



MUnit in MuleSoft

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Introduction

What is MUnit?

MUnit is a Mule application testing framework that allows you to easily build automated tests for your integrations and APIs.

Why use MUnit?

It provides a full suite of integration and unit test capabilities and is fully integrated with Maven and Surefire for integration with your continuous deployment environment.

With MUnit you can:

- Create your test by writing Mule code
- Mock processors
- Spy any processor
- Verify processor calls
- Enable or ignore particular tests
- Tag tests
- Check visual coverage in Studio
- Generate coverage reports

MUnit is fully integrated with Anypoint Studio, allowing you to create, design and run MUnit tests just like you would Mule applications.

What is Unit testing?

Unit testing is a software testing technique in which individual units or components of a software application are tested in isolation from the rest of the system. A unit is the smallest testable part of any software, typically a function, method, or procedure. The purpose of unit testing is to validate that each unit of the software performs as designed and expected.

In unit testing, the developer writes test cases that cover different scenarios and edge cases for each unit of code. These test cases are automated and run frequently during the development process. The goal is to ensure that each unit behaves correctly and produces the expected output for various inputs.

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The application we are going to test is





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Assert expression, Set event & Mock when

Objective:

We are going to write a Unit Test case for the above scenario (postman request and response)

Step -1: Click on the main flow that you want to write test cases (test-caseFlow) and then rightclick on it. Select "MUnit" and then click "Create blank test for this flow". This creates a blank test flow where you can write your test cases and also it creates a test-case-suite.xml.

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Step 2: Drag and drop a set event processor from the mule pallet in the MUnitt module onto the behaviour section of the test flow.

The Set Event Processor allows us to define a Mule Event.

This message processor is normally used at the beginning of an MUnit test, to define the first message to send to the flow being tested.

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Step 3: Now we are going to create an event with an empty payload and attributes should contain 2 query parameters "custName" with the value Yuvraj and format with the value "json".

Configure

```
{'queryParams':{'custName':'<u>Yuvraj</u>','format':'<u>json</u>'}}
```

as the value for attributes in the set event. (You can set the event according to the request you're calling it with)



Step 4: Now we are going to mock call the "fetching customer data"

Drag and drop the mock when on the behaviour section of the flow



Now click on the "pick processor" and select the component you want to mock (fetching customer data) select its "doc:id" and then click "ok"

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Step 5: Now set the value of payload in "Then return", with

```
output application/java
---
```

```
[
    {
        "CustId": 100,
        "OrderQty": "10",
        "CustName": "Yuvraj"
    }
]
```

And the media type to application/java

General	Thère are no errors.	
Metadata	Then return	
Notes	Payload Attributes Error Variables	
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	Media Type: application/java	
	Encoding: UTE-8	(
	Then Call	
	Flow //	191

Now go to the variables section and click on the '+' button. It will appear as below

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		×
Variable Add a n	e ew variable	
Key!		
Media Typ Encoding:	× [24 (14
3		OK Cancel

Now fill up the section with values below and click "OK"

Key = custName

Value = #["Yuvraj"]

Media Type = application/java (select from the drop-down)

Encoding = UTF-8 (select from the drop-down)

Now repeat the process and add the values below and click "OK"

Key = format

Value = #["json"]

Media Type = application/java (select from the drop down)

Encoding = UTF-8 (select from the drop down)

arral	C There are no	errors.			
	Then return				
adata	Payload At	tributes Error Variables			
ies.	***				
p	Key	Value	Media Type	Encoding	
	custName	#["Yuvraj"]	application/java	UTF-8	
	format	#["]son"]	application/java	UTF-8	
	Then Call				

("Then return" section is used to mock the event which is returned from the "fetching customer data" so set the values according to the component you are mocking)

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Step 6: Now we are going to mock the Flow reference "format-change-flow"

Repeat the above steps and we need to change the payload from the above steps, add the payload below and the rest steps are the same

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[
{	"CustId": 100, "OrderQty": "1 "CustName": " <u>3</u>	0", Zuvraj"			
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Now the flow should look like below



