SESA: A Scalable Multi-Channel Communication and Booking Solution for e-Commerce in the Tourism Domain

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Abstract — **In the Tourism domain, e-Commerce is becoming the dominant means for value exchange i.e. selling and buying touristic services. Considering the latest developments of the Web in the direction of user-generated content, information sharing, online collaboration and social media, all gathered under the umbrella term of Web 2.0, the number of channels for value exchange and interaction with customers has drastically increased. Nowadays, successful e-Commerce solutions require the ability to communicate and engage with customers for a better visibility, reputation and in the end, increased revenue. In this paper, we introduce the Seekda Social Agent (SESA), an ongoing effort that aims to deliver a platform which will help businesses in the tourism domain in dealing with the challenge of improving and maintaining their communication needs in order to engage with their customers in an efficient and timely manner that ultimately supports effective and efficient value exchange. Our solution integrates various social media channels such as Facebook, Twitter, LinkedIn, YouTube and Flickr, disseminates information items with one click through a multitude of channels, shows feedback collected from customers, and supports engagement and value exchange based on the use of *semantic technology*.**

Keywords – multi-channel communication, e-Commerce, e-Tourism, social media

I. INTRODUCTION

ICT technologies are changing the way commerce is realized. The buying and selling of products or services online through electronic means, i.e. e-Commerce, has been growing constantly in the last two decades and has now become a very popular activity performed on the Web. Although global e-Commerce has been growing by up to 13% annually over the past five years, there is still plenty of room to increase this growth. In Europe for example, e-Commerce accounts for less than 4% of the total European trade [5]. Worldwide the situation is very similar, e-Commerce representing only 6.5% of the overall retail[1].

With the latest developments of the Web in the direction of user-generated content, information sharing, online collaboration and social media, all gathered under the umbrella term of the Web 2.0, new challenges and great opportunities for e-Commerce growth are emerging. The traditional e-Commerce model in which businesses worldwide simply sell to customers has now been forced to change and develop solutions for listening to customers' voices, understanding their behavior, and actively and efficiently engaging with them in order to address their needs properly and in a timely manner. This will ultimately translate into a greater number of online sales, fulfilling to a larger extent, the core aim of e-Commerce.

Currently, the Web is one of the most important sources for planning trips, holidays and business travel. According to a European Commission survey from 2010[2], approximately 42% of tourists across Europe use the Internet to plan their trips. Furthermore, 70% of all on-line bookings are influenced by social media, and 80% of those making the bookings inform themselves about their destination via Web media. Research by four economists at the University of Chicago[3] has found that e-Commerce has affected the industry structure of tourism. More precisely, larger enterprises have grown at the expense of smaller and medium ones. With the rise of Social Media and its integration into e-Commerce, this can be balanced, providing SMEs the opportunity to become more visible on the Web, to better engage with their customers and to ultimately increase their sales.

The constantly growing opportunities in communication provided by Social Media can be both an enabler and a burden. Mulpuru [6] calls the later aspect "the growth of the multichannel monster". Being present in a multitude of different channels requires the effective management of a very large number of adapted contents, formats, and interaction patterns, fulfilling the communication and cooperation needs of distributed target groups.

In this paper, we introduce the Seekda Social Agent (SESA), an ongoing effort that aims at delivering a platform that will help enterprises in the tourism domain to deal with the challenge of improving and maintaining their communication needs in order to engage with their customers properly and in a timely manner, as well as to effectively and efficiently support value exchange with them. Our proposed approach provides a scalable solution for e-Commerce in the tourism domain by:

- **Efficiently and effectively supporting multi-channel communication based on machine-processable semantics.** Scalability is achieved by introducing a layer of abstraction over all communication channels as

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[1] http://pandodaily.com/2013/02/22/commerce-technology-is-a-massive-oppportunity-and-retail-is-not-dead/

[2] http://ec.europa.eu/public_opinion/flash/fl_291_en.pdf
[3] http://en.wikipedia.org/wiki/E-commerce

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).

- **Providing support in access, interaction, and value exchange (i.e., booking, multi-channel and direct)** of tourism services and their combinations. We need 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.

