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Augmenting computing capabilities at the edge by jointly exploiting mobile devices: a survey

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Abstract

The ever-growing adoption of smart mobile devices is a worldwide phenomenon that positions smartphones and tablets as primary devices, i.e., that people mostly use. In addition to this, the computing capabilities of such devices, often under-utilized by their owners, are in continuous improvement. Today, smart mobile devices have multi-core CPUs, several gigabytes of RAM, and the ability to communicate through several wireless networking technologies. These facts caught the attention of researchers who propose to leverage smart mobile devices aggregated computing capabilities for running resource intensive software at the edge of the network. Such idea is conditioned by key features, named singularities in the context of this work, that makes smart mobile devices resource exploitation a difficult problem. These are the ability of devices to change location (user mobility), the shared condition -i.e., non-dedicated nature- of resources provided (lack of ownership) and the limited operation time given by the finite energy source (exhaustible resources). In this paper, we provide an in-depth analysis of proposals materializing this idea. We show that a) existing approaches differ in the singularities combinations they target and the way they address each singularity through novel taxonomies, and b) this fact makes them suitable for distinct goals and resource exploitation opportunities also schematized in this paper. The latter are represented by real life situations where resources provided by groups of smart mobile devices can be exploited, which in turn, are characterized by a social context and a networking support used to link and coordinate devices. The behavior of people in a given social context configure a special availability level of resources, while the networking support imposes restrictions on how data/computational tasks are distributed and results are collected. We conclude our analysis by discussing strong/weak points of the approaches and by identifying prospective future lines in the area.

Keywords: Mobile cloud computing, edge computing, smart mobile devices, resource-intensive applications, resource allocation

1. Introduction

With the evolution of the semiconductor industry, cellphones, which were used mainly for communication and Internet access, were progressively equipped with more and more powerful components. CPUs with multiple cores, GPU, several gigabytes of main memory and storage space, a variety sensors, a high resolution screen and cameras, and multiple wireless data transferring interfaces are assembled in what is commonly known as *smartphone*. Tablets are smartphone-like devices equipped with higher screens and usually less communication technologies. Because of the rich capabilities derived from the combination of all aforementioned components, smartphones and tablets are commonly called *Smart Mobile Devices* (SMDs). This acronym as well as "device" and "node" will be used interchangeably in the rest of the document to refer to such type of devices.

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