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MULTI-PLATFORM MOBILE SERVICE CREATION: INCREASING BRAND TOUCH-POINTS FOR HOTELS

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With the introduction of smart phones, the marketing possibilities for businesses changed fundamentally. New advertisement and publication mechanisms developed a new way of communication between business and customers in a more frequent and more personalized way. This paper describes a design approach for the development and implementation of a tool which can be used by hotels as well as by other end-user oriented businesses to keep close contact with customers by using a technology almost everyone uses nowadays – the smart phone. Offering a possibility for the customers to communicate with the business is as important as leaving the business' imprint on the customer and keeping the customer's retention by increasing brand touch points. To accomplish the above mentioned requirements we propose the design and implementation of a content management system (CMS) rendering mobile apps for different platforms: Android, iOS and in mobile website mode. After the roll out of the resulting product and a testing phase with two customers it is apparent that the utilization of mobile marketing mechanisms really increases the brand touch points and has a high acceptance rate by customers of all ages, genders and social environments.

Keywords: mobile platforms, mobile service, apps, context awareness, online marketing, eTourism, service creation

1 Introduction

Since the creation of the first mobile phone, developed by Ericsson in 1956, the branch of portable devices for communication has undergone tremendous and rapid growth. In 1992, the first "smartphone" appeared. Since the release of the first iPhone in 2007, and the first Android device in 2008, the branch of "smartphones" continues to grow faster than ever before. The release of Apple's App-store and Google's Android Market created an opportunity for developers to generate additional software, now known as "Apps", for smartphones and to provide them for all users from a centralized platform. The constant growth of the smartphone- and app-market produces new ideas for the use of smartphones in everyday life and provides the user with a huge number of possibilities.

The tourism sector requires many possibilities to reach customers on a regular basis, to increase their satisfaction and to ensure their retention. This paper describes the idea of planning and implementing a framework that provides hotels and other touristic institutions with a variety of software instruments to help them benefit in their use of the new trend of

mobile advertising. The framework consists of a native Android application, a native iPhone application, a mobile-website, a web-based CMS to populate the apps with content, and of course, the communication infrastructure between the web server and the client applications.

In contrast to other products which provide a single application (either Android or iPhone) and do not provide possibilities to populate the application itself, this software is multi-platform based and flexible regarding the use of texts, pictures, videos and pdfs. Even if a user does not have an Android phone or an iPhone, he/she is able to visit a mobile website under the URL of the client which gives him/her the same content and the same look-and-feel which he/she gets in the native apps. Even though a mobile-website containing all the contents of the CMS is provided, it makes sense to provide native apps for Android and iOS, because native apps can make use of native capabilities of the devices like touch- and gesture actions, notifications and offline availability.

This paper is organized as follows: section 1 introduces the topic of mobile computing and advertisement in tourism. Section 2 states the motivation for tackling that problem, describing a typical user scenario and an approach to solving the described problem. Section 3 lists the technologies in use and mentions related work in the contexts of both industry and science. Section 4 describes the system design, section 5 presents the evaluation, the results and the outlook. Finally, section 6 concludes the paper.

2 Motivation And Problem Statement

This section defines and describes the problem this paper is addressing. It explains the motivation, shows an approach to solving the problem, and lists the requirements for finding the solution. In this section, we make consistent use of the two words **client**, which refers to the entity who uses the app to advertise its business (a hotel, restaurant, car dealer, ...) and **customer**, which refers to the entities who visit the clients facility (guest, ...) aka end users.

2.1 Motivation

In this project we want to design and develop an infrastructure intended initially exclusively for the tourism industry. In future, however, we would like to apply it to all types of businesses that interact with end-users.

The benefits for the client (for example the hotelier) are numerous. It enables better and faster interaction with their customers, provides information to customers on a regular basis and in several interactive ways (text, image, video, pdf,...), provides information on mobile devices in an attractive and state-of-the-art manner, increases customer retention and multiplies brand touchpoints.

There are also several benefits for the customer (e.g. a hotel guest). They are able to receive an overview of the facilities offered by the hotel (restaurants, bars, sport-, wellness- and/or spa) – offline, along with an overview of news and special offers – also offline. They have the possibility of direct interaction with the hotel (call, mail, ...), and it enables navigation to places in- and outside the hotel (indoor-map of hotel or Google Maps). They are able to share interesting app content with friends (Facebook, Twitter, Google+, ...), make reservations online without dealing with desktop optimized web-forms, and get news updates and special offers without opening the app via push- or sms messaging.

2.2 Typical User Scenario

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 he/she finds a pdf with the menu of the day. Since G is hungry, he/she makes a reservation for a certain restaurant in the hotel directly from the app (Figure 1).

