Inferno Architecture

https://inferno-framework.github.io/

V1.0 May 30 2024

Inferno Test Kit Template

A template for creating an Inferno Test Kit. It provides scripts to run Test Kits using Inferno Core and reuse existing Test Kits.

Inferno Core

Inferno Core is specified as a runtime dependency to be installed

Test file skeleton

A default file structure for writing a test kit as a ruby gem is provided.

Inferno Deployment Template

Required tools, configuration and defaults for running Test Kits using Inferno with Docker and for running front-end services (website, web API).

`% git clone`

Creates a Test Kit copied from the Test Kit Template Repository

Inferno Core

Main Ruby library used to create and execute Inferno Test Kits (Ruby-based test applications) to test HL7® FHIR API conformance. Major components include:

FHIR

Connect with FHIR servers and retrieve FHIR JSON/XML

Inferno DSL

Domain specific language for authoring FHIR API tests in Ruby

Interfaces

Web, CLI and API interfaces for executing tests and retrieving results

Data Management

Repository interfaces for persisting data in databases.

Test Reuse

Methods for reusing tests within a project or from other projects

Jobs

Manage execution of test run requests.

`% inferno new`

Inferno Core creates a Test Kit locally with supplied name

Inferno Test Kit

Set of tests and tools to evaluate conformance to FHIR specification and FHIR Implementation Guides.

Test Suite(s)

Collection of tests organized by group

Test Group(s)

Collection of related test code written in the Inferno DSL for specific FHIR IG components, functionality or requirements

Individual Tests

Child Test Group(s)

Test groups may contain child groups

Additional Test Group(s)

Test suites may contain multiple test groups

Individual Tests

Suite Options (optional)

Let users modify test suite behavior when run

Imported Test Kits (optional)

Test Kits may import and reuse existing external Test Kits as Ruby Gems, in part or whole, to provide additional test functionality.

Imported Test Kit | Imported Test Kit

Configuration Options (optional)

Test Kit authors can create custom configuration options at the test, group and/or suite level to handle naming conflicts with imported Test Kits, alter input properties, or load information at boot time.

.gemspec file

Enables Test Kit to be shared and imported by other Test Kits as a Ruby gem.

Defines runtime and development dependencies for loading Inferno Core, existing Test Kits and other Ruby gems.

Additional Test Tools (optional)

Inferno Reference Implementation(s)

Used to develop tests or interact with third party solutions

Custom resources (optional)

Additional site-specific resources, web pages, tools, datasets, docs, etc.

FHIR Resource Validators

Perform validation of FHIR profiles, terminology, models, etc.

HL7 FHIR Validator Wrapper

Used by Inferno Core to validate FHIR resources using HL7 FHIR Validator

Implementation Guide Package

FHIR Specification npm package.tgz for Implementation Guide under test

Input presets (optional)

Predefined input values for test suites

Inferno Deployment

A running instance of a Test Kit with Inferno Core and all necessary run-time dependencies.

Inferno Core

Inferno Ruby application which runs the Test Kit, and provides CLI and web interfaces, integration with data persistence layers and 3rd party validators.

Default Inferno Services

`nginx`
Reverse proxy to route requests to correct services, optional SSL

`inferno`
Serves static assets and JSON API

`worker`
Process which executes tests

`inferno_db (optional)`
Multi-user PostgreSQL interface

`redis`
Handles communication between inferno web and worker processes

`validator_service`
JSON API for HL7 FHIR Validator

`fhir_validator_app`
Web front-end for validator service

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inferno.healthit.gov

A custom Inferno Test Kit which hosts many separate Test Kits behind one website.

Test Suite(s)

https://inferno.healthit.gov is an instance of an Inferno Test Kit whose purpose is to provide a web interface to many existing Test Kits.

It does not have any Test Suite of its own, but uses the Test Suites from each imported Test Kit and is an example of Inferno as a platform.

Imported Test Kits

The inferno.healthit.gov Test Kit demonstrates how multiple existing Test Kits may be imported as Ruby Gems and run by a single instance of Inferno Core

- ONC Certification (g)(10) Standardized API Test Kit
- US Core Test Kit
- International Patient Summary Test Kit
- DaVinci US Drug Formulary Test Kit
- DaVinci Plan Net Test Kit
- Bulk Data Access Test Kit
- SMART Scheduling Links Test Kit
- Service Base URL Test Kit
- SMART App Launch Test Kit
- UDS+ Test Kit
- Carin IG for Blue Button Test Kit
- International Patient Access Test Kit
- FAST Security Test Kit
- At-Home In-Vitro Test Kit
- SMART Health Cards Vaccination: Vaccination and Testing Test Kit

Additional Test Tools for inferno.healthit.gov

Inferno Reference Implementation(s)

FHIR Resource Validators

HL7 FHIR Validator Wrapper

Custom resources

inferno.healthit.gov includes it's own website homepage, test kit pages, news & events, etc.

