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SNS-Navigator: A Graphical Interface to Environmental Meta-Information

Jörg Jochims and Wolf-Fritz Riekert[1]

Abstract

SNS-Navigator is a web-based graphical interface to environmental meta-information provided by the Semantic Network Service of the German Federal Environment Agency (UBA). Environmental topics can be searched for and displayed as interactive graphical representations of *topic map* fragments. Users can navigate through the topic map by clicking onto the displayed topics.

1. Introduction

Environmental meta-information, i.e., information about environmental information, is a very important aid for accessing and managing large collections of environmental information as contained in libraries, databases, or the worldwide web. Meta-information consists of descriptions that facilitate the retrieval, processing and management of such resources.

A vocabulary is necessary to construct the meta-information, i.e., formulate descriptions of information resources. In the simplest case a list of predefined *keywords* can be used for this purpose. The usability of the keywords can be enhanced by embedding them into a knowledge structure such as a *Thesaurus* (ISO 1985, 1986). Thesauri conceive keywords as *terms* that can be related to one another. Thesauri typically support three kinds of mutual relationships: (1) the "used-for"-relationship which allows finding terms starting from their synonyms, (2) a specialisation hierarchy, which reflects the relationship between broader and narrower terms, and (3) the linkage between related terms. A long standing example of an environmental thesaurus is UMTHES ("*Umweltthesaurus*"), which has been used as a vocabulary for a number of environmental information systems in the German Federal Environment Agency UBA ("*Umweltbundesamt*") for many years (Batschi 1994, UBA 2006). A similar example at the European level is the General Multilingual Environmental Thesaurus GEMET (EIONET 2004).

There are several approaches to extend the thesaurus idea towards more explicit knowledge structures also known as *Semantic Networks* or *Ontologies* (cf. Visser et al. 2001; Rüther et al. 2006). In these representations, terms are replaced by more specific types of entities and a larger number of specific relationship types can be represented. The work described here aims at such a kind of knowledge structure.

Due to the complexity of such knowledge structures, new interfaces to meta-information become necessary. In the following a graphical approach is presented and applied for environmental meta-information.

2. The Navigator

SNS-Navigator is a web-based graphical interface to environmental meta-information. It operates on a *semantic network* that is formed by entities of various categories such as *environmental terms*, *geographic*

[1] Media University Stuttgart, Wolframstr. 32, 70191 Stuttgart, Germany, E-Mail: riekert@hdm-stuttgart.de

locations, and *temporal events*. A query interface can be used to search for these entities also referred to as *topics*. Search results can be displayed as interactive graphical representations of *topic map* fragments. In this representation, the found topic is shown in the centre and it is surrounded by all related topics (Figure 1). Users can navigate through the topic map by clicking onto the displayed topics.

