An Advanced Performance Architecture for Salesforce Native Applications

A transformation of business and the applications that run business is upon us. For the first time end users are truly in the driver's seat; the digitally empowered customer becomes the focus: business scenarios and their data sets span the entire organization globally and externally including channels; and very complex high volume tasks need to be managed seemingly with ease. Companies are grappling with new technologies and new platforms to enable this change, while they seek to leverage the core data and systems that have been the backbone for their businesses to date. The Revvy architecture was designed from the ground up to support this digital transformation.

Drivers of the Digital Transformation

Business solutions are moving from an orientation around process efficiency and cost savings to a design center that is customer focused and growth oriented. It's no longer reasonable to envision system orientation as front or back office exclusively, since customers have needs that drive across the entire organization.

Cloud computing is the new IT infrastructure, the application paradigm has shifted to SaaS and the application consumer is mobile. Data volumes are increasing rapidly, products and processes are more complex, and legal and global considerations introduce many new policies and tracking needs into digital transformation initiatives. Applications need to be designed from the ground up to scale with many different kinds of users, extraordinary volumes of transactions, and the ability to add in complex computing as needed.

Traditional systems for process automation like ERP, CRM, Revenue Management and other apps all have roles in the digital transformation. While some of these applications may remain on-premise, the transformational solutions will be delivered via the cloud and thus these applications all need to interoperate seamlessly and efficiently, while fully respecting the security and best practices of enterprise IT.

Future applications for digital transformation need a highly robust architecture to orchestrate business processes, data integration, and analytic information across many touch points in the enterprise. These next generation platforms will align customer facing organizations and their processes with engines for "complex, high volume" enterprise level computation, and provide business users, channel partners and customers with seemingly simple cloud-based apps available on their browser or mobile device, that are actually performing very complex calculations and configurations across multiple systems.

We believe that IT organizations will require an enterprise grade architecture that supports the following 3 fundamental building blocks for transformational applications:

1. **End-to-End** — functionality that aligns and automates processes spanning multiple business organizations, that is inclusive of direct and indirect channels and that combines data and analysis from internal and external sources

2. **Robust and Interoperable** — with Master Data, CRM, and ERP so as to leverage these systems into the transformation, and to provide administration and management capabilities that simplify complexity and live up to enterprise IT standards

3. **Performance and Scalability** — characteristics that track linearly as systems scale with high volumes and complex models beyond the "comfort level" of most current transformation platforms

Salesforce in the Digital Transformation Landscape

The trend toward digital transformation is also ushering in a new world of technology and technology suppliers into the corporate IT landscape. Salesforce has become a leading platform in digital transformation projects. The company has positioned itself as the customer success platform fueled by rapid growth in front-office applications, particularly Customer Relationship Management (CRM). According to industry analyst Gartner Group, almost 50% of all CRM applications sales in 2014 were cloud-based. Salesforce leads the market with almost 20% of worldwide market-share, growing revenues at almost four times faster than the next nearest competitor.

As a result, many companies are bringing the Salesforce platform into their organizations to transform engagement with customers. Salesforce has also created a platform for 3rd party software companies to build "native" applications that interoperate with Salesforce. Software providers building on the Salesforce platform provide customers with a diverse and rich set of applications on a common cloud platform sharing a common user and administration experience. Salesforce benefits with acceleration in offering the components needed for large scale digital transformation projects.

Building on Salesforce for Revvy Revenue Management

There are significant benefits to building Salesforce native applications, such as shared data, unification of processes and user experience, common administration, security and management. These benefits accrue to both the app providers and the customers of both both Salesforce and native Salesforce apps.

There are also inherit challenges in using the Salesforce platform for enterprise grade applications. For example, built-in limitations on data volumes which come into play when dealing with big data such as processing transaction lines from distribution channels for chargeback and rebates calculation and processing.

