

D8.3

Version	Final
Author	ATOS
Dissemination	CO
Date	22-06-2018
Status	FINAL



D8.3 Exploitation Plans v1

Project acronym	ELASTEST
Project title	ElasTest: an elastic platform for testing complex distributed large software systems
Project duration	01-01-2017 to 31-12-2019
Project type	H2020-ICT-2016-1. Software Technologies
Project reference	731535
Project website	http://elastest.eu/
Work package	WP8
WP leader	Malena Donato, ATOS
Deliverable nature	***Confidential***
Lead editor	Malena Donato, Atos
Planned delivery date	30-06-2108
Actual delivery date	22-06-2018
Keywords	ElasTest Testing capabilities, Exploitation, value proposition, Business models, sustainability, SWOT, community, main innovations, IPR.



Funded by the European Union

DISCLAIMER

All intellectual property rights are owned by the ElasTest consortium members and are protected by the applicable laws. Except where otherwise specified, all document contents are: “© ElasTest project - All rights reserved”. Reproduction is not authorized without prior written agreement.

All ElasTest consortium members have agreed to full publication of this document. The commercial use of any information contained in this document may require a license from the owner of that information.

Contributors

Name	Affiliation
Malena Donato	ATOS
Guiomar Tuñón	NaevaTec
Emilia Nieto	ATOS
Andy Edmonds	ZHAW
Piyush Harsh	ZHAW
Cesar Sanchez	IMDEA
Varun Gowtham	TUB
Enric Pages	ATOS
Nikolaos Stavros Gavalas	REL
Francisco Lopez	URJC
Magda Kacmajor	IBM
Michael Pauls	TUB
Micael Gallego	URJC
Daniel Ilie Gheorghe Pop	Fraunhofer
Antonia Bertolino	CNR
Enric Pages	ATOS
Boni García	URJC

Version history

Version	Date	Authors	Description of changes
V0.1	25/10/2017	Malena Donato (ATOS)	Initial version of exploitation plan with inputs from partners thanks to business workshops held in meetings
V0.2	29/01/2018	Malena Donato (ATOS)	Exploitation plans
V0.2.a	30/01/2018	Guiomar Tuñón (NaevaTec)	Comments and inclusion Naevatec information
V0.2.b		Andy Edmonds (ZHAW), Piyush Harsh (ZHAW) Cesar Sanchez (IMDEA) Varun Gowtham (TUB) Malena Donato (ATOS) Francisco López (URJC) Nikolaos Stavros Gavalas (REL)	Exploitation plans per partner (draft)
V0.3	10/04/2018	Malena Donato, Emilia Nieto (ATOS)	Atos exploitation plan
V0.4	30/04/2018	Malena Donato, Lara López (ATOS)	Scenarios, potential business models
V0.5	14/05/2018	Eda, Daniel, and Anton	Scenarios applicability
V0.6	18/05/2018	Malena Donato, Emilia Nieto (ATOS)	SWOT, value proposition
V0.6	21/05/2018	Andy Edmonds (ZHAW), Piyush Harsh (ZHAW) Cesar Sanchez (IMDEA) Varun Gowtham (TUB) Enric Pages (ATOS) Nikolaos Stavros Gavalas (REL) Magda Kacmajar (IBM) Michael Pauls (TUB)	Components definition, description, innovation section.
V0.7	23/05/2018	Malena Donato, Emilia Nieto (ATOS)	IPR analysis, problem solved
V0.8	24/05/2018	Malena Donato (ATOS)	Business models, summary on exploitation, KPIs
V0.9	25/05/2018	Guiomar Tuñón (NaevaTec)	Value proposition and overall inputs

V.0.10	29/05/2018	Emilia Nieto (ATOS)	Atos Wordline exploitation
V.0.11	25/05/2018	Guiomar Tuñón (NaevaTec)	Exploitation plans
V.0.12	07/06/2018	Micael Gallego (URJC)	Competitors description
V.0.13	07/06/2018	Malena Donato, Maria Martinez (ATOS)	ElasTest approaches
V.0.14	07/06/2018	Antonia Bertolino (CNR)	CNR exploitation plans
V.0.15	08/06/2018	Malena Donato, Maria Martinez (ATOS)	IPR
V.0.16	11/06/2018	Daniel Ilie Gheorghe Pop (TUB)	Fraunhofer exploitation plans
V.0.17	11/06/2018	Nikolaos Stavros Gavalas (REL) Michael Gallego (URJC)	Exploitation plans, offering, ElasTest usage, stakeholders, value proposition, business models
V.0.18	14/06/2018	Malena Donato (ATOS) Nikolaos Stavros Gavalas (REL)	Overall inputs to business models
V.0.19	15/06/2018	Malena Donato (ATOS)	Final version to revise
V.0.20	20/06/2018	Guiomar Tuñon (NaevaTec)	Revision
V.0.21	21/06/2018	Michael Gallego, Patxi Lopez (URJC)	Main competitors and main capabilities
V.1.0	22/06/2018	Malena Donato (ATOS)	Final version for submission to the EC

Table of contents

1 Executive summary	11
2 Introduction.....	12
3 ElasTest Overview & Offering.....	13
3.1 Main capabilities	14
3.2 What key problems ElasTest is solving?.....	18
3.3 How is ElasTest used?	18
3.4 Stakeholders.....	19
4 Value Proposition	20
4.1.1 <i>Differential value</i>	21
4.1.2 <i>Competitors</i>	22
4.2 Expression of interest.....	24
5 ElasTest exploitable assets	26
6 IPR analysis.....	36
7 Business scenarios & Models.....	38
7.1 Business models	38
7.2 Offering scenario.....	41
7.3 Potential Business Models – Product Packages.....	44
7.3.1 <i>Open source</i>	45
7.3.2 <i>Knowledge Transference</i>	46
7.3.3 <i>Platform commercialization</i>	47
7.3.4 <i>ElasTest as SaaS</i>	48
7.4 Value chain	50
7.5 Validation of Proposed Business Models.....	51
8 Summary of Exploitation plans.....	52
9 Joint Exploitation and Sustainability.....	56
9.1 ElasTest as a whole	56
9.2 Community.....	57
9.3 ElasTest delivery.....	57
9.4 Next steps.....	58
10 Initial SWOT analysis.....	58
11 Impact KPI & Monitoring.....	61
11.1 Key Performance Indicators	61
12 Innovation	66
12.1 Innovation in complex distributed SuT testing	67
12.2 Innovation in WebRTC testing.....	67
12.3 Innovation in Industrial Internet of Things (IIoT)	68
12.4 Innovation in Recommendation Systems for Software Engineering (RSSE)	68
13 Summary, conclusions and next steps	69
14 Notes.....	71
15 References.....	72
Annex A: Individual exploitations plans	73

1 Preliminary Individual exploitation plans	73
1.1 Industrial partners.....	73
1.1.1 <i>Atos</i>	73
1.1.2 <i>NAEVATEC</i>	76
1.1.3 <i>IBM Ireland Ltd.</i>	78
1.1.4 <i>Relational SA</i>	80
1.2 Research & University partners	83
1.2.1 <i>IMDEA Software Institute</i>	83
1.2.2 <i>Universidad Rey Juan Carlos</i>	85
1.2.3 <i>Fraunhofer Open Communications Institute FOKUS</i>	87
1.2.4 <i>Technische Universität Berlin</i>	90
1.2.5 <i>Consiglio Nazionale delle Ricerche (CNR)</i>	94
1.2.6 <i>ZHAW</i>	96
Annex B: Questionarie for partners.....	99
Annex C: SWOTS & BUSS CANVAS.....	101
Annex D: IPR.....	105

Table of Figures

Figure 1. ElasTest overview	15
Figure 2. ElasTest Architecture	27
Figure 3: Business Model Canvas tool to examine the value proposition and potential business models of ElasTest	39
Figure 4. ElasTest Lean Canvas	39
Figure 5. Business model by Strategyzer	44
Figure 6. ElasTest Open Source Model Canvas	46
Figure 7. ElasTest knowledge transfer Model Canvas	47
Figure 8. ElasTest Platform commercialization Model Canvas	48
Figure 9. ElasTest SaaS Model Canvas	50
Figure 10. ElasTest Value chain	51
Figure 11. SWOT Analysis key building blocks	59
Figure 12. ElasTest 1 st SWOT Analysis – May 2017	59

List of Tables

Table 1. ElasTest competitors.....	22
Table 2: External stakeholders interested in ElasTest (at M18).....	24
Table 3. ElasTest exploitable assets	29
Table 4. ElasTest components description	35
Table 5. Apache License	37
Table 6. MIT License	37
Table 7. Business models per partner	52
Table 8. ElasTest 2 nd SWOT analysis – May 2018	60
Table 9. Exploitation through teaching activities table & status M18	62
Table 10. Exploitation through research activities table & status M18	63
Table 11. Technology transfer to industry table & status M18.....	65
Table 12. Creation of spin-off companies table & status M18.....	66
Table 13: Exploitable assets and results of Atos	75
Table 14: Exploitable assets and results of TUB	92
Table 15: IPR and Exploitable assets and results of ElasTest	106

Acronym table

Abbreviation	Full definition
APIs	Application programming interfaces
ARI	Atos Research and Innovation
BM	Business Model
CI	Continuous Integration
DoA	Description of Action
EDS	Device emulator service
E2E	End-to-end
GUI	Graphical User Interface
IIoT	Industrial Internet of Things
KPIs	Key Performance Indicators
KTI	(K C)ommission for Technology and Innovation
QADAvps	Quality Assurance and Development
QoE	Quality of Experience
RSSE	Recommendation System for Software Engineering
M2M	Machine to Machine (M2M) communication
MCC	Mobile Competence Center
RD	Research and Development
SDKs	Software Development Kits
SuT	Software under Test
SiL	Systems in the Large
TiL	Test in the Large
TORM	Test Orchestration and Recommendation Manager
TSS	Test support service
QoE	Quality of Experience
QoS	Quality of Service
UAT	User Acceptance Testing

1 Executive summary

The present document is the result of the work done by ElasTest project partners in the context of the Work package 8 (WP8) “Communication, collaboration and dissemination”. This deliverable is the first iteration of the exploitation plans released by M18 and includes agreement of the consortium partners among others on:

- (i) the business model canvas;
- (ii) the innovation items and exploitation assets with initial Intellectual Property analysis based on viable ElasTest architecture showing partners contribution to each component;
- (iii) the initial individual and possible combined exploitation plans as an extension of the defined ElasTest business models;
- (iv) an introduction to sustainability plan built on the ElasTest platform and intention to create a community of users around ElasTest (see the ElasTest OS community model in deliverable D8.1).
- (v) main ElasTest competitors and comparison with our solution.

During the upcoming eighteen months, the content of this document will be reviewed and updated with new research and with any updates in Individual Exploitation Plans (with assets provided and IPR fillings).

The initial market analysis (was included in the D2.1 State of the Art deliverable) which includes an overview of testing related markets, trying to gauge its size, current needs and ongoing trends, identifying the main players involved (potential competitors etc.,) and is not included in the present document to avoid duplication, but it was used for preparing the SWOT presented. We have included the main competitors and compare these to ElasTest.

For the purpose of creating this report partners have used methodologies and tools that are well known into the community and well described the literature, and were used to understand common approach and messages about ElasTest exploitation. The process of shaping this deliverable was based on a combination of standard innovation management tools and business strategy tools and thanks to “on-hands workshops” during all project meetings. Some of the tools used are: value chain analysis, value proposition, business model canvas, and problems/solving and potential user needs and their analysis, SWOT, and exploitation and innovation questionnaires prepared ad hoc to understand each partner intention.

This deliverable also identifies the different business models that are considered relevant open source, platform commercialization among others. Therefore, in the section 8 it is described the approach to be considered for the common exploitation strategy of ElasTest as SaaS. Following this procedure, the consortium has defined some initial roles in the community and as outcome the final ElasTest common product and the role of the partners in joint exploitation.

2 Introduction

The present deliverable expresses the exploitation plans and intentions of all partners. The materials presented in this document were elaborated during “hands-on” and face-to-face workshops during the different project meetings throughout the course of the first 18 project months: First Exploitation Workshop held on 5th of May 2017 in Berlin, Second Exploitation Workshop held on 7th of September 2017 in Madrid, Third Exploitation Workshop held on 11th of January 2018 in Pisa and last Partner Meeting in 4th May 2018 in Madrid. Those plans are the first of this type since the project started in January 2017. Those workshops aimed to get common understanding of different views such as definition of ElasTest value chain, vale proposition, main innovation, stakeholders, problems, needs among others.

The content of the deliverable is structured into the sections as follows:

- **Section 1: Executive summary**
- **Section 2: Introduction** - is a presentation of ElasTest project and underlines a common understanding and expertise in defining testing.
- **Section 3: ElasTest overview and offering**, explains the ElasTest component, main capabilities, problems that ElasTest solves and the identified ElasTest stakeholders.
- **Section 4: Value Proposition and Value Chain** – it elaborates and summarises for defined main categories of ElasTest stakeholders (technology providers, researchers, etc.) and the value proposition to be delivered and acknowledged towards end-end users (SMEs, start-ups); to define Value Proposition the Business Model Canvas tool was used.
- **Section 5: Exploitable assets**, this section provides a list of defined tangible ElasTest outcomes/assets developed by partners.
- **Section 6: IPR** a preliminary intellectual property management (IPR) foreseen in the project and its analysis.
- **Section 7: Business models and offering scenarios** it provides a pool of potential business scenarios which were sketched by partners - it means different configurations of composite software products which could be exploited later after ElasTest project ends
- **Section 8: Summary of exploitation plans.**
- **Section 9: Joint exploitation and sustainability** the exploitation strategy focuses on the discussions around joint exploitation plans and how an ElasTest platform can be delivered. It aims to explain the first sustainability ideas beyond the lifetime of the project thanks to the creation of the ElasTest community. The consortium idea is to present ElasTest as a solution for end-to-end testing.
- **Section 10: Initial SWOT analysis** describing the outcomes of two iterations to describe each aspect identified.
- **Section 11: Monitoring and KPIs** and their status assessment in each case.

- **Section 12: Innovation** – includes project main areas of innovation and our approach in: Industrial IoT and Innovation in the complex process of distributed System under test testing, WebRTC testing area and in the Industrial Internet of Things (IIoT), and for Recommendation System for Software Engineering (RSSE).
- **Section 13: Summary and Conclusions** - it supplies a summary of this deliverable as well as the planned activities for the next 18 months of the project to ensure the development of a consistent and sound final exploitation strategy for ElasTest.
- **Annex A: Individual exploitation plans** - includes individual strategies of the consortium partners (of different background: industrial partners, SMEs, technology providers and research/academics). Include plans about how to use the project assets/ results in their further activities (e.g. research/ standardisation activities, marketing a product, or commercial opportunities etc.). Also, at the end we have included the template of questionnaire which was circulated around the partners to capture their feedback.
- **Annex B: Questionaries' for partners.**
- **Annex C: SWOTs & Business canvas.**
- **Annex D: IPR management table and overview.**

3 ElasTest Overview & Offering

The goal of this chapter is to explain the nature of ElasTest project and present its main vision.

ElasTest is a research and development project which investigates the current difficulties of software testing of large distributed systems in the cloud. It addresses the complexity of those large systems under a “divide-and-conquer” strategy: many smaller testing units can be orchestrated to create a more complete set of tests of the system. The main objective is to **create a tool for increasing software quality and reduce the time-to-market of the software by providing testers and developers** a whole set of functionalities and capabilities to **improve the efficiency, productivity, code reusability and effectiveness of the testing process**. This is expected to have two main repercussions:

- Firstly, the software would be perceived by final users as more robust and reliable, and
- Secondly, the testers and developers would be able to perform more complex tests in less time.

ElasTest offers an **open source cloud-based testing service platform OS independent**, very **flexible** and compatible with current **Continuous Integration (CI) tools** and methodologies so that testers/developers can use it without disrupting their common practices. It offers capabilities to test end-to-end different type of applications including **web, mobile, real-time video communications and Internet-of-Things** under different configurations and environments allowing testers to reproduce real world conditions. It

aims to provide advanced testing capabilities to increase the scalability, robustness, security and quality of experience of large distributed systems.

Because end-to-end tests are hard to develop, they need to gather information from the system at runtime, and doing so requires a lot of effort (i.e., time, investment and costs). At the end, ElasTest's aim is to allow any software development team to deliver software faster and with fewer defects.

In few words:

ElasTest is an open source integrated end-to-end testing platform to test distributed systems in large (SiL) by:

1. Running end-to-end tests under real world conditions.
2. Gathering information from the tests and the software under test.
3. Presenting the information unified, integrated and enabling easy comparison of tests results from different executions.

The main **features** of the platform are:

4. **Easy to deploy, OS independent, and flexible.**
5. **Easy to use** and to configure all the components of the tested application. wherever they are and run the tests in a few clicks.
6. Get **useful information from all the components.**
7. Gather and **analyse logs.**
8. Ensure that the tested applications work properly in all browsers and versions.

3.1 Main capabilities

The project aims to improve the efficiency and effectiveness of the testing process to improve overall quality of large software systems. Therefore, ElasTest provides the following capacities/functionalities:

- Test orchestration: composing small test units into large tests so-called Tests in the Large (TiL)
- Test execution: the ability of running tests on top of a given infrastructure.
- Elasticity: running tests for large software systems is specially challenging due to the size of the software to be deployed, and usually requires an elastic platform on top of which the SuT can be deployed and tests can be run.
- Instrumentation of the Software under Test (SuT).
- Logs visualization, metrics and recording.
- Log Analysis.
- Testing services that can be used on demand like:
 - Web browsers as a Service (Chrome, and Firefox, Explorer is undergoing).
 - Sensor and actuator emulators as a Service for IoT applications.
 - Monitoring as a Service.
 - Security as a Service.
 - Costs estimation thanks to the Cost Modelling as a Service.

- QoE analysis for WebRTC applications.
- Test recommendatory.

In the future, there's one feature planned to be developed (and offered):

- Test execution comparison.

ElasTest platform integrates a series of services that enables the developers and testers to automatically test their SiL (System in the Large), thanks to the following components that are deeply explained in Section 5; the following picture shows the ElasTest platform in a visual and intuitive way:

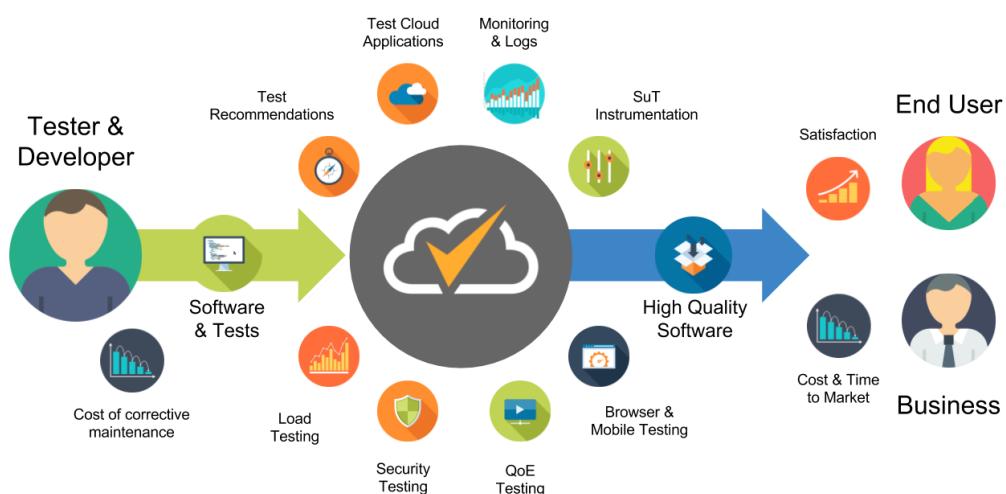


Figure 1. ElasTest overview

The main value of ElasTest is its ability to integrate in a seamless way all those different tools and making them available to developers and testers through a simple user interface or SDKs, Software Development Kits (ie., libraries) that can be leveraged from the test's code).

Moreover, ElasTest aims to be compatible with current Continuous Integration (CI) tools and methodologies commonly used in QA processes, so that developers can use it without disrupting their common practices. Following this line ElasTest will provide at least integration with:

- Jenkins¹, an open source Continuous Integration server with a huge community which currently accounts for more than 50% of market share.
- TestLink², the most widely used open source tool for test management.

Moreover, ElasTest Platform has been designed following a microservice architecture, where each component implements a related set of features in an independent unit. And the following characteristics from microservices are considered:

¹ <https://jenkins.io/>

² <http://testlink.org/>

- Packaged as Docker images & executed as Docker containers.
- Communicate with each other using a remote interface (REST APIs and a message queue for events).
- Manage their own persistence.
- Java, Go, Python, etc.

But in some aspects, ElasTest is not following strictly the microservices architectures:

- Some platform components provide a web interface along with their own remote interface.
- Not all are ready to scale horizontally. Then, service discovery and load balancing has a limited use.

Within this architecture (See deliverable 2.3) (and in Section 5) we can categorize the **components** as follows:

- ElasTest Core Components: These components constitute the enablers of the platform. They have the responsibility of providing management mechanism for the platform, the tests jobs and the software under evaluation.
- ElasTest Test Engines: The engines offer additional capabilities that can be used by the platform or the test support services, thanks to our modular architecture different engines may be plugged.
- ElasTest Test Support Service (TSS): These comprise reusable cloud services used to support the testing of the software under evaluation.

Moreover, ElasTest has the following **capabilities**:

ElasTest: the testing capabilities

The testing capabilities of ElasTest revolve around three main concepts:

- **The test orchestrator**: which enables developers and testers to compose complex test scenarios from simpler ones, giving raise to the concept of Test in the Large (TiL), a test that is a composition of smaller tests (tests in the small), usually with additional assertions specifically built towards assessing the composition behaviour. Notices that this is a research outcome of the project, and a novel idea not present on any other testing tool.
- **The testing services**: those are on demand services that can be used form tests through libraries, easing the development of automated tests. Some of these tools also provide features for manual testing. The following is the list of testing services that we plan to build during the project (note that by the review period 1 we have released several versions of each of them with some initial features, and are working fully integrated in the platform):
 - User impersonation as a Service: This service enables the impersonation of end-users' in their tests through GUI (Graphical User Interface) instrumentation and through mechanisms for QoS and QoE evaluation.

- Sensor, actuator and device impersonation as a Service: This service is useful for enabling tests to emulate customized device behaviour at the time of testing IoT (Internet of Things) applications.
- Monitoring as a Service: This service leverages runtime verification ideas (in turn inspired by formal verification) to represent the system behaviour as sequences of events that can be monitored in universal ways.
- Security Check as a Service: for security vulnerability checking targeting specifically the problems of SiL.
- Big Data Analysis as a Service: enables the collection, analysis and visualization of large volumes of logs.
- **The instrumentation services:** that allows testers and developers to specify real-world conditions to be applied to the SuT for assessing non-functional properties difficult to test in large applications like resilience, elasticity, or performance.

ElasTest Platform: the elasticity capabilities

These manage the deployment and execution of the ElasTest Test Support Services and are responsible for storing state and managing the elasticity of the whole ElasTest platform.

For achieving best reutilization, we followed two principles:

- Independence from the infrastructure. The ElasTest Platform Manager (EPM) is responsible of the different resources that are needed by ElasTest to deploy SuTs and run T-Jobs. Any component in need of some computational resources, will request them to the EPM. This way, we achieve independence of the underlying infrastructure, being it public, private, hybrid cloud or even plain VMs (no cloud orchestrator involved) or physical machines.
- Microservice approach. ElasTest is based on a Microservice architecture, and follows some of its principles:
 - Components are implemented as independent services providing specific features for a given domain
 - All services are packaged as Docker³ images and executed as Docker containers for better isolation. This allows co-locating services together on a single machine while at the same time keeping them independent
 - Components communicate with each other using a remote interface. We selected REST APIs, message queues and websockets as the standard ways for communicating components.
 - Each component decides how to persist its data.
 - Each component can be implemented in its own language. There are ElasTest components build in Java, Go and Python.

But in some aspects, ElasTest is not following strictly the microservices architectures:

³ <https://www.docker.com/>

- Some platform components provide a web interface along with their own remote interface.
- Not all components are ready to scale horizontally. Hence, service discovery and load balancing have a limited use. We plan to solve this issue in the second period of the project.

