

# Testing HL7<sup>®</sup> FHIR<sup>®</sup> Implementation Guides with Inferno

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# Inferno Overview

- Open Source FHIR Testing
  - Inferno is a streamlined FHIR Server testing tool that is use-case / implementation guide focused.
- ONC 2015 Edition Cures Update API Tests (Program Edition)
  - Inferno provides tests verifying conformance to the Standardized API for Patient and Population Services criterion § 170.315(g)(10) in the 2015 Edition Cures Update.
- Additional FHIR Implementation Guide Tests
  - Inferno will make it easier to write or reuse tests assessing conformance to other FHIR Implementation Guides with flexibility to test non-FHIR requirements.

## Session Focus

- Testing the *ONC 2015 Edition Cures Update API Criterion* with Inferno
- Hands-on overview of the standards required for certification

HealthIT.gov

This server is provided for demonstration purposes. Do not use to access sensitive data or Protected Health Information (PHI). Data is removed every Sunday at 12:01am ET.

## INFERNO PROGRAM EDITION

Test conformance to the Standardized API for Patient and Population Services criterion § 170.315(g)(10) in the 2015 Edition Cures Update.

Enter a FHIR Endpoint START TESTING

Or test Inferno against a [public sandbox](#)

This is a preview version that will be updated prior to the rule effective date. Please see release notes below for more information.

OVERVIEW | SAMPLE DATA | INSTALLATION INSTRUCTIONS | RELEASE NOTES

### Inferno Program Edition

Inferno Program Edition is a streamlined testing tool for Health Level 7 (HL7®) Fast Healthcare Interoperability Resources (FHIR®) services seeking to meet the requirements of the Standardized API for Patient and Population Services criterion § 170.315(g)(10) in the 2015 Edition Cures Update.

Inferno behaves like an API consumer, making a series of HTTP requests that mimic a real world client to ensure that the API supports all required standards, including:

- FHIR Release 4.0.1
- FHIR US Core Implementation Guide (IG) STU 3.1.0
- SMART Application Launch Framework Implementation Guide Release 1.0.0
- HL7 FHIR Bulk Data Access (Flat FHIR) (v1.0.0: STU 1)

Inferno is open source and freely available for use or adoption by the health IT community including EHR

Open Source | Issues | Version 0.9.5

<https://www.healthit.gov>

Try Inferno

<https://inferno.healthit.gov/inferno>

github.com/onc-healthit/inferno-program

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onc-healthit / inferno-program

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Code | Issues | Pull requests | Actions | Projects | Wiki | Security | Insights | Settings

FHIR API testing for the ONC Health IT Certification Program Edit

Manage topics

195 commits | 12 branches | 0 packages | 24 releases | 6 contributors | Apache-2.0

Branch: development | New pull request | Create new file | Upload files | Find file | Clone or download

arscan Merge pull request #67 from onc-healthit/fi-585-add-system-in-token-s... | Latest commit 22cfe16 20 hours ago

.github	add v2.6.0 changes	8 months ago
bin	update based on final rule	2 months ago
data	Initial commit	13 months ago
docker	update based on final rule	2 months ago
generator	add a search with system included for token searches	8 days ago
lib	Merge pull request #67 from onc-healthit/fi-585-add-system-in-token-s...	20 hours ago
public	Update to v0.9.5.	14 days ago
resources	Updates to generator and code validation methods to test codesystemin...	last month
test	add a search with system included for token searches	8 days ago
.codeclimate.yml	version 2.4.0P	10 months ago
.dockerignore	update based on final rule	2 months ago
.gitattributes	add 2.8.0 changes	6 months ago
.gitignore	update based on final rule	2 months ago
.gitlab-ci.yml	update based on final rule	2 months ago
.rubocop-windows.yml	version 2.4.0P	10 months ago
.rubocop.yml	update based on final rule	2 months ago
.rubocop_todo.yml	update based on final rule	2 months ago
.ruby-version	add v2.6.0 changes	8 months ago
.tool-versions	add v2.6.0 changes	8 months ago
.travis.yml	add program-specific changes	6 months ago
Dockerfile	add v2.6.0 changes	8 months ago
Gemfile	update based on final rule	2 months ago
Gemfile.lock	update based on final rule	2 months ago
LICENSE	Initial commit	13 months ago