Salesforce has limitations on parallel execution and calculation duration which affect applications such as pricing analysis and CPQ that may deal with large complex scenarios or models. There are also limitations in caching which can further degrade performance for applications such as CPQ that should be able to keep large models cached for better response time.

There are limitations on the Salesforce UI with view state limits that restrict the ability of the UI to incorporate advanced usability features to simplify complex user interactions. There are also areas of functionality or APIs that are missing for certain types of applications such as mathematical calculations.

Companies building applications on the Saleforce platform have taken three approaches to address these challenges. The most common is to work around the limitations by writing lots of complex APEX code – the Salesforce native development environment. This approach, although common, typically results in performance issues as transaction and user load scales.

The second is to wait for Salesforce to introduce enhancements. Model N works closely with Salesforce on coming developments such as Data Pipelines, BigObjects, Lightning UI and Wave Analytics to improve the Salesforce platform. However, our customer's digital transformation projects are underway and they need the additional capabilities now.

The third is to build external applications that interoperate with Salesforce. The challenge here is that the applications are not "native" and have issues with security, upgrades and overall management.

Salesforce Native Performance Architecture for the Enterprise

Model N decided to take the approach of transparently enhancing the Salesforce platform. Model N has enabled mission critical management of the end-to-end revenue lifecycle for some of the the world's largest companies. For over 16 years, Model N has been successfully delivering enterprise grade Revenue Management applications including pricing, quoting, contract life cycle management, rebates and channel management on a global scale. These applications manage over $200 billion in annual revenues in over 100 countries and are designed to be interoperable with our customer's ERP systems, in particular SAP.

Model N is bringing that proven expertise to the Salesforce platform in a suite applications called Revvy Revenue Management. These applications are built natively on the Salesforce platform and are designed specifically to leverage data and operational applications across the enterprise.

For over four years, Model N has been refining the architecture and deploying Salesforce native Revvy applications. We have become deeply familiar with the benefits and the limitations of the Salesforce platform. As a result, Model N has developed an advanced architecture to bring our Salesforce native applications to the enterprise grade level that we believe is necessary to enable digital transformation for our global customers.

Respect the Platform and Fully Leverage the Capabilities

The architecture for Revvy is built to leverage the full capabilities of the Salesforce 1 platform. Revvy applications are Salesforce native, multi-tenant SaaS solutions that are deployed in the same Salesforce org as the customer's Salesforce applications. They offer a highly available cloud infrastructure, with comprehensive security, proven upgradeability, device independence and easy configurability with simple developer tools. Revvy applications provide administration and management capabilities for the customer IT organization and a user experience that is consistent with Salesforce applications. There is no "punching out" to s separate application, no need to integrate security or user information, and no separate cloud platforms to manage.

The foundational aspect for enhancing the Salesforce platform was to respect and follow the platform framework for data models, transactions and UI actions, ensuring that Model N utilized standard APIs available in Salesforce. The models for all the data that are used by the applications are defined within Salesforce and stored within Salesforce.

Transactions are defined by the Salesforce platform, initiating and ending within Salesforce transparently to users, regardless of whether the transactions exclusively use basic Salesforce services or a combination of standard and enhanced Revvy services. And the user experience is always within the Salesforce UI. Revvy applications provide enhanced user experience for certain functionality within the Salesforce UI leveraging Lightning ready UI objects to deliver better usability.

The Revvy Salesforce Native Performance Architecture

Model N set out to solve three fundamental challenges in an architecture to enhance performance for Salesforce native applications: storage, calculation resources and memory resources.

The Revvy Advanced Salesforce Native Performance Architecture has three layers. The applications themselves are Salesforce native applications fully leveraging the Salesforce User experience. In certain parts of the Revvy applications, Model N has enhanced the UI with Lightning ready UI components to enable capabilities like a patent-pending model navigator in CPQ to simplify complex configurations.

