

WIRELESS INFO-COMMUNICATION AND NAVIGATION SERVICES IN EXHIBITION SHOWS

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ABSTRACT

Exhibition shows accumulate vast quantities of information and their success relies in the quantity and quality of interaction of the involved parties: exhibitors, visitors and organizers. The more effective the interaction between end parties, the more successful the exhibition. The application of advanced ICT applications in the exhibition industry has always been a major opportunity for leveraging the value proposition of exhibition-related services. More specifically, as the telecommunication technology evolves, unexpected possibilities arise for such information and communication rich environments and quite interesting applications, from both the technology and the business side, appear. This case study concerns extended discussion about an innovative wireless system, named as Wireless Exhibition Guide. The wireless system, which has been the primary research and development result of a European project funded under the IST programme, employs a set of integrated software components, mobile terminals, wireless networks and indoor location positioning technologies to introduce advanced information, communication and navigation services for a typical European exhibition environment. The discussion concerns several perspectives on the development and exploitation of the Wireless Exhibition Guide, such as applied technology (sub-systems and infrastructure), provided services, value chain analysis, candidate business models, and regulatory framework with which it complies.

1. INTRODUCTION

Considering the advances in wireless, mobile and positioning technologies, and the demand for distribution of targeted content in highly interactive and information-rich environments, mEXPRESS (mobile in-EXhibition PRovision of Electronic Support Services) – an EU funded project – has addressed the challenge of (Mathes et al., 2002):

“... exploiting the technological opportunities arising from evolution in the areas of wireless networks and indoor positioning technologies to support the professionals and customers in the exhibition industry in a context-aware manner”.

Current business practices in the exhibition industry limit the interaction between the three principal actors (exhibition organisers, exhibitors and visitors) to the actual visit. The exhibition organiser contacts and invites the exhibitors in the respective exhibition. The visitors go to the exhibition and interact with the exhibitors at their stands, where they perform their promoting activities. The exhibition organisers also interact with the users as part of the facilitation and feedback process for organizing the exhibition. Thus, most of the pre-visit and post-visit interactions are fragmented and isolated, while all interactions are limited to synchronous request-response mode.

In an attempt to provide a solution to the above problem, the project has developed a mediation platform, namely a *Wireless Exhibition Guide*, which aimed at: a) enhancing visitors' experience in terms of interaction and functionality in an information-rich environment such as an exhibition show; b) improving business communications and promotions within the exhibition; c) extending promotional effectiveness after the exhibition, and; d) assisting and supporting exhibition management by offering real-time location information of people inside the exhibition area.

2. THE R&D INTER-FIRM NETWORK

The Wireless Exhibition Guide has been the result of an inter-firm collaboration in an R&D network, including a group of partners that have contributed towards both the development and the exploitation of the Wireless Exhibition Guide. The **technology partners** include two Application Service Providers (INTRACOM, POULIADIS), a device manufacturer (L.M. Ericsson A/S), a mobile network operator (ELISA) and a positioning technology provider (SSF). All these partners have collaborated in an R&D network to combine their technical experience, and thus install the network infrastructure, develop the wireless application's functional components, and provide positioning technologies, such as indoor GPS (SSF) and Bluetooth (L.M. Ericsson A/S). The two **business users** of the consortium, which constitute dominant exhibition organisers in the Finnish and Greek market, the Finnish Fair Corporation, organiser and hall owner of the Messukeskus fair centre, and ROTA, organiser and owner of the Expo Athens centre, have provided their insight on how the exhibition industry operates as well as the needs and requirements of the targeted user groups. Moreover, they have provided access to their installations for testing and evaluating the Wireless Exhibition Guide. Finally, the research partners (RC-AUEB and

HUT) have brought their technical know-how and business background, but also have provided their experience in international dissemination activities to promote the *Wireless Exhibition Guide* in both the research and business (ICT and exhibition) communities.

3. SERVICE DESCRIPTION

3.1. Service Categories

The Wireless Exhibition Guide prototype has been developed to serve the information, communication and navigation needs and requirements raised for the three stakeholders (visitors, exhibitors, organizers) in an exhibition environment. Specifically, the Wireless Exhibition Guide service portfolio includes the following service categories:

- **Information Services.** They include delivery of information for visitors regarding the exhibition show, its organizers, parallel events, exhibitors' profile and product/service catalogue, as well as detailed information on specific exhibits that they bookmark. Moreover, organizers are provided with information on visitors as well as with statistics regarding the visitors' volume, traffic and behavior within the exhibition centre (e.g. which stands they visited, how much time they spent there, etc.). Under the organizers' consent, exhibitors may be given restricted access to such information.
- **Navigation Services.** They include real-time delivery of a navigation map depicting the visitor's location on a digital exhibition map and provision of routing advice for reaching a user-defined point within the exhibition centre (e.g. restaurant, presentations room, exit, or a stand).
- **Communication Services.** They include delivery of real-time messages between visitors (belonging to a group), as well as targeted messages sent by organizers and exhibitors to clusters of visitors (e.g. professionals, students, technology-aware, etc.).

