HANDLE MANAGEMENT ISSUES OF MOBILE WITH THE HELP OF CACHING TECHNIQUES

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ABSTRACT

In today's computing world, different technologies have come up. These have grown to support existing computer networks all over the world. Mobile computing is a revolutionary technology which active us to access information, anytime and anywhere. Recently, there has been many research area is into mobile computing. With the help of caching techniques reduce bandwidth consumption and data access delay. This paper describes about different impact that mobile computing has had in the area of data management. In wireless communication the data availability is the most important problem, so we have focused on the issues of data availability and discussed about replicating mobile databases.

KEYWORDS: Cache Management, Cache Consistency, Cache Invalidation, Cache Replacement, Data Management.

INTRODUCTION

Mobile infrastructure has enabled to introduce of new mobile applications which are ranging from simple ones to many commercial transaction. From business and technology perspectives, data management technology that can support easy data access from and to mobile devices is among the main concerns in mobile information systems. Due to mobile behaviour, it is difficult to employ the currently available database solutions because most of them had developed for the use on the fixed network environment. Mobile database is popular terminology which is having the attributed to the data management Technology that help to help to the use of databases on the mobile computing environment. This database is more advanced and challenging. Budiarto, Shojiro Nishio et. al [1] explain major challenges of the data management which are given below[1] .

Data are available anywhere independent of the availability of the fixed network connection.

With a help of mobile- devices, users can store a part of database and use it while being mobile. When a mobile user needs data which is not available locally, he can raise the request of for activating of the wireless communication of his device and initiate connection to the network via the closest mobile support station (MSS). Once it is connected, he can access the data from the data base which can be a part of distributed database .mobile users can virtually access any data, anywhere and anytime, even in the absence of fixed network connection.

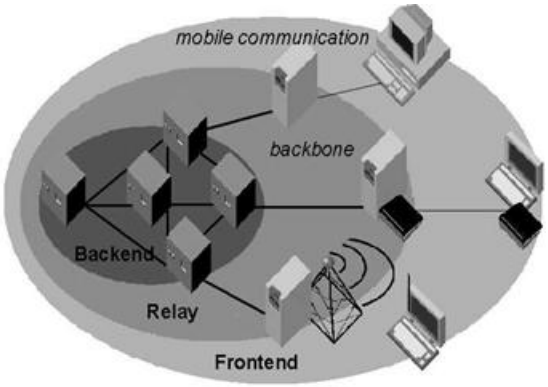


Figure 1(a): Mobile Inf.

Databases on both mobile and fixed hosts are shareable in seamless way

In mobile information systems, databases expended on both mobile and fixed hosts which is forming a distributed database system. There are many techniques are existing which use for data sharing in distributed databases .They are more complex than those algorithm which existing for centralized databases. In a mobile environment, use of wireless network which is known to be prone of frequent disconnections and the period of disconnection is also unpredictable.

MOBILE ARCHITECTURE

The architecture of the mobile environment is given in **Fig 1(b).** Mobile Environment consists of two distinct sets of entities: mobile units and fixed hosts. These fixed hosts are called Mobile Support System (MSS).This Mobile Support System are enhanced the wireless interface to Communicate with mobile units known as cell. This cell can be a part of cellular communication network or a wireless local area network within the area of building [3].In the Cellular Communication Network the bandwidth will be limited. It Supports data rates from 10 to 20 Kbits/sec. In the Wireless network the bandwidth is much wider up to 10 Mb/sec. Fixed hosts will communicate with the fixed network, while mobile units will communicate with other hosts via wireless channel .This host can be mobile or fixed [2].

In this architecture, all units will be tied with the wireless interface .This unit are provide the services for which mobile users are client. Due to mobile property client can change the location as well as the network connection. While changing the location it is necessary for /mobile Host to maintain the connection. For this it will take a support of fixed host /stationary host with the wireless communication abilities which will be provided by Mobility support System (MSS). In a cell, each MSS will communicate with all its mobile Hosts. At any point Mobile host can communicate with only those MSS which is responsible for that area. Movement of a MH (Mobile Host) from one cell to another is known as Handoff[2].

