

Instruction Cache Prefetching



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Agenda

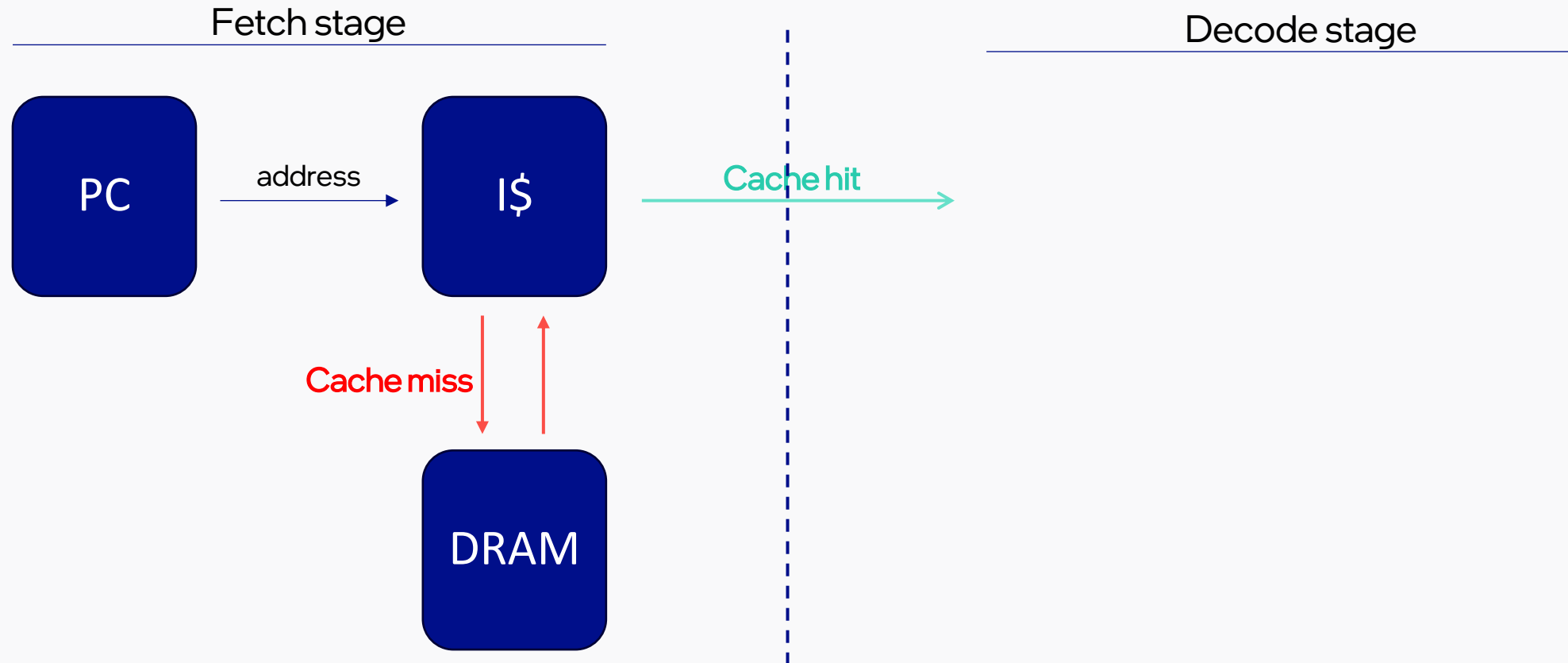
- Instruction Cache
- Prefetch Instruction
- LLVM Analyses
- Performance Impact

