Leadership in technology. SMURD: a telemedicine case study

~ *Ph. D.* **Camelia Cojocaru** *(Faculty of Administration and Business, University of Bucharest, Romania)*

E-mail: camelia.cojocaru@faa.ro

~ *Ph. D.* **Silviu Cojocaru** *(Faculty of Administration and Business, University of Bucharest, Romania)*

E-mail: silviu.cojocaru@faa.ro

Abstract: *The medical field is one of the most dynamic in Romania, regarding the adoption of IT. Dynamics is determined by two main factors. The first is related to the development of private health care market, and the second the benefits of using new technologies in medical processes. Telemedicine and advanced medical techniques are driven by new technologies. This paper aims to analyse the use of technology interoperability standards between applications and devices in medical institutions from Romania. Adoption of standards such as HL7 (Health Level 7), XML (eXtended Markup Language) and SOA (Service Oriented Architecture) can increase the quality of medical processes in Romania and can help reduce the cost of medical processes. In the article present a brief study on the use of new technologies in SMURD (Mobile Emergency Service for Resuscitation and Extrication). SMURD implementation is a clear proof of how technology could bring leadership in medical care.*

Key words: HL7, XML SOA, interoperability, system integration, web services

JEL Classification: O33-Technological Change: Choices and Consequences; Diffusion Processes

1. Introduction

There is strong push for clinical leadership in the development and procurement of information technology in health care (Wyatt, 1995). The general presumption of specialists is that technology is of benefit to health care and should be wholeheartedly embraced. This view is supported by assertions such as that general practitioner computing is seen "an essential technology for healthcare," and the levels of spending on healthcare information technology should be highly increased (Dick, 1991).

Steps have been made during the last period, such as HL7. Health Level Seven (HL7) is a non-profit organization involved in the development of international interoperability standards for medical IT. "HL7" also refers to certain specific standards created by the organization. Together with its members, HL7 guarantees a framework of associated standards for information change, integration, share and transmission regarding e-Health. HL7 and other Internet technology-based standards allowed real time sending of medical information and the development of complex telemedicine systems.

It is the case with the SMURD emergency telemedicine project, one of the most complex of its kind achieved in Romania.

2. Literature review

Web services are a standardized way of distributing Internet applications and fundamental technologies that are at the basis of this network. Also, web services offer the possibility of interconnecting a wide range of applications, which are available on different platforms and in several worldwide locations. One could say that Web technologies became an Esperanto of application communication, as the new technology opens the gate towards a new age dominated by intelligent applications that make smart decisions and Internet searches, as a basis for well-balanced decisions (Agosta, 2000).

Health Level 7 (HL7) is a standards-setting organization accredited by the American National Standards Institute (ANSI). They have developed communication protocols widely used in the United States, with growing international recognition and implementations. A vendor- and provider-supported organization, its mission is to provide standards for the exchange, management, and integration of data that support clinical patient care and the management, delivery, and evaluation of health care services. This encompasses the complete life cycle of a standards specification—development, adoption, market recognition, utilization, and adherence. The HL7 specifications are unified by shared reference models of the health care and technical domains. The HL7 version 2.4 messaging standard is currently in use, and version 3, which represents several fundamental changes to the HL7 messaging approach, is in an advanced stage of development. [Dolin, 2001]

Detailed specifications for expressing HL7 in SGML and XML have been developed. Some HL7 requirements are not readily expressed, while some ambiguous areas of the HL7 standard are made explicit in the SGML/XML representation. With the current design, an SGML/XML parser can extract any component of any data type from a message. SGML and XML can both serve as implementable message specifications for HL7 Version 2.3 and Version 3.0 messages. The ability to explicitly represent an HL7

requirement in SGML/XML confers the ability to validate that requirement with an SGML parser. The optimal message representation will be a balance of functional, technical, and practical requirements. (Dolin, 1998)

Telemedicine is the use of information and communications technology to provide health care services to individuals who are some distance from the health care provider. Rather than being a single technology, telemedicine is part of a wider process or chain of care. It has been assumed that telemedicine can improve this chain and thus enhance the quality and efficiency of health care. Telemedicine is also expected to increase the fairness and equality of the distribution of services, because the accessibility of health services, especially in remote areas, can be improved. Although the use of older approaches (telephone, fax) is commonplace, telemedicine applications increasingly use the latest innovations in computer and network technologies and other equipment (Roine, Ohinmaa, Hailey, 2001).

