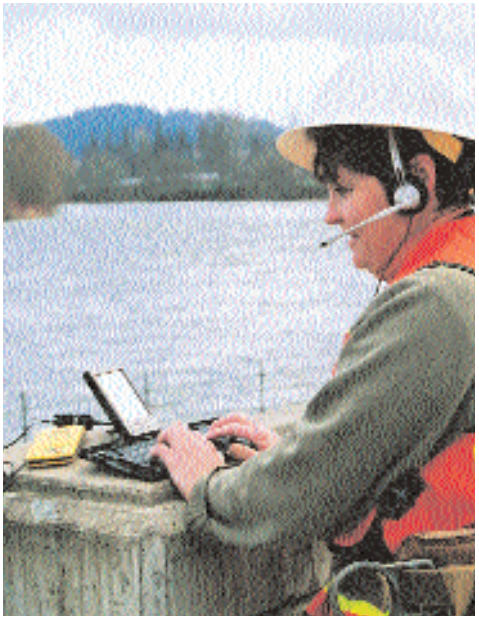
Mobile Enterprise Act One: The Players

Jonathan W. Lowe



Connie Gorham

This column covers the role of emerging technologies in the exchange of spatial information.

Can you imagine a communications sales person spatially prequalifying a potential customer at their initial meeting? He automatically calculates the cost of running cable from the PDA's current location to the nearest existing network point.

Rumor has it that a few daring communications companies, utilities, and government organizations with mobile field-based workforces already conduct business with this kind of mobile spatial flexibility.

This installment of "Net Results" overviews the mobile data exchange strategies of Autodesk, (www.autodesk.com), ESRI (www.esri.com), Intergraph (www.intergraph.com/gis), and MapInfo (www.mapinfo.com) for large enterprise organizations and lays the groundwork for future columns focused on the handheld hardware and software required for mobile enterprise solutions.

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To place the four companies' mobile GIS strategies in context, I'll outline a business problem requiring mobile data exchange, then describe a vendor's solution. In all cases, though, the broad ideal remains the same regardless of the implementation or vendor.

PDAs: Then and now

Of course, the use of portable computing hardware (PDAs, PocketPCs, and so forth) in the field is nothing new to the spatial market. In practice, field tests of these devices have met with only partial success. Until recently, PDA technology had limited storage and processing capabilities and could not communicate with other devices without being attached to a docking cradle. The technology, though, has advanced; PDAs can now communicate wirelessly with other nonportable computing hardware.

The biggest technical advance was the miniaturization and commercial availability of wafer-thin modems that allowed PDAs to connect to the Internet, either directly or via an attached cell phone. The problem, however, is that wireless data exchange over these micromodems is still fairly slow. Thus, the geospatial vendors' strategies for mobile applications range from either reducing the amount of data exchanged wirelessly, eliminating the need for wireless data transfer altogether, or relegating the data exchange problem to the wireless telecommunications firms. (This last group is focusing instead on building the spatial software that telcos will require when the networks and devices finally get fast enough.)

Autodesk: A centralized solution

Responding to suggestions by their utilities customers, Autodesk's strategy does not require wireless. For example, consider a utilities scenario in which, a day or more in advance, the boss reviews the upcoming jobs for a crew of field workers and clips a subset of spatial and tabular data in the area each worker will visit. This work order data may come from a variety of sources and formats, but all the boss has to do is reference a Web page to clip the area of the job site. Each worker's PDA (which is connected to the network at the end of the day) automatically loads this clipped dataset using synchronization software. The morning of their assignments, workers pick up their PDAs and head into the field. The clipped dataset is a reference for infrastructure design drawings as well as general navigation basemaps of the area.

Because field jobs often involve physical changes, the field workers make markup changes on the PDA maps just as they would on paper documents (see Figure 1). It's these markup changes that are the critical new information the boss wants in order to update the enterprise's central database. So, when the workers return to the office and dock their PDAs, their spatial and tabular changes synch backward to the corporate database. Now, when

the boss looks at the clipped area on his or her desktop browser, the markup appears just as a worker sketched it on the PDA. Following the boss's approval, a smaller team of spatial experts then alters the corporate source data. This division of labor means that the field workers don't have to be GIS experts — they just continue recording their changes, but on digital maps rather than paper.

