LIAISON IP Location Based Services:
Taxi on Demand

Stelios C. A. Thomopoulos[1], Panos I. Philippopoulos[1], Nikos D. Argyreas[1], Artur Krukowski[1],

Effie Makri[1], George T. Soulos[1], and Christos Dessiniotis[2]

Abstract — **FP6 IST-511766 LIAISON Integrated Project federates an EU pole of excellence committed to build commercial Location Based solutions, targeting mobile professionals, also applicable to the mass market. One of the 6 scenarios considered in LIAISON, targets an automated taxi booking, dispatching, and monitoring application, effectively addressing current taxi sector needs, and potentially expanding to emerging car-pooling / sharing models, allowing integration between modes of transport in urban / densely populated environments.**

Index Terms — **FP6 IST LIAISON, Taxi on Demand, Location Based Services Platform, Location Based Ad-hoc Groups & Dispatching.**

I. Introduction

THE LIAISON Integrated Project (FP6 IST-511766, http://liaison.newapplication.it) is a 42-month project co-funded by the European Commission under the 6th Framework Programme and led by Alcatel Alenia Space. LIAISON aims at providing end-to-end solutions for a wide range of professional environments, by combining existing standards and techniques with innovations resulting from EGNOS [1] and GALILEO [2], as well as capabilities of existing / emerging mobile networks (2G, 3G, TETRA, and WLAN).

Realized through a user-driven approach [3], the LIAISON solution addresses the potential needs of EU mobile worker environments, corresponding to 6 operational scenarios, and representing a wider range of EU mobile work-force segments: Incident Management (IM), Fire Brigade (FB), Electricity Grid / TV Network (e-Maintenance - eM), Urban Waste Data Collection (WDC), Taxi on Demand booking &

dispatching (ToD), and Security personnel (Lone Worker - LW).

LIAISON aims to bring consistent recommendations for the harmonization of labor legislation in Europe, contributing to the fulfillment of the E112 [4] directive and promoting the usage of EU space infrastructure.

In the above context, the ToD test-case aims to integrate and customize the LIAISON architecture into an automated taxi booking, dispatching and monitoring paradigm, and deploy a pilot in Athens, Greece, demonstrating a number of features including Location Based Ad-hoc Grouping & Dispatching (LBAG), multi-lingual presentation (MP) and request transcription (RTS), tracking for customised mappings & 3D settings, elevated 2D graphical I/Fs (e2D), route navigation / guidance with traffic hints, customised charging & billing (CAB), and automated emergency call over TETRA.

Automated taxi hailing / booking applications are currently emerging, following the wide adoption of GPS and GIS technologies in the mobile handset market.

The ToD design, implementation and demonstration is led by institute NCSR "Demokritos" IIT, and supported by Taxi cooperative / dispatcher EDMC, network operators Vodafone (GPRS/UMTS) and OTE (TETRA), GIS providers FORTH institute and Navteq, and the rest of the LIAISON consortium.

The paper is structured as follows: Taxi market background providing trends, drivers and requirements for the ToD application are presented in section II, based on the LIAISON market study and SWOT analysis [5]. Then in section III ToD overview and decomposition into major functionalities is provided and discussed, focusing on ToD specific aspects, such as location-based booking management (LBAG). The generic LIAISON architecture customized for ToD is presented in the sequel in section IV. Finally conclusions are drawn related to the advantages and potential of the system, and possible extensions in both technical and business context are briefly discussed in section V.

II. ToD Market Background & Drivers

The taxi sector in the EU is highly diversified concerning the types of enterprises, number of taxi licenses, variety of tariffs and drivers' qualifications. However, one common denominator in major EU countries is a strictly regulated taxi market. Contrary to the North of Europe, tariffs are fixed by law in most EU countries, thus limiting taxi companies' potential to acquire price sensitive customers. Fixed tariff

[1] The authors are with the Institute of Informatics & Tele-communications, National Center for Scientific Research "Demokritos", Tel: +30 210650-3150 or -3148; fax: +30 2106532175; e-mail:
scat@iit.demokritos.gr
pfilip@iit.demokritos.gr
nargi@iit.demokritos.gr
artur.krukowski@iit.demokritos.gr
effiem@iit.demokritos.gr
gsoulos@iit.demokritos.gr
[2] The author is with Vodafone-Panafon S.A., Tzavela 1-3, Chalandri, Athens 15231 Greece, Tel: +30 210-6702776, Fax: +30 210-6702090; e-mail:
christos.dessiniotis@vodafone.com

policies are thus considered as a driver for investing in new systems providing a broader range of services and a higher quality for attracting new customers.

