



## **W12**

API Testing

Wednesday, October 23rd, 2019 1:30 PM

# **API Testing Is Critical - Here's How to Do It Right**

Presented by:

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# Adam Sandman

Adam Sandman was a programmer from the age of 10 and has been working in the IT industry for the past twenty years in areas such as architecture, agile development, testing, and project management. Currently Adam is a director of technology at Inflectra Corporation, where he is interested in technology, business, and enabling people to follow their passions. At Inflectra, Adam has been responsible for researching the tools, technologies, and processes in the software lifecycle management space. Before Inflectra, Adam was a director at business and technology consulting firm Sapient.

# API Testing, Often Overlooked, Critical to Your Success

Presented by

Adam Sandman

STAR Canada Conference

October 2019 | Toronto, ON

#starcanada

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## Agenda

- The API Economy
- Types of API
- Pitfalls of APIs and API Testing
- Creating a Test Plan
- What about Developers?
- Questions

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## Takeaways

1. Why API testing should not be taken for granted, and what you can do about it
2. Overall strategies and best practices for a sound API test plan.
3. What types of API you are likely to encounter and tips for testing each of them
4. Things you can tell your developers to do, to avoid an API living hell

## The API Economy

Why APIs Are Vital for Today's Businesses?

# First, What is an API?

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API = Application Programming Interface

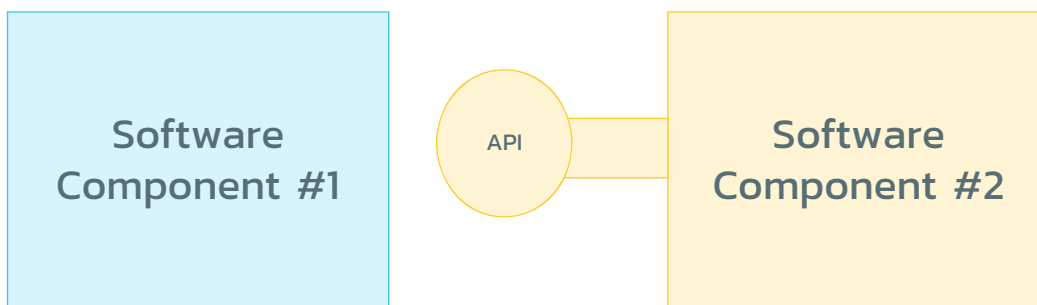
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OR

A way for one piece of software to use the functionality of another piece of software

How Does that Work?



## What is So Special?

- The API provides what's called an "interface"
- It acts like a contract between the software using the API, and the software providing the API
- Different people can develop their own implementations of the same API.
- Developers of Component #1 don't have to understand the inner workings of Component #2, just the implementation

## Why is this a big deal?

## Example #1

# Microsoft®

- IBM Created the “PC”
- Standard Hardware and Software
  - PC-AT, XT Hardware
  - MS-DOS / PC DOS
- The Operating System and System Specs were the API, used by Application Software
- Any hardware manufacturer could implement the same API.  
IBM no longer even makes PCs!



## Example #2

- Microsoft Created the Windows API
- Any Application Developer could use this API
- However Microsoft Was able to know its inner workings before other companies.
- Do you remember Word Perfect?
- Do you remember Lotus 123
- Thanks to the Windows API  
No one really does!





## Example #3

- OAUTH 2.x
  - Login to your favorite website with:
    - Google
    - Facebook
    - Etc.
  - Anyone remember Windows Live ID?
  - Anyone remember Microsoft Passport!
- APIs Need Critical Mass



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## Example #4



- Amazon Web Services (AWS)
- Anything you can do through their management interface, you can do through an API.
- Amazon went from having a cloud infrastructure built to support their “main” business, to being the dominant cloud platform in the world, thanks to APIs!
- Software companies like Microsoft, Oracle, IBM, having to play catch up...

