Implementing the Experience Factory concepts as a set of Experience Bases

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Abstract

This talk takes the Experience Factory concept, which was originally developed as organizational support for software development and generalizes it to organizational support for any aspect of a business, e.g., business practices. The Experience Factory supports the evolution of processes and other forms of knowledge, based upon experiences within the organization, and related knowledge gathered from outside the organization. It then discusses how you might design an appropriate experience base for the particular set of organizational needs determined to be of importance. Specific examples are given in developing experience bases for specific organizations and it discusses the Experience Management System (EMS) currently being evolved and how it has been applied.

Introduction

The Experience Factory [3] approach defines a framework for Experience Management. The approach has been successfully applied to software development at NASA for more than 25 years and recently at other organizations, [5],[6]. The Experience Factory enables Organizational Learning and acknowledges the need for a separate support organization that works with the project organization in order to manage and learn from its own experience. The support organization helps the project organization observe itself, collect data about itself, build models and draw conclusions based on the data, package the experience for further reuse, and most importantly: to feed the experience back to the project organization.

The Experience Factory approach was initially designed for software organizations and takes into account the software discipline's experimental, evolutionary, and non-repetitive characteristics. In our work with businesses outside the software community we have found that a tailored version of the Experience Factory approach is beneficial for creating a learning organization, even though the main business is not software. This is due to fact that most companies do not manage their experience well, i.e., what experiences are worth keeping, where are they kept, how are they accessed, how are they used, how are they changed. What does good experience management look like?

These questions are hard to answer. Often it is easier to describe problems related to bad experience management. The following is a mix of our own and other organization's experiences on this subject:

- An employee left with short notice. The organization lost all of its experience in a certain area and tries to recover it, but it doesn't even know what experience was lost (FC-MD).
- A consultant spends three weeks developing a course that already exists because he doesn't know that is was done before (Client1).
- Someone repeats a $35,000 mistake for which there is a simple solution (Client2).
- A consultant gave a customer a promise, but is now busy with other work. No one else knows about his promise so it doesn't happen (Client1).
- An employee learned a lot during a project, but has no time for packaging and dissemination so the knowledge cannot be leveraged (Client1).
- A new employee is hired, but is for a long time considered a burden instead of help because he needs detailed support from his coworkers, who do not have sufficient time to help them.
- An employee's application for taking a course is rejected, because with that knowledge he would be too "valuable on the market".
- A project manager underestimates *again* the time it takes to develop a certain kind of product because there was no data collected from previous projects.

Similar problems have been reported elsewhere, see for exampled [5]. These examples apply to many kinds of organizations, not only software organizations. More explicitly, to become successful the organization needs to change its way of doing business in four ways. First, it needs to become *less dependent on its employees* preventing the loss of important knowledge when the unavoidable happens that experienced employees leave

the company. Second, it needs to *unload its experts.* Experts in the organization have useful experience, but sharing experience consumes experts' time. The organization needs to systematically elicit and store experts' experience and make it available in order to unload the experts. Third, it needs to *create productive employees sooner*. New employees need much information to become productive, but they might not know what they are looking for. The organization needs to package experience in a form that makes it easy for new employees to get up to speed fast without bugging the experts of the organization. Fourth, it needs to *improve its business processes*. Improvement of business processes requires that experience be analyzed and synthesized, which in turn requires that it be captured, structured, and made available. Thus the organization needs to model its business processes and make them available to its employees, both for direction and for further improvement.

In order to become a learning organization, the corporate culture must become one in which sharing of experience, searching for experience, and learning from experience is a natural part of the daily life.

The Experience Factory is based on a set of underlying beliefs about the organizational culture that guides an organization that strives to become a learning organization. We call these the core values of the experience Factory.

The core values of the Experience Factory

The core values of the Experience Factory are the following. In order to improve, employees need to learn from past experience, and in order for employees to learn, the organization needs to create a learning environment. The characteristics of a learning environment are that it is allowed to make mistakes and learn from them, experience is not hidden or traded, but freely given to the employee who needs it, and last but not least; experience is collected, not in order to replace, degrade or evaluate people, but in order to help them (e.g. help them remember, help them collaborate, help them organize, spread and share data, information, knowledge, and experience). Instead people are encouraged to share experience and help others and are rewarded based on how much they share.

