SIRENE - An ICT and collaborative-based tool to cope with disaster-related emergencies

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Nowadays, there is a recognized need for designing and developing ICT and collaborative-based strategies to support decision makers in preparedness and management of disaster-related emergencies. An increased understanding of costs and impacts of natural disasters has triggered decision makers to plan in advance prevention, mitigation and response measures to reduce long-term social and economic consequences on communities living in most-at-risk areas (Disaster Statistics, UNISDR, 2016).

The European Civil Protection Agency, in its Disaster Prevention, Preparedness and Intervention programs (1999; 2006; 2011) recommends, among the others, two complementary modes of actions for reducing the impacts of natural disasters: improving communication and information sharing among authorities, technicians, volunteers and citizens, and increasing risk awareness among people living in most-at-risk areas by information and education campaigns.

It shows that efficient decision-making and use of advance information during response planning are key factors in the mitigation of disaster-related potential damage.

To handle the problem, an ICT based application (SIRENE - Sistema Informativo per la Risposta alle EmergeNzE - Information System for Emergency Response) has been designed and developed to cope with different emergency critical states. The main purpose is to increase, as much as possible, the resilience of the communities by improving their proactive attitude against disasters and by reducing the expected impacts and the potential damage.

SIRENE is presented with the following features: a decision support system to retrieve and display the relevant strategic information to cope with different emergency critical states; a distributed network of authoritative spatial data; a synchronized management strategy over multiple decision-making nodes; a visual representation of the available emergency decision paths; a collection of all the network-distributed generated logs for in emergency event tracing; an offline operation strategy with fault tolerant network synchronization and a session manager with user-level authentication. SIRENE functionalities can be further extended by elevating a node in the distributed system to the authoritative privileged role of data collector and dispatcher; the privileged node administrator is able to analyze the emergency activation state of every node in the same virtual network in real-time and collect the execution logs.

The key technological aspects we had in mind while designing and implementing SIRENE are: minimization of the required hardware and software equipment costs; maximization of functionalities by exploiting authoritative geo-data, research geo-data and user-generated geo-data; resilience even in the case of electric power and/or communication network failure and high availability.

SIRENE embeds a PostgreSQL server, a QGIS version, a customized project file and a dedicated plugin. SIRENE is an open-source software mainly developed in Python programming language to leverage on its flexibility and resilience.

A beta version of SIRENE has been deployed to eighteen hilly/mountain test municipalities (twelve located in the Italian Central Alps, Northern Italy, and six in Umbria region, Central Italy) which have been affected by natural disasters over the past years (landslides, debris flows, floods and wildfire) and experienced significant losses.