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Mobile location-enabled services

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Abstract

The paper will provide an overview of the technical, data and organisational issues related to the requirement for and implementation of Mobile Location Based Services within a number of business environments. The benefits to business of such systems will be discussed, with particular focus on currency and accuracy of the information available through such systems.

Existing and potential functionality available through the use of Mobile Location Enabled systems, including data retrieval and mapping, data capture and update, networking, routing and navigation, will be reviewed in relation to the requirements of, and development of, applications for different business sectors.

An overview of the enabling technologies and data will be presented, and options allowing data to be downloaded onto mobile devices, such as intermittent download and a continual open live link to the database, will be compared.

The integration of such systems with existing business systems and data will be discussed and the application of the technology to a Location Based Service (LBS) portal or application server environment will also be considered.

In conclusion, a discussion of the future of such technologies with the emergence of 3G telephony, broad band wireless networking and integrated phones and hand-held computing devices will be presented.

Introduction

Mobile Location Enabled Services (LES) have been available for a number of years, and yet their uptake has not been as prevalent as predicted. This paper examines the reasons for this, and attempts to distinguish the hype from what can actually be achieved.

What are Mobile Location Enabled Services?

Mobile location enabled services make use of existing and emerging location and communications technology to provide users with portable, location-sensitive applications. This includes maps of an area, routing, location-based advertising, tourist information, job planning, fleet management and asset management. Many of these applications are already available in one form or another, but location-sensitivity allows them to provide targeted results by tracking the user as he/she moves around in their day-to-day environment.

The availability of these services has been brought about as a result of the increasing bandwidth of mobile communications systems (mobile phone networks), increasing power of hand-held computing devices, and the decreasing size and increasing accuracy of locating technologies such as Global Positioning System (GPS).

How Can They Be Used?

The potential applications for such technology are numerous and include:

- Navigation - routing a user between two points, and tracking them as they follow the route

- Points of Interest - locating restaurants, pubs, cinemas and other entertainment venues in the vicinity of the user
- Advertising – sending details of special offers which the user may be interested in when they are in the neighbourhood of a particular retail outlet
- Real Time Information - traffic and weather notification for the user's current and predicted location
- Workforce Management – ensuring that the most efficient use is made of a number of teams of service engineers by tracking their current location and incorporating the results into a logistics application to minimise the distance travelled between call-outs
- Asset Management – particularly the capture and validation of an asset's location and condition on the ground
- Locating people – family members or friends, for security reasons or for other functionality such as gaming.
- Emergency Applications - allowing easy location of persons requiring assistance

What Can They Do For You?

Mobile Location Enabled Services provide business benefits through their exploitation of location enabling technology and their use of improved mobile communications technology. The increasing use of mobile Internet is itself a driver towards the greater uptake of these services.

The locational aspect of the services provide benefits such as:

- Enabling targeted information, as it is based on the user's current location and environment.
- Improved customer service by locating providers and facilities faster, more accurately and based on each user's particular needs.
- Improved decision support for location-based decisions such as 'where is my nearest' and route selection.
- Reduced risk through the visualisation of the geographic distribution of holdings, customers and policies.
- A reduction of late or rescheduled deliveries by providing current, integrated views of customer, driver and shipment information.

Mobile technology provides benefits such as:

- Improved decision support due to instant access to information, empowering the decision-making process for users on the move.
- Improved information dissemination through the use of centralised information stores to ensure that everyone has access to the same information, and that this information is as up-to-date as possible, supporting better and faster decision support.
- Improved workflow optimisation and efficiency gains through a permanent communication link to corporate information and business processes.
- A consistent provision of business process and procedures to users no matter where they are or how they access the system, ensuring that all users are applying the same rules to any work undertaken on behalf of that organisation.

The combination of these business benefits can provide proven gains in productivity, improved customer care, an increased efficiency at the point of sale and in the time taken to get products to market. This provides both public and private organisations with the opportunity to maintain a competitive advantage and provide an improved service.

Is It All Hype?

Greater clarity may be required concerning what can currently be achieved with Location Enabled Systems. This is because of the continual evolution and convergence of devices and technology. Some examples of such evolution include:

- Integration – a number of devices are emerging within the integrated mobile phone and hand-held (Pocket PC) environment. These devices currently provide less processing power and memory than a standard Pocket PC and are yet to be fully integrated with GPS technology without the requirement for additional sleeves for the devices to include GPS chips. Currently, integrated phone/Pocket-PC devices are available with 200 MHz processors and 32 MB of memory. Pocket PC devices, are generally higher in specification, currently 64 MB of memory, and may also be networked together using communication technology such as Bluetooth.

