



#### **Testing Automation and Methodologies**

14 May 2020



#### Specification by example & ATDD

- From Requirements to User Stories
- Specification by Example
- Acceptance Test Driven Development

#### Writing tests in ION

- Testing against asynchronous systems
- Kinds of validations

#### **Robot Framework**

- What is
- Architecture & libraries
- Testing styles and formats
- Reports

#### **Continuous Integration and Testing Automation**

- Problems that we want to address
- What is Continuous Integration
- Testing Automation with Jenkins and Robot Framework



# Specification by example & ATDD

#### Spec by example & ATDD Software Development Life cycle (classic)





#### Spec by example & ATDD Software Development – Possible outcomes





#### Spec by example & ATDD Reviewed development workflow





#### Spec by example & ATDD Deriving the scope from the goals



#### F-16 design team was asked to do the impossible: a cheap 2.5 Mach airplane!

When asked why they need Mach 2 - 2.5, the answer was "to be able to escape from combat."

The solution was **providing acceleration and maneuverability**, not maximum speed.





#### Refuse requirements that are a solution to an unknown problem!





## **User Stories**

A user story is an informal, natural language description of one or more features of a software system.

- Writing a user story is a good starting point to identify the business goals and their scope
- A user story must specify the **actor** and the **reason** of a **feature**

"As a ...... I want ......" in order to ......"

## As a Risk Manager, I want to limit the quantity traded by junior traders in order to avoid an excessive exposure.

#### Spec by example & ATDD Illustrating using examples, collaboratively



- Use a yellow circle
- Divide in two sections, top and bottom
- In the top section, there are two black filled circles, equally distant from the center
- In the bottom section, there is a curved arc equally distant from the outer circle, with two smaller arcs at the end



#### Spec by example & ATDD Illustrating using examples, collaboratively



## Specification by example

Set of collaborative process patterns that facilitate changes in software products, to ensure that the right product is delivered effectively.



#### Spec by example & ATDD Specification by example

- Use simple, concrete and concise examples
- Use real data and avoid abstract descriptions
- Examples must be easy to understand
  - They should trigger a discussion in the team!



#### Examples

RM: "Jeff is a junior trader, he should not create order with a quantity greater than 10k".

RM: "Paul instead is a senior trader, he'd be allowed to do it".

#### User Story

As a risk manager, I want to limit the quantity traded by junior traders in order to avoid an excessive exposure.



#### Spec by example & ATDD Specification by example



#### The specification by example is the result of a discussion among the team members

- Together with the stakeholders, the team members distill some key examples
- Additional examples can be added if considered relevant for the feature
- Standard formats to express the samples ease the process of making them *executable* (e.g. tabular format)

Order Quantity	Outcome	
15 K	REJECTEN This to	able can easil come a true
ISK	ACCEPTED	eptance Test!
ίοκ	ACCEPTED	
	Order Quantity ISK ISK IOK	Order Quantity Outcome 15 K RESECTED This to be 15 K ACCEPTED ACC 10 K ACCEPTED

12

## Spec by example & ATDD Collaboration model

#### Specifications (and tests) should be produced by a team composed of different skills.

#### Possible models are:

- Large workshop, such as a PBR
- Three amigos
  - Business Analyst
  - Developer
  - Tester
- Quick discussion, offline reviews
- Note: developers and testers are often the same people!







- A non-trivial system needs some level of documentation to be maintained and used properly
- Usual paper documentation can become old pretty soon, thus unable to properly describe the system behaviors



#### An authoritative source of truth for everybody is required



#### Spec by example & ATDD Acceptance Test Driven Development



### **ATDD**

Software development process that involves team members with different perspectives (customer, development, testing)

collaborating to write Acceptance Tests in advance of implementing the corresponding functionality.