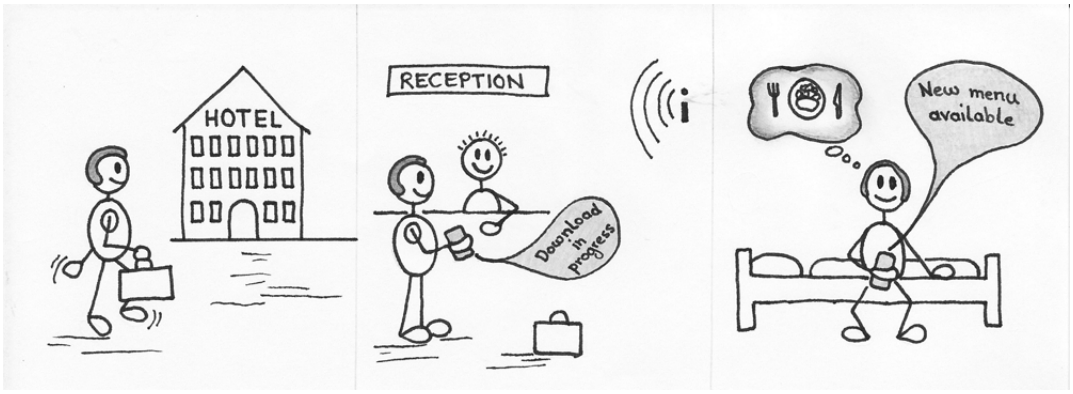

Fig. 1. Guest visits hotel and installs app (Illustration: Caroline Winklmair).

After G makes his/her reservation, he/she struggles to find the restaurant at which he/she made his/her reservation. He/she takes out his/her phone, browses to the restaurant site and finds a map, which easily guides him/her to the place where he/she has his/her lunch.

In the afternoon, G is up for some outdoor activities. He/she remembers that he/she saw a "Sports" section in the app. Quickly browsing through the outdoor and sport activities in the app he/she finds a place to which he/she wants to go. Since it is G's first visit to this town, he/she has no idea where he/she can find this place. So he/she clicks the "Details" button in the description of the place and finds a direct link to Google maps which directs him/her to where he/she would like to go.

2.3 Research Questions

From a scientific point of view, the following research questions are discussed and answered in this paper:

1. Would customers use app-based information services of potential holiday destinations or hotels to which they have been before?

2. What would be the benefit for the clients (for example hoteliers) if they introduced mobile services for their customers? Will there be a significant increase of brand touch points if customers had an app from a hotel on their smart phone?

3. Is it possible to implement a system that contains apps for Android and iOS, a WebApp and a CMS?

According to Spengler et at.[1], the so called "brand touch point" is the crucial measurement when it comes to marketing decisions, like whether or not mobile services should be introduced to a business. This is the reason why this is where the main focus of the scientific work lies.

2.4 Problem-solving Approach

This solution should offer a variety of functions for touristic use (especially the "sublime hotelerie"), such as a news broadcasting system, the possibility to deliver special offers, recommendation marketing, navigation and multimedia. It should be a modular system that allows us to design a product for the client in a relatively small amount of time.

The information the client enters into the system is automatically available on the two mobile platforms with the most sales in the last years, Android and iOS, and a mobile website (the so called "WebApp") is provided.

What makes this idea special is the client's ability to maintain its app via a well-structured and lucid CMS and to reach its customers via push-messaging or sms-texts triggered directly in the CMS. For every client the CMS is designed individually to fit all the client's demands.

2.5 Requirements

The following list shows the most important requirements the apps, as well as the CMS, have to satisfy. These requirements have been derived from a joint product definition with hotel owners, pilots, and potential customers.

- **Attractive appearance:** Since apps are not only sources of information retrieval, but should mirror their owners' image, an attractive appearance is a must. It makes the user utilize the app, gets him/her adjusted, and makes him/her re-visit the app.

- **Usability:** A well-structured and consistently arranged information hierarchy allows the user to find the desired contents faster, and without any troubles; as against an oversupply of information and an inconsistent and non-structured information hierarchy, which makes the user avoid or even uninstall the app.

- **Adaptable CI/CD:** For a client, it is necessary that the design of the app represents its 'Corporate Identity' and its 'Corporate Design'. Therefore, the look of the app must be highly adaptable to any design the client desires.

- **Offline availability:** Hotel guests are often visitors from foreign countries. For them, and for customers who have no internet connection contract with their phone carrier, it is very important that contents can be downloaded from WiFi at home or in the hotel and stay available, even if they are outside the WiFi-reception area.

- **Well structured CMS:** The CMS is where the client has the most interaction with the app and is filled with content. It has to be easy to use but at the same time it has to provide enough functionality to fit the client's needs. The idea is to accomplish this requirement by creating a CMS that looks like something familiar - for example, to accomplish a text editor everyone knows from office products or a page arrangement in a tree formation.

- **Highly adaptable app:** For the producer of the app(s), it is very important to create a system that enables the building of new and totally different looking apps for different clients in a very short time with a minimum amount of code-writing/changing. Therefore, it is planned to create a solid framework to achieve this very important requirement.

3 Technologies And Related Work

This section shows and briefly describes the technologies used in this project and lists state-of-the-art work related to the project as well as similar tools available, scientific research and market analysis.

3.1 Technologies

This project is an assembly of different modules. The scope of every module is different and hence needs to be written in a different programming language or realized with a different technology.

We used Java as the programming language for the development of the core software. Java is wide-spread, well supported, very well documented, and hence was the language of choice. We used the *Java Persistence API (JPA)* and below a MySQL database for storing contents in a database. JPA was chosen because it integrates well with Java and we chose MySQL as a database because it is free and for the amount of data we expected it is easily sufficient. The server side applications were developed with *Java Server Pages (JSP)*, because the syntax is very similar to Java and the core, written in Java, can be exported as a JAR-file and used as-is in the JSP project. We used two JavaScript frameworks for the front end of the web applications, ExtJS for the applications running in a browser on a computer, and Sencha Touch for the applications running in a mobile browser. Finally, for the native development of the mobile clients, we used the framework of Android, which is based on Java and Objective C for developing apps for iOS.