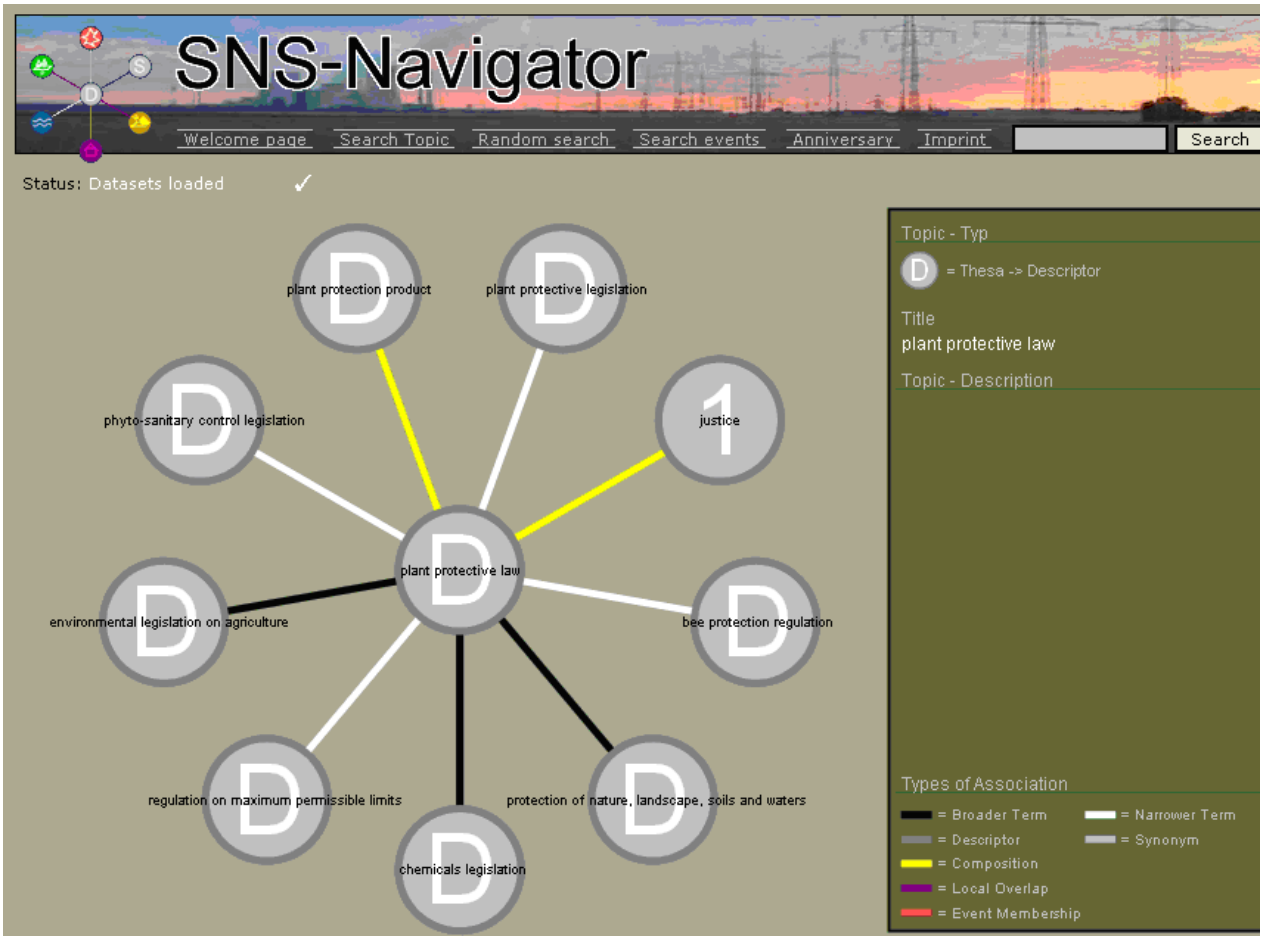

Figure 1: SNS-Navigator

3. The Semantic Network

The German Federal Environment Agency UBA is the owner of the semantic network that underlies the navigator. The semantic network is the result of the integration of three terminological information sources of the UBA:

- the Environmental Thesaurus UMTHES consisting of more than 33000 environmental terms,
- the Environmental Gazetteer GTU ("*Geo-Thesaurus Umwelt*") consisting of more than 18000 geographic names and their spatial relationships (namely overlap),
- an environmental chronicle consisting of events with an impact on the environmental situation.

The UBA makes the integrated semantic network available to the public via a web service known as *Semantic Network Service* (*SNS*). The purpose of this service is to provide a standardised environmental vocabulary that can be integrated into a number of environmental information systems thus supporting the easy access to environmental information (Rüther et al. 2006).

3. Implemented Search Options

The SNS-Navigator is basically a graphical user interface to the SNS. The retrieval of environmental topics in the semantic network is facilitated through a number of search options:

- Users can search for environmental topics explicitly by entering a search string (e.g., "animal protection").
- Users can search for environmental events by indicating a time interval (Figure 2).
- A special function allows identifying anniversaries of environmental events.
- A random search facility returns an arbitrary topic.

While the first three search options are directly supported by the SNS, the last-mentioned random search facility has been added during the development of the navigator. The idea behind this facility is to give newbie users an understanding of the service and inspire them to formulate their own queries.