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Step 7: Now we will Assert that the payload after invoking the "test-caseFlow" as [

```
{
    "CustId": 100,
    "OrderQty": "10",
    "CustName": "Yuvraj"
}
```

(we need to use assert expression because the output is an array object)

Now drag and drop an "Assert expression" on the "Validation" section of the flow



Step 8: In the expression section of "Assert expression" add



(keep in mind to turn on the expression mode)

Assert expressio	on Comole 1 Problems & Progress & Mule Debugger ¥MUnt Errom	
General	O There are no errors.	
Error Mapping	Display Name: Assert expression	
Notes	General 🔿	
Help	Expression in import * from dws:test::Asserts	IN
		*
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(feel free to change the output according to your flow)

Step 9: Now save the project and first select the flow then right-click on the flow



And click on "Run MUnit test"

You should see that the test cases are passed with no errors

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Step 10: Now go and change the value of "Expression" in "Assert Expression" to

```
import * from dw::test::Asserts
____
payload must equalTo([
        {
            "CustId": 101,
            "OrderQty": "20",
            "CustName": "Adrish"
        }
])
```

And again, run it. Now the test case will fail



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eneral > Expression				
P Input		P Output	1=import * from dw::test::Asserts	
Payload : Any <u>Define metadata</u> Variables format : Union-String, Nulli- custName : Union-String, Nulli- Attributes : Null		K VatcherResult description: Object? actual: String? expected: String? matches: Boolnon? reasons: Arroy-cString>? 	<pre>3=payload mist equalTo([4= 1 5 "CustId": 101, 6 "Ordergty": "20", 7 "CustBame": "Adrish" 8 } 9 1)</pre>	
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Writing functional test case

Objective:

Now we are going to write a functional test case for the scenario

Request: <u>http://localhost:8081/testcase?custName=Adrish&format=json</u>

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Response:

[
{	
"CustId": 101,	
"OrderQty": "20",	
"CustName": "Adrish"	
}	
] Body Cookles Headers (3) Test Results	😫 Status: 200 OK Time: 434 ms Size: 200 B 🔄 Since at montple 🛶
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What is a functional test case?

A functional test case for verifying the behavior of a system typically follows a structured approach to ensure that the system functions correctly as per the requirements.

Step1: Click on the main flow that you want to write test cases (test-caseFlow) and then right-click on it. Select "MUnit" and then click "Create blank test for this flow". This creates another blank test flow where you can write your test cases.



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Step 2: Drag and drop a set event processor from the mule pallet in the MUint module onto the behaviour section.

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Step 3: Now we are going to create an event with an empty payload and attributes should contain 2 query parameters "custName" with value Adrish and format with value "json".

```
Configure
{'queryParams':{'custName':'Adrish','format':'json'}}
```

as the value for attributes in the set event.

(You can set the event according to the request you're calling it with)



Step 4: Now we will Assert that the payload after invoking the "test-caseFlow" as [

```
{
    "CustId": 101,
    "OrderQty": "20",
    "CustName": "Adrish"
}
```

(we need to use assert expression because the output is an array object)

Now drag and drop an "Assert expression" on the "Validation" section of the flow

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Step 5: In the expression section of "Assert expression" add

import	* from dw::test::Asserts	
payloa { }	d must equalTo(["CustId": 101, "OrderQty": "20", "CustName": " <u>Adrish</u> "	
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(keep in mind to turn on the expression mode)

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(feel free to change the output according to your flow)

Step 6: Now save the project and first select the flow then right-click on the flow



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And click on "Run MUnit test"

You should see that the test cases are passed with no errors

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Step 7: Now go and change the query parameter format to "xml" in the attributes section of "Set Event".



And again run the test. The test case will fail because the output given by the request we made does not match the expression (

```
{
    "CustId": 101,
    "OrderQty": "20",
    "CustName": "Adrish"
}
```

) We gave in the "Assert expression"

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Verify call

What is the use of a verify call?

The Verify call processor allows you to verify if a processor was called.

Objective:

We will write another test case that will verify that "fetching customer data"(db:select) is called.

