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The NetAcademy Project:

A new concept in scientific knowledge accumulation and dissemination

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Summary

Over the last decade the speed at which knowledge is generated has greatly accelerated which exacerbates the problem of finding the right information at the right time and poses new kinds of challenges to the management of an ever increasing pool of knowledge.

Taking up the ideas of the ancient Greek concept of Academia, the “NetAcademy” (<http://www.netacademy.org>) is aiming at providing a knowledge medium to aid to the creation, integration, reviewing and dissemination of knowledge in the scientific community, taking full advantage of the unique characteristics of the Internet medium. The vision is to offer an open structure and management concept for virtually every research field in search of an intelligible organization of its contents.

The present paper emphasises the general idea of the NetAcademy project and its concept, motivation, and realisation on the basis of available Internet technologies. The main part discusses the two key concepts which differentiate the NetAcademy from more traditional approaches for digital libraries: firstly, the system-immanent vocabulary which allows powerful (semantic as well as syntactic) search mechanisms, and secondly, the modular, template-based design.

The NetAcademy concept consists of different main components. The first is the knowledge base for specific research fields, e.g. the NetAcademy on Business Media (<http://www.businessmedia.net>), which contains facts and knowledge, discussion contributions as well as work in progress. The second component are the participants, which represent the scientific community within a specific knowledge field. Participants dispose of designated roles which define their rights and duties. They follow defined processes which support and frame the knowledge generation process. Different forms of query mechanisms allow for effective and efficient retrieval of knowledge and are thus one of the most differentiating features of the system as a whole.

Keywords: knowledge media, digital libraries, digital documents, cooperative authoring

1 Introduction

Fostered by Information Technology and improved electronic storage devices the production of knowledge has increased dramatically over the last decades. Computers provide the possibility to easily edit, extend and replicate large amounts of information. The great success and the emergence of the World Wide Web [Berners-Lee et al. 94] additionally stimulates the global publication of books, papers, pictures and electronic hypertext documents, thus further increasing the speed of knowledge production and dissemination. These developments pose serious challenges for the management and organization of knowledge bases and exacerbate the problem of finding the right information at the right time. While Internet services become popular to many users of the net, difficulties with searching will get worse as the amount of information stored increases. This is mainly due to the problem of information overload, and vocabulary differences [Furnas et al. 87, and Chen 94]. Moreover, it becomes increasingly difficult to judge whether and to what extent a given piece of information is accurate, up-to-date, reflects accepted opinions and/or has been reviewed by the scientific community.

1.1 Empirical background / target audience

The quality of a Decision Support Systems (DSS) is subject to the supply of external as well as internal information of high quality providing management with relevant and accurate information. Information sourcing has become ever more challenging (more information but harder to find and select) due to the aforementioned developments. The collection, access and use of electronic information in a variety of formats requires powerful supporting tools, which we intended to implement in the NetAcademy platform¹. The focus of the paper will therefore be on information science and digital information technology.

The background of the "NetAcademy" [Schmid 97] is the academic sector and hence the platform's primary target audience are researchers and students but also practitioners all over the world. In addition to forming a large knowledge base, the NetAcademy is meant to provide a meeting place for the joint discussion of trends, the exchange of personal opinions and research results within a specific scientific field of research/interest.

1.2 Content and structure of the paper

In the first section we describe the motivation for the project and define the NetAcademy concept. The next section is concerned with the fundamental characterization of the NetAcademy which covers the underlying organization of the knowledge generation process. To make this knowledge generation process a lively and interactive action, the platform requires participation and contribution. How this participation and interaction will be implemented, is outlined in the third section. The fourth section focuses on the mediation of the assembled knowledge in a federated knowledge medium. The paper continues in a fifth section with the technical realization and the resulting software modules. The concluding section lists some initial experiences with the system and points out further research issues.

As digital libraries based on World Wide Web technology represent a highly dynamic field in which a lot of research still has to be done most of the references in this paper relate to empirical research - mainly project results - recent articles or electronic news.

¹ URL: <http://www.netacademy.org>

2 The NetAcademy project and definition

The term “academy” stems from the school for advanced education founded by Plato. Today the concept of an Academy is often referred to as

“a body of established opinion widely accepted as authoritative in a particular field”

[Ninth New Collegiate Dictionary 72].

Following up the spirit of the ancient Greek concept of *Academia*, the term “NetAcademy” is meant to combine the ancient meaning and the ubiquitous electronic information sphere.

2.1 Motivation

Supposed a student of a given field X is interested in accessing a knowledge base for information on X. He or she will be confronted with a magnitude of different media or media channels (see Figure 1).

