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Fuel for the mobile internet

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Summary

The theme of this conference is Location, Location, Location. A familiar mantra to the property profession and now it seems to almost anyone. There is no definition of the mobile internet except that it has something to do with the internet (and perhaps more specifically with the world wide web) and it has to do with location while being mobile. We are actually involved with a clutch of technologies which are synergistic – in combination they are much more useful than on their own. These technologies are:

- Position fixing using small automatic GPS and/or cellular phone signals;
- Spatial databases becoming readily available over the world wide web;
- Cost effective mobile phone services moving to the 'always-on' and high bandwidth capabilities of the 3G networks.

This paper looks at some of the issues involved in integrating these previously separate technologies and markets.

Introduction

Spatial data is the fuel for the mobile internet. In the conclusion to this paper there are some thoughts on this analogy in a more general vein. However the main topic of the paper is the importance to the GI industry of the mobile internet a.k.a. location based services (LBS) and the challenges that it presents. For many years, even since the advent of digital mapping and GIS, we have had separate markets for position fixing, navigation, surveying, cartographic publishing and tourist information – let alone telephone directories, mobile phones and web based information services. In the last five years there have been growing overlaps between some of these. Now with the imminent advent of cheap, broadband, on-line, mobile telecommunications it will become desirable if not vital for many of the protagonists in these fields to work together to provide seamless services for both business and consumer markets.

Where is my nearest.....?

A simple example would be the 'Where is the nearest whatsit?' query with which even existing WAP phones try to sell themselves. The person making the query must know (automatically or otherwise) where they are. The server must have knowledge (as up to date as possible) of all the possible entries in the whatsit category. The server must also have a sufficiently accurate and up to date map of the routes required to get from user to whatsit. Last, but by no means least, the user's device, with or without the help of the server, must portray the answers and the routes by means of some combination of text, graphics, audio or video.

Integration

In this example there is position fixing, search engine, on-line directory, spatial referencing, route finding and information portrayal all needing to work together in fractions of a second. It is also true, because it is

already being demonstrated on the web, that the 'one set of categories fits all' telephone directory and the 'one scale fits all' road map will not be acceptable in this market. Users will be able to search on their own criteria and will expect customised portrayal to fit their own ideas of what a route map or directory listing should look (or sound) like.

Position Fixing

Position fixing may be the easiest of these challenges. At present, with a WAP phone, a user may be asked to enter their postcode (fine if at home or in the office, but.....) or a street address that is recognisable to the address directory in the server. However cell IDs, tri-lateration from multiple transmitter masts and GPS signals from satellites give positions to the order of thousands, hundreds and tens of metres respectively. Serendipitously it appears that tri-lateration accuracies improve in urban environments where there are many more aerials whereas GPS accuracies are better in open country with no interference from tall buildings. Positions must then be converted to a standard co-ordinate system and must only be used with the permission of the customer. Refinements to the accuracy of positioning and to the time taken to achieve that accuracy will continue to be made.

The Real World

As soon as the position is to be used, and unless it is in completely open country, the position must be related to real world objects in the server database. Knowing a specific grid reference is not very useful unless the user (and the server) knows that it means they are on the A1(M) northbound between junctions 3 and 4. If the user is in town the system may need to know which side of a road (or canal) they are walking on. This is because any subsequent route calculation must take into account both the topography and the topology of the roads and paths that are available for any particular mode of transport. Do the accuracy of the position fixing, and/or the spatial network, enable the system to do this? There is no point in increasing the accuracy of the position fixing if the underlying spatial database cannot resolve features at that level of detail. However the apparent 'opposite' may not always be true. Even if the position fixing is very crude, it is still possible (perhaps by using confirmatory addresses or other map objects) to use a very accurate and detailed map to give information to the user and to find shortest or fastest routes.

Spatial database ≠ phone directory + street network

A position for the user is now well fixed both absolutely on a reference system and relative to the objects in the spatial database. The database must now be searched for the nearest (or most appropriate) whatsit. Even this is not as simple as it sounds and may require several iterations. If the user wanted to fill up with petrol and the database has up to date pump prices then there is a trade-off between distance (and hence cost) of travelling to any particular petrol station and the cost of filling our tank, not to mention the desirability or otherwise of there also being a McDonalds nearby! Does the database of petrol stations exist? Is it up to date? Does it have consumer information as distinct from business to business information? Since many directories have come from the world of fixed telephone lines there may be missing categories (think of any old high street network that now uses a single national call centre!). Directories, in general, have a requirement to provide addresses only for the purposes of differentiation between branches or, at best, for postal purposes. In the latter case the Postcode is much more important than the exact street address for commercial and industrial premises because the local postman will know where XYZ Industry is located on his patch without needing to know the exact street address.

