*Optimized DSP Software • Independent DSP Analysis*

# Evaluating the Latest DSPs for Communications Infrastructure Applications

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## Processor Requirements

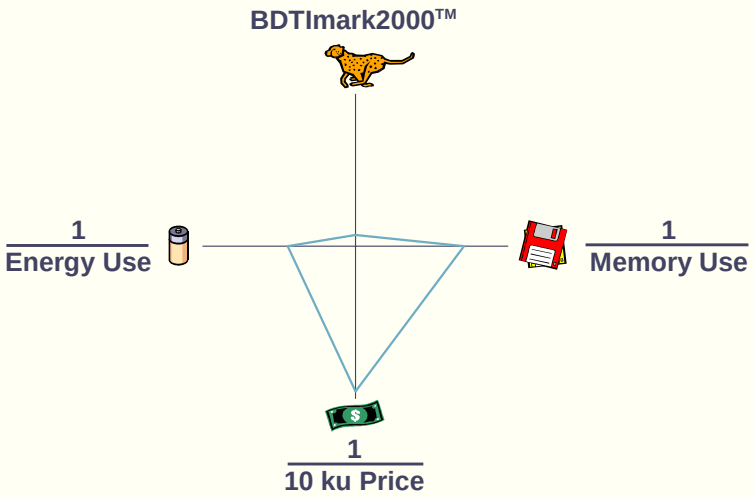
*Communications Infrastructure Equipment*

Key criteria

- Board area per channel
- Power per channel
- Cost per channel
- Large-system integration support
- Tools
- Application-development infrastructure
- Architecture roadmap

## Benchmark Results

*Texas Instruments TMS320C5409-120*







## Texas Instruments TMS320C64xx

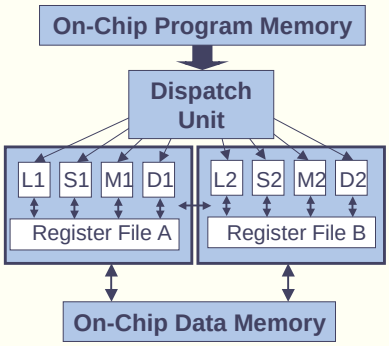
8-issue 16-bit fixed-point architecture
- Up to four 16-bit MACs per cycle
- Special instructions and co-processors for communications applications
- Compatible with 'C62xx, 'C67xx

11-stage pipeline with multicycle latencies

Two-level cache memory system

32-bit instruction set

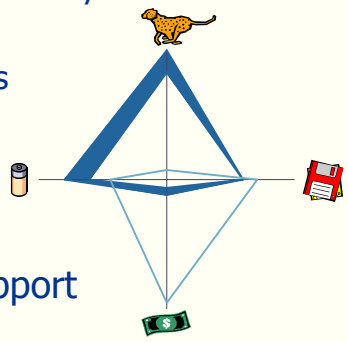
Sampling at 600 MHz, $111 (10 ku)



## Texas Instruments TMS320C64xx

*Strengths and Weaknesses*

- ↑ Good speed and cost-efficiency
  - ↓ But poor energy and memory efficiency
- ↓ Complex programming model
  - ↓ 'C6xxx is assembly programmer's worst nightmare
  - ↓ Caches reduce execution-time predictability
- ↑ Good integration
- ↑ Good tools and third-party support
  - ↑ Compatible with 'C6xxx family







## StarCore SC140

*Motorola, Agere,… and now Infineon*

6-issue 16-bit fixed-point architecture
- Up to four 16-bit MACs per cycle

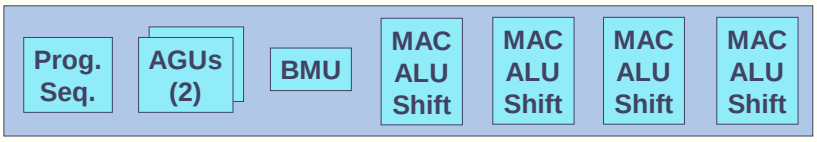
5-stage pipeline with single-cycle latencies

Some chips use caches

Mixed-width 16- and 32-bit instruction set

Motorola MSC8101 (one SC140 core) shipping at 300 MHz, $134 (10 ku)