3.2. Service per Target Group

The following table lists in more detail the services offered by the Wireless Exhibition Guide to each targeted user group, as they were defined through a user requirements capturing and analysis process (Fouskas et al., 2002).

| |
|--|
| Visitor Services |
| Online and Onsite Registration |
| Personalized and Location-aware Navigation Plan |
| Routing advice |
| Exchange of "virtual business cards" with Exhibitors |
| "Bookmark" stands and exhibits for receiving more information |
| Interaction within a user group |
| Receiving Targeted Messages (Offers, Announcements) from Exhibitors and Organisers |
| Message Board for communication with other visitors |
| Exhibitor Services |
| Online Content Management (products, stands) |
| Exchange of "virtual business cards" with visitors |
| Real-time information and history statistics on visitor behavior |
| Promotion of their exhibits via targeted spots |
| Notifications to organizers in emergency cases |
| Organiser Services |
| Information on profile and preferences of visitors |
| Online Content Management of information (profile, exhibition info) |
| Common and Targeted Announcements to Exhibitors and Visitors |
| Real-time information on visitors position |
| History statistics on visitor flows and behavior |
| Online feedback from visitors |

Table 1. Wireless Exhibition Services per User

3.3. A Service Provision Scenario: "Wandering Through an Exhibition Show"

This section presents a representative application scenario regarding the use of the Wireless Exhibition Guide by a visitor for wandering through an exhibition show.

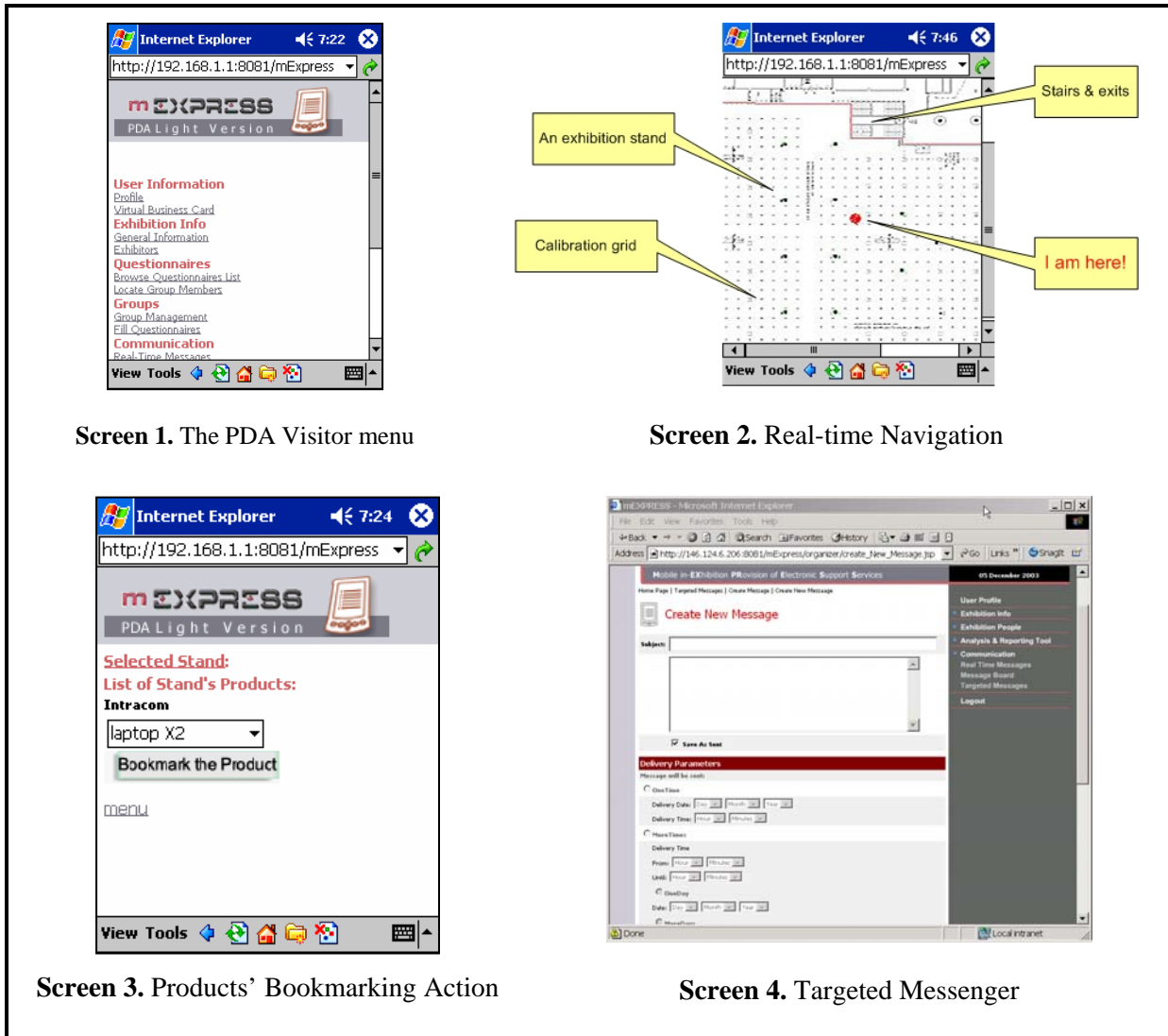
The visitor enters the exhibition centre and passes through the reception. The exhibition organisers ask for his invitation and the visitor informs them about his **online pre-registration**. The exhibition secretariat crosschecks the visitors' data with the computer. After verification, the secretariat asks the visitor if he wishes to get a printed copy of the catalogue and a nametag or he prefers to use the Wireless Exhibition Guide (if he is aware of the application). If he is not aware, the organisers inform him and then provide him with an access device. While he is about to enter the exhibition hall, he meets a colleague who is about to register onsite. The former visitor, who is assigned a leader and moderator of a group comprising of the company's employees, is inviting the latter visitor to become member of the group. After that, the colleague gets his device as well, and they go on their different ways as they intend to visit different stands. Before splitting, they both ask to view on their devices a **personalized and location aware navigation plan**.

