HYPO-BANK
MUNICH, GERMANY

EUROPEAN EXCELLENCE AWARD: IMAGING, GOLD

EXECUTIVE SUMMARY

Almost daily, the media raise questions concerning the economic advantages of computer-aided office automation. These questions often consider whether the potential benefits can now be fully realised through an efficient implementation of document and workflow management. Hypo-Bank believes that precisely the latter will not only achieve a reduction in costs for personnel and material, lost cases and filing errors, but also enhance customer service.

Efficient office automation (OA) requires the implementation of an integrated OA architecture that is oriented toward supporting several independent business processes. Word-processing, event and to-do scheduling, email and document management are important components of an OA architecture. In the bank's opinion, the prerequisites for achieving the goals will be fulfilled only when these components are linked to one another *and* to the application systems; in addition the components must be controlled by a workflow management system. Electronic document management in particular will play a central role because forwarding documents within and between companies without changing the storage medium is necessary for optimising business processes.

The processing of payment transaction documents can be used as an example. At Hypo-Bank, hundreds of thousands of transactions are processed with paper and archived on microfilm every day. As a result, complaints and tracing operations lead to time-consuming and personnel-intensive operations whenever there is a need to find the document or record belonging to a payment transaction.

At Hypo-Bank, the processing of payment transactions was chosen as a pilot application for electronic archiving (1993) and for workflow management (1995) because the benefit expected within the scope of economical feasibility and improved service quality appeared to be secure. In 1996 substantial efforts were undertaken in order to implement changes in the work processes in the loan department.

The rollout of the new applications for document and workflow management aroused great interest within the Hypo-Bank group. To integrate different user groups with their different requirements in a more flexible fashion, and reach business partners and customers via these technologies, the client/server-based document management system was being expanded with web-based components in 1997. So the proven strength of the Hypo client/server-based document management system (i.e. efficient data management, maturity,

scalability, stability) are combined with the well-known advantages of the web-based solutions (thin clients, platform independent applications, ease of use of browser interface, secure investment).

ARCHITECTURE OF APPLICATION-INDEPENDENT BASE SYSTEMS

Goals

Formulated generally, the goal is to establish corporate-wide application-independent OA base systems for integration in application systems. This applies here specifically to document and workflow management, but also to word processing, event and to-do scheduling and e-mail. Setting aside for the moment the large number and variety of the specific functions needed by document management applications and take a look at the technical requirements on the system, it was clear to Hypo-Bank that they scarcely differed from one another. Furthermore, they can even be met by one standard and homogeneous platform.

The functionality of a base system must be integrated easily and quickly into existing and future applications. Base systems ensure through encapsulation that the application programs are not affected by implementation details of the OA components. Availability of a convenient interface that provides the application developer with a set of functions clearly shortens the time needed for the development of new applications and it is the foundation for workflow enabling of this component. Base systems offer advantages for participants on both ends of the interface. For example, the application developer need not bother about the control and configuration of technical system components and the operators of the base system are able to make sure that changes remain transparent for the applications that are in practical use. The central control that thus ensures that a standard is mandatorily observed throughout the company makes it possible to cope with the complexity. The system is closed by encapsulation and is thus open for enhancements.

Infrastructure

Hypo-Bank's EDP environment reflects the high complexity that results from a combination of central mainframes communicating more than 600 decentral LANs with more than 10.000 PCs. Every new component has to be integrated in such a way that maintenance effort remains justifiable and existing systems to which maximum availability and performance requirements apply are not affected. The introduction of the document management system compelled the selection and integration of novel hardware in order to accommodate rising requirements in mass storage, network capacity and PC periphery (scanners and monitors).

EXCELLENCE IN PRACTICE

Economic feasibility

The design of base systems makes it difficult to perform an economic feasibility calculation because a substantial portion of the investments serves as an infrastructural measure for future projects. Furthermore, the qualitative and strategic benefit aspects of base systems can only be evaluated outside the scope of conventional calculations. Despite these restrictions, in the concrete case of the document and workflow management systems economic feasibility calculations were elaborated by virtue of the fact that the initial projects conducted a joint cost/benefit analysis. Nevertheless, it was possible to determine an amortisation time of less than two years for the investment made in relation to the document management system. A similar value is expected for the workflow management system.