Market study and SWOT analysis [5] carried-out in the context of LIAISON, showed that the taxi market is facing increasing costs (fuel consumption due to traffic congestion, increasing petrol/gas prices, vehicle maintenance, etc) and decreasing margins. As a consequence, more taxi owners (freelancers) and companies join radio dispatch centres, seeking business stabilization and/or augmentation. Dispatchers on the other hand, look for automated solutions to reduce co-ordination effort and increase efficiency and capacity to control larger fleets. There is also an increasing trend for high quality services addressing the needs of important niche markets (executive / VIPs, hotels, etc). Private hire (PHV) services represent today the most prominent sector related to the taxi market.

Current GPS-based solutions for taxi dispatching and fleet management, penetrate the market via promotion of major dispatch centres, with installation / maintenance cost, and taxation being the critical adoption factors. Therefore solutions such as the LIAISON ToD should in principle target large taxi fleets (>150 vehicles) in major cities, that can afford the cost of an integrated and full-featured system. Small taxi companies or freelance drivers do not often see the need of, or are unaware of solutions based on new technologies. This however is subject to change, considering the overall evolution in the automotive industry.

On the other hand, the car industry is now looking at a number of both critical (e.g. break-down support) and non-critical applications (e.g. car to car service roaming / communication[1]) that require location accuracy and speed at the levels that GALILEO promises to deliver. Such features will catalyze consumers' decisions in the coming years, when the overwhelming majority of newly manufactured cars will feature navigation and infotainment equipment. Users in the near future will be discovering Points Of Interest (PoIs) through their mobile devices and expect their vehicles to provide clever routing and accurate navigation to their selected PoIs. In such an environment, it shall be hard for taxi professionals to keep a sustainable business, based only on traditional street "knowledge", or systems that do not provide features up to their customers' expectations.

To sum up, the willingness of the taxi sector to embrace innovation and investigate new ways of value generation is strengthening[2]. Drivers look for increased safety and efficiency, while technology and content providers teaming with major taxi market stakeholders will not hesitate to invest on novel solutions, once their business will increasingly rely

on quality and efficiency. This is especially true for certain niche segments in the high end of the market. The taxi user in LIAISON (EDMC) is an example of such an early adopter [3].

III. ToD FUNCTIONAL DECOMPOSITION

From a functional architecture perspective, the ToD system ([8]) provides transparent booking, dispatching and tracking for navigation and security over public cellular networks, with an intelligent dispatching centre (RCC/EIS) hosting the LIAISON Platform capabilities [6]. The following figure illustrates an overview of the ToD system functionalities:
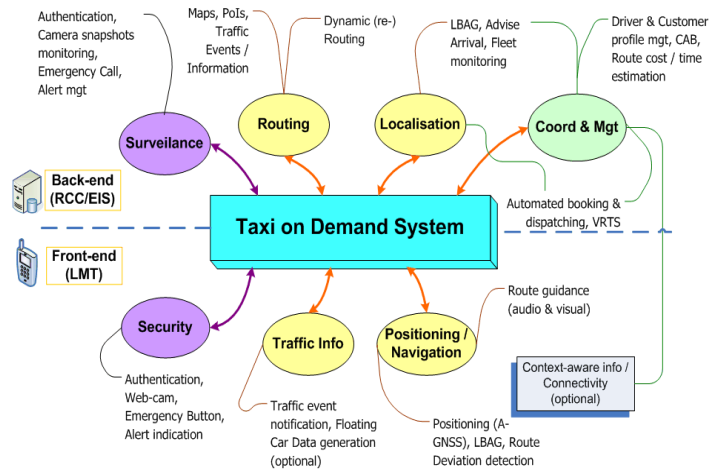

Figure 1: Taxi-on-Demand (ToD) Functional Overview

Functionalities in the above schema, are grouped as:
- ❑ Back-end functions, residing at the Operations Centre (RCC/EIS) include: Surveillance, Routing, Localisation, and Coordination & Management (COMA).
- ❑ Front-end functions, residing in the vehicle (LIAISON Mobile Terminal - LMT) include: Security, Traffic-Info, Positioning & Navigation, and context-aware information.