- Bandwidth - is continually increasing and has in recent years moved from GSM at 9.6 Kb/s to GPRS, which is currently available at bandwidths of approximately 35 Kb/s. Third generation (3G) mobile communications promise bandwidths of over 100 Kb/s, and are currently being trialled by a number of operators, such as BT in the Isle of Man.

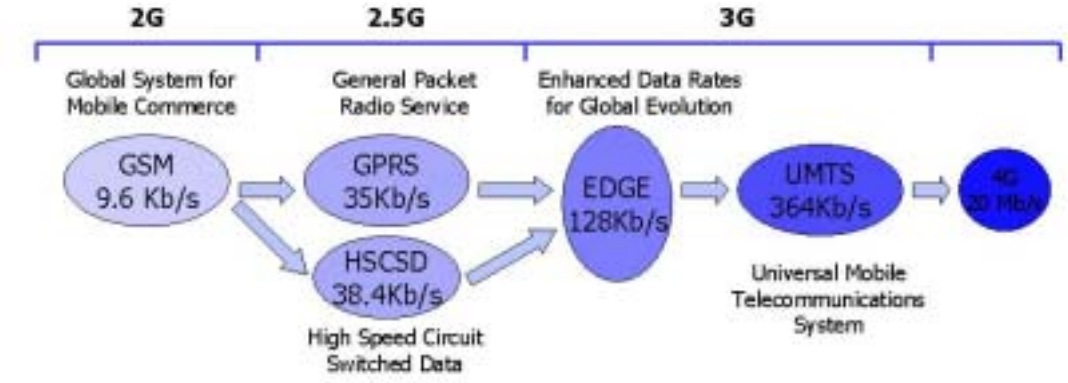

Figure 1 – Bandwidth Evolution

- Positioning technology - GPS availability in built-up areas is currently limited where corridors of tall buildings exist. These can cause problems with "line of sight" when obtaining a location fix from satellite GPS software. However, other technologies are in use by mobile phone providers, including Network Assisted GPS (A-GPS) which helps to overcome the time taken to obtain a GPS fix by sending assistance data to the handset. Should GPS not be available, mobile phone location can also be triangulated from a number of communications cells using technologies such as E-OTD (Enhanced Observed Time Difference). Whilst less accurate than A-GPS, this technology is already well established for WAP applications, and exploits existing cell infrastructure.

In practice, GIS vendors such as MapInfo, ESRI, Intergraph, Autodesk, Ionic and Smallworld have all delivered functionality to facilitate map display on mobile remote devices. A number of specialist firms have also entered the market place, including Webraska and SignalSoft.

These vendors all provide basic location based technology which can be deployed with or without interactive mapping functionality on the client device, allowing for the exploitation of a variety of communication bandwidths and devices. This software is available for use now.

An Application – Transportation Service Information

Public Transport organisations have traditionally published service information to the public in the form of posters situated at bus stops and train stations. This information has generally been provided in paper

format, and is therefore static, without the ability to offer solutions to real-time navigation issues such as a burst water main or bus cancellations.

As transportation information is frequently changing, the provision of paper route maps and service information at stops, stations, shelters and information points is expensive, both in the capture process and in the design, distribution and maintenance of the posters. There is a growing business case for the Public Sector to provide computerised alternatives. This information can be provided at bus stops, train stations, in public places such as interchanges, on-vehicle or direct to a user's handset. This facilitates the e-government initiative to publish service information to a wider audience.

Computerised alternatives also have the advantage of dynamic location sensitivity - real-time traffic information can be added to the data, and through the use of on-board GPS and vehicle tracking beacons, information provided can be specific to a particular service or destination. This could include information such as time to the next stop, alternative route maps and routes to specific events such as concert halls and football matches. Individual information screens can display information specific to their location. This information can be made available through an existing network using GSM or GPRS to send and receive data – users can therefore be made aware of any delays to their journey, with alternative routes being provided if required.

