DATA MANAGEMENT AND SYNCHRONIZATION IN MOBILE CLOUD COMPUTING

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ABSTRACT

The rapid development of Mobile Cloud Computing (MCC) in this era is significant, as the number of users accessing data continues to grow over time. Large data storage must serve high volume data transactions every day when users request the data; therefore, intelligent methods are required to solve the problem of insufficient data storage that some providers are experiencing. As a result, a pre-fetching technique and Machine Learning (ML) technique are used to provide cloud data storage management for users to easily access their data anywhere at high speed to avoid latency; the total response time while the user accesses the data. This paper discusses the use of MCC technology in conjunction with the pre-fetching technique to address the problem of latency in data management when large amounts of data are stored in the cloud. The pre-fetching technique is used to improve the performance of Cloud Computing (CC) when dealing with user data access. To support data management for the efficient and effective performance of MCC services, an enhancement to the MCC architecture is proposed.

Keywords: *Mobile Cloud Computing (MCC); data management; Synchronization; data management in MCC; Synchronization in MCC*

INTRODUCTION

Cloud computing is a new computing paradigm in which computing resources are delivered as utilities such as water, gas, and electricity in order to reduce infrastructure and administrative costs in most businesses. The mobile cloud is a collection of mobile devices such as smart phones, laptops, and PDAs that connect to the cloud via mobility and new ad-hoc infrastructure. It offers data storage and transaction processing services to mobile users via a cloud computing platform. Cellular connections are used by mobile cloud computing devices to perform data storage and transaction processing services on a cloud computing platform. According to IDC (International Data Corporation) and Gartner estimates, the average number of consumer mobile devices used by enterprise employees is increasing day by day, enterprise data growth is expected to be 60% over the next five years, and 44% of businesses will use cloud-based services. It is critical to manage and deliver an improved level of data management in this promising mobile cloud environment. Although wireless cellular connectivity may be lost or limited due to energy, storage, power, or a lack of cellular coverage, the situation will be improved by building a dependable mobile cloud for efficient data and transaction management.

Big Data in Mobile Cloud Computing (MCC) refers to a collection of data from users that is stored in the cloud; users can request these data at any time and from any location, necessitating the use of a good data management system due to the high data transfer. Billions of data transactions and streams are generated by devices around the world; one of the current data management challenges is to provide a service with no loss and low throughput latency. However, even after enabling and integrating a cloud management system, serving all data streams and transactions remains difficult. When there is big data storage in the cloud, the latency problem occurs if data management is not handled wisely, so pre-fetching and Machine Learning (ML) techniques are used to optimise performance, especially for big data. This paper evaluates CC performance by measuring latency, which is the total response time [1].

MCC provides better services to users by lowering costs, increasing reliability, and allowing users to access data from anywhere, with greater scalability and efficiency. As a result, it increases user demand for access to large amounts of data on clouds, which can slow down performance. As a result, the proposed architecture is critical for managing big data storage while avoiding latency issues. Several papers have been written about the current MCC architecture [2-3].

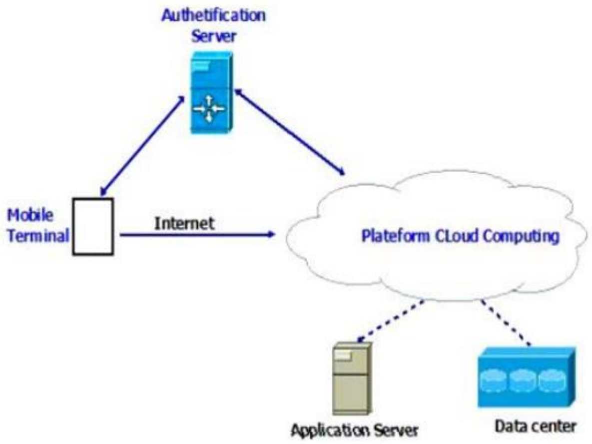

Figure 1: MCC architecture

The basic MCC architecture includes components such as a Mobile Terminal, which can be a laptop, PDA, or Smartphone. These terminals communicate with a hotspot or base station through 3G, Wi-Fi, an authentication server, or a CC platform, such as the application server and data centre. Figure 1 depicts the overall MCC architecture and its components [4].

