The PERSONA AAL Platform: Deployment in the Italian Pilot Site of Bardi

Michele Amoretti [1,*], Giorgia Copelli [1], Guido Matrella [2], Ferdinando Grossi [2] and Stefania Baratta [3]

1 R&S Info S.r.l., Borgo Pietro Giordani, 43100 Parma, Italy

2 Centro di Collaborazione sulle Tecnologie Assistive, Dip. di Ingegneria dell'Informazione, Università di Parma, Viale G.P. Usberti 181/a, 43124 Parma, Italy

3 Comunità Montana Valli del Ceno e del Taro, P. XI Febbraio7, 43043 Borgo Val di Taro (PR), Italy

E-Mails: persona@rsinfo.it (A. M., G. C.); guido.matrella@unipr.it (G. M.)

* Author to whom correspondence should be addressed; Tel.: +39-0524-906-147; Fax: +39-0524-905-723

Abstract: PERSONA (Perceptive Spaces prOmoting iNdepentent Aging) is a EU-funded research project aiming at developing a scalable open standard technological platform to build a broad range of *Ambient Assisted Living (AAL) Services*. Up to now, the PERSONA Consortium has developed a middleware, a set of general-purpose components (forming the *PERSONA Platform*) and a set of AAL Services. In this paper we summarize these technical achievements and we present the ongoing deployment, in the Italian Pilot, of PERSONA AAL Services related to security, safety, mobility and social inclusion.

Keywords: AAL, home automation, social inclusion.

1. Introduction

In the ambient intelligence (AmI) context [1], the European Commission recently started the Ambient Assisted Living (AAL) technology and innovation funding programme, aiming at extending the time older and impaired people can live in their home environment by increasing their autonomy and assisting them in carrying out activities of daily living, feeling included, secure, protected and supported.

The project PERSONA (Perceptive Spaces prOmoting iNdepentent Aging) is a EU-funded research project (FP6) aims at advancing the paradigm of Ambient Intelligence through the harmonization of AAL Technologies and concepts for the development of sustainable and affordable solutions for the independent living of senior citizens. PERSONA is one of the integrated projects funded by the

European Commission within the 6th Framework Program for IST (Information Society Technologies) on AAL for the Aging Society. It involves the participation of 21 partners, from Italy, Spain, Germany, Greece, Norway and Denmark, with a total budget of around 12 million Euros.

Up to now, the PERSONA Consortium has developed a middleware, a set of general-purpose components (forming the *PERSONA Platform*) and a set of AAL services, built on top of the PERSONA Platform and connected by the Middleware in a seamless way. PERSONA environments are being deployed in three different pilot sites, respectively located in Spain, Denmark, and Italy.

In this paper we summarize the technological achievements of project PERSONA, and we present the Italian Pilot that is being implemented in Bardi, a village which lays in a mountain area (namely the "Comunità Montana Valli del Ceno e del Taro"- shortly, CMV) characterized by small settlements. The CMV is responsible for welfare services for elderly and disabled people in the villages of the valley, and has established support centres, protected houses and aggregation centres for elderly and disabled along with home support services operated by dedicated personnel. The Italian Pilot of PERSONA is being deployed at "Cooperativa Bucaneve" in Bardi, whose building can host up to eight residents. Guests are middle-aged disabled persons (usually affected by Down syndrome). The structure is managed by five operators, at least one of which is always present. Recreation activities are organised both in the house and outside, and include: swimming and gym, rehabilitation, craftsmanship, communication through PC and Internet, participation to concerts and other social events.

2. Technological achievements of PERSONA

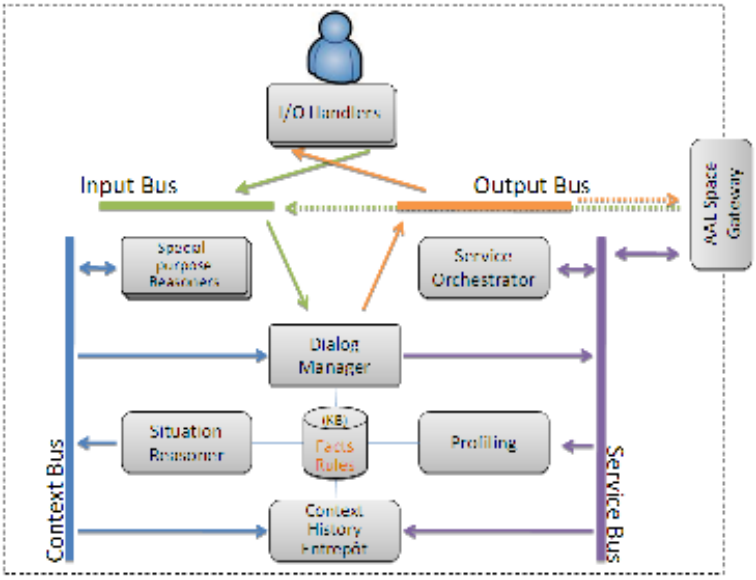
The PERSONA Platform is the set of PERSONA general-purpose components, i.e. components that are not specific for one particular AAL application, but needed by almost all AAL applications. The components of the PERSONA Platform interact with each other and with users by means of four different communication buses [3, 4]. Input and output buses support multi-modal user interactions with the system. The context bus is an event-based channel to which context sources are attached, such as Wireless Sensor Networks (WSN). Published events may be re-elaborated and transformed in high level events (situations) by components that have subscribed to the c-bus (e.g. context reasoners). The service bus allows to publish and consume atomic or composite services.

