Redpaper

Martin Keen
Rashmi Kaushik
Kulvir Singh Bhogal
Amit Aghara
Scott Simmons
Richard DuLaney
Sunil Dube
Adeola Allison

Case Study: SOA Banking Business Pattern

This IBM® Redpaper™ publication is one in a series of service-oriented architecture (SOA) papers that feature a case study that involves a fictitious company called *JKHL Enterprises* (JKHLE). In this paper, we focus on the banking division of JKHLE titled *JKHL Bank*.

The focus of the case study in this paper is the *banking industry sector* and how organizations can use SOA to construct solutions that improve top line growth, reduce costs, reduce operational risks, and improve customer experience. In this paper, we specifically focus on the *Core Banking and Customer Care and Insight* aspects of banking.

IBM Banking Industry Framework

IBM provides a unified banking framework that spans the enterprise and software foundation for end-to-end banking solutions. The *IBM Banking Industry Framework* is the strategic middleware foundation for solutions. IBM Banking Industry Framework domains provide software, industry extensions, and accelerators to address specific banking industry needs (as illustrated in Figure 1):

- The *payments and securities* domain provides the middleware tooling to help you progressively transform your payments operations to become more flexible and efficient.
- The *integrated risk management* domain supports taking a holistic approach to managing financial risk, operational and IT risk, financial crimes, and compliance.
- The *customer care and insight* domain helps you build a foundation for creating a single view of the customer and enabling more effective and efficient sales and service.
- The *core banking transformation* domain allows you to modernize existing applications that support core banking functions while aligning with the changing needs of the business.

Figure 1 IBM Banking Industry Framework

The IBM Banking Industry Framework provides the following benefits:

- Enables integration of information and processes across a bank's silos that can lead to greater efficiencies, better customer services, and reduced data requirements.
- Uses software technologies to solve different business problems ranging from improved customer service to better risk management.
- Maximizes re-use of software assets.
- Improves solution deployment time with foundational and module-specific software extensions and accelerators.

The case study in this paper focuses on the *customer care and insight* and *core banking transformation* domains from the IBM Banking Industry Framework.

JKHL Bank in the banking industry

JKHL Bank is a fictitious Tier 2 bank that over the last several years acquired five smaller regional banks to create a broader geographic presence. JKHL Bank identified several SOA initiatives intended to improve growth, reduce costs, reduce operational risks, and improve customer experience. These initiatives are the subject of this paper.

The case study that we describe in this paper includes the following key actors and roles:

- Thomas Arnold, Chief Operating Officer, JKHL Bank
- Sandy Osbourne-Archer, Chief Technical Architect, JKHL Bank
- Geoffrey Carroll, Banking Industry Architect, IBM

JKHL Bank business objectives and requirements

In a conversation with Sandy Osbourne-Archer, JKHL Bank's Chief Operating Officer, Thomas Arnold, outlines the company objectives and business requirements.

Thomas read a 2008 global study of Banking CEO's worldwide. The emerging theme from this study is that the industry is entering a period of turbulence. JKHLE must focus on key areas to differentiate themselves in the long term.

To address changing trends in the banking industry, Thomas makes the following observations:

- Change is accelerating and the effects are not always positive

  JKHL Bank reduced spending across several areas of the business in the short term and is focusing on simplification of its business in the long term. Leveraging existing, high value, core banking systems to achieve cost savings and keep pace with changing business and regulatory requirements is becoming increasingly important.

- Customers are becoming more demanding

  JKHL Bank must focus on customer data, insight, and analytics, in service of improved customer experience and an increased customer base in the long term.

- Globalization is a double-edged sword

  With operations in six different countries, JKHL Bank must tailor its product offerings and shape its portfolio through additions and pruning as a result of new acquisitions and to conform with local regulatory mandates.

- Further market disruptions are inevitable

  JKHL Bank must proactively understand risk positions by investing in a comprehensive risk analysis and monitoring solution. The ability to take action based on current information and demonstrate it to the market and to regulators is critical.

- New business model innovations are essential for long term success

  JKHL Bank must adopt a unified business process flow across all channels, which allows customers to use multiple channels to conduct business with the bank.

Thomas and Sandy decide to recruit Geoffrey Carroll, a Banking Industry Architect from IBM. They task Geoffrey with analyzing JKHL Bank's existing banking processes and providing recommendations for a business transformation.

Identifying the JKHL Bank company initiatives

Geoffrey Carroll, the Banking Industry Architect from IBM, meets with a team of JKHL Bank executives, including Thomas Arnold, to discuss JKHL Bank's company initiatives for banking. Geoffrey tells JKHL Bank that two of the most important trends in the banking industry are:

- Core systems modernization
- Customer care and insight

Why core banking modernization is important to JKHL Bank

Thomas and Geoffrey agree that core systems modernization is a top priority for JKHL Bank. The current core systems infrastructure is complex and does not support business initiatives effectively. Thomas highlights a number of concerns:

- JKHL Bank must adapt to changing business conditions quicker. The time to market of a new solution is currently too high.
- The cost to JKHL Bank of supporting the core systems is high.
- JKHL Bank cannot adequately support the functionality of banks it acquired.
- There are concerns about JKHL Bank's ability to comply with changing industry regulations.
- From a technology viewpoint, integrating the core banking systems with new applications is complex, and the skill set that is needed to maintain the heritage core systems is becoming harder to find.

Geoffrey cites an example of another bank that modernized its core banking systems:

> *Egyptian American Bank increased its profitability by 32 percent, according to Celent analyst Bart Narter, while more than doubling its back-office efficiency and more than tripling its efficiency ratio of customers to IT employees by converting its core systems.*[1]

Why customer care and insight is important to JKHL Bank

Thomas can see the value in investing in more efficient and flexible customer-centric offerings that are aimed at locking in customer relationships. He cites the following observations that he believes apply both to JKHL Bank and the banking industry as a whole:

- Customers are now better informed, more sophisticated, and more disruptive than in the past.
- JKHL Bank is lagging behind other industries in innovation to capitalize on emerging trends.
- Customer innovation in JKHL Bank is well behind other industries, such as consumer electronics, retail, and telecommunications.
- JKHL Bank risks being surpassed by institutions who develop more intimate, tailored relationships with customers.

[1] Source: Pain to Gain With Core Banking Swap Outs, June 2008, Bank Technology News

Geoffrey Carroll shares the IBM experience in this area:

> *Our experience shows that the average annual revenue potential per new U.S. deposit account is US$380. If 1.5 million accounts are lost per year, a bank is looking at US$570 million annually in lost revenue.*

Identifying the key initiatives at JKHL Bank

With Geoffrey and the JKHL Bank executives in agreement that core banking modernization and customer care and insight are the most important issues for JKHL Bank to address, they must now decide which areas of the business to start with. After examining a cost breakdown of the bank's activities they quickly agree on the following:

- Maintaining interfaces among disparate systems is a major challenge. Additionally, maintaining multiple account opening systems and applications across product lines and channels is the single most important cost challenge, accounting for 22% of JKHL Bank's total processing costs.
- The Account Open process is a major item of cost, accounting for 20% of total processing costs.
- The duplication of effort and systems increases the Account Open costs. A lack of an enterprise-wide account opening workflow results in duplication of effort across product lines and channels.

To address these front and back office concerns, Geoffrey and the JKHL Bank team agree that JKHL Bank must address the following capabilities:

- Provide channel-agnostic promotional offers.
- Offer products that are personalized to meet customer needs.
- Conduct extensive financial risk analysis and monitoring.
- Extend existing delivery channels and offer new channels for communication and conducting business.
- Automate key back office processes to align with front office improvements.

Core Banking and Customer Care and Insight

In this section, we discuss the Core Banking and Customer Care and Insight SOA Banking Business Pattern. This pattern is applied to the JKHL Bank case study.

Observing the existing business

Geoffrey Carroll, the Banking Industry Architect from IBM, performs a series of interviews with key JKHL Bank stakeholders to understand the current business. These key stakeholders include Sandy Osbourne-Archer who is the Chief Technical Architect, the Chief Information Officer, line-of-business executives, the business intelligence executive, the customer value executive, the marketing executive, and the business analysts.

Through these interviews, Geoffrey Carroll makes the following observations:

- Accounts

  There are many methods of opening accounts, for example, customers can call the bank call center, visit a local branch, or open an account online. Some of these channels do not satisfy the pre-requisites for opening an account, for example, when opening an account online, proof of assets, income, and other personal information must be submitted to a branch or mailed to a processing center. Customers cannot submit this information online.

  The information that is stored about an account is duplicated, and account information is inconsistent within multiple systems and lines-of-business.

  Promotions are not consistently offered across delivery channels and are not personalized for a specific customer, which results in many missed opportunities.

  There is limited risk management when opening an account. The current risk analysis is limited to credit scores, income verification, and information submitted in the application itself. There is little or no linkage between accounts.

- Customers

  There is an inconsistent presentation of information across delivery channels, for example, customer addresses might be inconsistent across channels because customer data is maintained within line-of-business applications and only synchronized periodically. There is no real-time synchronized view.

  Customers cannot exchange information with the bank using the channel of their choosing. Most transactions between the customer and the bank must

be submitted using mail or facsimile, whereas many customers prefer to submit changes online or over the phone.

Customers must resupply personal information to the bank for every new account that they open. Previously provided information for other accounts is not reused.

Customers do not understand why all accounts and services are not available using a single user interface.

- Systems

  The IT systems that support JKHL Bank's various channels and lines-of-business are all separate systems with little or no integration, for example, the online, branch, and call center systems are all in different infrastructures. The customer and product data are supported by individual line-of-business applications and as a result that duplicated data is frequently inconsistent across the lines-of-business. Additionally, most systems hold little historical customer account information.

  The IT systems contain many heritage applications. These applications are complex to support and not well understood. They are less flexible than newer technologies, comprised of home grown applications that are not easily adaptable to open standards.

  Numerous technologies are supported. Some technologies are nearly obsolete and others make use of newer Web-based technologies. The integration between these technologies poses a challenge, and there is no enterprise-wide SOA strategy to address the issue.

Based on these observations, Geoffrey notes the following key findings:

- Business requirements are no longer effectively supported by the existing system and processes. Processes are line-of-business specific. There is no global product management, customer and product information is inconsistent, and there is a dependence on manual efforts.
- There is an increasing burden on JKHL Bank to maintain complex heritage applications. People supporting these heritage systems carry a significant knowledge base with them, and if they leave the knowledge goes with them.
- The Account Open issues are making it difficult to respond to changing market conditions with new offerings, which is significantly constraining business growth.

Business process modeling

Based on Geoffrey's observations and key findings, JKHL Bank agrees that it must change its business processes. Through a further set of interviews with the bank's key stakeholders, Geoffrey documents the existing Account Open business process and makes recommendations for an improved process design.

Current business process analysis

In this section, we describe the current, existing JKHL Bank Account Open process. We discuss each phase of the Account Open process, and when combined these phases form the complete business process.

Customer initiates contact with the bank

In this phase, illustrated in Figure 2, an existing customer uses a channel of their choice to research information about a JKHL Bank product or service. The bank identifies the customer in various ways, depending on the channel of entry. Offers are presented to the customer based on JKHL Bank's current promotions.

