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Dual Implementation Guides in FHIR and CDA

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Abstract. Background: The Fast Healthcare Interoperability Resources (FHIR) and Clinical Document Architecture (CDA) are standards for the healthcare industry, designed to improve the exchange of health data by interoperability. Both standards are constrained through what are known as Implementation Guides (IG) for specific use. Objectives: Both of these two standards are widely in use and play an important role in the Austrian healthcare system. Concepts existing in CDA and FHIR must be aligned between both standards. Methods: Many existing approaches are presented and discussed, none are fully suited to the needs in Austria. Results: The IG Publisher has already been used for CDA IGs, beside of its intended FHIR support, but never for both in one IG. Even the International Patient Summary (IPS), existing as CDA and FHIR specification, does not solve the needed comparability between these two. Conclusion: As the IG Publisher is widely used and supports CDA, it should be used for Dual Implementation Guides. Further work and extension of IG Publisher is necessary to enhance the readability of the resulting IGs.

Keywords. Dual Implementation Guides, FHIR, CDA

1. Introduction

The current transition between two active health data standards is forcing standard communities such as HL7 Austria to ask themselves how Dual IGs should be built, including the transformation in-between and the balloting of the whole package. We compare approaches and recommend extending the IG Publisher to solve this challenge. This work is based on the results of a workshop held by the ELGA GmbH and Members of HL7 Austria's FHIR Technical Committee.

The Fast Healthcare Interoperability Resources (FHIR) and Clinical Document Architecture (CDA) are standards in the healthcare industry designed to improve the interoperability and exchange of health data. Both standards are constrained through what are known as Implementation Guides (IG) for specific use. An IG is a document, or in the case of FHIR, a website generated from a FHIR resource, that provides guidelines and instructions for the proper implementation and utilization of these health standards. These guides serve as a kind of manual, aiding developers, healthcare institutions and other stakeholders in effectively integrating and using the standards in their systems, with the goal of achieving interoperability between different vendors and domains.

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In the context of the Austrian healthcare system, the use of Dual IGs for CDA and FHIR can offer several important advantages over the next few years. Currently, the central hub of the Austrian healthcare system is the Electronic Health Record (Elektronische Gesundheitsakte - ELGA), which is based on CDA and implemented, maintained and further developed by ELGA GmbH. In recent years, ELGA GmbH has also started to provide FHIR interfaces, such as their self-made open source package TerminoloGit [1] for hosting and maintaining healthcare terminologies [2].

Since both of these two standards are widely in use, the challenge arises that concepts existing in the Austrian healthcare system must be correctly implemented and aligned in both standards. To enhance the acceptance of IGs by Austrian healthcare service providers (Gesundheitsdiensteanbieter - GDA) and other stakeholders, alignment between the two standards is necessary. Currently, this alignment is achieved by HL7 Austria [3] closely adhering to the existing CDA guidelines when creating new FHIR IGs [4].

At least for the next few years, during which both standards are actively being used in Austria, there is a need for so-called Dual Implementation Guides (IGs). The goal is to closely align the definitions in the standard and offer parallel interfaces providing healthcare data exchange via CDA or FHIR. For example, such IGs would enable the description of a guide for a specific healthcare use case, such as laboratory results or medication data, simultaneously for both standards.

As the active development of IGs in Austria requires a Ballot Cycle, another necessary consideration is how comments and issues in the IGs can be effectively reported and discussed. Currently, this is being done via shared documents for which comments are captured in Excel sheets, creating a significant workload of manual triage, duplicate alignment and discussion.

Particular considerations must be taken into account for Dual Implementation Guides (IGs), especially regarding the following questions:

- Which tools can be used to create Dual IGs?
- How can FHIR and CDA be presented alongside each other in the IG?
- How can mappings between the CDA and FHIR standard be defined?
- How can the content of the IG be balloted?

2. Methods

This section gives an overview of currently available methods, as a basis for possible answers to the questions and challenges regarding Dual IGs.

