

Developing an Approach for Aggregating Information From a EHR into a Fully Structured Patient Summary

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Introduction

Introduction (1)

- ▶ eHealth is often referred to as an essential prerequisite for more efficient, cooperative healthcare [1]
- ▶ Providing healthcare professionals with adequate access to well-filled electronic patient records and health-related information contributes to an improvement of the treatment process and, ultimately, the quality of patient care. [2, 3]
- ▶ Countries and healthcare organizations introduce generic eHealth infrastructures for Electronic Health Records (EHR), e.g. In Austria ELGA started officially in December 2015
- ▶ Such an EHR, however, is expected to contain much more documents and health-related artefacts than conventional EMRs (Electronic Medical Records)
- ▶ This raises concerns of information overflow amongst the physicians and health professionals [4, 5]

Introduction (2)

- ▶ It is therefore crucial to reduce and aggregate the amount of information that is returned by queries of the EHR.
- ▶ Presented information should be reduced to minimum to answer needs in respect to their information context (e.g. emergency or normal treatment situation) and role (e.g. physician, nurse, radiologist).
- ▶ A patient summary is a standardized set of basic medical data that includes the most important clinical facts required to ensure safe and secure healthcare, defined e.g. by the epSOS project [7]
- ▶ Aggregating information in an automatic manner is crucial for the reduction of complexity.
- ▶ This paper describes the concept and architecture for the compilation of a patient summary document on a technical level, how it fits the Austrian EHR ELGA and explains how it was developed.

Methods

Methods (1)

- ▶ A combination of qualitative research methods was used to elaborate requirements for a system that automatically extracts relevant information out of an EHR and aggregates these into a fully-structured patient summary
- ▶ **Semi-structured group interviews with experts and customers:**
 - ▶ Confirmation the necessity of information aggregation in EHRs
 - ▶ Gaining an understanding of the extent or scope of the extraction and aggregation

Methods (2)

- ▶ **Qualitative literature analysis was conducted**
 - ▶ Publications registered in PubMed and Google Scholar and included only papers published 2005 and later
 - ▶ Analysis was carried out in iterative steps which used the following combinations of keywords
 - ▶ *First iteration: “patient summary” AND “IHE”. This combination resulted in five hits*
 - ▶ *Second iteration: “patient summary” AND “EHR”. This combination resulted in 41 hits*
 - ▶ *Third iteration: (“IHE” AND “search”) AND “content”. This resulted in four hits*
 - ▶ Review stopped when the amount of redundant results increased and a content-wise saturation became obvious. In the end, three papers were identified as relevant.

- ▶ **Technical and medical standards** in the field of interoperability were screened.
 - ▶ The main focus was on health record frameworks defined by IHE [6] (e.g. IHE XDS, IHE XDR)
 - ▶ ELGA and its usage of the previously mentioned standards was analyzed

Results

Results: Requirements

- ▶ The resulting requirements from the interviews and the literature analysis, amongst others, mainly expressed the need for
 - ▶ Content based searching to avoid information overload by manually screening the documents contained in the whole EHR
 - ▶ Content based search capable of answering queries based on fine grained information items, such as keywords or codes
 - ▶ Summarization functionality of patient condition, history, hot spots and diseases based on the available information in connected (sub) systems.
- ▶ Main finding was that the document indexes of current EHRs which are based on the IHE profile XDS are not able to provide the necessary content for a fully-structured patient summary document

