SISU dokument

Applications of a Multimedia Information Retrieval System

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five case studies

Peter Rosengren

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1. Introduction

Today corporate users need to access and combine information from a number of information sources. Some business information is stored in relational databases, while other important information is accessed through searches in a text retrieval system. Additional sources of information may be picture and drawings archives. Each information source might have its own data model and access mechanism, or query language, causing severe usability problems.

The objective of the Intuitive project is to provide efficient and easy to use tools for end users to access information in heterogeneous corporate databases.

Within the project we are investigating users and application requirements to define a generic architecture for Information Retrieval from heterogeneous databases.

The project also address the needs of application designers in developing methods and tools for customising the generic software architecture for different applications. In this sense Intuitive can be seen as both a generic retrieval system as well as a system for creating information retrieval applications.

Rosengren et al have already given an overview of this work [Rosengren93a], [Rosengren93b], [Rosengren93c]. Wingstedt et al discuss the requirements on the functionality of end-user tools for Information Retrieval and their user interface [Wingstedt93]. Bern et al address the needs of application developers in describing a first prototype implementation of the Tools applied in three different applications [Bern93]. The reader that is unfamiliar with the Intuitive Project is referred to these reports.

The purpose of this document is to describe user requirements on a system for information retrieval from multimedia databases as they have been captured during discussions with the Swedish User Group for Intuitive. This work is an ongoing activity within the project and the requirements described here should not be regarded as final and complete. Rather than describing a complete set of requirements on a multimedia information retrieval system our intention is to give the readers some insights and ideas of how such a system can be applied in their own environment.

The document is organised as follows. Chapter 2 gives an overview of the Intuitive Tools and describes a prototype implementation. Chapter 3 presents the Intuitive User Group. The next five chapters will each describe and discuss requirements for five different applications. Note that all discussions have been based on demonstrations of prototypes of the Intuitive system [Bern93]. Finally Chapter 9 summarises the user requirements.

2. The Intuitive Tools

Before discussing different applications we will give an introduction to the Intuitive Tools and describe a prototype implementation to give the reader an idea of how the system looks to a user. The reader that is familiar with the Intuitive System can omit this chapter and continue to the next.

The four key components in the architecture of the Intuitive System are:

- Multimodal Interaction Manager
- End-User Tools
- Intelligent Dialogue Manager
- Data Access Layer

The role of the Multimodal Interaction Manager is to allow the user to input his request with a combination of speech and pointing. The End-User Tools provide the user with a visual interface and functionality for utilising large heterogeneous databases. The Dialogue Manager is responsible for interpreting user request according to the user's task. Finally the Data Access Layer is the glue that binds the information resources together.

The aim of the end-user tools is to make it possible to use multimedia information stored in a set of databases [Wingstedt93]. The four main objectives to be met by the these tools are:

- Provide overview and understanding of available information.
- Support the user in expressing his information need as a query to the system. The tools should provide a short mental distance between users information need and how to express a query with the tools.
- Help the users understand and interpret the results from querying the databases.
- Provide a seamless interaction allowing the users to switch between different operations in a non-obtrusive way.

The Tools' knowledge regarding the underlying databases is entirely based on conceptual models. The idea of conceptual models is to capture and represent the semantics of data stored in a database in terms familiar to users, not in terms of the underlying data structure.

The Tools will support the user in the following information retrieval tasks:

- *Selection.* The user will be given support for formulating queries that selects a set of information entities.
- *Navigation* The user will be provided with an overview of the available information resources at a conceptual level.
- *Browsing* The user will be assisted in seeking information by inspecting information entities at the instance level.

- *Presentation* The user will be supported in understanding and interpreting the result brought to him from a search in the information resources.

The support for these tasks may be implemented in various ways, using different methods, dependent on what is found to be the most suitable implementation for a given task.

To support the user in the above tasks four types of end-user tools will be implemented:

- *Selector*
- *Navigator*
- *Browser*
- *Presenter*

These tools will be general tools. This means that they can be applied in different applications for a different set of databases without re-programming which implies that Intuitive should be quick and easily customisable.

To validate our approach we have built a generic prototype system which have been used for early evaluations to get user feedback. This generic prototype shows the four end-user tools in their default mode. The database chosen as an application for the generic prototype is a database with information about SISU, its projects, employees, documents, results etc. Bern et al give a more detailed description of this prototype as well as two medical prototypes [Bern93].