Learning and improvement only occurs in an environment where it is possible to get feedback about the outcome of various activities. The learning organization creates feedback loops on several levels. Examples of feedback loops are an honest dialogue between employees in the organization, and the design of the experience management system so that it always is possible to feed data back to it. Another form of creating feedback loops is the principle of iteration, i.e. the work is iterated and improved in steps. First, it is very difficult to get something perfectly correct the first time; instead it takes much iteration to get it right. Another reason for iteration is that it makes it possible to remove defects early.

The Generalized Experience Factory

Software development is different from regular business, but we have found it useful to apply the Experience Factory concepts to the following common business problems, which seem to occur frequently in many organizations. The first observation is that organizations strive to reuse all kind of documented experience, e.g. proposals, budgets, but that it is not easy to do so in an effective manner. The reuse is rather ad hoc and unplanned and it is often hard to know what to search for or how to find useful documents. The second observation is that the “right” knowledge for solving a problem often exists somewhere within the organization, but the problem is to take the time to search for it, to identify it, to get access to it and then to learn from it. As experience is mainly represented by experts, the major problem is often to find and get access to the “expert” in order to solve a problem. The third observation regards organizations that have the ambition to manage experience, for example in terms of lessons learned. In these organizations organizing and disseminating lessons learned in order to learn from successes and to avoid known mistakes is a main issue. The fourth observation is that in organizations where raw experience, e.g. lessons learned, is managed the main issue is how to refine, analyze and synthesize the experience, for example by building models based on experience in order to improve business processes.

These problems are addressed by the general Experience Factory approach, which is the subject of this paper. We will start with introducing and describing our Experience Management System, its components and our methodology for tailoring it to an organization. Then we describe how we applied EMS to ourselves at FC-MD. The paper ends with some conclusions from this work.

The Experience Management System (EMS)

A physical implementation of the Experience Factory in an organization is called the Experience Management System (EMS). The EMS is composed of content, structure, procedures and tools. The content can be data, information, knowledge or experience, which for simplicity will be called experience from here on. The structure is the way the content is organized. The content and the structure are often referred to as the Experience Base. Procedures are instructions on how to manage the Experience Base on a daily basis, including how to use, package, delete, integrate and update experience. Tools support managing the content and the structure, and carrying out the procedures, as well as helping capture, store, integrate, analyze, synthesize and retrieve experience.

Methodology for Implementing an EMS

Different organizations have different needs and cultures and that is the reason why each EMS implementation needs to be tailored to the target organization. We use a

methodology to help us understand and setup an EMS for a specific organization. The methodology helps define the content, structure, procedures and tools that will be part of the EMS. The use of this methodology is very important in guiding the work so that the EMS is successful and accepted by the organization. The participation of people from the organization in the application of the methodology is crucial for the success of the EMS implementation because they are the ones who know their culture and problems best. The following is a description of the steps of the methodology to develop an EMS for a particular organization and domain of experiences. It is based on best practices derived from previous EMS projects and has been continuously improved. An important aspect of the methodology is that it serves as a medium for experience transfer internally at FC-MD.

Steps of the methodology

The first step of the methodology is to characterize the organization, and to define the current business processes and the existing knowledge. We distinguish between knowledge that is documented, undocumented and unavailable. Many organizations already have procedures in place to manage a subset of the experience but fail to manage all crucial experience. The characterization helps us understand what experience is not covered and how existing documented experience fit into the new system and how it can be reused.

After the characterization of the organization, user roles of the EMS are defined and use cases are developed based on the business processes and the user roles. The user roles are defined based on the culture of the organization and what type of roles different people will perform. Examples of user roles are: *consumer* (anyone who uses the EMS to search for experience), *maintainer* (a person who is responsible for maintenance of the EMS's EB) and *provider* (anyone who provides experience to the EMS's EB). The user roles can be refined for each main category. An example of this refinement is *topic managers* (anyone who is responsible for maintenance of experiences related to a specific topic). The use cases are defined based on the characterization of the organization, the business processes that are relevant to the EMS and the user roles. The use cases cover procedures that are already in place and add new ones as necessary.

