Chapter 19

PROTOTYPES: PROGRAMMED STOCK TRADING

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1. INTRODUCTION

We believe that the greatest growth potential for soft real-time databases is not as isolated monolithic databases but as components in open systems consisting of many heterogeneous databases. In such environments, the flexibility to deal with unpredictable situations and the ability to cooperate with other data sources (often non-real-time) is just as important as the guarantee of stringent timing constraints.

The focus of our research was to design a database system explicitly for heterogeneous environments, the STanford Real-time Information Processor (STRIP). STRIP, which runs on standard Posix Unix, is a soft real-time main memory database with special facilities for importing and exporting data as well as handling derived data. We chose program trading as the motivating application for the work. A program trading system monitors the prices of stocks or other financial instruments and looks for trading opportunities based on market inefficiencies or short term market models.

1.1 PROGRAM TRADING APPLICATION

In this section we describe the simplified program trading application (PTA) used to drive the STRIP research. In practice, program trading systems are custom built by each trading firm and their market models and trading algorithms are closely held secrets. Thus the example we present here is simplified both out of necessity, since very little information is publicly available, and also to focus our attention on the important issues of data management without getting
lost in the details of financial modeling. Still, we feel that our application model captures the important features of the real problem.

The PTA requires the database to maintain three types of prices: stock prices, composite index prices, and theoretical (call) option prices. The stock prices are the base data of the system, and are updated in the database according to the market feed. The composite and option prices, however, are derived data that must be computed from the stock prices. In actuality, the current trend of feed providers is to send more than stock prices with the feeds, including popular composite prices (e.g., Dow Jones Industrial Average (DJIA)) and other derived values. Still, additional derived data, such as that related to proprietary market models, will always need to be computed by the database system. Because composite averages and theoretical option prices have known functions, are easy to understand, and reasonably reflect the types of data that need to be computed, we choose to compute them as part of the PTA as representative of the proprietary derived data.

The database for the PTA contains the following six tables:

- **stocks** (symbol, price) - contains the current price of every stock as reported by the market feed.
- **stock-stdev** (symbol, stdev) - contains the standard deviation of the annualized rate return of every stock. The standard deviation is usually computed from the daily closing prices of the stock over a period of years. While periodic recomputation is supported by STRIP, we do not model the computation of standard deviation in this study since we are focusing on the behavior of the PTA during trading hours. For our purposes, this table is base data.
- **comp-prices** (comp, price) - contains the computed price of every composite average (e.g., DJIA). This table is a materialized view (defined below) and hence corresponds to derived data.
- **comps-list** (comp, symbol, weight) - describes the many-many relationship between stocks and composites. This table is entered by the trading firm and changes very infrequently.
- **option-prices** (option-symbol, price) - contains the computed price of every listed option. The data in this table is derived and its materialized view definition is given below.
- **options-list** (option-symbol, stock-symbol, strike, expir) - describes the one-many relationship between stocks and options. This table must be updated once every three months when the option exchanges create new options and expunge expired options. In this example we only consider call options so the attribute strike is the price...