#### Spec by example & ATDD What is an Acceptance Test?



An Acceptance Test is a procedure aimed to validate a feature respecting to the requirements

#### Acceptance Tests:

Only

relevant

cases are

tested

- can be easily derived from the specifications by example
- describe a specific behavior of the system (they are the effective documentation of a feature)
- are a live specification between the Dev Team and the Product Owner
- are readable and writable also by non-technical people

#	Price	Quantity	Verb	Outcome	ExpPrice	ExpQuantity	ExpVerb
Adding a valid Trade	100	10	BUY	TRADE BOOKED	100	10	BUY
Adding an invalid Trade	100	-10	BUY	FAILURE	-	-	-
because Quantity is negative.							
A testing framework	can parse	this table	and execut	e the test.		Tabular format:	the
Exai	mple: <b>Rob</b>	ot Framev	vork.			one preferred in	ION

The expectations contain only details relevant for the feature

#### Spec by example & ATDD Pyramid of tests







## Writing tests in ION

#### Spec by example & ATDD Writing tests in ION – The ION Platform







#### Spec by example & ATDD ION example of Acceptance Test

	LOC	CATION BAS	ED COMPONE	NT SCHEDUL	ING					
	Settings									
Resource	\${/}\${/}init.html	Cor	nponent New Yo	rk		Tokyo SysAdmin 17:00 (GMT+8)				
Force Tags	Force Tags         location_based_comp_scheduling         112         04:00 (GMT-5)									
Suite Teardown	Set Registration Daemon	MASTER			, K					
	Location Based Component Sc	heduling Test C	Test Cases		[Template]	Location Based Component Scheduling				
The test will	generate a schedule like "hhmm-hhmm" using th	e Component Ti	ne Zone, apply it to	the Time Zone's we	eek day, and verify tha	t the component is scheduled accordingly.				
Component Registration Daemon	Component Time Zone	Component Status	Scheduled START (Minutes from now)	Scheduled STOP (Minutes from now)		Expected Output				
Default / Legacy E	ehavior									
MASTER	Local	Waiting	-1	1	Component star	rted immediately and stopped in 1 minute.				
MASTER	Local	Waiting	-2	-1		Nothing to do today.				
MASTER	Local	Running	1	2	Component stopped in	nmediately, started in 1 minute, and stopped in 2 minutes.				
MASTER	Local	Running	-1	1	Cor	mponent stopped in 1 minute.				
MASTER	Local	Running	-2	-1	Con	nponent stopped immediately.				
Time Zones with n	egative offsets									
MASTER	(UTC-12:00) International Date Line West	Waiting	-1	1	Component started imm 12:00) Inte	nediately and stopped in 1 minute, using the (UTC- ernational Date Line West Time Zone.				
MASTER	(UTC-06:00) Central Time (US & Canada)	Waiting	1	2	Component started in 1	minute and stopped in 2 minutes, using the (UTC- 04:00) Caracas Time Zone.				
MASTER	(UTC-05:00) Eastern Time (US & Canada)	Waiting	-1	1	Component started imm 01:0	nediately and stopped in 1 minute, using the (UTC- 00) Cabo Verde Is. Time Zone.				
Time Zones with p	ositive offsets	_	_							
MASTER	(UTC+01:00) Amsterdam, Berlin, Bern, Rome, Stockholm, Vienna	Waiting	1	2	Component started in (UTC+01:00) Sar	n 1 minute and stopped in 2 minutes, using the rajevo, Skopje, Warsaw, Zagreb Time Zone.				
MASTER	(UTC+01:00) Brussels, Copenhagen, Madrid, Pari	s Waiting	-1	1	Component started in (UTC+05:	n 1 minute and stopped in 2 minutes, using the 30) Sri Jayawardenepura Time Zone.				

#### Spec by example & ATDD Writing tests in ION



#### Under the hood, in ION it's always a matter of stimulating an asynchronous system and waiting for a feedback

- Example: processes interacting using the publish \ subscribe over a network connection
- When the system is perturbed, you'll possibly get a feedback after a certain amount of time



#### Spec by example & ATDD Writing tests in ION

Test

Time

OK

End

#### Example

- Suppose a Trade Server component that, when a trade is made, should publish a record containing the trade data.
  - We want to verify the creation of the trade record with the expected data.
  - As soon as we see the condition satisfied, we can proceed further in our test.



