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# REST API Testing Strategy: What Exactly Should You Test?

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Roy Mor (<https://www.sisense.com/blog/author/roymor/>)

September 23, 2019

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The API layer of any application is one of the most crucial software components. It is the channel which connects client to server (or one microservice to another), drives business processes, and provides the services

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 Mike Conn's famous Test Pyramid (https://www.360logica.com/blog/sneak-peek-test-framework-test-pyramid-testing-pyramid/) places API tests at the service level (integration), which suggests that around 20% or more of all of our tests should focus on APIs (the exact percentage is less important and varies based on our needs).

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Once we have a solid foundation of unit tests which cover individual functions, API tests provide higher reliability covering an interface closer to the user, yet without the brittleness of UI tests.

API tests are fast, give high ROI, and simplify the validation of business logic, security, compliance, and other aspects of the application. In cases where the API is a public one, providing end-users programmatic access to our application or services, API tests effectively become end-to-end tests and should cover a complete user story.

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So the importance of API testing is obvious. Several methods and resources

help with **HOW** to test APIs — manual testing, automated testing, test

environments, tools, libraries, and frameworks. However, regardless of what

you will use, **Postman**, **Supertest**, **JMeter**, **mocha**, **Jasmine**, **RestAssured**, or

any other tools of the trade — before coming up with any test method you

need to determine **what to test...**

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## API test strategy

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The test strategy is the high-level description of the test requirements from

which a detailed test plan can later be derived, specifying individual test

scenarios and test cases. Our first concern is **functional testing** — ensuring that the API functions correctly.

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The main objectives in functional testing of the API are:

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resources and their types correctly reflect the object model, that the

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- and principles (here (<https://techbeacon.com/app-dev-testing/guide-restful-api-design-35-must-reads>), here (<https://restfulapi.net/rest-api-design-tutorial-with-example/>), and here (<https://hackernoon.com/restful-api-designing-guidelines-the-best-practices-60e1d954e7c9>)).

(<https://www.sisense.com/blog/combating->

(<https://www.sisense.com/blog/modernize-your-etl-processes-discover-better-insights/>) a new version of the API someday (e.g., /api/v2/), but even then backward compatibility might still be a requirement).

# So, what aspects of the API should we test?

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 Now that we have validated the API contract, we are ready to think of what to test. Whether you're thinking of test automation or manual testing, our function test cases have the same **test actions**, are part of wider **test scenario categories**, and belong to one of three kinds of **test flows**.

(<https://www.sisense.com/blog/enterprise-data-management-driving-large-scale-developments-in-business-analytics-data-to-an-on-prem-database-with-skyvia/>)

## API test actions

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Each test is comprised of test actions. These are the individual actions a test needs to take per API test flow. For each API request, the test would need to take the following actions:

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**1. Verify correct HTTP status code.** For example, creating a resource should return 201 CREATED and unpermitted requests should return 403 FORBIDDEN, etc.

**2. Verify response payload.** Check valid JSON body and correct field names, types, and values — including in error responses.

**3. Verify response headers.** HTTP server headers have implications on both security and performance.

**4. Verify correct application state.** This is optional and applies mainly to manual testing, or when a UI or another interface can be easily inspected.

**5. Verify basic performance sanity.** If an operation was completed successfully but took an unreasonable amount of time, the test fails.

## Test scenario categories

Our test cases fall into the following general *test scenario* groups:

(https://www.sisense.com/blog/combating-covid-with-embedded-advanced-analytics-extended-positive-testing-with-optional-parameters)

## Extended positive testing with optional parameters

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- Security, authorization, and permission tests (which are out of the scope of this post)

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API. We later extend positive tests to include optional parameters and extra functionality. The next group of tests is **negative testing** where we expect the application to gracefully handle problem scenarios with both valid user input (for example, trying to add an existing username) and invalid user input (trying to add a non-existent username).

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**Destructive testing** is a deeper form of negative testing, where we intentionally attempt to break the API to check its robustness in business analytics, data analysis and Sisense. For example, sending a huge payload body in an attempt to overflow the system.

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## Test flows

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**1. Testing requests in isolation** – Executing a single API request and checking the response accordingly. Such basic tests are the minimal building blocks we should start with, and there's no reason to continue testing if these tests fail.