In general, any software component that runs with an instance of the PERSONA Middleware may be enabled to register with the buses described above, to provide services and/or context events, to consume services and/or context events, to collect inputs or to provide outputs. The PERSONA Middleware is composed of a set of OSGi bundles organized in three logical layers:

1. The lowest layer, the abstract connection layer (ACL), is responsible for the peer-to-peer connectivity between instances of the middleware.
2. The Sodapop Layer implements the peer and listener interfaces from ACL and registers as the local peer to all connectors found. It introduces the concepts of bus (either event-based or call-based), bus strategy and message along with an interface for message serialization.

3. The PERSONA-specific layer implements the input, output, context, and service buses with their distributed strategies according to the Sodapop protocol, using an RDF serializer for the exchange of messages among peers.

Figure 1. The PERSONA architecture: distributed buses provided by the middleware allow to connect platform components, and any other kind of special-purpose component.



3. PERSONA AAL Services in the Italian Pilot Site of Bardi

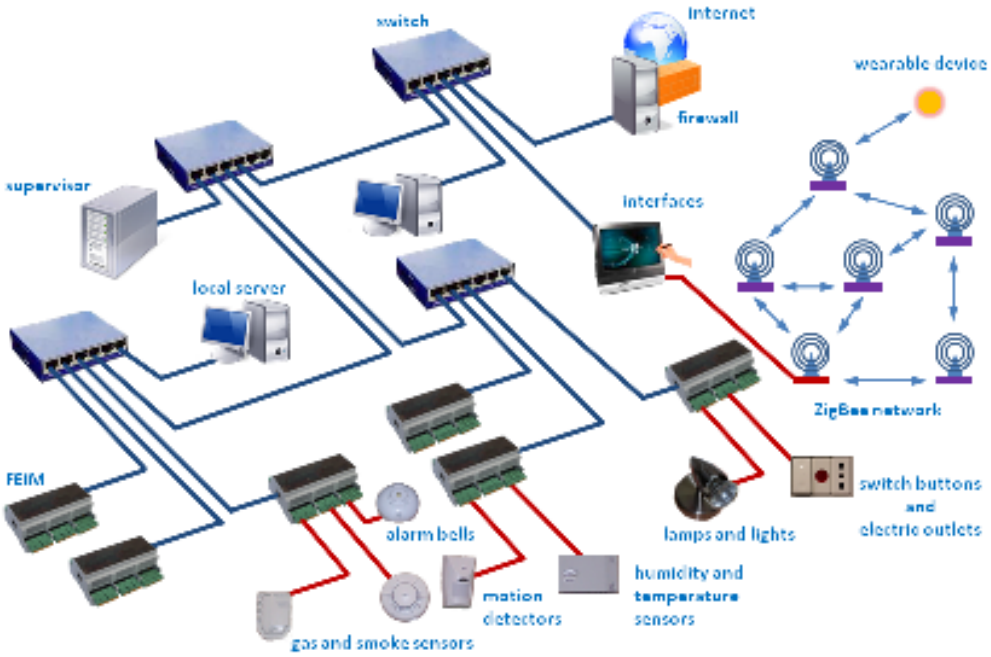
The Italian Pilot has been designed following a multidisciplinary approach that involved R&S and CMV, Partners in the project PERSONA, and the University of Parma. Several preliminary on-site inspections and interviews with the operators of "Cooperativa Bucaneve" have led to the decision to install and evaluate PERSONA AAL Services related to security (access control), safety (gas leak, flooding, CO, smoke detection), mobility (indoor/outdoor personal tracking, orientation feature when outside) and social inclusion (agenda, videoconference, remote participation to social activities). The making of the pilot has been particularly challenging because the building of Cooperativa Bucaneve is very large, consisting of five floors (basement, mezzanine, first floor with office, living room and kitchen, second and third floor with bedrooms). In the following we illustrate the first set of services that have been deployed and that we are currently validating.