Timeout





#### Spec by example & ATDD Writing tests in ION

## ION.

#### Writing tests against asynchronous environments

- Testing strategies should be carefully chosen
  - to avoid writing complicated code to interact with the environment (maintainability)
  - to avoid the usage of anti-patterns
    - Sleeps (let me sleep for enough time before making the check)
    - Polls (repeat until passes {check!})
- The timeout is a first class citizen
  - e.g.: the halting problem, some real cases:
    - Infinite loops
    - Deadlocks
    - Crashes
- Choosing the right timeout to be used is critical
  - Too short -> possible premature failures -> the test is unstable
  - Too long -> waste of time, but only in case of unmet expectations..
    - Quite annoying, expecially when adopting the Test Driven Development





## Robot Framework



#### What is it?

**Robot Framework** is a generic open source test automation framework for acceptance testing and acceptance test-driven development (ATDD).

#### Who does maintain it?

Initially developed by Pekka Klarck at **Nokia Networks** in 2005, it is now maintained by the **Robot Framework Foundation**, a non-profit consortium with the focus on developing, fixing bugs and managing community requests for Robot Framework.



#### Robot Framework Introduction



#### Which license?

Robot Framework is released under the Apache License 2.0.

#### What kind of technology?

The core framework was implemented using **Python**, but runs also in Jython (JVM) and IronPython (.NET).

#### Why?

- Native support to different testing syntaxes
- Modular system, it can be extended through test libraries
- Easy to read reports and logs in HTML format



#### Robot Framework Architecture





Robot Framework Workflow





#### Robot Framework does not know anything about the system under test.

The test libraries act as a driver between Robot Framework and the system under test.

#### Robot Framework Standard Testing Libraries



#### Libraries are officially maintained and distributed by the Robot Framework foundation

BuiltIn	Collections	DateTime	Operating System
Generic kewyords, always imported	To handle lists and collections	To handle date and time values	Basic OS activity, such as copy file
Process	Strings	XML	Telnet
Support for process execution	Manipulations of strings	To verify and modify XML documents	Telnet connection and commands over connection

