eTourism: The Knowledge-based Packaging Model

Tobias Schmeing
University of Essen
45141 Essen, Germany

Jorge Cardoso
Department of Mathematics and
Engineering
University of Madeira
9050-390 Funchal, Portugal

J. D. Fernandes
Expedita -Arquitectura e Gestão de
Sistemas de Informação, Lda
9050-390 Funchal, Portugal

Abstract- **The rapid growth of the Internet and the continual adoption of innovative technology have led to serious changes in the travel industry during the last decade. Due to the constantly changing business environment, one of the latest concepts of the tourist industry is "Dynamic Packaging". While Dynamic Packaging has been widely accepted by customers, the strategic impacts enabled by Dynamic Packaging technologies are still uncertain. This paper provides a study of an extension of the traditional packaging architecture and aims to present a new and extended model, called the Knowledge-based Dynamic Packaging Model.**

I. INTRODUCTION

Tourism is one of the sectors of the World economy with the best outlook. The World Tourism Organization predicts a 200% increase in tourist arrivals around the world by 2020 and a predicted change of the end-travelers behavior will lead to an average of 4 holidays undertaken per consumer in 2020 [1]. This is due to factors such as the increase in time for leisure activities and its social importance, together with global economic growth. According to Carl H. Marcussen from the Centre for Regional and Tourism Research of Denmark, the European online travel market size has increased from 2,5 Billion Euros in 2000 to 18,2 Billion Euros in 2004, and a further growth to 28,5 Billion Euros in 2006 is expected [2].

The enormous changes in the tourism industry during the last decade are related to the continual adoption of innovative technology and the increasing percentage of consumers that have the necessary knowledge and the resources (hardware, software and internet connection) to take advantage of this. Being a service sector with a particularly complex product, which depends on an extremely fragmented supply, each link in the chain offers one element in the overall product. Unlike the early travel online years, in which the supplier contracted with online travel agencies in order to use their distribution channels, while offering components for the different kind of package solutions, nowadays suppliers try to regain control of their inventory and improve direct sales on their own web sites. British Airways claims that 42% of their product is now booked at BA.com whilst for Aer Lingus this figure is nearer 70% [3]. At the same time, distribution has become more complex as various intermediaries, such as the trio of U.S.-based Expedia, Cendant and Sabre, who hold together 60% of the European online travel agency market [4], as well as European-based Amadeus and lastminute.com, connect directly to the customer, aiming on horizontal integration of tourism services in order to offer one complete holiday package to fulfill the special needs of the changing demands of their customer.

One of the latest concepts of the tourism industry is "Dynamic Packaging". Before the introduction of Dynamic Packaging, the increasing online sale of travel led to the erosion of margins and to the homogenization of the travel market. The low cost carrier challenges the airline companies and the zero commission for travel agents forces them to expand their business models. Dynamic Packaging, whereby the consumer combines individual travel components online to create a customized package, is quickly replacing both online and offline purchases of traditional vacation packages. Offering the flexibility, ease and appeal of creating customized, flexible vacations in real-time, Dynamic Packaging has been cited as the cure for the commoditization of travel and for the erosion of margins and brands.

In spite of everything, according to the findings of the Travel Industry Association in 2004 the achieved prices and package configuration have been even worse than those from travel agencies, booking on the internet has been still a time consuming act of searching and the e-Tourism market remains intransparent because of the difficulty to compare all the available distribution channels [5]. In our eyes the concept of Dynamic Packaging has to be extended in order to meet the needs of the present and future customer more efficiently. On the one hand it has to be considered that the tourism product is an extremely diverse and highly information-intensive product which offers ideal potential for value-adding informational services. On the other hand the process of creating dynamic packages should be customized to detailed individual customer information and based on the experiences of the broad mass of travelers. For these reasons we extend the Dynamic Packaging concept to the Knowledge-based Dynamic Packaging Model.