Since our visitor wants to locate specific products he is using his device in order to locate on the map stands with the specific products (i.e. software products). After locating those stands on the navigation plan, he is taking the routing advice of his device to get there. As he approaches the stand of interest to him, he gets **alerts for offerings** based on his profile as well as **targeted promotional spots of certain exhibits** from the exhibitors. While wandering through the stands, the visitor gets **recommendations for specific events** as well as **common announcements** (i.e. the exhibition is about to close or the license plates of a car that is obstructing the parking area). Some of the events seem interesting to him but are taking place later in the day so he decides to go on. He is visiting 3 or 4 other stands that are in his list and he follows the exact same procedure with the previous ones.

After being in the exhibition for 3 hours, he decides to take a break for a snack or coffee so he is moving towards the closest restaurant or rest area by using his navigation plan and routing advice on his device. On his way to the restaurant, he decides to meet with his colleague so he is using the system to track him since they both belong to the same user group. When he manages to position his colleague, he sends a real-time message asking him to meet in five minutes in the restaurant area. Before sitting in the restaurant, they get connected to the nearest kiosk in order to get information on their visit trail and movements up to this moment. Before leaving the exhibition centre, the visitor can get **links to useful information** for transportation means, traffic and other matters.

After the exhibition, while being at home or in the office, the visitor gets connected to the system and downloads the material that he requested through bookmarks, as well as additional promotion material sent either by organisers or exhibitors. Furthermore, replying to the organisers' request, he is using the system to send feedback by giving his response to an online questionnaire.

Following, four screenshots of indicative Wireless Exhibition Guide services, which were activated in the above scenario, are presented.



Screen 1. The PDA Visitor menu

Screen 2. Real-time Navigation

Screen 3. Products' Bookmarking Action

Screen 4. Targeted Messenger

4. TECHNICAL IMPLEMENTATION

The main components of the Wireless Exhibition Guide technical architecture are the following:

- **Application Server.** This is the core component of the wireless system. Its main functionality includes:
 - Receiving and handling user requests regarding bookmarking operations.
 - User authentication and provision of a privilege-based system access.
 - Adaptation of the output format based on the terminal device capabilities.
 - Monitoring of mobile terminal locations, receiving data from the GPS receivers that are adjusted on mobile terminals (PDAs/Mobile Phones).
 - Provision of notifications and statistics.
 - Provision of user navigation route in the exhibition and relevant personalized recommendations.

- Content management concerning content submission and content filtering in order to be adjusted to several access devices (PDAs, WAP phones, PCs).
- **WLAN/ Bluetooth cells.** The two wireless technologies have been employed to provide wireless access to visitors, exhibitors and exhibitor organisers within the exhibition boundaries. Both technologies may be used to provide interaction between the users and the Wireless Exhibition Guide system, enabling thus bookmarking requests, business cards exchanges, receiving of location relative multimedia content, etc. Furthermore, the use of Bluetooth technology for location tracking has been investigated but not tested due to endogenous inefficiencies of the technology at the time of the Wireless Exhibition Guide's development.
- **Indoor GPS system.** Taking into consideration the high accuracy of the GPS solution in the outdoor environment as well as the limitations of current indoor positioning technologies (Giaglis et al., 2002), the R&D network has initially opted for using and testing an innovative indoor GPS solution which was provided by SSF. The main components of the provided solution are:
 - a number of ground transmitters, pseudolites (pseudo-satellites PS) that emulate the signal structure of GPS satellites and replace the GPS in the exhibition environment.
 - a number of reference receivers that are used for signal integrity provision and synchronization of the pseudolites signals.
 - the Master Control Station (MCS) comprising of one or more computers running the control software for providing monitoring, configuration and control of the whole system.
 - The receiver that has been used is a slightly modified GPS receiver which is capable of receiving the signal transmitted by the pseudolites.
- **Wireless Terminals.** Several types of terminal devices have been used to provide access to wireless exhibition services including:
 - *PDAs.* PDAs have been used by visitors to make bookmark requests and receive multimedia content, notifications and routing information relative to their location. They have also been used by the exhibition organisers to receive notifications. These terminals are WLAN/Bluetooth-enabled and include GPS receivers.
 - *PCs/Laptops.* PC and laptops have been used by visitors for before-exhibition visit preparation and after-exhibition office review. They have also been used by exhibitors and exhibition organisers to receive statistics, notifications and content submission.

