

## Intelligent Gateways : Functions for the Benefit of the Electronic Library

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### Abstract

Library automation enhances the processes of offering and distributing information to library users. Nevertheless, that information is still a small part of the entire information available on the information market. Therefore, users having access only to local information pools of an electronic library might miss a lot of relevant information. Intelligent gateways offer a chance to reduce this disproportion by extending the access to more information pools, reducing the access problem, reducing the problems of selection, and offering the information in a way users want. Therefore, intelligent gateways offer complementary functions to the electronic library by adding value on a substantial and functional level.

This paper will give an overview on the possibilities offered by intelligent gateways and will explain the way in which their functions could be integrated in the concept of the electronic library.

## Intelligent Gateways : Functions for the Benefit of the Electronic Library

### 1. The Electronic Library - an Overview

The essential purpose of an electronic library is similar to that of libraries not yet electrified: improving the users' chance to obtain the information they need. Applying information technology within a library has three aspects:

- a) optimizing the internal workflow of the library;
- b) optimizing the services a library offers to other libraries and to the end user;
- c) optimizing the users' access to the world of - increasingly electronic - information.

In this paper I would like to emphasize the last two points. In other words, I am going to ask how the concept of intelligent gateways can be applied for the benefit of the users of an electronic library.

These are the topics I want to address in particular:

- Users and the access to electronic information - problems and possible solutions
- Intelligent gateways - a concept to minimize the problems of gaining information
  - The problem of selection
  - The problem of searching
  - The problem of output
  - The problem of accessing documents or the information itself
  - The problem of transparency
- Intelligent gateways - an option for diversifying instead of reducing information

## 2. Users and the Access to Electronic Information - Problems and Possible Solutions

When users come to a library today seeking information we will offer them several pools to search in: the local OPAC, networked catalogues, CD-ROMs or online databases. There will be a good chance for the users to obtain references and finally the documents and the information they are looking for. Nevertheless, there are not many users who are able to manage all these steps without help from the library's staff.

Typical problems users are confronted with are:

- a) How do users know what kind of information is available in the different sources they might have access to?
- b) Will they be skilled enough to select the right source by themselves?
- c) Do users know how to access selected databases? Do they know the conditions for using them?
- d) Will the users be able to retrieve all the entire information they want? Will they be skilled enough to switch between the different conceptual and syntactical frameworks of information retrieval systems?
- e) Will they be able to parametrize the systems in such a way that the information will be presented according to their special purposes or wishes, e.g. in terms of data structure, media and place?

Most of you have been confronted with these questions for a long time, too. And most of you know that we are the ones who are to assist these users. But the possibilities to assist them in managing these problems are getting worse. Not only because of reduced budgets for library staff, and because of the enlargement and diversification of user groups but also because the information being made available electronically is still increasing. And this trend will continue.

The only likely way out of this dilemma is to get help from machines. They will have to help us to solve the problems mentioned above. Their function will be to help the users manage the problems of selecting, searching, presenting and accessing information. They will take them by

hand and lead them through the information jungle, as Hawkins illustrated with a picture in a paper from 1988 (Hawkins 1988:32).



More and more often the users who will come to or in most times log in the electronic library want to get rid of all those selection and retrieval problems. They should have the chance to access information pools in an easy way by getting help from the systems they use. Members of the library staff will get involved only if the clients have problems using the systems. If these gateway systems manage the problems like our colleagues do now (perhaps even better in terms of available time and accuracy) they will perform some functions which we call "intelligent". Therefore we should call those systems "intelligent gateways". Their goal will be:

To guide the users to the information they want by offering access to (electronic) information wherever it is available and whatever the technical circumstances are.

## 3. Intelligent Gateways - a Concept to Minimize the Problems of Gaining Information

The concept of gateways - which in my understanding includes the functionality of front-end systems<sup>1</sup> - is sufficiently evaluated by famous

<sup>1</sup> Compare the arguments of Kuhlen 1991:2f who describes the complementary features of gateways and front-ends and gives explanations why "gateways" could be used as a broader term.

colleagues like Martha Williams, Dan Prickett, Efthimis Efthimiadis, J.A. Large, James Benson and Bela Weinberg and - adding a German scholar to the enumeration - Rainer Kuhlen<sup>2</sup>. There are several essential functions which I do not want to list and explain in this session. Instead I want to focus on five essential problems the users have to solve when seeking information. These main moduls of - finally - intelligent gateways will be conceptual prototypes for the solution of these (and other) intelligent functions assisting the users.

