), yielding six levels (see embedded image).

The ReEIF was endorsed¹⁸ by the 8th meeting of the eHealth Network (Brussels, 23 November 2015) as one foundation for cross-border eHealth Services (e.g. CEF eHealth) and to support the idea of establishing a platform of Standard Developing Organisations (SDOs) serving the Member States and European Commission.

3.5 Generalised Refined eHealth European Interoperability Framework (g)ReEIF

Following from the analysis of existing literature, including European policies, work on interoperability in the healthcare sector appears as a sophisticated frontrunner for providing fine-grained tools for enabling interoperability in complex fields that demand both semantic and technical interoperability. International harmonised nomenclatures, coding systems enforced by legal and financial regulations and families of interoperability profiles endorsed by European policies¹⁹ are just some examples. These standards are of course domain-specific and can only be applied in the health, wellness and social care domains.

However, the principles of the Refined eHealth European Interoperability Framework Interoperability Framework can be adapted for a Generalised Refined eHealth European Interoperability Framework (g)ReEIF that is well suited to underpin the generic requirements needed to implement interoperability in ICT for AHA – established as a PROGRESSIVE ethical tenet. This approach is exemplified by two carefully selected use cases, described in detail in chapter 4.

In a nutshell, the term “generalised” indicates that the type of service is transferred as a general principle from the specific case of care services to generic services in the eGovernment,

¹⁸ https://ec.europa.eu/health/sites/health/files/ehealth/docs/ev_20151123_co03_en.pdf, last accessed 30 July 2018.

¹⁹ Commission Decision (EU) 2015/1302 of 28 July 2015 on the identification of ‘Integrating the Healthcare Enterprise’ profiles for referencing in public procurement (Text with EEA relevance), <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32015D1302>, last accessed 30 July 2018.

AHA and health domains. In a future step, the framework (g)ReEIF may be further developed under a new name; so far the link to the “ReEIF” model, as endorsed by the eHealth Network, is maintained for the sake of clarity.

4 Application of the (g)ReEIF to real-life use cases in smart housing and well-being

The application of the Generalised Refined eHealth European Interoperability Framework (g)ReEIF is exemplified in the case of two use cases in the ICT for AHA domain. These use cases were identified by preparatory work (cf. D7.1). One straightforward selection criterion for the choice of these use cases has been the access to substantial documentation that would enable an in-depth analysis of the enabling factors for interoperability.

To provide a practical example for the application of interoperability frameworks and interoperability standards for this work, WP7 has defined a suitable assessment template²⁰ consisting of a two part assessment (for the full text of the assessment template: see Annex 2).

- ⇒ Part 1 of the template introduces the context (“purpose and scenario” etc.)
- ⇒ Part 2 follows explicitly the structure of the six interoperability levels as defined by the (generalised) Refined eHealth European Interoperability Framework.

4.1 Use case: Networked living in the neighbourhood (City of Hamburg, Germany)

An interesting example of networked living in the neighbourhood was demonstrated in Germany, in the middle of this decade: <http://www.vernetztes-wohnen-hh.de/>. The initiative received funding from the European Regional Development Fund. It has served as the foundation and pilot for AGQua²¹, a permanent smart housing programme of the City of Hamburg.

Called VWiQ (which stands for “networked living in the neighbourhood”), the initiative took place in the city of Hamburg. Sixty thousand citizens in the city already need some form of assistance or nursing care. Most of them prefer to stay in their own home and the familiar neighbourhood environment where they have lived for most of their lives.

The system that was trialled is based on smart home technology, ambient assisted living support systems, and neighbourhood services. The smart home technology created ‘easy living’. It included home automation, and electronic control of household appliances as well as doors, windows, and blinds. The support systems involved fall detection, social alarms, motion/activity sensors, an automatic barcode ordering system, and a smart laundry service.

One of the initiative’s images shows how control of the smart home technology can be done through a central screen with a touch function.

²⁰ The foundational work and documentation for the Refined eHealth European Interoperability Framework as endorsed by the Article 14 eHealth Network do not include an assessment guide for use cases.

²¹ see <https://www.agqua.de/startseite.html> (in German), last accessed 30 July 2018.