The following figure provides an overview of the technical architecture:

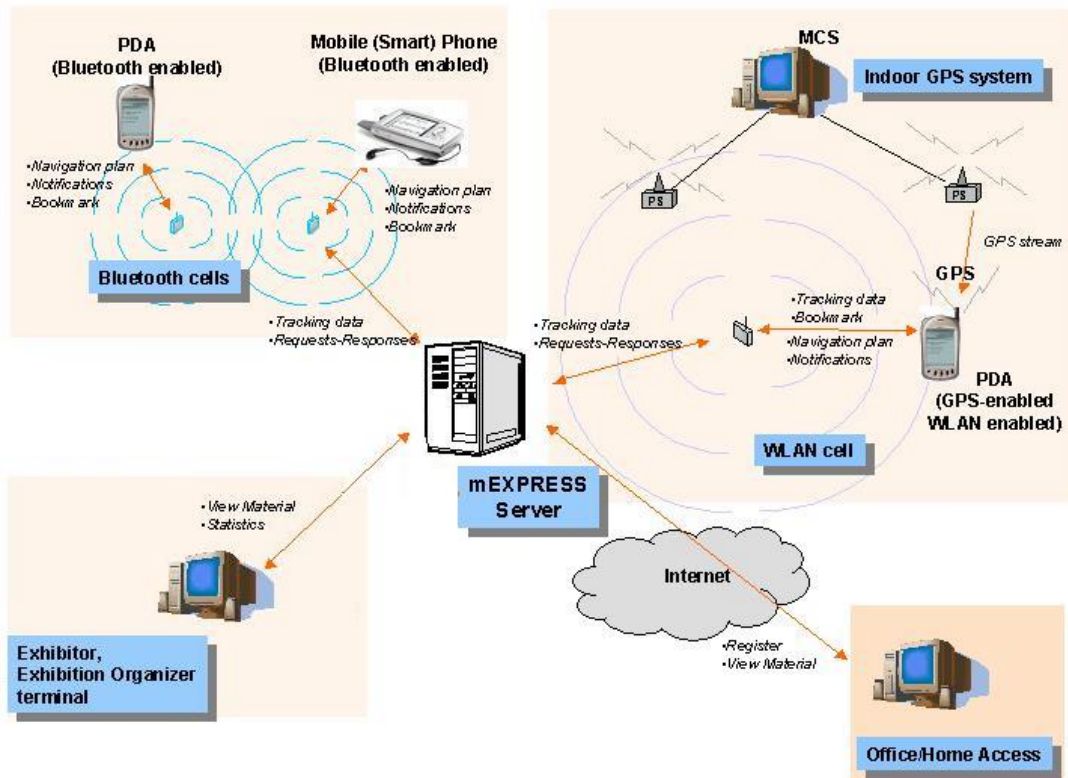


Figure 1. Technical Architecture of the Wireless Exhibition Guide

5. BUSINESS ISSUES

5.1. Value Chain/ Network Analysis

Value Chain Analysis has been used in multiple business and research cases as a method for acquiring knowledge and deep understanding of an industry's structure and dynamics (Porter, 1980). The linear form of value chain, from supplier to manufacturer to retailer and then to customer, is not appropriate for depicting the complex structure of the mobile business environment including a large number of players and their multi-lateral interactions. In telecommunications industry, value chain is increasingly evolving into a value network consisting of a series of inter-wined value chains with multiple entry and exit points (Li and Whalley, 2002). In this case, the concept of value chain has been used to identify the primary segments, as well as the principal actors, roles and competences, in the wireless exhibition market. However, in a later stage, when discussing the scenarios for alternative business configurations, the actors' relationships and the way in which value is created and distributed are described through a value network illustration.

The following paragraphs divide the market of wireless exhibition services into its primary segments (sub-networks) for facilitating the discussion on key mobile players, their roles, their competences and their interests in partnership with other players of the same or different sub-network. Hereinafter, we

have distinguished four main segments in the value system of wireless exhibition services. These are: 1) Technology (Software and Hardware) Provider, 2) Wireless Infrastructure Operator, 3) Wireless Application Service Provider, 4) Exhibition Content Provider, and 5) End Users.

- 1. Technology Provider.** This segment includes the actors that have developed and thus can provide the Wireless Exhibition Guide software. Their primary strengths include ownership of the Wireless Exhibition Guide as well as expertise in developing, customizing, and integrating the application to the special requirements of their business customer. In this segment, we also enclose actors that provide the hardware (Servers, PDAs, etc.) required for the operation of the Wireless Exhibition Guide. In this case, possible actors include the mEXPRESS consortium, the provider of PDA devices (with the required specifications), and the provider of the servers and PCs used by the business and individual users in the exhibition place.
- 2. Wireless Infrastructure Operator.** This is the core segment of the wireless application market. Actors that are positioned in this segment provide the required network infrastructure (e.g. WLAN access points) and are responsible for its administration and operation in support of the wireless application. In this case, possible actors include a third party, usually a technology or exhibition service provider, that has already expertise of the field from either the technical or the service point of view, as well as the IT subsidiary or department or staff of Hall Owner in which the infrastructure is installed.
- 3. Exhibition Content Provider.** This component includes actors designing, producing, packaging, delivering and supporting the exhibition content and services, from which customer value is derived. The primary actors in the exhibition content area are organisers, who possess data on the exhibition show history as well as on the sector concerned, and exhibitors, who provide information on their company's profile as well as their product catalogue or service portfolio.
- 4. Wireless Application Service Provider.** This is the segment responsible for the operation of the Wireless Exhibition Guide software and the provision of services to its users. Their primary competence combines abilities for software configuration and support, and experience of service provisioning to the business customers of this market. Possible actors belonging to this segment of the value chain include the IT department (or subsidiary) of exhibition hall owners, technology firms providing IT/ICT solutions for the exhibition industry, and exhibition organisers.
- 5. End Users.** This segment includes the business and individual customers of the wireless exhibition services. The three primary user groups identified in this case are: a) organisers, b) exhibitors, and c) visitors (professionals or individuals).

