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The NetAcademy

A novel approach to domain-specific scientific knowledge accumulation, dissemination and review

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Abstract

Over the last decade the speed at which knowledge is generated has greatly accelerated, thus exacerbating the problem of finding the right information at the right time and posing 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" is aiming at providing a knowledge medium to aid in the creation, integration, reviewing and dissemination of domain-specific 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 any kind of field of research in search of an intelligible organization of its contents.

The paper emphasizes on the motivation of the NetAcademy concept and its feasibility on the basis of available Internet technologies. The main part discusses the three key concepts which differentiate the NetAcademy from more traditional approaches to digital libraries: the system-immanent vocabulary allowing for the mediation of knowledge through powerful search mechanisms on a semantic level, an integrated system of roles that allows rights and duties to be assigned to agents interacting with the medium and the modular, template-based design.

1 Introduction

Fostered by the rapid dissemination of products and services that are based or heavily rely on information technology in almost every area of daily life and due to the immense increase in data storage capacity, the production of information and knowledge has increased dramatically over the last decades. With the rise of open global telematic infrastructures such as the Internet, which offers new channels for the exchange of information and the distribution of knowledge, this trend is being further stimulated. Whereas in past centuries the phenomenon of universal scholars could be observed, today it is no longer possible within the capacity of one single individual to keep pace with the ever accelerating development of human knowledge [Bleicher 92, p. 32]. These developments pose serious challenges for the management and organization of knowledge bases and aggravate the problem of finding the right information at the right time.

Especially academic activity requires the search for specific and accurate information in huge knowledge bases on a daily basis. Furthermore, the multiplication of available information sources in a global context exacerbates the problem of being able to judge information on account of its current state of research and the degree to which it has been reviewed and agreed upon by the scientific community.

In this paper the *NetAcademy* concept and project will be presented and discussed. The project aims at the design of a system for the structuring, acquisition, mediation and dissemination of domain-specific scientific knowledge on the basis of a generic, internet-based platform, thus adding a contribution to the solution of the above mentioned problems.

The first part of the paper presents an introduction to the project objectives and deals with the historical background and context as well as the basic concepts which make up the NetAcademy knowledge medium. In the following section, the organization of the knowledge contained within a NetAcademy instance and the interac-

tion with the user will be described. The fourth part contains a thorough discussion of the requirements of mediation of knowledge in a global knowledge medium and an overview of the solution implemented in the NetAcademy platform. The following section then gives an overview of the architecture and the modules that comprise the NetAcademy platform, briefly dealing with the technologies employed. Section six finally contains a short comparison between the NetAcademy concept and other approaches to internet-based knowledge media which focus on similar objectives.

2 The NetAcademy concept

2.1 Basic objectives

The NetAcademy project was initiated to make use of the new, interactive and ubiquitous information medium, which in its present incarnation as the Internet is subject to ever increasing growth. Thereby it is laying the ground for new kinds of information-based applications that were thought to be impossible just a few years ago. Besides the Internet's use as a global medium for conducting commerce these developments also open up new possibilities for its use in academic research, especially in the context of globally distributed digital libraries. For the NetAcademy the Internet serves in particular

- as a medium for data storage, in the same way as the traditional carriers of information, books or paper, in their organized form in a library.
- for the support of knowledge generation and the procedural aspects of information (in the sense of "in formatio") as it becomes visible in academic discussions or, in a more organized form, during conferences or the dissemination of information in academic journals and books.
- for the automation of processes in the field of academic research as it has long been realized for business processes through use of database management systems and method bases.

Thus, a first objective of the NetAcademy is the design and the use of the new information medium as a storage and production medium for academic information.

A second objective strives to design the information processes in such a way that the NetAcademy medium will be gradually adjusted towards a consistent, non-contradictory organization and a completeness of knowledge for a certain domain. In doing so the NetAcademy becomes a finalized machine whose results form a valid handbook of the knowledge within the respective knowledge area (domain) including coverage of ongoing research activities in that domain.

By representing a living platform, the NetAcademy should allow to bundle knowledge and processes and increase and disseminate knowledge thereby enabling the construction of a globally accessible reference source for the knowledge of a particular field of research.

