T2* - Personalized Trip Planner

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Abstract. In this research work we describe the framework for a Personalized Trip Planner identify as T2* (Travel to Anywhere) towards a digital concierge in everyone`s pocket by a tailor made aggregation of features and services. The mission is to empower key stakeholders in the travel and tourism industry (Travelers, Concierges, and Service Providers) to develop seamless travel experiences. This work is integrated with the MASAI H2020 project with the goal to serve in all stages of the travel process, including changes in travelers' mobility patterns, associated local travel, long-distance travel, and business as well as to be used for leisure purposes. A personalized travel advice is produced based on the user' profile created based on the user' Facebook information extracted through a semantic approach. The quality of the service provided is measured and high-level service is promoted by an implemented reputation service.

Keywords: Multi-Modal, Journey Planner, Ticketing, Personalized travel planner, Transportation Data integration, Integration, Concierge

1 Introduction

Consumers regularly search for, purchase and share travel information online. According to the Google Travel Study 2014, about 80% of business travellers and 78% of leisure travellers use online sources in their travel planning and for their eventual purchases [1], where 25% of total global travel sales are done online, and this percentage is rapidly increasing [1]. Air transportation comprises 46% of total online travel sales while online travel accommodation sales comprise 23% [1]. The US and Europe are the regions accounting for most of these sales, while the Asia Pacific region is expected to double its online travel sales by 2017. In Europe, online hotel sales are experiencing a rapid growth. By 2017, Western Europe is expected to reach a rate of 40% of total sales, while Eastern Europe is expected to reach 24%. Online Travel Agents (OTAs) offering superior site tools and options (e.g. Expedia, Priceline or Sabre) are increasingly consolidating the traveller market, leading to stiff competition with direct suppliers. OTAs from emerging markets are expected to expand in advanced markets in the near future [2]. According to the World Travel Monitor in 2015, about 70% of international travellers are active social media users. Social media is now influencing

the decision making process of approximately 25% of all international trips, with destination choices (about 40%) and accommodation choices (about 30%) being the most common. Nearly 50% of travellers are posting their experiences on review sites (e.g. TripAdvisor) and travel blogs / forums [2]. The trend in sharing travel related reviews and content on social media in recent times is expanding into a level ahead where the sharing of travel services (e.g. Airbnb, BlaBlaCar and Vayable) merge with active consumers providing apartments, cars, meals and tours. Shared usage platforms are changing the travel economy, giving people new options about where to stay, what to do and how to get around. Adapting to this new reality by monitoring user-generated content and cooperating with social media is of great importance for the tourism market and its destination management. Big Data, which is increasingly gathered from cities and public organisation by digital sensing devices and networks, allows Concierge and Service Providers to supply customers with targeted options and personalised offers for a more tailored travel experience. The customer's demand for real-time services is rising with services required to be easily accessible via multiple devices (desktop/tablet, smartphone) with a 24/7 availability. Since poor site experiences often lead to negative impacts on companies and brands, a flexible technological architecture is required to reach consumers on all screens. Concierge and Service Providers need to adopt a holistic approach capable of following customers through all stages of their travel process (dreaming, planning, booking, anticipating, en route, destination) [2].

The creation of seamless travel requires a closer cooperation between large varieties of industry and policy makers to design services involving integrated ticketing/pricing and infrastructures responding to all travellers' needs. Multi-stakeholders governance models require the alignment in a multi-stakeholder environment (authorities, citizens, and private sector) as well as supported implementation based on a suitable standard that can perform as a major driver of innovation for making travel more comfortable, efficient, and sustainable [3].

Drivers of this approach - The travel and tourism industry is changing due to consumer demand and new possibilities brought advances in technology. This is providing new business opportunities at a fraction of the cost that they were years ago. The future of travel is based on an open ecosystem providing a seamless multimodal door-to-door travel experience. The economics of innovation is altered with cloud based applications. New opportunities can be tested and piloted without major start-up costs. The mobile app ecosystem and connected services are suitable for immediate adaptation, allowing purchasing resources in real time. The cloud has the ability to dynamically scale up or down the infrastructural commitment when demand changes on a pay-as-you-go. This ability has an enormous impact on the service provider's costs. Risks can be reduced thereby increasing potential return [4]. Alongside of this there is a growing API [5] economy that is making our world even more than ever plugged in. Highly complex technical products, which have a development technique in the R&D and IT field based on the need of sharing information and enabling transaction processing APIs, are able to close the gap between business and IT and are supported by the trend of integration in sophisticated ecosystems - elevated to become business model drivers [6].