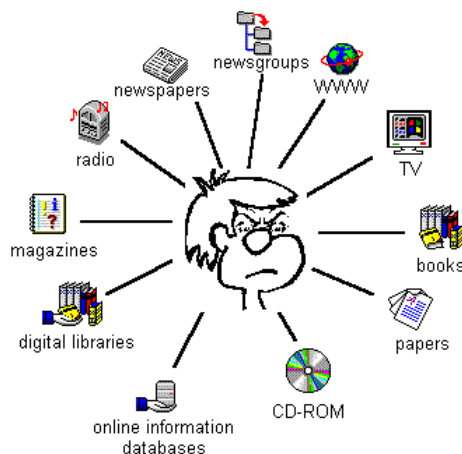


Figure 1: Information access (today)

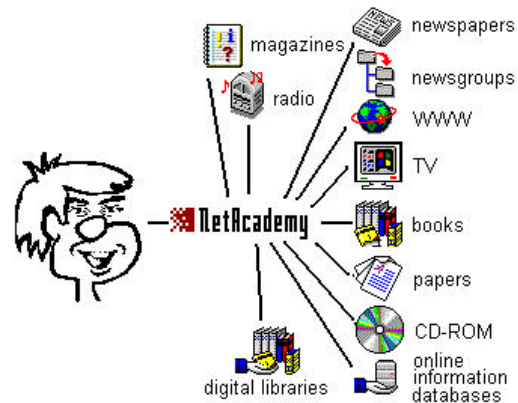


Figure 2: Information access via NetAcademy (uniform design and structure)

Like traditional media, the Internet contains an enormous amount of unstructured, distributed information. Users of the Internet are increasingly complaining about the perceived “chaos” in the “information jungle” of the World Wide Web. The NetAcademy tries to remedy some of the problem of unstructured information, offering a standardized platform adding:

- structure,
- information categories,
- extended search functionality, as well as
- behavioural rules for participants.

Thus not only an excellent information retrieval tool is established, but also an interactive platform where knowledge may evolve. The strength of the NetAcademy platform lies in the recognizable patterns in design and structure. The platform offers a uniform appearance for every knowledge category as well as a standardized discussion environment.

2.2 NetAcademy Definition: a 3-dimensional approach to the knowledge structure

The concept of the NetAcademy is based on the view that a piece of knowledge can generally be characterized by three different attributes:

- The **knowledge area** (language aspects) it belongs to, or in our terms, the specific **NetAcademy** it is a part of (e.g. Electronic Markets),
- The **nature** (reference aspects) of the piece of knowledge, so to speak the **world** it belongs to. The world also implies the specific topic of the information which can be provided in the following forms:
 - theory / vocabulary which supplies a basis of pre-defined notions (the basic knowledge commonly assumed to be correct),
 - a publication (built upon the theory/ vocabulary),
 - an activity developed within the framework of a specific NetAcademy, or,
 - a discussion contribution,
- The **participant** or the **process** (pragmatic aspects) that creates or is making use of the piece of knowledge and links it to other pieces. The participant may be an author of an article or paper, a contributor to a discussion, a search engine that produces a list of a commonly used vocabulary, etc.

These three primary attributes are used to model a three-dimensional space. Figure 3 depicts the emerging three-dimensional model.

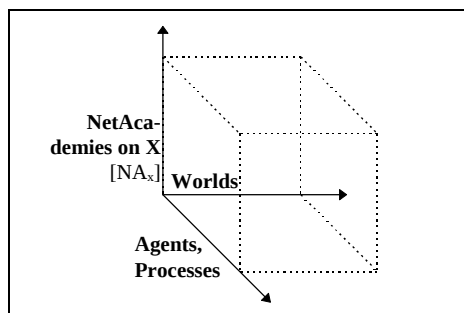


Figure 3: Three-dimensional concept of the NetAcademy

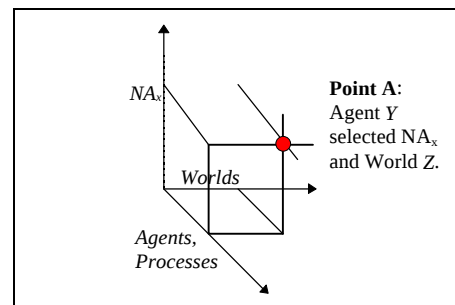


Figure 4: Attributed piece of knowledge marked by point A

As an example let us assume that a discussion participant seeks papers and articles on Electronic Banking (the specific world) which have recently been published in the field of Electronic Markets (NA_x = NetAcademy (Electronic Markets)). Point A in Figure 4 could then identify a paper about Electronic Banking which is a piece of knowledge of the NetAcademy on Business Media. The connotations of the three axis in Figure 3 and Figure 4 thus being:

- **NA_x :** NetAcademy on Electronic Markets with different views / theory,
- **World:** Electronic Banking, i.e. banking platform as an Electronic Market, x = Banking,
- **Participant:** a student seeking information on a researcher providing information on Electronic Markets in Banking.