Figure 2: Using a touch screen in the “networked living in the neighbourhood” initiative.
Source: Networked living in the neighbourhood documentation

Local resident, Ingeborg Schultz, aged 74, enthused:

“A big advantage is the networking of this apartment with residents and service providers in the quarter. I may not be able to use [the network] at the moment, but I have the option to use it when the time comes – if I am restricted to my bed or the like. That provides me with a great deal of reassurance.”

4.1.1 Part 1: Context (ambition, purpose, functionality, scenario ...)

<p>Title of the use case</p>	<p>“Vernetztes Wohnen im Quartier” (VWiQ) <i>(“Connected Living in the Neighbourhood”)</i> www.vernetztes-wohnen-hh.de²²</p>
<p>Context and Ambition</p>	<p>VWiQ was set up in Hamburg (Germany), where - by the year 2030 - one in every three citizens will be over sixty years old (while the number of people aged 80 and over will grow at an ever faster rate). Currently, 60,000 citizens already need some form of assistance and/or (nursing) care, while most of them prefer to stay in their own home</p>

²² A similar, although real-life example, may be the service(s) offered by Cubigo (a company based in both the USA and Belgium: <http://www.cubigo.com/en>), last accessed 30 July 2018.

	<p>and the familiar environment of the neighbourhood where they have lived most of their life.</p> <p>A two-year pilot study was run in a Hamburg neighbourhood by using a “model apartment” to test the acceptability of a network, intended for use by older adults, linked with a range of services.</p> <p>Both public authorities and private sector companies were involved in the study, which was co-financed through European funding and German funding. The exercise was a test only; an extended test is planned for the future.</p>
<p>Purpose / Rationale</p>	<p>The purpose of the VViQ service and technology platform is to allow older people to live independently in their own homes, through the implementation of intelligent and connected technologies and services that support activities of daily living, care provision and social contacts.</p> <p>The rationale for the platform is not necessarily to replace human contact and interaction, but rather to complement, enhance and support it.</p>
<p>Scenario:</p> <p>a) Approach and Description</p> <p>b) Procedures/processes</p>	<p><u>Approach:</u> The system is based on smart home technology, support systems (i.e., AAL) and neighbourhood services.</p> <p>Smart home technology is used for ‘easy living’ and includes home automation, electronic control of household appliances and doors/windows/blinds, etc.</p> <p>Support systems refer to ambient/active assisted living (AAL) solutions and include such systems as fall detection, social alarms, telephony services, smart laundry service, automatic barcode ordering system, motion/activity sensors, etc.</p> <p><u>Description</u> Neighbourhood services include shopping services, cooking/meal services, cleaning services, hairdressing, taxi/transportation service, pharmacy, homecare or home nursing, etc.</p> <p>VViQ provides different technologies and services that cover various application areas:</p> <ul style="list-style-type: none"> • leisure and participation (e.g. social contacts) • comfort and safety (e.g. technical maintenance) • mobility and service (e.g. laundry service, meal service) • prevention and health (e.g. medical services, vital signs monitoring, medication reminders). <p>Depending on the level of dependency (linked with physical and/or cognitive decline or impairments), the older</p>

