



**InLocation
Alliance**

Indoor Location Based Services in transportation hubs

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ABSTRACT

The transportation sector is investing in and expecting significant innovation from indoor Location Based Services (LBS). Earlier this year, ILA recognized three leading innovations in LBS applications, of which two were related to the transportation sector. Specifically, the leading innovations targeted critical transit hubs where people and goods are moved: airports and railway stations. LBS capabilities in these locations offer significant benefits to the operation of the facility, employees, vendors and customers, creating a classic “win-win” scenario for all the involved parties. This white paper addresses the growing value of indoor LBS, several specific applications and their value proposition, and the role of the ILA in accelerating the adoption of these capabilities.

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2. Notice to users

2.1 Laws and regulations

The indoor location technologies described herein make use of radio frequency devices for communications and location. All radio frequency devices are subject to regulations in the countries they are used. This paper does not address regulations for radio frequency devices and assumes all radio frequency devices are operated within regulation.

The determination of location creates information that may be owned or regulated. The ILA recognizes that in many jurisdictions there are rights to privacy and authorities who may have certain rights to information access. This white paper does not attempt to define rights to privacy, ownership rights or location data access authority. This white paper considers a generalized notion of these rights and offers suggestions and methods for how they may be addressed. This white paper is not to be considered an authoritative source on these rights; this white paper may require updating as legislation, regulations or common law are established.

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3. Introduction

The purpose of this white paper is to notify transportation industry thought leaders of some technical solutions being developed by the InLocation Alliance members; these technical solutions utilize the ILA developed technology-agnostic System Architecture which provides interoperability for ILA member developed use cases.

Although many notable examples of deployments in the transportation industry are already available with some being reported here, ILA believes that the time has come for a more extensive activity that will allow a deeper integration of the indoor location technologies in the business processes of the transportation industry to the benefit of all involved stakeholders.

Industry organizations and alliances as well as innovative companies in the transportation industry are invited to contact the ILA and cooperate with it to fulfill this intent.

To obtain more information about engagement possibilities with the ILA please see the contact information at the end of this white paper.

4. Location Based Services Go Indoors

With the wide availability of inexpensive GPS receivers, people and businesses have come to rely on the accurate positioning of smartphones, vehicles and other equipment. GPS performance is sufficient for a multitude of everyday outdoor tasks, from wayfinding and navigation to asset tracking and resource management.

The overwhelming success enjoyed by these “killer applications” has raised the expectation of similar functionality indoors and in urban canyons, where the GPS signal is often weak or non-existent as so cannot be used to reliably fix a position.

In the meantime, numerous other technologies capable of supporting reliable and accurate indoor positioning are maturing and are reaching mass-market scale. Unlike the uniform coverage of GPS in open-sky environments, a range of options are available or emerging for indoor positioning. Some systems exploit the Radio Frequency (RF) and networking capabilities of the device, such as by using cellular networks, WLANs and BLE; others are aided by the rich set of sensors available on the devices. There are systems that can achieve indoor positioning by almost any combination of accelerometers, gyros, magnetometers, cameras and microphones. Unlike the outdoor environment, there is no global infrastructure available for indoors and businesses will need to deploy solutions that best fit their applications and use cases. In some cases, the inertial sensors of the device provide good support to positioning and navigation. In other cases, combinations that exploit fingerprinting, wide-area beacons or cellular networks with sufficient precision for the intended applications, will be more appropriate. In one sense this adds complexity to a system (what technology to use), but it also unveils new opportunities for specifying the best “fit” for a given set of applications.

5. Why Indoor LBS: Transportation

Transportation is basically the business of conveying passengers and goods.

When people travel, their journey unfolds among large hubs corresponding to railway stations, airports and bus stations. Occasional travelers need guidance in finding their way through complex, unknown places and often unknown languages. They also may need assistance in finding family or friends, currency exchanges, food, consumer products, various hub services and restrooms in unfamiliar environments.

Conversely, commuters who repeat the same itinerary every day, may hardly be interested in finding their way. They may be more interested in finding friends and colleagues, getting repeated services, and managing their time more efficiently while traveling. For instance, a commuter pressed for time may decide to order breakfast while getting off the train. His table and meal can be prepared while the commuter is moving from the platform to the restaurant.

Transportation is also about moving goods. Luggage can travel with people and people may want to be able to keep track of forgotten or stolen luggage, especially if the contents are of high monetary value or are required for immediate use.

Often hubs are multi-modal and a large railway station is often located close to an airport with a multi-story car parking allowing easy access to both. The location of parked vehicle can be a daunting task if a parking check is mislaid, or the location of the vehicle isn't accurately recorded.

Airports are complex eco-systems, where multiple players compete and cooperate in providing services to one another and to traveling end users. The capability of positioning people and objects can prove to be valuable to multiple players for multiple purposes. Merchants, for instances, can improve customer relations and marketing but can also exploit the system for managing logistics and for theft prevention. Credit card companies can track the movements of people to verify that transactions are physically coherent with the user position. Security may be interested in geo-fencing people to verify that their position is coherent with the position of their baggage and with their intended gate and departing time. Given the complexity of the environment, some location-based resource management

capabilities associated with security or other staff could likewise be critical. Marketing agencies may be interested to reconstruct the user's behavior. Ultimately a single infrastructure can be exploited by many actors for many purposes.

