

# Custom DU—A Web-Based Business User-Driven Automated Underwriting System

*Srinivas Krovvidy, Robin Landsman, Steve Opdahl,  
Nancy Templeton, and Sydnor Smalera*

■ Custom DU is an automated underwriting system that enables mortgage lenders to build their own business rules that facilitate assessing borrower eligibility for different mortgage products. Developed by Fannie Mae, Custom DU has been used since 2004 by several lenders to automate the underwriting of numerous mortgage products. Custom DU uses rule specification language techniques and a web-based, user-friendly interface for implementing business rules that represent business policy. By means of the user interface, lenders can also customize their underwriting findings reports, test the rules that they have defined, and publish changes to business rules on a real-time basis, all without any software modifications. The user interface enforces structure and consistency, enabling business users to focus on their underwriting guidelines when converting their business policy to rules. Once lenders have created their rules, loans are routed to the appropriate rule sets, and customized, but consistent, results are always returned to the lender. Using Custom DU, lenders can create different rule sets for their products and assign them to different channels of the business, allowing for centralized control of underwriting policies and procedures—even if lenders have decentralized operations.

The mortgage industry is very dynamic with frequent volume fluctuations, shifting investor requirements, and evolving regulatory and compliance standards, not to mention ever-changing customer demands. In the mid-1990s, Fannie Mae introduced Desktop Underwriter (DU), an automated underwriting system (AUS) that significantly improved the underwriting process (McDonald et al. 1997). DU and other automated underwriting systems have created enormous efficiencies in the mortgage origination process, and most lenders now evaluate conforming mortgage applications using such systems. AUSs have expanded the number of loans that lenders can make by significantly reducing the time and cost of originating a loan and allowing lenders to tailor loan terms based on an individual borrower's risk profile.

The Internet and other technology advances make it a necessity that mortgage operations run efficiently and smoothly. The Internet era is changing the expectations of customers across all financial services including the mortgage industry (Pafenberg 2004). Consumers want personalized services and solutions for their individual financial situation, not off-the-shelf, one-size-fits-all financial products. Mortgage lenders are required to satisfy consumer expectations while still adapting a technology infrastructure that has been primarily designed to process transactions and to meet the needs of investors. The Internet provides the perfect communications conduit for informa-

tion, decisions, transactions, and procedures.

Building on the success of AUSs such as DU, lenders have started looking at ways to extend the efficiencies of technology to other parts of the mortgage process. Fannie Mae developed Custom DU as a comprehensive system that allows lenders to create and publish their own customized underwriting rules, investor variances, and individual loan product messages. Custom DU provides lenders with the ability to leverage the power of DU for their other product lines, gaining operating efficiencies that give them more control of their pipelines. Custom DU enhances the process by allowing additional rules that lenders can apply to their mortgage production. An example is portfolio products. Custom DU allows lenders to build proprietary underwriting rules for their portfolio products and minimize manual intervention required to underwrite the loan. This enhanced benefit also applies to different products and different channels as explained in the following sections.

Custom DU also allows lenders to customize transaction output, the underwriting findings report (see the sample underwriting findings report sidebar). The findings report includes data supporting the underwriting decision from the system in the form of customized, transaction-specific messages and underwriting calculations. The lender can choose to leverage existing DU messages or develop proprietary messages and conditions.

## Sample Underwriting Findings

Underwriting findings is the report generated after an underwriting transaction. The findings include several messages generated by the underwriting rules and results from several underwriting calculations, along with some other data. The messages can be grouped under different sections and are completely customizable by the administrative users. The following list includes some of the customization capabilities provided by Custom DU:

- Findings report and title
- Findings section and header
- Labels for recommendations from the system
- Messages from DU findings and how they are mapped in Custom DU findings

## Business Problem Description

Fannie Mae purchases residential home loans in the secondary market and either retains them for its own portfolio or pools them together as mortgage-backed securities (MBSs) for sale to investors with a guarantee of timely payment of principal and interest. More than 2650 lending institutions—including mortgage companies, thrifts, banks, and credit unions—are approved to do business with Fannie Mae in the secondary mortgage market. Fannie Mae's DU is used to determine whether a loan complies with Fannie Mae underwriting guidelines. Fannie Mae purchases only conforming loans whose amounts are below a specified maximum loan limit. In addition to the conforming loans, lenders originate loans that are either too large to be eligible for purchase by Fannie Mae or may not be eligible for sale to Fannie Mae. While lenders are able to take advantage of DU for some of their mortgage products, they still have to address a couple of challenges: first, lenders need to underwrite loans that are not sold to Fannie Mae, including the loans they hold in their own portfolios or sell directly to other investors, and second, many lenders want to serve borrowers whose needs exceed conforming guidelines.

To address these issues, lenders had to put in place different business processes for conforming and nonconforming loans. It also meant that lenders could not replace some of their manual processes entirely. Custom DU was developed as a tool to address these problems and address the business and technical objectives that are discussed next.

## Business Objectives

Custom DU addresses a number of business objectives. First, it creates a single process for all loans. Lenders prefer to underwrite all of their business with one automated underwriting system that they can manage. It is ideal to have a system that allows them to build their own customized rule sets based on their risk factors and operational challenges. These rule sets are typically managed and maintained by business users. Custom DU helps to support further their underwriting needs.