Note: In each of the business process diagrams, the pain points that JKHL Bank experienced are represented by shaded activities.

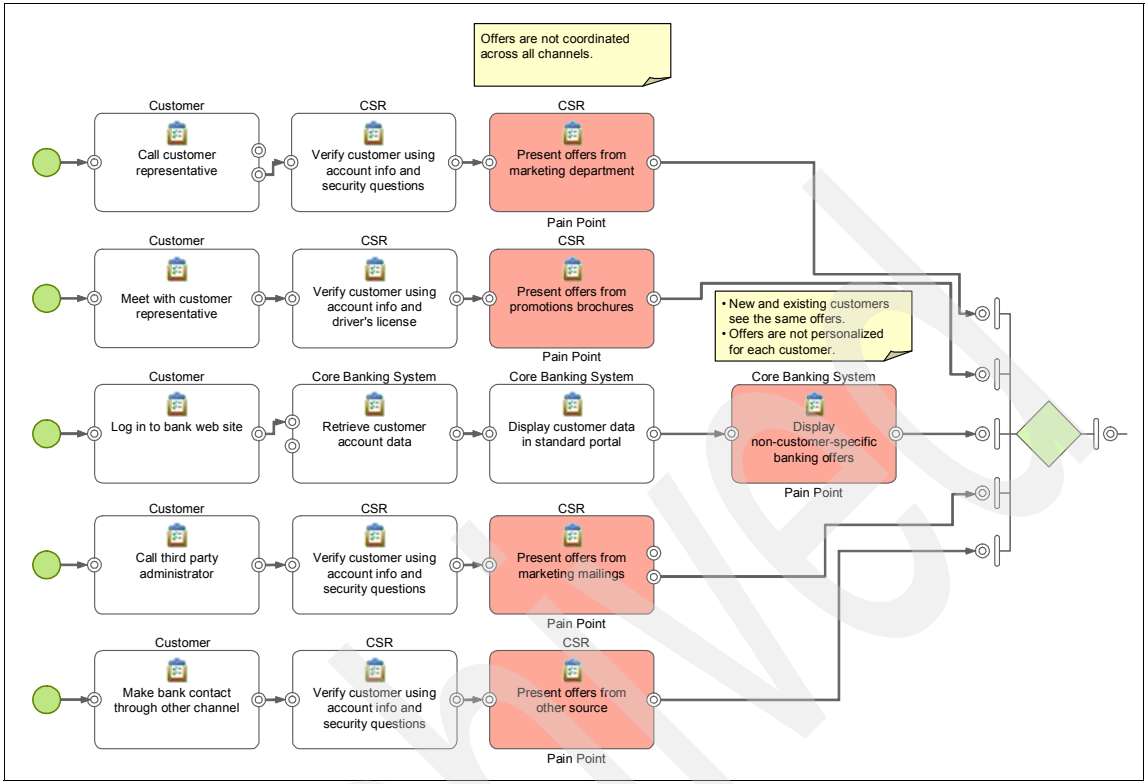

Figure 2 Current business process: Customer initiates contact with bank

Geoffrey Carroll, the Banking Industry Architect from IBM, identifies the challenges of this phase:

- Different processes are used to identify existing customers when the customer uses different channels.
- Promotional offers are not tailored to a customer's profile, which results in offers that are often unsuitable. Customers also do not understand why promotions are not consistent across channels.
- It is difficult to initiate a transaction in one channel and then continue it in another.
- There is no global product catalog available.

Customer chooses a product or service

In this phase, illustrated in Figure 3, the customer chooses the type of product or service they are interested in. The customer provides personal information, a list of assets and liabilities, and other details to open a new account. JKHL Bank then presents a standard bundle of promotional offers.

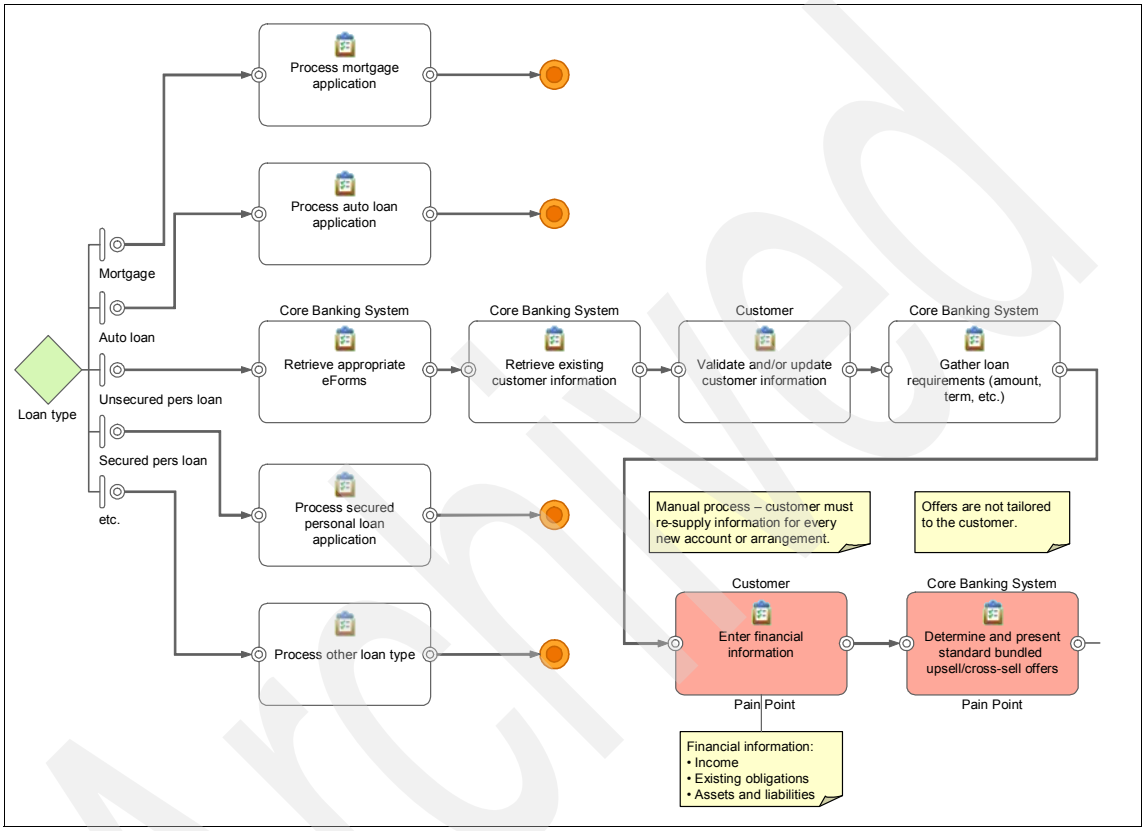

Figure 3 Current business process: Customer chooses a product or service

The challenges in this phase are:

- The customer is required to re-enter all personal information into their application even though it was previously provided to JKHL Bank for other accounts.
- The bank's current promotions are presented without personalizing the offers for existing customers (not all offers might apply to the customer), which causes JKHL Bank to miss out on cross-sell and up-sell opportunities to enhance customer profitability.

Customer submits loan request, bank decides to approve or reject

In this phase, illustrated in Figure 4, the customer submits a loan application by email, fax, online, or in a local branch. The customer receives a confirmation email. JKHL Bank analyzes the conditions for a loan arrangement offer and the customer is notified if the loan application is approved or rejected. Approved customers receive a loan arrangement offer.

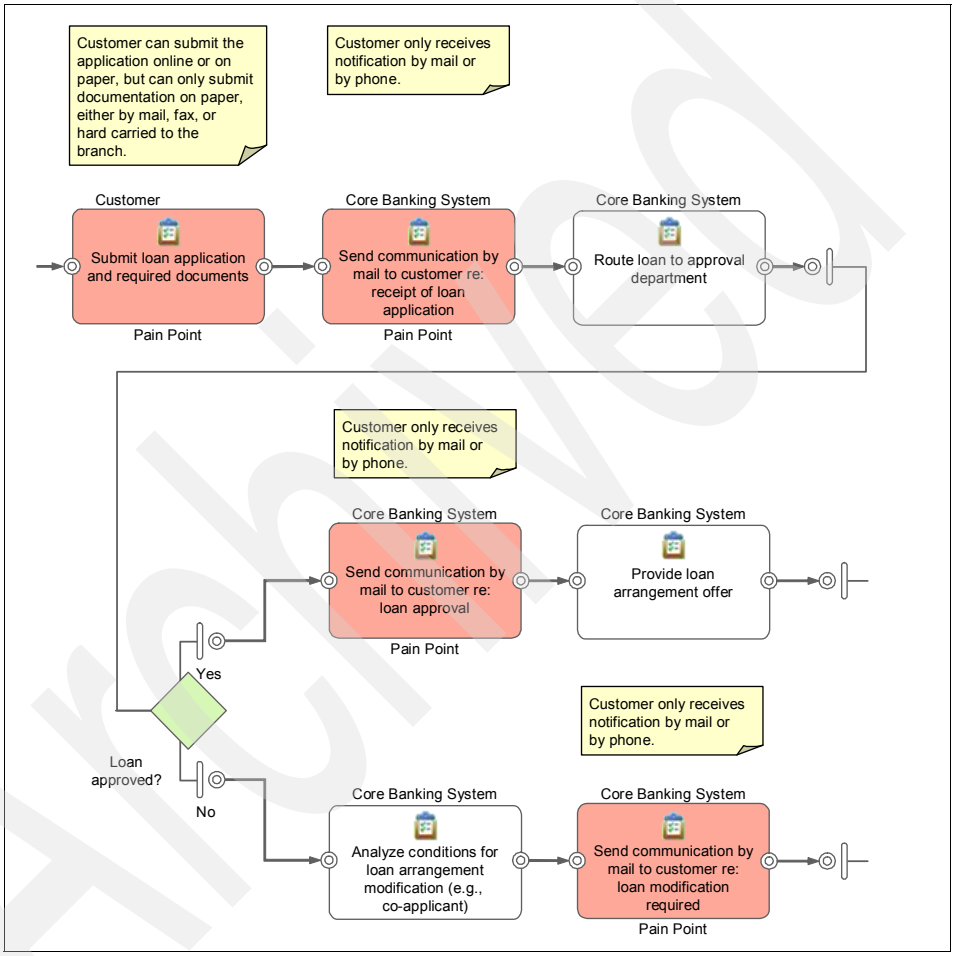

Figure 4 Current business process: Customer submits request, bank approves or rejects

The challenges in this phase are:

- For some products and services customers can use the online channel to submit their application but are required to mail or fax in supplemental information.
- Customer's communication preferences are not noted. JKHL Bank uses mail or telephone for most communications with customers.
- Limited risk monitoring is conducted prior to presenting the loan arrangement proposal. This risk monitoring does not take into consideration relationship analytics, the risk factors surrounding the future financial state of customer, and so forth.

Loan arrangement is activated

In this phase, illustrated in Figure 5, the customer accepts or declines the loan arrangement offer. The customer can also request changes to the arrangement offer. If the offer is to be modified, this process is completed using mail, fax, or in person. If the offer is accepted, the back office accounting systems are updated. Customers are contacted regarding loan activation.