Image courtesy of Autodesk

FIGURE 1 Autodesk's OnSite software captures in-field redline edits with tools mimicking conventional paper redlining symbology.

Web-based architecture. To understand the software architecture of Autodesk's strategy, start at the source — the enterprise's central data repository. Enterprise operations have notoriously heterogeneous data stores including flat files, databases, and programmatically joined combinations of both. Part of the Autodesk solution's simplicity is that no matter how complex the enterprise's records may be at the source, all spatial and attribute data are united by an Internet map server: Autodesk MapGuide.

MapGuide reads spatial data directly from only one professional spatial database — Oracle (www.oracle.com) — or reads flat files in AutoCAD DWG and DWF or ESRI shapefile format. (Other files such as ESRI coverages, ESRI Atlas BNA files, MapInfo MID/MIF files, Intergraph DGN files, data residing in object linking and embedding databases, and a variety of raster formats first require conversion into a directly readable format.) Using predefined lists of themes and symbology, MapGuide sends images or streams of live data to any Internet-based requesters.

Another Autodesk product, OnSite Enterprise, enables the boss to extract a work order file containing spatial information from the MapGuide application. The file is what gets transferred to the workers' PDAs. A third software component, Autodesk OnSite Viewer, reads the OnSite Design files on the handheld devices. OnSite Viewer stores the workers' markup changes as another file, called an OnSite Markup file (which can be converted into an extensible markup language file and viewed along with computer-aided design data in other Autodesk products).

Autodesk is using this multitier strategy for a good reason; as handheld devices and operating systems change (at different rates), Autodesk can modify the components independently of one another. In other words, MapGuide won't have to be reissued every time the OnSite Viewer software changes or the handheld operating system changes.

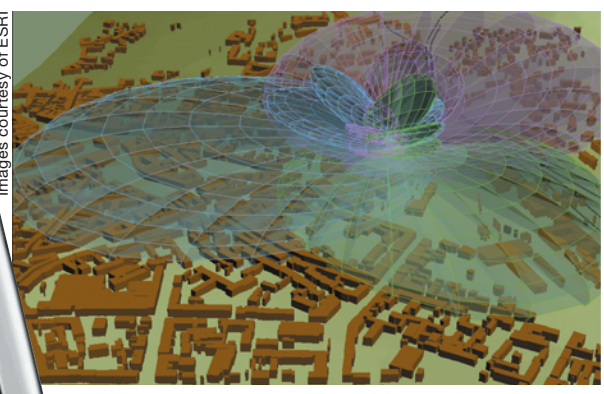
Autodesk OnSite Viewer can be installed only on a Windows CE (version 2.11 or higher) compatible device with a minimum of 16 MB of RAM. Autodesk's solution does not support Palm, Inc. (www.palm.com) devices, but does operate with all Windows CE devices regardless of form factor, including PocketPC to tablet devices.

ESRI: Braving the bandwidth

ESRI also combines Internet software with a spatial viewer for the PDA, but is braving the bandwidth challenge by sending spatial data to the field via wireless communications. For example, companies like Aircom (www.waveguide-components.com) site their towers by modeling wave propagation (see Figure 2). Moving the towers changes their territory coverage. In the old workflow, field technicians simulated a tower site plan and took wave-propagation measurements in the field, then returned to the office to analyze the results. If the analysis called for a different site plan, the whole field testing process had to be repeated at significant expense.

Now, field workers take PDAs with them when modeling and measuring. As soon as the measurements are done, the testers load the results into their PDAs and wirelessly send them back to the base for analysis on more powerful spatial servers. When the servers are finished, they send the outcome of the analysis back to the PDAs in the field. Any iterations of the original plan can then happen in a single day — the field crew stays out until they're satisfied with the analysis.

ESRI's software architecture for this or similar wireless scenarios is a combination of ArcSDE, ArcIMS, and ArcPad. The corporate data resides on a professional database — IBM's



Images courtesy of ESRI

FIGURE 2 Telecommunications companies, such as Aircom, site cell towers by modeling wave propagation. Using ESRI software, field workers employ PDAs for modeling and measuring a series of tasks without returning to the office.