	<p>person can choose to install and use various assistive and smart home technologies and access various services (via the VWiQ platform).</p> <p><u>Procedures/processes:</u> People are encouraged to start implementing and using the technologies at an early stage (and indeed at an early age), so that they are acquainted with the system and the interface, and so that they can easily use them once they ‘really’ need them (because of physical or cognitive impairments). Younger people can already make use of some of the leisure and comfort functions of the system, just to enhance their living conditions or to acquire basic services. Older people (with chronic conditions, or reduced mobility, or early dementia) will also use the system more and more for safety, mobility, and health applications.</p>
<p>Functionality incl. key components of implementation</p>	<p>The smart home and AAL functions as well as the neighbourhood-based services are linked together as building blocks into so-called ‘modules’.</p> <p>The user can access the modules in his/her home via a central communication platform. Since not every person needs the same modules, they can be customised according to the specific needs of a person into various ‘supply models’.</p> <p>For different life phases the appropriate supply model with the appropriate technology/service modules can be applied, ranging from ‘comfort’, over ‘prevention/compensation’, to ‘assistance’ and ‘care needs’.</p>
<p>Actors and Interfaces</p>	<p>Information system actors</p> <p>The information systems interfaces are numerous (15+).</p> <p>The neighbourhood (VWiQ) server runs on Apache2 with a MySQL database. The backend is programmed in PHP. Communication with the Gateway Server takes place via a Web socket. For external service providers, a REST API was created.</p> <p>The Gateway server (in the person’s home) runs on Node.js with a MySQL database. The backend is programmed in JavaScript. While the communication to the VWiQ server and the Hybrid app is via Web socket, the connection to the Smarthome takes place via a TCP / IP connection.</p> <p>Human actors</p> <p>Among the actors were the older adults themselves (who had differing conditions or were of various ages (yet, all were over 60 years of age). Also involved were carers and</p>

	family members, as well as neighbourhood-based service providers.
Accessibility and Usability	In terms of end-user interfaces, users (and also their carers and service providers) can access the platform via smart-TV, tablet (or mobile phone), or internet browser (computer). Certain smart home functionalities can also simply be operated via switches or buttons.

4.1.2 Part 2: Analysis for implementing with regard for the levels of (g)ReEIF

(g)ReEIF: Legal and regulatory: Compatible legislation and Regulation	<p>This use case is confined to a local geographic area, (i.e. a neighbourhood). It can be replicated in other local areas.</p> <p>The services offered must comply with local and national regulations around licenses, permits or concessions. Any medical devices, telecom terminal equipment and electronic equipment that is used or installed as part of the system must comply with relevant national regulations and with the European Directives for these types of products (CE mark).</p> <p>The use case also involves voluntary support on behalf of family carers, neighbours and friends, which is very important for the 'system' to work appropriately.</p> <p>Possible relevant areas of legislation would be: housing; community dwellings; services and service provision; data protection in accordance to the GDPR²³; accessibility/usability; eCommerce or commercial contracting; regulations related to availability of health data.</p>
(g)ReEIF Policy: Collaboration agreements, governance	<p>The VWiQ system/service involves various local service providers (shopping, laundry, hairdressing, transportation, nursing care, medical care, meal preparation and delivery, and more). It is not clear if – in the current VWiQ system/service – there are specific collaboration agreements or contracts in place. But these could easily be foreseen in order to guarantee adequate (and quality) service delivery.</p> <p>The precise contractual arrangements made among the 6+ project partners were presumably governed by the relevant project guidelines (European Union; German Health</p>

²³ General Data Protection Regulation: Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation), <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02016R0679-20160504>, last visited 30 July 2018.

	<p>and Consumer Protection Agency (BGV); also, Hamburg-based financing) and any (internal) consortium agreement. Contractual arrangements with the technical service providers would need to be subject to liability criteria. Business arrangements among small or large service businesses are not specified.</p>
<p>(g)ReEIF: Service process: Alignment of service processes and workflows</p>	<p>In this case, arrangements to be made in real life might be complex because of the public-private coverage, and the range of services involved e.g., housing; (washing and shopping; handy-worker) service provision; as well as the security elements of entry to the individual apartments. At the level of data, there is an implied “bringing-together” of personal / private data; calendar/appointment data; emails and texts; and e.g., health data, including nutritional data.</p> <p>There is still a need for alignment of processes and workflows among the different service providers that are involved in the local network.</p> <p>Examples:</p> <p>An appointment or activity outside of the user’s dwelling, may require a transportation or companion service. This should (preferably automatically) be foreseen or streamlined into the processes.</p> <p>If – or when – a user falls, and an alarm is generated by the system, a family member, neighbour or professional carer should be alerted.</p>
<p>(g)ReEIF: Information: Data model, terminologies, formatting</p>	<p>On information and data models, no data was available.</p> <p>From an interface design perspective, the VWiQ followed the objective to establish the same look and feel on all devices, i.e. Smart-TV, Tablet, Computer) and applied hence uniform specifications for size of text, background colours, layout, user guides, etc.</p>
<p>(g)ReEIF: Applications: Integration in healthcare applications</p>	<p>Health profile: All data on the health status of the end-user are displayed and recorded in the information system, e.g. if there are restrictions on the use of the arms, legs or feet. Nutritional intolerances are also identified.</p> <p>Usability/user-friendliness: This was an ambition of the VWiQ pilot. Some of the solutions offered were, however, viewed negatively by the trial end-users.</p> <p>The user accesses the system via the ‘platform’, i.e. a user interface on his/her smart-TV, tablet or other mobile device, or via an Internet browser on a computer.</p>