3.2 Related Work

The "mobile marketing" related work we found can be roughly separated into two groups. One group contains the frameworks and similar products for introducing mobile marketing in hotels with apps and/or mobile web sites. The other group consists of the scientific approaches for figuring out to which extent mobile marketing is useful and productive for businesses.

3.2.1 Related app frameworks and products

With the development of different mobile operating systems such as Android, BlackBerry, iOS, Windows Phone and others, different approaches appeared to provide cross-platform programming infrastructure, as described in [2] or compared in [3], to save, for example, development time. One company providing such cross-platform native app development technology is *Appcelerator*.[a] Its main product, Appcelerator Titanium, is an open source SDK where apps are written in JavaScript and can be deployed to Android, iOS and Windows Phone. Another company providing cross-platform development software is *Corona*.[b] It's main emphasis lies on cross-platform game development as used in [4]. We decided not to

[a] http://www.appcelerator.com/
[b] https://coronalabs.com/

Table 1. The products of *hotelapp.at*, *vioma* and *zooners* im comparison.

	this	**hotelapp.at**	**vioma**	**zooners**
WebApp	yes	no	yes	yes
Android App	yes	yes	no	no
iOS App	yes	yes	no	no
native implementation	yes	no	no	no
modern/attractive appearance	yes	yes	ns	yes
selfmaintainable content	yes	ns	ns	yes
human readable url of WebApp	yes	ns	ns	no
native looking WebApp	yes	ns	ns	yes

use a cross-platform framework like Appcelerator or others, because at the time we started to work on that idea, the cross-platform products were not yet well established and tested, though sometimes very expensive. But the decision as to whether or not to provide native implementations would probably look differently now, as a lot of cross-platform projects are well developed, well tested and popularly accepted in the app development area.

The following three products were chosen because they provide a functionality similar to our product, and the companies which produce them serve, geographically speaking, a similar audience.

Hotelapp.at is a collaborative project by the company *ZillertalWeb* and *HS Design* with focus on the development of Android and iPhone apps. Examples for clients of hotelapp.at are "Hotel zum Pinzger" or "Hotel Jakober"[c]. The products of *hotelapp.at* differ in two major points from our work which are at the same time big disadvantages of their apps. They do not support offline availability of contents, which means that the app only works if the user is online, and they do not provide native implementations for Android and iOS, but wrapped WabApps, which results in very bad performance even on brand new smartphones such as the *Samsung Galaxy S4* or the *iPhone 5*.

Vioma is a German marketing company. They offer ordinary websites, along with mobile optimized websites. Their clients are companies as well as hotels. Since their focus lies on website design and creation, they do not offer Android or iPhone apps[d]. As mentioned *vioma* does not offer native apps, which means, that the user has to be online to browse the contents of the app.

Zooners is an Austrian company specializing in WebApps. They not only serve clients from the gastronomy branch but also from branches like ski-schools, car services, musicians and shops[e]. Their hotel customers are, for example, Hotel Panorama or Hotel Krone. Since *zooners* only offers WebApps that do not provide offline availability of contents and no native implementations, but the apps have an attractive appearance and can be maintained by the customers.

For a summary of the competing products to our products see Table 1.

[c] http://www.hotel-app.com/
[d] https://www.vioma.de/
[e] http://www.zooners.com/

3.2.2 Research approaches to mobile marketing

The research in and around mobile marketing can be approached from several different directions. In the following section we divided those directions into four different topics.

Topic: data empowerment Smart Data, including Linked Data [5] and Semantic technologies [6] can enhance interoperability of distributed marketing resources to allow meaningful searches and efficient information dissemination. Overall within the touristic domain, service composition and combined service offers are typically addressed problems, requiring ongoing adaptation and co-development of new technology and approaches e.g. for touristic planning [7]. Also, touristic service packaging is an area of applied interest. For example, the aim of an Austrian TourPack project [8] is to design and 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 the touristic service offer. Given the growing amount of data and available services and their representation, the already common mobile service problems such as point of interest identification in location-based services [9] or the need for efficient large scale semantic reasoning [10] remain, and gain even more importance and the need for their further development and application.

Topic: efficiency in multimedia and networks Creation of travel information services with spatial, social and temporal dimension are already able to be built on Web 2.0 data, namely, as travel mashups [11]. With the appearance of smart data, especially global use of schema.org, also in tourism [12], the input coming from data processing components e.g. making decisions on yield management, would be more and more present in service composition approaches. It has also been shown that touristic application can leverage on extensive amounts of linked data and be operable even in rural areas [13]. Obviously, next steps envisioned in this direction would also be inclusion of further types of content and media e.g. television: again, this implementation will be possible with the support of linked data [14]. Taking into account steady developments towards the improvements of the quality of service of telecommunication networks [15, 16] as well as a better management of mobile ecosystem multimedia assets [17, 18], there is no doubt of further extensions of multimedia use in mobile touristic applications.

