Experiment #9

Forest Fires Prediction [Sim4Safety]

Overview and Objectives

Sim4Safety is an advanced system that provides the user with the ability to run detailed fire simulations based on a wide range of burning conditions, from the point of ignition to the type of vegetation, wind conditions and more. This tool has three essential elements, which guarantee the whole effective result and the precision of the simulation:

- A user-friendly graphical UI that permits the easy browsing of a repository of past fire simulations, which can be viewed in an interactive map interface.
- A solid data repository, backed by a strong API, as a solution for storing and managing information coming out of each of these simulations, ensuring access to results of previous simulations, further analysis, and refinement of simulations models.
- A simulation process engine, running highly complex scripts with the latest AI algorithms in simulating fire disasters. Thereafter, an effective, alive, insightful, and actionable result is presented from user input parameters.

As such, the Sim4Safety integration with 5G-EPICENTRE aimed at experimenting and validating the 5G-EPICENTRE platform capabilities, to support the deployment of the Sim4Safety repository and simulation process engine components, as well as how these simulations could be integrated with VS4 Mobitrust network application integration elements and dashboards, to extend forest fires scenarios with advanced simulation models, thereby increasing decision making quality. **Σφάλμα! Το αρχείο προέλευσης της αναφοράς δεν βρέθηκε.** depicts the integration of Sim4Safety into the 5G-EPICENTRE ecosystem.

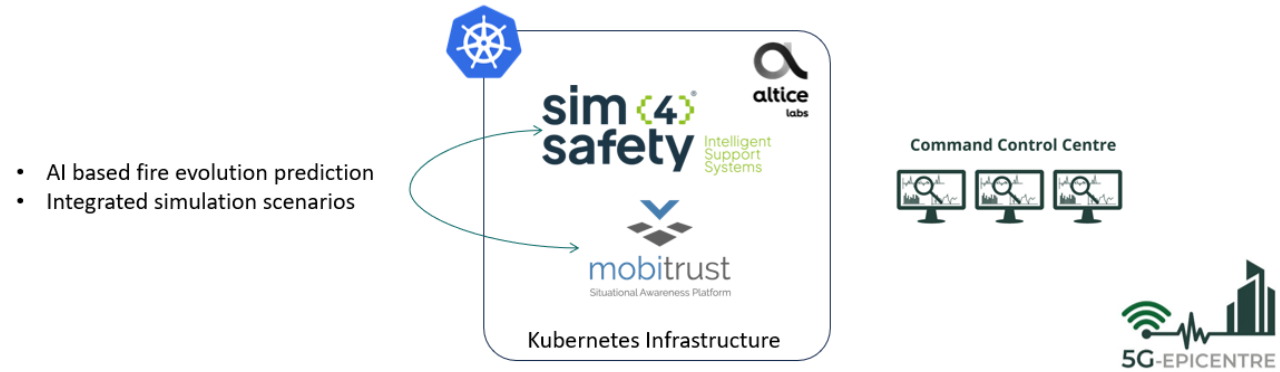

Figure 1: Sim4Safety Integration with 5G-EPICENTRE

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

Testbed Readiness and Deployment

Sim4Safety was deployed at the Altice Labs testbed via the 5G-EPICENTRE platform. To do so, several steps were taken: (i) preparation of the helm charts containing the description of the Sim4Safety components; (ii) upload of the helm charts to the 5G-EPICENTRE Helm Chart Repository; (iii) creation of a new experiment on the project Portal; (iv) acceptance of the experiment by the testbed owner; and (v) deployment of the application.

From a deployment point of view, the integration between Sim4Safety and Mobitrust happened smoothly, leveraging the Kubernetes features, namely, the exposure of the different components via service objects and its internal DNS, thus enabling the two applications to consume each other's endpoints. Figure 2 presents the deployment of Sim4Safety via 5G-EPICENTRE Portal.

