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«A TRAVEL & TOURISM INFORMATION SYSTEM PROVIDING REAL-TIME, VALUE-ADDED LOGISTICAL SERVICES ON THE MOVE»

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ABSTRACT

Travel and tourism activities constitute an illustrative example and an ample opportunity area for deploying the state-of-the-art mobile Internet technologies, since it is becoming increasingly needed to provide travelers with real time information to assist them preplan or plan their transport / travel activities while traveling. Travelers, whether leisure or business travelers want on the top of the attractions that a given destination offers, a fast, flexible, and convenient transport mean(s) to reach it, as well as other value added logistical information services. As a matter of fact, the provision of real time information constitutes a value added service (VAS) for the traveler that could more effectively cope with the stochastic elements and the dynamic nature of the intermodal system. In other words, what travelers in general, and tourists in particular expect are services that: i) are customised to their individual needs and preferences, ii) are available to them in a timely and accurate manner, either referring to demand responsive or "pushed" information services, and iii) are available to them when they are on the move.

Advanced information/communication and mobile Internet technologies provide ample opportunities for offering the much needed real time information for the seamless integration of intermodal passenger trips. In this context, an integrated information system providing value added logistical services on travel and tourism, while being on the move, is currently under the final phase of implementation. This system will be focused on providing decision support to the users on a threefold basis: i) access to real time, dynamically updated information, ii) access to travel and tourism information on the move, and iii) provision of customised information.

The objective of this paper is to briefly present the system implementation sequence from the elicitation of the user requirements and the development of the corresponding functional specifications and infostructure requirements to the real system design and implementation.

Keywords: Mobile Internet; Value Added Logistical Services; Travel & Tourism Information System; Trip Planning.

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1. INTRODUCTION

Tourism and transport activities constitute an illustrative example and an ample opportunity area for deploying the state-of-the-art mobile Internet technologies, since it is becoming increasingly needed to provide travellers with real time information to assist them preplan or plan their transport / travel activities during their trip (while being on the move). Travellers, whether leisure -tourists- or business travellers will want on top of the attractions that a given destination offers, a fast, flexible, and convenient transport mean(s) to reach it, as well as local weather information, accommodation options and availability, recreational and cultural activities and other value added information services.

Travellers need only a limited amount of information at each stage of their journey, but these multiple "info bits" should be self-consistent throughout the different stages of this journey. They currently obtain such information services by alternative ways in mostly a bulky, static -no real time- and generic -non customized- manner. However, information is becoming the essential component of the travel service, and therefore it is necessary to be provided at the right time, place and format. Moreover, real time information gains extremely valuable importance due to the stochastic, dynamic changes of the travel schedules of the various transportation modes. It is more than obvious that the transportation system is subject to several operational constraints of capacity, and mainly it is quite vulnerable to the dynamic changes stem from stochastic events introduced into the network(s). This is even more evident in the case of intermodal transportation, which is, by default, subject to the constraints posed by the effective coordination and the connection possibilities of the participating modes. As a matter of fact, the provision of real time information constitutes a value added service (VAS) for the traveller that could more effectively capture and cope with the stochastic elements of the intermodal system.

In other words, what travellers in general, and tourists in particular expect are services that: i) are customized to their individual needs and preferences, ii) are available to them in a timely and accurate manner, either referring to demand responsive or "pushed" information services, and iii) are available to them while being on the move.

Advanced information and communication technologies, and in particular, mobile Internet technologies provide ample opportunities for offering the much needed real time information while on the move for the seamless integration of intermodal passenger trips. Furthermore, particular data handling techniques and advanced data base structures represent the basic building factors for generating and "push" accordingly relevant, customized information to the end user of the system. In this context, an integrated system providing value added logistical services related to travel and tourism, the "World in your H@nds on the Move" system, is currently under the phase of implementation.

Based on the above stated capabilities, the system will provide the following Value Added Services: i) Pre-trip and On Trip Re-planning, ii) Transportation Mode Choice, iii) Destination Choice, iv) Accommodation Choice, and v) Transport Availability. The contextual value of the high level system description and capabilities will be achieved operationally by means of a system prototype addressing an intercity / regional multimodal tourist / traveler information service in Greece. This service will integrate real time travel information from different sources, that is, an airport authority will provide flight schedule information, while a major international port will provide information on short sea shipping schedules, and a hotel association will provide information regarding destination options and accommodation choices. In addition to the Greek prototype, two different prototypes will be implemented and communicate relevant travel and tourism information in Madrid (i.e., a city information and service centre covering the metropolitan area of Madrid) and Levi (i.e., an information centre serving Levi, a major touristic resort in Finland) [1].