A visitor to the NetAcademy may choose the views freely, fixate one of the axis, or choose a search mechanism that will guide her. Thus, a visitor may once be a passive, browsing information consumer, the next time she might select a specific World (e.g.

material on Electronic Banking) to look at the NetAcademy Universe (all the different knowledge areas) and the third time she can enter a specific NetAcademy and contribute actively as a participant. This basic of a NetAcademy requires a common language to be fully functional.

2.3 The NetAcademy language

The knowledge generation process is paramount to the NetAcademy concept. The platform requires participation and contribution of each participant who may perform different roles and tasks. To facilitate this interaction a basic vocabulary is established with well defined terms within a specific research field. The vocabulary problem has been discussed widely, see e.g. [Furnas et al. 87, and Chen 94]. The interaction of participants should guarantee continued improvement in the quality of the knowledge contained in the NetAcademy. The hypertext structure of the Internet allows the integration of definitions into new formulations thus enabling the rewriting of the information basis into a logical language.

This basic knowledge commonly agreed upon forms the base of a specific NetAcademy. Throughout this paper it will be referred to as theory or vocabulary. Figure 5 depicts the hypertext structure of the definitions for the example of the term “Electronic Markets”. Every word that is underlined is linked to a detailed definition thus providing the user with the possibility of a knowledge drill-down also known from data warehouse systems. The hypertext links can also be found each of the different NetAcademy “worlds” (see section “The NetAcademy design”) where the vocabulary can easily be integrated in papers, articles and even in discussion contributions.

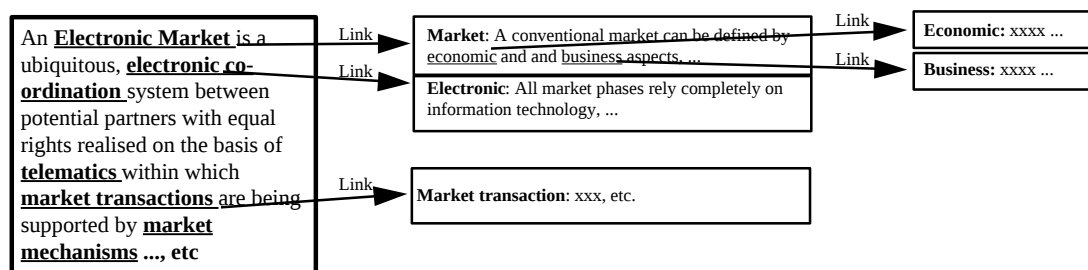


Figure 5: Hypertext structure of the contained knowledge

The result of the emerging knowledge base will be a common language which will be used by every author contributing new information to the system.

2.4 The NetAcademy concept

The NetAcademy platform implements the NetAcademy concept on a software level. It provides a template from which Net Academies as knowledge media may be instantiated covering a specific field of interest. We are currently in the process of building up Net Academies in our research fields of Business Media² and Knowledge Media³. Each component of a NetAcademy itself is interrelated with other Net Academies as the subjects covered are related to topics dealt with in other Net Academies. Individual NetAcademy instances, e.g. on Business Media or Knowledge Media, are combined into a larger structure according to relations of generalization and specialization forming an acyclic graph [cf. Figure 6]. All Net Academies, large and

² URL: <http://www.businessmedia.net>

³ URL: <http://www.knowledgemedia.net>

small ones, show the same conceptual logic. As the use of the NetAcademy platform increases over time a dynamic knowledge medium of global scale will evolve. At the graph's root node the "NetAcademy on NetAcademy" is located, which on one hand represents a meta-layer documenting the architectural concepts and laying the theoretical foundation and on the other hand provides a centralized entry point to the global knowledge medium.

