Betriebssysteme

8. Tutorium - Caches

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20. Dezember 2024

ITEC - Operating Systems Group

Caches

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- Spatial locality: If address X was accessed, $X \pm 1$ will likely be accessed soon
  $\Rightarrow$ Don't just cache single words but entire *lines*. How large?

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Caches

Cache lines

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Caches

Cache lines

Why is a cache line useful? Can't we just make N memory accesses? Reading a chunk from DRAM is *much* more efficient than reading them one after another

Cache Types

What types do you know?

- Fully Associative

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- Fully Associative
- Set-Associative
- Direct Mapped

Cache Types - Fully Associative

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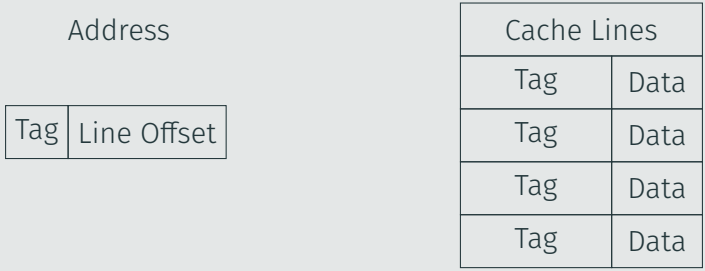

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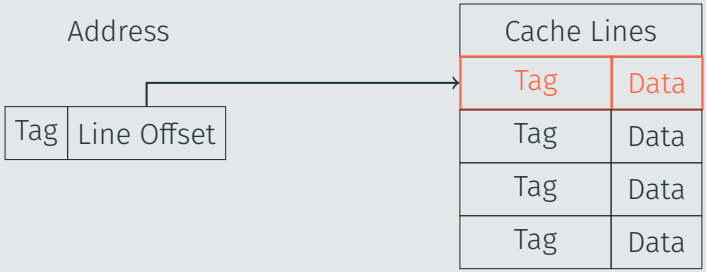

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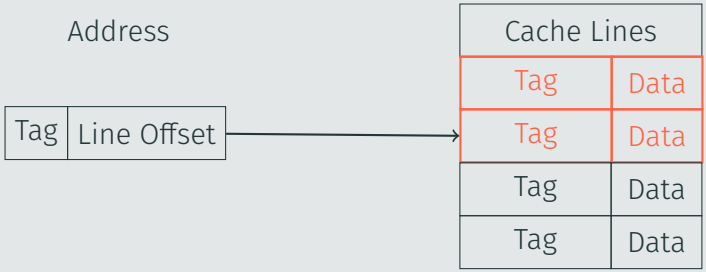

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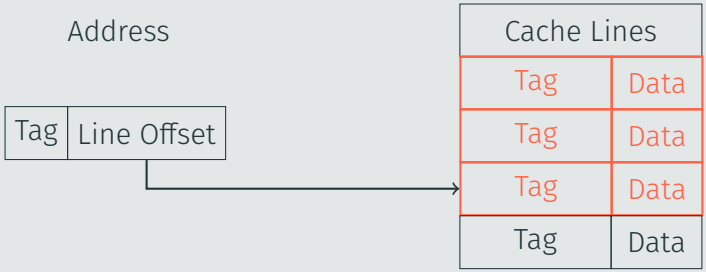

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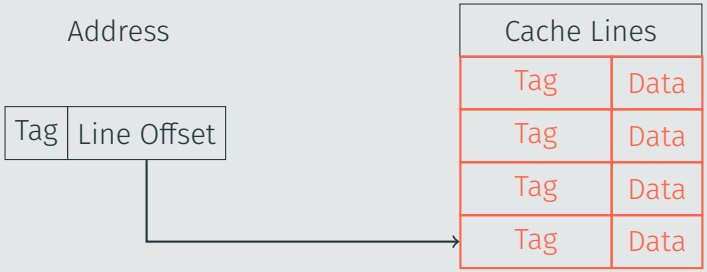

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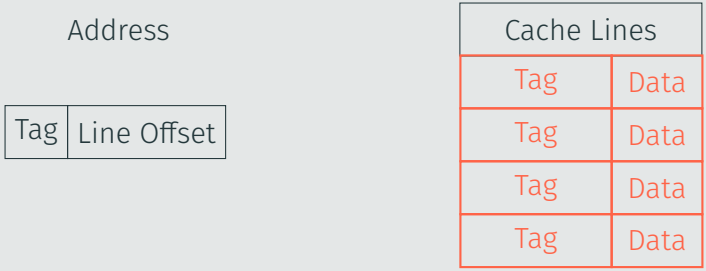