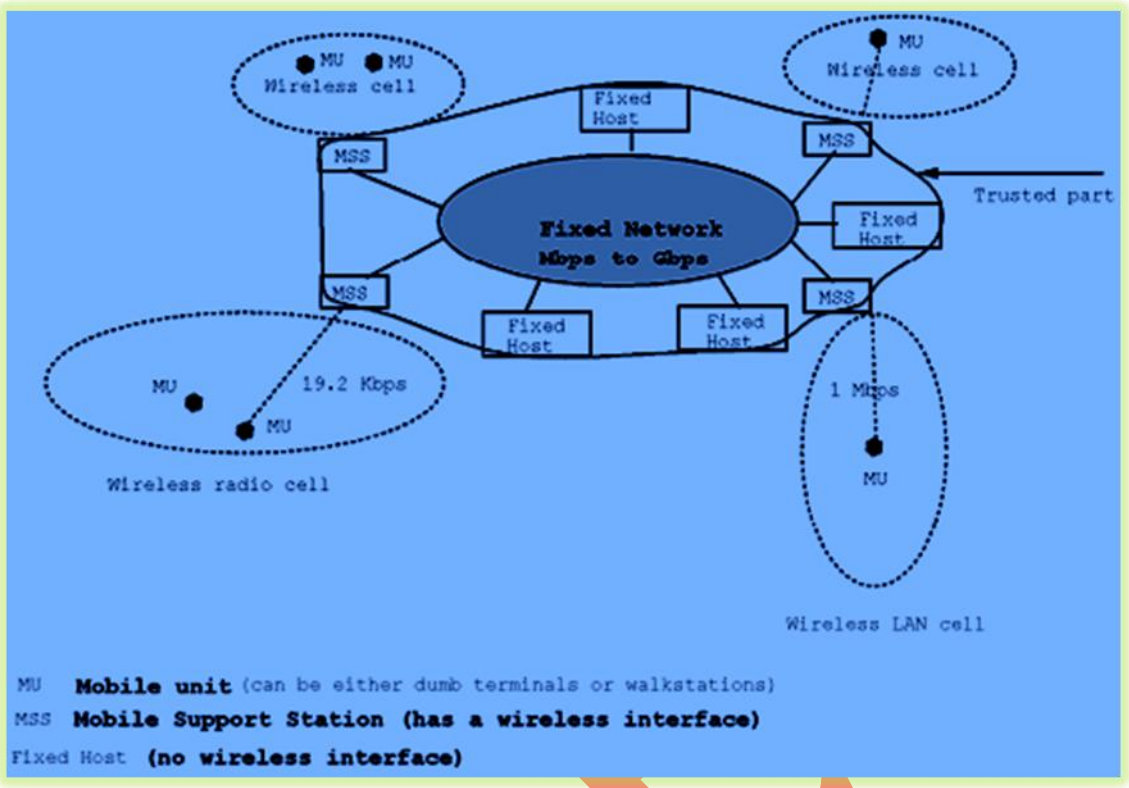
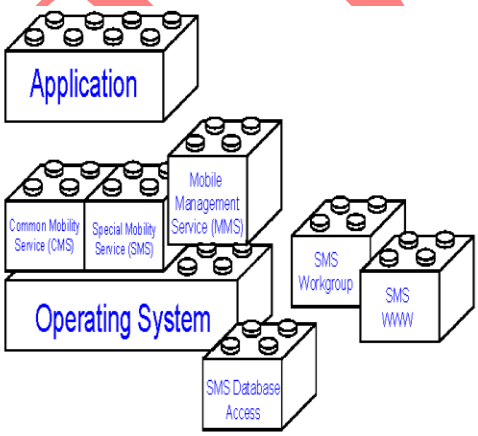


Figure 1(b): A Mobile Computing Environment [2]

The mobile database will exchange the information with host database. It helps mobile database to keep update its information. While communication, it is not necessary that mobile host and database host should be connected with the same network. Communication can be done at irregular intervals and for very short span of time. While using the mobile devices for storing the database it is very difficult to decide which part of the data can be stored in to the device and which part is required to be replaced. Maintaining the connectivity is also a big problem in mobile computing which can be intentional or unintentional [13]. The wireless medium will provide a powerful new method of disseminating information to a large number of users. New access method, algorithms and data paradigm have to be developed for broadcasting the data for the recipients[14]. Daniel Barbará[2] has suggested some characteristic features that make the mobile computing system unique and explore the fertile area of research. These are:



1. *Skewness in the communications:* The bandwidth for the downstream direction i.e. servers-to-clients is much greater than that in the upstream direction i.e. clients-to-servers. Even some times clients will be not having capacity to send messages to the servers.

