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Transformation of home care services, related working processes and business models due to introduction of mobile technology

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INTRODUCTION

In all developed countries people are more healthier than before and hence live longer and longer. For the society this means more elderly people to support and to do it for a longer period of time than before. This means more public responsibilities, more resources and higher costs in order to support and take care of elderly people. At the same time the number of people that can be engaged in care service for elderly is limited. The example shown in Figure 1 provides a typical situation with increasing number of elderly but more or less constant number of person in other age groups.

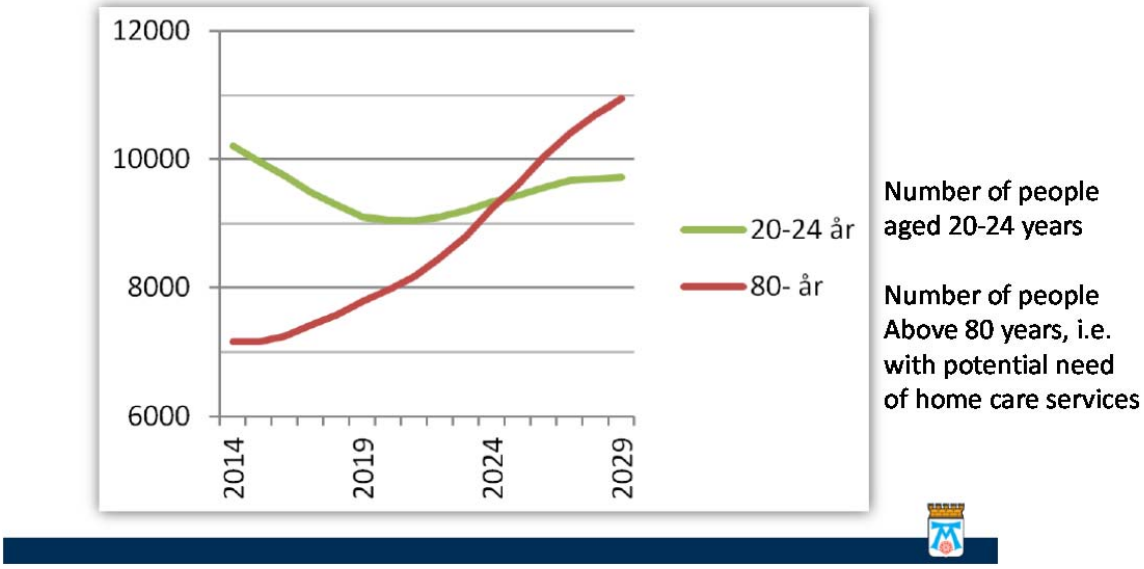

Figure 1. Part of motivation of need for e-home care services in the town of Västerås in Sweden, demographics showing increasing number of elderly and almost constant number of people 20-24 years.

This development has led to an increased interest from society, municipalities, health care and home care authorities to look into different ICT based solutions that can support and simplify working process and save costs. At the same time the quality of the services and the working conditions for the staff should be maintained or improved.

When it comes to healthcare, home-care and wellbeing services, a large number of initiatives can be identified including both research and actual services being deployed. The Ambient Assisted Living (AAL) initiative is an R&D effort motivated by the increasing relative number of elderly people[1]. The focus of the AAL program is ICT support in order to increase wellbeing for elderly people. The total funding of the 6-year program is 600 million €.

The trends and development described above reflect the *demand side* of services for elderly. At the same time there is a large interest from the *supply side* to develop and offer different mobile or ICT based solutions. This includes technology and solution providers, manufacturers of telecom equipment and mobile operators. However, many of these initiatives are technology driven and tend not to take off commercially. There are some examples where telecom actors have not been able to enter the market (Markendahl, Lays, 2013). Hence, we need to look into how technical innovations are able to match the needs of end-users and providers of health care and home care services for elderly people.

[1] http://www.aalforum.eu/

Technology companies have an increasing interest in the potential opportunities that can be achieved with the integration of smart devices to gather data or to automate processes. The type of communications between devices with minimal human intervention is referred to as Machine-to-Machine (M2M) communications. M2M solutions can be applied to improve industrial, commercial or service delivery applications (Wu, et al., 2011). We are also faced with Human-to-Machine (H2M) communications, e.g., when using a smartphone for interaction with sensors for remote monitoring and control of homes or when using mobile ticketing services. Internet of Things (IoT) is a related concept for services with communication between and with connected sensors and smart devices. Forecasts often refer to a figure of 50 Billion mobile devices that will be connected a few years from now[2].

The adoption of services based on smart devices usually entails the need to change the traditional business thinking, due to the transformation of the value network. Determining effective business models in these scenarios to create value from this technological shift is a must (Sharma & Gutiérrez, 2010); otherwise new actors will emerge to fulfil the required activities. M2M motivations are specific to each application and depend on the needs found on each market. For example, in the health care sector, there is an emphasis to change from episodic-care to continuous-care services and to minimize costs by remotely taking care of patients at home instead of the traditional care at hospital facilities (Kijl, et al., 2010). In addition, large scale applications related to smart metering, automotive and e-health count with strong incentives from public funding (TeliaSonera Business Day 2013, 2013).

The main contribution of this study is to analyze the different drivers and obstacles for the development of new services based on ICT related to healthcare, home-care and wellbeing services. Three different focuses have been identified as drivers for these services: focus on improving the working process for home care staff, focus on improving the service provided to the elders, and focus on improving the technical infrastructure needed for futures ICT services.

