Ref. Ares(2023)6707825 - 03/10/2023

5G ExPerimentation Infrastructure hosting Cloud-nativE Network Applications for public proTection and disaster RElief

Innovation Action – ICT-41-2020 - 5G PPP – 5G Innovations for verticals with third party services

D5.1: Third parties innovation web portal and documentation

Delivery date: September 2023

Dissemination level: Public

Project Title:	**5G-EPICENTRE - 5G ExPerimentation Infrastructure hosting Cloud-nativE Network Applications for public proTection and disaster RElief**
Duration:	**1 January 2021 – 31 December 2023**
Project URL	https://www.5gepicentre.eu/

This project has received funding from the European Union's Horizon 2020 Innovation Action programme under Grant Agreement No 101016521.

Document Information

Deliverable	D5.1: Third parties innovation web portal and documentation
Work Package	WP5: Experimentation
Task(s)	T5.2: PPDR third parties innovation
Type	Report
Dissemination Level	Public
Due Date	M30, June 30, 2023
Submission Date	M33, September 29, 2023
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Document history

Version	Date	Changes	Contributor(s)
V0.1	29/5/2023	Initial deliverable structure	Jorge Carapinha (ALB) Carlos Marques (ALB)
V0.2	26/6/2023	First incomplete draft	Jorge Carapinha (ALB) Carlos Marques (ALB)
V0.3	13/7/2023	First complete draft	Jorge Carapinha (ALB) Carlos Marques (ALB)
V1.0	14/7/2023	Internal review version	Jorge Carapinha (ALB) Carlos Marques (ALB)
V1.1	17/07/2023	1st version with suggested revisions	Antonio Zanesco (YBQ)
V1.2	31/07/2023	2nd version with suggested revisions	Rainer Wragge (OPTO)
V1.3	25/08/2023	First revisions after internal review	Carlos Marques (ALB)
V1.5	30/08/2023	Quality review (formatting and proof-reading)	Konstantinos Apostolakis (FORTH)
V2.0	05/09/2023	Final version for submission	Jorge Carapinha (ALB)

Project Partners

Logo	Partner	Country	Short name
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	NOVA TELECOMMUNICATIONS SINGLE MEMBER S.A.	Greece	**NOVA**
	Altice Labs SA	Portugal	**ALB**
	Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V.	Germany	**HHI**
	Foundation for Research and Technology Hellas	Greece	**FORTH**
	Universidad de Malaga	Spain	**UMA**
	Centre Tecnològic de Telecomunicacions de Catalunya	Spain	**CTTC**
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	OptoPrecision GmbH	Germany	**OPTO**
	Youbiquo SRL	Italy	**YBQ**
	ORamaVR SA	Switzerland	**ORAMA**

List of abbreviations

Abbreviation	Definition
CPE	Customer Premises Equipment
GA	Grant Agreement
GUI	Graphical User Interface
KPI	Key Performance Indicator
PPDR	Public Protection and Disaster Relief
QoS	Quality of Service
VNF	Virtual Network Function
VPN	Virtual Private Network
WP	Work Package

Executive summary

This document provides the plan for integrating external experimenters on the 5G-EPICENTRE platform, which represents one of the main objectives of the project, particularly in its final stage.

The process for deployment of 3rd party vertical applications or vertical systems is composed of six phases, starting with the engagement of 3rd party experimenters, identification of experiment requirements, and then proceeding to the preparation of the infrastructures, experiments' onboarding, execution, and finally, the evaluation of their results.

A key part of the process will be the identification of potential experimenters, and facilitating their motivation for participation. To accomplish the ambitious results, and engage a significant number of experimenters, the available dissemination tools, including the project web site and social media, will be of utmost importance. A dedicated web page targeted at engaging 3rd party experimenters, as of August 2023, is also presented in this document.

Events involving third party experimentation are a key component of the 5G-EPICENTRE dissemination activities. An update of the plans for this type of activities, as of August 2023, are provided in this document.