5.2. Future Business Model Scenarios

Taking into consideration the number of alternative actors in each segment as well as the n-n relationships that are usually developed through network formation between different players and segments in the mobile industry (Maitland et al., 2003), a wide range of alternative business models can be identified and designed. Based on analysis of the (technology, market, regulatory) environment of the Finnish and Greek markets, and discussions with the two exhibition partners of the R&D network, a scenario-based approach (Panis et al., 2002) has been followed for identifying three alternative business configurations and value creation mechanisms for future exploitation of the Wireless Exhibition Guide (mEXPRESS D6.1, 2004). The following figure depicts the structure and the players included in the value chain of each scenario. As it is illustrated, the three scenarios are primarily differentiated in terms of actors that take on the roles of Wireless Infrastructure Operator and Wireless Application Service Provider.

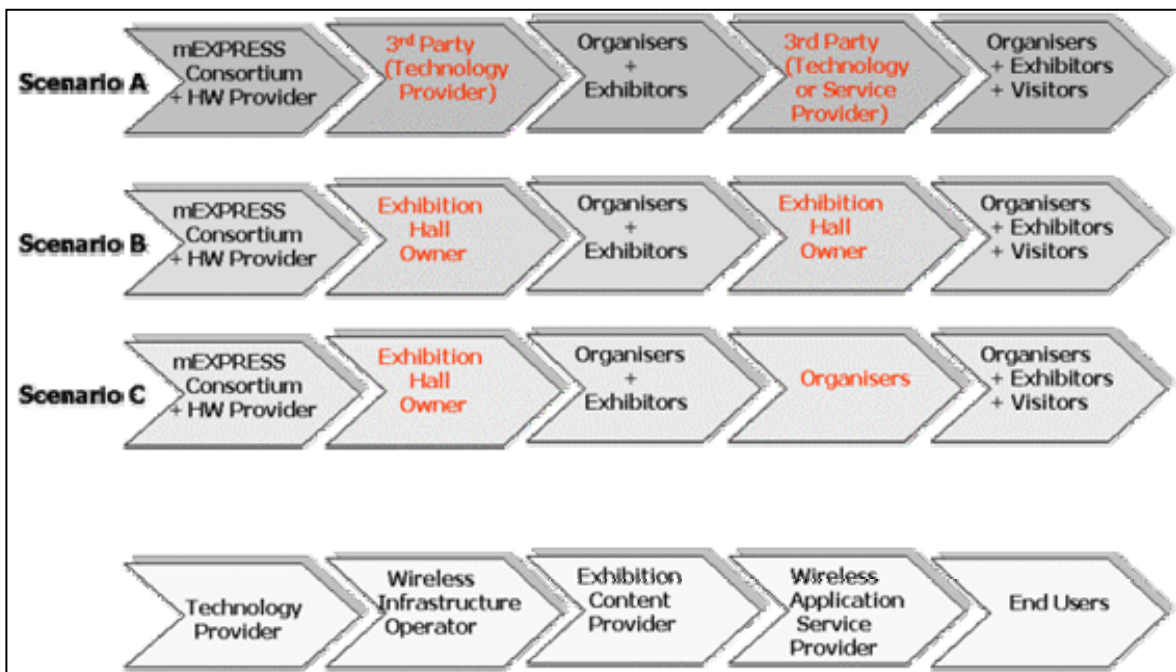


Figure 2. Value Chains of the 3 Scenarios

Following a brief description of each scenario, the concerned business model has been defined in terms of involved players and their competences, exchanged value, and revenue model (mEXPRESS D6.1, 2004). Regarding the revenue model, which constitutes prime determinant of a business model's viability, we have identified a list of possible revenue streams, derived from the direct users. The various revenue models that are discussed in each scenario constitute alternative ways of distributing these revenue streams, as well as revenue streams that accrue from firm's collaboration (e.g. commission), among the involved parties. The possible customer-generated revenue streams include:

- Rental fee paid by organisers for renting the Wireless Exhibition Guide software,
- Extra fee over the booth rent paid by exhibitors,

- Revenues from selling syndicated and customised exhibition content (e.g. statistical reports) to organisers and exhibitors,
- Fees paid by exhibitors for placing an advertisement in the Wireless Exhibition front page.

Revenue could possibly be generated from visitors by charging them for using the Wireless Exhibition Guide as a premium service. However, as the business users of the projects have contended, it is not business-wise to charge for a service that users are not aware of and are possibly afraid of because of the technologies that it involves. As a result, their intention for employing the Wireless Exhibition Guide to their shows is not offering that as a premium charged service but as value-added service, which means that this is offered free. Thus, visitors are not included hereinafter as possible revenue sources for the business models that are discussed.

