

MULTI-LEVEL MECHANISMS TO SUPPORT SPORADIC CLOUD COMPUTING MOBILE SERVICES BY RESOURCE-SHARING IN AD-HOC NETWORKS

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1. WORK MOTIVATION

- **Mobile Cloud Computing (MCC)** envisages several architectural solutions to enable execution of rich applications on a plethora of mobile devices [1].
- We want to develop a concept of **sporadic MCC services**, harnessing the largely underused resources of handled devices and on-board units mounted on vehicles.
 - **Sporadic** → sharing resources during **occasional encounters** to carry out **context-aware, short-lived tasks**.
 - Enabling a range of “**XaaS**” services [2]: *Networking as a Service (NaaS)*, *Collaboration as a Service (COaaS)*, *SEnsing as a Service (SEaaS)*, etc.
 - Building blocks for rich mobile applications in smart cities, concerning traffic safety, tourism, entertainment, etc.

2. OBJECTIVES:

Develop the mechanisms of **Sporadic Cloud-based Mobile Augmentation (S-CMA)** in a stack of protocols for ad-hoc networks.

- **OBJ1:** Turn the ad-hoc networks into reliable and stable communication environments.
- **OBJ2:** Develop the mechanisms to enable efficient sharing and allocation of available resources.
- **OBJ3:** Implement and validate an enhanced NaaS model that allows the integration of several 3G/4G/Wi-Fi connections.

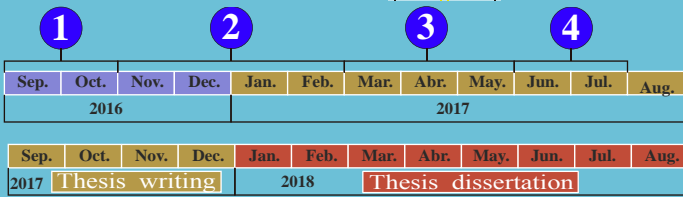
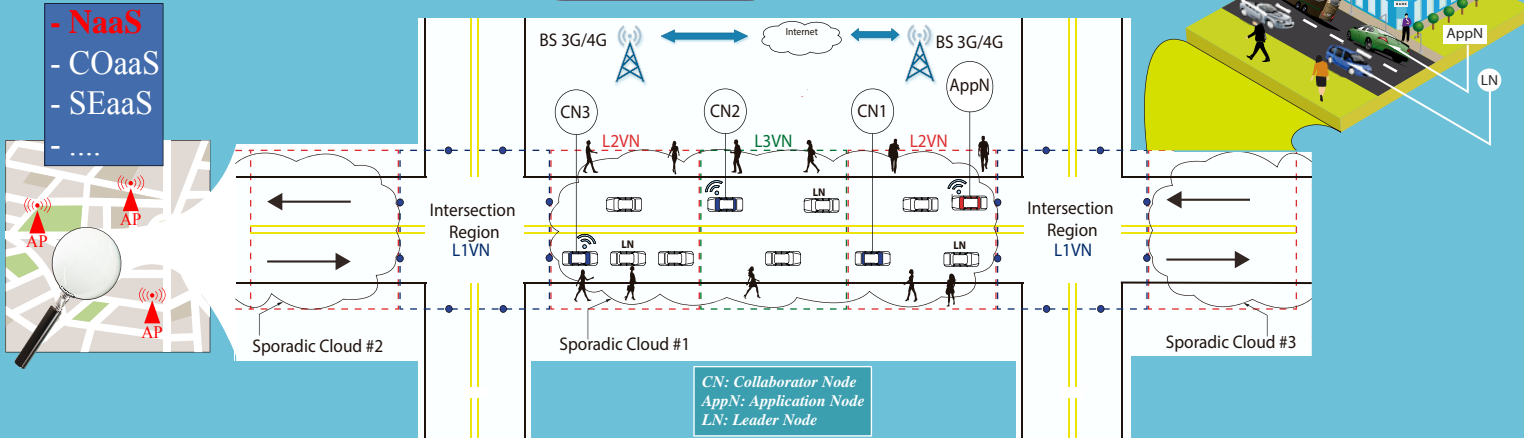
3. RESEARCH PLAN:

State-of-the-art

Application layer

Contributions

Progress	State-of-the-art	Application layer	Contributions
In progress	3 Lack of processes and mechanisms to enable an efficient sharing of available resources of the VNs	Mobile Cloud layer S-CMA	- Formation of sporadic clouds between intersections. - State-keeping and roaming procedures. - Common mechanisms to deploy "XaaS" services.
Done	2 Lack of a message exchange protocol among VNs to support S-CMA approach	Network layer (VNIBR)	- Routing protocols that do most of the decision-making at the intersections (Level 1 Virtual Nodes).
	1 High mobility of pedestrians and vehicles implies constant topological changes	Virtualization layer (VNLayer)	- Creation of a network of static <i>Virtual Nodes</i> (VNs) supported by physical ones [3]. - Stable repositories of information on an intersection-based layout.
		Link layer (IEEE 802.11p)	



4. RESULTS:

- **Related to OBJ1:**
 - a) We have added and validated new mechanisms for the **VNLayer**, improving performance in terms of packet delivery ratio, overhead and latencies (results published in [4,5]).
 - b) We have submitted one paper presenting three variants of VNIBR: reactive, proactive and encounter-based. Simulations show good performance in comparison with state-of-the-art routing algorithms for ad-hoc networks.
- **Related to OBJ2:** We have developed the foundations of the mechanisms of **S-CMA** (first results published in [6,7]).
- **Related to OBJ3:** We have submitted one paper presenting NaaS model to collaborative download of individualized content from internet by aggregating the connections available in a Sporadic Cloud. Our approach shows that despite the high mobility of the vehicles, reliable and stable communications among the application nodes and its collaborators are guaranteed thanks to the VNLayer and VNIBR layers.

DISCUSSION:

- Bottom-up, the VNLayer, the VNIBR protocols and the S-CMA procedures provide convenient foundations to develop sporadic MCC services.
- In typical urban scenarios, road segments are long enough to do useful work with the idle resources of devices passing by.

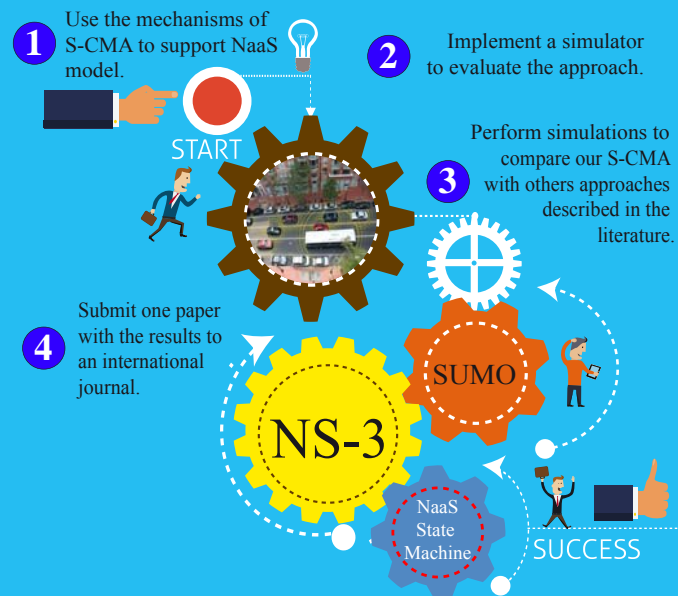
6. Bibliography

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5. NEXT YEAR PLANNING



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[7] Ordóñez Morales, E. F., et al. "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.