Large vehicles are another important component of transportation. A cruise ship, for instance, has a complex architecture and can host several thousand people. Reaching all the people in their native languages to help with a more informed utilization of the available amenities does improve user experience and helps the cruise company to better manage the available resources.

From the traveler point of view, journeys are often multi-modal. From start to finish will likely touch many indoor places en route to final destination.

Transitions between outdoors and indoors is most interesting and challenging as it requires the handover of positioning from GPS and A-GPS to Indoor Positioning Solutions.

Indoor car parking needs this interface zone to work, and there exists a huge opportunity in this space to connect the outside Auto Navigation world to an indoor Auto Navigation solution with handover to device companion app that can guide the user to and from their Auto. Use cases could include the Airport, the Train Station, the hybrid Train Station Shopping Centre, or the Cruise Ship Terminal.

6. The Landscape

Presently 53% of worldwide airlines implement mobile boarding services; however the transport communications firm SITA expects mobile boarding services to reach 91% by 2017¹. With a global statistic showing 97% of travelers carrying an electronic gadget, services for mobile boarding will develop at a frenetic pace². As airports are getting bigger, there will

¹ <https://secure.sita.aero/>

² <http://www.futuretravelexperience.com/2015/02/report-highlights-demand-for-personalised-trave-l-experience/>

be an increasing need for wayfinding. This expansion is creating both opportunities for new marketing channels, awareness for security, and prevention of bottlenecks in airports.



The majority of the 50 busiest airports in the world are planning to experiment with Location Based services over the next three years³. A few examples of such efforts are reported below.

The Amsterdam Airport Schiphol has installed 2,000 beacons to improve the digital service for travelers⁴. Hong Kong International Airport installed 50 beacons across Terminal 1 to provide information and offers⁵. Miami International Airport exploits location technologies to provide various services and promotions⁶. Around

200 beacons will be installed in eight United Kingdom airports for marketing strategies⁷. Easyjet has trialed ibeacons in three major airports for push-reminders to passengers⁸. Japan Airlines pilots Location Based services at 13 Airports to provide information to passengers as well as improving business processes beyond sending offers and product information to

³ <http://www.ft.com/intl/cms/s/0/fa76d8f2-70a3-11e4-8113-00144feabdc0.html#axzz3h4m1SoQI>

⁴ <http://www.atn.aero/article.pl?mcateg=&id=55476>

⁵ <http://www.nfcworld.com/2015/06/30/336309/beacons-guide-hong-kong-airport-passengers/>

⁶ <http://www.phunware.com/solutions/airports/>

⁷ <http://www.airport-technology.com/news/newsproxama-to-install-bluetooth-beacon-technology-at-eight-uk-airports-4580596>

⁸ <http://internetretailing.net/2014/07/easyjet-trials-beacons-to-guide-passengers-through-airports/>

customers⁹. Finavia (Finland) and the Brussels airports track passengers from the car park to the departure gate with a sensor-based system via Wi-Fi transmitters¹⁰.

Often beacons are used as an entry level technology as they are easy to deploy and widely supported by all recent smartphones without incurring excessive battery consumption. More demanding applications such as wayfinding, security and assistance of visually impaired passengers, just to name a few use cases, require more advanced solutions that can extend the functions and reach of the Location Based services already in place.

7. Illustrative Use Cases

ILA members are actively pursuing commercial opportunities in different industries and transportation is currently among the most active. The perceived benefit by venue owners, airline companies and travelers is resulting in increasing investment and innovation.

7.1 Airports

Indoo.rs GmbH, based in Austria, is working with **San Francisco International Airport (SFO)** to assist visually-impaired passengers navigating through Terminal 2. SFO is in California, in the United States.

Before deploying this app, navigation for the visually-impaired was just about getting from point A (e.g. the check-in) to point B (e.g. the departure). This solution gives spatial awareness, allowing visually-impaired passengers to find out which facilities/amenities are available in their surroundings. Users can get directions either from the display or by-voice, making this app useful to both the sighted and visually-impaired.

⁹ <http://www.rfidjournal.com/articles/view?12634>

¹⁰ <http://www.futuretravelexperience.com/2014/07/wi-fi-based-system-track-passengers-promote-personalisation-across-helsinki-airport/>

Additional features like proximity marketing or passenger traffic control (as already implemented in other projects) are under evaluation to bring additional value to the ecosystem.

Navigine is deploying a location based service to support passenger navigation within the **Sheremetyevo International Airport**. Through both Android and iOS apps, Navigine provides access to airport navigation, push notifications with flight information, and information on POI's. This provides numerous benefits for stakeholders as they can position themselves as being a modern and innovative airport whilst also improving the engagement of visitors aged 18-45. Other benefits include the possibility for businesses to place location-based offers to optimize sales with customer targeted offers and to provide additional feedback and sales channels to customers. Furthermore Navigine provides real-time analytics for better understanding of performances.

