

TourPack: Packaging and Disseminating Touristic Services with Linked Data and Semantics

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Abstract. While the touristic service offers become present and bookable in abundance on the ICT communication channels, TourPack aims to build a linked data -empowered system for touristic service packaging. Integrating information from multiple sources and systems employing linked data as a global information integration platform, and mining from the depths of the “closed” data, the touristic service package production system will be able to cater to creating the most optimal travel experience for the traveler. Further, the service packages will be efficiently published and made bookable to the end consumers via intelligently selected most suitable communication and booking channels: especially the ICT channels with rapidly growing user audiences, such as the social media and the mobile apps.

Keywords: Services, eTourism, Semantic Technology, Linked Data, Online Booking Systems, Social Media, Mobile Apps.

1. Introduction

During the past decades, the internet, especially the Web, as well as the mobile channels, have become the most important sources for planning and booking of trips, holidays and business travels. With this trend of the Web systems gaining more importance for the touristic service ecosystem, the appearance of the Linked Open Data, in combination with conventionally used proprietary semi-structured information sources and on-line services, delivers growing and significant potential to efficiently publish and access touristic offers.

Data centric information channels currently provide machine-processable information such as mountain bike routes or public transport schedules, restaurants with specific food preferences; on-line services allow booking of hotels, skipasses, concert tickets, etc. Making touristic services easy to publish for the service providers and easy to find and book for the tourists are the key challenges for the production of a complete online service tourist offer package. The abundance and variety of travel services and the restricted time the travelers typically have on vacations or in business trips, touristic service search, selection and combination requires a lot of effort from the service consumer, when aiming at an optimal travel experience. Also, as in many service-oriented businesses nowadays, the touristic service consumers want individualized experiences and no longer want the “one-size fits all” touristic packages, as, for

example, produced in a generic way by travel agencies. Thus, the aim of TourPack¹ is to design and a prototype a production system that creates “on-demand” touristic packages catering to the individual touristic service consumer needs and preferences – applying the smart usage of the open and proprietary data for the information integration and service composition, and eventually, improving the multi-stakeholder data-driven production processes of touristic service offer. Further, the pilot service prototypes will showcase the TourPack approach and infrastructure, and involve the real end user communities with varying sociodemographic factors and gender characteristics.

This paper is structured as follows. In Section 2, the current state of the art and the needed steps beyond are presented. The addressed problems and typical user scenario examples are in Section 3. The TourPack approach to the solution is described in Section 4. Finally, Section 5 concludes and summarizes the paper.

2. State of the Art and Current Knowledge

Progress beyond the state of the art in TourPack is mainly *in more efficient and interoperable booking of travel services by delivering a technical touristic service production system solution that integrates: (1) booking through various heterogeneous channels and devices, providing mobile access not as a separate solution but as an integrated aspect of a multi-channel communication, interaction and value exchange framework, (2) service combinations of core and external added value services and (3) yield management over heterogeneous channels and devices*. The progress in these relevant main directions is as follows:

(1) Mobile channels In this world of constant connectivity, consumer interactions with enterprises have transcended to the online world. The increasing number of mobile users around the world creates new opportunities for enterprises. Nevertheless, mobile users have different expectations in the way they access the information and services that shall not be neglected, especially by the tourism business, where a bad impression on a customer might bring fatal consequences. They want to connect to enterprises wherever, whenever, however they want, and will easily move elsewhere if dissatisfied.

Furthermore, consumers are more and more interested in communication via different (and multiple) channels. The ability to answer customer demands wherever they are, and using the channel and device of their choice, will make a huge impact in their experience and consequently in the business. The fact that customers want access to all the services (Gaffney, 2007) creates the necessity of an integrated strategy. Mobile services must be integrated in the business process, not seen as a separate endeavor.

To demonstrate the importance of the mobile experience, Google (Google, 2012) took a deeper look at users’ expectations and reactions towards their site experiences on mobile devices. Most interestingly, 61% of people said that they would quickly move onto another site if they did not find what they were looking for right away on a mobile site. The bottom line: Without a mobile-friendly site (that could be extended

¹ TourPack project: <http://tourpack.sti2.at>

to mobile access to services) one will be driving users to the competitors. Having a great mobile site is no longer just about making a few more sales. It's become a critical component of building strong brands, nurturing lasting customer relationships, and making mobile work.