The knowledge-based packaging model is based on an input of information concerning consumer experiences/reviews and individual user profiles gathered through social networks and personalized user accounts in order to create tailor-made packages with a maximum of customization. The model aims at pro-actively offerings wrapped in packages including destination information, information from social networks and public websites. . Additionally we suggest semantic integration as a desirable

optional functionality and will discuss the difficulty of integration of heterogeneous sources in this context

II. DEFINING DYNAMIC PACKAGING

Dynamic Packaging is a term that is used in various contexts. "For some it's just a technology for others it is an overall merchandising solution" [6]. Several definitions can be found in the literature. Some are partly contradictorily or complementary. According to [7], Dynamic Packaging is "an industry buzzword for enabling the consumer (or booking agent) to build a customized itinerary by assembling multiple components of their choices and complete the transaction in real time." Ref. [8] adds that Dynamic Packaging should provide a single, fully priced package (hiding the price of individual components) within 5-15 seconds. Fitzgerald [6] identifies that one important requirement for Dynamic Packaging solution is the existence of an infrastructure to integrate data in an automated way, allowing querying in a uniform way across multiple heterogeneous systems containing tourism related information." Ref. [8] point out that it is not because there is only one payment transaction for all vacation components that it is a dynamically packaged reservation. The key point of differentiation between dynamic and traditional vacation packages is the ability for the travel consumer to dynamically access data stored into several, separate inventory management systems. Meier [9] reiterates that a key characteristic of Dynamic Packaging is to be able to combine services which are described in local inventories or in external sources.

The main controversial about what is a dynamic package, bases on defining it as the solution to access into several, separate inventory management systems or to regard this interoperability as an add-on and accept a package to be dynamic, independent on how many and what kind of sources are integrated.

For us, Dynamic Packaging is based on an individual consumer request, including the ability to combine, multiple travel components like flights, hotels, car rentals, and any other tourism related component in real time and provides a single, fully priced package, requiring only one payment from the consumer and hiding the pricing of individual components. The products available to customer can be stored in local inventories or external sources.

III. EXTENDED PACKAGING ARCHITECTURE

The main components of the Extended Packaging Architecture (Fig.1) are the knowledge-based packaging process influenced by the social network and the user profile component, the Dynamic Package Wrapping process including descriptive information from social networks, public websites and Destination Management Systems and as a desirable optional functionality semantic integration. We will discuss each of those components individually in the next sections after presenting the different layers first.

A. Data Integration Layer

A modern Dynamic Packaging solution should be able to access product information stored in local database with own inventory and in external inventories with real time access or supported by cache mechanism.

Using only local databases limit the range of products that can be offered to customers. This approach has been used for several years and even today most companies have only a local database or inventory storing their own or externally by allotments/ agreements acquired products. For organizations that are not able to solve the interoperability problems between different tourism information systems, this is the only solution. Only few companies like the major on-line travel agencies and some airlines, which have historically always been one step ahead adapting new technologies, extend their database by combining their own inventory with real-time access to external inventory.

Cooperating with a critical mass of suppliers from various travel industries is an essential prerequisite for providing customized travel products. In order to have access to up-to-date information in real-time within tolerable response times it is crucial to establish linkages to diverse numbers of suppliers including the management of these business-to-business (B2B) links. Constrained by the own business it is of utmost importance to integrate Computerized Reservation Systems (CRS), Global distribution systems (GDS), Hotel distribution Systems (HDS) and Destination Management systems (DMS).

Furthermore it is necessary to integrate those systems that are not managed by the above mentioned systems, like for
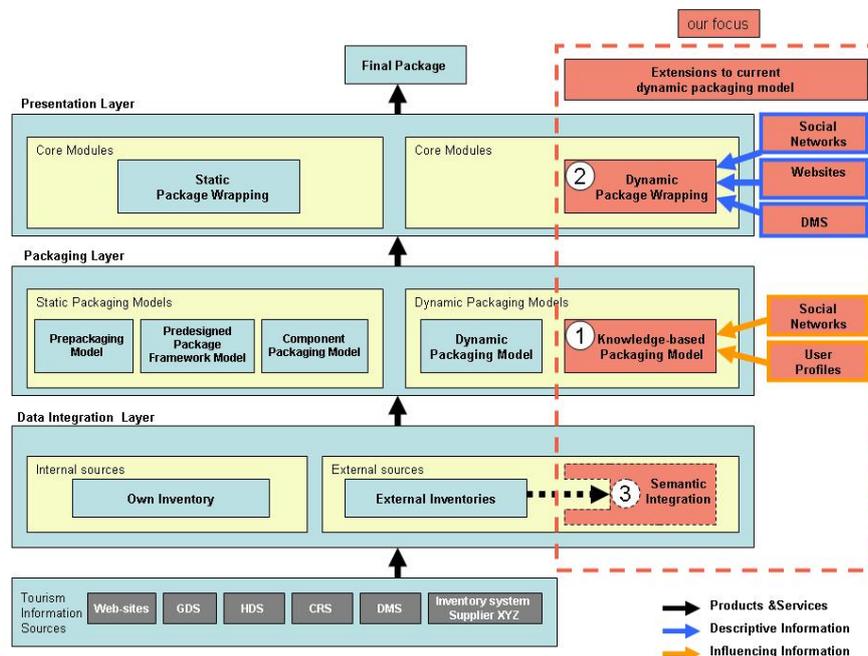