The Navigator gives the user an overview of the information available within the databases. To the left in Figure 2.1, one way of visualising the information structure is shown, where icons are used to illustrate important concepts.

Once the user has navigated in the information structure and found the entity classes he is interested in, he selects the part of the model he wants for further querying. The entity classes of interest are exported to the Selector where the user can add further constraints to restrict his query, for instance to add that he is only interested in pictures of persons working in companies in Stockholm. The Selector is shown to the right in Figure 2.1.

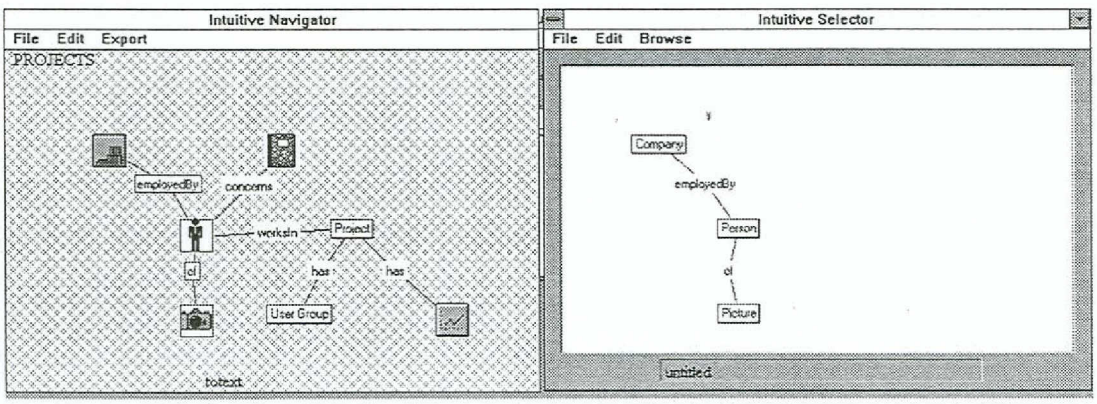

Figure 2.1 User formulates his query with a Selector.

The query is sent to the database. The result is retrieved and displayed in a Browser, where pictures are indicated with camera icons. If the user double clicks on the column

with camera icons, the corresponding pictures are displayed as miniatures, called *thumbnails*, see Figure 2.2.

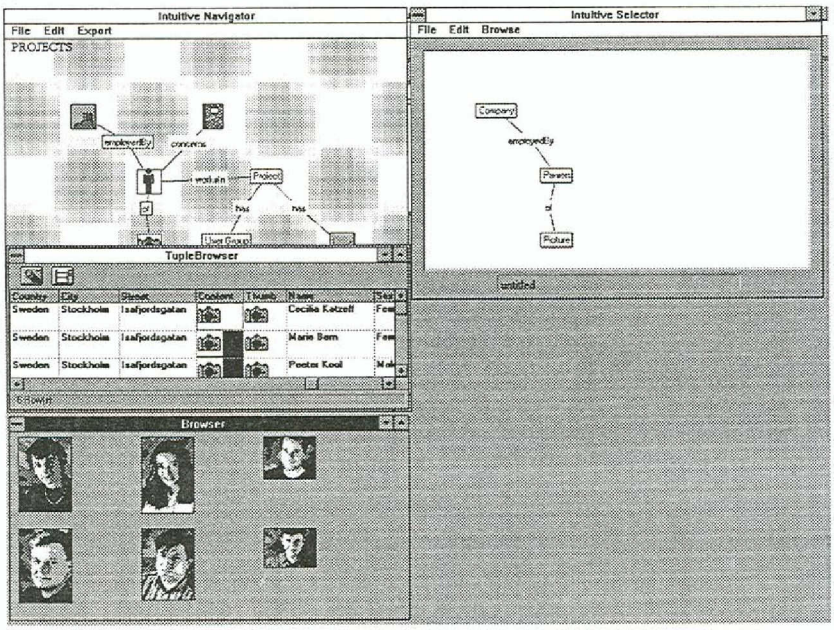

Figure 2.2 The result of a query can be viewed in different browsers.