The remainder of the paper is organized as follows. Section II describes our multi-channel communication while Section III details the multi-channel and direct booking solution. Section IV describes the implementation of our overall approach. Section V discusses the related work. Finally, Section VI sketches the future work and concludes the paper.

II. MULTI-CHANEL COMMUNICATION

The core idea of our approach for scalable, cost-sensitive and effective online multi-channel dissemination is to introduce a layer on top of the various Internet based communication channels that is domain specific and *not* channel specific [4]. The domain specific ontologies that provide the information models are one of the core elements of our approach. Additionally, three other core elements are required to build a scalable multi-channel communication solution, namely:

- a channel model (or communication model), that describes the various channels, the interaction pattern, and their target groups;
- mappings of information items to channels through weavers; and finally,
- a library of implemented wrappers for actual channel instances.

What is essential is to *distinguish* the communication or channel model from the conceptual descriptions of the information, similarly to cascade style sheets (CSS) that separate the content from its presentation. Our approach requires the creation of a communication model (i.e., an increasingly complete model of channels), and knowledge models for each vertical (such as hotels, restaurants, tourist events, etc.), and finally linking the knowledge model with the communication model through a weaver that weaves concepts with channels. Data and information can be expressed at the conceptual level, which the domain expert understands. The knowledge models are formalized using ontologies [1] and are not full descriptions of the verticals,

but rather are focused on the information chunks that are disseminated about it. In this section, we describe how the content and the multitude of communication channels are being managed and interweaved as part of our multi-channel communication solution.

A. Managing the Content

In our approach, information items being communicated are specified using a domain terminology that is easily understood by domain experts. Such a domain specific terminology is not an exhaustive formalization of the domain, but rather includes the concepts that are most frequently involved in the various acts of communication. The domain specific terminology is formalized as an ontology. For the touristic domain, we have developed the Accommodation Ontology [5] [4]. The Accommodation Ontology is an extension of GoodRelations[6], which was extended with additional vocabulary elements for

- describing hotel rooms, hotels, camping sites, and other forms of accommodations, their features, and
- modeling compound prices as frequently found in the tourism sector, e.g. weekly cleaning fees or extra charges for electricity in vacation homes based on metered usages.

GoodRelations is a very popular e-Commerce ontology for annotating offerings and other aspects of e-commerce in the Web and is the only OWL DL ontology officially supported by both Google and Yahoo. Only for very few features, readily standardized conceptual elements are provided by the Accommodation Ontology ontology, like: acco:occupancy, acco:occupancyAdults, acco:petsAllowed, acco:occupancyMinors, and acco:size.

We are using semantic technologies to support the overall management of content dissemination in a multi-channel and bi-directional communication setting. We use vertical domain models, which are shared and reused in a vertical area instead of being used for a single application only. The vertical domain models are formalized as ontologies in RDFS[7] or OWL[8]. Linked Open Data[9], RDF[10] vocabularies are not seen as models in our approach, but rather as channels for dissemination. Popular vocabularies, broadly used by organisations in the market and research institutes, such as *GoodRelations* and *Schema.org,* can serve for this purpose.

B. Managing the Communication Channels

A core feature of our approach is to abstract information from the underlying online communication channels. The channels are the vast amount of on-line communication possibilities. In our view, channels are means of exchanging

[4] See also as an excellent presentation on this idea:
http://www.slideshare.net/reduxd/beyond-the-polar-bear

[5] http://ontologies.sti-innsbruck.at/acco/ns.html
[6] http://www.heppnetz.de/projects/goodrelations/
[7] http://www.w3.org/TR/rdf-schema/
[8] http://www.w3.org/TR/owl-features/
[9] http://linkeddata.org/
[10] http://www.w3.org/TR/rdf-concepts/

information in the on-line space, and include a wide range of online communication possibilities, such as static dissemination, dynamic dissemination, dissemination through sharing, dissemination through collaboration, and dissemination through group collaboration (see [2] section 2.2)