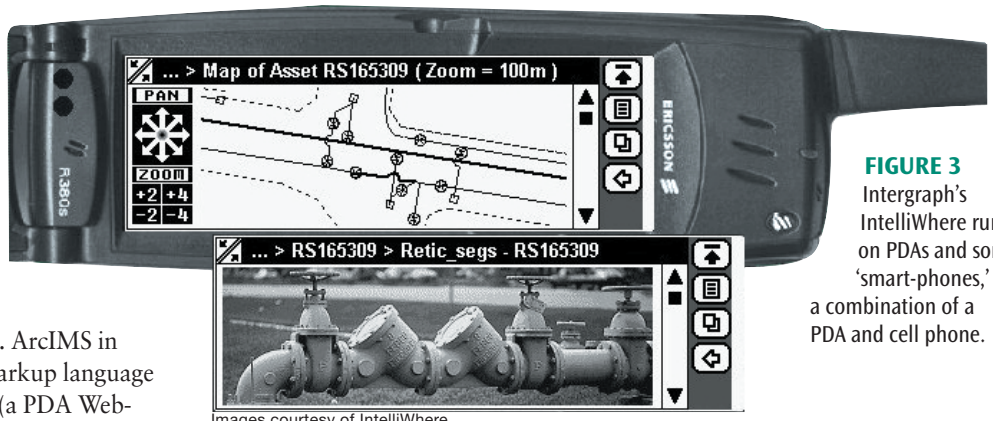


FIGURE 3
Intergraph's IntelliWhere runs on PDAs and some 'smart-phones,' a combination of a PDA and cell phone.

Images courtesy of IntelliWhere

(www.ibm.com) DB2 or Informix, Microsoft's (www.microsoft.com) SQL Server, or Oracle — from which ArcSDE pulls and translates data into a format palatable to ArcIMS, the Internet map-serving software. ArcIMS in turn sends wireless markup language and wireless bitmaps (a PDA Web-browser's version of HTML and bitmap formats) to ArcPad, the map viewer software for PDAs. ESRI's ArcPad software runs on PDAs with Windows CE operating systems. A wireless solution also requires hardware purchases. Either a wireless modem card or a connection between the PDA and a cell phone are added costs to the initial PDA and spatial software purchases.

Getting beyond wires. Though confident about the workability of a wireless solution given today's technology, ESRI reported that the main challenge with wireless business-to-business solutions is how to minimize traffic over the airwaves. Using ArcIMS as the data distributor enables data access via a Web page; this gives organizations great flexibility when designing their interfaces. All field workers have to do is connect to a URL. However, each pan or zoom may require another bandwidth-expensive wireless exchange. If workers preload the basemap data for their field operations before departing the office, and then transmit only the changes they make in the field, they will greatly reduce wireless transmissions while roaming. ArcPad can accomplish this by seamlessly storing the base data and overlaying an ArcIMS data layer . When panning or zooming, only the ArcIMS layer needs to beam across the airwaves.

IntelliWhere: Two-way wireless

Also ready to push data through thin air, Intergraph's IntelliWhere (www.intelliwhere.com) division recently announced IntelliWhere OnDemand, a new vector-based mapping software product for PDAs, available in April. As expected from Intergraph, this new product supports the Open GIS Consortium's (www.opengis.org) Open Location Services (OpenLS) initiative and a plethora of data formats. With Intergraph's solution, spatial data can travel wirelessly in both directions between the enterprise's center and its remote field workers.

In a business case similar to that described with Autodesk, workers redline maps on their PDAs, and then send the edits back to the office wirelessly for immediate ingestion into the system. Intergraph's solution for reducing wireless data-transfer includes a data-compaction method and an "occasionally connected mode" allowing field workers to extract data from the corporate GIS, view it, and disconnect until it's time to synchronize updates back to the corporate system. If the PDA loses its wireless connection to the base, it will continue running with the next best available data until the connection returns.