The next step is to define a data model, a taxonomy, that is suitable for the organization. The data model is used to classify the experience that will be included in the EMS in order to make it easier for users to find the experience later. In this step, the different types of experience that will be managed are identified and classified. Acceptable values for each component of the data model are also defined. The results of this step are documented into an EMS Requirements Document and a specification for the particular EMS system is created.

Based on the EMS Requirements Document and specification, the architecture of the EMS is defined. COTS, glueware, and in-house built components that together fulfill the requirements are used to define the architecture. Applications already in place and used by the organization are strongly considered to be part of the architecture.

The architecture is then implemented. Tools that will support the EMS are developed, installed and integrated.

After implementation of the architecture, a set of procedures for the regular maintenance of the EMS is created. These procedures are tied to the user roles and will make sure that the system works and that the managed experience is always up to date.

Following the development of the EMS procedures, the EMS's EB is populated with an initial set of experience packages and the EMS is configured and installed.

A rollout plan is prepared and executed to train, market and motivate people to use the EMS.

After the system is deployed, it is constantly improved based on feedback. Types of feedback considered are formal evaluations, including interviews and tests with users, direct feedback from users, feedback loops embedded in the tools and analysis of usage data of the tools. According to the feedback, the content is constantly updated, new experiences packages are analyzed and synthesized into new experience packages. This step is continuously iterated in order to improve the EMS.

How do you get people to use the EB?

The success of an EMS can be measured by its usage and by the reduction of problems related to experience management. Therefore, we need to motivate people to use and contribute to the system. Another aspect is that tools that will be part of the system should be carefully chosen.

It is obvious that the quality, relevance and timeliness of the information content are necessary conditions for a usable system. If users cannot find what they expect to find using the system, or if they do not think it is helpful, they will not use it. In order to satisfy and please the user, the content should always be up-to-date. In order to accomplish this, the maintainer always analyzes the content. He removes out of date experience packages and analyzes, packages and stores new ones. The providers provide new content to the EMS, therefore we need to do everything we can to motivate them.

Supporting the EB with tools

One important part of the EMS is its supporting tools. Supporting tools is a also a way to motivate people by encouraging the use of tools that help people capture experience while they carry out other tasks. Some of these tools used:

1. FAQ: the FAQ is a good source of experience. Users submit questions that are answered by experts. The questions and answers are automatically captured, analyzed, and added to the EB.

2. Focused chats: a chat tool is used as a medium for a focused discussion instead of the telephone. In the chat tool the discussions are automatically captured, analyzed and added to the EB.
3. E-mail: Much experience is exchanged through e-mail these days. The experiences shared through e-mail are, in a sense, always captured. These captured experiences can be added to the EB after they have been analyzed.
4. Project Presentations: in project presentations, project managers make a focused presentation on their project. It follows a template that allows linkages to related information. They are living things that can be filled with the appropriate information during a project and after termination of the project. It helps project managers analyze and capture experience that can be stored in the EB and, at the same time, inform other people about projects.

The user interface is another important aspect to the success of the EMS. It has to be as easy as possible to add and retrieve experience packages. The search and visualization tools that help users find and retrieve experience packages have to be attractive and easy to use see [8],[9].

The culture of the organization plays a major role in the implementation of an EMS. The tools and procedures have to be defined in a manner causing as little disruption as possible to the employees' work. Sometimes drastic changes are needed to change the organization into a learning organization. In such a case, a plan for the EMS implementation should be carefully designed in order to avoid rejection by the users. Everybody's involvement and the use of the right tools are ways to avoid rejection. People tend to stick to software packages and tools they are used to and if the EMS implementation includes what they are already using, the acceptance of the new system is much more probable. Also, if people are involved in the implementation of the new system they feel that they are a part of the project and are inclined to contribute and use the EMS. Recognition and incentive mechanisms should also be used in order to get participation of users. One way to do that is creating a reward system by for example giving rewards (e.g. bonuses) based on usage of the system and incentives to use the system (e.g. a project number that users are allowed to charge time spent on adding content or learning using the EMS). However, special attention should be taken to avoid reward systems that distract people from their tasks. For instance, if bonuses are given based on usage of the system, users might spend more time using the system than carrying out their regular tasks.

