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Chapter XIII

Location-Dependent Query Processing Benchmark

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Abstract

Benchmarks define techniques which can be followed to determine the effectiveness of a given software or hardware design. Ever since the development of the Wisconsin Benchmark and subsequent transaction-processing (TPC) benchmarks, there has been a concensus and general acceptance of these performance comparison tools. However, these benchmarks are not sufficient to determine the performance of mobile-based applications. For example, these traditional benchmarks ignore some of the important wireless-mobile features such as location-dependent queries and movement of the mobile host. In this chapter we examine the issues needed for the development of such a mobile query benchmark. In particular, we focus on queries which involve location-dependent features. We first examine the unique aspects of this mobile architecture which impact any benchmark design, and then propose a benchmark suitable for it.

Introduction

A benchmark defines a common testing criterium which facilitates the comparison of two systems. Benchmarks for traditional database systems have been thoroughly examined with several different types proposed (Gray,1993). Typically, a database benchmark consists of three features.

- *Queries:* These are typically simplistic versions of real-life queries which could be executed to evaluate the necessary components for query processing.
- *Data:* Data may be artificial data which are created to represent typical data in that domain. Definitions of data requirements need to be sufficiently abstract to ensure use in any possible system.
- *Execution Guidelines:* Execution guidelines indicate specifically how the benchmark is to be executed, what performance metrics are to be used, and how these metrics are to be generated. These guidelines should be applicable for evaluating a real implementation, a test bed, a prototype, or even a simulation of a proposed implementation.

Although these are the basic features for a benchmarking tool, generally there is no specific definition provided for the networking or connectivity characteristics of the environment. Today, mobile computing has become necessary for the applications to serve the mobile (and also stationary) users who want to be able to process from anywhere, anytime. Existing benchmarking tools, though, are simply not adequate for such a mobile computing environment. Data, queries, and execution guidelines are not directly applicable to the environment and do not include the architectural and connectivity issues that are specific to mobility. There is no "typical" application for mobile computing, moreover, a debit-credit banking application does not seem to be a reasonable choice for a mobile environment. It is obvious that a major reason the existing benchmarks are inadequate is because the mobility aspect is completely ignored. For example, if a query is requested from a mobile unit (MU), the way to test the movement of the MU should be specified in the benchmark. In this chapter we present the guidelines for a mobile computing benchmark.

We propose a benchmark in which queries are requested from the MU and executed at a node in the fixed wired network, a usual case for a mobile user. Although different types of queries should be included in a mobile computing benchmark, those that highlight the uniqueness of that environment are crucial. Such database queries are those whose results depend on the requester's location, *location-dependent queries* (LDQs; Seydim, Dunham, & Kumar, 2001a, 2001b). Examples include, "Where is the closest hotel?" and, "What Italian restaurants are within five miles?" Data used in the benchmark must include data which contain location components, *location-dependent data* (LDD; Dunham & Kumar, 1998; Ren & Dunham, 2000). Any proposed mobile computing benchmark should support not only the LDQs but also more traditional types as well. Moreover, the benchmark must characterize typical applications with the mobility characteristics. Therefore, a location-dependent benchmark should include the following features.