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Teaching Tip

Information Systems Integration and Enterprise Application Integration (EAI) Adoption: A Case from Financial Services

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ABSTRACT

Increasingly, organizations find that they need to integrate large number of information systems in order to support enterprise-wide business initiatives such as e-business, supply chain management and customer relationship management. To date, organizations have largely tended to address information systems (IS) integration in an ad-hoc manner. However, some organizations are now realizing the value of adopting a more strategic and systematic approach to IS integration, and are therefore turning to the Enterprise Application Integration (EAI) tools being marketed by a number of integration vendors. EAI initiatives, however, not only involve technical challenges, but also significant business and organizational challenges. This instructional case, adapted from a real-life case, describes the EAI initiative at a Europe-based financial services provider. The case brings out several important lessons in relation to EAI adoption including the business justification for IS integration, EAI vendor selection and evaluation, business process co-ordination and EAI customization.

Keywords: information systems integration, enterprise application integration, enterprise integration.

1. INTRODUCTION

1.1 Need for Information Systems Integration

Since the emergence of computing, organizations have become increasingly dependent upon information systems ('systems' for short). As a consequence, many organizations have, over time, built up large portfolios comprising of hundreds, possibly even thousands, of individual systems (Cummins 2002). From conception, many of these systems would have been designed to address the specific requirements in a particular functional area such as accounting, personnel and stock control. This functional orientation, however, has tended to reinforce departmental silos within the organization, resulting in disparate 'islands of applications' in which individual systems remained disconnected from other systems (Sawhney 2001). Significantly, such an approach has not generally served the needs of modern enterprise business solutions such as e-business (Storey et al. 2000; Markus 2000), supply chain management (Jayaram et al. 2000) and customer relationship management (Pan and Lee 2003), which require close integration of information and process across different parts of the organization. Thus, systems integration remains high on the agenda of many organizations, with one study (based on 1,350 interviews) indicating that over 80% of Chief Information Officers (CIO) and Chief Technology Officers (CTO) believing integration is either mandatory or a key enabler for addressing mission-critical activities within their organization (IDC 2002).

1.2 Challenges

The integration of systems is a major endeavor, and involves challenges of a technical, organizational and project management nature (Lam 2005; Themistocleous 2004). From a technical perspective, many systems, particularly of a legacy nature, were originally designed to be standalone with little intention for future integration. Such systems are not easily replaced by newer systems as they represent a huge financial investment and tend to embody a significant amount of corporate knowledge (Brodie and Stonebraker 1995; Robertson 1997). Furthermore, the systems within an organization may employ diverse technology architectures; this mix of legacy and modern computing platforms raises compatibility issues which impede integration (Lam 2004).

From an organizational perspective, information systems integration involves changes in business process, and more broadly, realignment of technology goals with business goals (Themistocleous and Irani 2001). However, resistance to business process change, particularly when such business processes have become engrained in the organization, can be

difficult to overcome (Sarkis and Sundarraj 2003). There are also major issues in project management. With systems integration projects potentially affecting so many different parts of the organization, there needs to be a high degree of co-ordination, communication and consensus across many diverse stakeholder groups (Sharif et al. 2004). The sheer scale of integrating so many different systems also adds to the complexity of the project, and finding individuals with the required skills and expertise in integration may also prove to be problematic (Lam 2004).

1.3 Integration Approaches
Traditionally, organizations have dealt with integration in a tactical way which involved building custom interfaces between the individual systems that needed to be integrated. This approach, known as 'point-to-point' integration, however, does not scale well as the number of systems to be integrated increases (Linthicum 2001). In addition, the maintenance costs associated with maintaining so many interfaces becomes a significant burden on IT budgets.

In the early 90's, distributed objects and component architectures were mooted as the answer to the challenge of integration (Digre 1998). This was typified by the Common Object Request Broker Architecture (CORBA), which provided an open standard for distributed systems to communicate (Vinoski 1997). However, CORBA projects were perceived as technically very complex, requiring significant development effort (Henning 2006). However, industry support and standardization efforts for CORBA provide problematic, leading to its slow demise.

