

Test the REST

Testing RESTful web services using REST Assured

An open source workshop by ...

What are we going to do?

- _RESTful APIs

- _REST Assured

- _Hands-on exercises

Preparation

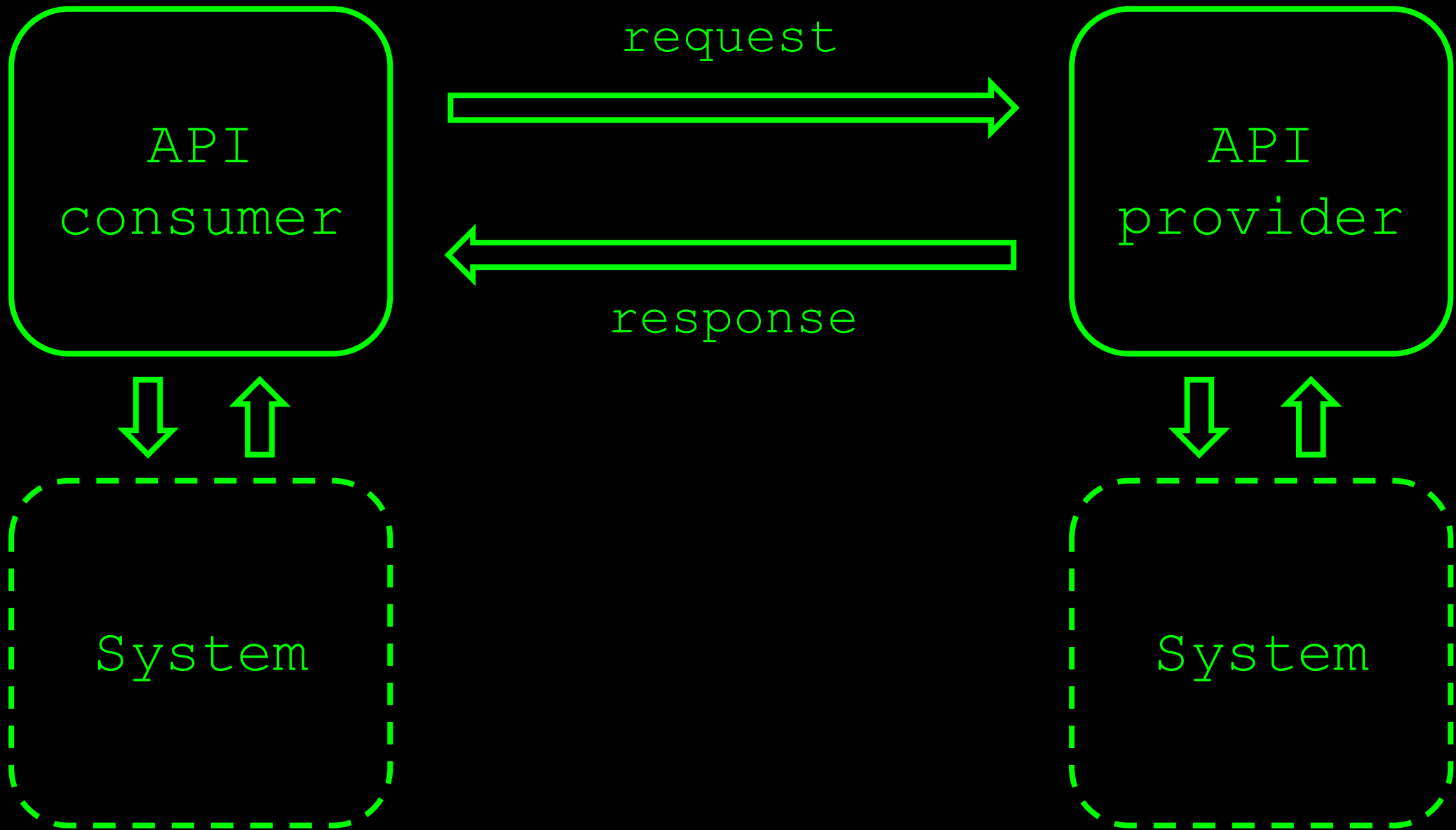
- _ Install a recent JDK (17)

- _ Install IntelliJ (or any other IDE)

