



## WIRELESS VOIP READY FOR PRIME TIME

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### Wireless VoIP

Voice-over-IP (VoIP, or voice delivered using the Internet Protocol) is gaining momentum as the benefits of the technology unfold. Lower costs, more advanced services, and the convergence of two traditionally separate networks into one make VoIP an option worth considering for most IT managers. VoIP is no longer a new technology, but instead is becoming a mainstream feature in telecommunications.

Both fixed LANs and now wireless LANs (WLAN) can carry VoIP traffic effectively. These wireless VoIP systems are ideal for hospitals, retail stores and other corporations that want to keep their employees connected. So as long as users are within range of a wireless access point, they can make and receive calls and even use the handheld device's functions at the same time. With a combination of a wireless infrastructure and an IP-based phone system, wireless VoIP becomes an integral part of the mix.

### Running Voice IP™

The Swedish company Pocket Presence offers a unique solution for handheld devices called Running Voice IP™. Running Voice IP is a high-quality voice over WLAN solution comprising all the software components needed to get started with wireless VoIP, including a Pocket PC client, a PC client, and a server component. By using GIPS VoiceEngine from Global IP Sound, the leading audio processing company, the solution provides unparalleled sound quality. Running Voice IP achieves an audio quality better than GSM standards and latency comparable to today's GSM networks. The solution also incorporates an integrated SIP stack, which enables connections not only to other PDAs and PCs but also to ordinary phones.

### GIPS VoiceEngine

GIPS VoiceEngine is a software plug-in that provides all of the necessary interfaces and components to improve sound in a software application, IP device, silicon, or board used for VoIP systems. It simplifies the integration of speech codecs, communication with sound cards, real-time performance, RTP protocol handling, and other voice-related tasks.

GIPS VoiceEngine is typically configured with GIPS SoundWare modules. For example, the Running Voice IP integration uses GIPS NetEQ, GIPS Enhanced G.711, GIPS iPCM-wb, and Acoustic Echo Suppression modules to significantly reduce the effects of packet loss, delay, jitter, and echo. Consequently, Running Voice IP applications are robust against adverse network conditions, providing better than PSTN voice quality even in conditions where there is up to 30% packet loss.

## Application Performance

Running Voice IP was initially developed for Intel® StrongARM-based PDAs, and worked on existing Pocket PC PDAs. However, when combined with the GIPS VoiceEngine., there were too few CPU cycles left over for other applications, and the device virtually became single-tasked during phone calls. This was not considered acceptable for a best-in-class solution.

It was believed that the increased power of the Intel® PXA250 Applications Processor would solve the performance problem. Initial trials, however, did not show the improvements expected. At this point Pocket Presence and Global IP Sound turned to the Intel Wireless Competence Center for advice.

Prior to Intel's involvement, Global IP Sound had gathered performance metrics for their VoiceEngine by using Windows CE timers embedded in threads. Using VTune™ Analyzer for Intel® Xscale™, initial results from Global IP Sound were refined and critical areas were highlighted in a more detailed manner. The GIPS Voice Engine used five threads to deal with the voice-processing running in full duplex on an IEEE802.11b network. Upon analysis using VTune, we discovered that their executable plus a device driver was consuming up to 48% of the CPU time on a HP iPAQ 3970. When launching other applications while in a call using Running Voice IP™, screen painting and navigation became painstakingly slow. The application plus a device driver was leaving virtually no headroom for other applications, and idle time was reduced to 4.8%.

## Optimization

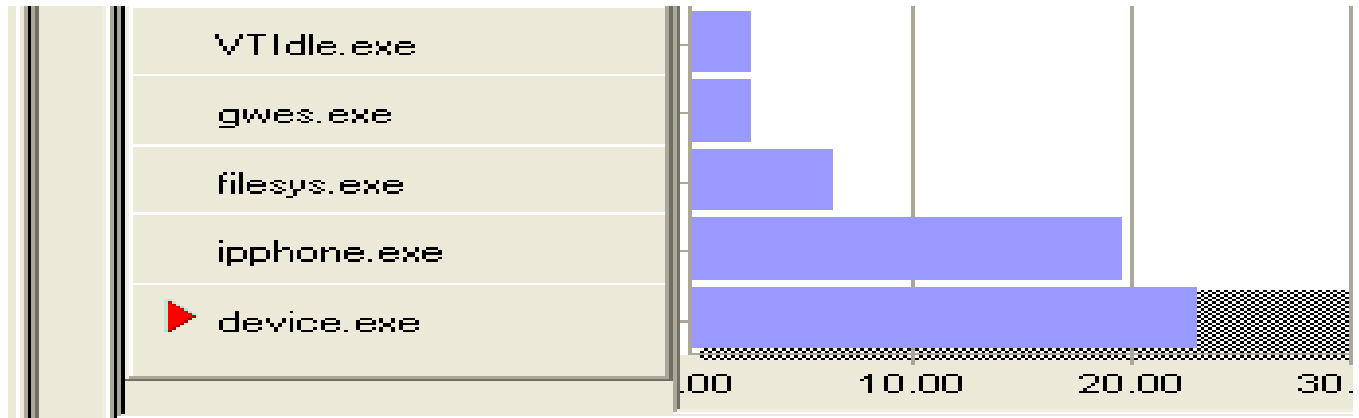
Further analysis of the GIPS VoiceEngine revealed a function for data logging. This function was not relevant in this specific application so we recommended the removal of the function together with a redesign of the threads that reduced the number of threads from five to three. The redesign provided complexity reductions in the range of 22% for the GIPS VoiceEngine on a HP iPAQ 3970.