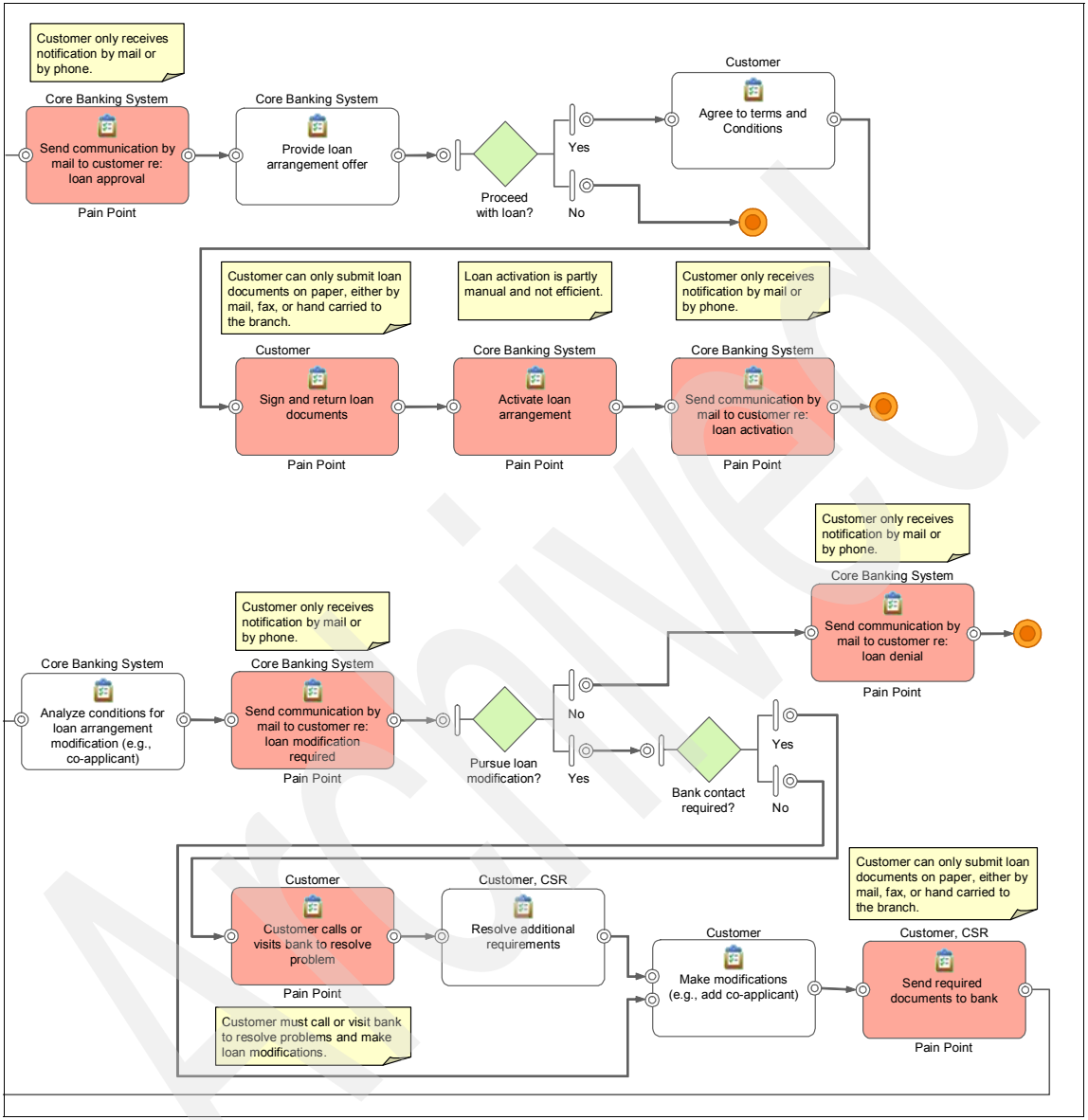

Figure 5 Current business process: Loan arrangement is activated

The challenges in this phase are:

- Communications between JKHL Bank and the customer is primarily conducted using mail or in-person, which slows down the loan activation process.
- Loan activation procedures are manual, inefficient, and error-prone, often causing delays in communications reaching the customer.

Proposed business process design

Thomas Arnold, Chief Operating Officer for JKHL Bank, explains the key design principles that the bank wants to see instituted in the redesigned process:

- JKHL Bank wants an easy way to access customer, product, and account information spread across all lines-of-business.
- The bank wants ways to maximize key expansion initiatives, such as cross-selling and up-selling, by facilitating customer and business insight regardless of system or application.
- Proven guidance that is based on industry assets and best practices is needed to enable agile and efficient customer-centric processes. These processes can address the areas of marketing, sales, customer service, and risk reduction.
- JKHL Bank needs an infrastructure that supports a robust, scalable production environment.

Geoffrey Carroll works with his team of IBM consultants and with the JKHL Bank stakeholders to design an improved business process. We describe the improvements to the JKHL Bank Account Open process in this section. Each phase of the proposed Account Open process is discussed in turn. When combined these phases form the complete business process.

Customer initiates contact with the bank

Geoffrey Carroll recommends that JKHL Bank implements a line-of-business and channel agnostic process that can help the bank better cater tor their customer's needs. This way, a customer can use the channel of their choice to find information about a product or service. A unified process allows the bank to retrieve customer information from a single source, analyze existing customer profile and account information, and to make suitable recommendations for other products and services.

Figure 6 shows this proposed business process design.

Note: In each of the business process diagrams, the improvements to the business process are represented by shaded activities.

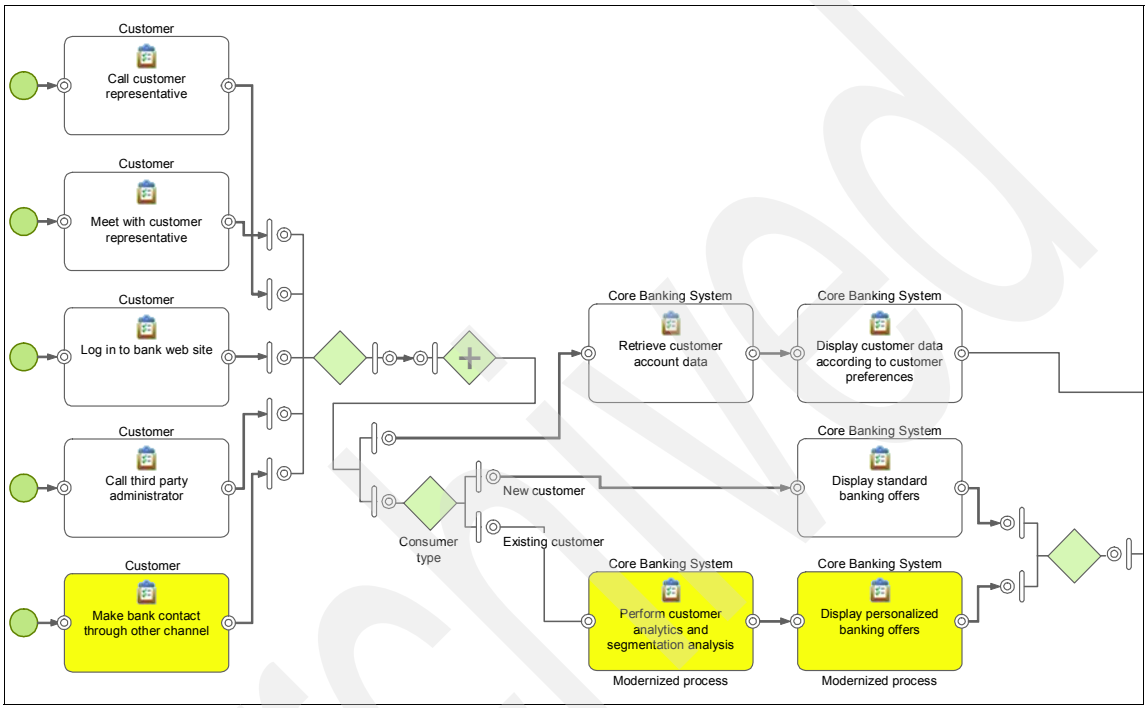

Figure 6 Proposed business process: Customer initiates contact with the bank

Geoffrey identifies the benefits that are realized in this phase:

- JKHL Bank now has a single, centralized view of customer, product, and account information.
- Customers can use the channel of their choice to research the bank's products and services, and each channel displays consistent information. Customers can also initiate a transaction in one channel and continue it in another.
- A global, company-wide, product catalog is now available.
- JKHL Bank can add new channels quickly and easily.
- JKHL Bank now has clear insight into their customer's choices and preferences, allowing them to make personalized offers accordingly.

Customer chooses a product or service

During the loan application process, customer information is pre-populated based on prior information that the customer submitted to the bank. The customer simply validates this information and makes updates as appropriate. JKHL Bank presents personalized bundled offers as appropriate (for example, the loan interest rate is reduced if a savings account balance is above a certain threshold).

Figure 7 shows the customer chooses a product or service phase.

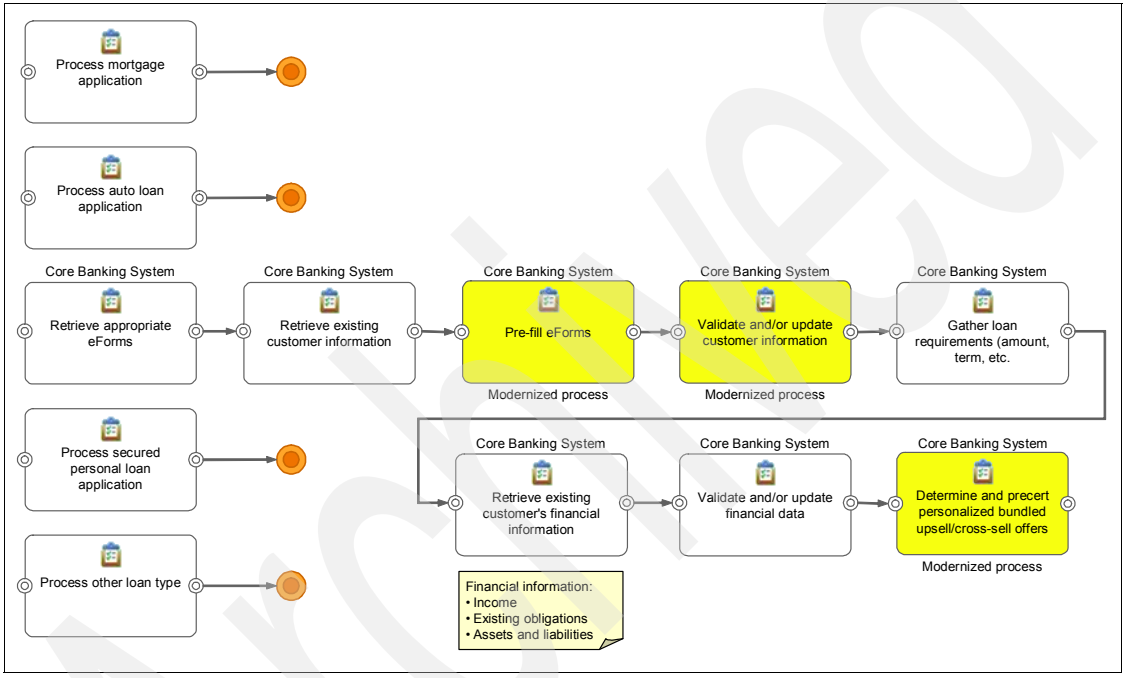

Figure 7 Proposed business process: Customer chooses a product or service

The benefits realized in this phase are:

- The account application process is easier and faster because the customer only needs to add new information, or modify existing information, to their application.
- JKHL Bank offers individually tailored offering bundles to customers, taking advantage of up-sell opportunities.