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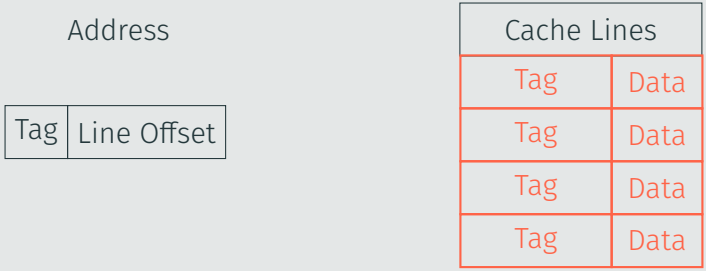

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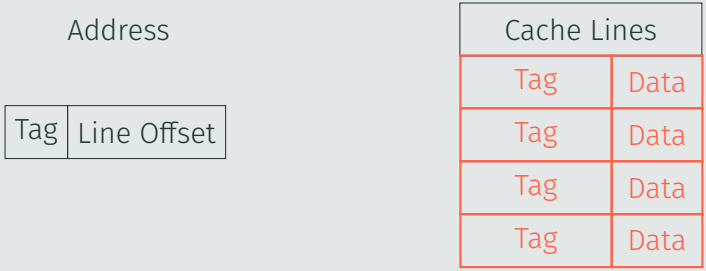

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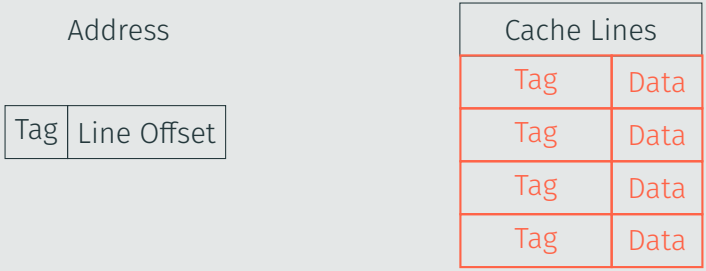

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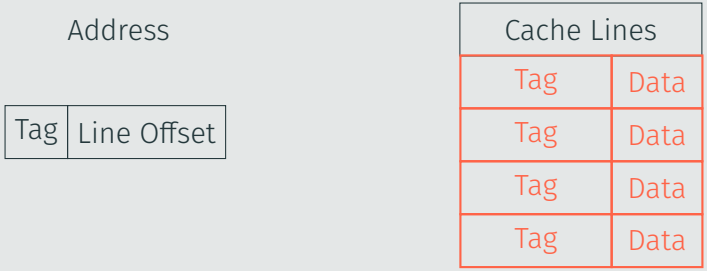

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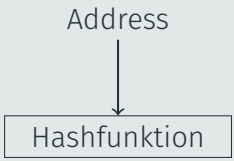

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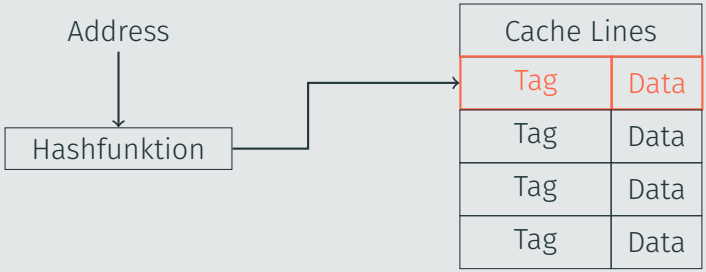

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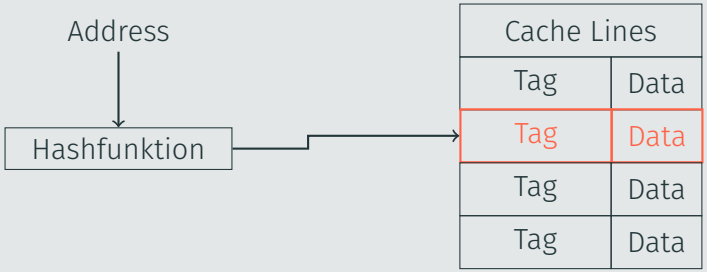