The objective of this paper is to briefly present the system implementation sequence from the elicitation of the user requirements and the development of the corresponding functional specifications and infostructure requirements to the real system design, implementation, and further business exploitation. The first part will cover the process of "translating" the elicited user requirements into

the respective system functionalities / modules, design characteristics / system architecture, and appropriate data structures capable of accommodating the proposed value added services. This analysis will, in turn, “feed” the actual implementation phase of the system’s modules and various interfaces (i.e., web, wap). Finally, the paper will be complemented with the description of the methodological approach and the algorithmic part / calculations governing the system functionalities corresponding to the on trip and pre-trip planning modules aiming to provide results on the feasibility of a given intermodal connection between the mainland and the islands of Greece.

The remainder of this paper is structured into four major thematic sections: i) the description of the Greek site demonstrator / application along with the formalization of the user requirements corresponding to the Greek WH@M application, ii) the development of the functional specifications and system architectural design, iii) the description of alternative business models / structures capable of deploying the business added value of the WH@M system, and iv) concluding remarks.

2. USER REQUIREMENTS

This section presents the user requirements elicited by both intermediate and end users of the Greek WH@M application [2,3]. The supply side of the user requirements summarizes the perspective, preferences and the stated requirements derived by the intermediate user of the system along with a macroscopic review of the potential barriers or technical, implementation considerations. On the other hand, the demand side results address the requirements elicited by the end users, and conveys their preferences and perspective to be considered for the “real” system development. The target groups of the Greek demonstrator site are structured into two major types of stakeholders:

End Users: The target group of the Greek WH@M end users are mainly international travellers - tourists and less business travellers - as well as national travellers making interurban trips by using more than one different transport modes (e.g., air / maritime transportation).

Intermediate Users: the intermediate users active in the Athens site are represented by three clusters of actors, that is, the Piraeus Port Authority (PPA) in cooperation with the Ministry of Mercantile Marine (MMM), the Hellenic Civil Aviation Authority (HCAA) in cooperation with the Athens International Airport, and a tourism association (i.e., SETE). Each of these three actor groups will constitute the content providers for the Athens demonstrator through catering the system with travel information regarding the short sea shipping and flight schedules, as well as tourism information addressing accommodation activities, cultural events, destinations and local attractions.

With respect to the intermediate users' part of analysis, their major business objectives, as well as the means (processes, subprocesses, functions) of accomplishing these objectives were identified per user. The importance and satisfaction derived by the above described means, and the contribution of the proposed WH@M functionalities to the improvement / enhancement of their internal operations efficiency is described in a second level of analysis. On the other hand, end users constitute the final consumers and receivers of the system's value added services (VAS), and they are supported in their travel and tourism related decisions and activities (e.g., hotel accommodation, transport mode, on trip re-planning) through the capabilities and functionalities exhibited by the proposed system. Therefore, an exploration of the importance of these services and the satisfaction derived by the current ways of obtaining them, in conjunction with the importance / contribution of the proposed WH@M functionalities to the provision of value added services was the outcome of this part of analysis [2,3].

Within the context of the intermediate users' requirements analysis, the Goal Function Modelling (GFM) was used [4], while thereafter being integrated with the Quality Function Deployment (QFD) methodology [5,6,7,8]. GFM can be basically defined as a means-end design method based upon the concepts of goal, function and module [4]. The idea behind the use of GFM was to identify in a systematic and consistent way the various processes, functions, sub functions, as well as the associated

flow of information of the actors / intermediate stakeholders involved in order to achieve their system's goals. As far as the analysis of the end user survey responses are concerned, the House of Quality Analysis [5,6,7,8] and descriptive statistics were used in order to elicit the system functionalities and value added services preferred by the end user (i.e., “What’s”), while simultaneously “translating” - through the corresponding QFD matrices’ calculations - these services / functionalities into technical features and specifications of the proposed system (“How’s”) [2].

This section provides an integrated analysis and a synthesis of the user requirements elicited by both types of stakeholders. In particular, by synthesizing the separate results of the intermediate and the end users' surveys, the following conclusions were drawn:

The Greek WH@M application,

- i) **SHOULD** provide real time information,
- ii) **SHOULD** provide information on the move,
- iii) **SHOULD** provide information from multiple sources,

In addition, WH@M:

- iv) **SHALL** exhibit capabilities of processing the collected information, and

Finally, WH@M:

- v) **MAY** use intelligent promotional / marketing techniques,
- vi) **MAY** exhibit capabilities of customizing the collected information and providing personalized suggestions to the users, while
- vii) It is **not required** to support interaction amongst different stakeholders, and
- viii) It is **not required** to support interoperability with other sites and tourism actors.

With respect to the value added services (VAS) to be provided by the system the following conclusions were reached:

The Greek WH@M information center,

- i) **SHOULD** provide transport availability information services,
- ii) **SHOULD** provide accommodation availability information services,
- iii) **SHOULD** support accommodation choice decisions.

In addition, WH@M:

- iv) **SHALL** support on trip re-planning decisions.

