

# Towards longer, better and more active lives

## *Mutual assisted living community for older people*

**The proportion of older people will keep increasing in this century and already becomes a predominant aspect of our societies. Solutions both efficacious and cost-effective need to be sought to provide needed services to the elder people timely. In order to help the older people living actively, solutions should also provide chances for them to get involved in social activities and communicate with the outside world. In this paper, the concept of mutual assistance community will be introduced, which aims at promoting longer, better, and more active lives for the older people.**

***In order to improve the efficiency and effectiveness to assist the older people to live independently, we believe the perspective of this problem should be focused on community level, rather than building safety environment on individual level; in order to help the older people living well, it is important to let them actively participate the events in their community.***

### **Introduction**

As well known, the proportion of older people has kept on increasing since the end of last century. The European overview report of Ambient Assisted Living (AAL) investigated this trend.<sup>1</sup> The studies of EUROSTAT<sup>2</sup> indicated that the share of the total European population (EU 15) older than 65 is set to increase from 16.3% in 2000 to 22% by 2025 and 27.5% by 2050, while those over 80 (3.6% in 2000) is expected to reach 6% by 2025 and 10% by 2050.

Studies of Counsel and Care in UK found out that older people would prefer to live in their own house rather than in nursing homes, thus they need support to remain independent in their home.<sup>3</sup> In order to improve the quality of life for the older people, it is important to guarantee that assistance to those people is timely arranged in case of need.

Assistive devices are developed to facilitate the daily lives of these older people. But they also have their limitations: For instance, in the AAL country report of Finland, it was remarked that 'the (assistive) devices are not useful if not combined with services and formal or informal support and help'.<sup>4</sup> We share this view and deem informal caregivers as indispensable when constructing timely and cost-effective services to assist the older people. We developed a design tool to evaluate the performance of informal caregivers in so-called mutual assistance

communities.<sup>5</sup> Simulations have shown that informal caregivers are indeed capable of contributing effectively to the community welfare. Our research also finds out that when older people are encouraged to participate in group activities, their social network is maintained, physical movement is encouraged, and a subset of their needs are met by activating or participating in a group activity, rather than requesting the service of professional caregivers.

Further on, we proposed to construct the mutual assistance community based on Service Oriented Architecture (SOA), where assistance from human side and applications from assistive devices are both described as services, and seamlessly integrated to provide the most effective services to the people in need.<sup>6</sup> Our proposed mutual assistance community provides an open access to people, regardless of their age. Both older and younger generations could enroll in such a community. The younger generation could assist the older generation on physical demanding tasks, while the older generation could also use their valuable experience to help the younger generation to solve problems – e.g. during their work and studies. In so doing, intergenerational activities could be carried out, social connections could be enhanced, and requests from older and younger generations could be met in a most efficient and effective way.

The remainder of the paper is organised as follows: In Section 2, related work is reviewed. Our proposed mutual assistance community is introduced in Section 3. Benefits brought by such a community are presented in Section 4, and conclusions and future work are given in Section 5.

### **Related work**

Much research is being carried out on building intelligent environments around people, such as Aware Home,<sup>7</sup> I-Living.<sup>8</sup> This research on 'smart houses' improved the independence of the older people, and reduced the required manual work. Devices such as RFIDs, motion detectors, etc. are used to accomplish tasks such as activity reminding, health monitoring, personal belonging localisation, emergency detec-

tion, and so on. However, their limitation is the lack of communication with the other people outside the house, which inherently limits the service exploration and may isolate the user from the outside world. Keeping the older people physically healthy is crucial, but helping them live in a normal and comfortable way is also important, and the communication between other people is indispensable to meet this goal.

There are some projects that begin to focus on the communication with the outside world. One such project is COPLINTHO,<sup>9</sup> which built an eHomeCare system combining forces from the patient's family, friends and overall care team. The limitation of this class of investigation is that the application is restricted to the recovery progress of a patient, thus the communication is mainly focused on exchanging the medical data of the patient.