In the initial phase of the NetAcademy project, the Institute for Information Management aims at establishing three different NetAcademies covering its main areas of research. These are:

- **Business Media**
  Since 1989, the Electronic Business Media Group has been carrying out research on electronic markets and commerce, developing reference models and carrying out a wide variety of pilot projects in the field of EDI and electronic commerce.
- **Knowledge Media**
  Integration of heterogeneous distributed databases, the representation of knowledge and information, its semantics and inference mechanisms and their application in the area of strategic corporate planning systems and electronic commerce are the main research interests this academy deals with.
- **Media Management**
  This NetAcademy publishes research papers and hosts discussion forums on how to analyze, define and manage the effects of new media on the economy, society, politics, law and culture.

2.2 Historical background and context

First ideas of how the body of human knowledge could be organized arose with the founding of schools for philosophy in ancient Greece. For some centuries now, a substantial portion of the world's knowledge has been generated and analyzed in universities and academies and has been passed on to succeeding generations through those channels. The first institutionalized academy was founded 387 AD by the Greek philosopher Plato as a place of knowledge disputation. The notion "academy" is derived from the place for gymnastics in the ancient city of Athens which was devoted to the greek hero Akademos. In this academy Plato and other philosophers gathered for their scientific discussions [LexiROM 95].

Subsequently the concept of academy evolved into different directions. A development of particular importance was the *Berliner Akademie* founded in 1700 by Gottfried Wilhelm Leibniz. Leibniz added new programmatic content to the idea of an academy. Sciences practiced in academies should not remain confined to purely academic goals, but in addition should aim at their practical realization (*theoria cum praxi*). This "world of Leibniz" is more than the unity of sciences and their internationalization. The world should not be changed into a place to which man is only attached due to his needs and problems but in the first place due to his interpretations of reality,

particularly in a philosophical as well as a scientific form. The appropriation of the world by manhood takes place through representation (theories and explanations). The "truth of reason" in the order of knowledge sought for is at the same time the truth of the world.

The NetAcademy concept intends to follow this approach contributing to its realization in a post-modern world and in the new digital medium.

2.2.1 Institutional context

In the last few years the notion of a virtual university has gained a lot of popularity [Heilmann 95, p. 3]. In some aspects this concept is closely related to the characteristics of a NetAcademy. Just like a virtual university a NetAcademy also aims at supporting and directing research by enabling and facilitating scientific discourse, dissemination of knowledge and qualification of scientific work through reviewing processes. Unlike a virtual university, however, which like its traditional physical counterpart still represents a private or state-funded corporate entity, a NetAcademy stresses the goal of building a virtual reference knowledge medium for a certain domain of knowledge to which a large number of researchers contribute. Thus, the entity running the platform should become largely irrelevant.

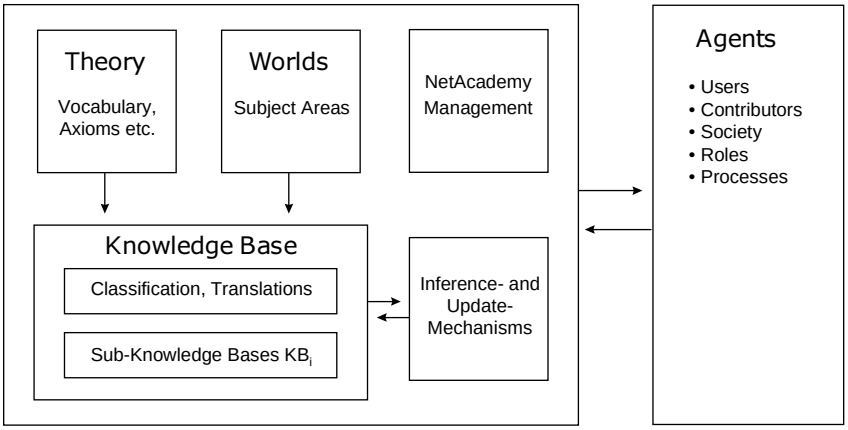


Figure 1: Logical architecture of the NetAcademy knowledge medium

2.3 Organization of knowledge within the NetAcademy

The NetAcademy concept [Schmid 97] aims at knowledge media for arbitrary domains. It can be applied to any subject matter and the agents working and interacting with it.

The NetAcademy platform as the software implementation of the NetAcademy concept offers a generic template from which NetAcademies for arbitrary domains can be instantiated. Thus, all NetAcademies follow the same conceptual logic.

At its core an instance of a NetAcademy contains a knowledge base. The knowledge base stores facts and procedural knowledge, discussions, research papers and other information relevant to the domain.

