MOBILE CLOUD COMPUTING MECHANISMS TO SUPPORT THE CREATION AND OPERATION OF INFORMATION SERVICES IN SPORADIC SOCIAL NETWOKS GROUNDED ON MOBILE MULTI-HOP AD-HOC COMMUNICATIONS

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WORK MOTIVATION

Nowadays, most people carry handheld devices that allow to run their favourite applications while moving. However, this situation leads to some negative effects: de-socialization [1] and FOMO [2] (Fear Of Missing Out).

► We fight both problems in the realm of the SPORANGIUM project (Spanish R&D plan, ref. TIN2013-42774-R) where the goal is to deploy Sporadic Ad-hoc Networks (SANs) over the devices of a group of users wo are near from each other during a period of time (e.g., in stadiums, museums, cinemas…) (Fig. 1).

► This to orchestrate tailor-made context-aware services that promote interactions among potentially like-minded strangers, by considering their personal preferences and interests: smart cities, urban games, interactions among vehicles' occupants...

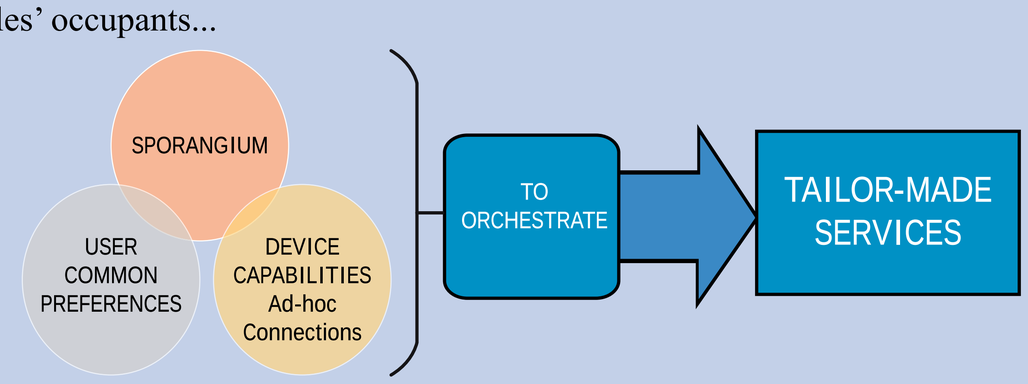

Figure 1. Handling activities and services by SPORANGIUM

► The complexity of our tailor-made context-awareness services exceeds the computational capabilities of the devices connected over the SANs. Therefore, the resources of these devices must be augmented by resorting to cloud principles and infrastructures (the so-called Cloud-based Mobile Augmentation or CMA) [3].

► Traditional CMA approaches increase the capabilities of mobile devices by leveraging the resources available in clouds that can be mobile/fixed and even distant/proximate.

► Long distances between the cloud and the mobile devices to be augmented lead to excessive bandwidth consumption and latency. For that reason, we resort to proximate augmentation clouds in SPORANGIUM.

► In existing CMA approaches based on proximate clouds, the mobility has not been completely explored. Actually, these approaches deal with fixed handheld devices that share their available resources for augmentation purposes.

► We contribute with an approach that work with sporadic clouds where the augmentation resources are borrowed from the moving devices of the SAN members —> For that reason, we have coined our approach as Sporadic Cloud-based Mobile Augmentation (S-CMA).

► The complexity stemmed from the mobility of the augmentation cloud is managed by a virtualization layer named VNLayer+, which is a cluster - based approach that divides the geographical area in regions. A static virtual node (VN) is located in each region, being emulated by the physical nodes (users' devices). In each region, a physical node is selected as leader to take charge of packet reception, buffering and forwarding.

► Thanks to the abstraction provided by the VNLayer+, our S-CMA approach takes in charge of sharing and allocating the resources available in each sporadic cloud, dealing with virtual nodes and ignoring the mobility of the users connected to the SAN. This contributes to:

(a) Deploye diverse XaaS models in the SANs, allowing the SAN members to leverage extra computing resources (CaaS), networking capabilities (NaaS), storing space (STaaS)… in order to run resource-intensive mobile applications.
(b) Alleviate limitations of existing CMA solutions that degrade the experience of mobile users..