In order to improve the efficiency and effectiveness to assist the older people to live independently, we believe the perspective of this problem should be focused on community level, rather than building safety environment on individual level; in order to help the older people living well, it is important to let them actively participate the events in their community. In the keynote<sup>10</sup> of ePractice's Aging Well workshop, it was pointed out that 'Active ageing refers to a continuous participation in social, economic, cultural, spiritual and civic affairs, not just the ability to be physically active or part of the labour force. Active ageing views older people as active participants in an age-integrated society.' It further stated that aging well in the society means 'staying socially active and creative, improving quality of life and reducing social isolation'.

The NeAT (Newham Advanced Tele-care) project<sup>11</sup> targets on assisting the vulnerable people active aging in Newham (a village in East London), on the community level. Broadband connections are widely applied in this project, connecting people together with their friends and relatives. Multi-channel services centered around a set-top box provide services including education, audio/video conference, etc. The impact of this project is that it builds up infrastructures to deliver wide range media services through the broadband 'pipe'. Some challenges of this project, as they stated in the cited workshop, are 'How to deliver the integrated services?', 'How to benefit the investor?' and 'Where does Assistive Technology best sit?'

All these above mentioned projects represent examples of the existing approaches that construct home assistance services. We may classify the approaches as person-oriented, family-oriented, and com-

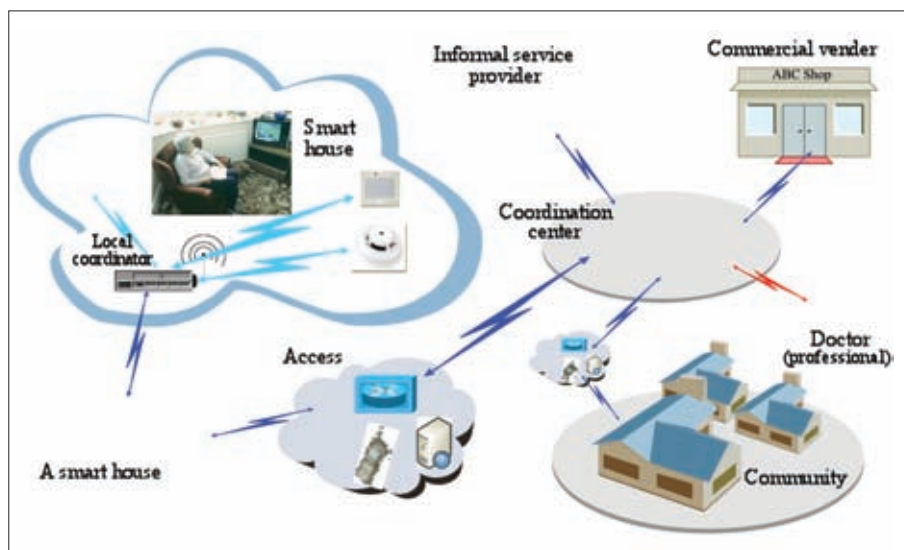


Fig. 1 Organisation of Mutual Assistance Community

munity-oriented. Person oriented assistive devices help to construct safety environment, and provide some tasks to enhance the daily lives of the older people; family-oriented individual networks help to increase the connections between the assisted people and their families; and the community-oriented scheduling system inspires the study on effectively utilising the social resources in the community level.

In the following section, we propose to construct mutual assistance community to harmonise the application of assistive devices and services from human side. Our proposed mutual assistance community could meet the above mentioned challenges and goals on the community level.

### Mutual assistance community

Rather than focusing solely on the technology facet to solve the problem of assisting aging people, we combine the advances of technology and sociology. We propose to build up a mutual assistance community where dwellers may help each other when they are able to, while assistive devices are still included to build up smart environments. By doing so everyone is making their contribution to the community, and the technology and social force are seamlessly combined providing best services to the people in need.

### Structure of the community

The structure of our proposed community is shown in Figure 1, which is a combination of assistive and ICT technologies and human participations. Assistive devices will be deployed to construct a smart house environment around the assisted people. These assistive devices will be developed as OSGI bundles and managed by a local OSGI gate-

way.<sup>12</sup> Based on the information from the assistive devices, the local co-ordinator could send alarm signals when the assisted people are in a dangerous situation. Other applications of smart devices could be used as described in the previous smart home researches.