Step 1: Click on the main flow that you want to write test cases (test-caseFlow) and then right-click on it. Select "MUnit" and then click "Create blank test for this flow". This creates another blank test flow where you can write your test cases.



Step 2: Drag and drop a set event processor from the mule pallet in the MUint module onto the behaviour section.

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Step 3: Now we are going to create an event with an empty payload and attributes should contain 2 query parameters "custName" with value Adrish and format with value "json".

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Configure

```
{'queryParams':{'custName':'<u>Adrish</u>','format':'json'}}
```

as the value for attributes in the set event.

(You can set the event according to the request you're calling it with)

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	Start with an empty event Other the incoming event and override varies	Undefined : Understant	
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Step 4: Now we will use the "Verify call" and verify whether the "fetching customer data"(db:select) is called or not.

Now drag and drop a "Verify call" on the validation section of the flow



Step 5: Now click on the "Pick processor" button.

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	docid	9b5cs800-972b-4e46-a962-710et368bit22	Dision + String, NaR+ 11/1000+ Ebring,
			w cutflame
			Union caring, Mars 1 (many arring,
	Validate that.		

Now select "fetching customer data" and then select "doc:id" and click "Ok"



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	Set Event			O Database
B	inecution Valids	Ref. a target processor Select a target processor from the Flow Distine an execution. The MUnit aperation will non whenever executed in the flow.	d choose attributes to match against during test a processor with matching name and attributes is	MUnit Tools MUnit Tools Sockets
D General Metada Notes Help	a caseHow e Row Grand Dements i y call © Consoler 1 © There are no e Display Name 1 Display Name 1 atta When processor Processor dis © If % % Attribute name docid	P * W test-case: Mule Configuration * I test-caseRow : How * Ustener: Lister * Usigning Lastimer hame: Lister * Setting formatin variable : 1 * Onder: Chase * * *(not stemptylasyload)) whe * format sherper-form: Row	Attributes for fetching customer data docname	Pick processor
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and I	C There are no errors.			Input Output
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	Validate that			1

Step 6: Now we are going to configure the "Validate that" section (this section is used to validate how many times the processor we are verifying is executed)

Comparison = Is equal to.. (Choose from the drop down) Value = 1

General	These are no errors G T S 36		loput Output
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	Companies Is equal to.		
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Step 7: Now save the project and first select the flow then right-click on the flow



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And click on "Run MUnit test"

You should see that the test cases are passed with no errors

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Step 8: Now go to "Validate that" section in "Verify call" and change the "value" to 2

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	this Z		Britan Malada

And again, run the project. Now the test will fail because the number of times the "fetching customer data" is executed is 1 and we have given 2.



java.lang.AssertionError: On db:select. Expected 2 but got 1 calls at org.mule.munit.mock.MockModule.verifyCall(MockModule.java:135)

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Before/After Suite & Before/After Test

Before Suite Scope

The MUnit Before Suite contains code that is meant to be executed before the whole suite. The Before Suite has one execution rule: Run before all the tests, just once. For example, suppose you have a MUnit Test Suite file with four tests. The code inside an MUnit Before Suite runs just once, before your four tests.

¥test-case	\mathbf{Y}^{*} test-case-test-suite \times					
test-case-test-suiteBefore_Suite						
Before Suite						
Actions to be set before the Suite runs						

After Suite Scope

The MUnit After Suite is a scope. It can contain code that is meant to be executed after the whole suite. The After suite has one execution rule: Run after all the tests, just once. For instance, let's suppose you have a MUnit Test Suite File with four tests. The code inside an MUnit After Suite, runs just once, after all your tests.



Before Test Scope

The MUnit Before Test Scope contains code that is meant to be executed before each test. Each Before Test scope follows the same execution rule: Run before each test. For instance, let's suppose you have a MUnit Test Suite file with four tests. The code inside an MUnit Before test runs before each of your four tests; it runs four times.



