IMPORTANCE OF COOPERATIVE CACHING IN MOBILE DATA MANAGEMENT

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ABSTRACT: *Mobile computing is a revolutionary technology. It is a result of advance development of computer, computer hardware and wireless environment. It enables to access the information anytime anywhere from server. It also enables to access information in the absence of physical network connection (in the offline mode). As it works with data, some strategies should be there to manage that data. But as it is mobile device, it has so many limitations and open key research issues. This paper introduces mobile database system, its real time challenges, and its open key research issues and data management technique. This paper also introduces how cooperative caching is useful in mobile database system to overcome its limitations and real time applications of it.*

KEYWORDS: Mobile Computing, Data management, Cooperative Caching, data availability.

1. INTRODUCTION

Mobile database is a database that resides on mobile devices such as a PDA, a smart phone or a laptop. Such devices are often limited in resources such as memory, computing power, and battery power. It is managed by a DBMS. It has limited functionality compared to a full blown database management system. This system is single user system and there for concurrency control mechanism is not required. Query processing and recovery may be limited. Communication takes place either via point-to-point connection between the mobile device and the server or via broadcasting the server. Direct updates from other mobile devices may use short range wireless communication protocols such as blue tooth or Wi-Fi.

Figure 1 shows mobile database system architecture in which things to be considered are: it is having Wireless network. Mobile computing devices: having low-power, low-cost, portable. Mobile users are not attached to a fixed geographical location. Constraints of mobile computing. Mobile databases typically involve three parties: (1) Fixed hosts: which performs the transaction and data management functions with the help of database servers. (2) Mobile units are portable computers that move around a geographical region that includes the cellular network (or "cells") that these units use to communicate to base stations. (These networks should not be cellular telephone networks.) (3) Base stations are installed in fixed locations which are used to pass communications between mobile units and fixed hosts. They are two-way radios [7].

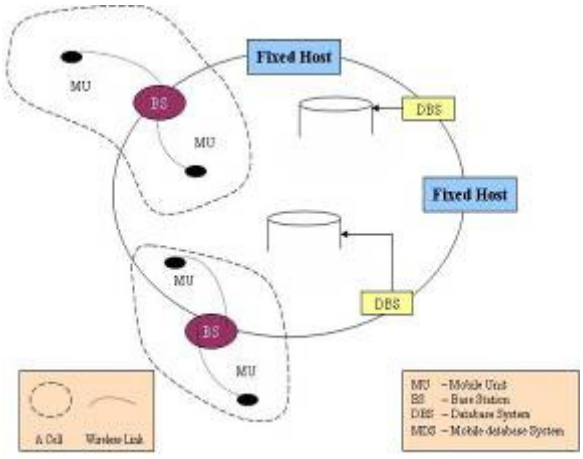

Fig 1 .Mobile Database System Architecture

2 REAL TIME CHALLENGES OF MOBILE DATABASE SYSTEM

Mobility:

A mobile node's physical location changes dynamically as well as its network changes and due to that accessed data items and states of transaction have to move along with the node. These changes affect the parameters of system configuration of the node and those of other nodes such as routing information in routing tables and also affect those transactions executed on the node. Mobility can also lead to high communication latency, long-lived transactions, multi-hop communication and frequent disconnections [1].

Low Bandwidth:

Wireless network bandwidth is much lower as compared to its wired counterpart. Within the system for the data requested by the node, server has to share and compete. It may keep sending requests until timeout if server fails. This low bandwidth may results in long lived transactions, a high risk of disconnections and communication delays as well [1].

Limited Battery power:

The battery technology is not developed rapidly as compare with mobile devices and wireless technologies. It compromises the ability of each mobile node to support services and applications when processing power is limited. If node runs out of power or it has insufficient power to function, disconnections happen, communication fails, execution of transaction is prolonged and some of the transactions may have to be aborted [1].

Limited Storage:

The sizes of memory and hard drive are smaller as compare with ones in wired network because of mobility and portability. The consequences of this are less cached or stored or replicated data, fewer installed applications and more communication [1].

Frequent Disconnection:

A node is disconnected when its battery runs out or when it roams freely and is out of the transmission range or it runs into some failures, or it fails to compete for the application.

It is normal for a node to become disconnected and this type of disconnections do not imply the failure of transactions initiated or executed by the disconnected node because disconnected node may reconnect after some time. The disconnected node can still be able to process the part of already started transactions while disconnection. But when disconnections happen frequently, more transactions may delay or block and even abort if they are real-time and miss their deadlines [1].

Long Lived Transaction:

Because of mobility, frequent disconnections, unbounded disconnection time, wireless communication delay, less processing power and transactions in mobile databases tend to be long-lived. The probability of conflicts with other transactions becomes higher when execution is prolonged and due to that transactions are blocked if pessimistic method applies or restarted if optimistic method is in use [1].

Small user interface:

Size constraints on a portable computer need a small user interface. It is impractical to have several windows open at a time regardless of screen resolution on small displays. Moreover, it can be difficult to locate icons or windows deeply stacked one after another. Also windows title bars and borders either become difficult to operate with pointing devices or consume significant portions of screen space [1].

