IBBT - COPLINTHO
Innovative Communication Platforms for Interactive eHomeCare

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Abstract— The objective of the IBBT-Coplintho project is the design and development of an ICT environment to support the care of patients in their home environment (referred to as an eHomeCare setting). This eHomeCare environment must serve as an overlay communication network, supporting the patient and his care-team in an ambient intelligent way. Through the eHomeCare network all actors involved in the care process can set up the necessary interactions, active or passive, covering data, voice and video communication. These interaction channels should be easy to set up, secure, user-friendly and should support the adequate communication at the point and the time of need. The actors that are taken into account in the IBBT-Coplintho project are the patient and his family and friends, and the overall care team (such as nurses, general practitioners, hospitals, alarm center etc). The IBBT-Coplintho project has been initiated 1st January 2005 and approved for a two year period. In the second half of 2006 a proof-of-concept demonstrator is planned.

Introduction

The ageing population and a shift in the burden of illness from acute (infections and injury) to chronic conditions (heart disease, asthma, epilepsy, cancer, etc.) drive up health costs and create a generation of people living with long-term illness

and disability. Furthermore nowadays health care, and home care in special, require multiple care providers (like general practitioners, nurses, etc) interacting and cooperating. At the same time information and communication technologies are opening up to patients and health care with considerable potential for improving delivery and quality of care. ICT is to play an increasingly important role, as it can create a re-active and pro-active surrounding supporting the existing health care processes.

The IBBT-Coplintho project will investigate how an eHomeCare environment could be designed and developed in order to support the care process for patients treated at home. A proof-of-concept demonstration will be installed of this platform during the second year of the project.

The eHomeCare communication network
The drawing below (Figure 1) gives a schematic overview of the eHomeCare overlay network that is envisaged within the IBBT-Coplintho project.

In the 2-year IBBT-Coplintho project (kicked-off 1st January 2005) both technical and non-technical issues are studied with respect to the creation of an eHomeCare environment. The non-technical research work focuses on the regulation, liability and social impact of the eHomeCare concept. Technical issues that are being studied are:

- the creation of an individual and trusted overlay network centered around the patient
- including devices such as an Interactive Nurse Terminal (INT) and an Interactive Patient Terminal (IPT)
- the usability of such devices in the eCare setting
- the overall architecture of data handling and exchange between all actors
- the set-up of advanced communication channels by the patient based on voice and video conferencing.
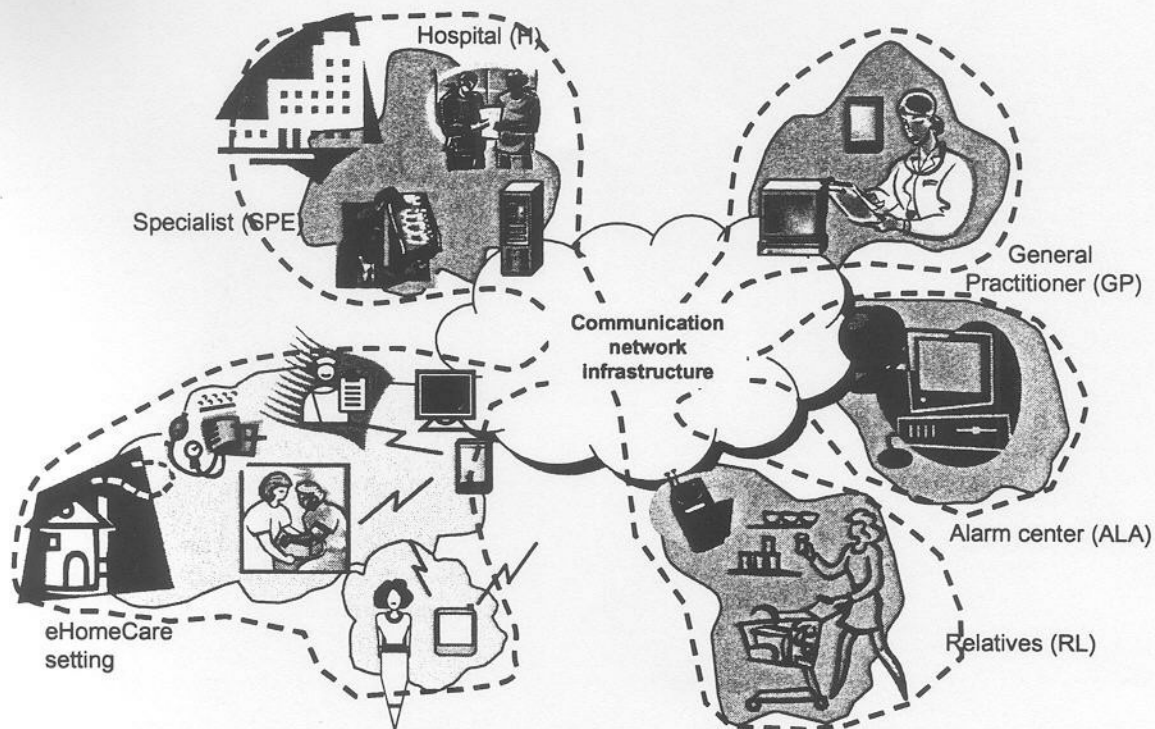
project website: https://coplintho.ibbt.be