<p>IT Infrastructure: Communication and network protocols</p>	<p><u>Interoperability standards and protocols</u></p> <p>The platform is connected via internet communication to a local 'Gateway Server' in the user's dwelling which stores all user data and 'communicates' with the smart home functions. It also ensures secure and private communication to a dedicated 'VWiQ Server'. The VWiQ Server is the primary interface between the individual users in the neighbourhood and the shared data storage such as services or events. It handles all communication between the residents and external users such as service providers. This includes messages, data requests from the Gateway Servers, and e-mail delivery.</p>
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4.2 Use Case: Support for Diabetes Self-Management in Wales

This use case is centred on an established and clinically approved app that supports people, through text messaging, with taking medication and reporting signs that relate to their health and well-being. The app in question is called 'Flo' (or Florence in full); its naming was inspired by internationally-renowned 19th century nurse, Florence Nightingale²⁴. It was developed within the national health service (NHS) in various parts of the United Kingdom, and supports self-care. It is used in countries/regions, such as England, Scotland, and Wales^{25,26}. Benefits are now in evidence in terms of individual well-being and cost savings to the NHS. There is an increasing imperative in the field of active and healthy ageing that people must play a pro-active part in the management of their own health and care. The 'Flo' app (and, no doubt, other apps with similar functions) contribute to this and to the building of health and digital literacy.

The Florence functionality (<https://www.getflorence.co.uk>) is a key component of the "Tele-health in Practice" service offered by NHS Wales to their patients.

Florence is a platform supports telehealth services by three basic functionalities:

- ⇒ Collecting Patient Readings: Florence reminds patients to take their own readings. They can use their own mobile phone from the comfort of their own home to do this.
- ⇒ Informing clinicians about the readings: Clinicians can manage patients' readings from a simple web interface. Clinicians can set Florence to alert them with an email or text when patient readings don't look right or show worrying trends.

²⁴ https://en.wikipedia.org/wiki/Florence_Nightingale , last accessed 30 July 2018.

²⁵ <http://united4health.eu/wp-content/uploads/2017/04/D6.7-v1.4-United4Health-Final-Study-Evaluation-Diabetes.pdf> (see the description of the trialling of Flo in Wales on p18-20), last accessed 30 July 2018.

²⁶ This use case is one which has developed out of trials/pilots also referred to in the following use case (from UNITED4HEALTH).

- ⇒ Sending alerts to patients via mobile platforms: Regular, personalised health tips and medication reminders are sent to patients based on their readings. Patients become more involved and take more responsibility for their own healthcare.

The description of the use case has been taken from materials provided by the partnering regions of the United4Health project, and the analysis has been undertaken using that detailed documentation. A diagram displaying processes and supporting information flow is given in the figure below.