If the user wants to see a picture in full resolution he double clicks on a thumbnail. The picture is then displayed in a Presenter, see Figure 2.3. If related information exists, buttons for accessing that will be displayed together with the picture.

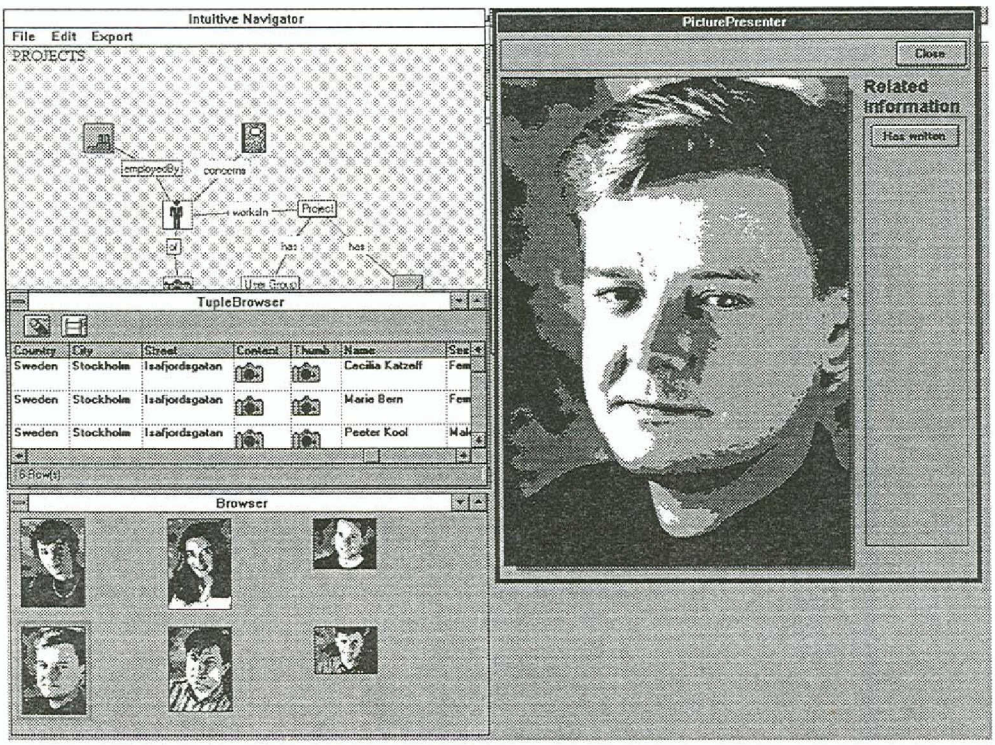

Figure 2.3 Data items can be viewed in full detail.

Then the user chose to follow a link from the picture to a related document by clicking the button "Has Written" in the "Related Information" column in the Presenter.

The document is then displayed in a new Presenter (Fig. 2.4). This document can be exported to Word or any other word processor if the user clicks on the button "Show in external".