7.2 Subways

The Navigine solution has also been deployed in the **Moscow metro**. The deployed system performs control of staff presence at workplace, including their schedule and working hours compliance. Indoor location is used to support security, with access control to restricted areas, identification of access violation cases from the side of illegal intruders ("friend or foe" functionality), and staff dispatching during emergencies.

Staff and equipment are provided with passive tags to enable tracking. Personnel utilize smartphones to get notifications and indications based on their position.

The benefits to the Moscow metro system are twofold: improved safety and security and improved effectiveness and efficiency of personnel operations.

7.3 Railway stations

infsoft GmbH has created an indoor navigation app "SBB - My Station" for **Swiss federal railways (SBB)**. It helps passengers to find their way through Zurich, Switzerland's Main Station. The app uses more than 1000 beacons and sensor fusion to locate the position of

the smartphone. It suggests the ideal way to the chosen platform and also considers barrier-free routing. Passengers can find points of interest, for example restrooms, cash machines, shops, and restaurants in an interactive map and the app guides passengers via turn-by-turn navigation. Special offers and further information about the station complete the application

Sailstech has developed iMap an indoor mobile navigation app for the



largest rail station in Taiwan - **Taipei Railway Station**, also known as the Taiwan's largest maze. The Taipei Railway Station handles over a half million visitors a day and first time visitors waste at least 15 minutes trying to find their way. The station is physically very large, of great complexity and the signage is confusing. Using the Wi-Fi signals in the building the application supports locating and navigation functionality for passengers. The app can locate the user and plan the shortest multi-floor route to the user's destination.

8. Where do we go from here

Indoor Location Based Services are expanding and will by no means be confined to transportations only. On the contrary we expect that they will span most businesses to fuel a new generation of context based functionalities that will improve how people interact with the venue they are visiting and improve how the venue owner manages resources to improve its business.

Prnewswire.com¹¹ reports the results of two different research reports. One report is forecasting a 36.9% compound annual growth rate (CAGR) worldwide by 2019 and a second report is forecasting a CAGR of 49.42% by 2018.

Main drivers are expected to be the spread of enabled phones to reach the billions a few years from now, and the decreasing upfront investments needed to set up an infrastructure within the venues of interest. In fact, next generations of fixed indoor Radio Frequency hardware (such as Wi-Fi and Bluetooth standards) are expected to be capable of broadcasting its location as Latitude, Longitude, and Altitude or Floor number.

Why this is important for indoor positioning is that these open standard RF units immediately become geo-spatial way-point markers that can be interpreted by any application that can address a geo-referenced model.

The availability of the technological enablers coupled with the improved awareness of the benefits will provide strong motivations to accelerate deployment rates.

9. The Open Innovation approach and ILA

As said, implementations can be based on fully or partially proprietary technologies.

ILA members believe that standard products and a consolidated approach will consistently reduce the upfront investments necessary for the development of indoor positioning solutions. Also Total Costs of Ownership are expected to decrease, thus consistently improving the cost / quality ratio and ultimately the ROI of the venue owners and service providers.

Further, the current proprietary solutions can be viewed as “closed” ecosystems that do not provide opportunities for the third party applications that have driven much of the mobile

¹¹ “Indoor Location Market Growing at 36,5% CAGR to 2019”. November 2014, <http://www.prnewswire.com/news-releases/indoor-location-market-growing-at-365-cagr-to-2019-282132411.html>

application innovation. Standardization will drive the definition of open interfaces that can be used by third parties to develop new solutions for customers and businesses alike.

The In-Location Alliance is the open industry forum where market players can reach a common technical understanding of the key components, interfaces and standards needed for end-to-end solutions. Standard based solutions shall also stimulate innovation, enhance service delivery, and allow companies playing different roles in the ecosystem to share use cases, experiences and results from pilots and trials.

The ILA was founded in 2012 with these objectives and has now over 65 members. In ILA, member companies find a good setting for identifying and evaluating business cases and customer needs, with the associated technical and business requirements. The ILA actively collaborates with relevant SDOs (Standard Developing Organizations) by contributing technical requirements rather than to create new standards itself.

The ILA has recently published a System Architecture white paper which defines a technology neutral architecture for indoor positioning solutions.

ILA is also active in showcasing concepts and technologies by organizing public panel discussions and demonstrations of solutions and concepts during key industry events.

Member activities are organized in the following working groups.

- System Architecture is developing an open, technology agnostic architecture for accurate mobile location for different types of venues.
- Promotion is responsible for the external ILA relations and offers member opportunities to expand marketing reach.
- Use Case is identifying indoor positioning use cases and using these to drive requirements to the system architecture and to analyze their business impacts.

Further information can be obtained at our web site <http://inlocationalliance.org/>

To become a member, inquire about collaboration or for further information please contact: admin@inlocationalliance.org.