It builds on their current investment and automated underwriting process and expands it to provide consistent loan recommendations and loan eligibility screening for all the products they originate. Custom DU provides seamless integration by leveraging the underwriting transaction, the loan file, and key components of the Desktop Underwriter recommendation.

Second, Custom DU originates more loans that meet investor requirements. Custom DU allows lenders to manage eligibility criteria for various investors without manual workarounds. Custom DU also provides a centralized way to change rules, resulting in consistent communication to all personnel.

Third, it reduces operational costs and increases efficiencies. By streamlining the entire loan origination and closing process, lenders can achieve greater efficiencies and potentially pass savings to customers. Fewer mistakes and less redundant workflows turn into quicker closings and an improved borrower experience. In fact, according to a recent mortgage benchmarking study, lenders that deploy automated underwriting at the point of sale recognize the largest per loan cost savings and achieve the greatest per person loan capacity.

Fourth, Custom DU targets specific niche markets or product types. Market changes demand that underwriting systems do the same. It is important that lenders can create products that are channel-specific or location-specific without additional paperwork or manual workarounds. Specifically, they need to be able to develop, automate, and implement complex niche products rapidly and on their own schedule. Custom DU allows them to create different sets of rules for different products without any programming assistance.

Finally, it ensures consistent communications. Automated underwriting provides a consistent approach for every loan. It also allows for centralized control of underwriting policies and procedures—even if lenders have decentralized operations. In addition Custom DU provides lenders with a capability to create customized underwriting findings with targeted messaging for pricing, processing, closing, postclosing, and vendor management.



## Technical Objectives

Based on the business objectives just discussed, the development team identified several overall technical objectives that directed the system architecture and design and the technology chosen for implementation. They determined that the system should have an administrative interface and a transaction interface with the following capabilities.

**Administrative Interface.** The system must allow lender product managers (or other nontechnical users with business expertise) to build and maintain a set of underwriting rules. It is critical that the user interface be easy to learn how to use and easy to remember how to use. The system must provide the ability for lenders to create new rules, change existing rules, and make changes effective immediately, or at a specified date and time. The system must provide a capability for lenders to assign different underwriting rule sets to different products. Appropriate rule sets must be chosen automatically based on the characteristics of the loan and the product under consideration during the transaction phase. The system must provide a capability for the administrative users to customize their underwriting findings including their format and headings. Changes to their findings setup must be effective immediately for future underwriting transactions. Finally, the system must provide a test interface so that users can test rules before rolling them out.

**Transaction Interface.** The system must provide a seamless integration for customers that are already integrated with DU. The system must deliver a fast, consistent, high-quality underwriting experience to customers by underwriting their custom rules without significantly increasing the underwriting transaction time. The system must provide a seamless process for end users. They merely need to submit a loan to underwrite and receive results.

**Additional Objectives.** The system must be easily maintainable, and system maintenance should not have any impact on the lenders' need to make changes to their underwriting rules at will. The system must be designed in a manner that supports complete backward compatibility when new enhancements are made to the system. Fannie Mae will handle all storage and processing requirements, and customers only need access to a PC and a browser. All processing (including writing rules and messages, testing, and so on) must be done 24 hours a day, 7 days a week, with no downtime for migrations. Minimal Fannie Mae technical support must be needed to answer/troubleshoot customer questions. End users must essentially be self-supporting from a technical perspective.

Based on these objectives, three core components were identified in the design of the system.

## Business Rules at Fannie Mae

Fannie Mae has a long tradition of developing rule-based systems, and the design of Custom DU benefited from various ideas successfully implemented in those systems. Fannie Mae developed and deployed a knowledge-acquisition and rule-management assistant (KARMA) and business rule server to allow policy changes to be implemented quickly and to provide business users with direct ownership and management of Fannie Mae's policies in a way that seamlessly integrates policy into the software applications (Sobieski et al. 1996). KARMA also introduced several business rule management concepts during the life cycle of business rules. As mentioned earlier, Fannie Mae developed and deployed Desktop Underwriter (McDonald et al. 1997), an automated underwriting system that applies heuristics and statistics to the underwriting problem. DU continues to be the leader among automated underwriting systems with periodic enhancements since its initial rollout. Building on the successes from KARMA and DU, Fannie Mae developed a formal business rule specification language (Krovvidy and McClintock 2000) that could be used by business users to specify their business rules in an unambiguous manner. More recently, Krovvidy and Bhogaraju (2005) discuss the concept of modeling rules as data and how the concept allows shipping and sharing of data and rules across applications, eventually leading to interoperability of business rules. They also mention a case study on how interoperable business rules can be used in the mortgage industry.

First, it should be a web-based GUI that can be used for editing and testing underwriting rules, customizing findings, and associating rule sets with appropriate products. Second, it should be a repository to store and retrieve lender-defined underwriting rules and data defined to associate lender rule sets with their products. Finally, it should have a rule engine that can accept loan data, identify the appropriate rule set, and dynamically load and execute the underwriting rules and generate customized findings.

