Use case document: Location, sharing of data

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Use case 1: Long Term Care (LTC) scenario

The user of this UC is a very old person whose physical as well as cognitive conditions have required his/her recovery in a hospice. The user is affected by non-critical pathologies (e.g. minor hearth problems).

Additional users are family members who may not necessarily live close to the health care facility therefore regular visit at the premises may not be possible. This requires family member to rely upon medical staff for getting information about his/her health conditions.

The hospice rely upon private ***cloud-based services****, which allows relatives (subject to explicit approval of the patient) and medical staff to access his/her clinical folder online and to be constantly updated on everything related to actions of the user. The hospice staff regularly use specific ***online evaluation tests**** (e.g., the Long Term Care Facility scale by InterRAI™) in order to periodically evaluate the user's cognitive conditions. If the parameters registered indicate a worsening of the patient's situation, an alert is generated. The medical staff can then identify a new care project, for example changing medical treatment.

Within the facilities, a warning is generated whenever it is time for the user to take medicines. This is done, for instance, through dispatching of a message to the users' mobile phone or tablet (via a dedicated ***app****) or to the TV ***set-up box**** inside the room where the user is located. Once medication is taken the user is asked to provide explicit confirmation for staff to be able to check if the action has been completed.

This requires indoor localisation system e.g. based on tags to be worn by the users (e.g. belt or similar) in order to monitor his position inside the structure and in the surrounding garden. This allows re-enforcing of positive habits, for instance user being left free to walk (often very desiderable in case of relatively good heath conditions) by their own in the garden. At the same time monitoring allows ensuring maximum safety of the user, ensuring he/she is inside a secure area and he/she is not encountering any problems. In fact, the interface communicating with the sensor would produce an alarm if the user moved outside the hospice safe area.

**) "set-up box", "system", "app" and "service" all refer to the various components being developed by the EC funded project UNCAP (www.uncap.eu)*

Use case 2: moving from specialised care facilities to home

The user of this UC is an elderly person who, due to an accident, has a temporary physical disability. After surgery (or other treatment) the user is required to stay for a limited time (e.g. a week) at specialised care facility designed to help patients experiment with, and identify, the most suitable level of aid technologies for them to use once back home.

Set-up boxes* are installed at the premises of this centre with location technologies specifically targeted to assessing appropriateness of each technology to each specific patient.

A ***camera-based tracking system**** (or other high-accuracy RTLS) allows precisely tracking of the user's movements (including libs) while in the living area of the apartment. Wearable sensors are used to assess the user's level of fatigue and stress. This information can be used to assess the patient's acceptability and the cost/utility ratio. The local public health agency runs a dedicated ***service**** on their servers to which all the devices within the public health system (including the one at the rehab center) can connect.

After a week the user identifies the most suitable aid and moves home where one of the family member (or other caretaker) installs a ***set-up box**** connected to the TV set. In addition, small position sensors (e.g. with embedded acceleration measurement) are attached to the user's garments (e.g., slippers and shoes, or wherever the user wants to in order to be as non-invasive and aesthetically acceptable). This allows monitoring the user's mobility, automatically compiling evaluation tests, like the Tinetti mobility test.

Typically a social operator, helps the user with the cleaning and cooking during working days, while relatives cam stay with the user on weekends. The user should perform some daily exercises in order to train the muscles and articulations subject to the surgery, and he/she should try to move as much as possible. Also in this case assessing position over time is essential to assess the user's conditions.

In addition family members can interact with the user through the ***set-up box**** (e.g. via integrated video conference), reminding him/her when it is time to train, or guiding him/her and monitoring his/her performances during the exercises. Besides, the sensors can produce an alarm when indicating an abrupt deceleration followed by a prolonged stillness, indicating that the user could be fallen and not able to get up.

Family members and the user communicate also through an ***App**** installed on their smartphones, which visualizes also the user's profile and health details. Family members (if granted privileges by the user) can receive an overall description of the events related to the user's visits and conditions. Besides, caretakers can use the ***system**** to warn of particular problems; for example they can write a shopping list of items missing from the user's house, or they can advise a consultation with a doctor, if the user observes a sign of depression.

Once a week the doctor comes to visit the user; the doctor is constantly updated by the system about every important event or observation regarding the user's conditions. After verifying the patient's status, the doctor updates the clinical folder and the care project, changing the required mobility exercises if necessary. At weekends, the system reminds user's family members to perform simple tasks with their relative, e.g. small walks, according to the care project indicated by the doctor.

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Use case 3: home-based (standard scenario)

The user of this UC is an elderly person with MCI (Mild Cognitive Impairment) who lives alone and is still autonomous. Typically the user may have been subject to some episodes of memory loss and disorientation, and he/she is currently being monitored by his/her doctor.

An additional users are both family members, who typically do not live with the user and the doctor. The latter typically prescribes medicines and has activated a program of activities that the user should be able to perform by himself/herself at his/her own place, in order to monitor the patient's condition and to implement some simple measures to exercise memory and attention.

The TV can typically considered as the interface of preference with the user, to which specific IT devices can be attached in the form of ***set-up boxes****. These ***set-up boxes**** can be used to turn the screen on when it is time to take medications, or to start a remote sessions with a doctor to perform a periodic evaluation tests.

Set-up boxes* can be regarded as gateways to compatible **smart sensors kit**, which communicates with the set-up via standard protocols (e.g. M2M). **Smart sensors** include consumer grade devices such as activity-sensing bracelet, The ***set-up box**** is also used to connect IP camera for video conferencing or more sophisticated localisation kits which can be attached to several objects (medicine boxes, remote control, home keys etc.) to help the user locate them.

