No API? No problem!

API mocking with WireMock.Net

An open source workshop by …

Originally created by Bas Dijkstra - bas@ontestautomation.com - https://www.ontestautomation.com

What are we going to do?

_Stubbing, mocking and service virtualization

_WireMock.Net

_Exercises, examples, …

Preparation

_Install .NET 6

_Install Visual Studio 2022 (or any other IDE)

_Import project into your IDE
  _https://github.com/basdijkstra/wiremock-net-workshop

Section 0:

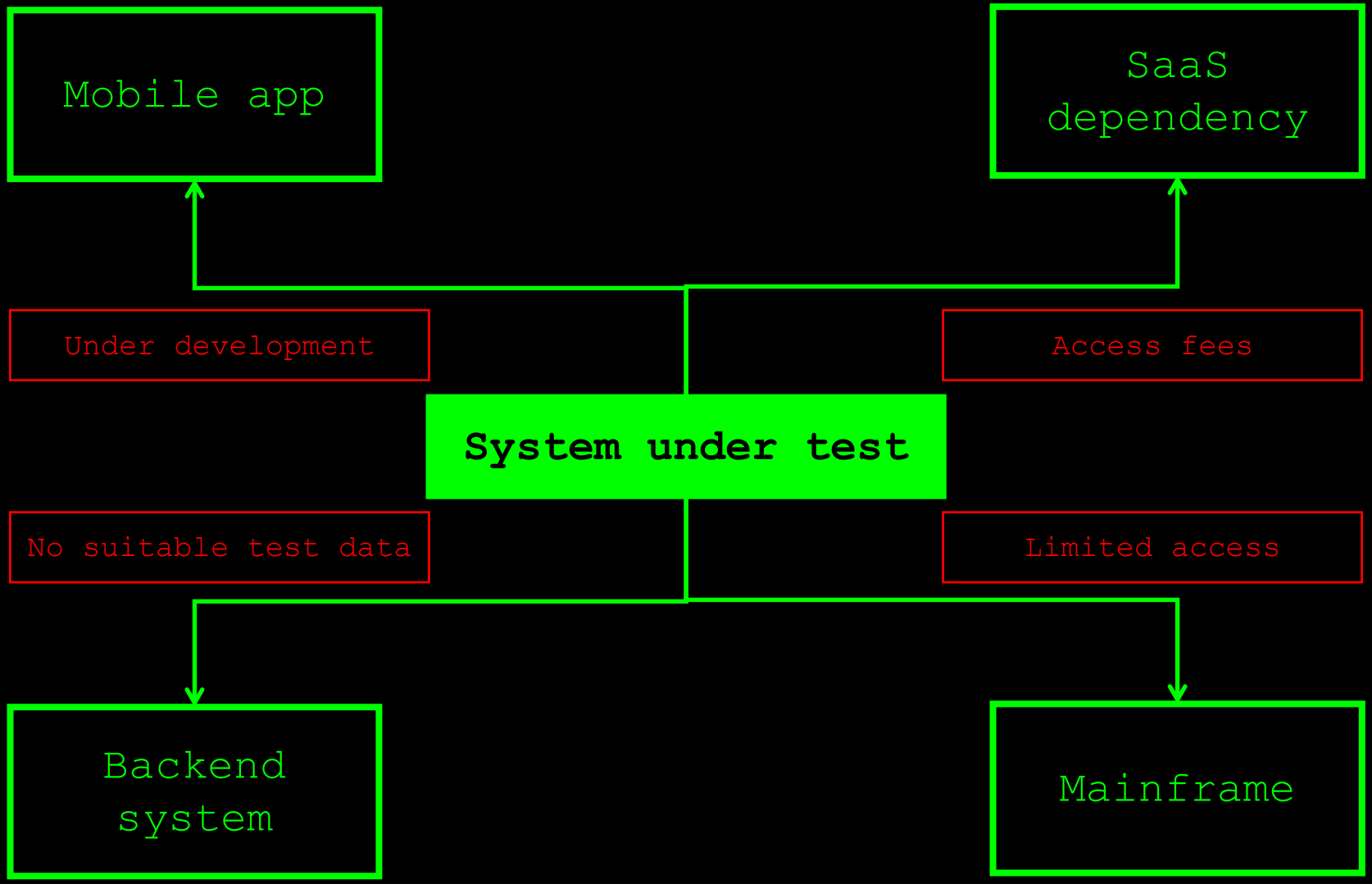
An introduction to service virtualization

Problems in test environments

- Systems are constructed out of of many different components

- Not all of these components are always available for testing
  - Parallel development
  - No control over testdata
  - Fees required for using third party component
  - …