The main contribution is to facilitate data sharing and processing across different transactions on different mobile devices in a cloud environment. This is accomplished by introducing a surrogate object over the cloud that can automatically perform local caching for faster data access on behalf of each mobile device. The paper makes two significant contributions to data management in the mobile cloud: A: provide proper support to execute the transaction without the assistance of a database server; B: provide support to access data across nearby surrogate objects in response to limited cellular connectivity, allowing mobile devices in a cloud environment to access data automatically in order to maximise wireless bandwidth utilisation.

Autonomic Distributed Surrogate Object based Cloud Caching (SOCC), proposed as a new transaction model. The surrogate object model for distributed mobile cloud systems defines the architecture that allows mobile devices to seamlessly participate in cloud transaction processing.

The basic idea behind this model is to use a surrogate object to bridge the gap between mobile devices and their supporting environments. This is accomplished by creating a surrogate object in the cloud platform to act on each mobile device's behalf. As a result, mobile users can continue to process transactions without requiring assistance from the database server. Autonomic transaction management is considered as a main factor, when databases are used and deployed as a service (DaaS) over the mobile cloud.

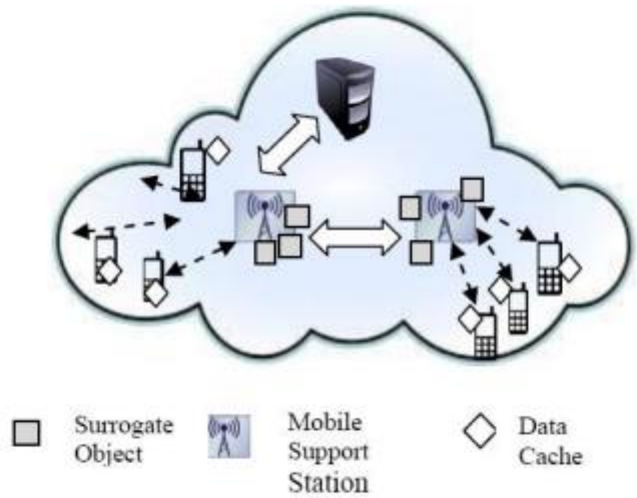

Figure 2: Surrogate object based cloud caching

Figure 2 depicts the process of transaction execution among mobile devices in the mobile cloud. In this model, whenever a mobile device joins the mobile cloud system for the first time, it registers with a mobile support station.

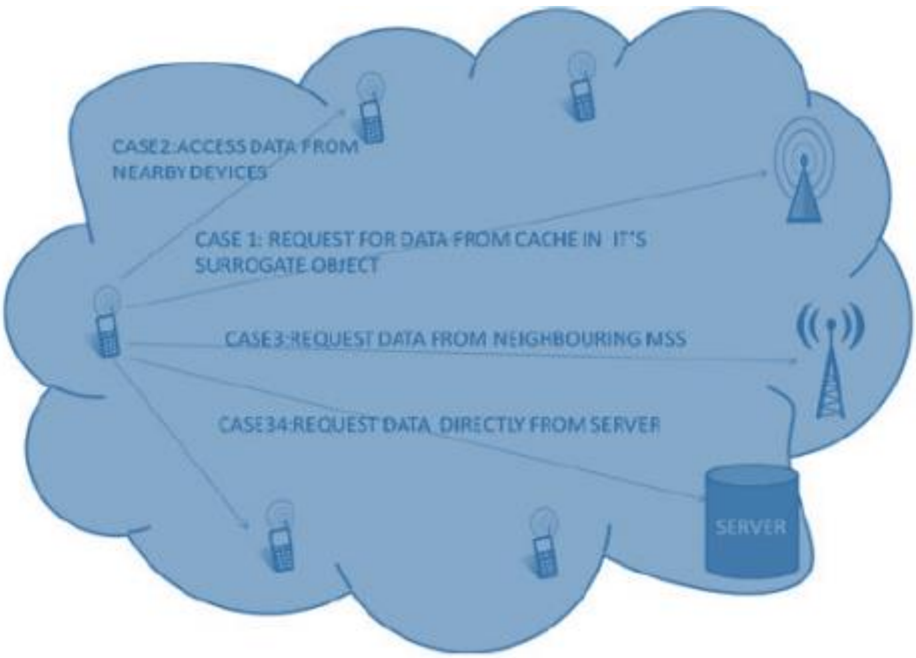

Figure 3: SOCC abstract flow of operations

Figure 3 depicts the SOCC algorithm, which uses a surrogate object-based caching mechanism to grant required data for transaction processing during normal and disconnected periods.