1

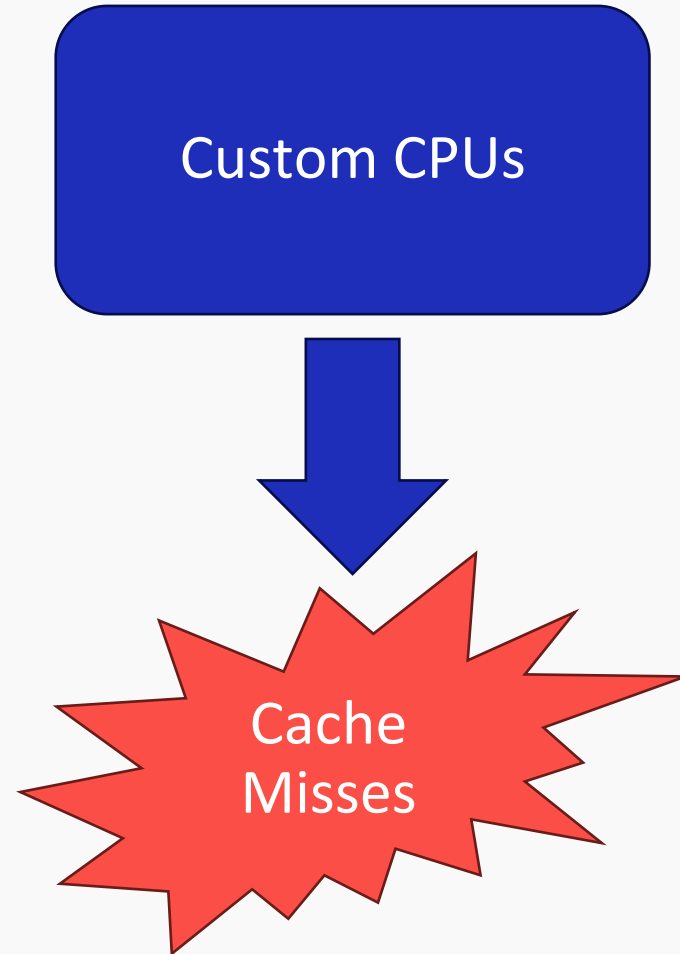
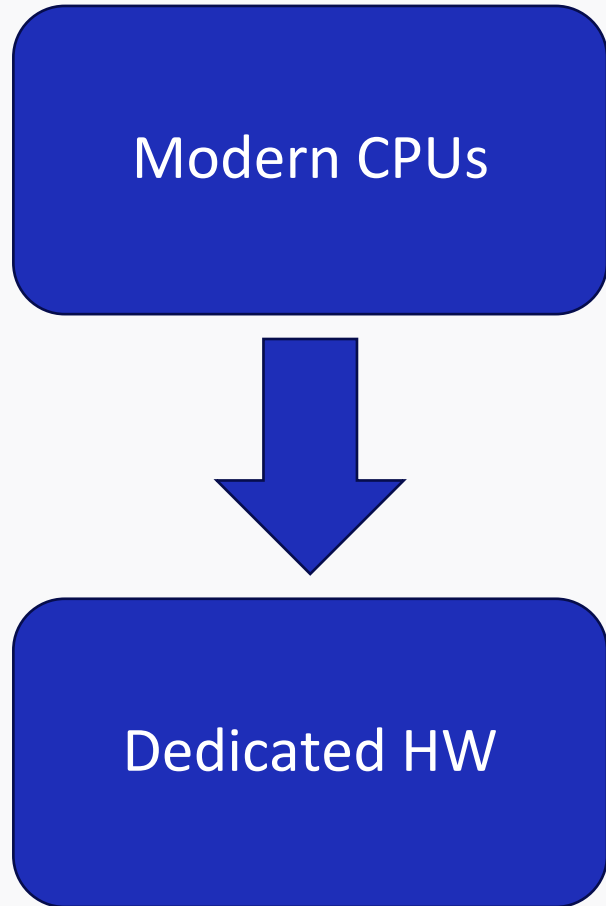
Instruction Cache

What is an Instruction Cache (I\$)

A small, fast memory inside the CPU that stores recently fetched instructions.



How do we keep the I\$ Updated?



2

Prefetch Instruction

Prefetch Instruction - Specifications

A **prefetch instruction** is a **hint** to the processor to fetch instructions into the I\$.