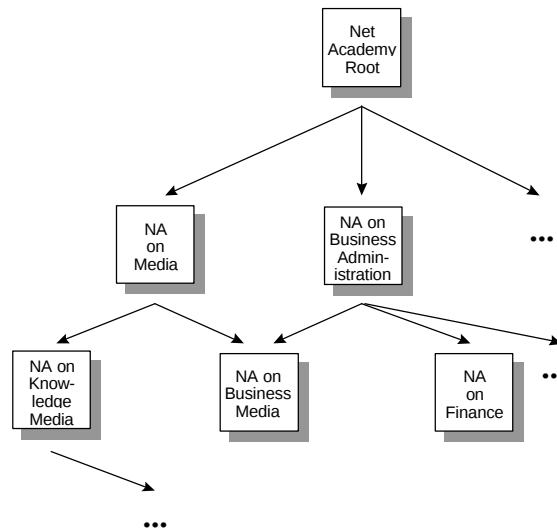


Figure 6: The NetAcademy Global Directory

Each NetAcademy offers a handbook service, with basic and accepted theories, definition of terms and an up-to-date vocabulary for the respective research field. It contains a facility for reviewing and discussion with an implemented state report of the ongoing discussions. The basic (technical) vocabulary as well as the cited cases and references within the presented theory and the discussion section are also available in a separate view.

3 The NetAcademy design

The following section deals with the design of the graphical user interface. It depicts the macro view on the knowledge medium. Conklin [Conklin 87] in his hypermedia survey, identifies two major dangers of free-formed hypermedia access within an associative network: disorientation and cognitive overhead. The design of the NetAcademy tries to counter disorientation by implementing a interface typology that remains the same throughout the NetAcademy Universe. The cognitive overhead problem is alleviated by subdividing each knowledge area and introducing a continual structure of the information proposed to the visitor.

3.1 User Interface

For the implementation of our vision we decided to use the Internet as a carrier medium in combination with the latest Internet technologies for the technical realization. Earlier projects such as the Electronic Mall Bodensee⁴ [Schmid 95, Zimmermann 96] have provided us with useful experiences in the area of Internet

⁴ URL: <http://www.emb.net>

application development. For the realization of our vision we had to define some criteria according to which the technical implementation should be carried out.

- The three dimensional NetAcademy model needs to be reduced by one dimension as the computer screen usually allows for two dimensions only. VRML (or similar technologies) are not used because we believe our target audience to be more interested in optimally structured content than in a sophisticated, time-consuming navigation tool.
- Our target public is the scientific community and the interested public in general. The GUI design of our WWW application should thus be functional and be centered on contents rather than on fancy design or entertainment elements.
- We expect the NetAcademy concept to be applied to other than IS research fields as well. The architecture of the NetAcademy platform must thus leave ample room to accommodate growth in the number of individual Net Academies.

The NetAcademy graphical user interface (GUI) was sketched in cooperation with two professional information designers. We started with the idea of designing a GUI representing all three dimensions (see Figure 7) but then decided to reduce the model to only two dimensions during a first period.

	NetAcademies
Worlds, Views	Contents MindMap
	Processes / Agents

Figure 7: The vision: a three-dimensional model

The processes/participants axis was not implemented into an independent navigation bar but was merged with the vertical navigation bar as well as integrated into the content screen (see Figure 8).

①	NetAcademies (②)
Worlds, Views (③)	Contents (④) MindMap

Figure 8: Two dimensional model

The screen is now divided into three sections which are:

- A general explanation of the NetAcademy (**about button**),
- **Entry points** to the different Net Academies (horizontal navigation bar),
- The different **worlds** within those Net Academies (vertical navigation bar),
- The **content screen**, the main area of the window.

The top left corner (①) is linked with a reference to the NetAcademy on the NetAcademy concept (what is NetAcademy all about). The main horizontal bar (②) (see also Figure 9) serves as a navigation guide to the NetAcademy Universe. The main Net Academies are directly linked to this bar. These are currently NA on Media, NA on Knowledge Media, and NA on Business Media which represent the research fields of the institute. The Electronic Markets Newsletter is the publication of the Competence Center for Electronic Markets which is offered on paper as well as electronically in the NetAcademy. In addition, there is a link to the Global Directory of all knowledge areas which facilitates a navigation through an almost unlimited number of Net Academies.

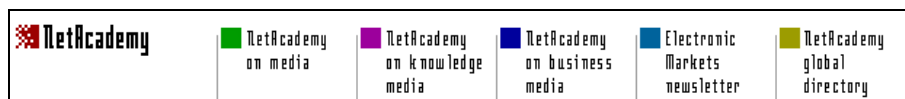


Figure 9: Horizontal navigation bar

The vertical tool bar (③) is the representation of the different worlds that are at the disposition of a visitor (see Figure 10).