Based on the successful use of business rules in automated underwriting systems, it was an easy decision early in the design that the underwriting rules in Custom DU must map to business rules.

Traditionally, business rule applications in busi-

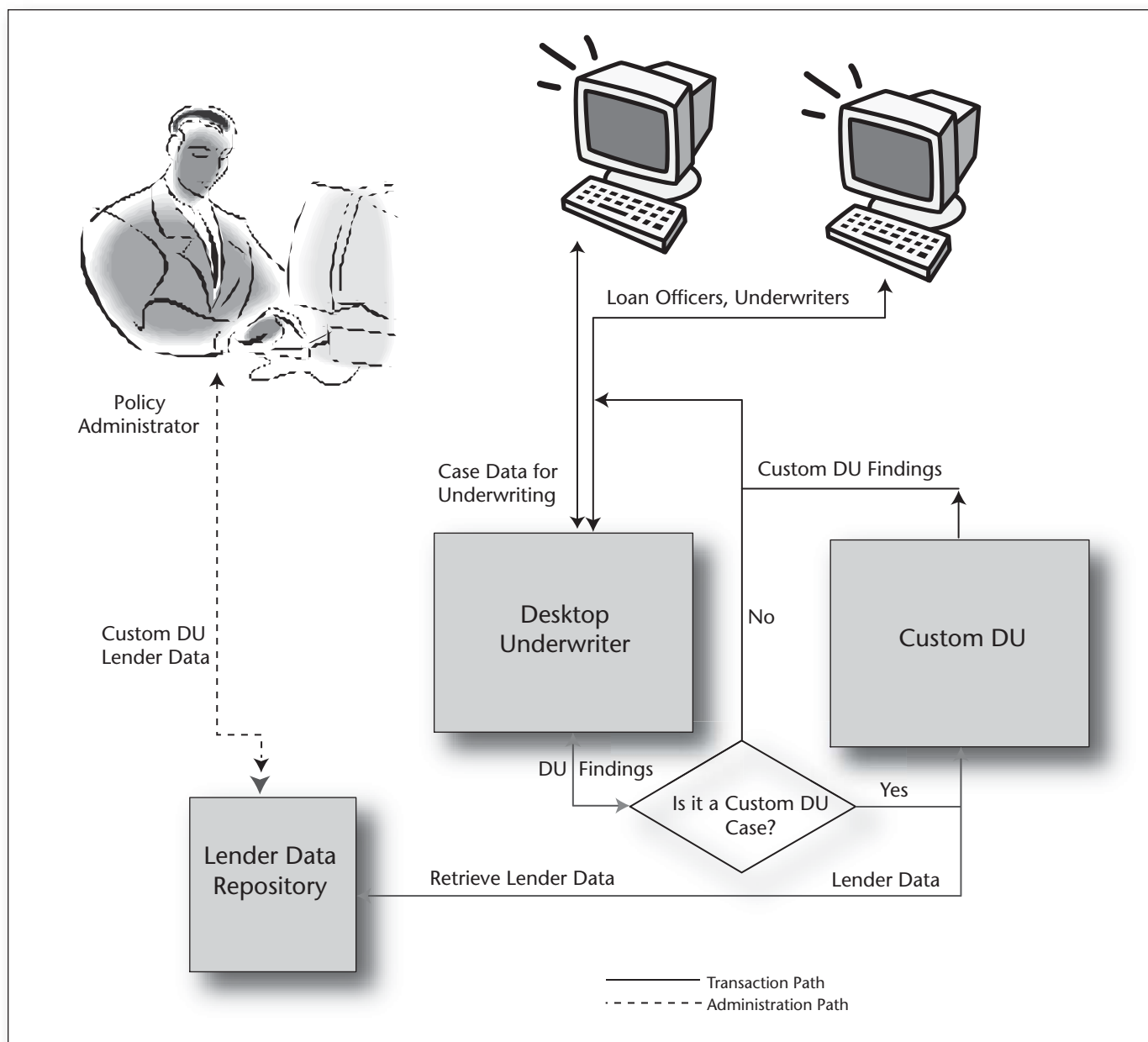


Figure 1. High-Level System Diagram.

ness to business (B2B) or business to customer (B2C) systems are designed such that they can receive data and execute a static set of business rules using the data shipped from the sender. The main advantage of using business rules for these systems is the efficient and consistent application of business rules. It is important to note that all transactions in these applications always execute the same set of business rules. For a system like Custom DU, however, the business rule set to be executed can be different for each transaction, as the appropriate rule set is based not only on the lender initiating the transaction, but also on the product that is being underwritten. In addition,

the business rule set can be modified in real time and the updated rule set must be effective for subsequent transactions. These requirements suggest that business rules should be treated as data and that each transaction should include not only the case data but also the business rule set as its input.