SCENARIO A: Partnership of Technology/ Service Provider(s) with Hall Owner

This scenario concerns a partnership agreement contracted between a Technology and/ or Service Provider with an Exhibition Hall Owner for collaborating in order to provide the wireless exhibition services. The concerned entities make an alliance, of either permanent or semi-permanent nature based on their strategic goals, which includes a distribution of roles based on their primary competence. Thus, the Technology Provider is responsible for installing and operating the Wireless Exhibition Guide infrastructure within the exhibition hall taking the role of Wireless Infrastructure Operator. The Service Provider, who can be either the same or a different entity from the Technology provider, is assigned the role of Wireless Exhibition Guide software administrator and operator, takes exhibition content from organisers and exhibitors, and is responsible for the reliability and quality of the Wireless Exhibition Guide services. Hall Owner relies on this Service Provider for providing the wireless services to the exhibition shows that are organised by itself or its hosted organiser companies.

The following figure constitutes an illustration of the value network of Scenario A.

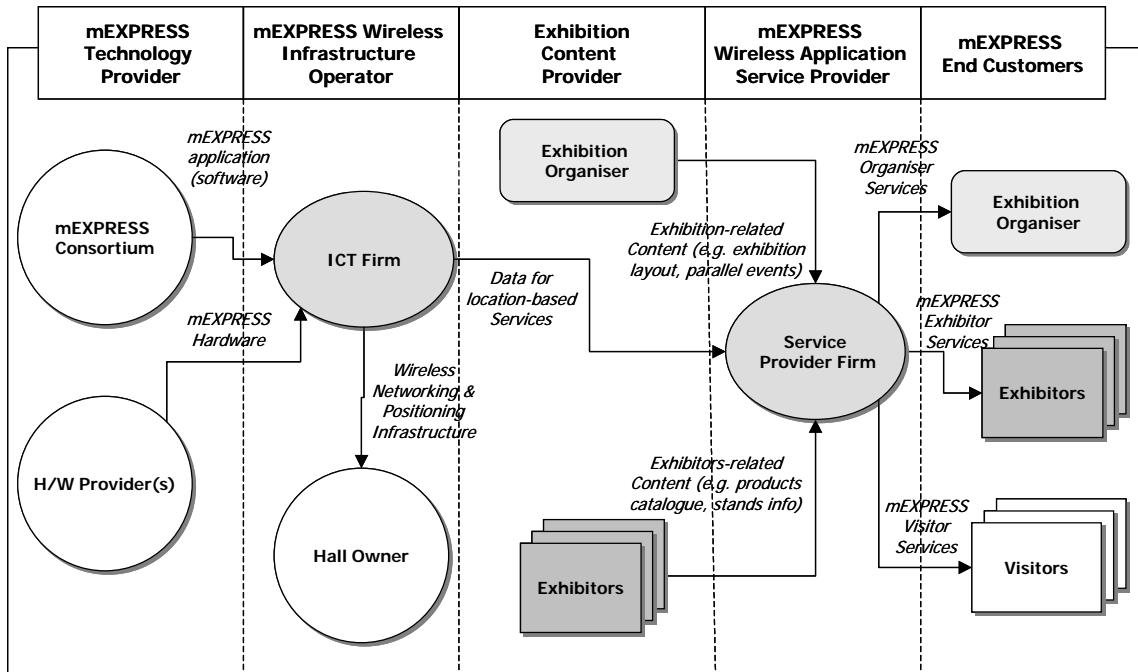


Figure 3. Value Network of Scenario A

The whole business model is based on a revenue-sharing agreement between the Wireless Service Provider with the other parties that provide significant value, such as the Hall Owner and the ICT firm. The direct receiver of this revenue can either be the Wireless Service Provider itself or the organiser, who usually acts as the interface for any service provided to exhibitors and visitors. In any case, the major part of the revenue goes to the Wireless Service Provider, who then pays a commission to the Hall Owner and the ICT firm, as it is specified in their revenue sharing agreement.

SCENARIO B: Acquisition and ownership of solution by Exhibition Hall Owner

This scenario concerns the case in which an Exhibition Centre Owner may wish to take full ownership of operating the software and providing its services to organisers, exhibitors, and visitors. Hall Owners can buy the Wireless Exhibition Guide service package from its developer, called hereinafter as Technology Provider. Then, they get fully responsible for working both as Wireless Infrastructure Operator, which means that they should buy and install themselves the required networking and positioning infrastructures over their premises, and as Wireless Application Service Provider, meaning that they should be able to take on the administration as well as the content management of the application for providing the wireless exhibition services. The only need for collaboration is with organisers and exhibitors for providing them with the exhibition content that is delivered through the Wireless Exhibition Guide platform. A basic prerequisite for this scenario to materialise is that Hall Owners develop internally the required technical competence for operating the wireless infrastructure and application. That means that they have the required human resources and skills to support themselves the provision of the wireless exhibition services. Under this scenario, Hall Owners are more

likely to pursue a competitive advantage from their ability to assure exclusive use and delivery of wireless services to the exhibition shows that take place in their premises.

The following figure constitutes an illustration of the value network of Scenario B.

