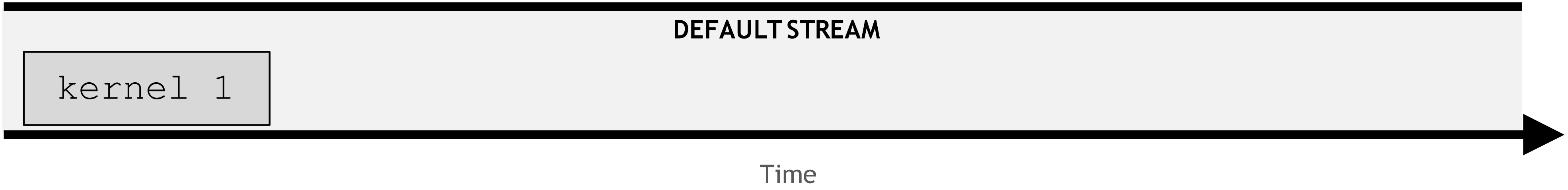
Concurrent CUDA Streams

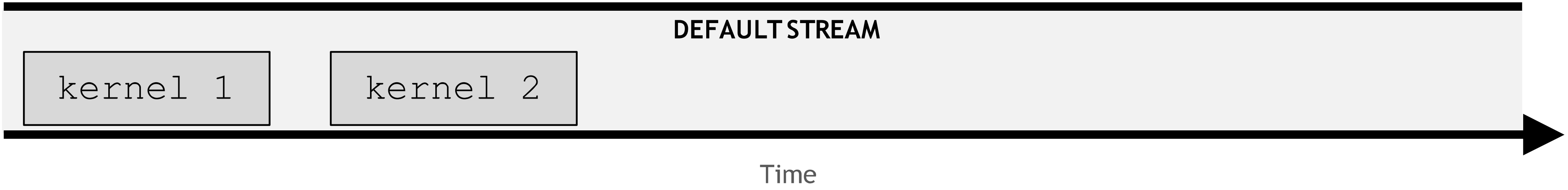
A **stream** is a series of instructions, and CUDA has a **default stream**

DEFAULT STREAM
Time

By default, CUDA kernels run in the **default stream**



In any stream, including the default, an instruction in it (here a kernel launch) must complete before the next can begin



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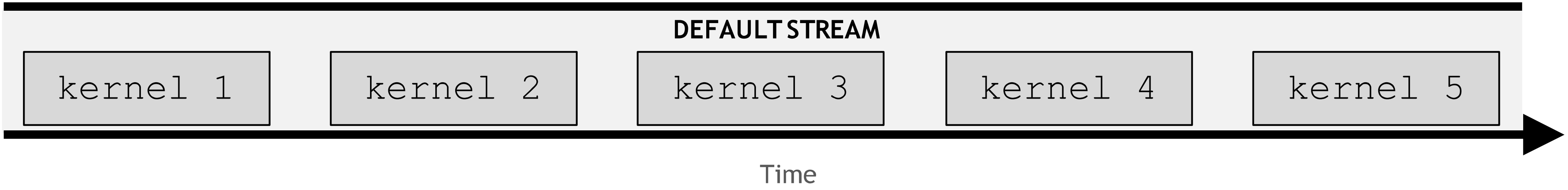
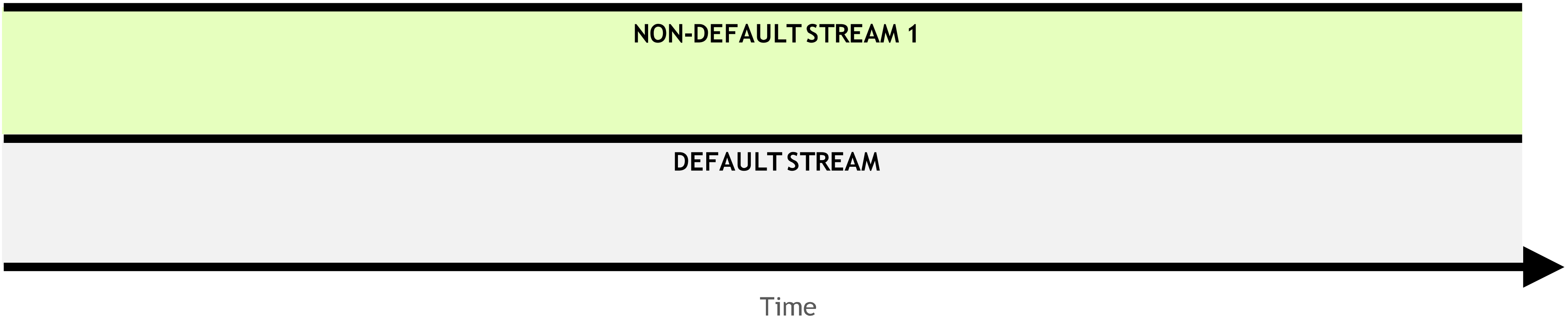


