Spatially-Aware Information Retrieval on the Internet

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User Requirements Specification

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Abstract: This document describes the gathering of user requirements for SPIRIT, through the use of scenarios, and their subsequent interpretation into a set of needs for consideration by the other SPIRIT work packages.

Contents

D3 7101

User Requirements Specification

1. Introduction

Collecting and specifying requirements is a crucial task for complex systems, since poor or inadequate requirements specification generally results in interaction difficulties, including lack of facilities and usability problems (Nielsen 1993). Requirements can be considered

- from a system perspective (Van Lamsweerde 2000, Rumaugh et al. 1999) as defining the goals that the system has to fulfil through a formal description of how these goals will be achieved,
- or from a user perspective (Nielsen 1993, Goguen & Jirotka, Schuler & Namioka 1993, Hackos & Redish 1998), focusing on psychological and social aspects of the user, their needs and the context of use.

The purpose is to provide designers with some understanding of users' needs and behaviours. The focus is on interface layout and the functional presentation of the system to the user. One of the main goals in understanding the interaction between user and system and designing user interfaces is thus to overcome the *mismatch* between the user's goals when using the system, and the functional system mechanisms (Norman, 1989 p.38). Therefore the user needs assessment process must start with the identification of users and the tasks that they will seek to accomplish.

The role of the user requirements in the SPIRIT project is not limited to listing a set of wishes. User requirements will also be a milestone for other activities. User requirements are expected to affect:

- The system design: in terms of the features SPIRIT should offer, the ontology and the metadata that have to be produced.
- The user interface: in terms of flow of interactions and possible layout elements.
- The evaluation: in terms of shaping the context of user tests.

Listing the user requirements for the SPIRIT project has not been a straightforward task. On the one hand, a system such as the one SPIRIT aims to produce does not exist today. Indeed, SPIRIT aims at producing a new service on the Web, thus it was not possible to set a visit to web users of geographical information and to elicit requirements by observing current practice simply because those people and context of use does not exist.

On the other hand, the general need for sophisticated forms of geographical information can be found in many different contexts, from city development planning and monitoring to general travel and tourism information gathering.

In the first case, geographical information is used by expert people, who are skilled in using many different sources, sometimes distributed and crypted in various ways. Their purpose is to analyse some kind of phenomena (e.g. economical development, bus route changes) in relation to the geographical area where it occurs. Despite its importance, this type of application is considered of secondary importance in the SPIRIT due to the difficulties in getting the necessary data (both geographical and non-geographical). Indeed, institutions, e.g. regional government, may generally hold very detailed geographical information often enriched with other type of data, e.g. economical development, but it is unlikely to be willing to share the knowledge on the net. The web itself and what is publicly available has to be considered the main resource to be used in SPIRIT. Additional data would be produced to complement those available and to ensure the effectiveness of the system.

As a consequence, a generic use was envisaged as the primary for the SPIRIT. As a matter of fact, search engines have become ubiquitous tools across many domains and it is reasonable to expect that most users of the Internet will have encountered some form of text searching mechanism. Spatial data is also widely used, and therefore a large body of users must exist, who have experience in both web searching and the use of spatial data. Finally, many web searches are likely to include some form of simple spatial component, e.g. cinemas in Munich, thus demonstrating that a need for spatial information exists.

A further dilemma is the application domain. Example domains might include tourism, hydrological modelling, socio-economic statistics, or sustainability indicators. Which domain to consider is of course a core decision for the development of ontology, gazetteers, and metadata structures; changing the scenario of use would mean changing domain. Thus a decision about which domain is used for developing and demonstrating SPIRIT has to be taken early in the project lifecycle.

Finally, since SPIRIT aims at producing a new and enhanced type of web search service, it would be beneficial to compare it to the current state of the art web search engines, e.g. Google and current web map services, e.g. Mapquest.

Given the above constraints, it was decided to investigate user requirements by means of interaction scenarios written by the SPIRIT partners. Scenario-based design (Rosson & Carroll, 2002) is a methodology that has been developed in the last ten years and is constantly gaining attention for its power of actively engaging developers and designers in a common task. Scenarios, as *use cases* (Rumaugh *et al.*, 1999), describe the possible interaction between a user and the system. The main difference is the focus on the user, for the scenarios, or on the system, for the use cases. For this reason they can be considered complementary techniques in the development of software systems.

In the next section we present a general discussion of the scenario technique. Then in Section 3 the importance of defining user needs and context of use is discussed. Section 4 shows how scenario technique was used in the context of SPIRIT. Section 5 lists the user requirements, while Sections 6 discuss the implications of the requirements for SPIRIT components. Conclusion and references, together with Appendices, A, B and C are included at the end of this report to support produced material.

2. Generating Scenarios

Among the many techniques that can be used to elicit user requirements (Hackos & Redish 1998), scenarios have been considered as the right technique for SPIRIT. As defined by Carroll (1997, pg. 384) scenarios are "a narrative description of what people do and experience as they try to make use of computer systems and applications. […] user interaction scenarios are a particularly pertinent medium for representing, analysing and planning how a computer system might impact its users' activities and experiences."

Through their strong narrative, focus scenarios help in simplifying the communication among many people involved in the design of an information system. Each person can equally contribute to the discussion, envisage problems and design solutions despite differences in knowledge and experience. Moreover, scenarios can be written at different levels of detail to accommodate the different stages of design. Thus, the first scenarios written early in the development cycle may be more vague and open, subject to modifications as the system design progresses. When choices are made, e.g. which functionalities or which interface layout the system will have, scenarios can be enlarged to include a storyboard of the user's interaction with the final system.

In SPIRIT we tried to be as specific as possible from the beginning to reduce the number of iterations and changes. Starting with a good level of detail allows us to focus immediately on key points such as the level of freedom allowed to the user while typing the input. However, a number of iterations will be necessary anyway as soon as the specification of the SPIRIT progresses.

An initial scenario was circulated in July 2002 as example of how to describe a user's interaction and at the same time underline critical points and open questions. Later, it was decided to adopt tourism as the domain. A total of 13 scenarios were then generated by members of the SPIRIT consortium in September 2002. The scenarios generated (all reported in Appendix A) were of different length and detail, and reflected different understanding and perspective of the functionality of the SPIRIT system. Despite the heterogeneity, several common points were detected, and those formed the basis of the user requirement list reported below in paragraph 5.

A further scenario has been written on the bases of an interview with a user of geographical information for city planning purposes, reported as 10.15 in Appendix A. This scenario is important to show commercial context of use. It is unlikely that SPIRIT would be able to support such a scenario due to the lack of the data/databases needed for the data fusion, economical and geographical in the case. However, we do not exclude that some kind of city planning scenarios could be simulated within SPIRIT, possibly with some sample of geodata sets that might be available for the project.

A limited number of scenarios were selected among the more detailed ones as representative of what SPIRIT will do; those have been expanded and further refined to include all important features. The main criteria used for the selection was the complexity in term of number and type of iterations required. Indeed, the many searches for services in a city (e.g. cinema in Cardiff, hotel in Munich, airport near Oxford) suggested by the simpler scenarios are part of these wider ones. Secondly, each scenario was considered relevant for a specific aspect of the geographical information it describes:

- General information gathering about the Black Forest: the area includes several cities and regions, there name has translations in other languages;
- Cities identification on th French coast: concepts like big city and coast have to be properly understood and merged to answer this query;
- Planning a mountain tour in Switzerland: mountains, as other geographic places (e.g. lakes), do not identify an area in a sharp and neat way.

Each of these scenarios has an associated need for services or activities (bicycle routes, hotels, windsurfing, and trekking) therefore well representing the searching of non-geographical information in relation to geographical places.

It should be noted that during re-writing of these scenarios attention was paid in trying to present different interactions thus suggesting different layout. Scenarios were used to start sketching out some initial ideas about a possible user interface and plausible interactions. Initial sketches are reported in Appendix C with the limited purpose of supporting a better understanding of the interactions described by scenarios of use (Appendix B). Indeed, each scenario can be supported by several different interface layouts and interactions as shown in Appendix B (10.2 and 10.3) by the re-writing of the same scenario on booking holidays on the Mediterranean coast of France envisaging a completely different interaction.

The 4 scenarios, reported in Appendix B, will be used throughout the SPIRIT project; modified and updated they will work as templates for comparison on the prototype under development to guarantee it is focused on a user-centred target. However, these four are not exhaustive and other can be added depending on the SPIRIT achievements, for example, a scenario on the searching for weather forecast using a PDA would be interesting but the possibility of using a PDA cannot be envisaged at this time of the project.

3. User Profile and Context of Use

[Tscheligi et al. 02] recommend that the design of an application be preceded by an analysis of the context (to characterise user groups, tasks and environment) and a comparative analysis (to situate the application regarding existing applications). To follow this line in the analysis of user requirements regarding SPIRIT system, we study the following points:

- What users would use this system (groups and tasks)?
- What are their global requirements regarding this application: expression of need and system's answer? In answering this question, we try to express requirements that can be absolute or relative to existing systems.

The first section of this chapter presents some experiments that were undertaken to support the context analysis. The next sections present the results of our analysis.

3.1. Experiments supporting the analysis

Three different experiments are presented in this section.

The first experiment is the study of the SPIRIT scenarios to provide information for the context analysis. In order to integrate them in the context analysis, we sum them up in Table 1 and highlight their output for this chapter. More precisely, each scenario is described as follows:

- Who are the users, what is their task and possibly is there something specific about the context?
- What are user global requirements regarding the expression of their need and regarding the answer they expect from the system?

User (context and task)	**Global requirements (/Expression of need and /SPIRIT answer)**
Frauke scenario User : ordinary Web user. Task : to find a place where to build a beach-volley ground.	/Expression of need : expression of constraints (wind, accessibility, price) regarding the place. /SPIRIT answer : SPIRIT integrates pieces of information from varied resources that can be in SPIRIT (ontology of things and geographic places to express the need) or outside SPIRIT (routing site, weather forecast, real estate broker,..). SPIRIT integrates the resources, at least spatially.
Syed scenario Context : An event (fire) happens somewhere. User : ordinary Web user Task : to evaluate the population safety actions.	/SPIRIT answer : SPIRIT locates a place and addresses things relatively to this place (communities leaving near it, nearest highway and communication facilities, nearest water body)
Monika scenario 1 User : ordinary Web user Task : to book a hotel for a business travel	/Expression of need: expression of spatial constraints on the hotel looked for (close to railway station, close (walk) to AgAconference center). /SPIRIT answer : SPIRIT locates AgAConference center and addresses hotels relatively to expressed spatial constraints.
Monika scenario 2 User : ordinary Web user Task : to prepare holidays (to find a city and some specific places associated to it)	/Expression of need: expression of constraints on the city (must have spatial relationships with other things like rivers, bicycle ride facilities, historic villages, monuments of Backsteingotik style) /SPIRIT answer : SPIRIT locates things and evaluate spatial relationships.
Sandrine scenario User : ordinary Web user Task : to find a place where to do wind surfing during holidays	/Expression of need: expression of constraints to find a place (near a specific place, supporting windsurfing activity) /SPIRIT answer : SPIRIT interprets the constraints and find a real estate broker that sell places corresponding to these constraints.
Dave scenario User : ordinary Web user Context : user has just moved Task : to find facilities in the new neighbour	/Expression of need: designation of a place through a map /SPIRIT answer : SPIRIT is able to address things (facilities) in a given place (neighbour or user place) and to detail their location to the user on a map. SPIRIT ranks the result.
Daniela scenario User : ordinary Web user Context : have just moved and already explored their new area Task : to find a house to buy in their new place, possibly a house they have noticed during exploration	/Expression of need: designation of a place with many criteria. /SPIRIT answer: SPIRIT is able to determine services sites selling house in their area, and more specifically the service that sells a house located at a specific address
Bénédicte scenario User : ordinary Web user that wants to visit Japan but not gifted in geography of Japan) Task : to chose a place for holidays	/Expression of need: expression of constraints on places (in Japan, big city) and searched relationships between these places (intercommunications) /SPIRIT answer: SPIRIT interprets the constraints and locate places and test their relationships. SPIRIT provides two parallel search methods (SPIRIT and Google).
Tim scenario User : ordinary Web user (hobby : archaeology) Context : goes to a conference abroad Task : to plan holidays after the conference (to find places supporting specific activities)	/Expression of need: designation of a zone of interest /SPIRIT answer : SPIRIT gives the possibility to express vague queries and to browse all types of answers associated to it
Sigrid scenario User : a biologist Context : visit friends in Australia Task : to find a zoo to visit during this trip	/Expression of need: definition of a zone of interest where to look for things /SPIRIT answer : SPIRIT addresses things inside a zone, locates them on a map
Juliette and Marc-Antoine scenario User : ordinary Web user (hobby : bicycle) Task : to learn things about varied topics	/Expression of need : the user might change of information retrieval strategy during the query process (if he thinks of something new he wants to learn). The user may define a zone on a map. /SPIRIT answer : SPIRIT displays browsable semantic nets associated to the user query terms. SPIRIT proposes a synthesis of varied information associated with a place.

Table 1. Summary of scenarios provided by SPIRIT members.

Another experiment was lead within the COGIT laboratory at IGN: the simulation of a SPIRIT system. Members of the laboratory were split into two teams:

- the "SPIRIT interface" team,
- the Web users.

Members of the *interface team* designed a mental model of a realistic system able to support spatial queries. They thought of the possible interactions between users and the system and of graphical components that could be drawn on a paperboard to mock up the system interface to users.

In the other team, each user wrote a use scenario composed of: the description of a user and his need depicted in natural language, and a use case of the Web site each of them would dream up to access the information they required.

The next step was to present each user with the storyboarded interfaces.

The *interface team* could communicate only through a paperboard with reasonably computable interactions such as "select an item in a list", "draw a window on a map". The "users" were also limited to the proposed interactions and could not communicate otherwise. Specifically they could not comment on the queries they were performing with the interface, nor ask any question not foreseen on the paper board. Each user tried that way to express their need using the proposed interactions. And the *interface team* tried to support, for each user, the specification of their needs and the answering of this need.