Figure 10: Vertical navigation bar

It offers the possibility to choose between:

- **Home**, Homepage of selected NetAcademy,
- **What's new**, activities, news, calls for participation, etc.,
- **General Overview**, everything about the selected NetAcademy
- **Participants / Contributors**, a brief presentation of the authors contributing to the NetAcademy,
- **Contents**, divided in the following sub-sections:
 - *Theory*, definition of notions, reviewed and generally agreed upon knowledge,
 - *Publications*, papers, articles, abstracts, etc. from external and internal NA participants,
 - *Activities*, conferences, projects, meetings, etc.,
 - *Discussions*, on topics related to the selected knowledge area,
- **Search**, different kinds of search, see section "Mediation of knowledge in a federated knowledge medium",
- **Feedback**, the possibility to get in touch with the people operating that particular NetAcademy.

The vertical navigation bar provides links into the body of the NetAcademy. The search button links a page on which several search facilities are offered. Default is a search of the currently visited NetAcademy but there are also options to expand the search into the entire NetAcademy Universe (see section "Mediation of knowledge in a federated knowledge medium"). Besides it offers a location orientation, positioning a small square at the edge of the bar, indicating the selected world (see Figure 10).

The vertical tool bar remains the same throughout all Net Academies being thus context sensitive in relation to the research area. The color changes according to the selected knowledge area. That means that at the entry level of a NetAcademy, e.g. the NetAcademy on Business Media clicking on the "What's new" button initiates a news overview of the NA on Business Media. The button "Activities" displays a listing with all current activities within this specific NA, e.g. the setting up of a Handbook on Electronic Markets. Advancing to a lower level, say to the mentioned Handbook a click on the "Publications" button will display a list of all publications contained in the

Handbook and the “What’s new” section will contain news in respect to the Handbook portion of the NA only.

Besides the navigation features, the content section of the screen (④) is devoted to the actual information presentation. The initial entrance page in the content section of the NetAcademy (the “real” NetAcademy Homepage) shows a special image – a Mind Map – which reflects the various Net Academies and their interdependent structure with a defined core and still to be outlined edges.

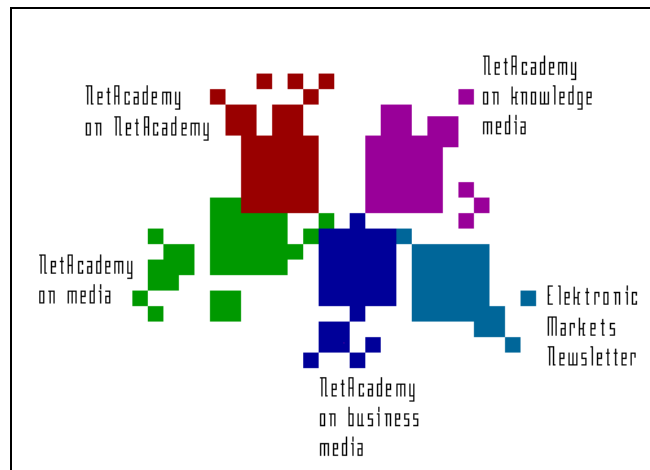


Figure 11: Mind map on entrance page

The “mind map” shows an overview of the currently established NetAcademy platforms. The symbols merge into one another respectively to the interrelations of research areas. The symbols are repeated on the Sub NetAcademy Homepages.

4 Mediation of knowledge in a federated knowledge medium

A federated, heterogeneous knowledge base, as it results from the NetAcademy architecture, acts as a medium between observer and inquirer.

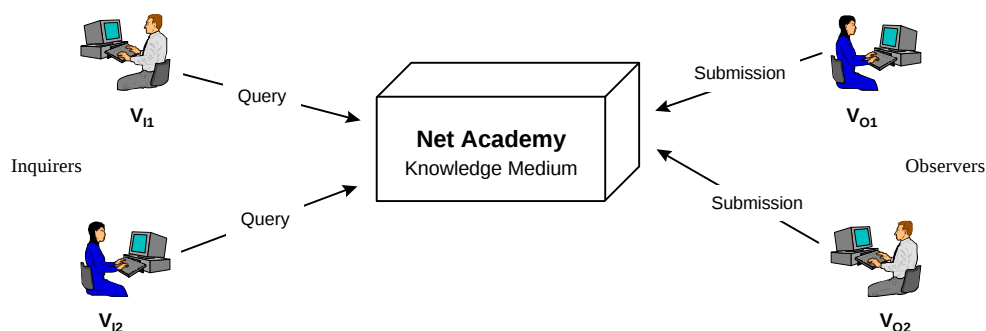


Figure 12: Exchange of information in the NetAcademy knowledge medium

The inquirer, e.g. V_{12} , does not elicit the information she is interested in directly from the source, the observer (V_{02}), but instead directs her query towards a knowledge base, which acts as an intermediary in the information acquisition process. Each observer contributing facts to the knowledge medium formulates his submissions using