Finally, WH@M system:

- v) **MAY** support destination choice decisions, while
- vi) It is **not required** to support mode choice decisions.

Based on the results of the user requirement analysis and the synthesis of the stated preferences of the particular WH@M user groups, the Greek WH@M Prototype was designed to be capable of collecting, integrating, processing, and disseminating well-structured travel and tourism related information with the purpose of supporting activities of the end users concerning the pre-trip planning as well as the on trip replanning activities. The content of information stored and delivered by the system is collected from multiple sources of the public (e.g., public authorities, terminal operators) and the private sector (e.g., tourism associations, companies) and it addresses the following areas [1,3]:

- ❑ Actual, as opposed to published, schedules of different modes of transportation, and especially those focusing on intermodal trips connecting the mainland with the Greek islands (e.g., air and maritime transport modes),
- ❑ Information on the expected travel time and the optimal itinerary to access the terminal supporting the desired intermodal connection (e.g., from airport to the port and vice versa) by public transport,
- ❑ Destination choices and tourist resorts all over Greece,
- ❑ Accommodation options per destination, hotel designation (e.g., luxury hotels, apartments, rooms to rent), and facilities / services provided,
- ❑ Recreational activities and options per destination (e.g., restaurants, theatres),
- ❑ Car rentals, yachting companies and other supporting tourist services.

The WH@M information centre can be accessed through either mobile assistants (i.e., handheld devices) or PC - laptop or desktop - clients. The PC client version consists of a web site, providing the above described informational content, and is accessible through the WWW with a browser. However, the major strength of the system is reflected on its capability of supporting mobility and on the move decisions through the mobile assistants. The Mobile Assistant version of the Greek WH@M site exhibits operational capabilities in a simplified pattern respecting the display and performance (e.g., speed, memory) limitations of the mobile device.

The WH@M wap version serves the following operational functionalities [10]:

- User registration into the system: log in and log out
- Profile creation and storage: creates the personal profile into the WH@M data base that can be accessed on the move through the mobile assistant
- Provision of information on actual travel schedules for supporting intermodal trips
- Provision of information on accommodation choices and touristic destinations
- Provision of cultural information and events, as well as local attractions

The Greek WH@M application targets international travellers - tourists and business travellers - as well as national travellers making interurban trips by using more than one different transport modes (e.g., air / maritime transportation). The Value Added Services (VAS) that are provided to the end user (i.e., tourist, traveller) are the following:

- ☒ Pre-trip planning: the system provides the traveller with the opportunity of creating multimodal trips to connect the mainland with the Greek islands, while also recommending alternative destinations and major tourist attractions.
- ☒ On-trip planning: the system provides the user with the necessary travel and tourism information to replan some parts or the whole of the trip elements, due to unexpected changes and the stochastic nature of the transportation system.
- ☒ Customised information: the system is able to issue customised recommendations and information on tourist activities within Greece, such as alternative destinations, accommodation, restaurants, local attractions, and services / facilities based on the individual's preferences (i.e., user profiling).

3. WH@M SYSTEM DESIGN

The objective of this section is to illustrate the functional specifications of the WH@M system that directly correspond and accurately reflect the elicited user requirements and stated preferences, that is, to design the appropriate system modules and functionalities so that the desired value added services

will be accommodated / delivered by the system. This preliminary system design, will, in turn, “feed” the core implementation phase, which will be called to develop the modules and capabilities dictated by the system design document and guidelines [10]. In what follows, Table 1 summarizes the functionalities designed for the application under consideration, while Figure 1 graphically illustrates the overall use case diagram pertaining to the Greek WH@M application.

FUNCTION	THE PURPOSE OF THE FUNCTION
Registration	To register a person as a WH@M user.
Quick Registration	To register a person as a temporary WH@M user with the minimum information. This will be provided in the case that the user is not willing to give some personal information requested by the system.
Direct Profiling	To create an initial user's profile through the registration process provided that the user is willing to provide the system with personal information to elaborate a specific profile for future customised recommendations.
Login	To log the end user and manage access into the system (=turn WH@M on).
Query	To support various end users' queries into the system's data content mainly through directory / catalogue menus.
Short-Sea Shipping Schedule Information	To provide the end user with real time information (actual as opposed to scheduled) on the short-sea shipping schedules.
Flight Schedule Information	To provide the end user with real time information (actual as opposed to scheduled) on the flight schedules.
Accommodation Search by Type	To provide the end user with information on certain accommodation options by type, location, and facilities offered.
Car Rental Services' Information	To provide the end user with information on car rental services.
Yachting / Cruise Services' Information	To provide the end user with information on yachting / cruise services.
Travel Agencies' Information	To provide the end user with information on travel agencies.
Pre Trip Planning	To provide the end user with information on public transport schedules (published) to access the port from the airport and vice versa along with the feasibility of a given intermodal connection.
On Trip Replanning	To provide the end user with real time, "actual" (as opposed to published) information in order to support the desired intermodal connection and on trip replanning decisions or the rescheduling of activities while being on the move.
Information update	To support the dynamic update of information provided by the content provider / intermediate user (i.e., updated travel and tourism information delivered to the end user).
Logout	To log the user out of the system (=turn Wham off).