Non-default streams can also be created for kernel execution



NON-DEFAULT STREAM 1

DEFAULT STREAM

Time

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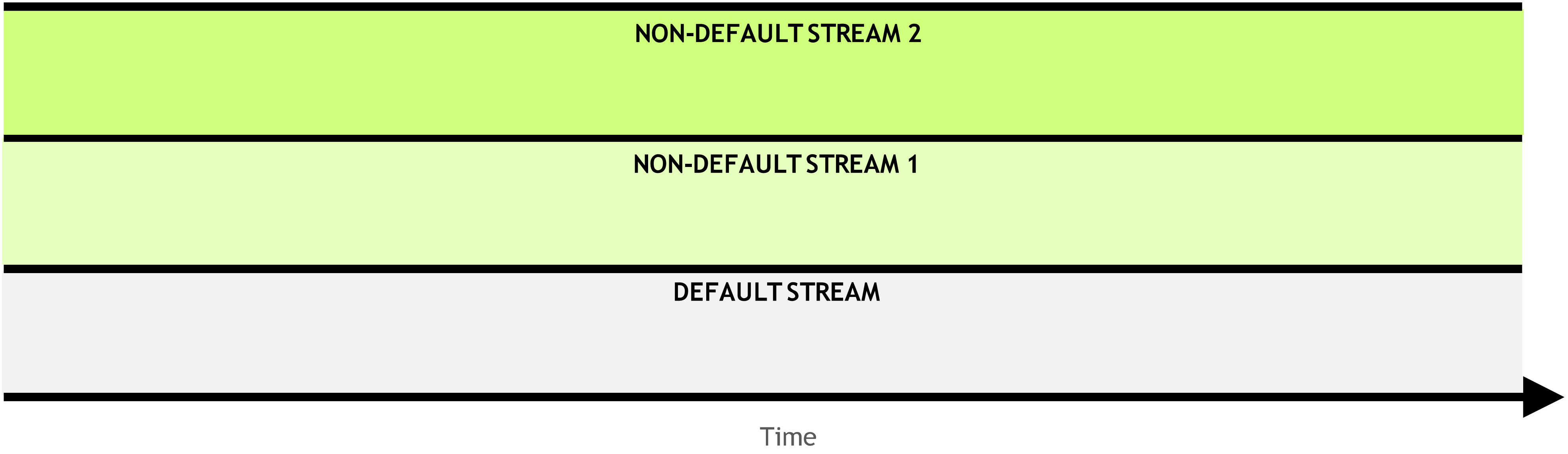
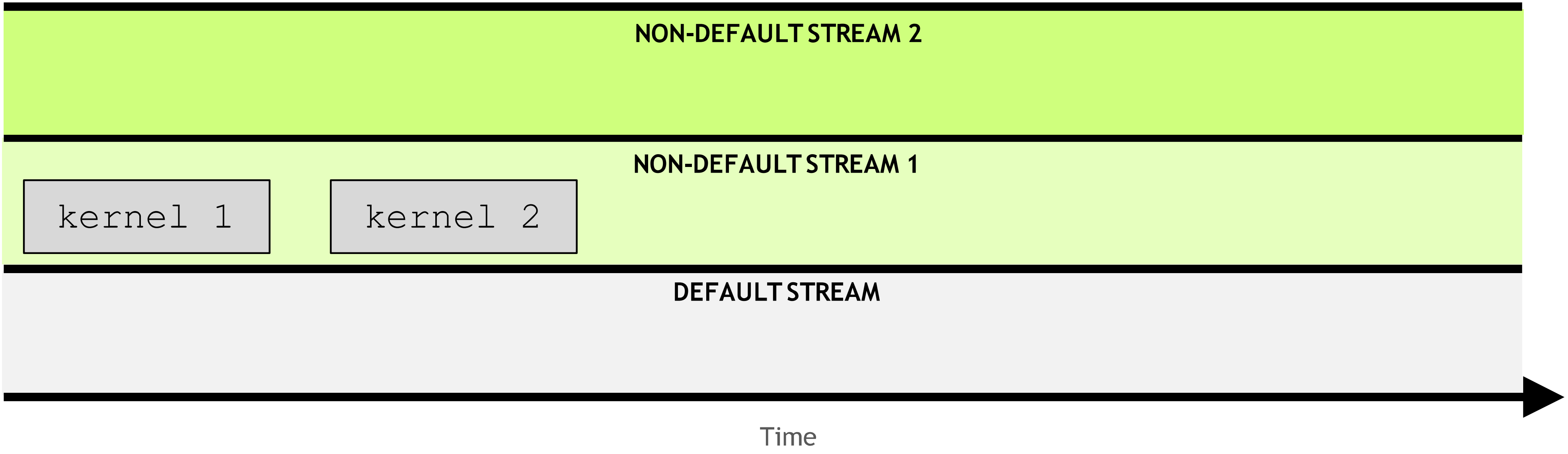
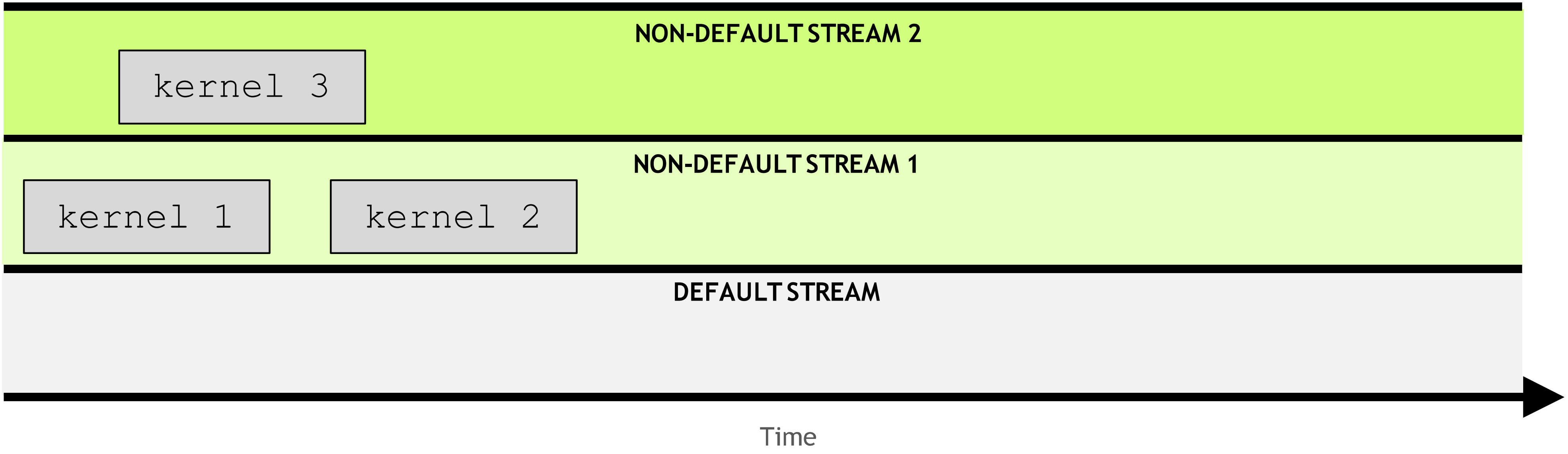


