

# Chapter 43

## Financial Software as a Service: A Paradigm for Risk Modelling and Analytics

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### ABSTRACT

*Software as a service as one of the cloud delivery models that supports fine-grained components. Financial applications demand better performance and accuracy in a cloud than the traditional computing platforms. Therefore, designing financial software as a service (FSaaS) requires an engineering and systematic approach. This paper has proposed an integrated service-oriented architecture and a SaaS component model for financial domain that provides the required scalability, flexibility and customisation. It has also demonstrated the design and customisation of service component interfaces to a financial simulation so that it provides automatic prediction models for investors to know accurate results for buy and sale prices. Therefore, large-scaled simulations can be achieved within a matter of 13.5 second for outlier removal and within 9 seconds for high-performance risk computation on the Cloud. This paper shows the holistic and complete approach of illustrating the system design of FSaaS, showing the two major algorithms and the results of experiments of running these two algorithms. It provides plans to integrate new and existing services with FSaaS.*

### 1. INTRODUCTION

Global economic downturn caused by the financial sector is an interdisciplinary research problem which requires that experts from different sectors work altogether. The problem itself is complex and involved with a number of different causes.

Firstly, Lord Turner, Chair of the UK Financial Service Authority (FSA), is quoted as follows: “The problem, he said, was that the banks’ mathematical models assumed a ‘normal’ or ‘Gaussian’ distribution of events, represented by the bell curve, which dangerously underestimated the risk of something going seriously wrong.”

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(Financial Times, June 2009). Secondly, there were reports of a lack of regulations on financial practices. Remedies have been proposed by several governments to improve on this (Financial Times, 2010; City A.M, 2010). Thirdly, there was the “Madness of Mortgage Lenders” as identified in a study conducted by Hamnett (2009) whereby uncontrolled lending to those who could not afford to repay, that led to a housing bubble and subsequent collapse. Hamnett (2009) concluded that irresponsible mortgage lending was a key factor in the collapse of Lehman Brothers and a number of banks which seemed to trigger the global financial crisis. Fourthly, MacKenzie and Spears (2010) conducted interviews and in-depth study in this subject and concluded that the cause of the problem was due to the ease of adopting an easy-to-use mathematical formula, Gaussian Copula, in which the traders have been misused and abused the formula for massive investment. MacKenzie and Spears (2010) asserted further that the founder of Gaussian Copula, Dr David X Li, was related to the cause of the financial crisis. Their argument was that if he knew the formula has limitations, he should not promote it even remedies and warnings were done later on.

Therefore, identifying a solution to any financial crisis requires a holistic approach to problem solving and accurate prediction model for the financial crisis. This involves accurate mathematical simulation models which are discussed in this paper and have been used in practice for large-scaled financial simulations. The aim is to make all these calculations as accurate as possible, while considering and using a number of reliable formulas to check that results are consistent with each other. Financial services should be transparent and its activities such as risk modelling and analysis should follow a more scientific and rigorous steps in ensuring the accuracy, performance, security, usability and scalability can be achieved. In our previous work, we demonstrate that the use of Financial Clouds and Financial Software as a Service (FSaaS) can meet those

objectives (Chang et al., 2011 a; 2014 a; 2014 b). An alternative solution is to deploy Business Intelligence as a Service to model pricing and risk which require real time and vigorous approaches to compute values of prices with their associated risks required for the investment and decision-making process.

As discussed in the last paragraph, four major factors contributed to complexity that caused global downturn. An alternative to allow experts of different disciplines working together is to have a platform such as Cloud Computing, which can offer innovative approaches for risk analysis, and knowledge sharing in a community-oriented culture (Feiman and Cearley, 2009). Cloud resources can be used to improve accuracy of risk analysis, financial modelling and knowledge sharing in an open and professional platform (Buyya et al. 2009; Martson et al, 2010; Chang et al, 2011 a; 2014 a; Chang 2014 a). To support this concept, there are demonstrations presented by authors to confirm the added values of Cloud adoption, particularly the finance sector and organizations that deploy business intelligence. Benefits include the improvement in efficiency, collaboration, revenue, cost-savings and service rating in healthcare, finance and education sectors as a result of Cloud adoption (Buyya et al. 2009; Martson et al, 2010; Chang et al. 2013; 2014 a; Chang 2014 a; 2014 b). The extended rationale for providing added value for finance is as follows: Clouds provide a common platform on which to run different modelling and simulations based on Gaussian and non-Gaussian models. The Clouds then offer the distributed high-performing resources for experts in different areas within and outside financial services to study and review the modelling together, including models using Monte Carlo Methods and Black Scholes Model. Complex risk simulations can be presented in the form of visualisation, so that any unexploited area due to the lack of understanding about risk can be presented to the stakeholders and investors with ease. The Clouds allow regulations to be undertaken transparently in parallel with

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