Table 1: WH@M system functionalities [10,14]

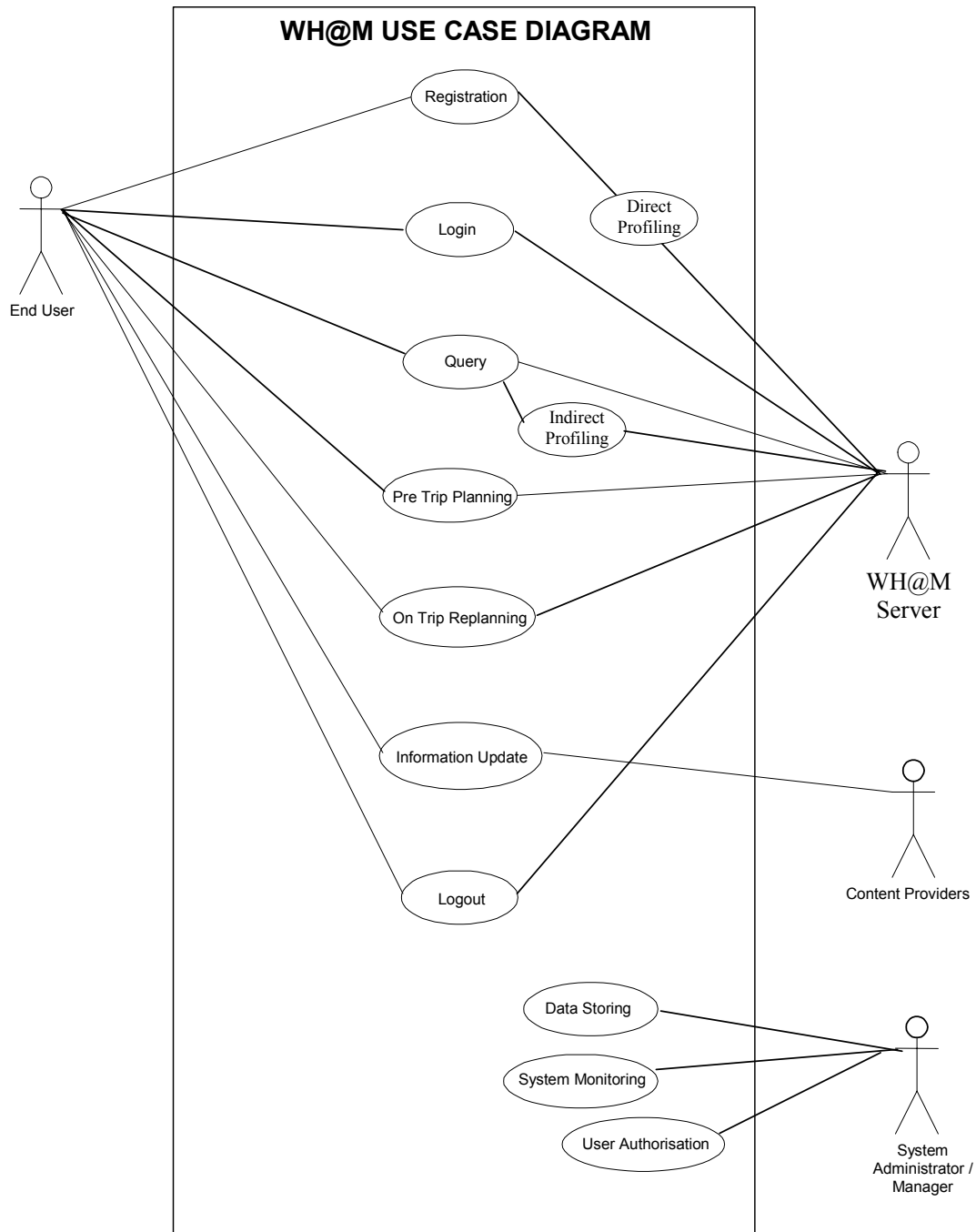


Figure 1: Overall WH@M use case diagram [10,11,12,13]

3.1 Architectural design

The overall hardware architecture is presented in Figure 2, where the deployment diagram illustrates the system configuration in terms of the various servers and hardware requirements in order to deliver the requested information service to the end users of the Greek WH@M site. More specifically, the

end user can access the system through WAP interface (i.e., WAP enabled mobile clients), as well as through mobile web interfaces (e.g., handheld devices) capable of displaying graphical web interfaces.