3.2 What key problems ElasTest is solving?

ElasTest intends to address common problems found currently in E2E (end-to-end) testing of complex distributed cloud applications such as:

- **High cost of time (effort), money, resources.**
 - ElasTest aims to provide innovative tools to save costs, estimate and audit them.
- **Complexity of testing environments** because of the elevated number of unintegrated tools to tests all different facets of the SuT (Software under test) such as functional and non-functional testing. Challenges considering front, back systems etc., and the different browser versions where applications need to be tested.
 - ElasTest provides options for both functional and non-functional testing, considering the system from end-to-end and allows to test simulating different conditions and browsers.
- **Difficult combination and orchestration of tests written for heterogeneous services** (generally testers want to execute the same test, but with different Input data, browser version, SuT configuration...etc).
 - ElasTest provides features to run and combine different tests.
- Currently the **testing tools have limitations for E2E test.**
 - ElasTest offers simplifying the complexity integration and offer testing tools capable of testing the reliability, scalability, consistency, security, and fault-tolerance.
- And solves issues such as:
Solves infrastructure-less testing.
 - Parent testing.
 - Focus on development logic (no wrong about resources, services to support).

In fact, ElasTest provides all this in **one single platform**, where, generally speaking, a tester needs to combine different systems to obtain same results. Whereas in ElasTest all it is integrated and allows: the possibility of doing log analysis, data collection, test execution and even the possibility of reconfigure test and interfere within tests at execution time. Now let's understand how ElasTest can be used.

3.3 How is ElasTest used?

ElasTest is conceived to be used mainly through its web. It provides a way to create, configure and execute tests using ElasTest services. In addition, information gathered during test execution can be inspected and analysed with tools like the included log analyser.

ElasTest is focused in helping testers to implement and execute end to end tests. The main advantage of these tests is obtained when executed periodically to assert the quality of the software and to avoid regressions. Also, ElasTest has a plugin to be used very easily from Jenkins.

On the other hand, some of the services provided by ElasTest can be used directly from the developer editor or IDE (Integrated development environment). For example, ElasTest User Impersonation Service (EUS) provides web browsers. These browsers are used from tests executed in the context of a TJob. But they also can be used from tests executed in the developer machine by means of remote protocol WebDriver.

ElasTest is used to implement tests in any programming language with any testing framework and with standard remote protocols when applicable. For example, tests can be implemented in Java, using JUnit 5 with Selenium. But they can be implemented with TypeScript, Jasmine and Protractor. The only requirement is that tests can be executed in a dockerized environment.

Software under Test (SuT) can be deployed by ElasTest or can be already deployed elsewhere. When is deployed by ElasTest, it should be “dockerized”, with a single container, with a docker-compose or a container will be created with a list of commands to launch the SuT. When SuT is deployed outside ElasTest, standard monitoring agents can be installed to send metrics and logs to ElasTest.

ElasTest main web site (www.elastest.io) has a very detailed documentation that are updated when new versions are released.

3.4 Stakeholders

We have detected multiple stakeholders from many layers of the society all related to software, from whole companies to independent developers. These are stakeholders who might be interested in ElasTest project outcome and findings. It can be seen as a generalization but everybody who makes, commercialize, research or uses software would benefit from the ElasTest platform. Therefore, the key stakeholders are:

- **Companies that make and/or commercialize software:**
 - Companies where testing is part of their business (i.e. PANEL Sistemas).
 - Developers and testers teams would be directly interested on the ElasTest platform because it would simplify some of their tasks so they can focus on other ones.
 - Managers and sales people would be interested in the results of using the ElasTest platform because it would help to achieve higher quality level in the software while reducing the time to market.
 - CEOs will also see the benefits of controlling the costs in advance as well the savings on time and resources ElasTest can achieve.
- **Open-source, Open-use and dedicated communities:**
 - For Open Source communities, would represent a very interesting testing tool (no licensing required).

- The engagement of the open-source or open use and dedicated communities can contribute to the further development of the project prototype.
- **Software and technology providers:**
 - For software users, this tool could represent a quality guarantee.
 - Software developers (supporting –or not- open source communities),
 - Service providers, testing companies, testing divisions (i.e. ATOS SPAIN Seville software factory dedicated to testing)
 - Developers, testing teams
 - Quality Assurance (QA) engineers
 - Testing engineers
- **Other Research and innovation consortiums:**
 - For teachers and researchers ElasTest would be a tool interesting in order to be used for comparing architectures, test other software, and also the research associated to the project would be interesting to these collectives.
 - Projects which can be continuation of ElasTest and those from which we can benefit, including collaborative projects.
 - Students (to study and elaborate the concept).
- **Standardisation bodies**, which are being evaluated seeking promoting new standards. Potential standards to which contribution could take place as it is being explored by ZHAW to the OGF and the OGGL group.
- **Certification authorities**.
- **Individual investors**, business angels or donors (who would be interested in funding further development activities).
- **Incubators and Innovation centres** for aggregating start-ups and SMEs.
- And maybe less, **governmental organization** (which push innovativeness in the region and will spread the concept around SMEs and start-ups).

The Consortium is aware that this list of stakeholders is not closed and will continue monitor changes for inclusions.

4 Value Proposition

Before moving on we need to stop for the **value proposition explanation**. As we have said, testing efforts are huge within organizations to ensure software quality. The value proposition of ElasTest has been subject of exam, analysis and discussion during different workshops held on site meetings. These workshops have let us describe our value proposition as follows.

ElasTest: a vibrant open source platform and the best tool for testing large software distributed systems on the cloud.

The first cut value proposition was defined, based on the expectations of users among project partners:

<p>For (target customer) who (statement of the need or opportunity) the (product/service name) is a (product/service category) that (statement of benefit)</p>	<p>For dynamic cloud software companies, who need to deliver quality software timely, for developers of cross-platform or distributed applications who want to test them in cost/effective way and for those developers who need certainty in their systems, and test and validate complex distributed systems. ElasTest is:</p> <ul style="list-style-type: none"> - Open platform for rapid and accurate end-to-end testing, - A testing infrastructure, that enables advanced end-to-end effective testing, (all-in-one elastic framework) - Supports test scaffolding, planning and execution over a variety of cloud technologies. - Delivers efficient, reliable testing with cost control.
<p>Unlike (primary competitive alternative), our product (statement of primary differentiation).</p>	<p>Unlike previous cloud-testing tools and platforms, ElasTest supports:</p> <ul style="list-style-type: none"> - end-to-end testing of both functional and non-functional properties, - reduces cost and complexity of the testing process for large software systems, - Unlike SOASTA, SauceLabs, Selenium, JMetter, TestRTC, and others, ElasTest provides a complete solution for testing, providing the resources to run the tests and easily integrating provided support services. And our product approach the testing process as all-in-one platform, where the tests cover functionality, performance, security, scalability and other critical features of complex distributed systems.

Figure 3. ElasTest Value proposition

4.1.1 Differential value

ElasTest is an integrated platform for end-to-end testing that is the first differentiator factor.

ElasTest will also use cognitive computing and machine learning mechanisms that will be trained with large amount of knowledge and capable of generating testing recommendations and answering natural language questions about the testing process and integrate different services tested in common environment and provide automation tool for testing that fixes all.

In sum, ElasTest offers an open source testing platform aiming to simplify the end-to-end evaluation of different types of systems (SiL, Systems in Large) in: Web, mobile, real-time, and IIoT.

As part of our sustainability approach discussed in further sections (See Section 9.2), ElasTest is building a community of users and open for contributors and accessible to everyone who is willing to engage in such community.

All these services are offered under the same interface so developers/testers can be focused on testing while the platform reduces the complexity and difficulties of all the side tasks related to testing.

4.1.2 Competitors

ElasTest is a tool that integrates several services focused on running tests, gathering information from those tests and analysis of the information gathered. For this, ElasTest offers:

- Browsers as a service
- WebRTC metric analytics
- Log analysis
- Management of job configurations

ElasTest is not focused on:

- Test management,
- Building UI tests interactively,

Therefore, we skip the tools focused on test management, and we will focus on those tools that provide browsers as a service, or provide tools for gathering information from the tests, or can manage job executions.

Table 1. ElasTest competitors

Tool	Description	Website	Differentiation
TestComplete 	Gives testers the ability to create automated tests in Windows, Web & Android and iOS. Screen capture to create scripts Easy debug scripts 1,500 mobile and desktop browsers in more than 65 operating systems.	https://smartbear.com/product/testcomplete/overview	Big set of desktop and mobile browsers available on many different operating systems.

qTest Explorer	<p>Simple and intuitive to use</p> <p>Easy-to-use UI and low ramp-up time.</p> <p>Records every step and screen of testing execution</p> <p>Take notes and annotate while testing.</p> <p>Archives complete test session recordings.</p> <p>LDAP integration</p> <p>qTest for Jira Test Management is the complete testing and QA platform providing test coverage and bug reporting for Jira issues.</p>	https://www.qasymphony.com/software-testing-tools/qtest-explorer/test-execution-recorder	<p>Annotations on screen captures</p> <p>Integration with JIRA and others.</p> <p>Generation of automation scripts from manual browsing sessions.</p>
Jenkins	A vibrant DevOps Automation Community.	https://jenkins.io	<p>Generic tool for running scripts (jobs)</p> <p>Not specifically tailored towards testing.</p> <p>Recently focused more on Continuous Delivery (DevOps) than on Continuous Integration.</p>
Travis CI	Test and deployment continuous integration service	https://travis-ci.org	<p>Simple definition of automation scripts.</p> <p>Not specifically tailored towards testing.</p> <p>Good integration with GitHub.</p> <p>Provided as a service.</p>

EasyQA	Test management tool for each IT	https://geteasyqa.com	Capturing information when mobile apps crash.
EasyQA	Development team to improve software quality.	m	
SauceLabs	Sauce's test automation cloud enables QA/QE and developers to easily perform functional, Java unit, and manual tests with Selenium, on web and mobile apps, in 500+ browser/OS different combinations.	https://saucelabs.com	Desktop and mobile browsers as a service Lack of metrics gathering.
Test RTC	TestRTC is a testing, monitoring and analytics platform designed and built for the new generation of WebRTC-based communication. TestRTC enables you to improve the user experience of your service pre-launch as well as in production.	https://testrtc.com	The number of browsers can be scaled as necessary Better WebRTC metrics.

4.2 Expression of interest

Here are listed the most important contacts achieved from exploitation activities that could lead to potential collaborations and that can be potential ElasTest customers.

Table 2: External stakeholders interested in ElasTest (at M18)

Organization	Expertise	Specific Interest	Country	Location	Webpage
		initial			

contact					
Panel Sistemas	Testing	Testing and ElasTest platform	Spain	URJC, Spain	https://www.panel.es/
Indra	IT consulting	ElasTest platform	Italy	CNR, Italy	https://www.indracompany.com/it/
Motorola	Telco provider	Testing capabilities	Brazil	CNR, Italy, Brazil	https://www.motorola.com.br/
STAMP (research project)	Testing amplification project	ElasTest platform testing capabilities	Spain	ATOS, Spain	https://www.stamp-project.eu/view/main/
FitSAAS	Software	ElasTest platform testing capabilities	Spain	ATOS, Spain	http://www.fitsaas.com/
Ericsson España	Telco vendor	ElasTest platform testing capabilities	Spain	URJC, Spain	https://www.ericsson.com
RatedPower	Photovoltaics	ElasTest platform	Spain	URJC, Spain	https://www.ratedpower.com/
Testing Factory Seville (ATOS Spain)	Testing factory	ElasTest platform testing capabilities, testing QA	Spain	ATOS (A Software Testing division separated of R&D area)	www.atos.net
Ericsson Eurolab	-Telco Vendor Participation to Advisory Board	Participation to Advisory Board	Germany	OPNFV plugfest, France	https://www.ericsson.com/
VSHN	IT consulting	service manager, orchestration, monitoring	Switzerland	ZHAW	https://vshn.ch

Keysight	Testing services	ElasTest platform testing capabilities, testing QA	Germany	FOKUS	https://www.keysight.com/us/en/home.html
Panel Sistemas	Testing	Testing and ElasTest platform	Spain	URJC, Spain	https://www.panel.es/
Indra	IT consulting	ElasTest platform	Italy	CNR, Italy	https://www.indracompany.com/it/
Motorola	Telco provider	Testing capabilities	Brazil	CNR, Italy, Brazil	https://www.motorola.com.br/

5 ElasTest exploitable assets

In the present section, we describe the ElasTest assets which are the tangible outcomes of the project. Let's remind the reader that the ElasTest main capabilities have been described in Section 3.1 and in the present section we briefly comment on the architecture and the table with the exploitable assets (as main platform result and to allow identification).

ElasTest cloud platform for testing offers integrated services for testers, such as: log analysis, device emulation, QoE analysis and comparison of test execution.

The implementation of this project idea will provide the following type of results:

- ElasTest platform
- A conceptual approach
- The vertical demonstrators
- Software components
- Scientist publications

The ElasTest platform

A conceptual approach and architecture based on microservices, is represented by the project idea and the conceptual architecture conceived for describing the proposed solution. The conceptual architecture described in other deliverable but below we include a simple overview to see key components. Also, there are other results and tangible outcomes that are not “software components” and these are mainly the first two:

- **The vertical demonstrators** (5G from Fraunhofer, IIoT from TUB, Web Atos Wordline and WebRTC from Naevatec).

- Several **scientist publications** will be produced by research partners (CNR, URJC, IMDEA, Fraunhofer, ZHAW and TUB). These publications will be proof of the research done and can be an inspiration for further work to others or even to ourselves. The publications are also the means of dissemination in journals, web sites or events.
- The **software components** are described separately in the next section as the most relevant and complex result to describe and deliver. The below picture shows all the components and the interactions among them.

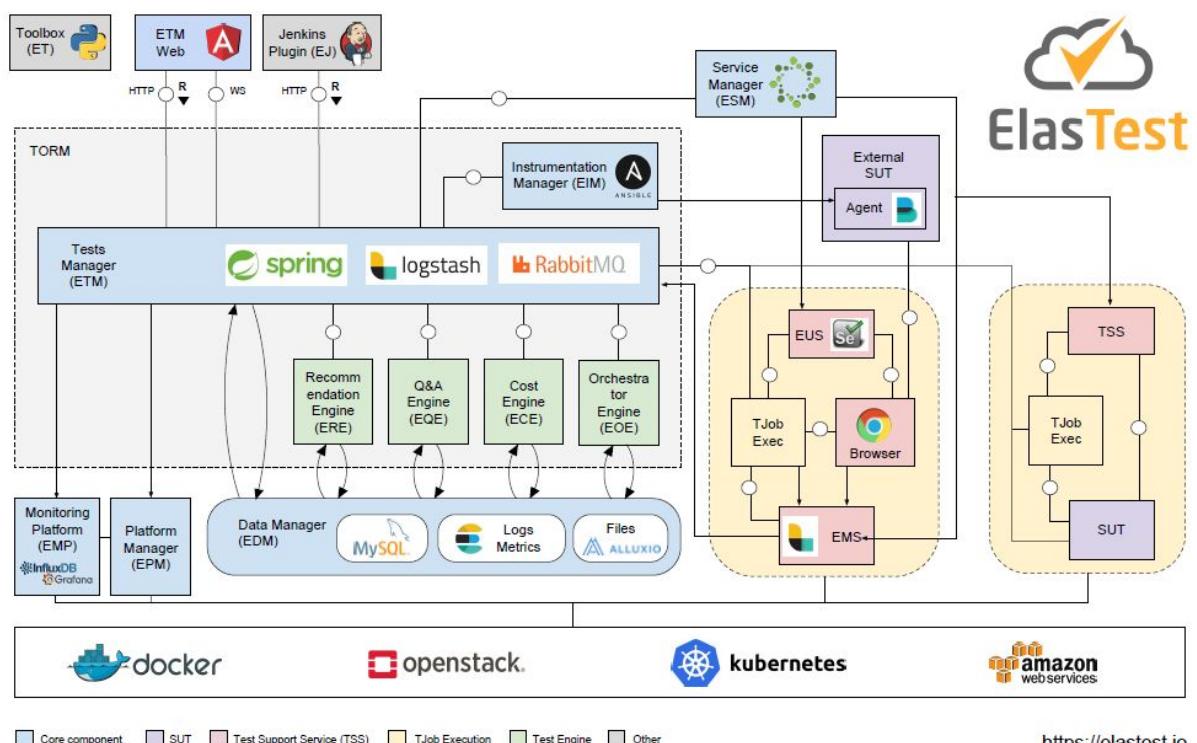


Figure 2. ElasTest Architecture

The complete description of components and the conceptual architecture description can be found in D2.3 ElasTest requirements, use-cases and architecture v1.

Despite the detailed technical description of the ElasTest components is available in the above-mentioned deliverable, next table summarizes the problem every component solves, the technical innovation provided and the added value brought to the project. This information will be useful for identifying potential market and exploitation strategies for each component, if applicable. Some components may not have stand-alone functionality without other core ElasTest elements. Many components have key functionalities that are unique considering the current testing offering.

The table in the next page summarises all ElasTest components and their description and the problem solved, their technical innovation, and added value.

Table 3. ElasTest exploitable assets

Exploitable asset /Component	Description	Problem solved	Technical Innovation	Added Value
TORM	Provides the main entry point for ElasTest and allows the tester manager Test jobs and SUTs.	Provides a controller to all ElasTest features. It is the brain of ElasTest. It is the entry point for testers and external components. It provides a GUI and also manages data recollection and analysis of tests executions.	Allows an easy way to gather information generated during test executions and show it to the user in an easy and comprehensive way. It also organizes the collaboration between test support services and engines with SUTs and TJobs.	It is a powerful glue of several open source technologies to be used in the scenario of tests execution. Especially in the case of complex and distributed SUTs.
Tests Orchestrator Engine	Provides a way to orchestrate, organize and prioritize individual tests against a SuT with a high-level language.	Allows the orchestration, prioritisation and organization of a set of tests.	Provides innovative ways to manage a set of related tests with powerful and high level languages and automated mechanisms.	Make easier to manage a set (potentially huge) of tests.
ElasTest Service Manager	Provides the means for testers to acquire a test support service.	Delivery and management of services on-demand.	Single point of standard-based management for the delivery of services. It doesn't depend on any orchestration technology.	Allows developers leverage pre-existing functionality delivered to their applications/TJobs without

them having to manage the lifecycle of that functionality.

ElasTest Platform Manager	The ElasTest Platform Manager enabling ElasTest to be deployed and to execute seamlessly in the target cloud infrastructure.	Virtualization-agnostic deployment and orchestration of virtual resources.	Uniform interface to talk to several virtualization technologies with advanced functionalities.	Testing-specific features to enable advanced management of virtual resources, such as, retrieving logs, executing commands, downloading/uploading files to the virtual instances at runtime.
Cyclops Open Source codebase	Provides the accounting and billing engine for usage tracking and cost prediction.	Enables accounting, rating, charging and billing of services based on defined pricing and billing models flexibly.	Uniform model driven algorithm to do accounting, billing. The same framework without much modification is usable for variety of billing use cases.	So far in ElasTest no further development has taken place regarding this component. ECE has been an independent design and development so far.
Cognitive Engines	Provides test recommendations and answers to questions related to testing.	Enables cost analysis of use of services based on sensible usage and cost models.	Flexible cost model capable of modelling cost parameters and meter specification of any service.	Allows test developers to estimate the cost of running their tests in ElasTest a priori. After execution, actual incurred cost can also be calculated by the engine thus

enabling transparency in
economics of testing.

Cost Engine	Generate a cost prediction and report the real final cost.	Generate automated test cases based on natural language descriptions.	Generate automated test cases based on natural language descriptions.	Increased code coverage along with better control over the process of automated test generation as compared to approaches such as adaptive random testing. Increased efficiency of testers with low programming skills.
Monitoring as a Service	<p>The goal of this task is to provide a monitoring infrastructure suitable for inspecting executions of a SuT and the ElasTest platform itself online.</p> <p>This service will allow the user and the platform to deploy machines able to process events in real time and generate complex, higher level events from them. This can help to better</p>	Enables the flow of events from the system under test to the test job, to allow the test job to guide the test. It also facilitates writing the outcome of tests.	An efficient engine to analyse events on the fly and subscription languages to describe correlations between input events.	Simplifies writing complex tests that require feedback from the SuT while the test executes.

understand what's happening, detect anomalies, correlate issues, and even stress the tests automatically; all of which aims to maximize the chances of uncover bugs and their causes.

Device emulator service	Provide emulated sensors and emulated actuators. Such emulated devices can be wired into into a user written IoT application.	Enables prototyping and testing of small and large scale IoT applications using the on2M2M industrial M2M communication standard.	Emulation of sensor and actuator devices. An orchestrator which can manage the lifecycle of such devices.	Prototyping of IoT applications does not require real devices. Such IoT applications can be first prototyped and tested for behaviour before deploying with real devices.
Data Manager	A fault-tolerant distributed file system.	Support all data persistence requirements of the platform, and provide the respective tools to backup/restore and visually manage the data.	Provides a single point of management for storing/managing and on-demand-scaling the data persistence services, regardless of the underlying platform.	A wide set of services is provided, allowing all other components to seamlessly integrate to the platform without the added overhead of managing the data stores.
Big Data Services	A distributed computing engine.	A computation engine was needed to allow other components (such as ERE) to perform calculations in a scalable manner.	The whole calculation cluster can be scaled up on demand and decommissioned after every usage, to ensure	Provide the platform with the ability to perform complex computations e.g. log

			minimal footprint in terms of resource utilization and cost.	processing and machine learning.
Instrumentation Manager	Controls and orchestrates de Instrumentation Agents.	Develop the appropriate technologies enabling the installation, configuration and control of the agents across SuT.	Infer unexpected behaviours during the execution of tests gathering their impact in real time.	Allow to observe the behaviour of the SuT tested in real time while is able to inject controllability actions emulating real world conditions.
Instrumentation Agents	Expose observability and controllability capabilities to the SuT Manager.	Instrument the operating system of the SuT host instances.	N/A	The use of well-known probes consuming well established operating system interfaces guarantees interoperability across distributions and versions, moreover guarantees that the tester will have enough information.
User Impersonation as a Service (user emulator Service)	Provides a service to allow tests to control a web browser and a mobile (emulated or real). Several additional features are provided when controlling the browser: session	There are some tools in the open source space to manage browsers and mobiles for testing, but they lack the integration with tests managers or CI systems. The main problem solved by EUS is the integration of the browser	Automated browser logs and WebRTC statistics gathering. Automated creation of dockerized browsers. Browser recording with audio and video. Advanced QoE	Easy of browser management and information gathering. Integration with the rest of ElasTest features.



	visualization in ElasTest web interface, recording, playback, several WebRTC specific metrics, etc.	management with the rest of ElasTest features like security testing, metrics and logs gathering, etc. Another problem solved by EUS is the ability to gather console logs and WebRTC statistics metrics from browser to be stored with the rest of information gathered by ElasTest.	analysis for real time video.	
Toolbox	Provide users automated ways to install ElasTest in several platform types. Currently it is supported the installation of ElasTest with Toolbox in the following platforms: Docker, Vagrant and AWS.	Systems composed by several components are complex to install and configure properly. For that reason, we have implemented several tools that can act like "installers" for different platforms. In that way, a user can install ElasTest in the desired platform easily.	We have implemented a tool called "platform" in form of Docker container. It includes docker-compose tool and a controlled logic to manage what components should be started inside ElasTest. This allow the user to configure ElasTest with a few command line parameters.	Reduced the complexity to install ElasTest in different environments.



Jenkins plugin	<p>It is a connector that allows Jenkins users to use ElasTest features in a seamless way, without changing the way they define jobs.</p>	<p>There are a lot of CI tools available. All of them uses slightly different ways to define the jobs to execute tests and SuT. ElasTest is proposing its own way to define TJobs. It is a problem because a user currently using Jenkins needs to rewrite all TJobs in ElasTest format. This component solves this problem because it allows reusing all existing Jenkins jobs and still take advantage of all ElasTest features.</p>	<p>ElasTest Jenkins plugin is being implemented with standard plugin tools. Hence, there is no innovation in this component.</p>	<p>Avoid the user to rewrite Jobs in ElasTest if he/she has implemented in Jenkins.</p>
----------------	---	--	--	---

Table 4. ElasTest components description

6 IPR analysis

In the present section, we describe the process of the IPR (Intellectual property rights).

The IPR covers two main areas:

- Industrial property (patents; utility models; trademarks; industrial design; and
- Protected designations of origin), and intellectual property in the form of copyright for creative expression (represented by literary, musical, artistic, photographic and audio visual works).

IPR in a nutshell is the monopoly conferred by IP laws which gives the owner the right to exclude other users and therefore privatizes what would otherwise be public. In ElasTest the IPR issues are referred to the software assets described before and as regards its ownership and licensing.

The purpose is to have a common understanding and collect the IPR of project-generated methodologies and/or technology components of the project to see if there are licenses conflicts etc. Very early in the project we have worked in the identification addressing licensing issues that may arise at selecting or developing a component to avoid licensing conflicts that could prevent the exploitation of project results or could make unfeasible the ElasTest sustainability plan.

At this point, there is no agreement for having only one common license for all components. However, all partners are committed to release their software under an Open Source license expect IBM that has a proprietary license. As stated in the DoA there was an agreement and confirmed during project meetings, the only allowed licenses for FOSS artifacts are under the following licenses LGPL, ASL2, and MIT. At this point it is not allowance for other licenses for ElasTest components. Partners developing proprietary artifacts can choose any proprietary license as for example the case of IBM, as we will describe later.