The second layer of the architecture is the Revvy Data Platform which provides a unified data layer for the applications. Revvy Revenue Management applications store the majority of the data in the standard Salesforce objects. Data types, such as direct sales lines or channels sales data which could be millions to billions of lines are stored in Revvy data services and surfaced in the unified data layer as native Salesforce objects using Salesforce rest APIs and Lightning Connect technologies. To native Salesforce applications this approach is transparent, as the applications all call a native Salesforce object.

Revvy Advanced Salesforce Native Performance Architecture
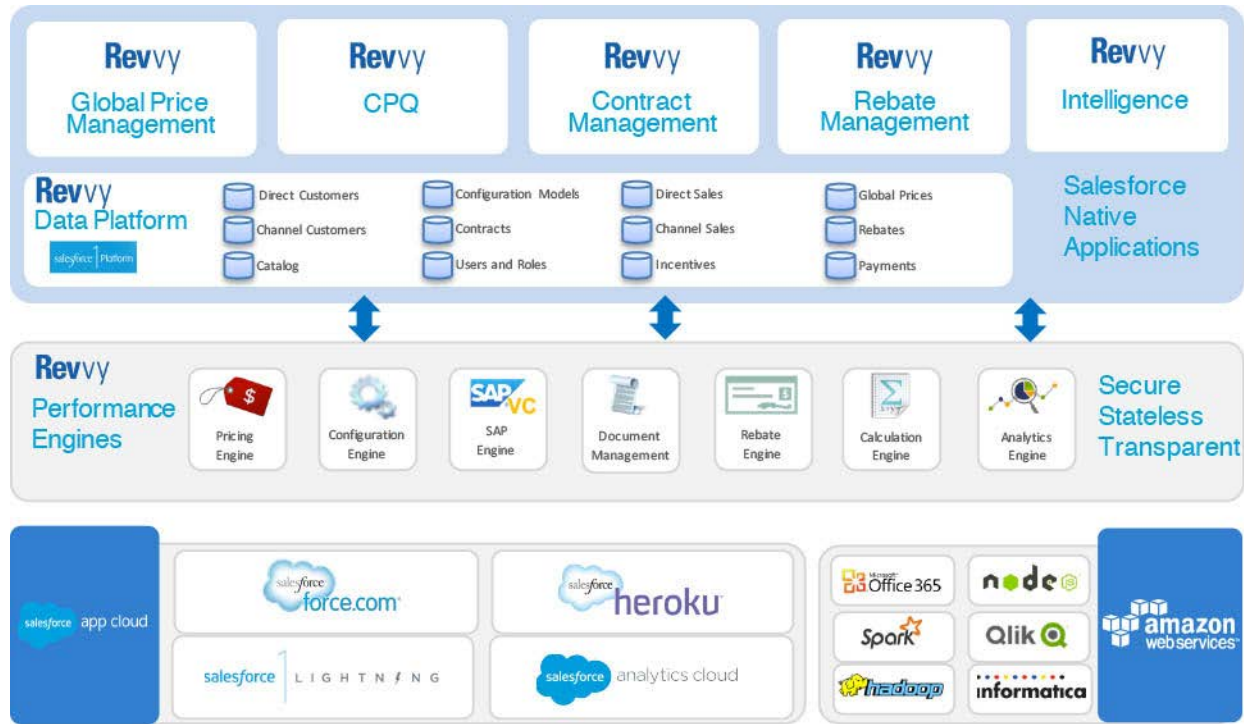
To address the challenges of calculation or computing time and memory limitations, Model N engineers developed a framework of specific, stateless performance engines. The engines do not store any data. They accept and process requests from the applications and everything they need to process the requests is included in the request. The engines operate within the Salesforce transaction and the service is completely transparent to the application user. In addition, the engines use highly secure 2-way SSL certificates to ensure that access is only through the known Salesforce entity. The engines are mutli-tenant, clustered services that are highly scalable and are operated within Salesforce App Cloud on Heroku or in a Model N AWS environment. The performance engines are used by several of the Revvy Revenue Management applications.