Another essential component represents the agents, which consist of the scientific community for that particular domain, and provides them with an organized communications platform. Agents are separable into different classes which roles can be assigned to granting certain rights and obligations within the NetAcademy. Furthermore processes can be defined laying out and enforcing procedures to be followed for certain actions, e.g. procedural details of reviewing processes that are triggered by a document submission or the enforcement of certain guidelines to be followed in discussions. Ideally, these processes should be structured in a way that development towards gradual completion of the knowledge in the domain is supported.

In addition a NetAcademy provides mechanisms for the processing of knowledge. These include:

- Query mechanisms, which in their simplest form allow information to be retrieved based on traditional syntactic approaches to information retrieval. In a more highly developed form based on a semantic model of the knowledge base these mechanisms allow for the processing of questions to which answers can only be found through logical inference [cf. section 4.2].
- Update mechanisms which facilitate the integration of new information. In the case of a consistent extension of the knowledge base this is easily accomplished, in the case of inconsistent extension, however, more sophisticated mechanisms (default reasoning) have to be called upon, which require the integration of conflicting vocabularies used [Kuhn 97; cf. section 4.2.2].
- Abduction mechanisms which support the formulation of hypotheses thereby contributing to the definition of relevant research questions and issues.

Again the latter two mechanisms should be employed in a way that the goal of reaching a convergence towards an ever more complete knowledge base for the domain is advanced.

In order to live up to these requirements a NetAcademy provides several more components:

First of all an agreement on the language and protocols used has to be reached. This includes the terminology used in a particular domain (vocabulary), definitions for

the vocabulary terms detailing their meaning and relations with each other and the axioms generally accepted to be valid for the domain. This component is referred to as *theory* and defines the specific perspective (view) through which the domain is viewed.

The vocabulary employed by the scientific community, the accepted methods of scientific proof and axioms are made explicit. Thus, taking advantage of the mechanisms and infrastructure provided by the Internet a common living and widely accepted electronic handbook for a field of knowledge can be established and is easily extended and kept up to date by a globally distributed group of contributing researchers.

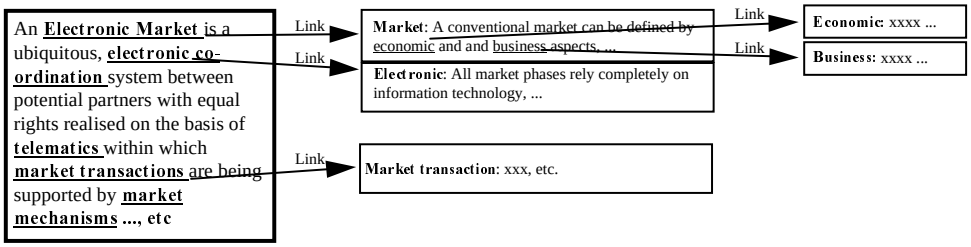


Figure 2: Example of vocabulary terms, their accompanying definitions and their interrelations

The knowledge base contains research results concerning theoretical issues as well as practical applications referred to as *worlds* in the context of a NetAcademy. The knowledge base is recursively structured and in general consists of a wealth of sub-knowledge bases taking the form of already existing knowledge bases or other NetAcademies, research information represented as papers or other kinds of information systems etc. Typically, most of these employ their own language and vocabulary. Thus, in order for the contents of those knowledge bases to be made available to participating agents, they have to be integrated into the NetAcademy knowledge base through use of translation mechanisms, or where such mechanisms are unavailable through formulation of characterizations, e.g. taking the form of abstracts.

In the case of not purely theoretical contents knowledge is referred to via the worlds it deals with. A NetAcademy contains a directory of those worlds and their characterization. This is also important because the NetAcademy concept envisions a network of NetAcademies. For a particular world several views and NetAcademies can exist that contain knowledge about it from each of those points of view. Thus, in order to be able to navigate through all the NetAcadmies containing knowledge that pertains to a certain world it is necessary to be able to explicitly refer to specific worlds.

Furthermore, each single NetAcademy is related to other NetAcademy instances according to the interrelation of the fields of knowledge covered. Thus, an acyclic graph of NetAcademies is formed ordered according to generalization and specialization relations, respectively. In the case of widespread adoption of the NetAcademy platform this holds the chance of the evolution of a dynamic knowledge medium of global scale and scope. By establishing integration of vocabularies across various NetAcademies semantic search mechanisms can be enhanced to perform queries over several NetAcademies along the graph [cf. section 4].