#### Robot Framework External Testing Libraries



#### External libraries maintained by the community

STANDARD	EXTERNAL	OTHER
Android library	AnywhereLibrary	AppiumLibrary
Library for all your Android automation needs. It uses Calabash Android internally.	Library for festing Single-Page Apps (SPA). Uses Selenium Webdriver and Appium internally.	Library for Android- and iOS-testing. It uses Appium internally.
Archive library	AutoItLibrary	CncLibrary
Library for handling zip- and tar-archives.	Windows GUI testing library that uses AutoIt freeware tool as a driver.	Library for driving a CNC milling machine.
ConfluentKafkaLibrary	CURFLibrary	Database Library (Java)
Library for python confluent kafka.	Library for testing CAN bus with support for ISO-TP and UDS.	Java-based library for database testing. Usable with Jython. Available also at <b>Maven</b> central.
Database Library (Python)	DataDriver Library	Debug Library
Python based library for database testing. Works with any Python interpreter, including Jython.	Library for Data-Driven Testing with external data tables (csv, xls, xlsx, etc.). Pairwise Combinatorial Testing support.	A debug library for RobotFramework, which can be used as an interactive shell(REPL) also.
Diff Library	Django Library	Eclipse Library
Library to diff two files together.	Library for <b>Django</b> , a Python web framework.	Library for testing Eclipse RCP applications using SWT widgets.
robotframework-faker	FTP library	HTTP library (livetest)
Library for <b>Faker</b> , a fake test data generator.	Library for testing and using FTP server with Robot Framework.	Library for HTTP level testing using livetest tool internally.
HTTP library (Requests)	HttpRequestLibrary (Java)	iOS library
Library for HTTP level testing using Request internally.	Library for HTTP level testing using Apache HTTP client. Available also at Maven central.	Library for all your iOS automation needs. It uses Calabash iOS Server internally.
ImageHorizonLibrary	JavaFXLibrary	KiCadLibrary
Cross-platform, pure Python library for GUI automation based on image recognition.	Library for testing JavaFX applications, based on <b>TestFX</b> . Has also remote interface support.	Library for interacting with KiCad EDA designs.
MongoDB library	Mainframe3270 Library	MQTT library
Library for interacting with MongoDB using pymongo.	Library that allows to create automated test scripts to test IBM Mainframe 3270.	Library for testing MQTT brokers and applications.
NcclientLibrary	Rammbock	RemoteSwingLibrary
https://github.com/ncclient/ncclient	Generic network protocol test library that offers easy way to specify network packets and inspect the results of sent and received packets.	Library for testing and connecting to a java process and using SwingLibrary, especially Java Web Start applications.
RESTinstance	RPA framework	SapGuiLibrary
Robot Framework test library for HTTP JSON APIs.	Collection of open-source libraries and tools for Robotic Process Automation (RPA), designed to be used both with Robot Framework and Python.	Library for testing the SAPGUI client using the internal SAP Scripting Engine
Selenium2Screenshots	SeleniumLibrary	SeleniumLibrary for Java
Library for capturing annotated screenshots with Selenium2Library.	Web testing library that uses popular Selenium tool internally.	Java port of the SeleniumLibrary.
SikuliLibrary	SSHLibrary	SudsLibrary
Sikuli Robot Framework Library provide keywords to test UI through <b>Sikulix</b> . This library supports Python 2.x and 3.x.	Enables executing commands on remote machines over an SSH connection. Also supports transfering files using SFTP.	A library for functional testing of SOAP-based web services based on Suds, a dynamic SOAP 1.1 client.
SwingLibrary	TestFX Library	TFTPLibrary
Library for testing Java applications with Swing GUI.	Library to enable to test Java FX applications using the <b>TestFX framework</b> . Has also remote interface support.	Library for interacting over Trivial File Transfer Portocol.
WhiteLibrary	watir-robot	
Library for automating Windows GUI. Based on White framework, supported technologies include Win32, WinForms, and WPF.	Web testing library that uses Watir tool.	

Only for internal usage of UniPI - Ingegneria del Software

#### Robot Framework Key concepts



#### Test case

- Single unit of testing
- Usually defined from a Specification by Example (SBE), covers a user story

#### **Test suite**

- Collection of test cases
- Every file containing a test case is considered a test suite
- Folders are considered test suites

#### Keyword

- Single unit of execution
- Keyword are the basic building blocks of test cases
- Keywords can be composed together to create higher-level keywords

#### Library

• Collection of keywords

#### **Robot Framework** Supported test data formats: HTML



		Sections are identified by the text contained in the first cell of a table					
	Test Cases						
	My first test	[Documente	ation]	This is a very simple	test		
		Log		This is a log messag	e		
		Send Trade	e With Qty	100			
	My second test	[Documente	ation]	This is another very	simple test		
		Check DB t	able	INSTRUMENT			
<ul><li>Pros</li><li>• Nice to re</li></ul>	ad		Table cells are used	d to naturally separate alues			

#### Cons

- Requires HTML editor
- Not SCM-friendly

#### Robot Framework Supported test data formats: Plain text



• SCM friendly

#### Cons

• Readability not excellent

#### Robot Framework Testing styles

#### **Keyword driven** (it can be used to describe a flow)



Test Cases	Action	Argument	Argument
User cannot login with a bad pwd	Create Valid User	Fred	12345
	Login With Credentials	Fred	6789
	Status Should Be	Access Denied	