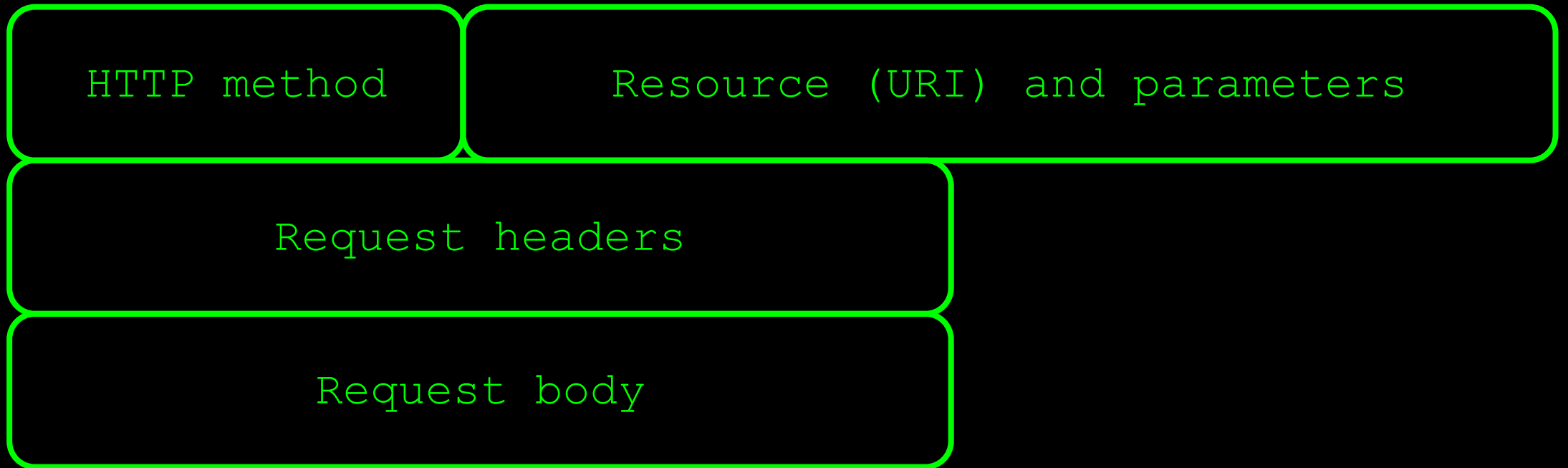
- _ Import Maven project into your IDE

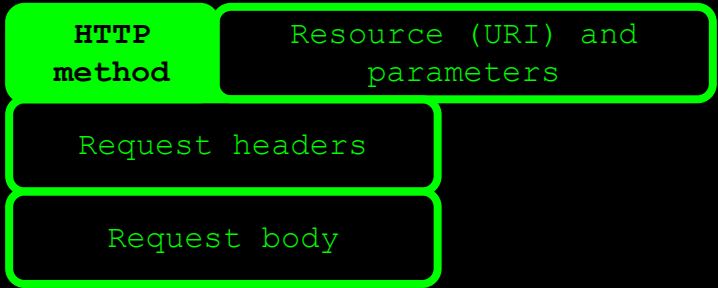
 - _ <https://github.com/basdijkstra/rest-assured-workshop>

(RESTful) APIs are
commonly used to
exchange data between
two parties



A REST API request





HTTP methods

_GET, POST, PUT, PATCH, DELETE, OPTIONS, ...

_CRUD operations on data

POST Create

GET Read

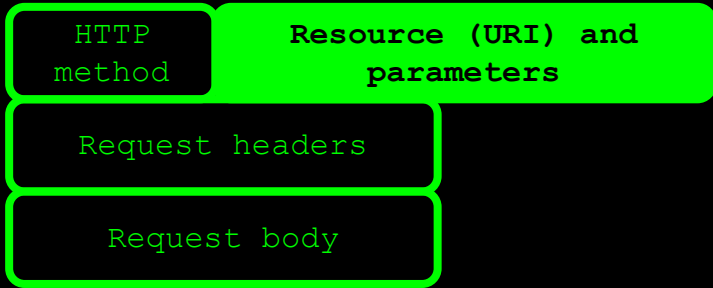
PUT / PATCH Update

DELETE Delete

...

...

_Conventions, not standards!



Resources and parameters

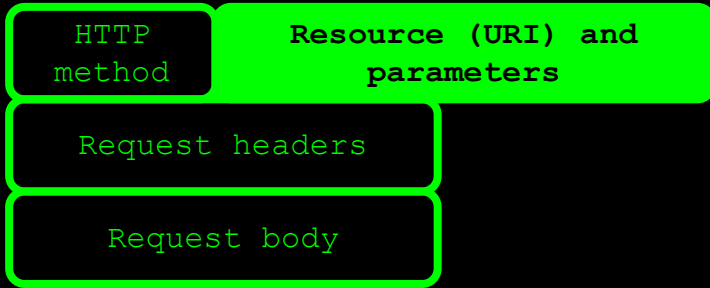
_Uniform Resource Identifier

_Uniquely identifies the resource to operate on

_Can contain parameters

_Query parameters

_Path parameters



Resources and parameters

_ Path parameters

_ `http://api.zippopotam.us/us/90210`

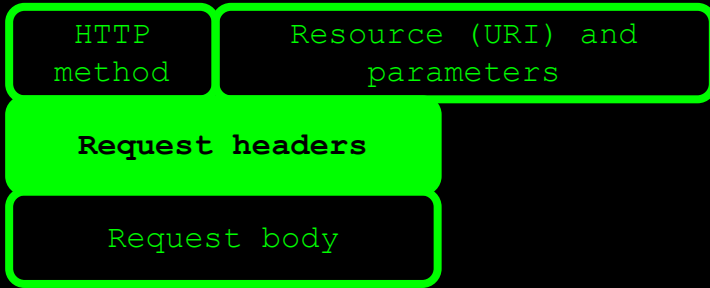
_ `http://api.zippopotam.us/ca/B2A`

_ Query parameters

_ `http://md5.jsontest.com/?text=testcaseOne`

_ `http://md5.jsontest.com/?text=testcaseTwo`

_ There is no official standard!



Request headers

- _ Key-value pairs

- _ Can contain metadata about the request body

- _ Content-Type (what data format is the request body in?)

- _ Accept (what data format would I like the response body to be in?)

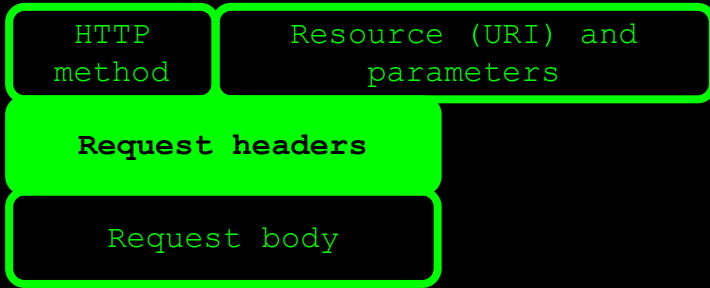
- _ ...

- _ Can contain session and authorization data

- _ Cookies

- _ Authorization tokens

- _ ...



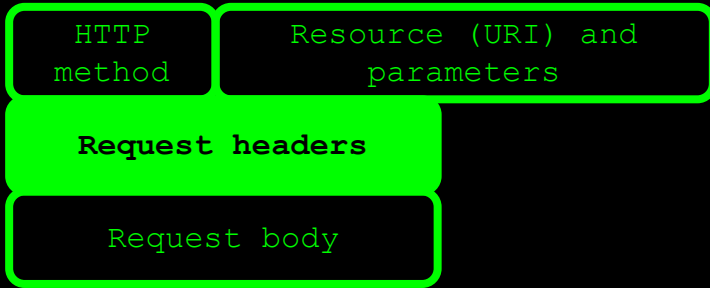
Authorization: Basic

_Username and password sent with every request

_Base64 encoded (not really secure!)

