HealthManagement.org

LEADERSHIP • CROSS-COLLABORATION • WINNING PRACTICES

VOLUME 23 • ISSUE 1 • € 22

ISSN = 1377-7629

AI & Robotics Implementation and Pitfalls

THE JOURNAL 2023

9 771377 762006 01

Why Should Radiologists Care about IT Standards and Interoperability?

Interoperability is essential in healthcare in general. In radiology, there are specific and relevant requirements, as radiology facilities are often completely digitised and a wide variety of systems need to communicate with each other. The use of IHE profiles is a great help for users when deciding on new modalities or IT solutions, as there is no need to define individual aspects of standards. By specifying specific IHE profiles, manufacturers can very accurately assess what the requirements and expectations are. However, both DICOM and IHE rely on the involvement of users to ensure that medical concerns are appropriately addressed in the further development of the standards or integration profiles and prioritisation.

PETER MILDENBERGER

Vice-Chair & Head of Radiology-IT
Department of Diagnostic and Interventional Radiology
University Medical Center Mainz
Germany

key points

- Always good to review starting at the beginning, in this case reviewing the digital process in imaging.
- Standards are necessary for interoperability to be seamless.
- For radiologists to be able to seamlessly integrate in the health care chain, they should be part of the development and implementation of these connectivity standards.

Radiology and Information Technology Have a Long History Together

The digitisation of imaging modalities began in the 1970s with digital radiography and computed tomography. This was followed in the mid-1980s by the introduction of the first radiological information systems (RIS). PACS (Picture Archiving and Communication System) solutions have been increasingly used in practice since the mid-1990s. Often, a dedicated IT department has been established in radiology facilities during this time. The use of IT solutions then continued with speech recognition.

For about 20 years now, the topic of structured reporting and clinical decision support has also been a major digital development in radiology. This is also reflected in an exponentially increasing number of publications on these topics; a literature search in PubMed, for example, yields over 16,000 hits for the topic of structured reporting. And for the last few years, there has been a topic that is generating even more attention in radiology: artificial intelligence (AI). In 2022 alone, there are already over 1,400 publications on this topic.

Without Standards: No Inter-operability

It is obvious and thus easy to understand that the use of such different solutions in a radiology department needs certain rules. The probability that all solutions can be provided by one vendor is rather low, resulting in a plethora of ‘plug-and-play’ applications. Therefore, standards are needed for these different issues, both regarding physical connectivity and, for example, content.

The term inter-operability refers to the ability to connect

and exchange information between different healthcare systems without any significant limitation in connectivity.

Which standards are relevant for radiology? On the one hand, these are standards that are used for the general definition of patient data or findings; historically, this is associated with the term HL7. For the imaging itself, the DICOM standard has been established in radiology for nearly 30 years. In addition, other general standards like from Internet technology, play a role.

A further development is the re-naming of HL7 to FHIR, and this standard is rapidly gaining in importance, since it provides support for web-based and mobile applications in particular.

As important and indispensable as standards are in radiology, they also have their limitations. Often variations, so-called options, are defined in the standard and depending on how these are implemented in an application, interoperability between different systems is easy, limited or even impossible. One can compare the implementation of standards with different gradations, for example, with different dialects of a language. Even if two people nominally speak the same language but have very different dialects, they may not understand each other. Therefore, special attention should be paid to this issue. One solution is to reduce such "language differences" through the use of so-called 'integration profiles'.

IHE is an international organisation that develops such integration profiles for various applications, especially in Radiology and in IT infrastructure. Manufacturers can then refer to these IHE profiles when developing their applications and submit corresponding integration statements.

A closer look at these most important areas for radiology:

DICOM

The DICOM (Digital Imaging and Communications in Medicine) standard is an international standard that was initiated in 1993 by NEMA (National Electrical Manufacturers Association) and ACR (American College of Radiology) as well as the RSNA (Radiological Society of North America) and is now supported and co-developed by numerous other organisations, including the ESR (European Society of Radiology) and other national (European) societies. DICOM started in radiology, but is now used in many other medical fields, for example ophthalmology, cardiology, pathology or surgery, also with appropriate extensions.

DICOM is organised into so-called working groups (WG), of which there are about 30. DICOM is probably the most successful standard in healthcare. It is accredited as a international standard by ISO under the number 12052. The DICOM standard is published in one version that is periodically updated. For this purpose, so-called supplements are developed that are later incorporated into the standard. Corrections to the standard can be made by so-called Change Proposals. DICOM has a continuous maintenance process, which is ensured by WG 6. Manufacturers of IT applications must publish a so-called DICOM Conformance Statement, which shows the tasks of a product or software and how the different options have been implemented or which forms of communication are supported. Based on such DICOM conformance statements, it is possible to check whether two applications can communicate with each other.