The most important asset integrated in this community, we think, is the people themselves. People located inside the community are connected together via different means of communication media, such as phone lines, mobile phones, the internet, etc. For the older people who are not familiar with new technology, the system allows them to access the community via interactive TV. For the younger generation, they may connect to the system by their smart phone or PDA, and serve as informal caregivers when they wish to. In this way, the different characters in the community are seamlessly connected, which allows disparate technologies and people working together to helping those who suffer from ageing or disabilities.

In the above mutual assistance community, people who are able to provide services are encouraged to do so and assist the requesting people as informal caregivers. Informal caregivers could be e.g. relatives, friends, or neighbours of the people who need service. We expect the involvement of the informal caregiver could reduce the dependency on the socio-medical care system.

Older people are also encouraged to participate in the group activities, which helps to maintain physical and psychological health and also reduces the requests of professional medical resources. Professional caregivers (such as doctors, specialists etc.) are included in the community to provide emergency and professional medical service – they are indispensable to

provide professional emergency services on professional medical caregiver or other challenging and professional healthcare.

Commercial vendors are also included in, which brings great convenience to the user and diversifies the service type. At the same time, including the commercial services lays out the foundation for self-sustainability and economical exploitation.

### Constructing the community

Figure 2 indicates the needed technologies to construct the mutual assistance community shown in Figure 1. The framework of the mutual assistance community is organised through SOA. SOA is a paradigm for organising and utilising distributed services (capabilities), allowing different applications to loosely couple together. Service providers describe and publish their services through service registry; service consumers look up wanted services also through the service registry. Once the availability of a needed service is verified, the service provider and service consumer will be bond together, and service will be delivered between them. In our mutual assistance community, requests for help, applications from assistive devices, and available services from commercial venter and different carers are all described as services, and the matching process between request and available resources is taken in the coordination centre automatically. The software architecture of the community, constructed with service-oriented approach, is shown in Figure 3.

Smart assistive devices are still necessary to build up safety environment around

the needed people. Applications provided by the smart devices will be represented in the form of services, and published in the SOA framework. The most important asset of the community, people themselves, are also integrated in the community through the service oriented approach – the requests of services and the abilities to provide services are published as service requests or service registrations. Human task computation defines services implemented by people as ‘human tasks’, and aims at integrating the human tasks in service oriented applications. The WS-HumanTask specification<sup>13</sup> and the BPEL4People specification,<sup>14</sup> both launched in June 2007 could be the beacons to bringing human activities into service-oriented applications.

Semantic service description and matching is the bridge, that connects the needed services and available resources. The dynamic availability of human services could be solved, as the SOA framework is able to track automatically the change of services using service registry or declarative services. An ontology library,<sup>15</sup> which defines objects and the relationship between certain objects in the ambient assisted living domain, should be pre-built so that the objects used in the service description could be recognised. Service matching tools already exist, such as OWL-S Matcher,<sup>16</sup> OWL-S UDDI/Matchmaker,<sup>17</sup> and OWLS-MX Matchmaker,<sup>18</sup> but their efficiency still requires improvements. Details of service matching in mutual assistance community can be found in our paper.<sup>19</sup>

Technologies of virtual reality and adaptive user interface could be applied to

create better user interface and increase the user acceptance. Virtual reality techniques could help to build up online mutual assistance community, imitating the community in real-life, bringing virtual tours to people who are not able to carry them out in real-life. Adaptive user interfaces could help break the technological barrier currently experienced by some of the older people.

### Longer, better, and more active lives

The proposed mutual assistance community could help the older people have longer, better, and more active lives. In our proposed mutual assistance community, the older people may increase their independence by participating group activities, thus increasing their self-esteem. Moreover, they may actively make contribution to our society through intergenerational activities.

### Participant model

The concept of participant<sup>20</sup> comes from the fact that some activities which the older people want to engage in may need more than one people to participate, such as walking in the park with someone else, playing chess, chatting, etc. Instead of asking for nurses or informal caregivers to meet these requests, the participant model would encourage the older people to participate or initiate group activities to autonomously meet such needs. When older people want to initiate or join a group activity, they will send a request to participate this activity. The request will be parsed by a service center. If such a group activity is ongoing, the requester could join this activity directly; otherwise, based on the time constraint of the requester, the system will either initiate a new joint activity or try to find service from informal or professional caregivers to fulfil the user’s requirement.