In the sequel, the aforementioned functionalities are outlined.

A. Surveillance / Security

The mission of these functions is to provide real-time passive protection and monitoring of the mobile worker, covering 100% of the dedicated work area, and being available on a 24-hour basis. Surveillance provides operations monitoring, including all data exchange between the vehicle and the Operations Centre. An elementary level of security support is provided via the authentication procedures of the system for all interacting actors, i.e. drivers, passengers, and human operators in RCC/EIS. Moreover, the LMT integrates an advanced alarm function to be used for particular emergency cases, allowing for instant delivery of position and other relevant information to the Operations Centre. The alarm function is activated automatically (upon generation of a security alert e.g. due to route deviation), or manually via the external (concealed) emergency button in the proximity of the driver. A web-camera appropriately installed in the vehicle is also activated in such cases, for the provision of car-interior snapshots. The Operations Centre is able to manually establish

---

[1] E.g. see http://www.car-2-car.org/ , a consortium built by 6 major EU car manufacturers, with the goal to create a European industrial standard for car communication spanning all brands.
[2] E.g., Taxi Stockholm controlling 150.000 cabs via a GPS-based voice-automated discovery and dispatch service, routes more than 44% of their calls automatically, and has already acquired more that 60% of the local market – no small feat considering 21 competing local companies.

(auto-recall) a voice communication (via TETRA and optionally GSM) to the LMT in the event of an emergency alert. It is also possible to configure the LMT to automatically, or manually accept the voice communication with the Operations Centre in the event of an emergency situation.

B. Localisation / Routing / Traffic / Navigation

The principle task of this function group is the geographic positioning and tracking of the mobile worker while operating on location, obtained with the help of the LMT. Localisation is interoperable with COMA regarding the tracking of taxis, transmission, and visualization of location information within the context of operational requests. Routing, route update, and navigation utilizes traffic hints provided to the system via an external source [7], and integrates an additional layer of traffic-related events on top of standard GIS information. These core functionalities of the LIAISON system are implemented in the Location Based Services Platform (LBS_P) server [6]. In addition, ToD-specific functionalities related to location based booking are implemented via LBAG [11], i.e. a mechanism addressing two principal problems, related to centralised systems and freelance drivers:

In the centralised case, the operator (dispatcher) broadcasts booking requests to all taxi drivers and waits for responses. This in effect floods the network with requests sent even to taxi drivers who are known NOT to be able to serve it for different reasons (already booked, too far, etc). The LBAG mechanism enables notification of only those taxis that are most likely / appropriate to undertake the booking, based mainly on proximity to pick-up point, bid time and other criteria (e.g. customer preferences, dispatcher policies, etc).

In the peer-to-peer case the LBAG mechanism publishes requests from customers only to taxis in an appropriately prescribed geographical area (ad-hoc group), which again results in optimizing network traffic. After accepting the request the taxi driver is able to directly communicate with the passenger, to e.g. provide booking confirmation (acceptance of request, provision of estimated route cost) and notify when the taxi is approaching the customer (advice arrival).

LBAG is implemented as a network-agnostic mechanism, thus providing a portable, cross-platform application tier where virtual groups of drivers are formed based on location data and other criteria. Group membership is updated as taxis move in and out of areas defined in a static (fixed areas), or dynamic manner (booking request distribution based area shaping on-the-fly). The introduction and evaluation of LBAG may lead to an extended Peer-to-Peer paradigm, for building similar applications without the need of a "handshaking" entity between service provider (taxi-driver) and service consumer (customer passenger). A possible extension of this concept is the use of LBAG for discovering other customers of the service that are currently in the area, and would be willing to share the ride. It thus acts as a car pooling application, for maximizing vehicle utilization in urban environments.

Floating Car Data (FCD) generation[3] relates to strong market requirement for nRT (near-Real Time) traffic information. Taxis, being heavily-used vehicles are best-suited for providing information derived from their movement and their whereabouts, to radio stations, local authorities, etc.

