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Reduce costs by converting CCAR Models to run with Cloudera Enterprise
Deloitte and Cloudera can help you reduce costs and more effectively manage data for running CCAR models

Passing the rigorous regulatory stress tests for capital adequacy is just the beginning of another journey for large retail banks. The next challenge is to reduce the operational costs associated with maintaining the data and running the models that simulate capital risk in the Comprehensive Capital Analysis and Review (CCAR) stress tests.

Maintaining the large volumes of data for stress tests is a significant effort. Because the data grows rapidly, periodic system upgrades are needed to increase memory and storage to run quarterly and annual CCAR reports and to support model development, validation, and archiving. Regulations are also continuously evolving. The annual CCAR supervisory rules specify new scenarios and datasets to be used in credit risk, liquidity risk, market risk, PPNR and capital management models that generate the forecasted stress estimates. It can be costly and time consuming to integrate the data required for CCAR and then to develop and run the models quarterly, yearly, or even more often. Separately, large institutions often pay millions of dollars per month in software license fees to run the thousands of analysis models required for CCAR regulatory reporting and compliance. CCAR implementations are often on-premise and tied to large distributions of hardware and software licensing that are not adequately provisioned for today's workloads.

While actual CCAR compliance costs are not available, costs for the largest banks are estimated to run in the hundreds of millions of dollars annually[1]. In an attempt to reduce both the cost of managing data and the software license costs, there is a movement in the retail banking industry to convert CCAR models to run in an environment that leverages open source technologies and is designed for big data.

Deloitte has teamed with Cloudera to design a solution that can reduce the ongoing costs associated with managing your data and running your CCAR models.

Deloitte's CCAR solution
Deloitte has developed a CCAR solution utilizing Cloudera Enterprise for data management that can offer cost savings for banks. The expected savings in software license and data management costs potentially exceed the costs of migrating your CCAR models. In addition, Deloitte has developed a number of tools and accelerators that help reduce the time, cost and risk of migrating your models to this new and more cost-effective open source environment that can be provisioned on-premise or in the cloud.

Deloitte's CCAR solution utilizes Cloudera Enterprise and supports two packages for scoring models execution, SAS DS2, a cost effective commercial package, and Apache Spark, a free open source package based on Python.. Cloudera Enterprise is a fully supported enterprise distribution of the open source Hadoop platform. It can provide a highly scalable centralized repository for managing all of your historical data, making it easy and cost-effective to extend your system as your data repository grows while also offering the ability to encrypt data at rest.

The solution includes accelerators to help streamline data selection, data quality, variables conversion, data ingestion and management, and to convert or migrate your models to the SAS DS2 or Spark programming languages. Visualization and dashboard tools included in the solution also allow you to interact with the results of your stress tests to quickly identify trends and potential sources of risk.

1 "Banks Keep Mum About Stress-Test Costs, Clouding Reg Debate," by Chris Cumming, American Banker, May 18, 2015. http://www.americanbanker.com/news/national-regional/banks-keep-mum-about-stress-test-costs-clouding-reg-debate-1074382-1.html.

As shown in Figure 1, models converted to either SAS DS2 or Apache Spark can utilize Cloudera Enterprise Data Hub to access the data they need for running your CCAR models. The main difference is that Spark is tightly integrated with Cloudera and can therefore execute within that Cloudera Enterprise Data Hub, eliminating the need to move your data to another server to run your models. If you prefer a commercial software programming language, SAS DS2 models can be tested in a separate server then converted to be executed directly on Cloudera Enterprise.

Figure 1. Solution overview.
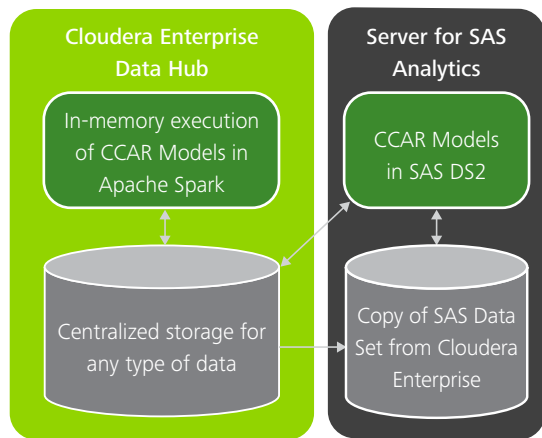
Operational savings

Bringing all of your data into a single integrated system with Cloudera Enterprise can simplify data management while reducing storage costs and the time and expense of transporting data through ELT or ETL routines. Cloudera Enterprise can store any amount or type of data, in its original form, for as long as desired or required.

Apache Spark can provide an agile, high performance, and cost effective way to operationalize CCAR models. The algorithms used in the risk models require iterative and cyclic data flow and can thus take advantage of the in-memory processing capabilities of Spark to optimize and run risk models more frequently. In addition, Spark can provide data scientists with high-level operators that make it easier to ingest data and run algorithms using the language of their choice, including Java, Scala, Python or R.

The biggest advantage of utilizing Apache Spark for operationalizing CCAR models is that Spark is part of the Apache open source foundation and has no software license fees. For some banks, this can mean millions of dollars of savings each month. Apache Spark is an open source, parallel data processing framework that

complements Hadoop to make it easier to develop fast, unified big data applications. Apache Spark can run in diverse application environments, including standalone or cluster mode, HADOOP Yarn, Mesos or Amazon Elastic Compute Cloud (EC2). It can also access diverse data sources such as the Hadoop Distributed File System (HDFS), Apache HBase, Amazon Simple Storage Service (Amazon S3) and the Apache Cassandra database.

