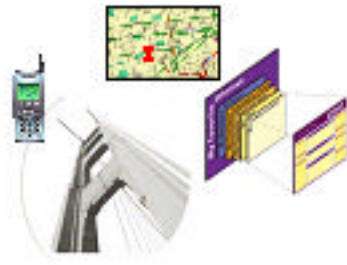


High Technologies report



Location Based Services

Author :
Stéphane Girodon

April 2002

E mail : stephane@girodon.com

1 Introduction

1.1 Objective of this document

For the MTI Master, the “new technologies seminars” required a working individual paper. This is the aim of this document. **Location Based Services (LBS)** is a strategic topic for Telecom world today. I will just ask to keep this report as **confidential** as possible.

1.2 Subject chosen

I worked for a French SIM card manufacturer during 2 years. I was close to the Telecom industry (working as a marketing resource for northern Europe) and I understood **Mobile Network Operator (MNO)** needs. Today they have to increase revenues per subscriber. LBS are one of the MNO killer applications. In the year 2001, the ARC group predicted that location-based services would reach \$33 billion by the year 2005 worldwide. This is the reason why I decided to work on LBS topic.

1.3 LBS definition

LBS are services (like Information On Demand, traffic, restaurant ...) qualified thanks to your location data. Looking for a restaurant, using your GSM in Paris; SFR by example, we will be able to help you to find the nearest Chinese restaurant from where you are.

1.4 Objective of this report

The objective of this report is to analyse the LBS business opportunity.

1.5 Content

You will get 4 main parts :

- LBS : how does it work ? (*Architecture, main technologies ...*)
- Who are the market players ?
- What are the main potential services ? (*Using location data ...*)
- What is the size of the LBS market for the coming years (*ARC sources*)

Happy readings !

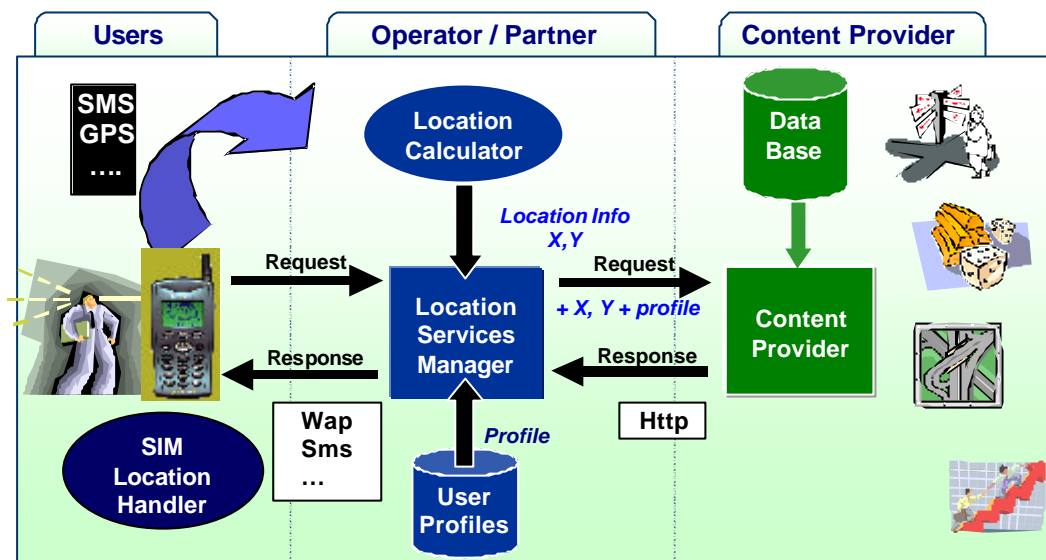
INDEX

1	<i>Introduction</i>	2
1.1	Objective of this document	2
1.2	Subject chosen	2
1.3	LBS definition	2
1.4	Objective of this report	2
1.5	Content	2
2	<i>Location Based Services how does it work ?</i>	4
2.1	Architecture	4
2.2	Location service components	4
2.3	Technologies and accuracy	5
3	<i>Location Based Services Market players</i>	6
3.1	5 types of market players (5 positioning)	6
3.2	Partnerships	7
4	<i>Location Based Services applications</i>	8
5	<i>Location Based Services a real market</i>	9
6	<i>Conclusion</i>	10

2 Location Based Services how does it work ?

2.1 Architecture

Here we will analyse the architecture without any choice of technologies (reference part 2.3). 3 main parts : a user requesting information, an MNO and its partners and several content providers (data, maps ..).