a specific vocabulary V_{Ox} . Likewise, an inquirer formulates her queries in a vocabulary V_{Iy} that may well differ from the vocabularies used by any of the observers. However, for the querying of information in a knowledge base to work, both sides have to agree on a common shared vocabulary based on the same language and relate the vocabulary terms to the same properties (see section “ The NetAcademy language”). Different people often associate different meanings with terms. Just think of all the different things which to denote the word “agent” is used for today. Especially in a global environment as diverse as the Internet where people from many different cultural backgrounds meet and a wide variety of languages is in use a proliferation of different vocabularies is unavoidable. To achieve consistency and integrity in the overall knowledge medium the vocabularies used by contributors of knowledge need to be integrated.

4.1 The traditional syntactic approach

Traditionally, we are often confronted with information submitted in the form of unstructured text. This approach allows for easy and cheap integration of full-text query facilities. A significant drawback, however, is that all information retrieval models [Belkin et al. 92] in use in full-text search engines today work on a predominately syntactic level. Thus, an inquirer is forced to adopt the observer’s vocabulary in order to be able to construct meaningful queries. Since a lot of the time the vocabulary employed is not known to the inquirer, poor relevance of results returned from a query is commonplace. When querying one of the big search engines available on the Internet this disadvantage becomes apparent immediately: Usually, the result set is to a significant part comprised of documents largely irrelevant to the original query.

Since semantic classification of information constitutes a manual process, in general, only part of the information contained in a NetAcademy will be accessible through semantic retrieval mechanisms. Therefore a full-text search interface is offered by the NetAcademy platform. In order to be able to accommodate a distributed system that is expected to grow substantially in the future the approach of the Harvest distributed indexing and retrieval system [Bowman et al. 94] was adopted for this purpose. This allows the document gathering and summarization process to be separated from the indexing and query processes, thus allowing for scalability as well as for query processing on the contents of a distributed set of knowledge bases.

4.2 A semantic approach to knowledge mediation

Considering the major disadvantages of a purely syntactic approach to knowledge representation it becomes obvious that a facility enabling processing of queries on a semantic level is desirable. For this reason, the approach taken for the NetAcademy platform is to construct and integrate vocabularies of terms leading to a taxonomic system for the classification of documents. The following sections give a short overview of the approach taken to support the handling of information on a semantic level within the NetAcademy architecture.

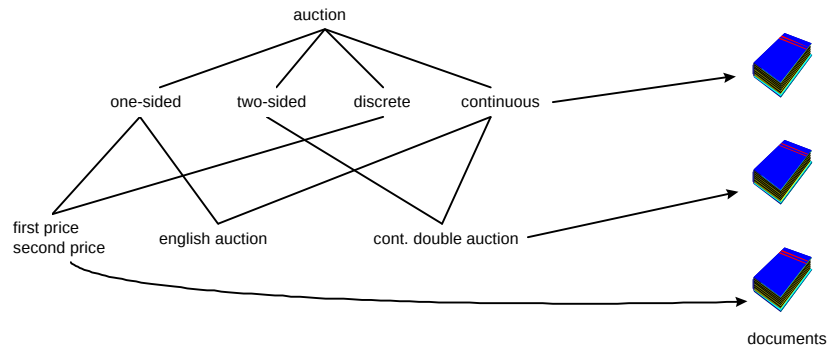


Figure 13: Example of the mapping of vocabulary terms to documents

One of the benefits of querying a knowledge base on a semantic level is increased relevance and thus quality of the results returned compared to traditional search mechanisms. A prerequisite to the implementation of such a query facility is a formal representation of knowledge contained within that knowledge base. In order to be able to facilitate the mediation of knowledge a formal language for its representation needs to provide facilities for the construction of vocabularies, the modeling of relationships between vocabulary terms and the integration of vocabularies into a consistent global vocabulary. By constructing a taxonomic system over the knowledge medium different vocabularies used can be integrated, thus enabling the implementation of semantic query mechanisms. Now an inquirer can formulate queries using terms of vocabulary V_{11} and receives results relevant to her query independent of the vocabularies used in the construction of the information being queried. By applying such a vocabulary-based approach even multilingual information retrieval becomes feasible [Sheridan et al. 96].

