IHE “Integrating the Healthcare Enterprise”

An update for Information Technology Infrastructure for 2005

Introduction

Integrating the Healthcare Enterprise (IHE) is an initiative undertaken by medical specialists and other healthcare providers, administrators, information technology professionals and industry to improve the way computer systems in healthcare share information. The goals of the initiative are described in its mission statement [1]: “In our society medical knowledge grows exponentially. Fully utilising these resources to improve patient care will require complete integration of information systems throughout the healthcare enterprise. These systems must be able to communicate relevant information to care providers upon demand. The goal of the IHE initiative is to stimulate integration of healthcare information resources [. . .]”.

The IHE initiative, which was founded in 1998 in Radiology today addresses the medical fields of Radiology, Laboratory, Cardiology as well as the general healthcare IT Infrastructure. A working group in the Surgery domain is on the way of been launched, Dermatology, Pathology and Ophthalmology are in a preparation phase. Medication/Pharmacology is in an exploration phase. In a geographical sense of growth, IHE–after starting in the USA–has now spread over Canada, nearly complete Europe [2] and has started in Asia (Japan, Korea, China) as well as Oceania (starting in Australia). Recently IHE has in particular worked on developing answers to important questions in the crossdepartmental and cross-enterprise IT infrastructure domain.

Methods

In an annual cycle the IHE initiative publishes the so-called IHE Technical Framework (TF) for each domain covered. The TF is a “handbook” for developers of medical IT systems that describes typical clinical use cases involving communication between IT systems along with a detailed definition of the systems involved, the interfaces required between these systems and the standard protocols to be used for implementing the interfaces. In summary, the TF enables system developers to gain a maximum of interoperability between IT systems in heterogeneous environments. The clinical use cases to be addressed by IHE are agreed between the users and vendors of IT systems in the medical environment, followed by an evaluation of available interface standards by a technical expert committee. After selection of the most appropriate standards (e.g. DICOM services, HL7 messages and many others) the TF presents a so called “Integration Profile”, carefully defined operations procedures which are explained extensively by use cases and data flow diagrams for better understanding by users as well as developers. Integration profiles describe the use case along with the IT systems involved (the so-called Actors) and precisely define the interactions (called Transactions) between the actors. One strength of IHE is its capability to decrease the possible degree of freedom in system interfaces to a minimum, thus preventing misinterpretation of messages or system incompatibilities. National amendments to the TF allow adaptation for national specificities, e.g. for the character sets used in Europe or for specific data protection laws (race and ethical group must not be communicated in France). Tests performed during so-called “Connect-a-thons” allow vendors to determine the degree of IHE conformant functionality of their systems under controlled “lab” conditions before going to public demonstrations or the market.

Results

In the year 2004 four new Integration Profiles have been developed for the IT Infrastructure domain: Personnel White Pages (PWP), Audit Trail and Node Authentication (ATNA), Patient Demographics Query (PDQ) and Cross-enterprise Document Sharing (XDS).

Personnel White Pages (PWP)

Personnel White Pages [3] provide access to basic information about the human workforce members. It precisely defines query/access methods and attributes of interest. It allows to set-up a central Authoritative Knowledge Database that can be coupled with user identity management (i.e., authentication) procedures such as the ones described by IHE in the Enterprise User Authentication Integration Profile. PWP enables fast access to workflow related information such as phone numbers and e-mail as well postal addresses. Fig. 1 shows the actors (ovals) and transactions (arrows with rectangular boxes) of the PWP integration profile. The PWP Consumer (i.e., client system) uses a Domain Name System (DNS) query to locate the local PWP Directory and then issues queries to the directory using the Lightweight Directory Access Protocol (LDAP).