The five problems I want to focus on are: the problem of selection (3.1), the problem of searching (3.2), the problem of output (3.3), the problem of accessing documents or the information itself (3.4) and finally, the problem of offering transparency to the users of the system (3.5).

### 3.1 The Problem of Selection

Frances Barker called the problem of database selection "a challenge for the 1990s" (Barker 1990), explaining that the increasing diversity of the information market will increase the complexity of database selection.

Clients who just want information normally will not be interested in the complexity of the information market. They are only looking for specific information. And they will need assistance to find it. In case of database selection this means

- a) different levels of information about available sources<sup>3</sup>;
- b) information about possible restrictions which could be applied to the available pools of data, e.g. in terms of economical restraints, updating, validity or language and the consequences of these restraints.
- c) information about the different structure of the data available.

To avoid increasing complexity, all these options should be available in the background, activated by the users when they want to use them.

On a basic level these are functions similar to those we have today when using EasyNet, for example. But a closer look at EasyNet (or other gateway services)<sup>4</sup> shows us the real challenge: The more automated

<sup>2</sup> Williams 1986; Prickett 1988; Benson et al. 1988; Efthimiadis 1990; Large 1990; Kuhlen 1991; Prickett 1991.

<sup>3</sup> For automating this function a numbering system for electronic products would be a great advantage; see Scharff 1991.

<sup>4</sup> See e.g. Bassewitz 1990 or Kelman 1988.

systems we apply the more we have to know in advance about the clients' interest. This is the only way to prepare adaptive systems for the special focus of these users.

A lot of research has been done to implement systems like these using artificial intelligence and expert systems<sup>5</sup>. The available solutions work well enough as long as they are restricted to a special field and there are no changes. But on the market there are always changes. To keep pace with these seems to be the real unsolved problem.

Meanwhile most of us are trying to reduce the complexity of the information market in a simple way: we reduce the number of systems and information pools offered to the users. But this cannot be the solution in the long run because it ignores the options of diversity and competitiveness the information market offers. Thereby we run the risk of restricting instead of widening the information access and in the result perverting the idea of an electronic library.

### 3.2 The Problem of Searching

Having solved the selection problem, users will have to take the next step: searching. Users surely would like to pose their questions in natural language, and there are great improvements in offering tools to make that possible (Lange 1991; Philip et al. 1991). Until these tools work well we will offer available retrieval interfaces to the clients: menus, commands, graphical interfaces, depending on our preferences, or as we can obtain them on the market.

This shows us another aspect of intelligent gateways: They should provide interfaces which are able to lead us through all the systems and information resources the electronic library will offer. Starting a search in a local information pool, extending it to off-line databases on CD-ROM or other optical disks and finally going beyond the locally available pools - all these searches should not be restrained by switching from one search language to another or by alternating the keywords needed to retrieve information. This all has to be done by the intelligent gateway.

In other words: we have to solve a syntactical and a semantical problem. As a consequence we need to enforce options like the disconnection of

<sup>5</sup> Hawkins 1988; Morris et al. 1988; O'Neill et al. 1988; Vickery 1989; Weckert et al. 1992

CD-ROM retrieval interfaces from the search engine they use (Hatvany et al. 1991). Thus the biggest chance to solve the syntax problem is to apply the standard which is available now: The SR-standard (ISO 10162) or Z39.50, as the ANSI-equivalent (Lehmann 1991; Lynch 1990). Even if it takes some more time to implement these standards in most of the commercially available products we have reason to be optimistic.

Nevertheless, we have to be aware of the fact that these standards do not overcome the problem Common Command Language (CCL) has not solved. Different information providers will insist on different search possibilities and on the special search options these offer to their clients. Therefore SR or, as the case may be, Z39.50 will still match only a limited range of search possibilities. But users won't be aware of that. Therefore, intelligent gateways will have to give these bad news to the networked users of an electronic library.

In the long run the demand by networked users will perhaps surpass the demand shown by users searching database systems via direct access. This might be the only chance to extend the core command set available to the standard user of the future.

### 3.3 The Problem of Output

There are different possibilities to obtain the retrieved information from the system. Users manipulating the output face three main tasks:

- a) the *selection of data*, a problem which goes beyond Boolean relationships, e.g. by checking duplications or checking output in terms of relevance, validity of data, or availability of documents;
- b) the *presentation of the data*, e.g. assimilation of data structure, field tags or insertion in an output frame for the convenience of the users;
- c) the choice of *output media and place*, e.g. mailed electronically, printed on paper locally or data output to a fax machine.