Kernels within any single stream must execute in order



However, kernels in **different, non-default streams**, can interact concurrently



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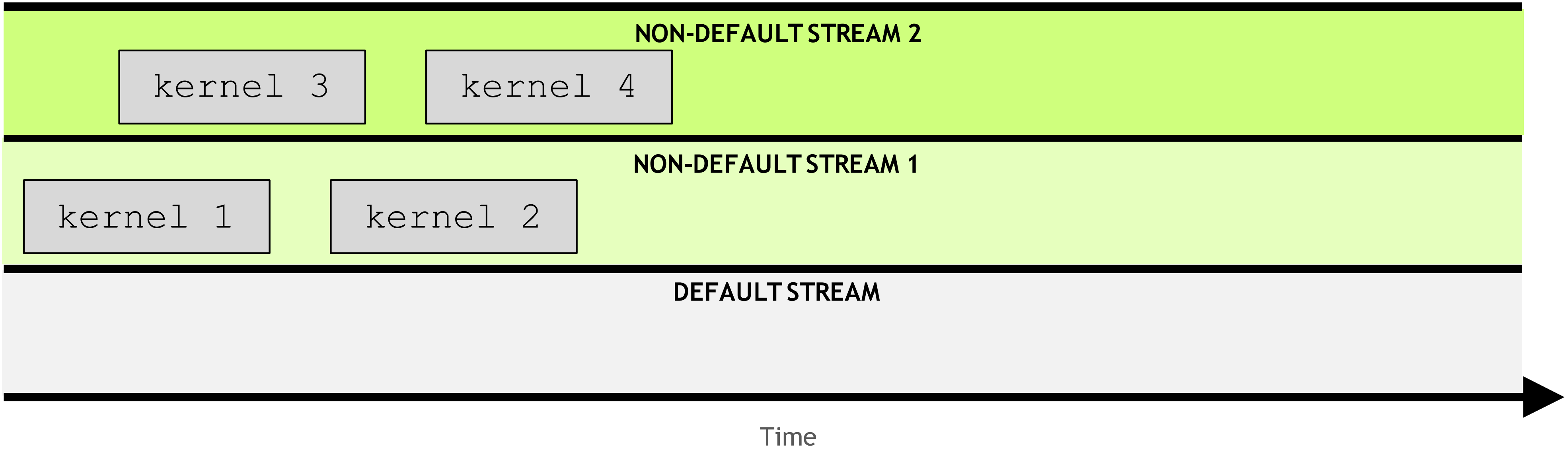

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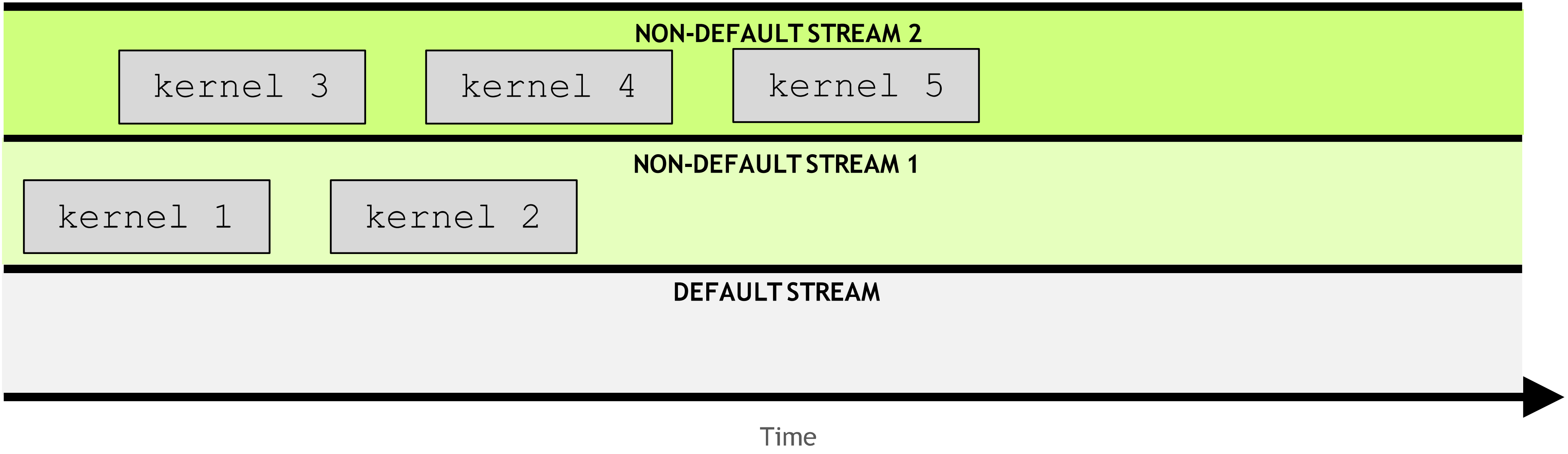

