International Journal of Interdisciplinary Telecommunications and Networking
Volume 13 • Issue 1 • January-March 2021

Setting Up Ad Hoc Computing as a Service in Mobile Ad Hoc Cloud Computing Environment

Muralidhar K., JNTUA, Ananthapuramu, India
Madhavi K., Department of CSE, JNTUACEA, JNTUA, Ananthapuramu, India

ABSTRACT

Despite the rapid growth in popularity and hardware capacity in mobile devices, they suffer from resource poverty, which limits their ability to meet increasing mobile users' demands. Computation offloading may give a prominent solution. But it relies on the connection to the remote cloud and may fail in situations where there is poor or no connectivity. Cloudlet was introduced to cover this problem, but mobile users miss free mobility when using cloudlets. Offloading to the cloud or cloudlet is not always the preferred solution. An alternative is to utilize the nearby mobile devices as local resource suppliers and pull their capabilities as a mobile device cloud. In this paper, the authors present such an approach known as ad hoc computing as a service (AhCaaS) model for computation offloading in an ad hoc manner by connecting to nearby mobile devices. They define a multi-attribute selection strategy to determine the optimal computation offloadee. They evaluated the proposed model, and the result shows that AhCaaS reduces execution time, battery consumption, and avoids task reassignment.

KEYWORDS

Ad Hoc Computing as a Service, Ad Hoc Network, Computation Offloadee, Computation Offloader, Computation Offloading, Mobile Cloud, Mobile Devices

1. INTRODUCTION

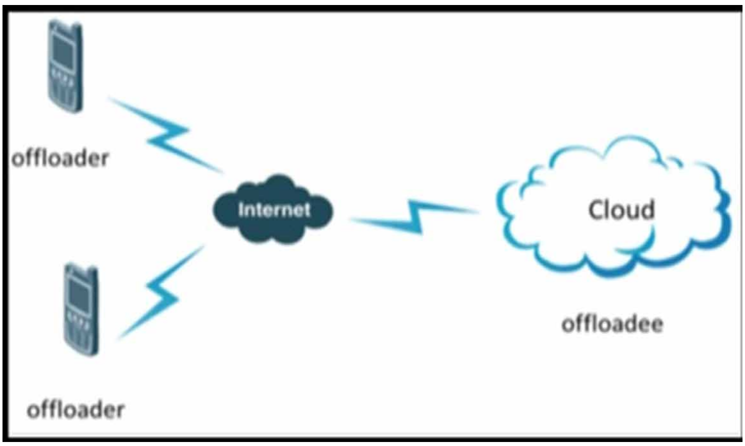
Due to the growth of mobile device technology, it is necessary to set up a firm ground for mobile devices to remain committed to application computing and completion. It can be concluded from (Balasubramanian & Karmouch, 2017) that over the decades, the level of use of mobile devices has increased. The introduction of smartphones not only has revolutionized computing and connectivity but also brought many useful software applications (A. ur R. Khan et al., 2017). Smartphones are not just phones; these devices are becoming more powerful and are used for personal information processing. They have become a central point of ubiquitous information processing. Such devices can be considered new portable sensors and expected to be the primary driver of smart applications (Huerta-canepa & Lee, 2010). Moreover, the development of mobile apps, such as real-time gaming, face recognition, and multimedia apps, also present a similar picture (Balasubramanian & Karmouch,

DOI: 10.4018/IJITN.2021010101

2017; Manukumar & Muthuswamy, 2019). A significant majority of such applications (A. U. R. Khan et al., 2015; Zhang et al., 2014; Shahzad Ali et al., 2014) are resource-intensive, requiring complex calculations and substantial energy consumption (A. ur R. Khan et al., 2013).

Computation offloading is an essential tool for enhancing the capacity of resource-constrained mobile devices by offloading a full or partial application from the devices to other more powerful devices to improve computational efficiency or increase battery life (Singh et al., 2019). One way to increase smartphone efficiency, i.e., to increase energy efficiency and save execution time, is to use mobile cloud computing by offloading computation-intensive tasks from smartphones onto a cloud and using the cloud's resources to assist smartphones improve their overall performance and gain energy efficiency (A. U. R. Khan et al., 2014; Wen et al., 2014). Using a remote cloud will allow the lack of local resources to be resolved. Offloading to the cloud is shown in Figure 1.

Figure 1. Offloading to the cloud



The use of remote cloud services depends strongly on network connectivity and fails in situations of low connectivity. The proposed approach suggested in this paper would be to use nearby mobile devices (mobile phones, PDAs, laptops, etc.) as resource suppliers and take advantage of their capabilities from a perspective that differs from the traditional approach by implementing a mobile cloud/mobile device cloud. (Zhou & Buyya, 2018). For devices and objects connected via a mobile ad hoc network (MANET), the surrounding nodes may be considered as potential resource providers. To that end, ad hoc mobile cloud computing could be set up over the MANET anywhere as soon as at least one device having the required resources connects to the same ad hoc network as the device in need. Offloading to nearby mobile devices through ad hoc MCC is illustrated in Figure 2.

In this way, for an end user or an object in the MANET, easy access to resources available on the mobile device cloud can be met. Others may join the mobile cloud and become cloud providers or cloud customers. The process will advance, and the mobile cloud will evolve dynamically. The combination of cloud computing with MANETs creates new opportunities and may provide additional advantages. This scenario would be suitable for networks created in an ad hoc manner where the mobile infrastructures are very pervasive or when there is a lack of connectivity to an infrastructure network. Cost and latency can also be the right motivation for the deployment of ad hoc mobile clouds.

This paper proposes such an ad hoc computation service known as ad hoc computing as a service for MANETs by using the nearby mobile devices, in which the mobile devices with a higher degree of computational capacity are selected using the fuzzy inference system for offering computational services on demand.

Related Content

Next-Generation Strategic Business Model for the U.S. Internet Service Providers: Rate-Based Internet Subscription

Charles C. Willow (2011). *Interdisciplinary and Multidimensional Perspectives in Telecommunications and Networking: Emerging Findings (pp. 141-149).*

www.irma-international.org/chapter/next-generation-strategic-business-model/52180

Wi-Fi Development: A Survey of Large New Zealand Organizations

Bryan Houlistonand Nurul I. Sarkar (2005). *International Journal of Business Data Communications and Networking (pp. 37-58).*

www.irma-international.org/article/development-survey-large-new-zealand/1408

MIMO Antennas

Eva Rajo-Iglesiasand Mohammad S. Sharawi (2016). *Wideband, Multiband, and Smart Reconfigurable Antennas for Modern Wireless Communications (pp. 145-175).*

www.irma-international.org/chapter/mimo-antennas/136613

Next Generation Access Networks and their Regulatory Implications

Ricardo Gonçalvesand Álvaro Nascimento (2009). *Handbook of Research on Telecommunications Planning and Management for Business (pp. 48-64).*

www.irma-international.org/chapter/next-generation-access-networks-their/21657

Mining Parallel Patterns from Mobile Users

John Gohand David Taniar (2005). *International Journal of Business Data Communications and Networking (pp. 50-76).*

www.irma-international.org/article/mining-parallel-patterns-mobile-users/1401