



BSQUARE's Engineering Services Help Palm® Successfully Launch Treo™ 700w Smartphone

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—Michael Plasterer, Senior Director of Windows Mobile Smartphones, Palm, Inc.

Customer Profile

Palm is a global provider of hand-held computing and communications devices, targeting consumer, business, education, and government users worldwide. Its Treo product line is primarily designed for business professionals and enterprise users. Palm launched the Treo 700w, its first smartphone using the Microsoft Windows Mobile operating system, in January, 2006.

Business Challenge: Rapid Development of Audio Management System and Bluetooth Driver

Until recently, all Palm® devices were based on the Palm operating system. However, many of Palm's corporate clients had expressed interest in a device based on the Windows Mobile operating system — one that would support standard Microsoft productivity applications and be easy to integrate into a Microsoft-based IT infrastructure.

To address this need, Palm decided to create a Windows Mobile version of its flagship Treo smartphone, to be called the Treo 700w. Because the user interface for Windows Mobile was different from what Palm users were accustomed to, Palm needed to engineer extensions to Windows Mobile that would align users' experience with their expectations for the Palm brand.

One of the extensions BSQUARE added was an audio management system—a complex piece of code that transparently shifts the audio output to whichever audio device the user is employing (for example, the phone's built-in earpiece, its speakerphone amplifier, a headset, or a hands-free car kit). Palm also needed to develop a Bluetooth transport driver and modify the existing Bluetooth audio gateway extension to enable the Treo 700w to work not only with Palm peripherals, but with any Bluetooth-compatible device.

Although Palm had extensive experience in developing audio management systems and car kits for the PalmOS,

their engineers hadn't worked with the Windows Mobile operating system before, so they did not have experience developing audio management systems and car kits for that platform. “We had extensive experience in these areas for PalmOS, but we didn't have the in-depth experience needed for a project of this magnitude and complexity on Windows Mobile—and we knew we had of the project and the need to get the device to market quickly,” said Michael Plasterer, Palm's Senior Director of Windows Mobile Smartphones. Accordingly, Palm decided to seek help in engineering the audio management system and Bluetooth extensions. Having worked with BSQUARE before on a different project, they turned to BSQUARE's Engineering Services department for help.

“We asked Microsoft for recommendations and they gave us several names, including BSQUARE,” said Plasterer. Michael Plasterer, Palm's Senior Director of Windows Mobile Smartphones. “Of the companies we called, BSQUARE was by far the most responsive—they

called us back within half an hour. The combination of our previous successful experience with BSQUARE, their in-depth expertise with Windows Mobile, audio management systems, and Bluetooth drivers, and their tremendous responsiveness made them an easy choice.”

Solution: BSQUARE Engineering Services

Brought into the project in early 2005, BSQUARE started with the PalmOS specifications for the audio management system and the Bluetooth driver. Then they wrote the Windows Mobile code for these components, tested it, and implemented the system.

The task was particularly challenging for BSQUARE because the hardware-related source code was owned by HTC Corporation, the manufacturer of the Treo 700w hardware. “Starting with the Windows Mobile 5.0 software development kit as a baseline, we had to reverse-engineer key parts of the audio driver,” says Bernardo Sulla, a senior engineer with BSQUARE. “Then we had to make the user experience on the Windows Mobile powered device similar to that of Palm devices.”

Audio Manager

Developing the audio manager was a complex task, involving keeping track of what the user is doing and which accessories are in use and then routing the sound accordingly. There is almost no limit to the number of modes the device can be in. For example, the user could employ the device as a speaker-phone by plugging it into a hands-free car kit—or as a media player, plugging a stereo headset into it. Each of these states places dramatically different

demands on the audio system, and the audio manager must act like an air-traffic controller, keeping track of which peripherals are in use and allowing the various components to share the device’s audio resources.

As an example, take the matter of how alerts (such as a low battery alert) are processed. Normally, the alert would be routed to the phone’s speaker—but if the user is on an active call, the system must mute the alert.

Bluetooth Audio Gateway Extensions

Of the tasks involved in the Bluetooth portion of the work, the audio gateway extension was particularly complex. Functions such as volume, signal strength, and the phone book had to be designed so that the Windows Mobile powered phone could intercept them from the Bluetooth hands-free device, process them, and send the information back to the hands-free device.

