SHORT TERM SCIENTIFIC MISSION (STSM) – SCIENTIFIC REPORT

The STSM applicant submits this report for approval to the STSM coordinator

Action number: CA15127
STSM title: "Application of Vehicular Crowdcell approach to post disaster Communications"
STSM start and end date: 10.12.2018 to 15.12.2018
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PURPOSE OF THE STSM/

Post-disaster communications represent a crucial component of any disaster response strategy. On the occurrence of a disaster, indeed, and particularly in those situations where a timely response is required, the availability of information and information channels is of paramount importance.

An innovative approach to the delivery of cellular communications in contexts of disaster is represented by the Vehicular Crowdcell approach. Such approach has been proposed first in order to flexibly densify the network in urban settings, in a cost efficient way, by exploiting the correlation between spatio-temoporal patterns of user mobility and the patterns of vehicular mobility.

The main goal of the proposed STSM is to foster the collaboration between HES SO and the group in Politecnico di Torino led by prof. Ajmone Marsan, on the topic of Vehicular Crowdcell for disaster communications.

DESCRIPTION OF WORK CARRIED OUT DURING THE STSM

The vehicular crowdcell approach consists in assuming that part of the cellular infrastructure is not static but is mounted on vehicles and hence, to some extent, follow users and densifies naturally where user density gets larger. Such paradigm is currently the object of investigation on several aspects, ranging from user association and interference management, and resource management.

A primary scientific objective of the STSM has been hence to perform a first assessment of the validity of the vehicular crowdcell in disaster scenarios. The analysis has focused on those scenarios where the disaster does not prevent vehicles from circulating in the zone, and in any scenario where the vehicles are UAVs which are less constrained than vehicles in the choice of their position and trajectory.

Among the many issues which the considered scenario implies, we have selected the problem of high handover frequency as being particularly critical. Indeed, with respect to traditional small cell scenarios, with static infrastructure, the mobility of the small cells increases the frequency of handovers, resulting in a higher

likelihood of loss of connectivity for users. In disaster scenarios, the higher unpredictability of user mobility patterns make the issue harder to tackle.

Among the possible approaches we have considered, we have chosen to explore the applicability of the Floating Content theoretical framework in order to address this issue. In particular, we have considered the combination of the non-spatial approach to modelling of population fluctuations over time, and of the geometrical approach, as they allow deriving some important parameters about the system such as the statistics of the amount of time a user is associated to a moving BS, and the frequency of handovers.

DESCRIPTION OF THE MAIN RESULTS OBTAINED

The main outcome of this work has been the individuation of a set of analytical results, mutuated from the theory on Floating Content, which enable a first order evaluation of the effects of mobility of users and vehicles on performance of the vehicular crowdcell approach.

FUTURE COLLABORATIONS (if applicable)

The two research groups plan to continue interact and collaborate in the near future, possibly through further exchanges of researchers, in order to fully explore the potential of the approach individuated. Specifically, the future interactions will aim at completing the analytical formulation of the approach, at assessing it numerically and publishing it at reputable conference venues.