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1 Introduction

Carrying out experimentation activities on the 5G-EPICENTRE federated platform by 3rd party experimenters is one of the main goals of the final stages of the 5G-EPICENTRE project and the key objective of its Work Package (WP) 5. Essentially, experimenters are expected to provide their vertical application components to the 5G-EPICENTRE platform for the purpose of running 5G experiments. The goal will be twofold – on the one hand, to demonstrate the flexibility and versatility of the 5G-EPICENTRE platform, and the ability to accommodate a wide range of experiments, going beyond the scope of the eight Public Protection & Disaster Relief (PPDR) use cases developed in the scope of the project; and on the other hand, to assess the value of the 5G technologies, and particularly key enabling technologies offered via the 5G-EPICENTRE platform (such as cloudification, cross-domain orchestration, etc.), to provide the required levels of performance, reliability and flexibility that specific PPDR use cases require.

The objective of this document is to describe the plan for 3rd party experimentation activities, in the scope of 5G-EPICENTRE Task T5.2 "PPDR third parties' innovation". This Task aims at bringing together teams from external organizations to experiment on top of the 5G-EPICENTRE infrastructure, by planning the integration and deployment of their pre-existing or novel innovative mission-critical applications.

The plans outlined in the present document may be adjusted if and when needed, according to specific requirements of the 3rd party experimentation activities to be conducted in the context of 5G-EPICENTRE.

The results of experimentation activities planned in the present document will be reported in D5.3 "Final evaluation report", due in the final month of the project.

1.1 Mapping of project's outputs

The purpose of this section is to map 5G-EPICENTRE Grant Agreement (GA) commitments within the formal Task description, against the project's respective outputs and work performed.

Table 1: Adherence to 5G-EPICENTRE's GA Deliverable & Tasks Descriptions

5G-EPICENTRE Task	Respective Document Chapters	Justification
T5.2 - PPDR third parties' innovation *"This Task will organize a 5G-themed third parties innovation with the aim of bringing together small teams from various organizations in the domain of NFV/SDN and 5G research (e.g. research institutes, universities, start-ups, SMEs, companies, etc.), and allowing them to experiment on top of the 5G-EPICENTRE infrastructure by designing and deploying innovative mission-critical applications for first responders".*	2 – Third party applications deployment plan	Section 2 describes the plan for deploying 3rd party experiments.

T5.2 - PPDR third parties' innovation *"[…] on the one hand, it aims to extend the capabilities of the 5G-EPICENTRE facility by extending its capacities and repositories of NVF/NetApp solutions".*	3 – Third party experimenters' web page	Section 3 provides an overview of the web portal that is used to engage external experimenters to deploy applications and use cases on the 5G-EPICENTRE platform infrastructure.
T5.2 - PPDR third parties' innovation *"[…] pitch, design, implement and demonstrate innovative PPDR solutions by third parties, who will validate the technologies offered by 5G-EPICENTRE and extend its experiments' portfolio".*	2 – Third party applications deployment plan	Section 2 provides an overview of the process to onboard PPDR solution by third parties
T5.2 - PPDR third parties' innovation *"Workshops will be held prior to third parties innovation event to allow participants to familiarize themselves with the 5G-EPICENTRE platform".*	4 – Third party experimentation events	Section 4 provides an overview of the plans for third party experimentation events as of August 2023.
T5.2 - PPDR third parties' innovation *"This Task will further draft the third parties innovation Open Call documentation and rules of participation and judging, setup the third parties innovation web portal and determine prizes for the winning teams".*	2 – Third party applications deployment plan	Section 2 describes the process to onboard applications and use cases on the 5G-EPICENTRE platform infrastructure.
	3 – Third party experimenters' web page	Section 3 provides an overview of the third parties innovation web portal.

2 Third party applications deployment plan

The deployment of 3rd party applications can be divided in six phases, as shown in Figure 1.