The architectural concept described will be concretely defined below with reference to the base systems for document and workflow management.

CONSTANT EVOLUTION OF A DOCUMENT MANAGEMENT SYSTEM

Components
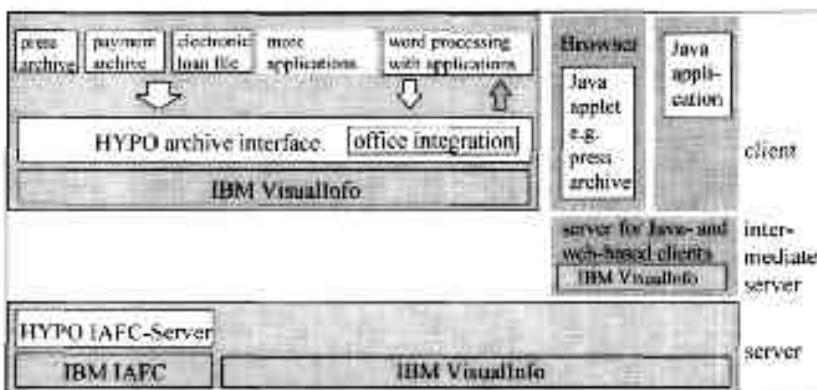
Figure 1: document management, three-tier architecture

The base system for document management is based on two independent standard software components, IBM ImagePlus VisualInfo and IBM IAFC (Item Access Facility). The strengths of both products are mutually complementary and are integrated to arrive at one complete system. An application can even alternately serve itself from both system components without this changeover being visible to the user.

On the one hand, the simplified layer model (Figure 1) shows the clear separation between the applications (at the topmost layer) and the base system through the HYPO interface and, on the other hand, it elucidates the role of the standard software within the base system.

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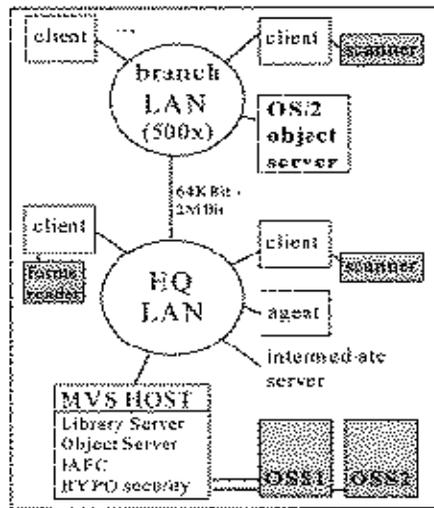
Figure 2: dm infrastructure

The document management functionality is also integrated in the word-processing application and other standard office software. Office documents can be archived directly out of the word processing application and can be queried again by way of convenient search dialogs. Nearly all of the integration work is done by the base system. The applications just need to provide their specific search- and indexing dialogs.

This scenario requires strictly defined interfaces. Long term readability of these application-specific formats will be guaranteed by virtue of the fact that they are stored both in their original format and also in the standardised image format (TIFF). This is also a feature of the Hypo-Bank base system. The application even doesn't have to care about that. It simply stores the office document in its native data format. An agent will detect this document, convert it and put the image copy into the document management system. Thus, an office document from the document management system can be displayed both in the original application and together with other images in a viewer. In turn, this office storing and search module can be integrated in any other application.

Crucial criteria for the choice of IBM ImagePlus VisualInfo were, besides the standard archive functionalities, the bandwidth of the client's *and* the server's operating system platforms, scalability of the central *and* the decentral components, the maturity of system and data management, the effort required for integration into the existing data processing environment and, not least, the five-year cost analysis.

It was necessary to use the IAFC product in order to arrive at a solution to the problem of the efficient archiving of very large quantities of records as are encountered in paperless payment transactions, for example. Technically, this is realised via the use of a hierarchical index for bundling of records. As IBM has not implemented IAFC as a client/server system,

EXCELLENCE IN PRACTICE

Hypo-Bank itself developed an OS/2 client and an MVS server in order to operate the HOST retrieval interface of IAFC. That's why there is currently no need to move to the IBM EDMSuite's successor of IAFC named OnDemand.

