

# OnTour

## The Semantic Web and its Benefits to the Tourism Industry

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## **Abstract**

The Semantic Web has major impact on the tourism industry. Its vision is to have Web data defined and linked so it can also be used by machines for automation, integration and reuse across various applications. In this paper the drawbacks and opportunities of the emerging ideas of the Semantic Web on the tourism information systems, in particular OnTour, are presented and potential solutions are sketched. A first prototype of OnTour, which is subject to ongoing improvements and extensions, was developed at the University of Innsbruck, Austria.

## **Introduction**

Currently there are two extremes looking at information systems and the Web with a tourism perspective. On the one hand there are big, well-structured information repositories which offer access to their systems via Web, but they are normally isolated and rarely include detailed information. On the other hand there is the Web as a whole with its many small, detailed pieces of information, about skiing areas, music festivals or regional style lodging. The OnTour project mainly focuses on narrowing the gap between those extremes. The objective is to connect the isolated pieces of information in order to assist the user finding and understanding the information sources and in order to allow individualized use of tourism offers. To achieve this purpose technologies of the Semantic Web are employed. The advantage of the Semantic Web is that background knowledge about the meaning of Web resources is stored in machine-processable metadata. These semantic descriptions enable services for finding, integrating and connecting information.

The search for first-class skiing areas and classical music festivals with corresponding travel arrangements and checking of availabilities for instance could be integrated by semantic means such that appropriate events and skiing areas in the region of Innsbruck are returned with corresponding travel and lodging arrangements though it has not been

questioned for explicitly. Innsbruck is likely to be a good choice as it provides numerous cultural events and lies in-between some of Europe's most accredited skiing areas. However it is only one of many destinations to be considered.

Semantics is a key factor in finding the way in the expanding Web and necessary basis of the OnTour system. Ontologies, which provide a formal conceptualization of a particular domain, are germane to the idea of using semantic descriptions. Vocabularies are described by ontologies as a kind of complex metadata schemata that are used in order to combine semantic metadata.

In the following two sections the basic notions of OnTour as well as its use of metadata is presented. The subsequent section comprises explanations of major issues that will affect the work on the OnTour project in the near future significantly. After the discussion of the semantic annotation of today's Web, the packaging and recommendation efforts in terms of OnTour are illustrated. In the last section before the conclusion an outlook is given providing further topics that have to be addressed in the rather remote future.

## **A Search Engine for Tourism Packages**

The need for searching information is one of the fundamental needs of a prospective tourist, but also a worker in a travel agency. Current state-of-the-art information systems belong to one of the categories mentioned above. Either they are neatly built, but with restricted coverage of topics, or they belong to the second category, the Web, that offers almost anything, but that makes the right piece of information nearly impossible to find.

To tackle that search engines are needed which take advantage of semantic descriptions and related ontologies. For instance, there may be information in some structured format that states facts such as

- the city Innsbruck is located in Tyrol
- the Easter Festival Tyrol that takes place in Innsbruck is a music highlight in March

- the Stubai Glacier located in Tyrol is Austria's largest glacier skiing area and home to world-renowned snow conditions

A tourist who is planning to travel the region might look for places and activities. They may ask for first-class skiing areas and classical music festivals in Tyrol. At present the person would have a hard time finding the necessary information, because the information is not in a central database and ordinary keyword search may not really help because the pieces of information are found at different places. A search engine like OnTour allows querying distributed data, considering the semantics of concepts and instances like Innsbruck, Easter Festival Tyrol and Stubai Glacier.

Another problem with the traditional information systems in tourism is that a lot of information somebody is looking for cannot be found by searching, because novices typically do not know what to search for. Most of them rather want to explore possibilities offered by travel packages. Today prospective tourists are often left alone with the problem of integrating a plenitude of information. For instance events, offered in a city or region, are frequently displayed on different Web sites with partially overlapping or even inconsistent content. There is an apparent need for an information system like OnTour that integrates available information and lets the tourist browse and explore the local offers which are ranked and bundled according to ones individual needs.

In tourism the match between providers and requesters must be made fast and there is a large volume of transactions. New offers typically come in by the minute and late vacancies of flights or lodging easily are lost. Automatic electronic markets help where those criteria apply. Tourism constitutes a very complicated product. Besides of location, time and amount, parameters like quality of lodging, entertainment and geographic location play an eminent role. In tourism a rich conceptual model is required such that the benefits of electronic markets may be applied. In this sense OnTour provides an electronic market place and integrates information.