SAS is in the process of developing an in-memory version of their popular DS2 language and Deloitte is collaborating with SAS to design our migration tools and accelerators to help you take advantage of in-memory processing in DS2 when the capability becomes available.

Deloitte at a glance
- Deloitte is one of the largest privately held professional services organization in the world based on headcount and breadth of capability, delivering audit, enterprise risk, tax, finance, strategy and operations, human capital, and technology services.
- Deloitte named a global leader in Business Analytics Services based on capabilities by Gartner. [2]
- Deloitte named a global leader in Business Analytics Consulting and Systems Integration Services by IDC. [3]
- Deloitte named the global leader in Analytics IT Consulting based on capabilities by Kennedy. [4]
- Deloitte is the largest consulting organization in the world. [5][6]
- Deloitte is the largest IT consulting organization in the world. [6]
- Deloitte is a global leader in Technology Transformation.
- Deloitte is a global leader in Information Security consulting.
- Deloitte is a global leader in IT Strategy Consulting.
- Deloitte is on *Fortune* magazine's list of "100 Best Companies to Work For" for the 14th year (Deloitte LLP and its subsidiaries).

2 **Source:** Gartner Magic Quadrant for Business Analytics Services, Worldwide, Alex Soejarto, Neil Chandler, 17 July, 2014.

3 **Source:** IDC MarketScape: Worldwide Business Analytics Consulting and Systems Integration Services 2014 Vendor Assessment by Ali Zaidi, May 2014, IDC #246675.

4 **Source:** Kennedy Consulting Research & Advisory; IT Consulting: Analytics 2014; Kennedy Consulting Research & Advisory estimates © 2014 Kennedy Information, LLC. Reproduced under license.

5 Includes S&O, HR, IT, Risk, FA, Audit, and Tax advisory capabilities; excludes regulatory audit and tax compliance.

6 **Source:** DTTL Global AR, February 2013; DTTL Strategy, June 2012.

Enterprise support to reduce risk

Cloudera can offer commercial support for both Cloudera Enterprise and Spark, giving you the ability to take advantage of open source software while benefiting from enterprise support to reduce risk. SAS also offers commercial support for its DS2 language and all SAS software applications and tools.

Deloitte's approach

The Deloitte CCAR solution consists of frameworks, tools, and methodologies that provide a starting point for implementing a customized solution for each banking client. Our methodology is tailored to address the unique challenges and complexities associated with modeling capital risk across a variety of business functions in the banking industry.

Model accelerators can be leveraged from one client engagement to the next, enabling us to help you implement a solution and migrate your models relatively quickly. We recommend starting with an initial set of models (perhaps from a single line of business) so that you can show results with your implementation.

Value of engaging Deloitte

Many banks simply do not have the manpower or institutional capability to accomplish all of the forecast modeling required to meet regulator requirements in a timely manner. Bringing in an experienced resource such as Deloitte can assist you in meeting your regulatory obligations and can offer a faster path to achieve the regulatory stress testing requirement with lower risk than relying solely on internal development.

Deloitte practitioners can help you reduce the cost of ongoing operations for your CCAR models. We'll use our extensive knowledge and experience to help you design and implement a highly efficient solution based on leading practices in the industry. We bring an uncommon combination of deep banking industry experience and recognized leadership in analytics. Our practitioners understand forecast modeling, including how the CCAR models work, and have significant experience using all Hadoop frameworks as well as Spark and SAS. We can help you quickly develop analytical models for a wide variety of use cases.

We have also invested in developing a set of tools and accelerators that can reduce the cost and risk of migrating your existing CCAR models to run in Spark or take full advantage of SAS DS2.

About the Deloitte Analytics practice

Deloitte has been widely recognized as a leader in business analytics (See Deloitte at a Glance sidebar). Our Analytics practice uses a fully integrated approach to analytics that can unlock the value buried deep in your data. We combine the science of business analytics with strategy-level insights and an understanding of how to bring analytics to the front lines of your organization.

Our experienced industry specialists can help you identify which questions matter and where to find the answers. Our services address an overall Information Management strategy as well as effective integration across the domains of technology, processes, and people. We bring an extensive set of capabilities that involve reporting applications, portals, information delivery, and basic as well as advanced analytics — all grounded in a deep understanding of the business issues that drive the industries and sectors we serve.

Figure 2. Sources of operational savings with Deloitte CCAR Solution using SAS DS2 or Apache Spark.

	Deloitte CCAR Solution with Cloudera Enterprise and SAS DS2	Deloitte CCAR Solution with Cloudera Enterprise and Apache Spark
Data management cost savings	Significant	Significant
Software license savings	Significant	Dramatic
Simplified system expansion to support data growth	Significant	Significant
Avoid having to move data to run models	n/a	Significant
Reduced need for server capacity due to fast in-memory processing	Coming soon	Significant
Tools and accelerators to reduce the cost and risk of model migrations	Significant	Significant

Learn more

To learn more about how Deloitte can help you reduce the cost of managing your data and running your CCAR models, please contact a Deloitte team member listed below.

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