

# FHIR Testing and Touchstone



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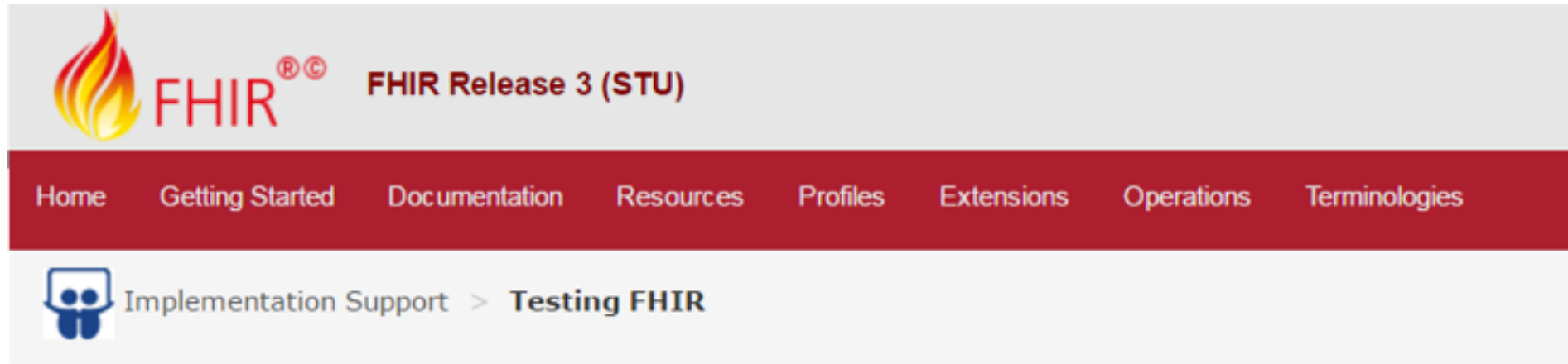
# Goal of Session Two

- 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



The screenshot shows the top portion of the FHIR website. At the top left is the FHIR logo, which consists of a stylized flame icon followed by the text 'FHIR' with a registered trademark symbol and a copyright symbol. To the right of the logo is the text 'FHIR Release 3 (STU)'. Below the logo and text is a dark red navigation bar with white text links: 'Home', 'Getting Started', 'Documentation', 'Resources', 'Profiles', 'Extensions', 'Operations', and 'Terminologies'. Below the navigation bar is a light gray area containing a blue icon of two people and the text 'Implementation Support > Testing FHIR'.

## 7.2 Testing FHIR

<a href="#">FHIR Infrastructure</a>  Work Group	Maturity Level: 2	Ballot Status: Draft
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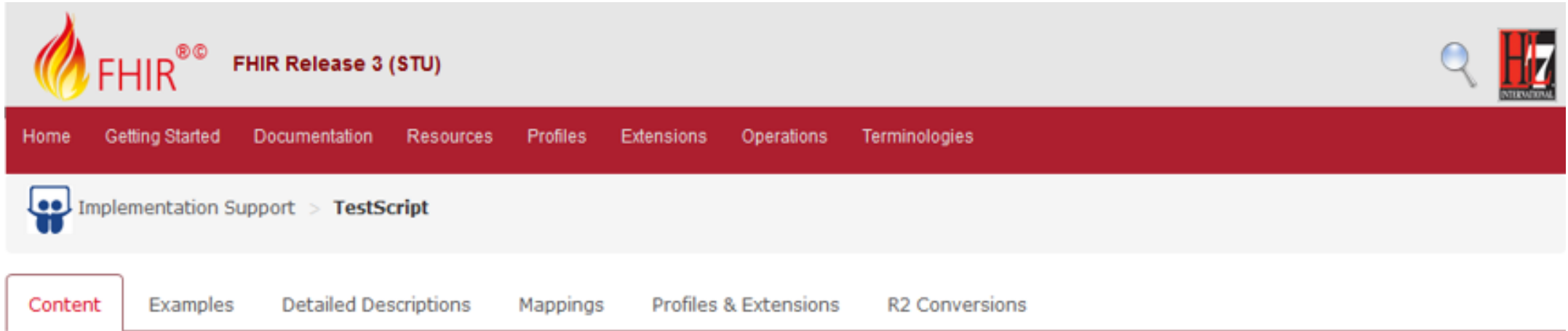
The FHIR specification describes a set of [resources](#), and several different frameworks for exchanging resources between different systems. Because of its general nature and wide applicability, the rules made in this specification are generally fairly loose. As a consequence and in order to insure 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