Nowadays compiling a consistent vacation package manually is a highly time-consuming task. When using OnTour as tourism information system it is sufficient to provide

preferences like maximum budget and minimum comfort and define further constraints including the personal schedule for instance to get complete packages proposed considering the information given on Web sites.

### A Web of Metadata

In Figure 1 an example for a partial instantiation of an accommodation is given.

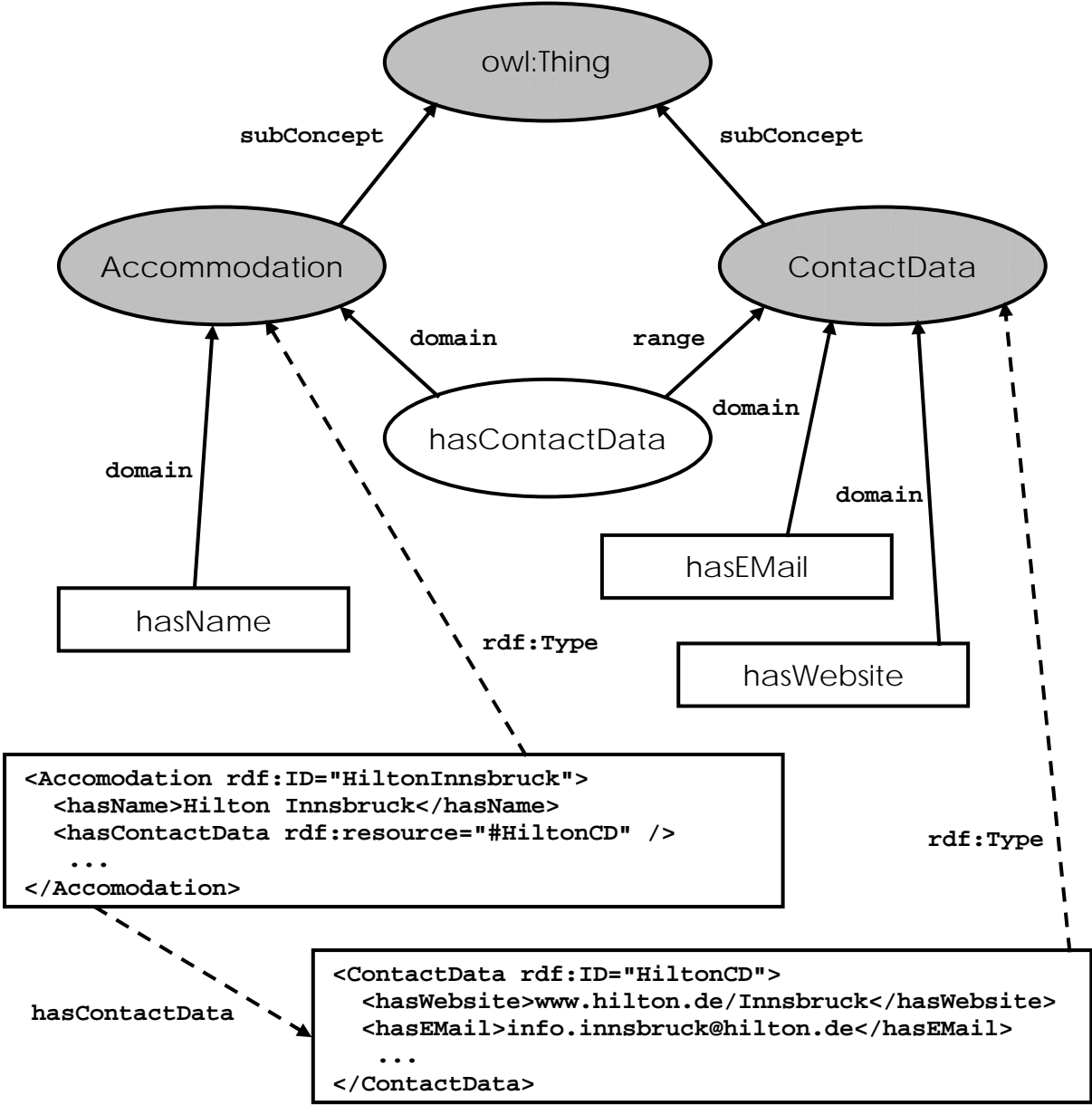


Figure 1: Example instantiation for the Semantic Web

It is based on the actual existing Web site of a specific hotel in Innsbruck. In the upper part of the figure a small part of the current OnTour ontology represented in OWL is graphically depicted. According to the RDF data model statements are specified for each Web page and serialized using XML syntax. By defining these descriptions the Web pages become machine-interpretable and understandable. The ontology is extended by additional rules. For instance a rule has been defined expressing that every accommodation must have exactly one contact data.