Syntax

`prefetch(&Label)`

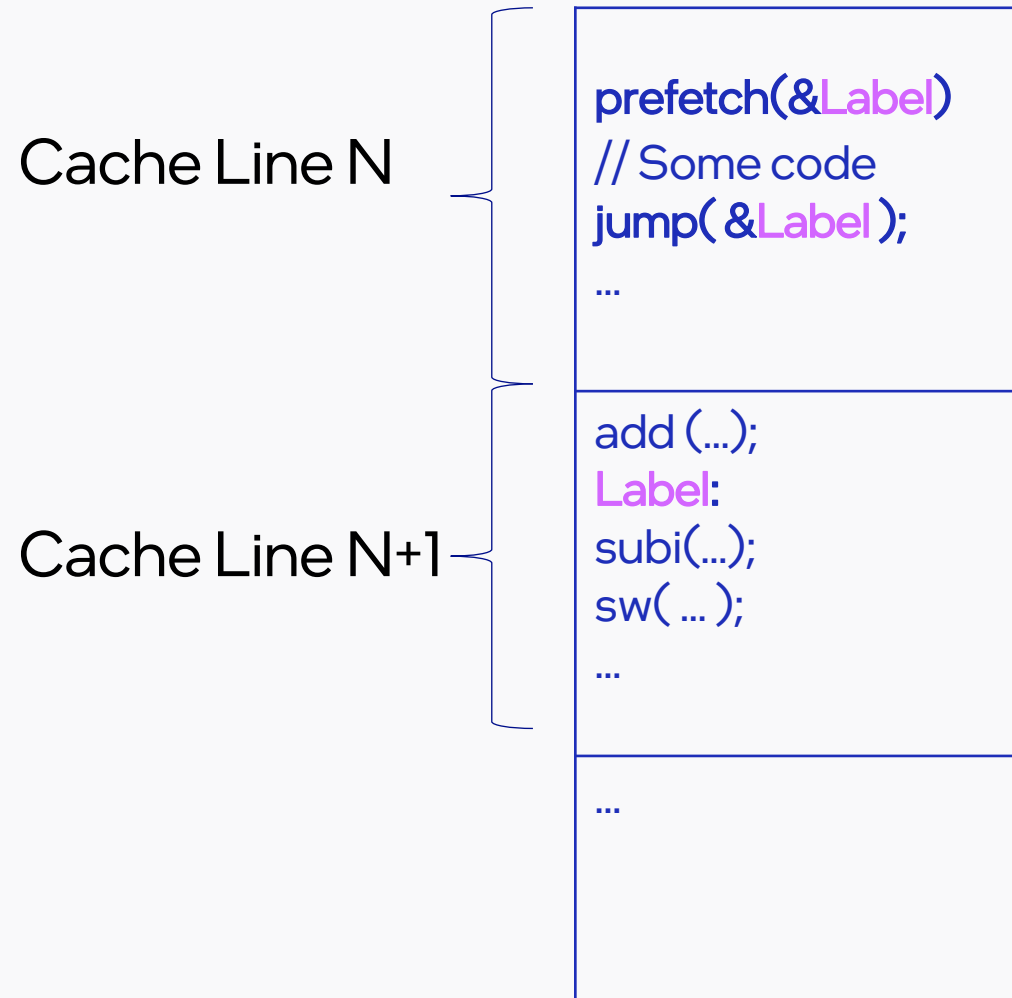
Semantics

Signals to fetch the cache line associated with Label

Sync/Async

Asynchronous non-blocking behavior