_Ex: username = aladdin and password = opensesame

Authorization: Basic YWxhZGRpbjpvcGVuc2VzYW1l



Authorization: Bearer

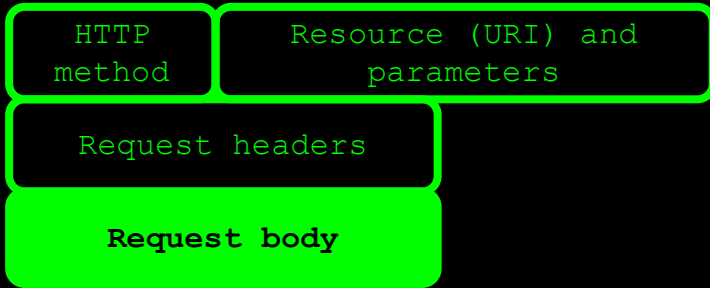
_Token with limited validity is obtained first

_Token is then sent with all subsequent requests

_Most common mechanism is OAuth(2)

_JWT is a common token format

Authorization: Bearer RsT50jbzRn430zqMLgV3Ia



Request body

- Data to be sent to the provider

- REST does not prescribe a specific data format

- Most common:

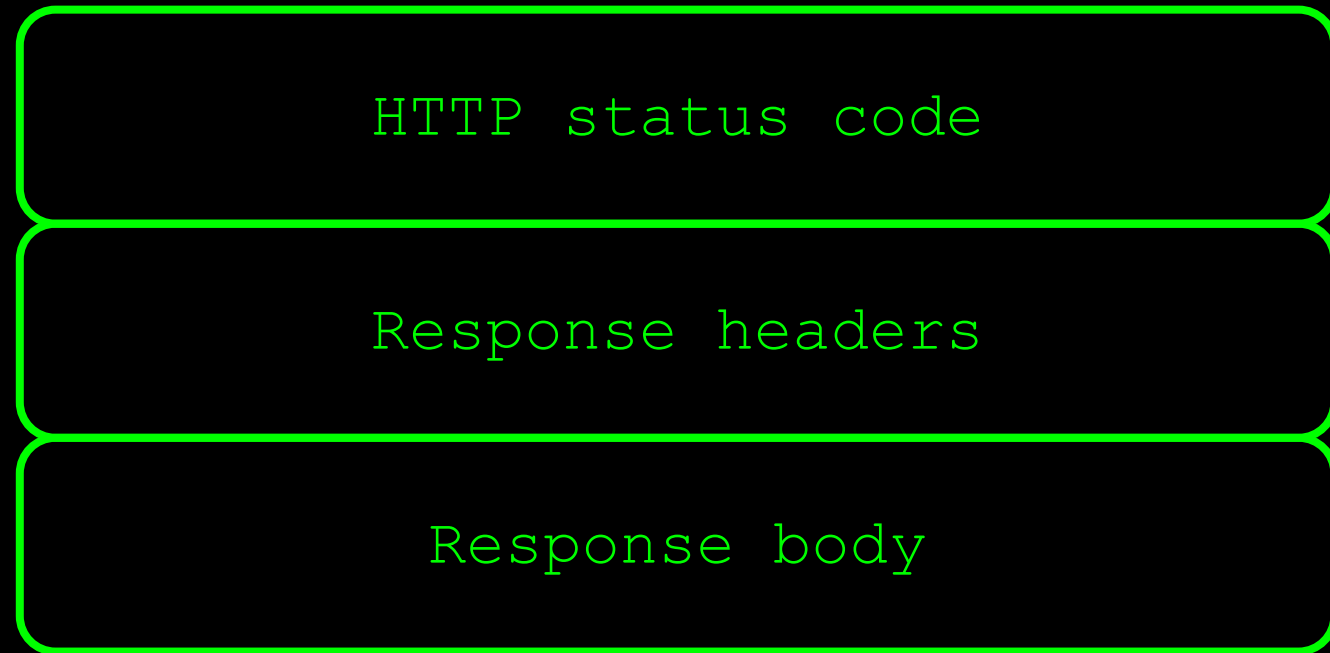
- JSON

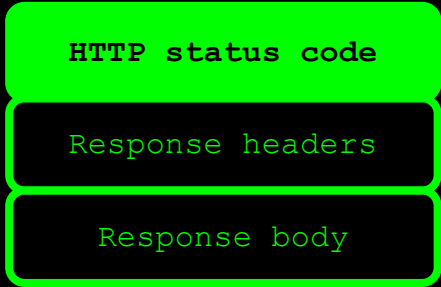
- XML

- Plain text

- Other data formats can be sent using REST, too

A REST API response





HTTP status code

— Indicates result of request processing by provider

— Five different categories

— 1XX	Informational	100 Continue
— 2XX	Success	200 OK
— 3XX	Redirection	301 Moved Permanently
— 4XX	Client errors	400 Bad Request
— 5XX	Server errors	503 Service Unavailable

HTTP status code

Response headers

Response body

Response headers

- _Key-value pairs

- _Can contain metadata about the response body

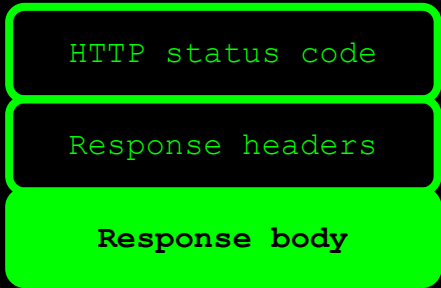
 - _Content-Type (what data format is the response body in?)

 - _Content-Length (how many bytes in the response body?)

- _Can contain provider-specific data

 - _Caching-related headers

 - _Information about the server type



Response body

- _ Data returned by the provider

- _ REST does not prescribe a specific data format

- _ Most common:

- _ JSON

- _ XML

- _ Plain text

- _ Other data formats can be sent using REST, too

An example

_GET http://ergast.com/api/f1/2018/drivers.json

```
{
  - MRData: {
    xmlns: "http://ergast.com/mrd/1.4",
    series: "f1",
    url: "http://ergast.com/api/f1/2018/drivers.json",
    limit: "30",
    offset: "0",
    total: "20",
    - DriverTable: {
      season: "2018",
      - Drivers: [
        - {
          driverId: "alonso",
          permanentNumber: "14",
          code: "ALO",
          url: "http://en.wikipedia.org/wiki/Fernando_Alonso",
          givenName: "Fernando",
          familyName: "Alonso",
          dateOfBirth: "1981-07-29",
          nationality: "Spanish"
        },
        - {
          driverId: "bottas",
          permanentNumber: "77",
          code: "BOT"
```