Since a NetAcademy acts as a medium of exchange between autonomous participants the integration of vocabularies of different sources of knowledge forms an integral part of its operation and represents a significant added value to its users. Integration of vocabularies also does not have to stop at a single instance of a NetAcademy but can be extended across a whole set of Net Academies. Thereby the scope of the semantic network can be greatly expanded, which should be especially interesting for Net Academies on fields which are closely related.

To best accommodate the needs of various types of users of a NetAcademy, it will offer not just one but a variety of vocabularies. Such a use of several vocabularies allows different kinds of taxonomy schemes to be applied to a knowledge medium.

4.2.1 Q-Calculus

One method of representing knowledge is Q-Calculus [Schmid et al. 96]. Q-Calculus defines the language in which a vocabulary denoting the universe of discourse can be defined. Employing a basic set of concepts allowing for the representation of generalization and specialization relations and first order logic predicates a semantic net can be constructed using Vocabulary Definition Language (VDL) [Kuhn 97].

Unlike Q-Calculus other methods for knowledge manipulation and representation like Knowledge Query and Manipulation Language (KQML) [Finin et al. 94] do not specify a specific method for the integration of vocabularies. Whereas Q-Calculus constructs a semantic network through static mapping of vocabularies, KQML dynamically resolves vocabulary expressions through use of facilitators (mediators).

4.2.2 Integration of vocabularies

The integration of vocabularies of different knowledge sources requires standardization of vocabulary terms, which can be carried out on a global or a local level. The notion of a global data schema as mentioned in [Boman 93] which envisions some central repository that, in terms of the knowledge medium, translates between the local vocabularies of the individual knowledge bases to a global vocabulary (schema) which is again translated to the inquirer's query vocabularies (external schemata). The drawback to this approach, as printed out by [Boman 93] lies in the management of the global schema which seems to be unfeasible due to the tremendous size it may achieve over time.

The approach taken by Q-Calculus lies in enabling vocabularies to import expressions exported from other vocabularies in a similar way as is done in the programming language Modula 2 [Wirth 85], thus implicitly incorporating standardization of terms into the integration process and avoiding the disadvantages of a global approach. Through the import/export abilities, it is possible to construct a vocabulary on the global level of the knowledge medium which enables to semantically describe the facts in the individual knowledge bases with their respective vocabularies. The process of vocabulary integration is a bottom up process, a central element of which is vocabulary comparison. Vocabulary comparison is needed to identify synonyms and homonyms resulting through the integration, that have to be resolved manually [Kuhn 97].

4.2.3 Integration of relational databases and user interface

Since structured data on individual data objects stored in a NetAcademy are kept in a relational database to enable query processing, the vocabulary layer has to be linked to the underlying relational data model. Queries to the knowledge base are formulated in VDL in the form of Q-tables. The mapping from vocabulary expressions to SQL statements takes the form of assigning vocabulary expressions to generic SQL templates. Placeholders in SQL templates are filled in according to the vocabulary expression defining a Q-table [Kuhn 97]. Thus, a Q-table serves as an interface to the relational database. This allows to integrate heterogeneous databases in a scaleable way [Stanoevska-Slabeva et al. 93]. Adding a database to a knowledge base simply requires to define a Q-table together with the corresponding SQL template. The result set returned from a query contains a set of documents ranked in order of relevance to the VDL query expression.

The vocabulary-based navigation and query interface is implemented as a Java applet. It offers the user the possibility to navigate the taxonomic network, to look at definitions of vocabulary terms and construct queries from them. The interface follows a query-by-example paradigm thus providing for fast and easy query construction while alleviating the user from the need to learn VDL.

5 Technical realization and software modules

A NetAcademy comprises large amounts of both unstructured information (e.g. papers, articles, discussions, etc.) as well as structured information (Q-vocabularies, publication attribute information and other meta information associated with pieces of unstructured information). Therefore it was important to select a mix building blocks that would easily interoperate and - in combination - could accommodate structured as well as unstructured information.

In addition to serving as an interface to the scientific community and other interested groups the local NetAcademy platform is also intended to be used as an internal knowledge base for the support of the faculty's daily work routine. Thus, besides a web-based interface to the outside world, a optimal degree of integration of existing information systems used internally was among the core selection criteria. We are relying on Lotus Notes groupware technology for practically all internal document management tasks. Thus adopting Notes as the primary means of managing unstructured information also in the context of the NetAcademy platform was an obvious choice. Integration with the WWW is achieved through supplementary use of InterNotes Web Publisher for publication of static pages and Domino for interfacing dynamic content to the Web. Another significant advantage of using Notes as a document management facility is that it allows to enforce rules on the logical document structure as well as layout policies and style guides. Thus, the necessary management effort to maintain the knowledge base - especially under substantial growth conditions - is greatly reduced.