The Greek WH@M system is conceptually implemented on a three-layer platform, that is, a web server provides web and WAP services to the mobile clients, while an application server accommodates the operational functionalities and application requirements through accessing and communicating with the database server that constitutes the repository point for the relevant travel and tourism data elements.

The Value Added Services pertaining to the Greek site with respect to the pre trip and on trip replanning modules, as well as the specific tourism information services are accommodated over external connections to the system with servers capable of delivering the specific data requirements. As a matter of fact, a combination of two separate servers is used to capture the transport related data cluster, where the shipping schedule server handles information requests addressing the maritime schedules, while the flight schedule server accommodates requests pertaining to the air transport schedules, accordingly. Finally, the tourism server aggregates information related to tourism (e.g., accommodation, travel agents, car rentals), and delivers it upon request.

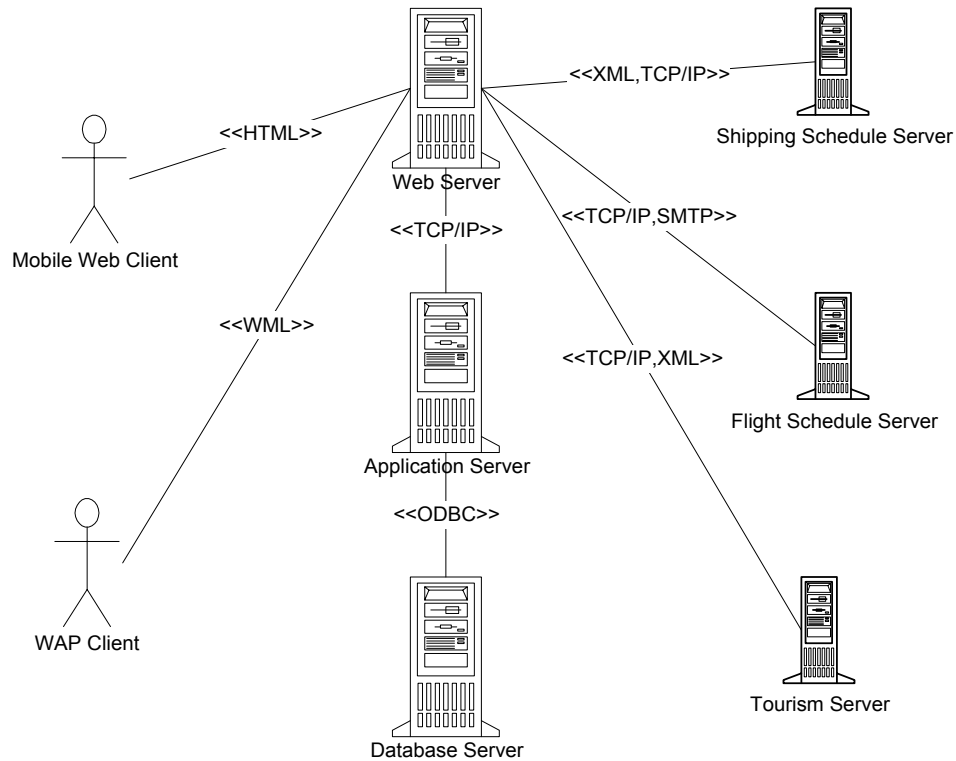


Figure 2: Deployment diagram [14]

3.2 Infostructure design

The purpose of the Greek WH@M site is to support and facilitate intermodal transport (air and maritime transport) connecting the mainland with the Greek islands, and serve the basis for the development of the value added services (VAS) to the final user (i.e., traveller, tourist). Throughout the process of building these value added services, various stakeholders are involved and several functions are implemented to accommodate the travel and tourism related information. These different information sources and categories are used to build the system infostructure with the purpose of

producing, disseminating, and publishing the basic information services pertaining to the Greek WH@M site.

With respect to the demonstrator of the Greek site, three major stakeholders were identified as intermediate users of the WH@M system: i) the Hellenic Civil Aviation Authority (HCAA), which is the governmental authority for the civil aviation in Greece and it is responsible for providing Air Traffic and Flight Information Services, ii) the Port Piraeus Authority (PPA), which is responsible for handling the transportation of passengers and freight (from Piraeus port to international and national/islands destinations), publishing short-sea shipping lines schedules, and conducting general naval activities within the port of Piraeus, and iii) the Association of Greek Tourism Enterprises (SETE), which is consisted of members and actors covering the whole spectrum of tourism activities.