These applications pinpoint the mobile's location at the request of the subscriber. We can imagine many kinds of applications : traffic information, services (restaurants, ...), "where am I ?" .

The subscriber requests a personalised service dependant on his geographical position. The system will ask the LSM* to pinpoint the location of the mobile. The LSM*, using a LC*, will ask the Content Provider to supply qualified information according to the mobile's geographical position. The LSM* will receive the answer from the CP* and send it to the mobile. The LSM* will translate data from an HTTP channel to a WAP/SMS/other channel.

* Please refer to part 2.2 for definitions !

2.2 Location service components

SIM Location Handler (SIMLH)

Handles location and sends location responses as well as implementing the following functions:

- Sending to the LC the terminal local information
- Handling in-coming SMS location requests from the LC
- Local STK configuration menu allowing different degrees of privacy.

Location Service Manager (LSM)

The LSM is in charge of handling location requests coming from content providers. The LSM is in charge of handling requests (send/receive to the LC).

Location Calculator (LC)

It computes the geographical position from the Cell-ID Network Measured Radio by example. It is in charge of handling location requests from the LSM and computing the geographical position in WS64 from the network information

Location Calculator Data Base (LCDB)

Flat text for each Base Transceiver Station (BTS) covered by the service fields: PLMN, Location Area Code (LAC), latitude, longitude, altitude ...

2.3 Technologies and accuracy

Here is a list of main important technologies available to provide location based services application. For each of them you will get the accuracy and advantages and disadvantages of using it.

Technology	Accuracy	Based on network / terminal	Advantages	Disadvantages
COO / Cell ID <i>Cell Of Origin</i>	150 m in urban area.	Network or Handset	No modifications required to network or handsets	Relatively low accuracy
<ul style="list-style-type: none"> • The Based Transceiver Station (BTS) is used as the location of the caller. • Less accurate than other methods – simplest method. • Fast speed of response (3 seconds). • Is used in the US for 911 services. • This kind of method can be acceptable in “Pico Cell” sites but generally must be combined with other methods to increase accuracy. 				
TA <i>Timing Advance</i>	100 m in urban area (linked to COO)	Network	No modifications needed to networks or handsets. Can be combined with other technologies	STK implementation 11.14 needed
<ul style="list-style-type: none"> • This measurement is used in “hand-over” methods allowing the choice of serving cell to be determined for a mobile station. • You can retrieve part of the Network Measured Radio (NMR) using a proactive SIM command. • Combining 3 NMR cells allows enough information to pinpoint the location within a 100 m. • This kind of method is only exploitable when the mobile is switched on. 				
E-OTD <i>Enhanced Observed Time Difference</i>	50 to 125 m	Network	Better positioning accuracy (compare to COO)	Software modified and new handsets needed
<ul style="list-style-type: none"> • The EOTD system operates by placing overlapping location receivers on the cellular network as Location Measurement Unit (LMU) at multiple sites dispersed in a wide geographical area. Each of the beacons has an accurate timing source and when signals (from at least 3 BTS) are received by an LMU, the difference between the times of arrivals is calculated and intersecting hyperbolic lines are produced to pinpoint the location. • This kind of method pinpoints locations more accurately compared to COO but has slower response speeds (5 seconds) and requires modification to both the software and handsets 				