The software Assets were distinguished in the following categories:

- Platform (software) artifacts shall be released through a FOSS license based on LGPL, Apache or MIT,
- Module (software) artifacts based on any license model, including proprietary ones,
- CI (software) artifacts shall be released using a non-restricted FOSS license.

Per our information gathered and first analysis and as can be seen in the Annex that includes the IPR table; most of the ElasTest components have the following three licenses:

- Apache 2.0
- MIT 2.
- One proprietary (that belongs to IBM).

Now, our first analysis based on the available information on the official Apache website states that for Apache 2.0, users can do what they want with the software available, if it is included the required notices. This is a “permissive license” and contains a patent license from the contributors of the code. Therefore, Apache 2.0⁴ in brief allows one to:

Table 5. Apache License

Can	Cannot	Must
Commercial use	Hold Liable	Include copyright
Modify	Use trademark	Include license
Distribute		State changes
Sublicense		Include notice
Private use		
Use patents claims		
Place Warranty		

The other license is MIT. The MIT is basically a short, permissive software license. Users can do whatever they want as long as you include the original copyright and license notice in any copy of the software/source. There are many variations of this license in use.

Table 6. MIT License

Can	Cannot	Must
Commercial	Hold Liable	Include copyright
Modify		Include License
Distribute		
Sublicense		
Private use		

Last but not least, there's one component that has a proprietary license by IBM.

In total, there are 15 components, which in ElasTest components have the following three licenses:

- 14 components are released with Apache 2.0
- 2 subcomponents of the Data Manager (released with Apache 2.0) have the MIT 2 license, these are: The Cloud Commander and the Cerebro.

⁴ <https://www.apache.org/>

- There's 1 proprietary license for the Cognitive Engines that belongs to IBM.

In this regards we will monitor the conflict that may arise as this will affect the ElasTest delivery model.

Some conclusions of the analysis are:

The components under Apache 2.0 license will make the overall release of ElasTest solution as Apache 2.0.

The detection of this conflict causes that the bundle distribution of ElasTest will not be possible since the adoption of Apache 2.0 license does not cover the exploitation intentions of all the partners (Namely IBM and Relational) as explained before.

Afterwards, the overall consortium had a brainstorming to discuss the delivery strategy in accordance to the analysis done by the IPR sheet. The strategy will be to deliver ElasTest in Apache 2.0. However, the partners will monitor the best strategy and any conflicting licensing.

7 Business scenarios & Models

7.1 Business models

Having analysed the offering, the value and the IPR we now can examine the Business Model Canvas. It is important to mention that Consortium sees "ElasTest as a whole" with some of its components being "optional", as a Testing as a Service platform, as a critical role in bringing ElasTest to the market and defines it in the twofold way:

- ElasTest offers services and consulting.
- The other scenario assumes that ElasTest offer services for testing, and afterwards proposing trainings and certification to other interested in understanding part of the analysis of testing done and offering additional support for different SuT analysed.

ElasTest can be expressed in many ways since it can satisfy the needs of developers, software teams, and software testers, DevOps teams as well as organizations such as SMEs, technology and services providers, also can serve to academic and of course FOSS communities. To better understand the value propositions regarding each of the main stakeholders, individual business models were presented by using the well-known "Business Canvas" tool (Figure 4). This tool helps to sort the following entities: Partners, Activities, Resources, Value propositions, Customer relationships, Channels, Customer segments, Cost structure, Revenue structure.

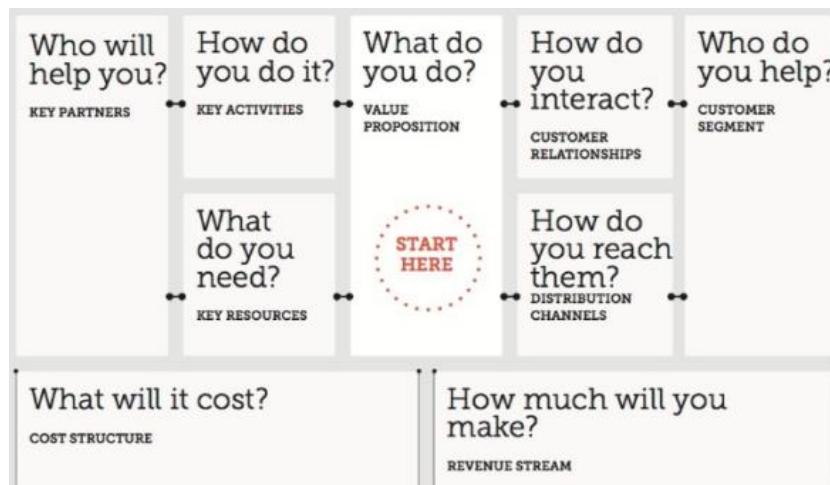


Figure 3: Business Model Canvas tool to examine the value proposition and potential business models of ElasTest

Source: The DIY Toolkit.

All the analysis has lead us to the Figure 5 Lean canvas¹, at the glance we explain it on the figure below⁵.

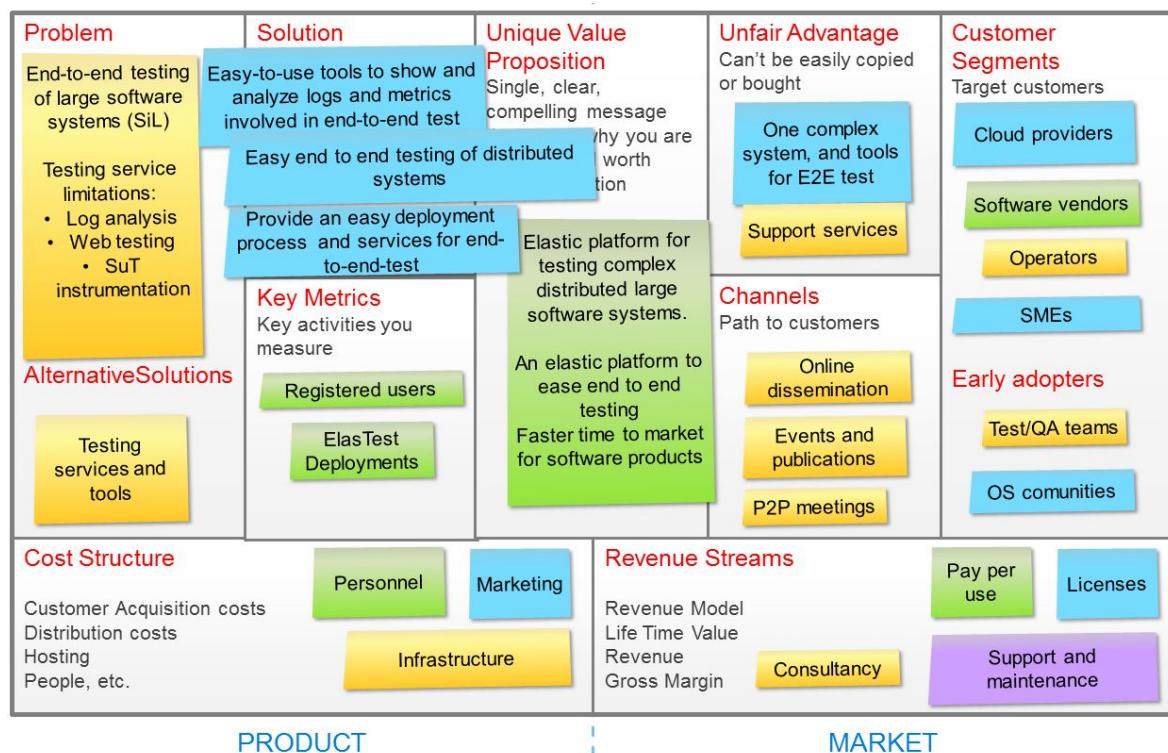


Figure 4. ElasTest Lean Canvas

⁵ Note that the Lean Canvas is adapted from The Business Model Canvas (<http://www.businessmodelgeneration.com>) and is licensed under the Creative Commons Attribution-Share Alike 3.0 Unported License.

To understand better the business model and their value for each category we considered the partners of the consortium and their position and needs in the market.

- ElasTest Platform Provider: ATOS, NaevaTec, IBM.
- Service Provider: ZHAW, ATOS, URJC, REL, IBM.
- Software Developer: ZHAW, Fraunhofer, IMDEA, TUB, URJC, ATOS, Relational and IBM.

7.2 Offering scenario

In the following table, we summarize the offering possible offering ElasTest scenarios that were agreed during meetings with initial ideas for next steps.

Nº	Offering scenario Name	Input	Output	Revenue-generating activity	Strength	Weakness	Viability	Next steps
1	TaaS –Testing as a Service: Basic SuT testing	SuT for testing SiL for testing.	Reports of SuT tested.	Based on licences.	TaaS model, on demand	System development and running costs, maybe similar to SaaS model.	Medium	See if this is feasible in market terms.
3	Selling the test suite as a service	Telco SuTs, IoT devices, emulated sensors, backend app, security, latency, sensors, reliable.	Report of test suites.	Pay per use Selling the simulation technology for sensors and actuators.	Reducing investment in industry environment. Competing offer for the reference market, Control over deployment	Resource intensive, Scalability, Commercial proposition.	Medium	Investigate if this is a viable exploitation route for some partners.

4	ElasTest as a Service (SaaS)	SuT, for load configuration resources for executing the tests.	Reports of SuT tested. Reproduced custom operational conditions for the SuT (System under Test) Enable complex test by composition of simpler ones.	Selling the testing platform as a service. Pay per use (users pay to access and use the software via the Internet).	SaaS model, usage and cost efficiency, community SaaS services	Usage scale, Implementation, Cost evaluation Resource intensive, Scalability, Commercial proposition Internal costs, Strong market competition.	High	Investigate if this is a viable exploitation route for some partners, some have already provided intentions to go for this option.
6	Advertisement	ElasTest as brand.	N/A	Funds come from associated advertising.	Simple to implement.	Based on community needs promotion budget.	Medium	Investigate if adds is a real source of revenue
7	Support, consultancy and training	Advanced knowledge as outcome of the project.	Courses, joint-publications and training.	Support services, training, and consulting services.	Simple to implement in academics.	May take long to validate.	Medium-high	Investigate which partners can be interested in consulting or training services.

9	Research	A standard QA tool in H2020 projects involving 5G, IIoT, and other software Technologies.	Validation of theory work (algorithms).	Common baseline testing ElasTest environment.	validate and benchmark the algorithms.	Cost, legal expertise, Commercial proposition.	Low-medium	R&D contracts need to be sold, so find out if exploitation is viable.
----------	----------	---	---	---	--	--	------------	---

7.3 Potential Business Models – Product Packages

The design of the appropriate **business model** (BM) is the plan implemented by a company before its operation that demonstrates the way of generating revenue. The BM differentiates the company from its competitors and is essential for its establishment and growth. The company Strategyzer⁶ definition is below:

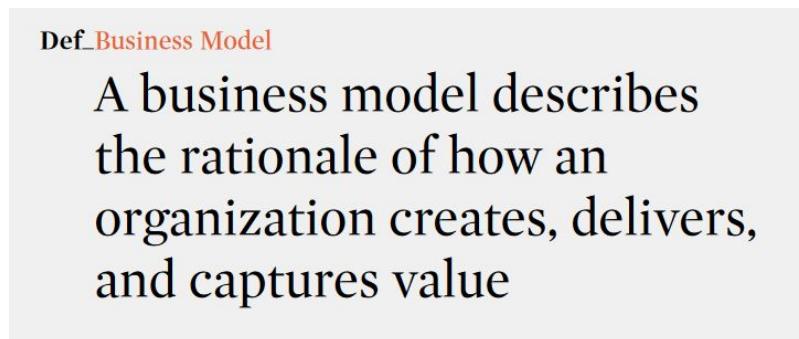


Figure 5. Business model by Strategyzer

And as defined by Harvard review⁷ “is essentially an organized way to lay out your assumptions about not only the key resources and key activities of your value chain, but also your value proposition, customer relationships, channels, customer segments, cost structures, and revenue streams”.

Basically it answers some basic questions.

1. What do you do? (to get the value propositions).
2. Who will help you? (key partners).
3. How do you do it? (for activities).
4. Who do you help? (to understand who are the customers, audiences etc.).
5. What will cost?

The partners through the help of a presentation tool, such as the one that will be described in the next section, answer the questions above, recording them and categorizing them in different groups. As shown in section **¡Error! No se encuentra el origen de la referencia..**.

Therefore, in open discussion we came up with different and potential business models for ElasTest: Open source, Knowledge transference, Platform commercialization, ElasTest as SaaS.

⁶ <https://strategyzer.com>

⁷ <https://hbr.org/2015/01/what-is-a-business-model>

7.3.1 Open source

There are several open source business models. Per Chesbrough, these models include:⁸

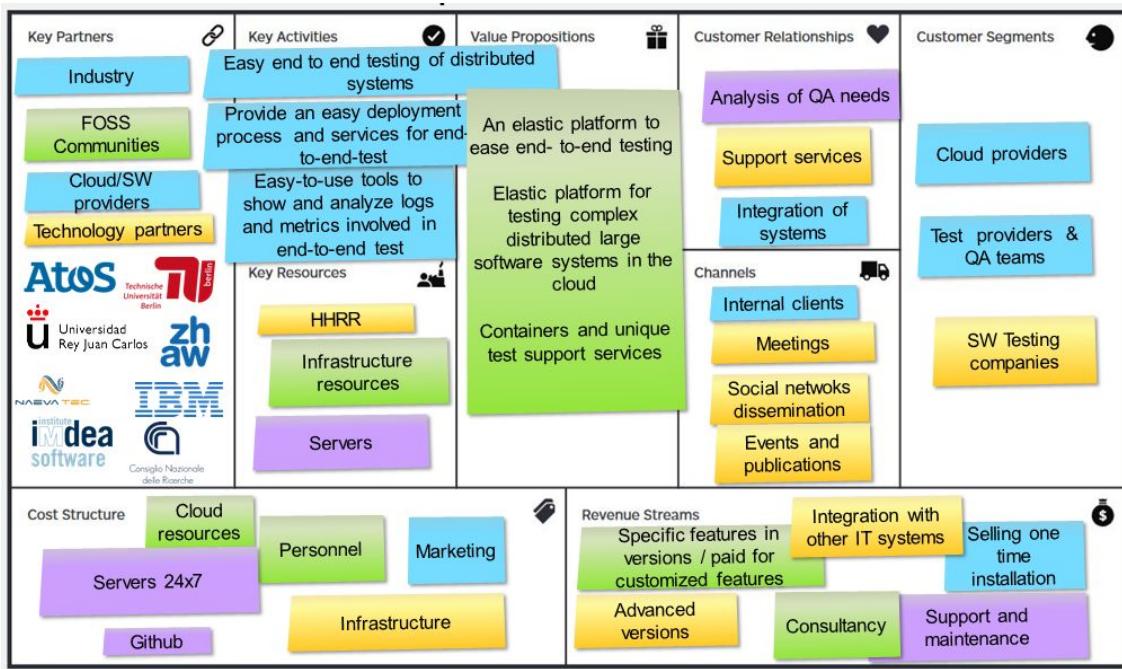
- Selling installation, service, and support with the software
- Versioning the software, with a free version as an entry-level offering and other, more advanced versions as value-added offerings
- Integrating the software with other parts of the customer's IT infrastructure
- Provide proprietary complements to open source software (these increase in value as the cost of the open source code falls; one version of this strategy is to create a creative common and then build a proprietary products or services on top of the commons).

In the case of ElasTest the model could work by offering the components available to the community of users and then in a later stage some specific software components, or more premium features could be charged separately. Other functionalities or features that are not basic could be also offered on top of others or in combination.

ElasTest by default is containerized. This was a design feature that allows it to be easily deployable and maintainable. In the case of exploiting ElasTest as FOSS software (maybe with the addition of proprietary complements too), the installation is something that maybe could be monetized. Moreover, a SaaS solution could be suggested instead, utilizing the partners' know-how in platform management, maintenance and scaling. This, in addition with selling support services could provide a great option, whose viability is already proven by many well-known products in the market (e.g. GitLab, WordPress). A more elaborate description on a SaaS model of ElasTest is given in this chapter.

Of course, the agreement on revenue and market/revenue share etc. should be also detailed in the case of offering open source. Each partner must have their revenue model e.g. proprietary license fee, pay per use, free license with obligatory expert service fee etc. The Open Source canvas model is below:

⁸ Henry Chesbrough, "Open Business Models", Harvard Business School press, 2006

Figure 6. ElasTest Open Source Model Canvas⁹

7.3.2 Knowledge Transference

The knowledge transference deals directly with actions like **courses, training, consulting, pilots** etc., and then charge a fee based on this offering. Some examples could be **training courses**; these could be organized by the academic partners; the teaching will be done at universities to allow students/learners to learn how to operate the platform and how to run their tests involving an active participation and support of different individuals and organizations that belong to the project.

The **teaching** in universities is merely to transfer the ElasTest knowledge and key findings on testing and problems faced in the process of making the platform available, how to operate and to teach students on the topic. The knowledge can be shared through courses, or publications, conferences, and formal or informal exchange, and then the knowledge acquired, could be later used to boost competitiveness of different institutions such as the European industry, academic institutions, or other organisations.

Then delivering **consulting services**, which is an agile approach to help outsiders and other business to understand ElasTest in order to then understand the solution and in a later stage become consultants offering also their knowledge to third parties.

Other ways of transferring knowledge would be through the **pilots** and showcasing a proof of concept based on these.

Considering the challenges that ElasTest faces but to ensure benefits that this solution could bring along, partners have been actively searching for ways to widen and improve our dissemination of activities, and some instruments we plan are:

- Provide knowledge and new services,

⁹ The Business Model Canvas from <https://strategyzer.com/canvas>

- Understand and overcome any funding barriers,
- Strengthen the links between science and industry,
- Establish the Open Source Community and governance, and
- Foster knowledge transfer to education.

The Knowledge transfer canvas model is below:

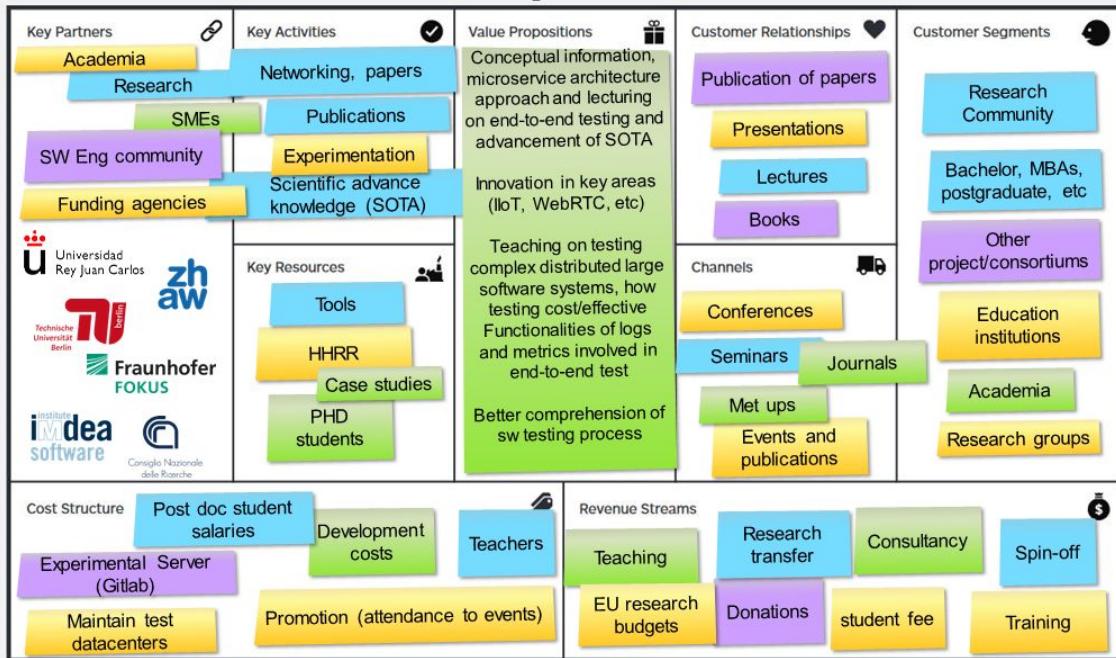


Figure 7. ElasTest knowledge transfer Model Canvas

7.3.3 Platform commercialization

The individual components in the ElasTest platform could be also referred as an ecosystem, and these require efficient connectivity and minimum transaction costs to produce the results that we are expecting. The “**ElasTest cloud platform commercialization**” could be a form of a virtual infrastructure that is offered to a third party. However, to reach this offering, first we need to define the platform commercialization and then how this can be achieved (e.g. through an **exploitation agreement** signed by the involved partners).

Fist, behind the platform commercialization there are compromises from partners such as personal contacts, networks, and knowledge intermediaries and brokers, etc., and to seek commercial business opportunities to an outsider or even for an internal use.

The most important factor for an effective ElasTest cloud infrastructure/platform is not so much the individual components (described in section 5) but how these components are connected and work in the ecosystem and our offering. The cloud infrastructure having all the necessary functionalities/services behind offering their advanced tools in place, but if there are some components that are not well connected or are defective will not function well to serve for its purpose. In the case of the cloud platform

commercialization option the consortium must ensure the functioning and ensure the instrumentation of the components is coherent and works properly. Once the offering is set forth, the next step would be to sign **an exploitation agreement that must include all the partners involved in the platform as components owners.**

In the context of the project, the partners could produce results in the form of separately exploitable components or agree on those components that are produced by one sole partner, while others could be produced on the collaboration of several partners, etc.

The purpose of an agreement among ElasTest partners should establish the terms under which all partners could exploit commercial business (or even for internal use) and to explore opportunities to commercialize the platform (including the assets); the exercise shall be done during the project and encompass a compromise even beyond the EU co-financing finishes.

Once this agreement is reached, the cloud platform could be commercialised to a third party (industry, investor, business angel, etc.) to be offered by them to the market. The agreement on revenue and market share should be also detailed in this agreement set forth. The option of singing an **exploitation agreement** will be analysed in a later stage (e.g. around M24 or M30) by all partners in the consortium, but this is something that has been in the pipeline since the project begun.

The Platform commercialization canvas model is below:

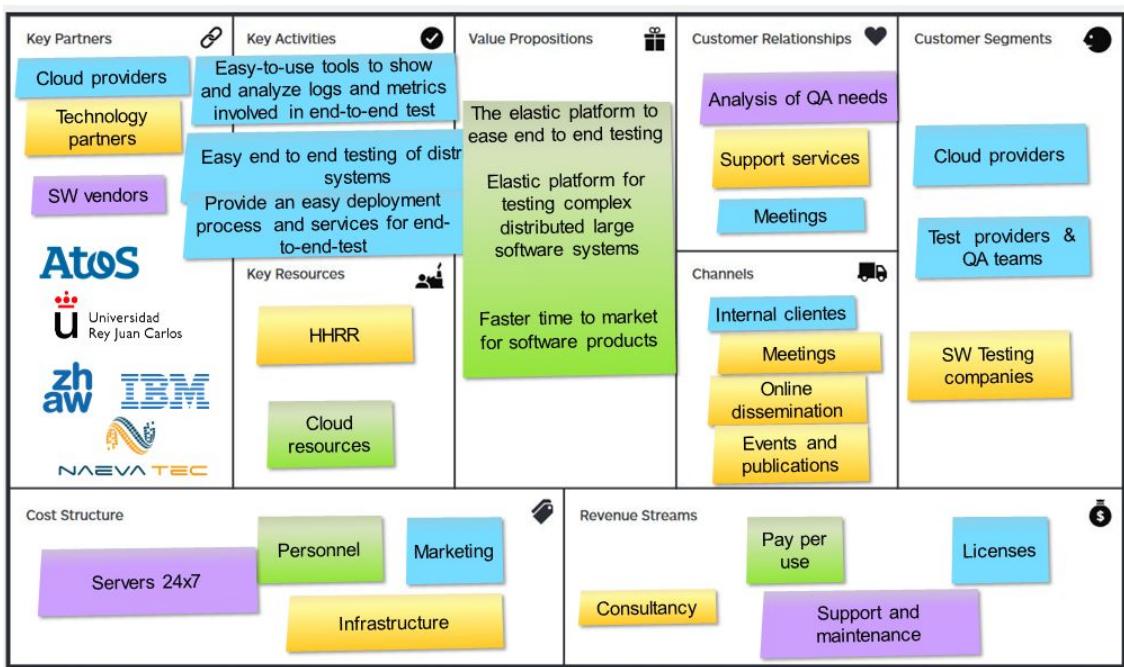


Figure 8. ElasTest Platform commercialization Model Canvas

7.3.4 ElasTest as SaaS

Software as a service (SaaS) is a fairly new business model in which connectors and APIs and mostly are open source but the server code is not accessible to the end-user.