Figure 2: Searching for environmental events in 2004. The events found are added to the search window using the Ajax technology

4. Graphical Display and Navigation

Major attention is turned to the graphical display of search results as topic map fragments. The display of the topic map is interactive (Figure 3):

- Users can navigate through the whole topic map by clicking onto the displayed topics.
- Dynamic content is being displayed in an information box close to the topic map whenever the mouse pointer hovers over a topic.
- In addition, links to external information resources associated to the topics can be provided. By clicking onto the links, the information resources can be opened in a separate browser window (currently only implemented for a number of topics in the German version).

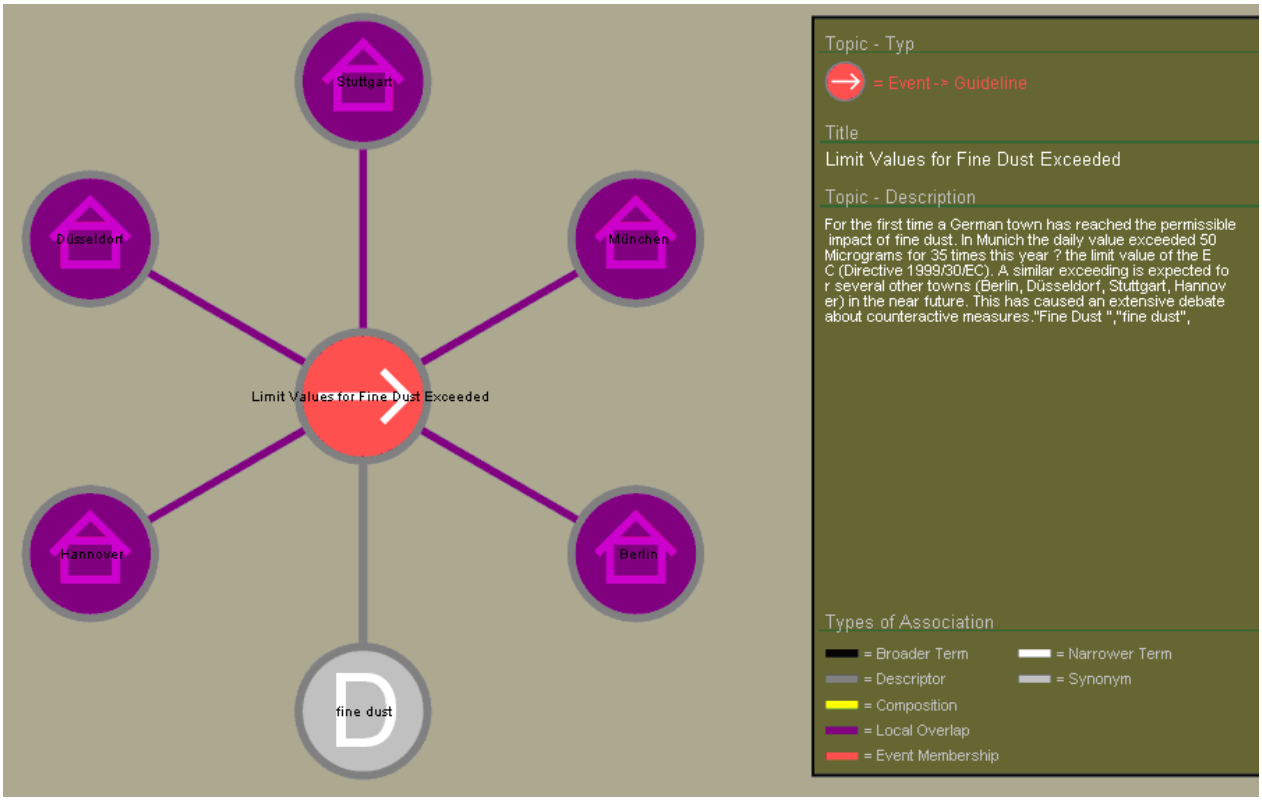

Figure 3: Displaying one of the found topics (here: "Limit values for fine dust exceeded")

Each of the 34 topic types defined by the UBA is displayed as a different symbol in order to improve the recognition of the displayed information and make the look and feel of the application more appealing. The colours of the symbols allow differentiating the major groups of topic types such as *events* (red), *administration units* (purple), *landscape types* (brown), *protected areas* (green), *water bodies* (blue), and *thesaurus vocabulary* (grey) (Figure 4).