Experience Base Analysis and Improvement

The Experience Base is a living thing and has to be treated accordingly. It has to be nurtured, cared for, and allowed to grow and renew itself. The Experience Base therefore has to be maintained regularly. Without maintenance the Experience Base will die because the users will not trust it anymore. Its users will soon discover that the Experience Base ages and will abandon it when they realize it provides them with less and less value. However, pure maintenance is not enough. In order to keep its users the Experience Base must also improve over time and continuously add value. Improvements of the experience base are addressed by two activities: Structural management and Content management.

Structural Management

The classification manager manages the structure and is responsible for growing the taxonomy according to new needs. Needs for more extended structures or new areas come from requests from users or providers or are discovered based on indirect feedback from users. Need for changes related to the structure also result from analysis of the structure and how it is used.

Content Management

The content is divided into topic areas represented by one or more package types. Each topic area is assigned to a topic manager who manages the content of that area. The topic manager is responsible for adding and organizing the content of his topic area with the help of assigned experts. Feedback from users on the content of a certain topic, for example, that experience is missing, can result in the topic manager soliciting experience packages from experts. EMS provides several tools for analyzing an Experience Base in order to improve it. We distinguish between structural, content, and usage analysis.

Structural Analysis.

The structural analysis helps understanding the structure of the experience base. It can answer questions like the following:

- What parts of the structure is growing?

Content Analysis

The content analysis helps understanding the content of the experience base and how it is distributed over the structure and how and from where the content has evolved over time. Based on content analysis the following kind of questions can be answered:

- Which topic areas are rich/poor in content?
- Who is our de facto expert in a certain area?

Usage Analysis

The usage analysis helps us to understand how the experience base is used and answers questions like:

- Which topic areas are the most/least frequently used today/over time?
- Which topic areas do have the most feedback from users and what is that feedback?
- What are the characteristics of the users compared to what topics of the experience base they user?

Applying the EMS to FC-MD

Fraunhofer Center for Experimental Software Engineering Maryland (FC-MD) does applied research in the area of Software Engineering. The main idea is to transfer and study ideas, technologies, and methodologies that have emerged from university research to organizations outside the university environment. Each such technology transfer project is viewed as an experiment in creating new knowledge about under what conditions a new technology works, when it is applicable and when it is not, how it needs to be tailored and how it should evolve. One of the main research ideas that FC-MD transfers to other organizations is the idea of the Experience Factory. In order to do so we have started a series of Experience Management projects that develop processes, tools, and taxonomies in general and work with organizations to tailor and implement the experience factory concepts to their needs. Even though the Experience Factory concept has been successfully applied to NASA for more than 25 years, and even though we have clear indications that it will apply to other kinds of organizations than software, we wanted to test the hypothesis that it also works at FC-MD itself. One of the main arguments behind this test is that if the concept doesn't work for FC-MD how can we expect it to work for other organizations?

While this is an interesting question in itself, the immediate problem drivers that led us to invest in an EMS at FC-MD were driven by business needs. Although employees at FC-MD do similar types of work, for example author proposals, run projects, hire people, partner with organizations, and write contracts there was yet no formalized mechanism for:

- collecting experience about research
- collecting experience on proposals, and projects
- reusing experience regarding hiring or contracts
- developing personal expertise, corporate competence

Part of the reason behind the existence of these problems was the fact that the center was still only three years old.
Our solution to these problems was to implement an Experience Management System for sharing business related experience. The organization at the time when the project started was fairly small, with the advantage that it was still possible to reach everybody in the organization. On the other hand there were not much of an organization to formalize and not much of experience to capture yet. Therefore we started by creating a culture of a learning organization.