More recently, Enterprise Resource Planning (ERP), which involves the replacement of existing systems with a suite of interconnected modular systems from a single vendor, was seen as the solution to the problem of systems integration (Davenport 1998). However, ERP systems tend to coerce organizations into adopting standardized business processes, often resulting in organizational misalignment in which the business rewards of ERP have failed to materialize (Soh et al. 2003; Ross and Vitale 2000). Organizations soon realized that no single ERP system could address all the requirements of an organization (Hong and Kim 2002), and that an ERP system needed to co-exist with existing systems, so heightening rather than removing the need for systems integration (Themistocleous et al. 2001).

Some organizations are therefore turning their attention to the Enterprise Application Integration (EAI) tools offered by integration vendors such as TIBCO, WebMethods, Seebeyond, BEA, Mercator and Vitria to address their systems integration problems. In many respects, EAI tools represent an evolution of message-oriented middleware tools, and have three main components:

1. An integration broker which serves as a hub for inter-system communication. The integration broker performs a number of key functions including multi-format translation, transaction management, monitoring and auditing. Some advanced integration brokers provide business process modeling and management tools that enable the sequence of communications between systems to be mapped out visually.

2. Adapters which enable systems to interface to the integration broker. An adapter is essentially a gateway

or wrapper that provides the means by which packaged applications (such as SAP), database applications (such as Oracle), legacy systems (such as mainframe) and custom applications (written in Java or other programming language) can connect to the integration broker (Brodie and Stonebraker 1995).

3. An underlying communications infrastructure which enable systems to communicate with each other using a variety of different protocols.

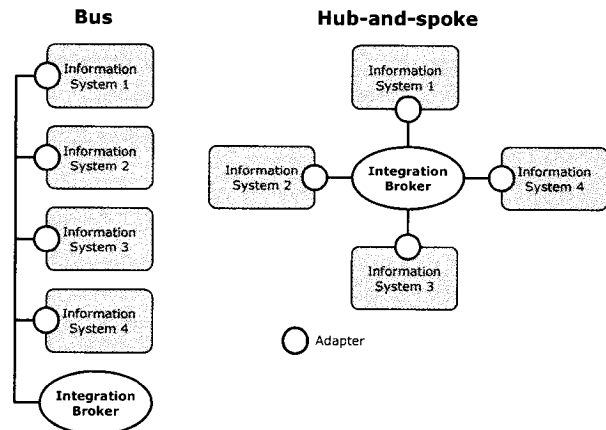Most EAI tools employ a hub-and-spoke or bus arrangement, as illustrated in Figure 1.

Figure 1: EAI architectures

Because each system need only be integrated with the integration broker once, EAI significantly reduces the overall number of interfaces that need to be built and maintained, thus avoiding the problem of 'spaghetti integration' (Linthicum 2001).

EAI, however, involves more than just the implementation of an EAI tool. As indicated earlier, the challenge of integration is not simply a technical one, but one that has significant organizational and project management challenges (Lam 2005). EAI should therefore be viewed more holistically as *"the plans, methods, and tools aimed at modernizing, consolidating, integration and co-ordinating the computer applications within an enterprise"* (Mckeen and Smith 2002).

1.4 An Instructional Case
The remainder of this paper presents an instructional case of EAI adoption which introduces students to a range of issues relating to the justification, planning and management of EAI adoption. Despite the growing importance of systems integration, there are relatively few published cases available in the literature. Furthermore, EAI is a relatively new and emerging area of information systems research, and so the introduction of a case in EAI is a timely one.

The case is adapted from the EAI experiences of a real company, although the actual name of the organization, its demographics and the names of those involved in the project have been changed to maintain confidentiality. What is particularly distinctive about this case is that it provides an end-to-end view of EAI adoption. When introducing students

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to the area of systems integration for the first time, such broad-based cases are more generally preferable to cases which are narrowly focused. At the same time, the case is sufficiently concise to enable students to follow the main thread without being distracted by peripheral details. The case also carries with it an element of tension and uncertainty about whether EAI has lived up to its promise. Such contentious issues serve as fruitful avenues for in-class discussion and debate.

