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eHealth Beyond the Horizon – Get IT There

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Citizen involvement and patient empowerment are based on awareness, confidence, and acceptance. An adequate level of awareness can be achieved by the respective level of information, education and training measures. This will lead to confidence with regard to shared care, the new healthcare paradigms but also the health card. With the regular use and based on the patients' respective behaviour, the level of acceptance is going to grow leading to an even higher level of awareness at the end of the day. Additional applications like the electronic signature, as a first step towards a real multi-application card, can foster these processes.

The more information citizens and patients do have regarding different procedures and processes in healthcare and welfare, the more they are able to significantly play their dedicated role within this partnership. Cards can and will contribute by allowing citizens and patients to get controlled access to administrative and medical data stored either on a card or in the network but also to determine who else shall have access to this data.

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A Deployment and Research Roadmap for Semantic Interoperability: the EU SemanticHEALTH project

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Abstract: The purpose of this EU funded project is to describe a short and medium term Research and Deployment Roadmap for Semantic Interoperability in e-health. It started by defining 4 levels and 3 dimensions for Semantic Interoperability. The vision is to reconcile the needs for the direct patient care safety, biomedical and clinical research and for public health by the reuse of direct care data.: from gene to individuals and populations. The methodology is presented and preliminary results and milestones for the short and the long term are set. We conclude by statements on the main characteristics and needs of the roadmap to sustain better health for individual and populations in the changing EU health care systems..

Keywords: Semantic Interoperability; Public Health; Electronic Health Record; Ontology; Multilingualism;

Introduction

Semantic Interoperability (SIOp) is widely considered a key ingredient for meeting present and future challenges of health systems such as ageing populations and increasing medical costs. The open challenges for SIOp result both from the clinical settings perspective of seamless care provision across all elements of the health care value system (like patient safety, multiple carers locations of health care delivery), from the research perspective of integrating life sciences and clinical information and

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owledge, and from the public health perspective of policy monitoring based on data ım direct patient care settings. Chapter 2 of this paper describes the chosen :thodology to create the roadmap, chapter 3 gives outlines preliminary results with an erview of the various levels of interoperability and chapter 4 briefly outlines the tial roadmap.

Methodology of the Roadmap

e roadmap follows the requirements of the technology roadmap program as :sented in [1] [2] [3]. It is designed to uncover the key issues that hamper efficacious Op in the health care system. For some problems the solutions are obvious and quire adequate planning for implementation. Others do need more (basic) research to :it a proper solution. This means different time scales for achieving different levels SIOp. The roadmap project produces medium- and long term recommendations for earch and deployment. We have defined five types of realistic use cases. A roadmap s three stages: preliminary activities, development, and follow-up [1][2][3].

Preliminary Activities

the preliminary stage, the project (a) has ensured that the essential conditions for rt-up were met, (b) has found the leadership and participants, and (c) has defined the ıpe and boundaries for the roadmap.

The literature and practice in SIOp has been reviewed. The outcome of that :rcise is presented in Deliverables D1.1, [4] D1.2 [5], D2.1 [6], D3.1 [9], D5.1[7], .0[8] and RIDE deliverable D4.1.1 [10]. It provides the baseline (common ıceptual framework, inventory of existing initiatives, technology and socio economic ıes, public health issues) for the roadmap development. Stakeholder buy-in was ıght to ensure a wide participation of key interested parties in the road mapping ort. This was done in several workshops involving Member States representatives Health Stakeholders Group, the Continua Alliance, e-Health Interoperability pert). Some have been dedicated workshops organised by SemanticHEALTH, and ers have been sessions run in parallel with larger scale or focussed events, in order naximise the range of inputs obtained.

Development of the Roadmap

e development of the roadmap rests on a careful consideration of enabling techno- y. The analytical dimension covers both technical and socio-economic aspects of)p [4][5][6][8]. The application dimension focuses on 3 specific application fields: e direct patient care with Electronic Health Record (EHR), the public health electro- record and the research dimension on ontology and multilingualism. The different)s have been processed and the final recommendations will be available in the ldle of 2008: a common conceptual framework based on the vision statements of the pose and goals of the defined SIOp in Deliverable D1.1 [4], an inventory of the ional and international e-health initiatives and assessment of their SIOp performance

in Deliverable D1.2[5], the enabling factors: legal, political agreements, financial, social, organisational in Deliverable D3.1[9],technologies and products with their critical and secondary specifications to be developed by industry in Deliverable D2.1 [6], definition of 5 major categories of use cases (patient care, public health, research and translational medicine, support for diverse markets and cost drivers) in Deliverable D7.1[11], a scenario-based planning.(developed by the e-Health Interoperability Expert Group for implementing Large Scale Pilots: patient summaries and e-prescribing[5], identifying the gaps against real situations in Deliverables D4.1[12], D5.1[7] and D6.1[13] and the major areas of technology and enabling factors to be mobilised and their milestones .