Problems in test environments

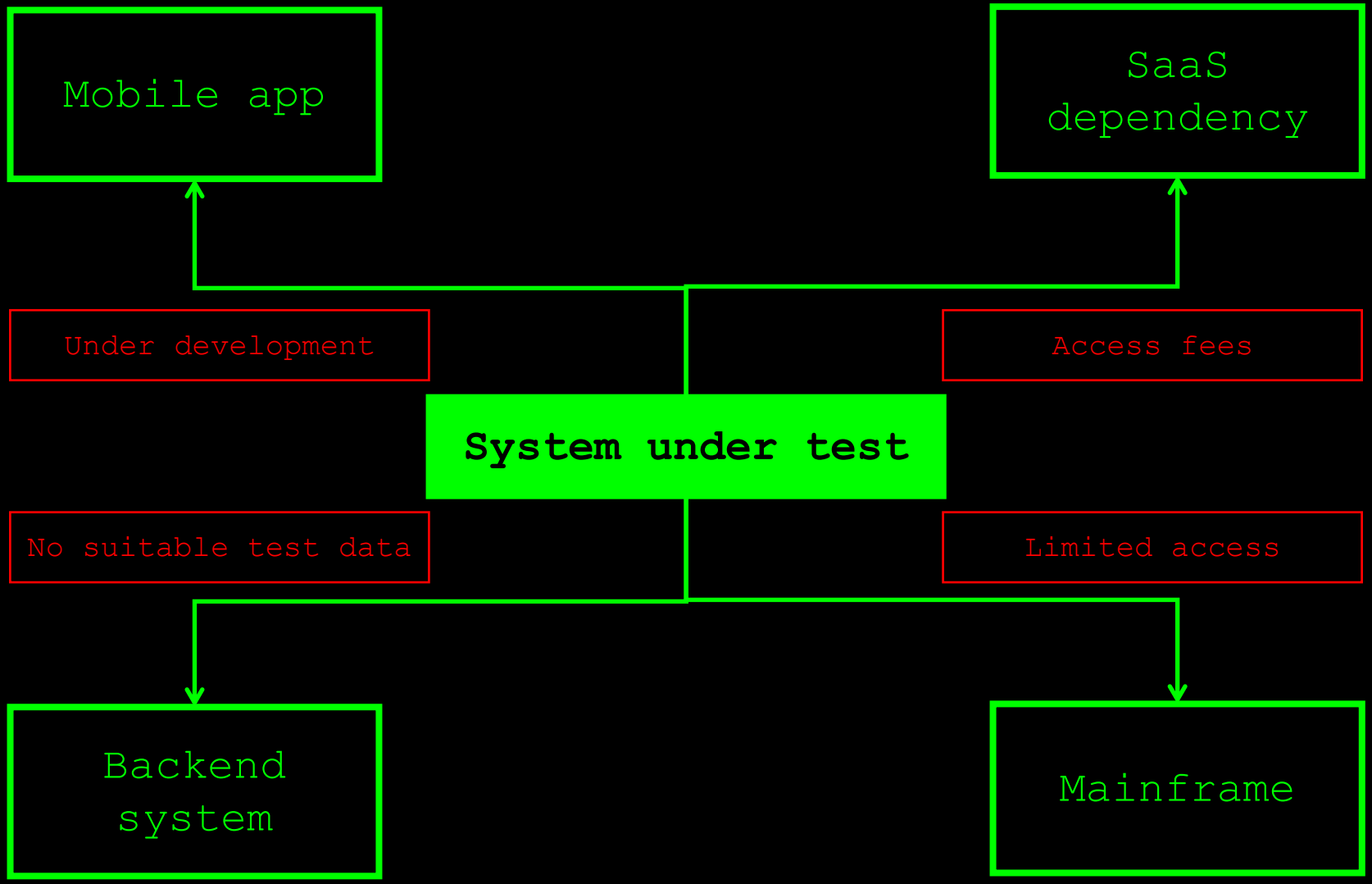


Simulation during test execution