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After Test Scope

The MUnit After Test Scope contains code that is meant to be executed after each test. Each After Test scope follows the same execution rule: Run after each test. For instance, let's suppose you have a MUnit Test Suite file with four tests. The code inside an MUnit After Test runs after each of your four tests; it runs four times.

¥test-case	¥*test-case-test-suite ×					
▼ test-case-test-suiteAfter_Test						
After Test						
Actions to be set after each test						

Objective:

We are going to create a scenario where we will have the same events for all the test cases. We are going to execute the "Set event" in the "Before suite" scope so that it can be utilized by all the test cases and executed once.

Step 1: Drag and drop a "Before suite" scope on the test suite.



Step 2: Now drag and drop a "Set event" processor on the "Before suite" scope.



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Step 3: Now configure the attributes section of the "Set event" processor with these values

{'queryParams':{'custName':'<u>Adrish</u>','format':'json'}}

And leave the rest empty

Q Set Ewert -	Consis Postern VMm VMetEnce		F # = 0
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Noten Help	Set Event Define the new event that will be output by the operation Start with an empty event Cione the incoming event and override values	w Paginad Undefreet : Instance w Attributes Undefreet : Instance Variation Variation	
	Payload Attributes Error Variables		
	Velae (# []'queryFermen':('curillese':' <u>Sdrieh</u> ', 'fuimat':(<u>'son</u> '))] Meda Type	© 1) [N	1
	Encoding		Reforch Metadata

Step 4: Now delete all the set events from the test cases



Step 5: Save the project then right-click and click on "Run MUnit suit"

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est-case-test-suiteBefore_Test	
Before Test	
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You will see that the functional test case and verify call test case are passing but the Unit Test case will fail



Message Flow Global Elements Configuration XML

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Mule Properties	Console	E Problems	WMUnit >:	¥ MUnit Errors	
Run: 3/3				Errors: 0	Failures: 1
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Y test-case-te	st-suite-test-ca	seFlowTest2			
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Step 6: To make the test cases pass we need to change both the "Mock when" payload and variables data.

Change the values by referring to the screenshots below

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Mook when O Console Problem General >	na VMinit VMinitEmora			100 CD - Preview Cone
P Input Payload : Unknown <u>Define metadinia</u> Variables Athibudes : Unknown <u>Define</u>	, and and a	P Output C+ Define métadata	<pre>1° output application/java 2 *** 3** 4* 4* 5 *Custid*:101, 6 *OcterGty*: *20*, 7 *CustRuns*: *Rdrish* 8) 5] 5]</pre>	

The "Mock when" which is mocking the db:select change the payload to

To go in expression mode click the button highlighted in red in the below screenshot.

					General Metadata
			5 2	hen return	
0		r Variables	ttributes Error	Payload A	res
, PI		ut application/java	/ #[output	'alue:	lp
4		eva	application/java	Aedia Type:	
			UTF-8	ncoding:	
		iva	application/java	'alue: Aedia Type: ncoding:	neip

And variables custname = #["Adrish"] and keep format as json.

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-			
Payload At	tributes Error Variables		
* @* *			
Key	Value	Media Type	Encoding
custName	#["Adrish"]	application/java	UTF-S
format	#["json"]	application/java	UTF-8

Click the button highlighted in red to edit the variables.

Now change the payload of the "Mock when" which is mocking "the flow-ref".

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And variables custname = #["Adrish"] and keep the format as json.

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taclata The tes Pay	n return foad Att	nibulles Error Variables			
lp 🗣 Ke cu to	ist Name mat	Value #["Adrish"] #["json"]	Media Type application/java application/java	Encoding UTF-8 UTF-8	

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Step 7: Now save the project then right-click and click on "Run MUnit suit"

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You will see all the test cases passed successfully.



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Spy Event Processor

What is the use of Spy Event Processor?

The "Spy Processor" enables you to spy on what happens before and after an event processor is called. This enables you to validate, for example, that a selected Mule Event reaches a specific event processor containing a specific payload or variable. Setting a spy processor tells MUnit to run a set of instructions (usually assertions or verifications) before and/or after the execution of the spied event processor.

