The Credit Assistant: The Second Leg in the Knowledge Highway for American Express

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This chapter describes the development and deployment of the credit assistant (CA), a knowledge-based system to support credit operations for Travel-Related Services (TRS) of the American Express Company. CA was developed using ART-IM, a rule-based programming environment from Inference Corporation. American Express developed this application under a UNIX environment (SUN and RS/6000) and deployed it into a high-volume real-time mainframe environment. CA was designed to be fully cooperative across business operation units with the authorizer's assistant (AA) and other knowledge-based systems currently under development. CA also reflects advances in technology and general trends in the AI industry that have taken place since AA was implemented in 1989. This chapter also introduces the *knowledge highway* concept, the design and construction of a series of cooperative knowledge-based systems to support a global operational strategy of authorizations, credit operations, fraud detection, new account processing, and customer service

at American Express.CA was designed to support online credit analysis of card members within the credit operations environment of American Express and to synergistically interact with AA (Dzierzanowski et al. 1989). Credit Operations reviews accounts for the Personal, Gold, Platinum, and OPTIMA card products for credit risk and potential fraud situations. The review process is driven by internal American Express risk management statistical models, which set up risky accounts to be reviewed by analysts. Accounts in question could be set up for many reasons, for example, those showing a delinquency or a history of past due balances. When an account is queued to an analyst for inspection, CA is invoked to support the review by denoting interesting features on the card member's account and recommending actions. Previous to the implementation of CA, a case required, on the average, 22 transactions to achieve resolution. With CA, one transaction can review data, synthesize information, annotate an account, and provide advice and recommendations to a credit analyst. Advice ranges from setting the account up to be reviewed again in several weeks to recommending the cancellation of a card in serious situations. To support continuous training, scripts are also generated if interaction with the card member occurs. In addition, CA ensures that credit policies are consistently enforced. For example, state laws vary on permissible collection activities. Collection procedures allowed in Minnesota might be illegal in Maine. CA takes all the different statutes into account and guarantees that the analyst is in compliance. As scheduled enhancements are rolled out, the system autonomously makes decisions on some cases, composes letters to card members, orders additional information when necessary, and routes accounts into queues for specific actions by analysts.

Designed as components in the knowledge highway of cooperative expert systems, CA and AA have been built for compatibility and allow for the real-time exchange of data. Results from one system can be incorporated into the decision process of the other. AA is part of American Express's front line of service in credit authorization at a point of sale. It interfaces with the TRS credit authorization system (CAS), which is based on a transaction-processing facility–based system built for high volume and transaction rates. AA handles transactions referred by CAS. Those charges that are not resolved by AA automatically are then sent to an authorizer with supporting advice and recommendations, thus serving as a decision support tool.

Credit Assistant Expertise and System Review

The CA expertise is segmented into components that analyze accounts

across a number of dimensions. These components include the credit-analysis expertise; expertise to recognize fraudulent use of the card (that is, mail-order fraud); a component to recognize misuse of the card by the card member or supplemental card members; expertise to recognize administrative errors on accounts and remove outdated information; a component to recognize special customer service situations; a component to generate scripts if interaction with the card member occurs; and a dimension that determines the reason the statistical models set up the account for review.

When an account is set up, it can remain in review for weeks and be reviewed a dozen or more times by many analysts before the issue with the account is resolved. Therefore, the expertise must support handling the account over time and consider the actions already taken by CA and analysts on the account. For example, suppose the initial recommendation was to talk to the card member to obtain additional financial information. Accordingly, the analyst attempts to telephone the card member but is unsuccessful. In this situation, CA aids the analyst in deciding what to do: for example, send a letter, fax the card member, or wait and try to telephone the card member at a later time. Also, depending on which of these actions is taken, CA decides what date to set for the account to be brought back up for a continuation of the work effort. These decisions vary depending on the account status (that is, whether the account is delinquent or perhaps has an unusually high balance), previous experience with the card member, and the credit laws where the card member resides that regulate how often contacts can be made with the card member. When the account is activated again to continue the work effort, CA must take into account the actions already taken or attempted as well as spending activity that has occurred in the interim.

