

## NEW TECHNOLOGY FOR TOURISM INFORMATION SYSTEMS

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### **Abstract:**

The Semantic Web as the next generation web is the vision of having background knowledge about the meaning of web sources stored in a machine-processable and – interpretable way. The area of tourism is highly dynamic area that currently already extensively uses the available Internet technologies. However, the shortcomings of the existing technology are that information finding and extraction as well as the interpretation of the information contained in the web sources is left to the human user

In this paper it is shown how the vision of the Semantic Web and already existing Semantic Web technologies can be used for next-generation tourism information systems.

*Keywords:* Semantic Web, Ontology, Metadata

In the last decade the tourism industry has been marked by a strong internationalization of its markets with new competitors entering and old ones leaving on a day-to-day basis. This has forced actors of the tourist market to seek for global business strategies and to achieve effective cross-border integration, coordination and control of activities in order to generate a sustainable competitive advantage. New forms of inter-enterprise partnerships seem to render obsolete old-fashioned market structures, existing barriers are quickly falling, the market is increasingly organized on a world-wide level, and there is a general process of deregulation occurring. More generally we can assume that the changes of market conditions lead to a redistribution of tourist flows both on a local level and for the whole industry. This is driving a new paradigm into the traditional environment of tourist actors and they are supposed to react with structural flexibility to the new tourist space that is more and more becoming an network of interactions. The tourism industry has already reported dramatic changes in its structure over the last few years. The customers' wish for more frequent, but shorter travel, last-minute reservations, global advice, service quality, market transparency and a certain self-service mentality - e.g. 'modern' travelers begin to gather recreational micro-services on their own and form their customized holiday package - is leading to an elimination of non value-adding stages in the tourist service systems. In order to stay competitive, to keep regular customers coming and to gain new ones, participants in the tourist market must learn to deal with these new circumstances, go new ways and develop innovative ideas. Recent studies also point out the urgent need for qualitative enhancements of the overall service providing process, as well as a profound understanding of the nature and evolution of the environment in order to stay in touch with the latter. Individual providers, following the trend and responding to the new dynamics of the tourist market, are generally characterized by small and medium enterprises having severe difficulties embracing the rapid changes. These enterprises mostly have little technological infrastructure and financial power, and they will begin to have reduced access to world tourist markets if no solutions can be found to strengthen their strategic position in this new environment. Tourist information systems begin to be identified as one possible way to close the gap

between service suppliers and the volatile demand side. New information and communication technologies are enhancing recent inter-enterprise collaboration schemes and their appropriate integration might offer new win/win-situations for every actor of the tourism industry. Each element of the tourism industry in fact is involved in a number of significant linkages that can be enhanced through electronic connections today. From a traveler's point of view, access to effective communication systems can provide reliable information on facilities and services. Today, efficient and inexpensive communications already allow travelers to stay in touch with the service provider, and this during all their decision making. Unfortunately most of the tourist sites have not yet adapted their management methods to the rising needs in information that characterize today's business and the majority of the tourism industry's marketplace activity has so far remained primarily paper-based. A possible reason for this could be that one single actor of the tourism business, however large or technologically adept, will probably not be able to generate a dynamic tourist milieu that quickly responds to fast environmental changes. This situation is actually resulting in a strengthening of the role of local, regional and national bodies, because there is a significant risk of marketplace exclusion for participants that are not ready to implement the new market paradigms. Governments are beginning to become a strategic player in the tourism industry and most of the countries have already initiated projects in the field of electronic commerce in order to offer new competitive advantages on an international level to its service providers. National bodies are understanding today the significant importance of the new tourist space and its side-effects on the other sectors of the economy.

To close this short overview of trends in tourism, we might simply say that competitiveness in today's tourist economy is increasingly determined by the ability to develop and assimilate innovative ways to respond to the dynamic environment and its new paradigms in the production process of value-adding tourist services.

Looking at current information systems with tourism perspectives, but also in general, one currently finds two extremes. On the one hand side there are well-structured information repositories, neatly built and maintained at high costs, mostly from large providers of touristic packages, travel or lodging arrangements. Virtually all of these providers offer easy access to their systems via the World Wide Web, but they are mostly isolated from each other and they rarely include detail information.

On the other hand, however, there is the World Wide Web as a whole with its many small, detailed pieces of information, e.g. about opera festivals, and touristic, offers in market niches, e.g. agrotourism in particular regions or regional style lodging.

Because of the vastness of the Web there lies a heavy burden on the user for accessing the latter kind of information, as well as for interpreting it and connecting it to the offers made by the large providers.

This paper sketches how the gap between the two extremes may be narrowed. The goal is to *semantically* connect currently isolated pieces of information in order to diminish the burden on the user of finding and understanding the information sources and in order to allow for individual use of tourism offers. The key to this goal is the Semantic Web and its technologies. Tim Berners-Lee coined the vision of a Semantic Web as an extension of the current World Wide Web that does not only provide information at the syntactic level to human users, but also at a machine-understandable, semantic level to machines (cf. (Berners-Lee, 1999)).

In the Semantic Web, background knowledge about the meaning of web resources can be stored as machine-processable (meta-)data. Services for finding, integrating, or connecting information may be based on these semantic descriptions. For instance, the semantic description of Ryokans as a Japanese style of lodging returns their existence

and the corresponding touristic offers even to the novice Japan visitor who is looking for accommodations and who did not know about their existence before.