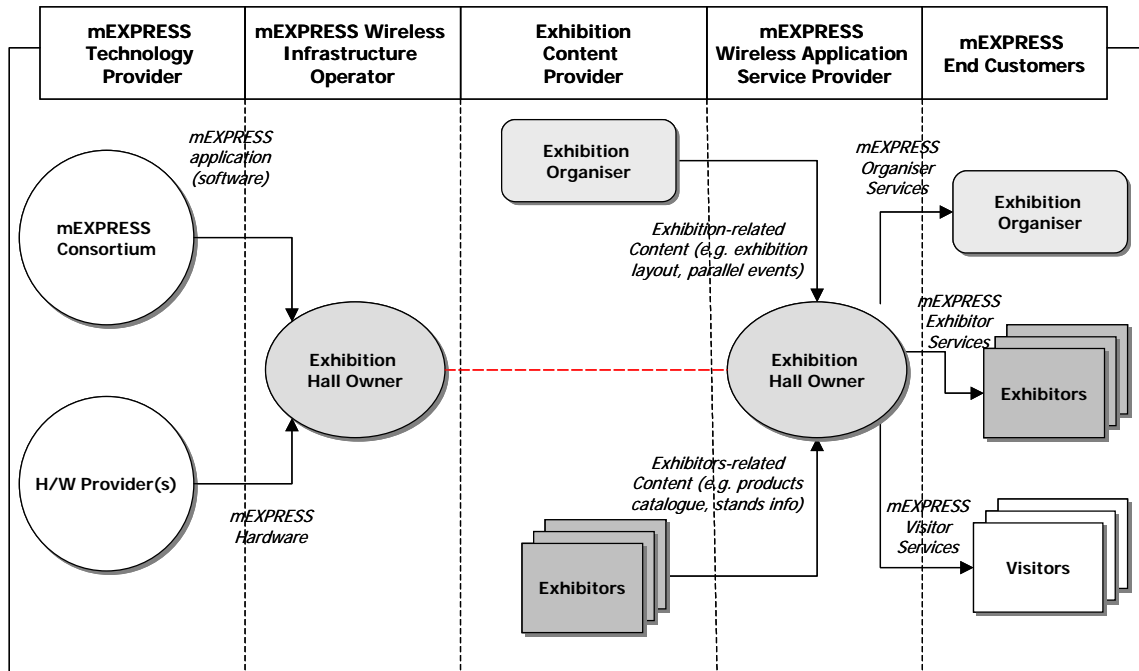


Figure 4. Value Network of Scenario B

Under this scenario, the revenue model is quite simple. The revenue usually comes from the end users, though the streams described the introductory paragraph of this section. The primary and only receiver of this revenue is the Exhibition Hall Owner who provides the services and manages the relationships with the end users of the system.

SCENARIO C: Contract-based agreement between Hall Owner and Organiser

Taking into consideration the evolutions of wireless networking evolution (technology), the trends towards WLAN implementation in public places and common work areas, accommodation and entertainment places (e.g. cafes, hotels, airports, exhibition centres) as well as the European Commission Recommendation [COM(2003) 65] to promote public wireless broadband services in Europe, WLAN infrastructure is expected within the next few years to constitute standard equipment for a great number of European exhibition centres. In terms of value chain configuration, that means that it is possible to separate, and thus assign to different entities, the roles of Wireless Infrastructure Operator and Wireless Application Service Provider. As owner of the establishments in which exhibition shows take place, Hall Owner is considered responsible for operating the installed wireless and positioning infrastructure. Of course, the technology provider that has installed the infrastructure or even a technology partner to which Hall Owner is tied can as well keep this role. However, the ownership of wireless infrastructure remains on the hall owner's side. In the role of Wireless

Application Service Provider, we can then find any organiser who signs a contract-based agreement with Hall Owner for renting and using the Wireless Exhibition Guide during the exhibition shows that it organizes within its premises.

The following figure constitutes an illustration of the value network of Scenario C.

