

Doc.dr.sc. Mario Kova...
(mario.kovac@fer.hr)

Multimedia Computer Systems: MM support principles

Evolution of Multimedia Processing Devices

- Initially:
 - < Separate special purpose device or chip for each media type
 - Audio boards
 - Video boards
 - 3D acceleration boards
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- Enhancements
 - < Devices were able to perform multiple algorithms (e.g. multiple audio decoding algorithms)
 - < Digital Signal Processors (DSPs) that could be reprogrammed for different algorithms
 - Still, each media required own DSP + DSPs for communication
 - Programmability at the low level - requires good HW understanding
- Today
 - < Low cost DSPs for audio applications
 - < Special purpose chips that support multiple video standards
 - < Special chipsets for different media support
 - < Enhancements of CPUs to directly support multimedia

Computer System Enhancements

- Merging of memory and processing requirements
 - < Common memory:
 - Allows dynamic redistribution of memory resources based on the workload or media data mixture
 - Bandwidth must be increased to accommodate sum of bandwidths of all components
 - < Common CPU design
 - Processors that can process video can be used for other data type processing with minimal cost
 - Processing power must be increased to be able to perform all functions in given time slots

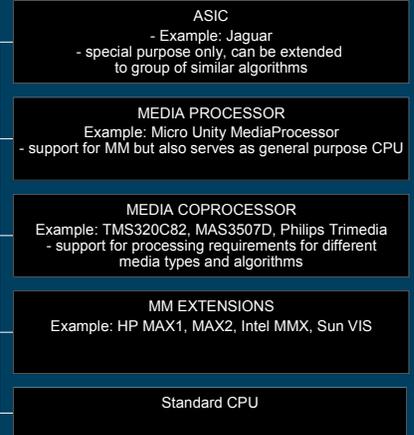
Computer System Enhancements

- Media coprocessors and media processors
 - < Media coprocessor
 - Single chip device (DSP like ?) that supports processing requirements of all multimedia data types
 - Attached to a general purpose CPU that handles other system functions (memory management, access rights, number crunching)
 - Example: TMS320C82 DSP, Philips Trimedia
 - < Media processor
 - General purpose CPU that simultaneously processes general data and multimedia messages
 - Example: MicroUnity MediaProcessor
 - < Alternatives:
 - Addition of multimedia acceleration features to general purpose processor
 - Example: Intel MMX Extensions

Processor ?

- What should be our task.....
- Do we design CPU (and computer system) to process general data and add multimedia extensions?
- Or
- Do we design CPU (and computer system) to process multimedia and add general purpose functionality?
- I hope two ideas will converge in the near future and result in a powerful general purpose and multimedia processor

MM Support Principles



Multimedia extensions: brief history

- Basic principle:
 - < Parallel operation of lower precision data packed into higher precision words
- Illiac IV (among first to use this approach)
- Hewlett-Packard PA-7100LC
 - < MAX-1 multimedia acceleration extensions
 - Parallel subword arithmetic
 - Typ. Application: real time MPEG-1
- SUN UltraSparc
 - < VIS
 - Large set of multimedia extensions
 - Parallel arithmetic
 - EXTRA: novel instructions for reduction of memory latency
 - EXTRA: some other video processing instructions

Multimedia extensions: brief history

- Hewlett Packard PA-RISC
 - < MAX-2
 - Addition of few new instructions to MAX-1
- Intel Pentium
 - < MMX
 - Between VIS and MAX-2 in number and complexity of new instructions
 - New: e.g. 16 bit multiply-accumulate instruction
- All approaches have the same goal: support for multimedia
- Differences: based on the target market
 - < e.g. 8 bit subword instructions: for lower end multimedia (games,...)
 - < Higher precision: high fidelity multimedia (workstations, medical,...)