

FMR Pricing Engine

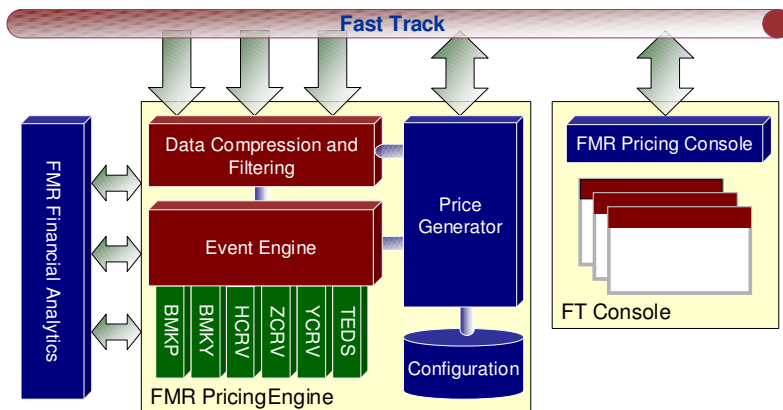
In the last few years, the financial markets have witnessed the rapid rise of several forms of electronic marketplaces, with a national or international scope, sponsored by private institutions or by Governments.

When competing on electronic marketplaces, the capability of dealing in real time with a large amount of securities is of paramount importance.

Leveraging on its extended experience in designing and developing pricing systems and analytics for real time operations and exploiting List Group FastTrack connectivity platform, F.M.R. Consulting has developed **FMR Pricing Engine**, a state of the art application for the **real time production of reference prices**.

FMR Pricing Engine is based on a **client-server architecture** and allows the automatic pricing of securities on several markets, using inputs from different sources and adopting financially consistent (arbitrage free) models. The system is designed to support the concurrent operation of several users and to sustain real time calculation for **hundreds of bonds**.

Leveraging on **robust financial models**, FMR Pricing Engine allows a minimal number of market operators to efficiently control a large amount of securities, targeting different output markets, in a full **multi-market environment**.



The calculation server (FMR Pricing Engine above) has been developed using object oriented C++ language, for maximum calculation performances. The application collects prices from different sources and performs data compression and filtering to obtain an internal *best* price upon which all subsequent calculations are based. When the reference securities change their market prices, the event engine handles the logical dependencies, sending recalculation signals to the correct models and instruments. All financial calculations required by the pricing models are performed by the FMR3000 system that produces **analytics** (yield to maturity, asset swaps and DVO1) and **preliminary prices**.

For each bond, the User selects the model, the reference instrument (benchmark bond, Futures contract or curve) and the driving leg (bid, ask or mid market). Based on this User input, the Price Generator automatically interacts with the connectivity platform to update the quotes on all target markets.

The Users interact with the server application by means of the **FMR Pricing Console** client, which is fully integrated with FastTrack FT Console. From this application, the User has full access to all FMR Pricing Engine functionalities and to all FastTrack services, including:

- visualize all data produced by the pricing server;
- dynamically change the pricing model to be used for each security;
- change the model reference instrument or calculation conventions;
- dynamically load or unload securities on the pricing server;
- adjust the pricing parameters of each instrument;
- customize the quote for each target market;
- activate/deactivate quotes;
- send buy/sell orders to the market.

All changes operated via FMR Pricing Console are persistently stored by the server application. This facilitates the system restart on the following day.

The screenshot displays the FMR Pricing Console interface with several panels:

- FMR Main Panel:** Shows a list of instruments with columns for Description, TT, Quote Bid, Bid, Ask, Quote Ask, Y Mid, Asw Mid, Mid, Mid Spread, Tweak, Quote Mid, Quote Status, Quote Type, Current Model, Mode, User, and BPV Mid. The table lists various BUND and OAT securities with their respective quotes and market data.
- FMR Instruments:** A table listing instrument details such as Instrument, Des, Curve, Instrument, Description, TTM, and Y Mid Diff.
- FMR Yield Curves:** A panel for configuring yield curves, including Curve (EURO), Type, and a table of instrument bid/ask prices.
- FMR Futures:** A table listing future contracts with columns for Instrument, Y Bid, Bid, Ask, Y Ask, and BPV Mid.
- FMR Future Deliverables:** A table showing future deliverable details, including Future, Instrument, Description, Fair Price, Net Basis, and IRR.

The pricing server supports **several pricing models** that generate prices for target bonds using one or more reference securities (benchmarks). Usually, benchmark instruments are chosen for their high liquidity and because they consistently represent the market variations. Typical choices are Future contracts, interest rate curves, etc. FMR Pricing Engine models map the benchmark variations into price variations for the target security by applying a *pricing parameter*. The financial meaning of the pricing parameter depends on the model. If the benchmark instrument has been correctly chosen, the pricing parameter is a slowly varying quantity, easily controllable by the User.

The following models are currently available in FMR Pricing Engine:

- **BMKP. Price spread** model. The target price is obtained by adding a spread to the benchmark instrument (bond or Futures). Gross basis quotation is supported.
- **BMKY. Yield spread** model. The target price is obtained by adding a spread to the yield to maturity of the benchmark instrument (bond or Futures).
- **HCRV. Historical yield variation** model. The target price is obtained interpolating on the historical yield variations of up to ten securities (bonds or Futures).
- **YCRV. Benchmark curve** model. The target price is obtained from a benchmark curve, defined by the yield to maturity of up to ten securities (bonds or Futures).
- **ZCRV. Asset swap** model. The target price is obtained from the swap curve, applying an asset swap spread.
- **TEDS. Ted spread** model. The target price is obtained from the strip of short-term rate Futures by applying a TED spread.
- **BRBL. Barbel** pricing model. The model allows pricing using 2 securities, using a duration weighted pricing scheme.

The modular architecture of the system easily accommodates the development of new models based on Users' requests.

FMR Pricing Engine also supports the following features:

- All pricing models may be automatically calibrated to the market prices. This automatically defines the pricing parameter in order to reproduce the market best prices.
- The Users' management system allows setting different privileges for each user.
- The advanced protection system automatically suspends all active quotes connected to a security if the pricing model becomes unstable or if the system detects (wanted or unwanted) client disconnection.
- The server applications may be installed in a fault tolerant configuration on several computers.

FMR Pricing Engine is fully integrated with other F.M.R. Consulting products, including FMR3000 analytic libraries and FMR HDF historical data management system.