Synchronization:

The process of establishing consistency among data from a source to a target data storage and vice versa, as well as the continuous harmonisation of the data over time, is known as data synchronisation. It is essential in many applications, including file synchronisation and mobile device synchronisation. File synchronisation is the process of ensuring that certain rules update files in two or more locations.

1. One-way file synchronization, also called mirroring

2. Two-way file synchronization

Synchronization techniques in mobile cloud computing:

Technique 1: It is used to synchronise files and directories between two different systems and requires the specification of a source and a destination, both of which can be remote, but not both. It is not automated as a utility and only performs the synchronisation when called upon. By default, update detection checks the modification time and size of a file name. To determine which parts of a file have changed, the md5 algorithm is used.

Technique 2: Regardless of the number of files, it completes the mirroring in a single round-trip, minimising the effect of high network latency. It cannot detect renames or moves, and the default detection method may miss some special cases in which a file is modified without changing its size.

Technique 3: UFS: When a data update occurs, the full content of the updated file f is delivered to the cloud. UFS is best suited for instant file addition rather than file modification or incremental file addition.

TFS: When a data update occurs, a timer is set to monitor whether there will be subsequent data updates in the next T seconds.

UDS: When a data update occurs, only the most recent data update are delivered to the cloud. It is faster, safer, and more dependable. Because it employs the delta sync mechanism, it is a complex mechanism. It is appropriate for infrequent incremental file changes [5].

Objectives:

1. It is necessary and important to explain mobile cloud computing.

2. Investigation and evaluation of existing technical synchronisation.

3. A suggestion for a more efficient synchronisation method.

4. Research into data management and synchronisation in mobile cloud computing.

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RESEARCH METHODOLOGY

Books, educational and development journals, government papers, print and online reference resources were just a few of the secondary sources used to learn about comparative public policy studies.

The internal and external validity of comparative studies determines their quality. The extent to which conclusions can be drawn correctly from the study setting, participants, intervention, measures, analysis, and interpretations is referred to as internal validity. The extent to which the conclusions can be generalised to other settings is referred to as external validity.

REVIEW OF LITERATURE

Ooi Beng Chin discussed the advantages and disadvantages of developing a scalable Cloud data management system. The goal of this scalable data management system is to investigate the anatomy of a Cloud data intensive system that offers multi-tenancy architecture, high throughput low latency transactions, and high performance reliable query processing on a cloud platform. Raghu Ramakrishna discusses the technical challenges of designing hosted, multi-tenanted data management systems that prioritise efficient cost management, averaging usage peaks, and enabling higher-level services [6-7].

Mishra et al. proposed a three-tier architecture of mobile-based cloud computing to connect mobile applications with a variety of cloud services. They presented the various components of the architecture as well as their services. Their goals with CC are to store and process data on mobile devices, thereby reducing their limitations. However, their works include a variety of cloud services, of which big data is a subset. As a result, latency can occur during the transmission of big data on mobile devices, affecting MCC performance [8].

C. Gang, A. Beloglazov, and R. Buyya describe various cloud platform works for distributed database processing and transaction management. As the volume of data processed by cloud applications grows, the need for an efficient data management system becomes increasingly important. Because of the rapid growth and widespread use of smart phones, deploying mobile devices such as smart phones into cloud platforms such as mobile clouds for large scale distributed transaction data management processing is also an important factor. Due to various limitations with mobile devices and wireless connections, data and transaction management on the mobile cloud causes a variety of issues such as transaction execution delay, transaction failure, low reliability, and no guarantee of transaction completion [9-10].