Technology	Accuracy	Based on network / terminal	Advantages	Disadvantages
TOA <i>Time Of Arrival</i>	125 minutes in urban area. Time of response 10 s.	Network	Uses existing CDMA network features	Low accuracy. No handset modifications.
<ul style="list-style-type: none"> The difference in time of arrival of a signal from a mobile device to 3 BTS is used to calculate the location. Location done thanks to cellular network synchronisation done using a GPS or atomic clocks at each BTS. Cost of synchronising a GSM network is relatively high but there are no additional costs. This kind of method is similar to E-OTD more expensive - with little increase of performance. 				
A-GPS <i>Assisted GPS</i>	5 to 10 m in free area	Handset	GPS is free to use	New handsets needed Power needed No need for network infrastructure
<ul style="list-style-type: none"> A-GPS is a centric mobile solution. The handset must be upgraded to allow satellite signal reception but much higher-powered battery is needed (extra costs/weight). Calculation can be performed in the handset itself or by a server linked to the network. The mobile receives satellite signals and sends them to the network. This kind of method necessitates new GPS handsets. 				
AOA <i>Angle Of Arrival</i>	Around 25 m	Network	No mobile device modifications	Complicated antennae required
<ul style="list-style-type: none"> AOA was first developed for military and government organisations. Difficult deployment in digital networks compared to that of a cellular network. The most common version of this technique is known as Small Aperture Direction Finding. When several cell sites can each determine their respective angles of arrival, the cellular phone location can be estimated from the point of intersection of projected lines drawn out from the cell at the angle from which the signal originated. This kind of method is complex but does not necessitate mobile phone modifications. Difficult task : the antenna is supposed to follow each movement of the caller (from cell to cell). 				
IN <i>Intelligent Network Solution</i>	Technologies dependency	Network	Location finding system independent	Multi choice of Location methods and Applications.
<ul style="list-style-type: none"> A component called the Mobile Location Centre (MLC) separates the location technology selection from the application selection. Network operators can deploy advanced location technology gradually without having to wait for 100 % coverage before offering new services. The switch system is programmed to send the location of the customers to an application. 				

The simplest solution is the COO (Cell ID) method using SIM card information and MNO network measures, but the accuracy is around 150m. The most accurate solution is the GPS solution but the costs are too high for mass market. The IN approach is of interest because it allow a market player to manage location information with all technologies available within the world.

3 Location Based Services Market players

3.1 5 types of market players (5 positioning)

Location Technology Providers - LTP

The LTP core business is to supply localisation technologies (E-OTD, GPS, COO ...).

Examples of LTP on the market : Webcell (France), CTMotion (Israel), CellPoint (Sweden) ...

Location services Manager – LSM

The LSM core business is to be the main interface with the different LTP and the different LBS. The LSM will manage subscribers using geo-localisation. The LSM will also integrate cartography knowledge.

Examples of LSM : Signalsoft (UK), Alternis (France), ISMAP (France) ...

Location Based Services Providers – LBS-P

The LBS-P core business is to supply personalised services linked with location. The LBS could be an operator itself with a Location Based Services on their portal or new comers.

Examples of LBS : Signalsoft (UK), CellPoint (Sweden), Nextenso (France) ...

Location Based Services Content Provider – LBS-CP

The LBS-CP core business is to manage information qualified second location data and user profiles (CRM). The LBS-CP will manage POI (Points Of Interests) and map data.

Examples of LBS-CP : ISMAP (France), Webraska (US/France) ...

Location Based Services Enabler – LBS-E

The LBS-E core business is not dedicated to location based services market but enabling such services will be profitable to their own businesses.

Examples of LBS-E : Gemplus (France), Schlumberger (France) both SIM card manufacturers (positive to push renewal of cards and to propose innovative services) or Nokia (Sweden) positive to push server renewal ...