Customer submits loan request, bank decides to approve or reject

In this phase, illustrated in Figure 8 on page 18, based on the customer's selection of a bundled offer, JKHL Bank presents a loan arrangement proposal. The customer must gather the required documentation and submit the loan application. Upon receipt, JKHL Bank sends confirmation of the application.

Geoffrey Carroll recommends that JKHL Bank uses pre-built IBM Information FrameWork process models and proven accelerators as reference assets that can be customized to speed up the project, for example:

- The pre-built process model *Provide arrangement proposal* (as shown in Figure 8) is designed to analyze a customer's current financial state, assess the risk, and tailor the proposal with an arrangement that is most suitable for the customer.
- *Customer Care and Insight* accelerators leverage deep industry expertise and customer experience to speed time-to-value for JKHL Bank's strategic implementations.

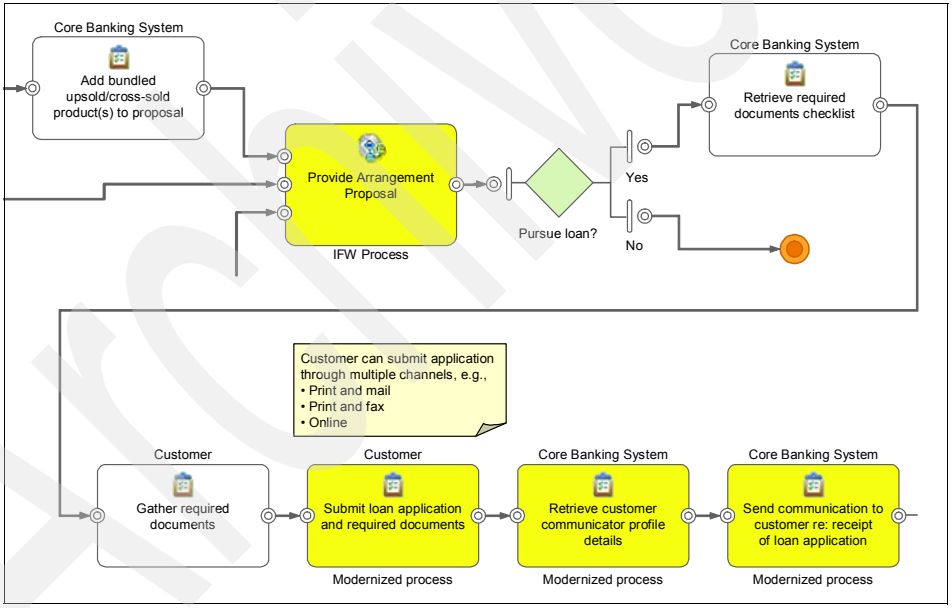

Figure 8 Proposed business process: Customer submits request, bank approves or rejects

The benefits realized in this phase are:

- Using the best practices in the IBM Information FrameWork model shortens the time-to-design of the proposed business process model.
- The IBM Information FrameWork model and accelerators bring tremendous industry expertise from IBM and lowers the risk of adoption of this solution for JKHL Bank.
- JKHL Bank takes note of customer's communication choices and works with customers accordingly, for example a customer who expressed a preference for online communication can chat with a customer service representative using instant messaging.

Loan arrangement is activated

In the loan arrangement activated phase, illustrated in Figure 9, after the application is processed, the loan arrangement offer is presented. The customer accepts or declines this offer. If JKHL Bank makes changes to an arrangement offer, the customer responds to the modifications of the arrangement offer using the channel of their choice. If the offer is accepted, the back office accounting systems are updated and a communication is sent to the customer regarding the loan activation.

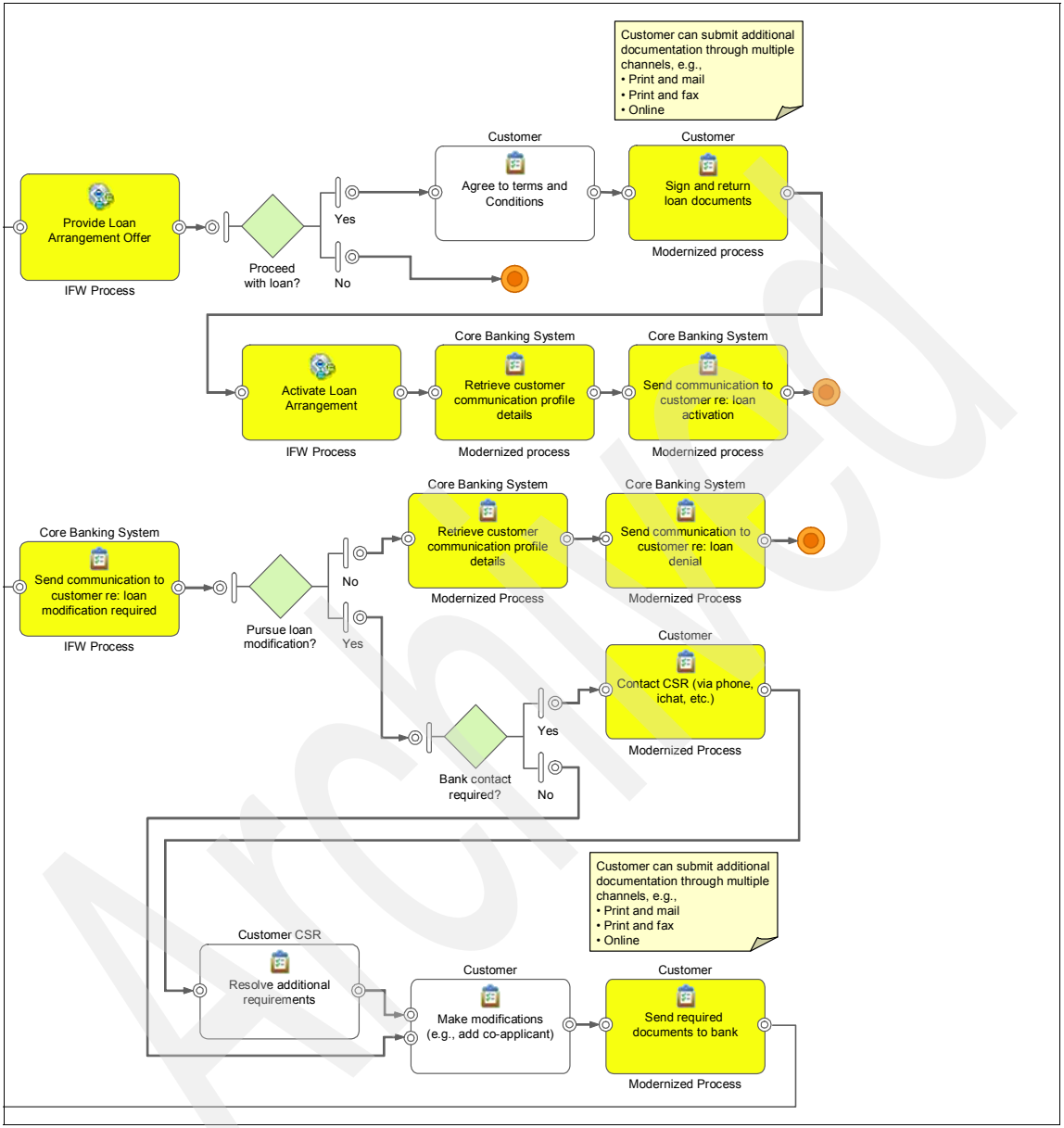

Figure 9 Proposed business process: Loan arrangement is activated

The benefits realized in this phase are:

- Loan activation procedures are now automated using pre-built, proven IBM Information FrameWork processes and accelerators making it fast, efficient, and eliminating redundancy.
- The customer now has the flexibility to choose the most convenient channel to respond to modifications of the arrangement offer and to submit required documentation.
- JKHL Bank manages and stores all legal documents (such as images of checks, agreements and contracts) in a centralized repository that is accessible to all lines of business, channels, and facilities.

Service modeling

After performing business process modeling, the next task is to delineate the services that comprise the proposed Account Open business process. JKHL Bank also wants to identify the services that must be enabled through the proposed SOA infrastructure. Geoffrey Carroll advises JKHL Bank to use the *service-oriented modeling and architecture* (SOMA) approach from IBM, illustrated in Figure 10 on page 22, to identify these services.

Understanding SOMA

SOMA provides an approach to building an SOA that aligns to business goals and ties the business processes directly to underlying applications through services. The process of SOMA consists of three general steps (Figure 10):

- Identification
- Specification
- Realization of services, components, and flows

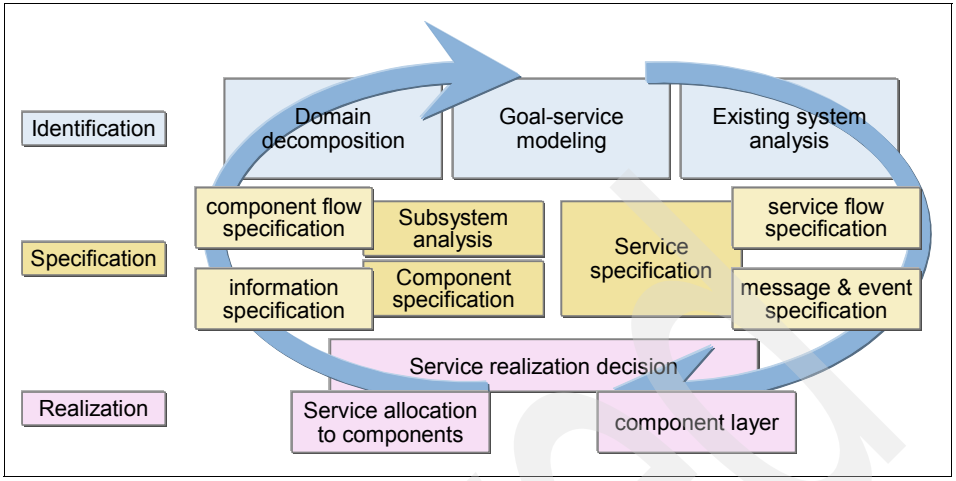

Figure 10 Service-oriented modeling and architecture (SOMA)

Geoffrey explains how the service identification step of SOMA consists of three techniques that can help JKHL Bank identify services for the Account Open business process:

- Domain decomposition

  This is a top-down view of the business process. It consists of process decomposition where processes are broken up into sub-processes and high-level business use cases, for example, the Account Open business process can be decomposed into *customer*, *product*, and *communication* sub-processes. Each sub-process can in turn be decomposed further, ultimately leading to a list of business use cases, for example, the product sub-process can be decomposed into *loans*, *credit cards*, and *accounts*. A business use case for credit cards might be *apply for credit card*. These business use cases are typically good candidates for business services.