#### **Behavior driven** (a.k.a. Given-When-Then or Gherkin style, good fit for SBEs)

Test Cases		Action		Argument		Argument
User cannot login with a bad pwd		Given a Valid User		Fred		12345
Given/When/Then terms are ignored		When He Logins With Credentials		Fred		6789
Given/when/ then terms are ignored		Then The Status Should Be		Access Denied		
Data driven (another good fit	for SBEs)		nput columns		Output	t columns
Test Cases						
User cannot login with a bad pwd	[Template]		Do login and verify status			
#	Existing user		Login credentials		Expected status	
	Fred : 12345		Fred : 6789		Access denied	
	Fred : 12345		Fred : 12345		Ok	



#### Robot Framework Reports

collapsed by default,

allowing anyway

manual drill down

st Execution Log		
SUITE Login Tests		00:02:06.031
Full Name:	Login Tests	
Source:	C:\TestAutomation\Robot\login_tests	
Start / End / Elapsed:	20170307 11:00:37.001 / 20170307 11:02:43.032 / 00:02:06.031	
status:	7 critical test, 6 passed, <b>1 failed</b> 7 test total, 6 passed, <b>1 failed</b>	
- SUITE Valid Login		00:00:25.089
Full Name:	Login Tests.Valid Login	
Documentation:	A test suite with a single test for valid login.	
	This test has a workflow that is created using keywords in the imported resou	rce file.
Source:	C:\TestAutomation\Robot\login_tests\01_valid_login.robot	
Start / End / Elapsed:	20170307 11:00:37.046 / 20170307 11:01:02.135 / 00:00:25.089	
Status:	1 critical test, 0 passed, <mark>1 failed</mark> 1 test total, 0 passed, <mark>1 failed</mark>	
- TEST Valid Login		00:00:24.813
Full Name:	Login Tests.Valid Login.Valid Login	
Start / End / Elapse	ed: 20170307 11:00:37.316 / 20170307 11:01:02.129 / 00:00:24.813	
Status:	FAIL (critical)	
Message:	Title should have been 'Company XYZ   UserXYZ Dashboard' but was 'Co	mpany XYZ   Some Other Pa
+ KEYWORD resource.	Open Browser To Login Page	00:00:09.103
+ KEYWORD resource.	Input Username planitowner	00:00:00.137
+ KEYWORD resource.	Input Password planitX89q	00:00:00.071
+ KEYWORD resource.	Submit Credentials	00:00:00.134
	Aircraft Page Should Be Open	00:00:10 154
Start / End / Elapse	20170307 11:00:46.766 / 20170307 11:00:56.920 / 00:00:10.154	00.00110.101
+ KEYWORD Selen	ium2Library.Set Selenium Speed \${DELAY5}	00:00:00.00
- KEYWORD Selen	um2Lbary Title Should Be Company XYZ   UserXYZ Dashboard	00:00
Documentation:	Verifies that current page title equals 'title'.	
Start / End / Ela	psed: 20170307 11:00:46.768 / 20170307 11:00:56.919 / 00:00:10.151	
+ KEYWORD S	kelenium2Library.Capture Page Screenshot	00:00:05.133
11:00:56.919	FAIL Title should have been 'Company XYZ   UserXYZ Dashboard' but wa Page	s 'Company XYZ   Some Other
TEARDOWN Selenium	n2Ltray.Close Browser	00:00:05.205
+ SUITE Invalid Login		00:00:58.523
+ SUITE Empty Login		00:00:42.334

Automatically drilled-down to the steps that caused the test failure

#### Robot Framework Creating a testing library



#### Robot Framework can be extended with a custom library of keywords to interact with a specific domain

Easiest and simplest way: set of user keywords in different files, loaded as resources

- Ok for simple keywords and as a first step
- Not recommended for more complex activities (Robot Framework is not a programming language)

More advanced way: keywords defined in Java, C#, or Python, using the APIs offered by Robot Framework

- Perfect choice to hide complex technical activities
- Proper developing effort is required (library code is like production code!)