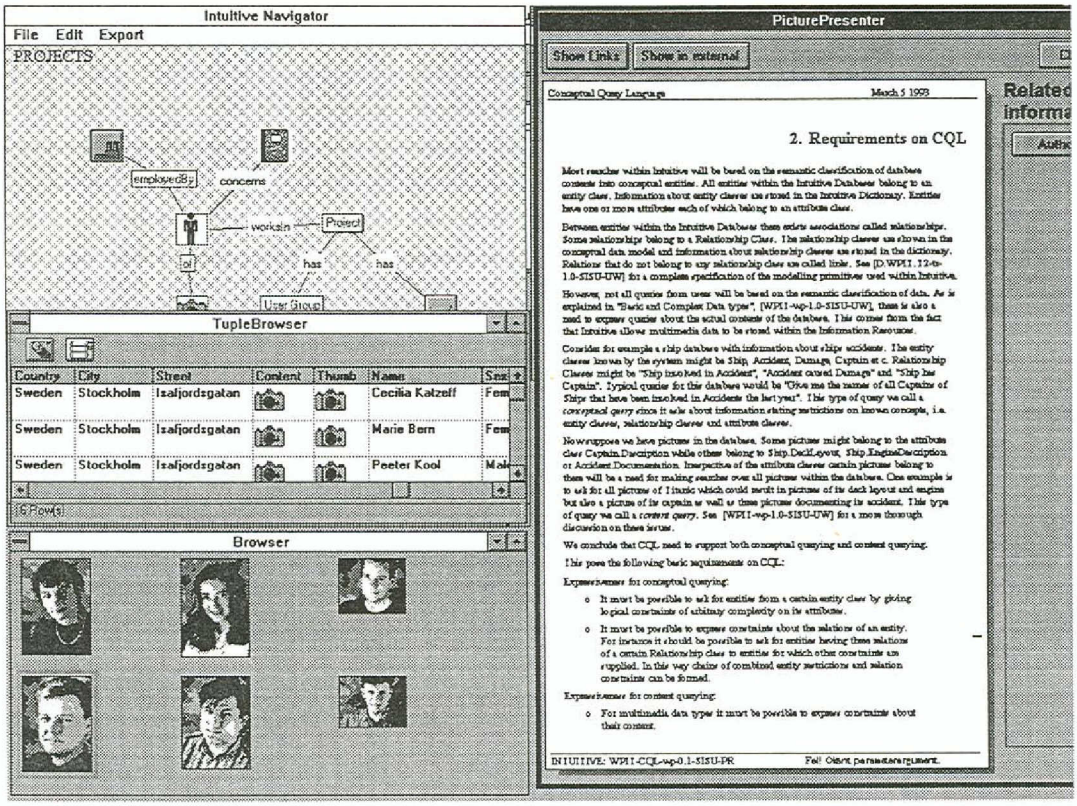

Figure 2.4 The user followed a link from a picture which lead him to a related document.

3. The Intuitive User Group

In November 1992, The Swedish User Group for Intuitive was formed. The Intuitive User Group is organised and managed by SISU. The purpose of the User Group is to keep its members informed and aware of the activities within the project.

The User Group has been very active during spring 1993 and met once a month. At each meeting the status and progress of the project have been reported. Also one or more participating companies have presented their experiences and needs for Information Retrieval solutions within their own organisation.

The Intuitive User Group consists of 10 members.

- Telia
- Sweden Post
- Digital Equipment
- Pharmacia LKB Biotechnology
- Skandia Data Systems
- SPADAB
- Cap Programator
- Volvo Data
- IBM Sweden
- ABB Infosystems

4. Knowledge Databank for Salespersons

The department Business Communication within Sweden Post need to build a general support system for their sales staff. To do that they have initiated the project "The Knowledge Databank" lead by Kristina Segerborg.

The aim of the project is to build a databank with information about customers, customer segments, different sales campaigns, brochures, slide presentations et c, in short all material a salesperson will need when visiting a customer.

To be successful in their work the sales staff at Sweden Post needs to have creative ideas about how a certain customer could do a marketing campaign. Therefore they need access to information about other successful campaigns and they must also be able to show a customer examples of how other companies have done campaigns.

Sweden Post's objective is to build a system for collecting, storing and delivering information about completed sales activities, examples of successful customer campaigns, articles, literature overviews. Another objective is to simplify ordering of sales material such as brochures, videos and slide shows.

A user will consult the system in four different situations:

- *Direct sales support* which means that the salesperson already have an interested customer. He now needs to know how to proceed in selling the concept. Therefore he needs access to check-lists that are specific for a certain postal service and a customer segment.
- *Searching for ideas* of sales campaigns to present to a customer.
- Preparation of a *customer presentation.*
- Preparation of a *seminar.*

4.1. Information Requirements

The information can be divided into two parts - the Idea Bank and the Sales Support Bank which correspond to two different views in the Navigator. When consulting the Idea Bank the user is looking for new ideas, therefore he will search and explore the database in an unstructured fashion, jumping between different focus of interest.

Within the Sales Support Bank the user has a more directed goal. The interaction with the system will be more traditional with queries and answers from the system.

Below is a list of information needed in the database:

- Documented Sales Project
- Golden Letters (each year Swedish companies send examples of Business Letters to Sweden Post. Some of them are appointed as Golden Letters).
- Examples of successful marketing campaigns for various segments.
- Articles.
- Literature overviews.

- Sales Support Material - brochures, videos, slide presentations
- Spreadsheets with simple calculations for offerings.
- Style Sheets for letters.