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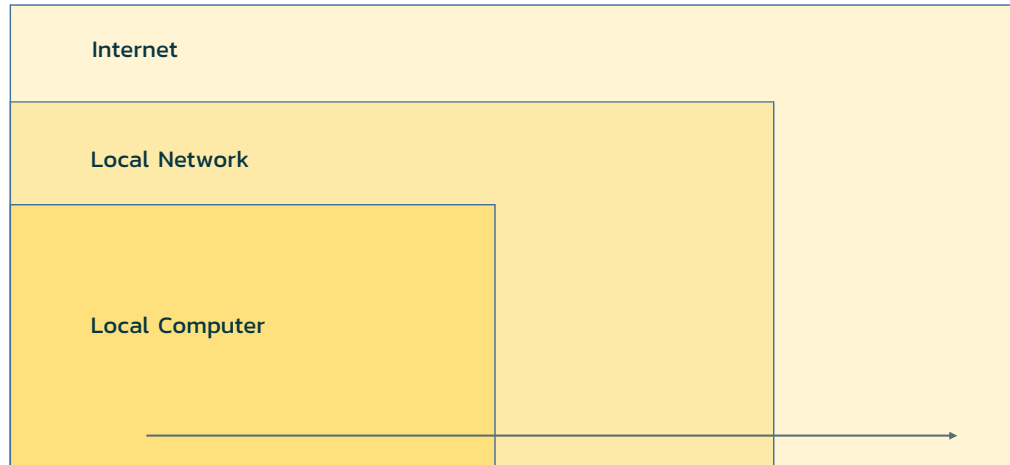
## Other Examples?

- Google Maps
- Salesforce.com (CRM platform)
- Lyft, Uber (mobility)
- Stripe, Square (payment)
- Twilio (telephony)
- Facebook
- Twitter
- ....

## Types of API

Including the Past, Present and Future

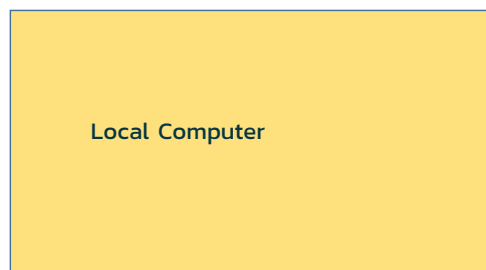
## APIs Scope Expanded With Networks



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## APIs Between Local Components



- Remote Process Call (RPC)
- Named Pipes
- ActiveX / OLE
- Microsoft Component Object Model (COM)
- Java Beans

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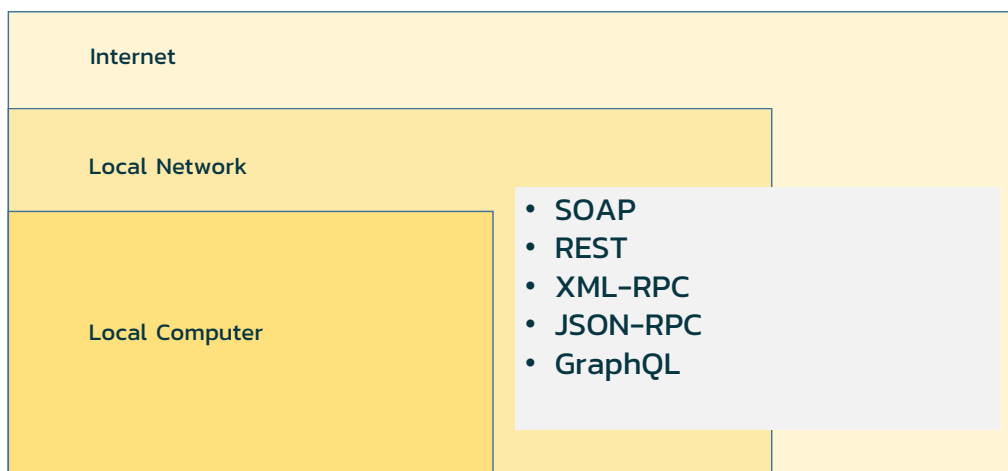
## APIs Extended to Local Network



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## APIs Become "Web Services"



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## Two Families of Web Service

### RPC Based

- Simple Object Access Protocol (SOAP)
- XML-RPC
- JSON-RPC

- Like calling functions.
- Self-describing
- Better for invoking actions
- Requires Tooling to use

### Query Based

- REpresentational State Transfer (REST)
- GraphQL

- Better for querying and retrieving data
- Better at modelling your domain (CRUD actions)

## Pitfalls of API Testing

Versions, Data Formats, Authentication, Live Systems....

