CIS-490H Edge Computing

With Dr. Zheng Song

Paper Review: Week 4

FemtoClouds: Leveraging Mobile Devices to Provide Cloud Service at the Edge

Student: Demetrius Johnson

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1. Summary.

(1) Motivation

The primary motivation for the FemtoCloud edge computing concept is to utilize clusters of mobile devices that are relatively predictable in their movements and with enough stationary time and computational power to contribute to and take advantage of a network where all nodes are helping each other through the management of a controller (the edge server). The concept originated from the idea of cloudlet devices – that is, devices that are smaller, less powerful versions of cloud servers but closer to the user devices. However, these cloudlet devices have the tendency to get bogged down with bandwidth and computation issues and are not a elastic solution.

(2) Contribution

So, to help mitigate the cloudlet problem, they propose using the cloudlet device (namely, the edge server) purely for controller purposes. Instead of handling raw computational requests from the user, it uses its computational power to manage clusters of mobile devices so that the devices can service themselves optimally.

(3) Methodology and/or argument

The idea is to implement several modules inside of the controller device, and the client devices. The client devices will gather and send user profile data to the controller device, then the controller takes the data from all of the users profiles to calculate estimations of bandwidth and computational abilities to assign computational tasks to devices that have joined the cluster. User profile information and estimations include average time spent In the cluster before a client will depart, number of devices expected to be in the cluster, computational power capabilities (or allowed by the client's resources specified by their profile settings), and communication speeds (bandwidth). These devices constantly send updates to the controller so that estimations can remain accurate. The scheduling problem presented by devices leaving a cluster before completing a computational task, or before sending the results to the edge server was mitigated primarily by making it so that each client can only compute a single task at a time to its completion and immediately send results to the edge device for storage as soon as possible.

(4) Conclusion

Overall, their final outcome was one of progress as their simulation and prototype results gave results that did not surpass some of the current cluster architectures, but it did land in a middle zone which leads the opportunistic edge-computing concept a few steps closer to being a viable solution to latency, energy, and bandwidth consumption problems for end users on mobile devices.

2. Critique.

The tests showed that the performance was better after mitigating the scheduling problem, however, the tests did not give any data analysis in comparison to other cloud solutions already in existence. For example, they could have given the results from similar tests in a standard cloudlet environment and made comparisons. Also, it seems like a big gap in the paper in terms of energy consumption analysis of user mobile devices since it did mention that this solution should conserve energy. There are many computational tasks that clients must continually run in order to make a given FemtoCloud cluster effective.

3. Synthesis.

Therefore, I recommend that someone could duplicate this example exactly, but include data analysis compared to current edge computing infrastructures such as standard cloudlet configurations. Additionally, I would recommend that energy consumption in such environments be tested so that we can see if the average energy consumption devices would be less or at least equal to current standards. We would need to do some sort of ratio in order to make a fare analysis; for example: energy-to-latency ratio or energy-to-bandwidth ratio, or even energy-to-executions ratios for better analysis metrics in terms of comparing network setups.