Introduction
The long term goal of the WITH project is the development of open hypertext systems which will allow the integration of information from various sources for diverse purposes and a wide range of applications. At the time we applied for the initial project grant, various types of commercially available databases were the main information sources which came into consideration. In the meantime developments in the context of internet especially WWW gave occasion for an integration of additional external information sources and thereby a shift in the emphasis of the project aims. As a consequence the expansion of the number of information sources has considerably increased the number of types of documents which is taken into consideration.

In this regard we developed the prototypical hypertext system KHS (Konstanz Hypertext System) which in the meantime has established itself as the core of the software work pursued in the project and serves as a basis for the experimental testing of procedures and methods developed to get a multi-resource hypertext system. Our goal is the integration of internal and external knowledge stocks, such as for example are constantly generated and managed by scientist in their workplaces, or initially processed in an electronic dossier organized as a hypertext. KHS is, however, not only a convenient interface or gateway to these services, but rather enables the appropriate hypertext processing and use of these stocks as they are embedded in a local hypertext, be it through a real or a referential integration.

To understand the KHS we will describe the basics of the system [Hammwöhner/Kuhlen 1994, Rittberger/Hammwöhner/Aßfalge/Kuhlen 1994, AßFalge/Hammwöhner/Rittberger 1993] the knowledge based methods employed in our system, which expand type- and content-oriented filtering processes, the opening of the system in regard to the World Wide Web and show hypertext-specific search methods used in KHS.

The hypertext-model of KHS
KHS allows the integration of various application domains, the use of multiple information resources and parallel use by an - in principle - arbitrary number of users. The unifying framework is supplied by a generic, application independent hypertext-model comprising a structure model which describes the structure of well-formed hypertexts with an interaction model which defines generic interaction styles. Both the structure model and the interaction model can be refined to suit the needs of special applications or individual users.
The structure model
The simple node-link structure of early hypertexts proved unable to provide sufficient orientation clues in large and complex hypertexts. KHS therefore employs additional structuring mechanisms as follows:

- Typing of hypertext objects allows the stepwise refinement of structure and behavior of hypertext objects. The type of a hypertext object determines its internal structure (content) and behaviour. KHS distinguishes between hypertext units, devoted to the representation of the information content of a hypertext and links, realizing the relations between such items of information.
- Semi-structured hypertext objects offer structured data where they are required for further inference processes.
- Composite nodes provide a polyhierarchical structuring mechanism. The KHS hypertext model regards composite nodes as the backbone of the hypertext structure and as a means for structured navigation. The types of units which are allowed in a composite unit are subject to type checking. If users know what kind of composite unit they have entered, they can anticipate the kind of information they will find.

The interaction model
KHS employs a multi-window interface to its hypertexts. At any given point in time user’s attention is concentrated on a particular hypertext unit. The unit’s content and a minimal set of contextual information (embedding in the structural hierarchy, outgoing links, etc.) are displayed within one central tool, the Hypertext Browser. Interaction with the unit takes place via a mouse click on a hotword or on lists of unit names. More complex functions can be activated by unit type-specific pop-up menus.

Nevertheless, no single tool can satisfy the presentation and interaction demands of a complex hypertext model. Therefore KHS provides a set of tools which can be additionally activated, providing access to:

- special properties of hypertext objects (units or links),
- the content of additional units,
- lists of units obtained by search processes, the dialogue history,
- overviews of the structural hierarchy and link webs

All of these tools communicate with each other and thus guarantee a consistent display of the actual state of the hypertext.

Working with KHS will in any case include exploratory interaction styles. When navigating through a hypertext (or a relevant subset), a user must take decisions as to which unit he regards as the most appropriate one to be read next. KHS assists him by providing as many discourse clues as possible to indicate where the next navigation step, whether it is a traversal of hierarchies, an exploration of relevance sets or link navigation.
Filtering and searching in KHS

Often, especially within highly interconnected hypertexts, too much information is retrieved by a single navigation or search step. Like many other hypertext-systems, KHS offers filter options which prevent any information from being presented which does not conform to special filter conditions. The most important KHS filter types are type and structure oriented.

- Type based filters preclude the presentation of any units or links which do not conform to one of a set of previously chosen types.
- Structure based filters only regard units (and links which lead to these units) as relevant which are embedded into special branches of the multihierarchy. As these structures may be constructed dynamically and temporarily (e.g. as result of a search), these filters can be used to combine the search results of several queries.

For retrieval purpose vector based statistical analysis of the content of hypertext is available in KHS. For the selection of information sources these statistical techniques are used for clustering information units containing the description of information sources in a formal and a content based way [Rittberger 1994]. Defining starting points in the cluster, users will be able to search in an contextual environment information units relevant to their search aim.
Besides filtering KHS allows different kinds of searching in KHS hypertexts, like key-word, full text search, passage retrieval and searching with external tools in online databases or the WWW [Rittberger/Hammwöhner/Assfalg/Kuhlen 1994] and including the result in KHS hypertexts. Besides this a search engine is going to be developed, which can search different information sources with the same tool. This tool should be able to have a search power depending to the server it is searching in, e.g. it should be more powerful in searching the KHS environment, than searching an OPAC or pages of a regular WWW-server.

Furthermore KHS will be used to evaluate whether building hypertexts with the possibilities of structuring, contextualisation, using typed units and links is more valuable than using other standard WWW-editors.