This work is integrated with the MASAI H2020 project (http://masai.solutions). The MASAI idea originates from the classical concierge model – introducing the conceptual role of a concierge between the traveler and the Service Provider, which can, in principal, be taken on by anyone in the ecosystem. This model, in fact, already exists in the form of hotel concierges and travel agencies as well as in the electronic form of OTAs and travel product related search engines. Tech Start Ups, betting on fully artificial intelligence enabled concierges [7] are continuously being launched. International companies like BMW with their Concierge Start-up Challenge [http://www.bmwstartupgarage.com] are supporting this trend by creating the most advanced humanoid artificial concierge.

2 Travel Planner Phases

Figure 1 shows that the traveler goes through different stages during every travel. Travel planning and booking is a process similar to a puzzle. The traveler often starts using search engines with only a vague idea in mind, before refining it based of further inspiration. At the beginning of the decision making process the traveler relies heavily on consumer reviews and social media. During the different stages, the customer switches devices, interfaces, apps and websites on many occasions in order to research destinations, to compare prices and then to book transportation or additional services. While according to some sources, travelers visit about 6,5 different websites on average per booking [8], Expedia research shows that average segment travelers visit up to almost 40 pages during the booking stage [9]. Some professionals quote an average of 80 to 100 clicks used to organize an accommodation solution. Travelers rely on the internet at all stages of the traveling experience, but some devices are more frequently used in certain phases than in others. Using smartphones and tablets for research, consumers often switch to their laptop or computer to make their final booking [9]. Statistics show that nearly half of those who use their smartphone for leisure travel information do not use this device for their booking [9]. The problem is that, as seen above, the traveler has to choose from many alternatives and has to put a lot of effort in the booking process. He can use different devices, encounter a variety of touch points and can choose from a large number of distribution channels, websites and apps. The fragmentation of the travel and tourism market described above is faced by the traveler who is then required to deal with this complexity, often feeling alone and overwhelmed by the process. Our proposal is an integrated solution, based on the usage of standardizations and complements to them in order to aggregate the services of the many Service Providers in the travel and tourism market. The aim is to provide a seamless intermodal travel experience for travelers through all stages of travel.

As suggested in Figure 2, this integration task is performed through a domain ontology definition for travel where local public transportation operators' databases are mapped and integrated with PoI (point of interest) and information from blogs, twitter and facebook, through a retrieval engine that collect information and creates representative profiles. This facebook information can be the basis for the creation of users'

Profiles stored in the MASAI folder (helps to organise travelling and to manage personal data such as preferences, payment details and tickets), which can be divided into two categories: positive and negative. Positive is used to retrieve travel topics that users are interested in and negative profile is used to avoid past relevant travel topics that users manifestly demonstrated their dissatisfaction with or past topics that th e user is no long interested in. This profile can be built directly (the user provides the information) or indirectly by the system, through the extraction of user's facebook using their autorization and avaliable API. This user profile information can be aggregated in user communities. This process is performed through a semi-automatic process based on the clustering of the user profile description (positive profile) for communities. Clustering is based on a distance function within an N dimensional space. The similarities measured by the distance will be evaluated based on experience and on the singularity of treated subjects. Communities are only effective after a human authority decision. Every time a new member arrives, all partners of the community and in their neighbor communities should be notified through an automatic notification service. Feedback from the partners on judging this classification will contribute to a better define the community in a collaborative way. A central profile is used as community representative and will be identified as the nearest to the geometric centre of the community. The user's communities will provide useful information to different systems' stakeholders.

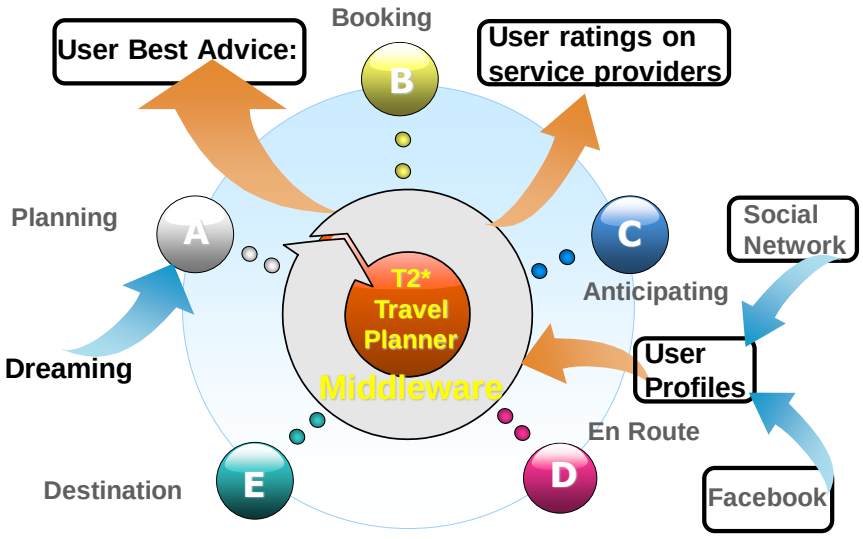

Figure 1. T2*, a personalized travel planner

Mobile tourist guides have been in the spotlight for the past decade and are becoming increasingly available in various forms to tourists visiting places. The majority of these mobile tourist guides are to be used via a constant network connection and some as proprietary standalone mobile applications installed on-device. Some are solely navigational assistants using positioning technologies for large cities offering exploratory services and others are used indoors, for example as museum guides. There is difficulty

