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Cloud based technologies and Regulatory Compliance

Thought Leadership Series #13 – Part 3

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This is the third and last article in this series on Cloud-based technologies and the role they can play in reducing the cost of regulatory compliance for the banking industry. In the first article, I presented a credit risk and integrated stress testing framework. In the second article, I illustrated the model design with an application and showed how the model design can be used to meet regulatory stress testing and reverse stress testing requirements.

This article will focus on the cloud-based architectural design which can host the credit risk and integrated stress testing framework. In this article I will illustrate how each component of the framework fits within a cloud-hosted solution. I should emphasize that the architectural design presented here is not the only possible design; it is one of many possible designs.

I'd also like to reiterate that the primary objective of this series of articles is to provide enough support to the argument that cloud-based technologies are fully equipped to enable banks to reduce the cost of regulatory compliance by shifting the burden of model development, validation, and maintenance to a specialist group of financial engineers and cloud computing and security experts. The message of this series of articles can be summarized as follows:

- The evolving regulatory landscape is both complex and costly:
  - It is complex because it requires a highly advanced quantitative environment managed by top-notch financial engineers and quantitative analysts, and;
  - It is costly because it requires a whole set of software applications, application developers, and financial engineers to run the required analytics and simulations.

- Open source programming platforms and the Cloud Ecosystem provide banks with a cheaper and more effective alternative solution.

- Banks can effectively outsource the software development, model documentation, platform maintenance, and model validation to the cloud-based software developers which are likely to be a team of financial engineers and big-data experts.

- Probably the most important by-product of this proposal is that banks can shift their focus back to more strategic objectives which take the form of enhancing customer experiences, tapping into new markets, expanding and diversifying the product line, adopting a digital platform, and so on. The proposal presented in this article is meant to reduce the time spent by senior management on matters relating to regulatory compliance. While the competitive landscape of the banking industry has witnessed some structural shifts in recent years due to Machine Learning, Artificial Intelligence, and other disruptive technologies, regulations remain to be one of the most important factors influencing the degree to which banks can compete in this new environment.

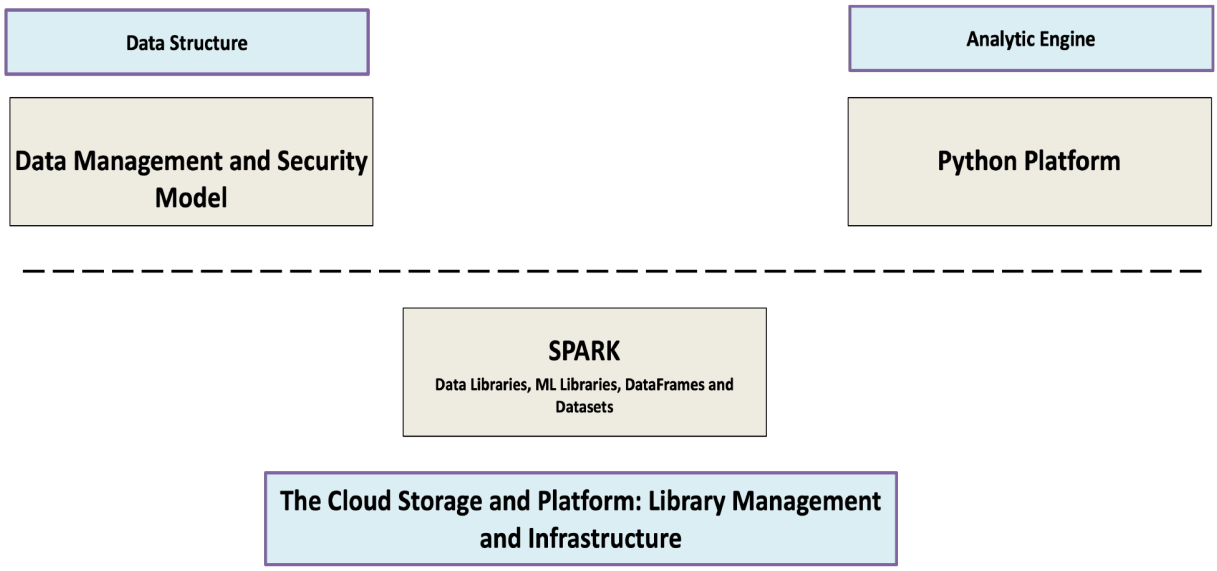
The Cloud-based Architecture

The components of the proposed cloud-based architecture are shown in Figure 1. Readers familiar with cloud platform services will recognize the proposed architecture primarily as Software as a Service (SaaS). SaaS refers to the delivery of a software application which leverages the cloud platform to deliver high quality, secure, and reliable service. In the current application, the service refers to the credit risk and integrated stress testing framework. SaaS software is a centralized cloud-hosted service which can be made available to a large number of consumers. The service is developed, maintained, and operated by the SaaS provider, and it is distributed as a common model to any number of users. In technical terms, the proposed architecture is a multitenant scheme where a common set of cloud resources are distributed to and requested by the users. With this architecture, banks won't have to invest in specialized hardware and/or IT experts to configure and run the application; the infrastructure costs are shifted to the model provider. In addition, banks won't have to invest in risk management experts and financial engineers to develop and/or run the model and interpret its results; the SaaS provider can assume that role.

The primary component of the architecture is Apache Spark. Spark is a powerful open-source data analytics and computing engine which provides a uniform data management and analytics environment. Spark is powered by rich libraries of machine learning algorithms and deep learning networks. It may actually seem an overkill to propose Apache Spark for the purpose of hosting the model design described in the first and second articles and the required datasets for running the credit risk and integrated stress testing model. That would be true if the choice of Spark was only motivated by the proposed model design which is not the case here. Spark, along with its machine learning libraries and Python APIs, provides a powerful data analytics and visualization platform. Thus, the Spark ecosystem can be leveraged to analyze borrowers' and counterparties' behavior, interpret default information and analyze default clusters, visualize market data patterns and detect outliers for use in stress testing, produce predictive analytics, and monitor market regime changes and spot potential turning points. It can in fact be argued that the data analytics provided by the Spark ecosystem is exactly what is needed to develop a comprehensive regulatory compliant platform on the Cloud. The regulatory requirements are no longer only based on static data; they now require on-going analysis of customer behavior, cash flow patterns, default clusters, and simulations of market networks. These requirements can be managed with the analytical libraries available in and through Spark.

The model design (described in details in the second article of this series) is built in Python. Python is an open-source programming language which integrates natively with Spark. Python provides a rich set of algorithms for data analysis and machine learning. The Spark machine learning library provides a set of high-level APIs for Python developers. Interested readers are encouraged to refer to my article "Hedge Fund Returns Replication in Python" for an overview of the kind of financial analytics that can be performed in Python.
There are further details which can be shared and discussed; however, it is best to leave those details to more technical articles.

Figure 1: High Level Cloud-based Architecture Design



Final Thoughts

I hope this series of articles on cloud-based technologies and banking regulations has served its intended purpose. The cost and complexity introduced and required by the regulators call for a more creative solution which can reduce the efforts required by senior management to achieve and maintain regulatory compliance. This series of articles introduced one such solution. The solution introduced in these articles is based on outsourcing the model design, maintenance, and validation to a group of financial engineers and data experts while leveraging the cloud platform services to host the model design and database architecture.

Please feel free to share your thoughts on the proposed solution and/or on alternative solutions.