Different Strategy for Data Management in Mobile Computing

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Abstract. Mobile computing is a revolutionary technology which enables us to access information, anytime and anywhere. Recently, there has been many research area found in mobile computing area. In this paper, we have discussed about different strategies 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 problem of data availability and discussed about replicating mobile databases.

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

1   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 behavior, 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] .

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.

2. Databases on both mobile and fixed hosts are sharable 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.

2   Mobile Architecture

The architecture of the mobile environment is given in Fig 1. Mobile Environment consists of two distinct sets of entities: mobile units and fixed hosts. This fixed host 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].
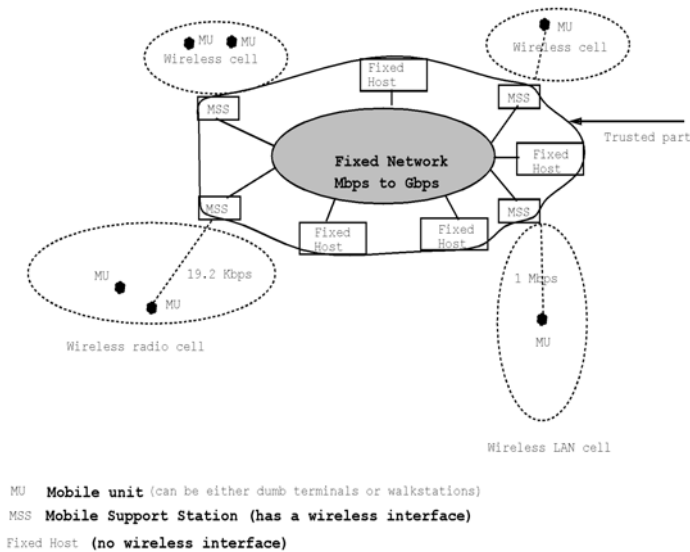

Fig. 1. A Mobile Computing Environment [2]

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].

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.

Some time portable units will be limited battery backup. They frequently All the above features has an equally impression for data management in mobile computing. These help to effectively mange the data into the system.

3   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, to ensure consistency of data. 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 updation 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. Bit Sequence algorithm suggested by the Jin Jing et al. [11] which use a static bit mapping scheme.

3.2   Cache Replacement

Caching frequently accessed data items on the client side can be considered to improve the performance in a mobile environment [4]. But due to the limitations of the cache size, it is difficult to store all the accessed data items in the cache. Hence, cache replacement algorithms can be used effectively to improve the cache management. Most of the existing cache replacement policies use cost functions to incorporate different factors including access frequency, update rate, size of objects ,location and movement of the mobile clients [5]. Cache replacement policies such as LRU, LFU and LRU-k [7,9,10], considered the temporal feature of data access, while policies such as FAR [9] only deal with the location dependent aspects of cache management but neglect the temporal properties. PAID policy [7] and MARS [8] considered both spatial and temporal behavioral, even it accounts updates to data .PRRP which takes consideration of the access probability, valid scope area, data size in cache and data distance ,based on the predicted square region [6].

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 algorithm are depend on two property 1.Stateful where server will be unaware of cache content of mobile users 2.Stateless approaches are scalable.Scalable Asynchronous Cache Consistency (SACCS) designed by Zhijun Wang et al. support scalable mechanism [11]. Sumit Khurana et. al. [12] had uses asynchronous call-back method for maintaining the cache consistency.

4   Conclusion

Management of the massive data in wireless mobile computing creates the new challenges. In this paper we have discussed about Data Management issues in the context of Mobile Computing. Cache Management approach like cache replacement, cache invalidation ,and cache consisting method are suggested to use for data management. Due to mobility feature of clients ,they can have different movement patterns,. It is necessary we should develop some adaptive techniques that can Consider that clients can move, and still o stay temporarily fixed.

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