C. Coordination & Management (COMA)

This function provides real-time monitoring and operational support for the taxi drivers including:
- Operations / Booking resources Management
- Routing (mainly estimations[4] of route cost and time)
- Data acquisition (driver and customer profile management)
- Safety purposes (emergency calls, car-interior monitoring)
- Worker status (position, statistics, operational capability)

COMA has to be interoperable with both "Surveillance" and "Localisation / Routing" functions. The management sub-system encompasses an application layer integrating the LMT with the Operations Centre. It contains several DBs with possible integration (as being beyond the scope of this project) with other external ERP systems, e.g. for billing and accounting, complex planning and optimisation tools.

The Operations Centre is able to assign priority levels and status to incoming and existing events and allow management of customised event displays. Priority assignment is to be predefined at configuration time and not handled dynamically.

D. Context Aware info / connectivity

This functionality is an optional component, relating to the acquisition / automated reception of content relevant to the vehicle location (e.g. local infotainment provision, etc).

IV. TOD ARCHITECTURE

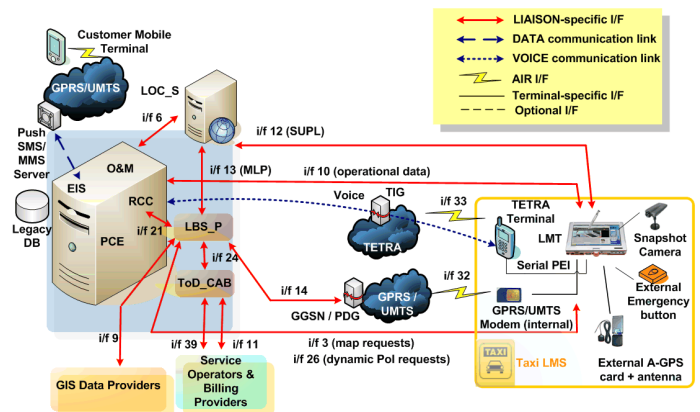An overview of the ToD system physical configuration[5] is illustrated in **Figure 2**.

Figure 2: ToD high-level architecture and LIAISON I/Fs

---

[3] Although potentially supported by the system, FCD is currently out of the scope of the ToD TC pilot and demonstration.
[4] The Operations Centre shall have at its disposal a list of fares associated with certain routes (e.g. routes of greater demand), used instead of calculated when the passenger request coincides with any of these routes.
[5] As design and implementation are still active, at the moment of writing this paper, certain features of the system may, or may not be available for demonstration, depending on technical and budget restrictions.

ToD solution consists of the following physical components:

- **Operations Centre server** hosting the following functionalities (corresponding to LIAISON subsystems):
  - <u>EIS:</u> The Enterprise Information System links the ToD system to the EDMC legacy DB providing a front-end to the ToD customer for registration and booking. Driver profiles and tariffs, i.e. data relating to dispatcher main business will reside in the RCC Customised Module. In ToD, the EIS box hosts the web service which handles customer orders.
  - <u>O&M:</u> Operation & Maintenance box hosts management functions relating to the operation of the ToD application and all supporting S/W and H/W.
  - <u>RCC:</u> The Remote Control Centre is the central control component of the system, involving all intelligence and resource handling for the ToD application. RCC hosts most of the functions that correspond to a traditional dispatch centre (fleet and booking management) plus new functionality such as Location Based Ad-hoc Groups (LBAG), Multi-lingual Presentation (MP) and Request Transcription Service (RTS).
  - <u>LBS_P:</u> : the LBS Platform and a DB containing the ToD demo (Attica) area Maps and the relevant no-turn, direction, and PoI information also resides on the Operations Centre. Its main task is routing / navigation (with traffic hints) and geo-coding data provision.
  - <u>CAB:</u> The Charging Accounting and Billing component of ToD also resides in the Operations Centre. Its main task is to collect charging records related to network transport and ToD system use, and bills from content / service providers. The taxi drivers are then invoiced (one-stop-billing) for their use of the communication network, GIS content and LIAISON services (LBS_P / LOC_S use).
- **TETRA Terminal Connected to RCC** provides access to the taxi drivers TETRA network. Voice communication between the Operations Centre (RCC) and the taxi driver is assumed via the connection of OTEs TETRA Infrastructure (Telephony Gateway - TIG).
- **Location Server (LOC_S)** hosting A-GNSS positioning, is the source of location information (e.g. A-GPS, etc) for all ToD subsystems.
- **GPRS (/UMTS) Infrastructure** represents the cellular data bearers (TCP/IP and SMS/MMS messaging) provided to the ToD system.
- **GIS Data Providers** provide maps and traffic information updating the LBS_P.
- **Service Operators and Billing Providers**, effectively represent all business actors providing services within ToD. Currently the assumption is that network providers use their legacy charging/billing systems to charge both passenger and driver. The driver charges the passenger and pays a subscription to the dispatcher. Location and GIS costs are integrated into the tariff. The dispatcher can provide a one-off charge to the drivers by aggregating all their bills. The passenger may also pay a small subscription to the Mobile Operator, on top of communication costs for using the ToD service.
- **LIAISON Mobile System (taxi)**, is implementing the LIAISON system in the taxi, and comprises of the following components:
  - LMT terminal hosting the ToD specific S/W (ToD Customised Module). An emergency button (concealed) will be attached to the LMT.
  - LMT device is complemented with an external GPS antenna appropriately mounted on the vehicle.
  - GPRS/3G Data modem (PCMCIA card) for supporting data communications.
  - TETRA terminal (Nokia THR880i) providing the air connectivity with OTE's TETRA network.
  - In-car camera (integrated or remotely connected to the LMT) for surveillance and emergency support.

