MIPS in Handsets – Why Not?

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An old adage in the processor business is that 'software sells hardware'. More specifically, operating system support enables a market for an instruction set architecture (ISA). The success of Intel and AMD's x86 ISA in PCs is due to Microsoft Windows' exclusive support. MIPS lost a great opportunity when Microsoft dropped MIPS support from early versions of Windows NT.

ARM's success in mobile phones is due largely to Symbian's mid-1990s decision to support only the ARM ISA. This was the result of a TI decision to use ARM in mobile phone ASICs for Nokia, then the dominant handset maker. At that time MIPS was part of Silicon Graphics. MIPS spun out after Symbian dominated the phone OS market and lacked incentive to support another ISA.

Aside from cost, power consumption is the largest factor in handset makers' choice of chip vendors. People have asserted, without compelling data, that the ARM ISA inherently yields lower power chips than other ISAs. Actually, fab technology is the biggest factor in power consumption. Microarchitecture—the pipeline depth and instruction level parallelism—is next, followed by EDA methodology. ISA has negligible impact on power consumption (http://www.dspdesignline.com/howto/216900203). ARM's dominance in handsets is due to historical business decisions, not its ISA.

As Joe Byrne noted, specs indicate higher power per frequency (mW/MHz) for the MIPS 74K than ARM's competing Cortex A8. Specs also show the MIPS 74K at about half the die size. Since leakage exceeds active power consumption in chips today, that die size advantage benefits MIPS.

Power differences being negligible, decisions boil down to software. Though OSs sell processors, apps sell handsets. Middleware such as Android, Java, and Adobe Flash enable portability between systems. This means that app developers need only write their code once to support any handset.

Symbian's tightly controlled OS will lose dominance as Google's Android gains acceptance. Android being open source enables a larger community of app developers, large and small. MIPS jumped at the opportunity to support Android. If Android achieves dominance in handsets then MIPS has an opportunity to make a business case for their cores in handset ASSPs. By supporting multiple ISAs, Google is bringing competition to the processor business. That is ultimately good for consumers.

A role for MIPS in handsets is not yet assured. ARM has Neon, a powerful set of DSP instructions unmatched by MIPS. ARM Cortex A8 with Neon runs video codecs at HD resolution. HD video is the primary business of some of MIPS' licensees. Perhaps that has dissuaded MIPS from developing DSP extensions that could create new competitors of MIPS current licensees.

ARM also offers important supporting IP such as their Artisan standard cell libraries, memory interfaces, Mali 3D graphics cores, and an interconnect standard. All are needed for handset SoCs and are licensed by ARM in package deals. Licensees of a MIPS CPU must still license technology from other IP vendors.

While processor IP vendors find themselves in greater competition, Intel has been making moves towards handsets and other mobile devices. Intel is the wealthiest semiconductor vendor and leads in advanced manufacturing process technology. Android is available for Intel's x86 ISA. ARM and MIPS chip licensees might find themselves in competition with Intel for handset business. ARM and MIPS have the advantage of an IP business model, putting their cores into many low-cost chips. Though handset volumes are much higher than PCs, the intense competition and resulting low margins in handset chips is new territory for Intel.

Conversely, as Linux gains prominence, ISAs besides x86 have new opportunities in PCs. Notably, Dell has included an ARM-based chip in some of its models (http://www.eetimes.com/showArticle.jhtml?articleID=220300243) and the Chinese government-backed Institute for Computing Technology uses the MIPS64 ISA (http://www.eetimes.com/showArticle.jhtml?articleID=210201017) in its Loongson chip.

Android is the only platform capable of attracting enough apps to challenge the iPhone. Consequently, many handset makers are implementing Android. Palm, RIM, and Apple are the exceptions, each suffering their proprietary platforms as their fads fade. Mobile carriers are also interested in attracting consumers with cool Android apps that require pricey data plans. It is no surprise that about 20 handset models that run Android will be available by year end. No doubt they will all use ARM. However, as Android gains popularity we might just see MIPS popping up in handsets.

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