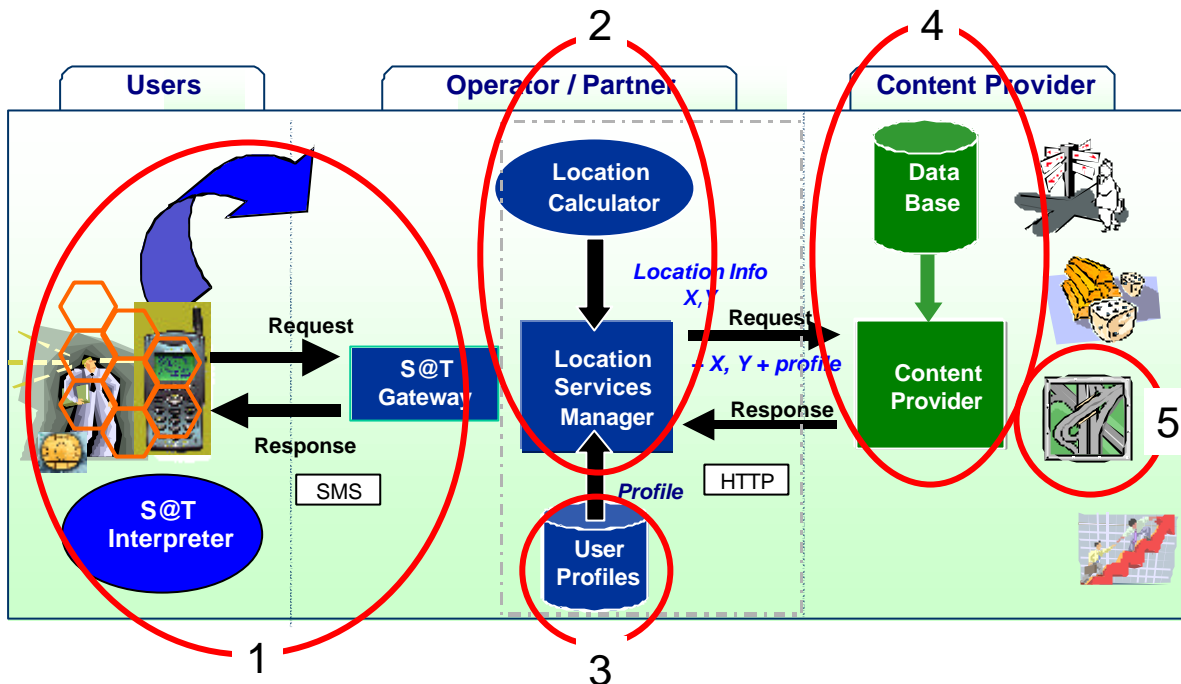
3.2 Partnerships

In terms of strategy, the LBS market is very interesting. 5 types of market players, from small parts to big multinational. In the "product cycle" theory, LBS is just at the "early adopters" stage. For the mass market, the key issue is clearly the market player positioning and the partnerships.

There are 5 fields of expertise :

- Companies who are in contact with the end users (MNO like SFR), SIM manufacturers *Actor 1*
- Companies who have location technologies (location calculation ...) *Actor 2*
- Companies who have marketing consulting approach (user profile / consuming habits) *Actor 3*
- Companies who have content aggregation (Restaurants of Marseille ...) *Actor 4*
- Companies who have cartography knowledge (Marseilles map, London map ...) *Actor 5*

These partnerships are of strategic importance to providing a complete LBS solution for customers and to be ready for mass market.



Market players – partnership opportunities – 2001

4 Location Based Services applications

Here are defined a list of most popular LBS applications planned or developed. For each of this service we could imagine a simple analyse to check the importance of doing it. Analysis in 5 points : description, benefits, technical requirements, business case (ROI), planning.

Family	Services	Description / Example
Information service	<i>Weather</i>	The weather I will have for this weekend, as I am going surfing in Biarritz.
	<i>Traffic road</i>	I am on the A7. Are there any accidents or traffic jams en route to Paris ?
Emergency services	<i>Emergency call</i>	Beep ... There is a road accident where I am ...
	<i>Security alarm services</i>	Beep ... your car has been broken into and it is in the street of Castellane in Marseille.
Commercial services	<i>Restaurant guide</i>	X;Y, I am looking for a Mac Donald's.
	<i>City guide</i>	I cannot find my way to the Theatre from where I am.
Push advertising	<i>Branding</i>	Beep ... Welcome in Roland Garros. Today's match is...
	<i>Find a cash machine</i>	Where is the nearest cash machine ?
	<i>Supermarkets</i>	Beep ... you are near the commercial centre "Auchan". Did you know if you buy 5 bottles of champagne you'll get one free today.
Logistic services	<i>Fleet management</i>	Where is Bob with my lorry number 54 ?
	<i>Goods tracking</i>	Where are my goods right now ?