In this study, selected cases in Sweden related to IoT and ICT services for home care services are analyzed. Two of the cases target support for the elderly and their communication with the home care staff and relatives. The two other cases target the home care service provider and the related working processes, see Table I. Hence the drivers are totally different for these two main types of services. In order to understand the motivation and critical factors for development of new services based on ICT and three research questions are be addressed:

1. What are the main drivers/benefits and why is it a driver for the introduction of these services?
2. (How are the working processes, activities and behavior of elderly, staff and relatives changed?
3. What actors contribute in the value creation and how do they interact?

Table I. Overview of cases analyzed in the paper

Functionality	**Case and solution**	**Target users**
Access control & time reporting	Phoniro solution	Home care provider Home care authority
Real-time work planning	Intraphone solution	Home care provider
e-Home care service	Västerås solution	The elderly Home care provider
Assisted living support	Alleato solution	The elderly, relatives Home care provider

[2] Ericsson vision "Everything that can benefit from a connection will be connected" and 50 Billion M2M connections by 2020.

RELATED WORK

The problem area addresses different types of research and perspectives. The work that has been done in the area of e-health and m-health focus on the services and have a clear demand side perspective. Most papers on IoT and M2M focus on the technology, solutions and different pilot project. In the second sub section below we focus on research that target adoption of new services and technology. The third type of related work addresses business model aspects including actors and activities. Besides IMP references we discuss research that highlight: a) limitations when you look into business models at a single firm level and b) co-creation of value including both suppliers and end-users.

Health care and home care using Internet, e-health and m-health

The Internet can be used for seeking and delivering health care including different types of service like; health information seeking, Internet-based peer support groups, online health consultations and delivery of health interventions (Griffiths, et al, 2006), (Kijl, et al, 2010).

When it comes to home care services for elderly many projects focus on “health care in the home”, one good example is the Old@home project (Scandurra, 2007) (Hägglund, 2009). Other examples of home based healthcare and monitoring using telephone services can be found in (Griffiths, et al 2007) and (Paré, et al, 2007).

It seems to be a research gap considering home care services in the sense how elderly people are supported in their daily activities while staying at home.

The focus in our study is not on health care, which can be one component, but on efforts to enable elderly people to stay at their own homes as long as possible. The involved actors are home care authorities, home care service providers, ISPs, technology and solutions providers (Markendahl, 2011), (Forsström, 2013) and (Markendahl & Laya, 2013).

Adoption of IoT and M2M solutions and services

Business models and scenario proposals are focused on generic or future markets and the role of new actors in M2M services (Gonçalves, 2010), but not on how M2M solutions can be seamlessly included in existing working services. Most proposals do not consider the complexity in established businesses, the actors needed and the actual benefits that can be achieved. M2M solutions that exist today are those where the value is clear and convey enough benefits by themselves to allow deploying a complete vertical solution, from connectivity to service delivery; this deployment strategy may lead to duplicated infrastructure and high implementation costs. Recently, there has been a strong focus on the benefits of shared and common infrastructure (IERC, 2012), (Swetina, 2012), meaning that if a common infrastructure can be used for different M2M applications the initial investment costs will be reduced and the range of future business opportunities will be expanded (Shelby & Höller, 2012).

The M2M vendor market is also very fragmented and solutions must be designed for each specific customer. Many small developers attempt to fill the gap with their own solution, leading to high design and deployment costs and poor economy of scale. Major Standards Developing Organizations (SDOs) are focusing on the need for globally agreed specifications that allow a seamless integration of M2M solutions (oneM2M, 2012), (ETSI, 2012). Additionally, network operators are actively entering the market with the creation of M2M business units and working directly with partners such as system integrators or other operators to expand their footprint (Hase, 2012), (Morrow & Glitho, October 2012).

Technical solutions only represent part of the overall user and business context. M2M solutions can hardly be offered as a standalone service, they need to be integrated in the overall context. Therefore, services are often part of a complex value constellation where the traditional provider-customer model does not apply (Leminen, et al., 2012). This makes cumbersome the tasks of analysing where the real value and benefits are. The real economic benefits are yet unclear in many applications

An additional characteristic that should be taken into consideration for the business relationships regarding IoT and M2M applications is the fact that most solutions are not directly oriented to end consumers. Most of the potential benefits of device interconnection are for product manufacturers and the different types of services suppliers. The asset of device connectivity is data availability. In M2M applications data can be used for remote diagnosis, tracking, monitor usage and status of products; this allows the provision of improved and customized services, reduction of expenditures and optimization of working times. End consumers do not behave passively but are part of the aftermarket and deliver feedback to manufacturers and service providers in co-creation of values (Heapy, 2011), (Mejtoft, 2011).

There is a common view of the benefit of infrastructure sharing and global partnerships, but all the major efforts are still oriented in connectivity instead of being service-driven (Diercks, 2012), (Zhou & Rodrigues, 2013). Most of the large scale projects are pilots that prove the benefits but fail to become widespread implementations (Kijl, et al., 2010). The deployed solutions count with their own tailored approach but there are few ready-made solutions that are simple to integrate and are dedicated to particular industry segments.

There is research gap in the quantification of values and benefits that can be achieved with large scale applications in many sectors including health care and home care. There is also a need to study whether if successful cases can be replicated in different markets in a large scale. This is fundamental in order to achieve scalability and economy of scale. The cases we study in this paper all seems to be examples of local initiatives or service providers developing services in very close cooperation with the home care authorities.