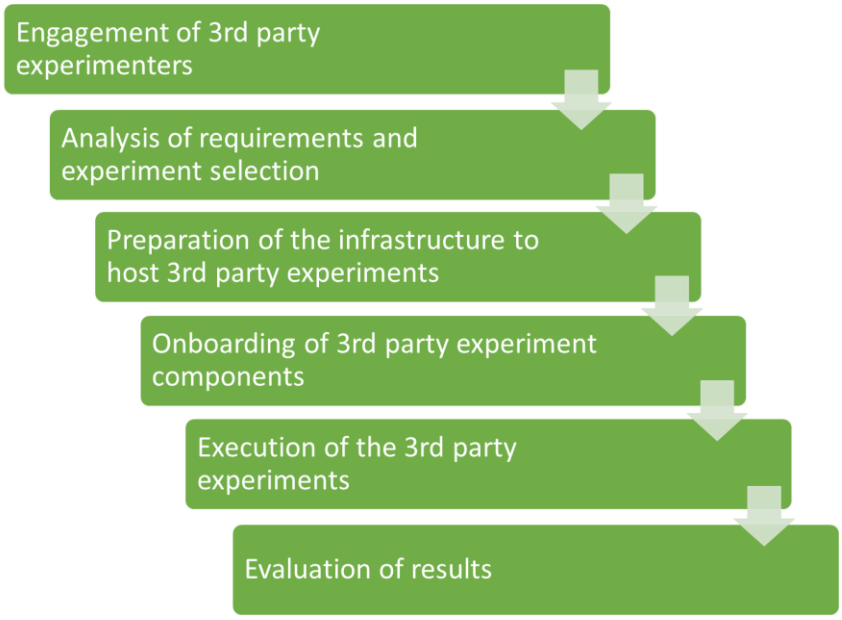

Figure 1: Phases for deployment of 3rd party applications

In the following sub-Sections, a general overview of these six phases is provided.

2.1 Engagement of 3rd party experimenters

This phase entails the most difficult step, as it targets a very restricted community (PPDR solution and application providers) and entails aspects that are beyond the control of 5G-EPICENTRE Consortium members. In any case, every effort will be made to maximize the number of 3rd party experimenters participating in Task T5.2 activities. Essentially, the strategy for engagement of 3rd party experimenters follows the below listed communication channels:

- Through the project web site and relevant social media, a call for 3rd party experimenters has been announced. In the project web site, a dedicated web page[1] has been created, directly accessible from the project web site root. It is key to engage 3rd party experimenters by describing the expected experimentation activities. An overview of this web page, as of August 2023, is provided in Section 3. In it, experimenters can also find the form to request an initial contact with 5G-EPICENTRE and kickstart the process. Further information on the 5G-EPICENTRE platform and project achievements, which may be useful to candidate 3rd party experiments, can be found on the project website.
- In parallel, all project partners will proactively search for companies, institutions and projects that may be considered candidate to participate in this effort. Therefore, they try to identify possible candidates in their own customer base, partner networks, and relevant companies in their respective countries.
- Furthermore, every partner tries to find influential individuals in the PPDR market, for establishing collaboration.
- Small and medium enterprises providing solutions in the area of PPDR should be a special target. In this way, 5G-EPICENTRE based solutions could be brought into the PPDR customers' focus.

[1] https://www.5gepicentre.eu/3rd-party-experiments/

- Additionally, synergies with other projects, ideally PPDR-related, will be pursued and collaboration plans will be established whenever feasible. At the time of writing, collaboration with 5GASP is under way with a view to the deployment, demonstration and validation of the FIDEGAD use case on the 5G-EPICENTRE federated platform. Preliminary contacts with VITAL-5G have been established with a similar goal.
- Demonstrate results and impact to share evidence of the project's success through case studies, testimonials, and data-driven reports.
- Continuous updates to keep the dissemination efforts ongoing throughout the project's lifecycle, providing regular updates and maintaining communication with the PPDR community.

2.2 Analysis of requirements and experiment selection

The 5G-EPICENTRE architecture is expected to be flexible enough to accommodate the requirements of a wide range of use cases and applications and, apart from basic infrastructure resources or specific components, significant extensions are not expected. In any case, specific requirements of 3rd party experiments will be properly evaluated.