Topic: multi-stakeholder and multi-channel ecosystems 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 [19] creates the necessity of an integrated strategy. Mobile services must be integrated in the business process and overall multi-channel communication and value co-creation ecosystems [20], and not seen as a separate endeavor. Successful examples of linked data empowered systems allowing efficient collaboration via a mobile terminal- already exist [21]: they can be also applied in tourism e.g. in scenarios where user contribution is expected. Finally, multi-lingual support of the data and content in such systems as ours is essential when it comes to touristic service marketing. This area has also been addressed within linked open data [22], and can be applied to further develop and expand our system.

Topic: mobile marketing With the rise of mobile phones, mobile marketing became an interesting field of research. The potential of mobile phones as ways to earn customers locality are described in [23]. The authors show a correlation between mobile marketing and customer loyalty and conclude that customer loyalty is positively related to mobile marketing. In 2008 Sharma et al. wrote a guidebook on how a brand can be advertised in the (at this time) brand new field of mobile marketing [24]. It helps the reader find a way to benefit of the "emerging multi-billion-dollar industry" and to understand and take advantage of "hot new advertising medium" as they call it. On the case study of three sportswear companies (Adidas, Nike and Puma), [25] examines the use of mobile marketing tools and finds out that their use creates stronger brand awareness and builds stronger relationships with customers. The importance of the increase of mobile marketing is shown in [26], where the authors talk about "new opportunities for companies to promote themselves and communicate with their customers" on mobile devices in the context of mobile search. The authors also provide a marketing strategy on how to work best with mobile markating and communication tools to be more competitive. The conclusion driven from that work is that this market is already highly vivid and the importance of being present is inevitable in order to stay competitive. A different approach to end user created mobile services is described in [27], where the authors propose new methods for (visual) mobile service creation, not based on a CMS like this approach. A study made by Beier and Aebli [28] surveys the potential of mobile apps for tourism organizations and discovers that the "propensity to use internet on holidays corresponds with the propensity to use mobile apps on vacation". Another study by Antunes and Amaro [29] aims to find out what drives the pilgrims of the Saint James' Way in Camino de Santiago to use mobile apps and gives valuable insights for the niche of pilgrimage app designers. A different approach for the same idea as ours is described in [30]. Instead of providing only an app for hotel customers the work of Hui et al. describes how clients react to hotels providing smart phones with pre-installed apps for their guests. The result shows that guests are mostly satisfied and show a high acceptance towards this software-hardware bundle.

4 System Design

This section describes the system requirements, the operating environment, the system and subsystem architecture, file- and database-design, in- and output format and layout, human-machine interfaces, detailed design, process logic and the external interfaces of the project. It provides the reader with an insight into the system design from several points of view, with an emphasis on the developer's perspective.

4.1 Overview

The goal of the development is a system which offers companies (in this case, hotels of the upscale hotelerie) a tool, to increase the customer retention and to keep the customers up-to-date on the events and the offers of the company. Therefore, the need arises for a piece of software the users always able to carry around with them - an app. Since the two most popular mobile operating systems are Google's Android and Apple's iOS, the need for implementing two native apps for those operating systems is evident. But there are numerous mobile devices on the market which run on different operating systems for which the Android and iOS apps are useless. Therefore, a mobile device optimized website is developed, a so called web app.

There is a CMS running on a website in order to provide the company with a software that allows the ability to enter the mobile device optimised data. After the company updates a part of the CMS, these changes are immediately available on the apps and the mobile website. The big benefit of native apps is that the downloaded content is also available if the user is not online. Therefore, after downloading the content once, it is possible to use the app even without internet connection. Figure 2 gives a high-level overview of the system and shows some interfaces to external systems.

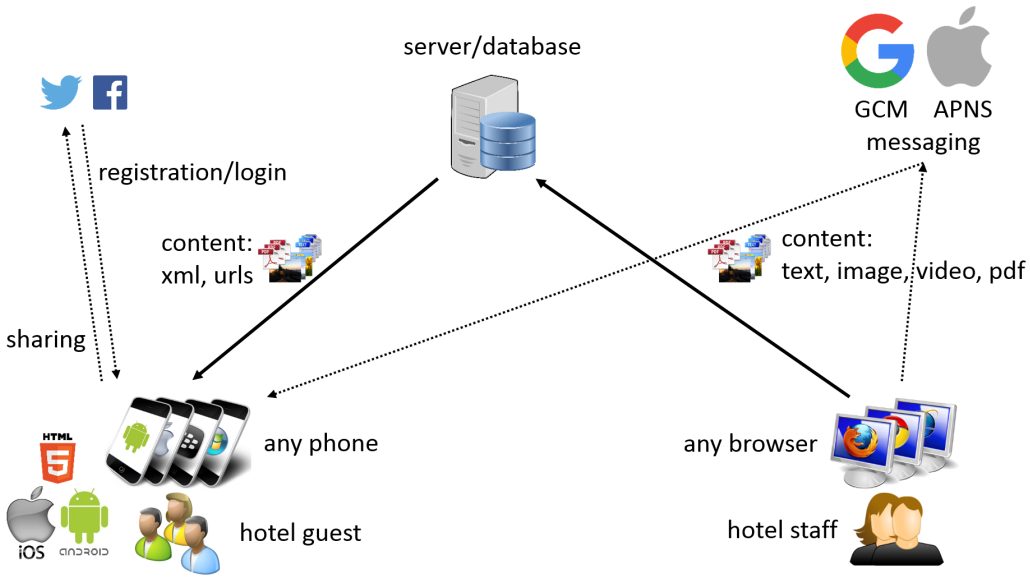

Fig. 2. High level architecture.