2. CASE DETAILS: FENTON ONLINE

2.1 Company Background and Organization Structure
The Fenton Financial Services (FFS) group has been providing corporate and consumer financial services across Europe for more than half a century. In 1996, having observed the rapid growth in e-business, FFS decided to create Fenton Online (FO), a separate business unit within FFS to specifically handle the provisioning of online consumer financial services, or e-finance, under the Fenton brand. The creation of FO was seen as a preferred alternative to having individual business units within FFS each launching their own e-finance initiative. The decision began to pay off in 1999, when FO posted its first annual profit. Since then, e-finance consumers have swelled with 30% of FFS consumers now using the e-finance services of FO.

The organization chart in Exhibit 1 depicts FO's senior management team, many of whom were the result of internal transfers within FFS. Chris Halliwell, Chief Executive Officer (CEO) of FO, was previously Vice-President (VP) of consumer banking at FFS. FO has six business divisions, of which the Savings and Mortgages divisions are the two largest in terms of revenue. Mike Goldberg is VP for the Savings division and Sally Roper is VP for the Mortgages division. Jane Watt is VP for Customer Services and oversees a group comprising of 20 customer service agents. As Chief Information Office (CIO), Edwin Yeo is responsible for all of FO's IT capability and heads a team of 35 IS professionals that handle the development and maintenance of FO's systems.

2.2 Setting the Scene: The Post-Project Review Meeting
This was one of those review meetings that could go either way. The pilot EAI project that FO had embarked upon to integrate the systems in the Mortgages division had had its fair share of problems. The 12-month timeline originally set for the project had dragged on to almost 20 months. The project budget had also been exceeded by almost 50%. Though things looked bad, Edwin was trying his best to emphasize the positives from the project:

Edwin: "I'll admit that the project scores low if we use our standard evaluation metrics like sticking to budget and on-time delivery. But the project is unlike a typical IT project and we've managed to successfully overcome the challenges on the first project we've done of this kind. More importantly, we've implemented a cornerstone piece of our IS architecture that will allow FO to integrate systems more easily in the future. Going forward, this will place us in a much better position for addressing our new strategy in the marketplace. So from

a business perspective, it ranks as one of our most important technology projects to date."

Sally and Jane, the major stakeholders in the project, were generally pleased with the outcome of the project, although both were frustrated that the project had taken so long. For Sally, the project enabled her to reduce the costs of mortgage processing and improve efficiency. For Jane, the project enabled her to deliver a higher level of customer service.

Chris, however, appeared less enthusiastic about the project. The IT budget was over-stretched and he was concerned about the heavy financial outlay of future integration projects. Seeds of doubt had been sown as to whether EAI really represented the best solution to FO's integration challenges. Should Chris continue further with EAI and accept the risks involved, or was there a better way to move forward? The following describes the history of the project.

2.3 The Project History: Motivations for Integration
In 2003, FO launched a major initiative within the organization to integrate systems and processes with the goal of enhancing customer experience and improving operational efficiency. Because of FO's large and growing portfolio of information systems, it was felt that EAI would be an appropriate solution to address FO's current and future integration needs. However, mindful of the scale of the exercise and the risks associated with adopting EAI for the first time, it was decided that a pilot EAI project should be first carried out before considering rollout across the entire organization. The Mortgages division, one of the most rapidly expanding parts of FO's business, was identified as a high-priority project for systems integration to deliver higher levels of customer service:

Chris (CEO): "The dynamics of the industry have changed considerably over the last 5 years. Today, people are no longer locked into mortgages for 25 years or more. Switching mortgage providers is now very easy to do. Also, customers have a much greater choice of mortgage providers to choose from, so the market is much more competitive. Customers can get their mortgage from an online provider like FO, a bank, or one of the main mortgage brokers. With a long-term product like a mortgage, having a good product is no longer sufficient to be competitive...the product must be sold and delivered in a high service-oriented environment."

Jane (VP Customer Services): "In the olden days of branch-based banking, bank managers knew their customers so were able to build relationships and deliver a high level of personalized service. In the era of tele-banking and e-business, relationship and high-quality customer services are still important, but organizations rely a lot more on technology. So when a customer phones in or sends us an email, it is important for us to have detailed electronic records of that customer's financial status and history at our finger tips so that we still provide customers with a personal level of service."