Fig.1. Extended Packaging Architecture

example airline's, hotel's or car rentals inventory systems or blocks of inventory managed by tour operators or vacation packager. Optimizing external inventory with real-time access in order to improve search response time and lowering the search cost, most Dynamic Packaging applications rely on external cached information.

B. Packaging Layer

The packaging layer, the second layer of our extended architecture (Fig.1), is composed of four packaging models (Fig.2), namely the prepackaging, predesigned package, component packaging, and dynamic packaging models.

Originally travel agents used the *Prepackaging Model* static 7, 10 or 14 night packages months in advance like e.g. 14-days-Mallorca-Holiday with flight and all-inclusive hotel. These packages are inflexible, not customizable products which offer the customer only one fixed option. The package consists of opaque components and the customer is only aware of one final price. The advantages of this model are more on the suppliers than on the costumers' side. Selling prepared packages increases the programmability and de-risks the travel agents business. Offering bundled opaque components allows that supplier of single components can offer special discounts without affecting their brand negatively.

The *Predesigned Package Model* is an enhancement of the prepackaging, which increases the choice-options of the customer. The options are still limited but the customer can alter or switch components of the travel within a Predesigned Package Framework like for example changing the airline carrier used. The package is made as well month in advance and offers one final price including opaque components. The travel agent de-risks his business, takes opportunity from the opaque pricing and depends on good negotiations with the supplier.

The *Component Packaging Model* has been introduced to fulfill the changing needs of the customer, who could not be satisfied by limited options. The advantages of this model are more on the side of the customer, because it offers total flexibility, meaning the travel agent purchases any wanted component from different suppliers, trying to fulfill all special needs of the customer, like for example a complex trip to Australia with many stopovers and complicated routings. By adding a fee for service the customer pays the price of the high customization and flexibility. A difference to all other models is that the customer is aware of the component prices and that the success, meaning a satisfied customer is dependent mostly on the abilities, knowledge and experiences of the travel agent.

Dynamic Packaging is where all travel components are put together at the request of an individual customer and are sold together as one trip with one price, providing at the same time the possibility of real-time booking and confirmation. The individual elements of it cannot be sold separately and nevertheless the customer knows which suppliers are being used in the pricing, each piece is opaque to them. The model is coupled with a mechanism for the retailer to make a margin on providing this service and with

the ability for the suppliers involved in the trip to offer their prices opaquely without disturbing their market component pricing. The model combines advantages for the customer without taking advantage of the travel agent. The main characteristics are increased customization and total flexibility for the customer.