For example:

- **Volume.** When the user presses the volume control on a Bluetooth headset to increase the volume, the headset sends an AT (modem) command to the phone to communicate this change. The Bluetooth audio gateway extensions then send the increased volume back to the Bluetooth headset.
- **Signal strength.** Bluetooth devices have no built-in ability to monitor signal strength—they have to obtain this information from the phone so they can display it (for example, on a car kit display). Again, the audio gateway extensions communicate requests from the Bluetooth headset to the phone, and send the phone’s response back to the headset.

- **Phone book.** At the time BSQUARE was working on the Treo 700w, Bluetooth devices had no built-in phone book support. Consequently, BSQUARE had to create the functionality to enable the Bluetooth device to obtain all the names and phone numbers stored in the phone.

Bluetooth Transport Driver

Another complex project was the Bluetooth transport driver, which serves as a host controller interface between the Bluetooth device and the phone. Palm assigned this task to BSQUARE because of the company’s extensive experience in developing host controller interfaces. The BSQUARE engineers took the baseline driver from the Windows Mobile 5.0 software development kit, got it running on the Treo 700w hardware, and added hooks for power management. The task was made more challenging by the fact that the engineers had to accomplish all this using only their knowledge of the chip and the hardware schematics, as no hardware-related source code was available at the start of the project. Once BSQUARE got the Bluetooth transport driver working, Palm took it and added power management capabilities specific to the chip used in the phone.

BSQUARE’s Bluetooth work was further complicated by the fact that each automobile manufacturer and Bluetooth manufacturer has its own implementation of the Bluetooth specification—so the code BSQUARE wrote had to be tested on many different cars and Bluetooth devices.

Benefits: Fast Time to Market, Knowledge Transfer

The primary benefit that Palm realized from BSQUARE's engineering services was rapid time to market. With BSQUARE's help, Palm was able to release the Treo 700w for carrier testing in September 2005—just six months after BSQUARE began work on the project.

A secondary benefit was knowledge transfer. Because BSQUARE worked closely with the growing Palm engineering teams as they continued to develop additional Windows Mobile phone products, the Palm engineers were able to significantly increase their own understanding of Windows Mobile.

Palm also appreciated the quick bug fixes that BSQUARE's engineers provided. "They don't—and their ability to introduce new features without break things when they introduce new features," says Plasterer. "And if bugs do show up, they're on them as fast as our own engineers, providing rapid fixes. ing existing ones.

Summing Up

Palm places high value on the work BSQUARE did for them. "BSQUARE was instrumental in getting the Treo 700w launched successfully—they were an integral part of our team," says Plasterer. "We simply couldn't have done it without them."

Even after the launch of the Treo 700w, Palm has continued to maintain a close working relationship with BSQUARE. "I've worked with a lot of contract engineers, and BSQUARE's people are definitely among the most responsive and professional," says Plasterer. "They're always there for us when we need them."

About Palm

Palm, Inc., a leader in mobile computing, strives to put the power of computing in people's hands so they can access and share their most important information. The company's products for consumers, mobile professionals and businesses include Palm Treo smartphones, Palm LifeDrive' mobile managers, and Palm handheld computers, as well as software, services and accessories.

Take the Next Step: Contact BSQUARE Today

To find out more about how BSQUARE can help your project, as well as BSQUARE professional engineering services, Windows Embedded licens- ing and development tools that can accelerate your time to market, contact BSQUARE at 1-888-820-4500 or email sales@bsquare.com.



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About BSQUARE:

BSQUARE is a solution provider to the global embedded device community. Our teams collaborate with OEMs at any stage in their device development to bring quality products to market faster. Since 1994, BSQUARE has been a trusted partner to smart device makers worldwide.

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By email at sales@bsquare.com

BSQUARE Headquarters
110 110th Ave NE Suite 200
Bellevue, WA 98004, USA
Phone: 888-820-4500 or
direct at 425-519-5900

BSQUARE San Diego
6450 Lusk Blvd. Suite E210
San Diego, CA 92121, USA
Phone: 858-535-9265

BSQUARE Akron
3480 West Market Street
Suite 105
Fairlawn, OH 44333, USA
Phone: 330-864-2300

International:

BSQUARE Vancouver
3751 Shell Road Suite 100
Richmond, BC V6X 2W2, Canada
Phone: 425 519 5900

BSQUARE Taiwan
18F-B, No. 89
Songren Road, Xinyi District
Taipei City 110, Taiwan
Phone: +886-2-8780-9100