2.4 Limitations in Current IS Architecture

The mortgages division within FO is supported by an IS architecture that comprises 25 different systems. Some of these systems are legacy systems, such as those ported over from FFS, while others are packaged 'best of breed' applications. Out of the 25 different systems, 5 are considered core systems that are mission-critical to FO's online mortgage business:

1) Financial portal: A web-based front-end application through which individuals can apply for mortgages online, and where existing customers can track their mortgage and savings accounts. The financial portals is developed using HTML, JavaScript and Java Server Pages (JSP) and utilizes a Microsoft SQL Server database.

2) Mortgage management system (MMS): A packaged application that manages the workflow associated with the processing of mortgage applications. The MMS accesses back-end support services such as address and credit checks. The MMS is a packaged application running on Windows NT provided by a specialist financial services technology company.

3) Account management system: A custom account management system written in COBOL ported over from FFS. Once a mortgage has been approved, an account is set up on the account management system.

4) Call-centre application: A customized version of the Siebel package, used by FO's customer service agents for handling enquiries over the phone.

5) Mortgage products and quotation management system (MPQ): Another custom account management system built on the SQL scripting language ported over from FFS. The MPQ holds the product record for each type of mortgage offered by FO and is also capable of generating mortgage quotations.

A detailed description of the functionality and the technical platform of each core system is given in Table 1.

Core Application	Functionality
Financial portal	• a Web-based front-end application • enables individuals to apply for mortgages through a set of Web forms; mortgage applications details are captured in the portal's database • provides a collection of mortgage calculators and tools • allows marketing and other information about mortgage products to be published via the content management function • allows existing customers to track their mortgage and mortgage payments • captures a customer's profile and their personal details in the portal's database
Mortgage management system	• a back-end application that processes mortgage applications and tracks the workflow associated with mortgage
(MMS)	processing • mortgage applications are transferred from the financial portal to the MMS by a daily batch process • has been customized to use FO's business rules for mortgage processing • accesses a variety of back-end services such as address checking and credit rating
Account management system	• a back-end application that manages mortgage accounts • when a mortgage application is successful, a mortgage account is created on the account management system • different kinds of mortgage accounts (fixed, variable payment etc.) are handled by the account management system • accesses banking gateways for account transfers from customer's bank account • a legacy mainframe application based on VME and COBOL
Call-centre system	• used by call-centre staff to handle telephone enquires • captures details of caller and the nature of the enquiry • issues a problem ticket for enquires that can not be sorted out during the call • based on the SEIBEL, an industry leading call-centre application, running on Windows NT
Mortgage product and quotation management system (MPQ)	• a back-end application used to store all the different kinds of mortgage products offered by FO • allows a user to maintain the product record for each mortgage product • can also be used to generate mortgage quotations

Table 1: Core Applications

The core systems are standalone in nature, and do not 'talk' directly to other systems. Instead, a set of batch processes run on a scheduled basis is used to export and import data files from one system to another. In addition, manual business processes exist in which staff key data directly into systems where needed. For example, mortgage account details taken from the MMS are keyed directly into the account management system because neither a direct interface nor batch process exists between the two systems.

Edwin acknowledged that the crux of the problem was the lack of real-time integration between the systems. Although the batch processes currently used by FO would be acceptable for periodic processing such as the generation of monthly reports, they were not deemed suitable for e-finance:

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Sally (VP Mortgages Division): "The financial portal is only a front-end for capturing mortgage applications. It is not until the following day that we can begin to process those mortgages in the MMS. Customers these days want as quick a turnaround on their mortgage applications as possible. That's what e-business is all about."

Jane (VP Customer Services): "Call-centre staff currently do not have a single, consolidated view of a customer or mortgage applicant. Siebel is a good tool, but call-centre staff still need to log into the other core applications to get information held in those systems. For example, they need to log into the account management system to get specific information about the current state of mortgage payments and the MMS to find out the status of a mortgage application. It's not an ideal scenario because it means that customers are kept waiting on the phone for a longer period of time than is necessary. This can be frustrating for the customer. The average length of each call is just over 3 minutes. We can reduce that if we had all the information available either in Siebel or a single tool. It also means that customers spend less time in the wait queue. At present, the average waiting time is 25 seconds. That's on-par with the industry benchmark, but we need to do better than that. It's not just about customer service though, it's also about operational costs and efficiency and call-centre productivity."

