

# Chapter 47

## Cost Effective for Erlang Traffic of Mobile Learning over the Clouds

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### ABSTRACT

*The progression of technology in this up-to-the-minute era keeps on booming rapidly from time to time (Aljabre, 2012). Cloud computing is the today's latest trend which offers unlimited and flexible shared storage server in a computer system. It can be used by any organizations and institutions. It provides services anytime anywhere. It gives user satisfaction because it enhances efficiency, preserves resource utilization, and improves information sharing. This technology is very beneficial to mobile learners as it helps eliminate problems of distance barrier and the access to education in different geographical locations. Software licensing and manpower training are no longer needed with this latest technology. However real-time applications have constraint with their response time. This paper investigates the cost effective for Erlang traffic of Mobile Learning over the clouds. Throughputs over cost are analyzed. The analysis results that although Google Cloud offers a poor performance but it is the most cost effective compared to the other four clouds.*

### 1. INTRODUCTION

Cloud computing is an evolving computing technology which centralizes data storage with remote servers hosted on internet. It offers unlimited data storage through network based on pay per use meaning cloud users only pay for what they use on the particular type of service availed. Cloud services the users to use software with no installation needed which cut expenses to buy software products, in-

stallations, operation, maintenance and upgrading of computers software. Moreover it is the easiest way to get data records or to browse information from anywhere all over the world with network connection (Alshwaier, Youssef & Emam, 2012). Another research referring to different network such as CSMA Networks with Correlated Traffic can be found in Shi, Beard, and Mitchell (2009), and Shi, Beard, and Mitchell (2012). The user only needs the network connections, or cellular signals.

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There are five vital features in the cloud model namely Broad Network Access, Measured Services, On-demand Self-service, Rapid Elasticity, and Resource Pooling. Four organization structure models of cloud computing are Public cloud, Private cloud, Community cloud, and Hybrid cloud. The three service cloud models which are Infrastructure as a Service (IaaS), Software as a Service (SaaS) and Platform as a Service (PaaS).

Mobile learning is the system where everyone can learn through different gadgets over wireless technology (Shuai, & Ming-Quan, 2011; Masud, Y., & Huang, 2011). It employed for learning over cloud computing. Through mobile learning, learners can access information and learning resources from the centralized shared data storage at anytime and anywhere (Rao, V., & Kumar, 2012; Zhao, Wang, & Yang, 2011). Mobile learning is the most convenient way of learning as well as the best solution for distance barrier to access the education in different geographical location.

An Erlang is a unit of telecommunications traffic measurement. Wireless Communication network traffic can be predictable as Erlang traffic model described in Fang (2001). The Erlang distribution can be used to model inter-arrival and service time with a coefficient of value ranging from 0 to 1. The standardized queuing statistics have been developed to facilitate the inter-arrival and services time. In order to yield more precise system measures for any statistic distributions which differ from traditional exponential queuing model, the publication (Plumchitchom & Thomapoulos, 2006) is introduced.

Throughput is the work done within a given time and measures the results based on the work carried out or processed. Performance is another way to gauge the computer productivity. It means the speed with which one or more set of batch programs operate with a particular workload or the number of times the user requests for responsiveness of the computer that is called as *response time*.

In evaluating the performance of computer, utilization is advantageous. In communication,

bottleneck exists when data flow is completely stopped especially when data are overloaded or heavy and excessive in user network or internal server resources, hence the flow slows down that affect the application performance. In other words, if the utilization is close to 100%, the system will cause bottleneck. This also results for a computer to crash. Some causes of bottleneck include mismatched hardware selection, poor network, and weak storage fabric design.

## 2. CLOUD ARCHITERCTURE

Figure 1 shows the design of different gadgets operating mobile learning accessing data or information from cloud. As different gadgets have their own data rate or speed, the promptness of accessing data or information from cloud could vary. However they all must have equal probability upon accessing into the cloud by computing, every device have the probability to access at 0.20. The probability of accessing data is equal to the number of ways it will occur over the total of outcome.

Technical specifications of five different gadgets, namely iPhone5, iPad mini, Samsung S3, Samsung Galaxy Note2, and Samsung Note 8.0 are shown in Table 1 and the speed of five different clouds are provided in Table 2. There are

*Table 1. Technical specifications of each five gadgets*

	Data Rate	Internal Memory / Storage
iPhone 5	42 Mbps	16/32/64GB storage; 1GB RAM
iPad mini	42 Mbps	16/32/64GB storage; 512MB RAM
Samsung S III	21 Mbps	16/32/64GB storage; 1GB RAM
Samsung Galaxy Note II	42 Mbps	16/32/64GB storage; 2GB RAM
Samsung Note 8.0	21 Mbps	16/32GB storage; 2GB RAM

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