Microservices Are the New Building Blocks of Financial Technology

This article first appeared as part of the November 2016 cover story in *Wilmott* Magazine. The story 'Vive La Difference' observes that with the continued migration of quant skills throughout the finance industry, it is now diversity that defines current trends in technology for quantitative finance. The full article can be accessed here: http://onlinelibrary.wiley.com/doi/10.1002/wilm.10549/abstract

Marc Adler, Chief Architect, Quantifi, introduces the concept of Microservices to *Wilmott* and explains it's all a matter of design.

The derivatives landscape has evolved greatly over the past few years, driven by the scale and pace of regulatory change, economic unease and competitive pressures. These drivers have heightened the attention on risk technology and operations, forcing firms to re-think their business operating models. The rapid pace of innovation in technology presents a whole new range of possibilities for how technology can be leveraged in financial markets.

There has been a great deal of talk about the need for capital markets to invest in technology. Leveraging better technology can increase flexibility, improve performance, reduce operational risk, and lower costs. Firms want to minimize the number of different technologies that are

in play, with the aim to lower costs and improve resiliency. They want to be able to upgrade functionality with minimal operational or organizational interruption to their daily workflow and avoid punitive project costs for what is sometimes limited added value.

Microservices: A winning paradigm

So how can firms construct scalable, next-generation technology building blocks to respond to the challenges of today and be flexible enough to adapt to the world of tomorrow? In today's innovation environment, large global enterprises have completely rethought how they build and deliver software using bleeding-edge technology. This new-age design philosophy is called microservices, a direction that fundamentally rewrites the structure of risk technology.

A key question we are often asked when engaging with our clients is "How can we leverage Quantifi and realize our value add without significant infrastructure change?" and the implied onerous costs that would go with that route.

Quantifi has stayed ahead of the competition by continuing to make smart investments in new technology that translate into long-term value for clients. A key focus has been to make Quantifi more open and flexible by separating out its architecture to microservices. This investment has reshaped how Quantifi serves its clients by addressing the modern business imperatives of speed, agility, and scalability. A microservices architecture (MSA) makes initial implementation and future upgrade simple and low risk. Clients also benefit from unparalleled flexibility and customization.

Each Quantifi microservice implements a different slice of

Advantages of a MSA
- Flexible and responsive to change as each loosely coupled service is independent
- Easier deployment as each service is autonomous
- High scalability – can be scaled to enhance performance if demand for a particular service increases
- Easy and flexible integration with minimal disruption to business processes and systems
- Improves system resilience - failure of a component can be identified and fixed without impacting other services

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functionality and exposes an API that is accessible through REST and industry-standard JMS messaging. New "events" are propagated to a common messaging infrastructure. Clients can write applications to call (or subscribe) to these events, and display the information in a proprietary GUI. This new architecture enables Quantifi to offer "headless risk services", where customers can

tional data (e.g., trades, static data, market data), for risk engine results (model calculations, scenarios, sensitivities, simulated exposures), and for reporting (fact and dimension data).

Cloud enabled

Cloud is a key enabler to reduce the complexity of building, implementing, and operating microservices. Quantifi's cloud-service fabric helps

able to respond and adapt to market conditions. This is where a combined cloud-strategy and MSA comes in. By utilizing a cloud infrastructure, as business processes change, individual or multiple services can be dynamically unplugged or replaced as needed. With a cloud framework, Quantifi can operate within a dynamic environment.

Responsive to change

The move to a MSA allows Quantifi to push new functionality to clients more rapidly. Some of the key benefits to our clients include reduced disruption on their side, a faster time to market, and an overall lower total cost of ownership. Improvements to individual services can also be deployed independently of the rest of the system and therefore not require a complete system upgrade. If a problem was to occur, it can be

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The migration to microservices was greatly facilitated by the fact that Quantifi already had abstracted the interfaces used to query or save data. This enabled us to implement separate repositories for transac-

connect and reliably serve various functions to our clients, making applications more manageable, reliable, and scalable. Processes within any organization need to be

isolated to an individual component and be swapped out without impacting other services. This reduces the operational impact and lowers the level of support required. Components within a MSA are loosely coupled, making them more flexible and responsive to change. This allows Quantifi to release a different implementation for each individual service that interfaces with a customer's internal systems. For example, Quantifi can release an authorization module that interfaces with a customer's own entitlement
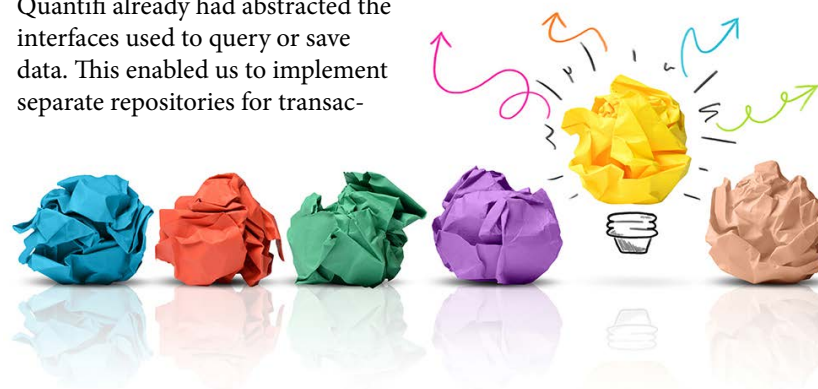
system as well as individual services that consume data that a customer publishes over their own messaging system. In general, the risk involved in changing or upgrading a single service is reduced.