The VisualInfo component consists of the library server and several object servers. The library server catalogs the documents and manages the user definitions, access privileges and system data in DB2 tables. An object server stores the documents themselves.
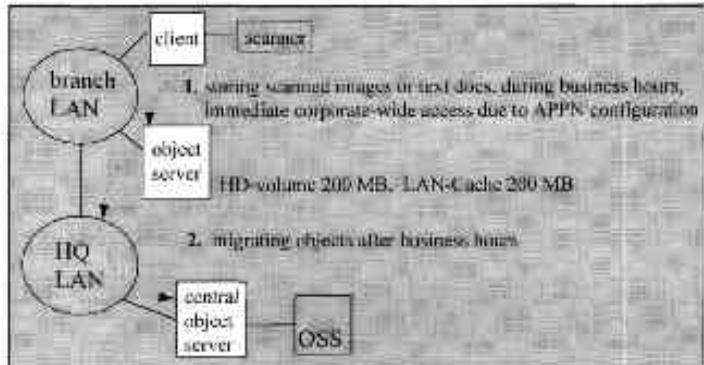
In the installation of Hypo-Bank (Figure 2) the library server, the central object server and IAFC are operated under MVS, while 35 decentral object servers are running under OS/2. These object servers are installed in selected locations primarily for two reasons: First for better response times for store/load actions (which the users strictly demand, even in locations connected through 2MBit lines); second, for reducing the network load during business hours. Scanned documents are stored fast on the local object server. After business hours the objects are migrated to the central object server because of its secure data management. Thus, no expensive and complex storage management has to be installed and maintained at decentral locations. On the other hand, when a client loads an object, it is also put into the LAN-Cache of the local object server. This helps minimizing the requests to the central object server and the jukeboxes. In addition there is an enormous reduction of the network load. Figure 3 shows the scenario and the role of the decentral object servers

Both the central object server and IAFC are storing the objects by means of OAM (Object Access Method). Depending on cost and performance aspects, the objects are first held on magnetic storage (DASD) and then migrated to optical storage media (WORM). Hypo-Bank uses two jukeboxes as an optical storage system. The system's capacity amounts to a total of five terabytes by using 14" WORM disks of 25 gigabytes each. The network architecture, which was expanded first with routers and ISDN lines to some branches in 1995, is being expanded further with ISDN lines to all branches and with 2MBit high-speed lines in special branches in 1997. In a first step about 50 high-end monitors (21 inch) with corresponding graphics adapters (1600x1200 resolution) were installed at selected locations.

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One of the most obvious benefits of the base system is the customized access control built in the programming interface. Any OA component with its own user database again challenges a company with several thousand employees with the problem of administration. Hypo-Bank maintains an enterprise security system for all kinds of system and applications with all users and their privileges. When a document management application is launched, users who have legitimated themselves in the enterprise security system are logged on in the background to the document management system with a role identifier. Therefore, not all users are managed in VisualInfo's user database but only a few roles with specific privilege combinations.

Additional components for web-based document management are now under development to extend and enhance the existing client/server architecture. Requests of web-based clients, i.e. browser possibly with an applet, or pure Java applications are processed via an intermediate server. The intermediate server represents the transition from the two-tier-architecture to the three-tier-architecture. Basic elements of this server are a Java-enabling process cooperating with a VisualInfo Client enriched with services and security mechanisms of Hypo-Bank.

Practical experience

The first applications have been in practical use since 1995. User response was largely very positive and the expected effects with regard to service improvement and savings have been achieved. Many decisions regarding ongoing enhancement of the systems are crucially influenced by experience gathered in problem areas of the following application fields.

a) Payment transactions archive

The development of the payment transactions archive enabled uninterrupted electronic processing of complaints and tracing operations. This is based on archiving the images of bank transfer and direct debit forms produced by the forms reader systems (currently around 70,000 per day) and of the data pertaining to paperless payment transactions (between 800,000 and 1,800,000 records per day). Formerly these tracing operations could only be done by staff at headquarters who searched through four lists with cross-references on microfiches and searched for the image on microfilm. Thus, it has been possible to substantially shorten both the processing time and also the cycle time.

