# Aura® Market Forecasting Web Services

*Global brain to solve world finance magic*

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## *Abstract*

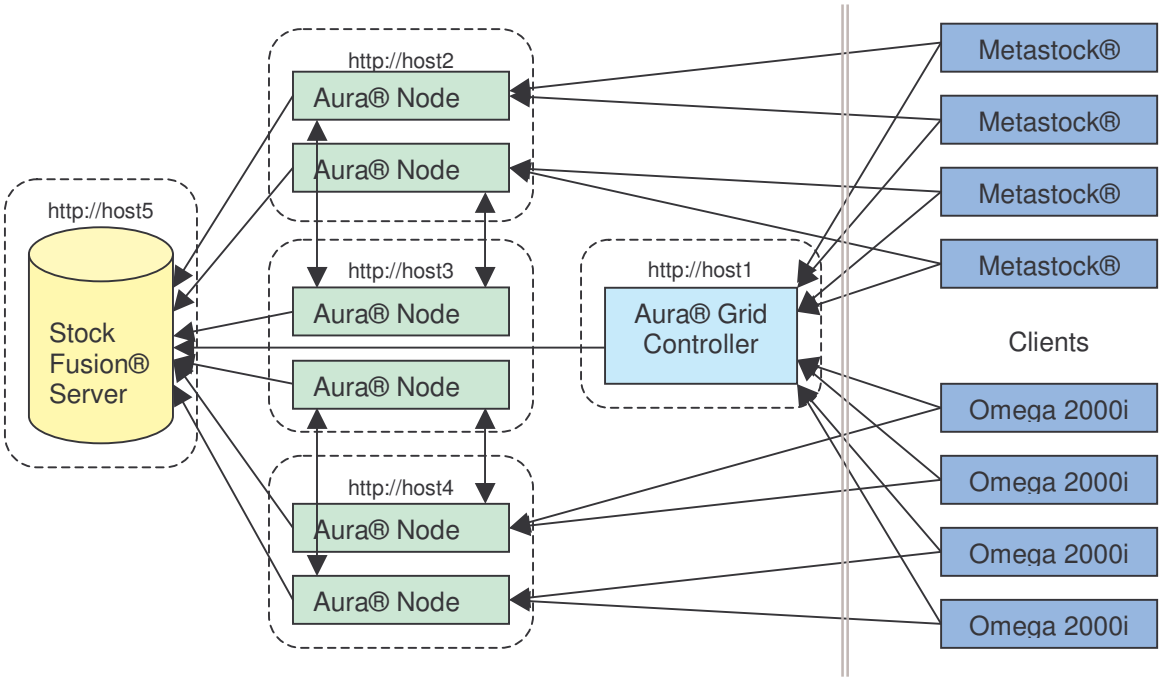
Analysis of massive time series data is very typical and essential problem in science, finance, marketing and many other areas. Fast solution of such problems requires application of parallel computing. Typical approach relies on using Linux clusters such as in well known Beowulf platform. However it cuts off very considerable amount of analytic components written for MS Windows and typically wrapped as COM modules or regular DLL. Thus the need for cheap and robust grid solutions on Windows platform is ever growing.

To ensure scalability and reliability of financial forecasting services and ensure easy web deployment we have developed universal grid infrastructure based on modern SOAP protocol. Resulting architecture is well applicable both to fast WAN Intranets and loosely coupled Internet grid solutions.

## *General Architecture*

Aura® Forecast Engine is implemented as high availability service provider scalable up to global scope over internet channels. Server is available to client requests as web service compatible to SOAP 1.1 specification. It allows to access service from virtually any platform and programming language, including Java, .NET, C++ etc.

Server consists of main server (host controller) and a number of worker servers which serve client requests for forecasts. Each server implements very same universal SOAP stack compatible to Aura® API specification.




All servers are standalone applications running on one or different network computers. Processing is unified and coordinated through StockFusion® data provider - DBMS which stores time series database and ensures data consistency and integrity between each server process instance.

This shared data access to centralized time series warehouse is implemented in StockFusion® through compatible SOAP data provider based on open RDBMS schema. Underlying relational storage is currently implemented for many platforms including IBM DB2, MS SQL Server and MS Access. StockFusion® server allows for visual creation of time series warehouses as well as fast direct retrieval of data by distributed grid nodes from the shared NAS.

## *Host controller*

The core element of software is Aura® Grid Controller - centralized job manager responsible for load balancing and task distribution as well as control of task completion and automatic recovery in case of failures with automatic switch of tasks between grid nodes. Each grid computer is equipped with local grid service responsible for local distribution of tasks between processors. Software supports unlimited amount of grid nodes and unlimited number of processors in each node workstation.

Host controller is the same instance of Aura® Forecast Engine server as any other, but with very limited functionality: it just processes client login requests and then launches node of regular worker server as separate process on other port and gives to the client the address of that new server to process client requests.

Because host controller has very little workload and operation scope, it is always available to client requests and very stable in itself. Even if case of emergency fault of host controller, clients will be very little impacted since their regular work is not dependent on host controller after login. And host controller will fast restart itself immediately after fault without all current users loosing their working sessions.