Figure 4 compares the participant model with the traditional one. A and B represent older people, N1 and N2 represent caregivers. When A and B want to participate a same event, the service center will try to establish a link between them in the participant model rather than requesting for help in the tradition model. Additional services are thus spared, so that the social costs are reduced; and such group activities also encourage social contacts and produce self-esteem (as the older people may stay active without assistance).

### Intergenerational mutual assistance

Intergenerational mutual assistance refers to activities held between older generation and younger generation, each side using their



Fig. 2 Mutual Assistance Community

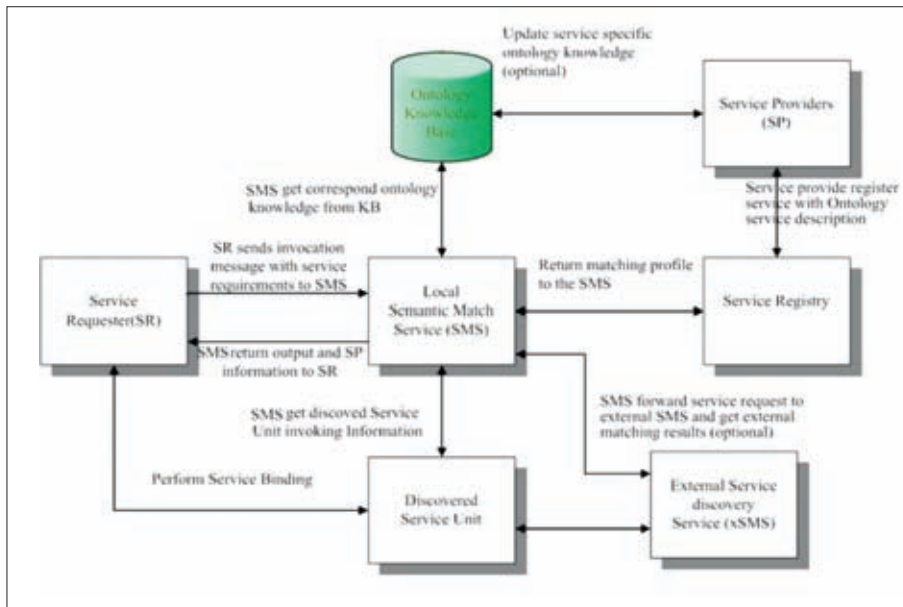


Fig. 3. Service Oriented Software Architecture

special knowledge and capabilities to help the other side. When people are getting old, their mobility degrades, and they become physically weak. In our so called intergenerational mutual assistance, the younger generation could help the older as informal caregivers on tasks requiring physical strength. Though physically weak, the older people accumulated valuable experiences and knowledge during their lives. They may use such knowledge to assist the younger generation solve their problems in work and studies. During this process, not only the younger generation gets their needed answers, the older generation also finds an access to make their contribution to our society. Elders may find themselves still useful, stand with more active living attitude, thus avoiding the frustration of considering themselves as ‘useless’.

Our society may also benefit from these intergenerational mutual assistance activities. Less assistance would be required for helping these older people as many requests are completed by younger generations as informal caregivers. The knowledge and experience of the older generation may also pass by to the younger ones, which would be beneficial for

their studies and works, so that the social resources are utilised in an efficient and effective way.

### Conclusion

This paper discussed the current issues of helping the older people living independently. Although the smart devices promised to build safety environment to support independent living, the lack of involvement of human being reduces the social connections of the assisted people and the outside world, and make them live in passive and inactive ways.

We suggest making efforts to combine the advances of machinery and human being, to seamlessly provide services to the older people. Mutual assistance community, where people are mutually assisting each other, is recommended to realise the above-mentioned goal. Smart devices can still be used in such as community to guarantee the safety of older people. Informal caregivers, together with commercial vendors and professional caregivers are also actively involved in, which diversifies the service

categories. The concept of participant model is proposed to organise group activities, where people may participate as peer levels rather than receiving help from others. Societal resources may be saved as additional services are spared. Intergenerational mutual assistance activities are also encouraged where the younger generation and the older generation are mutually helping each other. Social resources are thus utilised with efficiency and effectiveness. The older people may also find themselves still able to make contributions to our society, thus raising their self-esteem and living with an active attitude.