Figure 1: eHomeCare overlay network configuration

Domain analyses and legal context

The ultimate goal of this study is to focus on real user needs and real industrial opportunities. It has been decided to restrict the scope of the proof of concept demonstrators accordingly. The IBBT-Coplintho domain analysis will start with an overview study and state-of-the-art report of existing eHomeCare projects, followed by a description of all the actors who are directly and indirectly involved in homecare and of all interactions amongst them. These actors are (non-exhaustive list): patients, nurses and other care service providers, general practitioners, hospital physicians and specialists in ambulatory care settings, patients' relatives, social workers, pharmacists etc. An in depth requirements analysis will ensure that the eHomeCare system will deliver the expected services to a maximum number of stakeholders, including the patient, who will be put at the central place in the model. The scope of the analysis has deliberately been restricted as to achieve early proof-of-concept demonstrators, showing concrete and useful applications. Only two different groups of patients (pathologies) have therefore been chosen for the IBBT-Coplintho project: insulin-dependent diabetes patients (in majority of Type 2) and multiple sclerosis patients. This choice was made by taking into account a number of specific selection criteria. Legal and other issues such as safety, liability, insurances, security and privacy protection, and informed consent are carefully considered during the preparation phase.

The communication scenarios among stakeholders, the different types of information flows (data, telemetry signals, interpersonal communication, etc) and the content

of the electronic records (administrative, nursing and medical ones) are much influenced by the types of pathologies and will be analyzed for both target groups. This analysis will not only address services as they are currently organized, but also explore innovative ways of dealing with homecare.

Although for reasons of simplicity, the Coplintho proof-of-concept demonstrator will focus on the two selected pathologies mentioned above, the eHomeCare platform concept that is studied and developed within the project will be based on an open architecture so that it can be adopted to other pathologies and/or new services related to the home care process.

The user perspective

Concurrent design, including both technology-driven and market/user analysis, is essential for the successful introduction of eHealth applications. Within Coplintho concurrent research will be done on user needs and user perspectives for the design and development of an eHomeCare platform. Important research effort is spent on usability aspects and potential societal impact of the new application.

Usability research encompasses a user and task analysis. Task analysis focuses on identifying and describing a complete set of tasks and subtasks performed by users of the demonstrator. User analysis also takes into account how these tasks are performed in daily practice. Based on this analysis a conceptual model will be proposed enabling the designers to take into account the ease-of-use of the application. The prototype will be evaluated focusing on the user-friendliness of the proof-of-concept. This method

of usability evaluation will be iterative, considering different adjustment and developments of the prototype eHomeCare system.

In order to improve implementation in the sector and consider the acceptance of new modes of practice, we will consider the "field" of home care. Different players have over time developed their particular habits, interests, power, roles, needs and expectations Analysis of user needs and user expectations in the health and social care field is a fundamental issue to guarantee acceptance and penetration of the technology. The results of analysis of the social field are to be translated into (architectural) design rules for the development of the prototype.