×	Headers	Preview	Response	Timing
▼ General				
Request URL: http://ergast.com/api/f1/2018/drivers.json				
Request Method: GET				
Status Code: 200 OK				
Remote Address: 81.27.85.129:80				
Referrer Policy: no-referrer-when-downgrade				
▼ Response Headers view source				
Access-Control-Allow-Origin: *				
Connection: close				
Content-Length: 4494				
Content-Type: application/json; charset=utf-8				
Date: Tue, 29 Jan 2019 09:39:19 GMT				
Server: Apache/2.2.15 (CentOS)				
X-Powered-By: PHP/5.3.3				
▼ Request Headers view source				
Accept: text/html,application/xhtml+xml,application/xml				

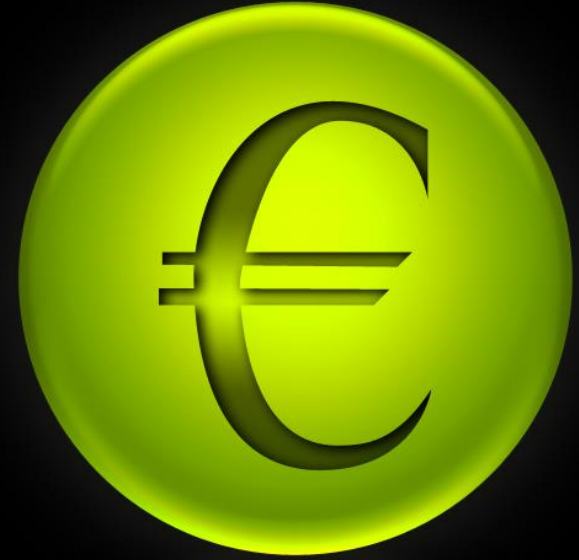
Where are APIs used?



Mobile



Internet of
Things



API economy

Where are APIs used?



Web
applications



Microservices
architectures

Why I ♥ testing at the API level

- _Tests run much faster than UI-driven tests

- _Tests are much more stable than UI-driven tests

- _Tests have a broader scope than unit tests

- _Business logic is often exposed at the API level

Tools for testing RESTful APIs

_Free / open source

- _ Postman
- _ SoapUI
- _ Code libraries like REST Assured, RestSharp, requests
- _ ...

_Commercial

- _ Parasoft SOAtest
- _ SoapUI Pro
- _ ...

_Build your own (using HTTP libraries for your language of choice)

REST Assured

- _ Java DSL for writing tests for RESTful APIs
- _ Removes a lot of boilerplate code
- _ Runs on top of common unit testing frameworks
 - _ JUnit, TestNG
- _ Developed and maintained by Johan Haleby

Configuring REST Assured

_Download from <http://rest-assured.io>

_Add as a dependency to your project

_Maven

_Gradle

```
<dependency>
  <groupId>io.rest-assured</groupId>
  <artifactId>rest-assured</artifactId>
  <version>5.1.1</version>
  <scope>test</scope>
</dependency>
```


REST Assured documentation

_Usage guide

_ <https://github.com/rest-assured/rest-assured/wiki/Usage>

_Links to other documentation (JavaDoc, getting started, release notes)

_ <http://rest-assured.io>

A sample test

REST Assured uses JUnit (this could also be TestNG)

```
@Test
public void getUserData_verifyName_shouldBeLeanneGraham() {

    given(). Make an HTTP GET call to retrieve data from the provider
    when().
        get(s: "http://jsonplaceholder.typicode.com/users/1"). // Do a GET call to the specified resource
    then().
        assertThat() // Assert that the value of the element 'name'
        body(s: "name", equalTo(operand: "Leanne Graham")); // in the response body equals 'Leanne Graham'
}
```

Perform an assertion on the returned response (here: on the JSON response payload)

REST Assured features

- _Support for all HTTP methods (GET, POST, PUT, ...)
- _Support for Gherkin (Given/When/Then)
- _Use of Hamcrest matchers for checks (*equalTo*)
- _Use of Jsonpath/GPath for selecting elements from JSON response

```
@Test
public void getUserData_verifyName_shouldBeLeanneGraham() {

    given().
    when().
        get(s: "http://jsonplaceholder.typicode.com/users/1"). // Do a GET call to the specified resource
    then().
        assertThat(). // Assert that the value of the element 'name'
            body(s: "name", equalTo(operand: "Leanne Graham")); // in the response body equals 'Leanne Graham'
}
```

About Hamcrest matchers

_Express expectations in natural language

_Examples:

<code>equalTo(X)</code>	Does the object equal X?
<code>hasItem("Rome")</code>	Does the collection contain an item "Rome"?
<code>hasSize(3)</code>	Does the size of the collection equal 3?
<code>not(equalTo(X))</code>	Inverts matcher <code>equalTo()</code>

_ <http://hamcrest.org/JavaHamcrest/javadoc/1.3/org/hamcrest/Matchers.html>

About GPath

- _ JsonPath is a query language for JSON documents
 - _ REST Assured uses the GPath implementation of JsonPath
- _ Similar aims and scope as XPath for XML
- _ Documentation and examples:
 - _ http://groovy-lang.org/processing-xml.html#_gpath
 - _ <http://groovy.jmiguuel.eu/groovy.codehaus.org/GPath.html>

GPath example

```
{
  "id": 1,
  "name": "Leanne Graham",
  "username": "Bret",
  "email": "Sincere@april.biz",
  "address": {
    "street": "Kulas Light",
    "suite": "Apt. 556",
    "city": "Gwenborough",
    "zipcode": "92998-3874",
    "geo": {
      "lat": "-37.3159",
      "lng": "81.1496"
    }
  },
  "phone": "1-770-736-8031 x56442",
  "website": "bildeard.org"
```

`body("address.geo.lat", equalTo("-37.3159"));`

Validating technical response data

_ HTTP status code

_ Response Content-Type header

_ Other headers and their value

_ Cookies and their value

_ ...

```
@Test
public void getUserData_verifyStatusCodeAndContentType() {

    given().
    when().
        get(s: "http://jsonplaceholder.typicode.com/users/1").
    then().
        assertThat().
            statusCode(200).
    and().
        contentType(ContentType.JSON);
}
```

