A service-oriented infrastructure approach for mutual assistance communities

A Service-oriented Infrastructure for Ambient Assisted Living Communities

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Abstract

Elder people are becoming a predominant aspect of our societies. As such, solutions both efficacious and cost-effective need to be sought. This paper proposes a service-oriented infrastructure approach to this problem. We propose an open and integrated service infrastructure to orchestrate all the available resources (smart devices, professional carers, informal carers) to help elder or disabled people. Main characteristic of our design is the explicitly support of dynamically available service providers such as informal carers. By modeling the service description as Semantic Web Services, the service request can automatically be discovered, reasoned about and mapped onto the pool of heterogeneous service providers. We expect our approach to be able to efficiently utilize the available service resources, enrich the service options, and best match the requirements of the requesters.

1. Introduction

As well known, the proportion of elder people keeps increasing since the end of last century. The studies of EUROSTAT [1] 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.

Requirements for health assistance are proportionally increased in order to help these elder people live independently at home. Studies found out that residing these elder people in their own house rather than in hospital not only meet their personal preference [2], but also reduce the caring expense [3].

Big projects are launched to assist the elder people living independently developing various assistive devices to facilitate their daily lives. However, investigation reported that those “devices are not useful if not combined with services and formal or informal support and help” [4]. Healthcare from human side is indispensable to fully explore the potential of the assistive devices, and best fit the elder people’s requirement. To the best of our knowledge, previous researches are either focused on employing assistive devices to build a safe environment [5], [6], or developing schedule schemes to manage the human resources in medical care [7], while no project combines these two forces together.

Our previous research suggests the introduction of informal carer greatly reduce the dependence on professional medical care resources [8]. In this paper, we continue along this path and propose a system named as iMACom developing service-oriented Infrastructure for Mutual Assistance Communities, which mediates among all the available resources, from human resource to smart assistive device, with the goal of providing timely and cost-effective service to the elder people.

In our system, a service oriented architecture is designed to explicitly support dynamicity in the availability of services. At the same time, a semantic analysis mechanism is employed to reason and map the service request to the heterogeneous service provider.

The remainder of the paper is organized as follows: In Section 2, an overview of the mutual assistance community is presented. The service architecture of the iMACom system is stated in Section 3. Conclusions and future work are given in Section 4.

2. Community Organization

A mutual assistance community (Fig. 2) is proposed to organize the resources in the community and build links between service requesters and service providers, through the help of a coordination center.

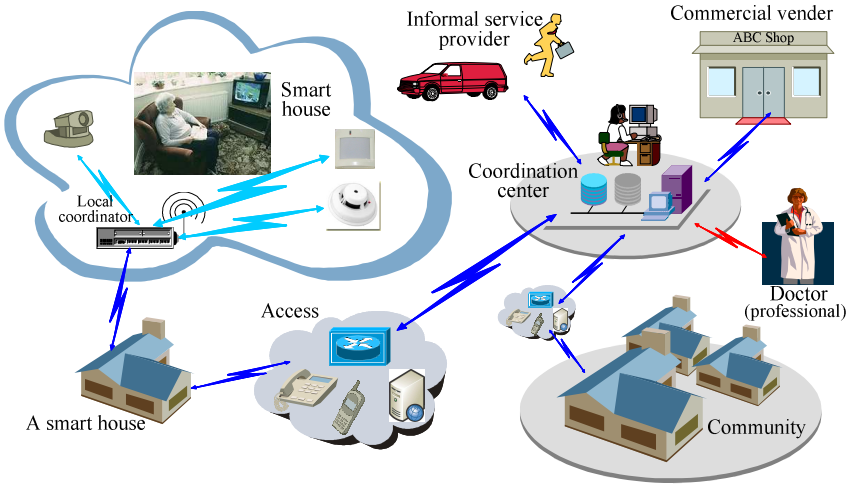

Figure 1: Mutual Assistance Community Organization

Such a community uses the current research on hardware devices for e.g. smart housing and software technologies to build a smart house environment around the elder people. We believe that the most important asset integrated in this community is people themselves. The community allows disparate technologies and people collaborating together to help people who suffer from aging or disabilities. Building blocks of the community are the following players:

Service Requester: A requester is a person or smart device that wishes to make use of a provider entity's service.

