

FHIR Testing and Touchstone



Presenter:

Richard Ettema

FHIR® Certified Implementer

Lead Consultant, AEGIS.net, Inc.

richard.ettema@aegis.net

Goal of Session Two

- Present the FHIR Testing framework
- Introduce Touchstone:
 - User registration
 - Account setup
 - Test system setup
 - Test execution (demo)

FHIR Testing Framework

- To ensure interoperability between applications claiming conformance to the specification, a testing framework has been established within the FHIR specification.
- This framework defines the TestScript resource as a natural language, computable format of a test case.
- It provides a defined test methodology for the FHIR specification which can be used to validate interoperability across FHIR server and client implementations.

FHIR Testing Framework



FHIR®[©] FHIR Release 3 (STU)

Home Getting Started Documentation Resources Profiles Extensions Operations Terminologies

 Implementation Support > **Testing FHIR**

7.2 Testing FHIR

FHIR Infrastructure  Work Group	Maturity Level: 2	Ballot Status: Draft
--	-------------------	----------------------

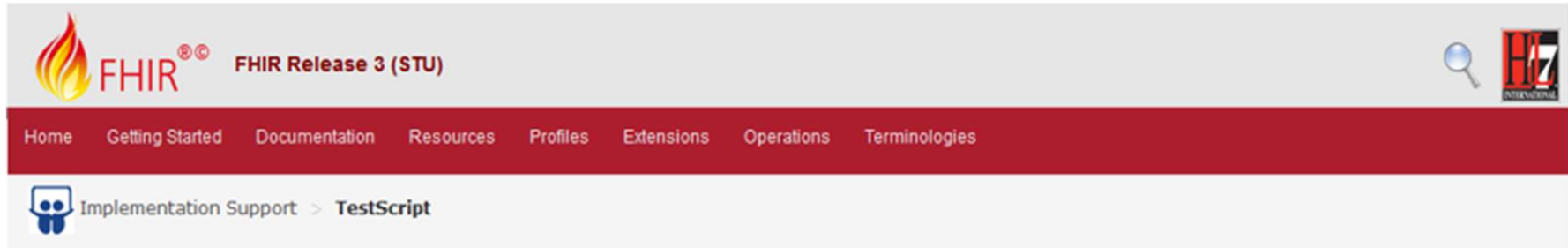
The FHIR specification describes a set of [resources](#), and several different frameworks for exchanging resources between different systems. Because of its general nature and wide applicability, the rules made in this specification are generally fairly loose. As a consequence and in order to insure interoperability between applications claiming conformance to this specification, a testing framework has been established within the FHIR specification. To this end, the [TestScript](#) resource provides an implementation-agnostic description of tests that allows test execution engines to evaluate if a FHIR implementation conforms with the FHIR specification. Providing a clear and concise test methodology for the FHIR specification through the TestScript resource helps to enable interoperability among various FHIR server and client implementations.

<http://hl7.org/fhir/STU3/testing.html>

FHIR TestScript Resource

- The TestScript resource represents an executable test definition for examining the results of FHIR RESTful API interactions.
- A TestScript example would be a set of tests that exercise a certain function, such as Patient Search, and validating the responses. For this example we require:
 - Patient resource(s) required to complete this test
 - A setup procedure to create those Patient resource(s)
 - The tests which execute the functions being exercised & evaluate the results
 - A setup or tear-down procedure to initialize or clean up the test data

TestScript Resource



Content

Examples

Detailed Descriptions

Mappings

Profiles & Extensions

R2 Conversions

7.3 Resource TestScript - Content

FHIR Infrastructure  Work Group

Maturity Level: 2

Trial Use

Compartments: Not linked to any defined compartments

A structured set of tests against a FHIR server implementation to determine compliance against the FHIR specification.

7.3.1 Scope and Usage

The TestScript resource is used to define tests that can be executed on one or more FHIR servers. The TestScript resource would typically contain

- a list of fixtures (required resources used in the tests)
- setup procedures
- a suite of thematically related tests
- teardown procedures

<http://hl7.org/fhir/STU3/testscript.html>

Test Engine Workflow

★ Pre-Processing

- Determine whether or not the TestScript interactions match the capabilities of the system under test. If supported, the test engine proceeds.
- Setup Execution
 - Optional operations that prepare the system under test for subsequent test execution.

★ Test Execution

- Execute and record each test's operations and assertions.
- Teardown Execution
 - Optional operations that revert the system under test to its pre-test state.
- Post-Processing
 - Cleanup of test execution data and collection of test results.