2.1. Which tools are being used to create (Dual) IGs?

There are closed source tools such as Simplifier and open source tools like ART-DECOR and IG Publisher, that can be used to create IGs in general.

Simplifier [5] is a product by Firely, with additional online hosting and a GUI in the form of Forge to create, validate and document FHIR IGs, but do not support CDAs. Its primary advantage over competitors is the cloud hosting that is available for all profiles per default.

ART-DECOR [6] is used to create and maintain HL7 templates, value sets, scenarios and data sets. It supports the creation of implementation guides that adhere to the core principles of using CDA R2. These principles include understanding the use of data types

in HL7 V3, the use of XML, the structure of a CDA document and more. It currently has a limited support of FHIR resources [7], possibly enabling Dual IG work.

Examples of outputs of such tools are the Implementation Guides by the Kassenärztliche Bundesvereinigung (KBV) [8], using Simplifier and a extra website and the ELGA CDA implementation guides [9], using ART-DECOR and a Wiki. This highlights a glaring issue in the current processes for implementation guide definition. The CDA standards suite has no sensible way of creating IGs for the standard and even tools such as Art Decor must be supplemented with other options, such as the Wiki HL7 Austria is using to create the Narrative for their IGs [10]. FHIR itself seems to have issues too, as KBV has also not chosen to use the FHIR IG resource, which was created to address this is- sue in the standard. While they have defined FHIR profiles in Simplifier, the narrative is hosted on a website [8] and most pages have an option to add comments for issues in the IG. Additionally, an overview page allows viewing all comments together.

IG Publisher [11] is the official tool by HL7 to create FHIR IGs and the FHIR standard itself is also created and published via the tool. In addition, SUSHI is a simple language to create FHIR Profiles, Extensions and Examples for IGs and directly integrates in IG Publisher. It also offers support for CDA, [12] with C-CDA being published as a full IG [13].

None of the aforementioned tools that currently exist support the creation of Dual IGs. Currently, Lantana is working on Dual IGs [14], which considers a separate process for the FHIR and CDA standards and creating mappings and transformations between them. The result would be two separate packages.

The Dental Data Exchange IG is another example of a currently existing IG which considers CDA and FHIR and goes the route of applying C-CDA on FHIR [15], e.g. using a Composition resource in FHIR to enable using FHIR in the context of documents. This option would not be considerable as a Dual IG but rather only uses the FHIR standard, to achieve its goals.

An example of an existing Dual IG is the International Patient Summary (IPS) [16]. The IPS is written in both CDA and FHIR and the two versions are closely aligned, however they are still two separate IGs which are written separate from each other in ART-DECOR and in IG Publisher.

2.2. How are FHIR and CDA presented alongside each other in the IG?

This is currently not done at all. Not even the IGs that exist in CDA and FHIR have any direct alignment whatsoever.

2.3. How are mappings between the CDA and FHIR standard currently defined?

There are two ways to create mappings. The simplest way of mapping from CDA to FHIR and vice versa, is in the implementation guide, in the Mappings section of an artifact (profile, extension, ...) [17]. This represents a simple mapping as free text, which is usually enough for implementers to understand the differences in the two standards.

The more complex mappings are possible via the *StructureMap* and *ConceptMap* resources, which can be used in the authoring friendly format FHIR Mapping Language (FML) to create unidirectional mappings. Using these resources in FHIR would allow automated translation between the CDA documents and FHIR resources. The advantage of such an approach would in addition to automated translation also be a definite-alignment between the two standards in the context of a Dual IG, since the considerations

must be made to enable automation. Executing a FML is possible by some open source tools written in Java, Pascal, JavaScript and C# [18]. Even the Java FHIR validator, which is well known in the FHIR community, is able to perform the transform operation. FML got a big upswing with the publication of the FHIR R5 specification, that implements a conversion for all resources to R4 as well as R4B and vice versa [19]. The disadvantage being that creating FML present a significant overhead in IG creation and that effort would double if a bidirectional mapping was required.

