

Accelerate Quality: Validating Your FHIR Implementation Guide

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Presented by

- **Name:** Richard Ettema
- **Position:**
 - Lead Architect, Touchstone, AEGIS.net, Inc.
 - HL7® FHIR® Proficient
- **Background:**
 - 36+ years IT industry experience
 - 16+ years leading HIT development/implementation efforts
 - 6+ years contributing to the HL7® FHIR® specification (focus on testing)
 - Sr. Architect / Lead Developer for the Touchstone Project
 - Author of the AEGIS WildFHIR public test server and client



Session Goals

- FHIR Implementation Guides
 - Validation Built-in
 - Publication (Demo)
- Testing and Certification Support
 - Support defined in IG
 - From Scenario to TestScript
- Testing with Touchstone
 - Test Execution and Evaluation (Demo)

FHIR Implementation Guides

An implementation guide (IG) is a set of rules about how FHIR resources are used (or should be used) to solve a particular problem, with associated documentation to support and clarify the usage.

<http://hl7.org/fhir/implementationguide.html>

- The contents are a set of logical statements that represent conformance requirements implementations must follow.
- Examples are included which illustrate the intent of the profiles defined in the implementation guide.

FHIR Implementation Guides – Validation

Validation testing for conformance to a FHIR IG involves:

- Verifying proper behavior based on the IG Narrative: Guidelines, Use Cases and Scenarios, and Security Requirements
 - *Read the IG carefully!*
- Use of Conformance Artifacts and the FHIR Validation Engine to verify the resource instances
 - Java RI Validation Engine from the FHIR specification (Grahame Grieve, James Agnew and Community)
 - .NET Validation Engine available as NuGet packages (Ewout Kramer, Brian Postlethwaite and Community)

FHIR Implementation Guides – Narrative

- IG Guidelines, Use Cases and Scenarios, and Security Requirements are used to define TestScripts:
 - Simple tests for individual operations
 - Complex tests with multiple operations simulating workflow patterns
 - Asserts to verify conformance to the FHIR spec and IG constraints
 - Asserts to verify specific requirements

FHIR TestScript Resource - <http://hl7.org/fhir/testscript.html>

Executed by a FHIR Test Engine - <http://hl7.org/fhir/testing.html>

FHIR Implementation Guides – Conformance Artifacts

Regardless of the publication tooling and repository, the IG defines and provides the necessary FHIR Conformance Artifacts for validation:

- **Profiles** (StructureDefinition)
 - Data structures, cardinality, constraints/invariants, terminology bindings
- **Operations** (OperationDefinition)
 - Custom operations/functionality
- **Search parameters** (SearchParameter)
- **Terminology** (ValueSet, CodeSystem, ConceptMap, NamingSystem)

FHIR Implementation Guides – Validate a Resource

- Validating a resource leverages the IG FHIR Profiles to check:
 - **Structure:** Check that all the content in the resource is described by the specification, and nothing extra is present
 - **Cardinality:** Check that the cardinality of all elements is correct (min & max)
 - **Value Domains:** Check that the values of all elements conform to the rules for each element type - primitive or complex
 - **Code bindings:** Check that codes/displays provided in the code/Coding/CodeableConcept types are valid
 - **Invariants:** Check that all invariant FHIRPath expressions evaluate successfully

Use a FHIR Validation Engine - Java RI, .NET

Supported by a FHIR Test Engine - <http://hl7.org/fhir/testing.html>

FHIR Implementation Guides – Publication Tools

A FHIR Implementation Guide (IG) can be published:

- Using SIMPLIFIER.NET FHIR Registry, from Firely
 - <https://simplifier.net/guides>
 - Examples – Canadian eReferral, **Nictiz MedMij** (with separate wiki)
- Using the FHIR publication tool, **igpublisher**, from the FHIR specification
 - <https://confluence.hl7.org/display/FHIR/IG+Publisher+Documentation>
 - Examples – **Immunization DS Forecast**, Da Vinci, US Core, etc.; see <https://registry.fhir.org/guides>
- Using Trifolia, from Lantana (relatively new, still under development)
 - Microsoft C#, .NET based; see <https://trifolia.lantanagroup.com>

FHIR Implementation Guides – Nictiz MedMij

SIMPLIFIER.NET <https://simplifier.net/nictizstu3-zib2017> SNIPPET FEEDBACK

Nictiz STU3 Zib 2017
Nictiz repository of FHIR STU3 conformance for HCIM Release 2017.
Includes MedMij and HL7 NL.