This experiment provided the following categories of information for context analysis:

- Use cases written by members of the *user team* described typical contexts in which participants thought they would need the SPIRIT system: preparation of a leisure activity, of a personal trip, of a journey, renting a flat or buying a vacation house, or simple curiosity.
- Global requirements were also described in these use cases: required interactions and expected output. Required interactions were consequently refined as a result of the process of interaction with the *interface team's storyboard* and each user.

A last experiment was also led within the COGIT laboratory. A short questionnaire was produced and submitted to geographical information users, concerning their work, their computer habits, their relation to geographic information, and their wishes about a potential system providing assistance on the Web for the exploitation of information related to geography. No type of resource was particularly highlighted in the questions: the users were free to concentrate on Web documents, geographical data, etc.

The questionnaire was diffused through discussion lists about geomatic and geography. This experiment is restricted to a user group of geographically “expert” people: i.e. working in GIS, in geography, or in domains requiring regular use of geographic data.

3.2. Analysis of user groups and tasks

During the analysis of the results provided by the three experiments presented in the previous section, it appeared useful to distinguish three dimensions in the description of user needs. This facilitates the analysis of user needs and of user groups and tasks.

A need can always be decomposed into three dimensions detailed below and in Figure 1.

User activity

The first dimension of the need is the activity that the user wishes to perform. We distinguish below two types of activities.

Activity to be realised : The user may intend to realise the activity immediately with the resources obtained. For instance, the user may be looking for information to rent a car and expect an answer that actually is a car rental service.

This dimension may be explicit in the user need expression, e.g. "I need to book a hotel room". The user expects the answer to allow him to immediately book a room.

Activity to be analysed : The user may need information to make a decision concerning an activity. For instance, most user scenarios refer to planning holidays.

In this case, this dimension would be expressed as "I need to make a decision about buying a house". This means that the user does not expect necessarily the answer to allow him to buy a house. Rather an answer giving information through which a decision on house buying can be made is required e.g. locations to look for a house, loan solutions, types of houses.

Lets us underline that such an activity can sometimes be decomposed into sub activities, which is a decomposition of the need itself.

Required information content

The second dimension of the need is the piece of information that the user is looking for, e.g. trains schedules between Amsterdam and Utrecht.

As specified in the SPIRIT proposal, SPIRIT is being designed for people looking on the Web for information that has a spatial component. The information content is of the form "something related to somewhere", e.g. information about hotels in Munich, time-table of cinemas in Zürich.

This dimension is detailed in SPIRIT in the ontology WP.

Required resource

The last dimension of the need is the expected resource. The user may express specific needs regarding the very resource he is looking for, e.g. aerial picture, homepage, official Web site.

Possible types of the required resources that could be accessed through SPIRIT geographical data and web documents.

Moreover, SPIRIT will produce maps rendering the geographical footprints of Web documents. The needed resource might thus also be a map produced by SPIRIT about several web documents.

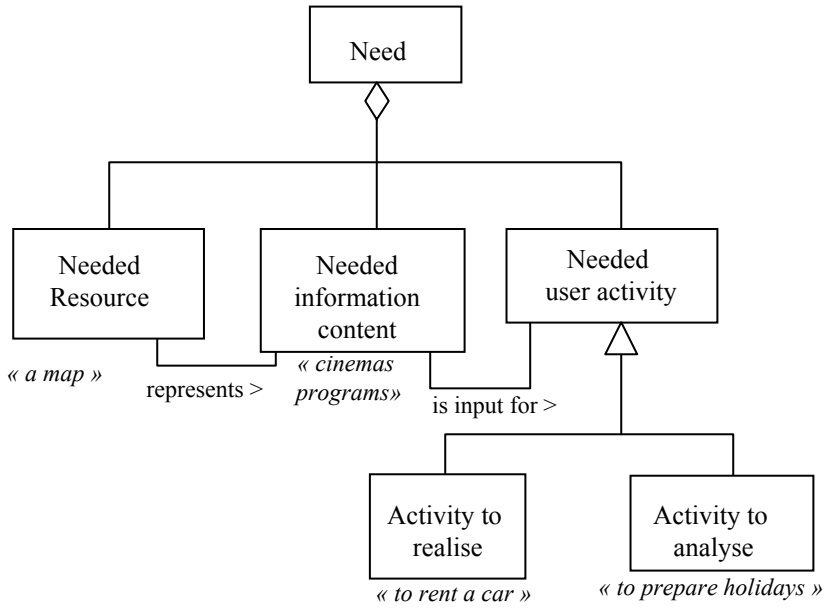


Figure 1. Dimensions of the need of SPIRIT user.

These dimensions are not independent. A need for activity can be translated into a need for information content to support this activity. The need for information content itself should be translated into a need for a resource representing this information in whichever format.

3.3. User groups and tasks in SPIRIT

There seem to be two emerging user groups in SPIRIT:

- users of geographical data and corresponding software that use the web to retrieve regarding geographic information application,
- other people that use the web to retrieve information that has a spatial component.

The questionnaire gave detailed information regarding the first group. It seemed very complex to organise high level tasks in this group. But this group can also be characterised by the *needed resource* dimension. In this group, users need not only geographical data but also geographical treatments, and geographical know-how. More precisely, the 35 responses let us distinguish the following types of needed resources for such users:

- need for data (e.g. where to find maps about Marocco ?)
- need for help to use data (e.g. How to create a 3D animation of a region ?)
- need for help to use geographic software (e.g. How to visualize map samples on a personal GPS ?)
- need for "computable" information about a place (e.g. How to go from town1 to town2?)

Geographical treatments are either wished to be executed online (e.g. an itinerary process), to be downloaded or to be only described (e.g. research of developed algorithms to build a Digital Terrain Model with data the user already has).

An important characteristic of these users is the GI knowledge (data, software and know-how) that they already have.

The scenarios and the simulation experiment focused more on the second group, i.e. people that are not users of geographical data and GIS software. The tasks of this group are also varied. As announced before, we distinguish:

- Tasks to realise: the user is looking for a Web resource that effectively provide a service associated to his task. These tasks may be very specific for instance to buy, book or rent something. In this case, the resources that provide a service associated to such a task have an explicit label like "real estate broker", "hotel", "car rental". On the contrary, when the task to be realised is the very generic task "to enrich my knowledge about topic A", the resources that answer this need do not have a specific label.
- Tasks to analyse: the user is looking for elements to support their decision. This is usually the selection of a place, e.g a city or a hotel, that fulfils specific constraints spatial or not, e.g. to be close to the sea, to contain Backsteingothic monuments.

3.4. Analysis of global requirements

Some requirements regarding the expression of the need are highlighted by the experiments.

Some users naturally refer to the dimension "needed activity to support" of their need but find it difficult to express a query for information content or also to have an idea of the type of resource they are looking for. For instance, a user who wants to go from one place to another but who does not know if there are planes or trains relevant to this need.

Others have a need specifically referring to a type of resource and not to information content, e.g. satellite pictures.

From that, we infer that a global user requirement regarding information retrieval in this field is to be able to express the dimensions of the need that the user wishes : required resource, required information content and the activity to support. Such a query would be typically "I need a resource that has the following characteristic [*required resource*] and that provides [*required information content*] in order to [*activity*]".

This supposes that the system can translate the user expressed need into a valid need for resource.

Moreover, these experiments showed that the expression of need was seldom formalised as a mere query. Users rather require a sort of dialogue with an information retrieval system; this system should be able to interpret each user expression in the context of the dialogue, i.e. of the information retrieval session.

In other words, a naturally expressed need is frequently an aggregation of several simpler needs. Two situations may occur: either the need is too complex to be expressed by a single query, or users need intermediate information to formulate their need (e.g. first, location and discovery of a place, and then, precise query about an aspect of this place). In both cases, the expression of the need has to be an iterative process, enabling the user and the system to progressively understand each other (by disambiguating user's terms and validating system's responses) and build a "common ground".

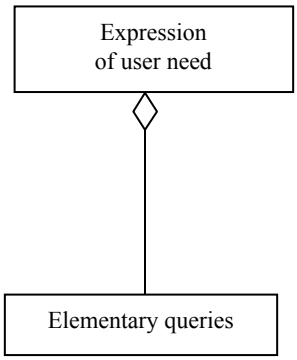


Figure 2. ***The expression of a user need should be composed of several elementary queries.***

The way the users naturally express their need can provide useful information for the design of user-system interactions (WP4, Multi-modal search engine interface). The strategies of interaction with the system, eventually taking into account the form of the query to better interpret the need substance are being studied in the scope of this WP.

A specific need that is not answered by existing systems is that the expected answer is not necessarily one document. This refers to two remarks:

- Several documents may contribute in answering different parts of the need so that the answer is not one document but a sum of documents, possibly organised.
- Users often wish to have several answers and to choose the best answer. Since they do not want to consult each resource to decide about their relevance, the system needs not only to display several answers but also to display their relevance regarding the query.

The answer users expect from SPIRIT is not only the designation of relevant resources that would meet their need but also the evaluation of this relevance, i.e. the ranking of the resources.

In many scenarios, intermediate answers are the determination of a geographic zone of interest thanks to SPIRIT's ontological knowledge.

Moreover, some requirements were expressed regarding the expected presentation of result. Users would like to see spatial information on a map. We may state that SPIRIT should provide users with an enhanced spatial apprehension of the answer to their need. More precisely it can be spatial context of an answer: for instance, if the user is looking for information about the British Museum in London, the answer may be located on a map. It could also be spatial relationships between resources: for instance, if the user is looking for information about tourist villages in South France, the answers may be located on a map so that one can see which villages are close to one another.

4. Analysing and Comparing Scenarios

Two quite homogeneous sets of examples arose from analysing the 15 scenarios produced - one set representing already defined user information needs, the other representing a more inquisitive state. The first set contains specific queries, e.g. “hotels in Munich close to main station”, “zoos and parks in south Australia”, “windsurf renting near Saint Raphael”, “cinemas in north east Cardiff” and “airports near Oxford”. The second set describes more open situations where explorative queries were entered, e.g. “big cities in

Japan", "cities Garonne France", "Black Forest Germany", "Aigle Switzerland Les Diablerets". However, in all the queries proposed there are two clear dimensions: a *where* and a *what*. *Where* is related to a geographical entity, a specific city, a mountain, and an area; while *what* describes non-geographical entities, hotels, airports, cities, or general information when nothing specific is mentioned (as in the Black Forest example). How much each dimension is specified in the query depends on the situation described in the scenario, and this would affect the type of interaction envisaged, e.g. a single request as while searching for an hotel in Munich, or an iterative search process, as when planning holidays in the Black Forest.

Whichever the elements in the query, there is always a spatial relation between the geographical element (the *where*) and non-geographical objects (the *what*). Sometimes more than one of such relations occurs in the query, as in "hotels in Munich close to main station" where there are 2 geographical entities (Munich and the main station) and the non-geographical object is related by "in" and "close to".

As mentioned above, tourism has been identified as the preferred domain. In this context *the what* can be specified in transports, housing, and services that represent the main categories of interest. The table below summarises the key elements extracted from the scenarios. Dimensions considered of interest are: type of service required, type of location, spatial relation, potential or state query.

	Service	**Location**	**Relation**	**Other**
Scenario 1	Accommodation Hotels	Paris Cities nearby	In Near No more than 15 miles away	
Scenario 2	Airport, cinemas, school, museums	North-East Cardiff, Somerset, Ile de France, Ruhrgebeit	Nearby, in, in the nearby area, within 10 miles/30 minutes drive	Translation of geo-name
Scenario 3	Hotels	West of London		
Scenario 4	Parks, Zoos	South Australia, Sydney, Melburne	Between, near	Active maps, free typing
Scenario 5	Cities	Garonne, south France	In (graphically expressed)	
Scenario 6	Hotel	Munich, main station,	In, close to, short walk	Distance respect to 2 points
Scenario 7	Accommodation, bicycle	River, bicycle paths	Along	Distance calculation
Scenario 8	Generic services Geo-info	Upper Petaca	Surrounds, close	Structured interface
Scenario 9	Hotels, windsurf renting	Mediterranean coast of France, Nice	In, within 20 min drive	The coast, free typing

Scenario 10	Big cities, hotels, museum, transport	Japan	In,	Structured interaction
Scenario 11	Parks, archaeological sites	Rome	Neighbourhoods	
Scenario 12	Accommodation, mountaineering, weather forecast	Switzerland, Les Diablerets (mountain)		Mixed languages
Scenario 13	General info, bicycle routes	Black Forest, Merdingen	Up to 50Km,	Mixed languages, structured interaction
Scenario 14	House Nursery	University campus, hospital	Distance from	Distance respect to 2 points

5. User Requirements List

By analysing the scenarios, a list of requirements have emerged. The list encompasses all the elements considered useful in the context of searching information related to geographical dimensions. However, not all requirements can be satisfied in SPIRIT. For example, the possibility of translating geographical names and searching in many languages is, at the time of writing (December 2002) unrealistic since the gazetteers available are monolingual English. However, we consider important to keep a single list despite the feasibility of all items, since unforeseeable possibilities could emerge during the next months of the project life.