**2. Multi-step workflow with several requests** – Testing a series of requests which are common user actions, since some requests can rely on other ones. For example, we execute a POST request that creates a resource and returns an identifier in its response. We then use this identifier to check if this resource is present in the list of elements received by a GET request. Then

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(<https://www.sisense.com/blog/combating-covid-with-embedded-advanced-analytics-sisense/>) to update new data, and we again invoke a GET request to validate the new data. Finally, we DELETE that resource and use GET again to verify it no longer exists.

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**Combining API and Web UI tests** – This is mostly relevant to manual testing, where we want to ensure data integrity and consistency between the UI and API. You can see this in action better-

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We execute requests via the API and verify the actions through the web app UI and vice versa. The purpose of these integrity test flows is to ensure that

- Enterprise Data Management — Driving Large-Scale Change in Your Organization although the resources are affected via different mechanisms the system still maintains expected integrity and consistent flow. (<https://www.sisense.com/blog/enterprise-data-management-driving-large-scale-change-in-your-organization/>)

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## An API example and a test matrix

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Let's assume a subset of our API is the /users endpoint, which includes the following API calls:

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API Call	Action
<input type="checkbox"/> GET /users	List all users
GET /users?name={username}	Get user by username
GET /users/{id}	Get user by ID
Subscribe GET /users/{id}/configurations	Get all configurations for user
POST /users/{id}/configurations	Create a new configuration for user
DELETE /users/{id}/configurations/{id}	Delete configuration for user
• PATCH /users/{id}/configurations/{id}	Update configuration for user

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 I would demand all GET endpoints allow optional query parameters *filter*, *sort*, *skip* and *limit* for filtering, sorting, and pagination.

#	Test Scenario Category	Test Action Category	Test Action Description
1	Basic positive tests (happy paths) ( <a href="https://www.sisense.com/get/watch-demos/">https://www.sisense.com/get/watch-demos/</a> )	See Sisense in Action	
	Enterprise Data Management — Driving Large-Scale Change in Your Organization ( <a href="https://www.sisense.com/blog/enterprise-data-management-driving-large-scale-change-in-your-organization/">https://www.sisense.com/blog/enterprise-data-management-driving-large-scale-change-in-your-organization/</a> )	Validate status code:	1. All requests should return 2XX HTTP status code  2. Returned status code is according to spec: – 200 OK for GET requests – 201 for POST or PUT requests creating a new resource – 200, 202, or 204 for a DELETE operation and so on
	Moving Data to an On-Prem Database with Skyvia ( <a href="https://www.sisense.com/blog/moving-data-to-an-on-prem-database-with-skyvia/">https://www.sisense.com/blog/moving-data-to-an-on-prem-database-with-skyvia/</a> )		
	Email Address	Validate payload:	1. Response is a well-formed JSON object
	<input type="checkbox"/> I agree to receive marketing and other emails from Sisense.  Subscribe		2. Response structure is according to data model (schema validation: field <b>names</b> and field <b>types</b> are as expected, including nested objects; field <b>values</b> are as expected; non-nullable fields are not null, etc.)

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<a href="https://www.sisense.com/covid-with-embedded-advanced-analytics-sisense/">(https://www.sisense.com/covid-with-embedded-advanced-analytics-sisense/)</a>	Validate state:	1. For GET requests, verify there is NO STATE CHANGE in the system (idempotence)
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<p>(<a href="https://www.sisense.com/covid-with-embedded-advanced-analytics-sisense/">https://www.sisense.com/covid-with-embedded-advanced-analytics-sisense/</a>)</p>	<p>Validate headers:</p>	<p>Verify that HTTP headers are as expected, including</p>
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<p><b>Related Posts</b></p> <p>• Combatting COVID with Embedded Advanced Analytics</p> <p>(<a href="https://www.sisense.com/blog/combattling-covid-with-embedded-advanced-analytics-sisense/">https://www.sisense.com/blog/combattling-covid-with-embedded-advanced-analytics-sisense/</a>)</p>	<p>Performance sanity:</p> <p>• Combatting COVID with Embedded Advanced Analytics</p> <p>(<a href="https://www.sisense.com/blog/combattling-covid-with-embedded-advanced-analytics-sisense/">https://www.sisense.com/blog/combattling-covid-with-embedded-advanced-analytics-sisense/</a>)</p>	<p>Response is received in a timely manner (within reasonable expected time) — as defined in the test plan.</p>