Download and run locally

<https://github.com/onc-healthit/inferno-program>



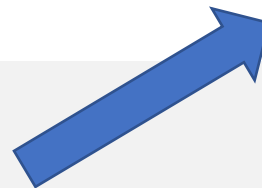
## INFERNO PROGRAM EDITION

Test conformance to the Standardized API for Patient and Population Services  
criterion § 170.315(g)(10) in the 2015 Edition Cures Update.

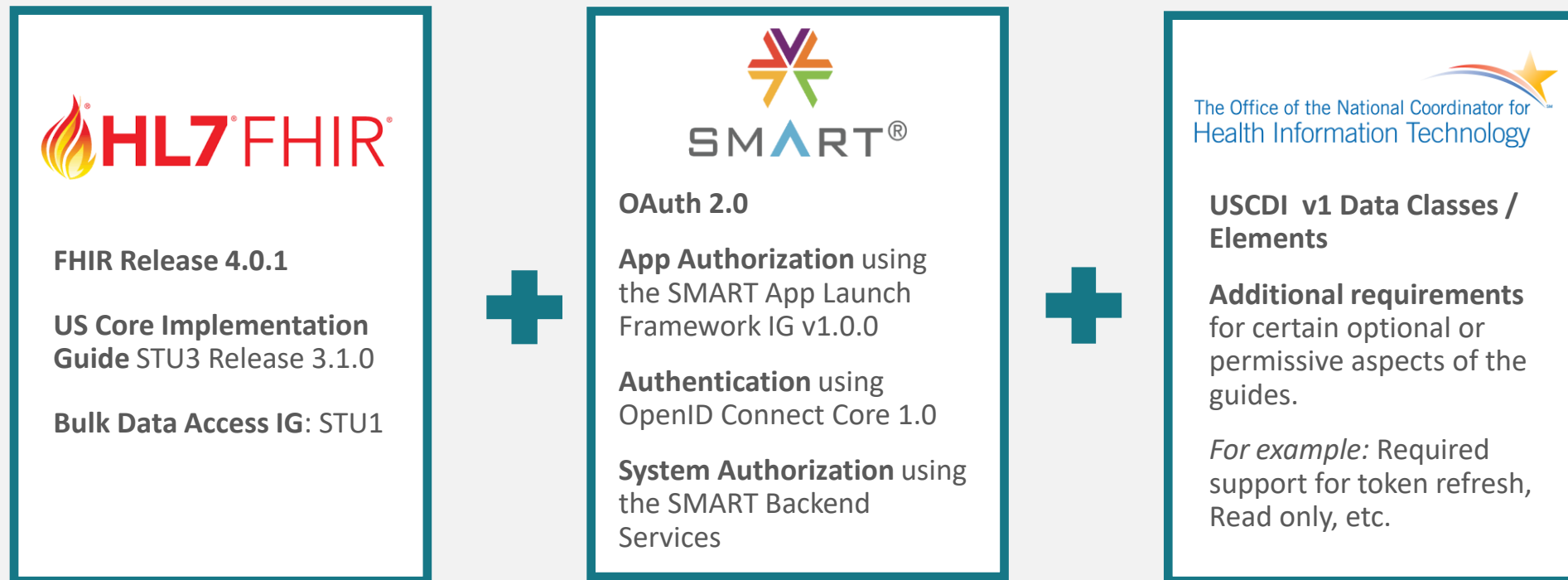
<https://inferno.healthit.gov/reference-server/r4>