Figure 4.1 shows a first version of the conceptual map. Note that designing a conceptual map like this is to define which information should be available in the system. Moreover, it is a very efficient way of capturing user requirements and it facilitates the communication between a user and a designer.

Typical questions to be asked to the system are:

- How do I sell service Y?
- Give me all sales material for product X.
- Give me a slide presentation for product X together with speaker's notes.
- Are there any examples of car sales campaigns that was done the last quarter?
- Do we have any videos for a certain service?

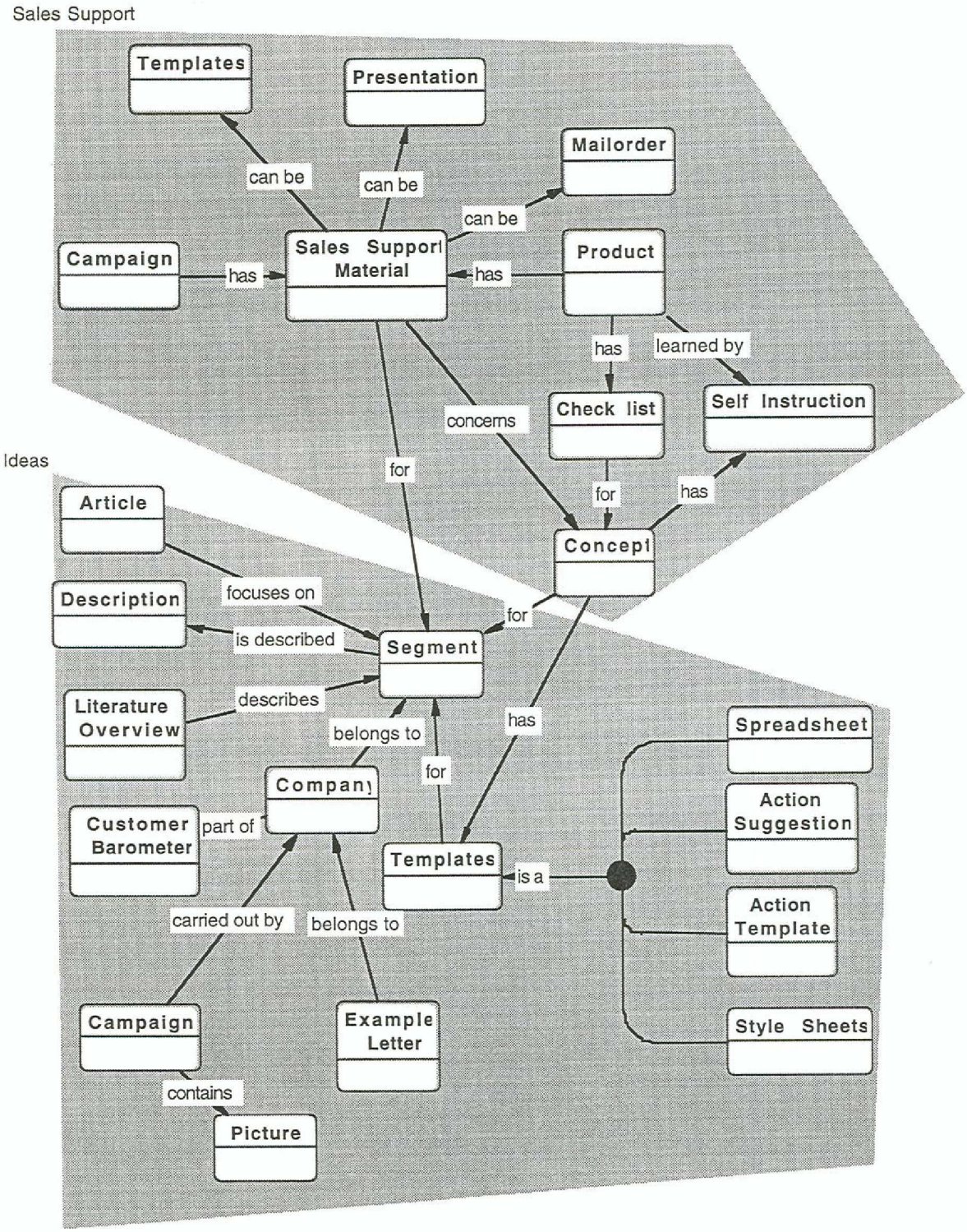

Figure 4.1 Conceptual map for a Knowledge Databank.