There are a series of different Revvy Performance Engines:

Pricing Engine – provides services for pricing sequence optimization and pricing for our Global Price Management, CPQ and Contract Management applications

Configuration Engine – supports high performance for complex configuration models and also includes an advanced caching mechanism. Model N built in a Node.js implementation of the Rete algorithm which caches models to improve response times for a user session. Any calls and rule chaining during the session are then evaluated in sub-second time, delivering instantaneous response for very large configuration models in order to overcome the inherent Salesforce synchronous heap limits of 6MB.

SAP Configuration Engine – a specialized engine that exposes the data and business logic of SAP pricing and SAP Variant Configuration to be called natively in Salesforce. This engine provides "out of the box" synchronization with SAP and prices and configures products from SAP exactly as if the action was being taken in the SAP system.

Calculation Engine – serves the Rebates Management application in processing and calculating massive amounts of sales transaction data for rebates. The engine utilizes Hadoop for distributed storage of data and Spark technologies to deliver high performance calculation for big data.

Document Engine – This engine enables the seamless use of Microsoft Word documents within our CPQ and Contract Management. The engine processes requests to create documents from data in the Salesforce environment and makes native use of SharePoint capabilities to very accurately merge document templates with data from Salesforce to produce hi-fidelity PDF and Word documents.

Utilizing the framework Model N uses for engines also allows the architecture to leverage world-class enterprise application integration (EAI) with robust high availability, monitoring and management tools, which is included in the Revvy platform and used to enable integration with many types of packaged applications and custom systems.

Delivering An Enterprise Grade Salesforce Platform

The Revvy Advanced Salesforce Native Performance Architecture was designed to meet the expectations of enterprise customers that are implementing corporate-wide digital transformation initiatives. Architected to leverage Model N's deep experience in delivering mission critical applications deployed on a global scale, Revvy Revenue Management brings enterprise grade capabilities to native Salesforce applications.

Design Principle 1 – End-to-End

Digital transformation is an end-to-end concept that incorporates processes that cross organizational boundaries, and include capabilities for both transaction processing and analytics. Price management or finance may own pricing models, but they are distributed across the company. Customer pricing and quoting is a sales and channel focus, but also increasingly self-service. Quotes are expected to have real-time access to back-end pricing, and are also expected to generate downstream orders and contracts seamlessly.

These contracts have a creation lifecycle with negotiation and redlining, but they also initiate price changes and incentive calculations once active. The traditional back-office incentives, settlements and accruals processing is now being exposed to the channels for self-service, while performance and compliance measurements are being fed back into the offer process for quoting and renewals.

The Revvy architecture addresses this enterprise grade principle by enabling a suite of salesforce native applications that span the entire revenue management lifecycle. The suite includes pricing, CPQ, contract lifecycle management, rebates and intelligence applications that are built to meet the needs of functional specialists in a shared process.

Unified by a common data layer, the architecture combines standard Salesforce objects with enhanced Salesforce native objects to handle the big data that digital transformation projects create, particularly those that embrace omni-channel sales.

Design Principle 2 – Robust and Interoperable

The demands of End-to-End transformations drive an architecture to deliver specific functionality and data regardless of traditional application silos. These systems are both on-premise and cloud based. It's not simply that data has to move between these systems, but data and services have to be available and delivered to a vast array of systems accurately, on-demand and without friction. For example, a CPQ solution should be able to leverage data and business logic in the ERP. However, if the CPQ is dependent on frequent calls back to the ERP for pricing and configuration this can cause a performance drain and bottleneck across the landscape. Duplicating the data and business logic is also sub-optimal in effort, cost and potential for error.

The Revvy architecture brings together critical master data and facilitates interoperability between multiple applications - particularly CRM and ERP systems - to create a foundation for transformation that leverages existing technologies. As a Salesforce native suite of applications, the architecture unifies CRM with a broad set of Revenue Management capabilities. Revvy offers deep interoperability with ERP and is designed to leverage the master data, financial systems and order management systems across the process revenue management lifecycle. The Revvy architecture also offers unique interoperability with SAP, and specialized engines tuned specifically to leverage the data and business logic in SAP Pricing and Variant Configuration.