## Application Description

Customers interact with Custom DU in two different modes. Figure 1 depicts the administrative path and transaction path in a Custom DU session. The administrative path is used to create underwriting rules and to customize how and when the

eFannieMae.com | Custom DU® Home

**Guideline Manager**

A guideline is a set of rules and messages. This screen lists the guidelines in your system

Guideline Name	Status	Creation Date/Time	Last Modified Date/Time
<input type="checkbox"/> Fannie Mae Special – Texas 50(a)(6)	Fannie Mae	8/15/2003 08:19:08 AM	09/23/2003 09:34:53 AM
<input type="checkbox"/> Product A - Guideline	Active	03/14/2005 10:45:16 PM	03/14/2005 10:48:42 PM
<input type="checkbox"/> Sample Community Lending Guideline – April 2006	Sample	03/9/2006 03:21:12 PM	04/11/2006 11:58:40 AM

Copy Delete Create New Guideline...

**Left Sidebar Links:**  
 Help/Custom DU  
 Guideline Manager  
 View Rules  
 Create New Rule  
 View Messages  
 Create New Message  
 Test/Troubleshoot  
 View Activations  
 Activate Product  
 View Loan Routing  
 Edit Routing  
 Setup Custom DU

Figure 2. Custom DU Administrative Interface.

rules need to be invoked along with an ability to customize the findings from the underwriting engine. During the transaction path, the case is first underwritten by DU. If it meets the lender-defined criteria to be underwritten by Custom DU, appropriate lender data (including the relevant rule set, findings from DU, and case data) are sent to Custom DU. After Custom DU completes underwriting using the lender rule set, the findings are returned to the customer.

The administrative interface allows policy administrators to create and update rules and messages, test rules and messages, create and update activation rules that determine how rule sets are associated with products, and customize findings.

Figure 2 is a reproduction of a screen shot from the administrative interface of Custom DU. The left panel provides links to various administrative features of the application. In the context of Custom DU, the guideline and rule set are used interchangeably. As shown in figure 2, the guideline manager lists different rule sets that belong to the user.

A guideline consists of several rules. Each rule in a guideline can be edited separately. Each rule consists of multiple conditions and actions, and as

shown in figures 3 and 4, these conditions and actions can be created through drop-down boxes. For example, the selection of a data field for creating a condition determines the choice of operator, and this in turn determines the data fields that can be compared to create the condition.

Some of the important design decisions made during the development of Custom DU to support the following core principles are discussed next.

**Rules as Data.** An abstract rule language was created and layered over an existing commercially available system. ILOG JRules was selected due to its ability to support dynamic rule loading and XML binding, as well as the dynamic view of rules and data that it incorporates. Custom DU also uses the open interfaces provided by the ILOG JRules product to generate executable code from business rules. As shown in figure 5, the business rules stored in the rule repository are in XML format, and these rules are translated into low-level JRules at the execution level. In addition, sequencing of rules and association of data are predefined, and only a small list of predefined actions is provided. A custom GUI supports the creation and organization of business rules and related metadata in an abstract XML format, and this metadata is persist-

Lender	Product	Channel	Rule Set	Effective Date
1	30 YR FRM, 20 YR FRM, 7 YR ARM	Wholesale—Dallas	Rule Set A	2/1/2007
1	30 YR FRM, 20 YR FRM	Retail—NY	Rule Set B	8/15/2004
2	7 YR ARM	All—Chicago	Rule Set C	4/1/2007
2	Default	Wholesale—NY	Rule Set D	1/21/2005

Table 1. Rule-Set Assignment.

Figure 3. Custom DU Rule Editor.

Figure 4. Adding and Creating Conditions.

ed to a data repository. A code generator is automatically invoked to generate executable business rules when needed for testing or loan transaction processing.

**Designed for Business Users.** The Custom DU GUI must enable users to express their mortgage underwriting policy rules as business rules. Users do not need to know about the syntax of the language. An abstract data model was created and layered over existing data. Users do not need to know the underlying physical data model. The data available for use in the rules is strictly limited to the abstract data model. Users are able to customize their own (enumerated list) variables and use them when building rules. The system includes numerous predefined calculations available for building rules.

**Designed for Multiple Lenders.** The system is designed for scalability and can support several lenders concurrently. The rules are stored in a central location and can be dynamically loaded on demand at run time.

Table 1 shows a high-level view of how lenders can create different rule sets for their products and assign them to different channels of the business. These channels can be based on region or line of business. Each row represents the underwriting rule set that needs to be executed based on the product, the channel, and the date of the transaction.

## Development Process

Once the project team determined that there were no off-the-shelf solutions that completely addressed the project needs, the development process began with an extensive analysis effort. Technical and business analysts worked together to identify the desired functionality, capture both business and performance requirements, and design the application flow and user interface. The analysis process was structured and method-