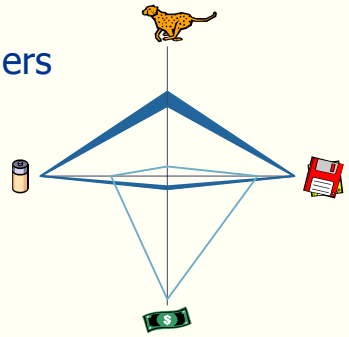
Agere SP2000B (three SC140 cores) sampling at 250 MHz, $200 (10 ku)



## StarCore SC140

*Strengths and Weaknesses*

- ↑ Strong performance on most metrics
  - ↓ But poor cost-efficiency
- ↑ Good target for compilers, assembly-language programmers
- ↑ Multi-vendor architecture
  - ↑ Backed by three of the largest semiconductor vendors
  - ↓ No roadmap or business plan from StarCore LLC
- ↑ Limited product offerings
  - ↑ Strong, relevant integration
  - ↓ But poor cost-efficiency



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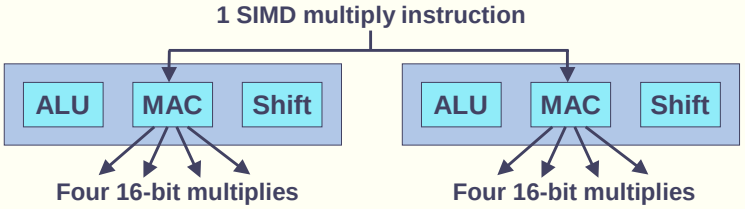
## Analog Devices TigerSHARC

4-issue fixed- and floating-point hierarchal SIMD architecture

- 8-, 16-, 32-bit fixed-point and 32-bit floating-point
- Up to eight 16-bit fixed-point MACs per cycle
- Special CDMA-oriented instructions
- High memory bandwidth (8 GB/s)

Five-stage pipeline with single-cycle latencies

Shipping at 250 MHz, $175 (10 ku)

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## Analog Devices TigerSHARC

*Strengths and Weaknesses*

- ↑ Speed rivals fastest fixed- and floating-point DSPs*
  - ↓ Poor cost-performance*
- ↓ Two-level SIMD complicates programming
- ↑ Sophisticated memory system
  - ↑ Leading memory bandwidth
  - ↑ Excellent multiprocessor support
- ↑ Good tools
  - ↓ But limited third-party support
- ↓ Uncertain roadmap
  - ↓ Only one chip announced so far
  - ↓ Can ADI support all of its new architectures?



*Based on architectural comparisons

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## LSI Logic ZSP400

*A 4-Way Superscalar DSP Core*

4-issue 16-bit fixed-point superscalar architecture
- Up to two 16-bit MACs per cycle
- ALUs also function as AGUs, shifters
- Good support for 32-bit operations

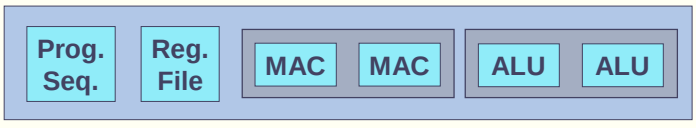
Five-stage pipeline with single-cycle latencies

16-bit instruction set with no conditional execution

Available as core, ASIC library component, ASSP,…

Compatible with higher-performance ZSP G2

Shipping at 200 MHz, $36 (10 ku)



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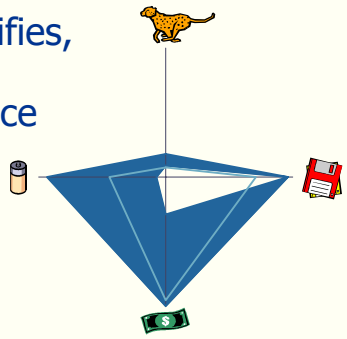
## LSI Logic ZSP400

*Strengths and Weaknesses*

- ↑ Cost-, energy-, and memory-efficient
  - ↓ Older chips are less cost- and energy-efficient
  - ↓ Relatively slow
- Superscalar architecture simplifies, complicates programming
- ↑ Roadmap to higher performance
- ↑ Available in multiple forms
- ↑ Acceptance appears to be growing
- ↓ Unproven tools and third-party support






## Conclusions

Developers of communications infrastructure equipment have many choices of processors.

There is no "ideal" processor:

- Any choice brings trade-offs
- The "best" processor depends on the details of the application

Performance and efficiency are key:

- Be wary of vendor hype; use reliable benchmarks

Factors other than performance are also critical:

- Vendors' roadmaps, business plans, etc.
- Tools and third-party support