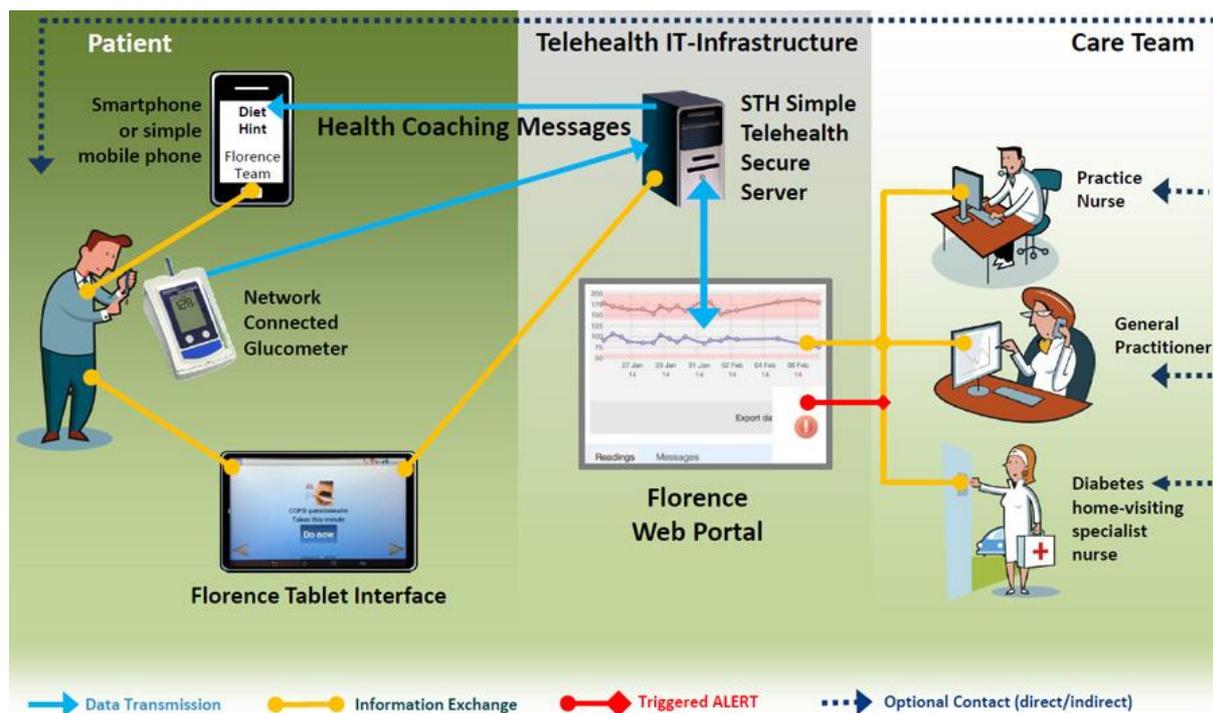


Figure 3: Diabetes telehealth configuration and key interactions: Wales (from United4Health, 2016)

4.2.1 Part 1: Context (ambition, purpose, functionality, scenario ...)

Title of the use Case	Support for Diabetes Self-Management in Wales
Context and Ambition	This use case is centred on an established and clinically approved app that supports people, through text messaging, with taking medication and reporting signs that relate to their health and well-being. The app in question is called 'Flo' (or Florence in full); its naming was inspired by internationally-renowned 19th century nurse, Florence Nightingale ²⁷ . It was developed within the national health service (NHS) in various parts of the United Kingdom, and supports self-care. It is used in countries/regions, such as

²⁷ https://en.wikipedia.org/wiki/Florence_Nightingale , last accessed 30 July 2018.

	<p>England, Scotland, and Wales²⁸²⁹. Benefits are now in evidence in terms of individual well-being and cost savings to the NHS.</p> <p>In NHS Wales, the emphasis of Diabetes Care is on empowering patients to establish a healthy lifestyle and to enable patients to manage their health conditions as much as possible themselves. Hence, Diabetes Care Management, i.e. routine care for patients with Type 2 diabetes, is undertaken by the patients themselves, supported predominantly by their General Practitioner and the General Practice practice nurse who has a special interest in diabetes in primary care.</p>
<p>Purpose / Rationale</p>	<p>The purpose of the Flo service is to provide monitoring and automated – yet individualised – feedback towards patients who check and send off their blood glucose level. The rationale is to improve the individual patient's self-management by timely and customised feedback, hence both enhancing the regularity of measurements as well as the adjustments of lifestyle and or food intake. To achieve this, the telehealth service receives patients' measurement data and provides health coaching interventions.</p>
<p>Scenario:</p> <p>a) Approach and Description</p> <p>b) Procedures/processes</p>	<p>Patients receive text message reminders to perform their blood glucose readings using their own glucometers according to a regime defined by their General Practice. Readings are transmitted via mobile interfaces, instantly (rule-based) processed. This results in staff actions and/or messages to the patient. Staff actions include the review of anomalous parameters and respective responses and follow-ups. Messages can include health advice, change of medication, reminders etc.</p> <p>Any worsening symptoms will be treated according to local standard protocols, e.g. General Practice appointments, with the option of referral to the home-visiting diabetes specialist nurse, emergency room attendance or hospital admission.</p> <p><u>Procedures/processes:</u></p> <p>The Simple Telehealth program analyses the patients' readings according to their individualised parameters, agreed between patient and clinical team. Flo provides instant feedback to the patient via their mobile phone along with locally agreed advice and health coaching messages, if required. Should a parameter be critically breached, the</p>