Commercial and taxation laws that have to be observed regulate electronic archiving. Which procedures adequately fulfil the principles of due accounting has currently not yet been conclusively clarified. This particularly applies to dispensing with the recording of images of document forms (so-called net images), as is usual with many commercially available document reader systems. This is why, for the time being Hypo-Bank continues to film all documents although they are practically no longer accessed.

EXCELLENCE IN PRACTICE

The net images of forms are stored in VisualInfo. They are archived and indexed without any user interaction by PC agents, using the VisualInfo API. These PC agents not only constitute an archiving bottleneck, it is also difficult to integrate them into a professional system management with a reliable job control system. This is why a review is being undertaken to determine whether archiving can take place via an MVS interface in the future.

b) Electronic loan file

The electronic loan file contains customer-related documents like loan agreement, life insurance policies, letters etc., which are scanned in more than 30 locations. The electronic processing of these documents is in production since September 1995 with a subset of the loan file. It was expanded to the entire loan file in 1997 with about 35,000 pages/day (1.8GB/day) at about 10,000 retrieve requests/day.

In the case of so-called living files, it is scarcely possible to avoid the problem of how to distribute logically coherent documents over several data media. If later documents for loan files have been acquired over a period of several years, then many different data media are accessed when leafing through a file. There was a need to review possibilities of how to solve the problem of leafing through thick files, embracing the possibility of complex reorganisation of the bodies of data.

c) Press archive

Every day, Hypo-Bank's press department scans and indexes selected articles from newspapers, HYPO publications and business reports and stores them in the press archive. Thus, for the first time ever it has been possible to establish a conveniently researchable archive. The most important articles of the day are combined in an electronic daily press folder. Thus, a large circle of interested readers is able to benefit from this press department service immediately after creation of the folder.

Indexing of documents without unique identifiers must be developed very cautiously. In the press archive, a solution was implemented that is capable of mapping synonyms and which knows the hierarchical relationships between search words and topics. Full-text search capability will be integrated in a next step.

d) Base system

Expansion of the storage hierarchy helps reducing the response times and the network load. The expansion strategy consists of keeping the documents needed by the user on less frequented and low-cost data media which, as far as possible, are kept in decentralised locations without abandoning the concept of the central document server, allowing access throughout the company. In doing so, maximum expansion of the storage hierarchy of IBM VisualInfo

is also being pursued. The complete storage hierarchy is transparent for the applications - even for the application developers. Despite ingenious storage management, there still remain queries with incalculable response times. These are queries that end up competing for access to jukebox data. Files that have not been needed for some time and which are requested suddenly during calls with a customer, for example, are most probably located at the lowest level of the storage hierarchy on the optical disks in the jukebox and access may involve a disk change.

Management of the client's local cache is taken here as an example for the problem of tele-servicing thousands of PCs. From experience the bank knew that the cache becomes inconsistent and may need cleaning up. This must take place without manual intervention on the part of an administrator. The document management system interface automatically detects an error in the cache, informs the application and cleans up the cache. This has only been made possible so conveniently through self-development of the interface and the application. Stable operation of dozens of decentralised object servers also places maximum demands on system management. Maintenance-free operation must be the higher-level goal, which is a proven achievement of the implementation at Hypo-Bank.

BEYOND THE CONVENTIONAL USE OF WORKFLOW TECHNOLOGY

The traditional OA components are essentially passive and function-oriented. Workflow management systems actively support the control and automation of work sequences, doing so in a process-oriented fashion. All corporate divisions of Hypo-Bank see an opportunity to handle business processes even more efficiently.

Solution

A successful BPR project requires much more than the modeling of business processes and the selection and installation of a workflow product. Even a careful vendor selection will lead to the result that no product fulfills all crucial requirements. The available products are not mature and the integration into the existing IT environment is very complex because of unsatisfactory implementation of standards. In addition the efficient support of work processes requires a tight integration with other office components (email, calendaring, document management) and application systems. The office components and application systems have to provide interfaces that allow processes to use their functionality according to the process status. That is, the BPR project arouses requirements to other application systems. For example, a program as an implementation of a process activity should be able to send and receive emails, create and archive text documents, query the calendar of another user etc. The user even doesn't have to know what the program does in the background as long as the program can execute its tasks through interfaces without user interaction.

In no other component of the office platform is the mere product so far away from the solution.