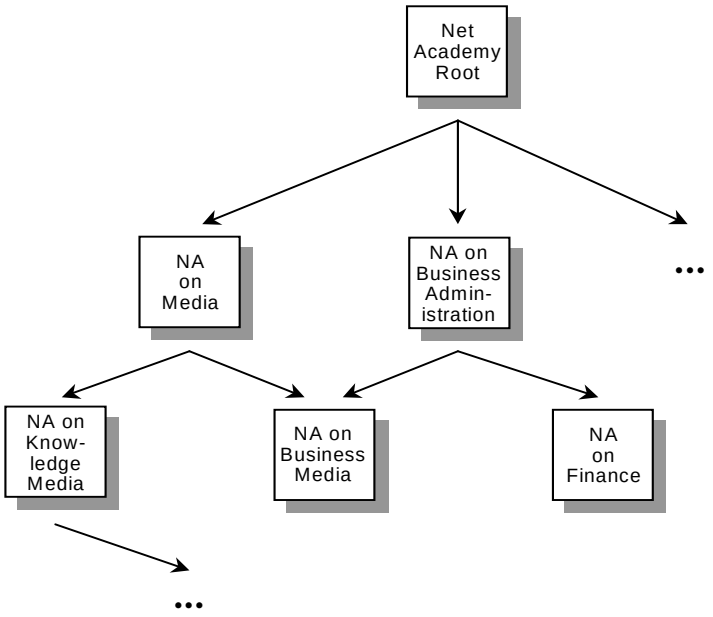


Figure 3: Acyclic graph of a global NetAcademy knowledge medium

At the root of the graph the *NetAcademy on NetAcademy* can be found, which acts as a central entry point to the distributed NetAcademy knowledge medium and offers a global directory of all NetAcademies. As a meta-

layer its contents present the theoretical foundation of the NetAcademy.

Another component is dedicated to the administration of agents and their privileges. In order to perform certain activities agents will have to register and will be assigned rights and obligations according to the role they take in the NetAcademy (e.g. discussion moderator, contributor of papers etc.). Closely related to agents and their roles are process scripts which prescribe procedures to be followed when carrying out certain tasks, e.g. concerning information retrieval, entry of new content which usually triggers a reviewing process etc.

3 The user interface

For the purpose of presenting information to the user (agent) and enabling interaction with the stored knowledge the knowledge contained in the knowledge medium is classified along three attribute classes. These are:

- The domain of knowledge which it forms part of, i.e. the NetAcademy it belongs to.
- The specific world which the knowledge refers to and deals with. Knowledge can be provided in any of the following forms and qualities:
  - Theory: Basic terms, definitions and axioms generally accepted an agreed upon by the scientific community of the specific domain that is covered by that particular NetAcademy
  - Publications
  - Activities: Descriptions and presentations of research issues and ongoing projects
  - Discussions
- The process or agent which generates or transforms specific knowledge, uses it or relates and links it to other pieces of knowledge. An agent can be the author of a publication, a participant in a discussion forum but also a software agent in charge of processing queries.

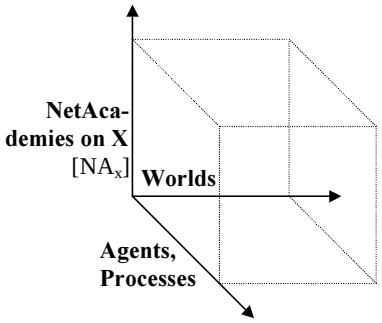


Figure 4: The NetAcademy information space

The three attribute classes span up a three dimensional information space in which every unit of knowledge contained can be addressed by constructing a specific vector. Suppose a guest user is in search of articles on the subject of telebanking. In order to find the desired information he will adjust the axis of the coordinate system in the following way:

- **Na$_x$**: NetAcademy on Business Media
- **World**: Telebanking, which constitutes a subject that is dealt with in the research field of Business Media.
- **Process, Agent**: Unregistered user who is only allowed access to resources and services released for availability to guest users.

Users of a NetAcademy should be unrestricted in their choice of views on the knowledge medium. When browsing a user can dynamically and flexibly expand or narrow down depth and breadth of the information presented by locking one or even two of the axis in a fixed position. Alternatively, she can navigate through the medium directly by taking a query approach.