Selecting which elements from the list are realistic goals and which items should be implemented first will be a matter of discussion inside the consortium. It should be noted that the feasibility depends often on constraints outside SPIRIT framework, for example in the use of mobile devices for ubiquitous access to geographical information while on site:

- Support **geographical concept expansion**, e.g. from “The Midlands” into “Nottinghamshire Leicestershire Derbyshire Northamptonshire Warwicshire Staffordshire”, or from “Schwarzwald” into “Murgtal-Schwarzwaldhochstraße Bäderregion-Nordschwarzwald-Weinland Ortenau-Vom-Kinzigtal zum-Neckar-Breisgau Feldberg-Südlicher-Schwarzwald Titisee-Villingen-Schwenningen”. This feature is considered essential for supporting an exhaustive retrieving of the information referred to a specific area.
- Support **spatial concepts** that relate different geographical entities as well as objects, e.g. “main station in Munich”, “beaches out of Nice”, “cities in south England” as well as “cinemas in Cardiff”, “hotels north London”.
- Support **different terminologies and notations of spatial relations**. Different terms are used in natural language to mean similar concepts. Hence, the system must be able to recognize synonymous notions for spatial relations. For example, the term “near” is synonymous with the terms “close to”, “ not too far from” and the term "touch” is synonymous with the terms “adjacent” and “nearby”.
- Support **any kind of spatial relationship** like “in Zurich” and “not in Zurich”,

- Support **fuzzy measures of distance**, e.g. “15 minutes drive”, “20 minutes walk”, “walking distance”, possibly combined. This is equally true for *qualitative distance* as in “in walking distance”. The system must also be able to interpret an approximate measure of definitive distances, e.g. within 10 miles could be matched with 8 or 12 miles, etc.
- Automatic **identification** and interactive **disambiguation of place names**, when the same name is shared with other place in the same country or in others.
- Support **description of geographical features**, e.g. “main rivers in France”, “abbeys in South England”, “Adriatic coast of Italy”. SPIRIT should be able to detect the area or the points under discussion.
- Support **fuzzy geographical areas**, e.g. “Les Diablerets mountain area”, “South Wales”, “North East London”.
- **Maps** are preferred display medium.
    - Maps have to be **enriched** with other types of information (mainly links and images), e.g. hotels, travel information, routes and paths.
    - **Direct manipulation of the displayed map** has to be supported; zoom-in and zoom-out are considered the basic, measuring the distances would be an interesting feature to have.
    - **Query-by-action**, i.e. some manipulation of the map like circling a region as query input is a desirable feature.
- **Clustering** of retrieved pages with respect to particular semantic concepts, e.g. information about accommodation classified in hotels, resorts, B&B, houses, huts, camping, etc.
- Offer document **ranking respect to distance** from a specific place, e.g. “hotels close to the Munich station” than the closer will be presented first.
- Offer document **ranking respect to spatial relation**, e.g. hotels in the city centre, those more in the centre listed first.
- Support **ranking by spatial non-spatial concepts**, e.g. hotels ranked respect to the distance from the station vs. respect to number of stars.
- Keep the **history of search sessions** for future queries: e.g. different queries, area specification, and relevant results.
- Support **query by sketching**, e.g. allow users drawing the map of the square where a person is, automatically identify the place and retrieve related information.
- **Maps** and listed **information** have to be **visually related**, e.g. map position blinking when the corresponding term in the list is brushed, automatic scroll of the info list when a certain place on the map is clicked.
- **Ubiquitous** retrieval of geographical information, i.e. while travelling by means of a PDA.
- Support **multi-language naming**, e.g. Black Forest has to be automatically translated into Schwarzwald, would be highly desirable. Often foreign geographic names have the original name translated; mapping multiple names on the same concept is thus fundamental for the retrieving.
- Some sort of **automatic translation** feature can be explored when essential information is retrieved only in a different language than the one in the query.

The above listed features have an impact on the different SPIRIT components. Implications, challenges and opportunities are discussed in the next section.

6. Effect on SPIRIT Components

6.1. Ontology and Gazetteers

Ontology and gazetteers can be used to transform a vague user query into something that is more precise and specific. For example expressions like “near” or “close” would be transformed into a set of expressions that are likely to retrieve potentially relevant documents, e.g. “in the neighbourhood of”, “in walking distance from”, “close to”, “nearby”. Gazetteers are important for mapping multiple names (possibly across languages) to the same concept.

A query expansion mechanism can exploit those tools to specify vague queries or when generalizing narrow requests. The resources can also be used for grouping retrieved pages by location or object type, e.g. hotels, resorts, B&Bs, rented houses, or camping sites.

6.2. Metadata Annotation

Metadata annotation is the way in which more information can be added to standard data. This feature could become the central point in, for example, output presentation when an image can be associated to a geographical place by means of metadata.

Similarly, simple text pages can be enriched with geo data extracted by the geo-ontology, therefore this might become a key feature for the effectiveness of the search task.

For some expert users, the SPIRIT engine might provide a description of the content of existing geo databases and not only the data itself. These geographical databases might not be directly accessible, but they should at least be described by means of classical geo metadata to indicate to the user the appropriate location.

6.3. User Interface

The user interface will have a central role in SPIRIT - it is the place where information derived from different sources (e.g. GIS as well as the Web) and of different nature (e.g. maps, text, images) have to be fused in an organic, usable and pleasurable design. Any layout is possible and the design of the interface is a creative act. However some elements have to be provided, e.g. a map, a list of links, possibly a set of images. Also, the interaction schema seems to emerge quite clearly from the scenarios: the map should support a direct manipulation interaction and possibly relate actions on the map to other elements on display. The map can be an input mode if the users, for example, select a country to start the search by clicking on the map of Europe displayed in the initial screen of SPIRIT, as presented in one of the scenarios of use (Appendix B, 10.3)

Fusing the data might not be an easy task since it implies being able to detect in the retrieved documents the best bits that can be extracted and used in the summary. Moreover, it might be quite complicated to, for example, highlight the position of a hotel with respect to a station if the data about the station, the hotel and the city map come from different sources.

A crucial decision for the user interface would be on how the user is allowed to input a query. It is clear from the scenarios that two distinct query types should be supported, *the what* and *the where*, but it is completely open to discussion if the SPIRIT interface should leave the user free to formulate any query (with the risk of some intractable inputs) or if each broad concept of *where* and *what* has to be decomposed in the basic elements that SPIRIT can manage with the drawback of offering the user only a limited selection of choices.

Finally, it is worth mentioning the categorization of the result. SPIRIT will search the web for possibly vaguely defined queries. It is likely that hundreds of documents will be retrieved and some sort of organization of the result would be helpful. More than a graphical solution that organizes the result in a visual way (e.g. Leuski & Allen 2000), SPIRIT should offer some sort of "content based organization" (e.g. Chen & Dumais 2000, Sanderson & Croft 1999) that organizes the result by concepts, possibly derived from the ontology.

6.4. Search Engine

As the ontology will transform user queries into more precise forms, it may be necessary to alter the query format of the search engine to allow it to deal with query word expansion and searching for relationships in text.

6.5. Relevance Ranking

The user requirements give rise to a flexible relevance ranking component. To allow different emphasis on the spatial aspect of the query (*the where*) with respect to the term part (*the what*), the relevance ranking needs to know the preferred dimension for this user. The user may also require ranking by distance. Effectiveness in the ranking depends here on the type of information retrieved and passed to the relevance ranking component - it has to be precise enough to allow for ranking by distance. The ontology can be used to infer this type of information.

An unwritten but obvious requirement for any search engine query is that the most important documents are to be listed on top. This is partly contained in the spatial match and the term match for the query, but also in the so-called term frequency and document frequency. For spatially related queries, it is worthwhile to study the spatial versions location frequency and spatial document frequency.

7. Conclusion

The user requirement acquisition was heavily based on the generation of scenarios from the members of the SPIRIT consortium. It has been a good exercise for both identifying common ideas on key features as well as different opinions on what SPIRIT should do. Opinions differ mainly on which interaction should be offered to the users, e.g. structured input vs. free text searching. The derived user requirements list includes several interesting points as well as challenges for SPIRIT to investigate and test.

From the original 14 scenarios a few were expanded and revised in order to be used as bases for the design of the user interface and the system in general. Those core scenarios will be revised and updated to better represent the SPIRIT final features. Indeed, as can be seen in the two version of the same scenario in Appendix B in session 10.2 and 10.3, the same user goal can be satisfied by deeply different interfaces that offer users deeply different interactions. This deliverable is not the place for defining the interface or functional features, our effort was directed towards the visualization at an early stage in the SPIRIT project of what is feasible and how to present it.

Finally, it is worth mentioning that the core scenarios listed here are not exhaustive. Some more and different scenarios are likely to be created as the project develops to describe special facilities, for example, searching by sketching. All the selected scenarios will then be used as task scenarios during the user evaluation of SPIRIT. In this way we should have created a system that support the user in the accomplishment of well-defined tasks.

8. References

(Carroll 1997) Carroll, J. Scenario-based design. In Helander M., Landauer T.K., Prabhu P. (eds.) Handbook of Human-Computer Interaction, Elsevier Science, 1997.

(Chen & Dumais 2000) Chen, H. and Dumais, S., Bringing Order in the Web: Automatically Categorizing Search Results. Proceeding of CHI2000, 145-152.

(Goguen & Jirotka 1994) Goguen, J. and M. Jirotka (eds.) Requirements Engineering: Social and Technical Issues, Academic Press, 1994.

(Hackos & Redish 1998) Hackos, J. T. and Redish, J. C., User and task analysis for interface design.Wiley, 1998.

(Leuski & Allen 2000) Leuski, A. and Allen, J., Lighthouse: Showing the Way to Relevant Information. IEEE Symposium on Information Visualization 2000 (INFOVIS 2000), Salt Lake City: Utah, October 9-10 2000, 125-130.

(Nielsen 1993) Nielsen, J., Usability Engineering. Academic Press, 1993.

(Norman 1989) Norman, D. Cognitive engineering. In: D. Norman and Draper, S., eds. *User centered system design. New perspectives on human-computer interaction*. Hillsdale, N. J.: Lawrence Erlbaum Ass., 1986, 31-61.

(Rosson & Carroll 2002) Rosson, M.B. and Carroll, J. Usability Engineering: Scenario-based development of Human-Computer Interaction, 2002.

(Rumbaugh et al. 1999) Rumbaugh, J., Jacobson, J., and Booch, G. The Unified Modeling LanguageReference manual'. Addison-Wesley, Object Technology Series, 1999.

(Sanderson & Croft 1999) Sanderson, M. and Croft, W.B. Deriving concept hierarchies from text, in the Proceedings of the 22nd ACM SIGIR Conference, Pages 206-213, 1999.

(Schuler & Namioka 1993) Schuler, D. and Namioka (eds.) Participatory design: principles and practices, Hillside: Lawrance Erlbaum Ass., 1993.

(Van Lamsweerde 2000) Van Lamsweerde, A. Requirements engineering in the year 2000: A research perspective'. 22th International Conference on Software Engineering, 2000.

9. Appendix A - Initial Scenarios

9.1. Sample Scenario

Oliver & Helen's Scenario

Oliver and Helen are a couple just moved to Sheffield (UK) from Germany. They have 2 children and are looking for a family house to buy. Oliver and Helen are doctors and look for a house for professionals, e.g. a detached or a semi-detached in the south west of the city (S10 and S11).

Every week Helen goes to the estate agents looking for new houses just put on the market. They have an Internet connection and often in the evening they browse the on-line estate agents.

Search houses.

Just moved in town from abroad.

On the way home Oliver has just seen a "for sale" sign out of a house he likes. That evening he and his wife sit ad the computer searching for information on that house.

The geographical position of the house is known.

First they connect to the "Sheffield Global Estate Meta-Agent", a service for searching in a unique manner all the information on the houses currently on the market available from the different estate agents.

Can we assume this meta-search on pages belonging to other entities?

The first screen displayed to our house-hunters shows the map of Sheffield split into quarters. Oliver knows where the road is (but not its name or postcode) so he uses the command offered by the interface to focus his search only on the area where he passed. From the "S11" quarter he goes to the road level and select the one he think is the good one.

How is it like? Any idea from other systems?
How is the zoom-in/zoom-out function represented?
Can we assume a smooth moving between levels of city details?

Unfortunately he did not pick the right road, but only one very closed. Oliver's search would not be successful if the system would search for that road only. Indeed the SPIRIT system can cope with this by analysing the neighbourhood of the road and automatically include in the search others streets close by.

This is a personal guess based on what presented at the kick-off meeting. Is it plausible? Doable?

Oliver is then presented with the result of his search. Houses for sale are displayed on the map he used for the selection.

Those houses are clickable and a page summarizing the house is presented.

The same result is also displayed as a list below the map. The order is based on the "closeness" of the house respect to the point Oliver specified in his query.

This requires fusing data from the retrieving with the map. Do we have enough metadata for this? I assume the house description page has the postcode and it is detected; and the map can display a certain road number. Is it true?

Oliver browses the map and sees that the road he thought the house was in was indeed the wrong one. He browses the displayed map looking for the one he saw.

Oliver looks also at the satellite views to get a full idea of the house surroundings. He zooms in and out to check how far the house is from his children's school and from the bus stop.

How is the browse done? Can we assume a zoom-in/zoom-out procedure? Can we imagine having satellite images of the road (with possible zoom-in and out) or pictures and panoramic views?

Oliver thinks he has found the house he saw but others have been retrieved. Together with Helen he selects the few they are interested into, print them and go for calling the estate agent.

9.2. Scenario 1

Clare's Scenario

Clare is a student at Cardiff University. She is planning a holiday to Paris in August. To find a nice and affordable accommdation, she searched the Web for the hotels in Paris. However, since August is a season with so many tourists, the hotels interested her are either fully booked or very expensive. Clare decides to change her idea to stay in a town which is near Paris. Though the transpartation is very convenient in France, however, Clare does not want spend too much time on transportation. She would like to stay in a hotel that is no more than 15 miles away from Paris. When she tries to search the web for such a hotel, she is stuck with the unexpected difficulies -- she does not know how to specify her search criteria. One reason for this is that Clare is not familar with France, thus she does not know which towns are near paris. Consequently, it is impossible for her to explicitly supply the search engine with such town names. She tried the key words "hotel near paris" with search engines, and among innumerable documents she found homepages of some hotels which claims that their hotels are in the towns near Paris. However, for business purpose, all the Web pages of these hotels advocate that their hotels are in a short distance of Paris, but none of them tell Clare explicitly how far its hotal is from Paris. To check whether these hotels are in 15 miles from Paris, clare has to phone them to verify.