In the tourism domain, an established means for hotels to disseminate primarily static information is through a classic website. Wiki websites like *Wikipedia, Wikitravel*, or *Wikivoyage* can be used in order to improve the experience of the users that are seeking information on hotel websites. Blogs, *RSS* feeds, newsletters, and *Twitter* are another means used regularly in the accommodation industry to post news and articles related to the hotel. Videos and images are a good way of presenting a hotel or destination to a wide audience relevant channels being *YouTube* and *Vimeo* for video files and *Flickr* and *Pinterest* for image files. Social networks are another type of important channel for sharing and exchanging information, as well as for collecting feedback. *Facebook* is especially notable offering not only many possibilities through which to disseminate information, but also offering the option to book hotel rooms directly on the hotel's Facebook page. While social networks such as *XING* and *LinkedIn* might be unimportant with regards to acquiring new guests, they may be very useful for finding new employees or business partners. Booking channels or Online Travel Agencies such as *Booking.com, HRS*, or *Expedia* are platforms where hotels should be present with current availability. This involves a lot of effort as the availability on the channels needs to be updated continuously, to avoid overbooking.

With the recent growth of User Generated Content, review sites have become increasingly important. *Tripadvisor* is considered to be the most important review site on an international level, while *Holidaycheck* is the leading platform in the German speaking market. Furthermore, *mobile channels* have gained importance with the rise of smartphone coverage. Travellers are frequently using mobile applications for example, to orientate themselves and navigate through a new region, book hotels or buy entrance tickets. A hotelier should therefore also present his/her offer on mobile booking applications such as, for example, *LateRooms*. Hotel chains, like Hilton or the Accor Hotel Group have already developed mobile applications which allow the user to check availability, book, manage bookings, or find a hotel by address or current location.

The channels mentioned above are very heterogeneous in nature, having various interfaces, allowing different content types, and supporting different interaction modes- just to name a few of the heterogeneous aspects. Our solution provides an abstraction from these channels, integrating and personalizing them. Basic interaction with each of these channels, e.g. the ability to read from the channel and write to the channel, is also supported. Finally, our solution supports the aggregation of channels into composed communication structures.

C. Weaving the Content and Communication Channels

The central element of our approach is the separation of content and communication channels. This allows reuse of the same content for various dissemination means. Through this reuse, we want to achieve scalability of multi-channel communication. The explicit modelling of content, independent from specific channels, also adds a second element of reuse: Similar agents (i.e., organizations active in the same domain) can reuse significant parts of such an information model.

Separating content from channels also requires the explicit alignment of both. This is achieved through a weaver [2], which formally includes a set of tuples that define the weaving process, an execution engine capable of processing these tuples, a GUI to enable the definition of these tuples and a management and monitoring component to supervise the execution of the weaver. Based on these features, the publication process can be formally defined in a way in which the multi-channel publication is managed automatically.

Currently, all commercially available solutions are only channel centric and do not provide any built-in support for what needs to be disseminated or where to disseminate what piece. In our approach, a knowledge-model is built and explicitly linked with the channel model. This must be done once for a hotel, and can then be reused for millions of them. That is, we aim for the major elements of reusability:

1. The same information element can be reused for various channels through its channel independent formulation using the information model.
2. The information model is developed as domain ontology for a certain vertical area such as tourist accommodations, gastronomy, medical doctors etc. Therefore, it can be reused for various agents active in the same vertical domain.

These elements of reusability deliver a major contribution to the scalability of our multi-channel communication approach.

III. MULTI-CHANEL BOOKING

The multi-channel problem is confronted not only in the context of on-line communication, but also in the context of hotel booking. Online hotel booking possibilities are growing exponentially in number and heterogeneity. Nowadays, one can use booking platforms (e.g. Booking.com, HRS, Venere.com), review sites (e.g. TripAdvisor.com), OTA sites (e.g. Expedia, Orbitz), meta-search and integrators (e.g. Kayak.com) blogs, mobile channels, and last but not least, direct distribution sites i.e. the hotel website itself, to book a hotel. The hotelier on the other hand, needs to make sure that his hotel's profile is consistent and up-to-date on the multitude of booking channels, and bookable on all these channels. Hoteliers are thus facing a challenging multi-channel problem, having to maintain the right balance of rooms' availability across a

multitude of heterogeneous booking channels on a daily basis. This obviously does not scale.