Host controller can balance the number of clients assigned to each worker server depending on its current load and response time. If worker server is overwhelmed with client requests, host controller will launch new worker server instance and assign new client to it. If on the other hand, worker server is idle, host controller may assign new client to it instead creating new worker server.

## *Worker servers and grid scalability*

Worker nodes are resource consuming applications. They make most work on calculating forecasts and processing client requests and may fail more often on various occasions especially in very long run prospect of weeks and months.

Taking that, it is very beneficial to isolate worker processes completely from host controller to ensure efficient resource recycling in case of faults. It is achieved by making separate process for each worker server. After worker server completes its job, it stores results in centralized StockFusion® from where they can be taken by any thread and delivered to client.

Different worker servers can reside on different physical machines and just communicate with RDBMS through the network and synchronize themselves over SOAP messaging. It gives virtually unlimited scalability especially on powerful RDBMS installations allowing parallel query processing such as with clustered Oracle servers.

Splitting among several physical machines gives very good fault tolerance and recovery due to resource redundancy. Client requests can be served even in case physical crash of certain server machines which can situate even in different geographical locations.

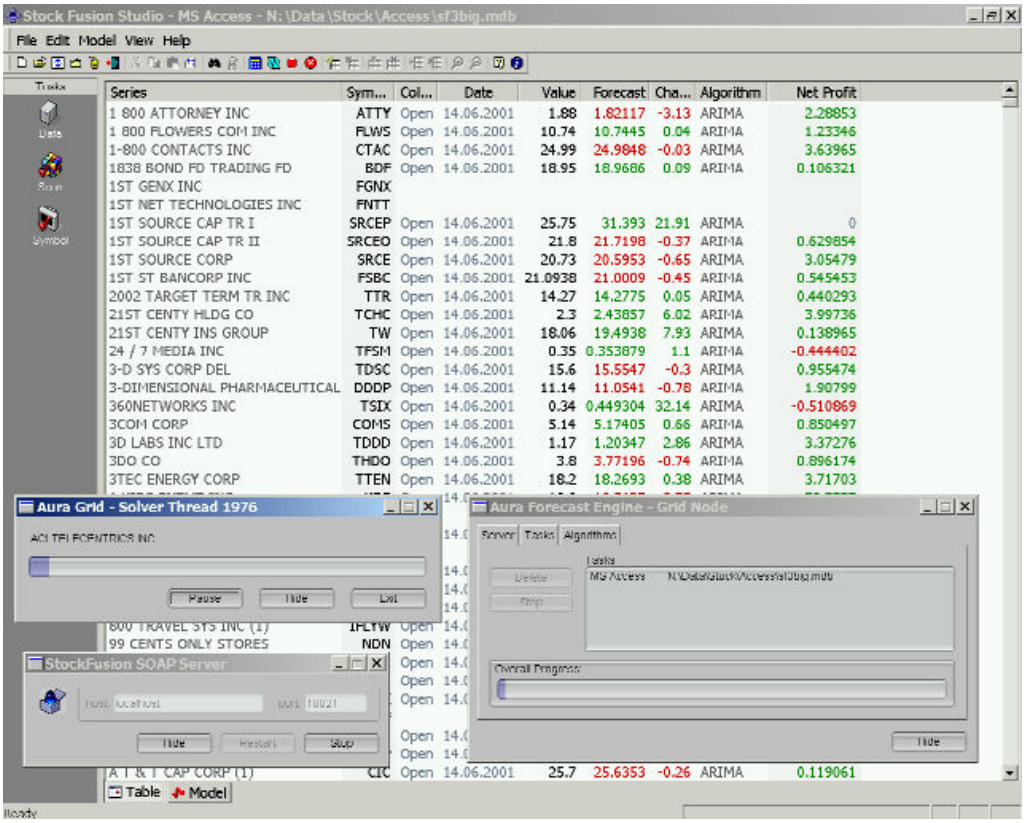
## *Client access*

Due to industry standard SOAP compatibility, forecasting services can be accessed from virtually unlimited variety of platforms and architectures. These are ranging from specially written Java, .NET, C++ and other client applications to standard financial front-ends such as Equis® Metastock or Omega ProSuite. Open client access API is shipped along with the product.

Multiple clients can receive forecasts to their favorite stock charting environment from any remote geographic location through any low band internet channel. Service will monitor user access rights, registration, subscription etc. and ensure high security SSL encryption of connection details and transmitted data. Access is controlled by unique session key which expires after client disconnects from service and is recreated upon each next connection.

## *Implementations*

Project is completely written on ANSI C++ with potential cross-platform compatibility to Linux clusters. Due to present customer demand only MS Windows version compiled under Visual Studio .NET is currently supported.




Sample screen of Aura® Forecast Engine

Server installation is very easy and does not require any special software except OS and proper RDBMS installation. Client software is packed as downloadable packages which automatically install on client side and connect to server without any manual setup needed.

## *References*

http://stockfusion.net