The selection of 3rd party experiments will depend on the fulfilment of the following conditions:

- The scope of the proposed experiment is aligned with the 5G-EPICENTRE objectives – public protection, disaster recovery and mission-critical applications for first responders.
- The experiment requirements, including all technical requirements and the effort needed for deployment and execution, can be fulfilled by the 5G-EPICENTRE platform and matches the experimentation-as-a-service offering of at least one of the 5G-EPICENTRE testbeds.

The technical requirements may include, but are not limited to, the following aspects:

- Performance metrics (*e.g.*, throughput, latency, reliability).
- Virtual Network Function (VNF) containerization and edge computing capabilities.
- Swift deployment of virtualized resources.
- Scalability of virtualized resources.
- Interoperability with external equipment or components – *e.g.*, 5G phones, Customer Premises Networks (CPEs), chipsets – to be provided by the experimenters if not available at the 5G-EPICENTRE testbed, needed to run the experiment.
- Remote access and configuration.
- Security and privacy.
- Protection of experiments data.

This phase also includes the selection of the 5G-EPICENTRE testbed that is best suited to host the experiment, depending on the specific technical requirements, infrastructure resources needed to perform the experiments or any logistic constraints (*e.g.*, geographical proximity to the testbed). Indicative case towards the end of the project (when strengths and benefits of the testbeds outside the scope of the first-party experimentation scenarios will have been determined) will pilot the usage of the 5G-EPICENTRE Portal (see D3.2 *"5G EPICENTRE Front-end components"*) as the tool to expedite this selection directly from the platform's front-end environment.

2.3 Preparation of the infrastructure to host 3rd party experiments

This phase includes the preparation of the selected infrastructure to host 3rd party experiments (*e.g.*, setting up a Virtual Private Network/VPN for remote access, deployment of Kubernetes cluster, onboarding of specific hardware components, and whatever actions are needed to accommodate the use case requirements on the testbed infrastructure).

In this phase, 3rd party experimenters should get the credentials to access the private area of the D3.2 experimenter's portal, through which network applications can be onboarded, managed, and controlled. Vertical application components can be delegated to the testbed owner through a Graphical User Interface (GUI) workflow provided by this portal. The level of interaction between the testbed operator and the 3rd party experimenter should be agreed at this stage. A detailed description of the process of scheduling and deploying a 3rd party experiment is provided in D3.2.

A plan for onboarding and execution of the experiments in the selected 5G-EPICENTRE testbed should be defined at this stage.

2.4 Onboarding of 3rd party experiment components

In this phase, the software resources required to deploy a network application on the 5G-EPICENTRE infrastructure are packaged through a Helm chart and uploaded to the respective a Kubernetes cluster, following the procedures previously agreed between the experimenter and the testbed owner.

Preliminary tests should be performed to ensure that the individual components are properly installed and ready to run the experiments as planned. Interoperability tests with external devices needed to run the experiment, if any, must be also performed at this stage.

If needed, 5G infrastructure should be configured to appropriately address any specific requirements of the planned experiment (*e.g.*, 5G Quality of Service/QoS parameters, 5G network slice characteristics).

2.5 Execution of the 3rd party experiments

The 3rd party experiments are executed in the selected 5G-EPICENTRE testbed, following the plan previously defined in the preparation phase, as described in Section 2.3.

Through the 5G-EPICENTRE Northbound Configuration Dashboard, experimenters are able to interact with the infrastructure and perform actions such as requesting and configuring specific QoS parameters required to run their experiments, thus ensuring optimal performance, reliability, and efficiency of their experiments.

D3.2 provides a guide to be used by 3rd party experimenters to test and validate their PPDR solutions over a 5G-EPICENTRE testbed. Instructions are included in the form of visual walkthroughs on performing actions such as experiment definition, on-boarding of experiment artefacts, calibration of platform network applications and traffic simulation conditions, as well as experiment reporting & visualization.

2.6 Evaluation of results

For 3rd party experimenters, the results of the experimental activities will provide useful indications about the value of 5G and cloud-native technologies to accomplish their objectives in PPDR scenarios.