The basic system helps the user to plan a vacation from beginning to the end. In a later phase of development OnTour will probably be able to look up a destination, check the weather and even make a recommendation about whether the user should fly, drive or take the train. Additionally it will be able to make recommendations concerning the best restaurants and venues for music and entertainment in the immediate vicinity. Sooner or later information systems such as OnTour will have to support mobile devices and their main purpose will shift from a pre-vacational planning assistant to a permanent supplier of relevant and useful information. The underlying technique of the OnTour approach is a system that on the one hand extracts pieces of information from structured Web pages and on the other hand conducts constraint-based reasoning for the integration of multiple information sources.

## **Major Issues concerning OnTour**

From time to time it will get more and more important to design new services extending the range of options to customize and configure products. Customization describes the process of individualizing products or services based on IT-enabled mass customization. While annotated Web pages are the basis of OnTour, product configuration and recommendation are intentions for additional value-generation. With such intentions established processes are changed and new services defined. While the Web is actively changing the needs of customers it is also forging new ways to satisfy them. According to [6] customers in tourism are increasingly less loyal, take more frequent vacations of shorter duration and take less time between choosing and consuming tourism products.

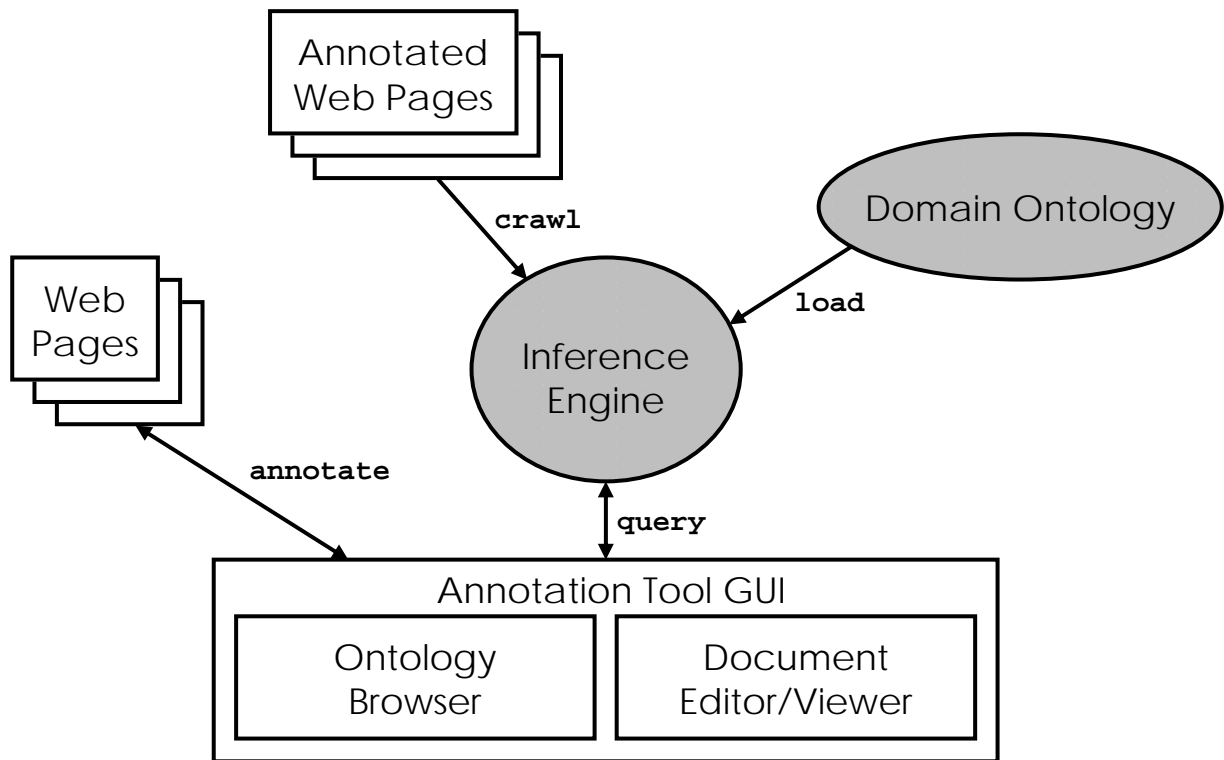
## **Annotation of Web Pages**

The Semantic Web builds on metadata describing the contents of Web pages. As OnTour relies on annotated web pages it's crucial to provide Web site authors with tools facilitating the comfortable creation of such relational metadata. It is very likely to be a good idea to combine authoring of Web pages and the creation of relational metadata describing its content.

