

Mobile Cloud Computing – Heterogeneous Architecture and Systems

Amitabh Mishra
Department of Computer Science
Johns Hopkins University
amitabh@cs.jhu.edu

1. Topics of Interest

1. Cloud Architecture and Systems; 2. Fault Masking in the Cloud; 3. Cloud Test-beds

2. Current Research in Cloud Computing - Abstract

Proliferation of mobile devices (Smart-phones, tablet-PCs, Laptops, and others) is taking place at an unprecedented rate and the trend is likely to continue thus fostering the vibrant research in mobile computing and networking. Our focus is to extend these vibrations to mobile clouds. In the first phase of mobile cloud computing research, we have exclusively focused on mobile clouds based on GPRS/UMTS cellular networks. We have considered two cloud architectures that are formed out of (1) a base station as well as (2) mobile phones served by the base station.

We have computed the performance of a mobile cellular cloud under following scenarios.

Workloads: Have been chosen mainly for compute bound applications, such as: (1) Common matrix computations such as inversion, eigenvalues and eigenvectors, determinant, fast Fourier transform, and Cholesky decomposition. (2) Sorting of large arrays and linear regression. (3) Fibonacci number calculations etc.

Configurations: Same computations are performed under three configurations: (i) a single smart phone (no redundancy), (b) Double modular redundancy, (c) Triple modular redundancy.

Probability of blocking: Computations have been repeated for different probabilities.

Mobility: We have also computed the results with different handoff rates, the probability of handoffs, and probability of handoff droppings under different mobility models.

Energy: For all these scenarios, we have computed the energy consumption also.

3. Future Research Plans

When Internet was design its main goal was communication among the interconnected, static hosts. Similarly cloud computing assumes a massive scale of compute, storage and communication resources that are also static. But, at present mobile hosts connecting to the Internet or forming other networks are about to exceed or have already exceeded the static hosts. This may become true for clouds too.

Mobile clouds based on IEEE 802.11 (Ad hoc Networks), IEEE 802.16 (Mesh Networks), IEEE 802.22 Cognitive Radios, and 3G-4G Cellular networks (with base station or mobile phones, or both) acting as cloud are all in the realm of possibilities. To make these cloud architectures more resilient and efficient with higher capacities, hybrid mobile cloud architectures are needed that will improve the management and security aspects of the cloud computing. Our future research plans, therefore include:

1. Research cloud architectures of mobile devices operating on heterogeneous wireless networks. Study interworking, efficiency, performance and energy issues.
2. Examine **hybrid** cloud architectures consisting of wired clouds (core) and interconnected mobile wireless clouds working in tandem and study performance tradeoffs for scientific as well as emerging social networking applications.
3. Develop concepts of coverage, connectivity and capacity for the hybrid clouds.
4. Prototype mobile cloud using Droid phones and GNU radios forming an ad hoc network and measure cloud performance and energy consumption in static as well as low mobility environment
5. Examine the reliability of computations and evaluate role the redundancy can play in fault masking in mobile cloud environments