- Existing system analysis

  In contrast to domain decomposition, this is a bottom-up approach. Existing systems are analyzed according to their suitability for inclusion in the Account Open business process, for example, JKHL Bank can analyze the services that make up the loan activation process (such as *define repayment schedule*, and *open business account*) to determine if any of these services meet the needs of the new Account Open process. Typically, reuse of existing systems and assets provides a lower cost solution to implementing service functionality than creating new assets.

- Goal-service modeling

  This meet-in-the-middle approach validates other services not captured by the domain decomposition and existing system analysis approach. In this

phase, business services are identified based on goals and metrics, for example, JKHL Bank can define a goal of a *seamless customer experience* for the Account Open process. This goal might consist of sub-goals, such as *increase customer satisfaction*, *customer-centric business model*, and *global product management*. Business services can be identified and grouped under these goals.

Note: For more information about applying SOMA, refer to the developerWorks® article, *Service-oriented modeling and architecture*, which is available at:

http://www.ibm.com/developerworks/library/ws-soa-design1/

How JKHL Bank applies SOMA

To understand the steps needed in the identification of services, Geoffrey Carroll recommends that the JKHL Bank architecture team download the SOMA plug-in for IBM Rational® Method Composer.

Note: The SOMA plug-in for IBM Rational Method Composer is available for download at:

http://www.ibm.com/developerworks/rational/downloads/06/rmc_soma/

To identify the business services that are needed for the Account Open business process, Geoffrey assembles a team that consists of an IBM SOA Architect, IBM Banking Business Architect, JKHL Bank Business Process Analyst, and JKHL Existing Application Systems Architect.

The team collects:

- The business goals that JKHL Bank wants to enable
- A list of existing systems that support the Account Open business process
- The proposed new Account Open business process design

The IBM SOA Architect and Banking Business Architect then apply the three steps of SOMA service identification (domain decomposition, existing systems analysis and goal-service modeling) to determine the business services that are needed for the Account Open business process.

The team finds that most of the business services that they need are identified during the domain decomposition stage where the Account Open process is decomposed into sub-processes and business use cases. The other two approaches (existing systems analysis and goal-service modeling) also yield some business services.

With service identification complete, the team gets together and groups the services that they identified from the application of SOMA. In some cases, the business services that are identified in each step are different. In many other cases, the three steps identified duplicate services. It is at this stage that the team can eliminate the duplicates.

The end result is a portfolio of business services that are enabled through an SOA operational architecture. The JKHL Bank team is delighted to identify this business services portfolio.

As-is architecture

With the existing business process modeled, an improved business process defined, and the business services identified, Geoffrey Carroll needs to fully understand the technical architecture that is currently in place, which is called the *as-is* architecture.

Sandy Osbourne-Archer, the Chief Technical Architect for JKHL Bank, describes this architecture. She tells Geoffrey that the current architecture has no true enterprise view of a customer. Information is duplicated in silos, which leads to inconsistent customer service and promotions across channels. Likewise, there is no centralized management of product information. Bank products are managed at the application level within line-of-business silos, which makes it difficult to create new products and product bundles.

Sandy Osbourne-Archer states that the core banking processes are supported by highly customized or internally developed applications that reside on many disparate platforms. These applications are hard-wired, and the associated processes they are in contain many manual steps, which makes it impossible to respond quickly to new challenges and evolving regulatory pressures.

Sandy also has concerns about the general lack of understanding about core systems, such as the mainframe banking application. This is making it hard to incrementally replace these systems as part of a modernization program. The current architecture needs to be improved to better integrate information, support cross enterprise intelligence, analytics, and reporting, and to support tightening security and management requirements.

Figure 11 shows the as-is architecture.

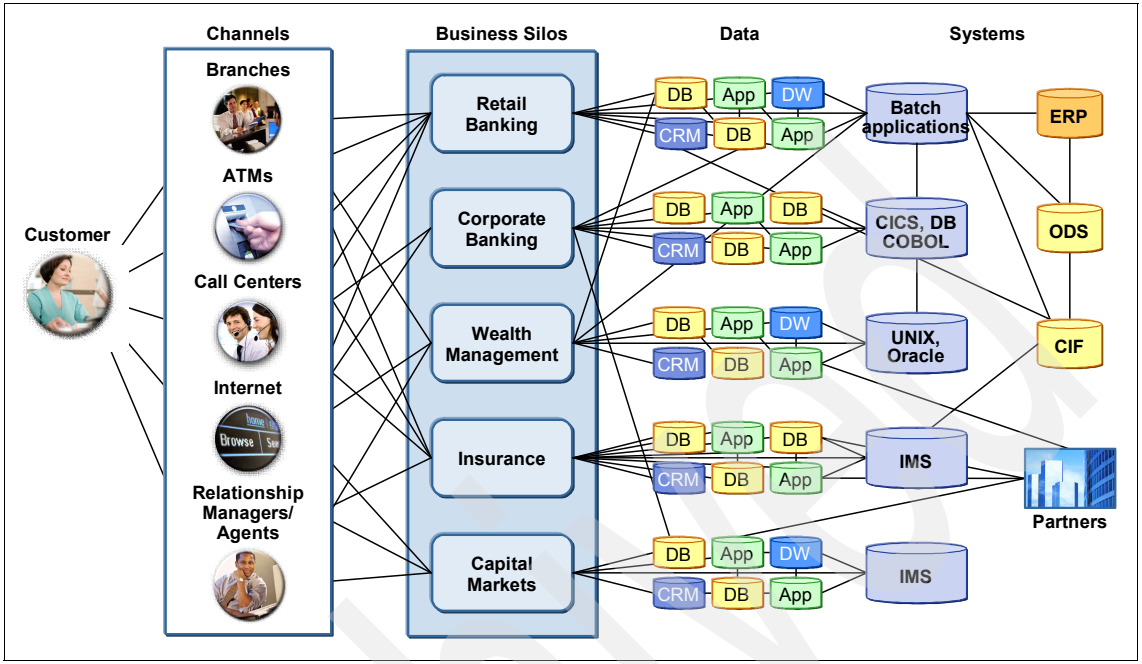

Figure 11 As-is architecture

Service-oriented architecture patterns

Geoffrey Carroll, the Banking Industry Architect from IBM, tells Sandy Osbourne-Archer that a good way to define an architecture that meets JKHL Bank's needs is to break the solution down into simple *SOA patterns*. These SOA patterns simplify the understanding of the overall solution from an SOA perspective.

Applying SOA patterns and best practices makes it easier for JKHL Bank to understand the impact of each piece of the solution and helps JKHL Bank adopt the solution in phases.

Table 1 shows the SOA patterns that Geoffrey recommends to JKHL Bank with the SOA entry point to which these patterns are related.

Table 1 SOA patterns used for realization

SOA entry point	SOA patterns that apply
Connectivity entry point	Simple connectivity
Information entry point	Master data management
	Enterprise content management
	Business intelligence
Reuse entry point	Service enable existing assets using indirect exposure
	Service enable existing assets using direct exposure
Process entry point	Business process management
People entry point	Invoking services on the glass
	Process portal
	Rich Web based applications

Geoffrey describes the technical problem that each SOA pattern aims to solve, how each SOA pattern is applied to JKHL Bank, and the business value that is brought about by adopting it.

Note: In “Applying the simple connectivity pattern” on page 27, each SOA pattern describes a single example of a technical problem that JKHL Bank is facing and then describes how the SOA pattern can be applied to solve that problem. In many cases, the SOA pattern can actually help to solve multiple technical problems (which might not be mentioned in this paper) for JKHL Bank.

These SOA patterns represent a roadmap for implementing banking solutions. By applying all of these SOA patterns, JKHL Bank adopts a reference architecture (see “To-be reference architecture” on page 39) that takes advantage of many SOA concepts. Organizations that adopt similar solutions can review these patterns and select applicable ones to their specific environments. The overall to-be reference architecture that we show in this paper illustrates a case where the bank adopted the patterns in phases and is now a fairly advanced SOA adopter.

Applying the simple connectivity pattern

The simple connectivity pattern describes how multiple internal clients can access services within an organization, for example, this SOA pattern can be used to describe how remote offices of an organization access headquarter systems using Web services standards.

Technical problem

JKHL Bank's environment is tightly coupled and contains many point-to-point connections between several business applications, making it inflexible to change current systems and easily add new ones. The bank needs hundreds of project hours to make changes to their existing monolithic, home grown, and heritage applications to meet new business requirements and to keep up with short and long term company goals in the areas of core banking and customer care and insight. Integrating these heritage applications with front-end applications is also a challenge. Additionally, because JKHL Bank acquired and merged with other banks over the years, applications and data became even more disintegrated.

How JKHL Bank applied this pattern

JKHL Bank adds an Enterprise Service Bus (ESB) into the corporate data center. The ESB provides loose coupling, basic routing, and integration to many of the heritage applications, such as the mainframe banking application, and other packaged applications.

The ESB provides support for multiple protocols and message formats between applications at the channels and corporate data center. IBM Information FrameWork provides the initial services design using the Financial Services-Interface Design Model (FS-IDM) to provide a common service language for JKHL Bank.

JKHL Bank applies this pattern, as shown in Figure 12.

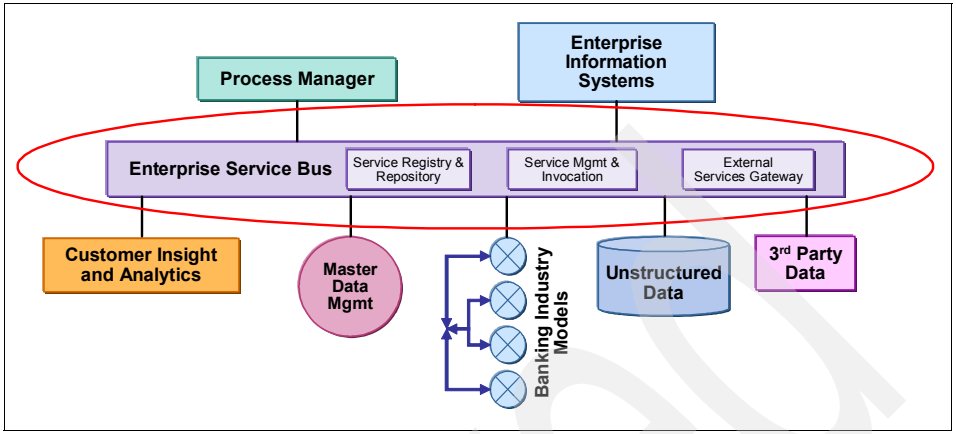

Figure 12 Simple connectivity pattern

Business value of adoption

The ESB provides a solution to serve account open requests in a channel agnostic fashion to support user interface flexibility. The ESB also provides the ability to modernize, extend, and customize existing high-value core banking applications and data without having to completely replace these systems, which results in extensive cost savings.

Further information: Refer to the Internal Connectivity pattern in *Case Study: Service Connectivity SOA Scenario*, REDP-4380.

Application of the master data management pattern

The master data management pattern illustrates how to reconcile customer data with a single, definitive, master source that can be the reference source when customer information exists in many different places.

Technical problem

JKHL Bank's customer, account, and product information is distributed across multiple heterogeneous systems in silos. The information distributed in these sources is inconsistent and exists in various formats. Several batch programs are required to periodically synchronize this information.