The architecture of an annotation environment suitable for OnTour in the style of a promising approach described in [3] is illustrated in Figure 2. In this environment the document editor/viewer visualizes the document contents and supports various formats. The metadata creator provides new metadata easily by selecting pieces of text and aligning them with parts of the ontology. The annotation tool GUI also allows the controversial authoring of documents with the aid of the ontology browser. Instances already available may be dragged from a visualization of the content of the inference engine and dropped into the document. This newly generated content is annotated automatically. Both document editor/viewer and ontology browser have to be easy to use. Drag'n'Drop helps to avoid syntax errors and typos. A good visualization of the ontology helps to correctly choose the most appropriate class for instances.

The inference engine reasons on crawled and newly created instances and on the ontology. On the one hand the inference engine is used to query whether and which instances already exist in the Semantic Web and on the other hand it serves the ontology browser because it allows to query for existing classes, instances and properties. During the metadata creation subjects must be aware of which entities already exist in the Semantic Web.

The OnTour approach envisions annotations to be stored in the documents itself but also in the inference engine for further consideration and processing. A simple replication mechanism crawls newly annotated Web pages into the inference engine.



**Figure 2: Architecture of annotation environment**

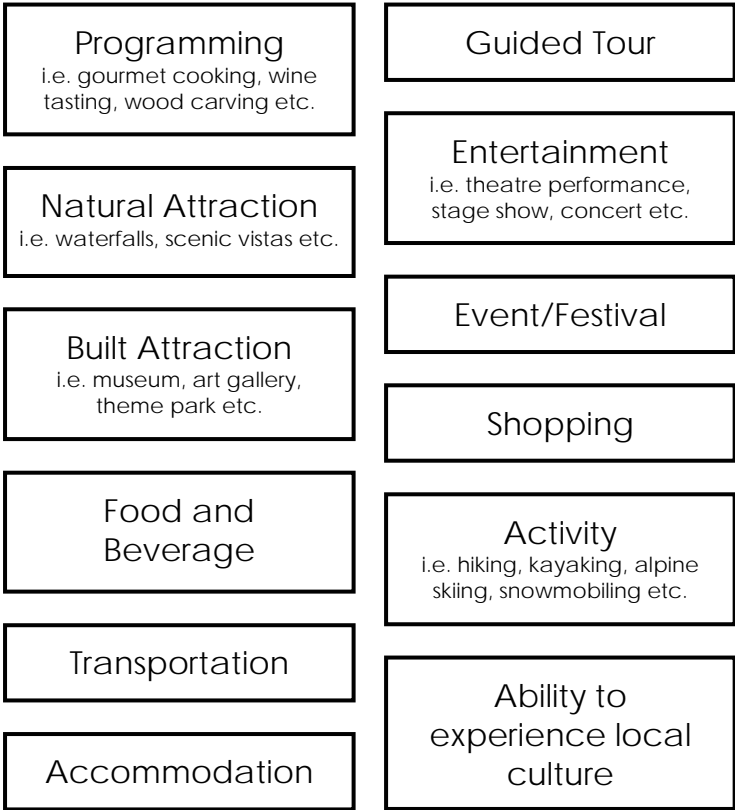
The success of the Semantic Web depends on the availability of ontologies as well as the proliferation of Web pages annotated with metadata conforming to these ontologies. Thus a crucial question is where to acquire these metadata. In [2] a method is explained which employs an unsupervised, pattern-based approach to categorize instances with regard to an ontology. The approach shows promising results but effectiveness, efficiency and range need to be improved. A semi-automatic use of this approach in which the users are asked to select one of the highest ranked categories increases the performance of the OnTour annotation efforts considerably.

## Configuration of Products

Configuration refers to the bundling of different product or service components to integrated offerings. When a tourist plans and books a trip to a destination for leisure or business purposes, they are buying an experience comprised of a range of products. A package, from a

tourism perspective, is the linking of a number of individual products and services into a single experience, typically for a single price. A package is a saleable item, with a set price for a set period of time. There is a broad range of products and services that can be linked in a package, including the ones showed in Figure 3. As an umbrella industry tourism relates to numerous sectors. Over 30 different industrial components have been identified according to [6] that serve travelers. The tourism industry is very heterogenic.