in obtaining information about traveling to, from and within a region, even in the same city due to the diversity of transportation operators. Most of these operators have their own system and plan the routes and schedules independent from nearby operators. Still, public transport systems differ from region to region. It is therefore understandable that when reaching at a destination, even for the most traveled person, it becomes difficult to use local public transportation due to poor organization of information and especially due to language barriers. This context denotes the scarcity of appropriate information systems to assist travelers in these destinations, including providing practical information essential to understanding the operation of the means of transport.

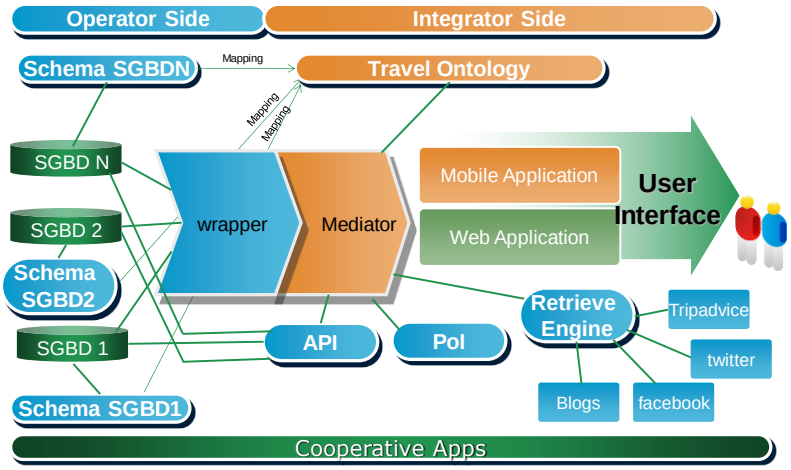

Figure 2. Information and data integration process

From several Public Transportation data base of consortium partners and standard specification, such as SIRI [10] and IFOPT [11], a common schema data was created. Figure 3 shows the main entities of the domain model. Travel Ontology is built on top of RDF using OWL (Ontology Web Language). Also in Figure 3 (on the right) it is represented the relationship between the Operator, the Service and the Contact entities. Public transport operators are represented by the Operator entity. This entity is associated with the entity that represents the Service(s) provided by a particular operator. For example, in the Portuguese case, it indicates the case in which the operator Carris offers two services: bus and tram. The relationship with the entity Contact is due to the need that exists to represent the contacts provided by operators of public transport. The Contracting Service represents the services provided by an operator of public transport that can be, e.g. rail, road, air or water (sea, river or lake). Each service will be linked to a type, represented by the entity Type, which represents the categories within each mode, e.g. rail, bus, plane or ship. Within these types may still exist variants, the Variant entity. The Contact entity, represents the contact types, such as: electronic mail (email), telephone, address and website. This authority is shared by all entities Operator and POI (points of interest), because both the transport operator and points of interest have similar types of contact. POI entity are divided into categories which highlight, for example, Academic (Academic), Rest (Restoration), Monument (Museums) and others. Also

Figure 3 (left), illustrates the relationship between the entities Schedule, Stop, POI, Interface and Contact. Stop entity include the attributes: name of the stop, geographical coordinates (Latitude, Longitude) zone (taking the subway as an example verifies the existence of two areas, one inside the city limits and another in the vicinity). The association of the entity with the entity Stop with POI should be relevant to the fact that giving information about the area around the station so that users from other countries have tourist information. The relationship between Stop and Schedule justified with the representation of a schedule. T2* performs the role of a Concierge, both human and artificial to connect the aggregated mobile service offers with the traveler through personalized interaction. The touch point for the traveler is, at any one time, only one Concierge App used on the traveler's preferred device. To provide the Concierge App with full functionality several modules with data integration were developed to cover Fig 1 main process of travel activity. From the first phase of dreaming and inspiration, the traveler can use the T2* Concierge App to get new ideas through interaction with the Concierge group. He can interact through one interface with his friends or travel experts who are also part of the group in order to discuss and plan upcoming journeys. As the final booking approaches, the digital Concierge will recommend hotels and look for the best prices. All of this is automated and requires no effort on the part of the traveler. To do this in a customized way and to respect personal preferences, the Concierge App accesses, with the traveler's permission, the traveler's personal data. All personal data from previous trips are saved and stored in the user's personal T2* Folder available in the defined midleware, which, for reasons of security and data protection, is in full control of the traveler at all times. The more information and travel preferences the traveler provides, the more accurate the ensuing search results and offers will be. With T2*, booking is quick, simple and convenient. The offered proposal of the T2* Concierge needs only to be confirmed and booking is finalized automatically. T2* uses a payment solution provider who handles the billing and distributes the payments. There is no need for the traveler to go through several transaction processes or to take care of many clearings or bills. Additionally, T2* allows recurring business trips to be easily booked with only one click. Ticket Organization and Travel Management with T2* After booking, all tickets are stored in the T2* Folder and displayed in the Concierge App in one central place, according to trip and date. This provides an easy overview of all tickets, and avoids issues with printed tickets or with the need to check several apps.