<http://hl7.org/fhir/STU3/testing.html#execution>

Pre-Processing

Capability Based Testing

- The test engine will use the CapabilityStatement of the system under test to determine how to process a TestScript.
- If the TestScript defines the testing of capabilities that the system under test does support, the test engine will continue the workflow process.
- If the TestScript defines the testing of capabilities that the system under test does not support, the test engine should allow the TestScript to be skipped.

Test Execution

Executing Operations

- Test execution consists of two action types:
 - **operation**: The FHIR RESTful API interaction to be executed.
 - **assert**: The rule that is evaluated against the results of the operation. If true, the assert passes.

 Key concept: The operation is always executed regardless of whether or not an assert follows.

TestScript Operations

FHIR Interactions

Instance Level Interactions

- Read (GET)
- Vread (GET)
- Update (PUT)
- Patch (PATCH)
- Delete (DELETE)
- History (GET)

Type Level Interactions

- Create (POST)
- Create via Update (PUT)
- Search (GET)
- History (GET)

Whole System Interactions

- Capabilities (GET/OPTIONS)
- Batch/Transaction (POST)
- History (GET)
- Search (GET)

Extended Operations

<http://hl7.org/fhir/STU3/operationslist.html>

- Base Operations (All Resources)
- Operations Defined by Resource Type

Asserts

Conditions, Rules or Expressions

- An assert acts on the immediately preceding operation.
- It states a condition, rule or expression that will be evaluated against the executed operation context.

Asserts provide support for:

- Evaluation of both the inbound request or outbound response
- Complex and simple evaluation of HTTP headers and response codes
- Operators for equality, relational comparison, containment, etc.
- Expression language support for XPath, JSONPath and FHIRPath
- Payload comparison to defined fixtures (static or dynamic)
- Payload validation against defined FHIR profile(s)
- *Plus a whole lot more...*

Recap: FHIR Testing and TestScripts

- FHIR defines a Testing Framework as part of the specification
- Test Engines should follow a prescribed Workflow
- TestScript Resource Type provides a complete, executable test definition
- Support for the entire FHIR RESTful API (Operations)
- Support for Evaluation of Extensive Conditions, Rules and Expressions (Asserts)

Discussion (Q & A)



Introducing Touchstone





Touchstone is an easy-to-use testing platform for health information exchange that implements the FHIR Testing Framework architecture.

Touchstone

- Is available as a publicly accessible cloud-based testing platform
- Provides automated, internet-based interoperability testing of the HL7® FHIR® specification
- Tests the capabilities of and interoperability between both FHIR Server and Client implementations
- Is a blend between Test-Driven-Development (TDD) methodologies and Natural Language Processing (NLP) TestScripts

Touchstone Landing Page



Touchstone Project

Sign In Register

Test Definitions

⚠ Getting the most out of Touchstone Analytics/Conformance Interface:
Please ensure your test system conformance (DSTU2) or capabilities (STU3) statement is available and accessible. Per the FHIR specification on [capabilities](#), 'All servers are **required** to support the capabilities interaction...'


TLS Security:
Based on the "Recommendations for Secure Use of Transport Layer Security (TLS) and Datagram Transport Layer Security (DTLS)", [RFC7525](#), Touchstone supports the secured protocol TLS v1.2 (see [RFC5246](#)).

The Touchstone Project - an *AEGIS* Developers Integration Lab (DIL) Initiative

The **Touchstone Project** is an Infrastructure as a Service (IaaS) and Testing as a Service (TaaS) Open Access Solution for health information exchange. Touchstone strives to live up to its dictionary *definition* - a *criterion for determining the quality or genuineness of a thing* - by offering thousands of tests in an easy-to-use system for determining a test system's conformance and interoperability against published specifications, standards, and profiles, including templates and implementation guides.

The Touchstone Project...

- allows for automated, internet-based interoperability testing against the HL7 FHIR specifications and standards.
- tests interoperability with other FHIR Server and FHIR Client implementations.
- has been engineered from the ground up to leverage the new FHIR [TestScript](#) resource.
- is a blend between Test-Driven-Development (TDD) methodologies and Natural Language Processing (NLP) test scripts.
- has been featured at HL7 FHIR Connectathons and is being leveraged in a continuous testing environment by numerous leading HL7 FHIR implementers.



