TÜBİTAK

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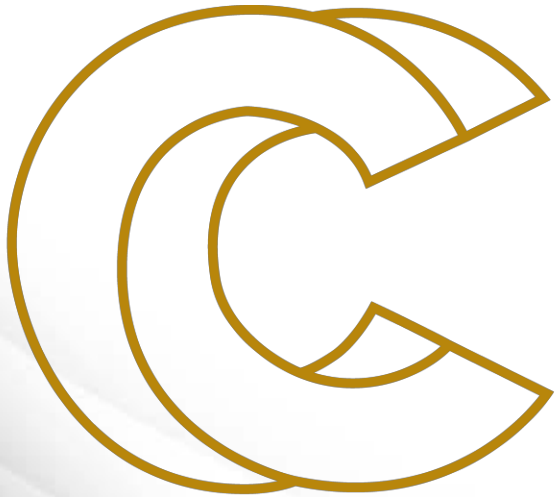

EURO^2

Performance Engineering on CPUs and GPUs:
- CPU and Memory: Things to be Careful for Performance -

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Memory: A summary

EURO²

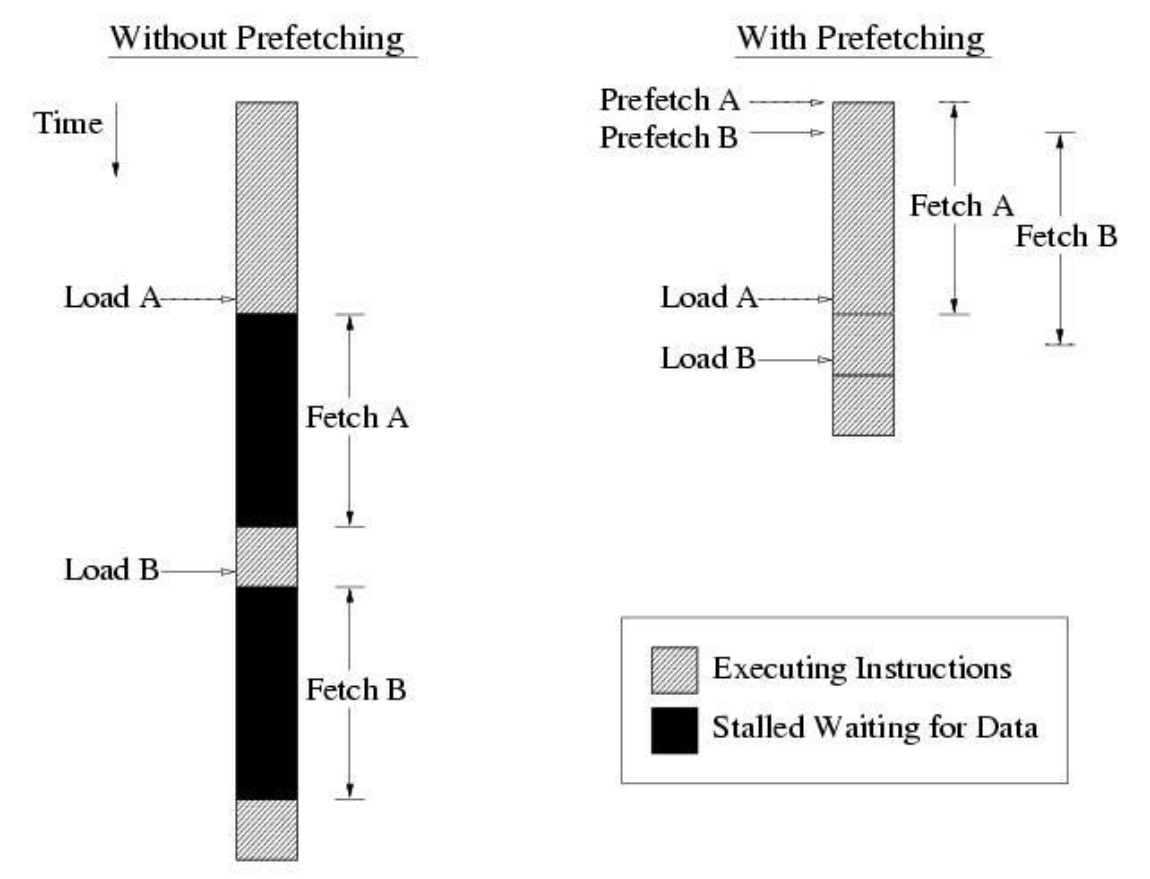
- The series of examples presented in this section illustrate the following concepts:
  - Exploiting spatial and temporal locality in applications is critical for amortizing memory latency and increasing effective memory bandwidth.
  - The ratio of the number of operations to number of memory accesses is a good indicator of anticipated tolerance to memory bandwidth.
    - Memory bound…
    - Compute bound…
  - Memory layouts and organizing computation appropriately can make a significant impact on the spatial and temporal locality.

Alternative Approaches for Hiding Memory Latency

- **Problem**: Misses on loads cause programs to stall.
- **Prefetching**: Why not advance the loads so that by the time the data is actually needed, it is already there!

- The main drawback is that you might need more space to store advanced loads.
- However, if the advanced loads are overwritten, we are no worse than before!

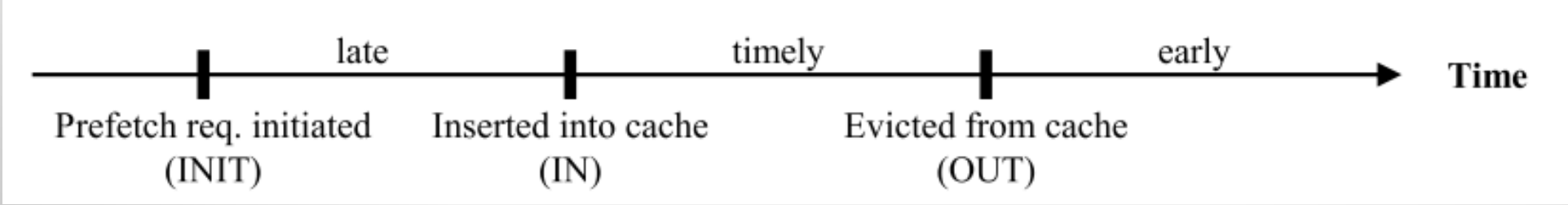
Memory: Prefetching



- Prefetching only address the latency problem and may often exacerbate the bandwidth problem.
- It also requires significantly more hardware resources in the form of storage.

Memory: Prefetching

- Prefetching can be done late, timely and early
- The following figure classifies this w.r.t. to the actual demand of the data item on a timeline.



- For more information: read “When Prefetching Works, When It Doesn’t, and Why”, Jaekyu Lee, Hyesoon Kim, Richard Vuduc. ACM Transactions on Architecture and Code Optimization (2012)

Memory: Prefetching

Let’s see one application for prefetching.

Thanks

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