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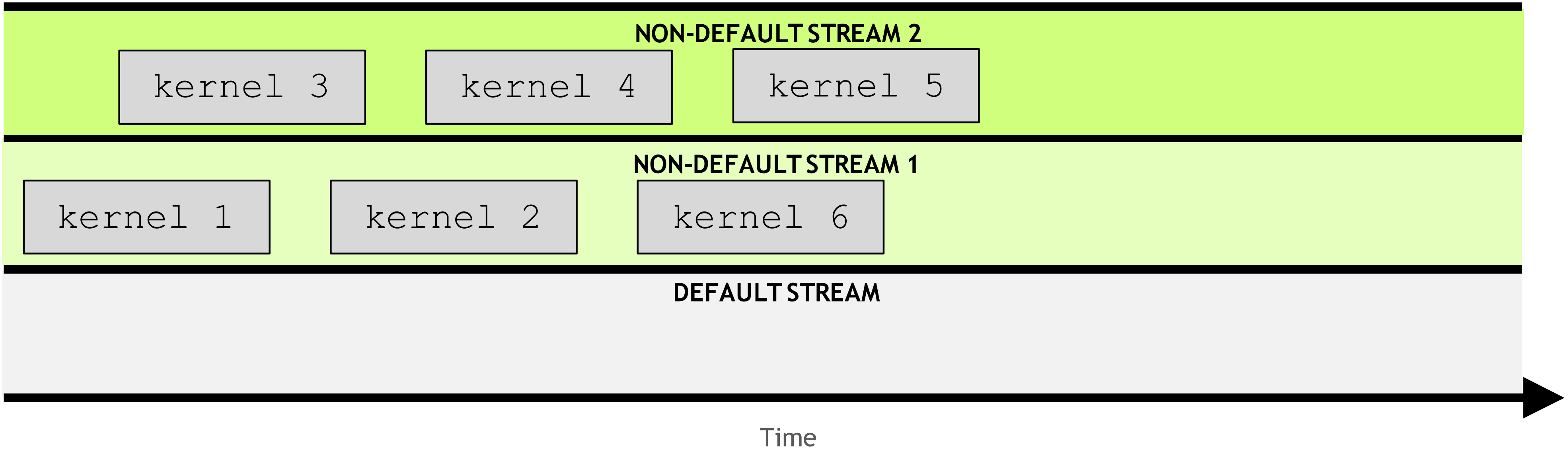
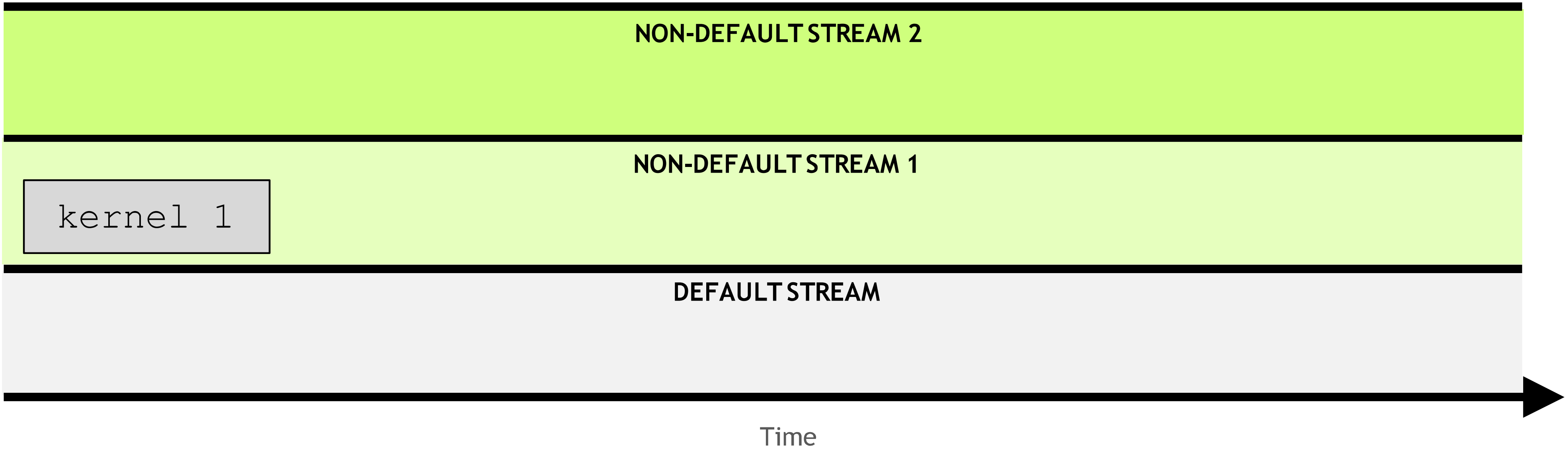