To help the hotelier be present with an up-to-date profile in as many booking channels as possible, seekda Gmbh[11] has developed a solution called seekda!connect that offers automatic support for online booking on multiple channels offering tools for the online multichannel distribution, and supporting the hotels to increase their online bookings and conversions. A single entry point provides a direct connection to different booking platforms (see Figure 1), which can be managed over a simple, web-based user interface.

The multi-channel booking solution includes a booking manager for centralized online data management, a dynamic shop, a booking engine for hotel Web sites including online payment, portal software for multi-property search and a booking engine for marketing portals (including DMOs), Google Connect for direct connection to Google tools and direct channels for direct connection to other hotel distribution channels (booking.com, expedia.com, etc.). Automated interfaces to 3rd party providers e.g. travel insurance companies, translators' platforms or ski rental providers complete the application.
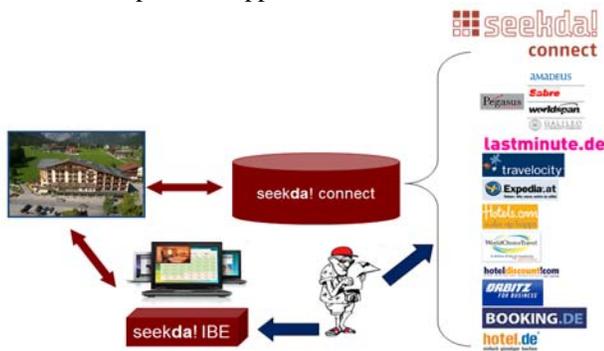

Figure 1: seekda!connect – multi-channel booking solution

Apart from the multi-channel booking problems, hotels are also facing another problem that is diminishing their income. More precisely, an increasing number of hotel rooms are booked online via booking channels that are taking a significant share of the hotel profits. To overcome this problem, a solution for direct bookability of hotels (which allows hoteliers to retain the profit), combined with the multi-channel communication approach to increase the visibility and trust in the hotel is required. seekda offers solutions for direct hotel bookings quickly and directly via hotel Web sites. This allows hotels to keep the profit they would otherwise lose through booking channels, and accelerates the booking time for future guests.

IV. IMPLEMENTATION

The implementation of our approach is under development as part of the Seekda Social Agent (SESA) project with the ultimate goal of enabling communication, collaboration and value exchange (i.e. booking) at scale for small and medium enterprises active in the tourism domain. In the scope of SESA, we specify and realize the concepts of channel model [2], weaving process of content and channels and communication patterns in order to achieve the aforementioned objectives.

SESA combines multi-channel communication and multi-channel booking. The multi-channel communication component hereinafter called *dacodi* is used to distribute information in various channels, as well as collect and analyze feedback from those channels and actively engage in conversations. The multi-channel booking (see Section III) hereinafter called *Seekda Booking Manager* makes use of *dacodi's* functionality by sending requests to the *dacodi* REST API. The data exchange is done via a REST interface, data being encoded in XML or JSON and sent to *dacodi*. The *Seekda Booking Manager* integrates the *dacodi* management frontend and widgets for the different steps, e.g. one for the publication, one for the feedback visualization. Each time a customer accesses the *Seekda Booking Manager* the related widgets are loaded and communicate with the *dacodi* platform.

The *dacodi* component is implemented using Ruby on Rail[12] and is conceptually split into different sub-components. One sub-component is the *Core* part that includes the REST API and the other is the *Adapters* that are responsible for the communication with the different channels.

The **dacodi-core** component is the main component of SESA. It is responsible for the application flow and consists of multiple modules which have different responsibilities. The Publishing Module, for example, is responsible for publishing information items – which is done asynchronously via the RabbitMQ[13] queueing system (see Figure 2). The Engagement Module is responsible for replying to posts, comments, tweets, etc.