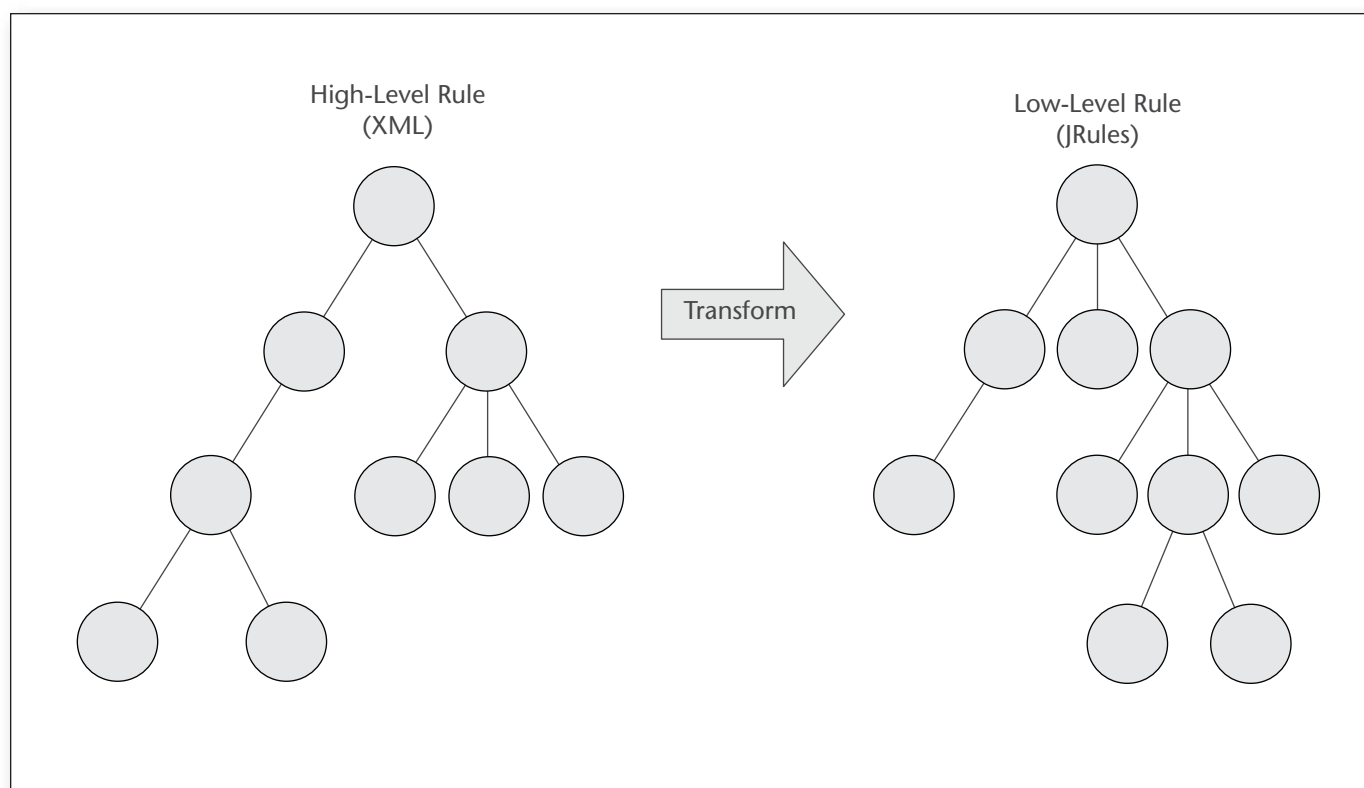


Figure 5. Custom DU Rule Translation.

ical with much work occurring prior to the start of any development tasks. Once the analysis phase was well under way and the core requirements were determined, the development team identified and prototyped some of the more critical algorithmic and risk aspects of the application. These prototypes served as both a proof of concept and a tool for eliciting input from business partners and other stakeholders. The decision to devote significant time to up-front analysis and prototyping resulted in minimal misunderstandings and little rework during the development phase of the pilot project.

### Architecture, Design, and Development

The project's senior architect put together the overall architecture document for the application and worked with the development teams in developing core architecture principles and interfaces between the different components of the application. Detailed high-level and low-level design documents were created and carefully reviewed for all the major components of the application. By careful interface design, a majority of the components could be developed in parallel. The project team during the initial development effort consisted of four to six developers and two to three analysts, depending on the tasks that were being performed

at a particular time. In addition, a quality assurance team was involved in testing the application. The first pilot version was completed in less than 12 months after the decision to build the product in house was made.

When the application was in pilot, the Fannie Mae business team worked closely with pilot customers to understand their experiences with the application. Feedback was solicited and reviewed in order to determine those enhancements that would be needed to make the application attractive to a wider audience. Custom DU was rolled into full production to interested lenders in 2004. Since the application was designed to be scalable and flexible, the pilot version of the application was seamlessly enhanced to become the production application without any disruption to the pilot customers. Since then there have been multiple releases with numerous functional and performance enhancements with virtually no customer impact.

In addition to the typical hurdles, such as staffing and budget concerns, the project also encountered some more atypical difficulties during the initial development of the application. The project team included a group of individuals who were brought together because of their skill sets. These individuals reported to several managers



scattered throughout the organization. The project team worked at multiple locations and had not previously worked together, a situation that could have caused project delays. Team members compensated for this by holding regularly scheduled meetings and by documenting and reviewing and revising all relevant information, including use cases and sample screens. In addition, the team members were accustomed to using different development methodologies including XP, Agile, and waterfall. The project team used this to their advantage. Within the overall project, the development methodology used for a component was based on the project timeline needs, including dependencies on other components. This approach gave developers the opportunity to learn methodologies that they would not have been exposed to otherwise.