Regarding the mobile experience, many customers prefer interactions via online channels rather than face to face, a fact that is currently supported by the increased number of mobile devices within the customer's reach. An appropriate mobile strategy integrated in the online multichannel world will also benefit the management and customer service for the tourism business (Revinat, 2012).

The initiative GoMo² from Google is a good example of best practices for companies to embrace the mobile world, providing also technical advice on how to make this adaptation while taking into account the expected effect.

In terms of current alternatives, there is a lack of integrated mobile support for a multi-channel communication and booking. In *TourPack* we enable mobility as an integrated feature, facilitating as a final goal the value exchange with the customers.

(2) *Service Integration* There are several approaches for spontaneous service integration: A technique to integrate web services into Jini service applications on the fly is proposed in (Gannod et al., 2003). Jini (also called Apache River) is a framework for the creation of distributed systems by the integration of modular services. In (Gannod et al., 2003) web services are used as Jini services by wrapping WSDL to Jini. The wrapping tool generates the services source code, the interface source and the Jini connection source. Using this approach the services can only be integrated into Jini applications. The solution supports the integration of WSDL based web services, but other web services like semantic web services or deep web services are not considered.

In (Leong et al., 2009) an intelligent web services architecture framework for on the fly service integration is introduced. The framework includes functionalities like service discovery, service engagement and service on the fly integration. The framework handles OWL-S, WSBPEL, WSDL, WSMO, WS-CDL and other SOA standards. However, it is not able to discover and handle deep web services.

MySIM is a spontaneous service integration middleware presented in (Ibrahim et al., 2009). It consists of four modules for the integration of services on the fly. The translator module translates all kinds of different services like web services into a generic service model. The generator module composes adequate services. The evaluation module evaluates the previous equivalence and composition relations. The last module, the builder module, implements the compositions and integrates the services in a chosen technology model. MySIM offers techniques for the spontaneous integration (translation) of OSGi and standard web services, but it cannot translate and integrate services from the deep web.

Our approach to the service integration will close the gaps of the approaches introduced above and create a production solution for the dynamic integration of touristic web services and deep web services on the fly that will enable the creation of enhanced integrated services that combine core and external added value services.

² <http://www.howtogomo.com>

(3) Yield management Yield management³ (Weiß, S. Haüßler, 2005) refers to the business activities that companies are doing in the scope of maximizing profits from a fixed and finite resource (e.g. availability of lodging businesses, airplane seats, etc.). Yield management could be considered as a multi-disciplinary concept as it needs information and data from various sources and departments. In this world of multi-channel distribution, multi-channel booking and multi-channel communication, the application of yield management in the most effective way is becoming a tough challenge for researchers to solve and make it available for use to the various business domains. The heterogeneity of the multi-channel ecosystem hinders the maintenance of offers as there are different constraints introduced from the various channels. Moreover, the major objective of maximizing the profits from a limited resource should be extended to cover the offering of combined services from various service providers.

Tourism is a domain with many cases relevant to the objectives of yield management (Amersdorffer et al., 2010). In the hotel industry it is also known as revenue management (Fandel, 2005). For instance, an hotelier has a finite number of rooms, which should be sold in a way that the profit is maximized and the cost is reduced to a minimum level. Yield management in tourism consists of various aspects like capacity management (Xylander, 2003), overbooking, dynamic pricing, length of stay (e.g. a lot of hotels are promoting offers with the two nights stays minimum due to yield management results), price limits (i.e. in relation to the average rate in the city of the hotel), last-minute reservations etc. In this respect hoteliers need to employ the appropriate tools in order to properly apply yield management and monetize its benefits. An example of such a tool is the Amadeus Hotel Platform⁴, which helps hoteliers to follow the revenue management objectives and fill their hotel rooms or other service capacities at the most profitable price.