The screenshot shows the top navigation bar of the FHIR website. It includes the FHIR logo, the text "FHIR Release 3 (STU)", a search icon, and the HL7 International logo. Below this is a dark red navigation bar with links for Home, Getting Started, Documentation, Resources, Profiles, Extensions, Operations, and Terminologies. Underneath is a light gray bar with a "Implementation Support" icon and the text "Implementation Support > TestScript". At the bottom of this section is a white bar with a "Content" tab selected, and other tabs for Examples, Detailed Descriptions, Mappings, Profiles & Extensions, and R2 Conversions.

## 7.3 Resource TestScript - Content

<a href="#">FHIR Infrastructure</a> <a href="#">Work Group</a>	Maturity Level: 2	Trial Use	Compartments: Not linked to any defined compartments
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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.
- 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<sup>®</sup> FHIR<sup>®</sup> 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

[Docs](#)[Sign In](#)[Register](#)[Analytics](#)[Published](#)[Test Definitions](#)

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

[Subscription](#)

**Touchstone** 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.

Touchstone ...

- 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.
- plays an active role in the HL7 Conformance Testing community, the HL7 Argonaut Project, and the HSPC Implementation community.



A E G I S

Features include...

- self-registration of user accounts and organizations.
- ability for users to execute FHIR test scripts against test systems with Touchstone serving as the initiator of message exchanges.
- ability for users to initiate message exchanges from their test systems against other peer test systems with Touchstone serving as the intermediary.
- ability to drill down to individual operations and assertions in test execution results.
- ability to save configured sets of test scripts as named "test setups" for re-execution.
- controlled access to test scripts, test systems, and test results at the user, organization, and organization group levels.

### 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

- > [Healthcare Interoperability Testing with FHIR Just Got Easier!](#) NEW Jun 18, 2018
- > [FHIR Connectathon Links Health Technology Efforts From 17 Countries](#) NEW May 29, 2018
- > [Dammit, Jim, I'm a Doctor Not an EHR Software Tester!](#) May 25, 2018
- > [DevDays June 2018 Boston & Touchstone and FHIR Testing, Take 2...](#) Apr 9, 2018
- > [Ready, FHIR, Test! Set your sights on testing](#) Feb 26, 2018
- > [HL7 FHIR Connectathon #17 - Sat Morning Breakouts](#) Jan 24, 2018
- > [Touchstone and FHIR Testing at DevDays 2017](#) Nov 9,

[www.touchstone.com](http://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:

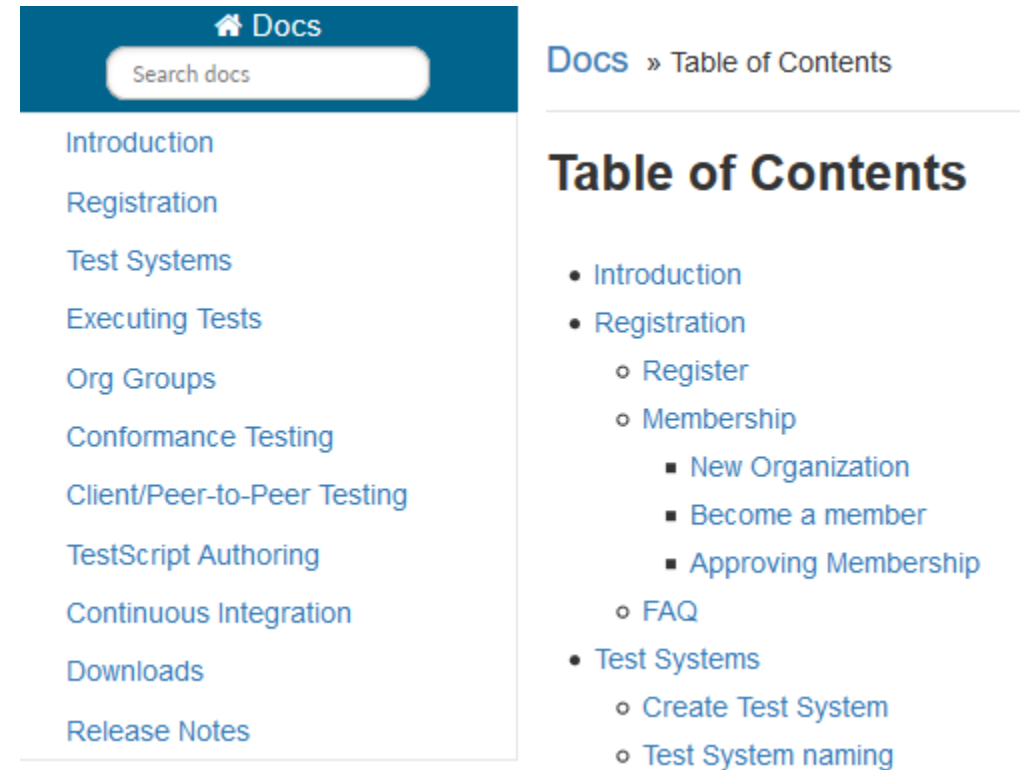
Based on the "Recommendations for Secure Use of Transport Layer Security (TLS) and Datagram Transport Layer Security (DTLS)", [RFC7525](#), Touchstone supports the secured protocol TLS v1.2 (see [RFC5246](#)).

