

PLAYSTATION TECHNICAL NOTE

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Date: January 25, 1996  
Ref:  
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Subject: Speed of D-cache

ABSTRACT

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This note describes the speed of the D-cache in relation to data reading and writing.

DETAILS

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o What speed is the D-cache in comparison to main RAM at reading data?

Five times faster. It takes one CPU cycle to read from D-cache, and it takes five CPU cycles to read from main RAM.

o What speed is the D-cache in comparison to main RAM at writing data?

It takes one CPU cycle to write to the D-cache from general registers. Writing to main RAM is the most complicated part of the R3000 CPU. I should say that only GOD knows the exact number of cycles for writing data to main RAM!

The R3000 CPU has a "Write-buffer" between registers and main RAM. The W-buffer is four step 32bit length fifo. It takes one cycle to write to the W-buffer. But if there are no free registers on the W-buffer, the CPU must flush the W-buffer: write ALL the data on the W-buffer to main RAM.

It takes one to four cycles to write the data on W-buffer to main RAM. If two or more write operations are done in a row, the first operation takes four cycles, but the second and subsequent operations take only one cycle each.

And, main RAM has 1KByte "pages". Any write operation on a new page takes four cycles. And, the programmer cannot control or detect the W-buffer flush timing, and cannot know the status of it. The R3000 has a Bus-Snoop-Mechanism and I-cache. You cannot predict the start of the flushing of the W-buffer, even if you know the complete assembler codes.

So, if you have good luck, it takes only one cycle to finish one store instruction. For the worst case, I can say nothing.

As a result, I can only say that writing to main RAM is VERY slow compared to writing to D-cache, and probably writing to main RAM is slower than reading from main RAM.

Best Regards,

Okamoto

PS. Each segment of the W-buffer is assigned to one store instruction. So if four Store-Byte-Instructions are executed, the W-buffer becomes full.