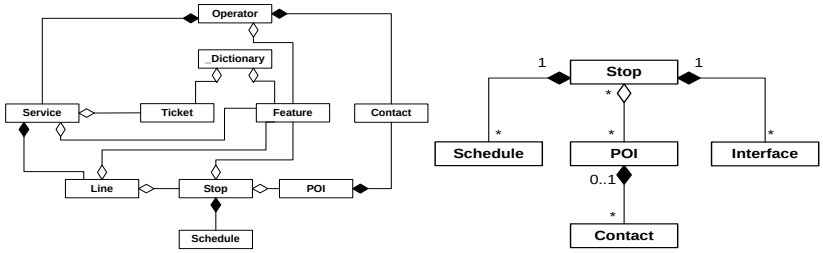

Figure 3. Travel Ontology: Entities in the domain model (left) and Stop hierarchy (right)

3 Services Providers Reputation System

A reputation system collects, distributes, and aggregates feedback about participants' past behavior, helping users to decide whom to trust and encouraging trustworthy behavior [12]. There are many empirical studies concerning reputation systems, see Resnick et al. [13] for an overview. Various trust and reputation systems have been proposed or implemented in different areas. Some proposed classifications use their application areas [14], algorithms [12] or some combined characteristics [15] as criteria. These classifications allow looking at trust and reputation systems from different perspectives always from zero development phases. Since there are common modules and strategies among different systems, the idea is to build one based on a modular structure using a service approach. The reputation levels' system is inspired from videogames like World of Warcraft [16], which needs exponential requirements to level up.

Our system provides an input for users to express their opinion related to the experience with the service providers in the context of T2*. The information quality is rated by the as being helpful or not helpful (+1, -1). This range allows a less ambiguous evaluation, since it will influence the reputation of those who submitted the item. Using this schema, it is possible to filter and organize information by its quality and, at the same time, indirectly rate the user who submitted that information. In order to calculate the service provider quality itself, our system also provides an input for users to express their mobility experience quality by a quantitative rating from 1 to 5 stars, plus comment (output of equation (1) in Figure 4). User reputation is based on their activity expressed by equation (2) in Figure 4:

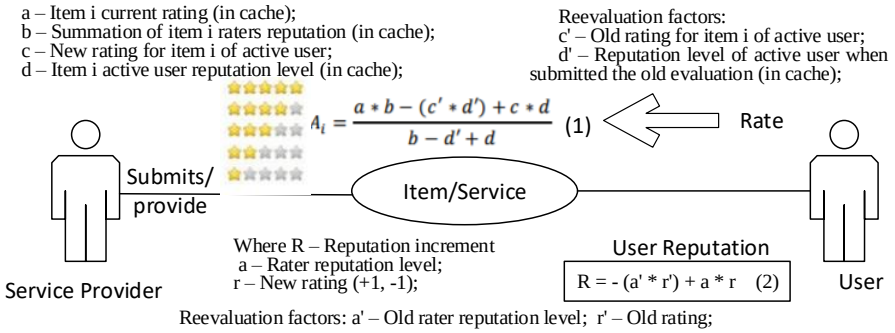

Figure 4. Implemented service provide and user reputation

4 Conclusions

This work addresses the interconnection of digital services in order to facilitate mobility in heterogeneous and diversified environments. The core idea originates from the traditional personalized concierge services offered by hotels. Here the Concierge is a digital concierge linking up the traveler's demand with the products and services offered by all Service Providers connected to the MASAI community. The traveler enters contacts a MASAI Concierge Provider by using his favorite MASAI Concierge App. In order to provide the traveler with a convenient and compliant offer, the Concierge

Providers' module is then linked to the modules of the multiple Service Providers participating in the MASAI community.

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