INTEROPERABILITY ISSUES IN A REGIONAL HEALTHCARE INFORMATION SYSTEM: THE CASE OF GREECE AND THE USE OF HL7

Berler A., Angelidis P., Koutsouris D.
HL7 Hellas, Greece

Introduction

The advantages of the introduction of information and communication technologies (ICT) in the complex Healthcare sector are already well known and well stated in the past. It is nevertheless paradoxical that although the Medical community has embraced with satisfaction most of the technological discoveries allowing the improvement in-patient care, this has not happened when talking about Healthcare Informatics. Many reasons could be proposed for this matter, though with a short analysis it is rather clear that new ICT are having integration problems in Healthcare because of the way this sector is organised. Healthcare is a strongly people-centred sector where ICT was dealt more as an intruder, as a spy to the healthcare professionals' way of doing things and as a competitor to this people-centred model. Thus, if ICT intends to prove its advantages towards establishing information society and much more a knowledge society, it has to focus on providing service-oriented solutions. In other words it has to focus on people and this has not been the case in most of the circumstances. It is common knowledge that in order to install any type of information system in healthcare, even more if it concerns knowledge management, six main groups of issues have to be dealt with:

1. Organizational and cultural matters related to healthcare.
2. Technological gap between healthcare professionals and information science experts
3. Legal requirements on the confidentiality of personal data, of patient related data and on data privacy.
4. Industrial and market position of healthcare informatics and interoperability complexity.
5. Lack of vision and leadership of the health care managers and health authorities.
6. User acceptability and usability of the proposed information systems.

In 2001 a reform of the Greek National Healthcare System was introduced in order to enhance the performance and control of healthcare provision in Greece. One of the main changes was the division of the country in 17 autonomous Healthcare Regions where the Regional Healthcare Authorities (RHA) are responsible for the regional healthcare strategy. In order to support this reform and with the substantial financial aid of the EU funded third community support framework, a series of information and communication technology oriented interventions were introduced. After a period of analysis and design the Greek Government started issuing a number of extremely detailed (more than 500 paged each) Request for Proposal (RFP) for each RHA.
The proposed information system in the RFP consists of a series of subsystems covering information management issues in a regional healthcare system. The system is innovative in the sense that it required the design and implementation of a complete and integrated information system at a regional level that comprises all types of healthcare levels (primary care, secondary care, home care, etc), that included interoperability issues (proposing the use of the HL7 protocol, for establishing a Master Patient Index for example) that covered most of the needed components (ERP, HIS, LIS, etc) and that could be able to work efficiently in a secure wide area network (i.e. a VPN) to ensure data privacy and confidentiality. Furthermore, envisioning the complexity of the required integrated regional healthcare information system, it should be made possible to ensure high service provision and business continuity by establishing a service level agreement with the vendors.

Interoperability Issues

Through the aforementioned RFPs, the need has arisen to make healthcare information systems in Greece to work together as the components of regional healthcare network (RHN), where newly introduced information systems must communicate with systems already present in various healthcare institutions.
The problematic of making disparate information systems work together is a common one. In computer science literature and European research project reports a number of solutions are suggested. Nearly all of these publications feature a *middleware* that is based on information exchange via messages utilising some application (ISO-OSI level 7) protocol.
The proposed architecture fulfils at least the following requirements:

1. Existing systems do not need to be altered;
2. No significant extra (hence unanticipated) load on existing systems is introduced;
3. Connecting existing systems is an economical viable activity.

The three requirements are met by an *asynchronous message based* information exchange infrastructure defining a uniform interface for any system that must or receive information. All systems are connected, through a uniform interface, to a *common communication infrastructure* (CCI). In an asynchronous message based CCI,

information is exchanged between two systems by breaking up the information into chunks. These 'chunks' are called *application protocol data units* (APDU). An APDU has an explicit structure that is defined by the APDU (or message) *syntax*. Additional encoding and decoding rules help sending and receiving systems to construct and to analyse APDUs. Sending systems can insert information into APDUs and receiving systems can extract information from the APDUs.
APDUs are not transmitted directly; they are embedded in so called *protocol data units* (PDU). APDUs form the 'payload' of PDUs. PDUs contain enough information for the CCI to be able to 'route' the information sent to the receiving application. Additional 'meta' data help the receiving side to understand if the PDU has been received intact and contains the APDU anticipated.
Using (A)PDUs to exchange information between systems bring a number of distinct advantages:

1. All systems can be interfaced in a uniform way with each other;
2. there is decoupling between systems which allows information to be routed, stored and forwarded, and processed independently from the actual exchange;
3. Information exchanging does not need to reveal their internal structure to each other. This form of 'information hiding' significantly improves the connectability of systems.

When a system provide a uniform interface for sending and receiving information they can be connected easily and even routing of information becomes feasible. The latter is very important to connect remote system that cannot communicate directly. Clearly the third advantage is the most important. The fact that two information systems do not need to know each others database schemata, database connection technology, tremendously simplifies the task of interfacing these systems.

Selecting the right protocol: HL7
HL7 is by far the most widely used message based information exchange standard in the clinical environment. It is in use on all continents of the world. If we restrict ourselves to Europe we see that in almost every country HL7 is used as the message based information exchange based standard. Nearly all intelligence diagnostic equipment is able to 'speak' HL7 and almost all serious medical information systems are capable of sending or receiving the appropriate HL7 messages using HL7 protocol.
Also HL7 is clearly the most mature message based information exchange standard. Research from both the academic community from the industry and consultancy companies have led to a standard which really can be used in practise. Furthermore, the HL7 standard is owned by the Health Level 7 non-profit organisations with local branches in almost all countries in Europe, in the United States of America, Australia/New Zealand, Asia, and the Pacific Rim. The HL7 standard has been recognised by many national standardisation institutes like the ANSI (USA) and the DIN (Germany). A final point in favor of the HL7 standard is that it is really everyday in hundreds of hospitals all over the world connecting a wide variety of applications and systems. As a consequense, the HL7 protocol was set as a mandatory requirement in the selection process for the implementation of the RHN for each RHA.
The Health Level 7 standard is not perfect and the way it is used is not perfect either. HL7 is the mostly the result of a pragmatic effort to come up with a mechanism to make it possible to exchange information between a variety of systems that communicate in a wide variety of ways. This has led to many ad hoc solutions that complicate the exchange of messages. Also the implementers of HL7 based communication between applications did have (and still have!) a liberal view on the HL7 standard. In order to deal with this issue the proposed RFPs have included in the selection process the evaluation of an HL7 conformance statemement based upon the work done by the "HL7 Conformance Special Interest Group" (SIG) estabilshed by HL7.

Conclusion
An important set of ICT developments has started in Greece that intends to promote the quality and continuity of care. The designers of these developments have recongnised that the establishment of a robust and mature interoperability framework has to be set up in order for information systems to interconnect and exchange valuable administrative and medical data. HL7 has been proposed as the most valuable solution since the advantages of HL7 clearly outweigh its disadvantages, namely: one standard for the exchange of information between medical applications, and systems, wide spread knowledge of HL7, word-wide acceptance of HL7 by the academic world and the industry. Continuous improvement of the HL7 standard through the international HL7 standard organisation.