2 ***Ubiquitous disconnections*****:** Due to mobile property mobile unit do not stay connected with the network continuously. They regularly switch their unite on and off.

3. ***Power limitations*****:** Some time portable units will be limited battery backup. They frequently need to be recharged.

4. ***Screen size*****:** Portable units like the Personal Digital Assistants, Mobiles are having very small screens. All the above features has an equally impression for data management in mobile computing. These helps to effectively manage the data into the system.

DATA DISSEMINATION

Mobile Computing environments are normally known as slow wireless links and relatively underprivileged hosts with limited battery powers, are prone to frequent disconnections. Caching data at the hosts in a mobile computing environment can solve the problems which are associated with slow, limited bandwidth wireless links, by reducing latency and conserving bandwidth [10]. Cache replacement, Cache Consistency, Cache Invalidation are the most frequent technique used for data management in wireless network. **3.1 Cache Invalidation frequently** needed data items in the database server are cached to improve transaction throughput [4]. It is necessary to maintain the data in the cache. It must be properly invalidated, for ensuring the consistency of data. Cache Invalidation strategies permit the mobile user to re-establish the cache state from invalid stage to valid stage. Even Cache validation algorithm should consider the scarce bandwidth and limited the resources. For this technique most of the time the data base server involved is cache invalidation, by sending Invalidation report (IR) to all the mobile clients. It is necessary to develop the effective cache invalidation strategies that ensure the consistency between the cached data in the mobile clients and the original data stored in the database server. There are three basic ways to design invalidation strategies [3]:

1. ***Invalidation with Stateful Server:*** The server knows which data are cached by which mobile clients. Whenever a data item is changed, the server will send an invalidation message to those clients which cached that particular item. This method necessitates the server to locate the clients. Since disconnected mobile clients cannot be contacted by the server, the disconnection of a mobile client automatically assumes that its cache is no longer valid upon reconnection. Also the mobile client needs to notify the server of its relocation. The mobility, disconnection of the clients and updating of data items will increase uplink and downlink messages.

2. Validation of cache data by mobile client: The clients that have cached the data items normally query the server to verify the validity of their caches, whenever any cached data is used or on reconnection after disconnection if any. This method generates lot of uplink traffic in the network.

3. Invalidation with stateless Server: The server is not aware of the state of the client's cache. The server simply periodically broadcasts an invalidation report containing the data

items that have been updated recently. The client assures the validity of the data item by listening to the report, going uplink only if the cache validity is no longer guaranteed.

Among all this cache invalidation technique stateless technique found more suitable. There are many algorithms has suggested for the invalidation. Barbera and Imilinski [23] have recommended another approach depends on the expected duration of the network disconnection. They are:

a) Broadcasting Time stamping (TS)

b) Amnesic Timestamp (AT)

c) Signature (SIG)

Bit Sequence algorithm suggested by the Jin Jing et al.[11] which use a static bit mapping scheme which is associated with the time stamp(TS).Tan [24] has modified the BS method for clients to select tune the portion of the reports. A new scheme has proposed by Hou et al. [25] for reducing invalidation rates relied on BS. Wu et al. [26] has modifies the IR algorithm by including cache validity checks after the reconnection. Roussouopoulos and Baker [22] has proposed an update propagation technique. An intermediate client caches the index entries for locating the clients; here contents are cached for reducing access latency and help for balancing the workload. Update propagation mechanism will propagate the update index entries that will maintain the intermediate client's index entries.