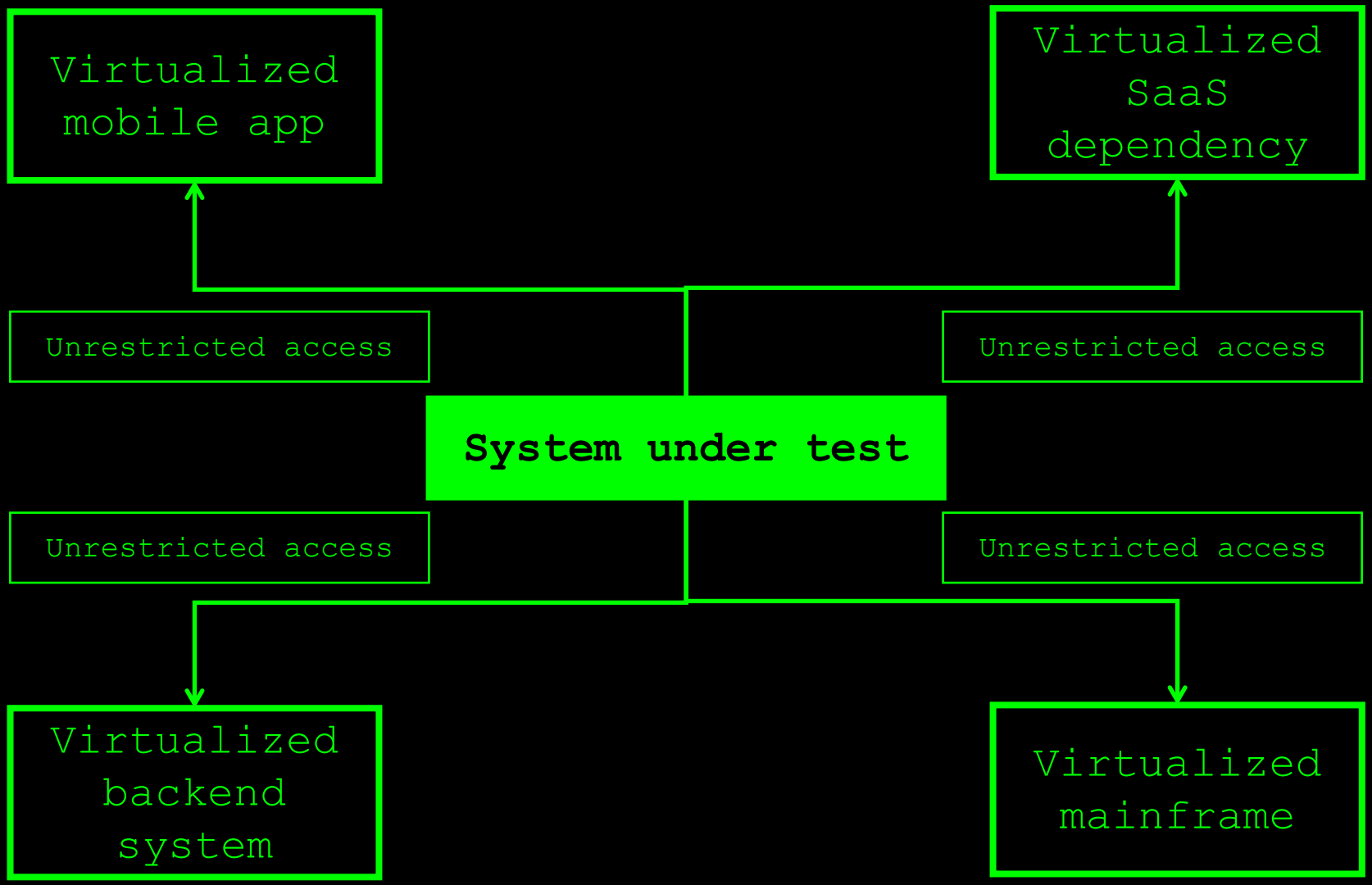
_Simulate dependency **behaviour**

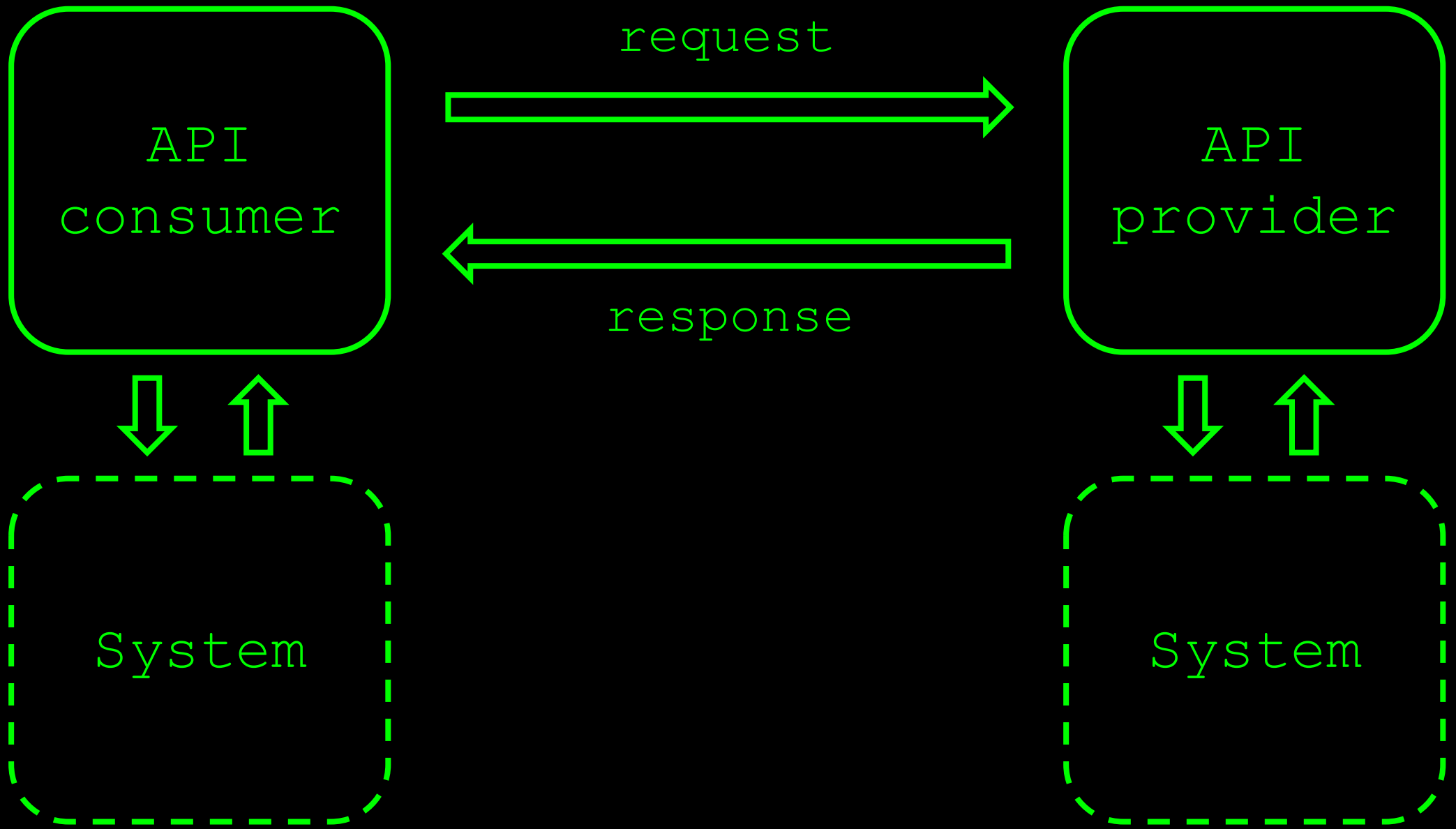
_Regain full control over test environment
  _Available on demand
  _Full control over test data (edge cases!)
  _No third party component usage fees
  _…