OBJETIVES:

To develop the mechanisms of the "Sporadic Cloud-based Mobile Augmentation" layer of the SPORANGIUM platform we need:

►OBJ1: Turn our SANs networks into reliable and stable communication environments with good performance in terms of overhead, packet delivery ratio and scalability, covering vehicular, pedestrian and mixed environments.

►OBJ2: Develop the mechanisms of the S-CMA to enable an efficient sharing and allocation of the available resource on the SAN.

►OBJ3: Deploy enhanced "X"aaS service models (e.g. NaaS, CaaS, STaaS, SEaaS...) through our S-CMA paradigm.

- Integration of several 3G/4G/Wi-Fi connections into one virtual connection with added-up bandwidth in our S-CMA.

RESEARCH PLAN:

►The review of the state-of-the-art in the area of mobile cloud computing has been completed. The Ph.D. has been conceived as an extension of the doctoral work BY Jack F. Bravo-Torres, where new refinements need to be envisaged in the VNLayer+ in order to support our S-CMA approach.

►Later, we will focus on designing, developing and validating the mechanisms necessary to deploy in our SANs "X"aaS models through our S-CMA so that the devices connected on the SAN can:

- Collaborate in tasks
- Share their computing capacity

►For this currently we are designing a state machine to define the possible states of each physical node (device) involved in our S-CMA approach and the transitions between them.

►We are implementing a simulator to consider diverse mobility scenarios for validation purposes.

RESULTS AND DISCUSSION:

Articles accepted for publication

►We have contributed ideas to develop a solution *to* ***enable individualized access to web contents from within vehicular ad-hoc networks using HTTP on the top of TCP and a routing protocol that works in tandem with the virtualization layer VNLayer+.***

○ In this context, the candidate has co-authored the following publication:

- (Related to OBJ1) "***VaNetLayer: A Virtualization Layer Supporting Access to Web Contents from within Vehicular Networks***". In Journal of Computational Science (Elsevier). 2015.

►Another contribution, related to OBJ2, has been published:

- "***SPORANGIUM: Exploiting a Virtualization Layer to Support the Concept of Sporadic Cloud Computing with Users on the Move***". In 3rd World Conference on Information Systems and Technologies (WorldCist 2015). Azores, Portugal.
- ***"Sporadic Cloud Computing over a Virtualization Layer: A new Paradigm to Support Mobile Multi-hop Ad-hoc Networks"***. In Doctoral Consortium on Cloud Computing and Services Science (DC CLOSER 2015). Lisboa, Portugal.
- ***"S-CMA: Sporadic Cloud-based Mobile Augmentation supported by an Ad-hoc Cluster of Moving Handheld Devices and a Virtualization Layer"***. In 5th International Conference on Innovative Computing Technology (INTECH 2015). To appear.

►We have been developing initial mechanisms to support our S-CMA paradigm, showing that the virtualization layer can be a cornerstone to extend the traditional approaches to support mobility in hybrid scenarios. The mechanisms developed have been concerning to:

- Distribution of Virtual Nodes on road in urban centers.
- Definition of message protocols to start deploying services in the S-CMA.
- Establishment of states and tasks of the physical nodes in order to support the mobile augmentation process.

NEXT YEAR PLANNING

►During the 2015-2016 academic year, the candidate will seek to further develop the concepts of S-CMA with regard to applications of SANs.

- The focus will be put on objectives OBJ2 and OBJ3.

►The candidate is currently recruiting students from Universidad Politécnica Salesiana (Cuenca, Ecuador) to carry out implementation works aimed at creating a simulator of SANs in smart venues and smart cities, which should be ready by June 2016.

►The candidate is also seeking to make a short research stays in the University of Vigo, most probably during the months of september and october 2015 / march and april 2016.

►At least two conference publications and one SCI journal article will be pursued.

Bibliography:

[1] D. J. Kuss and M. D. Griffiths, "Excessive online social networking: Can adolescents become addicted to Facebook," Educ. Heal., vol. 29, no. 4, pp. 68–71, 2011.
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[3] Abolfazli et al. "Cloud-based augmentation for mobile devices: motivation, taxonomies and open challenges". IEEE Communications Surveys & Tutorials, 16(1):337-368, 2014.