

Decoupled Access/Execute Computer Architectures + Retrospective

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Summary

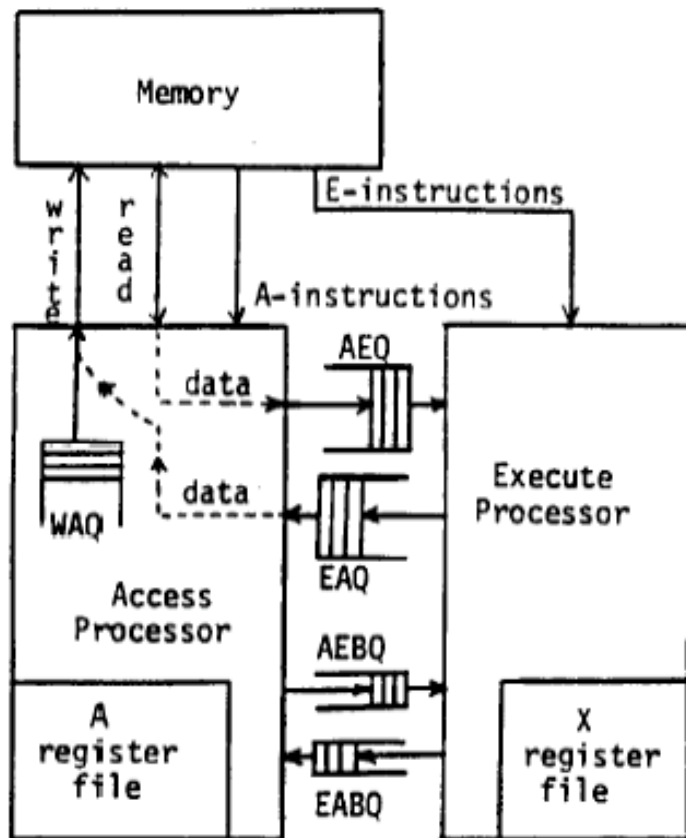


Fig. 1. Conceptual DAE Architecture

- Decoupling access from execution
- Implementation issues
 - Stores
 - Conditional branches
 - Queues implemented with registers

Issues

- Deadlock prevented by compiler
- How to merge instruction streams?
- Going from this to this

```

q = 0.0
Do 1 k = 1, 400
x(k) = q + y(k) * (r * z(k+10) + t * z(k+11))
    
```

<u>Access</u>	<u>Execute</u>
.	
.	
.	
AEQ + z + 10, A2	X4 + X2 *f AEQ
AEQ + z + 11, A2	X3 + X5 *f AEQ
AEQ + y, A2	X6 + X3 +f X4
A7 + A7 + 1	EAQ + AEQ *f X6
x, A2 + EAQ	.
A2 + A2+ A3	.
.	.
.	.
.	.

Fig. 2c. Access and execute programs for straight-line section of loop

Benefits

- Decoupling performance gains:
 - Processor-memory communication speed is less of an issue
 - One instruction per cycle bottleneck not an issue
 - Improvement = 1.71 on average
- Reduction of programmer responsibility
- Two PCs makes interrupts easier to deal with than in other multi-processor architectures

Critique

- Instruction stream merge
 - Performance evaluation?
- Deadlock prevention
 - Moving the problem to the compiler
- Hand-compiled code
- They assume optimum conditions in their evaluation
- How did they come up with the timings?
 - Human error seems to be likely
- “Does it work? Nyeeeh . . .” - Schwerin

Questions

- Max speedup from decoupled processor = 2.5, while for a pair of strictly serial processors = 2.0. If there were efforts to improve performance today, would a decoupled architecture be an option, or would the “design from scratch” be too costly?
- Arithmetic mean is apparently a faux pas. How are average speedups calculated today?
- What was the result of the study on the performance impact of the WAQ length?

More questions

- How do they decide queue length?
- What else can we decouple from what?
- What would happen if this joined forces with out-of-order processing?
- Did anyone get very far building a compiler for this? Are there any terribly clever compiler tricks we can apply?
- DEA vs. Superscalar in a fight to the death: who wins? Who gets the most points for style?