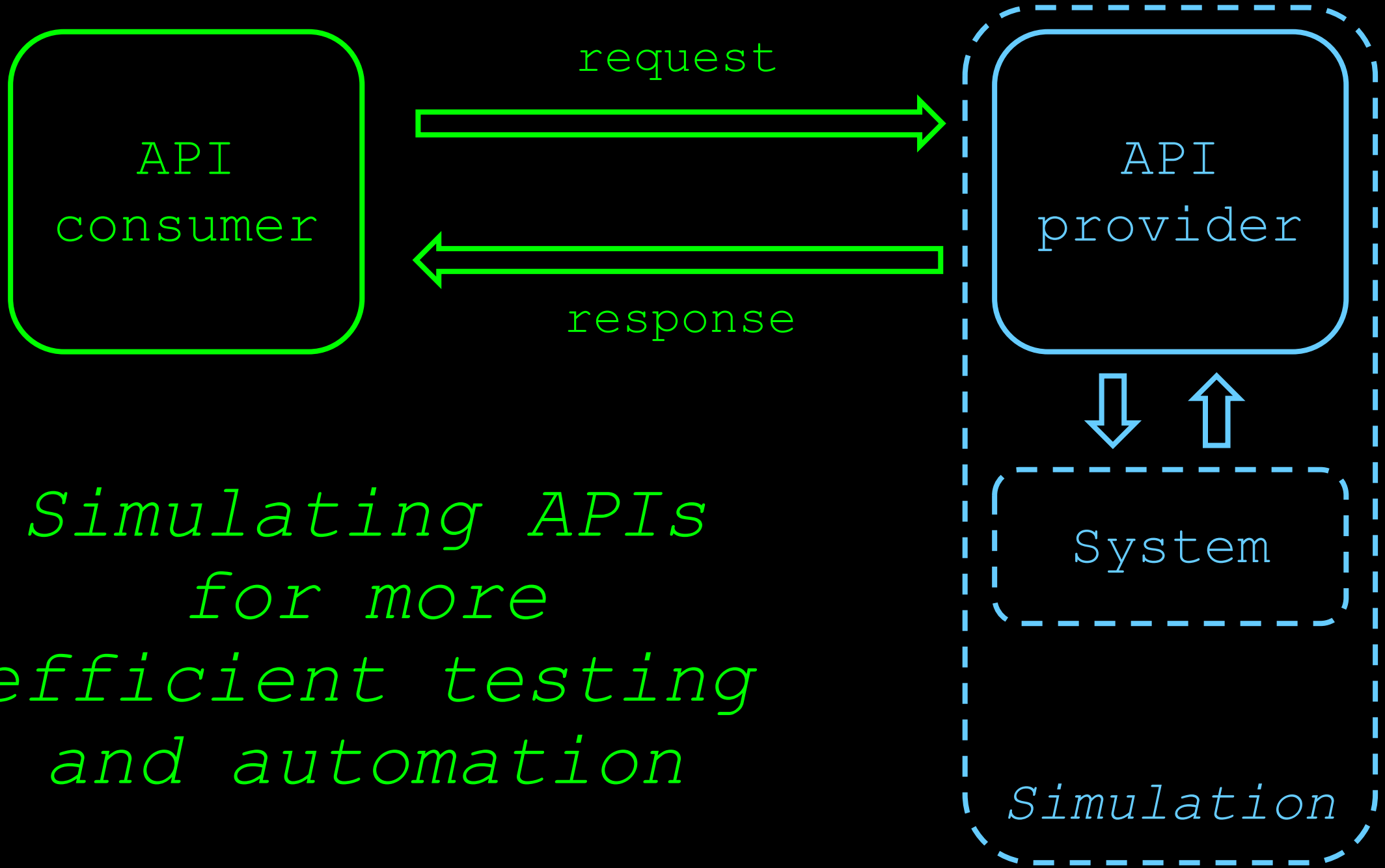
Problems in test environments



Simulation in test environments




request
API
consumer
API
provider
response
System
System



Simulating APIs for more efficient testing and automation

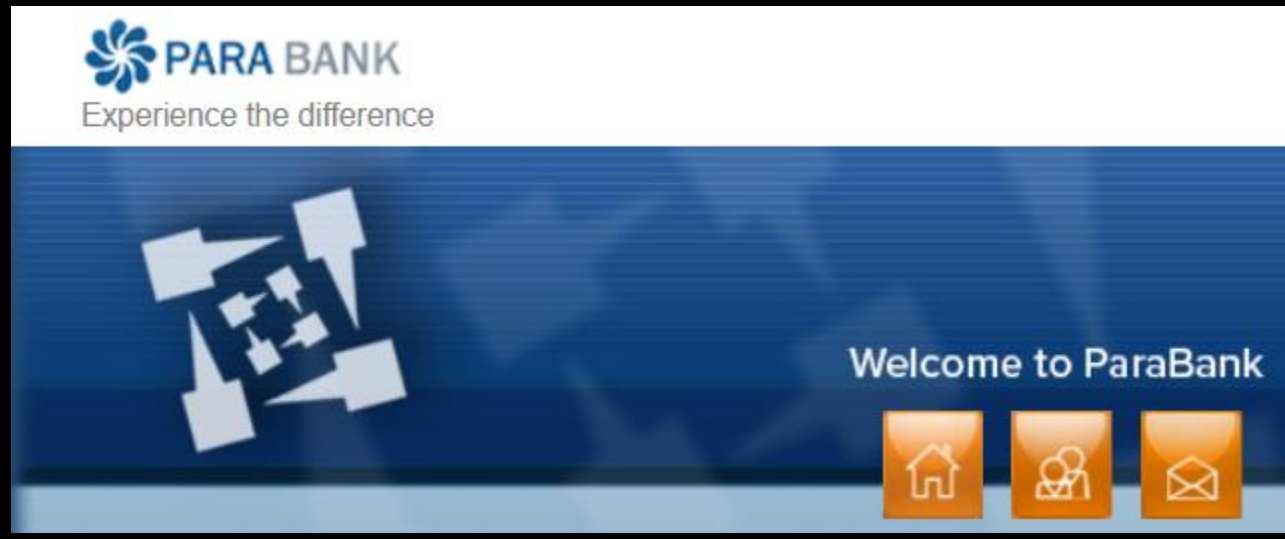
Our system under test

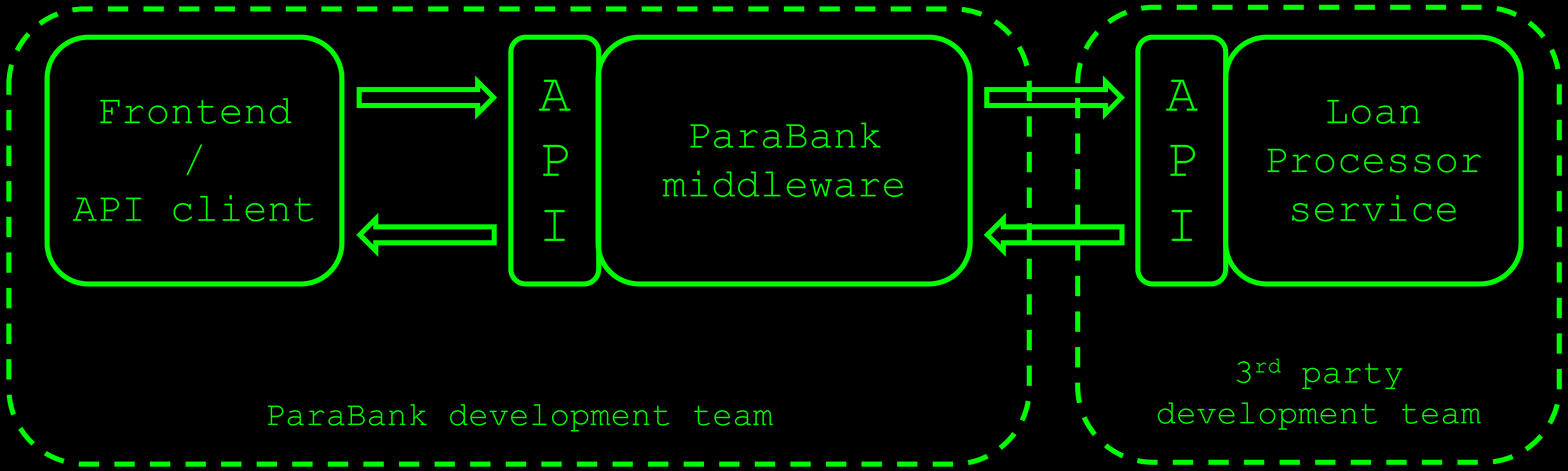
_ParaBank

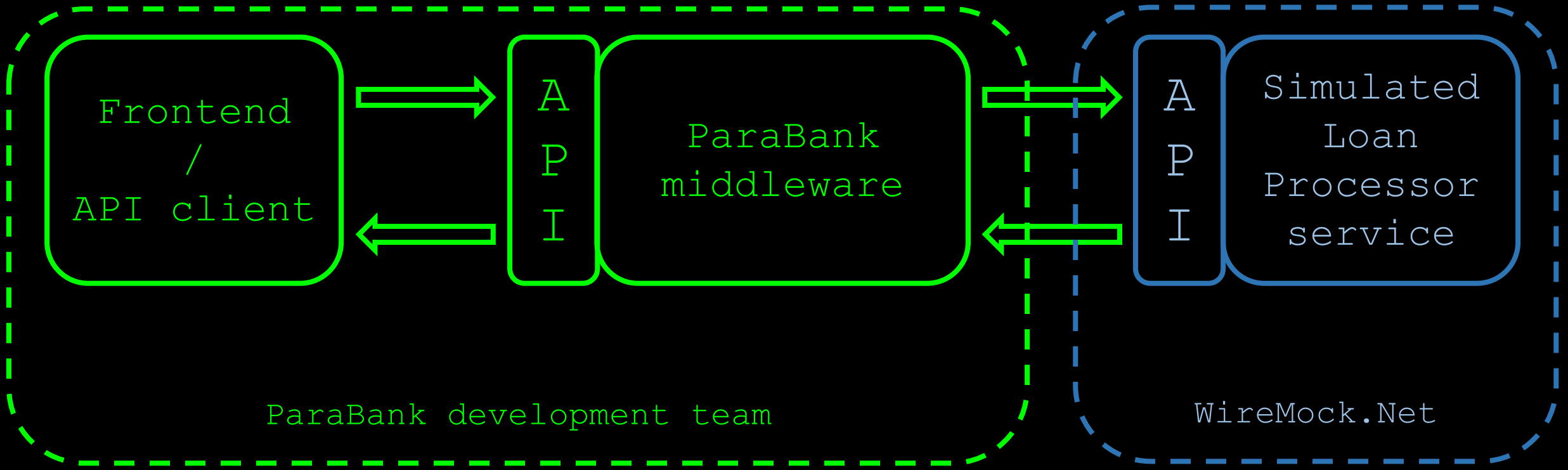
_The world's least safe online bank

_Request Loan process

_Loan application is processed by 3rd party loan provider component




Frontend
/
API client
API
ParaBank
middleware
API
Loan
Processor
service
ParaBank development team
3rd party
development team


Frontend
/
API client
API
ParaBank
middleware
API
Simulated
Loan
Processor
service
ParaBank development team
WireMock.Net

Start testing against features under development

Easy setup of state for edge cases

What might we want to simulate?