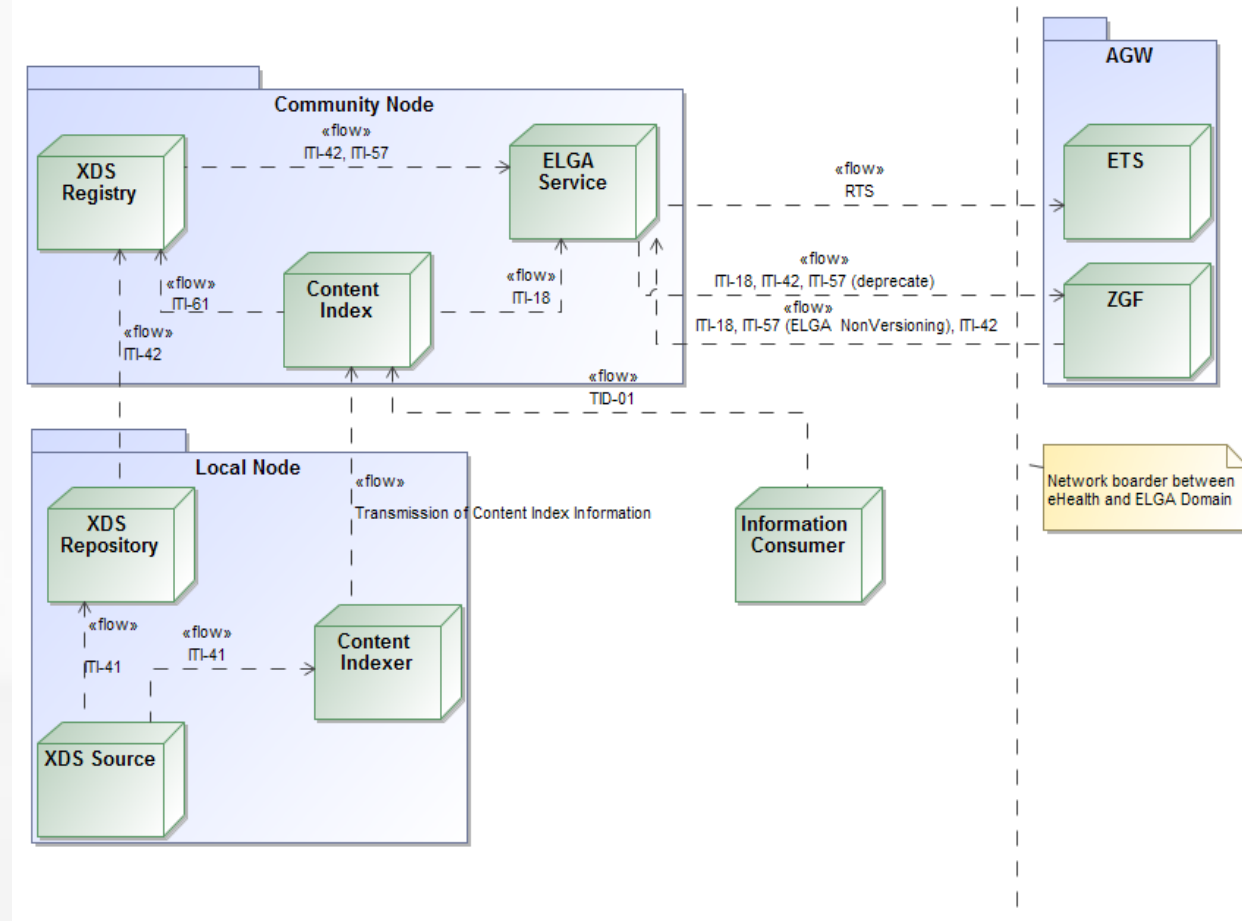
Results: Architecture Overview

- ▶ For realization in an XDS based environment, two new services are introduced to establish an on the fly, creation site centered data extraction and analysis
 - ▶ Content Indexer
 - ▶ Content Index
- ▶ Together these two services are intended to integrate into existing architectures and workflows using standardized interfaces as far as possible. In contrast to the approach described in the EHR-ARCHE project analysis is executed in the registration process [9]
- ▶ Indexing actors are integrated into the content producing workflows
- ▶ All accesses to the document infrastructure within the ELGA context must be associated with a responsible natural person and not by automated means. This is ensured by an active patient contact [8].

Results: Architecture Components

- ▶ Content Indexer located in the scope of the healthcare provider
 - ▶ Therefore documents never leave the scope of the provider.
 - ▶ The service is capable of receiving IHE ITI-41 transactions

- ▶ Transaction between Content Indexer and Index containing the following information
 - ▶ Identification information of the document (e.g. Document Unique ID)
 - ▶ Index Information: information that is needed to fulfill search requests for arbitrary content of the documents. These could be proprietary to industry established full-text search engines, such as Apache Lucene [11].
 - ▶ Extracted patient summary specific information.



Discussion

Discussion (1)

- ▶ Objective was to introduce a new concept for the automated aggregation of a fully-structured patient summary document based on information extracted from documents which are published in large-scale EHRs
- ▶ Capturing data in its registration process allows the extraction of information without executing automated transactions that do not involve human actors
- ▶ Since all document indexes are associated with document uniqueIDs [6] it is possible to integrate into current scenarios and access control systems. In case of ELGA, the developed architecture can interact with the workflow in a way that patient consents are respected. No information is sent to the user that is not aligned with the access rights.

Discussion (2): Future work and Drawbacks

- ▶ The approach also has some severe short comings that must be addressed in future research
- ▶ Most important drawbacks is that currently the full-text search and the information contained in the patient summary only represents the information from one affinity domain.
- ▶ Currently no concept yet on how to achieve a cross community full-text search. Such a cross-community-spanning query requires a concept for a hierarchical index (or alternatively, for doing queries across multiple affinity domains).
- ▶ Auditing requirements for such a system must also be elaborated in order to reflect data security and privacy. IHE systems are required to audit operations that are executed using the IHE ATNA profile [6]

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