3.1. Automatic Management of the Environment for Comfort and Security (AMECS)

The general aim of the AMECS AAL Service is to monitor the environment where the user lives, as well as user activities, in order to trigger comfort-oriented actions and to improve the security of the environment itself. The specificity of the Italian Pilot is the integration of the PERSONA Platform with the *CARDEA (Computer-Aided, Rule-based system for Domestic Environment Assistance) Home Automation System (HAS)* developed by the TAU-labs of the University of Parma [5]. This innovative HAS is well suited for supporting autonomy and independence of older persons or people with

disabilities. CARDEA is fully based on IP communication techniques, considering assistive and automation tasks as a component of a global "intelligent" environment, sharing physical resources and data framework with other technology-based home services. This feature allowed us to easily interface CARDEA HAS with PERSONA Platform components, leading to a specific deployment of AMECS AAL Service. Through the network interfaces, the home environment is fully abstracted: devices and events are described independently of their physical details. A multi-standard, fully configurable communication interface, called *FEIM (Field Ethernet Interface Module)*, enables the supervisor to manage the physical level. The operators at Bucaneve just have to select the configuration they prefer (night, day, travel, etc.) using a simple GUI. As a consequence of their selection, a specific subset of installed sensors and alarms is enabled.

Figure 2. The CARDEA architecture: it is fully based on IP communication techniques implemented on an Ethernet network; FEIMs ensure the interfacing to the field.



CARDEA system has his own rule-based decision engine, capable of managing any alarm and dangerous condition designed. The interaction via PERSONA system allows for enabling or disabling specific behaviors using a very simple GUI. Failsafe conditions are enabled by the distributed intelligence of CARDEA FEIM modules. They can operate on a peer-to-peer basis, to manage emergency condition when supervising system is in a fault condition. This is possible because FEIM can directly manage the emergency signaling system, following pre-designed emergency rules. CARDEA System allows also for a remote surveillance and monitoring of AMECS system via a WEB interface. This enables remote control of dangerous situation from a remote station, if needed. Exploiting WEB and Internet connections, alarms can also be routed to remote stations and personal via e-mail and other internet services. An automated telephone calling machine can be integrated to send SMS or voice calls to preselected numbers, to signal alarm conditions.

Currently we are deploying the AMECS subsystem related to user activity monitoring, which is based on an Indoor Localization System (spanning all 5 floors of Bucaneve building) and special carpets that reveal user presence when pressed.

3.2. Agenda and Neighbourhood Virtual Community (NVC)

Thanks to the complete integration with the advanced PERSONA middleware (which manages a large number of different software and hardware components), the NVC AAL Service is able to provide users with multiple assisted high-level services which couple multimedia communication capabilities to home automation and social interaction. Great emphasis has been placed on usability, i.e. user interfaces are simple and very user-friendly. The NVC videoconference and chat tool installed at Bucaneve in Bardi allows end users to interact with parents and friends. Moreover, the NVC service is integrated with another AAL Service, i.e. the Agenda. In a typical scenario, a remote user, e.g. a parent, uses the NVC client to call Bucaneve. If no one is available, the remote user sends an invitation for a meeting (virtual o physical). Once the end user at Bucaneve starts his NVC client, he/she receives the notification of the invitation. If he/she accepts, the event is stored in the Agenda, and reminders will be shown later to the user.

4. Conclusions

The deployment of the Italian Pilot of project PERSONA has shown the flexibility and scalability of the PERSONA Platform. Indeed, one valuable result is that most of the effort must be spent on *configuring* the system according to user needs, rather than *developing* new components.

References and Notes

1. Ramos, C., Augusto, J. C., Shapiro, D., Ambient Intelligence - the Next Step for Artificial Intelligence. *IEEE Intelligent Systems* **2008**, 2, 15-18.
2. Tazari, M.R., Furfari, F., Ramos, J.P.L., Ferro, E., The PERSONA Service Platform for AAL Spaces. In *Handbook of Ambient Intelligence and Smart Environments (AISE)*; Nakashima, H., Aghajan, H., Augusto, J.C., Springer US, 2009, p.1171.
3. Amoretti, M., Wientapper, F., Furfari, F., Lenzi, S., Chessa, S., *Sensor Data Fusion for Activity Monitoring in Ambient Assisted Living Environments*. In Proc. of the 1st International Conference on Sensor Systems and Software (S-CUBE 2009), Pisa, Italy, September 2009.
4. Fides-Valero, A., Freddi, M., Furfari, F., Tazari, M.R., *The PERSONA Framework for Supporting Context-Awareness in Open Distributed Systems*. In Proc. of the European conference on Ambient Intelligence (AmI-08). Nuremberg, Germany, November 2008.
5. Grossi, F., Bianchi V., Matrella G., De Munari I., Ciampolini P., Internet-based Monitoring and Control. In *Assistive Technology from adapted equipment to inclusive environments*; IOS Press, 2009, vol 25, pp 309-313.