Intel in Communications

Optimizing Rich Media IP Conferencing Systems

When development can't miss a beat

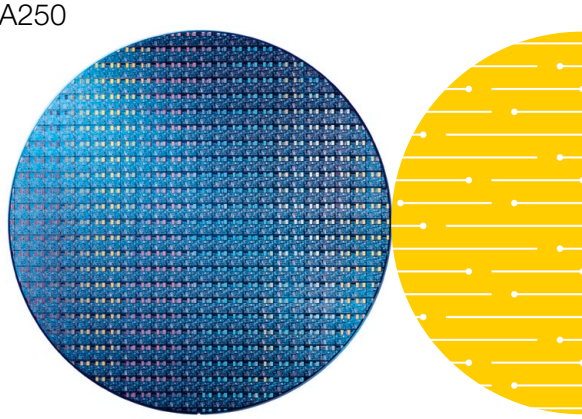
Faster time-to-market, added functionality and increased performance are all key success factors in the PDA market segment. To meet increasingly sophisticated customer demands, developers need to provide software with state-of-the-art capabilities and optimized functionality. But with today's ever-shrinking development windows, how can a developer ensure that new products are optimized to meet time-to-market deadlines? TABLETmedia* Inc. found that by using the Intel® Integrated Performance Primitives (Intel® IPP) library, they found a powerful tool that helped to simplify the development of optimized code for its iFon* Voice over IP (VoIP) and video conferencing application running on a PDA based on Intel® Personal Internet Client Architecture (Intel® PCA) processors.

Optimizing code with the Intel® IPP library

The Intel IPP library provides a cross-platform, low-level software interface that abstracts multimedia and signal processing from the applications processor. The library includes a wide range of functions for basic software functionality, including general signal, image, speech and audio processing, vector manipulation and matrix math. The Intel IPP library also includes more sophisticated primitives for construction of audio, video and speech codecs including MP3 (MPEG-1, and MPEG-2 Audio, Layer 3), MPEG-4, H263, JPEG, GSM-AMR and G723.1. The Intel IPP library for Intel PCA is highly optimized for Intel PCA processors, including Intel® PXA250 and Intel® PXA210 processors based on Intel® XScale™ technology and the Intel® SA-1110 processor.

Using the Intel IPP library helps enable developers like TABLETmedia to spend less time on optimization details and more time creating many of the value-added features that today's customers demand. This case study illustrates how TABLETmedia used the Intel IPP library to help optimize the performance of its extremely processor-intensive iFon application, while reducing time-to-market and development costs.

TABLETmedia already had the required algorithms available as standard C code implementations on PCs, but when the engineering team began the task of porting them to an Intel PXA250 processor based PocketPC device, they quickly discovered that significant optimizations would be necessary. The G.723.1 codec, for example, worked well on a high-speed Intel® desktop processor, but due to its high CPU utilization requirements, not even the decoder portion of the code would run on a 400-MHz Intel PXA250 processor. The H.263 decoder also needed code optimizations to run efficiently on the Intel PXA250 processor.



THE CHALLENGE

TABLETmedia iFon*

Real-time packet-based interactive communications such as VoIP and video conferencing are among the single most processor-intensive system-level applications for a computing device. The ability to simultaneously send and receive data from the network, record and play back audio, display video and capture high-speed images from a camera are extremely challenging operations for a handheld device. When one adds the burden of simultaneous audio/video compression and decompression to the already stringent demands of system I/O and standards-compliant real-time communication protocol handling, there never seems to be enough processing power to go around.

Audio and video compression algorithms are asymmetrical, and for this reason compression can require from five to 10 times more processing than decompression alone (as used in typical streaming video applications). Unlike streaming audio or video solutions which can overcome network or system-level limitations by buffering the data, in VoIP and video conferencing applications even a small degradation of system-level throughput can result in unacceptable delays or "clicks," similar to the static experienced on a poor quality cellular telephone connection.

This is not the only problem engineers must solve. Other challenges include the need to communicate over low bandwidth connections, including analog modems, 2.5/3G wireless networks (CDMA and GPRS), and the need to ensure there is sufficient bandwidth for several users on a broadband network such as 802.11b (WiFi). Low-bandwidth codecs use sophisticated compression technology, which requires a combination of high processing power and a highly optimized codec.

The TABLETmedia iFon was the first standards-compliant application to offer both VoIP and video conferencing on a PDA based on the Intel SA-1110 processor and Microsoft* PocketPC handheld platform technology. Once the basic functionality was implemented, some customers asked for more features. They were specifically interested in additional MIPS-intensive applications and low-bandwidth codes such as ITU-T-compliant G.723.1 and H.263 codecs running on a PocketPC-based PDA based on the Intel PXA250 processor.

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Photo caption to come

THE ANSWER

Optimization libraries-to-go

Optimizing the codecs for the Intel PXA250 processor would have taken many man-years of effort. To cut development time, TABLETmedia turned to Intel IPP for Intel PCA processors. TABLETmedia worked with Intel engineers to optimize the codecs by incorporating highly optimized Intel IPPs into iFon.

The results were amazing: within a few weeks TABLETmedia was able to deliver a highly optimized solution to its customers. TABLETmedia went a step further by optimizing the iFon application for an Intel SA-1110 microprocessor. As a result, iFon can dynamically select the optimized code for either processor to match the platform hardware.

THE ADVANTAGE

Unique capabilities differentiate TABLETmedia

During the development process, TABLETmedia had the opportunity to experience the advantages of code optimizations for the Intel PXA250 processor. In the case of the G.723.1 audio codec, an implementation on a PocketPC PDA would not have been possible without the use of Intel IPP libraries. The result was a codec that used only about 25 percent of the available CPU capacity of the 400-MHz Intel PXA250 processor, leaving sufficient CPU cycles for system I/O and video processing.

In addition, basing the H.263 decoder on Intel IPP improved the efficiency of the C implementation on a 400-MHz Intel PXA250 processor by 67 percent.

Overall, Intel IPP gave TABLETmedia a unique advantage, enabling it to be first-to-market with an application capable of supporting certain sophisticated, standards-compliant low-bit rate audio and video codecs on a wireless PDA, while helping to reduce the time-to-market and development costs.