4.2 Design constraints

Since the targets of the system are mobile devices, there are constraints concerning the content. Large amounts of text are hard to read on small screens and soon lead to users' annoyance. Big images with a large file size take a long time to download onto the device and make little sense since the viewing area on a mobile device is limited. The same applies for videos. The large file size which results in long download time annoys the user and may result in disinterest in using the app. The problem of file size, download time and screen size is also true for huge pdf-documents. Therefore, it is important that the contents uploaded to the CMS are optimized for the needs of the target device concerning screen dimensions and download speed. Another constraint concerns the availability of new contents. For the native apps, the user must be online to download new content which can result in high costs if the user is, for example, abroad- whereas the web app does not save content at all and the user has to be online permanently to even start the app. For future design adaptions there are plans for integrating new technologies built in mobile devices like *near field communication (NFC)*. One use-case for such a technology could be when it comes to vouchers on mobile devices where the validation could be made by touching a sensor with the phone and transmitting

the voucher information via NFC.

4.3 Architecture

The system is based on a client-server-architecture. The server part takes a web server, which stores the data provided by a CMS and offers interfaces for the clients to request data. The client parts are taken by the apps implemented on Android and iOS and the mobile websites (WebApps).

An overview of the architectures layers can be seen in Figure 3.

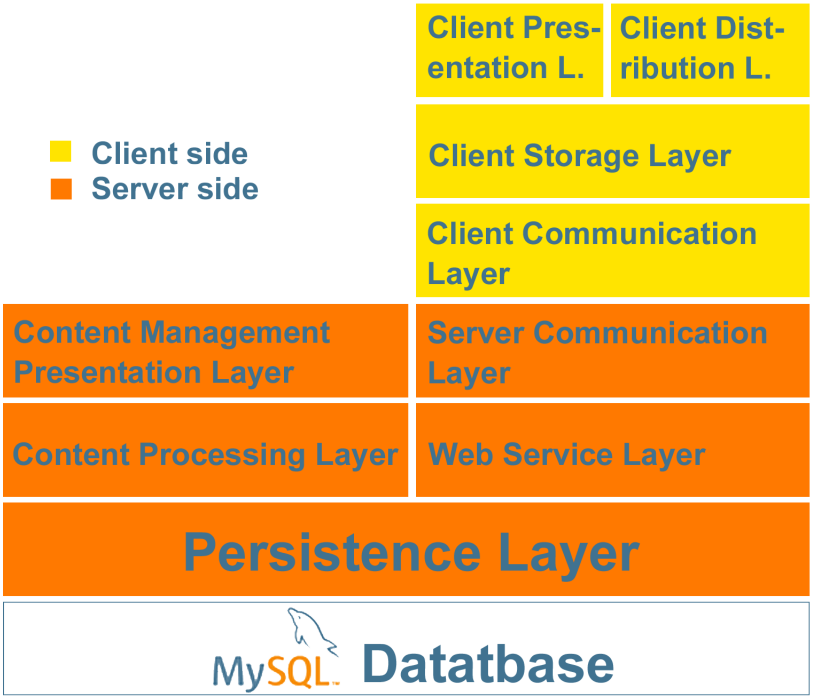

Fig. 3. Overview of the project's layers.

4.3.1 Persistence Layer

The persistence layer stores data in a relational database, in this case MySQL. This could either be data entered on the CMS, like text, references to pictures or documents, or data entered on the CMS or produced by the client. Data entered on the phone might be personal user data like the name, email address or date of birth. Data produced by the client is information about how often updates are made, for statistical reasons. As a link between the persistence layer and the relational database, we used the Java Persistence API (JPA).

4.3.2 Content Processing Layer and Content Management Presentation Layer

Those two layers, in combination with Persistence Layer represent the *model*, the *controller* and the *view* by means of the MVC-pattern. The Content Processing Layer, as the *controller*,

retrieves data from the Persistence Layer (the *model*), processes it and hands it on to the Content Management Presentation Layer (the *view*) to be presented to the user. After the user enters text or uploads data in the *view*, the Content Processing Layer hands the input on to the Persistence layer who stores it in the database. Since the client is not only allowed to enter text or upload data to the server, but also to create new screens, there have to be routines implemented which provide a highly flexible way of generating this content. These routines are built by implementing the factory method pattern.

4.3.3 Web Service Layer

The web service layer provides an interface on the server side for transmitting information from and to the server by the mobile client. It relies on the extensible markup language (XML) as a messaging format and the hypertext, transfer protocol (HTTP) for message transmission. The interfaces are only accessible with proper authentication by the client and the content is decoded before transmission with SSL to avoid abuse.

4.3.4 Client/Server Communication Layer

The Server Communication Layer and the Client Communication Layer, address the problem of serializing objects to xml and de-serializing xml to objects to be transmitted between client and server. Since the model on the server-side differs from the model on the client side there have to be two separate implementations of the communication layer. For Android clients, one difference for example is, that the marshalling/unmarshalling on the server-side could be done with JAXB while the same on the client side has to be done by hand with a sax-parser, because there is no JAXB support in Dalvik (the Android virtual machine). The same is true for the iOS client since there is no tool available to unmarshall automatically.