Creating a culture of a learning organization

Acknowledging that no technological innovation can be implemented in isolation, we started by growing a culture for a learning organization. The culture is based on a set of core values that we wished the organization to live by. These core values, which have been refined and turned into the list of organizational learning prerequisites mentioned above, were used in many different ways. They were for example used in the process of interviewing prospective new employees giving the organization a chance to state upfront what kind of behavior was expected from employees at FC-MD. This activity gave the prospective employee a chance to withdraw the application if the person thought that the core values deviated too much from the person's own values. As a matter of fact, it was never the case that the prospective employee withdrew the application; rather the effect was the opposite as prospective employees thought of the core values as very appealing.
The core values clearly state, for example, that is accepted to make mistakes and that employees are expected to share the lessons learned from such mistakes. Such statements are worth little if management does not live by them, instead blaming people for making mistakes when they are shared and made public. Soon employees would learn that core values exist only in theory and that the practices by which the organization lives are different from that theory. In order to avoid such problems we created an open atmosphere in general and specific events in particular to enable sharing of experiences. One such event is the project presentation.

Project presentations

All organizations need ways to share information about projects and do so by creating project reports and presentations on the project's status. Regular reports and presentations often focus on financial status and the project's general progress. Lessons learned are often extracted and examined when the project is done; during the post-mortem. During the post-mortem people are encouraged to brainstorm about what went right and what went wrong and how these issues could have been avoided or handled in a better way. The problem with the post-mortem is that it happens too late in the project, if it happens at all. We believe that there is so much to learn from each single project that a post-mortem at the end of the project is not enough. Instead we designed the format of the project presentation to be an event for sharing experience and for it to become part of the regular project work. Thus a project presentation can be held for a specific project many times during its lifetime and not only when the project is done. This enables people within the project to act on experience while the project is still in progress. The experience becomes useful right away.

The project presentation has two parts. The first part is something that each project manager in any project must do anyway. It is a regular status report that reports on the customer requirements, on the selected solution and its rationale, on who is working on the project, and on the financial situation. Critical issues are also mentioned and discussed. The first part of the project presentation is done as a regular presentation. We always expect some

interaction to occur, but it is primarily the project manager who does the talking. While the first part gives the context of the project and is mainly a one-way communication, the second part focuses on learning and is done in the manner of a structured brainstorming session. The project manager prepares the session by using a template that structures the session around our main areas of learning. These areas were identified during the business process analysis in which the main processes of the business and their inter-relationships were modeled. Thus, as a result of the project areas are:

- What have we learned about running projects?
- What personal expertise was gained?
- What was the impact on our corporate core competencies?
- What opportunities are now available?
- What can be packaged as a marketable service?

The project manager prepares each of these topics and formulates them in a couple of sentences. During the brainstorming session the project manager first makes suggestions for each area, then the audience brainstorms on what else was learned and how this new knowledge can be used in different ways. The process is designed as a journey from the specific project to more general results and how these can become part of the corporate knowledge and institutionalized in terms of future services to better serve our customers.

Another benefit of the project presentation is that it becomes an experience package right away. It has, for example, all the necessary information that would be required for a new employee to get up to speed on the project. It has links to all the project documents. All document deliverables are listed as links so that a new employee easily can find and bring up a document in order to understand what was delivered to a customer.

The problem with the empty Experience Base

We emphasized above the importance of Experience base content for it to become successful; if the potential users do not find the content valuable enough the Experience Base would soon die. This is especially critical when setting up a new Experience Base. It is a Catch 22 problem: to be useful the Experience Base needs to be populated, but few people want to spend the effort to contribute experience to a useless Experience Base. In order to avoid this situation the Experience Base needs to be useful even though it is almost empty.

This problem led us to considering the Answer Garden approach [2,3], The Answer Garden approach supports the Experience Base with a network of organized experts, making the Experience Base useful right away. This means that if the experience sought cannot be found in the Experience Base, there are other supported ways to reach an answer. In this case the user gets in contact with human experts who possess the experience. Another nice feature of this approach is that it lets the Experience Base grow organically, i.e. the Experience Base grows where there is demand for sharing experience. We implemented the ideas of the Answer Garden as a frequently asked question mechanism. This component is represented by FAQ in figure 2. Employees at FC-MD can access the FAQ and search for questions and answers related to what they are looking for. Question-and-answer pairs are grouped into topic areas enabling employees to browse topic areas they are interested in and look up answers. If they cannot find what they are looking for, they can post a new question that will end up in the content manager's mailbox. The content manager either answers the question or assigns it to one of the topic experts who answers the question and submits it to the Experience Base.