Delays, fault status codes, malformatted responses, …

…

Section 1:

Getting started with WireMock.Net

WireMock

_https://github.com/WireMock-Net/WireMock.Net/

_C#

_HTTP mock server
  _only supports HTTP(S)

_open source
  _developed and maintained by Stef Heyenrath

Configuring WireMock.Net

_Install as a NuGet package

Starting and stopping the WireMock.Net server

_Starting the server

```
private WireMockServer server;

[SetUp]
0 references
public void StartServer()
{
    server = WireMockServer.Start(9876);
}
```

_Stopping the server

```
[TearDown]
0 references
public void StopServer()
{
    server.Stop();
}
```

Starting WireMock.Net (standalone)

- Useful for exploratory testing purposes
- Allows you to share WireMock.Net instances between teams
- Long-running instances
- Use WireMock.Net.StandAlone library
- We're not going to run WireMock in that mode in this workshop

Configure responses

- In C# code
  - This is what we'll do in the workshop

- Using JSON mapping files
  - See https://github.com/WireMock-Net/WireMock.Net/wiki/Stubbing#json-mapping-example for an example how to get started with JSON mapping files

An example mock defined in C#

```
private void CreateHelloWorldStub()
{
    server.Given(
        Request.Create().UsingGet().WithPath("/hello-world")
    )
    .RespondWith(
        Response.Create()
        .WithStatusCode(200)
        .WithHeader("Content-Type", "text/plain")
        .WithBody("Hello, world!")
    );
}
```

Now it's your turn!

- Exercises > Exercises01.cs
- Create a couple of basic mocks
  - Implement the responses as described in the comments
- Verify your solution by running the tests in the same class
- Answers are in Answers > Answers01.cs
- Examples are in Examples > Examples01.cs

Section 2:

Request matching strategies and fault simulation

Request matching

- Send a response only when certain properties in the request are matched

- Options for request matching:
  - URL
  - HTTP method
  - Query parameters
  - Headers
  - Request body elements
  - …

Example: URL matching

```
private void StubUrlMatching()
{
    server.Given(
        Request.Create().UsingGet().WithPath("/url-matching")
    )
    .RespondWith(
        Response.Create()
        .WithBody("URL matching")
    );
}
```

- Matchers can be used for more flexible matching
  - https://github.com/WireMock-Net/WireMock.Net/wiki/Request-Matching#two-matchers

Example: header matching

```
private void StubHeaderMatching()
{
    server.Given(
        Request.Create().UsingGet().WithPath("/header-matching")
        .WithHeader("header_name", new ExactMatcher("header_value"))
    )
    .RespondWith(
        Response.Create()
        .WithBody("Header matching")
    );
}
```

_Matchers can be used for flexible matching

_https://github.com/WireMock-Net/WireMock.Net/wiki/Request-Matching#two-matchers

Example: cookie matching

```
private void StubCookieMatching()
{
    server.Given(
        Request.Create().UsingGet().WithPath("/cookie-matching")
        .WithCookie("cookie_name", new ExactMatcher("cookie_value"))
    )
    .RespondWith(
        Response.Create()
        .WithBody("Cookie matching")
    );
}
```

- Matchers can be used for flexible matching
  - https://github.com/WireMock-Net/WireMock.Net/wiki/Request-Matching#two-matchers

Example: JSON body matching

```
private void StubJsonBodyMatching()
{
    server.Given(
        Request.Create().UsingGet().WithPath("/json-body-matching")
        .WithBody(new JmesPathMatcher("fruit == 'banana'"))
        .WithBody(new JmesPathMatcher("contains(date, '2023')"))
    )
    .RespondWith(
        Response.Create()
        .WithBody("JSON request body matching")
    );
}
```

_Matchers can be used for flexible matching

_https://github.com/WireMock-Net/WireMock.Net/wiki/Request-Matching#two-matchers

Fault simulation

_Extend test coverage by simulating faults

_Often hard to do in real systems

_Easy to do using stubs or mocks

_Used to test the exception handling of your application under test

Example: HTTP status code

```
private void StubReturnErrorStatusCode()
{
    server.Given(
        Request.Create().UsingGet().WithPath("/error-status-code")
    )
    .RespondWith(
        Response.Create()
        .WithStatusCode(500)
    );
}
```

_Some often used HTTP status codes:

Consumer error	**Provider error**
403 (Forbidden)	500 (Internal server error)
404 (Not found)	503 (Service unavailable)

Example: delays

```
private void StubReturnResponseWithDelay()
{
    server.Given(
        Request.Create().UsingGet().WithPath("/delayed-response")
    )
    .RespondWith(
        Response.Create()
        .WithStatusCode(200)
        .WithDelay(TimeSpan.FromMilliseconds(2000))
    );
}
```

Example: faults

```
private void StubReturnResponseWithFault()
{
    server.Given(
        Request.Create().UsingGet().WithPath("/fault-response")
    )
    .RespondWith(
        Response.Create()
        .WithFault(FaultType.EMPTY_RESPONSE)
    );
}
```

_Options:

- _NONE (no fault)
- _EMPTY_RESPONSE (does what it says on the tin)
- _MALFORMED_RESPONSE_CHUNK (HTTP 200, garbage in body)

Now it's your turn!