9.3. Scenario 2

Having moved to a new area (or contemplating such a move), people are interested in finding out about the facilities available in their new (or proposed) neighbourhood. This could encompass queries about the siting and proximity of local amenities and services (e.g. schools, shops, entertainment centres, etc.), to queries about the surrounding environs and areas (e.g. nearest beach, nature reservations, possible airports and their connectivity to the continent, etc.).

Interaction

Textual interaction

Either directly via a triplet field or mapped on to that internally (which would require a form of natural language processing and parsing…):

<concept *(thing)*> <relationship> <place/area>

i.e. airports near Oxford

Possible that in early systems, a limited set of relationships could be presented to the user (e.g. within, near, South of, etc.), which are selected from a pull-down menu. This menu could be added to as system implements more relationships. Also possible that instead of menu, query expansion will substitute user input relationships with synonyms that it recognizes.

Expected to generate textual presentation of results (with option to depict graphically, depending on concept), in a ranked list/tabular form ("most relevant" first). Ability to select from list to either run follow-up query based on particular answer user perceives as most promising, or to view actual document (or a summary of it).

Graphical interaction

Allows area of interest to be selected from a graphical map (e.g. particular area, scale, orientation, scope, etc. selected by interaction with the user). Still requires a textual element in order to enter details of concept/thing interested in (could be from a pull-down menu, but that severely limits scope of system).

Queries entered in this fashion are translated into a textual form which the system understands and can process.

Expected to generate graphical output, numbered according to "most relevant". Option to depict textually, which may provide better choice for hard copy and selecting and generating follow-up queries.

Query expansion

Recursive procedure to refine query as entered by user. System may substitute place names with more common or less ambiguous form that may be expected to generate more hits (e.g. expands L.A. to Los Angeles - or vice versa depending on ontology definition…) or provide better coverage by including all possible synonyms (e.g. a query about Prague could be expanded to include the other names it is known by, i.e. Praha, Prag, Praga. …).

There is also a background element to this task to expand user input queries into compound queries (e.g. "the Midlands" in U.K. may be expanded, before passing to the Search Engine, into its constituent counties - Nottinghamshire, Leicestershire, Derbyshire, Northamptonshire, Warwickshire, Staffordshire, so the query "airports in the Midlands" could become "airports in Nottinghamshire and Leicestershire and …" etc.)

Possible this could be an option that is selected in entering a query, which would toggle whether user is involved in recursive query expansion and refinement or the system does this automatically in processing the query as a background process.

Possible Queries

The queries that IGN generated, gave me the idea that I should try and produce some of my own to illustrate the features I see SPIRIT being able to cope with. However, some of these are quite GIS-like, and I found it quite hard to come up with ones which in isolation accurately reflect exactly the type of thing I see SPIRIT doing.

Sites such as SomewhereNear.com or Vicinity.com rely on entries being entered in their database (either by companies registering or users sending in reviews of facilities, e.g. pubs) to increase their scope. Although similar queries to those below can already be asked of such systems, it is hoped that SPIRIT would produce a more comprehensive solution by first-hand investigation of the document sources.

These include:

Cinemas in North East Cardiff - possible expansion to constituent areas (e.g. Roath, Splott, etc.)

Football coaching in the nearby area - may require feedback as to what user considers an acceptable quantification of "nearby"

Childrens soft play areas within 10 miles/30mins drive - geometric limit to search

Concert venues in Somerset - mapping of administrative area to non-administrative features

School authority serving Greenwich

Musées des Beaux-Arts in the Ile de France

Leisure Centres in the Ruhrgebeit - possible expansion of indistinct district

9.4. Scenario 3

Here is my scenario of SPIRIT system. I'll write two of them which are pre-search process and post-search process.

1. Pre-search process

"I want to know hotels in the west of London because I want to visit Cornwall as well as London."

A query could be "hotels west of London".

Given a geographic ontology that contains some information of cities/towns with their location data, you can possibly list up cities/towns in the west of London, such as Bristol.

Then you can take two actions:

A: show the list of places found in the ontology to users (this is useful when the user has some knowledge about the place and is willing to articulate the information need);

B: automatically add those place names into initial query and re-run the search, show the result to the user (this is useful when a user can't be bothered to do anything).

These are pre-search process, or query expansion.

2. Post-search process

"I want to know hotels in the west of London because I want to visit Cornwall as well as London."

A query could be "hotels west of London".

Either with the above query expansion or not, you can cluster the result documents based on the geographical information. Note this would require pre-process of identifying geo-data for individual web pages.

Anyway, the result should be categorised based on the location, and a user can select one of those. This is post-search process, or clustering.

Obviously you can combine two of them. Both requires either some sort of ontology and/or geo-information metadata. But they keep the search engine component being simple, and let it do the job which works best. This would also simplify the interaction with other components.

9.5. Scenario 4

Sigrid's scenario

Sigrid is a biologist, working at a zoo in England. She will pay a working visit to a zoo in Sydney for one week and has plans to prolong her stay in Australia for two other weeks to see some National Parks. She also has friends in Melbourne, which expect her to stay a few days.

Tourist: Knows what she wants and the big-scaled area she has to look for it.

She is aware of the big Kakadu-National Park near Darwin, but as this is too far off her route, she is only looking for "National Parks and Zoos in South Australia". Surprisingly the SPIRIT system does not find any Zoos in Sydney, which she believed was in South Australia, so she starts a search "Where is Sydney in Australia". The system provides her a map of Australia, showing all major cities and Sydney as a link and she realizes that South Australia is actually a federal state of Australia, and Sydney lying in New South Wales.

Might be nice to get a world map from the very beginning to zoom in and specify the location.

Thus she refines her first query, changing it to "National Parks and Zoos" and drawing a line in the given map indicated with "south of". For the results she is switching to the "map view" where all the links found are represented on a clickable map. This gives her too much of a choice, the area is still too big, so she finally gives the query "Zoos and National Parks between or near Sydney and Melbourne".

Possible?

"List view" as common.

The SPIRIT System is not entirely satisfied with this query and asks her to refine the spatial parts "between" and "near". Sigrid chooses for the "in the area between" Sydney and Melbourne and defines "near" with a "radius of 50 km". Again she chooses for the "map view" and gets a clickable map of the area she specified.

Other possible choices: "On a route between", "On direct line between"…
"Near" as a buffer around a location. Radius is to be specified by the user.
Metadata/Ontology gives "reasonable" choices for the radius?

Clicking on Sydney, the System creates a zoom-in, showing her the city map with all locations of zoos in Sydney. Clicking on one of those she finally gets to the according homepage.

Zoom in/out function? How detailed?

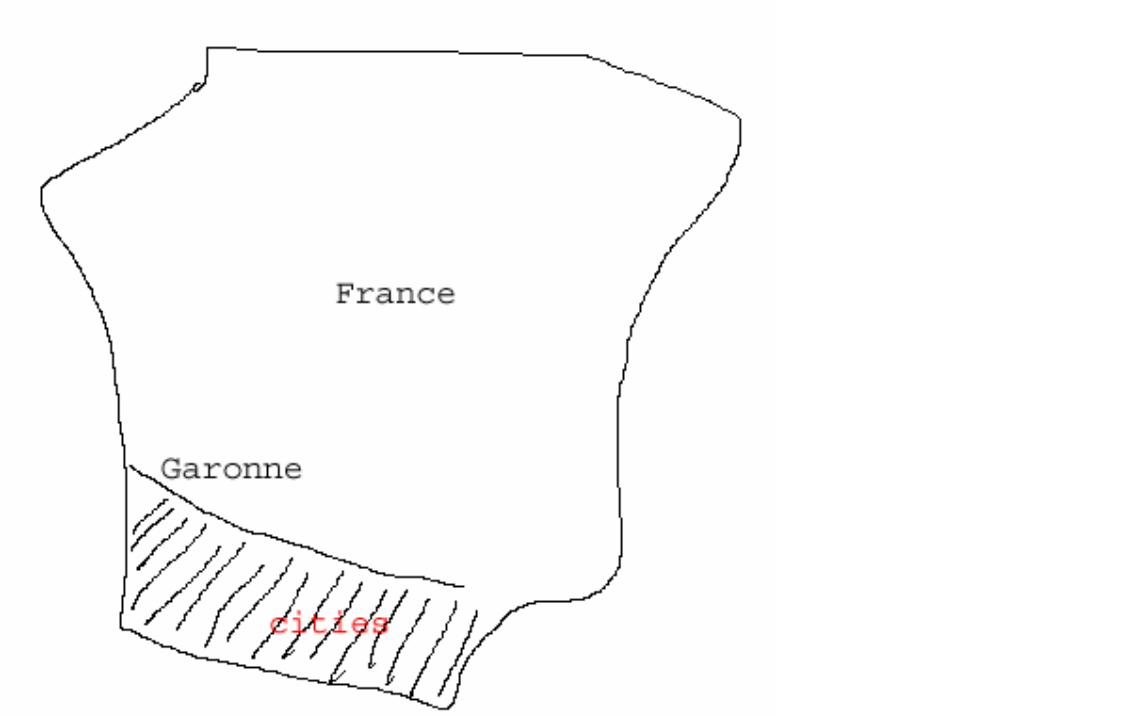
9.6. Scenario 5

The France Scenario

Let's assume we are travelling through Europe. We are equipped with a PDA that uses a small pen for typing on a software-keyboard and as a replacement of a mouse. We always have access to the internet wherever we are.

We start in France and what we want to know something about cities in the very south. What we are not interested in is where the cities are, we bought a quite good map. We simply want to access homepages of this cities without typing each name separately. We decide the river Garonne to be the northern border of our search.

Going to the SPIRIT search engine we choose the sketching tool because it's easier to make some strokes with the pen than typing complicate sentences with the simulated keyboard. We produce the following sketch:



The strokes are drawn with the "stroke" tool, while the names "France" and "Garonne" are typed in with the "geographical name" tool. The hatched area is recognized by the sketching tool as a region between the river and the border of France. The text "cities" which is coloured red is typed in with the "query name" tool which is more or less the keyword we want to recognize.

Pressing the button "search" sends this sketch to the processing application that has to guess what the user meant by his sketch. It recognizes the hatched area as the region of interest with the concept "cities" assign to it. Its location can be found by matching the names "France" and "Garonne" with entries in the ontology. The

ontology is then used to find an specific interpretation for the unspecific “cities” which is Bordeaux, Lourdes, Perpignon, …

Now a query with the city names used as keywords can be send to the search engine which sends back a ranked list of homepages that can be presented by the user interface. For a refinement of the query the location could be marked in the mapping tool and additional keywords could be given in the text input tool.

Scenarios

General problems / difficulties, when "decomposing" a spatial scenario or query:

- Identify places
- Understand notions
- Understand relations / context
- Understand distances in relation to person/object/vehicle

Scenario:

"I am looking for a hotel in Munich, close to the railway station, where I can reach the AgA-conference by a short walk"

I would expect as a result the optimal hotel, that is conveniently located as I requested in the query. The answer should also indicate, if it is impossible to find a hotel that satisfies both spatial constraints (being close to both railway station and conference location).

This query involves the following knowledge:

- Locations of Hotel, railway station
- Spatial relation "close to"
- Location of AgA-conference
- Notion of "short walk"

1. Locations of Hotel and railway station are given either by address or coordinates
2. Spatial relation "close to":
    a. Could either be explicitly coded in the web-documents
    b. Could be extracted by spatial query, e.g. in a distance from 1000m from railway station
    c. Could be annotated off-line to the web-sites of the hotel. This would further imply that there is a hotel-ontology that specifies also something like "vicinity".
3. Location of AgA-conference: would need to be inferred from announcement document -> address
4. Notion of "short walk" would have to be translated into a distance measure (which, however, is strongly person-dependent: for me, it would be no more than 2000m, for others it might be more!); it could also be translated into a spatial relation, e.g. "near", "close" or "vicinity".

Google-answer: The complete query could not be answered, thus I separated it into two:

1) Hotel close to main station in munich

Hôtels à **Munich**. Réservez votre **hôtel** à **Munich** maintenant en **...** - [Diese Seite übersetzen]
... town district. **Close** to the English Garden. Brunnenhof **Hotel**, Located in the heart of **munich** near the **main station**. Carlton, Located **...**
a-hotel-in-munich.com/hotels/munich_fr.html - 26k - Im Archiv - Ähnliche Seiten

Munich - [Diese Seite übersetzen]
... **Hotel** Ibis Altona (tourist class) **Hotel close** to Altona Train **Station**. Distance to Airport: 12 km; Distance to **Main Station**: 0,2 km. **...**
www.touring-germany.com/156Hamburg/ 052_Hamburg_hotels.html - 30k - Im Archiv - Ähnliche Seiten

Germany - **Munich** - hotels - [Diese Seite übersetzen]
... **main station**, airport and trade... **Hotel** Maritim - more information. **Hotel** MARRIOTT **MUNICH**. **Hotel** Marriott **Munich** rate from : 175: Marriott **Munich Hotel** is **close ...**
www.nbportal.com/germany/munich/sel2.asp - 12k - Im Archiv - Ähnliche Seiten

Short Breaks to **Munich** - [Diese Seite übersetzen]
... Aberdeen, **Munich**, £259 01 Jun 02-07 Sep 02 Book by 31 Aug 02 3 star - Kings centre **Hotel** - B&B, Centrally Located **close** to **main Station**, 2, FLIGHT SOLUTIONS **...**
www.cheapflights.com/shortbreaks_munich_sco.shtml - 23k - Im Archiv - Ähnliche Seiten

Second query: "landesvermessungsamt münchen, hotel" (AgA-conference was at the Landesvermessungsamt)

Rodel Tipp Oberau
... Skischule Oberau, **Hotel** Post, Tel.:08652/1351 Karte: Topographische Karte Berchtesgadener Land, Maßstab 1: 50 000 Bayerisches **Landesvermessungsamt München ...**
www.rodel-tipp.de/obau.htm - 13k - Im Archiv - Ähnliche Seiten

[PDF]Alten- markt
Dateiformat: PDF/Adobe Acrobat - HTML-Version
... 1 km 100 m Kartengrundlage: © Bayerisches **Landesvermessungsamt ...** Autobahn Salzburg - **München** Autobahn Salzburg - **München** P (P) P Bootsverleih **Hotel ...**
christian.loehnert.bei.t-online.de/alz1.pdf - Ähnliche Seiten

Etappe 1
... **Hotel** garni Märchenwald; Kräuterstrasse 39; D **...** und Literatur: Topographische Karte 1:100.000, **München** und Umgebung, Bayerisches **Landesvermessungsamt ...**
www.muenchenvenedig.de/Tourenbuch/ Etappe_1/etappe_1.html - 13k - Im Archiv - Ähnliche Seiten

[PDF]Tourenbeschreibung: www.muenchenvenedig.de 1. Wandertag: **München ...**
Dateiformat: PDF/Adobe Acrobat - HTML-Version
... Ruhetag: Sonntag ab 14 Uhr, Montag **Hotel ...** Karten und Literatur: Topographische Karte 1:100.000, **München** und Umgebung, Bayerisches **Landesvermessungsamt ...**
www.muenchenvenedig.de/Tourenbuch/ Etappe_1/Etappe01.PDF - Ähnliche Seiten
[Weitere Resultate von www.muenchenvenedig.de]

Obviously, the combined query is not possible; the first query yields results, as the nearness to the main station is directly coded in some hotels' web sites. Concerning the second, there was no useful answer: the sites relate to maps that are sold by the Landesvermessungsamt.