## Alerts: Important usage information

### Touchstone Updates

- > **Touchstone 4.0.0 and TestScript Editor 1.2.1 Released** NEW Sep 24, 2018
  - > Support for CDS Hooks Specification
    - > Touchstone now offers [CDS Hooks 1.0](#) testing, supporting the HL7
    - > CDS Hooks test scripts can be found under [Test Definitions](#) when y
  - > Support for FHIR 3.5.0 (R4 Ballot #2)
    - > Touchstone now offers [FHIR 3.5.0 \(R4 Ballot #2\)](#) testing, supportin
    - > [FHIR directory of versions](#).
    - > FHIR 3.5.0 test scripts can be found at [FHIR3-5-0-Connectathon19](#) test groups under [Test Definitions](#).
  - > TestScript Editor now supports automatic updates. You can download th
  - > See [Release notes](#) for more details.

**Touchstone Updates:** Describes significant released version updates



Docs

Search docs

Docs » Table of Contents

## Table of Contents

- Introduction
- Registration
  - Register
  - Membership
    - New Organization
    - Become a member
    - Approving Membership
  - FAQ
- Test Systems
  - Create Test System
  - Test System naming

**Online Documentation:**  
User Guide and How-Tos

# Touchstone Landing Page

Feeds
> <a href="#">Healthcare Interoperability Testing with FHIR Just Got Easier!</a> <span>NEW</span> Jun 18, 2018
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> <a href="#">Ready, FHIR, Test! Set your sights on testing</a> Feb 26, 2018
> <a href="#">HL7 FHIR Connectathon #17 - Sat Morning Breakouts</a> Jan 24, 2018
> <a href="#">Touchstone and FHIR Testing at DevDays 2017</a> Nov 9, 2017
> <a href="#">HL7 FHIR Connectathon #16 - Sat Morning Breakouts</a> Sep 7, 2017

**Feeds:** News links related to FHIR, Testing and Touchstone

Touchstone Totals	
<b>Users:</b>	722
<b>Organizations:</b>	260
<b>Test Systems:</b>	281
<b>Test Scripts:</b>	3,681
<b>Tests:</b>	18,840
<b>Test Script Executions:</b>	105,163
<b>Test Executions:</b>	648,173
<b>Message Exchanges:</b>	989,821

