

OFFRE de THÈSE

Sujet de thèse – Subject title: Radio resources management for machine-to-machine communications in future cellular networks

Description :

Machine-to-machine (M2M) communications refers to technologies that allow both wireless and wired devices to communicate with other devices. In opposition to the former forms of communications, which involve the human factor, M2M involves only devices. It is an ongoing standardized form of communications in mobile networks.

Two main communications scenarios can be considered, in such networks. The first scenario, which considers a communication between the M2M devices and one or more M2M servers, is the most typical communication scenario. Indeed, most of the use cases such as: health monitoring at home, water, gas, or power metering, consider the client/server model. Other type of applications may require alternative model of communication such as the peer-to-peer (P2P) model. These applications are represented by the second scenario, which considers a communication between M2M devices.

Supporting M2M communications, in mobile networks, and particularly in LTE-Advanced networks, is particularly challenging. In fact, the communications of such energy-constrained devices require most often a huge amount of signaling traffic for only a small portion of data, which may reduce the efficiency of such networks while shifting the congestion to the application level [1]. Besides, the forecasted dramatic growth of the number of M2M devices complicates even more their support in such networks. Indeed, this may aggravate the issues cited above may significantly increase the probability of congestion when performing the random access procedure [2].

To accommodate efficiently the increasing number of M2M devices, while preserving the regular cell phone communications from any service degradation, mobile operators have to reconsider some of the mechanisms that are currently in use [3]. Particularly, new algorithms need to be proposed in order to improve the communications of grouped M2M devices that allow reducing significantly the signaling overhead while saving the scarce network resources.

The objective of this PhD thesis will be to propose new resources management algorithms addressing the issues described below. The thesis will particularly address the case of M2M grouped devices communications, in LTE-advanced networks. It will consist in:

- Examining the related works on resource management in LTE-Advanced networks and M2M communications
- Examining the existing mathematical models and developing/validating new mathematical models for M2M communications
- Studying the problems pointed-out in the thesis description and identifying new problems
- Proposing new algorithms to improve the support of M2M devices in LTE-Advanced networks
- Proposing new algorithms to improve the support of M2M grouped devices
- Validating the proposed algorithms by both simulations and experimentations in real platforms
- Considering other extensions and notably the convergence with the Internet of Things (IoT).

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Début des travaux - Work start date: Dès que possible / As soon as possible

Bibliographie – References:

[1] A. Amokrane, A. Ksentini, Y. Hadjadj-Aoul, T. Taleb, “Congestion Control for Machine Type Communications”. In proc. of IEEE ICC 2012, Ottawa, Canada (Juin 2012)

[2] Shao-Yu Lien; Kwang-Cheng Chen; Yonghua Lin, “Toward ubiquitous massive accesses in 3GPP machine-to-machine communications”. IEEE Communications Magazine, vol.49, no.4, pp.66-74, April 2011

[3] Kim Chang; Soong, A.; Tseng, M.; Zhixian Xiang, “Global Wireless Machine-to-Machine Standardization”. IEEE Internet Computing (Standards), vol.15, no.2, pp.64-69, March-April 2011