#### ION has created its own Robot Framework library that allows to interact with the ION domain

The library is used both internally and by ION clients to perform end to end tests on the ION domain alone or integrated with third party systems.



## **Continuous Integration**

#### Continuous Integration and Testing Automation What problems we want to address?

#### **Typical integration scenario**

- You created or changed the code of a project
- To make it usable, you need to integrate it with a bigger solution
- Integration here means building the whole solution: compile, package, test
- The build is the ultimate artifact of the integration process



#### When does it happen?

- Testing for QA
- Demo for business
- New release



#### Continuous Integration and Testing Automation What problems we want to address?

#### Typical issues

- Conflicts with code committed by other developers
- The project does not build
- The program does not work as expected
- The program does not work on some platforms (Operating System, Database, ...)



#### Issues grow together with the solution complexity

- Bigger dev teams, more coordination issues
- More supported platforms, more portability issues
- More modules working together, more integration issues





#### Continuous Integration and Testing Automation When integration goes wrong

#### And when the release deadline comes...

- "It doesn't compile!"
- "The library is old!"
- "Who did commit that #\$%^&!?"
- "Sorry Dear, we have to release! I will come home tomorrow.."





#### Continuous Integration and Testing Automation How to avoid the typical integration issues

#### Key facts to avoid such problems

- Commit code frequently
- Deploy and test frequently
- Fix bugs promptly
- Make it a flow
- Automate
  - Build
  - Testing
  - Reporting

#### How can we achieve this?

The answer is **Continuous Integration** 



#### Continuous Integration and Testing Automation What is Continuous Integration?

#### **Continuous Integration (CI)**

It's a development practice that requires developers to integrate code into a shared repository several times a day.

- Each check-in is then verified by an automated build, allowing teams to detect problems early.
- By integrating regularly, you can detect errors quickly, and locate them more easily.
- Continuous integration is a necessity on complex projects and frequent releases.



#### Continuous Integration and Testing Automation Continuous Integration Cycles





Continuous Integration and Testing Automation C.I. Tools



Version Control Systems Git, SVN Continuous Build Systems Jenkins SON Artifact Repositories Nexus

#### **Code quality inspectors**

Sonar

#### **Testing Frameworks**

Junit, CppUnit, Robot Framework

#### **Deployment Tools**

Docker, Ansible



## Continuous Integration and Testing Automation Jenkins Continuous Build System

#### **Jenkins**

Open source tool aimed to perform Continuous Integration and build automation. The basic functionality of Jenkins is to execute a predefined list of steps, called *jobs*.

- Jenkins job: sequence of tasks or steps in your build process, example:
  - Build the application
  - Verify the code quality
  - Run a shell script
  - Package the build result
  - Execute the integration and acceptance tests
  - Deploy / Release
- The jobs can be triggered in various ways, and chained together
  - e.g. of triggers: every day, after a commit, after another job execution

	General Sou	urce Code Management Build Trigge t Build Post-build Actions	irs	
	Project name	MyProject		
l.	Description	Demo Project		
<i>JS</i> .				
	Discard old bu	[Plain text] <u>Preview</u>	Ø	
	GitHub project	ilus		
	Project url	https://github.com/MyProject/MyProje	ct	
Source Code Management			Advanced	
ourse ooue management	This project is	parameterized	0	
None		Add Parameter 👻		
	Throttle builds		0	
) Cit				
Git	Disable this pr	roject	Ø	
D Git D Subversion	<ul> <li>Disable this pr</li> <li>Execute concerning</li> </ul>	oject urrent builds if necessary	0	
© Git © Subversion Build Triggers	Disable this pr     Execute conce	oject urrent builds if necessary	0	
Git Subversion Build Triggers Trigger builds remotely (e.g., from scripts)	Disable this pr	oject urrent builds if necessary	0	
Git  Subversion  Guild Triggers  Trigger builds remotely (e.g., from scripts) Build after other projects are built	Execute conce	oject urrent builds if necessary	0	
Git Subversion Guild Triggers Trigger builds remotely (e.g., from scripts) Build after other projects are built Build periodically	Execute conce Execute conce	oject urrent builds if necessary Id Environment lete workspace before build starts	0	
Git Git Git Git  Git  Gitle  Gitle	Buil	oject urrent builds if necessary Id Environment lete workspace before build starts ae secret text(s) or file(s)	0	
Git  Subversion  Guild Triggers  Irrigger builds remotely (e.g., from scripts)  Build after other projects are built  Build periodically  GitHub hook trigger for GITScm polling	Buil	oject urrent builds if necessary Id Environment Hete workspace before build starts he secret text(s) or file(s) nort the build if it's stuck	0	
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#### Continuous Integration and Testing Automation A Jenkins pipeline