Business Model, Business Networks, Actors and Activities

The business model by Chesbrough and Rosenbloom (2002) contains the elements: i) the value proposition, ii) the market segment, iii) the cost structure &profit potential, iv) the firm organization & value chain, v) the competitive strategy and vi) the position of the firm in the value network. This approach is also discussed for innovation of business models (Chesbrough, 2007). Business model approaches and definitions usually contain the same key elements. The Business Model Ontology (BMO) proposed by Osterwalder and Pigneur (2005) argues that a business model should express the business logic of a specific firm describing:

"the value a company offers to one or several segments of customers and of the architecture of the firm and its network of partners for creating, marketing, and delivering this value and relationship capital, to generate profitable and sustainable revenue streams".

Actor networks and interaction between market players have been studied by business and market researchers like Ford, Gadde, Hakansson, Johansson, Mattsson and Snehota since the 1980´s. This analysis to a large extent builds on the so called ARA model with Actors, Resources and Activities (Håkansson and Snehota, 1995), (Ford et al, 2007). The elements in the business model definition by Chesbrough and Rosenbloom describing the value chain and the position of companies within the value chain or network is closely related to the ARA model. A similar business network approach is described by Zott and Amit (2010). They discuss Activity systems from different perspectives; the content refers to what activities that are performed, the structure describes how activities are linked, and the governance

describes who performs the activities. The approach by Zott and Amit also include analysis of business model dynamics in terms of Activity design theme indicating the main driver for a change: novelty, lock-in, complementarities, and efficiency (NICE).

All the four approaches, BMO, Chesbrough & Rosenbloom, ARA-model and Activity systems have similarities in the sense that they include aspects like networks of actors and how the activities are distributed among actors. However, the value proposition aspects are explicitly highlighted only in the approaches by Osterwalder et al. and by Chesbrough & Rosenbloom. In this paper the key aspects are the value proposition, what service that is offered to customers, the content of the service, the perceived value to the end-users (including negative values) and the distribution of activities among actors. The competitive strategy (Chesbrough & Rosenbloom) will be used in the paper to highlight conflicts between the main actors.

Previous studies have highlighted the limitations on the business model literature that focuses on a single firm level, claiming that this view is static and simplistic. Studies have already address this dynamic characteristic (Doganova & Eyquem-Renault, 2009), where findings suggest that technology innovation is a "knowledge-intense" field that makes cumbersome the dialogue among stakeholders; in such cases, business models are the most appropriate tool to explain the create of value. Palo & Tähtinen (2013) propose the concept of a networked business model as a dynamic device to be used in planning emerging business and creating markets in a net of actors. Adopting the concept of strategic network perspective on the business model. This perspective contributes to previous studies that focuses on the different phases of a business model development, where the initial phase of the study takes an critical period that defined the initial network of a new technology-based service (Kijl et al, 2005; Srinivasan, 2008).

According to service-dominant logic (Lusch & Vargo, 2006), customers become co-creators of values, underlining the relevance of the interchanges in the relation between customers and suppliers. Lusch & Vargo (2006) determine that "value can only be created with and determined by the user in the consumption process and through use". Another important component in co-creation is referred to as co-production, which refers to the participation in the creation of the core offering. A distinctive qualities of Service-Dominant logic, is that considers customers, employees and organization as dynamic resources; denoting that all parties are simultaneously value-creators and value beneficiaries. This perspective breaks the distinctions between offerer-customer and supply-demand. Payne, Storbacka & Frow (2007) present a comprehensive vision of the co-creation of value, emphasizing the dialogue as a process that enhance the identification of customers' needs. Payne, Storbacka & Frow (2007), propose a practical framework consisting of three processes in managing value co-creation:

- Customer value-creating processes: corresponding to the processes, resources and practices that customers use to manage their activities.
- Supplier value-creating processes: corresponding to the processes, resources and practices that the service supplier uses to manage its activities and the relationship with other stakeholders.
- Encounter processes: processes and practices of interaction and exchange, which needs to be managed to have successful co-creation.

In the cases presented in this study, the value co-creation opportunity is provided by a technological breakthrough (Payne, Storbacka & Frow, 2007), which corresponds to the inexpensive access to real-time information at both ends.

METHODOLOGY

Data Collection

The first round of interviews with the solution provider Phoniro[3] and Telia about mobile phone locks and time reporting was done 2009-2010 (Markendahl, 2011). Follow up discussions were made September 2013. Interviews with the municipality home care services in Malmö and the solution provider Intraphone[4] were done June 2013. Data is also collected during discussions with home care authorities in Västerås autumn 2013 and in Uppsala March 2014. Discussions with the Norwegian solution provider Caretech[5] started April 2014. These actors were selected since they early presented solutions.

Smart buildings including access control, alarms and the Alleato solutions was discussed at a workshop May 2013 with ACREO, Ericsson, Stockholm city, Telcred[6] and Alleato. September 2013 meetings were held with Alleato[7] including a visit to the demonstrator apartment developed with the Swedish Institute of Assistive Technology in Stockholm. The authors also have visited the Mobile health summit in Stockholm September 2013, the Assisted Ambient Living (AAL) conference in Norrköping September 2103[8] and the "inspiration day" about e-home services organized by the municipality in Västerås October 2013[9] and the e-health session at the IoT value creation network workshop[10] organized by Sintef in Oslo April 2014.

In total 15 interviews and meetings have been held, the actors and number of interviews are summarized in table II. The interviews were organized as discussions around these three themes:

1. How the development of the service or solution started
2. What drivers, needs and benefits that are seen as most important
3. What happened when the service was introduced, how did users and provider re-act?

