

Chapter 4.2

Transaction Management in Mobile Databases

Ziyad Tariq Abdul-Mehdi

Multimedia University, Malaysia

Ali Bin Mamat

Universiti Putra Malaysia, Malaysia

Hamidah Ibrahim

Universiti Putra Malaysia, Malaysia

Mustafa M. Dirs

College University Technology Tun Hussein Onn, Malaysia

INTRODUCTION

Recent advances in wireless communications and computer technology have provided users the opportunity to access information and services regardless of their physical location or movement behavior. In the context of database applications, these mobile users should have the ability to both query and update public, private, and corporate databases. The main goal of mobile software research is to provide as much functionality of network computing as possible within the limits of the mobile computer's capabilities. Consequently, transaction processing and efficient update techniques for mobile and disconnected operations

have been very popular. In this article, we present the main architecture of mobile transactions and the characteristics with a database perspective. Some of the extensive transaction models and transaction processing for mobile computing are discussed with their underlying assumptions. A brief comparison of the models is also included

TRANSACTION MANAGEMENT IN MOBILE DATABASES

A mobile database system is a special multi-database system on a mobile computing environment. It allows mobile hosts to access and manipulate

data stored on several pre-existing, autonomous, and heterogeneous local database systems located on different parts of the wired network. Transactions in a mobile database system may access data from several local databases at different sites. Management of these transactions requires different approaches in mobile databases than in a multi-database. This is mainly due to the fact that a mobile host is not suitable to manage a global transaction by itself due to the described nature of the mobile computing environment. Usually this management is done by the mobile host's base station or by coordination of it.

Due to the described nature of the mobile computing environments, transaction management has to be reevaluated for mobile databases. The transactions in mobile computing environments are usually long-living transactions, possibly covering one or more disconnected durations. Supporting disconnected operation (i.e., allowing a mobile host to operate autonomously during disconnection) raises issues in consistency. Providing disconnected operation also requires some pre-caching of data that will be required for the necessary operations to be performed during disconnection. The moving behavior of the transactions in mobile computing environments also requires new mechanisms. As a mobile host moves from a cell to another cell, its transactions might need to migrate from one base station to another. In general, transactions in mobile databases require relaxed ACID properties. There are several works on mobile transactions, each addressing some of the issues in mobile transaction management. We will explain some of them in the following sections.

Kangaroo Transactions

Kangaroo transactions (KTs) are introduced in Dunham and Helal (1997). As the name suggests, this model mostly addresses the moving behavior of the mobile transactions. As the transactions

hop from one site to another, the management of the transaction also moves.

In addition to the mobile computing environment we have described, these systems introduce a couple of other terminologies. The term *source system* represents a collection of systems that offer information services to mobile users. These systems could be any type of system that exists in the mobile computing environment. One good example is a distributed database system. The term *data access agent (DAA)* represents an agent that is hosted by each base station. Mobile hosts reach data in source systems by sending their transactions to DAAs. When a handoff occurs, the DAA at the new base station receives the transaction information from the DAA in the old base station. A *mobile transaction* is defined as the basic unit of computation in the mobile environment. The management of a mobile transaction might hop through different base stations, which are not known until it completes its execution. DAAs at base stations are responsible for management of the mobile transactions. One part of the DAA responsible for the management of the transactions is called the *mobile transaction manager (MTM)*. The main responsibilities of an MTM are maintaining the status of mobile transactions in execution, logging recovery information, and performing needed checkpointing.

In this model it is assumed that a mobile transaction issued by a mobile host to a DAA might include several subtransactions that require access to data at several global database systems (GDBSs) and DBMSs residing at different places of the fixed network. As a result DAAs serve as a mobile transaction manager built on top of GDBSs and DBMSs. DAAs also keep log information about the mobile transaction parts that have executed on them. Remember that a mobile transaction changes its DAA as it moves from one cell to another.

Since mobile transactions are long lived and include possible disconnected durations; the atomicity of a mobile transaction in this model

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