Arming David

In a market of Goliaths able to justify huge spend on enterprise management how are the numerous small capital management houses to meet regulatory pressures whilst remaining cost efficient?

Recent economic conditions have put pressure on margins in many classes of financial instruments. On the other hand, the number of market participants is increasing and there are more intermediates, many of them small- and medium-sized financial enterprises. To sustain and share reasonable margins increasingly complex deal types with shorter and shorter time-to-market cycles are being developed. These need to be integrated into structured risk control systems, and incorporate transaction processes to transfer risk, all in compliance with the constant evolution of regulatory needs. One of the areas of key interest is the current regulatory discussion on introducing requirements to view any risk decision in the context of a company's entire portfolio: Quantitative Enterprise Management.

Challenge for the small

Take a small capital management institution (we'll call them CMI), which needs to structure individual funds for a life insurance company. The insurer needs relatively high coupons (at least in the near future) to meet the contractual obligations offered to their clients.

They integrate structured products based on interest rate components – say, range accruals, TARNS, snowballs/memory notes, steepeners – most of them equipped with multiple callability.

They have €1 billion in assets under management. Legally, they are a bank and need to report to the regulators.

CMI's general manager remarks "The national financial market authority requests that we perform continuous stress tests, VaR calculations and aggregation to consolidated profit and loss/risk analytics, even if the most complex instruments are involved. They do not specify how we are to do this or what to do in the event that the number of deal types, positions and aggregation levels blow up our computing environment. I anticipate that we need to prove that our offers are market compliant and fair and give our customers insight. It is certainly not enough that I get prices and hedging

advice from my counterparties."

He knows that, in order to make this happen, he needs to integrate a flexible instrument structuring and pricing tool with a risk management platform and a trade-processing environment. The advantage: collaboration of the top management, fund managers and risk manages is very tight. Decision cycles are short. But, what does this mean from a system perspective?

CMI's functional requirements are as demanding as those of a large bank. The difference: CMI is much more focused in terms of strategy, market segments and product volume. And their number of different positions and cash flows is much lower. They need a feature-rich system for the small.

The large integrated systems available on the market are designed and implemented on a large scale for the large. This holds whether in terms of service culture, system architecture or implementation. They are highly integrated, so it is sometimes difficult to adjust them to the needs of the small, agile CMI. And they have their price. Can CMI develop such a system on their own? No.

The UnRisk option

The UnRisk consortium has geared itself to meeting the requirements of small and medium sized financial institutions. The UnRisk system is transformable into a "big system for the small" covering, in the first version, an instrument builder, a pricing engine and a calibration engine, a multi-data instrument and portfolio analysis and processing system with stressing portfolios in scenarios, calculating VAR and other risk management factors. The system supports multiple languages through a plug-in and link structures making data from information providers available and providing ease of integration with transaction systems.

Systems for the small need to be scalable from a single desktop, to a network, to computer grids, exploiting existing infrastructure to the maximum extent and enhance incrementally, if necessary. For the small especially it is vital that web technologies, like web services and web compliant front ends are available.

In general, this can only happen if we collect the latest technologies, reuse the best components and combine them with the proven UnRisk methods, tools and technologies.

The minimalist infrastructure

CMI's center of operations would be dominated by web-browser based front-ends. In this environment, users retrieve information like market data, structure/retrieve and valuate instruments and portfolios, define stress tests and scenarios, run calculations to identify risk spectra. External users would have restricted access rights but work in the same environment.

Intranet-server provides all services to all intranet-clients and manages the database and calculation engines.

UnRisk core services will be implemented through a RMI (remote method invocation) server. UnRisk services organize the queuing/parallelization and calculation requests.

Infrastructure needs to be powerful, but its management shall be simple, minimalist in this sense. Example, the system shall automatically transform the network into a grid, if it is free for overnight, or reserved-time calculations, like model calibration, VAR calculations.

Technology validation and hybrid programming

Optimized computational engines are realized in C++. They build the core and because they are often called millions of time, they need to be fast-paced and accurate.

Accuracy and speed of the UnRisk engine arises from high-end numerical schemes, like finite elements, streamline diffusion, adaptive integration, regularization which MathConsult has implemented in the UnRisk kernel. Its careful design and model selection is targeted at the pricing and risk management of financial objects, which represent a whole universe of real-world financial instruments. But financial experts in CMI do not speak C++ and structuring on that level is bumpy, even for C++ experts.

This is one reason why UnRisk has decided to integrate the engine into Mathematica. Other reasons are: symbolic computation with volumes of mathematical knowledge, graphics, a document-centered front-end, interactive help browser, declarative programming environment and open architecture and link structure based on its MathLink API. The link structure allows for the seamless integration of databases, Excel, .NET, Java applications into Mathematica. Its C++ component was used to integrate the UnRisk engine into Mathematica.

Mathematica also provides symbolic parallelization tools which make it easy to distribute computations (gridMathematica). Mathematica and all their applications can be wrapped for the web. The mechanism for this is webMathematica, a set of http wrappers, servelets, server pages and applets. This allows for the creation of comprehensive webUnRisk applications.

The declarative programming language enables UnRisk to present derivatives, structures, portfolios and scenarios in "the language of mathematics". In this language it is very easy to structure, configure and customize instrument, portfolio and scenario objects as well as models, schedules and even nasty details like holiday calendars.

Financial experts in CMI do not speak Mathematica either, hence the Excel front-end

But most of the aggregation and transaction systems do not speak Excel (except some Excel feed-ins). This is why an UnRisk application database is being developed as well as UnRisk services by wrapping Mathematica functions with Java.

But CMI experts do not speak Java! Correct, but they do not need to, because Java represents html base forms, which are intuitive and easy to use. For the UnRisk developers, every building block is realized in the environment, which fits to the needs. The UnRisk team is committed to hybrid programming and the exploitation of leading-edge systems.

Quick must not mean dirty. Small must not mean poor

"We want to do things which we are really good at; quantitative finance, algorithmic mathematics, especially numerics, technical computer science and support systems at the frontier of their field of use", summarizes Andreas Binder, head of MathConsult, the development partner in the UnRisk consortium. "As software vendors, the UnRisk consortium is a comparatively small outfit. By validating the best technology available, combining them with our proprietary high-end numerical schemes and mathematical software design, we can do things, which usually need large teams. And, because of our flexible tool set and team structure, we can make this scalable, from mini projects with development cycles of a few days to large projects with incremental deliverables."