According to the *"Experiment monitoring during execution"* Section, described in deliverable D4.5 *"5G-EPICENTRE experimentation facility final version"*, the experimenter can monitor platform-generated metrics and statistical information in real time, and through explanatory data visualizations, generated automatically at the start of the vertical application deployment. Insights generated and charted into graphics, include experimental condition indicators, network traffic metrics, Key Performance Indicators (KPIs) and detected anomalies.

From the perspective of 5G-EPICENTRE, the results are expected to demonstrate the 5G-EPICENTRE platform flexibility and adaptability to accommodate requirements from PPDR use cases, other than the 8 use cases built and evaluated in the scope of the project (see deliverables D1.1 *"5G-EPICENTRE experimentation scenarios preliminary version"* and D1.2 *"5G-EPICENTRE experimentation scenarios final version"*). On the other hand, possible gaps and limitations identified during the execution of the experiments may lead to updates, or enhancements of the testbed infrastructure, if considered relevant and feasible.

The results are expected to provide lessons learned about the value of 5G technologies in specific mission-critical and emergency PPDR scenarios, as well as identify possible issues and constraints that may represent limitations to the practical utilisation of 5G technologies in such scenarios.

This activity is expected to be conducted in collaboration with Task T5.3 *"Feedback-driven evaluation"*. Results will be included in the final WP5 deliverable D5.3 *"Final evaluation report"*, due in the last month of the project, which is expected to provide a global evaluation of 5G-EPICENTRE 1st party and 3rd party experiments. Its public version will provide lessons learned from running the 5G-EPICENTRE platform and executing the experimentation activities, as well as best practices and guidelines for deployment with a focus on PPDR and mission-critical scenarios.

3 Third party experimenters' web page

3.1 Objectives

The goal of the 3rd party experimenters' web page is to provide the relevant information about the process and the potential advantages to experimenters offered by the 5G-EPICENTRE platform.

The 3rd party experimenters page is directly linked from the 5G-EPICENTRE home page, and is shown in Figure 2.

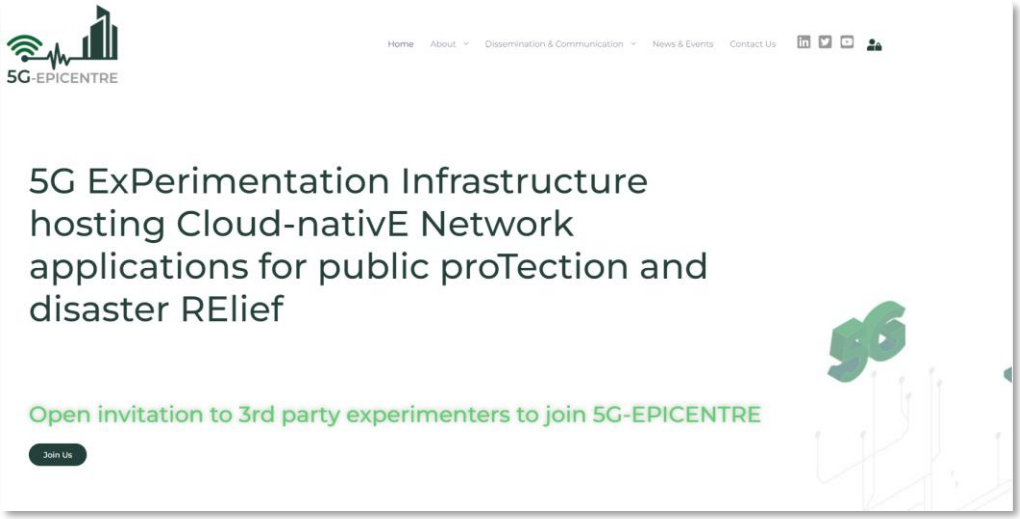

Figure 2: 5G-EPICENTRE home page with direct link to the 3rd party experimenters web page

This page is directly linked to the main project web page and includes the following sections: "Reasons to join", "Experiment Onboarding Process Overview", "Engaging PPDR entities", and "Contact us".