4.3.5 Client Storage Layer

This layer performs all activities concerning the persistent storage of data on the mobile client. Since there is nothing to store on the clients running the web apps, the Client Storage Layer is only implemented on the Android and iOS clients. After the Client Communication layer fetches a new version of the xml-file from the server, the Client Storage layer merges the new file with the old one and stores it in the local file system. After unmarshalling the newly merged xml-file by the Client Communication Layer, the Client Storage Layer checks all the URLs in the relevant objects, requests the files from the web and stores them on the file system. The settings made in the concerning menu of the app and the personal user data entered by the user are stored by the Client Storage Layer, that communicates with the device's native settings class on the device.

4.3.6 Client Presentation Layer

The Client Presentation Layer is responsible for the optical representation of information. It contains definitions of the general look of the app as well as special design wishes the customer made. Since the Client Presentation Layer plays, by means of the MVC-pattern, also the role of a controller, it also handles the user input and redirects requests made in the interface to the concerning underlying layers.

4.3.7 Client Distribution Layer

The only role of the Client Distribution Layer is to provide the ability to share content. After a user activates a share function on the interface the data is processed by the Client Distribution Layer and sent to Facebook, Twitter, Google+ or other share-platforms implemented in this layer.

4.4 File System And Database Design

In this project there are several uses of file systems as well as of databases. On the server side, the database holds the textual content, references of paths in file systems for images, videos and documents, user information and statistic information while, the file system only holds images, videos and documents in a straight-forward way, and hence needs no further mentioning. On the client side, the database is very light-weight, since there are only some user app settings that are stored. The file system holds images, videos and documents needed for the app as well as the xml file which holds the textual information and the information about how to build the structure of the app. Since the database only consists of one table and the file system only consists of one (hidden) folder which is stored in the root directory, there is no need for their further description. The database on the server side stores all the data to be shown in the app. Nearly every class of the core model is represented in a separate database table. The entity-relationship model (Figure 4) gives an overview of all the tables and relations inside the database.

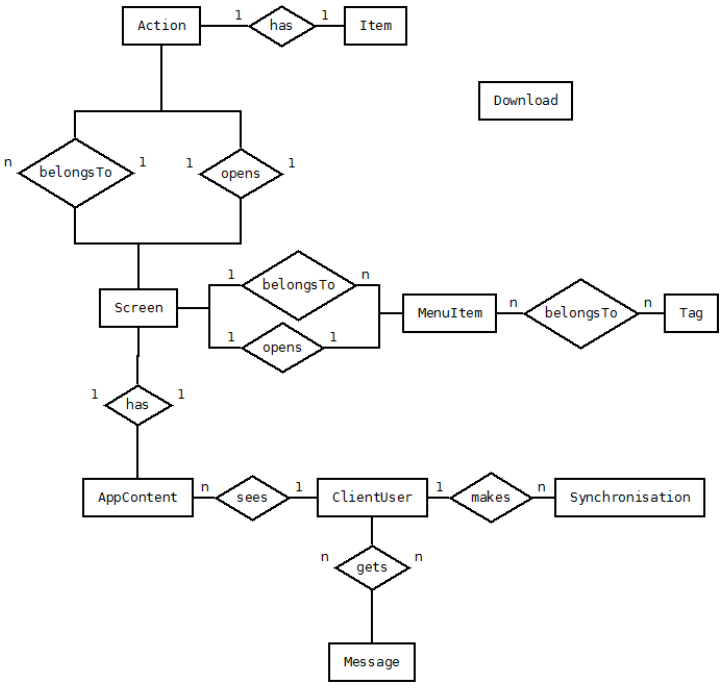

Fig. 4. The entity relationship model of the server-side database.

4.5 External Interfaces

In this project there are, besides the described self-written software, also external interfaces in use.

Messaging There are several ways to send and receive push-messages on Android and iOS devices. One example could be to send a SMS to the device, catch it before it shows up in the customers' message app, and show it as a push message in the app. This method has the big disadvantage of being very costly for the one sending the messages. Another possibility would be to implement a service which periodically requests a server address and checks for new messages (pull messaging). The disadvantages of this method are that this method is very energy consuming on the device, especially if the period of time is short. If the timeperiod is too long, the messages do not arrive on time. A third reason against this method might be that the Android as well as the iOS operating system observe the resources on the devices; if, for example, the RAM space is about to be exceeded, the operating system closes apps without asking. If the running messaging service gets closed by the operating system, there won't be any messages delivered. For the Android app, the decision fell on using the "Google cloud messaging service" (GCM) for sending push messages from the server to the Android phones. GCM requires a Google developer account where an API-key is provided. With this API-key, the app is able to retrieve a token from the Android server called the *push registration ID*. This ID is then sent to the project's server and stored within the user details. For iOS there exists a similar mechanism, called the "Apple Push Notification Service" (APNS). For the rare case that, despite the fact that SMS messaging is expensive, a client decides to send short messages to his/her customers, we send those messages via a self-made library which implements an interface to a sms-provider.

Sharing In order to share content on Android or iOS devices to social networks like Facebook or Twitter, there are several frameworks available. After some tests and evaluation of different solutions, we decided not to use existing software, but to implement our own sharing functionalities with the *Facebook Open Graph API* and the *Twitter API*. The sharing feature includes the sharing of text, for special offers for example, the sharing of URLs, which is important for sharing the link to the app itself and the sharing of images which is used in the "greeting cards" feature. Sharing of images is only available for sharing on Facebook. The other feature realised with the Facebook or Twitter integration is getting sign-up information. At the first start of the app or on the settings-screen the user is able to sign up for the app. Either he/she enters his/her personal data itself, or he/she uses the Facebook or Twitter integration to use the personal data saved on the concerning platforms.