In making a decision on an account, CA accesses a large source of internal and external information about the card member. Depending on what is available for each card member, these data can include card member banking information; statistical risk management model account evaluation; card member information (occupation, income, and so on); history of the account, including payments, delinquencies, and types and amounts of purchases; AA's evaluation of the account; history of the Credit Operations current and previous interactions with the card member, and the credit bureau report

CA is invoked when an analyst working at a 3270 terminal pulls a case out of a work queue from the work-flow management system. To fit into the MVS-IMS environment, CA is embedded into a transaction, which is controlled with a COBOL driver program. Part of the COBOL code maps data directly from IMS databases to a screen. The driver program also

passes the IMS data, AA's evaluation of the account, and the CAS information to the knowledge-based system portion of the CA transaction. The flexible advice and recommendations region is built by the knowledge-based system portion of CA and passed back through a buffer to the driver program for display. To further refine the information that is presented to the analysts through the advice and recommendations portion of the screen, rules were designed to select and prioritize account information for display. Therefore, the best of both technologies is used: COBOL for transaction control in a mainframe environment and display of static data and the knowledge-based system for the reasoning component and flexible display of account control information and analytic results. CA operates in a real-time environment and has become the primary credit review and analysis transaction.

Development and Deployment Strategy

The knowledge-based system industry has moved away from the requirement of highly specialized development hardware to more conventional environments such as UNIX workstations, personal computer (PC) platforms, and mainframes. In many cases, knowledge-based system vendors now fully support platform portability that allows application developers to select development and deployment options based on cost-benefit business issues. CA took advantage of these trends. The rule-based expertise was developed using ART-IM and MOTIF on a UNIX platform (both the SUN and the RS/6000 were supported). The rules were then deployed in a mainframe environment. Tools were specifically built on the workstation to represent American Express–specific data structures, address technology transfer issues, support context-sensitive help, and speed interactive development and testing. As a graphic user interface standard, MOTIF was selected to support portability, and resource languages were used to ease maintenance. The knowledge-based component of CA was designed for performance; therefore, a forward-chaining, data-driven approach was selected with rules to control expertise and the overall system.

Strengths and Weaknesses

As with any project, there are aspects that the developers recognize as accomplishments and issues with the system that would be handled differently in the future. Some of the strengths of the CA environment are as follows:

Regression test bed: CA has the ability to verify, validate, and statisti-

cally measure the expertise in terms of its impact on the credit operations environment.

Control panel: CA has the ability of a manager to control various aspects of the CA expertise to support the management of daily operations. For example, if volumes are unexpectedly high, CA can be empowered with greater decision-making authority to resolve certain cases without human intervention.

Information overload: CA handles the information overload situation by reviewing and subsequently presenting only the necessary account information with recommended actions, thus turning data and information into knowledge.

Ability to reason over time: CA can reason about previous actions that it recommended on an account, analyze effectiveness, and subsequently recommend new actions.

Weaknesses embodied in CA include the following:

Mainframe deployment: Because of mainframe release cycles and procedures, rapid change to the knowledge base is difficult.

3270 interface: Given the nonconversational IMS mainframe environment, the screen design and overall flexibility of the user interface is diminished.

Project Team, Timelines, and Cost

The project team comprised members from TRS Advanced Technologies, Business Systems Development, Credit Operations (business analysts were the domain experts), and Risk Management, as well as external contractors, to support one-on-one training. The project spanned a period of 18 months from conception to deployment. Although it might seem that this duration is lengthy, the time required to develop business requirements and achieve consensus from all U.S. operation centers demands such project length. It is the perspective of corporate American Express that knowledge-based systems have matured from a risky technology (as prevailed when the development of AA was undertaken) to a stable technology. Therefore, the corporate technology strategy currently funds knowledge-based system R&D projects to support a technology paradigm shift and infuse this technology into conventional system development and maintenance organizations. The project team consisted of one technical project manager, one senior knowledge engineer, 2 system development programmers, one knowledge engineer for technology transfer and rule development, one UNIX-MOTIF ART-IM developer for the construction of the workstation development environment, two business representatives, and one risk management representative.