4.2. User Interface Requirements

The users will not be computer experts and they will be in a hurry when using the system.

The need to have a links history list has been pointed out at demonstrations of Intuitive prototypes.

Also the need to have feedback in the Navigator when moving around in the database by following links has been articulated during demonstrations.

4.3. Other requirements

One major requirement for this application is that the system should know about information material that is not necessarily in the database such as thick brochures and videotapes. In that case the system should offer a way for the user to order it, i.e. an order form should be displayed where the user fills out his request.

The database will be Oracle on a Unix platform and the communication between server and client machines should be based on Oracle SQL-net. Client machines will be 486 PC with MS Windows 3.1.

Finally, it must be easy to update and maintain the Knowledge Databank.

5. Office of the Future

The second application belongs to the same domain as the first - Market and Sales Support. Sweden Post is divided into several regions and one region is planning to build "the Office of the Future" where the objective is to make the sales work more efficient.

One part of the project is to reduce the amount of paper handled within the office. To handle all documents produced within the department a common file directory hierarchy has been defined. The directories at the highest level are named after customers. At the next level in the tree, agreements, offerings, letters etc. are stored. See the figure below for an example.

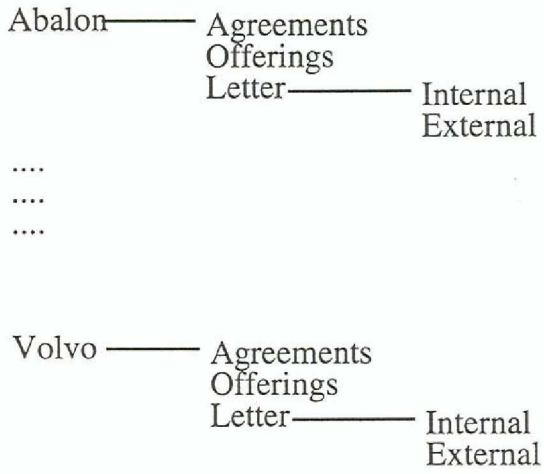

Figure 5.1 Part of the file hierarchy for Office of the Future

In parallel with this a Market and Sales Support Database exists. In the database information about customers, products, monthly sales, budgets, sales project et c are stored.

Documents from the file directory need to be combined with data from the database. An example is to search for customers that fulfil some criteria and retrieve existing agreements and offerings concerning these customers.

Currently we are discussing how to design an Intuitive system for this application together with Eva Ragnå and Lars Nordström. Also participating in these discussions are Håkan Pahlm and Stefan Wester, both from Sweden Post.

5.1. Information Requirements

- Of course all queries that are possible to express today should be supported by the new system. The addition of multimedia should not restrict the normal querying facilities.

- The need to do free text searches has been explicitly expressed. Most documents are Word documents and Word's internal free text search engine should be used.
- It should be possible to retrieve style sheets for different letter formats.
- Although many ad-hoc queries to the database are expected there is also necessary to have predefined queries which the user can execute by clicking on a screen button.

5.2. User Interface Requirements

The users will consult the database quite frequently, most of them at least once a day.

Since not all users need access to the whole database it is important that they are only shown the views of the database that are relevant to their task.

This application also requires advanced presentation planning facilities. One example is that if a user double clicks on a column with numbers in a tuple Browser, the numbers should be displayed as a graph.

Several times the users have expressed the importance of knowing where you are in the database.

Sweden Post expect to store scanned document in the database which will be brought to the screen. When shown a prototype the users complained that it is difficult to read small scanned text the way it was displayed in the prototype. Therefore it must be possible to zoom into a scanned text document to make it larger on screen.

5.3. Other Requirements

The database is Oracle on a Unix platform and the communication between server and client machines is based on Oracle SQL-net. Client machines will be 486 PC with MS Windows 3.1.

It should be possible to make connections to all Windows programs. The system must support OLE and DDE.

It is necessary to have a "What's new"-function to allow users to quickly view new material that has been put into the database.

6. Multimedia Repository

The third application is quite different from the previous two. The idea is to use Intuitive as a front end to a Multimedia Repository.

In the repository, information about all information systems will be stored. Examples are term and object descriptions and definitions, database descriptions and definitions, database schemas, application information, access information etc.