One of the key challenges was developing a system for external use and capturing requirements from a small group of potential users. Since many of these lender customers had never managed a rule-based system, it was a challenge to create an interface that accurately represented the way they conceptualized their products. During the requirements-gathering phase, lenders commented on screen mock-ups, and their initial feedback was to manage the rules with a single rule set that contained the underwriting rules for multiple products. Later, when they saw the prototype that depicted this approach, they realized this would not work for their environment, where the underwriting rules for many products change on a regular basis.

The production version of the tool allowed users to create separate rule sets for each product, so they could make changes to the products independent of one another. Lenders were happy to trade off the challenge of having the same rules replicated across multiple products for the flexibility to make changes for dynamic products in an easy and efficient manner. An additional challenge was creating a user-friendly interface for building rules that allowed business users to build rules as if they were experienced rule writers. The project team was able to leverage their experiences with previous systems such as KARMA (Sobieski et al. 1996) during this phase.

The application was designed from the outset to accommodate new functionality without affecting existing customers. One of the most challenging obstacles was the ability to thoroughly test the application prior to rollout, since exactly how each of the lenders will use the provided functionality cannot always be anticipated. This risk was mitigated by including testing partners from the onset of all development initiatives and by including significant testing time in the project plans.

The ever-changing nature of the mortgage

industry forced an iterative approach to development. It was understood from the beginning that the system needed to be built so that it could be changed easily and quickly. Creating multiple system components was one way to address the requirement for system flexibility. The team also learned that having the right set of skills was more important than having a large team and that up-front analysis was important in reducing the amount of rework and miscommunication.

Thorough and complete documentation also improved the development process and allowed the staff to provide a superior level of customer support. Additionally, the development team had experience from an earlier effort (Krovvidy and McClintock 2000) in translating business policy to formalized business rules. This experience was shared with business partners and included emphasizing the significant up-front analysis required before the tool could be used to build business rules. This in turn helped business partners when they trained lenders in creating and maintaining their underwriting rules.

Finally, the Fannie Mae business team works closely with lenders once they choose to use Custom DU by providing them with extensive training and helps them by sharing best practices on extracting business rules from business policy. Typically, it is more difficult to train users on the abstract concepts related to business rules than it is to train them on how to use the tool.

## Maintenance

Fannie Mae has a robust, three-tier product-support environment that can respond quickly and accurately to customer problems. The first tier is the DO/DU Hotline, which resolves customer problems directly or escalates them to a production support team. All problems that cannot be answered by the production support team are forwarded to the business team or the development team for more extensive analysis. These individuals are contacted when production issues arise. In addition, the system has a built-in troubleshooting capability that customers can use to debug their cases. This capability provides them with more detailed trace and debugging information about the rules.

As Custom DU production volume continues to increase, Fannie Mae continues to work proactively to detect and address issues as early as possible. The Custom DU business team regularly solicits feedback and enhancement requirements from lenders to ensure that the system continues to meet their needs. The development team regularly monitors performance and storage requirements and proactively implements software upgrades and performance enhancements on an ongoing basis.



Soon after Custom DU was rolled out for general use in 2004, the quick adoption of the tool by various lenders necessitated the implementation of more efficient indexing and compression techniques for storing and retrieving lender data. These enhancements were rolled out in 2005. Similarly, upgrades were made in 2006 to the underlying rules product and third-party products used in the application. These changes were made in addition to several functional enhancements made to the system since 2004.

## Insights Gained

We made several key observations. First, a simplified rule language is sufficient for most underwriting, and inadequacies can be rectified through predefined calculations or other mechanisms. Second, it is important to capture, model, and provide support for metadata outside the underwriting guidelines in order to prevent lenders from embedding it in their underwriting rules. Third, the additional layers of rule and data abstraction provided lenders with considerable stability to their underwriting rules, even when significant architectural changes were made to the system and when significant data changes were made to their underwriting data points.

Initially, the business users wrote simple rules with low complexity. Once they became proficient at rule building, they wanted much more complex and powerful capabilities. It is an ongoing challenge to balance the need for rule-building power with the amount of technical knowledge a user needs to be able to use the system.

## Lessons Learned

Approaches with no sequencing or prioritization of rules were tried but were insufficient for the problem domain. Implicit sequencing of the rules based on typical underwriting use proved to be remarkably well-received. Previous prototypes using less dynamic bindings to rules and data clearly indicated that an approach that used standard techniques of compilation, testing, and release dates would be unattractive to customers. The ability to create, edit, test, and deploy rules at any time against existing customer underwriting traffic through DU required an architecture that can treat all aspects of the system as data—including scheduling information, routing information, underwriting rules, and presentation styles, as well as traditional underwriting data points such as credit and loan information. There is a need to model the user interface based on how end users organize and segment their business. What makes sense from a rules perspective does not always make sense to business users.

## Application Use and Payoff

In 1995 it cost about \$4,000 to originate a loan and took 20 days to get approval, and the process relied heavily on paper, courier, and fax. After AUS entered the market, the underwriting space was changed forever. For example, in 2003 the estimated cost to originate a loan dropped to \$1,500 or less, and approval took an average of 20 minutes through the use of Fannie Mae's DU. Now Fannie Mae has again pushed the envelope and introduced Custom DU, through which lenders can customize DU with their own rules. The following is a sample set of lenders benefiting from Custom DU.