EXCELLENCE IN PRACTICE

Hypo-Bank meets these challenges primarily with the following elements:

- use of a product according to the WfMC *See* Workflow Management Coalition reference model

- API-based worklist frontend

- use of enterprise security system for dynamic evaluation of privileges

- defined interfaces for workflow enabling of applications

- automated user administration derived from enterrpise security system

- zero administration error handling

- email-based agents to reach business partners beyond enterprise boundaries

- event handling through API-based agents

- scheduling of activities without non-workflow database

A more detailed description about concepts and experiences is given in the following sections.

Concept
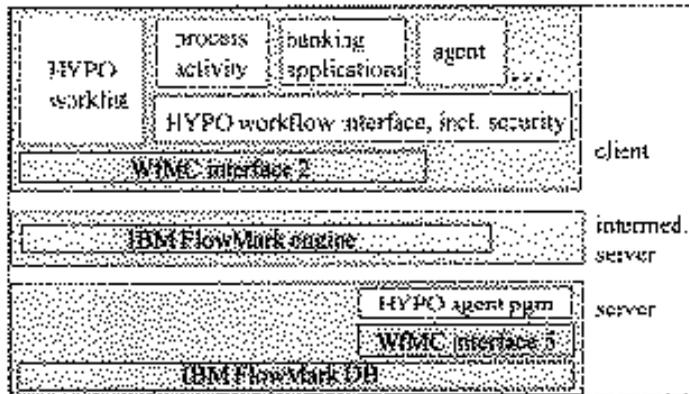
Figure 4: workflow management, three-tier architecture

Analogously to the **archive** project, the basic idea behind the **process** project is to establish an enterprise-wide application-independent base system for the support of any chosen processes. The base system provides the server platform with the workflow engine, the infrastructure for communication, agents for services and a basic client. In doing so, the client contains both the user interface (the so-called worklist) and a programming interface for the control of processes and activities (Figure 4).

HYPO-BANK

Owing to the base system concept, standards already had to be taken into account when making a product selection. With IBM FlowMark, a product was chosen as the basis for the Hypo workflow management system that not only meets the crucial technical requirements, but also conforms to the Workflow Management Coalition (WfMC) reference model.

To optimally integrate the worklist in the user desktop, Hypo-Bank has developed a worklist application based on the worklist handler interface. The worklist design is independent from specific properties of certain processes. Nevertheless—and this is the most significant advantage of self-implementation of the client—the worklist provides customizable views for each process type. For example every process type may define the data elements to be shown in specific columns of the worklist (e.g. loan number, customer name). This is imperative for finding a specific activity. The API-based worklist guarantees high flexibility in case of a FlowMark realease change. Furthermore, additional self-implemented functions are easily integrated: extended scheduling, transfer to roles and organizations, error handling and recovery etc.

A study of selected processes has shown that the following line items were affecting the design of the infrastructure.

- Processes may step over LAN boundaries at any time
- Users may move between LANs
- Process data must be changed according to external events, e.g. results of HOST batch programs or incoming emails.
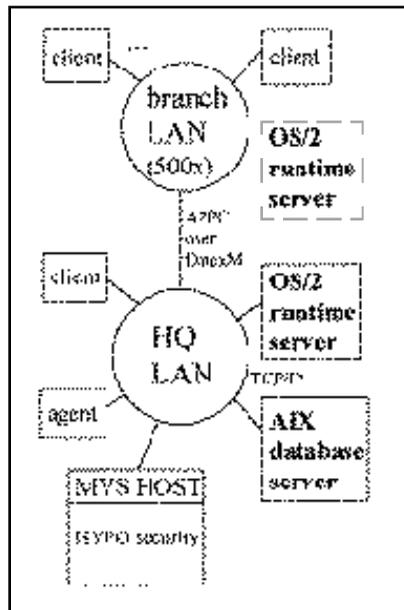

Figure 5: workflow infrastructure

EXCELLENCE IN PRACTICE

Considering a network embracing more than 600 LANs and the demand for transparency of the physical partitioning of the network, a central data server appeared to be the most expedient solution (Figure 5).