C. Presentation Layer

The presentation layer is in our opinion deciding if the package solution will be successful or not. Similar to any other business it is of utmost importance to present the product in a convenient way. The question of how to wrap the package in order to attract the traveller is essential for turning lookers into bookers. What destination brochures have been for traditional offline travel agencies, is replaced nowadays by on-line multi-media enriched content supported by several sources. Without proper presentation the package is worthless and having a look on actual on-line offers it is to say that lately the major companies are taking enormous efforts to enhance their presentation layer, but that the offers of most small and medium-sized companies still lack of proper shape of presentation. Instead of providing
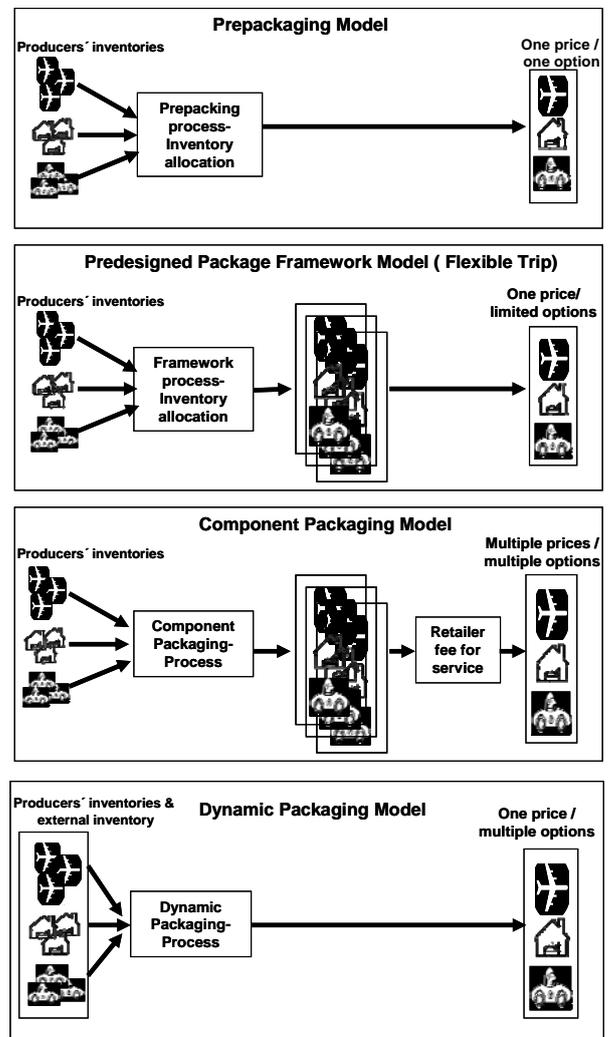

Fig.2 Traditional packaging models

additional information only the pure facts like product name, price and time are given. Only customers whose only preference is to achieve the lowest price can be attracted in this way but even those may be disappointed afterwards.

In order to create a suitable individual package, regarding that one can value this soonest after the trip, can only be achieved if the presentation layer is able to create a clear picture of the product in the customers mind. In the following section we present new opportunities for package wrapping using social networks, websites and Destination Management Systems (DMS).

IV. KNOWLEDGE-BASED DYNAMIC PACKAGING MODEL

The recent developments in Dynamic Packaging technology will enable to build a new breed of Dynamic Packaging solutions. In the following we present a new packaging model (Fig.3), which is based on an input of information concerning consumer experiences/reviews and individual user profiles gathered through social networks and personalized user accounts in order to create tailor-made packages with a maximum of customization. The model aims at pro-actively offerings wrapped in packages including destination information, information from social networks and public websites. In addition we suggest semantic integration as a desirable optional functionality.

A. Knowledge-based packaging process

The customization of travel products and services is one of the main objectives of Dynamic Packaging systems. It is important to understand that consumers do not want boundless choice. Rather knowledge-based packaging should scale down the vast quantity of choice in order to present the customer only what they are looking for and to spare them an information overload. This includes assembling customized travel packages as well as individual pricing on the basis of customer preferences. In order to allow the configuration of individualized products and to support the customer in the selection process, it is vital to improve knowledge about customers. This can be achieved by gathering and evaluating data on customer background and preferences. This information gathered from customers and saved in user profiles can be used to tailor individual packaging. It can be differentiated in general information –

such as personal dates (birthday, wedding day, sex, general likes and dislikes) and lift-style information – and travel related information including personal travel preferences as well as previous bookings and vacation data [10;11]. The data can be gathered actively by providing online questionnaires (for preferences and vacation feedback), or – without the customers direct input – by automated click-stream analysis, through collecting data of previous booking and peer group analysis. In addition information from social networks like web communities concerning special destinations or various activities during the holiday should be analysed and integrated. Once collected, this data can be used by Dynamic Packaging applications to adapt the products of a dynamic package to better meet the customer's interests and increase the probability of purchases.