Family	Services	Description / Example
Other ideas	<i>I lost my handset</i>	I don't know if I forgot my handset at the office or at the hotel ?
	<i>Where is my child ?</i>	Dan, do you know where is Suzie right now ? Is she still at school ?
	<i>My car has been stolen !</i>	Beep ... you car is now in Barcelonette !
	<i>Where are my friends (buddy tracker)</i>	I planned to get a drink after work with Peter and James but where are they ?
	<i>Zone couponing</i>	Beep ... you won a reduction cost, if you come within the next hour to the new Virgin Mega Store with this number, you'll get a free CD. Here is the way to get there.
	<i>Entertainment</i>	Beep ... you are entering in a new game zone. The Marseille sud one. 40 players are in the galaxy. Do you want to join them ?

Please notice that these ideas of new services are quite new and are author property ;-).

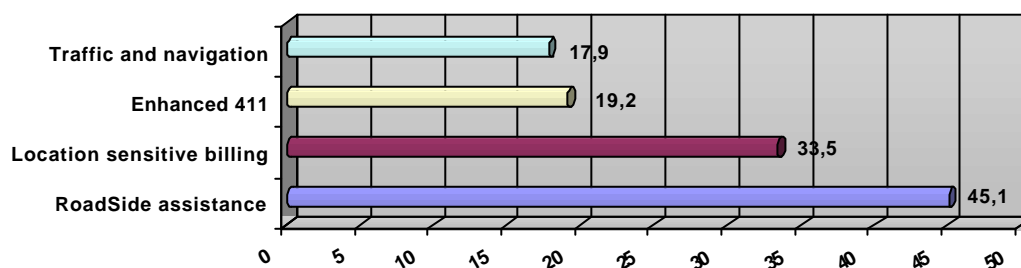
This is the reason why the "description, benefits, technical requirements, business case (ROI), planning" analysis is not inserted.

5 Location Based Services a real market

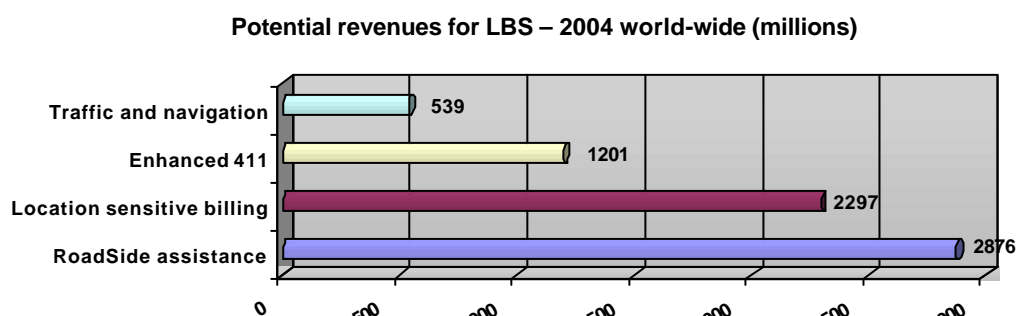
Strategists believe that network based location technologies will be deployed in the top urban market.

In the year 2001, the ARC group predicted that location-based services would reach \$33bn by the year 2005.

Location information will become an integral part of personalised mobile Internet applications and services. LBS can also target mass-markets as well as niche markets.



These graphics show the clear business opportunities of LBS applications. Traffic navigation or/and assistance and Enhanced 411 (US call emergency service) are the major's services



6 Conclusion

Location Based Services. Knowing where you are and who you are, Big Brother will be able to propose you relevant services. Due to the legacy problem, personal data management – privacy, end users will have the choice to be or not to be located by the system.

This is a great opportunity to increase the accuracy of marketing actions by asking permission to the end user to offer him new services.

In a context where MNO are currently searching new services to justify UMTS and 3G investments, Location Based Services is a killer application to generate new revenue streams.

If you need more information on this topic, you can have a look to these useful web sites related to the LBS topics, or you can contact me by mail on stephane@girodon.com. I have been working on the LBS project for 1 year now.

Web address	Content
www.mobilepositioning.com	The Mobilepositioning.com internet site is a resource for mobile communications professionals and the new mobile location services market players.
www.locationforum.org	The LIF organisation is an industry initiative from Ericsson, Motorola, Nokia and others in order to promote common MLS solutions.
www.mobilelifestreams.com	The Mobile Streams internet is a research company providing reports and white papers on Location Based Services.
<p><i>You will find all over the document other internet site with direct address (Nextenso, Ismap ...) the internet sites list here is only dedicated to LBS technologies and applications.</i></p>	