Objective:

We are going to spy "fetching customer data"

Step 1: Click on the main flow that you want to write test cases (test-caseFlow) and then right-click on it. Select "MUnit" and then click "Create blank test for this flow". This creates another blank test flow where you can write your test cases.



Step 2: drag and drop the "Spy Event Processor" from the "MUnit Tools" module on the behavior section of the test flow.







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Step 3: Now click on the pick processor button and select the "fetching customer data" (db:select) and then select "doc:id" and click on "OK".

Execution Flow Technology Flow-ref Message F	Spy A	Pick a target processor Select a target processor from the Flow Outline an execution. The MUnit operation will run whenever executed in the flow. P • • • • • • • • • • • • •	d choose attributes i a processor with mat Attributes for fetu docname docid config-ref	o match against du ching name and at thing customer da Techning customer Techning customer Techning control Casimine Control	x ring test ributes is ta edita	MUnit MUnit Sockets
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Notes Help	Processor: do	select				Pick processor
	Attribute name docid		When 9b6ce	s value 809-9725-4e46-a96	12-710ed368bd22	

Step 4: Now drag and drop an assert expression on the "Before call" section of the "Spy Event Processor" and configure its "Expression" as

import '	from	dw::test:	:Asserts
payload	must	beNull()	

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* Inst-cane-tret-u	Atter call	Second Se
Execution Message How Cor	Validation Sold Elements: Configuration 3ML	
Assert expressio	on , Console E Problems VMUnit VMUnit Errors ® Mule Debugger	
Paral Inc.	O There are no errors.	
Error Mapping	Display Name: Assert expression	
Notes	General	
Help.	Expression IR Import * from dwittestilAsserts	- 14
		(e)
	Message: P Assertion failed	

Step 5: Now drag and drop another "Assert Expression" on the "After call" section of the "Spy Event Processor" and configure its "Expression" as

```
import * from dw::test::Asserts
---
payload must equalTo([
        {
            "CustId": 101
```

```
"CustId": 101,
"OrderQty": "20",
"CustName": "<u>Adrish</u>"
}
])
```



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Step 6: Now drag and drop "Set Event" processor from the "MUnit" module on the behavior section after the "Spy Event Processors". And set the attributes as

```
{'queryParams':{'custName':'<u>Adrish</u>','format':'<u>json</u>'}}
```

GG Spy	Before call Assert expression After call Set Event Set Event	P Search © Search ⊕ Add M ★ Favorit ♥ Core ⊕ Dotab. ● HTTP © Munit ⊕ Munit ● Socket
Execution essage Row	Validation Add assertions and emfessives Global Elements Configuration XML Console Problems VMint Proces SMde Debugger	
General Metadata Notes	There are no errors. Define the new event that will be output by this operation Start with an empty event O Clone the incoming event and override values	
Help	Payload Attributes Error Variables Value: Attributes ['queryFarams':{'custRame':'Adrish','format':'json'}] Media Type: Forcefore:	\$1 N

Step 6: Now save the project and first select the flow then right-click on the flow and click on "Run MUnit test". The test case will run successfully.



Step 7: Now just switch the position of "Set event" and "Spy Event Processor"

tell-care-text-softe-te	nt-caseFlowText3
Set Event Se	Before call Assert expression After call Assert expression
Evenution Tipes-ref to	Validation

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Step 8: Now save the project and first select the flow then right-click on the flow and click on "Run MUnit test". The test case will fail.

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java.lang.AssertionError: Assertion Expected: [{ Custld: 101, Order Actual: [] Reasons: Expecting `(root)` to be A at org.mule.munit.assertion.inte	failed at file: [test-case-test- ·Qty: "20", CustName: "Adr rray size is 1 but was was 0 rmal.AssertModule.assertMa	suite.xml], line: [135] ish" }] to be equal to tcherResult(AssertModule.java:77)	

(This is a Bug in "Spy Event Processor" It changes the mule message to null (payload and attributes). It is best to keep the "Spy Event Processor" at first and then other processors. This may be fixed on further updates so it will depend on the version of anypoint studio if you face the bug or not)

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