3.2 Reasons to join

This Section presents the main selling points of 5G-EPICENTRE as 5G experimental platform for PPDR use cases:

- 5G-EPICENTRE is the only European 5G testbed federation exclusively gathered together to enable PPDR verticals to test and stress their applications in a 5G configurable environment.
- 5G-EPICENTRE simplifies interaction with testbed operators, by harnessing the power of Kubernetes: Pack your application into a Helm chart and deploy in any of the 4 testbeds in 4 simple steps.
- A solution for every problem: Whether your PPDR application requires optimal throughput for video live streaming, reliable drone management, independent slicing and QoS management or fast re-instantiation in case of failure, 5G-EPICENTRE has the testbed that fits your needs.
- Through the platform's Network Applications, developers can easily and effortlessly configure the network to fit their needs: Prioritize traffic flows, Guarantee Quality of Service, Detect and React to outside malicious interference and obtain custom visual reports of your KPIs directly on the platform Portal.
- Multi-cloud experimentation: Run your Cloud-native PPDR applications across multiple testbeds, achieving higher availability and for your services.

Figure 3 provides a screenshot of the 3rd party experimenters web page (section "Reasons to join"), as of August 2023.

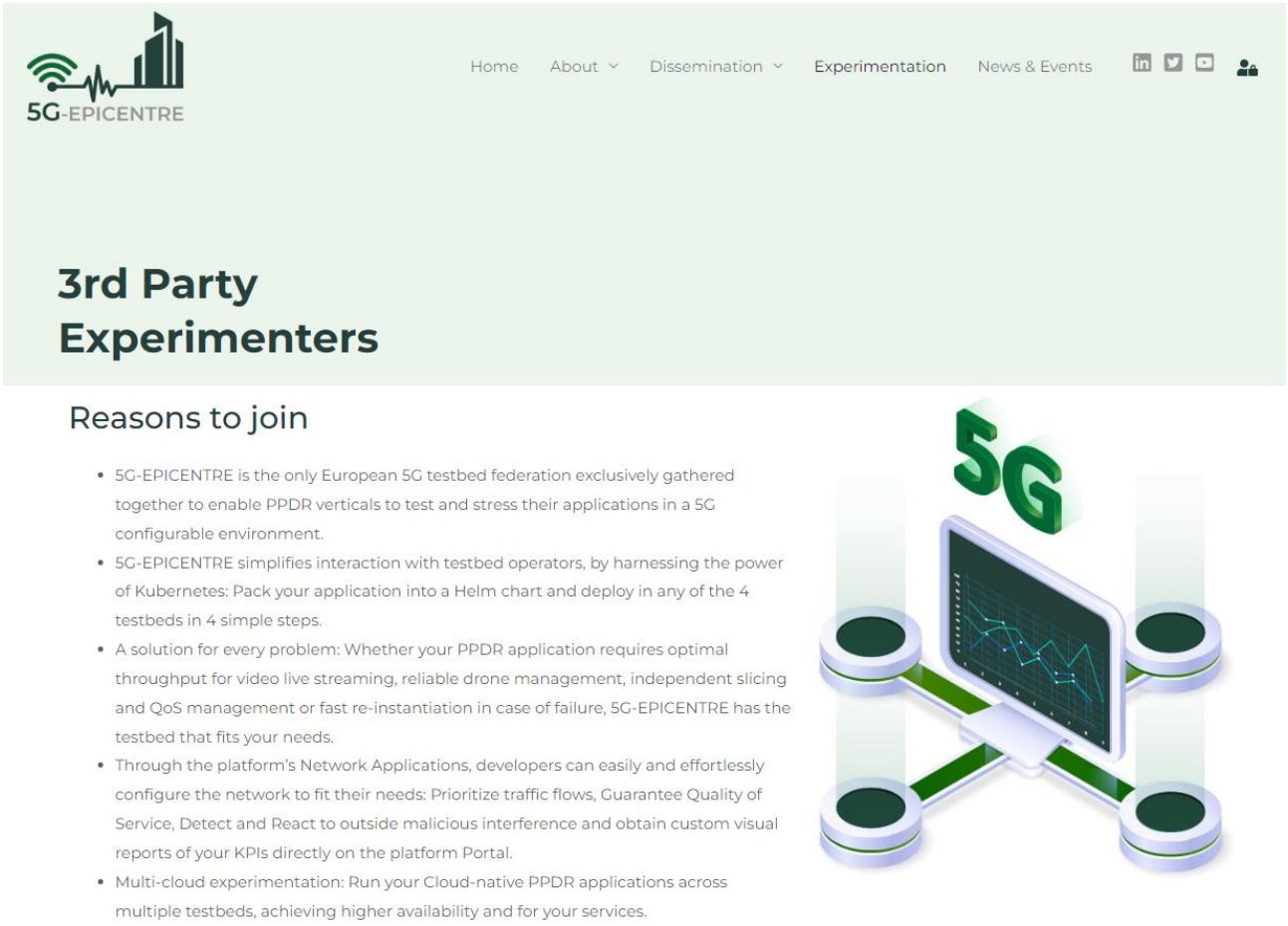

Figure 3: 3rd party experimenters web page, section "Reasons to join"

3.3 Experiment Onboarding Process Overview

This section presents the 5-step process of experiment onboarding for external experimenters, as shown in the dedicated web page.

1) Experimenters establish the contact with 5G-EPICENTRE by filling in the form provided below.