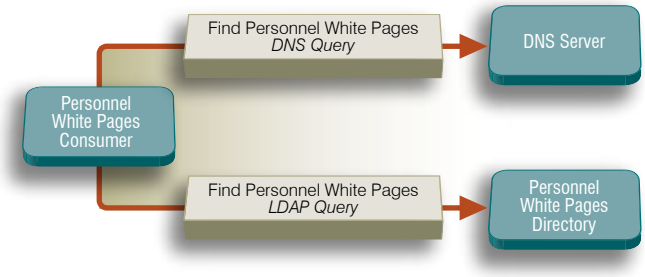

Fig. 1. Actors and transactions of the Personnel White Pages (PWP) integration profile.

Audit Trail and Node Authentication (ATNA)

Audit Trail and Node Authentication [4] defines basic security features for a healthcare IT infrastructure, including system-to-system authentication (but not user authentication), optionally an encrypted network communication, a consistent network time and a security audit trail repository that records events that may be relevant for a security review. The profile also describes the security environment (user identification, authentication, access control, etc.) to be implemented locally by compliant secure systems. The profile is an extension of the IHE Basic Security profile that has been available for a couple of years in the Radiology domain.

Fig. 2 shows the actors and transactions of the ATNA integration profile. A secure node (which could by any type of IT system, e.g. an information system, a workstation, an image archive, etc.) uses the Transport Layer Security (TLS) protocol to perform systemto-system authentication prior to communicating using DICOM, HL7 or other interface standards. It uses the (Simple) Network Time Protocol (SNTP/NTP) to synchronise the local system clock with a network time server. All events within the system and its interfaces that are relevant to a security review are reported to a central audit record repository using the “Reliable Syslog” protocol. IHE defines both the relevant trigger events and the type of information to be recorded in the audit repository.

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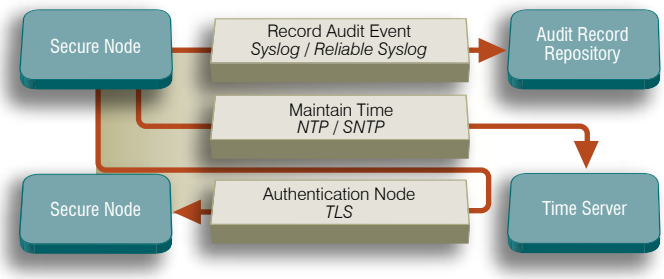

Fig. 2. Actors and transactions of the Audit Trail and Node Authentication (ATNA) integration profile.

Patient Demographics Query (PDQ)

Patient demographics such as a patient's name, date of birth, address and phone number frequently have to be requested from a patient and manually entered into IT systems of various types. Patient Demographics Query [5] allows applications to query a central patient information server for a list of patients based on user-defined search criteria. The profile allows to limit access to only a subset of the demographic data or visit information according to a rule based system. It can be combined with phonetic matching to allow for "near matches" if for example names are not spelled correctly. The central patient information server returns a list of possible matches from which the complete set of available demographics can then be chosen.

Fig. 3 shows the actors and transactions of the PDQ integration profile. The Patient Demographics Supplier (i. e., the central patient information server) is typically connected to one or more patient admission systems maintaining a database of patient identifiers and demographics. Patient Demographics Consumers, i.e. all kinds of client systems can send queries for patient demographics or visit information using HL7 version 2.5 query messages and receive responses also in HL7 format.

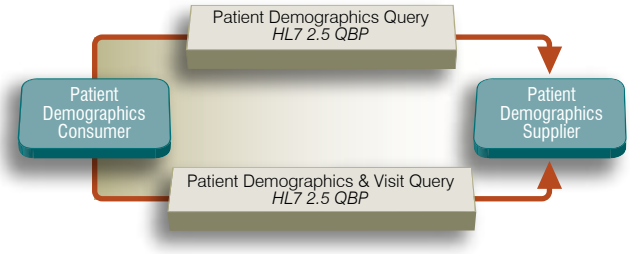

Fig. 3. Actors and transactions of the Patient Demographics Query (PDQ) integration profile.