For technical reasons the graphical user interface for the currently covered research fields deviates from this three-dimensional model in the first phase of implementation and integrates the second

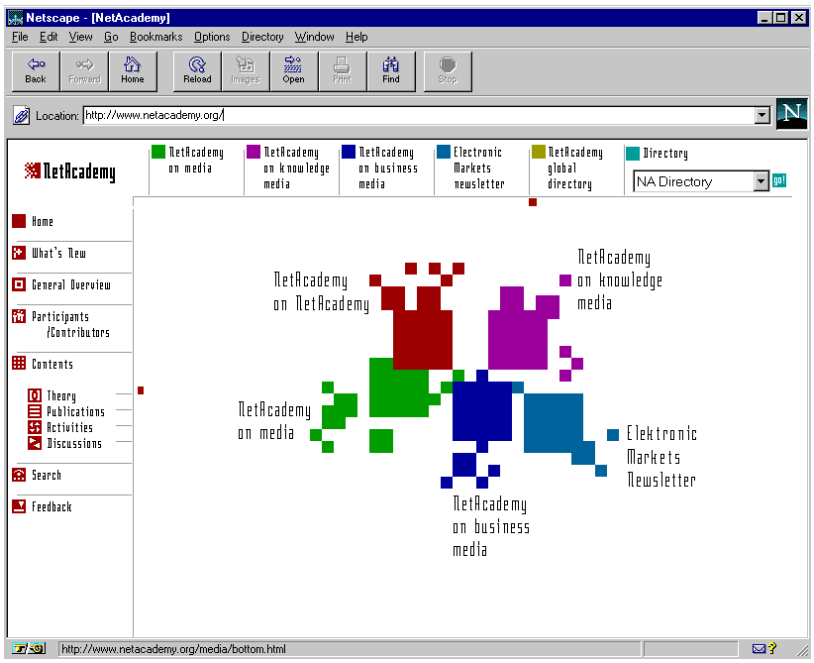


Figure 5: NetAcademy navigational interface

dimension of worlds and third dimension of processes and agents into the vertical dimension of the user interface.

The horizontal navigational bar extending across the top of the browser window allows for the selection of a particular NetAcademy to visit. To NetAcademies closely related to the domain covered by the currently selected NetAcademy direct links are offered. In order to jump to more remote fields of knowledge the NetAcademy Global Directory needs to be consulted, which is also available via the top navigational bar.

While the horizontal navigational bar symbolizes the breadth of knowledge accessible to the user, the vertical navigational bar offers entry points into the depths of a specific domain: the individual worlds and in the current version also agent- and process-related services and content (Participants/Contributors, Search, Feedback).

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. Whereas an observer is an agent contributing knowledge to the knowledge medium, an inquirer is an agent intending to extract knowledge from the medium by querying it.

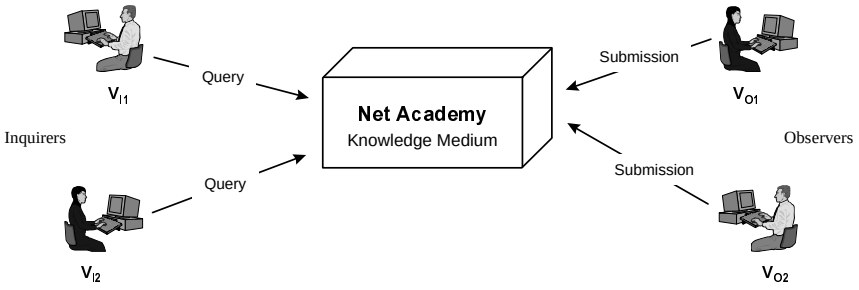


Figure 6: Exchange of knowledge in the NetAcademy knowledge medium

An inquirer, e.g. V_{I2}, does not elicit the information she is interested in directly from the source, the observer (V_{O2}), 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. 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 become 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 scaleability 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.

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_{I1} 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].