The lack of integration clearly limited FO from delivering the desired level of customer services. Indeed, behind the glossy veil of the FO Website, 'islands of applications' existed that reflected how FO's IS architecture had been rapidly assembled rather than strategically planned within a longer term vision:

Edwin (CIO): "When FO first began, the emphasis was on being first in the market to launch mortgage products online. We created the IS architecture within a short space of 8 months by acquiring the best packaged applications for each job, and keeping the level of custom development work to a minimum. However, what we now need to do is to knit all our applications together in order to provide a seamless end-to-end process for mortgage processing and for delivering high quality customer services."

The scope of the pilot EAI project at FO was to integrate all the 25 systems in FO's mortgages division. Chris set a 12-month timeframe for the project and overall responsibility for the project was given to Edwin.

2.5 Feasibility Study and Project Initiation
Edwin formed a team, a pair of his most senior architects, to conduct a feasibility study to examine different options for information systems integration and provide recommendations for moving forward. Edwin also enlisted the help of Gerry Kaplan, an integration consultant from one of the big 5 consulting firms, to work on the team.

The team studied some potential integration options. In particular, the team compared the EAI option with a non-EAI option which entailed replacing the existing batch interfaces with programmatic interfaces that could facilitate information transfer in real-time. However, that option was eventually rejected for the following reasons:

- A high level of custom development would be involved. Numerous point-to-point interfaces would need to be written from scratch. For example, developers would need to write an interface between the back-end mortgage application and the legacy accounts management system.
- There was a high level of development risk. The legacy accounts management system was based on old mainframe technology and it was not certain that a robust integration interface could be built from scratch.
- There was a high level of business risk. It was envisaged that the existing applications would need to be taken offline for a significant period of time.
- It would take too long to develop all the interfaces, easily exceeding the 12 month timeline given to the project.
- The existing IS staff at FO had little experience of integration projects and lacked the necessary expertise to complete the project in-house.

The EAI option was therefore recommended:

Gerry: "FO's IT architecture is constantly in a state of evolution. I know that individual applications will eventually be retired and replaced by better ones. However, what is really needed is an integration 'backbone' whereby applications can be 'plugged in and out'. This will allow FO to easily retire or replace applications with minimal disruption other applications and to the overall business. The EAI approach seems very well-aligned for this purpose."

The team gathered marketing materials from the Web for several of the leading EAI vendors, and put together a description of how EAI could be used to address the integration needs of FO's mortgages division.

With support from Chris, Edwin proceeded with the recommendations from the feasibility study. A team of six individuals was assembled, including the two senior architects originally involved in the feasibility study, two business analysts from the Mortgages division, and a customer services manager from the Customer Services division. Gerry was also retained on the project. Although at this formative stage of the project the exact nature of the EAI work was still being defined, Gerry put forward a tentative project plan that the team could work towards (Exhibit 2).

2.6 Integration Requirements Gathering and Business Process Analysis
A number of interview sessions were held with various project stakeholders, including members of the management team, to gather more detailed integration requirements. High on Sally's priority list was the turnaround time for processing mortgage applications and the ability to handle higher volumes:

Sally: "At the moment, we take on average 10 working days to process a mortgage application from the time when a customer submits his or her application. That puts us at average in terms of industry benchmark. However, we need to cut our turnaround time by a third, from 10 to 6 days, if we want to be ahead of our competitors. But we also need to be able to handle higher volumes. Right now, we handle about 120 mortgage applications per week. We need to be able to comfortably scale up from 120 to 300 mortgage applications."

From a technology viewpoint, it was important that the underlying architecture of the integrated solution was both stable and secure:

Edwin: "We need seamless integration and transfer of information between all core applications, and potentially the non-core applications in the future. We need a reliable and robust solution that gives a maximum level of uptime. When one application fails, we don't want that to have a knock-on effect on the other applications. The applications need to be integrated, but at the same time, the integration architecture should be fault-tolerant. Security is also an important consideration. We already have existing security policies place, so the integration of applications should not weaken the existing level of security."