AEGIS

Help and Documentation

- > [How to register in Touchstone](#)
- > [How to become a member of or create an organization](#)
- > [How to approve an organization membership request](#)
- > [How to create a test system](#)
- > [How to execute test scripts](#)
- > [How to execute client-side \(peer-to-peer\) tests](#)
- > [How to perform Conformance-based testing](#)
- > [How to integrate Touchstone with CI including Jenkins](#)
- > [How to reset my password](#)

Feeds

- > [HIMSS 2017 Debrief – FHIR Myths and Misconceptions](#) **NEW** Mar 2, 2017
- > [AEGIS - The Movie: AEGIS.net's CMMI success story, "Building a More Powerful Business Through CMMI"](#) Oct 4, 2016
- > [AEGIS Wins Inaugural CMMI Capability Challenge](#) May 17, 2016
- > [FHIR Testing and Lift-Off to the HL7 Conference](#) May 5, 2016

www.touchstone.com

Touchstone Landing Page

⚠ Getting the most out of Touchstone Analytics/Conformance Interface:

Please ensure your test system conformance (DSTU2) or capabilities (STU3) statement is available and accessible. Per the FHIR specification on [capabilities](#), 'All servers are **required** to support the capabilities interaction...'

TLS Security:

Based on the "Recommendations for Secure Use of Transport Layer Security (TLS) and Datagram Transport Layer Security (DTLS)", [RFC7525](#), Touchstone supports the secured protocol TLS v1.2 (see [RFC5246](#)).

Alerts: Important usage information

Touchstone Updates

- > **Touchstone 3.4.4 released** NEW May 2, 2017
Enhancements:
 - > FHIR 3.0.1 Support
 - > Touchstone now supports [FHIR 3.0.1](#) (the official FHIR STU3 release). See [FHIR directory of versions](#).
 - > FHIR 3.0.1 test scripts can be found at FHIR3-0-1-Connectathon15, FHIR3-0-1-Basic, and FHIR3-0-1-Advanced test groups under Test Definitions.
- > **Touchstone 3.4.0 Released** Feb 17, 2017
Enhancements:
 - > Assertion Dependency Support
 - > Touchstone now supports the conditional evaluation of assertions based on the state of message headers and/or content as well as the test system's conformance statement.
- > **Touchstone 3.3.0 released** Dec 20, 2016
Enhancements:
 - > FHIRPath Support
 - > Touchstone now supports and uses [FHIRPath](#) expressions in its test scripts.
 - > It can be used in [TestScript assert.expression](#), [assert.compareToSourceExpression](#), and [variable.expression](#).

Touchstone Updates: Describes significant released version updates

Help and Documentation

- > [How to register in Touchstone](#)
- > [How to become a member of or create an organization](#)
- > [How to approve an organization membership request](#)
- > [How to create a test system](#)
- > [How to execute test scripts](#)
- > [How to execute client-side \(peer-to-peer\) tests](#)
- > [How to perform Conformance-based testing](#)
- > [How to integrate Touchstone with CI including Jenkins](#)
- > [How to reset my password](#)

Help and Documentation:
Links to User Guide

Touchstone Landing Page

Feeds

- > CDS Hooks, Genomics and More: Update from HL7 FHIR Connectathon 15 in Madrid **NEW** May 25, 2017
- > AEGIS Wins ACT-IAC Innovation Award **NEW** May 3, 2017
- > Test Like You Mean It Apr 27, 2017
- > #FHIR Testing is Coming Apr 20, 2017
- > Hay on FHIR - FHIR Connectathon, May 2017, Madrid Spain Mar 30, 2017
- > HIMSS 2017 Debrief – FHIR Myths and Misconceptions Mar 2, 2017
- > AEGIS - The Movie: AEGIS.net's CMMI success story, "Building a More Powerful Business Through CMMI"! Oct 4, 2016
- > AEGIS Wins Inaugural CMMI Capability Challenge May 17, 2016
- > FHIR Testing and Lift-Off to the HL7 Conference May 5, 2016
- > FHIR'd Up for HIMSS16 Feb 26, 2016

Feeds: News links related to FHIR, Testing and Touchstone

Touchstone Totals

Users:	425
Organizations:	150
Test Systems:	180
Test Scripts:	1,642
Tests:	10,253
Test Script Executions:	52,599
Test Executions:	340,701
Message Exchanges:	512,732

Touchstone Totals: Tracks participation since Touchstone v1.0 release


Discussion (Q & A)