V. CONCLUSIONS AND EXTENSIONS

The taxi market faces ongoing changes. The volume of traffic is increasing dramatically, the costs for fuel are higher than ever, leading to increased costs and decreasing margins for taxi companies. This entails the necessity to implement new solutions to reduce costs and enable new revenue streams. Current solutions such as the ones deployed in Singapore [9], and London [10], provide taxi hailing based on the nearest coordinate method (taxi to pickup point), involving mainly SMS messaging for customer notification. ToD on the other hand provides a traffic-sensing based approach, integrating a wide range of features relevant to a number of professional market sectors (regular Taxis, Private Hire Vehicles, Hotel / medical / executive transport, traveling salesmen, etc) that seem eager to adopt innovation as an advantage in an upcoming landscape where competition will be on the range and quality of in-car Value-Added-Services. Functional features, resulting from comprehensive requirements analysis [3] and design [6] in LIAISON, equip the ToD solution with important advantages:

- The system improves operational efficiency by decreasing response times, thus enabling cost and time reductions. Benefits accrue to taxi fleet owners and operators, taxi drivers and customers. Faster automated dispatch processes lead to increased fleet management capacity, while reduced pick-up time enhances customer satisfaction. The system ensures fairness to all drivers and diverse policy options to operators.
- Route guidance addresses credibility issues by providing for increased transparency with regard to the chosen route. nRT traffic information integrated in ToD enables choice of the faster (not necessarily shorter) route, thus saving time, money, and fuel consumption (pollution relief).
- Taxi drivers are increasingly faced with violent assaults. Surveillance and advanced security (concealed button, alerts, camera, etc) features in ToD essentially improve the safety for both the taxi drivers and customers. Besides

violent assaults, the system also delivers additional safety in case of accidents, or other emergencies. In such events, police or ambulance vehicles may be immediately dispatched to the exact location of the incident.

➢ Facilities such as profile-based booking, emergency features, and peer-to-peer data communication between customer and driver, are beneficial to customers with special needs including disabled, elderly, etc.

➢ Location aware infotainment provided in the taxi provides an additional revenue potential for taxi drivers. Internet connectivity, mobile office facilities, multi-lingual support, tourist / shopping PoIs, and e-payment facilities are just some examples of a broad portfolio of services that are of interest to the high-end customer segments.
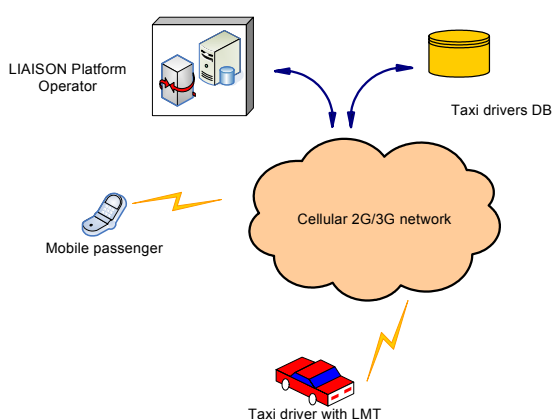
Figure 3: Peer-to-peer Taxi hailing actors