The provision of cloud SaaS infrastructure may be directly linked to one partner that could compromise in hosting the platform and offering the services or can form part of

the core activities of the ElasTest partners themselves (e.g. industry partners, entrepreneurs, investors, researchers, knowledge agents and so forth).

In ElasTest, one may use an application that can access certain data on a server, but not be able to access the actual source code (for example, the TORM system). This approach is the ElasTest current offering which merely allows users to directly test their system, and make the deployment, execution and monitoring of the tested system. The ElasTest architecture and its components have been developed as microservices so their functionality is well defined, encapsulated and feasible to be deployed in a service oriented environment. They would need some extra effort of storage capacity or RAM (mostly) to allow their direct consumption by users following a SaaS model. In addition, as will be described in Section 8 the URJC team, has already stated that "*ElasTest could be offered as a service on premises or in a cloud provider using a pay per use model*".

In fact, offering ElasTest as a SaaS solution provides a great opportunity for all the engaged parties. The benefits from a business aspect can be many and combined they can generate a great value, offering great potential to this specific scenario. More specifically:

- **Testing is generally seen as a cost with little value in the software sector.** Taking this into consideration, providing a one-stop platform such as ElasTest in a turnkey solution package offers a great advantage in penetrating the market; The already existing engineering pipelines of the customer do not need to change, infrastructure does not need to be accounted for and maintenance costs are translated to currency, instead of manpower. In the end, the customer may simply devote some time to test the platform and if they consider it to be a good value, continue in a pay-as-you-go model.
- **A SaaS solution will require a hosted infrastructure.** As such, the partners will need to develop/exchange/improve their knowhow in datacentre management, automated deployment, DevOps, etc. This is generally a slow-start process; however, it is not at all business specific. More specifically, **ElasTest currently sits exactly at the centre of modern datacentre technologies and approaches such as Docker, Kubernetes, microservices architecture** etc. Hence, building a deep knowhow in all the operations-related aspects of modern cloud systems by maintaining one or more production versions of a productized ElasTest is something that can be used to further provide similar services such as cloud services, consulting services, CI/CD services etc.

The SaaS model needs further investigation and analysis, although is a very promising business model especially for industrial partners. This type of canvas model is below:

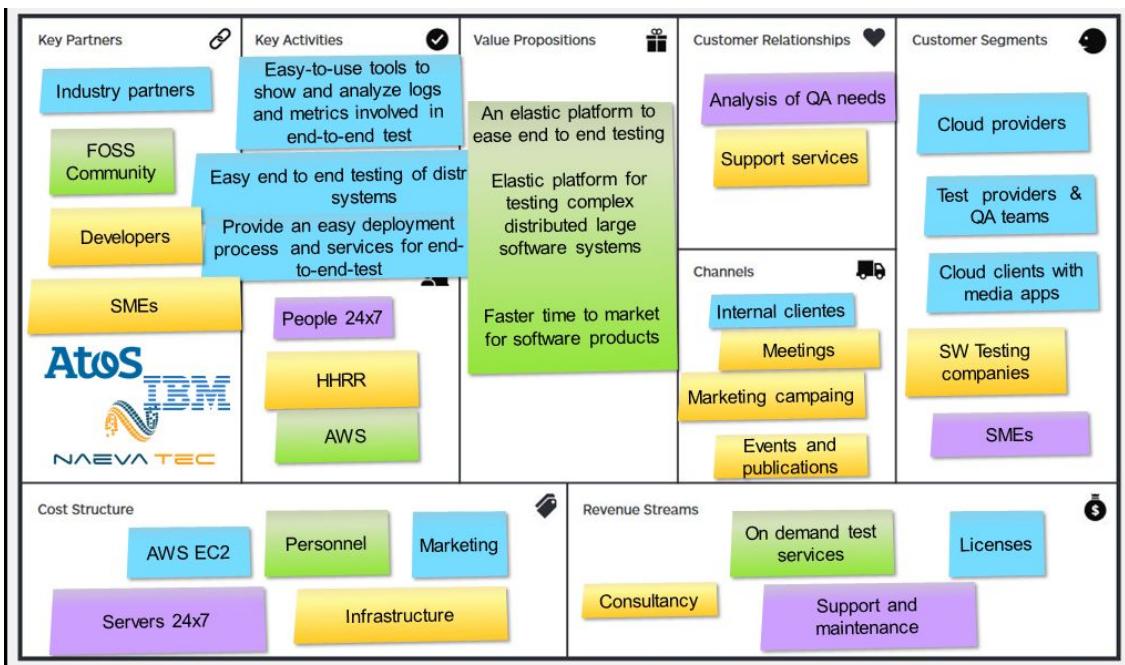


Figure 9. ElasTest SaaS Model Canvas

7.4 Value chain

The value chain consists on the “sum of parts” to deliver valuable product or service for the market. The value chain concept comes from business management and was first described and popularized by Michael Porter many years ago. The value chain analysis is done to understand the potential of the offering and then work towards reducing costs and/or working on differentiating from others. The idea is to recognize which activities will be of most value.

During the 3rd plenary meeting in Madrid, we have run a workshop to fist define our value chain and then analyse how components (and combination of these could provide value).

"The idea of the value chain is based on the process view of organizations, the idea of seeing a manufacturing (or service) organisation as a system, made up of subsystems each with inputs, transformation processes and outputs. Inputs, transformation processes, and outputs involve the acquisition and consumption of resources - money, labour, materials, equipment, buildings, land, administration and management. How value chain activities are carried out determines costs and affects profits."¹⁰

¹⁰ Porter, Michael E. (1985). *Competitive Advantage: Creating and Sustaining Superior Performance*. New York. Simon and Schuster. Retrieved 9 September 2013.

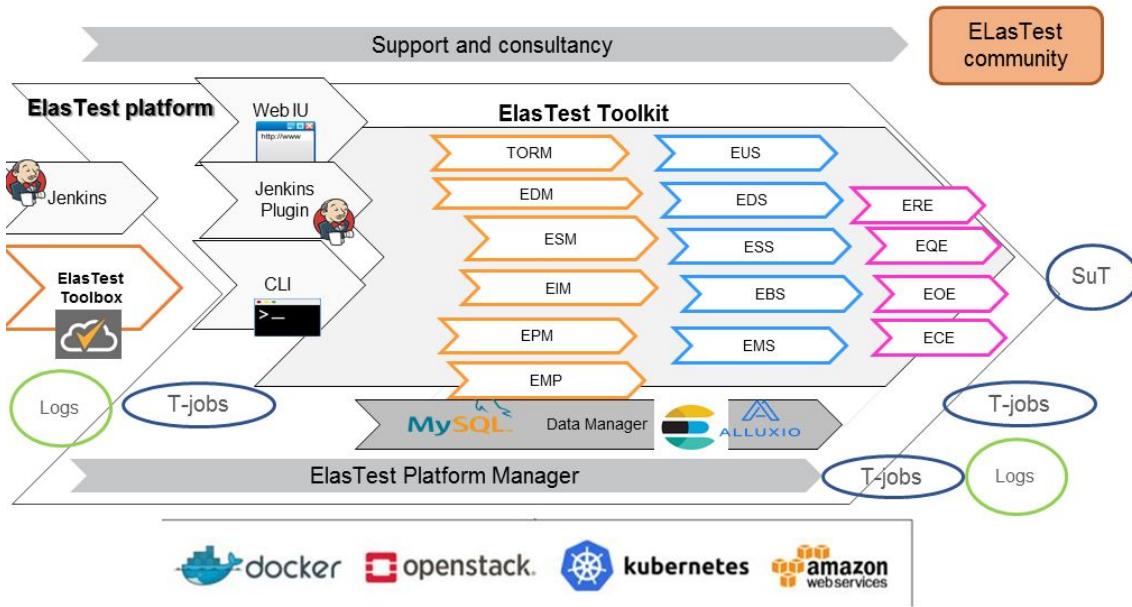


Figure 10. ElasTest Value chain

Actually, ElasTest value chain offers:

- An Elastic cloud platform (a product that will exist also after the end of the project that comprises all the components),
- The two key features of the platform are:
 - Easy deployment process and easy access to the necessary services usually involved in an end to end test and
 - Easy-to-use tools to show and analyze logs and metrics of all elements involved in an end to end test.
- ElasTest main features are:
 - Test management
 - Metrics monitoring
 - Web browsers
 - Log analyser

7.5 Validation of Proposed Business Models

In order to demonstrate the viability of the previously analysed business models it is necessary to validate them in the context of each partner. Therefore, and for this reason some specific questions were included in the business questionnaire for gathering business requirements performed within the scope of WP8 and during meetings. These questions were focused on the expectations of the different stakeholders regarding project results and this is the process and how each partner has elected a potential business model where they can provide value. The table shows the partner name and the four proposed/agreed business models: Open Source, knowledge transference, the Platform as a whole and its commercialization or delivering ElasTest as SaaS.

Partner	Open Source	Knowledge Transference	Platform commercialization	ElasTest as SaaS
URJC	x	x	x (spin-off)	
FRAUNHOFER		x		
TUB	x	x		
CNR	x	x		
IMDEA	x	x		
ATOS	x			x
ZHAW	x	x	x	
NaevaTec	x		x	x
RELATIONAL			x (spin-off)	
IBM	x		x	x

Table 7. Business models per partner

This is the first approach and possible commercialization intentions that need further investigation by consortium partners.

Therefore, the roles in each case are clearly identified. Each case will be updated as needed and each partner will analyse the elected business models and see their viability – and how each partner will work in each business model during the next period M19-M36. The challenge to overcome and that needs further work is to validate the level of innovation in each offering and work towards sustainability

8 Summary of Exploitation plans

Although all the exploitation plans are included in the first Annex A; the present section aims to summarize the main highlights of each partner to facilitate the understanding and approach proposed by each one.

Industrial partners

ATOS and ATOS WLI (Worldline) see exploiting ElasTest in different areas of the company where testing processes presents challenges. We foresee through the following areas: The Mobile Competence Centre (MCC) of Atos Worldline, the ATOS Software Testing Factory in Seville, FIWARE ecosystem, present the assets to the ARI (Atos Research & Innovation) has innovation board and for enriching the Common Development Methodology. Atos WLI will use ElasTest as an internal tool for improving the performance and result of testing phase, in the lifecycle of the solutions developed for Atos & Worldline customers. ElasTest as a SaaS could be added to the portfolio of services and offered to customers for validating software solutions developed by

themselves or by 3rd parties. Moreover, the outcomes will serve the ATOS Software Testing Factory, they provide testing services and ElasTest outcomes will be of great value for this Factory by allowing them to facilitate and automate some of the task they usually perform manually. In this sense, the two components **Instrumentation Manager** and the **Instrumentation Agents**, both for control and observability areas of testing present an opportunity to enrich the current testing systems in house. Moreover, as ATOS is one of the FIWARE foundation core members, we aim at improving our testing process; ATOS is responsible for the non-functional testing tasks. Also, Atos & Worldline are interested in the certification of ElasTest as a QA platform that guarantees to the customers the fulfilment of high standard quality, through the certification of a specialized organism. From a QA specialized service and team and will collaborate in the certification and recognition of ElasTest as a QA platform. Finally, ARI has the innovation board which is an internal decision making group composed by a mix of technical and business oriented profiles, to ensure exploitation of RD results (Research and Development) are transferred to the market, and the developed components will be presented to this board. Also, the testing specifications will serve to the common development methodology.

Naevatec needs to provide quality mobile and web audio/video communications software and ElasTest is expected to leverage the current quality of this type of software making the testing process more efficient and effective. The exploitation route is based on the following exploitable assets and results:

- ElasTest as whole.
- Processes implemented developing with ElasTest.
- Monitoring components.
- ElasTest Jenkins plugin.
- ElasTest Developed tests for WebRTC demonstrator.

Testing WebRTC services has proven to be a great challenge, and high consuming resources task. NaevaTec will benefit from an improvement in the SotA of WebRTC services testing, NaevaTec provides a demonstrator to WebRTC testing with ElasTest.

The **IBM Ireland team** envisages exploiting ElasTest in several key areas of their business, and sees significant potential and opportunity in different areas of the company. Namely, offering the Test Recommendation Engine - a cognitive system capable of learning from different sources of data (such as requirement specifications, test specifications, historical test cases, performance metrics, logs), and generating test recommendations based on learned knowledge. The Question & Answer Engine - a system to allow testers and developers to ask questions related to testing strategies or techniques, and provides answers based on previously gathered knowledge.

RELATIONAL has introduced to the market several proprietary products and services that have resulted from both internal and collaborative R&D activities. Relational foresees exploiting ElasTest outcomes in two technical units which are very relevant: Big

Data Unit and the Data Management Team (referring to Business Intelligence Services Unit). Relational intends to use the open source platform of ElasTest for providing the following new services and new processes:

- New process for performing FTV and UAT tests: Automated implementation of these tests using the ElasTest platform vs traditional method of performing FTV and UAT tests
- New service for its customers: Performing UAT tests for all their IT projects using the ElasTest platform
- New service for other IT companies: Use of ElasTest platform for performing FTV and UAT tests to their IT projects for their customers
- The use of these will decrease the duration and the cost of RELATIONA'S project implementation and make more competitive offers to its customers.

Research and academic partners

IMDEA considers that the EMS (ElasTest Monitoring Service), and particularly its internal monitoring engine, can serve as a core component in other research efforts, like for example on building sophisticated orchestrations of cloud deployments. Additionally, the data obtained from running tests of real SuTs using ElasTest can serve to validate other technologies, like offline analysis of dumped traces, etc. Considering security, they also foresee that ElasTest can serve as a platform to validate security attacks or vulnerability analysis in a much deeper scale than standalone tools can. Being an open-source project, ElasTest has the potential for attracting the developer and user communities. These communities are assets that can potentially contribute to:

- the improvement of the robustness of the tools and techniques we develop (through bug fixing, feedback etc.)
- the development and maintenance of ESS (ElasTest Security as a Service) and EMS.

URJC Code group foresees a demand of mobile testing and performance testing as soon as the first complete release of the platform goes public. They expect the core platform, including the components ETM, EMP, EPM, EUS, EDM and Toolbox (installer) could be exploited for web and mobile testing. Specific features like QoS and QoE offered by EUS could be exploited for WebRTC testing. The Jenkins plugin which provides an integration layer between the popular CI server Jenkins and ElasTest can be exploited with specific features (IPR protected) that clients might demand for their specific use-cases. URJC can help companies in adopting ElasTest and improving their CI practices. It can also develop or tailor the ElasTest tool towards their specific business domains. Code group is already doing training in testing and CI. ElasTest could be incorporated to the training offer. ElasTest could be offered as a service on premises or in a cloud provider using a pay per use model.

FRAUNHOFER FOKUS is committed to demonstrate the ElasTest platform capabilities in the in telecommunication infrastructures. The exploitation plans of Fraunhofer FOKUS

are all centered on existing and emerging testbeds and toolkits. Specifically, ElasTest is interesting for Fraunhofer FOKUS because it facilitates research and innovation on the 5G software components especially towards the core network, new radio technology integration, backhauling, multi-slicing support and software network management as well as the customization towards use cases. Fraunhofer has identified the following key strategic areas of the exploitation of project results:

- Development of the knowledge on the end-to-end 5G system and the further requirements beyond the initial 5G developments, enabling Fraunhofer to provide research and innovation capabilities towards the industry
- Development of comprehensive testbed management mechanisms enabling the optimization and the capacity increase of the Fraunhofer FOKUS testbed deployments
- Development of extensions and updates towards 5G of the Open5GCore and OpenSDNCore toolkits for addressing the 5G end-to-end architecture.

TUB is committed to provide its deep expertise in management and orchestration solutions to design and develop such a component for platform-agnostic management of heterogeneous virtualized resources. This will leverage the expertise of TUB in management and orchestration. In addition, testing complex software system becomes more and more important in the area of NFV and 5G, Industrial Internet of Things (IIoT), Industry 4.0 shop floor IIoT, the use of the device emulator service (EDS) as a test support service (TSS). They foresee to perform teaching activities for attracting new students and via standard channels transfer the knowledge to other companies, or research institutions etc.

The **CNR** is an academic partner, the exploitable assets and results for them are mainly those that provide opportunities for novel research papers and projects and potential benchmarks for experimenting in their research activities. Hence the main assets of ElasTest that CNR might exploit include:

- The ElasTest open source platform
- The outcome from continuous literature and market scouting
- The TORM methodologies concerning test orchestration

The key assets that result from **ZHAW's** efforts in the project will be the monitoring system, the service delivery manager and cost models. The cost model work will be integrated into the ICCLab's monitoring platform, Cyclops. The monitoring system and service delivery manager will be integrated such to provide a platform and system that can be offered to Swiss SMEs via technology innovation transfer programs, specifically KTI11. All assets will be exploited along the strategy of the ICCLab and will also be recorded not only as code but in academic publications that include measurements,

¹¹ <https://www.kti.admin.ch/kti/de/home.html>

benchmarks and evaluations of the created assets. Knowledge gained will also be transferred to ZHAW students enrolled in the bachelor- and master- level courses.

9 Joint Exploitation and Sustainability

The present section explains the different options that we have considered for ensuring ElasTest sustainability.

The maintenance of results beyond the financial resources provided by the European Commission is a must to ensure the ElasTest sustainability. The idea is to create a community of users around ElasTest apart of reaching an agreed scenario where all participants or those interested to pursue that provides incentives monetary or not to continue working on. The licensing will be as said before Apache 2.0 to ensure the project's sustainability. Some models and proposals need further investigation, but the three main areas agreed by partners are described as follows.

9.1 ElasTest as a whole

Different business models (as described in Section 7) have been identified and will be evolved until the project end. At this stage of the project the following Business models will be used in ElasTest:

- **ElasTest as SaaS:** In that case ElasTest is hosted by a cloud provider and offered to users as a service. Several pricing models can be specified, usually with different plans or pay per use. The most similar products offered as a service right now in the market are continuous integration systems like TravisCI or CircleCI.
- **Consultancy and added value services:** This model applies to the ElasTest consortium. Any project member can offer its services to companies that need to install, operate and/or customize ElasTest for its necessities. There are a lot of examples of this business model:
 - A company can have a SuT deployed in a system with some specific technology to gather logs and metrics from it. It could be possible to request some consortium member to adapt ElasTest to integrate with that existing system.
 - A company which has very specific IoT devices no supported by the ElasTest Device Emulator Service (EDS). The ElasTest partner in charge of this Test Support Service can improve this service to support other IoT devices.
- **Academic and educational purposes:** One of the harder aspects in the research area of software engineering is the availability of tools to gather data and perform experiments. The commercial and open source tools available in the market are designed to solve the issues faced in industrial environments.
- ElasTest provides interesting features to be used in **research**. For example, all the information gathered during test execution can be downloaded in a JSON file

to be analysed later. Also, the pluggable infrastructure of ElasTest allows researchers to include new modules tailored for their specific needs. Regarding to educational purposes, ElasTest can be used as a tool in teaching activities related to testing and continuous integration.

9.2 Community

The ElasTest consortium is already **creating a community around the project outcomes**. All components developed in the project are available for use, for other to test their SuT/SiL, including new releases of the software components, support and maintenance.

Creating a community of users is the best way to promote the technology transfer as the consortium offers directly the results to the interested users. It will be a connection between the project partners and the target market, the Open Source communities, large companies and SMEs and the Scientific Community.

There are different advantages by creating this approach:

- users will have a place to make end-to-end testing,
- partners will sponsor and announce their organization and services, a new channel to obtain new clients.

To achieve this goal the OS governance model has been drafted already and there's a way of engraining people wanting to join the community (in a separated document, See Deliverable 8.1).

9.3 ElasTest delivery

As we have seen in previous sections we have the potential business models to commercialise ElasTest or our assets. The models we have elected are currently four: Open source, Knowledge Transference, Platform commercialization and provide ElasTest as SaaS.

We need to see how the delivery of these will be done. We foresee the following options:

- In one case **Software as a Service**.

Other case could be:

- **Offering the platform** (as a package/whole for example)
- **Offering the platform as Open source** (and without direct costs for using it) and charging by consultancy services, training, knowledge transference etc.

In other case, it is true that one natural way would be creating a **university spin-off** as proposed in the DoA or for example offering the platform with licensing activities to increase the payoff of public research for innovation. There are different factors that may affect this approach and this has relation with IPR issues that needs to be further analysed in the second project period involving all partners and their legal departments for further thought. IPR analysis and their ownership is only a first step in a process that

requires additional steps before any research project could be commercialised. ElasTest needs to analyse and agree the IP ownership to serve as an instrument for innovation.

9.4 Next steps

The next steps regarding sustainability are:

- Create the community of users, adopters etc. (i.e. as already started by academic partners)
- Synchronize efforts between exploitation and dissemination tasks
- Intensify efforts needed to develop the ElasTest community
- Organize and distribute the tasks between the project partners for achieving success for conforming the community
- Improve the website and user engagement to build a community

ElasTest consortium is devoted to create a community and we are looking for interested people outside the consortium to join us and test, use and even contribute to our developments.

10 Initial SWOT analysis

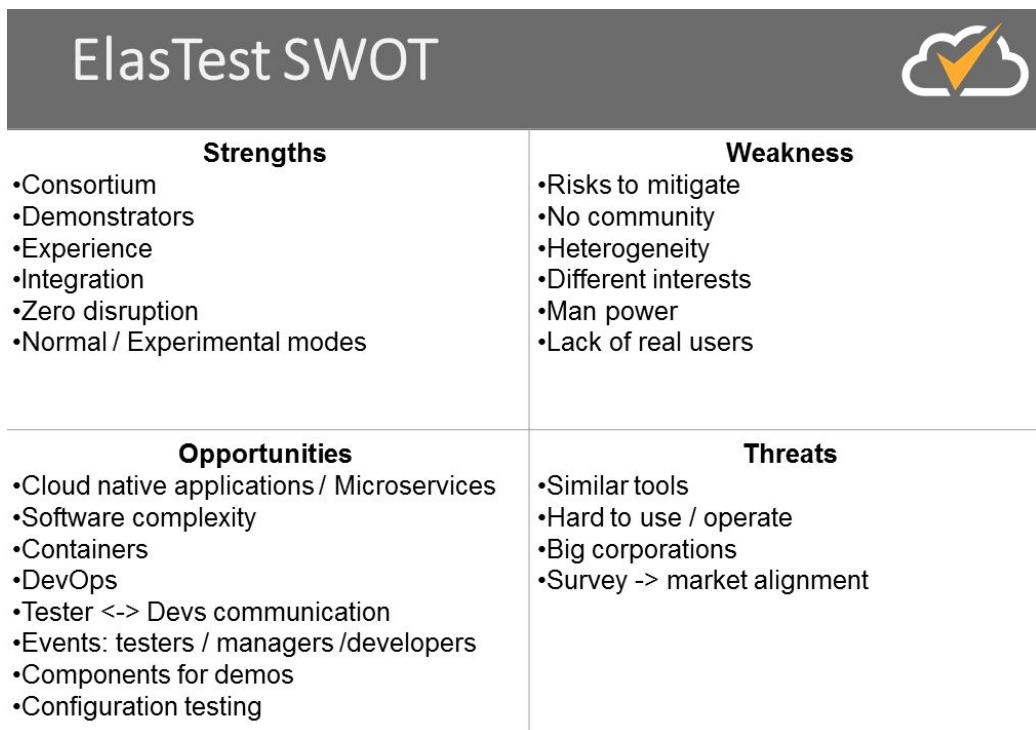
Now let's stop to analyse ElasTest from another perspective: the **SWOT Analysis** as part of the planning exploitation process and very early in the project during the first workshop. In fact, SWOT is an acronym of **Strengths, Weaknesses, Opportunities and Threats**, where both **internal and external aspects of a business are analysed**. The internal aspects are the ones related to our own project so it can be modified, totally opposite to the external ones, which are related to the market without the interaction of the project so they cannot be modified.

This kind of analysis is quite simple to perform, although it should be reviewed from time to time to proactively respond to the changing environment. The traditional way of presenting a SWOT analysis is using a four-square template, like the following one:



Figure 11. SWOT Analysis key building blocks

In ElasTest we have performed our own SWOT analysis in plenary meetings. We have come up with during the first exploitation workshop held on 5th of May 2017. As we have explained in the introduction we have done interactions to refine this analysis as the project evolved. The picture below presents the first approach to **SWOT**, and then we had other iterations to refine the analysis and complete it.