A solution would be that either the Landesvermessungsamt would specify some hotels in the vicinity – or there is a "service" that searches for locations (hotels) in the vicinity of an address.

Scenario

> "I want to spend my holydays in a region where I can ride my bicycle along a river, where I can visit historic villages and cities in a day trip and see monuments of the `Backsteingotik´"
>
> The expected result would be a set of route proposals that I could do with my bike.
>
> This query involves the following knowledge:

- Understand notion of “Backsteingotik” and relate it to place-names (e.g. Stralsund, Greifswald, Rostock, Wismar, Schwerin, …)
- Understand notion of “River”
- Spatial relation “along”
- Notion of “day trip”

1. “Backsteingotik” -> links to prominent cities with such historic buildings
    a. infer the location of those cities (in terms of place names, addresses, etc.)
2. “River” should be found in the vicinity of /going through those cities
    a. could be explicitly coded in web-site of city
    b. could be extracted from vector-data set by spatial query and then annotated to web site of city:
        i. presumes that the notion of “rivers going through city” is included in city-ontology
        ii. Further assumption is that a data set is available, where this information can be extracted: e.g. based on the metadata stored in a vector-data resource, it could be read that this vector-data set includes the feature class “river”; the selection of the appropriate data set could be derived from the spatial extent of the data set, also read from the metadata. This spatial extent is set into relation to the place name derived in 1a).
3. cycle tracks along the river have to be identified by a spatial query (buffer operation) – the question is where to assign this annotation to, in which ontology should it be appearing:
    a. the river,
    b. the cycle track ?
4. The distance between two cities along the cycle track has to be calculated.

Google-answer: „Backsteingotik“

Backsteingotik
www.wege-zur-backsteingotik.de/ - 1k - 22 Sept. 2002 - Im Archiv - Ähnliche Seiten

Backsteingotik in Mecklenburg-Vorpommern
... **Backsteingotik** in Mecklenburg-Vorpommern. **...** Marienkirche und die Jakobikirche der Hansestadt Greifswald sind sehenswerte Bauten der **Backsteingotik**. **...**
www.all-in-all.com/8022.htm - 17k - Im Archiv - Ähnliche Seiten

Die **Backsteingotik**, Greifswald
... **Backsteingotik** der Hansestadt Greifswald. Die Kirchen der Hansestadt Greifswald und das Kloster Eldena sind einzigartige Zeugen der **Backsteingotik**. **...**
www.all-in-all.com/1001_1.htm - 7k - Im Archiv - Ähnliche Seiten
[Weitere Resultate von www.all-in-all.com]

Second query -> refinement: „bicycle trip greifswald“

Health tips - Fitness, wellness and relaxing at MV - [Diese Seite übersetzen]
... **Bicycle** union MV. Sport and hobby at the Baltic Sea coast. Trail-Network **...** Active at the holiday country MV. Watersports at MV. All-clusive-wellness **trip** **...** **Greifswald**. **...**
www.m-v.de/social/fitness.html - 69k - Im Archiv - Ähnliche Seiten

[PDF]Five Hours of Opression
Dateiformat: PDF/Adobe Acrobat - HTML-Version
... in the Greifwald cost 1.50 Euro for one **trip** **...** use a healthy and cheap kind of transportation

- the **bicycle** ... Everyday in **Greifswald** more than 10 bycicles are stolen ... iswi.tu-ilmenau.de/gristuf/magazine/No3.PDF - Ähnliche Seiten

[PDF]BrunShine
Dateiformat: PDF/Adobe Acrobat - HTML-Version
... of the monastery (Klosterruine) are located near the **Greifswald** ... a note though that this is quite a long **trip** ... Brasil, he has crossed the Atlantic on a **bicycle** ... iswi.tu-ilmenau.de/gristuf/magazine/No2.PDF - Ähnliche Seiten

Ostseekuestenradweg 2000 - [Diese Seite übersetzen]
... their(her) construction, this aspect of the **trip** ... old Hanseatic towns Wismar, Rostock, Stralsund and **Greifswald** ... of the bikline publishing house with the **bicycle** ... www.radtourenberichte.de/bicycletours.de/ 2000/bericht.html - 17k - Im Archiv - Ähnliche Seiten

Only the last one gives hints to a cycle track through along the coast of the baltic sea (where most of those old hanseatic towns are located).

I gave it another try in german: “Fahrradtour Backsteingotik” – much better !!!

Touring by car, canoe or boat and hiking - special offers in ...
... **Backsteingotik** und Bäderarchitektur eine **Tour** ... Auf Schusters Rappen oder Aktivurlaub mit dem **Fahrrad** Angebote für Wanderungen und Radtouren ... www.all-in-all.com/english/8060.htm - 35k - Im Archiv - Ähnliche Seiten

Die Bahn - Der "Warnemünde-Express"
... Sollte jemand die **Tour** mit einem **Fahrrad** ... 2002 Ausstellung zur **Backsteingotik** Im Rostocker Kloster wird die norddeutsche **Backsteingotik** erlebbar gemacht. ... www.bahn.de/pv/angebote/regional/berlin_brbg/ die_bahn_warnemuende-express.shtml - 29k - 22 Sept. 2002 - Im Archiv - Ähnliche Seiten

Mecklenburg - Vorpommern: Mit dem Rad durch das Land (MVweb)
... ihren beeindruckenden Kirchen im Stil der **Backsteingotik** ... Restaurants zur Stärkung nach dieser langen **Tour** ... **Fahrrad**-Thurow G. Thurow 23936 Grevesmühlen, August ... www.mvweb.de/rad/routen/159.html - 28k - Im Archiv - Ähnliche Seiten

Mecklenburg - Vorpommern: Mit dem Rad durch das Land (MVweb)
... Wir beginnen die **Tour** vor dem Schweriner ... Innenstadt mit ihren wundervollen Kirchen der **Backsteingotik** ... **Fahrrad** Kather Kather 19053 Schwerin, Goethestraße 58 ... www.mvweb.de/rad/routen/158.html - 30k - Im Archiv - Ähnliche Seiten
[Weitere Resultate von www.mvweb.de]

New try: ***fahrradtour*** backsteingotik entlang fluss

Radwandern
... ließen Massen von Schwemmsand **entlang** ... Gewaltig lag der **Fluss** ... abwechslungsreiche Fahr - Rad - **Tour** ... Dezember. Mit dem **Fahrrad** ... Fachwerk und **Backsteingotik** prägen ... www.ft-preetz.de/rw.htm - 25k - Im Archiv - Ähnliche Seiten

[PDF]Weinberge, Auenwiesen und Großstädte Kulinarische Highlights im ...
Dateiformat: PDF/Adobe Acrobat - HTML-Version
... Deutschland im Zauber seiner **Fluss** ... dem Theater Heilbronn sowie **Fahrrad** ... Speisekarten der teilnehmenden Betriebe **entlang** der Schwäbischen Kartoffel- **Tour** ... www.deutschland-tourismus.de/pdf/travel_tipps_03_d.pdf - Ähnliche Seiten

[PDF] Der Eventbegriff aus verkehrsplanerischer Sicht
Dateiformat: PDF/Adobe Acrobat - HTML-Version

... Langlaufski auf Wasa-Lauf oder Engadin-Skimarathon oder mit dem **Fahrrad ...** Straßennetz für den Berlin Marathon, das außerörtliche Straßennetz für die **Tour ...** www.eventverkehr.de/datpdf/ events_zwischenbericht_Kurzform.pdf - Ähnliche Seiten

This query obviously was too complicated: only sites where the words occurred were presented – however not related to the spatial relation (track near river).

What is needed ?

Obviously, Google does worse with complicated queries, i.e. queries, where the result cannot be inferred from one site alone. Thus it would be necessary to combine more web sites (e.g. infer locations of "Backsteingotik" (or "big cities in Japan") from some web-sites and later re-formulate a query based on the result of the first (as Benedicte did in her example when decomposing the query into 3 different sets)).

Then there is definitely a lack of capabilities concerning the spatial relations (uff, that's good, since we want to do this in SPIRIT): some frequently used spatial relations are coded (e.g. the vicinity of hotels), however relations like closeness to river, to Italian restaurant, … are not explicitly coded.

9.8. Scenario 7

UPPER PETACA

Tres Piedras , NM (New Mexico) Sep 29th 2002 there is fire outbreak in the Upper Petaca.
The Upper Petaca is located 5 miles north of Tres Piedras and 3 miles west on Forest Road 576 The fire on the 1200 acre calls for immediate attention Smoke is visible from the communities of Tres Piedras and Taos during the burn.

I want the details about all the neighbouring communities of Tres piedras and Taos, with population density details, nearest national highways, communication facilities, Nearest water bodies.Nearest Railway Stations, Nearest Airports.

Use Case for Spirit:

1. the interface proposes the inputs what , where ,which . I enter Upper petaca,in what input and where i put Tres Pierdas, which i enter " of New Mexico"
The system should try to retreive the searches ,with an and operation or or operation the details of this region . Upper Pierdas is looked for in the thesaurus of places it should display a list of resultsets. and prompt the user whether he wishes to refine his search with input of specific ontologies for the search.

I feel the Initial Search Interface should answer some of these questions and then get into the specifics of ontologies--

Different Questions to reach to a place (to gather spatial information orally)

1. Where ? where is it located
2. which ? for specification (duplicate names of cities
eg we have hyderbad in india and hyderbad in pakistan)
3. How Best can i reach there ?
4. what is its Nearest Location ? (Near)
5. how far is it from a landmark ?
6.Directions ?

Google Search Querie
Near Upper Petaca + Tres Piedras

****
... acres; Dry Lakes I Project near Tres Piedras ... Petaca/Las Tablas Project near Petaca ... Camp,
1876 acres; Dollar Project near ... On the upper right column, click ...
www.swstrategy.org/library/Nexus%20NM-3%2006152001.htm - 25k - Cached - Similar pages

ENVIRONMENTAL ASSESSMENT NM-020-01-037 GRAZING PERMIT RENEWAL FOR ...
... The Upper Rio Grande basin contains ... developed recreation sites on or near ... The soils
include the Hernandez-Petaca ... Precipitation, The NOAA data (Tres Piedras ...
www.nm.blm.gov/www/tafo/tafo_grazing_ea/ EA_allotment_873.htm - 45k - Cached - Similar pages

[PDF]ENVIRONMENTAL ASSESSMENT NM-020-01-037 GRAZING PERMIT RENEWAL FOR ...
File Format: PDF/Adobe Acrobat - View as HTML
... The Upper Rio Grande basin contains ... developed recreation sites on or near ... The soils
include the Hernandez-Petaca ... Precipitation The NOAA data (Tres Piedras ...
www.nm.blm.gov/www/tafo/tafo_grazing_ea/ EA_allotment_873.pdf - Similar pages

ax03228i.aw
... providing turkey nesting habitat near water ... Red Mesa project area is Upper Petaca ... about
4,232 acres of the upper ... 2 miles southwest of the Tres Piedras ...
www.fs.fed.us/r3/carson/planning/ scoping_letter_05_23_02.htm - 70k - Cached - Similar pages

[PDF]Summary of Purpose and Need For Action
File Format: PDF/Adobe Acrobat - View as HTML
... habitat, * providing turkey nesting habitat near ... Red Mesa project area is Upper Petaca ... about
4,232 acres of the upper ... 2 miles southwest of the Tres Piedras ...
www.fs.fed.us/r3/carson/planning/ scoping_letter_red_mesa_5_23_02.pdf - Similar pages

Untitled
... minutes for the birds Bill West had had near ... 2 just west of Tres Piedras ... It showed
a buffy upper breast and relative ... 4 about a mile north of Petaca (Rio ...
members.aol.com/oldenet001/FNSummer01.html - 101k - Cached - Similar pages

Abstracts by Jim Reynolds and others
... Hornblende from Rio de las Piedras ... a transgressive sequence (fluvial Petaca ... Los Eucaliptos
319, B° Tres ... one from the west side near ... was thrust over the upper ...
tornado.brevard.edu/reynoljh/ vita/reynolds_abstracts.html - 70k - Cached - Similar pages

[PDF]NEW MEXICO-3116
File Format: PDF/Adobe Acrobat - View as HTML
... No one wants to see a landowner and a hunter get into a fight and cause injury
to each other over damage to property or camping near a waterhole. ...
www.gmfsh.state.nm.us/PageMill_Images/ Publication/wildlifenews11-2001.pdf - Similar pages

9.9. Scenario 8

Sandrine's scenario

I am planning to spend some holidays on the Mediterranean coast of France or Italy. I would like to reside in a big city (i.e. with restaurants and shops and many things to do) to occupy my evenings. And I would like to practice windsurf in a place nearby but not in the city itself where I expect to find too many tourists during the day.
As a result, I expect the URLs of : sites proposing hotels to stay in relevant cities, sites proposing renting of windsurf in places nearby, and I would like that the places concerned by these sites appear on one map.