Taking Advantage of New Technology

Many organisations may be waiting for the emergence of 3G mobile technology, however, it is now possible to deploy systems such as the one described above. Furthermore, making the right choices now can ensure that systems are ready to take advantage of new technology as it emerges. These choices can be examined under four broad categories:

- Application Development
- Communications Technology
- Mobile Devices and Positioning Technology
- Data and Data Strategies

Application Development

The example provided can be used to illustrate that making informed choices at design and development time will ensure that the application can take advantage of new technology as it emerges. Further, the choices made will facilitate longevity of the systems as increased demand is made for their use, in this case service information may be pushed to an increasing number of mobile, Internet and digital television users. This requires developing the system in an open, scalable fashion, to facilitate integration of new functionality and support expected user load.

Development Frameworks – providing room for growth

The use of standards-based frameworks such as Sun's Java J2EE or Microsoft's .NET provides scalability and extensibility to support future growth of systems. Business rules required to support the service information requirements can be designed and built once, and then re-used by a large number of different front end devices and communications technologies. This will allow users to swap out devices once new ones become available.

Web Services – sharing applications between organisations

The frameworks described above permit the development of Web Services, allowing information functionality to be shared with other organisations through agreed interchange mechanisms such as SOAP (Simple Object Access Protocol). This will allow third parties such as 3G mobile phone providers to re-distribute service information to a wider audience, without rewriting the application code. Transport providers can also subscribe to third-party web services – for example, a web service providing up to date locational information of any traffic incidents likely to cause delays. This information can then be incorporated into the transportation service model, reducing the need to further extract and conflate data between organisations.

Portals - enhancing the user experience

The use of portals allows a number of diverse business systems to be made available to the user through a single point of access, allowing transportation service information to be integrated with other relevant information such as news reports. Portal software is also able to present device-specific views to users, allowing for changing devices as new technology emerges. The same transport service information can be accessed from a desktop, a Pocket PC or a mobile phone, providing a service to users independent of their environment or location.

Personalisation – flexible user interfaces

Personalisation functionality is the ability of the system to provide a personalised view of an application or number of applications to the user. Applications, User Interfaces and data can be personalised according to user characteristics such as their business function.

Communications

Benefits to the business can be gained utilising existing, proven technology. Provided that application functionality has been correctly designed to be device independent, communications technology can be interchanged once higher bandwidth communications such as 3G become available and affordable.

Available Communications Technologies

With the emergence of GPRS (General Packet Radio Service) technology, connections at approximately 35Kb/s or more may be maintained from a mobile device. This technology can provide connections for flat screen devices where information relating to a change in transportation service can be pushed out to users. Users of more portable devices, such as integrated Pocket-PCs may also dial in standard or data-enhanced mobile connections, which provide bandwidth of up to 20 Kb/s, allowing intermittent, lower-cost access to transportation service information as and when required.

Mobile Devices and Positioning Technologies

The appropriate use of application technologies, such as application servers, portals and web services, will allow users to interchange devices and positioning technologies as required. The technology can be configured to automatically detect the device that the user is using, and provide an appropriate interface for that device, overcoming issues such as the screen size.

Mobile Devices

The emergence of higher-powered Pocket PC technology, allowing users to run sophisticated applications on a small, portable, relatively cheap device, has provided a base on which location based applications such as the one described above can be developed. Improved processor speeds and greater memory allow for the development of more sophisticated applications. Devices currently available include the Compaq iPAQ or the HP Jornada, which can be connected to mobile phone communication technology through Bluetooth. Fully integrated devices are also available, including the Kyocera Smartphone, the Nokia 9210 Communicator, the o_2 XDA and the Trium Mondo. In the context of the dissemination of service information, it is also possible to consider on-vehicle devices with larger flat screens to be utilised for information display at key points or on trains or buses. Touch-screen technology allows users to interact with these devices and query the transportation network.

Positioning Technologies

Mobile cell-based triangulation technologies, such as E-OTD (Enhanced Observed Time Difference) are currently the most suitable for use in a public transportation context, as these provide locational accuracy of around 100m, using existing infrastructure. They are also commonly used in WAP applications. Manual location methods such as gazetteering are also important to allow users to define alternate locations or provide a precise locational fix, or for use in situations where automated location technology violates privacy requirements.

Data and Data Strategies

The emergence of Location Enabled Services has benefited the Public Transport sector through the increased diversity of lightweight and intelligent third party datasets. Datasets such as pedestrian networks will better enable journey-planning solutions as urban areas become more pedestrian friendly. High quality third party data is available and able to meet the increasing demand of the mobile user.

Data Sources
Three main data sources can be considered here:

1. Context mapping
2. Directory information
3. Corporate and Enterprise data

Context mapping provides background information such as roads, buildings and landmarks. This is usually sourced from third party providers.