The relationships between the topics are displayed as straight lines that are also coloured depending on their association types such as *broader term* (black), *narrower term* (white), *descriptor* (dark grey), *synonym* (light grey), *composition* (yellow), *local overlap* (purple), and *event membership* (red) (Figure 5).

Figure 4: Symbols used to display the 34 topic types

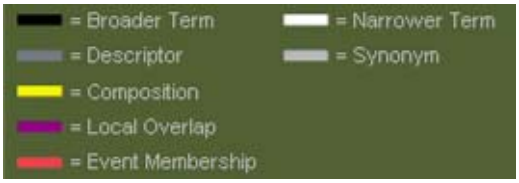

Figure 5: Association types and their colours

5. Implementation

The SNS-Navigator was developed as part of a diploma thesis conducted at the Stuttgart Media University (Jochims 2006).

The navigator is implemented as a web application and available for tests via the URL http://www.sns-navigator.de. It is a component of a three-tier architecture and mediates between the web browser of the user and the SNS server of the UBA (Figure 6). The SNS-Navigator is based on latest web technologies such as XML (*eXtended markup language*), Ajax (*Asynchronous Javascript and XML*), Web Services, XSLT (*eXtensible Stylesheet Language Transformation*) and SVG (*Scalable Vector Graphics*). It can be used with a modern web browser such as Internet Explorer 7 with Adobe's SVG plugin or Mozilla Firefox 2.0.

A number of challenges had to be overcome during the development of the system. For example, the genuine Ajax approach, i.e., to call the web service from a Javascript programme, could not be implemented in a straightforward way since the navigator and the SNS web service are hosted at different sites. Therefore a proxy was developed and installed at the navigator site that accepts the requests from the Javascript programme and forwards them to the SNS web service site.

Special attention is turned on the processing of the data delivered by the SNS web service. This data is represented in the XML Topic Map Standard (Topicmaps.org 2001). An XSL transformation is used to convert the XML representation into a user-friendly presentation format. The conversion results in either an HTML page or an SVG graphics display depending on the preferences of the users.

Special features of the system are the SVG-based visualisation of topics as scalable symbols and an Ajax-based display that informs about the status of a service request.

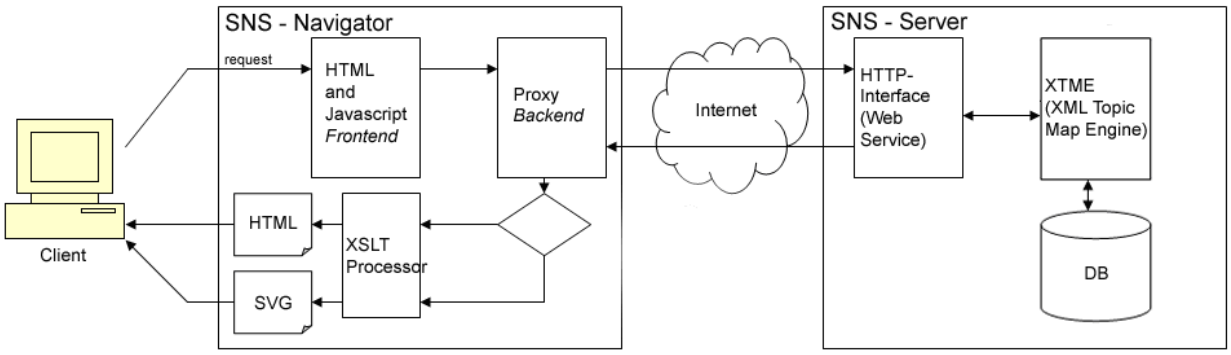

Figure 6: Three-tier architecture of the SNS-Navigator web application

6. Result

The SNS navigator makes it easy to access and understand the information content provided by the Semantic Network Service of the German Federal Environment Agency. An information presentation technique based on scalable vector graphics facilitates the use of the system. Environmental topics are displayed as a network of graphical symbols. This allows non-expert users to develop an intuitive understanding of these topics that serve as descriptors for a large number of environmental information resources.

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