When analyzing the rest of the application together with Pocket Presence, data collected with VTune identified the code parts consuming the most CPU cycles. Earlier efforts to speed up the applications had resulted in an application that executed a minimum of code during ongoing voice calls. However, the new performance data indicated that a module dealing with the call setup using an MFC socket class consumed a large amount of CPU time in one of its threads. The thinking was that this socket received notices of voice data not intended for this thread's consumption. We recommended closing this thread to the address server after the address was delivered, avoiding unnecessary data service.

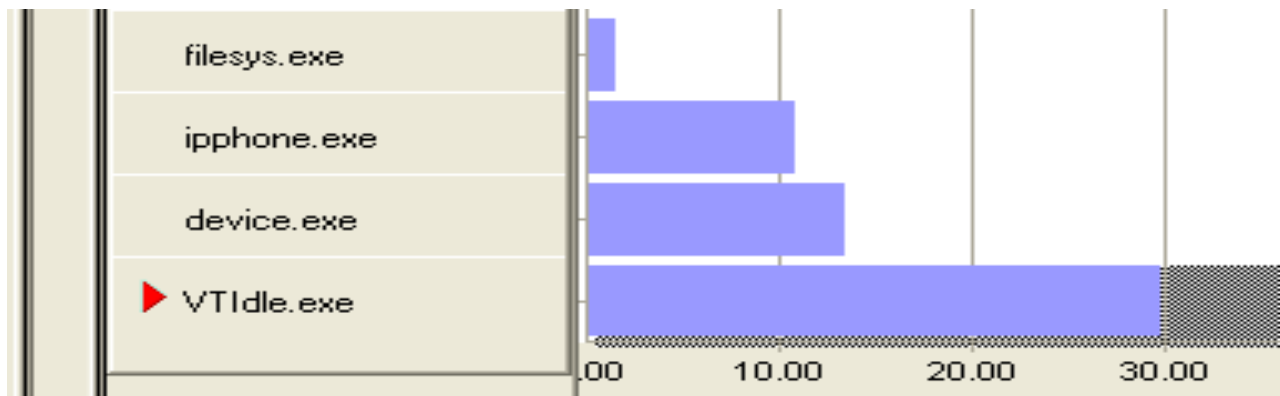
This unexpectedly high time consumption in one thread had not previously been detected with the available tools. To address the problem, Pocket Presence redesigned the module using native sockets in a more efficient

manner. Before optimization: CPU usage was 47%. After optimization, CPU usage was 6.5. This is an 86% improvement.

### Running Voice IP before



### Running Voice IP after



## Conclusions

By using VTune we were, together with the ISVs, able to identify a number of performance bottlenecks on the Intel® XScale™ implementation. This resulted in a number of improvements in the code, one being the overall reduction of running threads.

The result is a Running Voice IP application that, together with the GIPS VoiceEngine, has been optimized for the Intel® PXA250 Applications Processors. The combination of these adjustments resulted in the overall performance improvement of 2X.

The goal with this optimization project was to create enough headroom to allow the user to use other applications at the same time, such as performing a voice call. That target has been met.

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### Pocket Presence Company Profile

Pocket Presence is a leading provider of convergence software for wireless communication technologies such as GSM, GPRS, Bluetooth and 802.11a/b. The company, founded in 2000 as a spin-off from research house Newmad Technologies, offers several leading high-tech solutions that solves central problems and provides new functionality in the converging domains of telecom and datacom.

Pocket Presence's comprehensive portfolio of software products includes end-user products, OEM products and development platforms. More information is available at [www.pocketpresence.com](http://www.pocketpresence.com).

### Global IP Sound Company Profile

Global IP Sound develops embedded voice processing technologies for real-time communications on packet networks. GIPS SoundWare™ provides better than PSTN voice quality and fidelity in end-to-end IP communications with robustness against packet loss, even in degraded networks.

Global IP Sound's world-renowned speech processing and IP telephony experts deliver these solutions to Nortel Networks, Pingtel, Hotsip, and other VoIP providers. Global IP Sound is a member of the Intel® PCA Developer Network. Global IP Sound has offices in Stockholm, San Francisco, Boston and Austin. More information is available at [www.globalipsound.com](http://www.globalipsound.com).