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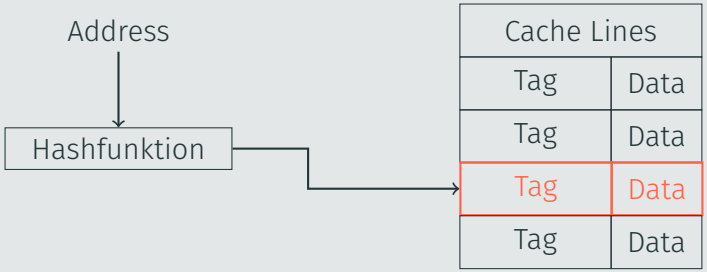

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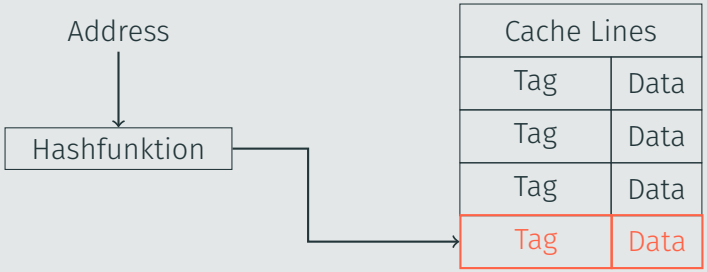

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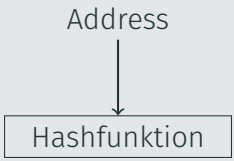

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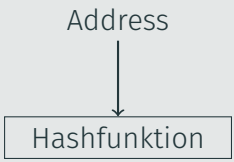

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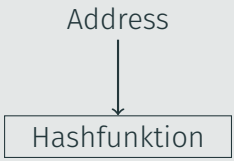

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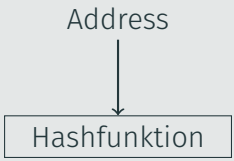

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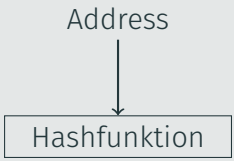

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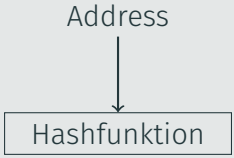

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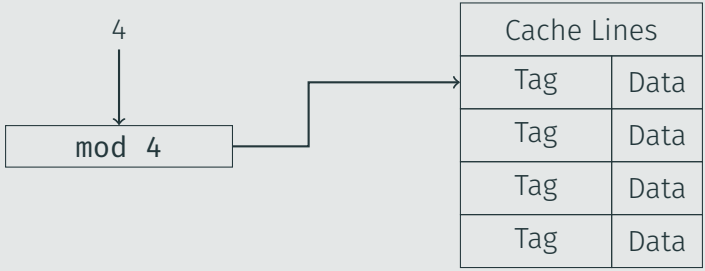

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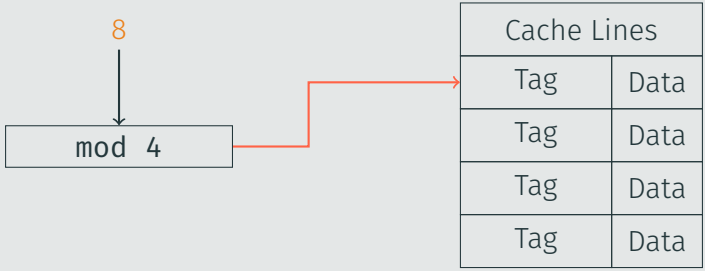

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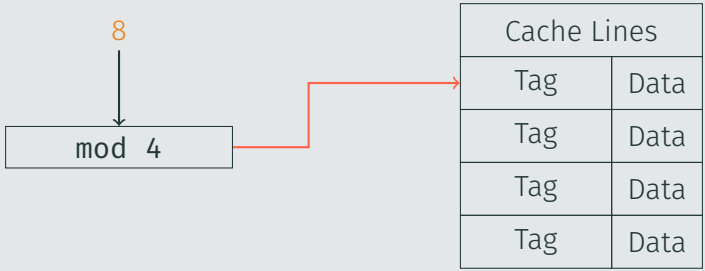

Conflict misses

There was space, but it was mapped to the same slot!