Garritano (2005) discusses how users like a large Dallas-based mortgage company are able to embed Custom DU into their loan-origination system and directly pass information back and forth seamlessly. With DU and Custom DU, this company has been able to take the automated underwriting decision directly to the point of sale because its messaging is so clear and comprehensive. According to this article, this company felt that Custom DU is one of the best systems built by Fannie Mae. It found that Custom DU was easy to learn and that one didn't have to have a lot of programming knowledge to build the rules. The rules were also easy to test, and the system was easy to roll out. Custom DU not only let the company customize the rules to meet its needs, but also provided it with the ability to move with the industry.

Kersnar (2004) highlights the following proven benefits lenders realize in using Custom DU: enhanced pull-through rates—enhanced as much as 20 percent—and an aggressive return on their investment within 12 to 18 months of fully implementing Custom DU. Another benefit is the improved relationship Custom DU creates for lenders with correspondents and brokers.

In April 2006, a large mortgage bank announced how it used Custom DU to leverage its custom business rules on additional products other than standard Fannie Mae loans. In July 2006, a major mortgage wholesale company announced how integrating with DU/Custom DU would enable brokers to get a preapproval prior to loan submission, giving its clients a decision in minutes, not days. Custom DU is also seamlessly integrated with some of the leading mortgage vendor technologies to make the service more readily available to the market.

A major mortgage bank successfully deployed Custom DU to provide easy and consistent underwriting responses. The system was used to evaluate each applicant for income, employment, credit history, assets, liabilities, the loan-to value/combined loan-to value, and other variables. These parameters were then compared to the requirements contained in the bank's underwriting guidelines and product summaries to determine

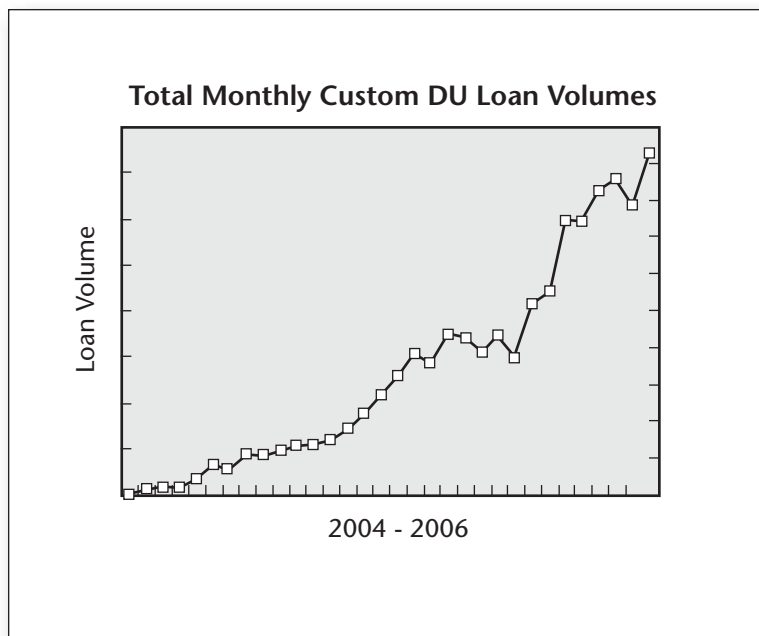


Figure 6. Growth in Custom DU Volumes since 2004.

whether the applicant was eligible for approval. This application provided several benefits to the correspondents of this bank, such as reduced underwriting turnaround time, increased production capacity, relief from certain reps and warrants (representations and warranties), and the ability to deliver loans with larger amounts, provided they were underwritten by Custom DU.

Prior to the development of Custom DU, Desktop Underwriter was used to obtain a credit evaluation from a borrower's application. However, an approve decision from DU would not automatically lead to a loan commitment, because the rules applied by Desktop Underwriter can differ from those applied by the bank's underwriting guidelines and product summaries with regard to items such as maximum debt-to-income ratios and required reserves. In addition, the streamlined documentation offered by DU findings was not allowed on some of the bank's nonconforming products. Custom DU eliminated these inefficiencies.