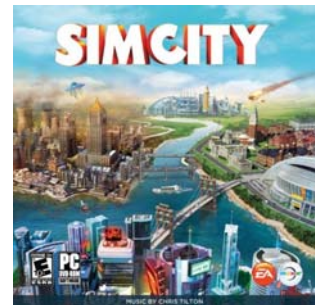
## Once APIs Are Released They Have a Life of Their Own

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### Why Test APIs\*

- MS About to Release Windows® 95
- Will Change the Computing landscape
- Testing that all applications that ran on MS-DOS will still work on Windows.
- Major Developer (SimCity) – game does not run on Windows 95 due to use of API in an unexpected way
- **Microsoft changed the API to detect SimCity and change its behavior**



What  
Would You  
Have  
Done?

\*Credit to Joel Spolsky: <https://www.joelonsoftware.com/2004/06/13/how-microsoft-lost-the-api-war/>

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# Changing the Test to Get the API to Pass = Failure in the API

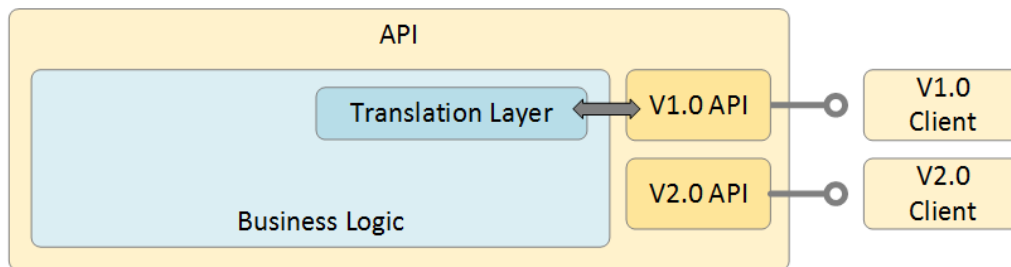
(Unlike UI Testing where the UI and Tests Constantly Change)

## API Versioning

- Once you have released an API into production it should never be changed
- Breaking changes should be in the next version
- You may need to write a compatibility layer?
  
- <http://myapplication/api/v1/projects>
- <http://myapplication/api/v2/projects>
- <http://myapplication/api/v3/projects>

## How Do You Deal With Breaking Changes?

- Consider a translation layer:



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## API Versioning

- Not only the endpoints need to be versioned
  - Make sure you separate data structures into versions:

Author (v1)	Author (v2)	Author (v3)
First Name	First Name	Full Name
Last Name	Last Name	Age
Age	Age	Gender
Gender	Gender	Race
	Race	DOB

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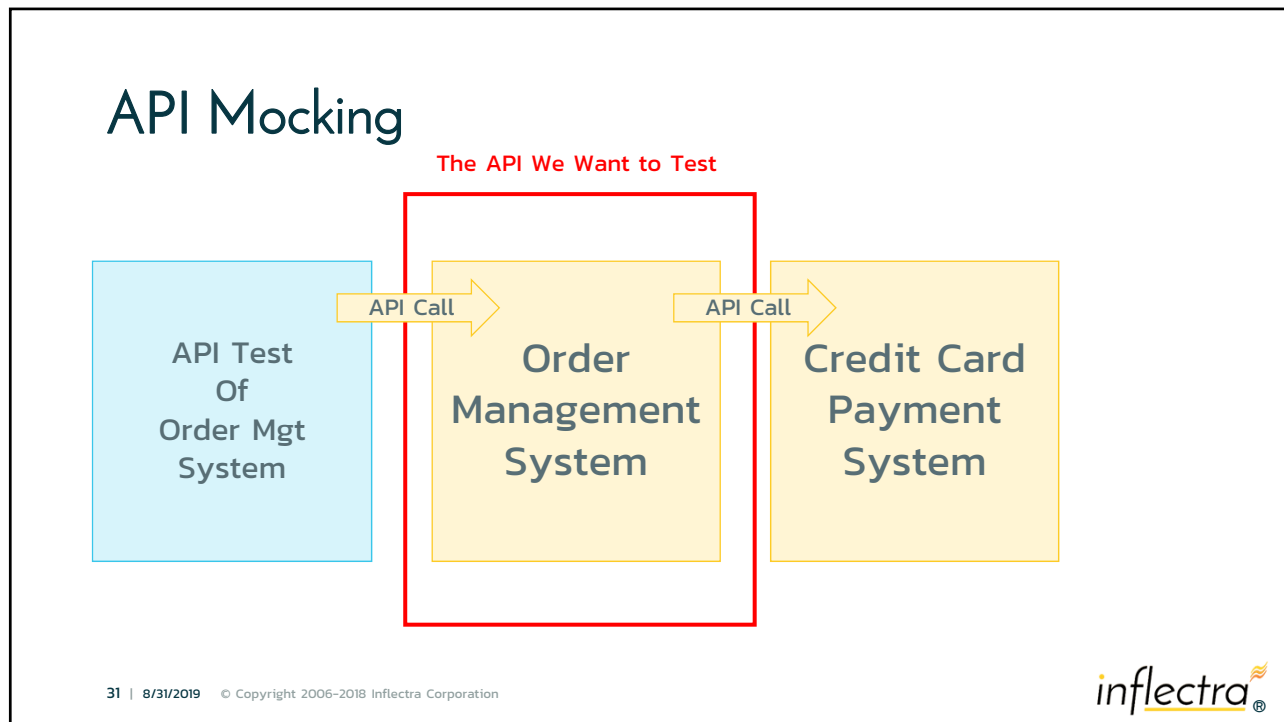


