Chapter XVII
A Framework for Semi-Autonomous Servers in the Wireless Network Environment

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ABSTRACT

The problem of server performance in a contemporary, rapidly developed and multi-discipline environment is examined. Multiple requests in a very short period of time increase the number of connections and push the server to the limit. Nowadays servers' ability to work semi autonomously, in regards to the decision of the appropriate query plan and the provision of the effective data location, plays a significant role for the query and network performance. For autonomous server operations many of the offered services need to be self-managed. Data sources' administration during the execution of the query plan becomes of primary interest especially for the starting query server. The proposed server grouping process, server's scale up capabilities and the application of Data Mining concepts in a wireless environment can contribute a lot to the optimization of the query plan and also increase server independence. Various methods of distributed data exploration and exploitation that support server's semi-autonomous operational behavior are developed. Simulation results are provided. This chapter covers a significant part of cooperative domains in the area of information management and can offer integrated solutions very attractive to the mobile users.

INTRODUCTION

The number of mobile and wired users has rapidly increased over the last few years. This large user base is playing a significant role on server available resources for internet services. A mobile-client/server model is developed. Servers in various network sites usually have a heavy workload to execute. In (Menasce, & Kephart, 2007) the need of building a large-scale fully autonomic computing, comprised of multiple components that work together to satisfy high-level business goals, is imperative. A more effective organization of data distribution and acquisition across the internet could mediate the server workload. Future database systems will need to optimize queries of much higher complexity than the current ones.

For some problems new solutions can be considered under more thorough elaboration. Our focus is the problem of query optimization considering also two additional factors: the group and query mobility and the dependency of servers. These two new factors play a significant role in the development of the query design. Moreover the new network infrastructure and the scale up capabilities of the servers can support this framework. The issue addressed in this study is to minimize the total cost of the queries and to discover, for at least some of them, a new less delayed solution in order to reduce the dependency of servers. In the context of information management and the rapid growth of wireless data applications, the study of the multidimensional problem for server autonomicity provides an innovative solution for the query performance. There are two servers that play a significant role for any query in our study; the starting server, from where the query starts the execution, and the last server where the data are produced.

The data have to follow the users' moves. This is accomplished by sending the results directly to the last server (or to the mobile user cache) in advance evading the round-trip delay of data requests. This *pairing* between the starting and the last server, for the most popular group and query paths, facilitates bandwidth reservation across the path, and replicates the data in advance whenever needed. Moreover, the Base Station (BS) is the key part of the wireless network infrastructure and it is responsible for sending and receiving data to and from a wireless host that is associated with that base station. A cell is the geographical area covered by a BS.

This work focuses on discovering periodical events (e.g., football match) over long time periods utilizing the most popular group route (critical routes). The predictive policy aids the service of hand off calls and shortens the query response time. The techniques for distributed database design are based on allocation, replication and fragmentation. Each database can be broken up into logical units called fragments which may be assigned for storage at the various sites. Each fragment (or each copy of a fragment) must be assigned to a particular site in the distributed system. This process is called data allocation. Data from a relation can also be stored in various sites. This is called data replication. Replication is useful in improving the availability of data (Silberschatz, Korth, & Sudarshan, 2006). The mobile environment needs dynamic replication schemes that will replicate the data when and where needed (Tang, & Chanson, 2004). For some queries the result is taken after the cooperation of servers.

The servers' dependency, based on the transferring of messages, data or subqueries, finally attenuates the network performance especially with the increasing number of the mobile and wired users' requests that might create congestion conditions. In order to avoid these undesirable network situations, we should reduce the *spread* of query part executions over various sites and minimize the query execution time. In this way the better allocation of services (messages, files, databases etc) can help the servers work with restricted *dependency.* We use Data Mining methods twice. First, to discover the group and query mobility via the Merge Itemsets Algorithm (MIA) and second to measure the server dependency, providing new metrics and analytical results. Finally, since the starting server knows in advance the distribution of data and the last server, where the user (or group) will be at the end of the transaction, it can prepare an *optimal* query plan (less response time) in order to send the results di-

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