Through the ***set-up box**** (acting as home gateway) sensors can connect to ad-hoc developed cloud platforms (this may be provided as part of public care service), where the user's medical records can be stored and made available to the medical team.

When it is time to take the medicines, the set-up turns on the TV screen and produces an alarm audio and video signal. Then, an audio message suggests the user where his medicines are located. The sensors on the user's wrist and on the medicine box is used to understand if he/she has taken the medicine. After that, the system asks the user to place the medicine back in the right place, or in different places (this way the next time, the system may ask the user if he/she remembers the last place where the medicine box was left, in order to train his memory).

The system will also produce alarms in case the sensor on the user's wrist remains still for many hours during the day. The alarm can be seen by the user's doctor and family member (if properly authorised by the user to do so), who can therefore call the user to assert his conditions. If the user is out for a walk, the sensor (through an embedded GPS receiver) can be used to monitor his/her position and communicates it to the system via a wireless network. If the user is out for too long, maybe the user is living an episode of disorientation; the interface will then alarm the family member. At any moment, the family member (if authorised by the user) can monitor the user's conditions and ask questions using the system.

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Use case 4: home-based (high tech scenario)

The user of this UC is an elderly person with MCI (Mild Cognitive Impairment) such as light dementia (due to age) who lives in a single person household (or in a nursing home with other elderly persons). The user suffers from multiple pathologies such as COPD (Chronic Obstructive

Pulmonary Disease) and diabetes and therefore needs to carry on daily checks. For instance he she may need to measure his/her blood oxygen and/or blood glucose level daily, as well as other bio signals together with indicators assessing his/her mental state.

The user has bought a specific ***set-up box**** with two additional compatible sensors, for measurement of blood glucose and/or blood oxygen levels. The user also uses a smartphone (or tablet or smartwatch) to run a dedicated ***App****.

To better support him/her with assistance at home and to support tele-monitoring, he/she had his/her house refurbished and fitted with various sensors as well as with a building automation system which can be used to control lighting systems, shading, climate etc. The building automation system is compliant with the KNX standard (conforms to EN 50090 and ISO/IEC 14543) and therefore can be controlled by the ***set-up box****. Lastly, the house is also equipped with compatible sensor flooring that can be used to track the location of people and identify when someone has fallen, and to provide activity monitoring.

On daily basis, the user uses the ***set-up box****'s user-friendly interface and web-based social networking/video-conferencing features to communicate with friends, family members and –most notably- with caretakers for routine checks. During one of these routine checks with the medical helpdesk, based on latest information from blood glucose and/or blood oxygen levels, the doctor prescribes a daily check of both values and adds this schedule to the user's calendar (which can be used for medical and non-medical events). Periodic checks are assessed and the appropriate actions suggested for taking the appropriate medicine from the cabinet.

Historic information from the checks is stored in encrypted form within a dedicated ***cloud service**** managed by the private care service provider. The cloud features high level of security and whenever each party receives data it is re-encrypted uniquely thus ensuring cryptographic separation of each recipient's data and allowing audit by both key management and document distribution.

At the due time, the ***reminder service**** recalls the user through "contextualised" reminders which are adapted to the specific context. According to the situation the user is in, the ***system**** autonomously takes the appropriate actions to produce alerts using the most appropriate objects (through semantic assessment of connected object descriptions) which are "qualified" to raise his attention: this could be a smartphone ringtone, a buzzer, flashing light in the room (through command sent to the building automation system), a message on TV etc.

Following acknowledgement of such alerts the user is reminded through his ***App**** how (and where) to properly perform the test and, in case of need, he/she is also guided to the place in the house where the medicine is located. In extreme cases, tele-monitoring is activated with his/her doctors / caretakers.

One night, the user wakes up and gets out of his/her bed in a state of partial confusion. The ***system**** recognises his movements thanks to a night vision video camera or sensor flooring. The system automatically turns on soft lights (through a message to the KNX home automation system). Preventively, the ***system**** turns on the lights of the corridor to illuminate the path to the toilet (included) to help him/her reach the restroom. After a couple of minutes, he/she turns off the lights and goes to bed. Longer times standing still in the night may have triggered a warning to a caregiver, as this may indicate a problem.

NOTE: some of the features within the following section may require prior explicit consent by the user.

Family members or caretakers may be alarmed whenever reminders are repeatedly ignored while, whenever a threshold violation is detected, the medical team is notified together with an aggregated report of daily and weekly values to evaluate the patient's condition.

Abnormal patterns and/or extreme values are software detected and dispatched to the helpdesk or attending doctors who have full access to the EHR. The report includes also macroscopic information on physical exercise by the user (e.g. number of kilometres the user has walked per day, average time spent still etc.) based on aggregation of position information related to the user's mobile phone, which are automatically retrieved by the ***system**** within indoor and outdoor contexts. The most important alerts are also automatically sent to close relatives or to emergency staff either when the user clicks on the "emergency function" on one of ***specific devices**** (e.g. the ***App**** or ad hoc devices) or whenever the ***system**** detects that the user has fallen.

This event could be triggered, as illustrated earlier, in an autonomous and context-aware manner, fitting the equipment available to detect that a fall has indeed occurred (i.e. sensor flooring, image processing on camera feeds, noise patterns recognition, wearable sensors data etc.).

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Related OGC Standards and non-OGC standards

The aforementioned use case will be addressed through the definition of a specific O&M Profile called AHA-ML (Active and Healthy Aging Markup Language), specifically designed to represents, through a standard information model, biometrics observations of relevance to the domain of AHA, to allow exchange of such data in a hardware-agnostic and manufacturer-independent form.

The activities leading to the AHA-ML will be carried on in conjunction with the MLS (Mobile Location Services) DWG of OGC.