All these options have to be offered to the users. Therefore they have to decide where and in which way they will get the data. The intelligent gateway has to offer those options - not only by adopting features of the system being used. Again this value adding service gets its goals from the idea that the electronic library should offer options instead of restrictions to the users.

### 3.4 The Problem of Accessing Documents or the Information Itself

There have been many efforts to improve interlending procedures and document delivery during the last several years (see for an overview Osswald 1992b:16-18 and 30-34). Projects like ION (Plaister 1991) or ADONIS (Stern et al. 1988; Korwitz 1992) have been discussed in the literature and here at the Essen Symposium as well. It is a great advantage that these projects include the changes of document production and availability. Even though it will take some more time until the vision of a paperless society becomes reality (Lancaster 1982), it is a fact that we will have an increasing amount of electronically available documents. These documents (or parts of them) will be much easier to access and deliver than printed ones.

Traditionally the access to documents retrieved during a search in a catalogue, a CD-ROM or an online database is not only timeconsuming but also yields unpredictable results. This causes a great demand for better document delivery services. The vision I have is a service by which most parts of the job will be done automatically - depending on the parametrization of the system by the user. Such a modul of an intelligent gateway performing an ideal document delivery service would improve library functions in a special way.

Most probably that modul will search for holdings information which could be added to the retrieved results. In case of electronic availability of the documents the system will initiate the output of these electronic documents (or the relevant parts of them) at a place the users want<sup>6</sup>. In case of availability on paper the system could be linked to interlending networks which are or will be available. Documents could then be ordered for delivery or be processed on demand by a converting routine. Originally printed documents would then be available in an electronic version after scanning and - depending on the order - OCR processing (e.g. Butler et al. 1989).

The existing problems of realizing such a concept cannot be discussed in my paper but I want to remark that I am aware also of the commercial and legal problems involved (Osswald 1992b:139-149 and 204-210; Pijnenborg

<sup>6</sup> See Osswald 1992a for the problems of identification of electronic documents. - Suggestions for a further standardization of the international exchange of electronic documents are given by the Group on Electronic Document Interchange (GEDI) (see GEDI 1991).

1991). Nevertheless, from a technical and procedural point of view this modul of an intelligent gateway seems to me the most likely one to come about.

### 3.5 The Problem of Transparency

The concept of intelligent gateways does not entail the users' interest in what happens inside the "black box" of the intelligent gateway. As long as the interface and the communication modul is adequate and able to lead users to the information they want, most of them will be satisfied because the system serves their needs.

On the other hand, there are users who want to understand or even control the way in which the service of the intelligent gateway is produced. These clients offer the chance for the development of a service partnership within the electronic library context.

Therefore, there has to be the opportunity for the user to use an self-explanatory modul of the intelligent gateway which explains the steps and the rules applied. For that reason the user must be able to switch between a "black box modus" and an "explanatory modus".

In my opinion this option is not only for the users' sake but also an advantage to the system designers and library experts who will have the chance to participate in the users' experiences and questions. This keeps the system open for improvements and at the same time reduces the danger of misunderstandings between the designers of the electronic library and the users.

### 4. Intelligent Gateways - an Option for Diversifying Instead of Reducing Information

Conventional gateways as we know them from the online market facilitate the access procedures by applying reduction concepts to the available options of the information market. These gateways available today offer substantial disadvantages, e.g.

- a) users do not get an idea of the diversity the information market offers;
- b) users are offered only a small segment of the function set being available in different information systems;
- c) users do not have much influence on the output options the gateways provide.

### 5. Conclusions

Users of existing gateway services are provided with limited services and with reduced options for adding value to the data they obtain. Moreover, they pay much more for that kind of service than users who retrieve information not using the gateway service.

Instead of this reduced service, intelligent gateways will provide a wider range and better quality of services because they:

- a) link the locally available resources of the electronic library with the functional and content-based options the information market provides;
- b) add on complementary information to the data the system has retrieved;
- c) add value to that information, e.g. by document delivery procedures;
- d) do not keep users in a state of ignorance but offer a chance to overcome the know-how-barrier and get them involved in the process of retrieving and selecting information.

Intelligent gateways are the tools which offer assistance to the users seeking information. Additionally, they will allow them to keep up with the development of the information market. Therefore intelligent gateways are the right tool for the electronic library to provide a wide range of services for the benefit of its users.

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