- Exercises > Exercises02.cs
- Practice fault simulation and different request matching strategies
  - Implement the responses as described in the comments
- Verify your solution by running the tests in the same class
- Answers are in Answers > Answers02.cs
- Examples are in Examples > Examples02.cs

Section 3:

Creating stateful mocks

Statefulness

- Sometimes, you want to simulate stateful behaviour
- Shopping cart (empty / containing items)
- Database (data present / not present)
- Order in which requests arrive is significant

Stateful mocks in WireMock.Net

- Supported through the concept of a Scenario
- Essentially a finite state machine (FSM)
  - States and state transitions
- Combination of current state and incoming request determines the response being sent
  - Before now, it was only the incoming request

Stateful mocks: an example

```
private void CreateStatefulStub()
{
    server.Given(
        Request.Create().UsingGet().WithPath("/todo/items")
    )
    .InScenario("To do list")
    .WillSetStateTo("TodoList State Started")
    .RespondWith(
        Response.Create().WithBody("Buy milk")
    );

    server.Given(
        Request.Create().UsingPost().WithPath("/todo/items")
    )
    .InScenario("To do list")
    .WhenStateIs("TodoList State Started")
    .WillSetStateTo("Cancel newspaper item added")
    .RespondWith(
        Response.Create().WithStatusCode(201)
    );

    server.Given(
        Request.Create().UsingGet().WithPath("/todo/items")
    )
    .InScenario("To do list")
    .WhenStateIs("Cancel newspaper item added")
    .RespondWith(
        Response.Create().WithBody("Buy milk;Cancel newspaper subscription")
    );
}
```

Responses are grouped by scenario name

Response depends on both the incoming request as well as the current state

The first mock should define the initial state

Incoming requests can trigger state transitions

Now it's your turn!

- Exercises > Exercises03.cs
- Create a stateful mock that exerts the described behaviour
  - Implement the responses as described in the comments
- Verify your solution by running the tests in the same class
- Answers are in Answers > Answers03.cs
- Examples are in Examples > Examples03.cs

Section 4:

Response templating

Response templating

- Often, you want to reuse elements from the request in the response
  - Request ID header
  - Unique body elements (client ID, etc.)
  - Cookie values

- WireMock.Net supports this through response templating

Enable/apply response templating

_This template reads the HTTP request method (GET/POST/PUT/…) using *{{request.method}}* and returns it as the response body

```
private void CreateStubEchoHttpMethod()
{
    server.Given(
        Request.Create().UsingAnyMethod().WithPath("/echo-http-method")
    )
    .RespondWith(
        Response.Create()
        .WithStatusCode(200)
        .WithBody("HTTP method used was {{request.method}}")
        .WithTransformer()
    );
}
```

This call to *WithTransformers()* is necessary to activate response templating for this stub

Request attributes

- Many different request attributes available for use
  - request.method : HTTP method (example)
  - request.PathSegments.[<n>] : n^{th} path segment
  - request.query.<key> : query parameter value
  - …

- All available attributes listed at

https://github.com/WireMock-Net/WireMock.Net/wiki/Response-Templating#the-request-model

JSON extraction example

_When sent this JSON request body:

```
{
    "book": {
        "author": "Ken Follett",
        "title": "Pillars of the Earth",
        "published": 2002
    }
}
```

_This stub returns a response with body “The specified book title is Pillars of the Earth”:

```
private void CreateStubEchoJsonRequestElement()
{
    server.Given(
        Request.Create().UsingPost().WithPath("/echo-json-request-element")
    )
    .RespondWith(
        Response.Create()
        .WithStatusCode(200)
        .WithBody("The specified book title is {{JsonPath.SelectToken request.body \"$.book.title\"}}")
        .WithTransformer()
    );
}
```

Now it's your turn!

_Exercises > Exercises04.cs

_Create dynamic mock by using response templating
  _Implement the responses as described in the comments

_Verify your solution by running the tests in the same class

_Answers are in Answers > Answers04.cs

_Examples are in Examples > Examples04.cs