In addition to the above considerations, a new business paradigm is enabled by technologies such as the LBAG, providing peer-to-peer service order and delivery, with a minimum of centralized functionality. A lightweight version of ToD focused on LBAG for receiving booking hints and participating to booking bids, would be an interesting alternative to the subscriptions required by major dispatchers today (~ €70-€100 monthly), provided that an entity with a strong market presence hosts CR and support. If the cost of dispatching would decrease thus lowering the entry barrier, then business opportunities for existing and new players would be created. Taxi drivers themselves becoming more familiar with in-car solutions, would seek solutions outside the traditional dispatcher-based structure. Brand names and especially Network Operators, Value-Added Service Providers (VASPs), and content providers could benefit by entering this new "booking transport" market. **Figure 3** illustrates the main value chain actors in such a scenario.

Automatic collection of traffic information and feeding to DBs (FCD) is another possible revenue generator for taxi professionals, and relates to the strong market need for nRT traffic info, following the evolution of traffic control / monitoring systems. ToD solution with FCD extensions could thus be used in road-charging schemes, or transport control systems, supporting dynamic traffic monitoring & scheduling.

Last but not least, the ToD paradigm may be useful in aiding integration into mass transport, i.e. taxis filling the gaps between public transport service points, in a dynamic (peer-to-peer hailing) and/or coordinated (via operations / dispatch centre) manner. In densely populated urban environments, shared rides with taxis could be the precursor to generalized car-pooling (sharing) application, that promotes environmental objectives, while at the same time lowers costs (e.g. economies of scale in commuting) and enables novel business models.

REFERENCES

[1] EGNOS web-site: http://www.esa.int/esaNA/egnos.html. Europa: http://europa.eu.int/comm/dgs/energy_transport/galileo/intro/steps_en.htm

[2] GALILEO web-site: http://www.galileoju.com/. Europa: http://europa.eu.int/comm/dgs/energy_transport/galileo/

[3] LIAISON *Service Definition Pre-op Deliverable 055*: document *3300_D055-Service-Definition_LIA-REQ-DEM-02_3C*, Jan 2006.

[4] European Commission Recommendation, *Official Journal L 189,* 29/07/2003 pp. 0049 – 0051.

[5] LIAISON *Market Analysis Deliverable 036:* document *2701_D036-Market-Analysis_LIA-RP-HITEC-02_3D,* Aug. 2005

[6] LIAISON *System Solution DDF Deliverable 041:* document *0306_D041-Liaison-System-Solution_LIA-RP-ASP-03_2D*, Jan. 2006

[7] Athens congestion map: http://www.transport.ntua.gr/map/en/index.php

[8] LIAISON *ToD Customized Module Design Del 041*: document 3312_D041-ToD-Customised-Module-Design_LIA-DF-DEM-03_1B, Jan. 2006

[9] http://business.singtel.com/upload_hub/mnc/SmartCab_Mar_2004.pdf

[10] http://www.netsize.com/pdf/en/TaxiPoint_NetsizeBC.pdf

[11] S.C.A. Thomopoulos, N. Argyreas, E. Makri, P. I. Philippopoulos and D.K. Bougoulias, "*LBAG: A Location Based Ad-Hoc Grouping Mechanism for Location Aware Booking Services*", Proceedings of the 15th IST Mobile Summit 2006, Mykonos, Greece, 7 June 2006.

Dr. Panos I. Philippopoulos, R&D manager with the Institute of Informatics and Tele-communications (IIT) at NCSR "Demokritos", Greece, received Diploma in Electrical Engineering & Computer Science (1994) and Ph.D. degree in "Mobile & Personal Telecommunications" (1999) both from the National Technical University of Athens. Since 1994, he has participated in numerous European and National R&D projects (RACE, ACTS, IST FP5/6). He has been head of the R&D section (2002-2005), in TEMAGON S.A. (now OTE Plus), consulting branch of Greek ex-incumbent operator OTE, S/W engineer at the Public Power Corporation (1992), the Greek Pentagon (GES-1997) and Human Factors expert at the Hellenic Standardisation Organisation (ELOT-1998). His research interests include, business modeling for pervasive service environments, location-based platforms and technologies, satellite / terrestrial mobile service integration, service discovery & provision over 4G hybrid networks. His publication portfolio includes 1 book and 25 papers in referred journals and IEE/IEEE conferences. He is member of IEEE (1998) and the Greek Technical Chamber (1994).