The success of the Custom DU application

ABC Lender Underwriting Findings			
SUMMARY			
ABC Lender Recommendation	Not Eligible	DU Recommendation	Approve/Ineligible
Primary Borrower	John Homeowner		
Lender Loan Number		Casefile ID	
Underwriting Run Date	Sep 25 2002 12:41:37PM	Submitted By	a9136dng
Mortgage Information			
LTV/CLTV	92.000% /90.000%	Note Rate	6.500%
Housing Expense Ratio	29.000%	Loan Type	Conventional
Total Expense Ratio	8.780%	Amortization Type	Fixed Rate
Total Loan Amount	\$100000.00	Loan Purpose	Purchase
Sales Price	\$114000.00	Refi Purpose	
Appraised Value	\$110000.00		
Property Information			
Address	123 Main Street Arlington, VA 22201	Property Type	Detached
ABC Lender Recommendation			
1	This case is not eligible. The maximum qualifying housing to income ratio for this case is 28 percent.		
2	This case is not eligible. The loan to value ratio has been exceeded.		
3	This case is not eligible. One or more borrowers have a 30 day late mortgage payment in the past year.		
4	This case is not eligible. John Homeowner has a FICO score less than the minimum value of 620.		
ABC Lender Product Requirements			
5	Verify this is not an assumable loan. Jumbo mortgages are not assumable. The borrower may not take over the sellers mortgage.		
ABC Lender Processing Instructions			
6	If more than 5% of the down payment is from gifts and grants, verify the source of funds meets Fannie Mae guidelines.		
7	If there are seller contributions, verify the contribution is less than or equal to 3 percent of the downpayment.		
8	Verify a reserve of at least 2 months PITI.		
9	Verify mortgage insurance of 30 percent, annual.		
10	Verify the employment history recommendation for each borrower follows Desktop Underwriter findings.		
11	Verify all borrower assets meet Fannie Mae guidelines. Follow Desktop Underwriter asset recommendations.		
ABC Lender Documentation Requirements			
12	Two full 1004 appraisals are required, regardless of the Fannie Mae findings report.		

Figure 7. A Sample Custom DU Findings Report

resulted in a continuous increase in the volume of transactions since 2004. Figure 6 depicts the growth in Custom DU volumes. Figure 7 depicts a sample Custom DU findings report.

## Acknowledgements

The success of Custom DU is the result of many individuals. We thank Celina Binns, Terri Davis, and Philson Lescott for their support, guidance, and thoughtful leadership of the project. Special thanks to Joe Hallett, Lisa Strachan, and Shannon Lloyd for their leadership during the project. Thanks to Milind Naikwadi and Linda Wilson for their significant contributions to the project. Additional thanks to all the developers including Cathy Doman, Kevin Bates, and Santanu Dutt and to the implementation team including Shane Hartzler and Colin Deaso. Special thanks to Crystal Ferguson Brown for help in testing. The project and the article benefited from the work of many other individuals from other teams, and the authors appreciate all their help. This article was developed by Fannie Mae. Desktop Underwriter and DU are registered trademarks of Fannie Mae. Custom DU is a trademark of Fannie Mae.

## References

- Garritano, A. 2005. Anchor's Way. *Mortgage Technology* (April).
- Kersnar, S. 2004. The Evolution of DU. *Mortgage Technology* (October).
- Krovvidy, S., and Bhogaraju, P. 2005. Interoperability and Rule Languages. Paper presented at the W3C Workshop on Rule Languages for Interoperability, Washington, DC, 27–28 April.
- Krovvidy, S., and McClintock, C. 2000. Integrating Business Rules and Objects. Paper presented at the Business Rules Forum, Atlanta, GA.
- McDonald, D. W.; Pepe, C. O.; Bowers, H. M.; and Dombroski, E. J. 1997. Desktop Underwriter: Fannie Mae's Automated Mortgage Underwriting Expert System. In *Proceedings of the Ninth Annual Conference on Innovative Applications of Artificial Intelligence*, 875–882. Menlo Park, CA: AAAI Press.
- Pafenberg, F. 2004. The Single-Family Mortgage Industry in the Internet Era: OFHEO Research Paper. Washington, DC: Office of Federal Housing Enterprise Oversight.
- Sobieski, J.; Krovvidy, S.; McClintock, C.; and Thorpe, M. 1996. KARMA: Knowledge Acquisition and Rule Management Assistant. In *Proceedings of the Ninth Annual Conference on Innovative Applications of Artificial Intelligence*, 1536–1543. Menlo Park, CA: AAAI Press.

**Srinivas Krovvidy** is a senior manager with Fannie Mae where he has been involved in managing design, development, and implementation of knowledge-based systems and knowledge acquisitions tools. He has been associated with knowledge-based systems development for



about 18 years and is also involved in enterprise architecture and infrastructure development efforts. His research interests include knowledge acquisition, machine learning, and business rules representation. He received his BE from Osmania University, MTech from Indian Institute

of Technology, and a Ph.D. in computer science and engineering from the University of Cincinnati. He is a member of ACM and AAAI.



**Robin Landsman** has worked in the IT industry for approximately 20 years. She joined Fannie Mae as an analyst in 2000. She has a BA in psychology from the State University of New York at Stony Brook and an MBA from Baruch College.



**Steve Opdahl** is a senior developer with Fannie Mae where he has worked on Custom DU since its inception. He has 20 years of work experience across a broad spectrum of technical areas spanning software development, system administration, data communications, and real-time systems. He holds

a B.A. and M.S. in computer science.



**Nancy Templeton** is a senior product manager at Fannie Mae. She has 20 years experience developing innovative software products and risk-management solutions. Templeton was the business lead on the Custom DU project and contributed to the concept development, business requirements, market test, and rollout. She received

a BA in molecular biology and an MBA from the University of Colorado and can be reached at [Nancy\\_Templeton@fanniemae.com](mailto:Nancy_Templeton@fanniemae.com).



**Sydnor Smalera** is a senior consultant at Fannie Mae, providing analytical support to knowledge-based systems for the past 7 years. She has been involved in software development for the past 12 years. She has a BS in psychology from Randolph-Macon College.