

Multi-lingual Dictionary Application

Prof. Marjan Gusev M.Sc. Aleksandar Bahtovski

Ss. Cyril and Methodius University, FCSE Skopje, Macedonia



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Cloudlet is

- A small cloud located close to the mobile users
- A set of trusted, resource rich computers well connected to the Internet
- Performs computational off-load
- Saves mobile phone resources (battery, processor, memory)



Motivation

- Need of additional resources for execution of resource-rich applications in mobile device.
- Recent cases show increased delays of mobile applications execution due to WAN latencies and interconnections with mobile devices.
- **Our goal**: A new solution for mobile applications using external resources for execution



Research challenge

- A cloudlet solution,
- positioning a small cloud located near the mobile user,
- which can perform the same processing tasks as a remote cloud by using Virtual Machines (VMs),
- its position close to the mobile phones enables them faster response, avoiding huge WAN latencies.



Background

- M. Satyanarayanan, P. Bahl, R. Caceres, and N. Davies, "The case for VM-based cloudlets in mobile computing," Pervasive Computing, IEEE, vol. 8, no. 4, pp. 14–23, 2009.
- A. Bahtovski and M. Gusev, "Cloudlet challenges," Procedia Engineering, vol. 69, pp. 704–711, 2014.



Augmented execution



Design

- Solution based on a cloudlet, which is a server that
 - receives entered words/phrases from the mobile device,
 - performs translation of the words/phrases and
 - returns the results back to the mobile device.



Multilingual dictionary





Dynamic VM synthesis



Virtual Machine overlay





Architecture

- All system components are designed inside the operation systems, both on the mobile device and on the cloudlet.
- The advantage of using such an implementation is the speed of execution, in our case translation of the words/phrases.



High-level architecture

A cloudlet solution





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Similar ideas

V. S. Achanta, N. T. Sureshbabu, V. Thomas, M. L. Sahitya, and S. Rao, "Cloudlet-based multi-lingual dictionaries," in Services in Emerging Markets (ICSEM), 2012 Third International Conference on. IEEE, 2012, pp. 30–36.



Implementation

- We have introduced a table-based approach with predefined words and their corresponding translation on English.
- Android based mobile application which communicates with a virtual server on EC2 cloud from Amazon
- The difference from cloud solution is that the execution on the cloud will be done via the cloudlet.



Implementation details

 A. Bahtovski, M. Gusev, Multilingual Cloudlet based Dictionary, in CICSyn 2014, Proceedings of 6th Int. Conference on Computational Intelligence, Communication Systems and Networks, Tetovo, Macedonia, IEEE Conference proceedings, in press



Implementation details





Workflow concept



The solution

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Initial tests

Number of devices	Translation time
Nexus 5	0.92 seconds
Nexus 5/Samsung S4	1.71 seconds
Nexus 5/Samsung S4/HTC One X	2.42 seconds



- Our solution shows decreased performance when accesses increase the server load with processing requests.
- When only one of the virtual devices is used for the execution of the application, translation of the words/phrases is relatively fast. When additional devices were connected, the application showed decreasing performance.



Future Work

- To develop a proof of the cloudlet concept including a benchmark application that offloads complex computations on the cloudlet and indirectly onto clouds compared to offloading directly to the cloud, without using a cloudlet.
- To realize a complete application that translates text on picture.