1) The query I submit to SPIRIT is "hotels in big cities on the mediterranean cost in France Italy"
SPIRIT site undertakes two parallel actions depicted below in 2) and 3). The action depicted in 2) is fast, the action in 3) is slower. If the action 2) is enough for the user, the action 3) is suspended.

2) The query is sent as such to Google (or Glass)
→ As a result, Google proposes several sites about travelling in south of France, about the region Languedoc Roussillon, about the city Nice.

3) The query is interpreted by SPIRIT as following :
what : hotels
where : (in big cities)AND(on mediterranean cost)AND(in France or Italy)

SPIRIT translates the "where" into names of cities and proposes the cities on a map. I select the city Nice
SPIRIT send the query "hotels Nice" to Google (or Glass).

4) Then I submit the query "windsurf renting near Nice" to SPIRIT
Like before, SPIRIT undertakes two parallel actions.

5) The query is sent to Google (or Glass) as such

6) SPIRIT interprets the query :
what : windsurf renting
where : near Nice
SPIRIT asks me to specify what I mean by "near" by specifying among the following choices:
within a ..mn walk distance, within a …mn driving distance, within ….km
I specify "within a 20mn driving distance".
SPIRIT displays a map of villages around Nice. I select the villages near the sea.

For each selected village, SPIRIT sends the corresponding queries "windsurf renting nameOfTheVillage" to Google (or Glass).

If there are answers, SPIRIT puts on a map symbols corresponding to the activity windsurf renting, located on the villages and linked to the corresponding Web sites.

If there are no answer, SPIRIT looks through its ontology of activities to find other activities attached to the geographic area mediterranean cost. It finds: diving, sailing. It proposes me to look for Web sites supporting these activities, I select diving…

9.10. Scenario 9

Bénédicte's scénario

Ben would like to discover Japan. For her first trip there, she would rather stay in big cities. She is looking for info to set up my holidays -decide about which city to stay long and maybe switch on to other cities….

1) Initial query expression

She expresses her query through the interface as a set of keywords : "holidays big cities Japan".

→ SPIRIT site undertakes two parallel actions depicted below in 2) and 3). The action depicted in 2) is fast, the action in 3) is slower. If the action 2) is enough for the user, the action 3) is suspended.

2) Google like response

SPIRIT sends the keywords query, as it is, to google.
The answer is very quickly displayed on one frame of SPIRIT server. One this frame, SPIRIT displays also a map of Japan and its neighbour and draws a link between each resource and the places which names appear in the description provided by google :

- ANNUAL CALENDAR: AUGUST -
... is the Bon odori (dance), which is held throughout Japan. ... The beginning and end of the Bon holidays are ... and expressways leading in and out of big cities ...
- Social Life
... in Tokyo and other big cities ... of the nation's 3,400 professionals are big ... In addition, Japan regularly participates in ... Related Statistics Holidays per Year (1984 ...
- ACE-Asia Information Bulletin: COMMUNICATIONS - Japan -
... on weekends (Saturday and Sunday) and national holidays ... at airports, hotels, and major office centers in big cities ... KDD by dialing 0051 from anywhere in Japan ...
- TRAVELSPOTS- Travel and Vacation Holidays: Japan
- Secrets on Teaching English in Japan in smaller cities, but in the big cities ... ads in the Monday edition of The Japan ... Working for a big chain school may or ... will you be working on national holidays ...
Description: Offers insights on finding work and teaching in Japan.

It is important that SPIRIT search engine keeps at least the efficiency of google, and proposes more services if the user has time and is not satisfied by google.

This answer is quite full of parasite sites.
Maybe because there are too many words in the query ?
Ben has an idea whether a site is relevant to her query or not just by reading the description provided by google.

3) SPIRIT reformulation of the user query

Meanwhile doing this, another frame of SPIRIT site tells Ben that the system is interpreting the query to enhance the retrieval process.

Thanks to its ontologies SPIRIT search engine makes the following inferences to interpret the keywords in to different forms.

The ontology are used to attach meaning to the query (translate the words into concepts).

- the first form is a structured user query. The ontologies allows SPIRIT to infer that : "in+Japan" is a place, "cities" is a type of place and a type of entity, "holidays" is an activity which maybe decomposed into sub activities (travel from place to place, stay in one place, do tourism in one place), each activity needs specific content for support, e.g. travel needs transport, stay needs hotels, stay needs city map, do tourism needs museum,…. The structured user query is :
{wanted activity = to spend holydays,
general keyword = tourism,
spatial relationship 1= (wanted activity, is_ inside,location1),
location1="big cities in Japan", needed content1 = transport, spatial relationship 2= (neededcontent1, to, location1),
needed content2=museum,
spatial relastionship3=(needed content2, inside, location1) …….}

- the second form is several sets of keywords :
set1 = {tourism, hotels, museums, transport, Tokyo}.
set2 = {tourism, hotels, museums, transport, Osaka}
set3 = {{tourism, hotels, museums, transport, Japan}
And thanks to its ontologies, SPIRIT generates other sets of keywords with synonymous keywords.

These answers are better than the preceding ones.

These sets of keywords are sent to the google search engine that sends back a set of resources.

Answer to set1 : • Access-Able Links Results -
... Accessible Tokyo This online guide provides access information ... and EMPLOYMENT for the disabled in the tourism ... It covers hotels, museum, transport ...
• Hugh's Asia Travel Guide -
... South Thailand Koh Samui (maps/transport ... Tokyo Slides Photo Gallery. General Information: Maps HK Tourism Board Hotels ... Guide Hotel and travel guide Museum ...
Description: A guide to travel sources and country information for Southeast and East Asia.
Catégorie: Regional > Asia > Travel and Tourism > Travel Guides
• Auckland hotel review - Auckland hotels in Newzealand and hotels ...
... malaysia hotel australia hotel tokyo ... museums, theatres, five star hotels ... Auckland Zoo, and the Museum of Transport ... [more travel informations and tourism ...
• KIAT.NET - Destination Guides - Asia-Pacific -
... Bali, Indonesia Travel Portal @ Indo.Com - Hotels ... Indonesia; The Best of Bali; Tourism ... Tokyo Motor Show; Tokyo National Museum; Tokyo Tower; Transport ...
• Japan Travel Guide -
... dining,drinking hotels,shopping,transport. ... Guide; Osaka Tourist Guide; Tourism ... Weather; Transportation; Nipponroom/Hotels. ... Mount Fuji(2). tokyo; National Museum; ...

Answer to set2 : • Japan Travel Guide -
... dining,drinking hotels,shopping,transport. ... Osaka Tourist Guide; Tourism ... Dining Out; Dining Osaka; ... Weather; Transportation; Nipponroom/Hotels. ... 2). tokyo; National Museum; ...
• KIAT.NET - Destination Guides - Asia-Pacific -

... Travel Portal @ Indo.Com - Hotels ... The Best of Bali; Tourism ... Prefecture; Osaka City Homepage; Osaka ... Motor Show; Tokyo National Museum; Tokyo Tower; Transport ...

…and so on

SPIRIT selects in each set of resources provided by google, the ones matching the more the specificity of the queries (here the placename) and presents the selected resources to the user. There again it uses the map of Japan to highlight to which places refers the description given by google about the Web site.

NB : Up to there, SPIRIT has not interpreted the resources content or used specific metadata like coverage. It has only interpreted the query to generate a better set of keywords.

4) User query refinement

If the user is neither satisfied by the process 2) nor by the process 3), SPIRIT presents to the user how his query has been interpreted :

you want information content to support the activity "spend holydays"
we think this content is : touristic information, museums, street map, hotels and transport
You want each of these information to be related to the places : Tokyo, Osaka, Japan
So we submitted the following keywords-query to google : {...}
[NB : the structured query is presented graphically thanks to a semantic graph and a map]

The user may :
- modify each elements in this structured query (activity, content,
relationships between content and places),
- suppress or add keywords in the sets,
- and valid.

→ Again there are 2(?) different strategies undertaken by SPIRIT to treat the query refinement : 5) and 6). Both strategies may be performed in parallel so that if the quickest yields a satisfying answer, SPIRIT suspends the other.

5) Modification of the sets of keywords and go back to step 2)

If the user did not modify the structured query but just modify the list of keywords, SPIRIT refines the structured query thanks to the new keywords, which modify in return the sets of keywords.
If the user did modify the structured query it might be interpreted as a transformation of the set ok keywords. For instance if the user valids the relationship museums in Tokyo but suppress the relation museum in
Osaka, "Osaka" is suppressed from set2.....*and so on*
Go to 2)

6) Use of SPIRIT (annotation) metadata database to refine the query.

SPIRIT generate an operational query (?formal query) that may be computed by the DBMS of its (annotation) metadata database.

This database records metadata about Web document or geo data, not all of them but the set that have been already documented. These metadata are ISO19115-like or DublinCore-like metadata, they have meaning.

The query is {metadatasets/coverage is included in.., keywords contains …,...}

If the query yield a result from the SPIRIT metadata database, then SPIRIT proposes the resources to the user.

If the query does not yield result, SPIRIT decides to increase its
metadata database. Therefore, it selects from the answers yielded by google all resources it has in his terabyte (on the long term, SPIRIT might actually retrieve randomly some resources from the answer). Then it performs data interpretation (textual or not) to document the metadata coverage etc.
Then it sends its operational query to the increased metadata database and sends the results to the user. In the presentation of the results, SPIRIT may specifies which resources have "enrichment" annotation metadata. these metadata provide useful info about the resource to help the user understand and exploit it.
For instance, it may specify that a Web site as a map in it and the metadata regarding this map (features...)

9.11. Scenario 10

Tim's Archaeological Web Excavation

A researcher called Tim will attend a conference in Rome, and would like to combine the trip with a few days of vacation. So he is interested in locations close to Rome that fit with his wishes and interests for vacation. Tim is interested both in nature and culture. However, Rome itself he has visited before. He has a quite vague idea of what he really wants and just wants to get a better idea from browsing the Web.

Easy query, normal search engine

So he asks a search engine in the first place for national parks in Italy. This leads to a Web site listing Italian national parks, which is sufficient for Tim because there are not that many national parks. Google would locate such a Web page easily too.

Next Tim looks for archaeological sites in Italy. However, there appear to be too many of them, so he makes his query more specific by asking for the greater Rome area (central Italy, in the neighborhood of Rome, …). Besides, Tim would really like to find the major archaeological sites, and not inside Rome itself.

Extra information requested by SPIRIT

The SPIRIT interface allows the input of a spatial relationship like "neighborhood", and maybe asks what the region of interest for the specified neighborhood is. The distance of interest is set to 100 km by Tim. However, still the sites in Rome itself pop up first. Then Tim decides to use the answer to the national park query and the clicking interface, to ask for archaeological sites within a certain distance from the selected national park that was shown on a little map after the query. So in his next query, he types the terms archaeological site, and to specify location, he clicks on the park. Although Tim queries with the words "archaeological site", he also finds links that don't contain these terms, but contain "Roman terms" and "amphitheatre". In the advanced user interface, he adjusts some weight settings to balance closeness to the location that was clicked, the closeness to the query terms, and the relative importance of location and terms.

Clicking interface to specify location in the query

The ontology specifies that "archaeologic(al)" is closely related to "amphitheatre", etc.

Balancing relative importances for the ranking

9.12. Scenario 11

Task

Mike is a geography teacher and keen mountaineer from Scotland. He has climbed in the French Alps but never in Switzerland. He is used to using the Internet as a source of information for avalanche forecasts and weather information for Scottish winter climbing.

Uses the internet already

Mike wants to go on a trip to the Swiss Alps with his family. He has heard from a friend that there is some nice mountaineering near a place called Aigle, and also some pleasant walks that he could do with his children (who are aged 7 and 9 respectively).

Knows a rough location, not exact. Wants to do a mixture of things.

He wants to book a chalet to stay in with his family, and also get information about mountaineering routes, rock climbing and hiking in the area. Since he won't have access to the Internet on the trip he wants to find out before he goes a good local source of weather information.

Wants to book a chalet. Find info. about climbing and weather. No internet access on trip.

He would like to use huts rather than camp in the mountains so would like to choose some routes based on local huts, and thought it might be fun to take his family to stay in one.

Wants to use mountain huts. Can he take his children.

One mountain he has heard of is called Les Diablerets.

Has heard of a mountain name.

He would also like to take some pictures of glaciers for teaching in his school at home and wondered if any research was being done in the general area.

Wants to find places where he can take pictures and see if anyone is doing research.

Process

Mike enters the SPIRIT system and gives the geographical information he knows – Aigle, Switzerland and Les Diablerets. He indicates that he thinks Les Diablerets is a mountain and Aigle is (he thinks) a nearby town.

A Google search here returns the ski resort of Les Diabrets and accommodation info

The system returns him a map with the objects he indicated highlighted and a list of the concepts associated with Les Diablerets (skiing, mountain?, accommodation, village, trains). He indicates on the map the geographical area he is interested in and the concept – mountaineering in the first instance.

Google can't do this – the map allows him to indicate the place and concept he is interested in as separate ideas – not the same idea. The gazetteer indicates a hierarchy of classifications for information he wants spatially, and the ontology finds analogous concepts – e.g mountaineering and climbing.

Now he can search for the information he wants

using the spatial concepts he knows and the concepts he is interested in. The gazetteer sequentially looks at broader scale spatial concepts when he makes a search. For instance when he asks for weather information for Les Diablerets he is given information about Les Diablerets, Vaud, and then since Les Diablerets lies on a canton boundary also about Vaud and the neighbouring canton Valais. Finally he is given weather information for the region “North of the Alps” and then Switzerland.