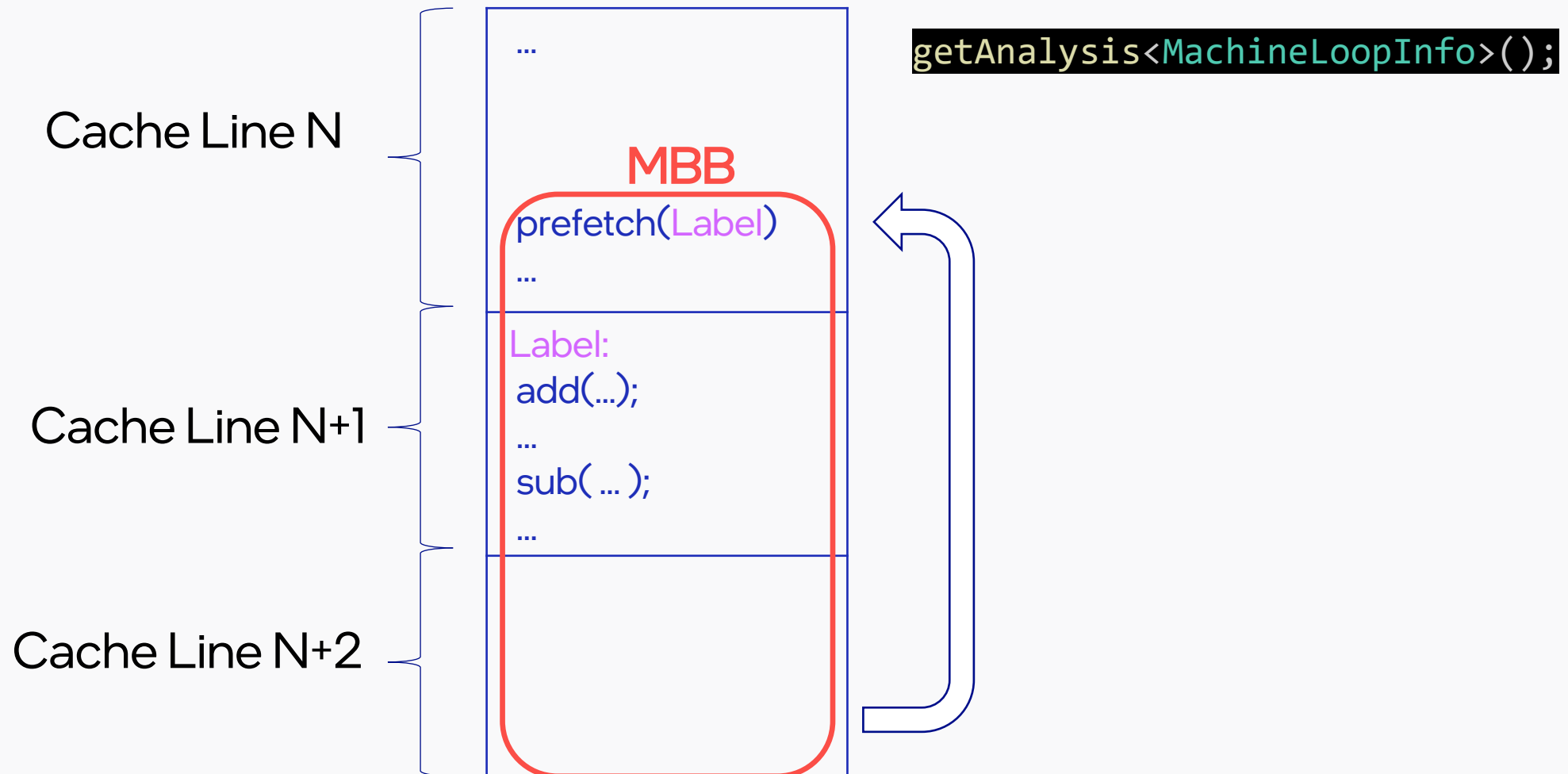
Example



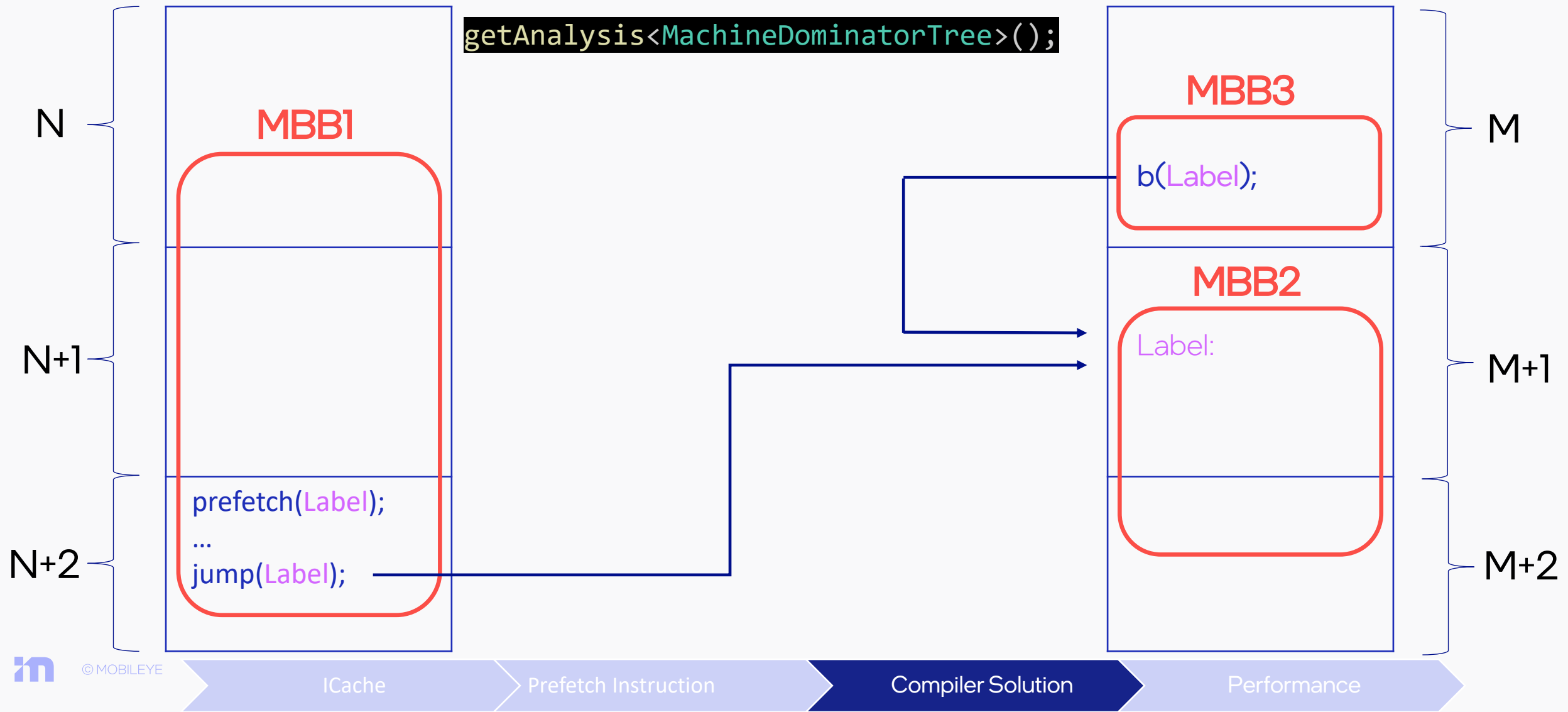
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LLVM Analyses