5 Evaluation, Results And Outlook

This section presents the results of the research, discusses the future of this software package and summarises the results of its use after one year of market availability in the first pilot client. We present statistics about downloads, synchronisation habits of the users and an insight into the distribution of age, sex and the devices used by customers. The app was promoted by the client via its Facebook page, on the hotel's own website and through in-house print media.

5.1 Evaluation

For the evaluation of the usage of the apps, this section takes a look at four different parameters which are the download statistics, the synchronization statistics, the registration statistics and the design/usage evaluation for Android.

Download statistics The iOS app was released in calendar week 14, 2011, and so far has been downloaded 5,913 times. The Android version was released in calendar week 41, 2011, and was downloaded 508 times (state: July, 16th 2012). For the average download per week, this means that every week the iOS version was downloaded 89.6 times and the Android version 13 times. Together, this was 6,421 downloads in 66 weeks where the iOS version takes 92.09% and the Android version takes 7.91% of all downloads.

Synchronization statistics Every time an app on a device is started there is a connection established which checks for new content on the web server. This process is the so called *synchronization*. Of course a user can deactivate synchronizations on start-up and initiate synchronizations manually, but since our statistics prove that this is almost never the case, we ignore this special circumstance in our statistics. For the web app, synchronization means that the start page is called for the first time in the life cycle of an initiated session. As long as the session is valid, there are no more synchronization requests on the server. The evaluation of the access logs proves that in more than 99% one synchronization request from the web app matches one visit of one user. Since tracking of synchronizations was a feature that did not come with the first release, the tracking started on May 30th 2012. Since then, there have been 11,752 synchronizations over all, 10,601 (90.21%) by the users of the iOS app and 1,055 (8.98%) by users of the Android app. The missing 0.8% are synchronization requests made by the newly introduced and not yet announced web app. Figure 5 shows a graph of synchronizations made over the period of 15 days.

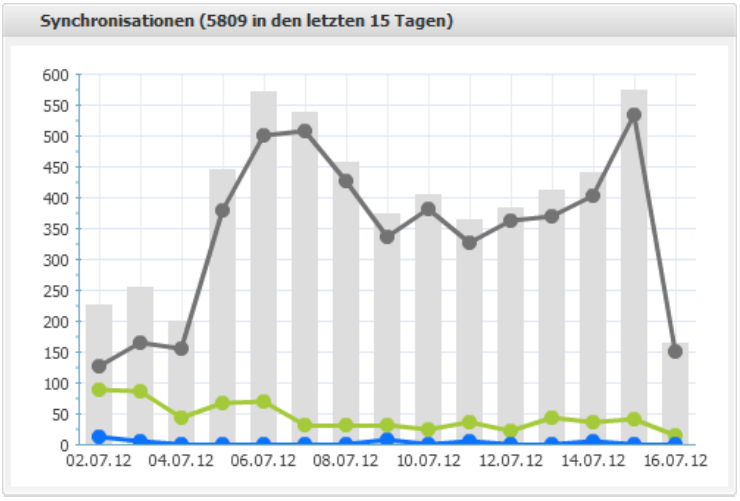

Fig. 5. Synchronization graph of typical 15 day period.

Table 2. Gender distribution of app downloads.

	male	female	not set	sum
Android	114 (3.3%)	87 (2.5%)	71 (2.1%)	272 (7.9%)
iOS	1,606 (46.7%)	738 (21.5%)	811 (23.7%)	3,155 (92.7%)
sum	1,720 (50.2%)	825 (24.1%)	882 (25.5%)	**3,427 (100%)**

Registration statistics Since the release of the app there have been 3,427 registrations by app users (Table 2). As in the download and synchronisation statistics, it is clear that the iOS app dominates with over 92.7% of the registered users whereas only 7.9% of the registered users use Android devices. The gender distribution shows that about 50% of their registered users are male, whereas only 24% of the users are female and 25% did not mention the gender.

Design/Usage evaluation for Android In version 2.0, the Android app design was updated. The main navigation that originally popped up after pressing the menu button on the device was thrown away because the use of the menu button decreased after the Android version 4.0 was released. To further stick to the design guidelines of the Android app design, we added an "action bar" to the screen and made it look like the iOS version with the bar fixed to the bottom of the page. We expected to observe changes in the use of the app, but were not able to measure any. It seems like the average user does not care whether the navigation bar is hidden behind a menu button or, iOS-like, isalways visible at the bottom of the page. Our first pilot appreciated the layout change, because now both apps look almost the same. In version 2.2 we again introduced a new design to the app, according to the client's wishes – a wood look.

5.2 Results

This section presents the results of our research and the answers to the questions asked in section two. The questions is answered based on the example of two of our pilots, a hotel located in Tirol and a hotel located near Salzburg.