According to (Hayes and Miller, 2010) the revenue management lifecycle for hotels includes five major steps, namely: a) establish prices, b) forecast demand, c) manage inventory, d) manage distribution, and e) evaluate results. The first step consists of the price establishment of the offered services and incorporates feedback from the last step of the previous iteration (in case it exists), the evaluation of results. Afterwards, the customer demand can be estimated (“forecast demand”), the management of the available rooms (“manage inventory”) is required and the distribution channels should be carefully managed to maximize revenue. The management of the distribution channels should be done in a way that minimizes the transaction costs and supports the maximization of the profit. Furthermore, the lifecycle of the yield management needs to be adapted to the offer of combined services in order to cover the package offerings that tourism businesses are promoting in nowadays (e.g. accommodation package integrated with car rental services).

The aim of the proposed solution is closely related to the steps that are considered crucial for the materialization of yield management. We enable the touristic service provider to manage the multi-channel communication and incorporate feedback that is gathered through the “forecast demand” and the “evaluate results” phases, which are the second and fifth steps of revenue management, re-

³ http://en.wikipedia.org/wiki/Yield_management

⁴ <http://www.amadeus.com/hotelit/hotel-platform.html>

spectively. In addition, the optimal management of the distribution channels (i.e. “manage distribution” phase) will be facilitated by minimizing the transaction costs and maximizing the profit via the direct bookability of the tourism services.

3. Description of Problem and User Scenarios

The internet, web-based communication and booking channels are becoming increasingly important in today’s competitive world. Organizations of all sizes, commercial and not-for-profit, regularly face the challenge of communicating with their stakeholders using a multiplicity of channels, e.g. websites, videos, PR activities, events, email, forums, online presentations, social media, mobile applications, and recently structured data.

The social media revolution has made this job for the organisations – as well as for their customers when spending time on learning about service offers - much more complicated, because:

- the *number of channels* has grown exponentially,
- the communication has changed from a mostly unilateral "push" mode (one speaker, many listeners) to an increasingly fully *bilateral communication*, where individual stakeholders (e.g. customers) expect one-to-one communication with the organization, and the expected speed of reaction is shrunk to almost real-time, and
- the *contents of communication is becoming increasingly granular* and more dependent upon the identity of the receiver and the context of the communication.

On the other hand, the booking market is moving online. In this context, data centered platforms – e.g. supporting booking, social media and mobile presence, are also becoming new dissemination and even main channels for **touristic service providers** to reach the customers. Currently, there are more than 100 booking platforms available on which the hotelier could be present.

Hence, the first challenge that needs to be addressed is *visibility*. To be found by relevant customers the tourism service provider needs to ensure to have the outreach to the most relevant customers as possible. This requires apart from time and resources, competence in the field of online marketing and commerce (which is intended to be supported by the interoperable intelligent service composition mechanisms).

This highlights the challenge of *scalability*, which is another problem that needs to be addressed in this context. The average time required for a service business to maintain a profile of a medium sized hotel at one portal is between 5 to 15 minutes a day. An effort of maintaining a business’s profile on 100 portals would then require at least 20 hours of work which for a medium size business, is a lot of time, effort and finally money that has to be invested in something that distracts the hoteliers from focusing on the core business. Tourism service providers are thus facing a challenging multi-channel problem by having to maintain the right balance of rooms’ availability across more than 100 channels on a daily basis. This obviously does not scale. Being accurate and visible in all the channels is a must in order to increase revenues. Yield management also plays an important role in this context. Adopting your offer and your price dynamically in response to the behavior of your (on-line visible) environ-

ment and selecting the right channel and customer will become critical to economic success.

In addition to the growing number of online channels, there are an increasing number of possibilities to access them. Mobile devices have become a popular means to access and book tourist related content and services online. It is therefore crucial for hotels to also be bookable through mobile devices, since most of the bookings will be done via mobile applications in future.