3. OPEN KEY RESEARCH ISSUE

Apart from these, the key research issues that the research community has tried to tackle are how to cope with frequent disconnection, energy limitation and mobility of the client. Also in number of database management issues like transaction management, data availability, data replication, data caching and location-aware query processing. Additional work is also found in the areas of privacy and security, especially for detecting transactions and preserving privacy in location-aware queries [2].

4. DATA MANAGEMENT TECHNIQUES

Here, Data availability is a vital issue since the ultimate goal of using this type of system is to provide information access to mobile hosts. To improve data availability there are two types of method used in mobile database system: (1) Semantic data caching- The cache contents are decided by results of earlier transactions or by semantic data set. Client maintains semantic description of the data on the database and results are cached at the client [6]. (2) Data broadcast on wireless channels- A set of most frequently accessed data is made available by continuously broadcasting it based on some fixed radio frequency. Mobile Units may tune to this frequency and download the desired data from the broadcast to their local cache. The contents of the broadcast reflect the data demands of mobile units. This can be achieved with the help of data access history, which may be fed to the data broadcasting system [6]. Apart from these two methods, for data broadcasting there is again issue as server has to broadcast though limited bandwidth and it may possible of disconnection. Based on this we can say, an attractive technique that improves data availability is caching.

5. IMPORTANCE OF COOPERATIVE CACHING

The important goal of this type of system is to provide mobile nodes with easy access to information. Although, this system is limited by restricted power supplies, limited computing resources and intermittent network connections. These restrictions raise several new challenges for data access applications with respect to data availability and access efficiency. Cooperative caching provides an attractive solution for these types of problems. Cooperative caching is a technique that allows the sharing and coordination among the mobile nodes. We can improve data accessibility, performance and availability, by the caching of frequently accessed data in the networks.

There are several benefits of cooperative caching. First, it can reduce the redundancy of cached data object because while receiving a data object, MHs can check the caching status of other group members. Second, it can store more different data objects and it increases the data accessibility. Third, the group has facility to store more data objects from the destinations compare to an MH because the group members are cooperative to cache the data objects.

By applying cooperative caching scheme rate of data transferred between client and server becomes less as compared to non-cooperative caching scheme [8]. Further server request ratio also decreases [9]. Number of messages passes between client and server becomes lesser [9]. At last response time of query processing at client side also decreases [8].

6. REAL TIME APPLICATIONS OF COOPERATIVE CACHING

Real time applications of cooperative caching or group based approach of mobile database systems are (1) People in same residential area generally used to access internet with the help of wireless P2P network. After downloading video file or MP3 audio by one node, other may get this file from this downloaded node instead of requesting again for the same to server located far away [3]. (2) Another example is during international sports events like Olympic Games or Cricket World Cup, demands from users to access internet to get related information increases. If users are in the same vicinity of domain, this accessed information can then be shared with other users of same area of interest. But this type of information is timely valid means they are not valid after certain period of time. So here any information accessed can be made to be relayed along with time related information [4]. (3) For the students in university campus, group may be formatted by considering the fact that many courses in university campus require students to work in group to collaborate on class projects during the semester. In this case group based scheme is used to access data regarding same project from one student to other [5].

7. CONCLUSION

This paper introduced mobile database system and its limitations and open research issues, data management technique. Apart from different limitations of mobile database system, data availability is main requirement. To fulfil this requirement group based cooperative caching is used, which is able to share data among mobile nodes within same network. With the help of this approach more data objects can be stored in different nodes of group which overcome data availability issue as well as data redundancy issue. This approach is good in low bandwidth environment in which there are more chances of network disconnection, low processing power and low storage capacity.

8 REFERENCES

[1] VISHNU SWAROOP, Gyanendra Kumar Gupta, UDAI SHANKER "Issue in Mobile Distributed Real time Databases: Performance and Review" *International Journal of Engineering Science and Technology (IJEST),* Vol 3 April,[2011].

[2] Le Gruenwald, Frank Olken "Mobile Database Research: What Is To Be Done? ".

[3] Arathi.R.R., Lilly Sheeba.S, Yogesh.P. "Efficient Cache Sharing Protocol for Mobile Nodes", *International Conference on Recent Trends in Computational Methods, Communication and Controls (ICON3C),* [2012]

[4] Jing Zhao, Ping Zhang, Guohong Cao "On Cooperative Caching in Wireless P2P Networks", *IEEE Proceedings of the 2008 The 28th International Conference on Distributed Computing Systems*, June, [2008].

[5] Hazra, Kurchi Subhra; Nahrstedt, Klara, "Group formation and communication in mobile wireless environments*", IEEE Military Communications Conference*, Nov [2011].

[6] Vijay Kumar, "Mobile Database System", *A John Willey & Sons, Inc., Publication.*

[7] Margaret H. Dunham; Abdelsalam Helal, "Mobile Computing and databases: anything new?", *ACM SIGMOD Record,* Vol 24 Issue 4, Dec [1995].

[8] Vancea, Andrei;Stiller, Burkhard, "CoopSC: A Cooperative Database Caching Architecture", 19th IEEE International Workshop on Enabling Technologies: Infrastructures for Collaborative Enterprises (WETICE), [2010].

[9] Chow Chi Yin; Hong Va Leong; Alvin Chan, "Peer –to –peer cooperative caching in mobile environments", *IEEE 24th International Conference on Distributed Computing Systems Workshops,* [2004].