SPIRIT knows something about spatial concepts and their relationships – and uses this to build a hierarchy of information about an idea. Weather is a nice example since at the local level there is unlikely to be a real source, though we might find something, and as we move to broader scales we find differing (and more or less useful) information.

9.13. Scenario 12

SPIRIT Scenario — Planning a Bicycle Trip to the Black Forest

A desperately construed scenario which should nevertheless allow to 'visualize' some functions of spatially enabled query, useful in getting to know an area and make inferences and plans about it.

Robert Weibel / 30 September 2002

Narrative	Assumptions	Open issues / Questions
Juliette and Marc-Antoine are a happy young couple from Paris, and fond bicyclists. Both are high-school teachers, and since they believe in the use of ICT in teaching, they have a computer with ASDL connection at home which they regularly use to retrieve information from the web that they can use in their teaching.	Users are computer and internet literate. They are typically people with a solid education and a keen interest in other places, sports and culture. Though not themselves IT specialists, they see IT as an opportunity and use broadband internet connections.	Is bandwidth an issue? Are mobile devices allowed?
They like to spend their vacations doing bicycle trips. As a rule, they are visiting the home countries of former Tour de France winners. They have already been to Texas, the home of Lance Armstrong. So, this year, it's 1997 winner Jan Ullrich's Germany. They search Google for 'Jan Ullrich', and, sure enough, they find his homepage www.janullrich.de. Jan Ullrich even lists his place of residence on his homepage: a village called Merdingen in the Black Forest.	SPIRIT must be more than Google as far as geographic search is concerned.	
Juliette's aunt is married to a German and Juliette remembers eating Black Forest Cake when she was visiting her aunt as a child. She didn't know, however, that this was also a place name, which the information given on Jan Ullrich's homepage does seem to suggest. Juliette would like to know more about that region, where it is and how large it is. She tries her favorite map services, www.mapquest.com and www.map24.com. However, both of them don't provide this kind of information; they require an address query. A Google search for 'merdingen' brings her to the www.merdingen.de, the homepage of the town of Merdingen (not maps, but pictures of Jan Ullrich at some local fun race…). Again through Google, looking for 'black forest' she finds www.schwarzwald -tourist-info.de, a portal with informations for tourists but	SPIRIT must be more than conventional map services as far as geographic search is concerned. Language is an issue also (and perhaps particularly) for geographic names. It must be possible to find SPIRIT through other search engines. SPIRIT should provide links	How do we deal with cross-language issues in ontologies and gazetteers? How do we ensure that the SPIRIT service is easily found by those not knowing it? Are these links provided by (tbd) industrial partners, and might some of them even charge a premium?

no maps. (Did Juliette speak German, she would have searched for 'schwarzwald' and would have found www.schwarzwald.de, a German language portal for tourism services, but with a nice little map of the Black Forest region; see below.)	to information related to geographic regions and places, as well as footprint maps and pictures of geographic entities.	Do our ontologies provide abstraction hierarchies?
Hence, Juliette asks Google for 'geographic location search' and finds a service called SPIRIT. Using the 'region footprint' feature of SPIRIT, the delineation of the Black Forest is found. Juliette and Marc-Antoine can now see that the Black Forest is called 'Schwarzwald' in German, that it is a geographic region in the South of Germany, in the State of Baden-Württemberg, and that it is not an administrative unit (but made up of several administrative districts, called Kreise). SPIRIT also provides loads of links to other information about the region, along with pictures which allow them to get a first impression of the area. It does indeed look pleasant there, with some exciting topography for bicyclists. Now, they are definitely convinced that this should indeed become a worthwhile trip.	Semantic net display of related terms for geographic entities. SPIRIT handles visualizations of variable granularity in the spatial/geographical as well as semantic sense. SPIRIT must definitely be better than text-based search engines, by enabling to make spatial inferences. SPIRIT allows to make spatial queries that involve topological as well as (geo)metric relations.	What are the things that SPIRIT does different and better than Google & Co.? We need to clearly spec this out. How extensive should the mapping cabapilities be? Can we not make use of existing mapping services through APIs, like we intend to do for the search engine functions through the Google API ?
And SPIRIT does more than just produce maps of an area. Because it is driven by a spatial ontology, it can display a semantic net of geographic entities that are semantically (and spatially) related to 'Black Forest'. Both the geographic map visualization as well as the semantic net visualization can be navigated horizontally (on the same level of granularity or scale) as well as vertically (coarser / finer levels of granularity). Juliette and Marc-Antoine are now definitely thrilled by the capabilities of SPIRIT. They start looking for route information on bicycle routes. Initially, they had intended to do this through Google, but since they are convinced by the apparent features of SPIRIT for geographic search, they decide to stick to it and try there. And SPIRIT doesn't let them down. The town of Merdingen is already a given on their trip; so, they decide to first ask for routes connecting to this place. This seems to be a small place,	SPIRIT should allow to make inferences about spatial relations as well as as visualize them, so the user can gain a better understanding of the portion of geographic space that he/she is interested in. It would be beneficial if we	Again, is it safe to assume that we link up to services such as map24.com through their API (see question above)? – If this was our aim, we would have to come into an agreement with the service provider of map24, a company called Netsolut (www.netsolut.com).

as it is only connected by small county roads (K4929, K4930, K4979). (All the better: You don't cycle on motorways if you can avoid it.) To find out more about the surroundings, Juliette and Marc-Antoine ask SPIRIT for 'populated places > 5,000 inhabitants up to 50 km from Merdingen'. They enter this query through a query interface that allows them to compose spatial queries in an intuitive way (menu-driven, but not via natural language). As a result, they find Freiburg (im Breisgau) and Breisach, along with a few other smaller cities. Using the maps of SPIRIT and the built-in zooming/panning capabilities, they soon are able to gain a picture of the region: Merdingen is not really located in the hilly and mountainous part of the Black Forest; it is located at the edge of the Upper Rhine Valley plain. The city of Freiburg lies some 8 km to the east, at the foothills of the Black Forest (which extends further to the east). With this enhanced understanding of the area, it becomes easy for Juliette and Marc-Antoine to decide how they should plan their trip. They decide to spend a couple of days in Freiburg (which seems to be a pretty city, guessing from the pictures provides on the official city tourism website), make a 'detour' to visit Merdingen as well as a few day trips to the hills of the Black Forest. After that, they plan to spend another few days in the higher parts of the Black Forest, in Titisee (Lake Titi), and perhaps even take short trips to Switzerland (e.g. to a fabulous town called Hallau, east of Schaffhausen).

For detailed planning of the trip, they find that SPIRIT is not really the best place to look for such information. It is not really geared towards locator and route maps. However, in tandem with www.map24.com, route planning becomes easy, with map24 delivering the detailed route maps (with excellent zooming facilities) and SPIRIT taking care of the spatial and semantic linkages.

Perhaps if Jan Ullrich had SPIRIT, he could win the Tour de France again?

tried to team up with a mapping service. Map24 (driven by technology developed by www.netsolut.com) provides probably the best mapping service (in terms of cartography) as well as APIs and hence might be a natural partner. Just like Google for the search engine part.

Is it possible already today (without SPIRIT) to find out about the ware-abouts of the Black Forest?

Yes. it is. However, it is really painful and you might get a completely wrong idea, depending on which website(s) you end up on. It is also close to impossible to find a delineation (footprint) of the region. Most often, what you find is road maps that somewhere have the name 'Black Forest' or 'Schwarzwald' written on it – amidst zillions of city names, road numbers etc. Given that the Black Forest is a rather important tourist region, it is quite surprising that it would be so hard to get good visualizations today. Apparently, most providers are mainly interested in providing links to tourist sites, which themselves mainly push hotel reservation services, city tours, etc.

Also of note: The Black Forest seems to be a nice example of competing portal providers (frequent in the tourism domain) that use similar names and offer services and content of very variable quality – and of course never link up to their competitors (who may actually be different administrative units, such as different cities, counties, provinces, etc.). Some examples: www.schwarzwald.de, www.schwarzwald.com, www.schwarzwald.net, www.schwarzwald-tourism-info.de etc. etc. etc.

The best I could find in terms of region delineations of the Black Forest are the maps below.

This one I found on http://www.schwarzwald.de/d/fr_info.htm. In order to get there through Google you have to ask for 'schwarzwald' not 'black forest' (unless you want to scroll down to hits that are considered less relevant). So, you have to know German or you have to use a translation service such as www.dicdata.de.

This one I found it on http://www.schwarzwald.com/karte/index.html. Again, the magic word was 'schwarzwald'.

9.14. Scenario 13

Tony Jackson's Scenario

Tony Jackson is working for a bank in Newport (Wales, U.K.) for the last five years. Tony is interested in changing his career and moving over to academics. He has always been interested in pursuing a research-based qualification, but had to postpone it in the past for various reasons. Tony has a fairly good idea about his *future research area*. He keeps visiting relevant web sites and is aware of the leading academics/researchers in his field of interest. In the last five years Tony has got married and has a two-year-old son. Tony's wife was working as a nurse in the local hospital but her contract has just ended. She needs to find a job soon so that she is able to partly fund Tony's fee and pay other bills!

Tony will have to leave his job if he has to register for a full-time Ph.D. Tony want's to go to a reputed university within U.K./Europe (he has clear idea in ranking a university), but his move is based on his wife finding a good job in that city. Other criteria for him in making a selection are:

- House Rent for a two-bed room house and distance from the university
- Child care facilities (Cost and distance from the chosen rented accommodation)
- Hospitals/Health centres that may offer job to his wife

Tony is trying to arrive at a decision by going to various web sites and record his results in the following table:

University Name and Tony's Rank	**U1**	**U2**	**U3**
Tony's University Rank	3	7	6
Distance of Accommodation from the University Campus (Km)	23	41	14
Distance of Nursery from the Accommodation (Km)	8	6	11
Number of Hospitals where Tony's wife may get a job	7	3	2
House Rent (£)	500	450	375
Nursery fee (£)	400	420	300
Tony's Overall Rank	2	1	3

Tony knows that he has to search very hard on the web by using different search engines and criteria. Then one day he visits the SPIRIT web site and is relieved to know that some one may know exactly what his search criteria are. Can SPIRIT help Tony to create a comprehensive table for a range of universities?

9.15. Florance scenario

This scenario was collected at IGN from by interviewing a person who daily works with geographical information. Despite the fact that it cannot be used in SPIRIT as one of the core scenarios since it requires the fusion of data SPIRIT cannot have, we considered it important to be included to give a view of the commercial possibilities.

Florance works at XX IGN please fill XX . Her job is to provide analysis on the economical or social trends of regions or areas. She has just received a request from the city council of Paris to analyse the distribution of retailers and commercial activities in a particular road.
Bus drivers reported persisting problems in crossing a certain area specially at certain time of the day; Florance task is to check if there is any relation between the types of shops that are located in the area and the traffic problems reported by the drivers. To decide if and which actions have to be taken the city council needs all the information.

Florence starts her job by connecting with the main database and searches for the road she is interested into. When the map is displayed she explores the shops and activities that are located along the road especially in correspondence of the crucial points as crossing and bus stops. She can do this action by simply clicking on the little boxes representing the shops on the map since the geographical information (the map) is enriched with economical information (the shops).

Following the bus route Florance explores all the roads and marks on the map the critical areas. The highlighted points on the map allow Florence to identify if the problems reported by the drivers are all referred to specific areas and which type of activities is done in those places.

When the bus route has been completed, Florance has a map with areas of potential problems highlighted. She now looks for evidence of an effective relation between the type of shops and the traffic problems by searching for similar condition, that is to say bus routs along roads with that type of commerce. She indeed discovers that a tobacco shop in the corner of the street closed to a bakery have caused traffic problems in another bus route.
Florence finishes her task by writing the report for the city council.

10. Appendix B – The Final Scenarios

10.1. Juliette & Marc-Antoine

Juliette and Marc-Antoine are a happy young couple from Paris, and fond bicyclists. Both are high-school teachers, and since they believe in the use of ICT in teaching, they have a computer with ASDL connection at home that they regularly use to retrieve information from the web that they can use in their teaching.

Users are computer and internet literate. They are typically people with a solid education and a keen interest in other places, sports and culture. Though not themselves IT specialists, they see IT as an opportunity and use broadband internet connections.

They like to spend their vacations doing bicycle trips. As a rule, they are visiting the home countries of former Tour de France winners. They have already been to Texas, the home of Lance Armstrong. So, this year, it's 1997 winner Jan Ullrich's Germany. They search Google for 'Jan Ullrich', and, sure enough, they find his homepage www.janullrich.de. Jan Ullrich even lists his place of residence on his homepage: a village called Merdingen in the Black Forest.

Juliette's aunt is married to a German and Juliette remembers eating Black Forest Cake when she was visiting her aunt as a child. She didn't know, however, that this was also a place name, which the information given on Jan Ullrich's homepage does seem to suggest.

Juliette would like to know more about that region, where it is and how large it is. Hence, Juliette asks Google for 'geographic location search' and finds a service called SPIRIT.

It must be possible to find SPIRIT through other search engines.

Juliette goes to the SPIRIT page, a special service to search geographical information on the web. The SPIRIT interface has organized slots to push the user specifying the query as much as possible. Juliette types fills only two fields of the many offered:

An hypothesis of structured interface; the layout is sketched in Appendix C.

- COUNTRY: Germany
- OTHER: Black Forest

Using the 'region footprint' feature of SPIRIT, the delineation of the Black Forest is found together with basic information about it. As a result SPIRIT displays the map of the Black Forest region and the data related: German name, area covered, main cities, type of roads, and so on.

SPIRIT should provide links to information related to geographic regions and places, as well as footprint maps and pictures of geographic entities.

Juliette and Marc-Antoine can now see that the Black Forest is called 'Schwarzwald' in German, that it is a geographic region in the South of Germany, in the State of Baden-Württemberg, and that it is not an administrative unit (but made up of several administrative districts, called Kreise).

