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Enabling and Optimizing Resource Constrained Ad-Hoc Mobile Clouds

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Abstract

Recent years have seen a rapid adoption of mobile devices, and an increased reliance on them, which has lead to increasingly computationally complex mobile applications. As a result, there have been several proposed systems that offload computationally intensive workloads from mobile devices to other computing resources, such as remote servers or local cloudlets. Although these proposed systems have been shown to provide benefits to the mobile applications, there are situations where the high latency communication to reach a remote server cannot be tolerated, or where there is no network connectivity to such resources. In these situations, offloading to other local devices is the only option. To this end, I have proposed a system that utilizes ad hoc communication protocols to create a local cloud that can be used for computational offloading.

By extending an existing mobile computing platform, I show the viability of offloading computation to devices within one hop, and model the cost in terms of time and energy for this hybrid system. Additionally, I have designed and developed several approaches to enable multi-hop communication within a network of mobile devices utilizing the WiFi Direct communication protocol. By doing so, I have further enhanced mobile computing by enabling the necessary infrastructure to facilitate multi-hop ad hoc computational offloading. With an implemented system, I was able to model the performance of this multi-hop computational offloading system, as well as model the task distribution problem as a linear bottleneck assignment problem and thus provide a provably optimal task distribution.

In summary, by providing the infrastructure for enabling multi-hop ad hoc computational offloading with off the shelf devices, and providing a provably optimal task distribution scheme, I have enabled and optimized the performance of ad hoc mobile clouds.