²⁸ <http://united4health.eu/wp-content/uploads/2017/04/D6.7-v1.4-United4Health-Final-Study-Evaluation-Diabetes.pdf> (see the description of the trialling of Flo in Wales on p18-20), last accessed 130 July 2018.

²⁹ This use case is one which has developed out of trials/pilots also referred to in the following use case (from UNITED4HEALTH).

	<p>patient will be advised on what immediate action to take and who to contact.</p> <p>An alert message is also sent to the nominated diabetes care professional (either Practice Nurse, General Practitioner, or Home-Visiting Specialist Nurse). This can be reviewed immediately via a secure internet connection, or the next working day if the anomalous parameter occurred out of working hours. The patient continues on low-level telemonitoring, receiving it on their mobile phone and through web links to be viewed via the Internet on a device of their choice, different text prompts via Florence©, Simple Telehealth web-based monitoring system (Stoke-on-Trent, NHS England) for up to 12 months following enrolment. Any worsening symptoms will be treated according to local standard protocols, e.g. General Practice appointments with the option of referral to the home-visiting diabetes specialist nurse, emergency room attendance or hospital admission.</p>
<p>Functionality incl. key components of implementation</p>	<p>Florence© (Flo) is programmed to generate and display automated text message reminders on patients' devices ("old" mobile phones, smart phones or tablets).</p> <p>Flo also provides the transmission of parameters and their processing on a central platform ("Simple Telehealth program"), that is available for secure login for health professionals. Flo offers here the functionality to flexibly define the rules for the rule-based actions.</p> <p>The Simple Telehealth program analyses the patients' readings according to their individualised parameters agreed between patient and clinical team. Flo provides instant feedback to the patient via their mobile phone along with locally agreed advice and health coaching messages, if required. Should a parameter be critically breached, the patient will be advised on what immediate action to take and who to contact.</p>
<p>Actors and Interfaces</p>	<p>Information system actors concerned are the central hub for collecting and integrating the data, the measurement devices that are gated through the mobile phone at the patient's home/end and the mobile phone as a "display unit".</p> <ul style="list-style-type: none"> • Reminders from Simple Telehealth Server to patient • Measurements from patient to Telehealth server • Access by health professionals via web technology • Messages from Telehealth server to patient.