Creating an overlay network in the eHomeCare environment

The Coplintho project will investigate the use of personal networks and transparent authentication schemes in order to facilitate secure and trusted eHomeCare without the need for tedious authentication procedures. This solution will be based upon a trusted relation between the interactive nurse terminal (INT), a PDA-based device, and an interactive patient terminal (IPT) located in the home of the patient. This IPT, connected to the internet, will provide a secure gateway to the electronic care records, a base station for logging/forwarding tele-monitoring data and a device to set up trusted relations between the actors in the home care process. In order to realize this in a transparent fashion that requires no user interaction, the Coplintho project will investigate the use of dynamic ad hoc formed networks based on different heterogeneous devices, which will be extended with location/context aware services in order to automate/speed up administration for the nurse (e.g. automatic authentication & transfer of the latest monitoring data from IPT to INT). It is indeed clear that the replacement of the 'paper-interface' working method of today by an ICT-interface should not impose additional time constraints on the nurse, but should instead assist in the improvement of these tasks. Within this eHomeCare network, it will in future also be possible for other members of the care team (GP, paramedics) to log in to this network. Even mobility of the patients can be supported in such a

eHomeCare network. Within the proof-of-concept the focus will be on the INT and the IPT in the home environment

Advanced Communication technologies serving the patient at home

Besides facilitating the (para)medical aspects of eHomeCare, IBBT-Coplintho also aims at supporting interpersonal communications between the patient and his/her broader social network (not only their caretakers, but also family, friends, other patients, etc) To this extend, advanced communication technologies will be devised and assessed in the eHomeCare situation.

At the core, client-server based videoconferencing will be used. At the client side, an API will be provided to allow the superposition of applications on top of the audio/video-communication. Through this API, specific applications like information sharing (e.g. a nurse showing a group of patients how they should use certain medication), video streaming (e.g. an instruction video on the treatment of diabetes) and entertainment (e.g. a group of patients playing cards or pictionary) could be supported.

The server that will be used in this setup will be a high performance conference server that provides high quality audio and video to all participating clients. Setting up and destroying conference sessions is handled through the Simple Object Access Protocol (SOAP). Client joining and leaving requests are handled through the Session Initiation Protocol (SIP). The server implementation differs from traditional servers in the fact that it only forwards the media streams to the right destination clients. No transcoding or multiplexing is done at the server side. This implies that for three clients, every client has one video and one audio upstream and two audio and two video downstreams (Figure 2). As a result, the server delays are negligible, which improves the media quality experience at the client side. Another result is that no quality loss is introduced due to the lack of re-encoding the streams at the server side. It is clear to the project consortium that this approach introduces higher bandwidth demands for the connection; however this should not be a constraint due to the increasing availability of higher bandwidths in the home environment such as ADSL and in future probably VDSL.
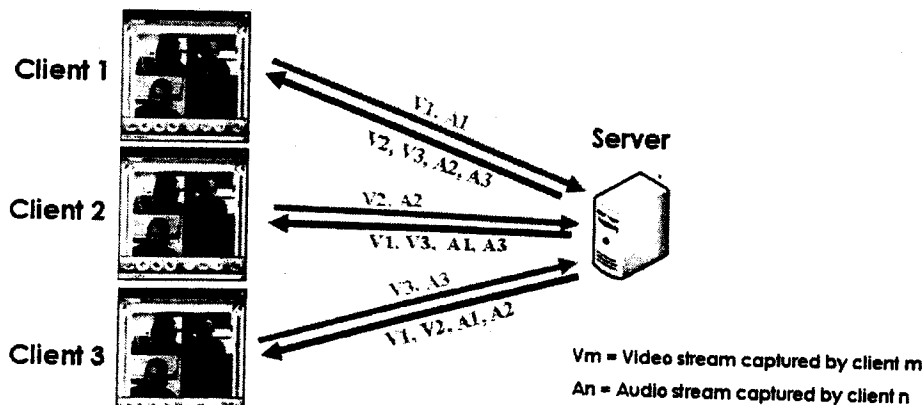

Vm = Video stream captured by client m
An = Audio stream captured by client n

Figure 2: Client-Server media flow for the communication platform

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The eHomeCare record / a hybrid architecture

During recent years the healthcare field evolved to a multi-disciplinary process involving more and more information of a complex nature. Providing the adequate information to the health provider at the point and the time of need should be able to improve the care process, lower the risk of medical errors and assist in lowering the overall expenses.

