MPIGate: Multi Protocol Interface and Gateway

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Abstract: **We present MPIGate, a multiprotocol gateway and interface for assisted living applications. This project aims to facilitate the development of applications thanks to the abstraction of sensing data and the facility of access to read and write functions over the devices plugged to the network. The contribution includes modularity and a middleware layer offering modularity and quality of service. The proposed unified syntax of messages facilitates interconnection with other systems, networks and devices.**

1. Introduction

The interest of using Information Technologies (TI) to provide services in assisted living context is growing in these days. In industry/literature we can find several projects aiming to bring services facilitating patients suffering a chronic disease or any kind of physical dependency stay at home during long-period treatments. Professionals in health and public entities share this interest and they are working together to propose a solution in a long-term basis to face the growth of dependent population. Elderly people percentage and diseases associated to age are growing as well: living longer increases probability of suffering chronic diseases and/or dependency [1].

In this context, we point out the interest of having a system incorporating existing infrastructure (in domotics, sensor networks, actimetry systems) in a home living environment. Until now, the industries in these fields have developed systems for a very specific technology/market. In the existing systems we can identify an individual activity of each of these industries based on their (proprietary/specific) technologies and it is difficult to imagine a migration of these systems to a unified//homogeneous system.

This contribution describes MPIGate (Multi Protocol Interface and Gateway for Telecare, Environment Monitoring and Control), a technical solution for system interoperability in an assisted living context by using a middleware offering modularity and quality of service. We propose a gateway, which can be used in a home assisted living system to integrate multi-platform systems in a unified framework. Information coming from different systems

can be processed and used for having a real state of home environment, human activity, etc. The gateway uses existing and standard industry infrastructure incorporating wireless sensor networks to complete and propose new sensor and mobile applications (Figure 1).

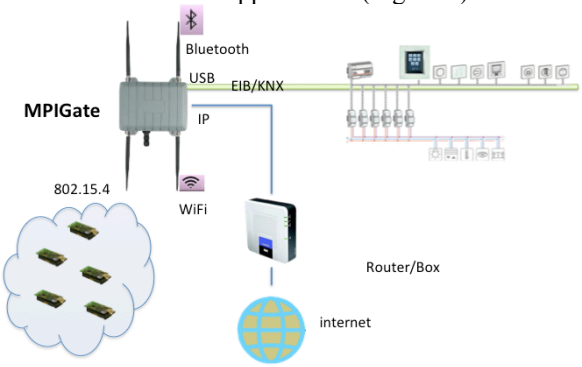

Figure 1. MPIGate in an assisted living network.

The paper is organized as follows. In Section 2 we describe architecture of the proposition. In Section 3 we discuss the importance of the QoS in the field of health care and the aspects we considered during the project design. Finally we present the on going work and future tests of MPIGate.

2. Architecture

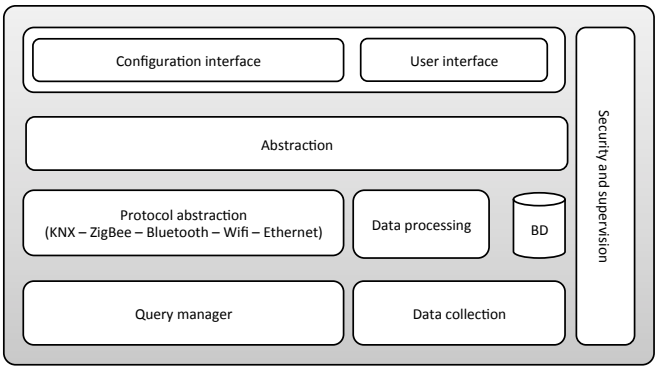

Figure 2. MPIGate components.

In this section we describe the MPIGate architecture from the functional point of view.

Configuration interface: is an interface to configure different parameters of the system. By using this interface we can provide and modify necessary information to process the information in Data processing layer.
User interface: provides an Application Programming Interface (API) allowing the programmer of applications to read each sensor of the system. The API allows sending queries to update the sensing values if this is needed. A Graphical Interface is also included to visualize the state of each sensor and actuator, their historical information and the reports generated by the system.
Abstraction: this layer hides the heterogeneity of the system for the users, by providing communication facilities between the interface layer and the other parts of system. The user doesn't need any prior knowledge of the protocols behind the system, greatly facilitating the application developers' task.
Data processing: this layer is the main part of the system. It processes the information collected from the network and save the results in the database.
Query manager: receives the query from user interface, creates the query and sends them to the network. The query might be a command to control an actuator or a request to read a sensor data.
Protocol abstraction: provides necessary information about each communication protocol used in the network.
Security and supervision: it is the responsible of providing the security of the system.
Data collection: collects the data from the network and sends them to the data processing layer. It implements the reading daemons or sniffers for KNX, Bluetooth and IEEE 802.15.4 over the peripherals of MPIGate. The syntax of the messages has been defined in an internal report of INRIA. It is defined as follows:

Node Id, Location, Date, NameOfVariable(i), ValueOfVariable(i), …

Types of variable *i* can be environmental, biometric, equipment state…

3. Discussion

An important point considered in developing this concept is Quality of Service (QoS) requirements like availability and response time. As the healthcare industry is turning to information technology to help solve its business issues, specially provide to quality patient care services, it is important to develop QoS specification in distributed health information systems [3]. Unlike traditional systems, many non-end-to-end mission-critical applications envisioned for healthcare systems, which are complex

systems, because in these systems, we can find different subsystems, such as, wireless sensor networks, LANs, software platforms, home automation systems, mobile systems, Internet… that require different QoS requirements on the system, and these requirements pose unprecedented challenges in the area of QoS support in healthcare systems. Any failure or lack of performance on the system which could not be tackled in a reasonable delay may have some damageable consequences on the solutions' acceptance and development potential: the confidence is a basic and elementary factor of acceptance or reject, such incident could also generate a psychological defiance towards ICT's in general and towards such innovative assistance and monitoring services.

For these raisons and for providing real-time data collecting, we use a context-aware middleware [4] to give a dynamic and intelligent QoS to the system. It provides context data and takes into account QoS requirements of the applications. Measurements on a test bed have been carried out showing the good performance of our design. This context-aware middleware is a bridge between the healthcare applications and the sensor networks, to guarantee QoS needs, for supervision of the system and for easy configuration and installation of the sensors and actuators.

4. Conclusions

A prototype of MPIGate including a simple application for telemetry is under development. Practical tests are overseen on the Assisted Living Environment platform at LORIA (www.infositu.loria.fr). The development to include other protocols libraries is in study.

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