Table II. Overview of interviews

Type of actor	Companies or organizations	Interviews or meetings	Total number of persons
Mobile operator	Telia	2	In total 2
Home care authorities	Västerås, Malmö, Uppsala	5	In total 8 (2, 4, 2)
Providers of technical solutions and systems	Alleato, Caretech, Intraphone, Phoniro, Telcred	8	In total 8 (2,1,1,3,1)

[3] http://www.phoniro.se/sv/
[4] http://www.intraphone.com/en/
[5] http://www.caretech.no/
[6] http://www.telcred.com/
[7] http://www.alleato.se/
[8] http://www.newtoolsforhealth.com/press/news/34-aal-forum-in-norrkoping-2013
[9] http://www.viktigvasteras.se/ehemtjanst/inspirationsdag/
[10] http://www.internet-of-things.no/iot_net_conference_02_april_2014.html

Analysis approach

We will look into how new ICT based services are introduced in the home care sector by analysing what activities that are introduced by different actors. For each activity the need for new resources (devices, service platforms, applications or skills) will be identified. This is typical ARA modelling with actors, resources and activities (Håkansson & Snehota, 1995).

We also look into if the new activity is entirely "new", if it replaces an existing activity or if it makes an existing activity more efficient. From an empirical perspective the activities (and related solutions) can be organized grouped in the following groups:

- Activities and solutions focusing on tasks and the efficiency of the home care staff
- Solutions focusing on the elderly and the activities of and the communication with the elderly
- Solutions with focus on the infrastructure and home environment

We can also see clear links to the framework for describing value co-creation proposed by Payne, Storbacka & Frow (2007). *Customer value-creating processes* correspond to the activities of the elderly themselves. This can to a large extent also be seen as Encounter processes (processes and practices of interaction and exchange) since it deals with and how the elderly interact with the staff of the home care providers. For the *supplier value-creating processes* we can identify two different types; one corresponding to the activities of the home care staff (in order to improve efficiency) and another one related to the deployment and operation of an ICT infrastructure in the home environment.

These groups represent different perspectives and starting points of different actors. We will discuss how home care service are developed from different perspectives and how these different evolution paths evolve and how they may overlap.

CASES

Mobile Phones for Access and Time Reporting -the Phoniro solution

A solution developed by the Swedish company Phoniro uses mobile phone to open doors, removing the need to store physical keys by using Bluetooth communication between the phone and the electronic lock[11]. This solution is used for home health care in over 30 municipalities and towns in Sweden to improve convenience and efficiency. The system saves a considerable amount of time for the home care staff. There is no need to go to the central office and collect keys, the time reporting is done in real time and hence no need to go to the office and do the reporting. During a pilot project clear time savings were found, cases with up to 3 hours of time saving per working day were reported.

The Phoniro in-home lock module is added to the existing lock without causing any damage to the existing door and without any cabling and it is battery-powered. The health care staff uses a Bluetooth enabled phone to open the door by typing a password on the phone. This means that the lock will work also at power failures and where there is no radio coverage for the mobile network. The password also acts as a digital identification card. If the mobile phone is stolen entrance using the phone is prohibited. The key and access control information is distributed over the air. The user of the home care service can use a traditional physical key or a remote unit. The visits are recorded and used for time reporting and security assurance of who enters the home. Linked to the access control system is a web based portal service that enables relatives to monitor who enters the home of the care taker (Markendahl, 2011).

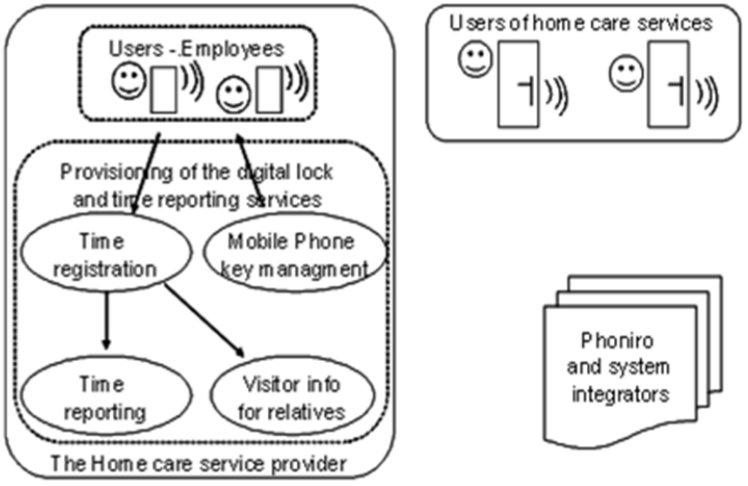

Figure 2. Main activities for home care service with mobile phones and digital locks

The home care services with digital locks, mobile phone keys, time registration and reporting target users within the own organization. The home care staff opens the door of the customer using the *Phoniro Phone application* in the phone. The system is managed by the *Phoniro Admin* software. This includes authorization for the staff to access the locks of the customers and management and processing of time registration data. Once the application is installed, the mobile phone keys can be issued without any involvement of Phoniro, unless the home care authority wants Phoniro to be a service provider. The keys (the authority to open a specific lock) can be managed and issued by the home care authority.

[11] www.bluegiga.com/solution?g=Consumer&n=Phoniro

For some years the mobile operator TeliaSonera promoted these services where electronic keys in mobile phones were combined with time registration and reporting. For the home care sector, Telia marketed this service called *Telia Kvittens Hemvård*. However, all services within the time registration and reporting area were phased out after 2010. Ongoing projects were handed over to the business partner Avista time. The motivations for TeliaSonera to change strategy include the following factors: low sales, lack of suitable phones, complex product for the sales force and long sales cycles in the public sector.