The structure of our proposed mutual assistance community has been presented. Such a structure is our vision on how to assist the older people aging well, rather than a real-world implementation. Needed technologies and researches have been investigated and we have also carried out preliminary researches on organising services in the target domain. The next step of our research is to call for wider collaboration from industrial, academic and government organisations to bring this proposed mutual assistance community to implementation.

### Reference

- 1 H. Steg, et al. Ambient Assisted Living – European overview report, September, 2005
- 2 EUROSTAT. www.eurostat.com: ECHP – UDB, 2004
- 3 Counsel and Care, Community Care Assessment and Services, April, 2005
- 4 AAL Finland. Ambient Assisted Living, country report, Finland, 2005
- 5 H. Sun, V. De Florio and C. Blondia. A design tool to reason about Ambient Assisted Living Systems. In the Proceedings of the International Conference on Intelligent Systems Design and Applications, Jinan, China, 2006
- 6 N. Gui, H. Sun, V. De Florio and C. Blondia. A Service-oriented Infrastructure Approach for Mutual Assistance Communities. Proceedings of the First IEEE WoWMoM Workshop on Adaptive and Dependable Mission- and bUbusiness-critical mobile Systems (ADAMUS 2007), Helsinki, Finland, 2007
- 7 See Aware Home Project, <http://awarehome.imtc.gatech.edu/>
- 8 See I-Living Project, <http://lion.cs.uiuc.edu/assistedliving/>
- 9 See COPLINTHO Project, <https://projects.ibbt.be/coplintho/>
- 10 See <http://www.epractice.eu/files/upload/workshop/13771-1208261154.pdf>
- 11 See NeAT Project, <http://www.newham.gov.uk/>