Cache Types - Set associative

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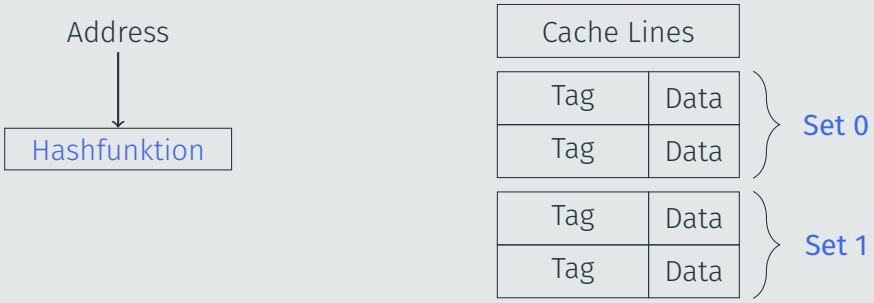

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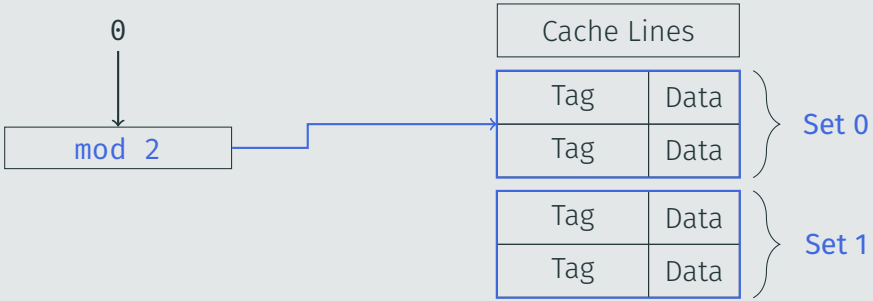

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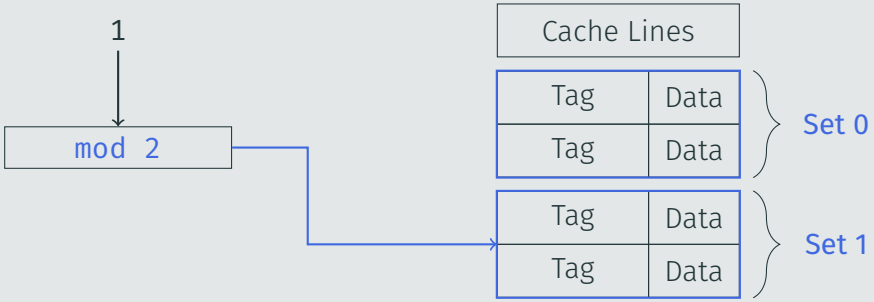

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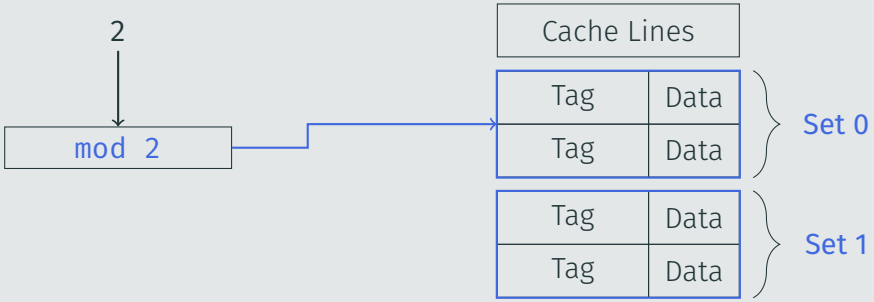

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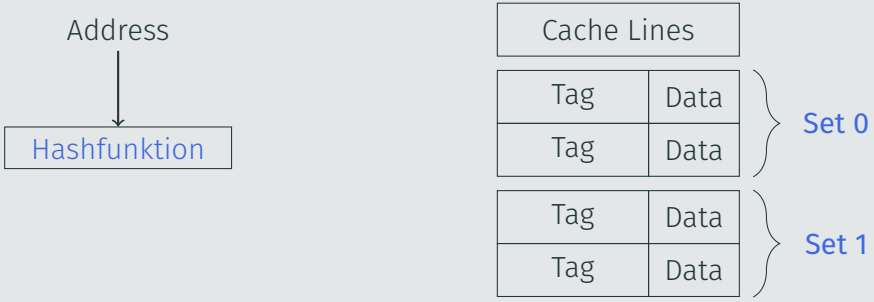