Logging request data

```
@Test
public void logAllRequestData() {

    given() .
        log().all().
    when() .
        get(s: "http://jsonplaceholder.typicode.com/users/1") .
    then() .
        assertThat() .
        body(s: "name", equalTo(operand: "Leanne Graham"));
}
```

log().all() after *given()* logs all request data to the console

You can also use *log().body()*,
log().headers() as well as other options

Logging request data

```
@Test
public void logAllRequestData() {

    given().
        log().all().
    when().
        get(s: "http://jsonplaceholder.typicode.com/users/1")
    then().
        assertThat().
        body(s: "name", is("test"))
}
```

Request method:	GET
Request URI:	http://jsonplaceholder.typicode.com/users/1
Proxy:	<none>
Request params:	<none>
Query params:	<none>
Form params:	<none>
Path params:	<none>
Headers:	Accept=*
Cookies:	<none>
Multiparts:	<none>
Body:	<none>

Logging response data

```
@Test
public void logAllResponseData() {

    given().
    when().
        get(s: "http://jsonplaceholder.typicode.com/users/1").
    then().
        log().all().
    and().
        assertThat().
        body(s: "name", equalTo(operand: "Leanne Graham"));
}
```

log().all() after *then()* logs all response data to the console

You can also use *log().body()*,
log().headers() as well as other options

Logging response data

```
@Test
public void logAllResponseData() {

    given().
    when().
        get(s: "http://jsonplaceholder.
    then().
        log().all().
    and().
        assertThat().
            body(s: "name", equalTo(operand:
}
```

```
HTTP/1.1 200 OK
Date: Wed, 28 Oct 2020 16:37:56 GMT
Content-Type: application/json; charset=utf-8
Transfer-Encoding: chunked
Connection: keep-alive
Set-Cookie: __cfduid=ddc99ce478f9e81d2e127ecfaf86376851603903076
X-Powered-By: Express
X-Ratelimit-Limit: 1000
X-Ratelimit-Remaining: 993
X-Ratelimit-Reset: 1598842094
Vary: Origin, Accept-Encoding
Access-Control-Allow-Credentials: true
Cache-Control: max-age=43200
Pragma: no-cache
Expires: -1
X-Content-Type-Options: nosniff
Etag: W/"1fd-+2Y3G3w049iSZtw5t1mzSnunngE"
Via: 1.1 vegur
CF-Cache-Status: HIT
Age: 15396
cf-request-id: 0611abd0ce0000e668cd9360000000001
Report-To: {"endpoints":[{"url":"https://a.nel.cloudflare.com/"}]}
NEL: {"report_to":"cf-nel","max_age":604800}
Server: cloudflare
CF-RAY: 5e9615947bb2e668-LHR
Content-Encoding: gzip

{
  "id": 1
```

Our API under test

_(Simulation of) an online banking API

_Customer data (GET, POST)

_Account data (POST, GET)

_RESTful API



Demo

- _How to use the test suite
 - _Executing your tests
 - _Reviewing test results

Now it's your turn!

_src > test > java > exercises > RestAssuredExercises1Test.java

_Simple checks

- _ Validating individual elements
- _ Validating collections and items therein
- _ Validating technical response properties

_Stubs are predefined

- _ Don't worry about the references to <http://localhost>
- _ You only need to write the tests using REST Assured

_Answers are in answers > RestAssuredAnswers1Test.java

_Examples are in examples > RestAssuredExamples.java

Parameters in RESTful web services

_Path parameters

_ `http://api.zippopotam.us/us/90210`

_ `http://api.zippopotam.us/ca/B2A`

_Query parameters

_ `http://md5.jsontest.com/?text=testcaseOne`

_ `http://md5.jsontest.com/?text=testcaseTwo`

_There is no official standard!

Using query parameters

`_GET http://md5.jsontest.com/?text=testcase`

```
@Test
public void useQueryParameter() {

    given().                                     Define a query parameter and its value
        queryParam(s: "text", ...objects: "testcase").
    when().
        get(s: "http://md5.jsontest.com").
    then().
        assertThat().
        body(s: "md5", equalTo(operand: "7489a25fc99976f06fecb807991c61cf"));
}
```


Using path parameters

`_GET http://jsonplaceholder.typicode.com/users/1`

```
@Test
public void usePathParameter() {

    given().      Define a (custom) path parameter name and the parameter value
        pathParam(s: "userId", o: 1).
    when().
        get(s: "http://jsonplaceholder.typicode.com/users/{userId}").
    then().
        assertThat().      Define the location of the path parameter
                           using the chosen name between {}
        body(s: "name", equalTo(operand: "Leanne Graham"));
}
```

Exchange data between consumer and provider

GET to retrieve data from provider, POST to send data to provider, ...

APIs are all about data

Business logic and calculations often exposed through APIs

Run the same test more than once...

... for different combinations of input and
expected output values

Parameterized testing

More efficient to do this at the API level...

... as compared to doing this at the UI level

'Feeding' test data to your test

```
@ParameterizedTest
```

```
@CsvSource({
```

```
    "1, Leanne Graham",
```

```
    "2, Ervin Howell",
```

```
    "3, Clementine Bauch"
```

```
})
```

```
public void checkNameForUser
```

```
(int userId, String expectedUserName) {
```

```
    given().
```

```
        pathParam(s: "userId", userId).
```

```
    when().
```

```
        get(s: "http://jsonplaceholder.typicode.com/users/{userId}").
```

```
    then().
```

```
        assertThat().
```

```
        body(s: "name", equalTo(expectedUserName)).
```

```
}
```

Define test data in the @CsvSource annotation (one record for every iteration, parameters separated by commas)

Use parameters to pass the test data values into the method

Use parameters in the test method where required

Running the data driven test

```
@ParameterizedTest
@CsvSource({
    "1, Leanne Graham",
    "2, Ervin Howell",
    "3, Clementine Bauch"
})
```

```
public void checkNameForUser
```

```
(int userId, String expectedUserName) {
```

```
    given().
```

```
        pathParam(s: "userId", userId).
```

```
    when().
```

```
        get(s: "http://jsonplaceholder.typicode.com/users/{userId}").
```

```
    then().
```

```
        assertThat().
```

```
        body(s: "name", equalTo(expectedUserName));
```

```
}
```

✓	checkNameForUser(int, String)	3 sec 11 ms
✓	[1] 1, Leanne Graham	2 sec 893 ms
✓	[2] 2, Ervin Howell	62 ms
✓	[3] 3, Clementine Bauch	56 ms

The test method is run three times, once for each array ('test case') in the test data set

Now it's your turn!