How JKHL Bank applied this pattern

JKHL Bank incorporates a centralized master data management (MDM) repository, located in the corporate data center, to store a consistent set of customer, account, and product information.

The MDM repository is initially populated using the Extract / Transform / Load (ETL) pattern. Data synchronization patterns are used to apply near-real time changes between source and target applications and the MDM repository using services. Information is also loaded into, and extracted from, the MDM repository by several other systems, such as the marketing systems and banking data warehouse repositories. This information is synchronized to the MDM repository, which eliminates inconsistencies of data.

The data domain models in the IBM Information FrameWork models are used as the reference assets for the MDM solution implementation.

JKHL Bank applies this pattern, as shown in Figure 13.

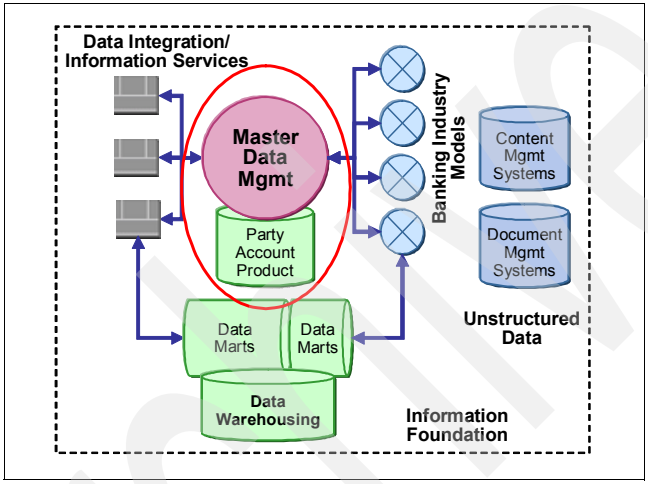

Figure 13 Master data management pattern

Business value of adoption

By adopting MDM, JKHL Bank can save costs by avoiding duplicate customer entries and processing when opening new accounts and maintaining existing accounts. It also stands to increase customer satisfaction by providing a global product catalog that contains accurate, real-time product information that can be accessed by any channel of choice.

Further information: Refer to *Case Study: Information as a Service SOA Scenario*, REDP-4382.

Applying the enterprise content management pattern

The enterprise content management pattern adds unstructured content to the Information as a Service scenario. It shows how to make content and the

integration of content and structured data available to business processes as first-class services.

Technical problem

JKHL Bank is struggling to efficiently manage unstructured content that is growing exponentially (examples include account and product documentation). Each line-o- business maintains their content using different procedures. This poorly managed unstructured data poses an unknown exposure due to potential litigation or policy non-compliance.

How JKHL Bank applied this pattern

JKHL Bank adopts a single, central repository to maintain documents and content for all products, customers, and accounts, for example, electronic forms are now available for use within multiple business processes within the bank. Also other types of unstructured data can now be stored and accessed from one common repository, such as legal documentation, electronic signatures, customer information arriving through faxes, email, and mail during account opening.

JKHL Bank applies this pattern, as shown in Figure 14.

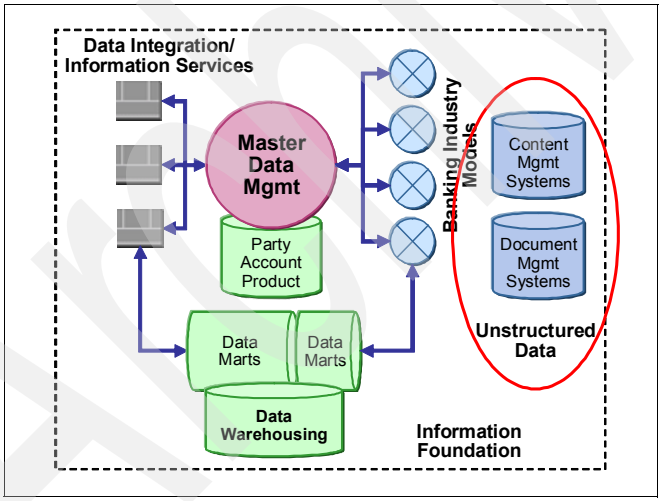

Figure 14 Enterprise content management pattern

Business value of adoption

JKHL Bank can deliver integrated content to employees, customers, and partners from a single, accurate repository. The bank can access the right content at the right time quickly and easily. The exposure to litigation and external mandatory regulation compliance is managed. This solution increases productivity at the bank, for example, content-centric processes are automated

and integrated with other enterprise applications, and all line-of-business applications access the central repository.

Further information: Refer to *Case Study: Information as a Service SOA Scenario*, REDP-4382.

Applying the business intelligence pattern

The business intelligence pattern describes how to use customer, product, and account information from across an enterprise to make informed business decisions. Applying the business intelligence pattern and leveraging the IBM Banking Data Warehouse helps financial services companies accomplish an integrated, enterprise-wide view of risk across divisions, products, geographies and risk classes.

Technical problem

JKHL Bank recognizes that it lacks in-depth intelligence reporting to understand customer buying patterns, account trends, and product profitability. The bank also lacks an integrated, enterprise-wide view of risk across divisions, products, and geographies.

How JKHL Bank applied this pattern

IBM Banking Data Warehouse is used to extract accurate and current information from the MDM repository for the purposes of analytics and intelligence reporting. JKHL Bank also uses IBM Information FrameWork models to provide best practices, definition, and monitoring of KPIs and metrics to support common banking processes, such as account opening. JKHL Bank can now capture troubled account details quickly and easily. Metrics are used to analyze accounts that required restructuring of loan arrangements, and back-end performance metrics offer trailing indicators that provide information about accounts that were charged-off or foreclosed.

Business value of adoption

JKHL Bank adopts this solution for business users across lines-of-business to facilitate seamless business decisions using dashboards, reporting, and real-time event management, which provides the bank with a rapid return on investment because dashboards and analytics are pre-integrated into the physical banking data warehouse and highlight information regarding organizational risk, product profitability factors, and so forth.

Applying the service enable existing assets using direct exposure pattern

This pattern shows how to expose a back office application (such as an application running in CICS Transaction Server) as an SOA service by accessing the back office system using SOA technologies directly.

Technical problem

JKHL Bank desires a strong Web services architecture that consists of standardized business functions to access back office applications, such as mortgage loans and credit cards, that reside in enterprise information systems, such as, CICS Transaction Server. Access to these back office applications must be flexible with a short deployment cycle.

How JKHL Bank applied this pattern

JKHL Bank exposes their corporate banking applications in CICS as Web services. Direct exposure enables the service interface to be exposed as defined by the existing application (for example CICS COBOL applications can be exposed directly as Web services). Any Web service consumer within the enterprise, including many line-of-business applications can access these services. IBM Information FrameWork provides the initial service specification using the FS-IDM.

JKHL Bank applies this pattern, as shown in Figure 15.

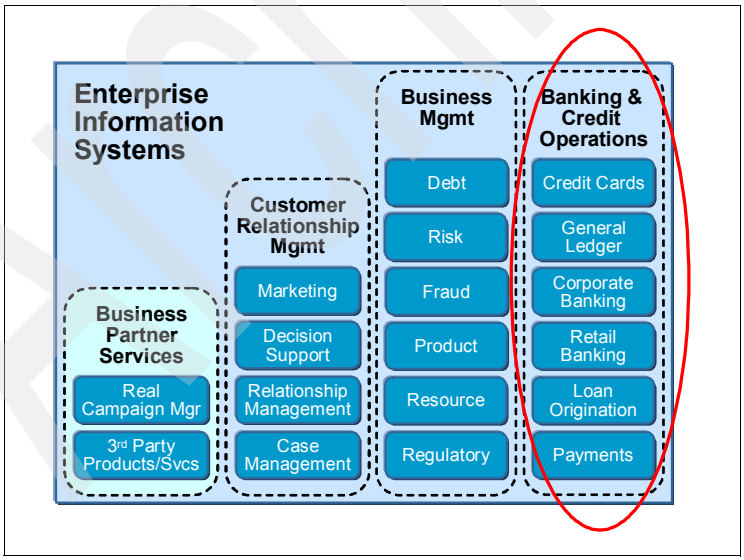

Figure 15 Service enable existing assets

Business value of adoption

By exposing back-office applications as services, they are made available to other parts of the enterprise; therefore, back office functionality can be easily reused throughout the enterprise. The solution requires a short deployment cycle for the back office applications to be exposed as services.

Further information: Refer to *Case Study: Service Creation SOA Scenario*, REDP-4377.

Applying the service enable existing assets using indirect exposure pattern

This pattern shows how to access a back office application (such as an application running in CICS Transaction Server) as an SOA service through an adapter.

Technical problem

JKHL Bank desires a strong Web services architecture that consists of standardized business functions to access back office applications, such as Customer Information Systems (CIS) and consumer loans, that reside in enterprise information systems, such as IMS and CICS/DB2.

How JKHL Bank applied this pattern

JKHL Bank uses an outdated version of a core banking application that they have customized over the years. The applications in this system did not naturally map to the business services that they wanted to expose. Therefore, using a top-down process, the bank implements a Java™ adapter to expose the functionality in the retail banking system to other parts of the enterprise. IBM Information FrameWork provides the initial service specification using the FS-IDM.

JKHL Bank applies this pattern, as shown in Figure 15 on page 32.

Business value of adoption

JKHL Bank benefits from well-designed service interfaces for older, existing applications without redesigning the applications themselves. The back-office applications can be easily replaced without impacting the front-end applications that consume the information (if, for example, the existing deposit system is replaced with another application in the future). JKHL Bank recognizes that the Indirect Exposure pattern is more beneficial in the long term for their business and IT strategy, even though the Direct Exposure pattern was quicker to implement.

Further information: Refer to *Case Study: Service Creation SOA Scenario*, REDP-4377.

Applying the business process management pattern

This pattern addresses business process management for modeling, automating, and monitoring business processes and addresses dynamic process invocation.

Technical problem

JKHL Bank's existing processes are rigid and manual. There is duplication of processes across channels that make it cost inefficient, for example, the Account Open process is manual and varies across channels, which makes it difficult to track the efficiency of the processes and improve the business model.

How JKHL Bank applied this pattern

JKHL Bank automates many of its processes, including Account Open. The automated processes can be monitored and key performance metrics can be measured, such as the number of accounts the bank approves and declines and the average time taken to open an account. These metrics can be closely monitored to identify areas where operational efficiency can be improved.

Business policies handle variations in business processes that run in different geographies, for example, loan rate calculation is a business policy that can be varied dynamically.

By using dynamic process invocation, JKHL Bank can easily extend their operations to new regions, geographies, and can introduce new customer interaction channels with minimum overhead, for example, points-of-variability can be added into JKHL Bank's processes for country-specific operations.

IBM Information FrameWork process models are a key asset in designing and implementing processes, such as loan arrangement proposal and loan arrangement offer. JKHL Bank also purchases and installs the pre-built Customer Information File (CIF) Composite Business Services (CBS) asset for helping the bank's user community to interactively manage customer master data issues and updates captured during the new loan process. The CIF business component is reused across the bank with other processes that must add or update customer information steps.

JKHL Bank applies this pattern, as shown in Figure 16.