Currently, Greek intermediate users do not have established interrelationships among each other, and their operations are focused on providing either travelling (i.e., HCAA, PPA) or tourist services (i.e., SETE) to travellers and tourists. In the presence of WH@M, information services and travelling / tourism decisions will be supported and facilitated by a central information hub that will function as a single access point, which will collect information from multiple sources, and it will disseminate it to the end users in a whole package of information. This particular infostructure is built upon various data sources and contains data related to the following [9]:

- Tourism related data addressing information requirements in terms of accommodation, car rentals, yachting/cruise companies, and travel agencies. This information is delivered by SETE as the prime content provider for the tourism infostructure elements.
- Travel related information addressing flight and shipping schedules (i.e., published / actual). This information is collected from the content providers pertaining to the travel infostructure elements (i.e., HCAA, PPA). In practice, however, both HCAA and PPA experience several problems to communicate the required data to the WH@M system. On the one hand, security problems arise from the integration of HCAA system, also known as PALLAS, with the proposed WH@M system since PALLAS handles confidential data that in no case allows other systems to attach to and obtain flight information or establish any other type of interaction. Alternatively, HCAA forwards the flight information data, produced by PALLAS system, to the Athens International Airport (AIA), which processes these flight data and produce the information published in the Flight Information Display System (FIDS) of the airport. This is essentially the prime source of the flight information requirements for the WH@M platform. On the other hand, PPA has rather an operational role in the port management activities, which are planned and overall supervised by the Coast Guard and the Ministry of the Mercantile Marine, which decide upon and provide the schedule of the shipping lines to PPA, which, in turn, publishes the shipping schedules to travellers. Therefore, the Coast Guard and the Ministry of Mercantile Marine constitute the direct sources of the relevant shipping schedule information.
- Information related to the algorithm's data requirements in order to estimate the feasibility of a given intermodal connection. It addresses the information requirements in order for the algorithm to run and provide answers on the basis of the feasibility of a given intermodal connection (Airport to Port and vice versa). In general, this cluster of information contains data representing the network configuration and transport mode elements (i.e., modes, nodes, routings), the time required to travel or transfer transport modes, and the timetables for the various transport modes. These data requirements are collected from various public transport organizations and other relevant authorities and are stored for further processing in the central WH@M database.

The specific infostructure pertaining to the Greek WH@M site is schematically illustrated in Figure 3.