2.4. How is the content of the IG balloted?

Currently, balloting is done in one of three ways, balloting with web-support, balloting via issue tracking tools and balloting through Excel sheets.

Examples for balloting with web-support are the KBV FHIR profiles as mentioned above, as well as currently ongoing SNOMED-CT German translation project [20]. In the case of KBV, the comments can also be publicly viewed.

Issue tracking is the official process that HL7 International follows when developing their standards, such as FHIR and CDA. The advantage of this is, that there is less redundancy since ballot participants can actively search for issue duplicates and issues are public and can be commented by other participants to enable discussion. The disadvantage of this approach is that it may be less accessible to non-technical users.

The final method, currently used by HL7 Austria, to enable participation from non-technical users is Microsoft Excel. A ballot is announced via email, to which participants can respond with Excel sheets, filled with their comments or concerns. This approach can be used for any type of ballot and is a very common misuse of Excel for business cases it was not designed for. The primary disadvantages of this approach are that they prevent discussion and pose a severe overhead of sifting through and aligning comments.

3. Results

The following are recommendation based on the need of a Dual IG that supports both CDA and FHIR and the available state of the art.

3.1. Which tools can be used to create Dual IGs?

The best way to go with a Dual IG is most likely IG Publisher. It has a large base of developers and implementers that are actually using the toolchain, including HL7 Austria. ART-DECOR is open source and could be used in a similar manner, however it does not support complete IG create for CDAs or FHIR as IG Publisher already does.

IG Publisher has base templates for both CDA and FHIR. A necessary tooling step to enable Dual IGs would firstly be to combine both templates to support both the CDA-XML based generation process and the FHIR generation process based on *StructureDefinitions* (machine readable definitions of FHIR resource types), enabling the IG Publisher toolchain to build artifacts for both standards at the same time.

Some approaches have been made in a working group from the FHIR technical committee HL7 Austria, by testing the usage of the FHIR logical model. By adapting an existing FHIR logical model for C-CDA, a logical model analog to the Austrian extended Schema could be created and used as a basis for FML transformation on CDA. As a next test step, SUSHI will be applied for profile creation, to fit specific Austrian use cases.

3.2. How can FHIR and CDA be presented alongside each other in the IG?

There is no current solution for presenting FHIR and CDA alongside each other. When following the IG Publisher approach, this would require more severe changes to the publishing process, as IG Publisher was designed to present artifacts individually. As the narrative between overlapping FHIR and CDA artifacts is the same and only the structural views are duplicate, this would require modifying IG Publisher to allow presenting two artifacts on the same page. The presentation itself via a HTML view is no issue.

3.3. How can mappings between the CDA and FHIR standard be defined?

Mappings between CDA and FHIR could be similar to the current way of the mapping table in FHIR. The presentation could be improved to not only use the mapping tab, but rather extend the visualization to draw lines between the two artifacts. However, this would require following a syntax instead of free text and possibly even require the full use of the *StructureMap* resource for mappings.

Similar to the FHIR R5 IG an own conversion tab per resource would give commenters a full insight and show developers how Dual IGs could be implemented.

3.4. How can the content of the IG be balloted?

The process by HL7 International to use issue tracking has clear advantages, which also align with HL7s values of open development and discourse.

The disadvantage for non-technical users exists and could be remedied similar to the proprietary solutions that exist. Comment-plugins in the IG website could be used to automatically create issues in an issue tracker and maybe even show already existing issues. This enables discourse and eases the balloting process as the comments are made at the point of issue. An open challenge with this balloting process is, that the underlying technical resources are separate from the rendered HTML, thus preventing directly referencing the underlying sources that define the CDA or FHIR profiles or extensions.

4. Discussion

The final recommendation of this work is to use IG Publisher to create Dual IGs based on the existing templates for both standards, which should be combined. This would be a relatively low-effort first step to create IGs which contain both standards.

