

Chapter 18

Towards Achieving Semantic Interoperability in eHealth Services

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ABSTRACT

One common and primary vision of eHealth is to achieve seamless interoperability between eHealth systems to enable the delivery of the right information about the right patient to the right person at the right time. However, the high sensitivity of the clinical domain and the vast differences in eHealth systems pose a great interoperability challenge for solutions that rely solely on prior knowledge of common interoperability standards will not sufficiently scale. This chapter presents a service-based approach that utilises domain ontologies combined with extensible problem models, enriched with domain terminology and knowledge services to enable autonomous data governance and semantic interoperability. The chapter addresses the resulting requirements and proposes a solution outlining the results from the prototype of the approach.

INTRODUCTION

Data sharing in the health domain is increasingly being recognised as a critical factor for improving healthcare and facilitating clinical research (Stead W. et al (2000), Garde, S. et al (2007), Taweel, A. et al (2006), Taweel, A. et al (2004)). The need

for integrated systems that can provide up-to-date information about patients and their healthcare is not only critical to the day-to-day running and delivery of health functions but also potentially means saving lives. It is increasingly expected that patient health information is available at the point of care irrespective of its location. This

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expectation is driven by rapid developments in information technology, alongside their increasing dominance at the heart of individual healthcare institutions, through the use of data-intensive electronic health records systems (EHRs) that drive the health care process. One of the primary visions of eHealth has been to achieve a technology supported, seamlessly integrated health service that ensures the delivery of the right information about the right individual to the right person at the right time (Stead W. et al (2000), Taweel, A. et al (2006)). This vision, however, present many challenges, including:

- The heterogeneity of eHealth systems and their data representations across health institutions, not just across the eHealth domain as whole but even within individual clinical domains, e.g. secondary care, primary care etc.
- Delivery of complete clinical information at the point of care, potentially requires health information exchange across geographically distributed health centres, thus creating a massive scalability challenge that puts demands on networking and distributed system architectures.
- Legacy and propriety systems and the lack of, or at best, slow pace adoption of standards make exchanging clinical data more difficult and hampers the chances of integrated healthcare. This puts demands on knowledge representation methodologies that must cope with the complexity of (heterogeneous) eHealth information, whilst remaining easy to deploy and use by system providers.
- The requirements of patient privacy and confidentiality that require strict data governance policies. These policies vary across institutions to include a variation of access constraints that observe strict ethical rules to maintain patient confidentiality

at all times. This requires secure yet configurable independent data sharing policies that reflect the needs of the participating organizations within the domain.

However, the most serious challenges to achieving the eHealth vision are not only technological but also ethical and structural. The large number of system providers and their business models and variations in ethical and regulations for accessing clinical information across health organisations (let alone individual health centres) implies an exponential explosion in the number and type of stakeholders that need to be involved in achieving the seamless interoperability required to achieve the above vision. To achieve the need is to enable interoperation between data centres not just at the system or data levels but also at the governance level. However, consider the complexity involved in reaching agreements on or enforcing conformance to interoperability standards at these different levels within a single enterprise let alone multiple countries. Therefore, the approach taken here is motivated by the practical implications of not being able to completely rely on the use of common interoperability standards to address this issue. Instead, this needs to be addressed at the granularity of the application, data and/or centre levels, in which an interoperability framework should overcome heterogeneity and adapt at run-time and dynamically interoperate with data providers. Heterogeneity between eHealth systems and data, however, takes several dimensions; the most challenging of which is the semantic one, which the approach proposed in this paper attempt to address.

In this chapter, we focus on eHealth data sharing in the context of clinical research, in the context of health organisations that use electronic health records systems (EHRs) through which patient health data is managed and stored. The stores that hold patient health data are referred to in this chapter as data sources. We present an approach

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