So how good will the directories be at positioning the target whatsit for a route-finding exercise? Will they have many entries with only PO Box numbers? Will they be consistent in their use of street addresses? Will they have any knowledge of the whereabouts of premises on large industrial estates or retail malls? They will certainly not have any knowledge of different entrances for customers and 'goods-in'. They will not know that Marks and Spencers in Cambridge is in two separate buildings with entrances on three different streets. BUT does that matter? Only the companies marketing LBS services can decide how accurate they need to be to get and keep their customers. Only they know (or estimate) how much they can charge for a particular service and how good that service has to be. There is no point in providing information that costs more than people will pay for it – unless the object of the exercise is to provide a 'loss-leader'.

Familiar address problems

Does some of this sound familiar? Aren't these the same issues that we here about with respect to local government, BS7666, NLPG, NLIS, etc. etc.? Yes they are! So where is the synergy? Can the very organisations that are complaining about the cost of carrying out their data cleaning for 'joined up government' get their data used by the whole LBS market where fortunes appear to being spent on licences and networks? The infrastructure will be useless without users and users need applications. LBS has been touted as a killer application – but it needs locally collected information in a standard form to do the killing. National organisations, with the best will in the world, cannot provide very detailed and current local information as well as local organisations – if they have the vision or the incentives to do so.

Global or local

Many of the LBS solutions for data are global in scope – reflecting perhaps the premium rates that can be charged to globe trotting executives and the need to be seen to have a 'global' brand. However the data on which they are based must often be collected locally, then aggregated, generalised and reformatted into global systems. This presents many issues about the consistency of datasets across the world. It may be easy to be consistent with satellite or even aerial imagery; it is very difficult to be consistent with addresses and Postcodes which are country specific and quite often inconsistent within countries.

Routing

When the most appropriate whatsit has been found, a route and a set of navigational directions must be generated. This has been a standard output from in-car and internet based navigation systems for several years. Reliable route networks with drive restriction information are available. More work is needed however for multi-modal routes (including options for walking and public transport) though Transport for London (for example) is now providing some information on its web site. At the pedestrian level there are parts of the puzzle available – rights of way in the countryside and in most cases we can assume that roads in towns are also pedestrian routes. However we lack information on pedestrian crossings, subways, minor paths and alleyways as well as which roads are safe to cross at any point and which are dual carriageways with central barriers. Some of this information exists within local authorities but is not standardised or easily available.

Portrayal and generalisation

Perhaps the biggest challenge in the LBS field is how to portray the answers to a query for an end user. There are 'normal' mobile phone with very small monochrome screens, PDAs with a bigger, brighter colour screens and in-car screens. The devices can display text, graphics (including maps), sound and video clips if appropriate. In the 3G world bandwidth for downloading pictures and video will be available at minimal cost. The challenge to the 'cartographer' or 'publisher' for these media is to deliver information that is customised to a particular user for a particular task. A cartophile may ask for a representation similar to a paper map; conversely, a cartophobe may specify that they only want to see a map when absolutely necessary and then as simplified as possible. A profile may be set up to get voice messages for in-car use or text representations for texting to friends who don't yet have a 3G device.

One of the issues in portrayal is goes back to the problem of positioning on maps of different scales – generalisation. Typically in the past there have been several scales of maps from, for example, the Ordnance Survey. As the scale decreases so the amount of generalisation increases. Whereas a 1:1250 map shows every building and the pavements on the side of a road, at 1:50 000 the buildings have merged into a solid block and the pavements have just disappeared. Not only is there selection and merging of detail but there is also movement of some detail (so that important features don't overlap) and symbolisation (e.g. a 200m long railway station becomes a red circle). Can this all be done in real time, to a different specification for different users while maintaining the linkage to other attributes of objects? One simple example might be that of a retail park that shows individual units (with the names and type of retailer attached to each) at a large scale but which merges into a single building (with a concatenated list of all the retailers) at a smaller scale. It may be important to maintain the topology of objects as we generalise for portrayal. A petrol station only accessible from one side of a dual carriageway must always be seen to be on that side of

the road – even if the road or the petrol station are independently moved or symbolised for portrayal purposes.

Conclusion

GI can be thought of as the fuel that powers the mobile internet.

Fuel is:

- homogeneous, can only be used once and pollutes the environment
- pumped from the earth, refined and piped or tanked to distributors
- subject to many safety regulations and it is sold as a commodity
- fundamental to transport, priced in a near perfect market and taxed heavily

GI is :

- non-homogeneous, can be used any number of times and can be refined or even generated by the user – may save some unnecessary pollution
- measured from the earth, processed into standard formats and delivered on line or by CD.
- subject to copyright and royalties, often to governmental organisations but is not yet a commodity
- improves efficiency of transport, is priced arbitrarily but is only subject to VAT

So not only is the mobile internet 'consuming' the GI fuel; it is also creating and refining more GI fuel for itself or others to use and perhaps without any input at all from the users themselves. Information as a commodity can be consumed by multiple users, simultaneously, without necessarily losing value. But will it get taxed like fuel as soon as it becomes a vital resource?