_src > test > java > exercises > RestAssuredExercises2Test.java

_Data driven tests

_Creating a test data object using @CsvSource

_Using test data to call the right URI

_Using test data in assertions

_Answers are in answers > RestAssuredAnswers2.java

_Examples are in examples > RestAssuredExamples.java

Authentication

- _Securing web services

- _Most common authentication schemes:

 - _Basic authentication (username / password)

 - _OAuth(2)

Basic authentication

```
@Test
public void useBasicAuthentication() {

    given() .
        auth().
            preemptive().
            basic(s: "username", s1: "password").
    when() .
        get(s: "https://my.secure/api").
    then() .
        assertThat().
            statusCode(200);
}
```

Adding *preemptive()* makes REST Assured send the credentials directly, saving us from dealing with the provider challenging mechanism

OAuth (2)

```
@Test
public void useOAuthAuthentication() {

    given() .                                The authentication token is typically
        auth() .                             retrieved prior to running the tests to
        oauth2 ( S: "myAuthenticationToken") . ensure that a valid token is used

    when() .
        get ( S: "https://my.very.secure/api") .
    then() .
        assertThat() .
        statusCode(200) ;
}
```

Sharing variables between tests

_Example: uniquely generated IDs

_First call returns a unique ID (e.g. a new user ID)

_Second call needs to use this generated ID

_Since there's no way to predict the ID, we need to capture and reuse it

Sharing variables between tests

```
@Test
public void captureAndReuseUserId() {

    String userId =

        given() .
        when() .
            post( s: "http://my.user.api/user") .
        then() .
            extract() .
            path( s: "id" );

    given() .
        pathParam( s: "userId", userId) .
    when() .
        get( s: "http://my.user.api/user/{userId}") .
    then() .
        assertThat() .
            statusCode(200) ;
}
```

The return value can be stored in a variable...

path() takes a GPath expression to extract the required value

... and reused at a later point in time

RequestSpecifications

_
Reuse shared properties shared by many calls

_
Base URI

_
Port

_
Authentication data

_
...

Defining and using RequestSpecifications

```
private RequestSpecification requestSpec;
```

```
@BeforeEach
```

```
public void createRequestSpec() {
```

```
    requestSpec =
```

```
        new RequestSpecBuilder().
```

```
            setBaseUrl("http://api.zippopotam.us").
```

```
            setPort(9876).
```

```
            build(); Build your RequestSpecification using the Builder pattern...
```

```
}
```

```
@Test
```

```
public void useRequestSpec() {
```

```
    given().
```

```
        spec(requestSpec).
```

```
    when().
```

```
        get(s: "/us/90210.json").
```

```
    then().
```

```
        assertThat().
```

```
            statusCode(200);
```

```
}
```

... and use it by calling
spec() in the given()
section of your test

Sharing checks between tests

_Example: checking status code and MIME type for all responses

_Another maintenance burden if specified individually for each test

_What if we could specify this once and reuse throughout our tests?

Using a
ResponseSpecification

```
@BeforeEach
public void createResponseSpec() {

    responseSpec =
        new ResponseSpecBuilder().
            expectStatusCode(200).
            expectContentType(ContentType.JSON).
            build();
}
```

Build your ResponseSpecification using the Builder pattern...

```
@Test
public void useResponseSpec() {

    given().
    when().
        get(s: "http://jsonplaceholder.typicode.com/users/1").
    then().
        spec(responseSpec).
    and().
        body(s: "name", equalTo(operand: "Leanne Graham"));
}
```

... and use it by calling
spec() in the *then()*
section of your test

Now it's your turn!

_src > test > java > exercises > RestAssuredExercises3Test.java

_Apply value reuse as shown in the slides

_Use basic and OAuth authentication schemes

_Answers are in answers > RestAssuredAnswers3Test.java

_Examples are in examples > RestAssuredExamples.java

XML support

- So far, we've only used REST Assured on APIs that return JSON

- It works just as well with XML-based APIs

- Identification of response elements uses XmlPath instead of JsonPath

- No need for additional configuration

- REST Assured uses response content type header value to determine how to process a response body

XmlPath - examples

```
<?xml version="1.0" encoding="UTF-8" ?>
<cars>
  <car make="Alfa Romeo" model="Giulia">
    <country>Italy</country>
    <year>2016</year>
  </car>
  <car make="Aston Martin" model="DB11">
    <country>UK</country>
    <year>1949</year>
  </car>
  <car make="Toyota" model="Auris">
    <country>Japan</country>
    <year>2012</year>
  </car>
</cars>
```

Check country for the
first car in the list

```
@Test
public void checkCountryForFirstCar() {

    given().
    when().
        get( S: "http://path.to/cars/xml").
    then().
        assertThat().
        body( S: "cars.car[0].country", equalTo( operand: "Italy"));
}
```

XmlPath - examples

```
<?xml version="1.0" encoding="UTF-8" ?>
<cars>
  <car make="Alfa Romeo" model="Giulia">
    <country>Italy</country>
    <year>2016</year>
  </car>
  <car make="Aston Martin" model="DB11">
    <country>UK</country>
    <year>1949</year>
  </car>
  <car make="Toyota" model="Auris">
    <country>Japan</country>
    <year>2012</year>
  </car>
</cars>
```

Check year for the
last car in the list

```
@Test
public void checkYearForLastCar() {

    given().
    when().
        get(S: "http://path.to/cars/xml").
    then().
        assertThat().
        body(S: "cars.car[-1].year", equalTo(operand: "2012"));
}
```

XmlPath - examples

```
<?xml version="1.0" encoding="UTF-8" ?>
<cars>
  <car make="Alfa Romeo" model="Giulia">
    <country>Italy</country>
    <year>2016</year>
  </car>
  <car make="Aston Martin" model="DB11">
    <country>UK</country>
    <year>1949</year>
  </car>
  <car make="Toyota" model="Auris">
    <country>Japan</country>
    <year>2012</year>
  </car>
</cars>
```

