



Automotive & Transportation: Wireless help to drive Toyota vehicle research

Remote Wifi networks are enabling more accurate GPS positioning of test vehicles

Vehicle technology research and development is extremely important to innovations in driver safety applications and other vehicle functionality. The Toyota Technical Center research and development team is dedicated to developing the industry's safest and most technologically advanced automobiles. As part of this mission, the group seeks to improve GPS-related vehicle functionality such as route recommendations, traffic updates and advanced features such as auto parking and auto pilot.



Founded in 1977 in California, the centre is a subsidiary of TMC Japan. It conducts research and development and work in everything from testing and evaluation of parts and materials to emissions certification and technical research. It has operations in Michigan, California and Arizona, and is playing an increasingly important role in the design engineering and development of Toyota products, particularly those developed for the North American market.

The Michigan facility is located in Ann Arbor and is comprised of engineering design, parts engineering, materials engineering, powertrain evaluation and prototype development. In July 2002, the vehicle evaluation groups also moved to Michigan.

Because vehicles are in need of highly accurate positioning information to perform such tasks, the centre needs the most accurate GPS information to test and develop these technologies. GPS information can be affected by issues such as satellite behaviour, cloud coverage, weather patterns and other variables. Engineers can use this information to calculate a test vehicle's position accurately. However, satellite and weather information are extremely time sensitive. To allow engineers real-time access to this information while in the test vehicles, the centre deployed the Digi Wi-Point 3G, a PC card based 3G cellular router with an integrated Wifi access point. It acts as a cellular-to-Wifi hotspot and provides secure, high-speed internet access to engineers in the remote test vehicles.

"Our goal is to observe, calculate and broadcast the satellite messages regarding which satellites are behaving poorly to our test vehicles within seconds," said Michael Samples, research engineer at the Toyota Technical Center. "In order to provide the most accurate information possible to the vehicles, we must be connected in real-time."

The card creates a Wifi network in the test vehicle allowing any engineer with a laptop in the car to connect to the internet and access the real-time GPS information. It creates the Wifi network via a high-speed cellular connection.

"The Digi Wi-Point 3G provides an on-the-fly network allowing each vehicle its own Wifi hotspot and constant internet access," said Samples. "Engineers can now use their laptops in the field to access information in real time and do the calculations remotely. It is nice too because they basically have internet access for other things like email. Essentially our team can work a full day just as easily in a test vehicle as they can in the office."

The centre considered other wireless options including point-to-point wireless radios. Wireless radios proved inefficient, however, because each time a testing vehicle is added a radio must also be added to the basestation and the vehicle. Using the Wi-Point 3G, the centre can set up a web server allowing for multiple clients.

"It's much easier to add another client onto the web server than adding another radio to the basestation," said Samples. "The Digi Wi-Point 3G solves our current problems and should work well for future applications. We find it to be a very good testing and development platform and anticipate using it in other areas of R&D."

The centre is also pleased with the ease of use and set up of the device.

"We have had no problems with these devices," said Samples. "With a product like this you expect to get an internet connection right out of the box, and that's exactly what we got."

The centre is also using the Digi One SP, a serial server that makes it easy to connect any device with a serial port to the Ethernet. This connects to its GPS processing box, which has a serial port to the Digi Wi-Point 3G via the router's Ethernet port.

"What I value the most about Digi is that they anticipate a lot of problems and provide nice, easy solutions," said Samples. "Whether it's a 3G connection that provides Wifi access to multiple computers or a serial converter, they anticipate a customer's problems and provide a complete solution. We'll certainly be using Digi products in the future."

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