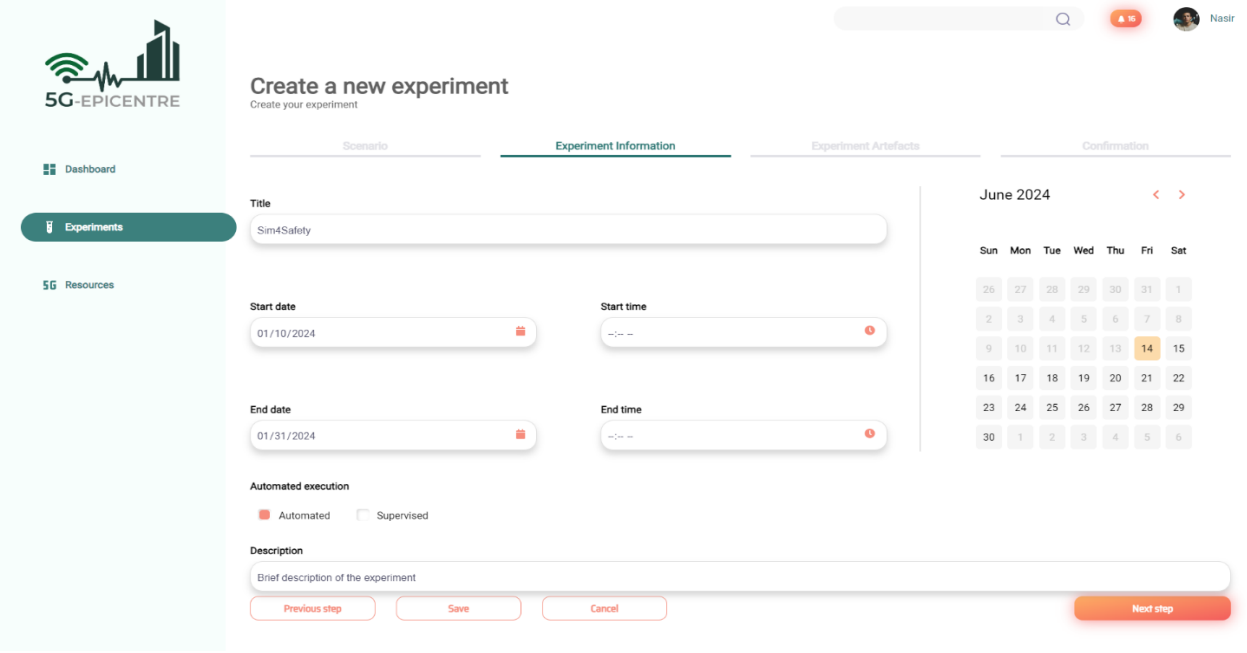

Figure 2: Deployment of Sim4Safety via 5G-EPICENTRE Portal

Figure 3 describes in further detail the interactions between the Sim4Safety, the Mobitrust application and the PPDR Agent using a UE. In detail, the PPDR Agent visualizes the fire progression simulation in a UE (using the Mobile Command Control Centre from Mobitrust), which is connected via 5G to the Mobitrust deployment at the ALB testbed. The Mobitrust platform invokes the Sim4Safety APIs to obtain the fire model simulation, which, in turn, executes the AI-based fire simulation mechanism and invokes external APIs to obtain the most up-to-date environmental information, like temperature, humidity, winds velocity and direction.