#### Continuous Integration and Testing Automation Jenkins Monitor



#### The Jenkins monitor displays in real-time the progress of the jobs being executed

Usually, every development team has its own dedicated screens to monitor the status of the team's projects.



#### Continuous Integration and Testing Automation Jenkins Monitor – ION Core Architecture Team – Builds



			Platform Mo	nitor » Build			¢
DB Reader (Windows 32-bit) Rentry Water View Print Programs	DB Writer (Linux 64-bit)	DB Writer (Windows 64-bit)	PLAT to PLAT Adapter (Linux 64-bit)	PLAT to PLAT Adapter (Windows 32-bit)	PLAT to PLAT Adapter (Windows 64-bit)	Reuters EMA Gateway (Linux 64-bit)	Reuters EMA Gateway (Windows 64-bit)
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#### Continuous Integration and Testing Automation Code quality checks – ION Web Server

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## Testing Automation & Continuous Testing



#### What is testing automation?

It's the use of software separate from the software being tested to control the execution of tests and the comparison of actual outcomes with predicted outcomes.

#### What is continuous testing?

It's the process of executing automated tests as part of the software delivery pipeline to obtain immediate feedback on the business risks associated with a software release candidate.



#### Testing Automation and Continuous Testing Continuous Testing with Jenkins and Robot Framework



#### Jenkins allows to execute Robot Framework tests

- The Jenkins job sets up the test environment and triggers the tests
- The outcome of tests is reflected in the job status
- Test reports are automatically attached and accessible on the Jenkins job
- Advanced testing environments can be easily setup
  - The slaves executing the tests can be dynamically allocated (e.g. cloud resources)
  - Containerization (e.g. Docker) is natively supported, allowing to spawn containers on demand for testing purposes





## • Heavy usage of the cloud and containerization to allocate the required hardware resources

• Several teams, geographically distant, share the same C.I. environment

ION uses Jenkins and Robot Framework to automate the execution of tests



• Tens of thousands of tests executed automatically every day

Testing Automation and Continuous Testing Testing Automation in ION



New York

Delhi

#### Testing Automation and Continuous Testing Jenkins Monitor – ION Core Architecture Team – Acceptance Tests



	Platform Monitor » Tests				
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Only for internal usage of UniPI - Ingegneria del Software

#### Testing Automation and Continuous Testing Maintenance



#### Like the production code, the testing code requires maintenance

Real team scenario: several developers possibly changing the production code or adding new tests every day. The probability of affecting negatively the C.I. is not negligible, some examples:

Debugging required

- On purpose backward incompatible changes in the production code
  - Luckily, they are very rare
- Regressions in the production code!
- Bugs in the tests
  - Instabilities
  - Not educated tests
- Performance issues
  - Not trivial tests often require a lot of time and resources to execute
  - Over the years, this can become a serious issue

#### What does maintenance mean

- Few supervisors check the status of the C.I. daily
  - For minor issues, they apply or delegate to other team members the required action points
  - For bigger issues, the team stops working on the production code (No tests?!? No developments are possible!)





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