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Optimal dynamic edge device deployment : the challenges

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Abstract— **With the increase of IoT, one can witness the deployment of more and more IoT devices. These devices are mostly characterized by heterogeneous mobility and connection patterns and limited resources such as memory, computing resources and energy. To overcome this, some of their computing tasks should be offloaded to a cloud or edge devices. In order to serve them as much as possible, there is a need to predict the kind and amount of resources these devices will request and the location of these resources. Some edge resources may need to be deployed sporadically and temporarily at different locations based on IoT devices needs and mobility. This talk will present the different challenges that have to be addressed to provide IoT devices with the best services. With the increase of IoT, one can witness the deployment of more and more IoT devices. These devices are mostly characterized by heterogeneous mobility and connection patterns and limited resources such as memory, computing resources and energy. To overcome this, some of their computing tasks should be offloaded to a cloud or edge devices. In order to serve them as much as possible, there is a need to predict the kind and amount of resources these devices will request and the location of these resources. Some edge resources may need to be deployed sporadically and temporarily at different locations based on IoT devices needs and mobility. This talk will present the different challenges that have to be addressed to provide IoT devices with the best services. .**

I. INTRODUCTION

IoT devices of all kinds are invading our daily lives in a more and more transparent and seamless fashion. There are numerous, heterogeneous and independent devices. Such IoT devices could be either plain air quality sensors deployed in a city or mobile phones. They can offer very low computing and sensing capacities or at the contrary be very powerful. They can be either fixed or mobile and the mobility itself can be very heterogeneous since it could be easily predicted (like bus) or completely unknown (when hold by people or cars), featuring different speeds. Devices are wireless and can access edge resources either directly or through a multi-hop path.

II. MAIN CHALLENGES

A. Depending on the application they are deployed for, the data they sense and collect could require a local processing to meet latency and delay requirements in spite of their potential limited computing capacity and memory storage. Adaptive edge computing could offer an interesting solution to process data close to the source (compared to cloud computing) with the use of more powerful devices located at the edge of the network. Nevertheless, as mentioned, these devices could be highly mobile and the edge services should be deployed where they are and will be. There is thus a need to anticipate the deployment of edge services and to estimate the time they will be needed at a given place to decide whether it is worth deploying durable edge resources or mobile temporary resources could suffice. In this latter case, the estimation of the location and quantity of required resources should be anticipated enough to allow their timely deployment. The deployment of edge resources will be such that a maximum of IoT devices can be served within the required latency, either directly or through multi-hop communications. Direct communications will be favored for low-energy devices with very-low latency requirements when multi-hop communications could be used for weaker latency requirements.

The mains challenges are thus :

- How to estimate jointly the quantity and location of edge resources requested by IoT devices in spite of their heterogeneity in hardware and mobility patterns ?
- How to anticipate the deployment of these resources taking account of the mobile edge resources available and their deployment speed ?
- How to define efficient trade-off for the location of edge resources to be able to serve different IoT devices based on their priority

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