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Hybrid Location Technology

"Is GPS Dead?" questioned the web banner advert. Well, of course, with a title like that you have to read on ...

The premise was that many applications needed better performance than GPS alone, which would drive multi-GNSS chipsets. In addition, hybrid location would become the norm, with technologies like Wi-Fi positioning and small "MEMS" inertial sensors complementing satellite positioning.

I have talked about multi-GNSS before in this column, but not so much about hybrid location. GPS (or assisted-GPS in mobile devices) works very well with a good sky view. Multi-GNSS can help in the built-up "urban canyons", as more satellites are visible, improving availability. Indoors, however, GNSS is rarely accurate and often will not work at all. In these situations, Wi-Fi positioning or short-term augmentation using inertial sensors can provide the positioning information.

Wi-Fi positioning ("WFP") uses access points, or "hotspots" to determine the location of the mobile device. At the most basic level, WFP can be a basic identification and position approximation. In other words, you're within range of hotspot X, so your approximate location is Y. It's sometimes also possible to use the power level received from one or more hotspots to provide a more accurate location. Measured power levels can be compared to database knowledge of access point locations and transmit power to determine range. With sufficient access point visibility, a more precise position can then be derived using standard triangulation techniques.

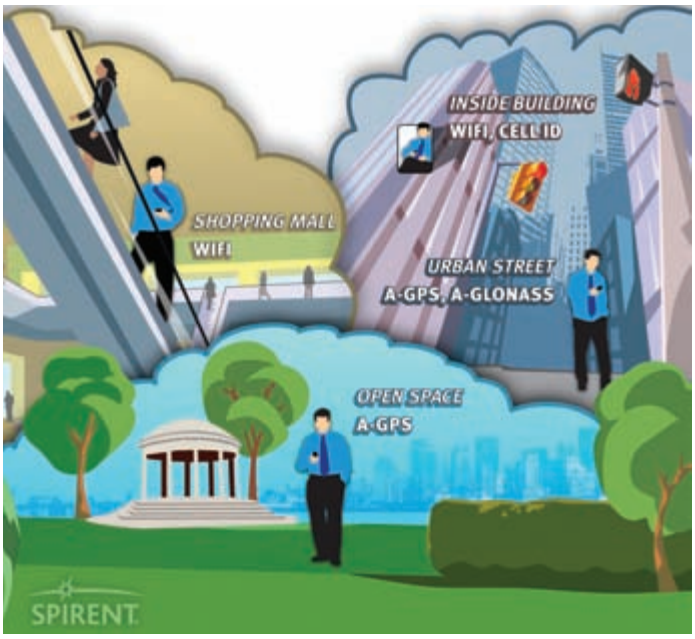
Wi-Fi positioning has many advantages when used with GPS: hotspot density is often highest in cities or indoors where satellite visibility is poor or blocked; several technology suppliers have database information of hotspots; there is no inherent infrastructure cost, as

WFP simply uses whatever hotspots can be seen.

Because of these advantages, network operators are beginning to require WFP as a compliment to GNSS derived position information. Many handset manufacturers are offering this technology already, or are looking to do so soon.

Inertial is another technology that is quite complimentary to GNSS. Inertial will work all the time, even where GNSS is not available. However, inertial technology is "open loop", so any position errors will be cumulative. These can be re-calibrated, the theory goes, using GNSS position information when available. In practice, this approach is extremely challenging in consumer level devices as the MEMS (microelectromechanical systems) sensors used are often of low accuracy. GNSS positions may also not be available for some time. As such, position errors will accumulate quite quickly, in a matter of seconds. Exacerbating this challenge is the fact that users, often pedestrians, regularly take complex routes in GNSS-denied areas such as shopping malls, making precise location tracking more complex.

Hybrid location, then, is a combination of these approaches. The best features of each are used and this leads to an overall user experience that is satisfactory everywhere. Or, rather, it will lead there one day. Today the performance of the latest devices is extremely impressive in many situations. However, users of such devices will be aware that it's still possible to find environments where position information is inaccurate or even not available. A significant level of testing and refinement is currently under-



way to achieve the elusive 100% availability with good accuracy that is needed to deliver location based services to consumers.

Another development that is receiving a lot of attention currently is connected vehicles. Various projects and consortia are underway under the generic title of C2C (car-to-car), C2i (car-to-infrastructure) or C2x (car-to-[whatever]). There are many conceptual advantages with connected vehicles, that include:

- collision avoidance
- hazard information
- reduced roadside infrastructure costs
- reduced vehicle emissions

C2C has safety-critical and commercially-critical elements to it and, as such, a significant amount of standards-based work is underway. Particularly notable is the COMeSafety report as part of the European ITS Communication Architecture. Issue 3.0 (February 2010) of the COMeSafety group report includes a profile concept, or road map, so early implementations can be compatible with future systems as far as possible. There is also a use case validation that ensures the architecture specifications are consistent with envisaged uses. Later this year, there will be a demonstration of connected vehicles in Ulm, Germany.

Beyond GNSS, other developments continue apace that will all lead inexorably towards the vision of a connected, location-aware society. These include better battery life, display technology and memory/processing power. The 21st Century has truly arrived!