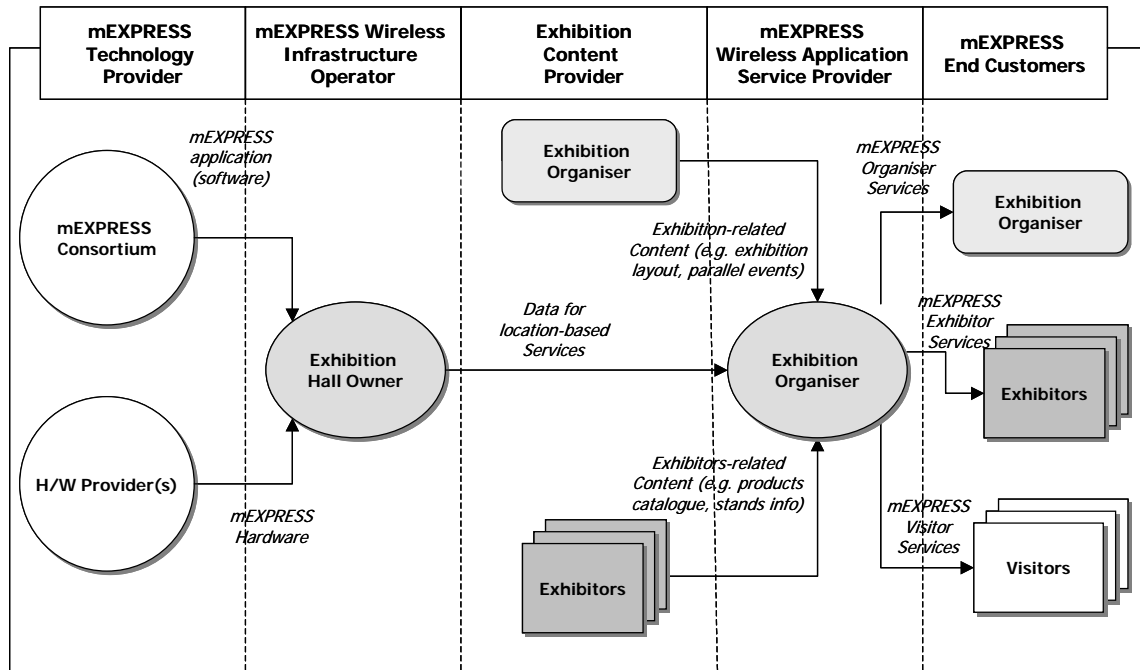


Figure 5. Value Network of Scenario C

In Scenario C, the revenue model is defined by the ad-hoc financial terms of the contract that is signed between the Hall Owner and the Exhibition Organiser. The revenue, which can be generated from fees imposed to exhibitors and visitors or even from other sources (e.g. sponsorships), is collected by the Exhibition Organiser, who acts as the Wireless Exhibition Guide's interface with its users. Depending on the type of agreement that it has made with the Hall Owner, the Exhibition Organiser may pay either a commission of its revenue or a standard once-paid fee every time that it uses the Hall Owner's wireless networking and positioning infrastructure.

6. THE EU REGULATION CONCERNS

In 2000, the European Commission proposed five directives to replace the instruments then in force. These are the Framework Directive (2002/21/EC), the Authorisation Directive (2002/20/EC), the Access and Interconnection Directive (2002/19/EC), the Universal Service and Users' Rights Directive (2002/22/EC), and the e-Privacy or Location Data Protection Directive (2002/58/EC). In parallel with this process the Commission adopted a directive on the basis of Article 86 of the Treaty (Competition Directive), consolidating previous directives liberalising the provision of services on these markets [COM(2000) 239].

The main regulation concerns raised from the Wireless Exhibition Guide implementation and delivery relate to the Location Data Directive (2002/58/EC). This directive particularizes and complements Data Protection Directive (1995/46/EC) by including regulations for the processing and protection of two new types of personal data, that is traffic and location data, as well as for the provision of value-added services based on such data. Based on the directive articles, '**traffic data**' means any data processed for the purpose of the conveyance of a communication on an electronic communications network or for the billing thereof. '**Location data**' means any data processed in an electronic communications network, indicating the geographic position of the terminal equipment of a user of a publicly available electronic communications service. Finally, '**value added service**' means any service which requires the processing of traffic data or location data other than traffic data beyond what is necessary for the transmission of a communication or the billing thereof.

Following Directive 2002/58/EC, the Wireless Exhibition Guide processes location data collected after positioning users (visitors, exhibitor, and organiser's personnel) in the exhibition area, anonymously or with the consent of the users to the extent and for the duration necessary for the provision of the relevant service (mEXPRESS D7.2, 2003). More specifically, the Wireless Exhibition Guide provides services that make use of location data such as visitor's statistics, personalized messages and proposed route within the exhibition. The type of location data mainly used for such services can be the position of visitors within the exhibition, the visitor's trail and other similar data concerning mainly visitors and exhibitors. The collection and processing of this data is accomplished accordingly to the provisions of the European Location Data Directive.

Complying with paragraph 1 of Article 9, the above-mentioned location data are processed in an anonymous way, so that only the system can identify the exact location of its users. This information is then kept in order to provide the above-discussed value-added services. None of these value-added services makes apparent a matching between individuals and the presented location data. Adding to that, the users of the Wireless Exhibition Guide services are provided with the possibility to deny the capturing of their location data when registering. Even if they have provided their consent at the first place, they have anytime the possibility of refusing the processing of such data by updating their registration form (mEXPRESS D7.2, 2003). Finally, only the service provider, and not any exhibitor or even organizer, has the authority of processing the users' location data. In doing so, the service provider should be considerate, so that the amount of location data collected is restricted to what is necessary for its initially declared purpose.

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George is currently Assistant Professor of eBusiness at the Athens University of Economics and Business, Greece. He has also held full-time academic posts in Brunel University (UK) and the University of the Aegean (Greece), while he has been a visiting professor in universities such as the University of London, Nottingham Trent University, and Henley Management College. His main teaching and research interests lie in the areas of eBusiness (emphasising on mobile and wireless applications and services), technology-enabled business process redesign, business process modelling and re-engineering, information management, and information systems evaluation. He has published more than 50 research articles in leading journals and international conferences, including the Information Systems Journal, the International Journal of Electronic Commerce, and the International Journal of Information Management. Since 2001, he is the Director of the Mobile/Wireless Research Group hosted within the ELTRUN research group of the Athens University of Economics and Business.