3.2. Cache Replacement

Caching the frequently data items is consider as an effective mechanism for improving the system
performance. Cache replacement algorithm are providing the solution for finding suitable group of items from the cache .Most of the cache replacement existing algorithm are based on the time since last access ,entry time of the item in the cache, hit ratio, expiration time of the item in the cache, location etc.

Most of the time cache replacement algorithm has designed in the context of operating system virtual memory management and database buffer management [16]. Imaran and Tauheed has explained about the different caching strategies[17]. They have divided this strategy into four categories.

1. Broadcast based strategy where mobile nodes broadcast the request to find out the mobile nodes which reply the response with the requested document.

2. Information Based or location based strategy where mobile nodes will exchange or store the information about the location where data is available.

3. Role-Based Strategy is based on the cluster. Cluster will be creating on the base of functionality of the node .Depending on the architecture some mobile node will be selected as a coordinator.

4. In the Directed Request strategy client will send direct request to the server and it expected the reply from the same way.

Most of the cache replacement algorithms are influenced by location based strategy. Least Recent Used (LRU), Least Frequently Used the cache. Least frequently used algorithm is determined by the reference count of each object. **LRU-K algorithm** is considered the recent and frequency of the object. These algorithms are restricting it by not considering the location and direction of the client movement. **Manhatten Distance Method** [18] calculates the distance existing between a client's current location and the location of each cached data item. Cache replacement also calculated on Cost based Algorithm. The Cost based Prediction based algorithm follow the cost function which will be calculating the cost, where cost is associated with the cached data. Probability Area [19,20]algorithm is one of well known algorithm which follow cost-based replacement policy ,each cached object is associated with a cost . **PAID** (Probability Area Inverse Distance [19, 20] is an extended version of Probability Area algorithm. Distance between mobile clients and data objects is become a part of cost function that can used for Cache replacement decision .Mobility Aware Replacement Scheme(MARS)[8] calculate the cost function includes temporal locality, spatial locality and a cost for the data object. Most of these algorithms show the consideration of distance factor whereas fails to identify the predicted region or area where the client can be in near future.

There are many algorithms has designed on the base of prediction of the movement of the mobile client. Predicted Region Based Replacement Policy (PRRP) [6] and Prioritized Predicted Region based Cache Replacement Policy (PPRRP) [21] which takes into consideration the access probability, valid scope area, data size in cache and data distance based on the predicted square region. **Ren et al. [15]** has designed an algorithm called Furthest Away Replacement(FAR),which is a semantic caching scheme considers the location, speed and direction of users.

3.3 Cache Consistency

Caching frequently accessed data objects at the local buffer of a mobile user (MU) can significantly improve the performance of mobile wireless networks [5]. Marinating the cache consistency in mobile environment is a challenging task due to frequent disconnections and mobility of MUs. Several cache consistency maintenance schemes have been proposed for the for mobile wireless environments. The goals of these schemes and algorithms are to ensure valid data objects in the cache to enhance their availability and minimize overhead due to consistency maintenance. Major cache consistency algorithms are depending on two properties:

1. Stateful where server will be unaware of cache content of mobile users'

2. Stateless approaches are scalable.

Anurag Kahol et. Al.[27] suggested asynchronous stateful strategy for maintaining the cache consistency. In this method MSS only broadcast those data which is updated in to the relative cache host. It avoids all the unnecessary IR's .MSS keep track of all caches. Scalable

Asynchronous Cache Consistency (SACCS) designed by Zhijun Wang et al. support scalable mechanism [11].In SACCS method, MSS keep only minimum state information of IR's. Cost based Cache Invalidation (CCI) designed by Song -Yi et. al[28] for mobile clients .This consider the disconnection time and the update frequency on server side. Sumit Khurana et. al. [12] had uses asynchronous call-back method for maintaining the cache consistency.

CONCLUSIONS

Management of the massive data in wireless mobile computing creates the new challenges. The major aim of Mobile data management is to give surety of data availability and consistency even when the node will disconnect. Data management issues exhibit new challenges for both global and local. In this paper through, we have discussed about Network Mobility, Disconnection, Battery Backup, design of wireless information system and how they effect the implementation of database for wireless network and mobile computing.

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