The actors and relations are shown in Figure 3. The actual end-user, the user of the home care service, is not directly involved as user in the service provisioning. There are three different actors that benefit largely from the system; i) the home care provider and its staff, ii) the home care authority, and iii) the relatives of the elderly person. A very big value correspond to the fact that home care authorities can prove that the patient is getting the agreed care and that relatives can monitor who enters the home of the patient over a web-based portal.

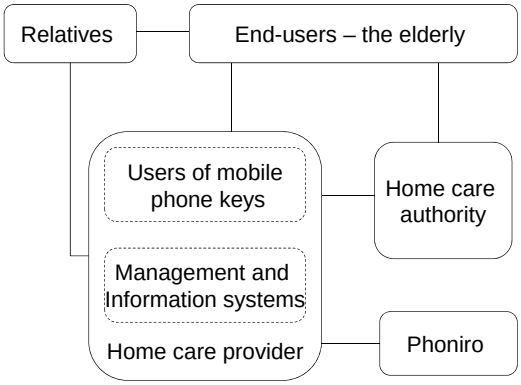

Figure 3. Actors and relations for home care service with time reporting and portal for relatives

Discussions with Phoniro revealed that they consider including other type of functions in addition to the access control (keys) and the time reporting. Such functions include time planning and status information about the elderly; but system integration would be needed with exiting planning tools. Figure 4 illustrates the types of functionality discussed where access control and time reporting currently are the core functions.

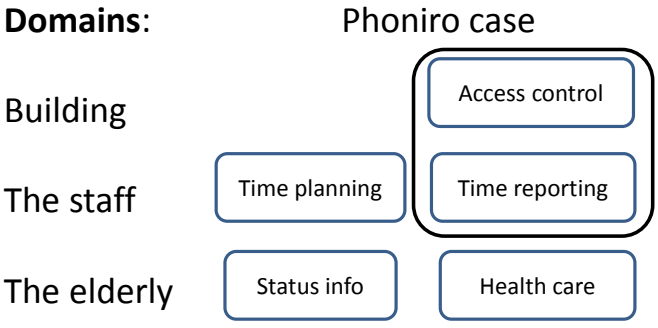

Figure 4. Activity mapping for the Phoniro solution

Real-time work planning in Malmö using the IntraPhone solution

In the city of Malmö, the homecare authorities in one part of the city have run a trail on work planning for the homecare staff which is based on smartphones and real-time status updating. The mobile solution is intended to be a replacement for an offline system where the daily work planning is made manually and distributed by means of printed material that includes the allocation of working tasks and the list of elderly that must be visited during the working hours. This approach required the staff to visit the office every day at the start of the working day in order to collect the corresponding task allocation and also to make last minute changes in the schedule.

With the new system, the working tasks are distributed over the mobile networks directly to the smartphones using a web-based staff portal provided by the IntraPhone service and hence the people in the working staff do not need to detour to collect the printed material at the office premises. This simple solution saves time and reduces stress level. Moreover, another benefit is that any unexpected re-planning can be made and distributed very quickly in real time to all in the working group.

Other features included are hand-over of the status report of the elderly, the notification of critical issues requiring a specialized follow-ups and access control using digital locks together with digital keys in the smartphones. At the moment when the data collection was performed, no health care data or activities were included in the system but this is considered for future developments.

When using the smartphone with the IntraPhone system, additional technology can be used to enhance the location information and proof that the staff makes the corresponding visits. In order to achieve so, QR code tags or RFID tags can be placed at the client's home. When arriving and leaving each home, the tag is scanned and a timing report is issued automatically. The system relies on a centralized server provided by IntraPhone that is independent from the communication provider. Therefore, there is no direct relationship or dependence on a single provider.

In this case, it can be appreciated that the ICT support starts with the time planning for the staff. This includes both the basic daily allocation of working tasks and the possibility to re-allocate tasks e.g. if someone gets ill or if some problem occurs with some of the elderly.

Nevertheless, the solution opens the possibility to implement new features to further enhance the system. Some of the features that are discussed include mobile phone keys to access homes, automatic time reporting and to include support for health care follow up activities.

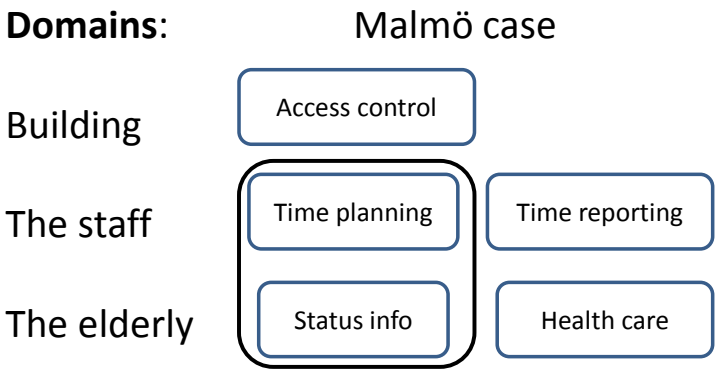

Figure 5. Activity mapping for the IntraPhone solution

e-Home Care in the town of Västerås

The Swedish town Västerås is developing an e-home care service for elderly people. The home care customer needs assistance several times per day but with ICT technology and video communication some of the daily physical visits can be replaced by a video conversation with the home care staff.

These activities are focused on communication with the elderly person. The overall driver for introducing these services is to improve the care quality for the elderly. This was stressed many times at the information day organized by the municipality of Västerås. However, savings in time and money will also be achieved, but this is not the main driver. This is different to other municipalities where cost savings is the main driver. Another motivation is the change in demography with much more elderly population and less young people that can be engaged for home care services.