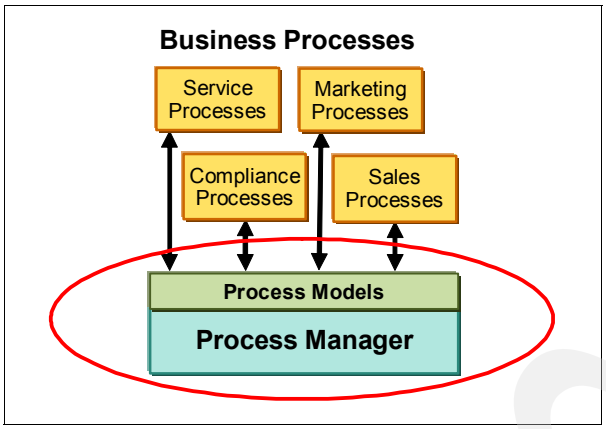

Figure 16 Business process management pattern

Business value of adoption

JKHL Bank benefits from the adoption of business process management by gaining operational efficiency, cost savings, elimination of manual and redundant processes, and flexibility to continually improve their business model. The bank can also quickly and easily add processing for operations in new geographies and stay abreast of the competition.

Further information: Refer to *Case Study: Business Process Management SOA Scenario*, REDP-4383.

Applying the invoking services on-the-glass pattern

The invoking services on-the-glass pattern describes how to provide a common user interface and experience to access disparate applications from a single location.

Technical problem

JKHL Bank uses multiple interfaces and disparate applications, such as, 3270 green screens and portals, for various users within the bank, which led to a wide range of software manageability and deployment issues, which in turn led to higher costs.

How JKHL Bank applied this pattern

JKHL Bank moves towards an open interface in which common, channel agnostic services can be served by any front end, which also allows a transaction initiated on one channel to be completed on another.

JKHL Bank provides an integrated desktop capability that allows all disparate desktop business applications to be integrated into a composite application, for example, an integrated bank teller desktop application integrates a CICS system, Eclipse-based applications, collaboration and messaging tools, and Web-based RSS feeds together.

Business value of adoption

JKHL Bank provides increased productivity for their end users through composite applications and integration of existing applications. They can support enterprise-integrated desktops across application types and surface role-based workspaces for given tasks. IT and administration costs are reduced through remote deployment and management of software across all customer segments

Further information: Refer to *Case Study: Interaction and Collaboration Services SOA Scenario*, REDP-4375.

Applying the process portal pattern

The process portal pattern addresses the need to add process flow capability to current processes and the need to interject human tasks within process flows.

Technical problem

Workflows at JKHL Bank are currently manual and discontinuous. A method to compose and automate workflows is lacking, making it difficult to provide the right set of capabilities within the user interface context.

How JKHL Bank applied this pattern

JKHL Bank implements dynamic business processes that are coordinated through different systems, bank roles, and business units in a more intuitive, interactive, and automated fashion. JKHL Bank is improving its business process efficiency through iterative and continuous improvement. The bank can use electronic forms (eforms) as a full participant in this overall solution. Using these eforms, users can invoke a business process or participate in other processes as needed. IBM Information FrameWork process models help integrate workflow-oriented activities with back-end solutions.

JKHL Bank applies this pattern, as shown in Figure 17.

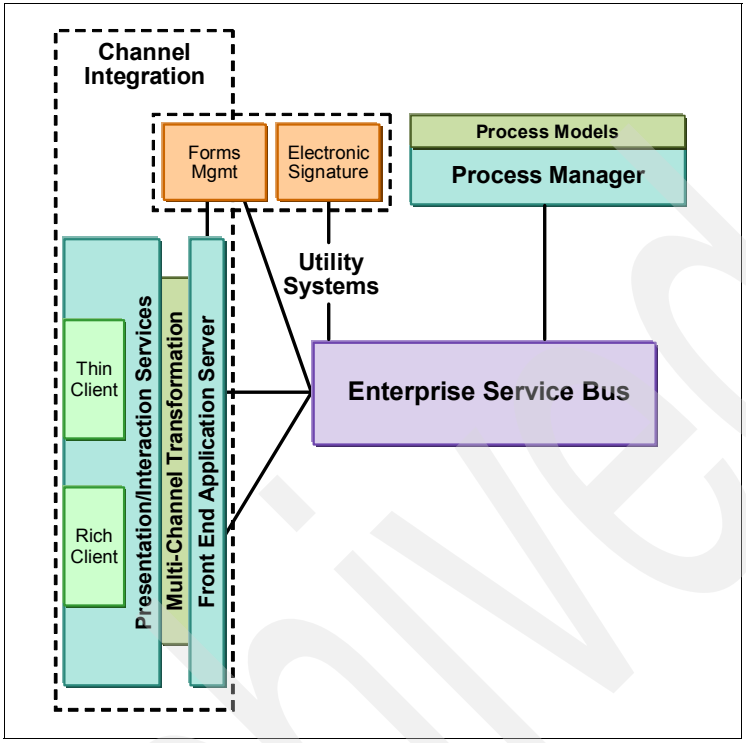

Figure 17 Process portal pattern

Business value of adoption

JKHL Bank now has a customizable, single user interface that allows the bank to easily manage products, customers, and accounts through a portal interface. The bank provides a role-based, real-time, collaborative experience within the context of a business process (for example real time communication and exchange of information during the Account Open process).

Further information: Refer to *Case Study: Interaction and Collaboration Services SOA Scenario*, REDP-4375.

Applying the rich Web-based applications pattern

This pattern demonstrates the value proposition of AJAX portlets over classic or simple portlets, which includes benefits in performance and responsiveness.

Technical problem

JKHL Bank wants to provide user interfaces that facilitate collaboration and sharing between users and that also speeds up Web interface responsiveness.

How JKHL Bank applied this pattern

JKHL Bank uses AJAX-based user interfaces in the Account Open process over the Web channel. These interfaces are used to, for example, dynamically load content during loan application submission where information is pre-filled. Atom and RSS feeds personalize content for end users. Mashups are used to quickly develop situational line-of-business applications for power users within the bank.

Business value of adoption

End users (both customers and bank employees) can work more efficiently, with faster user interface response times. Considering the amount of data that banks deal with during account opening, the cumulative savings in time is substantial.

Further information: Refer to *Case Study: Interaction and Collaboration Services SOA Scenario*, REDP-4375.

To-be reference architecture

By applying the SOA patterns, Geoffrey Carroll with his team of IBM consultants and Sandy Osbourne-Archer can define a proposed reference architecture for JKHL Bank.

Figure 18 shows the to-be reference architecture.

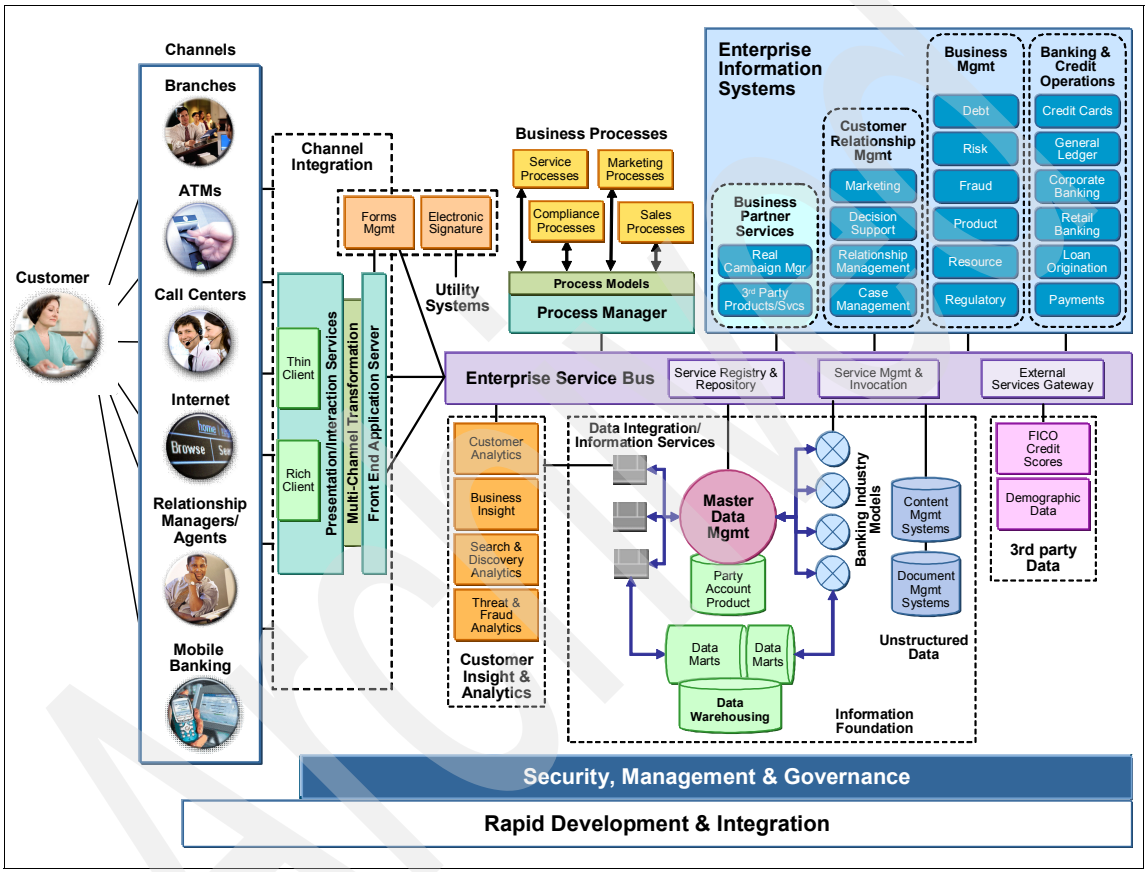

Figure 18 To-be reference architecture

The to-be reference architecture contains the following components:

- Channel integration
- Master data management
- Process flexibility
- Customer analytics and intelligence
- Rapid development and integration
- Document and forms management

- Transparency and tracking
- Core systems modernization

Channel integration

Channel integration provides a multi-channel SOA-based platform to support internet banking, ATMs, branch staff, call centers, and other customer extensions that are aimed at delivering a consistent customer experience.

The IBM component options for channel integration are:

- WebSphere® Portal
- Lotus® Expeditor
- WebSphere Multichannel Bank Transformation Toolkit
- Sonata® / Banking Industry Components (BIC)
- WebSphere Application Server

Master data management

Master data management provides access to a thorough and holistic view of customer-relevant data across the enterprise for all core systems in the bank.

The IBM Banking Industry Framework component options for master data management are:

- InfoSphere™ Master Data Management Server
- InfoSphere Information Server (DataStage® and QualityStage)
- InfoSphere Warehouse

Process flexibility

Banking operations involve efficient and flexible processes and workflows that orchestrate all of the services that are needed to perform business functions and to provide quality customer care while continuously optimizing these processes.

The IBM Banking Industry Framework component options for process flexibility are:

- WebSphere Dynamic Process Edition
- Composite Business Services (Know Your Customer, and CIF)
- WebSphere Process Server

Customer analytics and intelligence

Integrated analytics and insight capabilities provide real-time analytics and decision support based on reliable customer and business data. These components support customer segmentation based on strategic concepts, such as profitability, risk, persona, and behavior.