> The term inter-operability refers to the ability to connect and exchange information between different healthcare systems without any significant limitation in connectivity

DICOM continues to be a very active standard that continuously publishes further developments, in 2021, for example, on cone-beam CT dose reports, on MR prostate structured reporting, or on notation in pathology. In 2022, developments followed in the area of video transfer or support for PACS migrations through a so-called "Archive Inventory".

DICOM Working Group 23 has as its focus AI applications and application hosting. One of its goals is to ensure that AI applications that communicate with modalities or PAC systems use correct metadata.

HL7

HL7 (Health Level 7) version 2 has been known in the healthcare sector for many years; in the hospital environment, in particular, it is the standard for entering patients' medical data. A broad installation of HL7 faces some limitations, especially in the area of content definition, the so-called semantic interoperability. HL7 has developed a version 3 for this purpose, which provides for a so-called Common

Document Architecture (CDA) and can thus ensure a further developed semantic interoperability. However, the adaptation of this standard in the market is very cumbersome and limited.

HL7 has drawn the consequences from this and developed a completely new approach under the name FHIR (Fast Healthcare Interoperability Resources), which is intended to ensure simple access, especially for web-based or mobile applications. This standard has been met with great interest worldwide and can already be found in numerous applications.

IHE

IHE (Integrating the Healthcare Enterprise) is an initiative that was initially started by RSNA and HIMSS (Healthcare Information and Management Systems Society) about 20 years ago and was intended to improve the exchange of information in healthcare by reducing the interoperability problems that were based on different interpretations and uses of options. IHE therefore coordinates established standards and develops these so-called integration profiles with the aim of improving communication, simplifying implementation and thus ensuring more effective use of information in healthcare overall.

IHE has a standardised development process whereby a relevant topic is first identified, the interoperability requirement is defined, and an integration profile is developed. This can then be implemented and tested by developers. Further down the line, adoption into products is then facilitated, while governance of interoperability is ensured through the publication of IHE interoperability profiles.

In the meantime, there are numerous integration profiles, especially in radiology, but also in other medical fields, for example cardiology, ophthalmology, endoscopy and others. A very essential area for IHE is also the definition of integration profiles for the general IT infrastructure, these are used in numerous regional or national eHealth concepts.

More recent examples in radiology are REM (Radiation Exposure Management), which was published about ten years ago and today forms the basis of dose management systems that have been in use now for several years. Another interesting application is the documentation of contrast medium application, whereby the CM injectors can document the volumes for contrast medium, saline solution as well as the pressure values in corresponding templates. This information can then be used across devices. The associated IHE profile CAM (Contrast Administration Management) has been published in 2021 as a so-called “Trial Implementation” edition.

Current integration profiles that are attracting a lot of interest in radiology are two profiles in the field of AI: on the one hand, the documentation and communication of AI results and, on the other hand, the orchestration of the workflow of AI tools. Here, it can be ensured according to certain rules that for certain examinations, for example a thorax CT, the relevant AI tool, in this case for the detection of lung foci, is assigned the task and the results are returned to the higher-level PAC system or RIS.

A very important development for IHE is the implementation of so-called Connectathons. These are usually five-day events for interoperability testing. Often 300 or more experts from numerous companies are involved who can live-test the interoperability of their applications with various other partners under the supervision of independent IT experts, so-called monitors.

In 2022 this Connectathon took place for the first time as a joint event simultaneously in Europe and the USA. A total of 89 profiles with 2,128 tests were tested, 219 of these tests were transatlantic. The results of the Connectathons can also be freely viewed in a browser, sorted by various criteria such as company or profile.

This type of product validation is supplemented by a web-based online offering from IHE, the so-called “IHE SHARAZONE”. Here, data for various applications are available, which allow interested developers to test their own products regardless of time and place.

Internationally, IHE is organised in various regional committees and subsequent national committees for the further development and dissemination of IHE. The actual development of the integration profiles is done in domain-specific committees, for example for radiology, IT infrastructure and others.

For the first time in 2015, the European Commission referenced 27 IHE profiles that should be used for calls for tender. These are mainly profiles in the area of IT infrastructure, but also general profiles for use in radiological facilities, for example.

Conflict of Interest

None. ■

acknowledgement

This paper has been prepared by Peter Mildenberger (Board member of IHE-Catalyst), Esther Peelen (former Chair of the IHE-Europe MarCom) and members of the IHE-Europe Extended Executive committee. Special thanks to Martina Szucsich for the review of the manuscript. secretariat@ihe-europe.net

HealthManagement

Promoting Management and Leadership