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https://informatiestandaarden.nictiz.nl/wiki/MedMij:V2018.03_FHIR_MedicationProcess Aanmelden Download

MedMij **Overleg** Lezen Brontekst bekijken Geschiedenis weergeven Zoeken

MedMij FHIR use case Medication Process

Scope National NL Bookmarks 7

MEDICATION AFSPRAKENSTELSEL FUNCTIONEEL **TECHNISCH**

Inhoud [\[weergeven\]](#)

Introduction

Nictiz is the centre of expertise for standardisation and eHealth in The Netherlands

This page describes patient's use cases, in a personal health record (PHR) context, in relation to the information standard [Medication Process](#) (MP). These use cases are based on version 9.x of this standard. Functional

FHIR Implementation Guides – ImmDSForecast (igpublisher)

<https://build.fhir.org/ig/HL7/ImmunizationFHIRDS>



Immunization Decision Support Forecast Implementation Guide STU1 (Release 0.2.0 Ballot 2)



Home Guidance Use Cases Profiles & Extensions Operations Terminology Security Conformance Downloads

TOC Home / Implementation Guide Home Page

Immunization Decision Support Forecast, published by HL7 International - Public Health Work Group. This is not an authorized publication; it is the continuous build for version 0.2.0). This version is based on the current content of <https://github.com/HL7/ImmunizationFHIRDS/> and changes regularly. See the [Directory of published versions](#)

1.1 Implementation Guide Home Page

Contents:

- [Introduction](#)

1.2 Introduction

The Immunization Decision Support Forecast (ImmDS) Implementation Guide is based on [FHIR Version R4](#) and defines the minimum conformance requirements for implementations.

FHIR Implementation Guides – Publication Demo



Tool: FHIR igpublisher

IG: Immunization DS Forecast

Focus: Validation Package Download

Testing and Certification Support

- Support for testing and certification is defined and based on a FHIR Implementation Guide
- A FHIR Implementation Guide:
 - Is **published** to a local/public website and/or PDF docs
 - Provides human-readable information (narrative)
 - Contains formatted text, pictures, attachments, ...
 - Explains how to implement specific use cases - **read carefully**
 - Provides conformance artifacts for **validation** of data contents

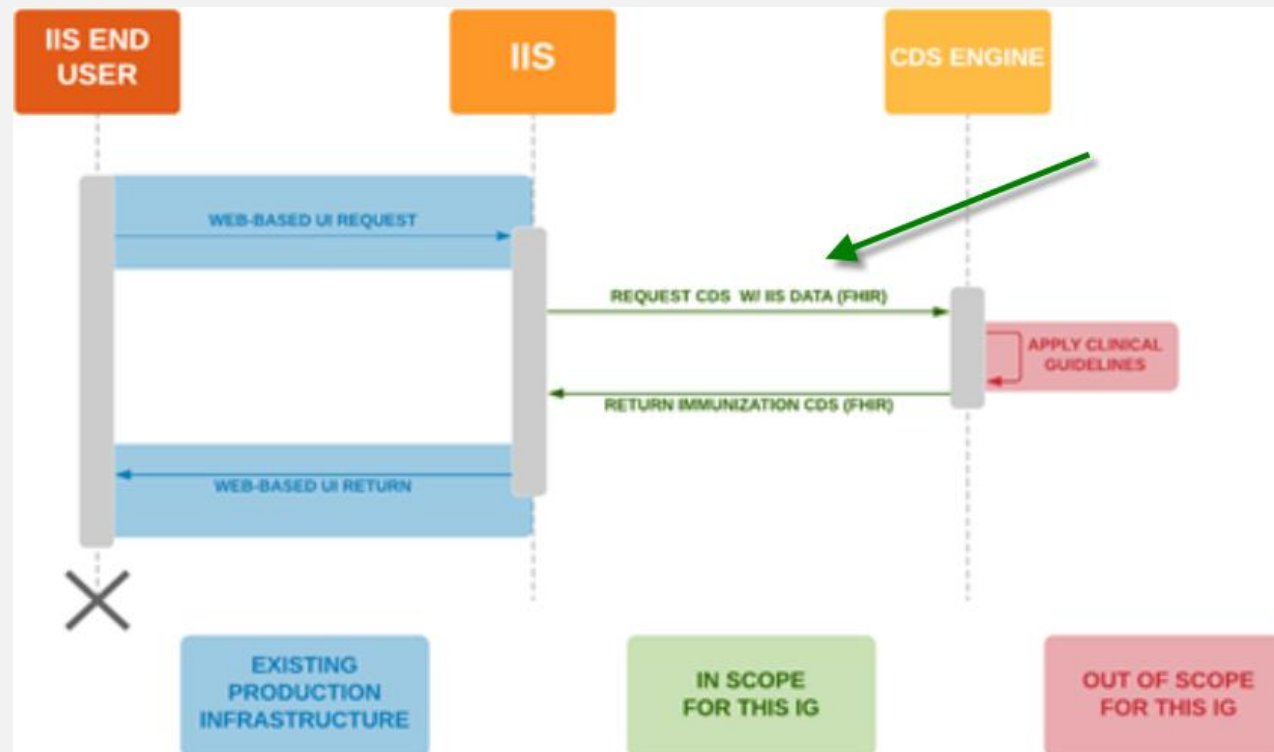
From Scenario to TestScript - Overview

- Immunization DS Forecast - Introduction
 - <https://build.fhir.org/ig/HL7/ImmunizationFHIRDS/usecases.html#introduction>