Due to these recent developments, competence in on-line communication and marketing as well as on-line sales is *crucial for ensuring the competitiveness of a country with a large tourism intake*. Losing the value of bookings via payment of commissions should be limited as far as possible. Consider the booking of hotel rooms as an example. More than 12% of all on-line hotel room bookings in Austria are done through hotel booking channels such as HRS or booking.com⁵. A portal such as HRS takes 18% of the price of a hotel room for offering this service. On a global scale, we are also seeing rising worldwide competitors such as Google, that are defining and implementing new business models and techniques for online marketing and booking that may once again change the transfer and distribution of these fees. Losing control and competence in this cornerstone of the tourist value chain may generate significant risk for the economic and social future of Austria as a touristic destination. Maintaining competence and competitiveness in on-line marketing may therefore be key to future prosperity.

Summing up it can be said that touristic service providers need an integrated production solution that provides management and execution of communication and booking goals primarily in an automated fashion, with costs equivalent to mass-media communication, along with the granularity of individual experts, and at the pace of real-time social media. We are aiming to mechanize important aspects of these tasks, allowing scalable, cost-sensitive, and effective communication for small-or-medium sized business units and comparable organizations for which information dissemination is essential, but resources are significantly limited. Considering these challenges, it is crucial for all touristic service providers to introduce appropriate technical solutions to be competitive in a future online world and to maintain their current ability to participate in the economic tourist value chain.

On the other hand, for **touristic service consumers**, the data-driven production service system would certainly be crucial when finding and consuming the most relevant services on the fly. Below, as typical end user scenarios, two short stories describe a customer (guest) on an average day on holidays and show how the software can be integrated in a hotel's and a hotel-guest's every-day business.

End user scenario A. A guest G enters the hotel for the first time. At the check-in desk the receptionist introduces G to the newly launched smartphone app of the hotel. G downloads the app in the free WiFi of the hotel and back in his/her room he/she starts exploring the contents. In the "restaurants"-section of the app she/he finds the menus of the day generated on the fly from linked data of the available restaurants in the nearby, catering to the user's food preferences and dietary restrictions. Since she/he feels quite hungry he/she makes a reservation for a certain preferred type of restaurant in the area directly out of the app (Fig. 1).

⁵ <http://www.slideshare.net/Roli1219/the-power-of-online-travel-agencies-ota> (slide 25)

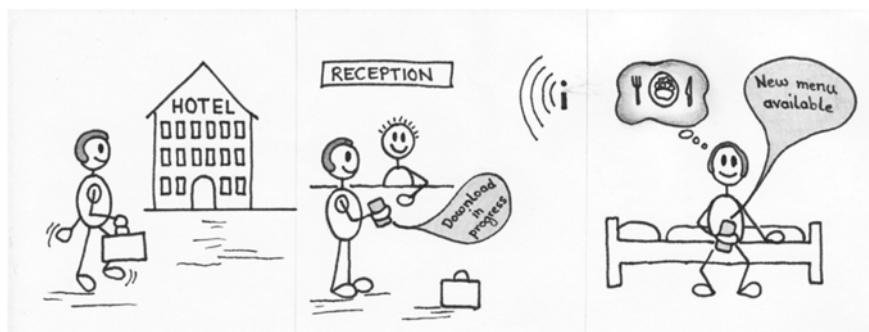


Fig. 1: Guest visits hotel and installs app (Illustration: Caroline Winklmaier)

End user scenario B. After G made her/his reservation she/he struggles to find the restaurant the reservation is made at. The tourist service consumer takes out his/her phone, browses to the page of the touristic service production data and finds the preferred transportation directions – based on the open data of public transport, taxi services and maps, which easily guide him/her to the desired lunch (Fig. 2).

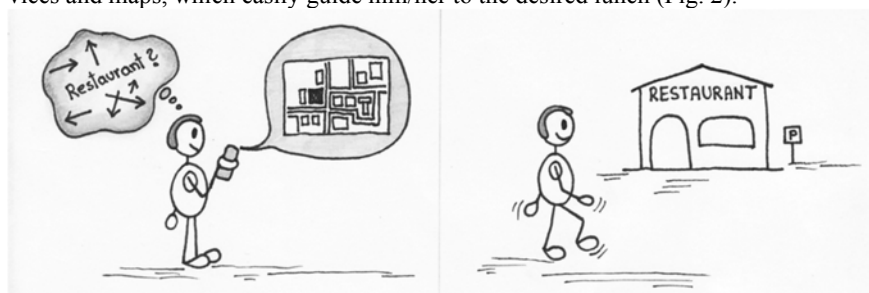


Fig. 2: Guest navigates to restaurant with the linked data empowered map (Illustration: Caroline Winklmaier)

Naturally, the touristic service production system would extend to heterogeneous types of services (e.g. in wellness, shopping, sports, culture), and in the same personalized manner would deliver to the end users packaged offers for experiences matching their expectations.