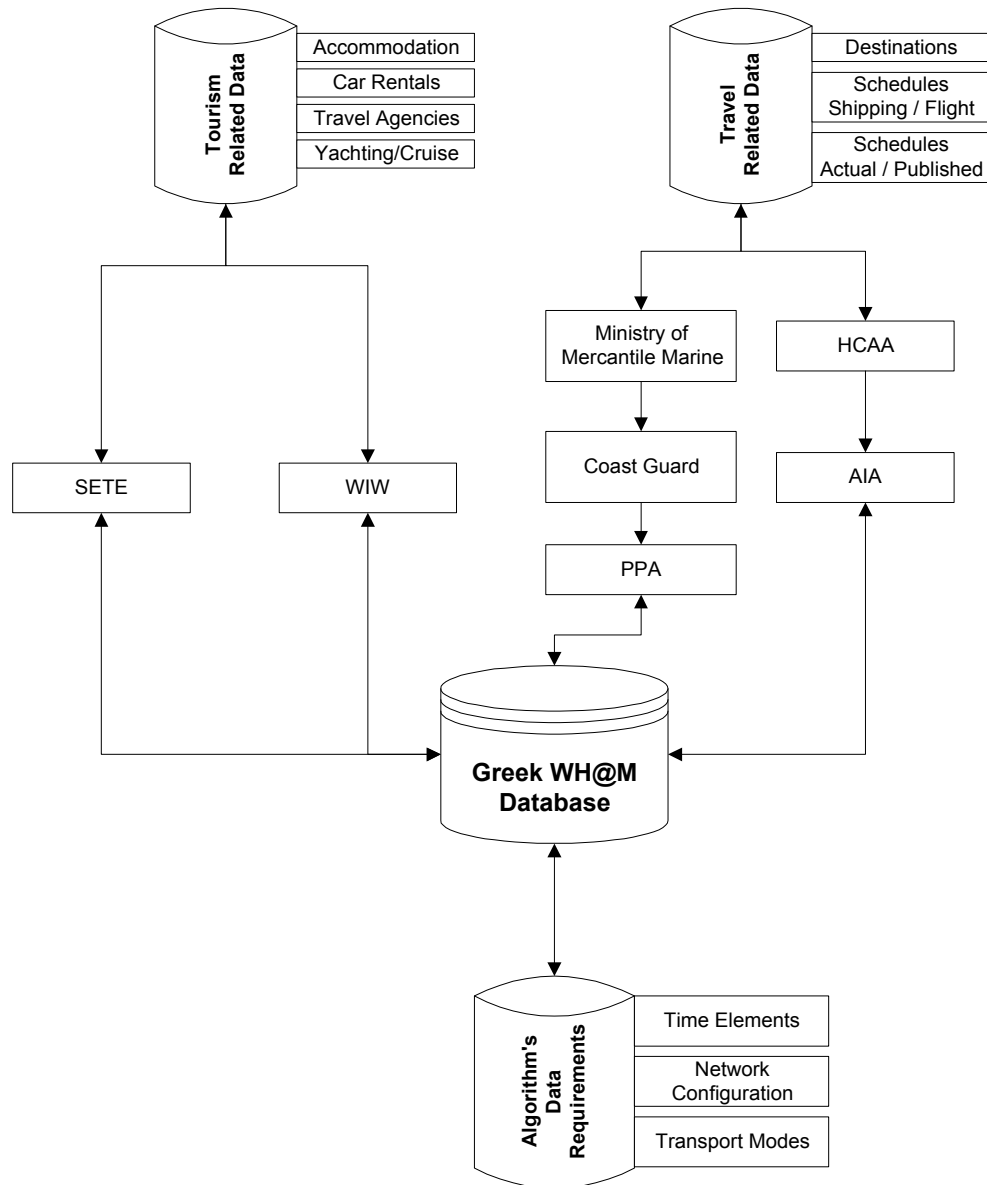


Figure 3: Greek WH@M infostructure [9]

4. EMERGING BUSINESS MODELS FOR WH@M EXPLOITATION

The objective of this section is to describe the various WH@M business scenarios along with the main actors and stakeholders involved in the aforementioned scenarios developed within the framework of the Greek WH@M application. With respect to the Greek WH@M site, three major groups of potential business actors to exploit the WH@M business concept were identified: i) intermediate content providers (i.e., tourism associations, individual tourism actors) active in the tourism industry (i.e., Greek Association of Tourism Enterprises - SETE, Who-Is-Who Publishing Company - WIW), ii) public (i.e., Hellenic Civil Aviation Authority, Port Piraeus Authority, Ministry of Mercantile Marine) and public-private (i.e., Athens International Airport) transport authorities involved in the

travel industry, and iii) telecommunication / mobile communication service providers (e.g., TELESTET, PANAFON / VODAFONE, COSMOTE).

The above described WH@M stakeholders (i.e., intermediate, end users) along with their interrelationships and alternative business exploitation schemas are illustrated in Figure 4 presented below [15].

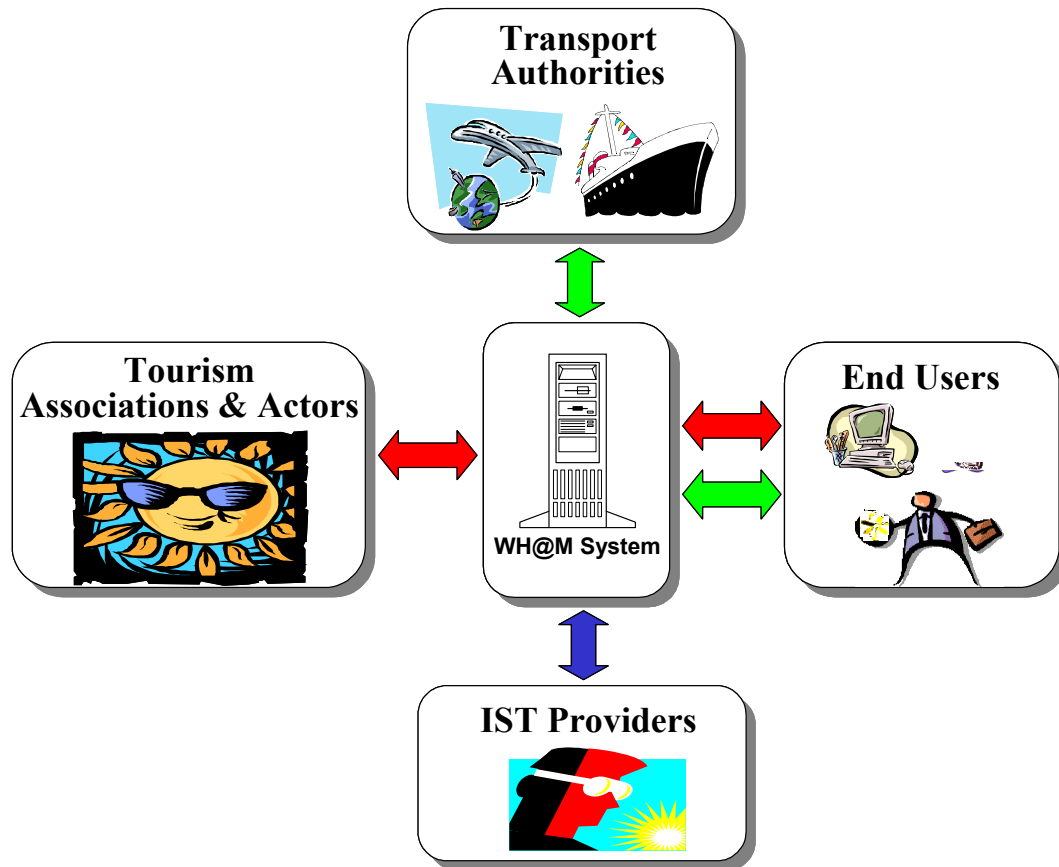


Figure 4: Greek WH@M site stakeholders [15]