The default stream is special: **it blocks all kernels in all other streams**



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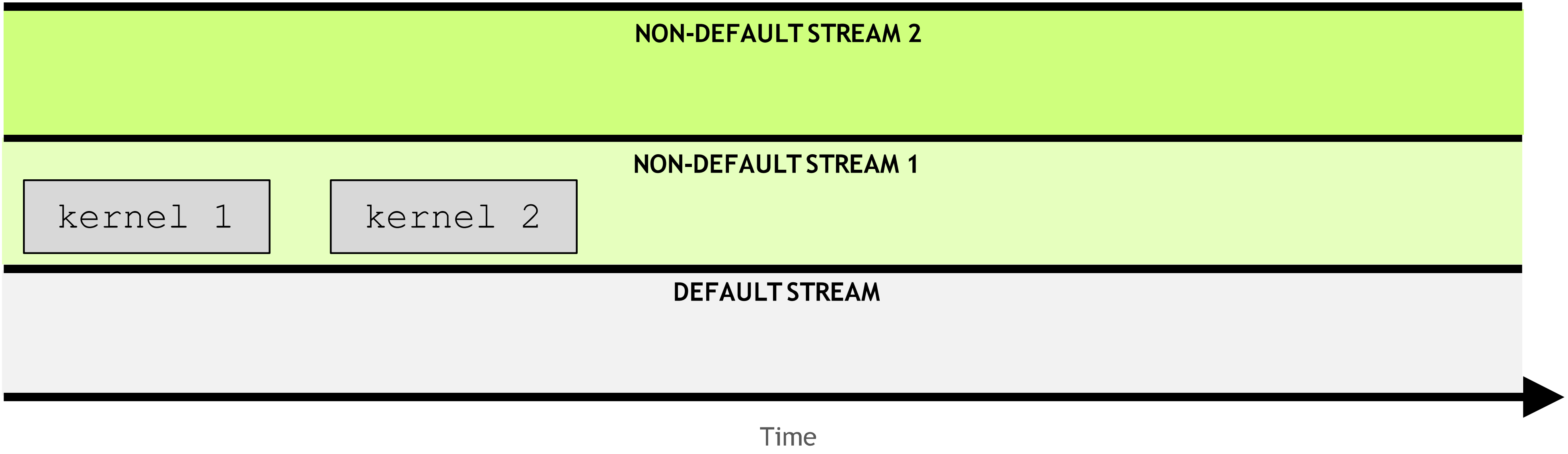