ElasTest SWOT	
Strengths <ul style="list-style-type: none"> Consortium Demonstrators Experience Integration Zero disruption Normal / Experimental modes 	Weakness <ul style="list-style-type: none"> Risks to mitigate No community Heterogeneity Different interests Man power Lack of real users
Opportunities <ul style="list-style-type: none"> Cloud native applications / Microservices Software complexity Containers DevOps Tester <-> Devs communication Events: testers / managers /developers Components for demos Configuration testing 	Threats <ul style="list-style-type: none"> Similar tools Hard to use / operate Big corporations Survey -> market alignment

Figure 12. ElasTest 1st SWOT Analysis – May 2017

Strengths

The identified internal attributes of ElasTest that will help to achieve the project objective to reach the market are:

- Strong consortium partnership and from the research perspective, the solid background gained during the project will result in having the standard platform for end-to-end testing, being a reference in the market.
- Strong demonstrators showcase ElasTest potential
- Open source, each user can configure their test.

ElasTest is a research and development project where all members of the consortium are highly skilled in their areas of expertise; this brings up solutions based on solid principles and innovative ideas not disruptive but sound and incremental innovation. ElasTest platform is promising from the conceptual and technical point of view as one of the main advantages ElasTest is that is offering end-to-end test.

Weaknesses

There are different areas that need to be considered and risks: such as that we lack a community of users to validate our approach and testing offering. Although, ElasTest aims at creating and building a community, that will ensure the platform sustainability.

Some risks to mitigate and to watch are: heterogeneity of partners and each of us with different interests and need to use the man power and resources to achieve best results. Also, we must seek real users as at the beginning the project lacks real users although is solving a key problem in the industry.

Opportunities

The raise of cloud native applications and microservices architectures and the increase of the complexity of the software provides a clear opportunity for ElasTest to capitalize, as ElasTest is designed to test this kind of complex and cloud based systems. Other great opportunity is the DevOps trend where ElasTest philosophy fits perfectly.

Threats

We consider that there are tools in the market that covers the functionality of ElasTest even if they are not as complete as ElasTest they have been on the market for more time. Also, there is the threat of other organizations to release a similar product soon.

ElasTest could be difficult or complex to use and operate (from an external viewpoint). There is option for manual testing with ElasTest, developers can do it but without track of it. Another important aspect, to consider is the lack of success in community building

We have actively worked on this during the project. Addressing (iteratively) new brainstorming for understanding our strengths, opportunities, weakness and/or threats. During the last partner Meeting in 4th May 2018, we have agreed a more mature and detailed present SWOT:

Table 8. ElasTest 2nd SWOT analysis – May 2018

Strengths	Weaknesses
<ul style="list-style-type: none"> • Solving real problems • Use Docker technologies • SaaS delivery model 	<ul style="list-style-type: none"> • Lack of huge data sets to make enough experiments (i.e. Try ElasTest with ElasTest)

<ul style="list-style-type: none"> Real demonstrator's (use cases) tailored to community/developer's needs OS product and modular and unique extendable platform (SaaS) Generation of business and new services on top of ElasTest outcomes Large and growing microservice market and demand 	<ul style="list-style-type: none"> Scalability issues may arise in very large projects/communities, depending on the usability of the ElasTest. Performance/Storage capacity will be dependent on available resources of existing IT infrastructure. Complexity inherent to the combination of knowledge based on components. Jenkins integration may be difficult
Opportunities	Threats
<ul style="list-style-type: none"> New approach: "QADaV" = Quality Assurance and Development Lack of similar technological solutions (end-to-end) test and records of it Increasing awareness of cost of testing OS platform unique and compatible Focus on Jenkins Create a community 	<ul style="list-style-type: none"> Lack of integration and difficult learning curve. Other organizations may release similar products for testing, with some features not included. Lack of success in community building Rely too much on Docker

See Annex C: for more details on the discussed ElasTest SWOTs.

In the present SWOT analysis, the main strengths we see is that there's an opportunity for the product we offer and to use the SaaS delivery model, at the same time we see the community as an opportunity to gather adopters.

11 Impact KPI & Monitoring

To monitor the progress of impact activities ElasTest consortium has defined many Key Performance Indicators (KPIs) to help us monitor all the implementation aspects of our strategy. This initial set of indicative KPIs is how success of our communication plan can be measured.

11.1 Key Performance Indicators

The KPIs may be subject to modification during execution of the project per feedback, opportunities considering maximizing value for money in impact activities. The summary table included in this section explains each action addressing KPIs. The table only shows main actions achieved, but without details, for concrete details on links/websites or summer schools, events etc., the dissemination table has been included as one Annex in D8.2 and contains all events explained here).

We consider the KPIs as described in the DoA and in the present table we show the partner responsible, the description of the KPI and the status at M18:

To simplify we have include this denomination:

- Status: Replacement.
- Status: Achieved + activity description.
- Status: Planned.

Also in the cases where the KPI has been reached (most cases) there's an explanation of the Activity done and its description.

Table 9. Exploitation through teaching activities table & status M18

Partner	Exploitation through teaching activities and Target	Status at M18
URJC	To use ElasTest in the “Telecommunication Engineering” Master in, at least, 1 course.	<p>Status: Replacement.</p> <p>The Telecommunications Master may not fit at the end in the URJC group involved in the project. However, the URJC computer science school is using ElasTest in a Degree course in the subject Advanced Software Engineering, where we conducted an experiment with the students to compare troubleshooting using Jenkins vs ElasTest.</p>
	To use ElasTest in, at least, 5 Bachelor/Master Final Projects or Mini-Theses.	<p>Status: achieved and planned.</p> <p>Activity description: There are already 6 students who already are using ElasTest for their final thesis projects. The foreseen date for submitting/finishing their works is September 2018.</p> <p>Activity planned: Also, there's a plan to engage more students for 2019, maybe again 5-7 students more.</p> <p>Also, the URJC has launched a call to attract students who wish to do the thesis in testing with ElasTest. Specifically, 2 calls done in first semester of 2018 that, if these are granted, would allow students start of research work in testing.</p>
	To introduce ElasTest in, at least, one URJC Summer School course.	<p>Status: planned.</p> <p>The Summer School course is scheduled for 2019.</p>
TUB	To use ElasTest in, at least, 1 Bachelor/Master course.	<p>Status: achieved.</p>

		1 teach lessons/ dedicated lecture covering complex testing (including ElasTest) in the master course "5th Generation Mobile Networks (5G)".
	To use ElasTest in, at least, 3 Bachelor/Master mini Projects or Theses.	Status: achieved and planned (more for 2019). Activity description: 1 Master project: "Performance evaluation of ElasTest Device Emulator Service deployed in ElasTest TORM vs local environment".
CNR	To use ElasTest at the Degree studies at Pisa University in at least one course.	Status: planned. The course/ seminar is planned for 2019.
	To use ElasTest at Gran Sasso Science Institute PhD School in, at least, one course.	Status: achieved. Activity description: 2 courses were taught in GSSI PhD School (during 2017 and 2018).
	To use ElasTest in, at least, 1 course a PhD Summer School (e.g. TAROT).	Status: achieved. Activity description: TAROT summer school was done in 2017.
IMDEA	To use ElasTest lessons learnt at the EIT Digital Master School in 1 seminar.	Status: planned. The EIT digital master lectures are scheduled for 2019.
ZHAW	To use ElasTest in, at least, one bachelor course in the area of cloud computing.	Status: achieved and planned (more for 2019). Core ElasTest technology used in ElasTest (Jenkins, Docker, Docker-compose, etc.) has already been taught in all ZHAW cloud computing courses.
	To use ElasTest in, at least, one Master course in cloud computing.	Status: achieved and planned (more for 2019). Core ElasTest technology used in ElasTest (Jenkins, Docker, Docker-compose, etc.) has already been taught in all ZHAW cloud computing courses.

Table 10. Exploitation through research activities table & status M18

Partner	Exploitation through research activities	Status at M18

URJC	To make ElasTest technologies part of, at least, 1 PhD Thesis.	Status: planned for 2019.
	To integrate ElasTest as the reference testing platform for the Kurento.org community.	Status: planned Activity planned starting end of 2018.
	To generate, at least, 2 additional project proposals evolving ElasTest.	Status: achieved. Activity description: 1 proposal submitted as part of ICT-16-2018
FRAUNHOFER	To use ElasTest as the reference testing platform for its telecom environments and toolkits used by operators worldwide including OpenBaton and Open5GCore toolkits.	Status: partly achieved and planned (see below).
TUB	To integrate ElasTest as the reference testing platform on the OpenBaton community.	Status: achieved. Activity description: (Exploring) Providing a connector (so called EPM adapter) to use the ElasTest to deploy complex System under Tests (SuT) via Open Baton to enable further testing of certain SuTs. This relates also to Fraunhofer's demonstrator to allow on-demand deployments of the Open5GCore via the Open Baton framework.
CNR	To generate at least 2 additional H2020 project proposals leveraging ElasTest results.	Status: achieved. Activity description: 2 proposals submitted.
IMDEA	To use ElasTest in, at least, 2 PhD theses.	Status: achieved. Activity description: The researcher Felipe Gorostiaga will include results in his thesis.
ZHAW	To integrate ElasTest as testing tool for ZHAW software stacks in cloud orchestration (Hurtle), cloud	Status: achieved.

incident management (Watchtower) and cloud billing (Cyclops). Activity description: currently being considered for use within cyclops.

Table 11. Technology transfer to industry table & status M18

Partner	Technology transfer to Industry	Status at M18
URJC	4 consultancy / training activities to industry beyond the consortium.	<p>Status: achieved.</p> <p>Activity description: 3 training activities were done to the following institutions: Ericsson, Zooplus and Panel Sistemas</p>
	4 consultancy / training activities to ElasTest partners beyond the project.	<p>Status: partly achieved and planned</p> <p>Activity description: 1 consultancy for ATOS Worldline on "Test Link integration developments".</p>
	50 declaration of interests (formal or informal).	<p>Status: partly achieved and planned.</p> <p>Activity description: to be collected during 2018-onwards. For now received intentions from: Panel, Ericsson, INDRA Italy, fitSAAS.com and more.</p>
	Technologies/activities obtained through active participation on the ElasTest FOSS community.	<p>Status: partly achieved and planned in gaining community adopters.</p>
	At least 2 presentations to FOSS communities including GStreamer and Docker.	<p>Status: planned for 2019.</p> <p>Activity description: Target DockerCon and Jenkins World, which are more aligned to the project than GStreamer</p>
FRAUNHOFER	At least 2 presentations on industrial events organized by private companies.	<p>Status: planned for 2019.</p>

TUB	At least 2 presentations on industrial events organized by private companies.	Status: partly achieved and planned in 2019. Activity description: 1 presentation done during the “Layer123 SDN NFV World Congress 2017”, title: “An open playground for prototyping and testing complex 5G software-based networks”.
	At least 2 presentations to FOSS communities including OPNFV and OpenStack.	Status: planned for 2019.
CNR	At least 2 seminars/presentation ElasTest to national or international companies.	Status: achieved. Activity description: 1 presentation done to INDRA premises in Rome and another one done to Motorola research Centre in Recife, Brazil.
IMDEA	Will explore technological transfer through the EIT Digital Infrastructures action line.	Status: planned for 2019.
ZHAW	At least 1 transfer project based on ElasTest submitted to the Swiss Commission for Technology and Innovation. This proposal will include at least one industry partner and ZHAW.	Status: planned for 2019.

Table 12. Creation of spin-off companies table & status M18

Creation of spin-off companies		Status
URJC	1 spin-off company based on ElasTest results for exploiting the specific assets generated by URJC and/or the FOSS.	Status: achieved and planned. The URJC is considering this approach and analysing pros-cons of creating a spin-off.

12 Innovation

In the present section, the work on business stops for a moment and considers the **ElasTest main innovations**. We aim to answer and explain why the project ElasTest is

innovative, understanding and highlighting which areas of the project are most innovative and how.

What key innovations do we see as having standalone value? Innovation is based on two types of innovation disruptive or incremental. In research is incremental, but what is our approach? How we are approaching to this innovation. In asking these questions we present this section attempting thought a thoughtful process in answering these.

Therefore, we have identified the following key areas of innovation in the project:

- In the complex process of **distributed System under test testing**,
- In the **WebRTC** testing area
- In relation to the **Industrial Internet of Things (IIoT)**,
- For **Recommendation System for Software Engineering (RSSE)**.

All of them are described as follows.

12.1 Innovation in complex distributed SuT testing

ElasTest platform provides several innovations to test complex distributed applications. In the current version, logs and metrics of every independent service that compose the SuT (Software under Test) are gathered and stored for further inspection. Also, ElasTest provides features to easily analyze and inspect the logs of the services. The main innovation here is the ability to bind metrics and logs to failing tests, allowing more complex analysis and making the tester's work easier. In future versions, ElasTest will also provide the ability to specify network conditions such a maximum bandwidth or latency to simulate several real situations (3G mobile networks, for example).

12.2 Innovation in WebRTC testing

WebRTC is a new web standard to allow real time communication through Internet using web browsers. It is the result of years of joint work between big players on the Internet industry. Today, all major browsers have full support of this technology or are in the way to do so. But this is a very complex technology, very sensible to network topologies and bandwidth conditions. Also, depending on application type, several independent services must be configured to work together correctly (media servers, STUN or TURN servers and application/signalling servers). For that reason, end to end testing of WebRTC based systems requires the ability to test complex network conditions that simulate real conditions in some specific scenarios (high latency, low bandwidth and high jitter). Also, in case of failed end to end tests, it is very important to have as much information as possible for every independent service involved in the test, because failed tests are often the cause of bad interactions between services. For that reason, ElasTest is especially interesting to test WebRTC based applications.

On the other hand, non-functional requirements like video and audio quality are very important in WebRTC applications. These kinds of requirements are over the umbrella of Quality of Experience (QoE). ElasTest will provide specific services to measure QoE of WebRTC applications to allow testers to assert if required quality necessities are meet

in the current SuT configuration or load conditions. QoE services provided in ElasTest will advance the state of the art of the available open source tools.

12.3 Innovation in Industrial Internet of Things (IIoT)

The area of Industrial Internet of Things (IIoT) in the context of Industry 4.0 is an interesting field. An industrial shop floor is continuously evolving, catering to the demands for production and changing towards providing optimal efficiency. Automation is no doubt the heart of production lines in industry which enabled by a close-knit orchestration between Cyber Physical Systems (CPS) and IIoT systems.

The monitoring of industrial shop floor is automated using a cause and effect relationship using sensor as a source of cause and an actuator used to realize the effect. The decision whether to apply an effect based on a set of causes is provided by a logic, which is implemented using a program. The association of the hardware components (such as sensors/actuators) and software components (such as the programmable logic), brings about challenges from defining hardware/software interfaces, to communication and connectivity. The recent advent of fog computing technology has made it possible to distribute sensors/actuators on top of fog nodes which can communicate with other fog nodes to enable Machine to Machine (M2M) communication.

To realize and test IIoT solutions, it is necessary to first procure hardware and software components. To make feasible decisions, it would be helpful if there is a means to test IIoT applications using virtual devices first which are compatible with concepts of M2M communication and fog node architectures.

ElasTest applies incremental research in the field of IIoT, providing a way for rapid prototyping and testing of IIoT solutions. ElasTest has a dedicated microservice and a demonstrator to show the relevance of the project to Industry 4.0. As against the SotA, ElasTest can provide emulated sensors, actuators and smart devices that can be used to implement and test IIoT applications all in a single platform. In particular, with TUB's expertise and knowledge in the field of IIoT, ElasTest extends the SotA which makes it self-sufficient when it comes to testing IIoT solutions. Not to mention the host of other microservices in ElasTest, that can be exploited to increase the technological reach of IIoT applications.

12.4 Innovation in Recommendation Systems for Software Engineering (RSSE)

Recommender systems support decision-making for users confronted with choice overload. While traditional recommenders produce their output in the context of user's profile, the context for Recommendation System for Software Engineering (RSSE) is often defined through the type and characteristics of the task performed by the user.

Tasks related to software testing typically incur serious choice overload; yet the extent of support offered by RSSEs for testers is limited, with most work dedicated to recommending test prioritization based on identifying error-prone code. ElasTest introduces an innovative approach to generating test recommendations. The core novelty is the application of neural translation model to test code, which results in

generating complete and compatible implementations of automated test cases from natural language descriptions provided by testers. This unique approach makes test generation process more transparent to human users and allows them to directly control this process. Furthermore, neural vector space learnt by the model enables a novel way of generating recommendations for test case reuse, based on relative semantic distance between test cases representations.

In next iterations of the agile ElasTest development, this functionality will be extended by a Question & Answer engine which is going to tighten the link between a human decision-maker and machine processes generating test cases, by engaging in a dialog with the user and enabling interactive information exchange.

13 Summary, conclusions and next steps

The material presented in this document is the summary and main conclusions of the analysis conducted and revised over the past 18 projects months. It comprises the value of the project and what main problems aim to solve, stakeholders, and exploitable assets and business models. Also, provides information on the exploitation plans an overview and approaches to sustainability and the assessment of KPIs proposed in the project. The analysis of main areas of innovation is also described.

No.	Performed the following tasks (M1-M18)	Next steps for M18-M36
1	Stakeholders' analysis with completion of the business model canvas and Value Chain analysis.	<ul style="list-style-type: none"> Reviewing (possibly adding) new stakeholders or exploring real competitors for offering ElasTest as SaaS. Update the identified value proposition and unique selling points (if necessary).
2	Market Analysis of competitors (included in the SOTA deliverable) and briefly explained the competitor landscape; and SWOT analysis and different business models per delivery model (OS, SaaS, etc.)	<ul style="list-style-type: none"> Revision of market conditions extended with the market positioning of ElasTest by conducting a feature comparison with leading competitors. PEST analysis.
3	Exploitation research with the ownership model (looking at ownership of the assets, licenses and their dependencies, IPR analysis)	<ul style="list-style-type: none"> Further exploitable component analysis: update with latest IPR analysis and licensing policy to check how the IP protection from each partner's component may impact the joint exploitation, targeted users etc.
4	Individual exploitation plan	<ul style="list-style-type: none"> Analysis and revision and provide guidelines to effectively management of the individual exploitation plans into a whole sustainability approach.

5	Different delivery and business models analysed	<ul style="list-style-type: none">• Analysis of viability of the university spin-offs.• Analysis IPR issues and conflicts, go/no go strategies.• Generation of the ElasTest business plans suitable for evaluating ElasTest services sustainability.
6	ElasTest as a whole/SaaS	<ul style="list-style-type: none">• ElasTest consortium decision on possible joint exploitation (go/ not to go).• Examination of best possible ElasTest configuration on the market with defining approaches.
7	Community set for creation, initial intentions, dissemination, governance rules defined, etc.	<ul style="list-style-type: none">• Consolidation of the ElasTest Community.• Roles of partners in joint exploitation (with possible actors interested in sponsoring the continuation, maintenance and promotion of the underlying project results).• Second and final governance rules and selection of the final product, including sharing revenues among involved parties, etc.• Analysis for each activity of the value chain, cost structure: set up costs, running costs, investment costs, and of course ownership of the branding and goodwill of the project etc.

14 Notes

Tools and methodologies

The short description of the business analysis tools used for this report:

SWOT - is an acronym for strengths, weaknesses, opportunities, and threats analysis - and is a structured planning method that evaluates those four elements within our project.

Business Model Canvas - is a strategic management and lean template for developing new or documenting existing business models, the canvas allows users to describe, design, challenge, and pivot their own business model, and we have used in the context of the ElasTest project. It is a visual chart with elements describing the value proposition, infrastructure, customers, and finances of a firm or a product. It assists firms in aligning their activities by illustrating potential trade-offs. The Business Model Canvas was initially proposed by Alexander Osterwalder.

Value Chain Analysis - is a set of activities and open questions for clarifying how a firm can deliver a valuable product or service for the market.

15 References

- [1] ElasTest project Description of Action (DoA) – part B. Amendment 1. Reference Ares (2017)343382. 23 January 2017.
- [2] Bertolino, A., 2007, May. Software testing research: Achievements, challenges, dreams. In *2007 Future of Software Engineering* (pp. 85-103). IEEE Computer Society.
- [3] Apache 2.0 license terms. <https://www.apache.org/licenses/LICENSE-2.0>. Accessed on 07 March 2017.
- [4] Grant Agreement number: 731535 - ELASTEST - H2020-ICT-2016-2017/H2020-ICT-2016-1. EUROPEAN COMMISSION. Communications Networks, Content and Technology. 11 November 2016.
- [5] https://en.wikipedia.org/wiki/Apache_License
- [6] Lean Canvas is adapted from The Business Model Canvas (<http://www.businessmodelgeneration.com>)
- [7] Porter, Michael E., "Competitive Advantage". 1985, Ch. 1, pp 11-15. The Free Press. New York.
- [8] Rowe, Mason, Dickel, Mann, Mockler; "Strategic Management: a methodological approach". 4th Edition, 1994. Addison-Wesley. Reading Mass.
- [9] Porter M.E., Kramer M.R. (2019) Creating Shared Value. In: Lenssen G., Smith N. (eds) Managing Sustainable Business. Springer, Dordrecht
- [10] Identification of business models through value chain analysis: A method for exploiting large technology projects. Daniel Field 2011. <http://www.scribd.com/doc/66408751>
- [11] Business model generation, by Strategyzer, 2018 retrieved 10 May 2018. <https://assets.strategyzer.com/assets/resources/business-model-generation-book-preview-2010.pdf>
- [12] The Business Model: Recent Developments and Future Research, Zott, Christoph and others. Volume: 37 issue: 4, page(s): 1019-1042. Article first published online: May 2, 2011; Issue published: July 1, 2011
- [13] Bonacorsi, A., Giannangeli, S., & Rossi, C. 2006. Entry strategies under competing standards: Hybrid business models in the open source software industry. *Management Science*, 52: 1085-1098.
- [14] Chesbrough, H.W., & Rosenbloom, R.S. 2002. The role of the business model in capturing value from innovation: Evidence from Xerox Corporation's technology spinoff companies. *Industrial and Corporate Change*, 11: 533-534.
- [15] Doganova, L., & Eyquem-Renault, M. 2009. What do business models do? Innovation devices in technology entrepreneurship. *Research Policy*, 38: 1559-1570.

ANNEX A: INDIVIDUAL EXPLOITATIONS PLANS

1 Preliminary Individual exploitation plans

1.1 Industrial partners

1.1.1 Atos

Partner profile

Atos provides Consulting & Systems Integration services, Managed Services & BPO, Cloud operations, Big Data & Cyber-security solutions, as well as transactional services through Worldline, one of their branches which is the European leader in the payments and transactional services

Atos SE (Societas Europaea) is a leader in digital transformation with circa 100,000 employees in 72 countries and pro forma annual revenue of circa € 12 billion. Serving a global client base, the Group is the European leader in Big Data, Cybersecurity, Digital Workplace and provides Cloud services, Infrastructure & Data Management, Business & Platform solutions, as well as transactional services through Worldline, the European leader in the payment industry. With its cutting-edge technology expertise and industry knowledge, the Group supports the digital transformation of its clients across different business sectors: Defence, Financial Services, Health, Manufacturing, Media, Utilities, Public sector, Retail, Telecommunications, and Transportation. The Group is the Worldwide Information Technology Partner for the Olympic & Paralympic Games and is listed on the Euronext Paris market. Atos operates under the brands Atos, Atos Consulting, Atos Worldgrid, Bull, Canopy, Unify and Worldline. Atos' objective is to empower its clients on their digital journey by applying its in-depth market knowledge and extensive portfolio of services. Pursuing this objective, Atos identified four key challenges that its customers face, whatever their industry sector and whatever their geography: Business Reinvention, Customer Experience, Operational Excellence, Trust & Compliance. Atos has the resources, the scale and the expertise to help its customers meet all the challenges of their transformation.

The motivation and commitment

Atos wanted to participate in ElasTest because in different areas of the company testing presents many challenges that it wants to overcome. It aims to use ElasTest in four different areas:

- Mobile Competence Centre of Worldline.
- For enriching and supporting the FIWARE ecosystem through the testing task (that Atos contributes).
- For providing innovative testing tools for the Testing Factory in Seville.
- For presenting the assets to the ARI innovation board.
- For enriching the Common Development Methodology.

The **Mobile Competence Centre of Worldline** provides to its customers services that cover the full development cycle of mobile applications including testing. In the mobile sector, testing is particularly critical and complex, characterized by a large diversity both of hardware and software, with a plenty of different devices from many branches, models and sizes, and several operating systems with many different versions. This extreme diversity makes testing to be complex and difficult to manage, with many different procedures, flows and tools to be used, hence becoming an expensive service difficult to afford. Using ElasTest Atos plans to minimize these problems increasing the efficiency and effectiveness of mobile testing processes.

ElasTest results will help Atos also in improving the **Testing process in FIWARE** in which Atos is responsible for the non-functional testing. At the moment, the testing team in FIWARE is defining adhoc and by hand all the scripts and use cases for testing each of the Generic Enablers of FIWARE platform. By using ElasTest tools, this process can be automatized, making faster, more efficient and free of errors the testing task.