Directory information provides information relating to businesses and services and can either be sourced internally or from third parties. In the transportation context, this includes lists of rail stations, bus stops, or landmarks, or taxi stands.

Corporate and enterprise data relates to any proprietary datasets sourced and managed in-house. This may include asset databases and customer databases.

Data Strategies
In order to support the demand for high quality service information, many organisations will need to consider a data capture and maintenance strategy that is applicable to their business requirements. Public Transport data provided to end users must be as accurate, consistent and as up to date as possible. This will involve continual updates to ensure that real world events such as the movement of bus stops, alterations to the journey and the cancellation of services and accidents are all consistently reported to the users.

Evolution of Transportation Service Information
Applications can be deployed today that will allow for the evolution of the infrastructure underpinning their delivery without requiring major application rework. This evolution is shown in the figure below.

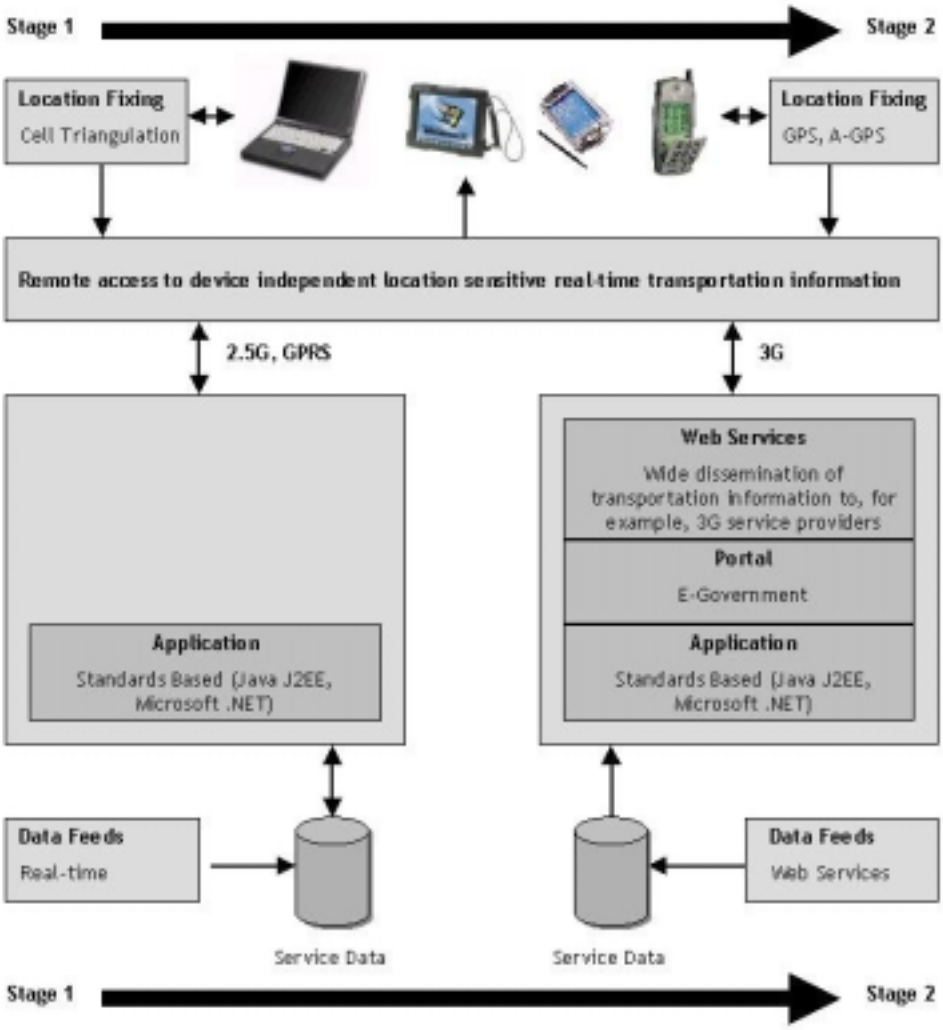

Figure 2 – Application and Infrastructure Evolution

Conclusion

Current technology is available to facilitate the use of mobile Location Enabled Services. Systems exist that are able to provide real benefits to both public and private sector businesses.

Businesses that are able to take advantage of the current communications, hardware and software infrastructure and are able to align consistent data capture and data maintenance strategies will gain competitive advantage from the deployment of such services.