Seamless integration

Integration is one of the most important aspects of technology associated with microservices. Since microservices operate at a granular level, Quantifi can offer services on an à la carte basis so that clients can select different services. These chosen services can be seamlessly integrated to coexist within a client's existing framework to form a holistic system. This is important for a number of our larger clients who only want to replace specific functionality without the need to 'rip and replace' their entire system.

Horizontal and vertical scaling

With an MSA we have gained significant benefits around reliability, ease of modification, and scalability. Quantifi currently supports horizontal scalability (by the use of the Microsoft HPC compute grid) and vertical scalability (by support of multi-core processing). Unlike a layered architecture where you have to scale everything together, with a MSA each individual component can be scaled separately. This scalability of services makes it easy for Quantifi to start up additional instances of a service to deal with periods of excessive load. Data and processing can also be load-balanced across the various instances of a service. This level of scalability also improves the resilience of the Quantifi platform.

Messaging

Another interesting feature of a MSA is messaging. JMS-based messaging and REST are two ways that applications can communicate with the Quantifi services. These are open standards supported by different programming languages. A customer can write an application in C#, C++, Java, or Python. There is no requirement for a customer to know C# and Microsoft .NET in order to interface with a Quantifi service, thus avoiding the need to add additional resources or skillsets. The resulting financial benefits are overwhelming.

Separating our architecture into microservices has reshaped how we serve our clients, but even more so, it underlines how we are going to market to help clients navigate the most pressing issues ahead and realizing ROI from their technology. A MSA makes initial implementation and future upgrades simple and low risk. Clients will also experience the unparalleled flexibility and customizability that the new architecture offers.

Shifting from the monolith

A number of firms still rely on systems that are more than 20+ years old. During this time, market and economic change, new regulation, management changes and structural organization generate new or modified technology requirements. Over time, most systems end up as a colossal, dense tangle of interconnected code that can make it incredibly difficult to update or improve on. This usually results in what developers call a 'monolithic codebase', or 'monolith'. A monolithic architecture includes various functionality contained within the same codebase, running in a single process. This can create problems when it comes to scaling the technology.

System disorder

Monolithic apps are problematic to maintain and test. Imagine a large code base without unit testing (the ability to test functionality of just one class or one service to ensure it works without errors). It is very difficult to know when you make a change in these monolithic applications whether the system is still operating. You have the same physical code cutting across logical boundaries, scattered among a range of different modules, i.e., pricing, reference data, or market data module. Physical code across a wide surface area of code base creates system disorder.

Monolith to microservices

Google, Amazon, Netflix, and eBay have all evolved from monolithic to microservices architecture. The primary reasons for the move to microservices had to do with flexibility, scale, and speed. Their older monolithic architectures did not allow them to incorporate new or modify old functionality rapidly enough. They needed an architecture that allowed them to available 24/7, scale to the next order of magnitude, and be optimized for speed. These first companies helped pave the way for other companies to do the same.

Intelligent technology

A microservices architecture promotes developing, testing, deploying, and managing of applications composed of autonomous self-contained components built around system functionality, with each running its own process. This is fundamentally different from the way traditional applications are designed, developed, and deployed. A Microservices Architecture (MSA) allows for functionality to be consumed in different ways that are most applicable to unique business requirements. Our clients will be able to write applications that interface with Quantifi, and also seamlessly interface their existing systems with the data and services that Quantifi provides. This move to a MSA makes systems more receptive to technological evolution and incremental change.

Outlook

Most firms have invested in technology capabilities to satisfy new practices and regulatory requirements; however, much remains to be done to operate efficiently. As traditional systems grow and more updates are bolted on they become too complex and inflexible to the extent that they become incompatible with new technologies and tools. Forward-looking firms are realizing that in this new world, the ability to achieve scale, reliability, and flexibility will be winning factors – all of which will facilitate a lower total cost of ownership.

In the mid- to long-term, we expect that the smart evolution, utilization, and deployment towards MSA will be one of the bedrocks for the future evolution of front office, risk, and compliance systems innovation. Firms will be able to realize the benefits of reducing integration expense, increasing asset reuse, promoting business agility, and reducing business risk in an environment where the pace of technology innovation is accelerating.