Would customers use app-based information services of potential holiday destinations or hotels they have been before? The simple answer is yes. After developing and testing the software for our first pilot, we rolled it out for Android and iOS in July 2011. Within days we reached the mark of 1,000 app downloads. As one can see in section 5.1 for pilot one the iOS version was much more successful than the Android version. Now, one and a half years later, the first pilot's apps count over 12,000 downloads and more than 130,000 synchronisation requests on our servers. A similar situation appeared when we rolled out the software for our second pilot. Released late in 2011 up to now there are about 3,000 app downloads (more than 80% iOS downloads) and nearly 30,000 synchronisation requests. What can be clearly seen is that pilot two has much more requests to our server from the web app than from Android and iOS apps together. Web app synchronisation requests hold more than 50% while iOS takes one third and Android under 10% of the requests. What we can derive from this scenario is that not only are the native apps highly accepted, but the mobile-device-optimised web pages – the WebApps, are also popular.

What would be the benefits for the clients (for example hoteliers) if they introduced mobile services for customers? Would there be a significant increase

of brand touchpoints if customers had an app of a hotel on their smart phone? First of all, we have to define what a "brand touchpoint" is. When it comes to marketing strategies, brand touchpoints are "[...] all experiences and situations in which clients and other market partners get in contact with a certain brand and thereby undergo the brand" [1]. So in our case that means: every time a customer takes a look at his/her phone and recognises the logo of our client's hotel, it is a brand touchpoint. If the customer starts the app (which we can measure looking at our server-synchronisation database), he/she creates even more brand touchpoints. What, in former times required, or in different marketing strategies requires a poster, a flyer or a newspaper- or TV-advertisement, is now simply achieved on the customers very own phone. As question two states itself, it is all about brand touchpoints and the question if a mobile marketing strategy, a.k.a. app, increases those touchpoints. After a talk with our first pilot they agreed on giving us an insight into their hotel visitor and website visitor statistics. Last year they had about 110,000 overnight stays. The website recorded over 600,000 visitors, whereas 110,000 visitors came to the site with mobile devices. Since the app was synchronised more than 100,000 times in 2012 alone, we can clearly see that this resulted in a growth of brand touchpoints of more than 16%, which means that this mobile marketing strategy really paid off for the first pilot. Our second pilot was also kind enough to give us an insight into their figures, and also from this example one can derive that the brand touchpoints were increased significantly and it was absolutely worth adapting a mobile marketing strategy. The second pilot had about 65,000 overnight stays in 2012 and the website recorded about 170,000 visitors. There are about 30,000 synchronisation requests, which also means an increase of brand touchpoints by about 16%.

Is it possible to implement a system that contains apps for Android and iOS, a WebApp and a CMS? This question can also be answered with *yes*. We started by discussing and developing a data model that fitted all the needs to represent data relevant to the system. Based on this model, we started to build the CMS to create data. After that, we adapted this model to the two platforms we wanted to support, Android and iOS, and build apps upon it. The final step was to establish a communication layer and a communication protocol to bring data created by the client to the customers' phone and to save user data to the server's database. The problem, therefore, was not the creation of the data model or the communication layer, which was quite straight forward, but the complexity and the flexibility of the CMS and the need to provide adaptable interfaces in the apps. To allow the CMS to provide interfaces for every type and combination of input and to offer possibilities to manage and contact signed up members, we spent more time and thought than for the rest of the system.

5.3 Discussion and Outlook

A major limitation of this study was that by the time we started to do the evaluation, we only had two pilots. To derive a more comprehensive study we would need more clients from different geographical areas and with a more versatile clientele. Another weakness of this study is the fact that no cross-platform development tools were used, as described in the related work section. For a relaunch of the system the use of technologies like *Appcelerator* would make sense and save a lot of development time.

The software was first developed as a customer-retention-tool for so called "upscale hotel-

ery". But after acquiring three hotels in Austria and Germany we came up with the idea of extending the software to also be used for shopping malls. We were able to acquire a system's client which has several branches of business and therefore wants three systems in one app. And one user from the hand craft business wanted us to implement a reference list of his buildings using augmented reality and a time tracking tool for his employees. Some of the system's clients came up with the idea of having a multilingual app, and there also was the need of providing content in the app which is user-related and cannot be seen by everyone. In the future, the system will probably be extended to not only provide information about a certain hotel and its surroundings but to also be able to acquire and pack touristic service in real time, as described in the related work section about the TourPack project. Such a system would then offer the customer information on interesting events and services and a direct booking possibility also for out of the hotel happenings.

6 Conclusion

As described in section 5.2, we discovered that customers are using software for mobile devices such as the one just described, that clients benefit from introducing mobile services for customers, and that it is possible to develop a software system such as this one, fitting all the needs of clients and customers. What can be learned from this research is that for hotels, shopping malls or event centers of a certain size, it pays off to introduce mobile marketing services such as ours, but it takes great effort to develop such a system. If a business is too small due to a small customer base, or an insufficient degree of brand awareness, it does not pay off to use a system of this size. Either the acquisition costs or the development effort is too high regarding the increase of brand touch points, and hence customer growth. From the technical side, we achieved the goals we set for ourselves: we managed to release the app for three different platforms, Android, iOS and the web, we successfully developed an intuitive and easy-to-use web-based CMS to maintain the apps contents, we provided a messaging service for hotel-to-client messaging and established a system to allow contents offline to be available on phones. It was very interesting to work with real-life clients and their customers, and since the demand for mobile-advertising systems is growing, one can predict a great future for systems such as the one described in this paper.

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