RESULT AND DISCUSSION

The proposed IMCC architecture results in faster access to information when using mobile-based technology for the MCC. In addition, to explain the performance time difference in Figure 4, an access time comparison of the four situations is presented.

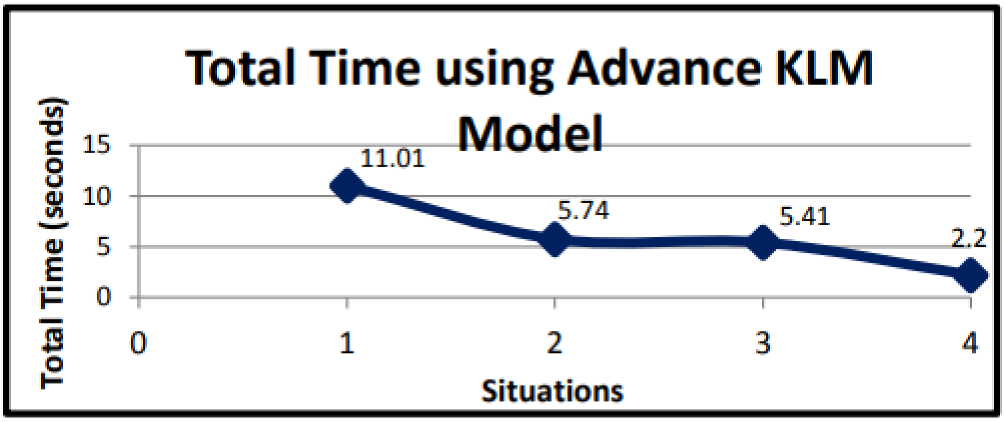

Figure 4: Data accessing using mobile based MCC

Synchronisation in mobile cloud computing employs a variety of techniques to keep data synchronised. To compare, various techniques are employed [11].

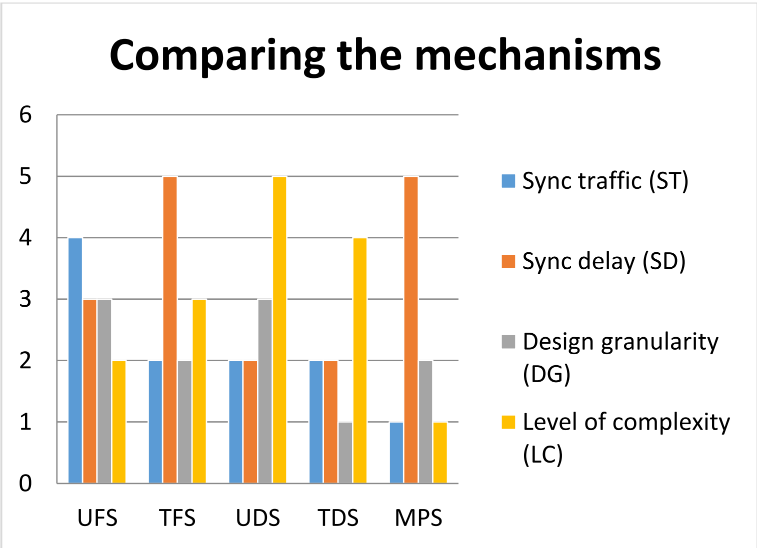

Figure 5: Comparison mechanism using various synchronization technique

Figure 4 compares the results of data synchronisation in mobile cloud computing using various synchronisation techniques [12].

CONCLUSION

Data management in cloud computing functions as a database for data stored in the cloud, allowing users to access their data from anywhere at any time. Increasing the volume of data stored must be handled carefully to avoid latency; thus, infrastructure support is required to provide high quality services; otherwise, the system will provide poor services. The architecture's structure is critical for providing good data management for big data. It requires the proper IMCC architecture for proper implementation to ensure better CC service performance. As a simulation prototype, this concept is implementing on a mobile cloud. This SOCC technique aims to measure the average waiting time for transaction execution, as well as the average success rate of transactions during

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dynamic changes in environmental conditions, in order to calculate the throughput of the proposed algorithm for concurrent transaction execution and estimate the costs incurred.

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