SHORT TERM SCIENTIFIC MISSION (STSM)
SCIENTIFIC REPORT

This report is submitted for approval by the STSM applicant to the STSM coordinator

Action number: CA15127
STSM title: Fog-cloud computational offloading and resource allocation
STSM start and end date: 18/03/2019 **to** 25/03/2019
Grantee name: Thibault Degrande, Ghent University, Belgium (BE)
Host: Pavle Skočir, University of Zagreb, Croatia
WG: 3 – Technology-related disasters

PURPOSE OF THE STSM:

The aim of this STSM is to analyze techno-economic aspects of fog-cloud computational offloading and resource allocation. A use case will be delivered by University of Zagreb - Faculty of Electrical Engineering and Computing (UniZG-FER), which is currently focused on technical aspects, while during STSM also economic aspects will be considered. The envisioned use case of the project is in the smart home/smart city environment in the Internet of Things laboratory (IoTLab) at University of Zagreb - Faculty of Electrical Engineering and Computing (UniZG-FER). The possible integration with smart city (City of Things) and smart home environments (HomeLab) at the University of Gent will be regarded. The plan is to evaluate the need for fog-cloud offloading in terms of latency, throughput for specific applications, and energy consumption of devices. Economic analysis should show the cost efficiency of the proposed solution for the envisioned applications. We will work towards producing a conference or journal paper based on the proposed solution and results.

DESCRIPTION OF WORK CARRIED OUT DURING THE STSM

During this short research stay (4 days), various activities were performed to complete the workplan of the STSM. First of all, the applicant and the host got to know each other, their respective research interests and the competences of the different research groups they are residing in in more detail. Based on these discussion, we defined the topic and the scope of the our work. We came up with a smart meter use case, as it perfectly resides in the smart home/smart city context we envisioned. Reasons for this topic include that smart meter deployments are very relevant now in both Belgium and Croatia and the host institution has ongoing research projects in the field. Furthermore, we started joint research on the state-of-the-art of the smart meter communication requirements and the need for edge, fog or cloud computing to help communication technologies such as NB-IoT support more challenging use cases. Finally, we started drafting a paper that documented our first findings.

DESCRIPTION OF THE MAIN RESULTS OBTAINED

As described, we came up with a smart meter use case, as it perfectly resides in our shared interest in smart home/smart city research.

There is a growing consensus worldwide about the need to promote clean energy technologies to address the risks of global warming. A key enabler of clean energy deployments is advance metering infrastructures (AMI), commonly known as smart meters. Across the European Union, large variations exist in market penetrations of smart meters. While countries such as Sweden have achieved more than 90\% market share, some others have not yet started with large-scale deployments, both in Western Europe (Belgium) and in Central and Eastern European Countries (Croatia). Most of the current existing smart metering architectures make use of communication through a Power Line Communications (PLC)/Broadband over Power Lines (BPL) data concentrator, or via a PLC/BPL gateway, while only a minority uses direct communication through a mobile operator network. As Belgium and Croatia are late adopters in deploying smart metering infrastructure, they face unique opportunities to implement new technological advances in the latter solution type (e.g. Narrow-Band Internet of Things), if this would turn out to be justifiable form a techno-economic point of view. However, in order to support future demanding use cases that will be dependent on smart meter communication (e.g. strong latency requirements), and because Smart environments such as smart homes or smart cities need to be operational even if cut off from the Internet or physically cut off from the surrounding areas, these techno-economic analysis should also consider the necessity of edge/fog computation.

FUTURE COLLABORATIONS (if applicable)

The work on the paper is ongoing, and will be continued. In the near future, Dr. Pavle Skočir from the host institution comes to Belgium to further elaborate to work on this topic. Once the concept has been theoretically addressed, smart metering/monitoring test setups could also be used to obtain results similar to the work Dr. Skočir did during his PhD, allowing to identify also techno-economic trade-offs. The City of Things or HomeLab infrastructure in Belgium could be used for that purpose.