## API Data Formats

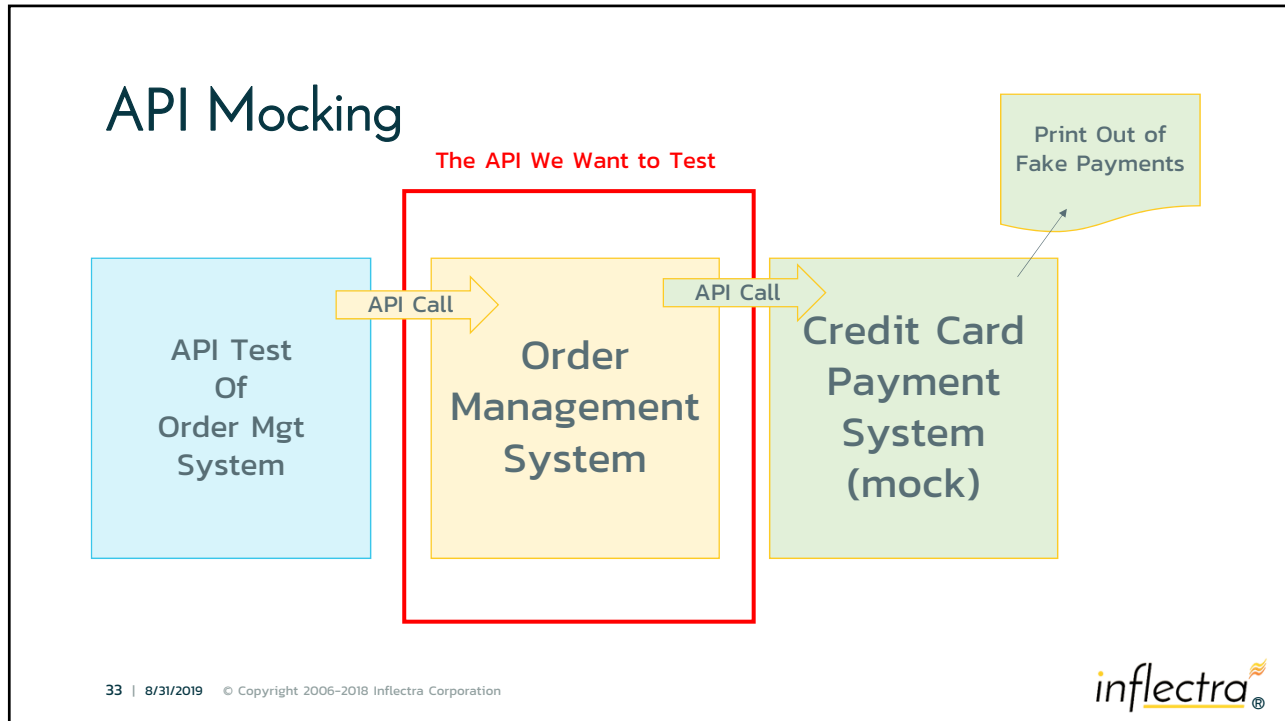
- Some things you may need to test for:
  - Date Formats: 2012-08-01 vs. /Date(2000039843-0500)/
  - Nullable Fields vs. Empty Fields (“” vs. Null vs 0)
  - Missing Fields vs. Null Values (same thing?)
  - Enumerations (Red, Green, Blue) vs literals (“Red”, “Green”, etc.)
  - Binary Data (Base 64 encoded vs. Byte Arrays)
  - Unicode Characters (ëéĆĂŒ—ﻣﻮﺳﻰ)
  - Right-to-left languages (e.g. Hebrew)
  - Lengths (massively large or tiny)
  - Mismatched values (items that belong to wrong categories)