2) An online meeting is booked to discuss the experiment requirements and envisaged results. Based on the analysis of requirements, a 5G-EPICENTRE testbed is selected.
3) Experimenters provide the application software packed in a Helm chart to be deployed on 5G-EPICENTRE cloud-native infrastructure (as well as additional components, if required). Experimenters are granted access to the 5G-EPICENTRE platform Portal to configure the relevant network parameters, as needed to run the experiment.
4) Experiments are scheduled and executed according to the plan.
5) Results are compiled and a final evaluation is performed.

3.4 Engaging PPDR entities

To support strategies for attracting actors from the PPDR community, a comprehensive set of guidelines has been compiled. These guidelines provide a systematic approach to help establish fruitful connections and successfully demonstrate the value of 5G-EPICENTRE and PPDR solutions.

Building lasting relationships and fostering collaboration with PPDR entities are key aspects highlighted in these guidelines. In the corresponding file, available below for download, valuable insights on how to nurture supportive partnerships within the PPDR community can be found. This resource covers effective approaches to engaging with PPDR actors and offers guidance on maintaining stable contact with them.

3.5 Contact us

The contact request by external experimenters is available in a simple way, by filling in a few fields with basic information: Full contact Name, Contact Email Address, Contact Phone Number, Organisation Name and Message.

Figure 4 provides a screenshot of the 3rd party experimenters web page (section "Contact us"), as of August 2023.