For the storing and management of structured information a relational database management system was selected. Information contained in the relational database is tightly coupled with documents stored in Notes databases. Except for a few static elements which make up the generic navigational structure and interface all information is managed either in Notes or a relational database.

Figure 14 depicts the current stage of our implementation of a NetAcademy platform on the research fields of *Business Media* and *Knowledge Media*.

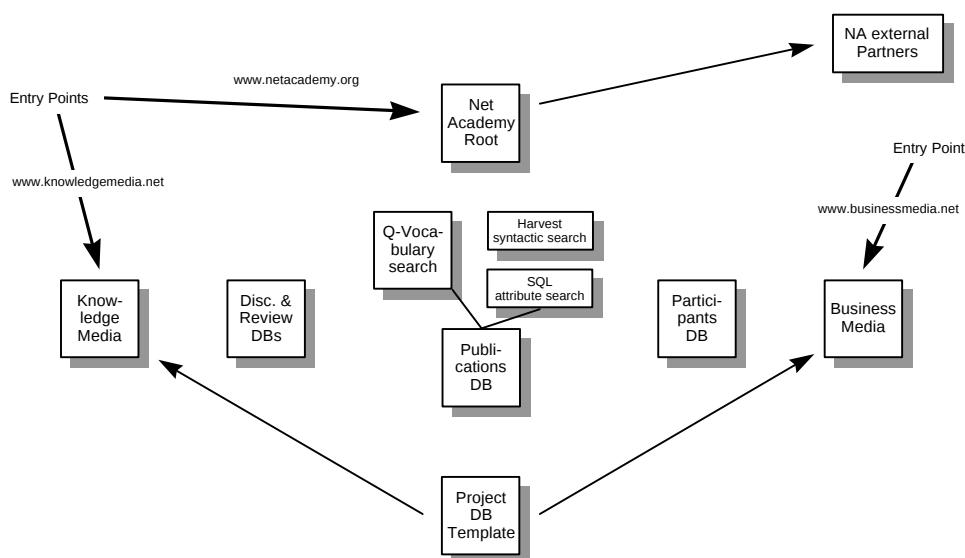


Figure 14: Current stage of implementation

The publication database forms the nucleus of the NetAcademy platform. It consists of a relational data model, storing all structured meta-information coupled with a Notes-based document repository used to manage abstracts and full texts of publications (where available). Typically, each NetAcademy will employ its own publication database. However, for practical reasons we chose to have the two initial Net Academies share the same database schema. Grouped around that core are the different kinds of query facilities provided. As the semantic query interface is still in its early testing phase as of this writing a direct, SQL-based query interface to the publications database is also provided.

The database of participants contains information on all authors of publications, participating researchers and reviewers of submitted contributions. It forms part of the publications database's relational data model. The discussion and review database is a generic template, which is adopted whenever a new discussion forum is opened or a new reviewing process initiated. Being implemented as Notes database exported to the Web through Domino it is an example of Notes' ability to accommodate internal as well as external users each in their preferred working environment. A project database is created from a Notes database template for every research project presented in a NetAcademy. This approach allows to enforce a uniform logical structure of documents across all projects and provides automatic application of layout rules.

Besides being reachable by traversing down the NetAcademy hierarchy starting at the NetAcademy root the two Net Academies currently being implemented feature their own explicit entry points and distinct domain names.

6 Conclusions

Today the NetAcademy concept is still at its early stages of development. The next important step is the full integration of the above described powerful query tool in conjunction with the defined vocabulary for each knowledge base. It is intended to start small (with the institute's main competence areas) becoming larger in the course of time. A major concern will be the cooperation with external partners. The further development of the platform along with the generation of knowledge classified by vocabularies will allow to gradually approach the final vision of a powerful, globally available knowledge medium.

A problem we have encountered during the first phase of the NetAcademy project was the integration of the knowledge generation process into the internal process organization. There are two approaches to solve the problem. An incentive structure for contributing to the system has to be developed. It is evident that doctoral students will find it easier to write their thesis after contributing actively to the system for some time combining their knowledge with contributions of other authors. The second important factor is the use of technology familiar to the users as it is the case for Lotus Notes (internally and externally) as well as for the World Wide Web (externally).

We expect to have first usage results by spring 1997. The analysis of these results will give an indication for the further development process of the NetAcademy concept. Especially the interaction of users and their use of the vocabulary-based interface will be of major importance to the project.

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