The repository will serve as a tool to catalogue important business rules and will help Sweden Post in reusing existing terminology and definitions when developing new information systems and when maintaining old ones.

The repository will be implemented as an Oracle database. This application is discussed together with Teddy Hector and Hans Hogedahl from Sweden Post.

6.1. Information Requirements

Typical examples of queries to the system are listed below:

- In which applications are the concept "customer" used and how is it defined?
- In which databases do there exist information about both customers and products?
- Show me all term definitions for this object.
- Do we have any business rules that restrict the use of this concept?
- Free text searches over definitions.

6.2. User Interface Requirements

It should be possible to browse through pictures of database schemas and conceptual data models.

6.3. Other Requirements

The database is Oracle on a Unix platform and the communication between server and client machines is based on Oracle SQL-net. Client machines will be 486 PC with MS Windows 3.1.

A possibility for the future is to distribute the repository on CD-ROM for local use within Sweden Post.

7. Family Doctor Information System

Currently a major reform of the Health Care System in Sweden is planned. In short the suggestion is to move Family Doctors out from the central hospitals into locally run receptions. The Family Doctor will have to do all sorts of diagnosis and treatments. When he is not able to do a treatment he must know to which hospital specialist he can send his patients. The working situation for a Family Doctor will change from being a doctor into becoming an expert consultant in choosing the correct and most efficient treatments for his patients.

We are currently trying to define what kind of information system a Family Doctor will need and how its user interface should look.

7.1. Information Requirements

The Family Doctor needs to know about his own patients and their diagnosis and treatments over the years. But he also need access to economical and administrative data. Moreover he needs to have access to medical journals with the latest updates on medical care.

The system can be divided into two parts - a patient database and a reference database. Each part will consist of a local and an external part:

	Patient	**Reference**
Local	Medical Records Lab Findings Treatments ...	Merck Manual CD-ROM
External	X-Rays	MEDLINE

Figure 7.1 Architecture for a Family Doctor Information System.

The patient database will store information about a Family Doctor's patients. Examples of local data needed are data about patients, previous treatments, symptoms presented by the user, laboratory findings, signs derived from laboratory tests.

Laboratory findings are different modalities and sources such as values from blood chem. lab, pictures and text from X-ray and other imaging departments, biosignals and text from clinical physician lab etc.

In some cases the doctor will need to access external information sources such as X-rays of a patient which is stored in a central hospital database.

The reference database must give the doctor access to articles, medical handbooks and other relevant literature. Examples of contents in the local reference database is published CD-ROM literature and the Merck Manual for acute medicine. An example of an external reference database is MEDLINE where a doctor can do on-line searches for published articles.

Below follows some examples of queries that have been discussed:

- How did I treat this injury the last time?
- I treated this injury two years ago, but what does the medical literature say about state-of-the-art now?
- Give me a treatment scheme for this injury.
- Which hospital offers the best conditions for my patient if I send him there?

7.2. User Interface Requirements

The doctor might need to consult the system during a treatment. This could be a very critical situation such as a myocardial infarction. Therefore voice input might be necessary.

7.3. Other Requirements

Access to external on-line medical databases such as MEDLINE is needed.

There is a need for co-operation between the local information system at the Family Doctors site and the information systems at hospitals. This could be solved with a federated database architecture. The scope of this is probably outside Intuitive.

8. SISU Knowledge Database

SISU is a research institute which is partially sponsored by Swedish Government and industry. The industrial group behind SISU consists of 40 companies, called SISU *members*. One problem for an organisation like SISU is how the results and knowledge from research projects can be transferred to our members.

One solution is to build a Knowledge Database which can be accessed from our members sites. In the database we will put information about our research projects. This includes SISU reports, project descriptions, project deliverables, project documentation, literature overviews, video seminars et c. The information already exist within SISU but has not been put in a database since we have not had a solution to how it should be accessed.

We will also encode information about the employees at SISU, their work, their expertise and interest and how to contact them. Bern et al give a thorough description of this application [Bern93].

8.1. Information requirements

This application has been discussed within the Swedish User Group since they are the natural users of the system. Examples of what we know users would like to query the database about are:

- Which projects is SISU participating in at the moment?
- Do SISU and Cap Gemini Innovation have any collaborative projects going on?
- Which people at SISU work with HCI issues?
- Give me the report about tools for graphical user interface design.
- Give me the video of the seminar "Business Design".
- Have any persons from my organisation participated in a project together with SISU?