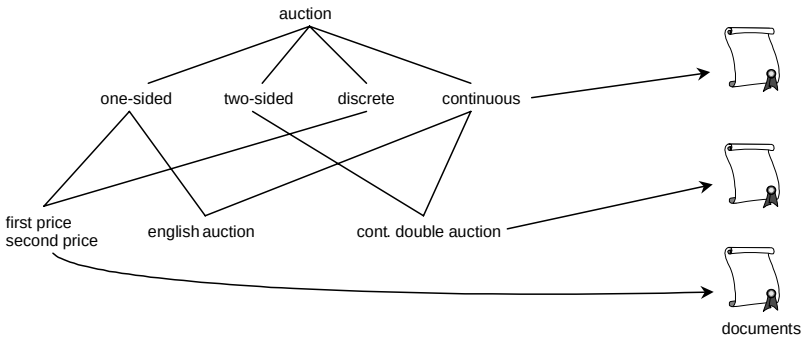


Figure 7: Example of the mapping of vocabulary terms to documents

Since a NetAcademy acts as a medium of exchange between autonomous agents 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 query 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 architecture 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. Furthermore in order to accommodate the knowledge processes (e.g. review processes) carried out within a NetAcademy support for workflow mechanisms formed another requirement.

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

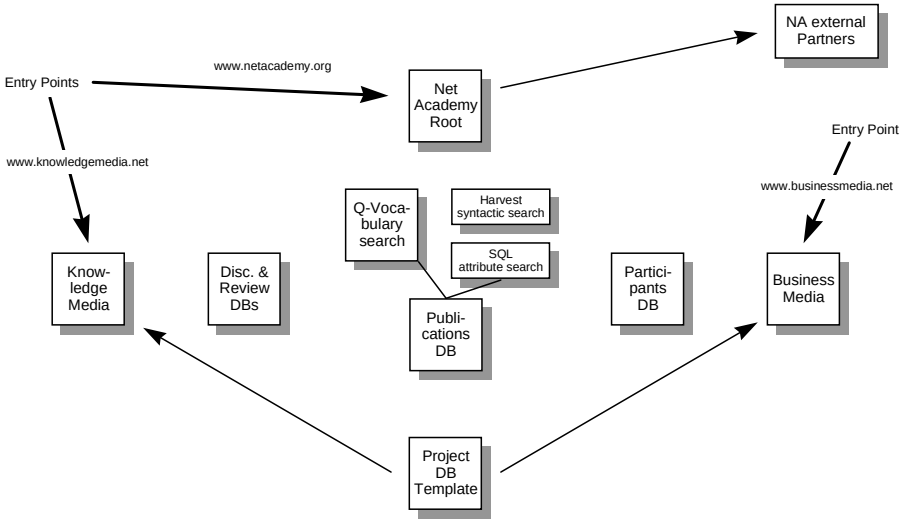


Figure 8: Current stage of implementation

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. For these reasons, 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 infor-

mation is managed either in Notes or a relational database.

Figure 8 depicts the current stage of our implementation of a NetAcademy platform on the research fields of *Business Media* and *Knowledge Media.*

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 Related work

Today a whole range of services can be found on the Internet that are claiming to be or hoping to become a reference source for a certain area of scientific knowledge. An example for the field of information management with focus on telecommunications is the *Virtual Institute of Information* [Noam 96], an activity of the Columbia Institute for Tele-Information at Columbia University.

As with most similar approaches a theoretical foundation of the underlying concepts of knowledge organization and representation is also missing in this case or is not being made explicit. Furthermore, no organizational independence of the knowledge medium from the organization operating it is attained, which tends to significantly lower the acceptance as a reference source by researchers from other institutions and might limit active contributions from users. Thus, domain-specific islands are created often struggling with a very fragmented knowledge base due to lack of outside involvement and missing out on the really big opportunities the new digital medium offers. In addition most of those platforms are lacking sophisticated retrieval mechanisms which go beyond purely syntactic approaches.

7 Conclusions and outlook

At the time of writing, the NetAcademy concept and platform are still in the early stages of development and deployment. A next important step will be the full integration of the vocabulary layer with its semantic query mechanisms into the existing NetAcademies.

In order to expand the use of the NetAcademy platform, cooperation with several external partners is currently under way. This, along with further development of the platform based on the analysis of first usage results and extensive vocabulary-based classification of contained knowledge will hopefully allow to gradually approach the final vision of a powerful knowledge medium of global scale and scope.