IntelliWhere OnDemand is not just a generic tool, but an industry specific application targeting utilities' field workers. Intergraph hopes to enable workers without GIS training to intuitively zoom in and out, run basic searches and queries, redline, call up details of an asset, capture GPS positions, acquire or create other critical data, and edit attributes for uploading.

IntelliWhere OnDemand runs on PocketPC and Windows CE operating systems and can be customized to specific workflows, such as inspection or installation reports, using embedded Visual Basic or Visual C++. Demonstrations at the IntelliWhere site include a water main repair scenario with an Ericsson (www.ericsson.com) phone–PDA (see Figure 3).

MapInfo: Talking about telcos

Although MapInfo could describe a wireless application for its technology, its prime target is the wireless carriers themselves. In other words, MapInfo aims to sell platforms to telecommunications companies. A platform, in this instance, is a service manager that lets applications talk to core server technology. Said another way, MapInfo is focusing on building software that can interpret and manipulate the location information captured by the internal switches within the tower infrastructure.

MapInfo's decision reflects a gradually emerging reality of location-based services: The owners of coordinate data for all those moving cell phones and PDAs are, first and foremost, the wireless telecommunications firms. As we place calls on our phones, the telcos can triangulate the approximate location of our phone as their signals reach three or more towers nearby. The switches themselves include hardware and software that performs the triangulation and captures the changing latitude and longitude of each caller. Any location-based services (LBS) provider will probably have to partner with a telco to access these data. MapInfo hopes that LBS providers

FIGURE 4 Based on their continued use of the platform-independent Java language, only MapInfo supports a spatial interface on the Palm OS.

will choose the software package that has a proven smooth fit with this switching equipment. The complexity of the technology pales in comparison with the elaborate business models still being forged to divide up the revenue from LBS services. MapInfo and ESRI both realize that getting involved early will eventually help GIS vendors' long-term sales, so both are competing to partner with telcos and telco partners like SignalSoft (www.signalsoftcorp.com), a vendor handling the spatial data capture at the switch level.

Custom geocoding. All this is not meant to trivialize MapInfo's software for bringing maps to PDAs. In fact, the company's miAware and MapXtend software packages support the widest range of devices, including the Palm OS (see Figure 4). In the MapInfo scenario, a mobile user clicks a button on a PDA saying, "I want information about my surroundings." The PDA determines where the mobile user is (latitude and longitude) and then, back at the office, reverse geocodes at an appropriate level. For instance, if the user is seeking airport information, the geocode will be to the level of a city, whereas, if the search is for restaurant information, a cross street might be more helpful. Depending on the information needed, the office then wirelessly returns a list of, say, airports or restaurants to the PDA. The user then picks one and asks for more information, which might include a map, a photo, or directions.

MapInfo's software, as usual, is geared to developers. It is built on a Java architecture, with Java 2 platform, Enterprise edition, for the server and Java 2 platform, Micro edition, for the client. Supported PDA devices are Handspring (www.handspring.com) Visor, Palm IIIc, Palm V (all running Palm OS 3.5), Hewlett-Packard (www.hp.com) Jornada 540, or Compaq (www.compaq.com) iPAQ (both running Windows CE 2.1 or greater). And don't forget the phones — MapInfo also supports the Motorola (www.motorola.com) i85s and i50sx phones as map-viewing clients.

In a rush to field mobile wireless?

Is it time to rush into wireless spatial field enablement? Depending on who you are and what you want to do, it may very well be. Autodesk's reference customer, Telestra (an Australian Telco) is field testing 100 mobile devices with plans to roll out 3,000 iPAQs and 4,800 mobile notebooks to its field force. ESRI is partnering with the likes of SignalSoft and Intrado (www.intrado.com), while simultaneously developing solutions for clients like Aircom. And MapInfo reports landing a deal with a large network services provider to deliver miAware to global operators. Big organizations are making the leap. The nice thing is that handheld devices are cheap to prototype — most cost less than $500 plus a $10 monthly charge for the wireless support. Definitely test in advance — as future articles will show, even the fastest PDAs have few similarities to the desktop spatial environments to which we're accustomed.