



## GemFire Enterprise Data Fabric Drives Trading Strategies at a Leading Asset Management Firm

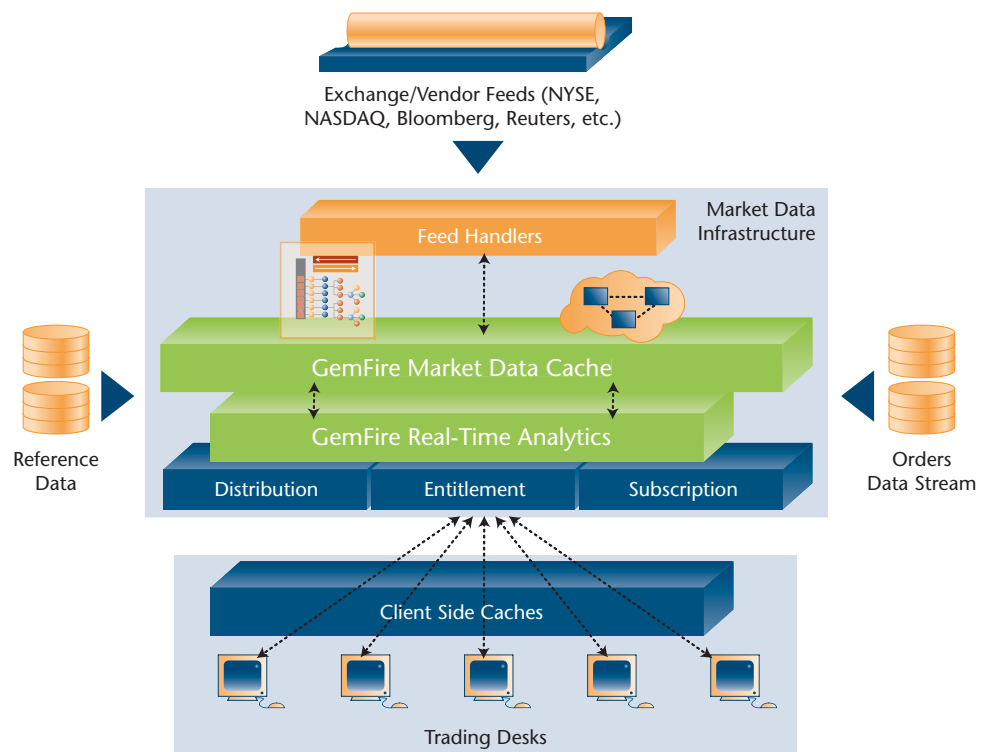
### GEMFIRE EDF BUSINESS BENEFITS

- Intelligent real-time decision making through an event driven architecture
- Enables trading strategists to monitor for opportunities that are profitable and in compliance with investment guidelines based on history
- Provides the ability to drive trading desks across the world (NYC, London, Tokyo and Hong Kong) through real-time event distribution
- Extremely high performance (thousands of events/second) and low latency platform with a low TCO
- Facilitates users to alter or register new scenarios dynamically based on prevailing market conditions

One of the largest assets and investment management firms is using GemFire Real-Time Events (RTE), a component of the GemFire Enterprise Data Fabric (EDF) to enable trading strategy management across global markets, and to drive profitable trade executions based on real-time market information as well other sources like reference data and historical trading information.

The existing solution uses a combination of an in-memory cache (TIC) and a rules engine to continuously analyze incoming data and

dispatched events to subscribers based on their interest. This solution involved significant custom development and did not provide the users with the ability to dynamically redefine their rules or queries based on market conditions. Further, the system was also susceptible to failure under increased data volumes as well as increased user load. These factors served as a motivation to deploy a robust, flexible platform that provide sophisticated event management solution for real-time trading strategies.



The new RTE based solution provides traders with real-time access to recent orders and related data as well as market data and permits applications or users to register queries of interest on relevant subsets of the data. The queries registered can also be updated dynamically on an as needed basis. Registered applications are notified in real-time as the underlying data changes throughout the trading day with RTE managing all this data in memory across multiple machines. Based on these real-time, updates trading strategies and execution venues can be determined appropriately

The overall system architecture is depicted in Figure 1 seen below. This system drives the order management and trading in exchanges all across the globe - New York, London, Tokyo, Hong Kong. Future applications of the RTE-based architecture include Transaction Cost Analysis, compliance and control for detecting faulty or fraudulent trades and for normalizing market data streams from multiple sources.

## SOLUTION OVERVIEW

As can be seen in the figure, events and data from a variety of sources such as market data feed handlers, trade audit database and reference data are brought into RTE through standard interfaces. A single data model is used to represent such disparate data and the RTE in-memory data repository becomes the data integration point providing the application a single consistent model to work with. Users (the trading strategists at this firm) can define queries, which are business conditions they want monitored, through a simple SQL based semantics making RTE extremely simple to deploy and use even in complex environments such as the one under discussion. As the events flow into RTE, the queries are continuously evaluated. Unlike a traditional database where queries operate on resident data, in RTE, the query evaluation happens as the events arrive. Any registered query remains active within RTE and the system constantly evaluates these queries based on underlying data changes. Such queries are referred

to as "Continuous Queries" or "CQs". A CQ provides the equivalent of a query being continuously run on a database.

### *Advanced Correlation Capabilities*

Unlike pure stream based data management solutions, RTE evaluates queries as events arrive and can also correlate these events to historical events and other static data sources. In this particular use-case as well as in general trading scenarios, the trader workstation not only needs to be cognizant of trades and market quotes as they arrive but also needs to correlate these events with reference data for securities as well as historical information. Lack of management of such additional data elements would require the client application to execute expensive queries on reference data repositories. Such correlation capabilities also enable the business analysts to define real-time strategies that account for several different considerations that are relevant to the trading operations at this firm.

### *Intelligent Event Routing*

Not all market changes affect all traders or trading activities. The RTE engine uses a variety of algorithms to instantly determine how in-coming events affect the registered queries. This analysis is completed rapidly to identify business scenarios or queries that are impacted by new market or trading events. Once this analysis is complete, the RTE engine computes how exactly the result set in the client needs to change (for e.g., changes in prices of securities or incremental trades) and ships just the delta to each affected client application substantially minimizing the traffic on the network.

At times when the input data rates are too high, it may not be possible to ship events to client applications at the same rate at which events enter the system. The client application may be incapable of consuming events at that rate. To accommodate such circumstances, the client can specify a refresh interval when the query is registered. For instance, a refresh

interval of 500 ms guarantees that changes caused by an event will be received by the client within 500 ms of that event's occurrence in the RTE server. Rapid events such as price ticks are processed in the server and received by the client based on the refresh interval specified.

### ***High Availability***

As all data is managed in memory, it is paramount that the data be replicated to a secondary system to protect registered applications from any single points of failures. Data can be transparently replicated to one or more secondary systems at very high speed. Besides serving the purpose of making the trading platform highly available the secondary servers also play an active role by managing a subset of the registered CQs. In other words, the registered CQs can be load-balanced across many servers allowing the system to scale. The distributed system automatically detects failures in any node and re-routes any connected clients to an alternate server.

Given the fact that this customer's event processing needs are bound to increase with additional clients being added to the system and a greater number of CQs registered in the system, the existence of such sophisticated high availability capabilities is of great significance from the standpoint of ensuring a non-stop event-driven architecture.

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