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Modifying Caches

You have a Cache and real memory behind

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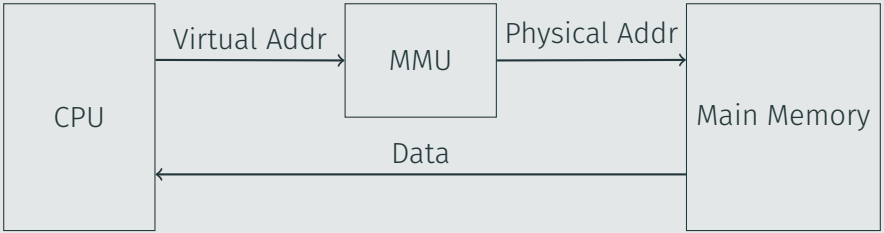
At which position do you put the cache?



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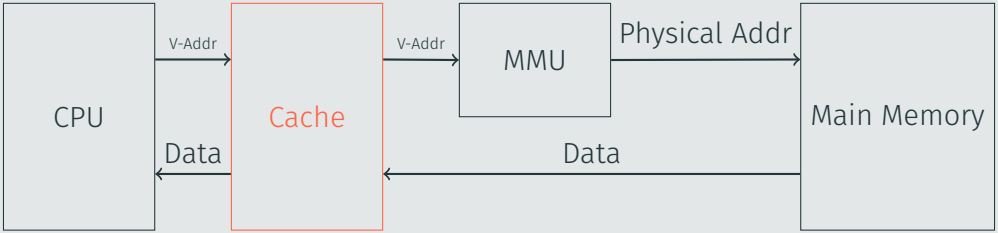

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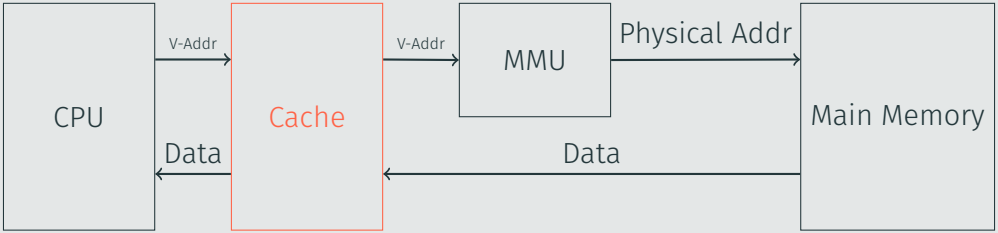

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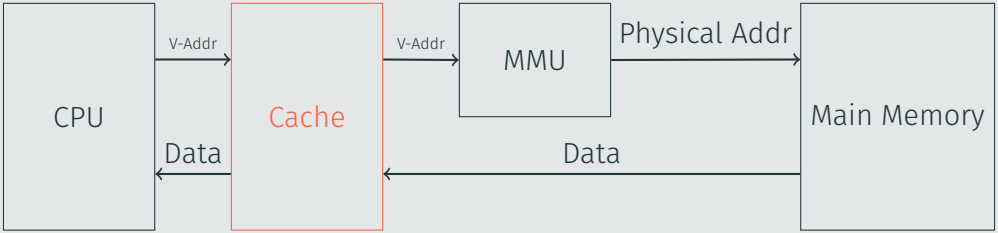

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- Alias Problem (Multiple virtual addresses might point to the same physical address)

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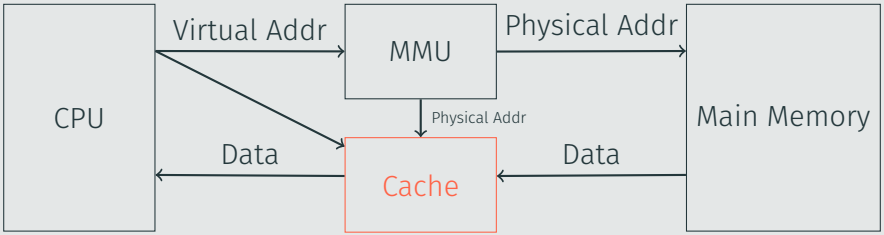