Semantic net display of related terms for geographic entities. Does our ontology provide abstract hierarchy?
Support visualizations of variable granularity in the spatial-geographical (zoom in&out) as well as semantic sense (cities, regions, rivers, …).

SPIRIT also provides loads of links to other information about the region, along with pictures which allow them to get a first impression of the area. Since SPIRIT searches geographical items using names in different languages, pages in more than one language can be retrieved. Indeed SPIRIT retrieves in this case pages in English and German.

SPIRIT complements map and links with pictures.

Juliette and Marc-Antoine browse through the pictures and the general links. It does indeed look pleasant there. Manipulating the map they discover some exciting topography for bicyclists. Now, they are definitely convinced that this should indeed become a worthwhile trip.

The spatial ontology connects semantic net of geographic entities (e.g. the bicyclist maps) that are semantically and spatially related. Both the geographic map visualization as well as the semantic net visualization can be navigated horizontally (on the same level of granularity or scale) as well as vertically (coarser / finer levels of granularity).

Juliette and Marc-Antoine are now definitely thrilled by the capabilities of SPIRIT. They start looking for route information on bicycle routes. Initially, they had intended to do this through Google, but since they are convinced by the apparent features of SPIRIT for geographic search, they decide to stick to it and try there. And SPIRIT doesn't let them down.

The town of Merdingen is already a given on their trip; so, they decide to first ask for routes connecting to this place.

Can we consider a set of key info to be displayed with the map as commands so that is the user clicks on those the set is highlighted? For example an icon with a bicycle would highlight bicycle roads and renting points (this by using geographical and semantic knowledge).

CITY: Merdingen
TRAVEL: roads
ACTIVITY: cycling

This seems to be a small place, as it is only connected by small county roads (K4929, K4930, K4979). (All the better: You don't cycle on motorways if you can avoid it.) To find out more about the surroundings, Juliette and Marc-Antoine ask SPIRIT for 'populated places > 5,000 inhabitants up to 50 km from Merdingen' in this way

Can the map be partitioned so that the "surround search" is done graphically and not textually? For example the user can select a point and by moving the mouse over a region a label appears with the indication on how far this is from the selected point.

They enter this query through a query interface that allows them to compose spatial queries in an intuitive way (menu-driven, but not via natural language). By using the one sketched in Appendix C the query might look like this:

CITY: small
OTHER: 50 Kilometres from Merdingen

As a result, they find Freiburg (im Breisgau) and Breisach, along with a few other smaller cities. Using the maps of SPIRIT and the built-in zooming/panning capabilities, they soon are able to gain a picture of the region: Merdingen is not really located in the hilly and mountainous part of the Black Forest; it is located at the edge of the Upper Rhine Valley plain. The city of Freiburg lies some 8 km to the east, at the foothills of the Black Forest (which extends further to the east).

With this enhanced understanding of the area, it becomes easy for Juliette and Marc-Antoine to decide how they should plan their trip. They decide to spend a couple of days in Freiburg (which seems to be a pretty city, guessing from the pictures provides on the official city tourism website), make a 'detour' to visit Merdingen as well as a few day trips to the hills of the Black Forest. After that, they plan to spend another few days in the higher parts of the Black Forest, in Titisee (Lake Titi), and perhaps even take short trips to Switzerland (e.g. to a fabulous town called Hallau, east of Schaffhausen).

For detailed planning of the trip, they find that SPIRIT is not really the best place to look for such information. It is not really geared towards locator and route maps. However, in tandem with www.map24.com, route planning becomes easy, with map24 delivering the detailed route maps (with excellent zooming facilities) and SPIRIT taking care of the spatial and semantic linkages.

10.2. Sandrine's Scenario - 1

This scenario is the revised version of the scenario number 6 described above. The description of the internal mechanisms have been here removed in favour of a better description of the interaction. A sketch of the interface is in Appendix C.
A scenario similar to this one follows; it presents Sandrine interacting with SPIRIT in a different way: the maps have a central role in the search while the text typed in is greatly reduced.

Sandrine is planning to spend her holidays on the Mediterranean coast of France. She would like to stay in a big city (i.e. with restaurants and shops and many things to do). Sandrine wants also to practice her favourite sport, windsurf, in a place nearby but not in the city itself where she expects to find too many tourists during the day.

Would SPIRIT be able to parse an input like "hotels in big cities on the Mediterranean coast of France"? It means that SPIRIT has to be able to separate the geographical request, i.e. cities on the Mediterranean coast of France, from the non-geo, i.e. hotels. Here I assumed two separated actions.

Sandrine knows SPIRIT is a special Web search engine for tourism in Europe so she connects with the site. The interface is very simple and on the interface she types:

big cities on the Mediterranean coast of France

SPIRIT processes the query and present as a result a map of the south of France with the cities for which information has been retrieved highlighted. Sandrine looks on the map and browses around clicking Marseille, Toulon and Nice. Clicking on the map shows information on the selected city, thus Sandrine can now decide that Nice is the place where she wants to spend her holidays.

Next step will be to find an hotel in Nice. Sandrine types

hotels in Nice

SPIRIT asks to better specify "in Nice" by proposing Sandrine to select one of the two options:

- In the city of Nice only
- In the city of Nice and in its surround

The query "hotels in Nice" should be interpreted with the strict meaning, thus excluding those that are nearby. If so, should the interface display a warning?
How should the query "near Nice" be interpreted? Is Nice included or excluded from the search? In other words, should SPIRIT retrieve document on windsurf renting both in Nice and around or should the city be excluded?
No idea on what can be the standard behaviour of users.

Sandrine selects the first option and SPIRIT returns a list of hotels organized by number of stars. Brushing on the names Sandrine can see where those hotels are located on the map of Nice, now displayed.

Sandrine brows around for a while clicking on the retrieved hotels to see their websites. There is one she particularly likes so she books on-line a room from the hotel website.

Now Sandrine wants to book also a place at the seaside where she can practice windsurf. She types:

windsurf renting near Nice

The user interface offers a single space for input, not a structured one as for the Juliette&Marc-Antoine scenario.

Again SPIRIT asks for explanation for properly resolving the concept of "near Nice" and displays the options:

- In the city of Nice and in its surround
- In the neighbourhood of Nice only (exclude the city)

Can we suppose SPIRIT will be able to disambiguate automatically so we can avoid this interaction steps?

Sandrine selects the second and SPIRIT requires specifying the distance. The dialog box shows different type of measurement and asks to insert the number for the selected one:

- Within walking distance: # minutes
- Within driving distance: ~ minutes
- Within # meters
- Within # kilometres

Sandrine select the second and specifies 20 minutes. Then SPIRIT searches for "windsurf renting in villages around Nice reachable in 20 minutes drive".

The list of places is displayed and the map now shows Nice and its surround. Sandrine browses around the villages highlighted until she finds the place she is interested into.

By doing so Sandrine discovers that SPIRIT has automatically expanded her query to search all sports that can be done at the seaside. So she decides to book in a place that offers windsurf as well as diving facilities.
From the link in the SPIRIT result page Sandrine can access the website and books a windsurf for her summer.

Can we assume that SPIRIT would expand the query automatically by using the ontology if only few webpages have been retrieved? Or should we assume this expansion is always done?

10.3. Sandrine's Scenario - 2

Sandrine is planning to spend her holidays on the Mediterranean coast of France. She would like to stay in a big city (i.e. with restaurants and shops and many things to do). Sandrine wants also to practice her favourite sport, windsurf, in a place nearby but not in the city itself where she expects to find too many tourists during the day.

Sandrine knows SPIRIT is a special Web search engine for tourism in Europe so she connects with the site. The interface shows a map of Europe and Sandrine selects France. SPIRIT displays France and its different regions. Sandrine selects all the south of France from the border with Spain to the border with Italy and types in:

big cities

Allowing map browsing greatly simplify the queries.

SPIRIT highlights on the map the cities for which information has been retrieved. Sandrine looks on the map and browses around clicking Marseille, Toulon and Nice. Clicking on the map shows information on the selected city, thus Sandrine can now decide that Nice is the place where she wants to spend her holidays.

By brushing on Nice she sees that the area of Nice is divided into "city centre" including only the historical centre, "city" including city centre and suburbs, or "city area" including the villages around.

The concept of "in" can be exploited using the map.

Sandrine wants to stay in the city centre so she clicks on the map when only the city centre is highlighted.
SPIRIT displays the map of Nice city centre and Sandrine types:

hotels

SPIRIT returns a list of hotels organized by number of stars. Brushing on the names Sandrine can see where those hotels are located on the map of Nice.

Sandrine brows around for a while clicking on the retrieved hotels to see their websites. There is one she particularly likes so she books on-line a room from the hotel website.

Now Sandrine wants to book also a place at the seaside where she can practice windsurf. She does not want to stay in the city of Nice for practicing windsurf so she zoom out on the map to select Nice and the its surrounding villages. Then she types:

windsurf renting

SPIRIT search for windsurf renting places and other seaside activities. Then it highlights the points where those outdoor activities can be done.

Sandrine browses around the map and the websites of the places listed. Clicking on each highlighted points she can see the key information of the place like the distance from Nice, if there is a bus/train service, parking places etc.

There is no need for asking the user the distance or the type of distance: the info are available and the user look and decides.

Finally she decides for the "Tortuga Beach" in Saint Jean Cap Ferrat that offers windsurf as well as diving facilities. She books online for her summer holidays and happily goes back to work.

10.4. Mike scenario

Task

Mike is a geography teacher and keen mountaineer from Scotland. He has climbed in the French Alps but never in Switzerland. He is used to using the Internet as a source of information for avalanche forecasts and weather information for Scottish winter climbing.

Uses the internet already

Mike wants to go on a trip to the Swiss Alps with his family. He has heard from a friend that there is some nice mountaineering near a place called Aigle, and also some pleasant walks that he could do with his children (who are aged 7 and 9 respectively). One mountain he has heard of is called Les Diablerets.

Knows a rough location, not exact.

He wants to book a chalet to stay in with his family, and also get information about mountaineering routes, rock climbing and hiking in the area. Since he won't have access to the Internet on the trip he wants to find out before he goes a good local source of weather information.

Goals: 1) book a chalet. 2) find information about mountaineering routs 3). wants to use mountain huts 4) find information. about climbing and hiking No internet access on trip.

He would like to use huts rather than camp in the mountains so would like to choose some routes based on local huts, and thought it might be fun to take his family to stay in one.

Can he take his children.

Process

Mike sits at his computer and enter the URL for the SPIRIT website. The home page has a form on the left where Mike can type in, and a Europe map on the right. He could start his search by clicking on the map but since he known the name of the place but not its position he prefers to type. The form on the right is divided into 2 sections: where and what. The *where* section gives Mike the possibility of specifying the place as much as he can, so he fills the field "city-town-village" with Aigle, the "country" field with Switzerland and the "other" box with mountain:LesDiablerets

Here first ideas of a possible user interface with a form on the left and an active map on the right. Users can start searching in the modality they prefer. NOTE I assume we limit SPIRIT to Europe and we have geo data for active maps.

WHERE: is for specifying geo info. I identified country and city-town-villages + other info. The last field need a little parsing to detect which geo entity the name is about, e.g. mountain, lake, …

The system returns him a map with the objects he indicated highlighted (on the right side of the screen) and a list of the concepts associated with Les Diablerets (outdoor activities, accommodation, recreation, transports, …) on the left in 2 columns. The form has been moved horizontally on the top of the screen with the two section "where" and "what" available for query refining; a set of thumbnail pictures extracted from the top documents retrieved is displayed on the bottom of the screen. These images are related to the map and to the corresponding web page displayed in the list.

We could envisage the use of the WHAT for retrieving info related to geo-data if the user wants to be more specific from the beginning. This part might be divided into "travel", "housing", "recreation", "sightseeing" but many other aspects can be identified… maybe it is worth keep it open for the user to specify as for the mountain example above? The same elements can be the bases for the links organization. Organization from the ontology maybe?? A Google search here returns the ski resort of Les Diabrets and

accommodation info

First he browses through the "accommodation" list to look for a chalet. Clicking on the listed pages open the corresponding website. The summary used in the list contains the key elements of each entity, thus rented houses will have info like price, location, availability, services (e.g. weekly cleaning), etc.

Information in the summary can be inferred by the ontology. Which element the ontology has to be used at the organization/presentation level?

After the accommodation Mike looks for information on outdoor activities. He indicates on the map the geographical area he is interested in by drawing fixing the centre of the area on the Les Diabletes mountain and enlarging the circle used to define the radius. Then Mike add types "mountaineering" in the "activities" field of the What pane.

A set of keywords for the WHAT part has to be identified soon since this affects many components, e.g. ontology, user interface, IR.
Google can't do this – the map allows him to indicate the place and concept he is interested in as separate ideas – not the same idea. The gazetteer indicates a hierarchy of classifications for information he wants spatially, and the ontology finds analogous concepts – e.g mountaineering and climbing. This is a key issue.

I would suggest to have this second part as an additional scenario because it offers other interesting points - why not using a PDA for this?
Now he can search for the information he wants using the spatial concepts he knows and the concepts he is interested in. The gazetteer sequentially looks at broader scale spatial concepts when he makes a search. For instance when he asks for weather information for Les Diablerets he is given information about Les Diablerets, Vaud, and then since Les Diablerets lies on a canton boundary also about Vaud and the neighbouring canton Valais. Finally he is given weather information for the region "North of the Alps" and then Switzerland.

SPIRIT knows something about spatial concepts and their relationships – and uses this to build a hierarchy of information about an idea. Weather is a nice example since at the local level there is unlikely to be a real source, though we might find something, and as we move to broader scales we find differing (and more or less useful) information.

11. Appendix C – Interface sketches

These sketches have the purpose to visualize a possible organization of the interface components as emerged from the scenarios; they are by no means a first layout of the interface. It should be noted that the command for manipulating the map are missing; and the input is here envisaged as an organized set of well defined topics as well as a free text input.