Implementation Strategy for Knowledge-Based Systems

When management decided to continue the construction of knowledge-based systems based on the success of AA, a case study of the success of AA was initiated, and the results were applied to other portions of the business. The study indicated that systems of this type can broadly be applied in operations such as (1) work-flow management, (2) referral reduction, and (3) advice and recommendations.

Knowledge-based system technology can be applied to the work-flow management of card member accounts as cases are moved from one area to another for work and can perform a series of simple actions on the account. Referral reduction is a goal in a high-volume, transaction-oriented environment. Systems such as AA and CA allow for the automation of many decisions that previously would have been referred to an analyst for action. Finally, when a card member's account cannot be handled automatically by a knowledge-based system, advice and recommendations are generated and provided to the analyst on how to handle the account. With these three broad strategies, knowledge-based systems support growth of the business while they control expenses, help enforce compliance with regulatory laws, help implement American Express best business practices, decrease training time, and provide consistent quality service to the card member.

Knowledge Highway Concept

The knowledge highway is the concept of a series of cooperative knowledge-based systems that utilize the results of each component member of the highway to support company-wide service to the card member. An example from the medical domain illustrates the concept of the knowledge highway: Imagine a patient undergoing medical treatment by a general practitioner, who consults with an orthopedic surgeon and a neurologist for diagnosis of spinal pain. In consulting with specialists and using their expertise, the general practitioner accesses specialized expertise outside his/her own realm of expertise. He/she taps into a cooperative human network (knowledge highway) that he/she has established with a number of medical specialists to help properly diagnose and treat the patient. In a comparison of this notion with the business of American Express, a card member can call in with a customer service issue, which invokes a knowledge-based system to support the interaction between the card member and the customer service analyst. In resolving the customer's concern, other knowledge-based systems can be invoked to review a possible fraud or credit-related issue.

The deployment status of the knowledge highway in American Express is as follows:

Authorizer Assistant
U.S.–wide production, November 1989

Credit Assistant
Initial production operating center, August 1991
Full U.S.–wide Production, December 1991

New Accounts Assistant
Expected deployment, November 1992

Information Technology Issues: Waterfall Versus Modified Spiral

The waterfall development methodology has been used successfully in traditional large system development; however in a practical sense, the waterfall methodology was not designed to support largely heuristically based systems. In contrast, the spiral methodology is most often used in object-oriented programming systems, but it does not explicitly denote the incorporation of management control and review. Therefore, a blend of the best of both approaches was used to develop a methodology that would support knowledge-based system development in our corporate environment.

The spiral methodology was modified to incorporate an empowered user into the technical development team for immediate decisions and, most importantly, couple the development process with the appropriate management checkpoints to ensure development was meeting user requirements and expectations. This modified spiral approach supports the rapid prototyping concept that contributes to faster time to market and improved developer productivity with the appropriate management controls often required in large corporations.

Maintenance

CA was designed to rapidly add expertise enhancements and provide legacy. The members of the system development organization that is responsible for the support and enhancements to American Express applications were part of the CA development team. One of the major goals of the project was to facilitate the technology transfer process of knowledge-based systems from an advanced technology group to the system development organization. The system group is now responsible for all CA changes and enhancements.

Conclusion

CA was successfully deployed to provide online interactive support to the credit operations business of American Express. From a technology perspective, one accomplishment of CA was to develop a system on a UNIX workstation using industry-standard products (ART-IM and MOTIF), supporting developers with a fast, portable, and flexible environment, and deploy the knowledge base into a mainframe environment for economies of scale. Finally, from a higher corporate business view, CA is the second leg in a continuing strategy to build and deploy cooperative knowledge-based systems (the knowledge highway), provide improved customer service, manage business operations and growth, and reduce credit and fraud losses.

Acknowledgments

References

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