

# MediaBench

A tool for Evaluating and  
Synthesizing Multimedia and  
Communication Systems

# MediaBench

- Benchmark that target on multimedia and communications application.
- Special purpose microprocessor :VLIW, SIMD Microprocessor architecture.
- Capture essential elements of modern embedded multimedia and communications applications.

# Benchmarks

- SPECint, SPECfp : Scientific and general purpose computing application.
- TPC : Data base application.
- MediaBench : Multimedia, DSP, image processing and communication application.

# Tool used

- DineroIII : Uniprocessor cache simulators written by Mark Hill.
- Impact complier and simulator.
- Shade : Fast instruction set simulator which use a binary translation by SUN.
- Spixtools : Collection of programs which allow instruction-level profiling of applications programs by SUN.

# Goals

- Accurately represent the workload of emerging multimedia and communication system.
- Portability.
- Effective for system evaluation as well as system synthesis.

# Media application

- JPEG : Implement JPEG image compression and decompression for full-color and gray-scale images.
- MPEG : Standard for high quality digital video transmission. Used by mpeg2enc and mpeg2dec.
- GSM : Implementation of the European GSM 06.10 provisional standard for full-rate speech transcoding.

# Media application

- G.721 : The files in this package comprise ANSI-C language reference implementations of the CCITT G.711, G.721 and G.723 voice compressions.
- PGP : Use message digests to form signatures.
- Pegwit : A program for performing public key encryption and authentication.

# Media application

- Ghostscript : Interpreter for the PostScript language.
- Mesa : 3-D graphics library clone of OpenGL\*.
- SPHERE (Speech Header Resources) : A set of library functions and command-level programs which can be used to read and modify NIST-formatted speech waveform files.



# Media application

- RESTA : A program for speech recognition.
- EPIC (Efficient Pyramid Image Coder) : An experimental image data compression utility.
- ADPCM : Adaptive differential pulse code modulation.

# Performance evaluation

- Single-issue processor.
- 16 KB Direct-mapped split caches with 32 bytes line.
- Impact tool suit provides cycle level simulation of the processor.
- Use mean of all the applications for comparison.

# Performance Characteristic

- Doesn't stress instruction cache : Higher I-cache hit rate than SPECint.
- D-cache read : More effective than SPECint.
- D-cache write : Less effective than SPECint.
- Bus utilization : Very low compare to SPECint.

# Performance Characteristic

- Branching rate : Approximately equal for the two suits.
- Integer ALU utilization rate :  
Approximately equal for the two suits.
- IPC : Slightly higher than SPECint.

# Synthesis Validation

- Simple single-issue RISC processor core and on chip cache memory.
- Processor core : IBM 40x PowerPC core with an estimate size of 8 mm<sup>2</sup> in 0.5 μm technology.

$$\frac{\textit{Performance}}{\textit{Cost}} = \frac{\textit{Instruction Count}}{(\textit{Core area} + \textit{Cache area}) * (\textit{Instruction count} + \textit{Misses} * \textit{Miss penalty})}$$

# Synthesis Validation

## *Performance/cost VS. cache size*

- Split direct mapped cache with 16 byte lines.
- Caches are sized between 1KB and 16 KB.

# Synthesis Validation

## *Results*

- Optimal design point for SPECint is 2 KB I-cache with 1 KB D-cache.
- Optimal design point for MediaBench is 1 KB I-cache with 1 KB D-cache.

# Synthesis Validation

## *Results*

- Performance benefits of large caches do not compensate for the increased cost.
- I-cache of the system that synthesized by SPECint is 2 times larger than system that synthesized by MediaBench!!!



# Conclusion

- MediaBench is suitable benchmark for embedded system target on multimedia, DSP, communication.
- Coded in high level language and has been compiled by multiprocessor architecture.
- Different characteristic lead to different system configuration.

# Reference

- Chunho Lee, Miodrag Potkonjak, and William H. Mangione-Smith; MediaBench: A Tool for Evaluating and Synthesizing Multimedia and Communications Systems.
- <http://www.cs.ucla.edu/~leec/mediabench/>