Check model for the
second car in the list

(use an @ to refer to
an XML attribute)

```
@Test
public void checkModelForSecondCar() {

    given().
    when().
        get( S: "http://path.to/cars/xml").
    then().
        assertThat().
        body( S: "cars.car[1].@model", equalTo( operand: "DB11") );
}
```

XmlPath - examples

```
<?xml version="1.0" encoding="UTF-8" ?>
<cars>
  <car make="Alfa Romeo" model="Giulia">
    <country>Italy</country>
    <year>2016</year>
  </car>
  <car make="Aston Martin" model="DB11">
    <country>UK</country>
    <year>1949</year>
  </car>
  <car make="Toyota" model="Auris">
    <country>Japan</country>
    <year>2012</year>
  </car>
</cars>
```

Check there's one car from Japan in the list

findAll is a filter operation

```
@Test
public void checkTheListContainsOneJapaneseCar() {

    given().
    when().
        get(S: "http://path.to/cars/xml").
    then().
        assertThat().
        body("cars.car.findAll{it.country=='Japan'}.size()", equalTo(operand: 1));
}
```

XmlPath - examples

```
<?xml version="1.0" encoding="UTF-8" ?>
<cars>
  <car make="Alfa Romeo" model="Giulia">
    <country>Italy</country>
    <year>2016</year>
  </car>
  <car make="Aston Martin" model="DB11">
    <country>UK</country>
    <year>1949</year>
  </car>
  <car make="Toyota" model="Auris">
    <country>Japan</country>
    <year>2012</year>
  </car>
</cars>
```

Check that two cars have a make starting with 'A'

grep takes a regular expression to search in a list of values

```
@Test
public void checkTheListContainsTwoCarsWhoseMakeStartsWithAnA() {

    given().
    when().
        get( S: "http://path.to/cars/xml" ).
    then().
        assertThat().
        body( "cars.car.@make.grep(~/A.*/) .size()", equalTo( operand: 2) );
}
```

Now it's your turn!

_src > test > java > exercises > RestAssuredExercises4Test.java

_Communicating with an API returning an XML document

_Use XmlPath to select the right nodes

_Use filters, in, grep() where needed

_Answers are in answers > RestAssuredAnswers4Test.java

_Examples are in examples > RestAssuredExamplesXml.java

(De-)serialization of POJOs

- REST Assured is able to convert POJO instances directly to XML or JSON (and back)

- Useful when dealing with test data objects

 - Creating request body payloads

 - Processing response body payloads

- Requires additional libraries on the classpath

 - Jackson or Gson for JSON

 - JAXB for XML

```
<dependency>
  <groupId>com.fasterxml.jackson.core</groupId>
  <artifactId>jackson-databind</artifactId>
  <version>${jackson.databind.version}</version>
  <scope>test</scope>
</dependency>
```


Example: serialization

_POJO representing an address

```
public class Address {  
  
    private String street;  
    private int houseNumber;  
    private int zipCode;  
    private String city;  
  
    public Address(String street, int houseNumber, int zipCode, String city) {  
  
        this.street = street;  
        this.houseNumber = houseNumber;  
        this.zipCode = zipCode;  
        this.city = city;  
  
    }  
}
```

Example: serialization

```
@Test
public void serializeAddressToJson() {

    Address myAddress = new Address( street: "My street", houseNumber: 1, zipCode: 1234, city: "Amsterdam");

    given().
        body(myAddress). Pass the object as a request body using body()...
    when().
        post( S: "http://localhost:9876/address").
    then().
        assertThat().
            statusCode(200);
}
```

... and REST Assured will serialize it to JSON using Jackson
(which means you can customize the field names if required)

Body:

```
{"street": "My street", "houseNumber": 1, "zipCode": 1234, "city": "Amsterdam"}
```

Example: deserialization

```
@Test
public void deserializeJsonToAddress() {

    Address myAddress = ... store the deserialized response payload
                        in an object of that type...

    given().
    when().
        get(s: "http://localhost:9876/address").
    then().
        statusCode(200). Perform response verifications as usual...
    and().
        extract().
        body().
        as(Address.class); Specify the type to deserialize to using as()...

    assertEquals( expected: "Amsterdam", myAddress.getCity());

}
```

... and then use it in the remainder of your test method as required

Example: deserialization (without initial checks)

```
@Test
public void deserializeJsonToAddressWithoutInitialChecks() {

    Address myAddress = ... store the deserialized response payload
                        ... in an object of that type...

    given().
    when().

        get(s: "http://localhost:9876/address").
        as(Address.class); Specify the object type to deserialize to
                        using as()...

    assertEquals( expected: "Amsterdam", myAddress.getCity());
}

... and then use it in the remainder
of your test method as required
```

Now it's your turn!