Example Interoperability Flows
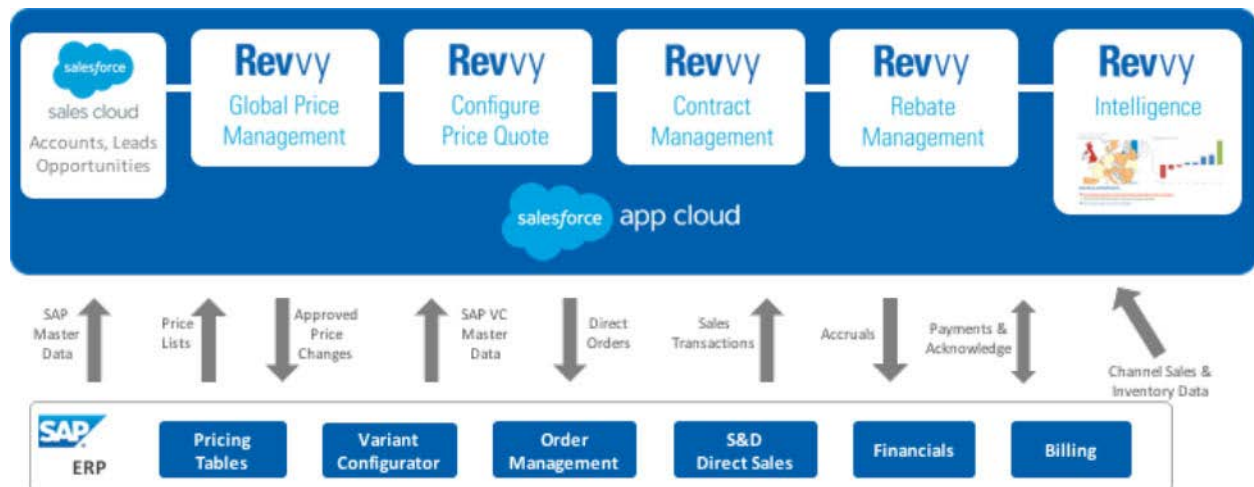
The example above is a typical interoperability scenario for the processes of pricing, quote to order, and rebate management in an SAP environment. Master data is loaded from the ERP incrementally as it changes. New pricing and promotions are published back to the ERP price tables and relevant downstream applications. SAP Variant Configuration KMATs are exposed to Revvy CPQ natively in Salesforce and completed orders are published directly into SAP order management as full functioning orders. As rebates are validated, Revvy sends accruals information to SAP financials, and when payments are calculated Revvy sends cheque/credit memo requests into SAP billing for execution.

Revvy also enhances the Salesforce platform with robust capabilities to perform demanding calculations and deal with mathematical inputs not possible in the standard Salesforce platform. The enhanced usability and caching improve upon the Salesforce platform memory limitations to deliver an improved user experience, particularly with complex models for configuration and analytics. In addition, Model N built out comprehensive tools to manage the complexities of the data, models, documents, prices and products included in transformation projects.

Design Principle 3 – Performance and Scalability

Digital transformation via cloud computing places a level of unpredictability on the corporate IT infrastructure. In addition to global scope, transformation projects reach out to channels and consumers, creating a potential user base that can be far greater than previous enterprise applications. In addition, services in the background need to be able to easily scale to accommodate peak usage which can be driven by any number of factors.

Revvy performance engines deliver a significant improvement in response time and scalability for the Salesforce platform. The performance engine's multi-tenant clustered design enables fast and efficient scalability as load increases, offering computing cycles for specific functionality transparently to Salesforce native applications.