Anything that is expected to grow needs a seed. We started to seed the Experience Base with a small set of frequently asked questions regarding company policies and the system drew some attention. However, a system like this is mostly useful for non-experts. Non-experts are typically new employees or employees who have moved from one position to another. As we had no new employees at the time, the utilization of the system was relatively limited. However, one of our most experienced employees in the Human Resource department resigned. We immediately took the opportunity to interview her during a couple of sessions in an effort to capture as much of her experience as possible before she left. This activity resulted in a set of question-answer pairs that was submitted to the Experience Base. By conducting this activity we captured some of the experience that we otherwise would have lost when the human resource expert left. This seed had the positive effect of making the Experience Base much more attractive as it now encompasses experience that is difficult to get to in other ways.

Seeding the Experience Base with Chat logs

Another software component of the EMS is a regular Chat tool equipped with capturing and distilling features, see figure 2. We have been using the Chat tool in order to capture and analyze technical discussions in real time in order to create new knowledge. The idea behind using a Chat tool as a vehicle for knowledge creation was to create a low-cost conferencing media that allowed for immediate and automatic capture and analysis of the discussion. We used this tool during the CeBase eWorkshop on top ten defect reduction techniques [4]. We invited top experts from all over the world to discuss, corroborate or refute, the published top ten list. During the eWorkshop the participants discussed the subject under the guidance of a moderator. The discussion was analyzed in real time by the scribe. The scribe drew conclusions based on the discussion, which were then fed back to the participants. The participants then had the opportunity to comment on the conclusions. After the eWorkshop the conclusions were further analyzed and are now submitted to the participants for review. The next

step is to turn the result into experience packages that will be submitted to the CeBase Experience Base for experience based on empirical software engineering.

Analyzing the Experience Base

We use the Visual Query Interface (VQI), which is based on Shneiderman's work [7], as one way to search for information in the Experience Base [8], [9]. But it is also a useful analysis tool, see figure 1. The VQI visualizes the content of the Experience Base graphically using three dimensions: x- and y-axis, and color. Using the attributes of the experience package the user can select how the packages should be visualized. Typical attributes are a package id (a number), name (a string), submitted (a date), and a hit history (a list of all hits). The attributes indicate which packages to show or hide and what attributes should constitute the x- and y-axis as well as what attribute should be used for coloring. A typical example of an analysis scenario is that the user wants to know which package is the most popular one and which one is the least popular. For this analysis he would chose package identification as the x-axis and the number of hits as the y-axis. The result would be a scatter plot with each dot representing one experience package. The most popular package type would be found in the upper area of the screen, the least popular in the lower area. Color could be used to group experience packages together, for example by category. Coloring enables the user to identify patterns regarding popularity of groups of experience packages. The same strategy is used to analyze the Experience Base in many different ways. Examples of common question that can be answered this way are: How has the Experience Base evolved over time? and Who is our de facto expert in a certain area? The VQI is a general tool that lets the user visualize the underlying data in an easy and flexible way.

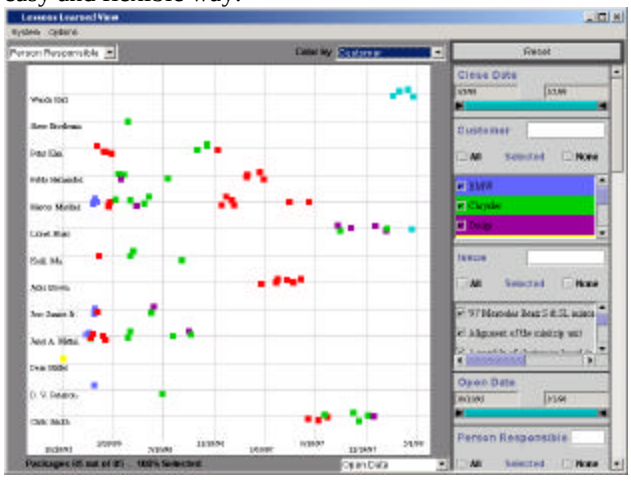

Figure 1. The Visual Query Interface (VQI)