<p>(<a href="https://www.sisense.com/blog/2020/07/19/rest-api-testing-strategy-what-exactly-should-you-test/">https://www.sisense.com/blog/2020/07/19/rest-api-testing-strategy-what-exactly-should-you-test/</a>)</p> <p><b>2. Positive and optional parameters</b></p>	<p>Advanced analytics- sisense.com</p>	
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	<p>Validate status code:</p>	<p>As in #1</p>

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<p>Email Address</p> <p><input type="checkbox"/> I agree to receive marketing update a resource and other emails from Sisense (e.g., rename a configuration to an existing name)</p> <p>Subscribe</p> <p>– Attempting illegal operation (e.g., delete a user configuration without permission.)</p>		
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<p>Email Address</p>		<p>3. Verify that there is a clear, descriptive error message/description field</p>
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<p>Boundary value testing</p> <ul style="list-style-type: none"> <li>Modernize Your ETL Processes, Discover Better Insights (https://www.sisense.com/blog/modernize-your-etl-processes-discover-better-)</li> <li>Enterprise Data Management — Driving Large-Scale Change in Your Organization (https://www.sisense.com/blog/enterprise-data-management-driving-large-scale-change-in-your-organization/)</li> <li>Moving Data to an On-Prem Database with Skyvia (https://www.sisense.com/blog/moving-data-to-an-on-prem-database-with-skyvia/)</li> </ul>	<p>Watch a Demo</p> <p>See Sisense in Action</p> <p>Subscribe to Our Blog</p> <p>Using incorrect HTTP headers (e.g. Content-Type)</p> <p>Sign up to get the latest news and developments in business analytics, data analysis and Sisense.</p>	<p>Empty payload</p> <p>Empty sub-objects in payload</p> <p>Illegal characters in parameters or payload</p> <p>Small concurrency tests, concurrent API calls that write to the same resources (DELETE + PATCH, etc.) and other emails from Sisense.</p>	<p>○</p>
<input type="checkbox"/>	<p>Email Address</p>	<p>Validate status code:</p>	<p>As in #3. API should fail gracefully.</p>
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- Test cases derived from the table above should cover different **test flows** according to our needs, resources, and priorities.

## Going Beyond Functional Testing

Following the test matrix above should generate enough test cases to keep us busy for a while and provide good functional coverage of the API. Passing all functional tests implies a good level of maturity for an API, but it is not enough to ensure high quality and reliability of the API.

In the next post in this series we will cover the following **non-functional test approaches** which are essential for API quality:

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## Security and Authorization

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  - Check that the API is designed according to correct security principles: deny-by-default, fail securely, least privilege principle, reject all illegal inputs, etc.
    - Positive: ensure API responds to correct authorization via all agreed auth methods – Bearer token, cookies, digest, etc. – as defined in spec
    - Negative: ensure API refuses all unauthorized calls

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- Role Permissions: ensure that specific endpoints are exposed to user based on role. API should refuse calls to endpoints which are not permitted for user's role  
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(<https://www.sisense.com/blog/covid-with-embedded-advanced-analytics-protocol-check-http/https-according-to-spec>)



• **Data leaks:** ensure that internal data representations that are desired to

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## Performance

• Check response time, latency, TTFB/TTLB in various scenarios (in

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## Load Tests (positive), Stress Tests

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• Find capacity limit points and ensure the system performs as expected

under load, and fails gracefully under stress

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## Usability Tests

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- For public APIs: a manual “Product”-level test going through the entire

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`void PS_Wykresl()`

```
Pen(this.PS_Kolor, this.PS_RodzajLinii;  
this.PS_pioro, (ps_x - ps_Margines, ps_y - ps_Margines);
```

## Overcoming Common Challenges in Natural Language Processing

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Tips for Overcoming Natural Language Processing Challenges

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