4. Follow-up

The group of experts who developed and drafted the technology roadmap is relatively small. To enable a broad acceptance of the roadmap and to ensure future action, critical assessments - validated and accepted by a large audience including clinical bodies - is of utmost importance. To avoid the process coming to a halt over the course of the roadmap definition, all participants agreed to develop an action plan advocating investment decisions and setting out the means and time lines for implementation. Finally, since both the needs and the technologies are constantly and rapidly evolving, the implementation plan includes provisions for the periodic review and update of the initial roadmap. This activity was developed with the involvement of the RAG (Roadmap Assessment Group).

The roadmap document has been distributed to a large group of stakeholders representatives, who will thoroughly evaluate it and validate it or possibly suggest modifications. These reviewers will be asked to address specific questions such as the following:

1. If the recommended alternatives are developed, will the targets be met?
2. Are the technology alternatives reasonable?
3. Were any important alternatives or enabling factors missed?
4. Is the roadmap clear and understandable?
5. Are the recommendations feasible?
6. Can the recommended actions be completed in the required time frames?

5. Preliminary Results

As a specific support action, SemanticHealth is based on real existing implementations, or implementations planned for the near future. It distinguishes 4 levels of interoperability, 2 of them allow for semantic interoperability. To explain and distinguish the 4 different levels, consider the following scenario: 56 year old Pádraig recently moved from Ireland to Spain to take up his new job in a multinational IT company. A few weeks after arriving, he falls ill, consults his local (Spanish) GP and his being transferred to the next hospital for further tests.

- **Level 0** (no interoperability at all) – Pádraig has to undergo a full set of lengthy investigations to find out the cause of his severe pain. Unfortunately, results from the local GP as well as from his Irish GP are not available at the point of care within the hospital due to e.g. the missing technical equipment.

- **Level 1** (technical and syntactical interoperability) – Pádraigs doctor in the hospital is able to receive electronic documents that were released from the Irish GP as well as his local GP upon request. Widely available applications supporting syntactical interoperability (such as web browsers and email clients) allow the download and provide immediate access. Unfortunately, none of the available doctors in the hospital is able to translate the Irish document, and only human intervention allows interpreting the information submitted by the local GP for adding into the hospitals information system.
- **Level 2** (partial semantic interoperability) - The hospital doctor is able to securely access via the Internet parts of Pádraig Electronic Health Record released by his Irish GP as well as the local GP that he visited just hours earlier. Although both documents contain mostly free text, fragments of high importance (such as demographics, allergies and medical history) are encoded using international coding schemes, which the hospital information system can automatically detect, interpret and meaningfully present to the attending physician. Within the notion of partial SIOp, the term degree is being used to identify the degree of SIOp, e.g. 40% or 90%. A degree of 0% partial SIOp describes a situation where no SIOp is available whereas 100% identifies full SIOp. Two subcategories have been identified to distinguish between unidirectional semantic interoperability (level 2a) and semantic interoperability of meaningful fragments (level 2b).
- **Level 3** (full semantic interoperability, co-operability) - In this ideal situation and after thorough authentication took place, the Spanish hospital information system is able to automatically access, interpret and present all necessary medical information about Pádraig to the physician at the point of care. Neither language nor technological differences prevent the system to seamlessly integrate the received information into the local record and provide a complete picture of the Patients health as if it would have been collected locally. Further, the anonymised data feeds directly into the tools of public health authorities and researchers.

6. Initial Roadmap

The roadmap shall show the road for the deployment of the different solutions to the requirements of the European e-Health policies on: the interoperable structured patient summaries, intermediate interoperable EHRs, fully interoperable EHRs and regional public health data bases from interoperable EHRs.

The roadmap shall use the technical standards when they are available: EHR international standard (ISO), common nomenclature and agreed equivalence among medical products, the setting of an international infrastructure to support interoperation of ontology-based multilingual terminologies and the definition of a public health metadata from an EHR.

Finally the roadmap shall comply with legal rules when they are available: liability and responsibilities of the actors involved in the exchange of EHRs, legal transparency and liability concerning the e-Prescription, data protection compliance to patient privacy. The overall representation of the preliminary roadmap is illustrated below.