START TESTING

Or test Inferno against [Inferno Reference Server](#) ↕



# 170.315(g)(10) Standardized API for Patient and Population Services



Criterion integrates multiple standards and implementation specifications

# 170.315(g)(10) Test Procedure Sections

- [Application Registration](#)
  - Functional requirement for apps to register with authorization server
- [Secure Connection](#)
  - Follow security requirements for [US Core IG](#) and [SMART IG](#)
- [Authentication and Authorization for Patient and User Scopes](#)
  - Conform with [SMART IG](#)
- [Patient Authorization Revocation](#)
  - Functional requirement to enable patients to revoke authorization at any time
- [Authentication and Authorization for System Scopes](#)
  - Conform with Backend Services Authorization section of [Bulk IG](#)
- [Token Introspection](#)
  - Functional requirement for authorization server to validate issued tokens
- [Supported Search Operations](#)
  - Conform with [US Core IG](#) for single patients; [Bulk IG](#) for multiple patients
- [Data Response](#)
  - Conform with [US Core IG](#) and [USCDI](#) for single patients; [Bulk IG](#), [US Core IG](#), and [USCDI](#) for multiple patients
- [Documentation](#)

Test procedure allows flexibility in how to test and is tool agnostic

“Functional requirements” are those that do not require a standards-based implementation but still need to be demonstrated

# Inferno 170.315(g)(10) Test Approach

- Acts as a very demanding single-patient and multi-patient client application
  - Tests integrated authorization and data access
- Avoids redundant testing
- Servers can provide their own complete test data
  - Inferno leverages FHIR built-in conformance rules to ensure data returned is correct and internally consistent
  - Inferno tracks which **MUST SUPPORT** data elements have been provided and which have not
- Inferno provides an interface to log visual inspection or attestation when automated testing not possible

## Test Structure

- 5 high level scenarios
- 51 component sequences
- 380 individual tests

A typical testing session performs thousands of HTTP requests

STANDALONE PATIENT APP

LIMITED APP

EHR PRACTITIONER APP

SINGLE PATIENT API

MULTI-PATIENT API

OTHER





# WALKTHROUGH

<https://inferno.healthit.gov/>

# 170.315(g)(10) Test Data and Installation

- **Test Data**

- Inferno tests do not require a specific test data set to be loaded by system under test
- Complete US Core FHIR test data is available if needed
- Additionally, scripts are provided to generate your own unique, complete synthetic data designed for testing
- <https://github.com/inferno-community/uscore-data-sets>

- **Installation**

- Reference server available but users encouraged to download and run locally; data cleared periodically
- Local installation allows testing behind firewall and data can be retained
- Docker-based installation is recommended, additional deployment options available
- Scripts provided to download and install ValueSets locally

# 170.315(g)(10) Test Procedure Coverage

- Inferno covers entire test procedure
- Inferno prompts tester to document ‘functional’ requirements
- Test Matrix provides complete mapping and all test information

Inferno Program Tests (v0.9.2)

	Standalone Patient App					Limited Scope App		EHR Practitioner App				Single Patient Query																								
	SPA-OSD	SPB-OSLS	SPC-OIDC	SPD-TR	AVU	RPA-OSRLS	AVR	EHA-OSD	EHB-OELS	EHC-OIDC	EHD-TR	USCCAP	USCP	USCAI	USCCP	USCCT	USCC	USCID	USCDRRN	USCDRLRR	USCDR	USCE	USCG	USCI	USCMR	USCSSO	USCPWHO	USCLRO	USCPBMAIO	USCPO	USCOBH	USCOBT	USCOBP	USCOBW		
APP-REGISTRATION-1																																				
APP-REGISTRATION-2																																				
SECURE-CONNECTION-1																																				
AUTH-PATIENT-1																																				
AUTH-PATIENT-2																																				
AUTH-PATIENT-3																																				
AUTH-PATIENT-4																																				
AUTH-PATIENT-5																																				
AUTH-PATIENT-6																																				

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