Service Provider: A service provider could be further divided into the following classes:

Professional Service Provider: Those who have specialized intellectual or creative expertise based on personal skills, education or experience.

Non-professional Service Provider: This type of service providers consists of ordinary people, volunteers or specifically employed people that do not necessarily have specialized expertise.

Smart Device: Devices located in the smart house domain that can provide services such as health monitoring, alerting, localization etc.

Coordination Center: It is designed to coordinate the services and requests inside this community and establish connections with other communities. It deals with: providing service registration for the service provider; storing service information; accepting the user request and mapping it to the best fitting service.

In this community, we envisage that there will be an intelligent terminal (local coordinator) in the house domain coordinating the smart devices. The coordination center acts as a bridge which connects people inside smart houses with external resources.

3. Service Architecture

Based on our previous analysis, we design the iMACom software architecture, which is shown in Fig. 2, aiming to provide an efficient infrastructure support for building AAL communities. It consists of the following services which act as basic service components:

3.1 Service Registration

Service providers register their services in directories along with profiles that describe their various relevant capabilities and characteristics. Service registry contains semantic service descriptions in order to perform the semantic discovery service.

3.2 Semantic Match Service

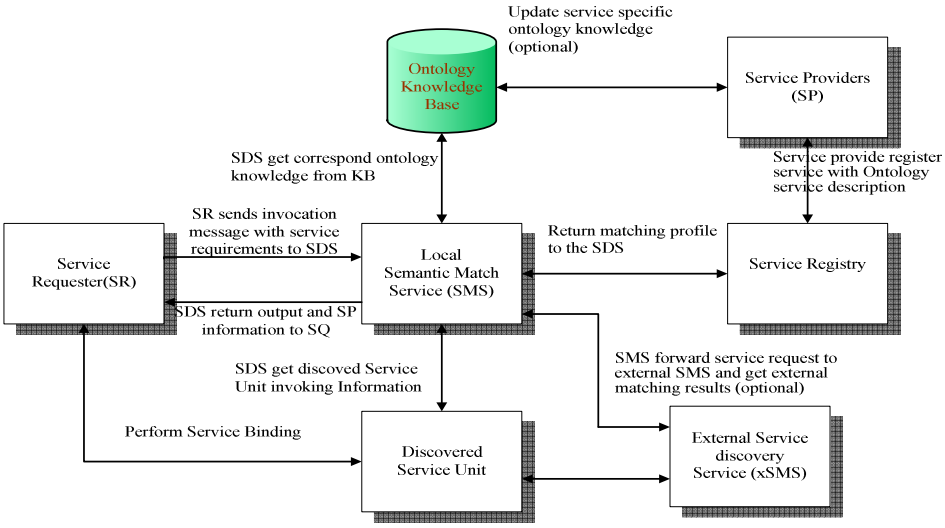

Figure 2: The iMACom software Architecture

The Semantic Match Service (SMS) is responsible for semantic processing, reasoning and matching the request to service by employing logic reasoning. Normally, this service consists of a semantic service reasoner and an ontology-based Knowledge Base (KB). The semantic service reasoner has the functionality of providing deduced ontology information from the ontology service descriptions and the KB. The Knowledge base (KB) consists of a set of sub-domain ontologies in the different domains and a set of correspond rules in these sub-domains.

3.3 Service Binding

After the SMS and scheduling Service, if suitable service providers are present in the service registry, the binding service will provide a scheme to sign a “contract” between the service requester and service provider.

4. Conclusions

The need for the assisted living supportive environment is compelling, due to the increasing economic and social problems posed by aging. In this short paper, we briefly provided an overview of iMACom, a service-oriented infrastructure for mutual assisted communities aimed at helping the assisted person’s daily life by orchestrating available resources. Different types of service provider and different services are unified together in this infrastructure, e.g. smart devices, informal carers, private firms or the municipality. The ability to effectively orchestrate informal carers despite their intrinsic dynamic availability is expected to have positive relapses on the service cost and on the quality of the AAL service.

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