



Case study :

Data Science in the Cloud

Massively speeding up risk calculations

When a large financial institution needed to speed up the time taken to produce business-critical outputs from economic capital risk models to support its capital strategy, DiUS Computing delivered a new model implementation that reduces the time taken to crunch 600 billion calculations from 208 days to just 8.5 hours through the power of on-demand parallel computing in the AWS cloud.

Faster scenario analysis modelling to support risk monitoring and management

Against the backdrop of the global financial crisis, the Australian arm of a leading global financial institution wanted to improve the flexibility and performance of its economic capital risk modeling and management capabilities. The client's economic capital risk models produce business critical outputs including reserving, loss forecasting, capital estimation, ICAAP submissions, risk adjusted return measures (RAROC) and pricing.

The client's objective was to leverage the power of parallel processing and the elasticity of Amazon Web Services (AWS) cloud computing to realise a new and fully integrated economic capital modelling solution that would deliver more timely and informed results to better support the financial institution's capital strategy.

Data science in the cloud

DiUS was engaged to deliver a better performing implementation of the economic capital risk model. Drawing on its data science expertise and AWS tools experience, DiUS recommended an approach to get the project up and running quickly, deliver the accuracy and speed required, provide on-going flexibility and leverage the on-demand nature of AWS resources to ensure a cost-effective execution. The new implementation would:

- Re-implement the risk model in Python to more quickly create, test and identify the best algorithmic approach to the model implementation.
- Run the model in a massively parallel manner using the open source big data batch processing platform, Hadoop, via AWS's hosted Hadoop service, Elastic MapReduce (EMR).



- Leverage AWS EC2 spot instances to reduce the cost of model execution.

Project highlights

- Identified a secure, stable and efficient approach to speed up economic capital risk model execution.
- Optimised and re-implemented algorithm so that it ran in a massively parallel way using EMR.
- Leveraged the on-demand nature of AWS resources to minimise operational costs.
- Delivered dramatic improvements in speed of model execution with a 99.83% faster execution time.
- Created interface for risk analysts to easily set up and initiate model executions and collect results.

Speeding up model execution

Over a four-week period, two DiUS consultants used an agile and iterative approach to develop the three components of the new solution:

- The new economic capital risk model: the DiUS team worked closely with the client's chief risk analyst to optimise the model's algorithm and ensure that calculation outputs from the new model matched the existing model, as well as enable speed of execution in a distributed, highly concurrent manner using EMR.

- The orchestration component: a Ruby implementation to setup and teardown EMR resources required for model runs, distribution of jobs to clusters in the AWS Sydney region datacenter, monitoring of jobs and collection of modelling results. The desensitized dataset is stored temporarily on the AWS servers and erased after each run.
- A front-end web user interface: to provide an easy way for risk managers to use the orchestration component to set up modelling runs, upload input data to clusters, request AWS spot instances, execute runs, view progress and download results.

Technology

- Python
- Hadoop
- Amazon Elastic MapReduce (EMR)
- Ruby on Rails

Markedly faster risk calculations

The results were impressive. The previous economic capital risk model built on a relational data analytics platform was estimated to take approximately 208 days to run the 600 billion complex calculations required to fully model 10,000 economic scenarios against 1.1 million policies predicting out over 60 quarters into the future. With the power of parallel processing, the new model crunches the 600 billion calculations in 8.5 hours. That's a 99.83% improvement.

The risk team is now able to run the full set of scenarios overnight and come in the next day to drill down to investigate the drivers behind variations in the results, as well as passing them on to senior management for more timely business decision making.

Future enhancements

DiUS designed the model to be maintainable and easily scale to accommodate future increases in the number of scenarios, policies and quarters that the model will need to calculate.

A number of model performance enhancements have been identified that will help further reduce the costs and execution time of the model, as well as a number of web user interface improvements that will simplify the operation of the user interface while providing safeguards around unexpected costs.

Delivering long-term competitiveness

DiUS delivered a new economic capital risk model to meet the client's need for speed of execution, ease of use and cost-effective operation. It also provides a scalable platform to support the company's future capital strategy.

The client's improved ability to model scenarios will help drive capital optimisation through improved understanding of capital requirements and capital drivers. It will also improve financial decision making in terms of pricing decisions, segment profitability, risk policy and appetite setting, as well as providing more robust estimates to meet regulatory requirements.

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