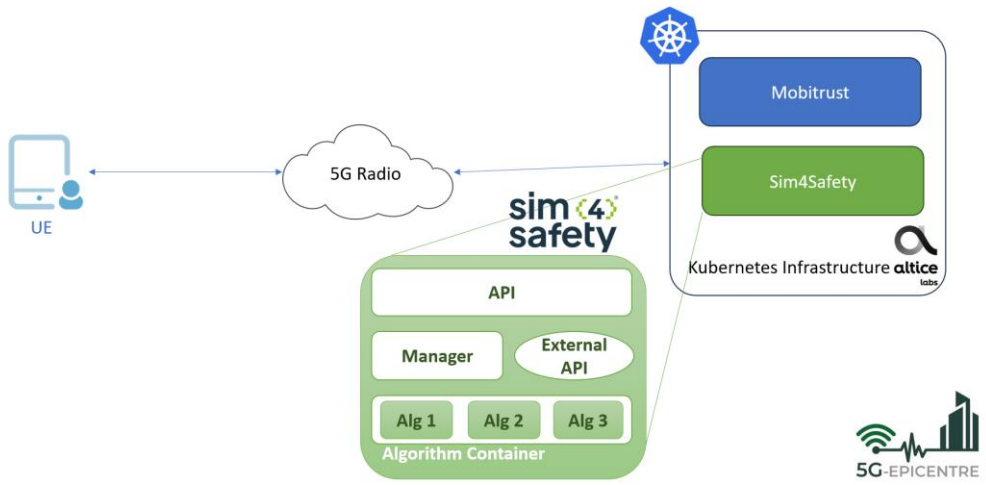

Figure 3: Sim4Safety Integration with 5G-EPICENTRE

Experiment Execution and Results

This experiment focuses on lab experimentation of the integrated result. The Sim4Safety and OneSource teams tested different simulations, and validated the outputs. In Figure 4, the simulation conditions were set; here, the user can configure the simulation parameters that are put into consideration during the simulation process. Important factors that are taken into consideration, among others, are the ignition points, types of vegetation, terrain factors, among other important variables. Then, the reader easily does a cross-reference with this as a foundation of the simulated fire.

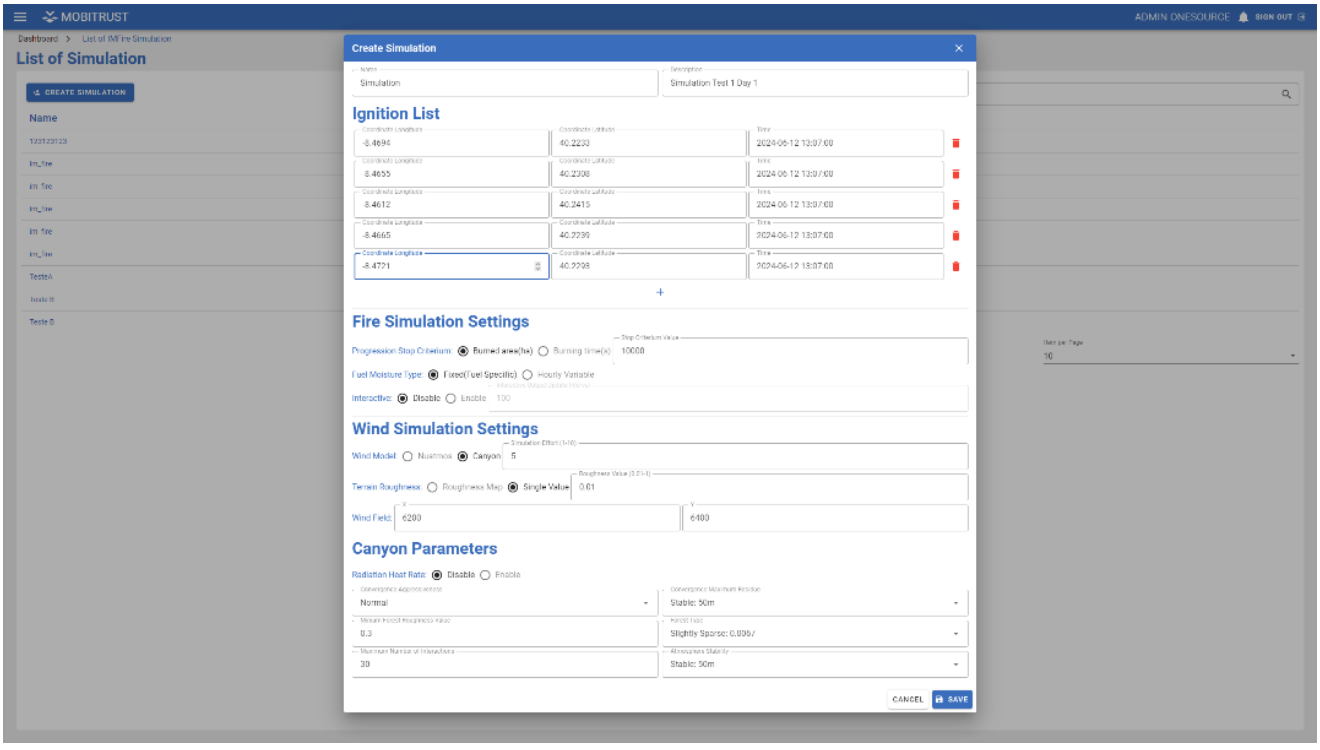

Figure 4: Sim4Safety Simulation Settings

Figure 5 presents the results of the simulation in a way that is graphically very effective in demonstrating the magnitude and consequences of the simulated fire event. The graphic contains three main pieces of information:

- **Fire Points:** These are shapes that depict areas of ignition, or source points within the modelled environment. Each point represents a point of initiation of fire, and one is therefore able to determine their pattern of spatial distribution.
- **Fire Lines:** These depict the advancement of the modelled fire across the landscape over time. This line indicates the boundary of a progressing fire front, from which fire-line direction and fire behaviour is crucially inferred over landscapes.
- **Fire Polygon:** The fire polygon is the boundary that demarcates the region affected by the fire event simulated by the application. It is the delimitation of the fire zone at a given time. With this, the user can determine how extensive the fire is in space and make judgments about the influence that the fire exerted on the environment around it.

It provides an overall summary of the simulated fire scenario globally, therefore enabling rationally made decisions in the choices to make, as well as the plan to follow, regarding fire management and mitigation.

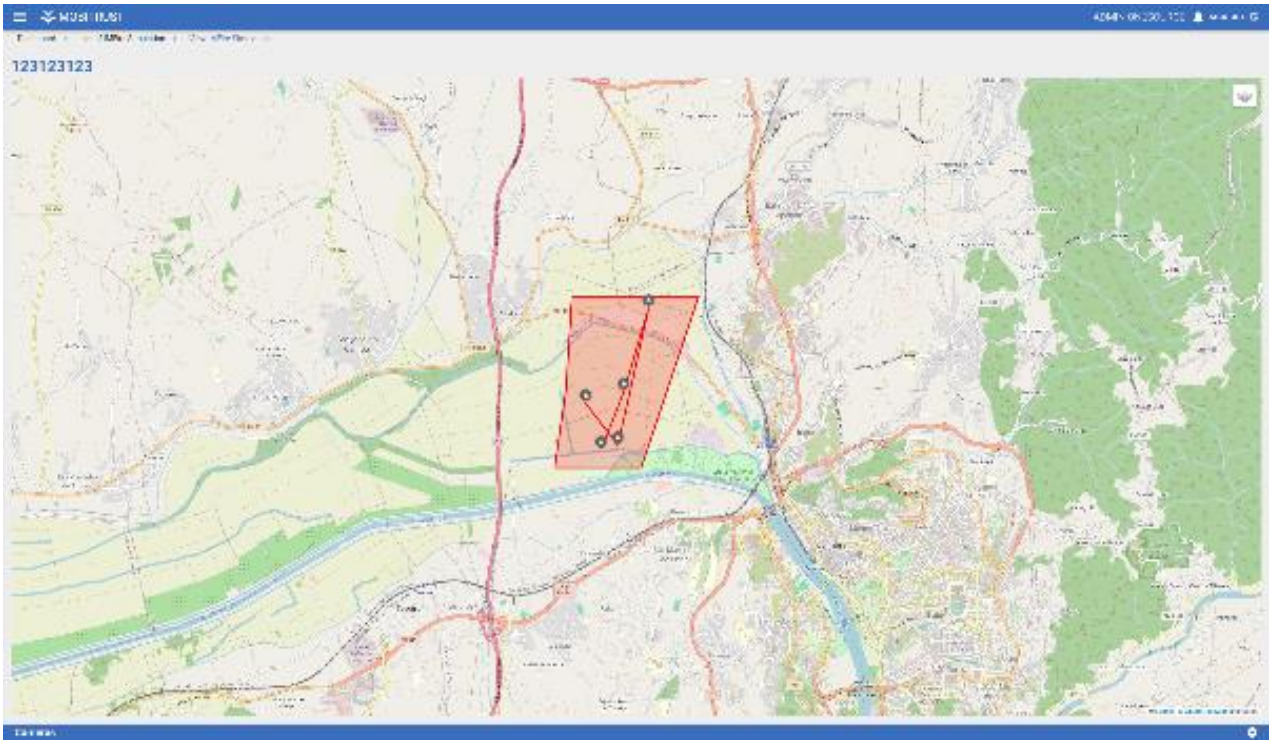

Figure 5: Simulation Results

Overall evaluation

The integration of Sim4Safety with 5G-EPICENTRE has been resoundingly successful. This collaboration has not only validated the capabilities of the 5G-EPICENTRE platform, the ALB testbed, but also demonstrated the robustness and versatility of Mobitrust platform, and its network application extensions.