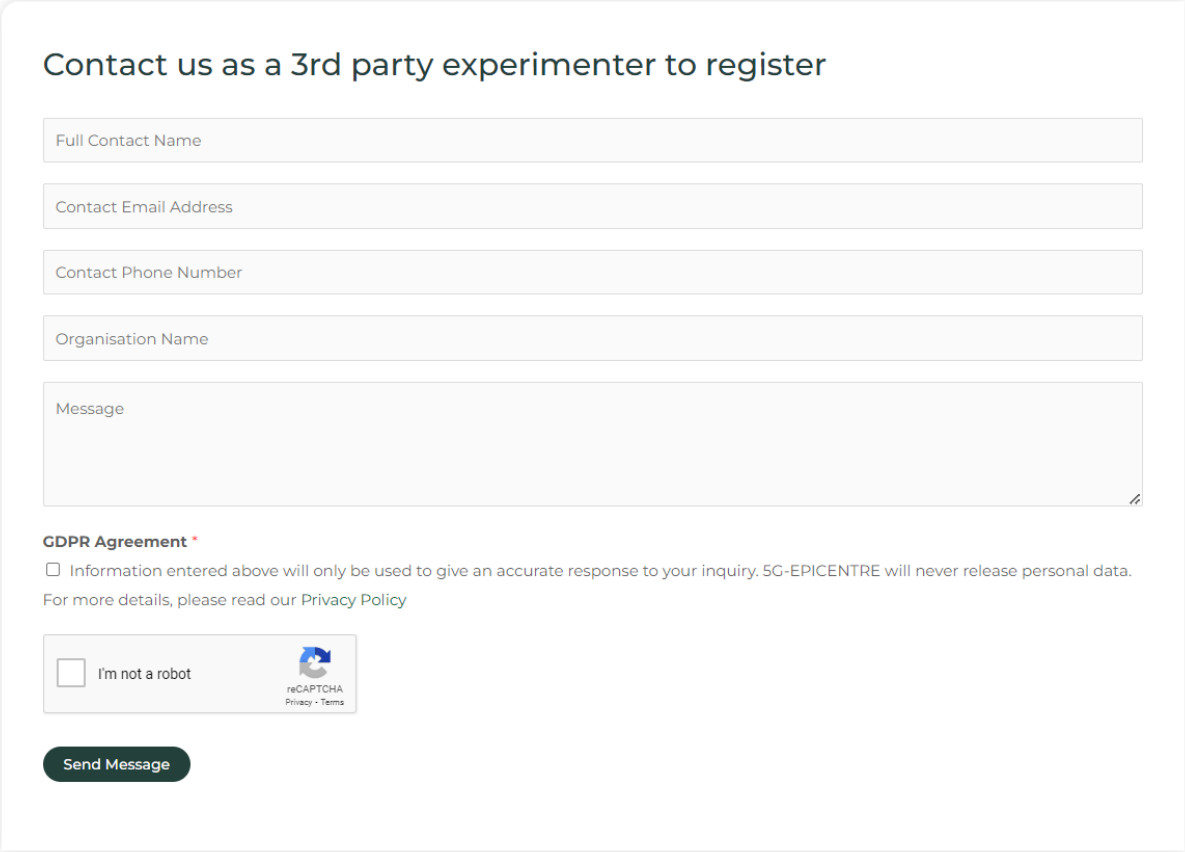

Figure 4: 3rd party experimenters web page, section "Contact us"

4 Third party experimentation events

In the final phase of the 5G-EPICENTRE project, dissemination events will be organized to showcase and promote the results of the third party experimentation activities.

At the time of writing, a joint event with the 5GASP project (https://www.5gasp.eu), and potentially other ICT-41 projects, to take place on 23-24 October 2023 in Aveiro, Portugal, is under preparation as a satellite session of the IEEE 9th World Forum on Internet of Things (https://wfiot2023.iot.ieee.org/). The plan is to demonstrate the deployment and operation of PPDR use cases on each other's testbeds, taking advantage of the relevant 5G features and capabilities.

From the 5G-EPICENTRE perspective, this activity aims at demonstrating the project's capacity to utilize its federated platform to accommodate external use cases and vertical applications, including features that may go beyond the eight use cases developed and demonstrated in the context of the project. At the time of writing, the plan is for 5G-EPICENTER and 5GASP plan to provide access to their local Aveiro testbeds, but remote access to other testbeds should also be made available. Other ICT-41 projects are also welcome to join this effort.

In collaboration with WP6, other events involving third party experimentation will be prepared, which will be reported in future WP5 and WP6 deliverables.

5 Conclusions

This document provides an overview of the work planned to be conducted in the scope of Task T5.2 to integrate 3rd party experiments into the 5G-EPICENTRE platform.

In particular, engagement of 3rd party experimenters is expected to be a major challenge in this process. Through the web page available at https://www.5gepicentre.eu/3rd-party-experiments/ and other social media, the objectives of this initiative will be disseminated in order to maximize the feedback and expected results.

The next steps will be the engagement of external experimenters and the operationalization of the plan outlined in Section 2, which will be adapted as the process goes along, if and when necessary, to accommodate specific requirements or challenges.

Results of 3rd party experimentation, as well as relevant lessons learned, best practices and deployment guidelines, will be provided in D5.3, one of the final project deliverables.