



The Three Deadly Sins of GPS **Manlio Allegra | June 19th, 2008**

[Editor's note: We've already had one contributor from the mobile industry describe the opportunities that the new iPhone' built-in GPS service could provide to third-party mobile software developers. But GPS technology is still a work in progress. In the article below, Polaris Wireless Chief Executive Manlio Allegra, pictured, discusses issues with using GPS in dense, urban environments -- and solutions to the problem.]

With Apple's announcement last week that the new 3G iPhone will be GPS-enabled, the media's attention is once again on wireless location technology and the drive to improve performance for location-based services (LBS) applications. Once these capabilities are truly commercial, wireless carriers will be able to deliver timely, location-specific content to mobile users from real-time traffic reports and inventory tracking solutions to people finder and other concierge services.

However, GPS is not the technology that can get us there—at least not alone. Sure, GPS works wonders for most open sky applications like traffic navigation, but the technology fails to deliver high-accuracy locations in environments where end-users make most of the wireless calls—such as dense urban environments and indoors—due to obstructions from large buildings and walls. For this reason, the future of LBS cannot rely solely on GPS. Because the vast majority of today's wireless usage is indoor and urban, GPS delivers a 50 percent solution (at best!), and here's why.

1. Missing the L in LBS

Consistently pinpointing accurate location is essential for LBS, making sure consumers get relevant content in real-time. Most LBS applications that rely on GPS, Assisted-GPS (A-GPS) and their fall-back solution, Enhanced Cell-ID (E-CID), fail to reliably deliver high accuracy. These solutions can only produce urban and indoor accuracies within hundreds of meters, making the technologies undependable for delivering location specific content city block to city block. Alternate solutions can determine location with a much higher degree of accuracy in challenging environments.

According to most research, more than 50 percent of cell phone calls are made in urban areas (cities) or indoors (office buildings, schools, malls, convention centers). Since the majority of wireless usage is concentrated in these dense

settings, it is essential that wireless carriers use a location technology that is optimized for these environments.

Unfortunately, GPS and A-GPS have serious limitations in these dense environments, because the satellite signals are too weak and corrupted by reflections from nearby buildings and walls. Location errors in these environments are more than 250 meters for many of the calls—errors that are larger than two city blocks.

2. Unacceptable Time to First Fix

Time is an essential ingredient in successfully providing LBS to consumers. Positioning latency—or Time to First Fix (TTFF)—determines how fast a service or content can be delivered to a mobile user. Time is of the essence because most users are typically on the move and need accurate, real-time and location-specific information. However, GPS can take up to a full minute or longer to make a first fix—an unacceptable delay—while non-GPS technologies can often determine a location in seconds. Customer satisfaction and the proliferation of LBS applications necessitates that information is provided in seconds. Consumers simply aren't willing to wait minutes.

3. Throwing Satellites at the Problem

These severe GPS limitations in urban and indoor settings are not going to be solved in the foreseeable future. GPS solution providers are trying to address these problems by adding new satellite constellations (Galileo) to their receivers, hoping that density will yield better coverage. Unfortunately, they are finding that adding satellites only leads to more complexity and higher cost in the handset, without adding much indoor performance.

Satellites simply cannot provide the level of accuracy needed in those dense urban and indoor environments—no matter how many birds are flying overhead and how much power is added to the satellite signals. The fundamental problem is that GPS satellites fly at over 20,000 km from the ground, making the signals exceedingly weak. Satellites also have limited power budgets due to their solar power supplies. Even when the weak signals can be received, they are corrupted by reflections from nearby buildings and walls. And since GPS signals can never effectively penetrate deep inside buildings another solution is needed.

A More Reliable, Accurate Wireless Location Solution

Given these inherent drawbacks of GPS, Apple decided to enhance its GPS capabilities with a wireless location solution from Skyhook Wireless based on WiFi Access Points (AP). However, location technologies based on WiFi continue to lack complete coverage in dense environments, failing to cover ALL buildings in a wireless network—a capability that will not be added in the foreseeable

future. How many times have you tried to log onto the Internet via a public WiFi network and couldn't receive a strong signal? How many times have you gone into a building and couldn't even get a WiFi signal? The coverage simply isn't there, and that is an unreliability that LBS (or Public Safety) applications cannot afford.

In addition, the AP database on which the Skyhook technology relies is highly variable, as consumers and IT departments change AP locations all the time while lacking a reliable mechanism to keep track of the changes. The root of the problem is that WiFi is an unlicensed band that is unplanned, unmanaged and dynamic—essentially an ad hoc network. It is nearly impossible to produce a reliable and accurate location in a timely manner from the chaos—an absolute necessity for the proliferation of LBS.

Fortunately, there are carrier-grade solutions out there that are much better suited to LBS applications, including solutions that take a hybrid approach by leveraging multiple wireless location technologies to pinpoint highly accurate positions. These technologies range from hardware-based Uplink Time Difference of Arrival (U-TDOA) to Wireless Location Signatures (WLS). Polaris Wireless, Andrew Corp. and TruePosition are the leaders in this hybrid approach, building a combination of technologies that synergistically work together to accurately pinpoint the location of handsets. However, there are clear advantages between these competing technologies.

Andrew Corp.'s Geometrix Mobile Location Center (MLC) system uses a combination of U-TDOA, A-GPS and E-CID to determine handset location. TruePosition also incorporates multiple location technologies for its Position Determining Equipment (PDE) solutions, including a similar combination of U-TDOA, A-GPS and E-CID. These approaches with U-TDOA are inherently complex and costly to deploy and manage, with new radio hardware required at the base stations.

Taking what we have found to be a simpler and more cost-effective hybrid approach, Polaris Wireless has developed a reliable network-based solution based on Radio Frequency (RF) Pattern-Matching and A-GPS to determine handset location to a higher level of accuracy. The Polaris WLS Technology is a software-only, network-based solution that provides a much higher level of accuracy in dense and indoor environments than solutions that rely on other wireless location technologies or exclusively on A-GPS.

Polaris is more reliable, commercially available, much easier to deploy and does not require new hardware or widespread buy-in from customers, making the initial deployments more scalable, cost-efficient and powerful. The technology

has been successfully deployed in the US for public safety applications (E911) as well as for LBS applications.

This Polaris WLS technology is based on the principle that every location has a unique radio frequency (RF) signature. Like a fingerprint's pattern of lines and swirls, a location can be identified by a unique set of values including measurements of neighboring cell signal strengths, time delay and other network parameters. Polaris capitalizes on this substantial suite of existing network measurement information, combining it with A-GPS to determine accurate locations to within 50 meters.

While GPS-enabled iPhones are certainly a step in the right direction, wireless carriers need to get past the hype surrounding A-GPS and look to more accurate and cost-efficient hybrid approaches that provides a rich user experience. Only then will the industry finally be able to truly capitalize on the power of location enabled applications.

Manlio Allegra is CEO of Polaris Wireless, a leading wireless location company that provides network-based software products for accurately determining the location of mobile phones.