Table II. Overview ICT solutions and areas where they are used for e-home care services

Application areas of e-home care services	Messaging services using SMS, TV, e-mails	TV based video conversations	Mobile phoned based video conversations	Camera based monitoring during nights
Day time supervision and monitoring	YES	YES	YES	
Night time supervision and monitoring				YES
Response on “silent alarms”			YES	YES
Encouragement and reminder messages	YES	YES	YES	
Social networking and interaction		YES	YES	

Table II illustrates how the different ICT solutions are applied for different e-home care applications (Västerås inspiration day, 2013). It turns out that the video conversations work fine for some types of communication, e.g., checking if medication is taken, reminders, and the first contact in case of alarms. However, this solution requires the homecare customer to be acquainted with the person on the other side of the video screen to improve the comfort of the customer in relation to the virtual experience.

In a pilot project, one of the visits during nighttime could be replaced by contact using the e-Home care services. This meant 300 less visits per day where 100 visits were made by care. The town of Västerås estimates that the annual cost savings for the 300 e-home care customers would be up to 2 M€ while providing the same quality of service (Forsström, 2013).

However, it turned out that the traditional business model for Internet access services did not provide the proper solution. Less than 30% of people of age above 70 years have Internet connection at home, they are not used to it and are not willing to either pay or use it. These customers also tend to mistrust the installation staff of the ISP, mostly since they do know the persons. For the ISPs the e-home care service represent a very small and price sensitive market segment, in addition these customers require a lot of help and customer care. With this setting, the home care authorities will act as helpdesk but do not have any responsibility on the technical side (left side of
Figure 6).

Hence, a new business model and offer was developed for the e-home care services. The customers do not need to order or pay for a private broadband subscription, instead they are offered e-home care as part of the overall home care package. The installation of the equipment is done by the well-known (and trusted) homecare staff. The IT service department of the town of Västerås buys broadband connectivity capacity and acts as service provider for the home care authorities and is fully responsible for the technical solution (Forsström, 2013). This setting is shown on the right side of
Figure **6**.

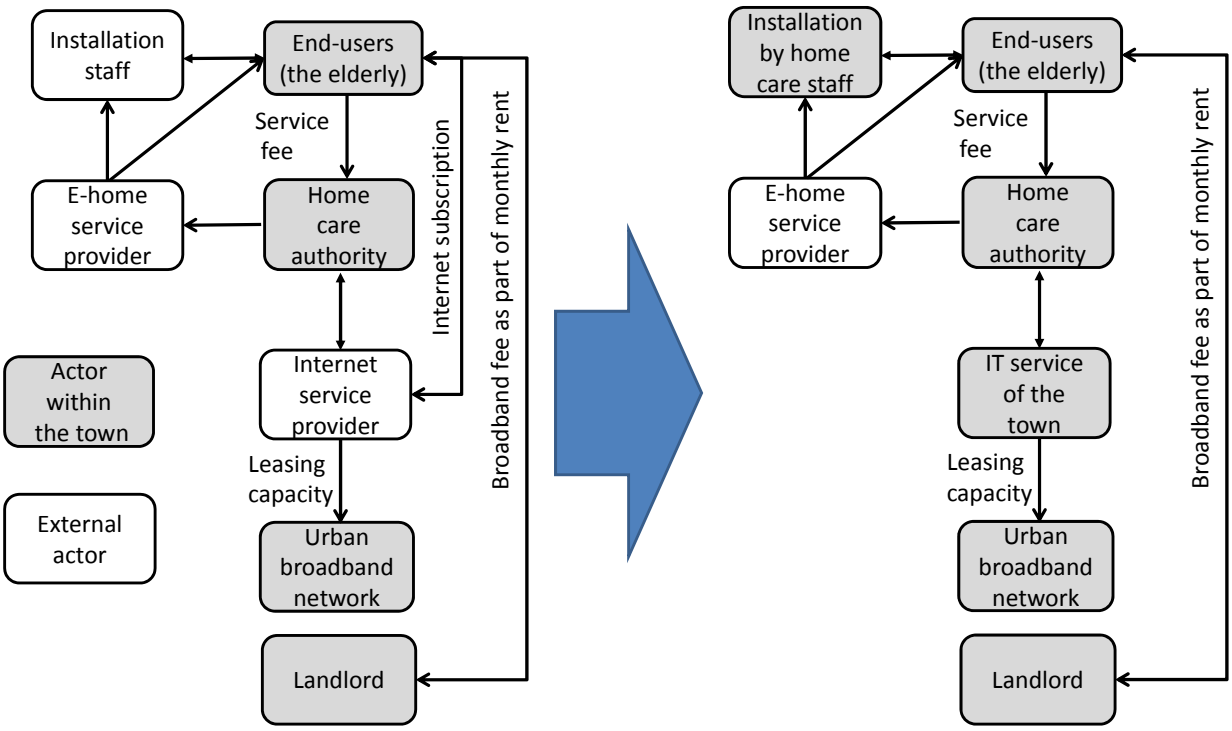

Figure 6. Change of actors and responsibilities for the e-home care service, from (Forsström, 2013)

The main activity targeted in this case is checking status info of the elderly, with a direct reduction of the working time required to perform it. Not because the time dedicated to each customer is decrease, but because the travelling time from one place to another can be is eliminated with the use of video communications.

Ambient Assisted Living Solution: Alleato "Safe at Home"

The company Alleato[12] has developed the "safe at home" system in order to provide automatic reminder of daily notices. The system can guide and inform about the equipment in the home. For example, a "goodnight button" that can inform about unlocked doors and windows, if the stove or the lights are on or the water stands or runs.