4.2.2 Part 2: Analysis for implementing with regard for the levels of (g)ReEIF

<p>(g)ReEIF: Legal and regulatory: Compatible legislation and Regulation</p>	<p>Telemonitoring must be foreseen in the standards of professional practice and included in the reimbursement. Devices that are placed in patients' hands need a CE marking and must comply with relevant regulations of the Medical Device Directive. Compatible legislation and regulation may come into play when buying devices from different suppliers (this element has not been investigated for this use case).</p>
<p>(g)ReEIF Policy: Collaboration agreements, governance</p>	<p>The data exchange for the service is constrained to patients and health professionals working in one jurisdiction. Clear and transparent agreements between all organisations and persons involved have to be in place. However, this has not been the subject of available documentation.</p>
<p>(g)ReEIF: Service process: Alignment of service processes and workflows</p>	<p>The Telehealth processes involved in Flo are located in addition to an already-existing self-management oriented service: Diabetes Care Management - routine care. Usual care for patients with Type 2 diabetes is undertaken by the patient themselves, supported predominantly by their General Practitioner and the General Practice practice nurse who has a special interest in diabetes in primary care. Patients are invited to have, as a minimum, annual reviews as part of the Quality and Outcomes Framework (QOF) which includes testing their average blood sugar glucose level (HbA1c) and renal function, measuring their blood pressure and lipids, undertaking a microvascular/neuropathic assessment, and providing them with health and lifestyle advice. In addition, patients receive a retinopathy screening appointment annually.</p> <p>Patients can be referred to medical and nursing diabetes specialists in the hospital and/or community services, if required.</p>
<p>(g)ReEIF: Information: Datamodel, terminologies, formatting</p>	<p>An assessment of the Wales diabetes telehealth service by the industry advisory team of the United4Health project revealed poor interoperability with regards to data models and terminologies: The current system is set up to be "stand-alone". It enables the combination of automatic and manual data entry. However, it does not use data or messaging standards. Flo is, nevertheless, intended to be part of standard of care for diabetes in the Wales NHS services.</p>
<p>(g)ReEIF: Applications: Integration in healthcare applications</p>	<p>The devices used for diabetes participation were glucometers (several brands were used, as patients already have their own glucometers) and smartphones. The glucometer</p>

	devices were not connected directly to a gateway communication hub. Instead, patients manually entered the information into their smartphone.
IT Infrastructure: Communication and network protocols	Standard mobile network and internet communication is established using international networking standards.

5 Annex 1: Matrix of ICT for AHA service domains based on the “WHO Flower”

	A. Employment, education and training	B. Participation in Society	C. Independent Living
1. Homes and Buildings	1A. ICT for age-friendly workplaces	1B. Accessibility and usability of ICT in public buildings	1C. Accessibility and usability of dwellings (e.g., home automation)
2. Social Participation	2A. Mentoring platforms, e.g. that are web or social media- based	2B. Leisure activities and intergenerational activities associated with ICT	2C. Assistive technologies making use of ICT
3. Respect and Social Inclusion	3A. Diversity charters (specific human resource policies and initiatives for older workers that are related to ICT)	3B. Volunteering platforms, e.g. that are web or social media- based	3C. Social inclusion initiatives related to ICT
4. Civic Participation	4A. Vocational training and policies on work-life balance with a special relationship to ICT	4B. eGovernment and participatory eDemocracy	4C. Lifelong learning using ICT
5. Communication and Information	5A. Computer training / Digital literacy	5B. Accessibility of ICT devices in community facilities	5C. Accessibility of ICT and software
6. Community Support and Health Services	6A. Occupational safety and health policies / services with a special relationship to ICT	6B. Community care services and motivational coaching with a special relationship to ICT	6C. Home care (health & social care) and remote health monitoring
7. Outdoor Space and Built Environment	7A. Safe routes and accessibility of buildings, e.g. using indoor navigation or motion-driven lighting	7B. Emergency services in outdoor spaces with a special relationship to ICT	7C. Geolocalisation devices
8. Transport	8A. Smart transport-solutions to serve economic centres (public transport, car sharing...), and remote and flexible (electronic) working	8B. Accessibility and affordability of smart public transport	8C. Personalised (smart) transportation solutions

Table 1: PROGRESSIVE use case matrix - June/July 2017 collection and mapping exercise

Legend: Fields highlighted in light green indicate the two chosen use cases:
Smart Housing: 1A and 2A, Enabling Self-Management for health conditions: 6C

6 Annex 2: Template for assessing use cases vs. an interoperability framework

6.1 Part 1: Context (ambition, purpose, functionality, scenario ...)

Title	Title of the use Case
Context and Ambition	Explains the domain of the service; policies guiding its implementation, etc.
Purpose / Rationale	The purpose and scenario describe the rationale and aims
Scenario	The scenario describes the approach to implement the rationale, i.e. what is it, how does it work. Subdivided into a) Approach and Description and b) Procedures/processes
Functionality incl. key components of implementation	Functionality explains key components of implementing the use case, what it does; how it “comes together”
Actors and Interfaces	List of the interfaces of the information systems / human actors
Accessibility and Usability	Accessibility and usability aspects for the service.