Moreover, Atos has a well-known and appreciated offering in testing service developed from a dedicated **ATOS Software Testing Factory** located in Seville. This factory is providing testing services to many customers in public administrations and in the private sector, employing many people specialized in testing techniques. ElasTest will be of great value for this Factory by allowing them to facilitate and automate some of the tasks they usually perform. Also, ARI has the **innovation board** which is an internal decision making group composed by a mix of technical and business oriented profiles, to ensure exploitation of RD are transferred to the market, and the developed components will be presented to this board. Also, the testing specifications and knowledge to automatize certain tasks thanks to the use of tools will serve to the **common development methodology developed in ARI**, which is the next step towards adopting DevOps philosophy within ARI.

Means to achieve the objectives

Worldline has a specialized team of testing due to its focus is the development of mobile apps. The necessity to guarantee the compatibility and good performance over the wide diversity of mobile devices makes it fundamental pillar of Worldline company. At the same way, Worldline has a lab with more than 100 mobile devices with different operating systems, versions and screen sizes; and finally, Worldline has configured a farm of mobile devices for Android, that allows the execution of the same test plan in devices from different manufacturers, characteristics, and processors simultaneously. iOS farm configuration is still on-going. ElasTest will be the perfect tool for completing the current infrastructure, and it will allow to extend this model to web application development and to guarantee the compatibility with different web browsers and their versions.

Visible opportunity

In the three areas mentioned above:

- Mobile Competence Centre of Worldline.
- For enriching/supporting the FIWARE testing task (that Atos contributes).
- For providing innovative testing tools for the Testing Factory in Seville.
- The best practices for testing will be used for the ARI common software development methodology developed in ARI. The testing is of paramount importance and will serve for adopting the testing best practices into it.
- Innovation management. The outcomes of ElasTest will be used as well as for serving the testing knowledge to the methodology Atos has for easing the gap between the research and innovation. Thanks to a methodology for incubating assets and present ATOS assets to the innovation board (the Innovation management process defined in ARI with their own methodology).
- The exploitable assets that will be presented to the innovation board are described below.

Exploitable assets and results

Atos has the following two components:

- Instrumentation Manager
- Instrumentation Agents

Asset	Short Description	How Exploited
Instrumentation Manager (ATOS)	<ul style="list-style-type: none"> • Control and orchestrates de Instrumentation Agents 	<ul style="list-style-type: none"> • Develop the appropriate technologies enabling the installation, configuration and control of the agents across SuT
Instrumentation Agent	<ul style="list-style-type: none"> • Expose observability and controllability capabilities to the SuT Manager. 	<ul style="list-style-type: none"> • Consultancy setting for this type of components.

Table 13: Exploitable assets and results of Atos

In addition, ATOS (Atos Research) has a methodology for software development with certain guidelines and rules on how to develop software -to design, integrate, develop and store-, it aims to incorporate testing methodology (based on ElasTest) in this methodology for their own software development. In terms of quality assurance, there's a group now in ARI that is dealing with QA (Quality Assurance) and it is expected to reinforce the QA process thanks to ElasTest outcomes/guidelines on testing.

Rationale

From the point of view of Atos and Worldline as industrial partners focused in the development of software solutions, and provider of services for their customers, it is assumed a double approach:

- ElasTest as an internal tool for improving the performance and result of testing phase, in the lifecycle of the solutions developed for Atos & Worldline customers.
- ElasTest as a SaaS, added to the portfolio of services and offered to customers that trust in Atos & Worldline for validating software solutions developed by themselves or by 3rd parties.

Finally, Atos & Worldline are interested in the certification of ElasTest as a QA platform that guarantees to the customers the fulfilment of high standard quality, through the certification of a specialized organism.

Value towards Joint Exploitation of ElasTest

- As final users, Atos & Worldline will contribute with the detection, definition and implementation of new adaptations of ElasTest for customers.
- From a QA specialized service and team, Atos & Worldline offer their experience to validate the adaptations of ElasTest,
- Atos & Worldline will collaborate in the certification and recognition of ElasTest as a QA platform.

Roadmap for using exploitable assets

After the first review in M18, will be arranged an internal meeting with the Director of the MCC (Mobile Competence Centre) and the Business Development Manager to elaborate a business plan for offering ElasTest to current customers as an added value.

In M21 will be organized a meeting with the project managers with the aim to select two projects where ElasTest will be used as a testing platform for the QA team. The results obtained in these projects will condition the extension of ElasTest to new projects.

Measurement

As it mentioned, Atos & Worldline have two approaches for ElasTest and its measurement will be based in the results obtained by every one of them:

- Number of solutions or projects developed by Atos / Worldline whose testing is based in the utilization of ElasTest as a QA platform.
- Number of customers of Atos / Worldline that have incorporated ElasTest as QA platform for solution developed by themselves or 3rd parties.

1.1.2 NAEVATEC

Partner profile

NaevaTec provides solutions for mobile and web audio/video communications that are customizable to the client's needs. Based on the Kurento initiative NaevaTec provides a leading infrastructure to build WebRTC services. Also, NaevaTec offers an integral

support service to manage IT infrastructures. Task automation and integrated processes allows an unprecedented resources optimization and big costs savings.

The motivation and commitment

Testing WebRTC services has proven to be a great challenge, and high consuming resources task. NaevaTec has plenty of experience with WebRTC services, and they would benefit from an improvement in the SotA of WebRTC services testing so they provide a demonstrator to WebRTC testing with ElasTest. Also, NaevaTec offer their experience with IT infrastructures, task automation and integrated processes in order to optimize the resources needed by the project.

Means to achieve the objectives

NaevaTec has plenty of experience with WebRTC services as they have collaborated with the Kurento Project. They have also provided plenty of customized solutions for mobile and web audio/video communications to clients such as: SettleWare, GHX, Hospital Universitario Niño Jesús, etc. Assuring high quality products is now one of their main objectives to place themselves as reference in web audio/video communications sector as provider of customized solutions based on WebRTC. ElasTest will help NaevaTec to improve the testing capabilities and the final quality of the products.

Visible opportunity

NaevaTec's participation in the project is related to their own necessities for providing quality mobile and web audio/video communications software and the nonexistence of a tool that could make WebRTC testing process more efficient and effective.

Exploitable assets and results

- ElasTest as whole.
- Processes implemented developing with ElasTest.
- Monitoring components.
- ElasTest Jenkins plugin.
- ElasTest Developed tests for WebRTC demonstrator.

Rationale

Currently NaevaTec is focused on providing customized solutions for mobile and web media communications, and they would be using ElasTest as an internal tool. So mainly they are interested in all functionalities related to WebRTC as well as those functionalities that could help them to detect any misbehaviour that impacts the QoE, whether functional or not functional.

NaevaTec also foresees providing consultancy services for other companies that would want to make use of ElasTest, or even provide ElasTest as SaaS for their clients.

Value towards Joint Exploitation of ElasTest

NaevaTec foresee three main ways towards joint exploitation:

- In the case the commercialization of **ElasTest as a SaaS**, collaboration with the proprietary components (ElasTest Recommendation Engine). NaevaTec would look forward to collaborate with IBM to provide this component to their clients on demand.
- In the case of the Jenkins Plugin, NaevaTec presumes collaboration with the community to make the Plugin usable in many different use cases.
- In the case of an ElasTest (Quality) badge, of quality certification NaevaTec expects to collaborate with mainly Industrial Partners to create a standard and value behind the Quality badge/certification.

Roadmap for using exploitable assets

NaevaTec has divided its roadmap in three stages as follows:

- **1st Stage (By M18):** plan to evaluate some of the assets and plan a future for the assets within the company projects and processes.
- **2nd Stage (By M21):** to have the selected WebRTC project tested on ElasTest and all new WebRTC projects that would start after M21 to be tested (end-to-end) exclusively on ElasTest.
- **3rd Stage (By M30):** offer ElasTest as a SaaS to their clients to tests their own WebRTC applications.

Measurement

NaevaTec will measure the success of the platform adoption within their business model, by looking at:

1. % of ongoing WebRTC projects that are successfully tested with ElasTest.
2. Number of clients that have subscribed a contract for consultancy on ElasTest or are using ElasTest as a SaaS.

1.1.3 IBM Ireland Ltd.

Partner profile

The IBM Ireland Lab is a strategic IBM location, one of IBM's largest collocated sites in Europe. The lab is responsible for delivering enterprise software, cloud and IoT technologies to their clients via enterprise scale offerings, proof of concepts and partner collaborations. IBM innovations serve multiple industries including Health, Telecommunications, Social, Financial, Retail, Banking, Automotive and Manufacturing sectors. IBM lab is home to over 70 different nationalities and represents a rich pool of skills and experiences. In 2015 the Ireland Lab have launched an open innovation initiative named the "IBM Ireland Innovation Exchange" (IIX) which is intended to realize

the potential of cross industry and sector convergence to stimulate economic, scientific and societal opportunity.

The Innovation Exchange are currently participating in 10 active Horizon 2020 projects and IBM Ireland Ltd have been chosen as one of “Ireland’s Champions of EU Research” for achievement of a Horizon 2020 collaborative project portfolio of scale. IBM Ireland is one of the European Commission’s Top 50 Companies in Horizon 2020.

The motivation and commitment

One of key challenges for IBM is to maintain the trade-off between the costs, efforts and time-to-market for the whole development life cycle, from one side, and the quality of software that IBM's clients expect from the largest IT Solutions provider in the world, from the other. This becomes extremely challenging recently since most IBM products started being ported into highly distributed and interconnected heterogeneous environments. This implies substantially larger system of systems infrastructures and associated exponential increase in scale, to levels that are substantially higher than what current testers and technologies can manage today.

For IBM Ireland to retain their dominant position in Europe and worldwide the IBM team intend to leverage ElasTest results and the collective expertise of the consortium members to partner on IBM's forward path and trajectory to exploit ElasTest solutions within Dublin, Cork, Galway and Belfast Testing teams.

Means to achieve the objectives

Software Development: The IBM team has a wide range of practical skills for developing complex and quality software and in particular machine learning models.

Machine Learning: The IBM team has experience in machine learning and statistical learning, and in particular supervised, unsupervised and semi-supervised learning algorithms.

Cognitive Computing: Experience in developing novel Natural Language Processing modules for cognitive Q&A system that is the core of Watson Technologies.

Exploitation Capability: The IBM team has a strong exploitation capabilities demonstrated by their well-known Global Entrepreneur Program.

Communication: The IBM team accounts for more than 40 relevant scientific publications focusing on Machine Learning and Data Analytics.

Visible opportunity

The IBM Ireland team envisage exploiting ElasTest in a number of key areas of their business, and sees significant potential and opportunity in: (a) Extend IBM's suite of solution offerings in IBM Rational test automation solutions. (b) Decrease the testing cost internally in IBM Ireland which is a home for 800 to 1000 Testers across different products including IBM Kenexa, IBM Connections, IBM Sametime and several more. Of

specific interest to IBM is the recognition that the ElasTest Cognitive Q&A engine might open the possibility of applying Watson technologies, which are currently used in complex decision taking in areas such as health or marketing, for testing.

Exploitable assets and results

- Test Recommendation Engine - a cognitive system capable of learning from different sources of data (such as requirement specifications, test specifications, historical test cases, performance metrics, logs), and generating test recommendations based on learned knowledge. The engine leverages machine learning and cognitive computing techniques to extract meaningful patterns from the ingested data. It facilitates testers to design test cases more efficiently by recommending them about creating new T-Jobs or orchestration logic that might be missing in a test suite.
- **Question & Answer Engine** - a system to allow testers and developers to ask questions in relation to testing strategies or techniques, and provides answers based on previously gathered knowledge. The Q&A Engine accepts questions asked in natural language and tries to identify user's intention or information need. This may require generating prompts for the use so that the user formulates the question more precisely or provides additional constraints. Having identified the intent, the system analyses the linguistics of the question, searches corpus for documents that are similar to the question and generates candidate answers, scored for best linguistic fit.

1.1.4 Relational SA

Partner profile

Relational Technology SA, founded in Athens, Greece in 1995 is a software integrator, specializing in Software Development, Integration, Web, Mobile and Cloud technology along with Wireless LAN and/or Wi-Fi Network Systems Monitoring and Wireless Sensor Network (WSN) platforms, with substantial experience in the integration of the above mentioned solutions in security intensive environments.

More specifically the company operates in the following fields:

- It offers leading IT solutions for Process Automation, Business Process Management, Business Intelligence, Datawarehouse, Data Mining, Data Collection, Management Information Systems and reporting, as well as product/project related services – requirement analysis, design of architectural and technical solution, installation, configuration, project management and technical support.
- It develops mission critical software assets for Financial Institutions, Government, Retail, Telecoms and SMEs, while in addition represents actively and exclusively a number of International software vendors and their respective product portfolios, namely SAP AG, Informatica SA, Microsoft, BMC Software and UC4.

Since 2001 Relational Technology SA is since 2001 an SAP/BW Certified Partner specializing in the Business Intelligence offerings of SAP AG, and since December 2013 a Gold Partner of Microsoft for its competence in Business Intelligence.

The motivation and commitment

The R&D and technical teams of Relational Technology SA have a thorough experience in big data analytics inserted in proprietary products and services (e.g. i-Apply, Atlas etc.) that have been introduced and lead the financial & telecommunications market for the past decade.

In addition, the company has introduced to the market several proprietary products and services that have resulted from both internal and collaborative R&D activities. These products have been applied to the financial and telecommunications sector for a number of years and can be considered a solid leader in the Greek and other European markets.

Means to achieve the objectives

Relational has two technical units which are relevant to its contribution to the project:

- Big Data Unit
- Data Management Team (referring to Business Intelligence Services Unit)

Visible opportunity

Relational usually follows waterfall methodologies to deliver its solution to its customers. Based on its methodology, there is a FTV task and a UAT phase. Currently, the FTV task lasts on average 2 calendar weeks (10 person-days) and the UAT phase lasts on average 4 calendar weeks (50-60 person-days) for projects such as loan origination, debt collection, business process management, which are its main source of revenues. The real need is to reduce the duration of these projects and the person effort to be able to provide more competitive offers to its customers, given its strategic decision to increase its market share in the Balkans, Africa and Middle East regions.

Exploitable assets and results

Relational is gaining valuable know-how about open source technologies and developing open source software. Relational intends to use the open source platform of ElasTest for providing the following new services and new processes:

- New process for performing FTV and UAT tests: Automated implementation of these tests using the ElasTest platform vs traditional method of performing FTV and UAT tests
- New service for its customers: Performing UAT tests for all their IT projects using the ElasTest platform

- New service for other IT companies: Use of ElasTest platform for performing FTV and UAT tests to their IT projects for their customers

Apart from the abovementioned new services and processes, Relational examines entering the open source software community, e.g. development of open source versions of its products with less functionalities than their commercial versions. Relational aims to use the open source versions of its products for marketing purposes in order to attract more clients for their commercial versions.

Asset	Short Description	How Exploited
Big-Data Service	Provides a bundled disposable and scalable calculation engine. EBS provides a non-intrusive, easy way for customers to work with modern architectures side by side with their traditional systems.	<ul style="list-style-type: none"> • EBS will be extended by adding APIs for full integration with ElasTest. • Existing customers are introduced to ElasTest as a means to test their big data pipelines. • New customers are attracted by the potential to fully test their different software services from the same platform.

Table 8: Exploitable assets and results of Relational

Rationale

We are approaching the ElasTest platform in two different ways.

First, ElasTest will enable Relational to decrease the duration (and hence cost) of project implementation, by utilizing the advanced features of this platform.

Second, Relational plans to provide ElasTest as an Open Source system testing platform to customers, enabling them to decrease their time to market and increase their competitiveness. Specific features of ElasTest will also allow Relational customers to improve their end-to-end and security oriented tests. Supporting ElasTest operations for customers, while in the meantime building know-how due to using it in their own software will provide an extensive know-how to Relational. This will allow Relational to extend to the software testing market as well, also improving their own internal testing processes at the same time.

Value towards Joint Exploitation of ElasTest

The benefits that will be delivered to the customer are the following:

Lower CAPEX for IT projects because IT vendors will perform FTV and UAT tests using ElasTest platform (reduced person effort for performing these projects)

Lower person-effort on behalf of the customer's business users during the UAT phase, which means that the business users will not spend a lot of time off their daily duties.

Roadmap for using exploitable assets

Relational's schedule for the 1st phase is the following:

- M12: Meeting with CEO and the technical directors about the potentials of ElasTest platform.
- M13: Meeting with the key technical staff (project managers, business analysts, developers) about the use of ElasTest platform for FTV and UAT tests.
- M14-M18: Use of the ElastTest platform for performing only FTV tests in Relational's IT project implementations to its customers.

1.2 Research & University partners

1.2.1 IMDEA Software Institute

The IMDEA Software Institute is an independent research institute promoted by the Regional Government of Madrid with the objective of performing research in Computer Science, and in particular in software related technologies. The IMDEA Software Institute is a member of the Madrid Institute for Advanced Studies (IMDEA) network, together with six other institutes dedicated to promoting excellence in research and technology transfer in the key strategic areas (energy, food, materials, nanoscience, networks, and software). The mission of IMDEA Software is to perform the research required to devise foundations, techniques, and tools to develop software products with sophisticated functionality and high quality in a cost-effective manner. To this end The IMDEA Software staff includes around 30 tenured, contracted and post-doctoral researchers, and 60 researchers in total, including research assistants and interns. The Institute has a long-term strategic cooperation agreement with the Technical University of Madrid (UPM) and a number of major industrial partners, including Boeing Research Europe, Microsoft Research, the US Office for Naval Research, Telefónica, Atos, Indra, BBVA, LogicBlox, and Absint, some of them taking part of EIT Digital's Spanish node, of which IMDEA Software is coordinator.

The motivation and commitment

The main motivation to participate in this project is to collaborate with a heterogeneous group of collaborators, including cloud developers, applied researchers within cloud computing and users of ElasTest (developers and testers of verticals). More concretely, the motivation is to bridge a gap between foundational research and potential applicability as follows. First, to guide the research they do at IMDEA in runtime verification and security with efforts towards an important application domain (software reliability of cloud applications) and validate the techniques developed at the institute, in these areas. Second, to obtain insight from practitioners about problems and challenges that could be attacked from the research point of view to solve practical problems within cloud computing. Finally, to obtain realistic case studies to challenge current techniques and compare alternatives.

Means to achieve the objectives

There are two groups in combination participating in ElasTest from the IMDEA Software Institute: the reactive systems group, led by Prof. Cesar Sanchez and the Security group led by Prof. Juan Caballero. These groups have extensive expertise in building foundational efforts with tool support and empirical evaluations in the areas of runtime verification, malware and vulnerability analysis and security. These groups also have a strong publication records in conferences and journals in their related areas. For ElasTest, the IMDEA Software Institute has hired two post-docs with expertise in security and in cloud computing, and one PhD student with a strong background in programming, cloud computing and formal methods.

Visible opportunity

The security team at the IMDEA Software Institute has developed different approaches to uncover vulnerabilities in Internet services, so the opportunity of assessing these technologies in a larger effort which covers end-to-end testing was perfect for improving and testing these developments against realistic systems. The reactive systems group has a research line on runtime verification focused on theoretical aspects of monitoring and it is looking for application domains to apply these efforts in realistic case studies.

Exploitable assets and results

IMDEA Software Institute foresees that the EMS (ElasTest Monitoring Service), and particularly its internal monitoring engine, can serve as a core component in other research efforts, like for example on building sophisticated orchestrations of cloud deployments. Additionally, the data obtained from running tests of real SuTs using ElasTest can serve to validate other technologies, like offline analysis of dumped traces, etc. From the security viewpoint, they also foresee that ElasTest can serve as a platform to validate security attacks or vulnerability analysis in a much deeper scale than standalone tools can. Being an open-source project, ElasTest has the potential for attracting the developer and user communities. These communities are assets that can potentially contribute to:

- the improvement of the robustness of the tools and techniques IMDEA Software Institute develops (through bug fixing, feedback etc.)
- the development and maintenance of ESS (ElasTest Security as a Service) and EMS.

Rationale

IMDEA Software Institute foresees exploiting ElasTest as a test-bed of assessing the applicability of security technologies. We also foresee extending the monitoring techniques and the EMS itself developed to further efforts in cloud computing (like sophisticated orchestrations based on event-based processing) and into other application areas, like hardware monitoring and network verification.

Value towards Joint Exploitation of ElasTest

The value proposition is that the current and future technologies that they research and develop at the IMDEA Software Institute will be more aligned with what practitioners need, and more attractive by having been guided and validated on real systems under test. This will make their research publications more appealing by these validations with realistic cases studies and improve their chances for real technology transfer.

Roadmap for using exploitable assets

The IMDEA Software Institute plans to continue implementing sophisticated functionality within the EMS in the second half of 2018 and to complete the full functionality and assessment in 2019. During the second half of 2018 and 2019 they will also be collecting traces from the verticals provided by the SuTs, as well as from other systems tested with ElasTest, for further validation and guidance of their techniques. Similarly, the security-as-a-service component will exercise complex functionality to perform security analysis of the SuTs, which will guide further more sophisticated security tests in 2019.

Measurement

The main measurement will be on the publication related KPIs. It is planned to publish (both on security and on runtime verification) papers derived from the work accomplished in ElasTest in the main conferences in 2018 (one long paper and one short paper already published related to the EMS, one more paper in preparation), followed by more conference submission and by journal submissions in 2019. The number of publications is the main measurable KPI (four conferences and two journals at the end of the project).

1.2.2 Universidad Rey Juan Carlos

Partner profile

URJC is an academic institution with more than 40,000 students, 100 degree programs, 50 Master's programs, and several MOOC courses, being the second largest university in Madrid. URJC has a strong tradition on multidisciplinary research. The CodeURJC group (<https://www.codeurjc.es/>) is young research group focused on Software Engineering Methodologies and Tools. It is also interested in WebRTC technologies. Despite its recent creation, the group has strong connections with several industrial companies in the Madrid region, including Ericsson, Meta 4, RatedPower, among others. The group maintains the Kurento (<http://www.kurento.org/>) and OpenVidu (<https://openvidu.io>) open source projects aimed at embedding of videoconferencing capabilities within web and mobile applications with ease.

The motivation and commitment

URJC is coordinating the project and leaded the proposal. The motivation for the proposal came from past experiences building end-to-end tests for complex videoconferencing scenarios, for instance, scenarios involving several browser versions, with one or several NATs (Network Address Traversal), low bandwidth connections, or firewalls. In general, for any sufficiently complex cloud native application, assuring the quality of such applications is hard, and requires some background on different levels: from system administration (operation) to orchestration.

Means to achieve the objectives

CodeURJC group is comprised of 5 people with almost full-time dedication to the project. Two of them are associate professors at URJC and they need to share efforts in the project with other activities at university, like lectures and management. Four out of the five members of the project have a strong experience for more than 10 years at development and research. The group owns hardware infrastructure that enables the deployment and testing of the ElasTest assets. In addition, there are public cloud resources available as well.

Visible opportunity

CodeURJC group keep some companies on the wheel of ElasTest, including Panel Sistemas, a company that offers testing services, Ericsson R&D Spain, Gigigo, a company with a strong background on web and mobile testing, Meta 4, among others. From those companies who expressed their interest in the ElasTest product, Panel Sistemas and Ericsson where specifically asking for it, and plan to include it as part of their Continuous Integration (CI) approaches. We foresee a demand of mobile testing and performance testing as soon as the first complete release of the platform goes public.

Exploitable assets and results

CodeURJC foresees that the main platform components (ETM, EMP, EPM, EUS, EDM, ET and EJ) could be exploited for web and mobile testing. Specific features like QoS and QoE offered by EUS could be exploited for WebRTC testing.

The Jenkins plugin which provides an integration layer between the popular CI server Jenkins and ElasTest can be exploited with specific features (IPR protected) that clients might demand for their specific use-cases.

Specific components (IPR protected) could be developed, in addition to those developed as part of the ElasTest project, for specific purposes. One such example would be performance testing, for which a specific testing service running a distributed performance test by means of jmeter could be developed.

CodeURJC can help companies in adopting ElasTest and improving their CI practices. It can also develop or tailor the ElasTest tool towards their specific business domains. The

group is already doing training in testing and CI. ElasTest could be incorporated to the training offer.

ElasTest could be offered as a service on premises or in a cloud provider using a pay per use model.

Rationale

CodeURJC is interested in exploiting ElasTest in different areas:

- Providing a commercial solution offered following a Software as a Service model.
- Using ElasTest in consultancy and training in its training courses.
- Using ElasTest as a standard QA tool in H2020 projects involving 5G, HPC and Software Technologies.

Value towards Joint Exploitation of ElasTest

CodeURJC proposes to protect specific developments for clients. CodeURJC shares interests with partners involved in infrastructure management, security testing, monitoring services, big data services and monitoring platform. With those partners they foresee a good collaboration that could bring new opportunities to monetize the project.