Dr. Stelios C. A. Thomopoulos holds a Diploma in Electrical and Mechanical Engineering from the National Technical University of Athens (NTUA), Greece (July 1978), and an M.S. degree (January 1981) and Ph.D. degree (January 1983), in Electrical & Computer Engineering, from the State University of New York at Buffalo. He has served as a faculty with the Electrical & Computer Engineering Departments of Southern Illinois University (1983-1989) and the Pennsylvania State University (1989-1996). In 1984 he founded Intelnet, a consulting company in the telecomm industry. In 1995 he co-founded Intelnet Inc., a company specializing in biometrics, information management and access control systems and data mining applications. He served as President and CEO of the company and chief product designer from 1995 to 1999. In 1998 he was elected Director of the Institute of Informatics and Telecommunications of the NCSR 'Demokritos'. Dr. Thomopoulos has authored or co-authored over 160 publications in peer reviewed professional journals, proceedings and books. He holds US Patent No. 5,978,495. He has served as premier consultant and advisor to the US Air Force Pre-detection Fusion Program, advisor to the French CNRS and DRET and to the US and Greek industry. He has served as representative of Greece to the European Space Agency Joint Communication Board (ESA JCB). His R&D activities have been supported by various government, private and venture capital organizations.

Mr. Nick D. Argyreas holds a degree in Mathematics from the University of Patras (1998) and an MSc degree in Informatics from the University of Athens (2002). He used to work as system administrator for UNIX based servers and supercomputers. His research interest has included Biometric Security, Artificial Intelligence, Chaos Theory and Non Linear Mathematics.

Dr. Artur Krukowski has been with the University of Westminster (London, UK) since 1993 on the position of the Researcher and Industrial Consultant. His areas of interest include multi-rate Digital Signal Processing for telecommunication systems, VLSI integrated circuit design, Digital Audio and Video Broadcasting, e-Learning technologies, computer security and cross-platform programming, and recently also satellite positioning technologies and GIS information systems. He is associated with NCSR Demokritos since the end of 2004 where he is working on the Framework 6 European Research Project LIAISON-IST-2004-511766. His publication portfolio includes 2 books and over 30 papers in referred journals and IEE/IEEE conferences.

Ms. Effie Makri holds a degree in Informatics Engineering from the Technological Educational Institute of Athens (1994) and an MSc degree in Electronic Engineering from the University of Dublin, Trinity College (1996). She is currently in the process of a PhD in Mathematics, researching Objective Number Theory and its application to Cryptography, and specifically Key Management Techniques for Wireless Ad-hoc Sensor Networks. She has extensive software development experience in J2EE for banking applications, and knowledge of Object-Oriented Technology. Her research interests have included optimization of Broadband ATM networks, Airborne Radar Systems, Wireless LANs and currently Wireless Ad-hoc Sensor Networks and Location Based Services.

Mr. George T. Soulos holds a degree in Electrical and Electronic Engineering (2001) and a MSc in Modern Digital and Radio Frequency Wireless Communication (2003) from the University of Leeds. He currently started his PhD study in the domain of Wireless Sensor Networks in the University of Athens and works on NCSR Demokritos as a young researcher on several national and European projects. His research interests include ambient intelligence, wireless sensor networking, Digital Signal Processing, Optimisation Theory and Protocol Design.

Mr. Christos Desiniotis was born in Athens, Greece, in 1977. He received a Diploma degree in Electrical Engineering (1999) and MSc degree in Techno-economic Systems (2001), both from the National Technical University of Athens (NTUA), Greece. In 2000 he joined NTUA as a research engineer, participating in many R&D National and European projects. He joined Vodafone-Panafon GR in 2003 working in *Network Strategic Planning-R&D* Sector. His current work is focused on EU and intra-company projects that target to improve performance and apply new services in Vodafone's private network. His research interests are in the areas of wireless communications, optical transmission systems and mobile positioning techniques. C. Desiniotis has been involved in several EU IST projects like LION, ADAMANT, CREDO, LoVEUS, MCAST. etc.