There is also a need to support more fuzzy searches, for instance free text search over all documents in the system or keyword searches over all multimedia information, irrespective of its type:

- What do SISU know about Business Process Re-engineering?
- Do the database contain anything about Visual Languages?

8.2. User interface requirements

We expect that the users of this system will use it infrequently. This implies that it must be easy to learn but also easy to remember how to use.

The overview of the available information is crucial, therefore the Navigator design is of uttermost importance.

Due to the wide range of different query types a natural language interface as a complement to the graphical interface is believed to be important.

During one of the User Group Meetings we had a design session together with the participants to gather comments and requirements on an application like this.

The following are a summary of the users, slightly edited, comments:

- The representatives thought that the typical usage scenario for the SISU Knowledge Base would be that the user wants to know if SISU or someone else can help him with a specific subject. The queries in this case could be "Is there any at SISU who knows anything about X?" or " Does SISU have a report about X?".
- The knowledge base should be organised in different subject areas. Instead of using concepts like project, employee, department et c., the focus should be for instance Multimedia, Conceptual Modelling and HCI. For each of these subject areas there should be information about ongoing and finished projects, compilation of references covering the subject, seminars, courses and people working with the subject.
- Apart from this structure, it would also be useful with a parallel one for seminars and courses, in order to give a quick view over what activities there are.
- It is important to give the users possibilities to cross subject areas (for instance a reference could belong to many subject areas) in order to give the user wanted but unknown information. Hypertext style links are also important for crossing subject areas.
- The user interface should be as simple as possible in order to accommodate less frequent users.
- The links were considered an important feature. The links that were considered to be the most important were the links that couldn't be visualised by the information map. E.g. connections between a product group and similar products that your competitor has.
- A link history list was considered necessary in order to give a useful system.
- An interface for easily creating links should be developed in order for the user to be able to define new links in run-time. These links should possibly be private for the user and not directly available for others
- The system should stimulate the user to discover and retrieve more than his primary need. This is taken care of by a good link structure, but is perhaps not enough. A "What's On" and an open bulletin board could be useful as a complement. This "extra" information that user occasionally find is added value.
- All users must easily realise how to find information, but users think differently which imply there must also be alternative ways to find it. If someone wants to know more about HCI, the system must give

him the opportunity to find it by different kinds of links from for instance Mr Rosengren, the "Electronic Course Catalogue" or documents on the subject.

8.3. Other Requirements

It must be possible to print the material retrieved.

If it is not possible to print the material the system should offer a way to order it from SISU.

9. Summary

In this chapter we try to summarise our experiences from demonstrating and elaborating application definitions together with users.

The various applications discussed in this document shows many differences at first sight but if we analyse them more in detail we see they have many things in common:

- There is a need to make information of various formats available to many users.
- Multimedia information already exists, in many cases even in electronic form.
- There does not seem to be a major demand to have physically distributed databases. All applications, except the Medical application, discussed can be solved with a relational database with BLOB handling facilities or a single object-oriented database.
- In all applications it seems impossible to define all information needs of a user. Therefore the exploring and ad-hoc querying facilities are important.
- In almost all applications there is a need to do updates in the database.
- Many times the importance of knowing where you are in the information space has been pointed out.

Other interesting and important but more application specific demands are:

- Easy-of-use and naturalness of interaction is of course important in all applications above, but for two of them it seems crucial - (SISU, Sweden Post Knowledge Bank) the user will not bother to use the system if it is to complicated since he can get the information in other ways.
- It does not seem necessary that all information actually has to be delivered on screen as long as a user is aware of its existence and get directions on how to get it (SISU, Sweden Post Knowledge Bank).
- There exists a need to access external databases (Family Doctor Information System).
- Voice input (Family Doctor Information System).

We have also found that it is easy for users to express their needs through the design of conceptual maps. This is part of the application design methodology currently being developed within the Intuitive Project [Bern93].

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SVENSKA INSTITUTET FÖR SYSTEMUTVECKLING
SISU

Electrum 212, 164 40 Kista
Isafjordsgatan 26
Telefon 08-752 16 00 Telefax 08-752 68 00