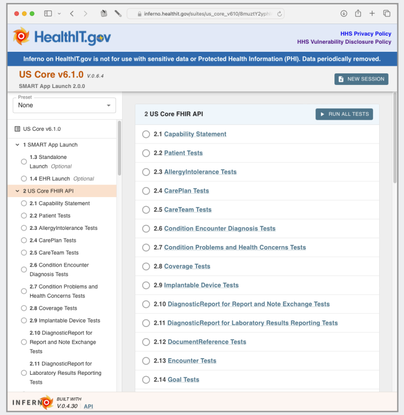
This is a custom resource for the inferno.healthit.gov test kit.

Inferno Deployment

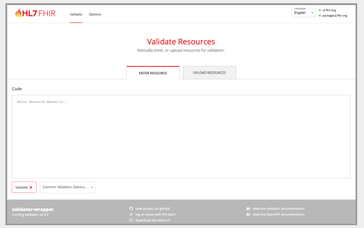
Inferno Core

Inferno Ruby application which runs the Test Kit, and provides CLI and web interfaces, integration with data persistence layers and 3rd party validators.

Shows the Inferno Core application interface and runs the selected Test Kit.



HL7 FHIR Validator web interface is part of the Inferno Deployment



Inferno Framework - Glossary

Formats

- **Fast Healthcare Interoperability Resources (FHIR)**
  FHIR (pronounced “fire”) is a standard describing data formats and elements and an application programming interface for exchanging electronic health data.
- **FHIR Implementation Guide (IG)**
  A set of rules describing how FHIR resources are to be used to exchange data for a specific situation or standard, and how it should be used to demonstrate conformance to the rules.
- **FHIR Validator**
  A tool which determines if given input conforms to existing rules for a given context, such as the specification for FHIR formatted data.
- **FHIR API**
  An application programming interface (API) used by systems which support the exchange of data in the FHIR format. Testing FHIR APIs is the main purpose of the Inferno Framework.
- **Ruby Gem**
  A packaged application or library written in Ruby. Inferno Test Kits are themselves valid Ruby gems, allowing them to be easily added to other Ruby applications or libraries, such as another Inferno Test Kit.

Inferno

- **Inferno**
  The name of an effort to provide tools, resources and documentation for testing interoperable systems based on the FHIR standard.
- **Inferno Framework**
  A set of tools and coding conventions which allow developers to create and execute fully automated tests for FHIR-based APIs.
- **Inferno Core**
  The primary application to execute a suite of tests written in Ruby, and provide interfaces to a variety of third-party tools.
- **Inferno DSL**
  A Domain Specific Language (DSL) that test writers use to define the tests in an Inferno Test Kit. The DSL provides built-in functionality that is useful in testing FHIR APIs, such as a FHIR client and built-in assertion libraries.
- **Inferno Test Kit**
  An executable and distributable stand-alone application for testing system conformance to specific FHIR IGs, certification criteria, or other FHIR-enabled data exchange use case. Test Kits may import and reuse existing Test Kits to extend its functionality, and it may include additional resources to enrich the testing capability.
- **Inferno Test Suite**
  A collection of individual tests, written in Ruby using the Infero DSL .
- **Inferno Test Group**
  A set of related tests within a Test Suite. Test authors can use groups to run subsets of tests without needing to run an entire Test Suite, or for skipping optional test functionality.

Systems

- **Inferno CLI**
  A command line interface to Inferno Core, which allows automated testing to be done through shell scripts.
- **Inferno Deployment**
  A web host running one or more Inferno Test Kits. An individual Test Kit can also be run as an Inferno Deployment on users’ local machines without any additional configuration. An Inferno Deployment includes a web interface as well as a RESTful API to enable third-party integration.
- **Reference Implementation**
  A program which implements all requirements for a given specification and demonstrates ‘correct’ behavior. These are useful for developing tests without needing to install extra applications or access running systems.
- **Inferno_db**
  An interface between Inferno Core and a multi-user PostgreSQL database. The default database is SQLite, which is not suitable use in a multi-user deployment, and inferno_db should be used instead.
- **HL7 FHIR Validator**
  Inferno Core utilizes the HL7 FHIR Validator through the FHIR Validator Wrapper service. This allows Inferno Core to verifiy that instances of FHIR resources provided by systems conform to expectations of the FHIR specification and any applicable FHIR profiles.