Meanwhile the generic concept of a knowledge medium, which the NetAcademy concept is based on, has already been prototypically implemented for other user groups besides the scientific community, namely for the area of strategic corporate planning systems in the Enterprise Knowledge Medium (EKM) research project [Schmid et al. 97]. In that context the theory component contains a company's basic business rules and valid definitions of terms. Besides traditional transaction-based information systems the knowledge bases also integrate unstructured and informal information, e.g. in the form of hypertext documents in an intranet. The agents are those employees that are involved in strategic corporate planning and controlling processes with their respective right and obligations. Process scripts describe and implement planning and communication processes.

8 References

[Belkin et al. 92]
Belkin, N. and Croft, W.: Information Filtering and Information Retrieval: Two Sides of the Same Coin. Communications of the ACM, December 1992.

[Bleicher 92]
Bleicher, K.: Das Konzept Integriertes Management. Campus Verlag, New York, 1992.

[Boman 93]
Boman, M.: A logical specification of federated information systems. PhD Thesis, Report Series Department of Computer and Systems Sciences, Stockholm University, 1993.

[Bowman et al. 94]
Bowman, C.; Danzig, P.; Hardy, D.; Manber, U.; Schwartz, M.; Wessels, D.: Harvest: A Scalable, Customizable Discovery and Access System. Technical Report CU-CS-734-94, Dept. Of Computer Science, University of Colorado, 1994, URL: ftp://ftp.cs.colorado.edu/pub/cs/techreports/schwartz/Harvest.Jour.ps.Z

[Finin et al. 94]
Finin, T.; Weber, J.; Wiederhold, G.; Genesereth, M.; Fritzson, R.; McKay, D.; McGuire, J.; Pelavin, R.; Shapiro, S.; Beck, C.: Specification of the KQML Agent-Communication Language. 1994, URL: http://logic.stanford.edu/papers/kqml.ps

[Heilmann 95]
Heilmann, H.: Editorial: Virtuelle Organisation. In: Handwörterbuch der Modernen Datenverarbeitung: Virtuelle Organisation, Vol. 185, 32. Jahrgang, September 1995.

[Kuhn 97]
Kuhn, C.: Designing a market for quantitative information. PhD Thesis, Institute for Information Management, University of St. Gallen, 1997.

[LexiROM 95]
LexiROM 2.0 CD-ROM: Microsoft Corporation und Bibliographisches Institut & F.A. Brockhaus AG, 1995.

[Noam 96]
Noam, E.: What is the V.I.I.: About the Institute. 1996, URL: http://www.ctr.columbia.edu/vii/mwhat.html

[Runge 97]
Runge, A.: State of the Art und kritischer Vergleich von Virtual University Angeboten auf dem World-Wide Web. Institut für Wirtschaftsinformatik, Universität St. Gallen, 1997.

[Schmid et al. 95]
Schmid, B.; Dratva, R.; Kuhn, C.; Mausberg, P.; Meli, H.; Zimmermann, H-D.: Electronic Mall: Banking und Shopping in globalen Netzen. Stuttgart: Teubner Verlag, 1995, URL: http://www.obs-us.com/obs/german/books/teubner/elecmall/

[Schmid et al. 96]
Schmid, B.; Geyer, G; Wolff, W; Schmid, R; Stanoevska-Slabeva K.: Representation and automatic evaluation of empirical, especially quantitative knowledge. Final report of the Swiss National Science Foundation Project #5003-034372, March 1996.

[Schmid 97]
Schmid. B.: The Concept of a NetAcademy. Work in Progress, Institute for Information Management, University of St. Gallen, 1997.

[Schmid et al. 97]
Schmid, B.; Schwan, T.; Röpnack, A.; Schwartz, M.: Enterprise Knowledge Medium (EKM): Konzeption eines Mediums zur Unterstützung von Führungsprozessen. In: DV Management 2/97, 1997.

[Sheridan et al. 96]
Sheridan, P. and Ballerini, J.: Experiments in Multilingual Information Retrieval using the SPIDER System. Swiss Federal Institute of Technology (ETH), Zürich, Switzerland, 1996.

[Stanoevska-Slabeva et al. 93]
Stanoevska-Slabeva, K.; Geyer,G.; Höhener, T.: Acquisition and Processing of Quantitative Information Within a Distributed Heterogeneous Environment. Proceedings of the Eleventh IASTED International Conference, Annecy, France, May 19-21, 1993. pp. 142-146.

[Wirth 85]
Wirth, N.: Programming in Modula-2, Third, corrected edition. Springer Verlag, 1985.