**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 \*

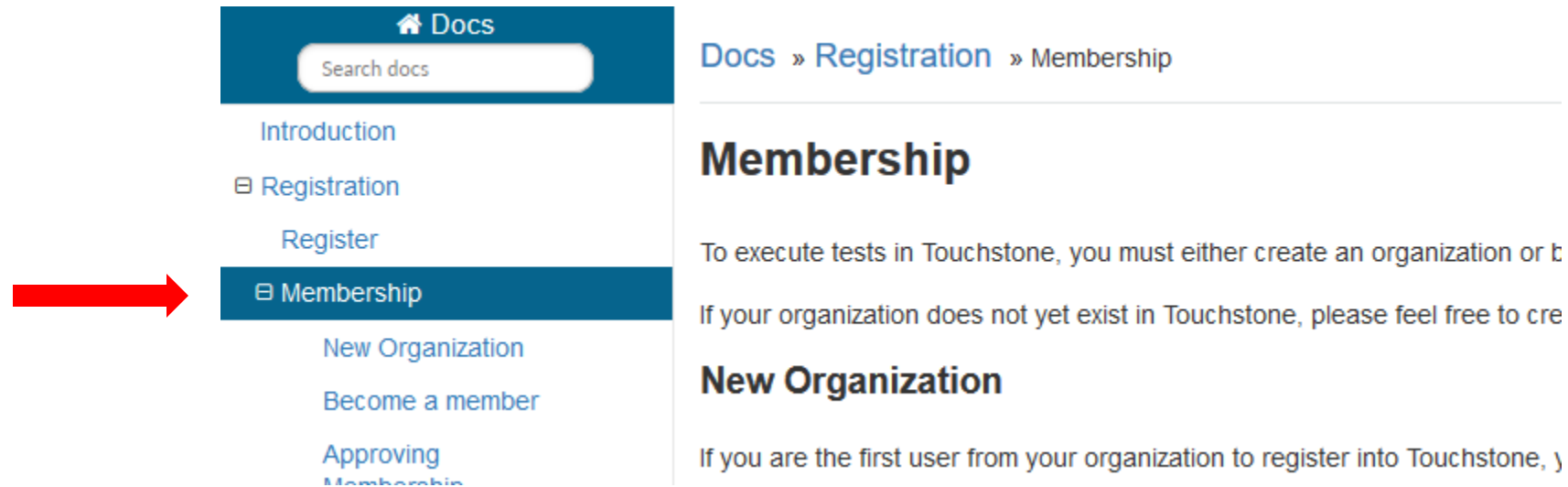
I'm not a robot  reCAPTCHA  
Privacy - Terms

Register

# Create or Join an Organization

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

- Create an organization with your team
- Join an existing organization
- Use the Online Documentation if guidance is needed



The screenshot shows the documentation interface for Touchstone. On the left is a sidebar with a search bar and a list of navigation items: Introduction, Registration, Register, Membership (highlighted with a red arrow), New Organization, Become a member, and Approving Membership. The main content area shows the breadcrumb 'Docs » Registration » Membership', the title 'Membership', and introductory text: 'To execute tests in Touchstone, you must either create an organization or t...' and 'If your organization does not yet exist in Touchstone, please feel free to cre...'. Below this is a section titled 'New Organization' with the text 'If you are the first user from your organization to register into Touchstone, y'.

# 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

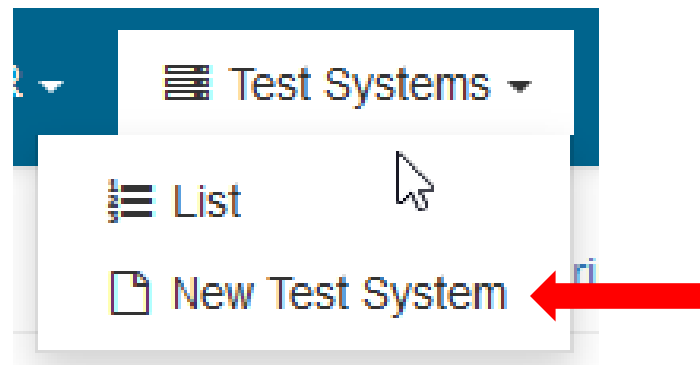
- Become a member of an existing organization:

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

## New Test System Create

**Name \***

**Specification \***

**Formats Supported \***  JSON  XML

**Base URL \***

**IP Addresses** (comma-separated)

**Requires**

OAuth2

Can be viewed by	Can be executed against by	Can be modified by
<input type="radio"/> Me	<input type="radio"/> Me	<input type="radio"/> Me
<input type="radio"/> My organization	<input type="radio"/> My organization	<input checked="" type="radio"/> My organization
<input type="radio"/> My organization groups	<input type="radio"/> My organization groups	<input type="radio"/> My organization groups
<input checked="" type="radio"/> Everyone	<input type="radio"/> Everyone	<input type="radio"/> Everyone

Allow Touchstone to pull capability statement once a day (recommended)

**Available Profiles**

**Supported Profiles \***

Create

# Touchstone Demo – Test Execution



# Discussion (Q & A)