Table 2: Template for capturing the context of interoperability use cases

6.2 Part 2: Analysis for implementing with regard for the levels of (g)ReEIF

<p>(g)ReEIF: Legal and regulatory: Compatible legislation and Regulation</p>	<p>On this level, compatible legislation and regulatory guidelines define the boundaries for interoperability across borders, but also within a country or region.</p>
<p>(g)ReEIF Policy: Collaboration agreements</p>	<p>On this level, contracts and agreements between organisations have to be made. The purpose and value of the collaboration must be set. Trust and responsibilities between the organisations are formalised on the policy level. In governance documents, the governance of collaboration is anchored.</p>
<p>(g)ReEIF: Service process: Alignment of service processes and workflows</p>	<p>After the organisations have agreed to work together, specific care processes are analysed and aligned, resulting in integrated care pathways and shared workflows. This level handles the tracking and management of the workflow processes. The shared workflow prescribes which information is needed in order to deliver the integrated care.</p>
<p>(g)ReEIF: Information: Datamodel, terminologies, formatting</p>	<p>This level represents the functional description of the data model, the data elements (concepts and possible values) and the linking of these data elements to terminologies that define the interoperability of the data elements.</p>
<p>(g)ReEIF: Applications: Integration in healthcare applications</p>	<p>On this level, agreements are made about the way import and export of medical information are handled by the healthcare information systems.</p> <p>The technical specification of how information is transported is at this level (communication standards).</p> <p>The information systems must be able to export and import these communication standards.</p> <p>Another aspect in this level is the integration of the information and knowledge in a user-friendly way.</p>
<p>ReEIF: IT Infrastructure: Communication and network protocols</p>	<p>The generic communication and network protocols and standards, the storage, backup, and the database engines are on this level. It contains all the “generic” interoperability standards and protocols.</p>

Table 3: Template for capturing implementations regarding the levels of the (g)ReEIF

7 Annex 3: Implementing Interoperability Frameworks: Profiles

NB: Following the feedback given to the PROGRESSIVE consortium at the Annual Technical Review in January 2018, this report has been streamlined towards a targeted summary for ICT for AHA. As a result, the section on interoperability profiles has been limited and moved to the Annex.

Generally speaking, an interoperability profile is a guideline for implementation of a specific process that provides precise definitions of how interoperability standards can be implemented to meet specific needs in a particular application domain, e.g. clinical needs.

Widely-used interoperability profiles in the health and social care domain, are Continua profiles maintained by the Personal Connected Health Alliance (PCHA³⁰) and Integrating the Healthcare Enterprise (IHE³¹).

For healthcare, a set of interoperability profiles that were defined by IHE, have been endorsed by the European Commission and published in the Official Journal of the EU³², making them a reference for tenders launched in the field of Health-IT software.

- ⇒ IHE Profiles organise and leverage the integration capabilities that can be achieved by coordinated implementation of communication standards, such as DICOM³³, HL7³⁴, HL7-FHIR³⁵, W3C³⁶ and security standards.
- ⇒ IHE Profiles provide a common language for purchasers and vendors to discuss the integration needs of healthcare and the integration capabilities of healthcare IT products.
- ⇒ IHE Profiles offer developers a clear implementation path for communication standards supported by industry partners and carefully documented, reviewed and tested.
- ⇒ IHE Profiles give purchasers a tool that reduces the complexity, cost and anxiety of implementing interoperable systems.

³⁰ <http://www.pchalliance.org/>, last accessed 30 July 2018.

³¹ <https://www.ihe.net/> (IHE International) and <https://www.ihe-europe.net/> (IHE Europe), last accessed 30 July 2018.

³² Commission Decision (EU) 2015/1302 of 28 July 2015 on the identification of 'Integrating the Healthcare Enterprise' profiles for referencing in public procurement (Text with EEA relevance), <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32015D1302>, last accessed 30 July 2018.

³³ <https://www.dicomstandard.org> , last accessed 30 July 2018

³⁴ <http://www.hl7.org>, last accessed 30 July 2018

³⁵ <http://www.hl7.org/fhir/?ref=learnmore>, last accessed 30 July 2018

³⁶ <https://www.w3.org>, last accessed 30 July 2018