It was also important that any integration work would have minimal disruption to business operations, i.e. there should not be an extensive period of downtime where customers would be unable to submit mortgage applications or carry out normal operations on the financial portal. Any such outage would be unacceptable to FO.

In conjunction with requirements gathering, there was also a parallel activity of understanding and analyzing FO's business process. The team started by examining the current business process and pinpointing areas of weaknesses. In particular, the reliance on manual processes was identified as a major area of inefficiency and error:

Team member: "Once a mortgage application has been accepted, a new mortgage account is created by viewing the customer details in the MMS and re-keying the data into the accounts management system. As a manual process, this is really tedious and error-prone. The manual processing also becomes a bottleneck when we launch marketing campaigns for new mortgage products. We get a flood of new applications and our manual processes just can't cope. It can become really slow when staff take holiday or fall ill."

In addition, data was duplicated in multiple systems, and manual processes were relied upon to keep the information consistent across each system. For example, when a customer phoned in with a change in their details (e.g. address), the customer service agents would enter this change into the call-centre application, but also needed to remember to re-key the new details into the financial portal. The manual processes were tedious and error-prone, and

could, in some cases, lead to data inconsistencies across different systems.

Project review meeting: By this time, three months since the start of the project had elapsed, and the project was already one month behind schedule. However, Edwin reassured Sally, Jane and Chris that there was little cause for concern as this slippage could be recouped in the remainder of the project.

2.7 Integration Architecture Analysis and EAI Tool Evaluation

Having thoroughly understood the weaknesses in FO's business processes, the team proceeded to a more detailed design of the integration architecture and an evaluation of candidate EAI tools. An overview of the proposed EAI solution to integrate the core systems (a key part of the overall EAI solution) is shown in Exhibit 3. Under Gerry's lead, the team conducted an 'on paper' evaluation of several of the market leading EAI tools based on literature downloadable from the vendors' website and various industry articles sourced from the Web. Gerry had identified several key criteria in the selection of EAI tools based on FO's requirements (Table 2).

Selection Criteria
1. Availability of pre-built adapters, either supplied by the EAI vendor or a third-party, that could connect all of the core home loans applications together with the least amount of effort. For example, FO needed to be sure that adapters were available for its VME based legacy account management system.
2. The back-end mortgage application was a specialist application that provided a set of Java APIs for interfacing. It was therefore important that a Java adapter existed for the EAI package.
3. Sufficient flexibility in the EAI tool to support the business rules inherent in FO's mortgage application process.
4. Load-balancing to handle high business volumes (even though the volumes being considered here were far less than what one might find in a typical trading application) and 'hot' failure standby to provide maximum server uptime.
5. Ability to integrate new applications in the future. FO was planning to launch a business intelligence initiative in the near future which would involve collating data from different systems into a data-warehouse.
6. An established track-record of large-scale deployment in financial institutions.

Table 2: Selection criteria for an EAI package

Gerry: "Selecting the right EAI package is as much a strategic business decision for FO as it is a technology one. The EAI package will become a hub that brings all of FO's applications together, so there must be a close match to FO's overall application integration needs. But the EAI vendor must be more than just a vendor; they must also be capable of becoming a strategic partner of FO. That means understanding FO's business needs and

working hand-in-hand with FO on the implementation to ensure project success."

From an initial short-list of four of the market-leading EAI tools, two were quickly eliminated because they did not appear to have the necessary pre-built adapters. For example, the call-centre application used at FO was based on the Seibel application, so it was essential that a Seibel adapter was available for the EAI tool.

More in-depth face-to-face presentations and discussions were held between the team and the remaining two EAI tool vendors. The two EAI tools were closely matched in functionality. A consensus was reached amongst the team, however, to go with TIBCO, the vendor that was considered by FO to have a stronger track record working with financial institutions on large-scale EAI implementations. However, even after this decision had been reached, a month of negotiation between Peter and the vendor followed regarding a combined package of tools and consultancy, training and support services. As part of the package, two of the EAI vendor's consultants were appointed to the project to facilitate the deployment of the EAI solution.