Although this definition includes medical uses of the telephone, facsimile, and distance education, telemedicine is increasingly being used as shorthand for remote electronic clinical consultation. Interest in the field has increased dramatically in the latest years. Around the world, state and private allocations for telemedicine and related technologies increased constantly. Many state and private organizations have begun telemedicine research and demonstration programs. Many states are using their own resources to build state-of-the-art telemedicine systems, some with large capital investments. Faith in this technology is not universal, however. Depending on one's viewpoint, telemedicine may be seen as a valuable tool for providing badly needed specialty care services.

Telemedicine can be beneficial to patients living in isolated communities and remote regions, who can receive care from doctors or specialists far away without the patient having to travel to visit them. Recent developments in mobile collaboration technology can allow healthcare professionals in multiple locations to share information and discuss patient issues as if they were in the same place. Remote patient monitoring through mobile technology can reduce the need for outpatient visits and enable remote prescription verification and drug administration oversight, potentially significantly reducing the overall cost of medical care. Telemedicine can also facilitate medical education by allowing workers to observe experts in their fields and share best practices more easily.

Telemedicine also can eliminate the possible transmission of infectious diseases or parasites between patients and medical staff. Additionally, some patients who feel uncomfortable in a doctor's office may do better remotely. For example, white coat syndrome may be avoided. Patients who are homebound and would otherwise require an ambulance to move them to a clinic are also a consideration.

The downsides of telemedicine include the cost of telecommunication and data management equipment and of technical training for medical personnel who will employ it. Virtual medical treatment also entails potentially decreased human interaction between medical professionals and patients, an increased risk of error when medical services are delivered in the absence of a registered professional, and an increased risk that protected health information may be compromised

through electronic storage and transmission. There is also a concern that telemedicine may actually decrease time efficiency due to the difficulties of assessing and treating patients through virtual interactions; for example, it has been estimated that a tele dermatology consultation can take up to thirty minutes, whereas fifteen minutes is typical for a traditional consultation. Additionally, potentially poor quality of transmitted records, such as images or patient progress reports, and decreased access to relevant clinical information are quality assurance risks that can compromise the quality and continuity of patient care for the reporting doctor. Other obstacles to the implementation of telemedicine include unclear legal regulation for some tele medical practices and difficulty claiming reimbursement from insurers or government programs in some fields.

Another disadvantage of telemedicine is the inability to start treatment immediately. For example, a patient suffering from a bacterial infection might be given an antibiotic hypodermic injection in the clinic, and observed for any reaction, before that antibiotic is prescribed in pill form.

Roine and colleagues found the following forms of telemedicine to be valuable: "teleradiology, teleneurosurgery, telepsychiatry, transmission of echocardiographic images, and the use of electronic referrals enabling email consultations and video conferencing between primary and secondary health care providers."(Roine, 2001) In general, cost savings were not impressive. This is not surprising, because such

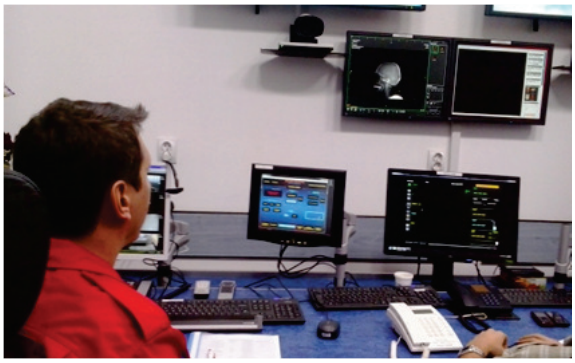
technology is expensive, especially to develop and support However, the economic analyses that the authors reviewed did suggest that teleradiology, especially the transmission of CT images, could be cost-saving (Wallace, 2001).

The evaluation of the impact of telemedicine is difficult (Wallace, 2001). This is the reason that this paper is presenting a study case of successful implementation of telemedicine in Romania, in Tg. Mures.

3. SMURD Case Study

Established during 1991, SMURD (The Emergency, Reanimation and De-Caging Mobile Service) pushed forward, by means of professionalism, a new standard regarding the emergency services quality in Romania. SMURD is currently called upon for all emergencies where individual or multiple lives are in immediate danger.