## API Authentication

- Test that the API works appropriately for:
  - Authenticated Users
  - Non-Authenticated Users
  - Authenticated, but not Authorized Users
  - Authenticated and Authorized Users
  - Locked Out Users
  - Users Logged in Multiple Places
- Warning: Check that all values are appropriate for the authorization level
  - E.g. users in project A can access/update IDs in project B ☹️



Suppose We Don't Have a Test Credit Card System, What Should We Do?



# Creating the API Test Plan

Including the Past, Present and Future

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## Scope the Effort

- **Identify the API Endpoints**
  - How Many Versions (v1, v2, v3)
  - How Many Types (SOAP, REST)
  - How Many Formats (XML, JSON)
- **How far back do you support?**
- **What API Endpoints are most widely in use?**
  - Deep, robust tests on 20% most widely used
  - Broad smoke tests on remaining 80%
- **Sample Applications that can be used to scope coverage**

## Plan and Integrate

- **Developers write basic API tests for all coded endpoints**
- **Should cover all operations for all versions in all supported data-formats**
- **New APIs Should Have Unit Tests Written in Parallel**
- **Testers / other developers write additional, deeper tests for the most widely used APIs**
- **Integrate into CI pipeline along with non-API tests**
- **Mock any dependent systems that cannot be run in CI**

## Real Applications

- Don't just rely on coded API tests
- Get real applications / API clients
- Try them out with all versions of the API
- Get old versions of the applications that could be in use
- You will find things that the API tests miss ☹️

## Tooling

- Some tools we have found useful:
  - SOAP API Tests
    - SoapUI
    - Rapise
    - Visual Studio and NUnit
  - REST API Tests
    - Postman
    - Rapise
    - Apigee
    - Rest-Assured
    - JMeter (Load Testing)



# Case Study: SpiraTeam

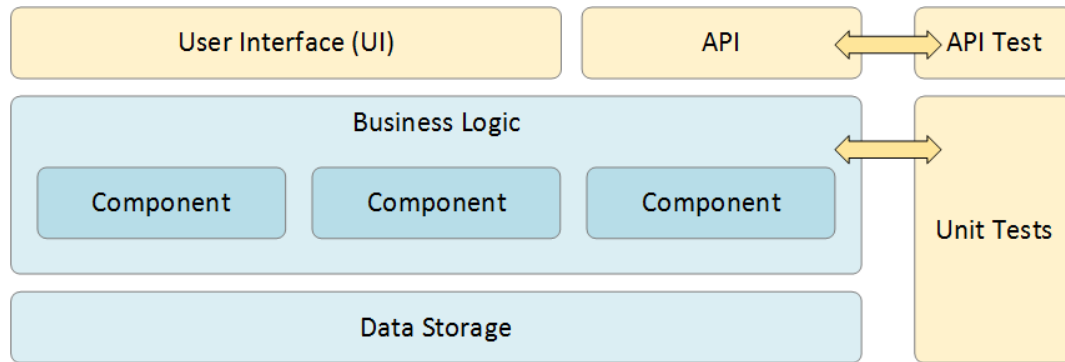
How We Created a Robust API for our Products

## What Formats? REST, SOAP, Versions?

This table provides a list of all the web services available, by version and protocol in this instance:

Protocol	Documentation	Service URL
Version 5.0		
REST	<a href="#">/Services/v5_0/RestService.aspx</a>	<a href="#">/Services/v5_0/RestService.svc</a>
SOAP	<a href="#">/Services/v5_0/SoapService.aspx</a>	<a href="#">/Services/v5_0/SoapService.svc</a>
Version 4.0		
REST	<a href="#">/Services/v4_0/RestService.aspx</a>	<a href="#">/Services/v4_0/RestService.svc</a>
SOAP	<a href="#">/Services/v4_0/ImportExport.aspx</a>	<a href="#">/Services/v4_0/ImportExport.svc</a> <a href="#">/Services/v4_0/DataSync.svc</a>
Version 3.0		
SOAP	<a href="#">/Services/v3_0/ImportExport.aspx</a>	<a href="#">/Services/v3_0/ImportExport.svc</a> <a href="#">/Services/v3_0/DataSync.svc</a>
Version 2.2		
SOAP	<a href="#">/Services/v2_2/ImportExport.asmx</a>	<a href="#">/Services/v2_2/ImportExport.asmx</a>
Version 1.5		
SOAP	<a href="#">/Services/v1_5_2/Import.asmx</a>	<a href="#">/Services/v1_5_2/Import.asmx</a>
Version 1.2		
SOAP	<a href="#">/Services/v1_2/TestExecute.asmx</a>	<a href="#">/Services/v1_2/TestExecute.asmx</a>