The IBM Banking Industry Framework component options for customer analytics and intelligence are:

- Cognos®
- OmniFind® Analytics
- OmniFind Discovery
- Entity Analytics Solutions (Global Name Recognition, and Relationship Resolution)

Rapid development and integration

Rapid development and integration provides tools to build customer care and insight solutions using industry-leading application integration tools, common processes, and data models. Accelerators leverage deep industry expertise and customer experience to reduce project risk and accelerate time to value.

The IBM Banking Industry Framework includes the following component options for rapid development and integration:

- Information FrameWork
- Rational Data Modeler
- Rational Software Architect
- WebSphere Business Modeler
- WebSphere Business Services Tool Pack

Document and forms management

Document and forms management provides structure around unstructured data and content within the enterprise. and integrates electronics forms, making them available for use with multiple business processes within the bank.

The IBM Banking Industry Framework component options for document and forms management are:

- Enterprise Content Management (IBM FileNet®)
- Lotus Forms
- WebSphere Portal
- WebSphere Application Server

Transparency and tracking

Transparency and tracking provides transaction-level logging and tracking for customer, product, and account information while improving regulatory industry compliance. It also leverages dashboard reporting tools and techniques.

The IBM Banking Industry Framework component options for transparency and tracking are:

- Tivoli® Monitoring and Transaction Tools
- Cognos Reporting
- WebSphere Business Monitor
- Business Space powered by WebSphere

Core systems modernization

Core systems modernization implements and manages a service facade and integrates with the current core banking systems, such as retail banking, credit cards, corporate banking, loan origination, and payments to support account opening and loan originating activities.

The IBM Banking Industry Framework component options for core systems modernization are:

- WebSphere Enterprise Service Bus
- WebSphere Message Broker
- WebSphere DataPower® SOA Appliances
- WebSphere Service Registry and Repository
- WebSphere Adapters
- CICS Transaction Gateway
- IMS Connect

Service-oriented architecture disciplines

Geoffrey Carroll, the Banking Industry Architect from IBM, tells Sandy Osbourne-Archer that now the SOA patterns are adopted, the next thing to consider are *SOA disciplines*. These SOA disciplines add robustness to the overall SOA solution.

Geoffrey recommends that JKHL Bank consider the following SOA disciplines:

- Service security
- Service management
- SOA governance

Applying the service security pattern

The service security pattern covers aspects of security management in two areas:

- Consistency of security policy and configuration across a multiple set of endpoints for authorization, message security, and access control.
- Management of identities within SOA environments.

Technical problem

JKHL Bank needs an integrated and centralized SOA security policy management across all endpoints for interactions with service requestors and providers. The bank needs to efficiently manage identities, and this identify information must be available across request flows (including access to services on z/OS®). The security of transactions is important to JKHL Bank, and they must assess compliance to their business policies.

How JKHL Bank applied this pattern

JKHL Bank adopts a federated security framework that is a combination of mainframe security (such as ACF2, RACF®), Java security, LDAP, firewall security, message security, and Web-based security. Enforcement of authentication is managed by a combination of JKHL Bank's enterprise access server authentication module and Tivoli Directory Server.

JKHL Bank uses Tivoli Federated Identity Manager to support a security token service that maps identities and tokens as they flow from requestors through the ESB to service providers. Tivoli Access Manager enforces authorization policies.

Business value-of-adoption

By adopting a federated security approach, JKHL Bank can secure its environment end-to-end, control access to its back-end systems, and comply with security policies across all business applications.

Further information: Refer to *Case Study: SOA Security and Management Scenario*, REDP-4378.

Applying the service management pattern

Service management covers aspects of monitoring and managing SOAs.

Technical problem

JKHL Bank wants to efficiently manage composite applications, which includes life-cycle management, business processes, transactions, Web services, and interactions with partners. The bank needs to closely monitor transactions, which includes services on z/OS. Contextual information must be available for critical points in the flow. The bank needs the ability to specify service level agreements (SLAs) and monitor and report them.

How JKHL Bank applied this pattern

JKHL Bank uses a variety of IBM products to implement SOA management:

- IBM Tivoli Composite Application Manager for WebSphere Application Server monitors the portal, ESB, and business process execution.
- Tivoli Composite Application Manager for SOA monitors service requests that flow from the process engine to the core banking systems and MDM repository.
- IBM Tivoli Monitoring monitors service components against SLAs.
- Tivoli Enterprise Console/Omnibus is the IT event management system that aids problem determination.
- Tivoli OMEGAMON® XE for CICS monitors and manages CICS transactions and resources on z/OS.
- Tivoli Change and Configuration Management Database is the platform that is used to store deep, standardized enterprise data.

Business value-of-adoption

By implementing a mechanism to perform event correlation across IT tiers, JKHL Bank reduces time for problem determination, for example, if the MDM system is down, call centers can spend less time finding the problem remotely by analyzing events that the middleware emits. Management of systems on z/OS helps to quickly detect and isolate problems when they occur on complex CICS systems. Integrating, automating, and optimizing data, workflows, and policies helps JKHL Bank align the ongoing management of its infrastructure with its business.

Further information: Refer to *Case Study: SOA Security and Management Scenario*, REDP-4378.

Applying the SOA governance pattern

The SOA governance pattern includes regulating new service creation, getting more reuse of services, enforcing standards and best practices, service change management and service version control, and implementing SOA policy.

Technical problem

JKHL Bank has no enterprise-wide governance strategy. The execution of governance practices are currently manual, but the bank needs proactive best practices and enforcement. Compliance reports must be stored and retrieved for audits. Because the bank is now embarking on the SOA path, they are struggling to identify new service candidates and prioritize these candidates.

How JKHL Bank applied this pattern

JKHL Bank plans, develops, and deploys an enterprise-level governance strategy that aligns with business objectives. They institutionalize governance best practices with executive sponsorship and support across lines-of-business. Artifacts are built based on best practices from the IBM Information FrameWork process, IBM Information FrameWork data, and IBM Information FrameWork service models, which are now managed as part of the overall solution life cycle.

JKHL Bank now complies with government, banking, and regional regulations, such as ITIL®, SOX, and Basel II. To regulate the creation of new services with future SOA projects, JKHL Bank implements, a centralized registry and repository, using a combination of Rational Asset Manager, WebSphere Service Registry and Repository, and Tivoli Change and Configuration Management Database.

Business value of adoption

By adopting an enterprise-level governance strategy, JKHL Bank benefits from reduced costs because the standards enforce usage of the same monitoring tools, technologies, procedures, and reporting for audit compliance.

JKHL Bank now reduced exposure to litigation and is trusted by its customers and partners by following banking, government, and regional regulations.

Further information: Refer to *Case Study: SOA Governance Scenario*, REDP-4384.

Summary

By adopting the SOA-implementation roadmap using SOA patterns and disciplines described in this section, JKHL Bank can construct a solution to improve top-line growth, reduce costs, reduce operational risks, and improve customer experience.

IBM SOA Sandbox

Get hands-on experience at no cost with the IBM SOA middleware portfolio in a Cloud environment through the IBM SOA Sandbox at:

http://www.ibm.com/developerworks/downloads/soasandbox/

The team who wrote this paper

This paper was produced by a team of specialists from around the world.

Martin Keen, Senior IT Specialist, IBM ITSO, U. S.

Rashmi Kaushik, SOA Scenarios Product Manager, IBM SOA Portfolio Consumability

Kulvir Singh Bhogal, SOA Scenarios Product Manager and SOA Sandbox Product Manager, IBM SOA Portfolio Consumability

Amit Aghara, Solution Architect - Financial Services Sector, IBM Banking Solutions

Scott Simmons, Lead Banking Solutions Architect, IBM Worldwide Banking Center of Excellence

Richard DuLaney, Business Analyst, IBM SOA Advanced Technologies

Sunil Dube, Executive IT Architect - Cross Brand Solutions, IBM Techline

Adeola Allison, Worldwide SOA Sales Executive, IBM Worldwide SOA Sales

Thanks to the following people for their contributions to this project:

- Keith Melton, FSS Executive IT Architect, IBM Banking Solutions
- Santhosh Kumaran, Senior Manager, IBM Banking Solutions
- Kevin Daley, Asset Intensive Solutions Leader, IBM SOA Solutions Enablement and Delivery

Notices

This information was developed for products and services offered in the U.S.A.

IBM may not offer the products, services, or features discussed in this document in other countries. Consult your local IBM representative for information on the products and services currently available in your area. Any reference to an IBM product, program, or service is not intended to state or imply that only that IBM product, program, or service may be used. Any functionally equivalent product, program, or service that does not infringe any IBM intellectual property right may be used instead. However, it is the user's responsibility to evaluate and verify the operation of any non-IBM product, program, or service.

IBM may have patents or pending patent applications covering subject matter described in this document. The furnishing of this document does not give you any license to these patents. You can send license inquiries, in writing, to:
IBM Director of Licensing, IBM Corporation, North Castle Drive Armonk, NY 10504-1785 U.S.A.

The following paragraph does not apply to the United Kingdom or any other country where such provisions are inconsistent with local law: INTERNATIONAL BUSINESS MACHINES CORPORATION PROVIDES THIS PUBLICATION "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Some states do not allow disclaimer of express or implied warranties in certain transactions, therefore, this statement may not apply to you.

This information could include technical inaccuracies or typographical errors. Changes are periodically made to the information herein; these changes will be incorporated in new editions of the publication. IBM may make improvements and/or changes in the product(s) and/or the program(s) described in this publication at any time without notice.

Any references in this information to non-IBM Web sites are provided for convenience only and do not in any manner serve as an endorsement of those Web sites. The materials at those Web sites are not part of the materials for this IBM product and use of those Web sites is at your own risk.

IBM may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligation to you.

Information concerning non-IBM products was obtained from the suppliers of those products, their published announcements or other publicly available sources. IBM has not tested those products and cannot confirm the accuracy of performance, compatibility or any other claims related to non-IBM products. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

This information contains examples of data and reports used in daily business operations. To illustrate them as completely as possible, the examples include the names of individuals, companies, brands, and products. All of these names are fictitious and any similarity to the names and addresses used by an actual business enterprise is entirely coincidental.

COPYRIGHT LICENSE:
This information contains sample application programs in source language, which illustrates programming techniques on various operating platforms. You may copy, modify, and distribute these sample programs in any form without payment to IBM, for the purposes of developing, using, marketing or distributing application programs conforming to the application programming interface for the operating platform for which the sample programs are written. These examples have not been thoroughly tested under all conditions. IBM, therefore, cannot guarantee or imply reliability, serviceability, or function of these programs. You may copy, modify, and distribute these sample programs in any form without payment to IBM for the purposes of developing, using, marketing, or distributing application programs conforming to IBM's application programming interfaces.

This document REDP-4467-00 was created or updated on March 16, 2010.

Send us your comments in one of the following ways:
- Use the online **Contact us** review Redbooks form found at:
  ibm.com/redbooks
- Send your comments in an e-mail to:
  redbook@us.ibm.com
- Mail your comments to:
  IBM Corporation, International Technical Support Organization
  Dept. HYTD Mail Station P099, 2455 South Road
  Poughkeepsie, NY 12601-5400 U.S.A.

Trademarks