B. Dynamic Package Wrapping

Tourism and travel products are "confidence goods", because they cannot – in general – be tested before purchase. In order to turn lookers into bookers, Dynamic Packaging solutions should integrated systems to disseminate comprehensive information about destinations and local tourism products, allowing customers to preview their destinations before they travel. This destination information will facilitate the planning and management of their selected destinations. Customer should have access to information in different digital formats, such as textual description, interactive maps, photographs, 360 degree views, webcams, and videos. "The content of the package and how the package is priced and offered really are the intellectual property of the on-line travel agency "[3]. DMS are a very good example of systems that play an important role in the electronic marketing and the management of destinations (O'Connor, P., 1999). Successful examples of DMS include the Irish Tourist Board (http://www.ireland.travel.ie), the British Tourist Authority (http://www.visitbritain.com) and Tiscover (http://www.tiscover.com). Not only destination information system, but as well information extracted from usual websites of smaller or medium-sized suppliers has to be taken into account. Integrating this information constitutes an enormous challenge, because retrieving information from HTML automatically is highly
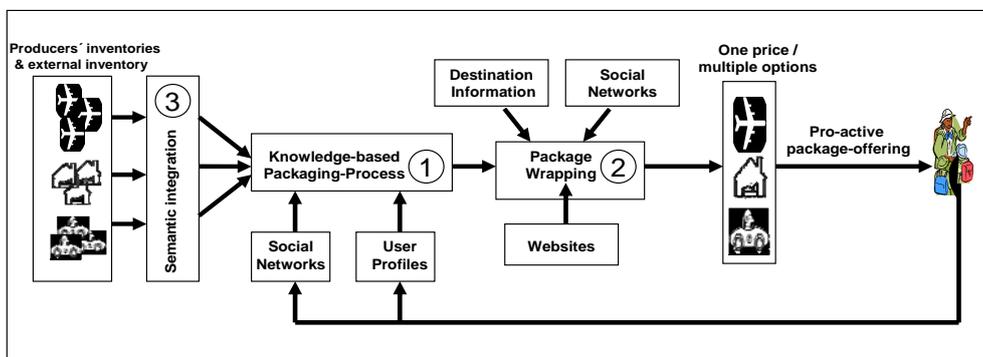

Fig.3. Knowledge-based Dynamic Packaging Model

complicated. The customer-confidence in tourism products can be strengthened by building a social network of travelers, allowing the exchange of vacation experience between customers. For us it is important that the relevant and to the customers wanted destination related essence of those discussion forums is extracted and displayed in order to support the traveler decision-making process with insider information of other travelers. Furthermore those social networks act auxiliary to tie the traveler closer to agencies websites, transforming the customer into the wanted kind of a loyal customer.

"Expedia referenced an increase of 50.000 new user reviews and over 2.000.000 reviews on Trip Advisor. Travelocity and Priceline also stated plans to build out their content and community capabilities [...]and Orbitz has received around 27.000 reviews since launching in the second quarter of 2005".[3].

C. Semantic Integration

Tourism information systems integration is a challenge for dynamic packaging applications since they need to query across multiple heterogeneous, autonomous, and distributed (HAD) tourism data sources produced independently by multiple organizations in the travel industry. Tourism data sources can be hosted by Computerized Reservation Systems (CRS), Global Distribution Systems (GDS), Hotel Distribution Systems (HDS), Destination Management Systems (DMS), and Web sites (see Figure 1). Integrating HAD data sources involves combining the concepts and knowledge in the individual tourism data sources into an integrated view of the data. The construction of an integrated view is complicated because organizations store different types of data, in varying formats, with different meanings, and referenced using different names [12].

By integrating tourism related data into one transparent information distribution process, modern travel agencies can offer better support to dynamically compose travel packages for its customers. Dynamic packaging applications are characterized by the combination and integration of distributed tourism information systems, each with their own intended purposes and goals. The goals of these information systems are independent and the integrated information system reuses the information from the local systems for new purposes and new goals.

V. IMPORTANCE OF INTEGRATION

Dynamic packaging applications need to access tourism data sources to query information about flights, car rentals, hotel, and leisure activities. To develop a knowledge-based dynamic packaging application it is important to identify each data source according to its type of data since the type of data will influence our selection of a solution to achieve data integration. For dynamic packaging applications, tourism data sources can host three major types of data: unstructured data, semi-structured data, and structured data. Highly unstructured data comprises free-form documents or objects of arbitrary sizes and types. At the other end of the spectrum, structured data is what is typically found in

databases. Every element of data has an assigned format and significance.