Roadmap for using exploitable assets

ElasTest has published a 0.9.1 version in April 2018. It is planned to publish the 1.0 version at the beginning of July 2018. This version will be ready to be used in production workloads to test complex distributed applications. In the next months, new features will be included in ElasTest to support new testing scenarios and improve the existing ones with the feedback obtained from the first users.

1.2.3 Fraunhofer Open Communications Institute FOKUS

Partner profile

Fraunhofer Open Communications Institute (FOKUS), based in Berlin, Germany, develops solutions for the digital transformation of business and society. The research institute explores digital networking for the seamless linkage of the real world with the digital world how those technologies will contribute to a more secure and convenient living. FOKUS addresses important challenges in society, including access to information, economic and sustainable use of resources, smart mobility and modern governmental administration. In its projects, Fraunhofer FOKUS establishes close ties between industry, local economy, governmental administration and end users. Besides offering access to testbeds and experimental infrastructures, Fraunhofer FOKUS creates practical concepts, applications and prototypes. For companies and governmental administration, FOKUS is a competent partner in realizing IT projects specializing in developing multi-domain networks and interoperable, user-centric solutions.

Independent from specific manufacturers, products and technologies, the institute provides a neutral platform.

Addressing current opportunities and challenges in the broadband communication market, Fraunhofer FOKUS with its business direction for Software Networks - former Next Generation Network Infrastructures (NGNI) has become internationally recognized as testbed experts, particularly in the field of software based converged network infrastructures. The NGNI toolkits Open5GCore (www.open5gcore.net), OpenSDNCore (www.opensdncore.org), Open5G-MTC (www.open5GMTC.org), OpenBaton (www.openbaton.org) enable fast prototyping, evaluation and dissemination of novel R&D concepts on a realistic comprehensive integrated testbed infrastructure ranging from access networks to service platforms.

The motivation and commitment

FRAUNHOFER FOKUS is committed to demonstrate the ElasTest platform capabilities in the area of telecommunication infrastructures.

Means to achieve the objectives:

FRAUNHOFER is a worldwide reference in the area of software development for telecommunication infrastructures and the research group leads different development including Open5GCore (www.open5GCore.org), OpenMTC (<https://www.openmtc.org/>) and OpenSDNCore (<https://www.opensdncore.org/>). In the area of Network Function Virtualization (NFV). Open Baton is a comprehensive NFV orchestration practical implementation and Open Baton (www.open-baton.org).

Although FRAUNHOFER is a research institution, it is clearly oriented towards applied research and transfer. FRAUNHOFER has tens of customers of its products and services in the area of cloudified telecommunication infrastructures, which gives the institute a deep market knowledge towards multiple verticals: eHealth, automotive, industrial communication, massive M2M, massive multimedia, etc.

Visible opportunity

Having a unified testing platform with expandable support services dramatically reduces the experimentation resources needed for innovation.

Exploitable assets and results

The exploitation plans of Fraunhofer FOKUS are all centered on existing and emerging testbeds and toolkits. Specifically, ELASTEST is interesting for Fraunhofer FOKUS because it facilitates research and innovation on the 5G software components especially towards the core network, new radio technology integration, backhauling, multi-slicing support and software network management as well as the customization towards use cases. Fraunhofer has identified the following key strategic areas of the exploitation of project results:

- Development of the knowledge on the end-to-end 5G system and the further requirements beyond the initial 5G developments, enabling Fraunhofer to provide research and innovation capabilities towards the industry
- Development of comprehensive testbed management mechanisms enabling the optimization and the capacity increase of the Fraunhofer FOKUS testbed deployments
- Development of extensions and updates towards 5G of the Open5GCore and OpenSDNCore toolkits for addressing the 5G end-to-end architecture.

Development of knowledge and practical know-how in deployment of customized testbeds dedicated towards the verticals or specific use cases.

Asset	Short Description	How Exploited
Open5GCore	Open5GCore is a practical implementation of the carrier-grade network towards the 5G environment. It mirrors, in a prototypical form, the pre-standard advancements on the core network, radio network integration, distributed management and virtualization.	<ul style="list-style-type: none"> • Open5GCore will be extended by adding adaptor plugins and APIs for a full integration with the ElasTest Platform • Existing customers are introduced to the ElasTest platform for test management • New customers are attracted by additional testbed deployment and management features

Table 10: Exploitable assets and results of OPEN5Gcore, Fraunhofer

Rationale

- Improve the end-to-end system knowledge related to 5G networks within the Software-Defined Networks (NGNI) group.
- Increase testbed management capabilities and toolkits portfolio. Increase dissemination potential and accelerate knowledge transfer process.

Research

- Improving the current 5G network benchmarking and evaluation technologies.
- Contribute to the SotA techniques for 5G Network testing.

Knowledge Transfer

- Training partners and internal staff in the area of system in the large (SiL) testing and complex system deployment applied to 5G Networks and 5G Testbeds.

- Improve the competitiveness of European industries leveraging management and orchestration capabilities in cloud computing.
- Generate a strong ecosystem of experts and expertise in the area of complex testing in complex software systems.

Roadmap for using exploitable assets

Fraunhofer FOKUS plans to include ElasTest as a complex software system testing platform in the Open5GCore toolkits by the end of 2018.

Fraunhofer FOKUS plans on increasing its ElasTest dissemination activities within the year of 2019.

ElasTest concepts such as continuous integration and development support will be considered in the evolution of the Open5GCore Phoenix platform.

Measurement

The exploitation of ElasTest by Fraunhofer FOKUS will be measured using the following KPIs:

- Number of active partners using ElasTest as a testing platform as part of the Open5GCore Testbed License.
- Number of dissemination events during which the ElasTest platform will be showcased.

1.2.4 Technische Universität Berlin

Technische Universität Berlin (TUB) is one of the largest technical universities in Germany and member of TU9, a network of the leading Institutes of Technology in Germany. The Next Generation Networks (NGN) chair – Architektur der Vermittlungsknoten (AV) was founded in 2004 and is led by Prof. Dr. Thomas Magedanz. It works on educating Masters and PhD students and to carry out pioneering and sustainable research based on fundamental principles, architectures, components, interfaces, and protocols at the network and application layers. Being active in many international research projects under the banner of the European Commission's FIRE, FI-PPP and Cloud research frameworks, (such as OpenLab, Fed4FIRE, XIFI, Fantaastic, TRESCIMO, CIFIRE, BonFIRE, PII, NUBOMEDIA, Mobile Cloud Networking, SoftFIRE and Embers), AV has started a set of joint research activities in the context of realizing a service oriented secure Future Internet and next generation mobile network (5G), which can be witnessed in its Future Internet laboratory. Hot topics currently covered include next generation networks to Future Internet migration and interworking (NGN2FI), semantic FI federation and management, FI security and identity management, FI QoS and emergency services support, FI client and network APIs and service composition, FI Services Delivery in federated provider environments. A particular focus has been set to the development of 5G related toolkits in conjunction with the Fraunhofer institute FOKUS such as OpenMTC (IoT), OpenSDNCore (SDN), Open Baton (NFV) and the Open5GCore.

The motivation and commitment

TUB is committed to provide its deep expertise in management and orchestration solutions, in particular, to design and develop such a component for platform-agnostic management of heterogeneous virtualized resources. This will leverage the expertise of TUB in the area of management and orchestration. In addition, testing complex software system becomes more and more important in the area of NFV and 5G, and ElasTest is a perfect opportunity to consolidate expertise in these areas. In the area of Industrial Internet of Things (IIoT), ElasTest provides an opportunity to demonstrate Industry 4.0 shop floor IIoT applications using ElasTest device emulator service (EDS) as a test support service (TSS).

Means to achieve the objectives

The TUB team accounts for many relevant scientific publications and has participated in several technological and industrial events in the area of software development during the past years. In addition, this TUB department has been active in research activities in the cloud computing area for many years as shown by its participation in project such as Mobile Cloud Networking, CogNET and SoftFIRE.

Furthermore, the TUB team has proved solid experience in complex software development, particularly in networking, virtualization, and software defined network areas. It demonstrates its expertise through the main role in the development of software products such as Open Baton among others where it has gained experience in FOSS communities through the open source Open Baton project and its community. It also carries an expertise in implementing IoT applications under the umbrella of OpenIoTFog.

Visible opportunity

As University, the main objective is to provide degree courses to students in order to generate value from knowledge developed in the different sectors. There are three main mechanisms that are used for generating added value:

- **Teaching:** transfer knowledge to students that can later use such knowledge for increasing the competitiveness of European industries, organizations and institutions.
- **Research:** generation of novel ideas that can be transformed in added value to existing products. This is typically realized via student projects/seminars, national research projects, or even large collaboration projects with industry players.
- **Transfer:** transfer the acquired knowledge to industry players either via scientific publications or open source activities.

TUB plans to exploit ElasTest results on all these three axes. Hence, the exploitation plan is split into three interrelated but, to some extent, independent plans that develop each of the axes.

Exploitable assets and results

Teaching:

- Activities for attracting new students via standard channels of TUB.

Research:

- Research partners for collaborative projects are reached through different mechanisms:
 - Networking taking place in the context of other research projects.
 - Research professional networking platforms (e.g. twitter, etc.).
 - Events organized by the European Commission.
- Research partners for publications are reached through different mechanisms:
 - Participation in scientific conferences and workshops.
 - Networking through participation in projects and publications.

Knowledge Transfer:

- Transfer the knowledge to other companies interested in professional services. Some of the mechanisms used for achieving this objective:
 - Using the Open Baton and the ElasTest open source software communities.
 - Using OpenMTC to program fog nodes to achieve IIoT applications.
 - Generate awareness about the expertise of the TUB team participating in additional open source communities and standardization meetings.
- Industries and investors seeking to invest in the generated ecosystem are reached through different mechanisms:
 - By generating awareness of the skills and expertise of the team through the participation in relevant blogs, newsletters and mailing lists related to the target technological areas.
 - By participating in selected industrial events.

ASSET	SHORT DESCRIPTION	HOW EXPLOITED
Open MTC	OpenMTC is an implementation of the oneM2M standard. It brings the competence of Machine to Machine (M2M) communication in the form of a middleware to ElasTest.	-OpenMTC is used in developing the TSS EDS microservice, for device emulation. It is also used in developing the demonstrator for WP7 with support of EDS. - OpenMTC is a generic FIWARE enabler - OpenMTC attracts new customers interested in implementing M2M communication technologies in ElasTest.

Table 14: Exploitable assets and results of TUB

Rationale

Teaching:

- Enhancing the teaching modules of its master degree related to Next Generation Network Infrastructures (NGNI) at its AV chair.
- Disseminating among potentially interested students the teaching offer.
- Performing the appropriate teaching activities.

Research:

- Developing new internationally recognized master degree in the area of testing complex cloud services and Cloud Computing.
- Contributing and/or leading novel collaborative research projects developing further TUB research ideas.
- Disseminating TUB research ideas both through formal scientific publications and informal communication mechanisms.

Transfer:

- Enhancing its management toolkits and offer these to the different operator-, developer- and experimenter-communities.
- Disseminating results via scientific publications or worldwide industry events.

Value towards Joint Exploitation of ElasTest**Teaching:**

- Professional trainings for experts in Cloud Computing thanks to the worldwide recognized expertise of the TUB staff members in the area of NFV and Cloud Computing.
- Student training in the emergent area of complex testing in the area of 5G, NFV and Cloud technologies.

Research:

- Improving the technologies and techniques behind testing in NFV and 5G.
- Contributing to the general awareness of testing in Cloud technologies in society.
- Emulating complex IIoT applications, in order to test and validate them.

Transfer:

- Improving the competitiveness of European industries leveraging management and orchestration capabilities in cloud computing.
- Generating a strong ecosystem of experts and expertise in the area of complex testing in complex software systems.

Roadmap for using exploitable assets

TUB plans to include testing in complex software system (in 5G and NFV), and add the design and development platform-agnostic orchestration and management in the lectures offered by the chair in 2018. In addition, student seminars and projects will be offered with relation to ElasTest.

Concepts leveraged within ElasTest, such as, continuous integration will be considered in other projects and open source communities (e.g. Open Baton).

Measurement

With respect to cover the concepts of ElasTest in teaching at the university, two KPIs can be measured:

- Attendees of the 5G lecture where complex testing and continuous integration will be covered.
- Number of students which have taken a seminar and/or project topic related to ElasTest (and its main concepts).

1.2.5 Consiglio Nazionale delle Ricerche (CNR)

CNR is a public research body, carrying out, promoting and transferring multidisciplinary research through its scientific network of more than one hundred institutes all over Italy. ElasTest will involve researchers from ISTI (Institute of Information Science and Technologies), which is a large research institute focused on information science and technologies. In particular, ElasTest will be carried out by the Software Engineering and Dependable Computing (SEDC) laboratory of ISTI. The research of SEDC spans over two macro areas:

- Software Design Methodologies and Solutions, suitable to address modern system challenges such as complexity and adaptation;
- V&V Methodologies, Techniques, and Tools, to analyse, assess and validate functional and non-functional properties such as QoS and dependability indicators.

The group possesses a solid expertise and a long outstanding research curriculum in software and services engineering, specifically concerning their non-functional testing and monitoring, and methods and tools for testing and analysis. Hence it is evident that the scope of ElasTest is very central to the research interests of SEDC.

The motivation and commitment

CNR motivations to join ElasTest are both scientific and pragmatic. From scientific viewpoint, ElasTest objectives perfectly align with some of their “historical” research themes, such as how to improve the cost/effectiveness ratio of software testing, how to automate the testing of large complex systems, how to address the testing challenges posed by novel software paradigms. Therefore, in joining ElasTest CNR saw the opportunities to collaborate on those very topics with an international consortium of highly qualified partners. From pragmatic viewpoint, it is very convenient for the CNR to conduct research within European collaborative projects because doing so CNR is directly exposed to the real-world scenarios offered by the project demonstrators and stay aligned with the evolution of technologies. CNR commitment to the project is to contribute to the advancement of the state-of-art in software testing automation and to ensure rigorous validation of project achievements. More in general, ISTI as a whole is strongly bound to pursue its mission of producing scientific excellence and playing an

active role in technology transfer and education in the context of national, international and industrial research projects.

Means to achieve the objectives

The ElasTest working group includes a very competent set of researchers in software engineering and software testing: they have widely published on the topics of software system validation and monitoring, and have developed several open source tools for software testing and monitoring, many of them in the context of several FP6-FP7 European projects. ISTI has a solid infrastructure to supports the laboratories in their research activity both for administration and for the needed computing resources. Last but not least, members of the group are actively involved in dissemination, by direct involvement in the flagship scientific events in software engineering and testing (ICSE¹², ESEC/FSE¹³, ISSTA¹⁴), and in organizing conferences and workshops on frontier topics.

Visible opportunity

The very topic of ElastTest, how to effectively support software test automation, is highly relevant to the laboratory mainstream research. Thus, the participation offered the CNR the opportunity to contribute with its background skills, while strengthening their expertise in advanced testing technologies and tools, and broadening its network of international collaborations.

Exploitable assets and results

As CNR is an academic partner, the exploitable assets and results for it are those that provide opportunities for novel research papers and projects and potential benchmarks for experimenting research. Hence the main assets of ElasTest that CNR might exploit include:

- The ElasTest open source platform.
- The outcome from continuous literature and market scouting (WP2).
- The TORM methodologies concerning test orchestration (WP4).

Rationale

The development and usage of ElasTest platform will allow CNR to exploit it as the scenario of future prototype tools. Moreover, CNR will be able to embed its future research prototypes within it thus making results more visible, attractive and valuable.

¹² <http://www.icse-conferences.org/>

¹³ <https://conf.researchr.org/home/fse-2018>

¹⁴ <https://conf.researchr.org/home/issta-2018>

The outcome from continuous literature and market scouting –to which CNR also contributes- will allow them to stay up-to-date with the technology and to be able to publish novel results on top of it.

Finally the development of practical approaches for test orchestration can be exploited for a crucial research topic in software testing, and will certainly spur novel important research from the group.

Value towards Joint Exploitation of ElasTest

CNR is a public research body and as such it can contribute to the joint exploitation of ElasTest in the following ways:

- By helping with its own neutral and somehow authoritative position the promotion of ElasTest as the reference state-of-art platform for testing of cloud applications.
- By providing education and training support for companies in the IT sector.

Roadmap for using exploitable assets

Along the project lifecycle, we have already established some interesting contacts with a couple of companies for joint experimentation and research based on ElasTest, and we have made plans for relevant research that originated from ElasTest work and collaborations. The first perspectives are depending from companies' commitment and schedule, so even though contacts have already happened, the timing is not well defined.

Concerning the research rooted on ElasTest this will be likely published in the next year (2019).

1.2.6 ZHAW

Partner profile

With almost 11,000 students, 26 bachelor degree programs, 13 consecutive Master's programs and a broad range of continuing education courses, the Zurich University of Applied Sciences (ZHAW) is the largest multidisciplinary university of applied sciences in Switzerland. ZHAW has a long engineering pedigree and it is no coincidence that School of Engineering is the largest faculty in the institution.

The Service Engineering Research Area (<http://blog.zhaw.ch/icclab>) is the largest research group within the School of Engineering comprising of 25 people (4 faculty, 4 Senior Researchers, 15 Researchers at different levels and 2 support staff).

The group itself is organized into two laboratories, the Cloud Computing Lab (ICCLab) and the Service Prototyping Lab (SPLab)

Both labs are at the forefront of cloud computing research and perform applied research across the entire Cloud Computing technology stack and value proposition. The ICCLab

is focused on infrastructure and platform services (IaaS/PaaS) while the SPLab is devoted to design, prototyping, and operations of service-oriented applications built natively for the cloud (e.g. based on IaaS and/or PaaS) and offered as a service (SaaS).

Having an applied focus, a key motivation for the Service Engineering Research Area is to transfer knowledge, skills and technology to industry; key to this is the lab's Research Approach which comprises of three driving principles – Strong Scientific Foundation, Impact in the form of Software, Standards, and Academic Publications, and ultimately Knowledge Transfer.

The members of the lab comprise a mix of skills and experiences ranging from classical academic research skills to industrial research lab experience to experience in the start-up world at various levels. The lab has a strong focus on Open Source Software and considers this to be an important dimension of its output as well as classical research papers.

The lab has very strong international profile both in terms of its constitution (15+ nationalities in 25 people) and its connection throughout both Europe and further afield. It has a very extensive network of connections at both national level, European level and intercontinental level, having concrete nationally funded projects with Swiss partners (e.g. CloudSigma, Exoscale, SafeSwissCloud and others) as well as large EU-funded projects (FP7 FI-WARE, FP7 FICORE, FP7 MCN, FP7 T-Nova, FP7 GEYSER, H2020 SESAME etc.).

The motivation and commitment

ZHAW has much knowledge and experience in all things related to the cloud native application and service lifecycle - from design, through deployment to runtime management all the way through to delivery. ZHAW also comes with much experience in the management and operation of EU funded projects and so this was also an advantage to the consortium.

Visible opportunity

The opportunity here is to transfer the knowledge and assets to Swiss SMEs through Swiss innovation transfer programs. Also of importance, it the transfer of knowledge gained through publications and towards ZHAW students enrolled in bachelor- and master-level education plans.

Exploitable assets and results

The key assets that result from ZHAW's efforts in the project will be the monitoring system, the service delivery manager and cost models. The cost model work will be integrated into the ICCLab's monitoring platform, Cyclops. The monitoring system and service delivery manager will be integrated such to provide a platform and system that can be offered to Swiss SMEs via technology innovation transfer programs, specifically KTI. All assets will be exploited along the strategy of the ICCLab and will also be recorded

not only as code but in academic publications that include measurements, benchmarks and evaluations of the created assets. Knowledge gained will also be transferred to ZHAW students enrolled in the bachelor- and master-level courses.

Rationale

There are many Swiss companies wishing or already offering their software as services. To be able to do this with a minimum effort on the companies' behalf this software has to be delivered reliably and as automated as is possible. This is the drive behind the service delivery manager and monitoring system. As such companies deliver services to their end-users they too need to bill their end-users (customers) and it is here where the work on cost modelling will be used within Cyclops, a system that already has usage by Swiss SMEs.

The main functionalities of ElasTest that will be certainly used are the cost estimation engine, the service manager and the monitoring platform. These are of particular interest as they are core enablers to cloud native applications and platforms with which ZHAW carries out extensive research with and upon. Other components within ElasTest are also to be evaluated to see their relevance within the ICCLab portfolio.

Value towards Joint Exploitation of ElasTest

Knowledge and guidance on cloud native applications and services. The delivery of those services and applications such that they're maximally automated and reliable. This is technically realized through the service delivery manager, monitoring system and cost modelling.

Roadmap for using exploitable assets

Planning of a KTI (K|C)ommission for Technology and Innovation) submission will begin by Q3 of 2018 and submission of it no later than Q2'19. This submission will be based on the work carried out in WP5 and WP5.

By Q4 of 2018 there will be at least 2 publications related to the assets produced.

Measurement

References to code contributed to Cyclops. This can be measured by lines of code contributed and where those contributed lines of code lie within the codebase.

Projects funded is a simple KTI - the success or failure of project proposals that directly use the service delivery and monitoring asset. In the case of the service delivery manager (plus monitoring) a clear KPI will be the number of funded technology transfer projects funded based on the outputs created by ZHAW in ElasTest. For the use of cost models within Cyclops, this will be measurable by the presence of the code in the open source version of Cyclops.

ANNEX B: QUESTIONNAIRE FOR PARTNERS

ELASTEST - Individual Exploitation Plan – questionnaire

Individual Exploitation Plan of

This sheet is to provide your initial ideas for exploitation linked to your institution goals within the project.

	QUESTIONS
PROFILE AND MOTIVATION	<p>1. Partner profile: brief introduction about your organization, explaining your background (technical or business) and what is your field of operation.</p> <p>2. Your motivation to participate in the project and commitment: why did you join consortium and your role in the project.</p> <p>3. Means to achieve your objectives: show that you have necessary background (resources, dedicated department or working group, infrastructure).</p> <p>4. Opportunity which appeared/appears: your participation is the result of the real need of your customers (with whom did you speak, which client asks you to provide it, all existing/potential requests, etc.). For academic partner mention if ElasTest is in line with other projects (continuation). If there are other opportunities in the pipeline when project finished?</p> <p>5. Exploitable assets and results: Describe what assets (whether this involves specific components, tools, knowledge, methodologies, skills, etc.)</p>
WHAT AND WHY	<p>Please provide information about all the options that your institution has to potentially apply the results of ElasTest on areas of your company/ institution for its adoption as innovations within an innovation process that will create value.</p> <ul style="list-style-type: none"> • Explain the asset as such (what and why) simple describe what assets (thinking in components or tools, knowledge, methodologies, new skills, etc). • ElasTest outcomes that are envisioned to have innovation and exploitation potential and are planned to be used (how do you plan to create/use IPR?) • Identify possible innovations (new product, new service, new process, something else?) that will be created/enhanced/tested thanks to these outcomes • Your potential Products and/or Services that will use ElasTest, and how • Make sure you include why they are relevant for your company/institution • You could also identify clear outcomes of ElasTest that will be used, for what part (product/service) of your company to create business options, and why.

6. **Rationale:** Explanation of why are you interested on those assets (the added-value they provide), how do you plan to exploit them (academically or industrially: e.g. provide as commercial solution, certification services, standardization, consultancy, further R&D, Brand positioning)
-

7. **Your Value Proposition towards Joint Exploitation of ElasTest:** what do you propose to project, what benefits will be delivered to customer, end users, what components/interest do you share with other partners.
-

8. **Roadmap: the timeline plan you have for using those assets:** (what, where, to who, e.g. meeting with a board to present them in 9 months, inclusion in your portfolio in 1 year, etc.). Provide concrete actions for months M1-M18
-

Please provide information about all the expectations that you identify at this point in time, early in the project (we are now at M9). But please set up goals to pursue and a roadmap of actions to carry out during the whole project lifetime. There are two phases: **1st phase: M1-18** and **2nd phase M19-M36** (two steps as component are more mature). For now just write plans for 1st phase (Dec2016-June2018).