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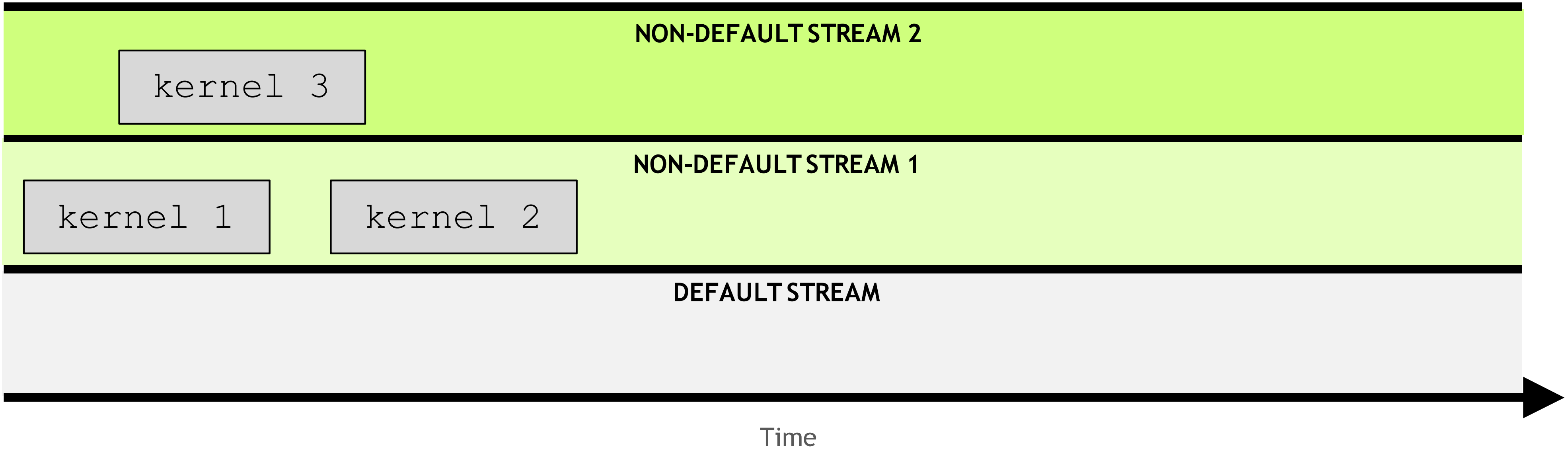

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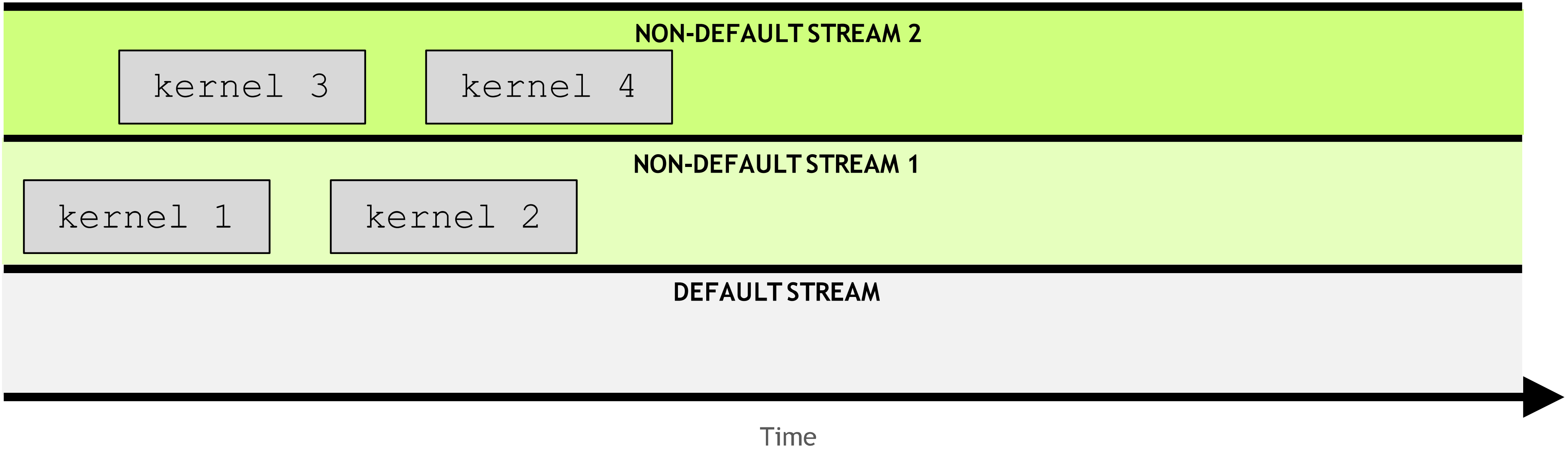

