



"The World's Most Efficient Audio Engine for Mobile Devices"

About microQ®

microQ is a compact, hardware-independent and highly efficient software audio engine that enables polyphonic ringtones, 3D game sound and enhanced music playback with numerous audio effects for mobile devices. Modular, scalable components of microQ have been adapted specifically for the ARM® environment, with the requirement for platform-specific code simplified to input and output interfaces (API).

microQ is written in highly-optimized C++ using fixed-point math, featuring the combination of small footprint and high efficiency that is the hallmark of QSound audio platforms. An optional C interface is also available.

microQ is available for DSP and RISC architectures running Linux, Symbian OS®, Nokia® Series 60, and Microsoft® Windows Mobile

- ARM7™/ARM9™/ARM11™ processor families (Optimized by ARM)

QSound's Optimization of microQ®

QSound Labs has done extensive work to optimize its microQ software to achieve one of the most efficient audio solutions in terms of memory footprint and CPU performance. In close partnership with ARM, QSound Labs has undertaken further optimizations of microQ for ARM based environments.

ARM - QSound Strategic Collaboration and Optimization of microQ®

ARM and QSound Labs entered into a strategic collaboration to bring industry leading MIDI synthesis, stereo expansion, audio effects, enhancements and 3D positional audio solutions to the wireless market. The partnership includes engineering and marketing initiatives.

From an engineering perspective, ARM has undertaken further optimizations of QSound's highly regarded and efficient software. The focus of the optimization is centered on the core components of microQ:

- mQSynth™ Polyphonic Wavetable Synthesizer
- mQFX™ Digital Effects
- mQ3D™ Positional 3D Audio Engine

The improvements achieved range from 23 - 40+ percent less mega cycles per second (mcps) using v2.4.5 of the microQ audio engine on the ARMv5E and ARMv6 architectures. Details are shown overleaf.

ARM - QSound Collaboration

"After evaluation of the QSound microQ technology, we found it offered the best combination of audio quality, performance and memory usage, resulting in a highly competitive solution."

In addition, the modular, component-based architecture creates a flexible solution which addresses the audio requirements of mobile handsets in a more scalable fashion."



Lance Howarth
General Manager
Embedded Software

The microQ Competitive Edge

- Industry leading, ARM® optimised
- Proven track record and established brand recognition
- Replaces dedicated hardware music synthesizer
- Single-vendor full audio solution:
 - Simplifies integration
 - Saves platform resources
- Selectable, scalable modular components for easy implementation
- Small memory footprint
- High efficiency processing
- Supports earphones and speakers
- Tunable 3D for all narrow geometry speaker configurations



microQ Product Suite and Corresponding Optimizations

microQ's modular audio suite consists of the following highly optimized components:

mQSynth™ Polyphonic Wavetable Synthesizer

For ringtones and background music in interactive applications (like games), mQSynth plays musical scores contained in performance files (MIDI or similar formats) using digital sample-based instruments.

mQSynth performance improvements achieved significant reductions in mega cycles per second (mcps), providing system level resource benefits and making this the industry's most optimized synthesizer!

- 41 percent from ARMv4 to ARMv6
- 34 percent from ARMv4 to ARMv5E.

mQFX™ Digital Effects

The mQFX suite enhances music listening with:

- **QXpander®** 3D stereo sound stage expansion.
- **QSizzle™** dynamic high-frequency enhancement.
- **QRumble™** dynamic low-frequency enhancement.
- **QEQualizer™** parametric spectrum control with presets.
- **QXtremeVolume™** handset speaker volume maximizer.
- **QAutoLeveler™** automatic gain control.
- **QDRC™** dynamic range control.
- **QLimiter™** anti-saturation dynamic range control.
- **QVerb™** digital reverberation.

QXpander optimization activity resulted in significant reductions in mega cycles per second (mcps) enabling additional cycles available for utilization by other applications. The results were:

- 32 percent from ARMv4 to ARMv6
- 23 percent from ARMv4 to ARMv5E.

The other mQFX components optimized to similar levels!

mQ3D™ Positional 3D Audio Engine

mQ3D Positional places multiple sounds independently in 3D space for interactive gaming. Applicable to arbitrary streams or mQSynth synthesizer channels using native or custom instruments and sound effects. The results were:

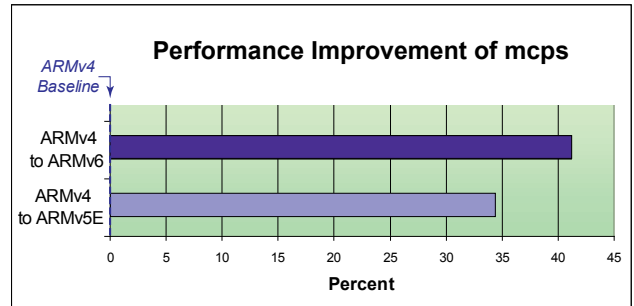
- 34 percent from ARMv4 to ARMv6
- 26 percent from ARMv4 to ARMv5E.

With minimized system resources for audio more cycles are available for graphics intensive use cases associated with 3D.

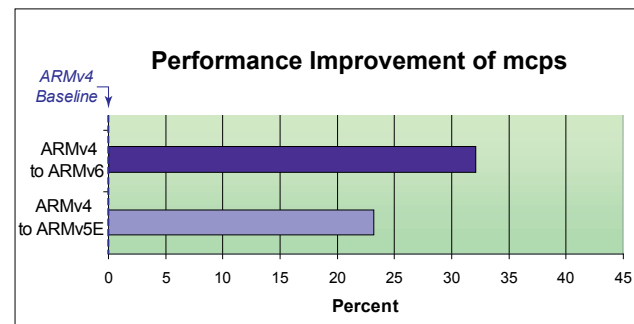
Notes

- The above results have been brought together in collaboration with ARM.
- There is no equivalent correlation between the reduction of MIPS and MCPS, although, a reduction in MCPS has a tangible impact in terms of performance because the code runs more efficiently requiring less use of the processor (minimized system resources). This creates opportunities for better resource utilization for other applications and / or may have an impact in the choice of final clock speed chosen for the system.

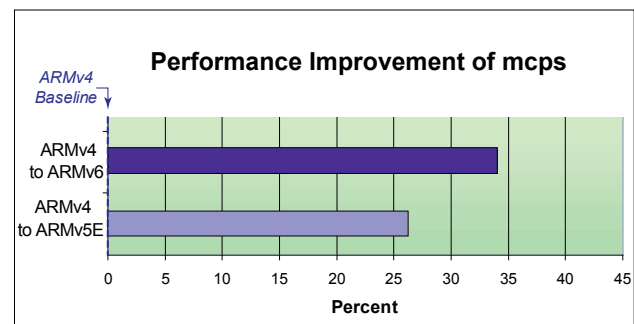
mQSynth Optimization



QXpander Optimization



mQ3D Optimization



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