The Revvy Advanced Salesforce Native Performance Architecture was designed to support linear scalability with deployments of 1000s of end users in a single org. The applications are built to handle 1000s of line items in quotes and pricing documents and millions of sales lines for rebates processing.
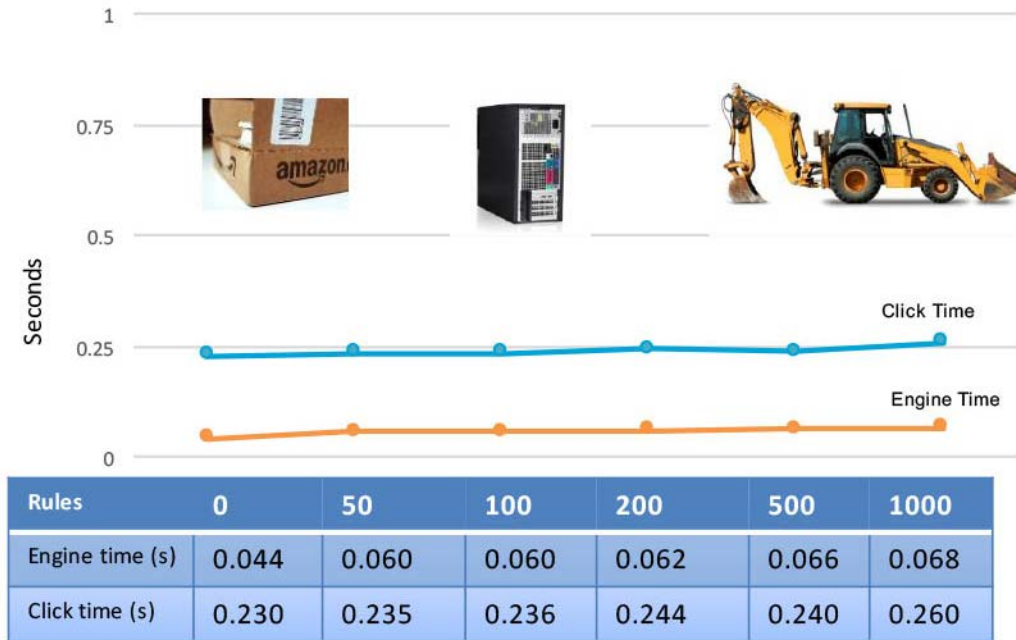
Model N tests and benchmarks the architecture seeking to continually improve performance. Two of the critical measures that are used in benchmarks are: response times as user load increases, and response times as model complexity increases for configuration.

For the sample below, we tested running up to 1000 users concurrently editing quotes of moderate complexity to ensure that response time holds steady as we scale.

Total users	100	200	300	400	500	600	700	800	900	1000
Response time	0.946	0.885	0.889	0.938	1.154	1.053	1.265	1.262	1.271	1.371

Jakob Nielsen's study provides a reference point with a target of 1 sec of less to deliver a seamless user experience. The response times show that the platform scales well: response times hold steady as the number of users increases by 10-fold.

Tests are done with configuration models growing to 1500 rules (mix of independent and dependent rules) over 100s of option groups to ensure that the engine responds linearly.

Rules	0	50	100	200	500	1000
Engine time (s)	0.044	0.060	0.060	0.062	0.066	0.068
Click time (s)	0.230	0.235	0.236	0.244	0.240	0.260

The architecture, supported by the configuration performance engine, responds extremely quickly even as the number of rules that fire grow significantly.

Conclusion

Digital transformation is driving a major change in the corporate IT landscape. In addition to the introduction of new technologies, digital transformation is unifying the traditional application silo's across the company. Model N has moved with this trend to unify our proven mission critical Revenue Management applications with CRM, leveraging the Salesforce 1 platform. Model N has enhanced the platform to bring enterprise grade capabilities to the Revvy Salesforce native applications. With the Revvy Advanced Salesforce Native Performance Architecture, Model N addresses critical areas within the Salesforce platform that can limit the usability of Salesforce for enterprise scale digital transformation, and delivers a Salesforce native foundation for our suite of enterprise grade Revenue Management applications.

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