## Testing our API - Automated (CI/CD)



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## Testing our API - Automated (Tools)

The screenshot shows the SpiraTest application in Visual Studio. The main window displays a unit test for API authentication:

```

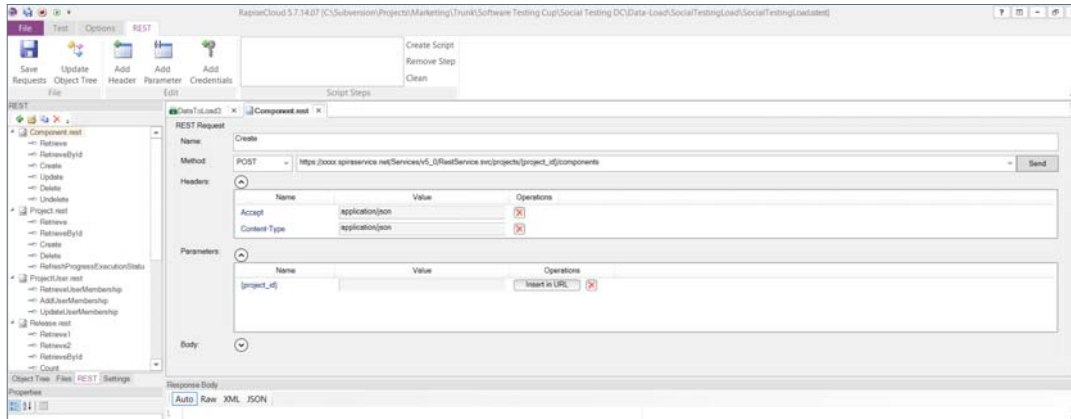
147     }
148     }
149     /// <summary>
150     /// Verifies that you can authenticate as a specific user.
151     /// </summary>
152     [
153     Test,
154     SpiraTestCase(1411)
155     ]
156     public void _01_Authentication()
157     {
158         //First Authenticate as Fred Bloggs (should succeed)
159         bool success = spiraSoapClient.Connection_Authenticate("fredbloggs", "PleaseChange");
160         Assert.IsTrue(success, "Authentication 1 Failed");
161
162         //Next Authenticate as System Administrator (should succeed), specifying the client name
163         success = spiraSoapClient.Connection_Authenticate2("administrator", "PleaseChange", "MyPlugin");
164         Assert.IsTrue(success, "Authentication 2 Failed");
165
166         //Finally Make sure that an invalid authentication fails
167         success = spiraSoapClient.Connection_Authenticate("testtest", "wrongwrong");
168         Assert.IsFalse(success, "Authentication 3 Should Have Failed");
169     }
170
  
```

The Solution Explorer on the right shows the project structure, including the **API Tests** folder containing **V1\_ApiTests**, **V2\_ApiTests**, **V3\_ApiTests**, **V4\_ApiTests**, and **V5\_ApiTests**.

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# Testing our API - Automated (Tools)



# Testing our API - Real Use Cases??

Developer IDEs



Unit Test Frameworks



Build Servers



Bug-Tracking Tools



Modelling Tools



Functional Testing Tools



Legacy Test Management



Performance Testing Tools





## Wrap Up

- API Testing is critical for any software platform business, and very important for almost all organizations
- API Testing requires an understanding of how the API is being “used in the wild”
- You need to work with the product owners and developers to scope the API testing effort appropriately
- Testing with dedicated, automated API tests is necessary, supplemented with real testing using actual client apps

## Further Reading

- <https://www.inflectra.com/Rapise/Highlights/API-Testing.aspx>
- <https://www.inflectra.com/Ideas/Entry/rest-vs-soap-what-did-we-choose-266.aspx>

# Questions?

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Thank you for attending this  
workshop/session.  
*Please fill out an evaluation form.*

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