Unstructured data is what we find in text, files, video, emails, reports, PowerPoint presentations, voice mail, office memos, and images. Data can be of any type and does not necessarily follow any format, rules, or sequence. For example, the data present on HTML Web pages is unstructured and irregular.

Semi-structured data lies in between unstructured and structured data. Semi-structured data is data that has some structure, but is not rigidly structured. This type of data includes unstructured components arranged according to some pre-determined structure that can be queried using general-purpose mechanisms.

A very good example of a semi-structured formalism is XML [13] which is a de facto standard for describing documents that is becoming the universal data exchange model on the Web and for business-to-business transactions. XML supports the development of semi-structured documents that contain both metadata and formatted text. Metadata is specified using XML tags and defines the structure of documents.

In contrast, structured data is very rigid and uses strongly typed attributes. Structured data has been very popular since the early days of computing and many organizations rely on relational databases to maintain very large structured repositories. Recent systems, such as CRM (Customer Relationship Management), ERP (Enterprise Resource Planning), and CMS (Content Management Systems) use structured data for their underlying data model.

A. Difficulties to integration

Problems that might arise due to heterogeneity of the data in tourism information systems are already well known within the distributed database systems community (e. g. [14],[15]). Heterogeneity occurs when there is a disagreement about the meaning, interpretation, or intended use of the same or related data.

Current dynamic packaging applications are developed using a hard-coded approach to developing interfaces among various systems to allow the interoperability of decentralized, autonomous, and heterogeneous tourism information systems (see also [16, 17]). The approaches to integrating tourism information systems to develop dynamic packaging applications only give a solution to syntactic and structural heterogeneity [18, 19]. Syntactic heterogeneity occurs since data sources may use different representations and encodings for data. Syntactic interoperability can be achieved when compatible forms of encoding and access protocols are used to allow information systems to communicate. Structural heterogeneity occurs since different information systems (e.g. CRS, HDS, DMS, etc) store their data in different document layouts and formats, data models, data structures and schemas.

Syntactic and structural integration are critical areas of concern for dynamic packaging applications because tourism organizations need to create B2B (Business-to-Business) links. In order for these B2B links to be successful,

heterogeneous systems from multiple companies need to interoperate seamlessly. Automating inter-organizational processes across supply chains presents significant challenges [20]. The current approaches to enable syntactic and structural integration of systems include the use of Enterprise Application Integration (EAI) [21] and Business Process Management (BPM) [22] tools or systems.

Despite the use of EAI and BPM systems, achieving syntactic and structural integration is a difficult task and the cause of many failures. Recently, Gateway wrote off $140 million from its failed effort to run their on-line store with a purchased software system [23]. The software did not work well with Gateway's existing systems. Another example is the candy maker Hershey Foods. They installed three software application packages, part of a $112 million system, with disastrous results due to incompatibilities with other application programs [23].

Due the high level of autonomy and heterogeneity of tourism information systems, dynamic packaging systems cannot be successfully developed by considering only syntactic and structural integration. One important aspect that needs to be contemplating to develop a new breed of dynamic packaging systems is semantic heterogeneity. Semantic heterogeneity considers the content of an information item and its intended meaning. The meaning of the data can be expressed in different ways leading to heterogeneity. Semantic heterogeneity can be solved by using techniques to achieve semantic integration. This approach will reduce the potential failures that may occur when integrating tourism information systems.

B. The next level of integration: semantic integration

To allow the seamless integration of HAD tourism data sources and information systems the use of semantics is indispensable. The semantic integration requires knowledge of the meaning of data within the tourism data sources, including integrity rules and the relationships across sources. Semantic technologies are designed to extend the capabilities of data sources allowing to unbind the representation of data and the data itself and to give context to data. The integration of tourism data sources requires thinking not of the data itself but rather the structure of those data: schemas, data types, relational database constructs, file formats, etc.