4. Goals and Results

TourPack generates the next generation of technologies for eTourism that can be easily deployed in the hospitality industry and needed to ensure visibility, interaction, and access to tourist services. Specifically, TourPack aims at providing pragmatic technology for online touristic service offer production and its efficient and scalable multi-channel online communication and booking through a multitude of channels

(i.e. web sites, wikis, social media channels) through various mobile devices. The major TourPack technical objectives are:

- i. ***design and implement a scalable online service packaging and provisioning solution based on machine-processable semantics.*** Scalability is achieved by introducing a layer of abstraction over all communication channels as well as a layer for capturing customer domain information. These two layers can then be dynamically mapped and connected, depending on the particular use case and direction of information propagation (publishing of messages or collection of feedback).
- ii. ***deliver the technology for interacting with this multi-channel solution through various and heterogeneous mobile channels.*** We will develop a mobile toolkit that can be used to develop adapters, integrate and use mobile channels into the *TourPack framework*.
- iii. ***provide support in service packaging, such as accessing, interacting, and value exchange (i.e., booking) of tourism services and their combinations through this infrastructure, using linked data as a global integration platform.*** We would like to support the hospitality industry in optimizing their revenue and profit management through easy and liquid booking in numerous channels and through numerous devices. We provide support in empowering the service provider towards low-fee (e.g., direct) booking opportunities to reduce the share of the income that is taken by external booking providers.
- iv. ***validate and apply the TourPack research and development outcome in pilots focusing on the booking of tourism services.*** We will show how *TourPack* technology will enable tourism enterprises to simplify and automate their communication activities, to engage possible customers via this multitude of channels, to gain visibility and in the end to increase their income by gaining more direct booking but also by saving on fees that are required by some of the booking channels.

Today's service ecosystems, including the ones addressing travel service offers, deal with increasing quantities of unstructured and semi-structured information in e-mails, text documents, spreadsheets, webpages, news articles, collaborative posts, social media to name but a few. Unstructured and semi-structured information is a vital part of an enterprise, for daily operations as well as for long-term strategic management. While these resources contain truly valuable contents, they are of limited use if they cannot automatically be handled by applications. Extracting knowledge from unstructured and semi-structured sources is the focus of Information Extraction (IE) research. TourPack developments are aiming at providing a state-of-the-art IE-driven semantic tool for (semi-)automatic touristic service semantic annotations and packaging in order to heavily reduce manual data entry for the population of the touristic service providers and consumers. IE is often supported by domain ontologies in order to identify the ontological concepts and relations that semantically describe the text content (Kiryakov et al., 2003). Proof of concept systems such as SOFIE (Suchanek et al., 2009) can parse natural language documents and extract ontological facts. Systems such as YAGO (mpi-inf.mpg.de/yago-naga) and Kylin/KOG (Wu and Weld, 2008) exploit supplementary semantics from Wikipedia and WordNet to extract semantically enhanced information from textual data. Semantic annotation platforms such as KIM (ontotext.com/kim), GATE (<http://gate.ac.uk>) or OpenCalais

(<http://www.opencalais.com>) locate and extract entities, relationships, and facts in texts, and create semantic links between different documents, data, domain models, and Linked Data. Once extracted from various sources, relevant manufacturing ecosystem knowledge can be inter-linked and then clustered in order to enable better search and navigation of virtual artefacts. This can be realized using approaches and techniques such as those provided by LarKC (larkc.eu) or LOD2 (lod2.eu). LarKC developed methods and tools to recognize entities and relations, and to interlink these entities with existing documents to provide richer search experiences. LOD2 supported Sindice (sindice.com), a platform for building applications on top of RDF-based Linked Data.