2.8 Proof-of-Concept Development and EAI Tool Configuration

The team felt that it would be too risky to introduce the EAI tool directly into the live production environment at FO. Instead, a proof-of-concept would first be developed in a test environment to demonstrate that EAI was feasible and to iron out any unexpected problems that might arise.

Although installation of the EAI tool in the test environment was relatively problem-free, the team spent considerable effort configuring the EAI tool. Adapter configuration enabled the services and/or data within a system to be visible to the EAI broker. Business process configuration then allowed the business processes of FO to be captured in the EAI tool in order to specify the flow of information between the individual systems. Critical to business process configuration was an understanding of the business rules associated with FO's processes:

Team member: "Knowledge of the business rules that governed the mortgage application process was essential for proper business process configuration so that business events would trigger the appropriate information flow. For example, if an applicant already had an existing mortgage when they applied for a mortgage at FO, additional checks would be needed to determine the applicant's track-record in servicing their existing mortgage payments. Hence, this would trigger checks in supporting applications. The process isn't simple. There are lots of rules and procedures that we follow."

One major issue was that business rules were not centrally documented, and in some cases, did not seem to be documented at all. The team therefore had to interview several business analysts from the mortgages division in order to explicitly uncover the business rules. However, the elicitation, definition and validation of business rules was a non-trivial process that took much longer to complete than expected.

2.9 Custom Adapter Development

There were instances where pre-built adapters were unavailable and where custom adapters had to be developed. For example, the MMS was a specialist packaged system for which no pre-built adapters existed. Instead, the MMS provided an integration interface through a set of Java Application Programming Interfaces (APIs). The EAI tool included an adapter software development kit (SDK) with a Java API that enabled a custom adapter to be created for the MMS. The technical staff at FO did not have the necessary technical knowledge to undertake the development work themselves so the work was outsourced to the development services of the EAI vendor. The EAI vendor had done many such custom adapter development projects before, so were well versed in the design and development of adapters. However, the development work for the custom adapters extended the project by an additional 4 months.

Project review meeting: At this stage, 14 months had elapsed, and it was clear that the project would be delivered later than the originally planned 12 months. Both Sally and Jane were concerned about how soon the project would be completed. Chris was also concerned about project costs. The costs of custom adapter development came somewhat as a surprise, as Chris was led to believe that using an EAI solution would avert the need for custom development work. In addition, the longer the project went on, the further project costs would increase.

2.10 Proof-of-Concept Testing and Rollout into the Live Production Environment

Testing was conducted in two main parts: unit testing, which involved testing system-to-EAI broker integration, and end-to-end testing which involved system-to-system integration via the EAI broker. Several logic errors in the business process modeling were identified that required subsequent investigation and correction. This in turn extended the time for testing, and the team ended up spending one month additional effort on testing than they had originally planned.

Once the solution had passed testing, the rollout of the EAI solution into the live production environment began. Unlike a typical application development project where there was a clear 'cut-over' from the old to a new system, the EAI project involved the introduction of adapters, the EAI broker and other components of the EAI solution into the live environment. Rather than introduce the full EAI solution into the live production environment, a phased approach was adopted where the core systems were integrated in phases:

Peter: "A phased approach is less risky than trying to introduce a full EAI solution into the live environment in a shotgun approach. Introducing different elements of the EAI solution in phases makes things much more manageable. We also isolate risk so that any problems that occur don't affect the other core applications. We can also rollback more easily what we've done."

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However, while the phased approach enabled risk to be better managed, it significantly lengthened the duration of the project. It was not until month 20 when the EAI solution had finally been rolled out in full, far beyond the original 12-month schedule, and that the whole EAI team could breathe a sigh of relief. Whether or not this, the first EAI project at FO, would be considered as a project success or failure, would be a matter of debate at the upcoming post-project review meeting.