Analogously, the search for *classical music festivals* with corresponding travel arrangements and checking of availabilities could be integrated by semantic means such that the *opera event* in Usedom, a German island in the Baltic sea, is returned with corresponding travel and lodging arrangements though it has not been questioned for explicitly.

Thus, semantics is seen as a key factor to finding the way in the expanding web space, where currently most web resources can only be discovered via syntactic matches (e.g., keyword search). Germane to the idea of using these semantic descriptions are *ontologies*. Ontologies provide a formal conceptualization of a particular domain that is shared by a group of people. Ontologies describe vocabularies as a kind of complex (meta-)data schemata that are used in order to combine semantic metadata and offer added-value services on top of semantic descriptions.

The high-level idea of Semantic Web-based applications in tourism information systems has been sketched above. In this section, we want to elaborate on desiderata one would like to have fulfilled for tourism information systems. We here describe some application scenarios that are within reach today and that subsequent descriptions of methods and techniques in Section 4 may refer to and indicate how to solve. The following scenarios are given at increasing levels of sophistication.

One of the first needs of a prospective tourist, but also a worker in a travel agency, is the need for searching information. This need, however, contrasts with the coverage and possibilities allowed through current state-of-the-art systems. Either systems belong to the first category mentioned above: neatly built, but with restricted coverage of topics. Or, there is the second category, the Web, that offers almost anything, but that makes the right piece of information nearly impossible to find.

Then, a tourist who is planning to travel the region might look for places and activities and she may ask for *classic music events*.

A lot of the information one looks for cannot be found by searching, because novices typically do not know what to search for. They may rather want to explore the possibilities offered by the travel package they have bought. This often leaves them with the problem of integrating an abundance of information, e.g. cultural events offered in a large city and displayed on different web sites with partially overlapping content.

Thus, what is needed are topic or location specific portals that integrate available information and let the tourist browse and explore the local offers.

A similar problem occurs when a tourist wants to explore new types of offers, e.g. river rafting and has to sieve through multiple sites.

Automatic electronic markets help where the match between providers and requesters must be made fast and/or there is a large volume of transactions. In tourism information systems both criteria apply. Late vacancies of flights or lodging easily are lost, and new offers and requests come in by the minute.

However, the difference between touristic offers and power supply is that the former constitutes a much more complicated product. Besides of location, time and amount, parameters like quality of lodging, entertainment, geographic region, etc. play an eminent role.

This requires a rich conceptual model about the tourism domain such that the benefits of electronic markets may be applied in tourism. One eventual goal could be that the final customers let their agents trade against the final providers with agencies providing the market place and the integrated information.

Imagine registering for a conference online. The conference Web site lists the event time, date and location, along with information about the nearest airport and a hotel that offers attendees a discount. With today's Web, you have to first check to make sure your schedule is clear, and if it is you have to cut and paste the time and date into your calendar program. Then you need to make flight and hotel arrangements, either by calling reservations desks, or by going to their Web sites. There's no way you can just say, 'I want to go to that event', because the semantics of which bit is the date and which bit is the time has been lost.

The scenario one would like to have is that one gives some preferences about maximum budget and minimum of comfort, let your software find out about the constraints. We have already mentioned that the Semantic Web is based on machine-readable and processable metadata. The interchange of data represented in the Semantic Web must be facilitated through a concrete serialization syntax. XML is an obvious choice frequently used by the upper layers. However, it is important to mention that the Semantic Web is not tied to a particular syntax. Within the syntax layer Unicode2 is used, that provides a unique number for every character, no matter what the platform, what the program, or what the language is. Beside Unicode, the usage of so-called URI (unified resource identifiers) is essential.

The Semantic Web concept is to do for data what HTML did for textual information systems: to provide sufficient flexibility to be able to represent all databases, and logic rules to link them together to great added value..

Ontobroker comprises languages and tools that allow to semantically mark-up content on web pages and let the user semantically query the WWW taking advantage of semantic inferences. Ontobroker is based on the use of ontologies that guide the semantic mark-up of web documents, the querying interface and that formulate semantic rules for the domain. Thus, conventional web pages are augmented with a facility for intelligent brokering services without requiring to change the semiformal nature of web documents. Ontobroker has, e.g., been applied to needs of the knowledge acquisition community.

Knowledge portals provide views onto domain-specific information on the World Wide Web, thus facilitating their users to find relevant, domain-specific information. The construction of intelligent access and the provisioning of information to knowledge portals, however, remained an *ad hoc* task requiring extensive manual editing and maintenance by the knowledge portal providers. In order to diminish these efforts ontologies are used as a conceptual backbone for providing, accessing and structuring information in a comprehensive approach for building and maintaining knowledge portals. It consists of an ontological reasoning service which is used to represent a sophisticated conceptual model of document terms and their relationships, a Web-based open hypermedia link service that can offer a range of different link-providing facilities in a scalable and non-intrusive fashion, and integrated to form a conceptual hypermedia system to enable documents to be linked via metadata describing their contents and hence to improve the consistency and breadth of linking of WWW documents at retrieval time (as readers browse the documents) and authoring time (as authors create the documents).

In this paper we have introduced the vision of the Semantic Web and its potential benefits to tourism information systems. In tourism much data is only loosely structured or given in texts – a mode that is too weak for rich querying. The Semantic Web provides additional mechanisms adequate for dealing with these structures, enabling new applications for commerce and communications, especially.

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