We will support automatic generation, clustering and packaging of semantically annotated touristic service offers from a variety of sources. More precisely, existing information extraction, clustering and publishing will be adopted and extended in order to:

- obtain the extracted data in a Linked Data format, (semi-)automatically associating metadata;
- generate service representations in Linked Data format according to ontological models;
- interlink, cluster, package and provide services in an automatic way;
- provide a semantic service and an online interface for easy publishing and access to the above mentioned functionalities.

As confirmed by the industry partners involved in this proposal, costs remain the main decisive factor for SME adoption of innovative ICT solutions. We plan to build upon open source tools for information extraction, interlinking and clustering many of the ones mentioned above. In particular we will consider OpenCalais for information extraction as well as linking and clustering tools developed by LarKC and LOD2 projects.

Further, the TourPack approach addresses a number of innovative challenges, and expected technical outcome and own contributions of the project are summarized in the following table:

Challenge	Outcome
<p>Multi-channel communication</p> <p>see (Fensel et al., 2012), (Toma et al., 2013), (Fensel et al., 2014)</p>	<ul style="list-style-type: none"> • Semantic based representation of content (ontology) in intuitive and familiar terminology for tourist service providers. • Scalable methods for separating and interweaving content and communication channels, particularly, employing linked data as an integration platform. • Online multi-channel communication technical solution.
<p>Online interactions</p> <p>see (Fensel et al., 2014), (Stavrakantonakis et al., 2014-1)</p>	<ul style="list-style-type: none"> • Formal communication pattern description mechanism as business processes. • Reusable set of communication patterns to structure the online interactions for the tourism domain.

<p>Service integration and yield management</p> <p>see (Toma et al., 2014), (Stavrakantonakis et al., 2014-1), (Stavrakantonakis et al., 2014-2)</p>	<ul style="list-style-type: none"> • Integration of a booking engine with the necessary infrastructure for tourism services to be directly bookable and configurable for yield management and tailored to the preferences of the end consumers. • A technique for enablement touristic service providers to annotate their offers employing linked data for the subsequent multi-platform reuse.
<p>Mobile service provisioning</p> <p>see (Kärle, 2014), (Davies et al., 2011), (Qiao et al., 2015)</p>	<ul style="list-style-type: none"> • Online mobile strategy definition for tourism organizations. • Mobile toolbox for the integration of booking services for travel service providers. • Mobile framework and components for multi-channel and online interactions management.

6 Conclusion

This paper presents the TourPack approach to designing, developing and deploying touristic service packages based on semantic technology as an enabler for tourists and tourism businesses to participate productively by providing new experiences and finding new direct dissemination and booking channels, while leveraging on touristic data value chain.

The effort already runs pilots, such as with Touristic Association of Innsbruck, and already implemented semantic dissemination support by implementing schema.org support on their website⁶ and publishing the touristic data of the Innsbruck region as linked open data (Toma et al., 2014). Also, in cooperation with SalzburgerLand, the touristic data of Salzburg are published in Linked Open Data format with schema.org, and are usable⁷. We are deploying our solution also with direct touristic service providers: starting with hotels, and extending to further touristic services.

Acknowledgments. This work has been partially funded by projects TourPack and OpenFridge, supported by the Austrian Research Promotion Agency (FFG) within the program “Future ICT”, FWF-funded project OntoHealth, as well as an EU-funded project BYTE, and ÖAD project RESIDE. The author gratefully acknowledges useful inputs of TourPack industry partners: Austrian SMEs m-Pulso, Redlink and Seekda, members of OC working group⁸, as well as the STI Innsbruck’s start-up ONLIM⁹, specializing on online social media marketing.

⁶ Website of Touristic Association of Innsbruck: www.innsbruck.info

⁷ SalzburgerLand Data Hub: <http://data.salzburgerland.com>

⁸ Online Communication (OC) Working Group: <http://oc.sti2.at>

⁹ ONLIM – Online Communication and Marketing Tool: <http://onlim.com>

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