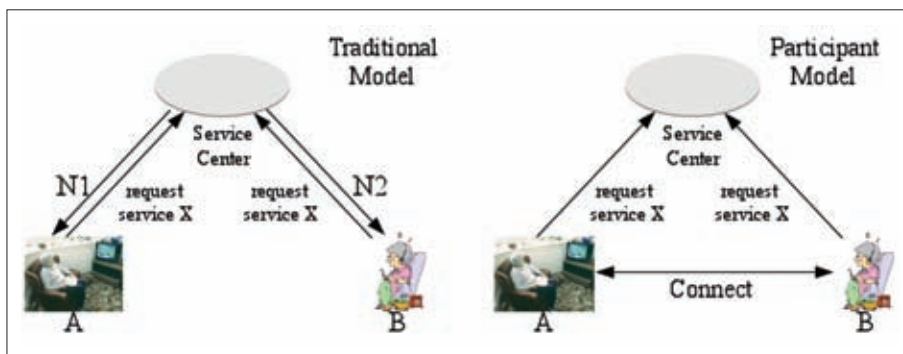


Fig. 4. Comparison between traditional model and participant model

- 12 OSGI. Open Service Gateway initiative, OSGI Service Platform Version 4, <http://www.osgi.org/>
- 13 See Specification: Web Services for Human Task (WS-HumanTask), version 1.0 [http://download.boulder.ibm.com/ibmdl/pub/software/dw/specs/ws-bpel4people/WS-HumanTask\\_v1.pdf](http://download.boulder.ibm.com/ibmdl/pub/software/dw/specs/ws-bpel4people/WS-HumanTask_v1.pdf)
- 14 See Specification: WS-BPEL Extension for People, (BPEL4People), version 1.0. [http://download.boulder.ibm.com/ibmdl/pub/software/dw/specs/ws-bpel4people/BPEL4People\\_v1.pdf](http://download.boulder.ibm.com/ibmdl/pub/software/dw/specs/ws-bpel4people/BPEL4People_v1.pdf)
- 15 Dean, M.; Schreiber, G.; Bechhofer, S., et al. OWL Web Ontology Language Reference, 2004
- 16 Tang, S. & Liebetrueth, C. The TUB OWL-S Matcher <http://owlsm.projects.semwebcentral.org>, 2006
- 17 Srinivasan, N. OWL-S UDDI Matchmaker <http://projects.semwebcentral.org/projects/owl-s-uddi-mm/>, 2004
- 18 Klusch, M, et al. OWL-MX Matcher. [http://projects.semwebcentral.org/frs/?group\\_id=90](http://projects.semwebcentral.org/frs/?group_id=90), 2005
- 19 Sun, H.; De Florio, V.; Gui, N. and Blondia, C. Service Matching in Online Community for Mutual Assisted Living. in the Proceedings of The Third International Conference on Signal-Image Technology & Internet Based Systems (SITIS' 2007). IEEE Computer Society. Shanghai, China, 2007
- 20 Sun, H., De Florio, V., Gui, N. and Blondia, C. (2007.). Participant: A New Concept for Optimally Assisting the Elder People. In the Proceedings of the 20th IEEE International Symposium on Computer-Based Medical Systems (CBMS-2007), Maribor, Slovenia

## The authors



**Hong Sun** received his degree in information engineering from Southeast University (China) in 2004, and his master's in electronics from University of York (UK) in 2006. He is currently a PhD student in PATS group at University of Antwerp, and he is also working as a research assistant for the IBBT. He has published more than 10 reviewed research papers.



**Vincenzo De Florio** has an MSc CompSci (Bari, Italy, 1987) and PhD Eng (Leuven, Belgium, 2000), is a researcher with the PATS research group at the University of Antwerp, where he has the key responsibility in PATS' branch on adaptive-and-dependable systems. He published about 60 research papers.



**Chris Blondia** has a master's in science and PhD in mathematics, both from the University of Ghent (Belgium) in 1977 and 1982. In 1995 he joined the department of mathematics and computer science of the University of Antwerp, where he is currently a full professor and head of the research group 'Performance Analysis of Telecommunication Systems'. He has published a substantial number of papers in international journals.



**Ning Gui** received his degree in information engineering from Central South University of Tech. (China) in 1999, and his master's in computer science from Central South University (UK) in 2002. He is currently a PhD student in PATS group at University of Antwerp and is also working as a research assistant for the IBBT. He has published more than 6 reviewed research papers in international journals.

## CALL FOR PAPERS

First launched in 1908, *The Journal* is in its second century of publication. As a result, the editorial board is calling for authors across the ICT spectrum to submit articles during this pivotal year in *The Journal's* history.

The publication contains articles by leading experts and academic researchers on a wide range of subjects relating to the latest developments in technology. It is considered an essential reference resource for universities, libraries, and many commercial organisations.

"*The Journal* has been printing cutting edge articles for over 100 years, providing a forum for discussion and a platform for those immersed in the industry," says ITP CEO Brendan O'Mahony. "Importantly, our authors and contributors bring to bear expert knowledge which helps to pave the way to an exciting telecoms future."

### Getting involved

Authors are encouraged to submit articles for publication in *The Journal*, either by issue theme or by areas of specific interest, from information security and Next Generation Networks, to convergence and mobile developments.

Interested parties should e-mail [journal@theITP.org](mailto:journal@theITP.org) in the first instance with topic suggestions. Guidance notes for full submissions can be viewed at [www.theITP.org](http://www.theITP.org)



# Next Generation Networking Today

Whilst other organisations are merely talking about providing NGN-based services, Viatel has been doing it since 2005.

Businesses increasingly depend on their networks. Moving to NGN-based services increases flexibility, improves communications and reduces costs, whilst ensuring that the business is ready for future developments.

With a full portfolio of IP services to choose from including:

- Voice over IP
- Internet Connectivity
- MPLS IP VPN
- Managed Hosting and Co-location
- Internet Security

Viatel can help companies migrate cost-effectively to Next Generation Networking based services, enabling them to work the way they need to both now and in the future.

To find out more:

Phone 0870 166 2269

Email [services@viatel.com](mailto:services@viatel.com)

Or visit [www.viatel.com](http://www.viatel.com)

**Vi@tel** // simply different