“The Immunization Decision Support Forecast (ImmDS) use case covers the exchange of data between a **system seeking a patient evaluated history and forecast** and the **clinical decision support engine** capable of providing that history and forecast. Today, this layer is not standardized and leads to several unique/proprietary interfaces which are costly to implement. *The scope of this implementation guide is to create a standard interface layer between the initiating system and the CDS engine.*”

From Scenario to TestScript - Use Case Definition

- Immunization DS Forecast Scenario
 - <https://build.fhir.org/ig/HL7/ImmunizationFHIRDS/usecases.html#application-user-interface>



From Scenario to TestScript - Implementation Details


- Immunization DS Forecast Scenario - FHIR operation
 - <https://build.fhir.org/ig/HL7/ImmunizationFHIRDS/OperationDefinition-immds-forecast-operation.html>

Narrative Content
XML
JSON
Turtle

5.1.1 Immunization Decision Support Forecast

OPERATION: ImmunizationDS Forecast

This is an Immunization Decision Support Forecast Request operation. It provides standardized request and response interfaces to Immunization Forecasters.

URL: [base]/\$immuds-forecast 

Parameters

Use	Name	Cardinality	Type	Binding	Documentation
IN	assessmentDate	1..1	date		The date on which to assess the forecast
IN	patient	1..1	Patient		Patient information
IN	immunization	0..*	Immunization		Patient immunization history
OUT	evaluation	0..*	ImmunizationEvaluation		The evaluation against a schedule
OUT	recommendation	1..1	ImmunizationRecommendation		The immunization engine produced forecast

From Scenario to TestScript - Test Definitions

- **Happy Path - Positive Testing**

- Title - “Immunization Forecast OK”
- Description - “Test a FHIR server that implements the FHIR operation 'immuds-forecast'. Assertions test all required and optional response HTTP Headers and validate the returned payload.”

- **Failure Conditions - Negative Testing**

- Title - “Immunization Forecast Failure”
- Description - “Test a FHIR server that implements the FHIR operation 'immuds-forecast'. The expected outcome is a failed operation. Assertions test all required and optional response HTTP Headers and validate the returned payload.”

Test Execution and Evaluation Demo



Tool: <http://touchstone.com>

IG: Immunization DS Forecast

Focus: Happy Path and Negative

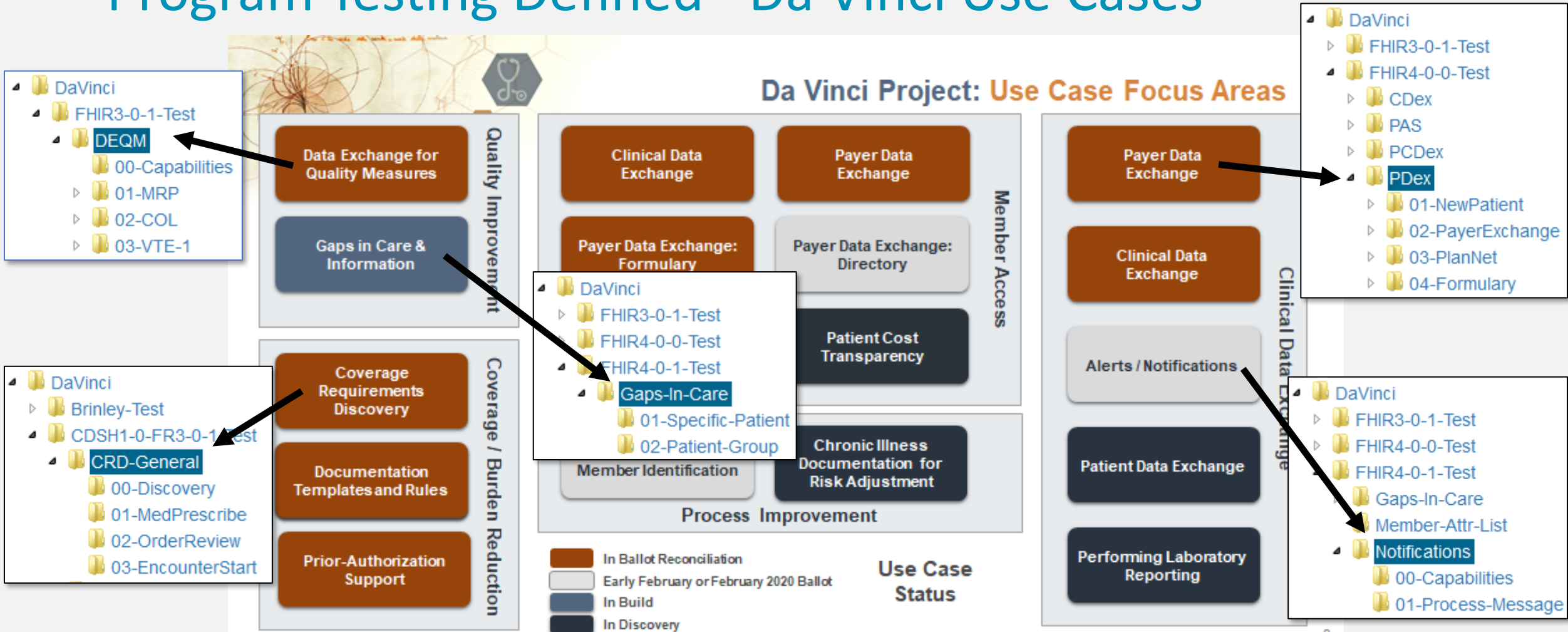
Testing and Certification Support with Touchstone