Consequently, as said in many discourses, it would be more efficient when all information about a patient is gathered in one unique patient record. Centralizing the patients' complete medical history however will result in bottlenecks concerning performance, data storage and the patients' feeling of security and trust. Coplintho will investigate how the development of a so called 'health record platform' could alleviate this problem. The electronic health record platform should allow on one hand the patients to view relevant parts of their own record online (increasing the active involvement of patients in their own health process), while on the other hand

the sharing of medical records between care providers across medical disciplines and institutions. This platform will be neither be centralized nor distributed but of a hybrid nature, satisfying the eHealth actors' needs, but also respecting the patients' empowerment and feeling of trust. Within this study, such an architecture will be designed for the eHomeCare setting. As can be seen in Figure 3, this architecture will be more than simply exchanging information and improving communication. A true eHomeCare architecture means sharing not only information, but also sharing responsibility, services (eScheduling, ePrescription, alarmingService, etc) and decision making. Technical issues that are being studied during this architectural study are Web service technologies, dynamic service selection and composition mechanisms, scalability and robustness, security and privacy, Quality of Service and the ability to continuously innovate and extend the architecture.
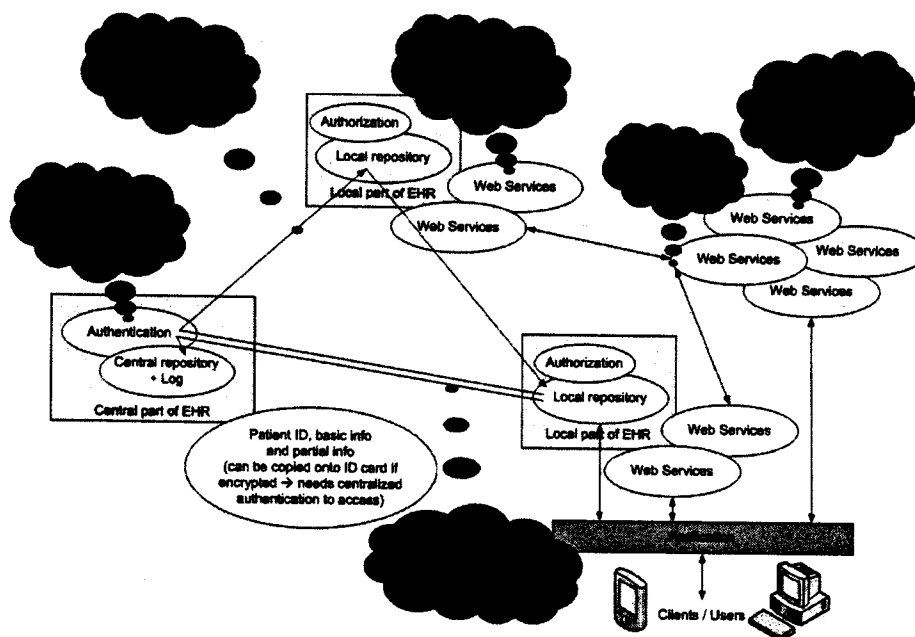

Figure 3: eHomeCare record architecture

Conclusion

This paper highlights the eHomeCare setting that will be studied and developed in the IBBT-Coplintho project. The project tackles the design of such an eHomeCare environment from a multi-disciplinary viewpoint, taking into account as well the care-takers as the patient's needs, and looking at the video, voice and data communication. Concurrent design takes into account both the technical possibilities and the user perspective from the very start of the project.

It is clear that an ICT environment brought to the home setting should support patients and the surrounding care team in their care process, but at the same time keep in mind that the well-being and home comfort of the patient is predominant. More active involvement of the patients in their own health care process, independent living systems for the elderly and the disabled are primary settings where an eHomeCare environment could be beneficial.

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5 Workshop on Applications and Services in Wireless Networks

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ASWN 2005 is the fifth workshop on Applications and Services in Wireless Networks. The workshop addresses the challenges and advances in future wireless applications and services that span all wireless architectures and technologies, such as cellular, WLAN, WPAN, ad hoc, and sensor networks. The format of the workshop is based on three-day single-track sessions, with presentations of invited and regular papers from academia and industry. This year's special theme is the impact of newly emerging technologies, such as personal networks, sensor networks and P2P on wireless applications and services. The workshop addresses also, through a Panel, the impact of these disruptive technologies including nanotechnologies, on the organization of the value chain in wireless services and on the information society.

This volume contains papers presented at the fifth workshop on Applications and Services in Wireless Networks (ASWN 2005).