The **dacodi adapters** represent wrappers to 3rd party APIs of the platforms that are supported by dacodi. For each channel, an adapter has to be implemented. The architecture, as shown in Figure 2, allows us to add adapters (i.e. add channels) without touching the other components of SESA. Adapters can be run independently of the core component, even in a distributed fashion on multiple hosts, providing inherent scalability.

The **dacodi model** (not shown in Figure 2) is an ontological model which represents the data structures and entities that are manipulated by SESA. The model includes User models, Authentication models for single authentication of a user, Channel models for specific channels where content can be published or retrieved, ConceptToChannelMapping models used in the channel selection process, Remote models for entities published in the channels, Feedback models for any form of feedback, Publication models for information items

that were published via dacodi and CommonWeaverModel models for weaving the content and channels.
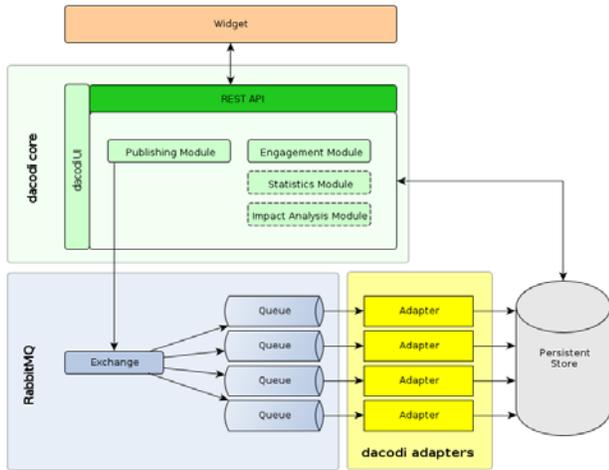

Figure 2: The "Big Picture" of the SESA architecture. Arrows depict the data flow of the application.

The following functionalities are implemented in dacodi:

- *Role Management/Single SignOn*

In order to support the different stakeholders different roles are introduced and supported in the system i.e. system user and administrator. These roles map the real world users to the platform.

- *Publication*

The publication process dissemination adapted content to different channels. The adaption is made on the basis of the channel capabilities, e.g. shortened messages are posted to microblog platform, such as twitter. The current implementation supports a number of channels including Facebook, YouTube, Twitter, Flickr and LinkedIn. To achieve scalability, dacodi uses a message-oriented architecture to implement an asynchronous publication process. For this purpose, the Advanced Message Queuing Protocol, short AMQP[14] is used.

- *Feedback Collection*

dacodi is able to collect diverse feedback across multiple channels. Feedback can have different forms. It can either be textual (comments, replies, etc.), a certain amount of positive (like, +1, thumbs up, etc.) or negative feedback (thumbs down, bury, down vote, etc.), or some other measurement of a user's response to a published item. dacodi can collect all these different types of feedback using various polling strategies.

- *Front-end*

The dacodi Front-end is composed of two types of components. One component is the server-side Front-end which can be accessed from the Social tab on Seekda Booking Manager Front-end. Already integrated with help of iFrames, this prototype provides the basic functionality of dacodi, demonstrating the dissemination of different concepts like videos, microblogs, pictures, etc. on the

different integrated social channels. The second component integrated with Seekda Booking Manager consists of more JavaScript widget based subcomponents, that handle the notifications retrieved from the feedback collection, show additional bookings gained through the disseminated concepts on different social channels via dacodi, and provide the possibility to publish touristic packages.

Figure 3: Front-end for managing social media accounts

SESA provides a Web interface to manage social channels' accounts and register them in *dacodi* (See Figure 3), in order to create a publishing information item i.e. touristic offers and packages descriptions, including various media types such as images, text and videos.