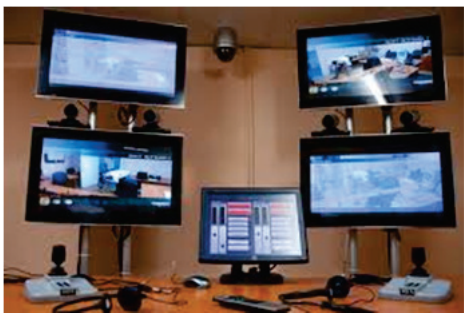
Fig. 1 – SMURD implementation in Tg Mures Hospital



SMURD has recently finished a telemedicine project where the Tirgu-Mures based service can provide real time assistance for more than 40 hospitals in Romania. These hospitals do not have qualified personnel needed for emergency services. The IT solution has been developed based on the latest technologies from Microsoft. Included among these technologies is the latest Microsoft operating system – Windows 7.

Within Romanian small towns there are no qualified medical personnel able to provide emergency medical services. When emergencies occur within such hospitals, an ambulance or a helicopter is called for taking over the patient. The decision is taken by the doctor taking care of the patient, and no support can be provided as well as no case trial by the emergency unit. For most situations, the lack of specialized personnel results in inefficient use of resources.

Fig. 2 – SMURD implementation: data transmission



As those resources are limited (the medical emergency helicopter from SMURD Targus Mures and a certain number of ambulances), an eventual wrong resource allotting may even result in loss of lives.

Telemedicine allows distance transmitting of data related to patients. As such, vital signs, imagery exams and other analysis of such patients may be sent in real time. Our case study refers to a telemedicine project for medical emergencies. We connected the main regional hospital (the hospital in Targus Mures) with other 40 smaller hospitals, managed by the Targus Mures hospital and by the SMURD helicopter. These smaller hospitals do not benefit from all possible medical specialties and in most cases they do not have an emergency doctor, a radiologist or a doctor for critical situations.

The telemedicine system is compatible with all standards in the medical field, which are high due to demands related to interoperability and security. The Windows Communications Foundation (WCF) was used in order to integrate IT systems. It is a technology that generated important advantages in terms of application development process and alignment to medical standards.

The telemedicine solution centralizes vital sign flows received from monitored patients and shows them by means of a graphic interface based on Windows Presentation Foundation (WPF) technology. Doctors are thus able to manipulate relevant information for medical processes, especially the emergency ones. The monitoring devices are compatible with HL7 (Health Level 7) standard,

and the application and data management services are built according to HL7 Resources Location and Update Service. The database used by the solution is Microsoft SQL Server 2008, and the solution fully meets all complex demands the medical field asks for.

Fig. 3 – SMURD operations in Tg Mures Hospital

Windows 7 OS has been integrated within the solution for vital signs sending and visualization, and this new Operating System allows the development of a flexible interface for this application.

The telemedicine system allows audio-video connections with all the smaller hospitals connected. More than that, the patient vital signs are real-time posted on monitors within SMURD Targus-Mures headquarters. This information helps the doctor with constant evaluation of the patient and in taking decisions on short notice. Besides that, the doctor is able to see how the patient reacts to treatment and to make useful and timely corrections.

The telemedicine solution contributed to the optimization of the way medical resources are used, generating an increase of the intervention speed and providing special medical cooperation opportunities.

Authentication and authorization are key demands for medical applications. The solution uses Windows Communication Foundation (WCF) and Web Services Security and Web Services Trust standards for security purposes. The WCF technology and these standards provide full support for applications dedicated to the medical field, one of the best standardized in terms of security and interoperability.

The SMURD Targus Mures telemedicine system provided new opportunities in terms of performing the medical act, by improving communications and speed of sending medical information.

4. Conclusions and implications

According to Wallace (2001) we have moved well beyond the pioneering stages of telemedicine. Longer-term planning is required, and our health care budgets must incorporate telemedicine as part of regular operating expenses.

Emergency telemedicine system SMURD brought significant advantages in the development of medical processes in Romania. New technologies for interoperability - HL7 predilection - allow a wide integration of medical devices with other applications.

SMURD is successful in this regard. Although advanced medical technologies are

less spread to new telemedicine projects are quite rare in turn, develop a national emergency telemedicine project is a commendable thing. Savings made by this project were significant and resulted in more judicious use of resources.

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