Process elicitation

Processes have a tendency to develop informally, but remain undocumented. As long as processes are not documented it is hard to reason about and improve them. It also takes long time for new employees to get up to speed because there is no way for them to see the whole picture. Instead they must ask other people about what the processes are and then try to understand how they are carried out. This is a typical problem of a growing organization, which needs to constantly inform new employees about the business. In order to formalize our processes we formed a team of one local employee and one external expert on process elicitation. The team interviewed employees about their work and how it was performed and elicited processes based on the results. The result was fed back to employees who had an opportunity to review the processes and correct misunderstandings. After the review process was done the processes were packaged in terms of experience packages and submitted to the Experience Base. We keep all our elicited "experience" on a server, which we call the Z-drive. Planning to fully integrate the information from the Z-drive into EMS when the final tool set is selected and integrated.

Where is my file on the Z: drive?

As stated above, a common problem in many organizations, especially distributed ones, is the problem of sharing and reusing all kinds of experience, such as documents, proposals, contracts, and presentations. Often the problem is less one of sharing or reusing documents and more one of *finding* a good document to reuse.

We have been experimenting with many different solutions to this problem, both standard solutions, such as AltaVista Discovery and specially developed tools, such as the VQI mentioned above. The result of our study to date is that we plan to use the Hyperwave information server (HIS) as part of the backend and Hyperwave information portal (HIP) as part of the front-end, see figure 2. HIS implements many of the features that any document sharing community needs, such as distributed file sharing, automatic indexing of documents, access control, and version control. HIP is a portal that gives users access to their shared documents from any Internet connected computer and enables users to find documents using a built in search engine.

We are working on a full integration of HIP and HIS with all EMS software components. One example is an integration of VQI and HIS enabling analysis of and access to the HIS database through the more advanced visual query interface. At the moment we use our regular file server, the Z: drive, for regular file management, while the HIS would be used for file sharing among geographically distributed working groups.

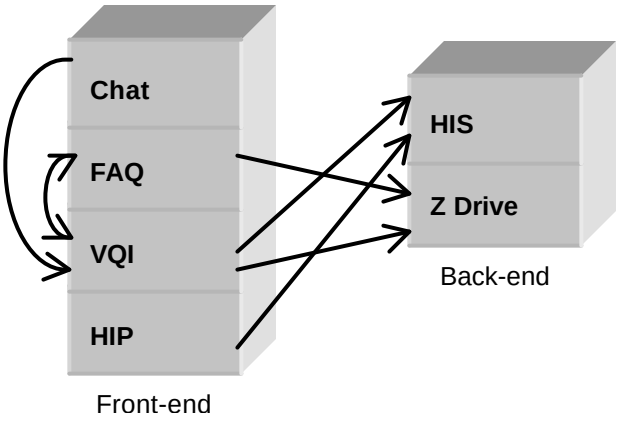

Figure 2: Software components of the EMS.

Conclusions

In this paper we described how we generalized the Experience Factory approach to fit organizations who's business is not software. We then explained what constitutes the Experience Management System and how we applied it to ourselves in order to identify its weaknesses and strengths. We discussed a number of different activities and tools that we used in order to create a culture of organizational learning and how we created experience packages and seeded the experience base. Last we described how we analyze the Experience Base in order to improve it.

What has been most important in this work? It is clear that what is most important are cultural issues. Without a culture that enables organizational learning it will never happen on a larger scale. It might happen in pockets of the organization thanks to individual employees who see the direct need of improving the work situation. But in order for it to happen on a larger scale, the organization needs to change.

However, changing the culture is necessary, but not sufficient! There must also be support of various kinds. How can employees of a larger organization reuse documents if they cannot find the document they are looking for? We must provide support for questions such as: what experiences are worth keeping, where are they kept, how are they accessed, how are they used, how are they changed, how are the managed? EMS attempts to give such support using the concepts of the Experience Factory to enable a learning organization. By applying the system to ourselves, by implementing EMS at FC-MD we learn what works and what does not so that we only transfer technology that is empirically tested to be good and useful.

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