The functionality of the *Seekda Booking Manager* is extended with the publish functionality for touristic packages. The *dacodi* widget enables dissemination of touristic information items i.e. offers and packages on social channels. The touristic information item provides the content to the widget, and the widget displays the information item to the hotelier as a post form. The hotelier can edit the post, modify it, as well as see on which channel the offer or the package is about to be published. The results of publishing offers and touristic packages on the channels become visible in the dissemination channels selected by the hoteliers. Furthermore, the feedback received on the published items is displayed (See Figure 4) and the hotelier can engage with possible customers on the social channels.
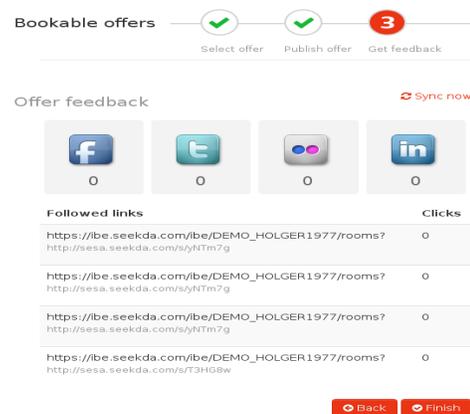

Figure 4: Feedback for a published information item

[14] http://amqp.org/

V. RELATED WORK

Most of the current approaches and tools for multi-channel communication can, with one click, post on many different channels. They usualy involve Web 1.0 channels and social Web 2.0 channels. Such tools generally use simple mechanisms to adapt the content to fit the channel output. Additionally, most of the tools are able to process the content, allowing the user to create statistics and publish posts as well as retrieve feedback. However, currently none of the toolkits really support the user in showing where to publish, when to do so, what content should be disseminated and how the individual channels should be used. Furthermore, current tools do not abstract and distinguish the communication or channel model from the conceptual descriptions of the information. In the remainder of this section, we briefly review some of the most important tools for multi-channel communication available on the market.

Revinate (revinate.com) is a multi-channel communication tool particularly designed for the hospitality industry suited for wide adoption, from front-desk staff to sales and marketing executives, and from general managers to corporate users. The tool is able to take unstructured guest feedback and turn it into crucial business and competitive intelligence. Last but not least, Revinate is partnering with TripAdvisor. Tools such as Virtue (vitrue.com), Direct Message Lab (directmessagelab.com), CrowdFactory (eu.marketo.com/), or HubSpot (hubspot.com), give brands and agencies the means to execute their social marketing strategies, including social media promotions and contests, advertising, measurement and analytics. Such tools make possible consolidated publishing activities for channels such as Facebook, Twitter and Google+, monitoring of ROI for social campaigns and interaction with customers.

Tools such as Radian6 (radian6.com) or MeltWater Buzz (buzz.meltwater.com) put a strong emphasis on social media monitoring and management. They provide means for listening to social media, analyzing and measuring the raw data, producing insights based on Natural Language Processing and engaging with the streams of posts across multiple social media channels.

Most of the multi-channel communication tools provide complex dashboards that integrate, visualize and report on social activities in a unified display. Radian6, Virtue, Syncapse (syncapse.com), and Hootsuite (hootsuite.com) for example offer social media dashboard for managing social content and engagement on multiple networks with team workflow and statistics.

Our approach advances the state of the art on multi-channel communication by using processable *semantics* in order to provide a scalable and efficient multi-channel communication solution. In comparison with existing tools, our approach introduces a layer of abstraction over all communication channels and facilitates the task of specifying communication content using customer domain information based on semantic technologies. We explicitly separate and interweave content and communication channels as a principal means for achieving reusability and thereby scalability over various heterogeneous channels.

VI. CONCLUSION AND FUTURE WORK

In this paper, we proposed an approach for multi-channel communication and booking of touristic services. Our approach combines technical solutions for multi-channel communication as well as direct and multi-channel booking. The multi-channel communication enables various actors to listen, communicate and engage with each other and thus increase their visibility, online presence and ultimately, their profits. Direct and multi-channel booking enables scalable yield management over a multitude of heterogeneous booking opportunities and enables tourism enterprises (i.e. hoteliers) to save on commission fees requested by booking channels. Our e-Commerce solution enabling multi-channel communication and booking for the Tourism domain will be extended in several different directions. We will support integration and interlinking of external data, such as Linked Data[15], and services in our solution in order to empower the hoteliers to offer new touristic products and services. We plan to extend our approach to include a wider range of interaction channels, such as mobile channels. Contextual information will be used in order to provide the right service at the right location and time. Mobility will be an integrated feature, facilitating as an ultimate goal, the value exchange with customers.

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