- Organization Groups – Public/Private Access to Test Results
- Security and Privacy Settings for Test Definitions
- FHIRSandbox where you can upload your own Test Definitions
- Touchstone RESTful API
 - Remote launch and monitor of test executions
 - Integration with continuous build environments (Jenkins, Travis, ...)
- Touchstone IDE
 - Eclipse-based IDE for TestScript development and upload to Touchstone
 - Integration with Simplifier
- WildFHIR Test Servers
- Java Validation Engines (incorporated as internal services)

Program Testing Defined - Da Vinci Use Cases

- Da Vinci engaged with AEGIS early last year for FHIR Testing Support with Touchstone
- Training delivered on use of Touchstone and TestScript Development
- AEGIS staff leading development of TestScripts against Da Vinci Implementation Guides and FHIR Profiles
- To-date twenty (20) active use cases have been identified
 - <https://confluence.hl7.org/display/DVP/Da+Vinci+Use+Cases>
- Reference Implementation (RI) Test Server instances available, for example:
 - MITRE RI for CRD Use Case - <https://github.com/HL7-DaVinci/CRD>
 - Logica Sandbox for MRP Use Case - <https://github.com/HL7-DaVinci/MRP-Reference-App>
 - AEGIS WildFHIR - <https://wildfhir4.aegis.net/fhir4-0-1>

Program Testing Defined - Da Vinci Use Cases



Check out our FHIR Testing and Validation Paper

<https://medinform.jmir.org/2018/4/e10870>

Original Paper

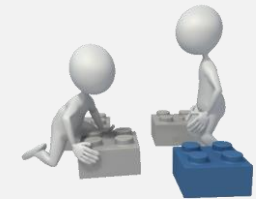
Validation and Testing of Fast Healthcare Interoperability Resources Standards Compliance: Data Analysis

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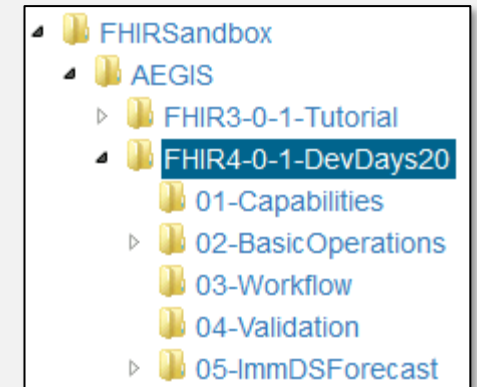
³The Office of the National Coordinator for Health Information Technology, US Department of Health and Human Services, Washington, DC, United States



Touchstone - TestScript Execution and Review

FHIRSandbox/AEGIS/FHIR4-0-1-DevDays20-06

- Test Setup and Execution
 - *Capabilities*: capabilities (metadata) operation
 - *Basic Operations*: read, search, create, update, delete
 - *Workflow*: basic operations in a single TestScript illustrating a simple workflow
 - *Validation*: show use of the integrated validation engine
- Immunization DS Forecast Use Case Review
 - Demonstration TestScripts for \$immds-forecast operation



Discussion (Q & A)...

To learn more about  **TOUCHSTONE**
AEGIS.net

- Product information: <http://www.aegis.net/touchstone.html>
- Training: <https://touchstone.aegis.net/touchstone/features#Training>
- Support: email Touchstone_Support@aegis.net

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