

Cache Memory HW

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Please send corrections (or suggestions) to youngwlim@hotmail.com.

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Briefly describe the following terms.

- Tag
- Line
- Block
- Word

Describe the following in detail with figures and examples.

- Direct Mapping
- K-way Set Associative Mapping
- Fully Associative Mapping

Direct Mapping

- Tag : t -bits
 - Line : l -bits
 - Word : w -bits
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- Main memory address bits? $(t+l+w)$ -bit
 - How many blocks exist in main memory? Upto $2^{(t+l)}$ blocks
 - How many words in a block? 2^w words
 - How many lines in the cache? 2^l lines
 - Cache memory size? $2^l * (t+2^w)$ words

* valid bits are excluded

K-way Set Associative Mapping

- Tag : t -bits
 - Set : s -bits
 - Word : w -bits
-
- Main memory address bits? $(t+s+w)$ -bit
 - How many blocks exist in main memory? Upto $2^{(t+s)}$ blocks
 - How many words in a block? 2^w words
 - How many lines in the cache? 2^s lines
 - Cache memory size? $2^s * (t+2^w) * K$ words

* valid bits are excluded

Fully Associative Mapping

- Tag : t -bits
 - Word : w -bits
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- Main memory address bits? $(t+w)$ -bit
 - How many blocks exist in main memory? Upto 2^t blocks
 - How many words in a block? 2^w words
 - How many lines in the cache? N lines assumed
 - Cache memory size? $1 * (t+2^w) * N$ words

* valid bits are excluded

References

- [1] <http://en.wikipedia.org/>
- [2] https://en.wikiversity.org/wiki/The_necessities_in_SOC_Design
- [3] https://en.wikiversity.org/wiki/The_necessities_in_Digital_Design
- [4] https://en.wikiversity.org/wiki/The_necessities_in_Computer_Design
- [5] https://en.wikiversity.org/wiki/The_necessities_in_Computer_Architecture
- [6] https://en.wikiversity.org/wiki/The_necessities_in_Computer_Organization
- [7] https://en.wikiversity.org/wiki/Understanding_Embedded_Software
- [8] Digital Systems, Hill, Peterson, 1987