Compared to the traditional perspective on vacation packages the approach that was chosen for OnTour is slightly different. First of all the proposed packages are not standardized. They are optimized individually considering the user’s preferences and constraints. Hence, the price is not set for a set period of time. The OnTour bundles are highly flexible and fully reflect the need for a fast matching of providers and requesters in tourism as mentioned above.



**Figure 3: Range of products and services to be bundled**

The tourism product itself is a bundle of basic products. To support the rather complex bundling, products must have well-defined interfaces with respect to consumer needs, prices, distribution channels and so on.

Packages compiled manually or by using engines like OnTour have many advantages for tourism suppliers and customers. Packages or itineraries that someone else has already thought through simplify planning for prospective tourists clearly. A package provides one stop shopping, often at one, all-inclusive price. That goal is for OnTour only relevant in the very long run as it requires enhanced information sources and cooperative partners in the tourism industry. In many cases, a package costs less than when the customer assembles the same product into an experience themselves. For some travelers, this is an attractive feature. Visitors first look for a destination or area to visit and typically base this on a region or area that has the type and variety of attractions and services they are seeking. Then, once that destination has been identified, more detailed planning takes place. Some like their entire trip planned ahead of time, with a detailed and fully planned itinerary. Others will use packages as only part of a larger experience. OnTour is flexible enough to deal with that.

As a consequence of the bundling efforts of different product or service components companies are forced to compete and cooperate simultaneously. Boundaries within the industry are blurring as well as boundaries between individual and packaged tours.

## **Recommender Systems and Competence**

It is often necessary to make choices without sufficient personal experience of the alternatives. In everyday life, people rely on recommendations from other people either by word of mouth, recommendation letters, reviews printed in newspapers, or general surveys such as restaurant or lodging guides.

Internet travel information systems such as OnTour provide new market functionality and technology, focusing on personalized intelligent tools for travelers. In tourism,

applications focus on destination selection and travel product bundling. On the one hand unsolicited suggestions about supplemental topics or objects can be delivered at any time as a kind of enriching the packages according to certain, possibly learned, rules or common sense. On the other hand recommender systems suggest products and provide consumer information to facilitate the decision process. Tourism recommendation as OnTour provides it, poses peculiar requirements related to the complexity and intangibility of the travel product. Recommendations must refer to a variety of products and services such as locations, attractions, accommodations and flights in order to provide a meaningful picture of the proposed travel.

As explained in detail in [5] and from a different angle in [1] it has to be considered how to incorporate competence into the recommendation process. Competence implies the overall ability of the system to provide consistently good recommendations to its users. As all recommender systems also OnTour relies on the fact that users provide ratings on the items the system recommends. There is obviously a trade off between non-invasive and high quality methods of acquiring user feedback. This user feedback is crucial for the improvement of recommender systems in terms of competence and robustness.

## **Outlook**

According to [6] the support of heterogeneous data formats and business functions as well as distributed data sources has to be enabled as it will be extremely difficult, if not impossible, to align currently running systems. It is crucial, that OnTour accounts for different types for participating entities with their functional differences. Scalability and openness with regard to geographical and functional extensions is necessary to be able to be up to the mark with constantly increasing demands. The core benefit of the distributed approach of OnTour is the full autonomy of the prospective participants while enhancing cooperative behavior through packaging and information exchange. In the long run mobile services will be integrated with the fixed services enabling multi-channel access to the services provided. Furthermore it's decisive to support attentive user interfaces and personalization through extensive exploitation

of user modeling. Therefore user behavior as well as emotional aspects have to be taken into consideration. As described at length in [2] also using Web service technology will bring many advantages in the tourism domain. In the medium run Web services will be an integral part of OnTour. However to exploit Web services to their full potential, it is necessary to introduce semantics.

## **Conclusion**

In tourism a vast amount of data is only loosely structured or given in unstructured form. A mode that is by far too weak for rich querying. The Semantic Web provides additional mechanisms adequate for dealing with these structures, enabling new applications for commerce and communication. The increased complexity associated with the evolution of tourism calls for technical innovations to generate superior consumer services such as market overview and price comparison. A very promising approach is the OnTour information system, which provides a unification of numerous emerging ideas and technologies. However, it remains an extremely challenging work for the future.

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