Further topics such as mappings between the individual artifacts and side-by-side visualizations, as well as better balloting support via plugins to connect to issue trackers are all also recommended, but can be worked on in subsequent steps. These would not only provide advantages on Dual IGs for CDA and FHIR, but also open the possibility to create comparative views between different IG versions of the same topic or different FHIR major versions or even different standards themselves, other than CDA and FHIR.

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References

[1] G. Kleinoscheg, N. Tanjga, N. Svec, S. Rainer-Sablatnig and S. Sabutsch, *TerminoloGit – An Open Source Terminology Server for Large Scale eHealth Environments*, 2022. doi:10.3233/SHTI220351.
[2] ELGA GmbH, ö. e-Health-Terminologien, last access 2024-01-18. https://termgit.elga.gv.at/.
[3] HL7 Austria, HL7® Austria FHIR® Core IG, last access 2024-01-18. https://fhir.hl7.at/.
[4] R. Egelkraut, B. Traxler, E. Helm, O. Krauss and A. Schuler, *Open Infrastructure for Standardization of HL7® FHIR® Implementation Guides in Austria*, 2022. doi:10.3233/SHTI220372.
[5] Firely, About Simplifier.net, last access 2024-03-14. https://simplifier.net/about.
[6] ART-DECOR Open Tools GmbH, ART-DECOR® – an open-source collaboration tool that supports healthcare interoperability, last access 2024-01-18. https://art-decor.org/.
[7] agile health data information systems, artdecor2ig - scripts to create a FHIR Implementation Guide for an ART-DECOR project, last access 2024-01-18. https://github.com/ahdis/artdecor2ig.
[8] Kassenärztlichen Bundesvereinigung (KBV), KBV-BASIS-PROFILE, last access 2024-01-18. https://mio.kbv.de/display/BASE1X0.
[9] HL7 Austria, Wiki-Portal von HL7 Austria, last access 2024-01-18. https://wiki.hl7.at/index.php?title=ILF:Ambulanzbefund.
[10] S. Sabutsch, M. Frohner, G. Kleinoscheg, A. Klostermann, N. Svec, S. Rainer-Sablatnig and N. Tanjga, *ELGA Outpatient Clinic Report and ELGA Telehealth Note: Two HL7-CDA®-Based Modular Electronic Documents*, 2022. doi:10.3233/SHTI220350.
[11] HL7 International, IG Publisher Documentation, last access 2024-03-14. https://confluence.hl7.org/display/FHIR/IG+Publisher+Documentation.
[12] HL7 International, Template used for most HL7-defined CDA Implementation Guide, last access 2024-01-18. https://github.com/HL7/ig-template-cda.
[13] HL7 International, Consolidated CDA Release 2.2, last access 2024-01-18. https://build.fhir.org/ig/HL7/cda-ccda-2.2/.
[14] Lantana Consulting Group, Dual FHIR/CDA IG Development, last access 2024-01-18. https://www.lantanagroup.com/wp-content/uploads/2019/12/Dual-FHIR-CDA-IG-Development.pdf.
[15] HL7 International and American Dental Association, Dental Data Exchange, last access 2024-01-18. https://build.fhir.org/ig/HL7/dental-data-exchange/index.html.
[16] Joint Initiative Council for Global Health Informatics Standardization, The International Patient Summary, last access 2024-01-18. https://international-patient-summary.net/.
[17] HL7 Austria, HL7® Austria FHIR® Core Austrian Patient Mappings, last access 2024-01-18. https://fhir.hl7.at/r4-core-ballot_2021_01/StructureDefinition-austrian-patient-mappings.html.
[18] HL7 International, Using the FHIR Mapping Language, last access 2024-01-18. https://confluence.hl7.org/pages/viewpage.action?pageId=76158820#UsingtheFHIRMappingLanguage-CodeLibraries.
[19] HL7 International, FHIR StructureMap Conversions, last access 2024-01-18. https://hl7.org/fhir/extensions/conversions-StructureMap.html.
[20] SNOMED-CT German Translation Group, Kommentierung von Übersetzungen, last access 2024-01-18. https://confluence.ihtsdotools.org/pages/viewpage.action?pageId=146867107