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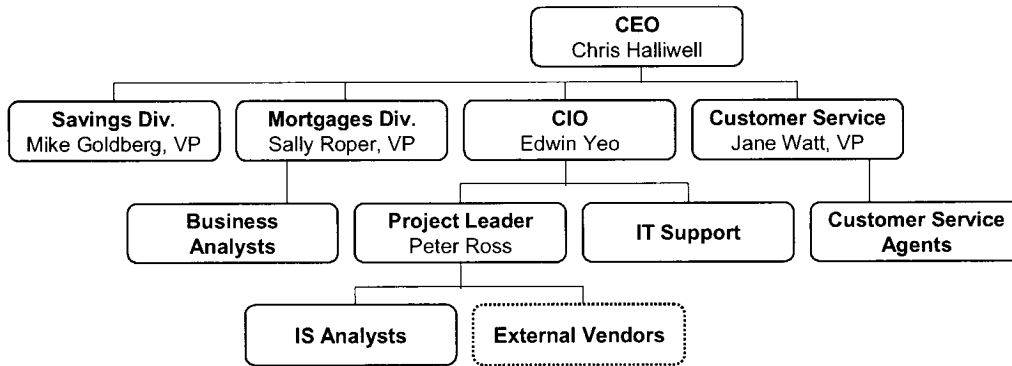
APPENDICES

Exhibit 1: Organization chart for FO

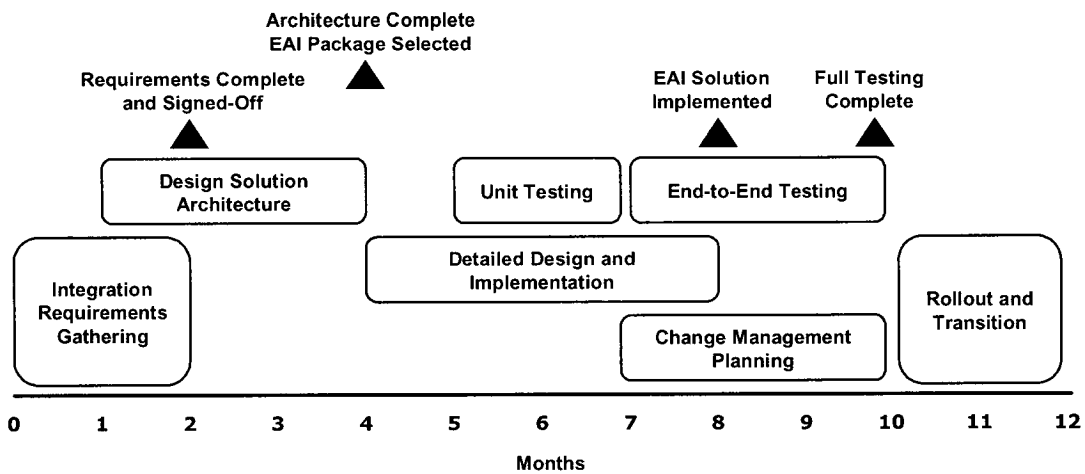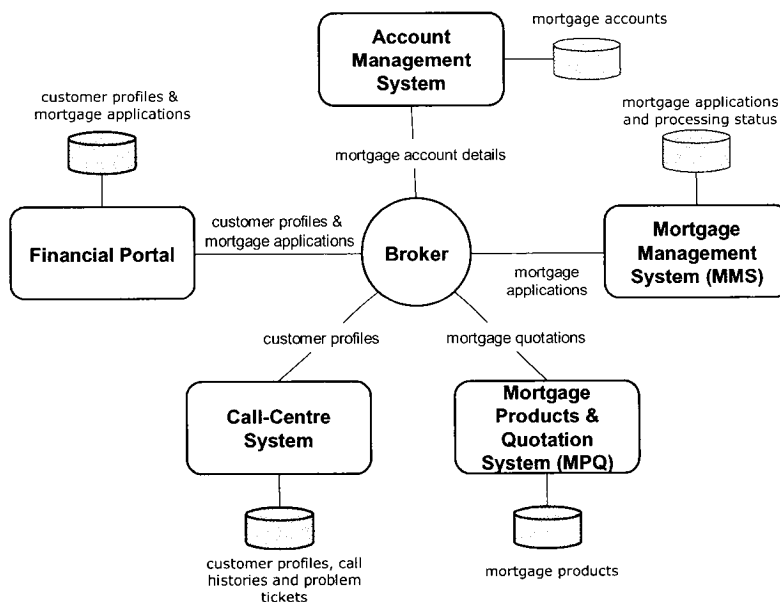## Exhibit 2: Tentative project schedule

Exhibit 3: EAI Architecture

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