Obviously, other reminders can be performed, such as taking medication, going to the doctor or eat lunch. Whoever gets access rights to the web interface, such as a relative or home care provider, can help to set the features according to the specific needs. The information from the system can be delivered via SMS, PCs or pre-recorded audio messages, self-selected images (photographs or pictogram) or text.

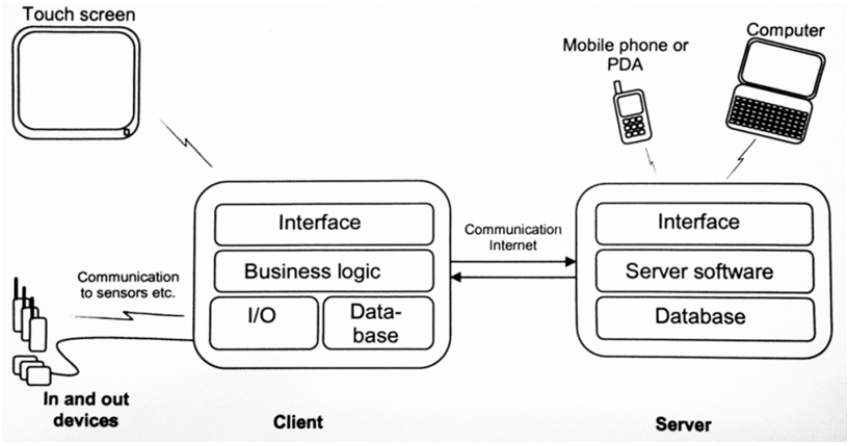

Figure 7. The Alleato "Safe at home system"

In Sweden, Micasa Fastigheter is a property company that owns and manage assisted living properties in the Stockholm area, together with the Swedish Institute of Assistive Technology; they have equipped some apartment for senior citizens using Alleato's solution. Alleato is in charge of setting up the connexion box and providing the connectivity outside the house, making it completely transparent to the final user. The "in and out devices" installed in the house can be supplied by different providers that develop wired or wireless sensors and instruments, building automations systems and so on.

These devices are supervised by the "Alleatoboxen" (the client, installed in the home), which is in charge of the local communication. The information from this local system is transmitted to master server using encrypted connection over the Internet (or fixed or mobile connection). The server hosts the different services that are presented through different interfaces, such as data collection, alarm logic, operation monitoring and remote control. A demonstration apartment (i.e. home environment) developed as part of the SmartLabs project, together with the Swedish Institute of Assistive Technology represents an open showcase to demonstrate how assistive technologies in combination with personal efforts can increase the security and well-being at both ends, for the care giver and the care receiver[13].

Alleato provides a web-based integrated solution for safety in the home, some example of different features is safety monitoring, access information, alarms, reminders for medicine, laundry, visits and alerts when leaving home or going to bed regarding stove turned on, open doors, windows, electrical equipment, turning on/off lamps. The information can be accessed remotely by home care staff and relatives. Nowadays, the system is installed in several homes, hospitals and sheltered homes, with positive effects for the end-users.

[12] http://www.alleato.se/

[13] Technology that Cares: Quadruple Helix Cooperation and SmartLabs

ANALYSIS AND COMPARISON OF CASES

ICT services focused on home care staff

The two cases based on the Phoniro system and the IntraPhone system target the home care staff and their working processes, it is *supplier value-creating processes.* The enabling technology is the use of mobile devices and deployments of digital locks, both correspond to the decision to improve the working processes for the staff in the daily and routine activities, by reducing the time required to access to time planning and schedules. The two service sets cover different aspects and have different entry points to drive the development. Phoniro and their customers (home care providers) initiated the development in order to enhance the time report and access control activities for the staff and now the discussions are centered in the considerations to include time planning activities, as shown in Figure **8**. From Phoniros perspective it was started form the infrastcruture, i.e. locks and doors, but they realized that they could develop a service from their products.

In the Malmö case, it started as a service, the entry point was centered on providing better solutions for the time planning and status info activities. The development plans include access control, time reporting and health care follow up activities, as shown in Figure **9**. It is interesting to see how, to a large extent, the same type of ICT support features are discussed in different cases but the development starts from totally different perspectives. In other words, the target in both cases is to implement the same functionalities, but the starting point to drive the innovation came form different perspectives.

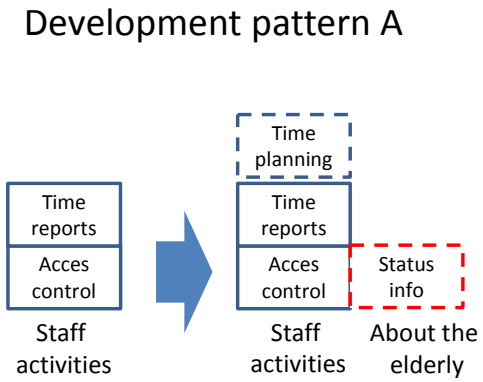

Figure 8. One type of development pattern for homecare services. The starting point for the innovation is on the left-hand side. The full set of discussed functionalities is on the right-hand side.