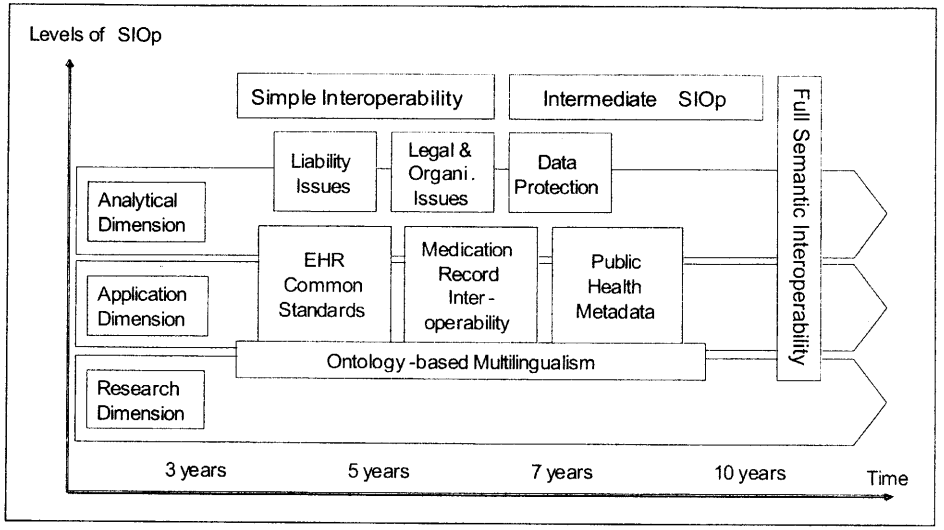

Fig.1 The overall representation of the preliminary roadmap

On a 10 years time line we represent the three levels of SIOp corresponding to the three deployment required by the eHealth policies. The three dimensions (analytical, application and research) are represented by the three horizontal stripes.

On the short term (5 years) the level 1 SIOp can be achieved with the implementation of patient summaries and ePrescription subject to compliance with legal rules (responsibilities of actors and legal organisation of e- prescription), and to the approval by ISO of the EHR standard and to an agreement on a common nomenclature of medical products.

On the medium term (5 to 7 years), if Level 2 SIOp is to be achieved it is necessary that legal rule on data protection compliance to patient privacy within an interchangeable EHR environment and a definition of the public health metadata from EHR are set.

Finally on a 10 years perspective the Level 3 SIOp can be achieved when an international infrastructure based on an ontology repository supporting multilingual terminologies and on repositories of structured EHRs is set.

7. Conclusion

The SemanticHEALTH roadmap is based on three statements, an environment framework and four types of actions:

1. SIOp is necessary for (a) translational medicine, (b) speed, and (c) coping with knowledge magnitude, not a goal of itself. The efforts needed to promote SIOp shall be aligned on scalable goals and realistic time schedule before showing the positive impact. There is a significant net social gain from SIOp, i.e. the benefits exceed the costs for quality, access, cost effectiveness paradigm, communication in healthcare between all actors including the citizen, care transfer and safety.
2. An environment framework is needed to initiate a paradigm shift from technical products to sustainable processes and structures (including legal

requirements, economic analysis and policy management), to design a dynamic, language-independent, sustainable reference repository of terminology , a cost benefit model allowing to decide the level of desirable SIOp and of scalability and a step-by-step test of conformance to SIOp.

3. Four types of actions shall be planned: (a) adoption of existing solutions, (b) wide-scale evaluations, (c) investment in development and (d) further research.

We are convinced that the proposed roadmap offers a viable option for better health in the currently changing health care systems.

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DebugIT for Patient Safety – Improving the Treatment with Antibiotics through Multimedia Data Mining of Heterogeneous Clinical Data

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Abstract. The concepts and architecture underlying a large-scale integrating project funded within the 7th EU Framework Programme (FP7) are discussed. The main objective of the project is to build a tool that will have a significant impact for the monitoring and the control of infectious diseases and antimicrobial resistances in Europe; This will be realized by building a technical and semantic infrastructure able to share heterogeneous clinical data sets from different hospitals in different countries, with different languages and legislations; to analyze large amounts of this clinical data with advanced multimedia data mining and finally apply the obtained knowledge for clinical decisions and outcome monitoring. There are numerous challenges in this project at all levels, technical, semantical, legal and ethical that will have to be adressed.

Keywords. Infectious disease, patient safety, semantic inter-operability, multimedia data mining, decision support, clinical outcome monitoring

Introduction

Building a safer and more efficient care system has become the most shared goal of all actors involved in healthcare. From a historical perspective, there has been an impressive shift towards awareness of the impact of errors in medicine in the last 25 years. In the early nineties, research papers and reports about patient safety, incident reporting and initial order-entry systems were published, mostly originating from academic settings. At about the same time, the first reports of the US Institute of Medicine (IOM) on computerized patient record systems stressed the ability of ICT-based solutions to improve the quality of care [1]. Ten years later, by the end of the nineties, a famous report of the IOM called attention to the wide prevalence of errors in healthcare [2]. While medical errors are under the spotlight, (re-)emerging infectious

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