The **first business scenario** stems from the technology / telecommunication providers' part, as the owners and operators of the mobile telecommunication infrastructure. The current industry landscape is consisted of three companies, currently active in the Greek mobile telephony industry (i.e., COSMOTE, PANAFON / VODAFONE, TELESTET). Concerning the first scenario, each of these telecommunication companies could provide the business structure to operate WH@M business concept in conjunction with the provision of the technological infrastructure. All companies examined in the Greek mobile telephony industry plan or have already ventured similar approaches, through which information services can be provided to the end user while being on the move. From this viewpoint, these companies have already the experience and the technological know-how / capability to maintain the WH@M platform. Besides, the current patterns of information service systems developed by these companies do not include any application capturing the needs and information requirements for travellers and tourists. Information services based on the accommodation and intermodal transportation activities of the end users currently constitute a service "gap" in the existing applications developed by all three Greek operators.

The **second scenario** addresses a business structure involving actors and intermediate users in the travel industry. These organizations might obtain the full benefits of the WH@M system

implementation in terms of more efficient terminal management, better demand management and traffic balancing, and consequently higher customer service level. Moreover, the development and implementation of such information systems by the specific organizations will be indisputably necessary in the immediate future in view of the Athens Olympic Games of 2004 and the significant amount of traffic congestion that will be resulted due to the various capacity shortages. In addition, these actors already have the relevant content of information regarding the transportation schedules.

The **third scenario** relates to the development of a business structure that will be consisted of intermediate users within the tourism industry. These companies will be able to obtain considerable benefits either in terms of better promotion of tourism in Greece or as an alternative promotion channel added to the advertising capabilities provided by tourism advertising companies. A major strength of this business structure is the availability of the relevant content of information with respect to the tourism information, as well as the direct contact and interaction with the individual tourism actors. Furthermore, both intermediate users have the opportunity to capitalize on their members / clients base and therefore to develop and exploit the business concept altogether. Finally, these organizations have a significant expertise in the promotion and marketing activities, which might be crucial for the successful launching and "critical" growth of WH@M services.

5. CONCLUSIONS

Tourism and transport activities constitute an illustrative example and an ample opportunity area for deploying the state-of-the-art mobile Internet technologies, since it is becoming increasingly needed to provide travellers with real time information to assist them preplan or plan their transport / travel activities during their trip (while being on the move). Information is becoming the essential component of the travel service, and therefore it is necessary to be provided at the right time, place and format. Moreover, real time information gains extremely valuable importance due to the stochastic, dynamic changes of the travel schedules of the various transportation modes. As a matter of fact, the provision of real time information constitutes a value added service (VAS) for the traveller that could more effectively capture and cope with the stochastic elements of the intermodal system.

Advanced information and communication technologies, and in particular, mobile Internet technologies exhibit the technological capability of providing the much needed real time information while on the move for the seamless integration of intermodal passenger trips. Furthermore, particular data handling techniques and advanced data base structures represent the basic building factors for generating and "push" accordingly relevant, customized information to the end user of the system. In this context, an integrated system providing value added logistical services related to travel and tourism, the "World in your H@nds on the Move" system, is currently under the phase of implementation. Based on the above stated capabilities, the system will provide the following Value Added Services: i) Pre-trip and On Trip Re-planning, ii) Transportation Mode Choice, iii) Destination Choice, iv) Accommodation Choice, and v) Transport Availability. The contextual value of the high level system description and capabilities will be achieved operationally by means of a system prototype addressing an intercity / regional multimodal tourist / traveler information service in Greece. This service will integrate real time travel information from different sources, that is, an airport authority will provide flight schedule information, while a major international port will provide information on short sea shipping schedules, and a hotel association will provide information regarding destination options and accommodation choices.

Three major clusters of potential actors have been considered to represent the major candidate business entities being capable of exploiting the WH@M concept: i) intermediate content providers active in the tourism industry, ii) public and public-private transport authorities involved in the travel industry, and iii) telecommunication / mobile communication service providers. Content providers could act either as individual tourism actors that are willing to provide content as a means for establishing alternative promotion / advertising channels through the WH@M platform, or meta-

intermediate users between the individual tourism actors and the WH@M system. In the second business scenario, the major public and public-private transport authorities involved in the travel industry can provide the relevant transport data as a means of supporting intermodal connections and travel in Greece. On the other hand, mobile communication service providers in Greece, and in general technology providers represent an additional candidate party for the business implementation of the proposed system, aiming at enhancing their service portfolio and offering competitive differentiation elements to their customers.

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