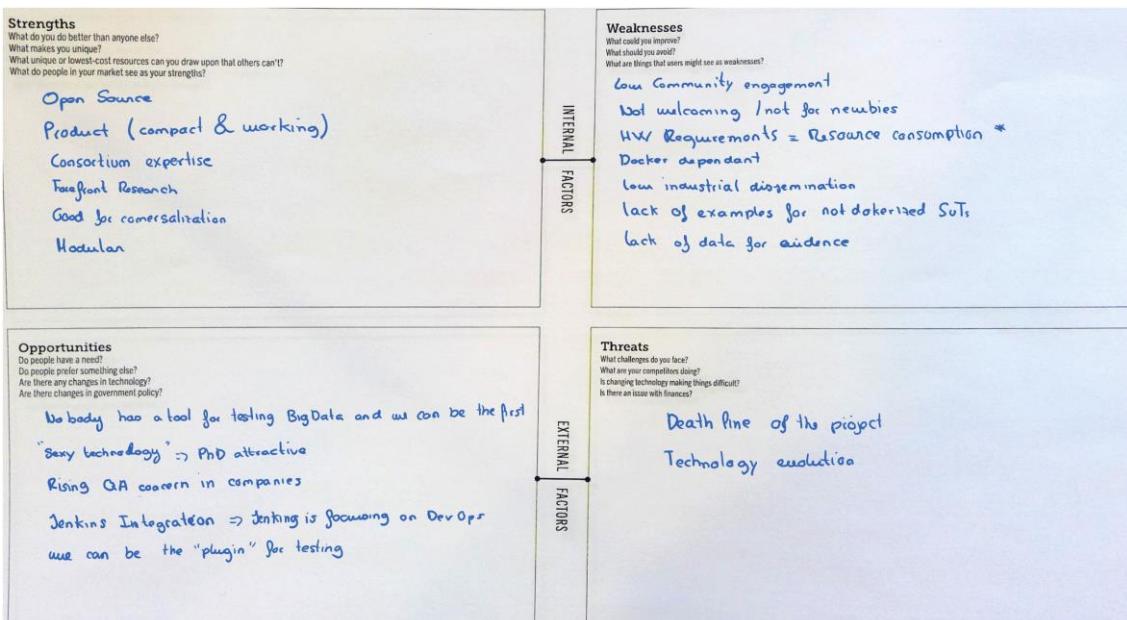
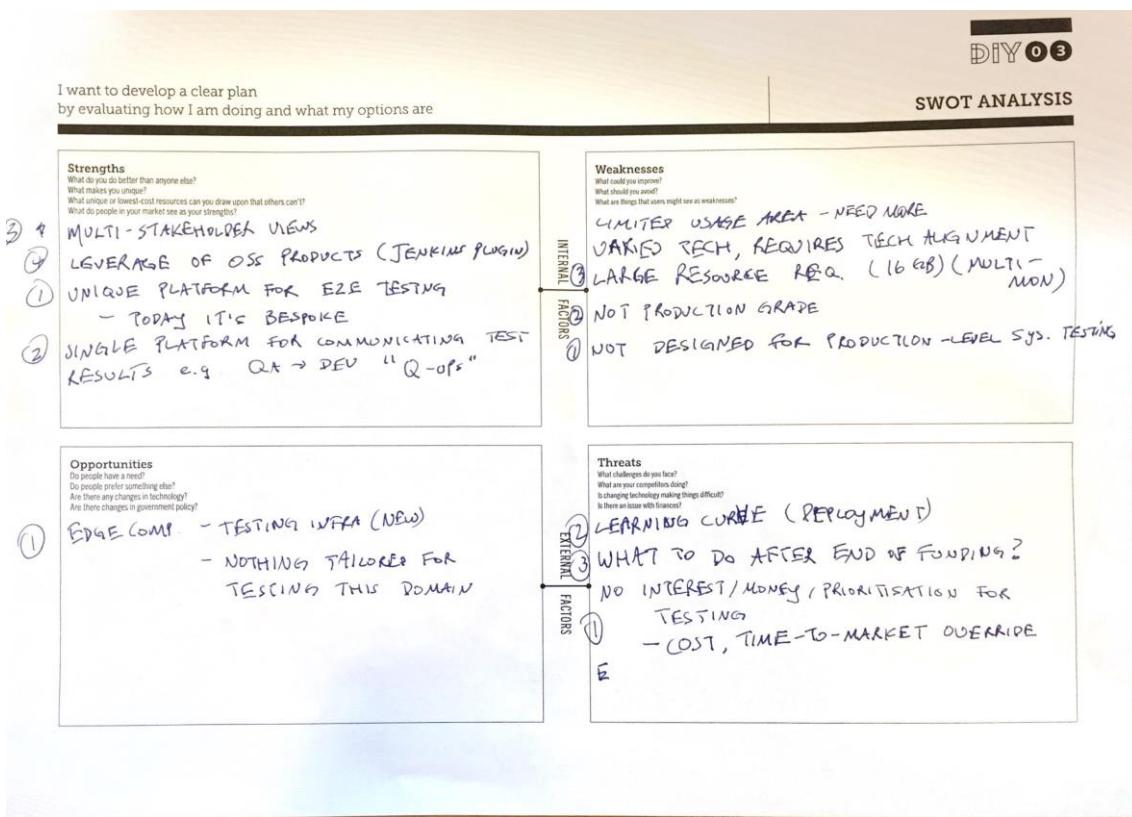
9. **Measurement:** how do you plan to measure impact of planned actions (some KPIs defined and criteria for success to reach)
-

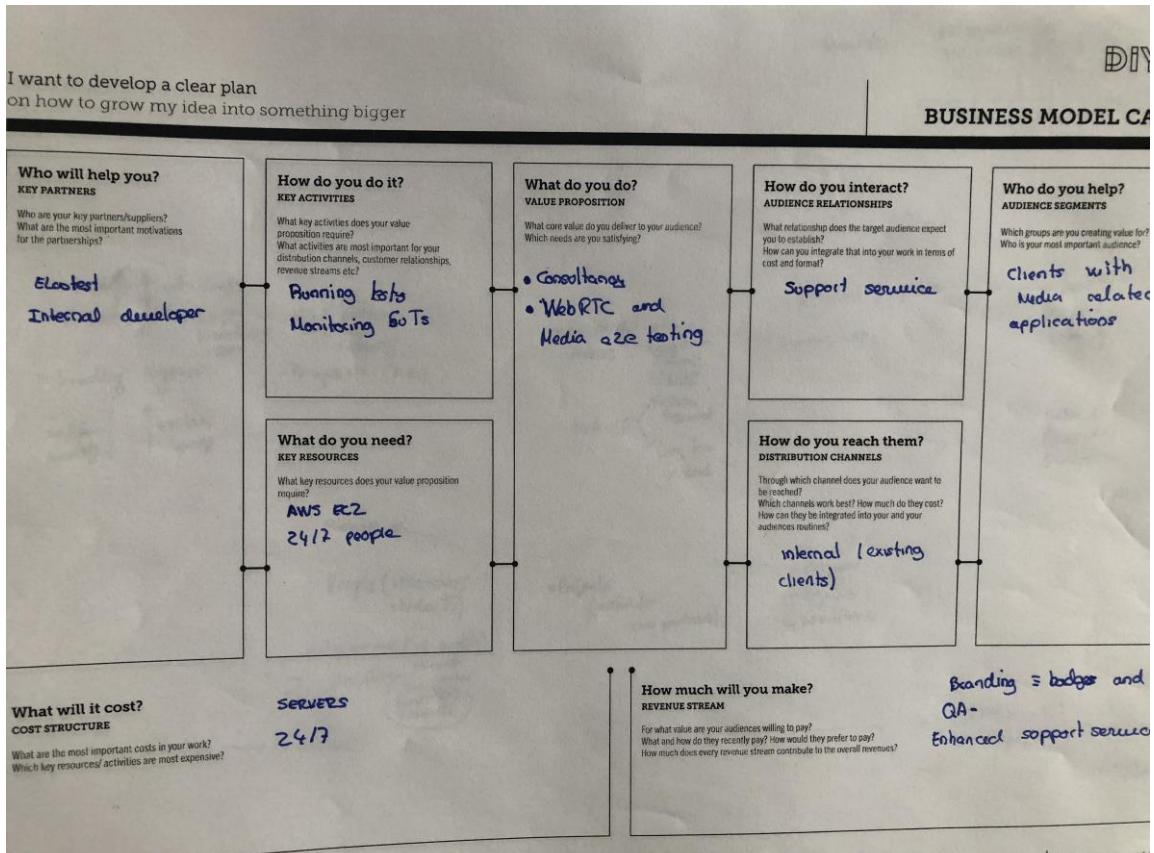
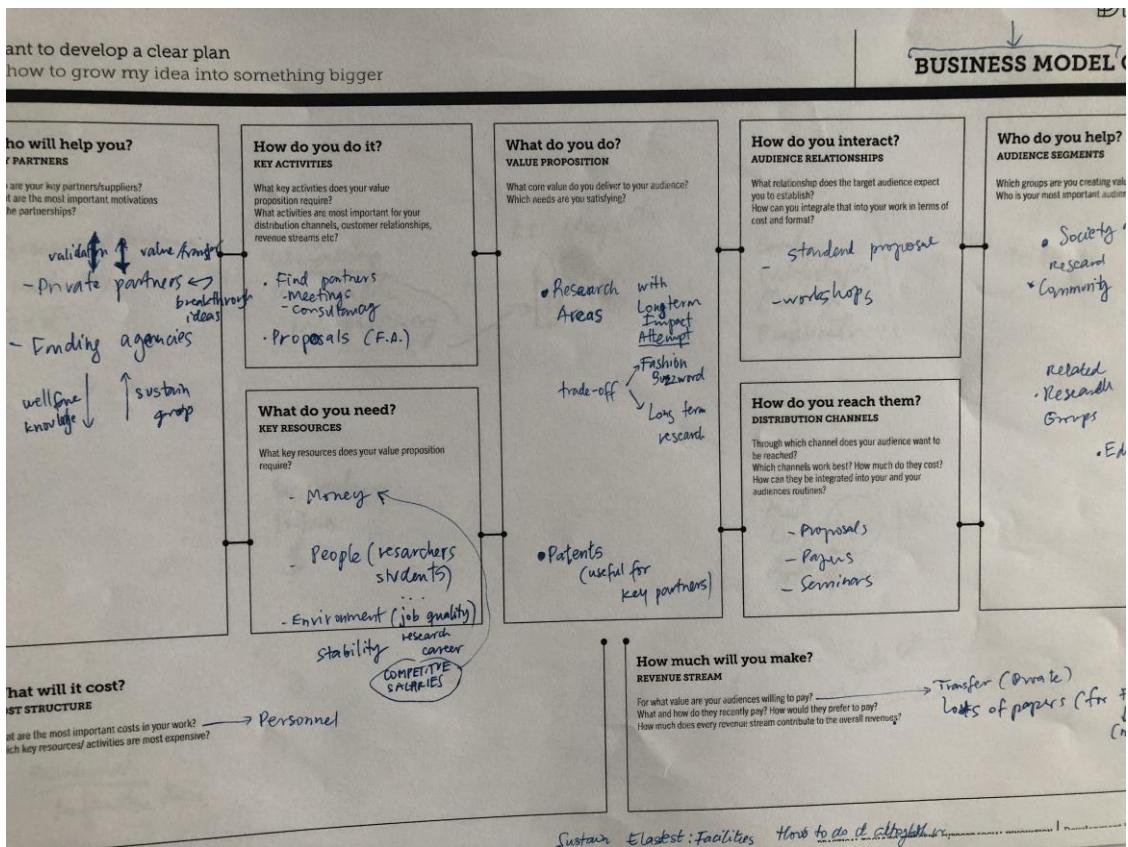
If possible, define some KPIs to measure how you would measure the innovation degree and how the adoption of the technology impacts on your expected targets (quantitative preferred over qualitative).

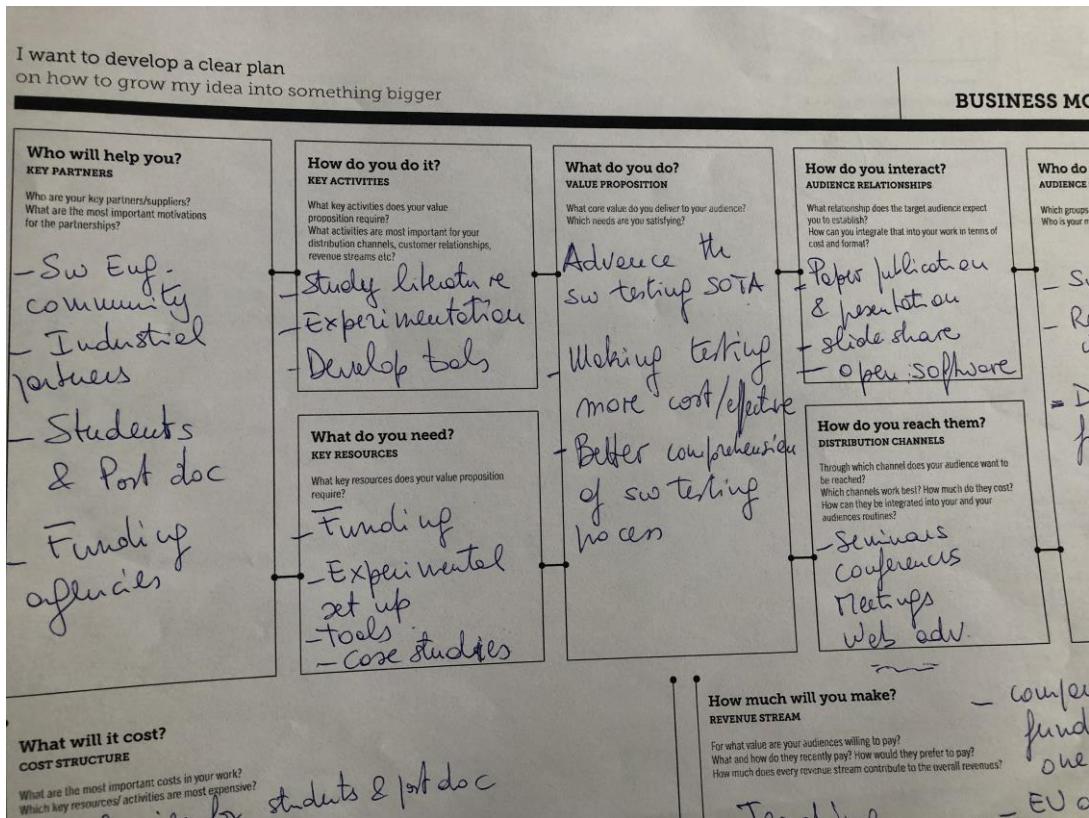
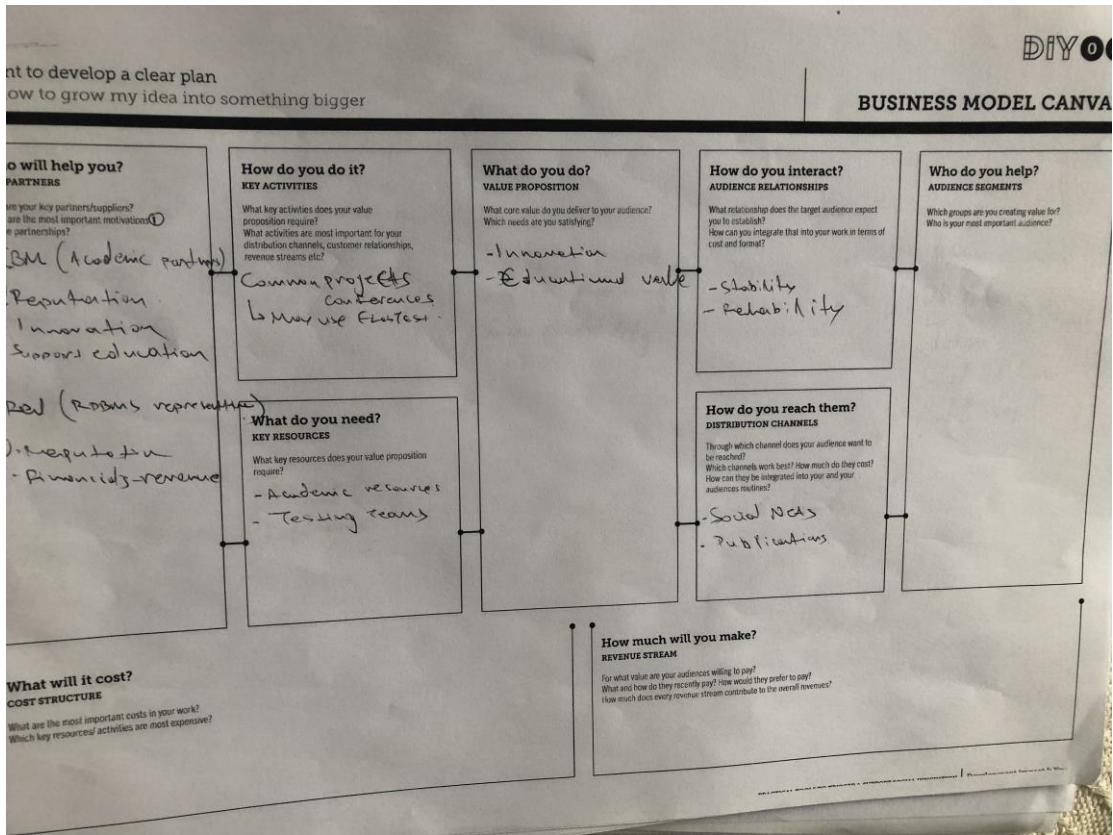
10. **Numbers:** if you can provide any figures as a reference point to show what is above, would be more than appreciated
-

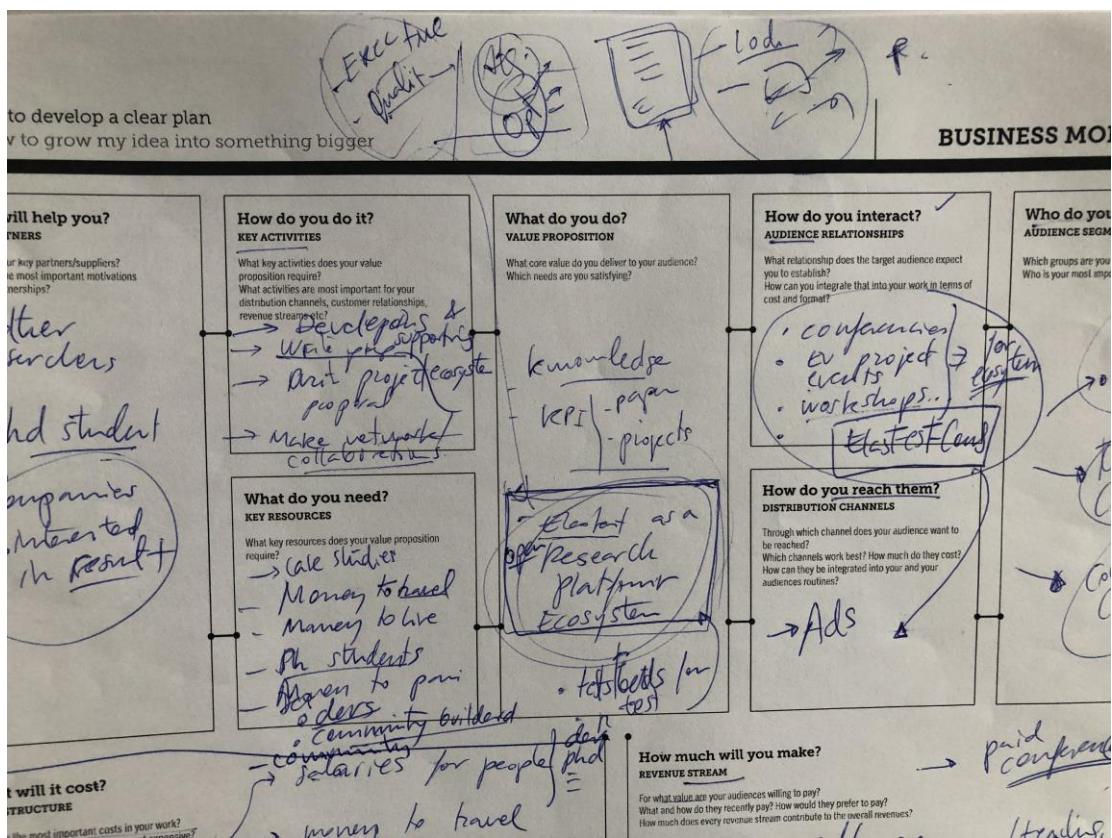
ROADMAP WITH TIMELINE

ANNEX C: SWOTS & BUSS CANVAS









ANNEX D: IPR

Intentionally left blank



Table 15: IPR and Exploitable assets and results of ElasTest

Component	Sub-components	Description	License	Does it have dependencies with other subcomponents (yes or no?)	Exploitation ways	Copyright holder	Component License	URL
TORM	ElasTest Tests Manager (ETM)	Provides the main entry point for ElasTest and allows the tester manager Test jobs and Suts	Apache 2.0	EPM, ESM, EIM, EMS, EDM	OSS	URJC	Apache 2.0	elastest.io
Tests Orchestrator Engine		Provides a way to orchestrate, organize and prioritise individual tests against a SUT with a high level language	Apache 2.0	ETM, EIM, EJ, EDM	OSS	URJC	Apache 2.0	elastest.io
ELASTEST Service Manager		provides the means for testers to acquire a test support service	Apache 2.0	no	OSS	ZHAW	Apache 2.0	n/a

ElasTest Platform Manager		The ElasTest Platform Manager enabling ElasTest to be deployed and to execute seamlessly in the target cloud infrastructure	Apache 2.0	no	OSS	TUB 5G	Apache 2.0	n/a
Cyclops Open Source codebase	collectors	provides the accounting and billing engine for usage tracking and cost calculation	Apache 2.0	no	OSS	ZHAW / Cyclops Labs GmbH	Apache 2.0	open source code base is available here: http://github.com/iclab/cyclops/
	rule engine							
	billing							
	cdr							
	udr							
Cognitive Engines	Recommender	Provides test recommendations and answers to questions related to testing	proprietary	Yes in current version (this is being subject to change)	Royalty free for interoperability, demos and research. Other uses may involve charges.	IBM	proprietary	n/a
	Q&A System							

Cost Engine	Billing	Generate a cost prediction and report the real final cost	Apache 2.0	Yes - Cyclops Core	OSS	ZHAW	Apache 2.0	n/a	
Monitoring as a Service (EMS)	Logstash (https://www.elastic.co/products/logstash)	The goal of this task is to provide a monitoring infrastructure suitable for inspecting and correlate executions of a SuT together with the relevant information about the execution of the test itself (from TORM and TSSs) in an online manner. This service will allow the user and the platform to deploy subscriptions that describe how to process events in real time and generate complex, higher level events from input	Apache/ 2.0	no	OSS + evaluation platform for empirical evaluation to obtain research results and publications including doctoral dissertation s	IMDEA Software Institute	Apache 2.0	n/a	

events. This outcome can help to better understand what's happening during the test, to detect anomalies, correlate issues, and even help the TJob to direct a test and to stress the tests automatically. The ultimate goal is to help the TJob to maximize the chances of uncover bugs and surface their causes.

Device emulator service	OpenMTC	Provide emulated sensors and emulated actuators. Such emulated devices can be wired into an user written IoT application.	Apache/ 2.0	no	OSS	TUB IIOT	Apache 2.0	elastest.io
Data Manager	Hadoop HDFS	A fault-tolerant distributed file system	Apache 2.0	No	OSS	REL	Apache 2.0	elastest.io
	Alluxio		Apache 2.0	No	OSS	REL	Apache 2.0	elastest.io
	Elasticsearch		Apache 2.0	No	OSS	REL	Apache 2.0	elastest.io
	Cloud Commander		MIT License	No	OSS	REL	Apache 2.0	elastest.io



D8.3 Exploitation Plans v1

	Kibana		Apache 2.0	No	OSS	REL	Apache 2.0	elastest.io
	Cerebro		MIT License	No	OSS	REL	Apache 2.0	elastest.io
	MySQL		Apache 2.0	No	OSS	REL	Apache 2.0	elastest.io
Big Data Services	Apache Spark	a distributed computing engine	Apache 2.0	EDM	OSS	REL	Apache 2.0	elastest.io
Instrumentation Manager	Conf. Mgmt System (not selected yet)	Control and orchestrates de Instrumentation Agents	Apache 2.0 ???	Instrumentation Agents	OSS	ATOS	Apache 2.0	n/a
Instrumentation Agents	BEATS agents https://www.elastic.co/products/beats	Expose obesvability and contralability capbilites to the SuT Manager	Apache 2.0	MaaS (LogStash or similar)	OSS	ATOS	Apache 2.0	n/a
User Impersonation as a Service (user)	Browser Manager Mobile Manager WebRTC metrics	Provides a service to allow tests to control a web browser and a mobile (emulated or real). Several additional features are provided when controlling	Apache 2.0	Yes	OSS	URJC		elastest.io



emulator Service) _____ the browser: session visualization in ElasTest web interface, recording, playback, several WebRTC specific metrics, etc.

Toolbox	Platform	Provide users automated ways to install ElasTest in several platform types. Currently it is supported the installation of ElasTest with Toolbox in the following platforms: Docker, Vagrant and AWS Cloudformation _____	Apache 2.0	Yes (All components)	OSS	URJC	Apache 2.0	elastest.io
Jenkins plugin		It is a connector that allows Jenkins users to use ElasTest features in a seamless way, without changing the way they define jobs.	Apache 2.0	No	OSS	URJC	Apache 2.0	

Intentionally left blank