Getting Started with Touchstone

- All testing participants need to first Register with Touchstone
- Organizations may have 1 or more registered users on Touchstone (based on the organization's subscription level)
- Registration and acceptance of registration must be completed before any testing can begin
- An organization will typically have at least 1 test system and may choose to run tests against other publicly available test systems

Register an Account in Touchstone

- Click  Register
 - Enter your user name, email, password twice, and select “I’m not a robot”
 - Click the [Register](#) button

Registration


Name *

Email *

Password *

Confirm Password *

☐ I'm not a robot


reCAPTCHA
[Privacy](#) - [Terms](#)

Register

Create or Join an Organization

Your user account must belong to an organization. You can:

- a. Create an organization with your team
- b. Join an existing organization
- c. Use the Help and Documentation links if guidance is needed

Help and Documentation

- > [How to register in Touchstone](#)
- > [How to become a member of or create an organization](#)
- > [How to approve an organization membership request](#)
- > [How to create a test system](#)
- > [How to execute test scripts](#)
- > [How to execute client-side \(peer-to-peer\) tests](#)



Create or Join an Organization

- If you are the first person from your organization to register, select [Create a new organization](#)
- If your organization is already registered, select [Become a member of an existing organization](#). Then select your organization from the dropdown list.

Organization Registration

☐ Become a member of an existing organization:

☒ Create a new organization

Name *

Website

Register

Organization Registration

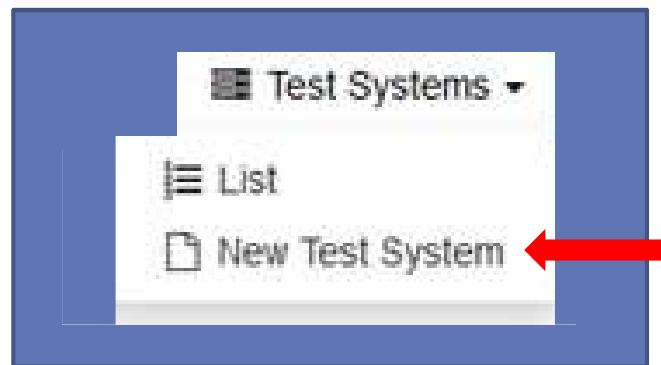
☒ Become a member of an existing organization:

Submit

☐ Create a new organization

Create a New Test System Definition

- To run tests, a Test System must be defined
- From the top menu
 - Go to Test Systems
 - Select [New Test System](#)
- Once selected, a new entry for Test System will display



Create a New Test System Definition

- Enter the test system name
- Select the specification version and supported formats
- Enter the base URL
- The IP addresses are optional
(Touchstone will determine this if left blank)
- Select OAuth2 if required
- Select privacy settings:
 - who the Test System can be viewed by
 - who can execute against the Test System
 - who can modify the Test System
- Assign the supported actor profiles

The screenshot shows the 'New Test System' form in the Touchstone application. The form is titled 'New Test System' and has a green 'Create' button in the top right corner. The form fields are as follows:

- Name ***: A text input field.
- Specification ***: A dropdown menu with 'FHIR 3.0.1' selected.
- Formats Supported ***: Two checkboxes, 'JSON' and 'XML', both of which are checked.
- Base URL ***: A text input field.
- IP Addresses (comma-separated)**: A text input field.
- Requires**: A checkbox for 'OAuth2' which is unchecked.
- Can be viewed by**: Three radio buttons: 'Me' (unchecked), 'My organization' (unchecked), 'My organization groups' (unchecked), and 'Everyone' (checked).
- Can be executed against by**: Three radio buttons: 'Me' (unchecked), 'My organization' (checked), 'My organization groups' (unchecked), and 'Everyone' (unchecked).
- Can be modified by**: Three radio buttons: 'Me' (unchecked), 'My organization' (checked), 'My organization groups' (unchecked), and 'Everyone' (unchecked).
- Allow Touchstone to pull capability statement once a day (recommended)**: A checkbox which is checked.
- Available Profiles**: A list box containing 'FHIR-Client', 'FHIR-SDC-FormFiller', 'FHIR-SDC-FormManager', 'FHIR-SDC-FormReceiver', and 'FHIR-SDC-FormProcessor'. There are right and left arrow buttons next to the list box.
- Supported Profiles ***: A list box containing 'FHIR-Server'.

A green 'Create' button is located at the bottom right of the form.

Touchstone Demo – Test Execution



Discussion (Q & A)