Contrary to the document management system, the workflow management system must be capable of distinguishing the individual users. This is why the simple method of the role identifier was not applicable here. To be able to manage a permanently up-to-date user database in parallel with Hypo-Bank's central privilege system without the need for manual administrative updating, user management must be derived from the existing system by way of a completely automated process. Nevertheless, it is not intended to immediately import all potential Hypo-Bank users (around 15,000) to the database. Therefore, the database will not be filled until a user unknown to the workflow system attempts to log on. If the user is privileged according to the central security system, he will be created automatically as a user. His data will also be updated if a discrepancy is detected during the course of comparison.

Procedure

Following the project launch in the fourth quarter of 1995, the project team arranged a workshop on "Workflow Management at Hypo-Bank" for all corporate divisions. At this workshop, participants were shown the possibilities offered by this technology within the scope of business process reengineering. Thus, it was possible to identify numerous processes that are to be supported by a workflow system. In the area of payment transaction, the "Direct Enquiry" process was implemented for efficient handling of enquiries from other banks. At the same time, the "Payment Securing" process was developed in the mortgage bank area to provide efficient support for the processing of overdue loans. These process implementations are in production since December 1996 with about 250 users by December 1997. Successive expansion of support for the clerks in the area of loans is already being planned.

Practical Experience

a) Direct Enquiry—Reaching Business Partners

As a pilot application, the bank is again using a business process in the area of payment transaction, in this case direct inquiries between banks. Since September 1996 such queries are exchanged paperless between banks via e-mail. The control by a workflow system ensures efficient processing of these queries which results in reduction of turn-around-time and costs. An incoming e-mail automatically invokes a process start, the WF-engine distributes the tasks onto the worklist of the responsible clerk. Thereby, a further step is taken toward achieving a paperless workflow management between companies

b) Loan Management—Securing Process Quality

Supporting the processing of overdue loan amounts is a key factor in one of the reengineering projects of Hypo-Bank, in order to react to rising risks in a very early stage. Using this approach standard collection proceedings can be dropped in favor of individual customer counseling. All activities are assigned to roles. This makes rotating responsibilities possible. Thus, a competent contact person should be available for the customer at all times. Again, processes are normally not started manually but automatically through an agent controlling the results of a MVS batch program. This program lists the overdue loan amounts and the agent starts a process for every single case.

c) Base System

The performance of the runtime server becomes a bottleneck with increasing numbers of clients and processes. When FlowMark moves to a more flexible system architecture with Version 3, Hypo-Bank will install a multi-server environment to solve this problem. Furthermore high refresh rates cause a heavy network load, which they want to lower by implementations of call-back functions available with FlowMark Version 3.

From experience the bank knew that program errors may cause inconsistencies of process states. Currently an automated recovery procedure for activities and processes is being developed for integration into the HYPO worklist application.

From the organizational point of view, a tool for a support of process modelling is desirable. Up to that point, however, no method has been supported completely by standard software from the modelling stage up to implementation in the runtime system without incurring information loss. This is why, at least for the time being, Hypo-Bank is making do with a graphics-oriented editor for process modelling and must ensure correct implementation itself without any reliable automatic processes.

Another so far unsolved problem is the problem of rescheduling. When an activity is attached to (the members of) a role or a organization, the activity is not put onto the worklist of new members of this role or organization and—the other way round—it remains on the worklist of users, who are no longer members of this role or organization.. The workflow engine must provide a kind of reschedule for these situations.

SUMMARY AND OUTLOOK

Hypo-Bank's management has acknowledged the use of document and workflow management as an important success factor in relation to competitiveness, and has initiated corresponding activities. The foundation for the successful implementation of this decision was laid by development of the base systems in which a application-independent and corporate-wide approach was adopted. It has been possible to achieve a first measurable success through the payment transactions archive, electronic loan file and press archive applications. Thus, Hypo-Bank was able to give a positive answer to the initially formulated question as regards

implementation capability and economic feasibility. From the technical point of view, the central document server has proven itself with a high availability and security standard. The problem areas have been recognized, solutions have already been developed and, to some extent, they have already been implemented.

Expansion in steps has already been commenced. On the one hand, the application areas will be expanded after an in-depth review in order to forge further ahead with parallel processing steps involving small amounts of paper. On the other hand, the functionality of the document management system will be integrated in the business processes even further by way of the workflow management system in order further to enhance customer service.