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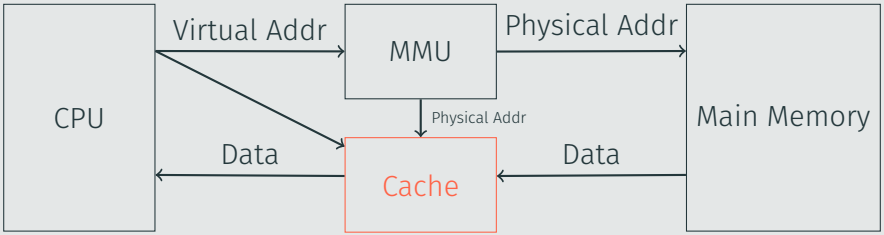

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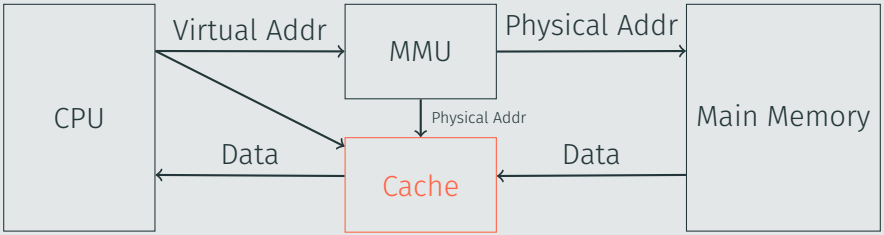

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- Alias Problem (sometimes!)

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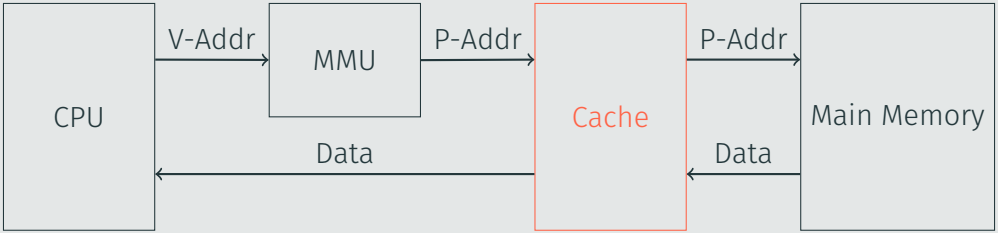

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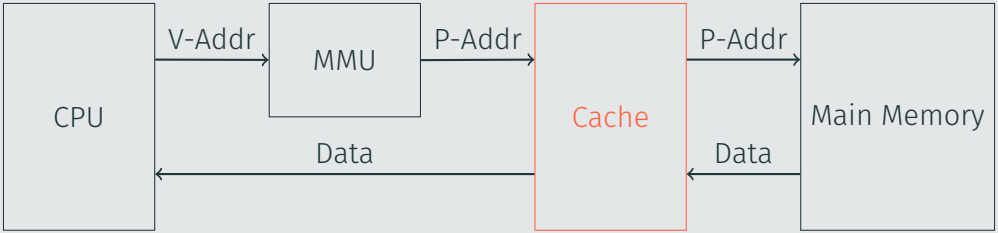

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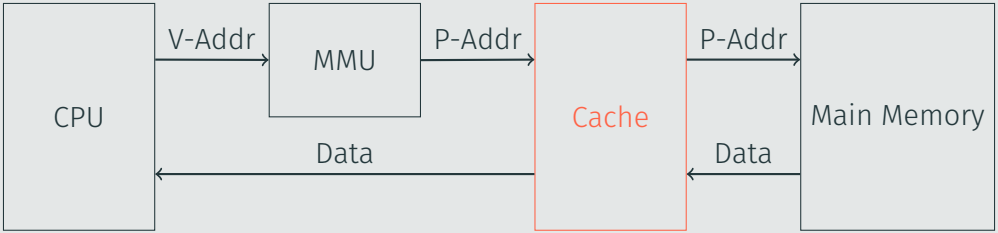

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Physically Indexed, Physically Tagged (PIPT)

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- How well do you think *contiguous* virtual pages fit into the cache?
- Maybe not so well. The cache operates on *physical* addresses

$\Rightarrow$ Sequential virtual pages might be mapped to *conflicting* physical ones!

Pipes

`ls | less`

Write a C-program for Linux that creates two child processes, *ls* and *less* and uses an ordinary pipe to redirect the standard output of ls to the standard input of less.

Ende

XKCD 361 - Christmas Back Home

F R A G E N?

https://forms.gle/9CwJSKidKibubran9

Bis nächste Woche