Cross-enterprise Document Sharing (XDS)

Cross-enterprise Document Sharing [6] is the first step towards a longitudinal dimension of the EHR (Electronic Healthcare Record). It allows easy and safe sharing of medical documents between different healthcare enterprises. XDS is centred on documents but is content neutral, i.e. the document content is processed only by the source and consumer IT systems, but not the repository. XDS provides standardised registry attributes (meta-data), enabling a deterministic document search. Fig. 4 shows the actors and transactions of the XDS integration profile. The central component of an XDS installation (called an Affinity Domain in the IHE TF) is the Document Registry which maintains a database of all known clinical documents, along with their location in one of the repositories and a set of meta-data. The Patient Identity Source provides the patient identifiers used in the XDS domain, e.g. in the form of a master patient index. Document Sources are systems that submit clinical documents to the archive by transmitting them along with their meta-data to one of the repositories which store the document and forward the meta-data to the central registry. Document Consumers are systems that query the registry for documents and retrieve, if found, documents from one or more repositories. Most of the communication between the systems involved takes place using ebXML (electronic business XML) Registry Services which can be communicated over the Hypertext Transfer Protocol (HTTP) or, in the case of document submission, even be performed by e-mail.

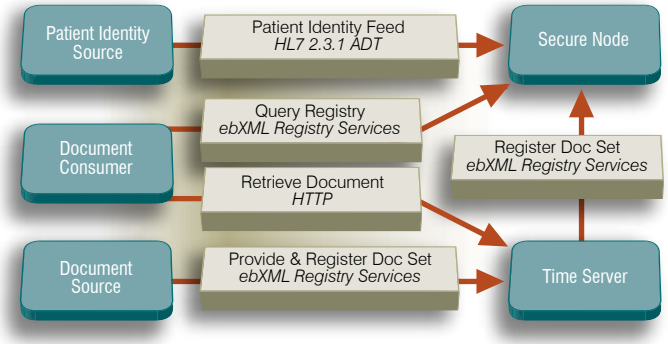

Fig. 4. Actors and transactions of the Cross-enterprise Document Sharing (XDS) intergration profile.

Conclusion

Because it has shown high practical relevance, and is continuing to do so, IHE has become an integral part of many requests for tenders in Germany, for the purchase of complex systems such as PACS, HIS or RIS. IHE has reached a critical mass in product support, enabling a significantly higher level of interoperability compared to former system installations. In particular the Integration Profiles from the IT Infrastructure domain allow a broad implementation in, and useful extension of, existing and newly developed IT systems in healthcare. Further information regarding the IHE initiative, including the IHE Technical Framework, are available from the European and International IHE homepages. [7, 8]

References

1. IHE: The IHE Initiative's Mission, http://www.rsna.org/IHE/mission.shtml
2. M. Eichelberg, et al., IHE Europe: extending the IHE initiative to the European healthcare market, in: H.K. Huang, Osman M. Ratib (Eds.), Medical Imaging 2003: PACS and Integrated Medical Information Systems: Design and Evaluation, Proc. SPIE, vol. 5033, 2003, pp. 1 –10. B.B. Wein et al. / International Congress Series 1281 (2005) 169–174 173
3. Integrating the Healthcare Enterprise. IHE IT Infrastructure Technical Framework Supplement 2004–2005, Personnel White Pages (PWP). Trial Implementation Version (2004).
4. Integrating the Healthcare Enterprise. IHE IT Infrastructure Technical Framework Supplement 2004–2005, Audit Trail and Node Authentication Profile(ATNA). Trial Implementation Version (2004).
5. Integrating the Healthcare Enterprise. IHE IT Infrastructure Technical Framework Supplement 2004–2005, Patient Demographics Query (PDQ). Trial Implementation Version (2004).
6. Integrating the Healthcare Enterprise. IHE IT Infrastructure Technical Framework Supplement 2004–2005, Cross-enterprise Document Sharing (XDS). Trial Implementation Version (2004).
7. IHE Europe Homepage, http://www.ihe-europe.org/
8. IHE International Homepage, http://www.ihe.net/