Knowledge base in KHS
KHS tries to integrate the knowledge base into the hypertext by using special types of nodes and links to represent all needed domain-knowledge as hypertext objects [Assfalg/Zink 1994]. This formal knowledge consists of the well known frames, rules and a restricted form of constraints, but also of less known forms of knowledge like tasks and access paths. Two short examples for query expansion and mail classification are given.

KHS allows context-based link presentation. If the link is a text-inclusion link, the presentation of the node content is changed too. Each user of a hypertext (reader/author) has a profile where the tasks of the user and the navigational history are stored. Depending on these tasks (especially the one the system thinks that the user is performing) and the current context (that is the history, the current node and its links, ...), the system filters the available links and eventually presents automatically constructed ones. This link filtering and creation process is controlled by rules attached to a task that controls the guidance of users.

As an open hypermedia system, KHS is connected to internet services like email. We will take a look at the mail classification, which was the first knowledge-based service in KHS. When mail comes in, the system looks (after parsing it) for a mail folder in which it can be included. It knows where to find all the mail folders of a user, and checks them for whether the mail should be included or not (a single piece of mail may be included in several mail folders). If a rule is connected to this mail folder with a special link, then this rule decides whether the mail should be included or not. This can be regarded as an approach for the knowledge-based organization and construction of (new) documents in a hypermedia system.

World Wide Web and KHS
With the acceptance of WWW through the scientific community as a publishing and information service a need for opening the KHS to the WWW exists [Assfalg/Hammwöhner 1995] . On the one side, comparable to the integration of email and online databases a WWW-client is integrated into KHS [Bekavac 1995], available as a special unit type and usable in the common environment of the Hypertext Browser. Organization, analyzing, annotating and linking with other WWW-pages or other types of units is possible with the WWW-units as usual in KHS.

Besides this KHS allows also publishing KHS-hypertexts on the WWW [Assfalg/Hammwöhner 1995]. Accessing KHS documents, which are handled on an object oriented database system, in principle is
possible along the Common Gateway Interface of the WWW. The HTML-Code of a KHS-hypertext object is generated by the database and along the Common Gateway Interface available all around the world with a regular WWW-client (e.g. Netscape). Besides the functionality of WWW, special KHS-features mentioned before are available for 'normal' WWW users, like navigating along the polyhierarchy, context information, unit-to-unit links, structured history, and a table of contents.

References

**Aßfalz/Hammwöhner 1995**

*author:* R. Aßfalz / R. Hammwöhner  
*title:* Das Konstanzer Hypertext System als Teil des World Wide Web  
*year:* 1995  
*citeKey:* assfalz_hammwoehner1995  
*language:* German  
*booktitle:* Informationsmanagement in der Informationsgesellschaft. Proceedings des 2. Konstanzer Informationswissenschaftlichen Kolloquiums (KIK '95)  
*pages:* 184-195  
*publisher:* Universitätsverlag Konstanz  
*editor:* P. Schieber

**Aßfalz/Hammwöhner/Rittberger 1993**

*author:* R. Aßfalz / R. Hammwöhner / M. Ritter  
*title:* The hypertext internet connection: E-mail, online search, gopher  
*year:* 1993  
*citeKey:* assfalz_etal1993  
*booktitle:* Online Information 93. 17th International Online Information Meeting, 7.-9. December, London  
*pages:* 453-464  
*publisher:* Learned Information Ltd: London  
*editor:* D.I. Raitt / B. Jeapes  
*isbn:* 0-904933-85-7

**Aßfalz/Zink 1994**

*author:* R. Aßfalz / V. Zink  
*title:* Wissensbasierte Dialogplanung für WWW am Beispiel des Konstanzer Hypertext-Systems (KHS)  
*year:* 1994  
*citeKey:* assfalz_zink1994  
*pages:* 429-438  
*publisher:* Universitätsverlag Konstanz: Konstanz  
*editor:* W. Rauch / F. Strohmeier / H. Hiller / C. Schlögl  
*volume:* 16  
*series:* Schriften zur Informationswissenschaft

**Bekavac 1995**

*author:* B. Bekavac  
*title:* Das Konstanzer Hypertext System (KHS) als WWW-Client  
*year:* 1995  
*citeKey:* bekavac1995

5 The Konstanz Hypertext System: Progress Report
Hammwöchner/Kuhlen 1994
author: R. Hammwöchner / R. Kuhlen
title: Semantic control of open hypertext systems by typed objects
year: 1994
citeKey: hammwochner_kuhlen1994
journal: Journal of Information Science
volume: 20
number: 3
pages: 175-184

Rittberger 1994
author: M. Rittberger
title: Support of online database selection in KHS
year: 1994
citeKey: rittberger1994
booktitle: National Online Meeting'94, New York 10 -12 May
pages: 379-387
editor: M.E. Williams

Rittberger/Hammwöchner/Aßfalz/Kuhlen 1994
author: M. Rittberger / R. Hammwöchner / R. Aßfalz / R. Kuhlen
title: A homogenous interaction platform for navigation and search in and from open hypertext systems
year: 1994
citeKey: rittberger_etal1994
booktitle: RIAO 94 Conference Proceedings. Intelligent multimedia information retrieval systems and management
pages: 649-663
organization: Rockefeller University
address: New York, NY - USA October 11-13