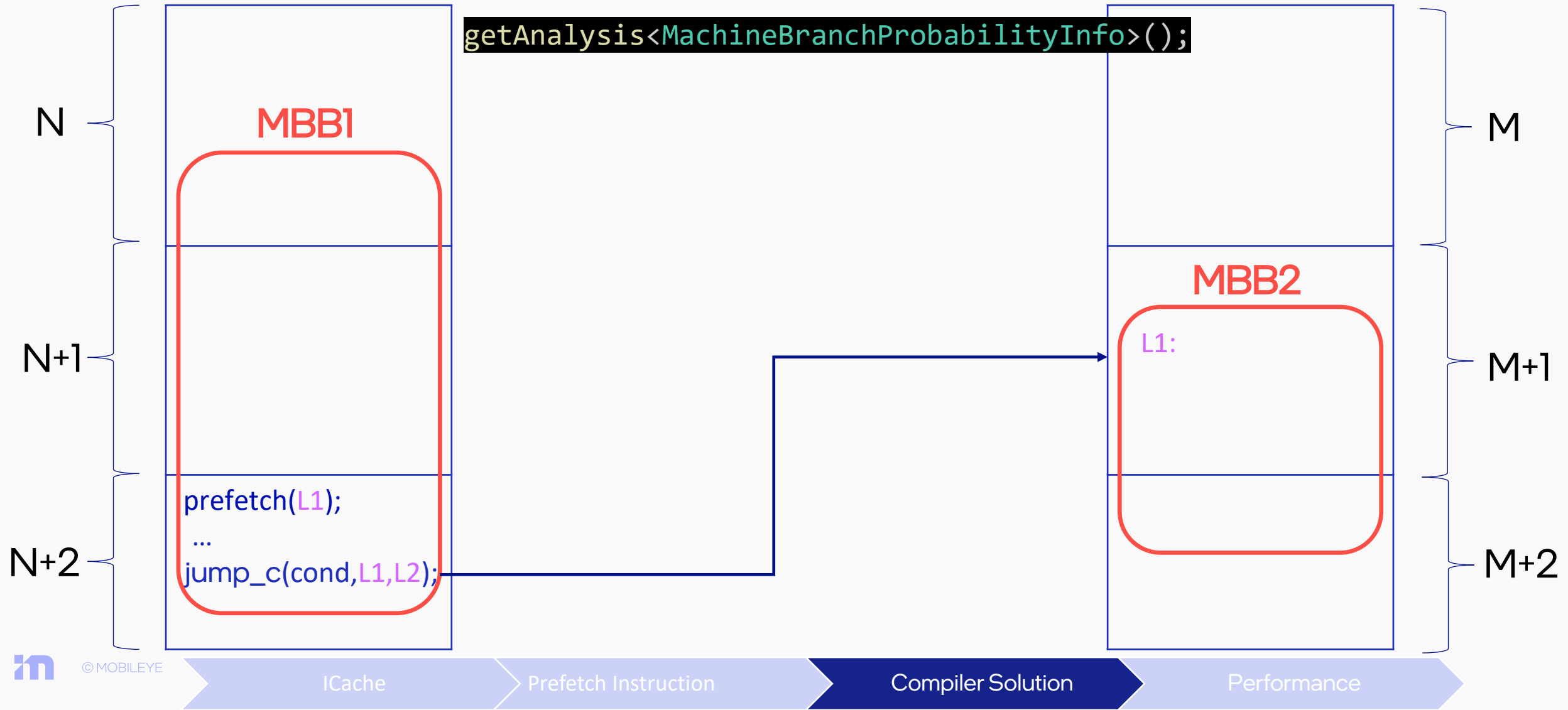
Useful Analyses



Useful Analyses



Useful Analyses



4 Performance

Performance Impact

I\$ Performance

45% reduction in stalls

Total Performance

3-4%

Conclusion

- Advanced architectures handle I\$ efficiently, but simpler ones don't.
- LLVM framework makes this optimization comfortable to implement.
- Compiler-driven prefetching is a viable software solution.



Thank you!

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