_src > test > java > exercises > RestAssuredExercises5Test.java

_Practice (de-)serialization for yourself

_You don't need to create or adapt the POJOs

_Answers are in answers > RestAssuredAnswers5Test.java

_Examples are in examples > RestAssuredExamples.java

The problem with
'traditional' REST APIs

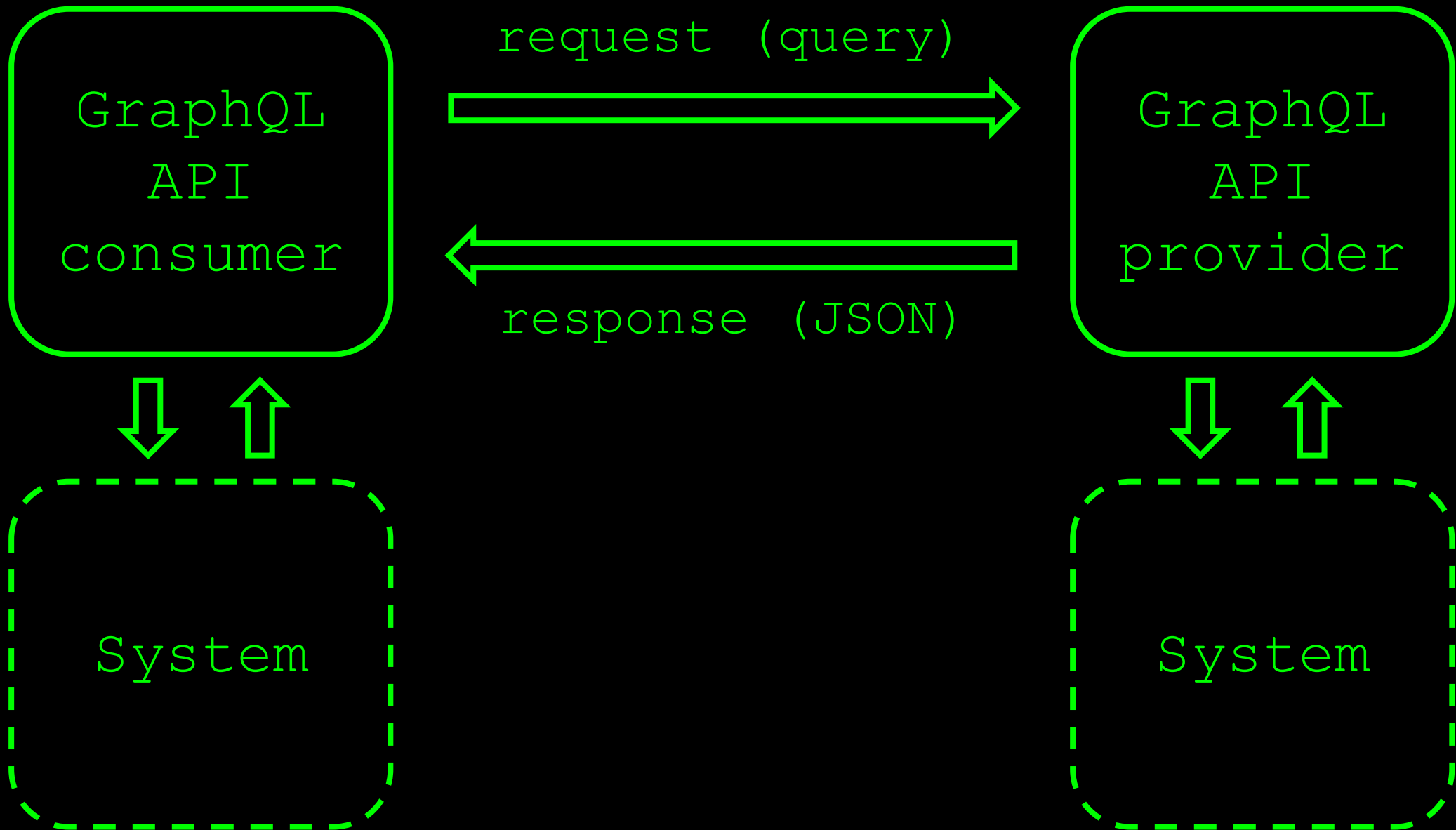
Query language for APIs...

... as well as a runtime to fulfill them

GraphQL

"Ask for what you need,
and get exactly that"

<https://graphql.org>



Create a valid GraphQL query...

... and send it in the request body (*query*)

Sending a GraphQL query

"Ask for what you need,
and get exactly that"

A Java

HashMap<String, Object>

structure is a good fit
for this situation

These are 'regular' REST responses, with...

... an HTTP status code, ...

GraphQL API responses

... response headers...

... and a JSON response body
containing the requested data

Sending a basic GraphQL query

```
String queryString = ""
```

The query can be a simple (multiline) String

```
{
  getCityByName(name: "Amsterdam") {
    weather {
      summary {
        title
      }
    }
  }
}
```

```
@Test
```

```
public void useHardCodedValuesInQuery_checkTheWeather() {Initialize the GraphQL
                                                           query object...
```

```
    HashMap<String, Object> graphqlQuery = new HashMap<>();
    graphqlQuery.put("query", queryString);
```

```
    given().
```

```
        contentType(ContentType.JSON).
```

```
        body(graphqlQuery).
```

```
    when().
```

... and send it as the request body

```
        post(s: "https://graphql-weather-api.herokuapp.com/").
```

```
    then().
```

```
        assertThat().
```

```
        statusCode(200).
```

The response body is regular JSON,
so we know how to handle that already

```
    and().
```

```
        body(s: "data.getCityByName.weather.summary.title", equalTo(operand: "Clear"));
```

```
}
```

Parameterizing GraphQL queries

```
String queryString = ""
```

```
query getWeatherFor($name: String!) {
  {
    getCityByName(name: $name) {
      weather {
        summary {
          title
        }
      }
    }
  }
}
```

Initialize the GraphQL query and set query variable values...

GraphQL queries can be parameterized, too

Let's create a test that queries and verifies the weather for three different cities

```
@ParameterizedTest
@CsvSource({
    "Amsterdam, Clouds",
    "Berlin, Clear",
    "Rome, Clear"
})
public void useJSONObjectInQuery_checkTheWeather(String cityName, String expectedWeather) {

    HashMap<String, Object> variables = new HashMap<>();
    variables.put("name", cityName);

    HashMap<String, Object> graphqlQuery = new HashMap<>();
    graphqlQuery.put("query", parameterizedQueryString);
    graphqlQuery.put("variables", variables);

    given().
        contentType(ContentType.JSON).
        body(graphqlQuery).
    when().

```

... and send the parameterized query to the API endpoint

✓	useJSONObjectInQuery_checkTheWeather(String, String)	3 sec 442 ms
✓	[1] Amsterdam, Clouds	2 sec 892 ms
✓	[2] Berlin, Clear	297 ms
✓	[3] Rome, Clear	253 ms

```
isEqualTo(expectedWeather));
```

Now it's your turn!

_src > test > java > exercises > RestAssuredExercises6Test.java

_Working with the SpaceX GraphQL API

_Create a basic query, send it and verify the response

_Create a parameterized query and a data driven test,
create and send queries and verify the responses

_Answers are in answers > RestAssuredAnswers6Test.java

_Examples are in examples > RestAssuredExamplesGraphQLTest.java

Now it's your turn!

_src > test > java > exercises > RestAssuredExercises7Test.java

_Capstone assignment

_Combines several concepts we have seen throughout this workshop

_Extracting values from responses

_Deserialization

_Using filters

_Parameterization, assertions, ...

_Answers are in answers > RestAssuredAnswers7Test.java



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