Semantically enriched reference tourism data sources are important to dynamic packaging applications because they provide a shared and common understanding of data and services of the tourism information systems to integrate. Semantics can be used to organize and share tourism information, which allow for a better interoperability and integration of inter- and intra-company information systems. The corner-stone of semantics and semantic integration are ontologies [24]. Ontologies are the key elements enabling the shift from a purely syntactic to a semantic interoperability. An ontology can be defined as explicit, formal descriptions of concepts and their relationships that exist in a certain universe of discourse, together with a shared vocabulary to refer to these concepts. With respect to an ontology a particular user group commits to, the semantics of data provided by data sources for integration can be made explicit.

The development of suitable ontologies for the tourism industry can serve as a common language for tourism-related terminology and a mechanism for promoting the seamless exchange of information across all travel industry segments. Depending on the approaches, models, or methods used to add semantics to terms, such as controlled vocabularies, taxonomies, thesaurus, and ontologies, different degrees of semantics can be achieved. Compared to other approaches, ontologies provide a higher degree of expressiveness. Furthermore, standards have already been developed (for example, OWL [25]) and are being used in practical applications. For these two reasons, ontologies can be applied in the area of dynamic packaging to explicitly connect data and information from tourism information systems to its definition and context in machine-processable form.

VI. Outlook into the future

The way that travelers shop for and purchase travel is dramatically changing. For an increasing section of the population, the Internet has become a convenient, inexpensive way to buy travel products. Dynamic packaging, including more direct consumer involvement and choice, is replacing pre-packaged, tour operator programs.

The growth and evolution of the European online travel market is creating both a challenge and an opportunity for the travel industry, particularly independent and small local/regional chains, will find advantages in developing and using their own websites to produce direct bookings.[4]

The changing demographic structure of Europe is going to affect the tourism industry seriously. By 2020, the population aged over 65 years will have increased by 17 million compared with today and due to better health and higher life expectancy this figure will continue to grow. In addition, people aged between 50 and 65 years, who are generally liberated from their family obligations, very mobile and often in a good financial position, will be more important to the tourism market.[26] Alongside these demographic changes there will be a change in demand regarding the type of tourism. According to a sustainable market study published by Cendant the average traveler's attitude will change to identifying themselves not any longer with what they buy but with what they do. This development will lead to an "experience economy" in which, how the study conducts a large percentage of tomorrow's tourists will be buying a series of one-off experiential holidays, rapidly moving from one adventure to another. [3] Additionally many tourists will have individual needs, which have to be taken into account to enable them to be part of the leisure industry. Apart from the 10 % of the European population recognized as handicapped in one way or another, a growing number of tourists can be expected to suffer from reduced mobility as a result of a temporary disability or age. Dynamic Packaging and its enhancement to Knowledge-based Packaging offers the right concept to face the above mentioned demographic and attitude changes. These

concepts will make it possible to provide a portfolio of specialist holiday offers from short-breaks to adventure travel and personal development holidays, tailored to the needs of consumers, who will require up to four different "experiences" a year. [3]

VII. CONCLUSION

The future trends in the travel industry will be significantly affected by new technologies like the Knowledge-based Packaging. In our eyes the future of packaged travel is dynamic and knowledge-based. Tour operators and packagers reluctant to retire the practice of pre-packaging vacation products will lose more and more ground. Knowledge-based dynamic packaging is simply the most cost effective way for travel distributors to package, distribute and sell vacation products today. Implementing knowledge-based dynamic packaging suppliers will be enabled to meet the needs of their customer in a way that there will be a Win-Win-Situation for the travel industry and the traveller. Technologies that give travel consumers more variety, flexibility and booking incentives will continue to have an advantage on the competition. This can be achieved by gathering and evaluating data on customer background and preferences within user profiles and collecting information from social networks like web communities concerning special destinations or various holiday activities.

Knowledge-based Packaging solutions/systems cannot be successfully implemented without taking into account the importance of data and information integration. One effective way to achieve this integration is to use semantics. Without a doubt, the successful implementation of semantics will facilitate the organization and sharing of tourism information and will therefore allow better interoperability and integration of inter- and intra-company information systems.

REFERENCES

[1] WTO – World Tourism Organization 2005. http://www.world-tourism.org/

[2] Marcussen, Carl H. Trends in European internet distribution- of travel and tourism services http://www.crt.dk/UK/staff/chm/trends.htm.