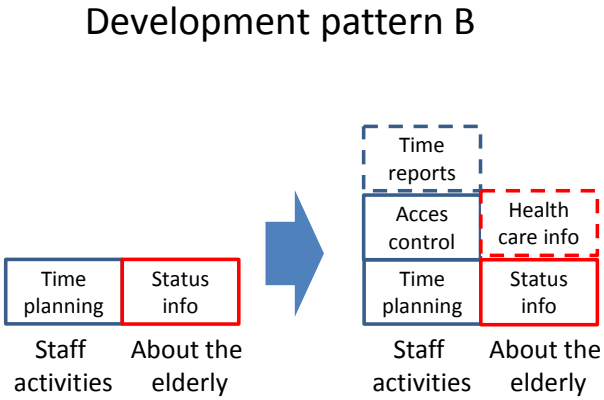

Figure 9. Another type of development pattern for homecare services. The starting point for the innovation is on the left-hand side. The full set of discussed functionalities is on the right-hand side.

ICT services supporting daily life of elderly

Here we compare the Alleato "Safe at home" solution and the e-home care solution in Västerås. The underlying technology and support functions for communication with the elderly show large similarities but main setup are different for the two cases. The facility owner deploys the Alleato system and then homecare companies (and relatives) can connect to the system. In contrast, the e-home care system is an integrated part of the overall home care services.

The entry point for the Alleato system is the "smart house" concept where the smart support features are more or less "built in" into the building or flat. In this case three types of drivers can be identified:

- The solution provider Alleato wants to promote their solution and make facility owners willing to invest and deploy their system.
- The facility owner can offer a "ready-made" infrastructure that is attractive to home care authorities and elderly persons when selecting where to move when you need daily assistance.
- The technology is a complement to personal care and releases personnel to provide more personal contact and nursing care[14].

For the Alleato system the working processes of the home care staff and the communication with the elderly needs to be adapted to what can be offered by the system. The coordinated functions in the apartment can be individually tailored for the person's needs. Our view is that these potential the *supplier value-creating processes* of the facility owner are not clearly linked to the *value-creating processes of the customer of the home care provider.*

The e-home care services are driven by the home care authorities in order to offer both the elderly and the home care provider an improved service quality. As a result the working situation for the staff is improved; the work can be better planned and performed which also leads to cost savings. The working processes for the staff are already from start the key issues. The deployment and installation of equipment is done case by case for the elderly.

In this case we can see clear links between the *value-creating processes* of the customers (the elderly and their relatives) and the supplier of the home care service. The ICT solutions enable customers and suppliers to interact and the value to a large extent is a result of this interaction and communication. Hence, the Västerås case also can be described *as encounter processes*.

[14] http://www.micasa.se/Documents/Intern%20service/Kommunikation/Infomaterial/Broschyrer/visningsl%C3%A4genhet-eng_090921.pdf

Comparing all solutions

The systems cover different but overlapping aspects and they have been developed from different starting points. We can consider three domains of activities and resources:

- The elderly person (the care receiver)
- The home care staff (the care giver)
- The building

For the e-home care services the focus has been the daily activities of the elderly person and how the home care staff communicates with the elderly. For the Phoniro and IntraPhone solutions the working efficiency of the home care staff is the key. These solutions seem to be developed in very close cooperation with the home care authorities in different towns and municipalities. The Alleato solution targets the infrastructure to provide the integrated solution for safety in the home.

It seems like most new ICT based features result in large or very large benefits. Some features replace existing “man-made” activities or visits. Other features introduce new types of services, e.g. a portal for relative and possibility to social interaction using Internet, see more in table III.

Table III. Comparison of ICT related activities and functions

Application areas	ICT service is new or replacement	Value co-creation process	Improved working efficiency	Change of working processes	Added value (type?)
Focus on home care staff					
Use of mobile phone keys	Replace	Supplier	YES	YES	Very large
Key management system	Replace	Supplier	YES	YES	Large
Phone activity reporting	Replace	Supplier	YES	YES	Very large
Portal for relatives	NEW	Supplier and customer			Large
Authority track record	NEW	Supplier and customer			Large
Daily time planning	Replace	Supplier	YES	YES	Very large
Real time change of plan	NEW	Supplier	YES	YES	Very large
Focus on the elderly					
Day time supervision	Replace	Supplier/customer/encounter	YES	YES	Large
Night supervision	Replace	Supplier/customer/encounter	YES	YES	Very large
Response on silent alarms	NEW	Supplier/customer/encounter	YES	YES	Large
Reminder messages	NEW	Supplier/customer/encounter	YES	YES	Large
Social interaction	NEW	Supplier/customer/encounter		YES	large
Health records	NEW	Supplier/customer/encounter			Large
Handover info	replace	Supplier			Large
Focus on infrastructure					
Integrate service	N/A		YES	YES	Enabler
Secure communication	N/A	N/A			Enabler
Unified framework	N/A	N/A	YES	YES	Enabler

CONCLUSIONS

We can see that there is a need to study home care services for elderly. Existing studies to a large extent focus on health care services provided in the home using telephone or Internet. This paper is about how solution providers, home care authorities and home care providers develop and introduce new ICT based solutions for support of the daily activities of elderly.

Although we can see many overlaps two main types of drivers can be identified:

1) to improve the service quality for the elderly by offering of a multitude of communication channels complementing physical visits
2) to improve situation awareness, work planning and handling of emergency; all leading to improved working efficiency and less stress

The working processes are changed since the home care staff has a better overall awareness, both of the condition of the elderly and the own working situation. As a mobile work force the home care staff can avoid unnecessary travels to the office (to collect keys or activity plans or to make reports) or to the elderly (in case of false alarms or for reminders)

Many actors contribute to the value creation. Home care authorities and solution providers in cooperation drive the development of new solutions and support tools. The main user groups are both the staff of the home care provider and the elderly, all these need to be trained in order to be able to exploit the benefits. In addition, relatives can contribute and also benefit from the new ICT based solutions.

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