[3] Wilson, Gordon (2005). Dynamic Packaging and the future of on-line travel. FVW Kongress 2005. http://www.cendant.com/media/lpm/getlpm.cgi/297/GordonWilsonFVWSpeech230805.pdf

[4] Carroll, Bill and O'Connor, Peter (2005). European Hotels: Managing Hospitality Distribution. Preview published by PhoCusWright Inc.

[5] TIA (2005). Travel industry Association of America. www.tia.org

[6] Chicke Fitzgerald (2005) Dynamic Packaging: The impact of technology on the sale of commodity products, both online and offline. The Solutionz Group International, Inc. http://www.solutionz.com/pdfs/01-Dynamic_Packaging.pdf

[7] Lofgren, Stephanie. http://Metadata for Improving Commercialisation of Dynamic Tourist Packages. www.ibit.org/dades/doc/864_ca.pdf

[8] Trisept Solutions (2005) Making sense of Dynamic Packaging. http://www.triseptsolutions.com/Dynamic_Packaging.pdf.

[9] Meier, Armin (2005). Analysts and Investors day Mallorca 10.June 2005. Published by Kuoni Group. http://www.kuoni.com/corporate-site/investor-relations/pdf/AM_Technology.pdf.

[10] Amerongen, T. (2003). Hitting the mark with CRM (Beating the odds and ensuring CRM success), ifusion Solutions. http://crm.ittoolbox.com/white-papers/hitting-the-mark-with-crm-beating-the-odds-and-ensuring-crm-success-3106

[11] Nyheim.P.D., McFadden, F.M., et al (2004). Technology Strategies for the Hospitality Industry, Prentice Hall

[12] Lawrence, R. and K. Barker, Integrating Data Sources Using a Standardized Global Dictionary, in Knowledge Discovery for Business Information Systems, J.M. Zurada, Editor. 2001, Kluwer Academic Publishers. p. 153-172.

[13] XMLSchema, *XML Schema, http://www.w3.org/XML/Schema*. 2005

[14] Kim, W. and J. Seo, *Classifying schematic and data heterogeinity in multidatabase systems.* IEEE Computer, 1991. 24(12): p. 12-18.

[15] Kashyap, V. and A. Sheth, *Semantic heterogeneity in global information systems: The role of metadata, context and ontologies*, in *Cooperative Information Systems: Current Trends and Applications*, M. Papzoglou and G. Schlageter, Editors. 1996, Academic Press: London, UK. p. 139-178.

[16] Dell'Erba, M., et al. *Harmonise: A Solution for Data Interoperability.* in *2nd IFIP Conference on E-Commerce, E-Business and E-Government.* 2002.

[17] Fodor, O. and H. Werthner, *Harmonise: A Step Toward an Interoperable E-Tourism Marketplace.* International Journal of Electronic Commerce, 2004-5. 9(2): p. 11-39.

[18] Sheth, A., *Changing Focus on Interoperability in Information Systems: From System, Syntax, Structure to Semantics*, in *Interoperating Geographic Information Systems*, M.F. Goodchild, et al., Editors. 1998, Kluwer, Academic Publishers. p. 5-30.

[19] Ouskel, A.M. and A. Sheth, *Semantic Interoperability in Global Information Systems. A brief Introduction to the Research Area and the Special Section.* SIGMOD Record, 1999. 28(1): p. 5-12.

[20] Stohr, E.A. and J.L. Zhao, *Workflow Automation: Overview and Research Issues.* Information Systems Frontiers, 2001. 3(3): p. 281-196.

[21] Slater, D., *Costly, Painful and Worth It*, in *CIO Magazine*. 2002.

[22] Q-Link, *BPM2002: Market Milestone Report.* 2002, Q-Link Technologies. http://www.qlinktech.com.

[23] Hopkins, J. and M. Kessler, *Companies Squander Billions on Tech*, in *USA TODAY*. 2002. p. 1A.

[24] Gruber, T., *A translation approach to portable ontology specifications.* Knowledge Acquisition, 1993. 5(2): p. 199-220.

[25] OWL, *Web Ontology Language (OWL)*. 2004, World Wide Web Consortium (W3C).

[26] . *Working together for the future of European tourism.* http://www.iacvb.org/iacvb/american_crisis/eu_tourism_study1.pdf