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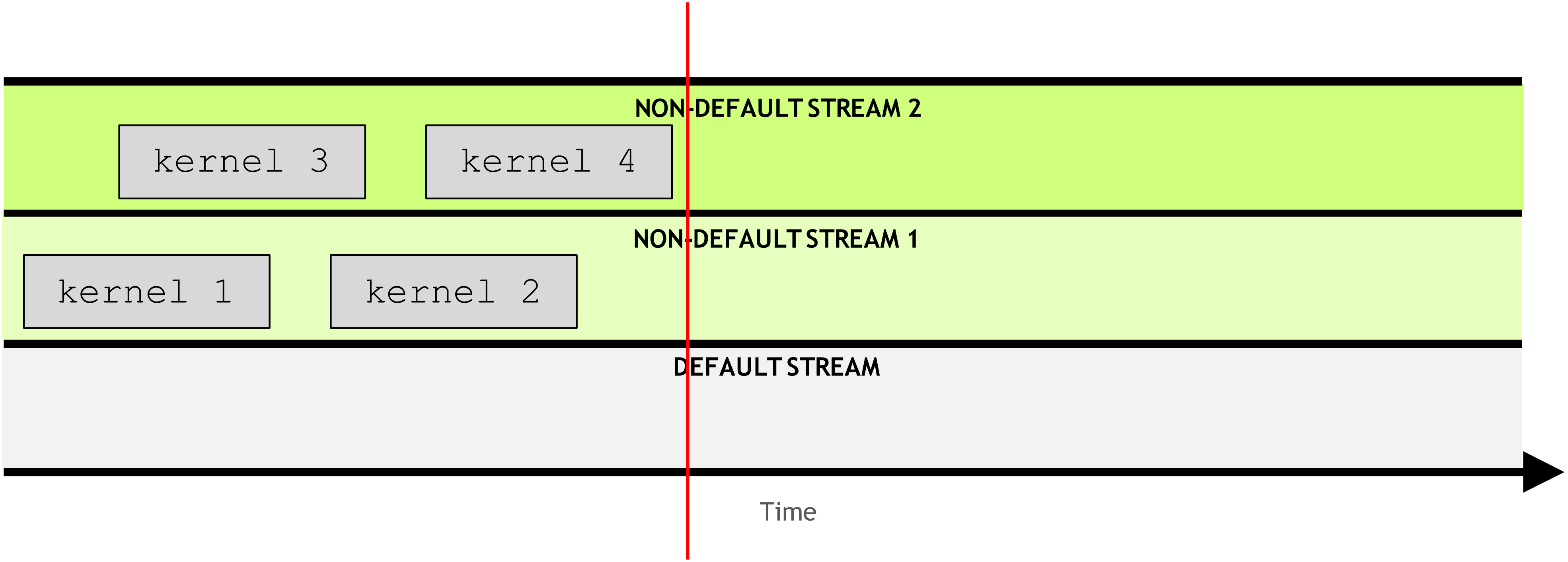

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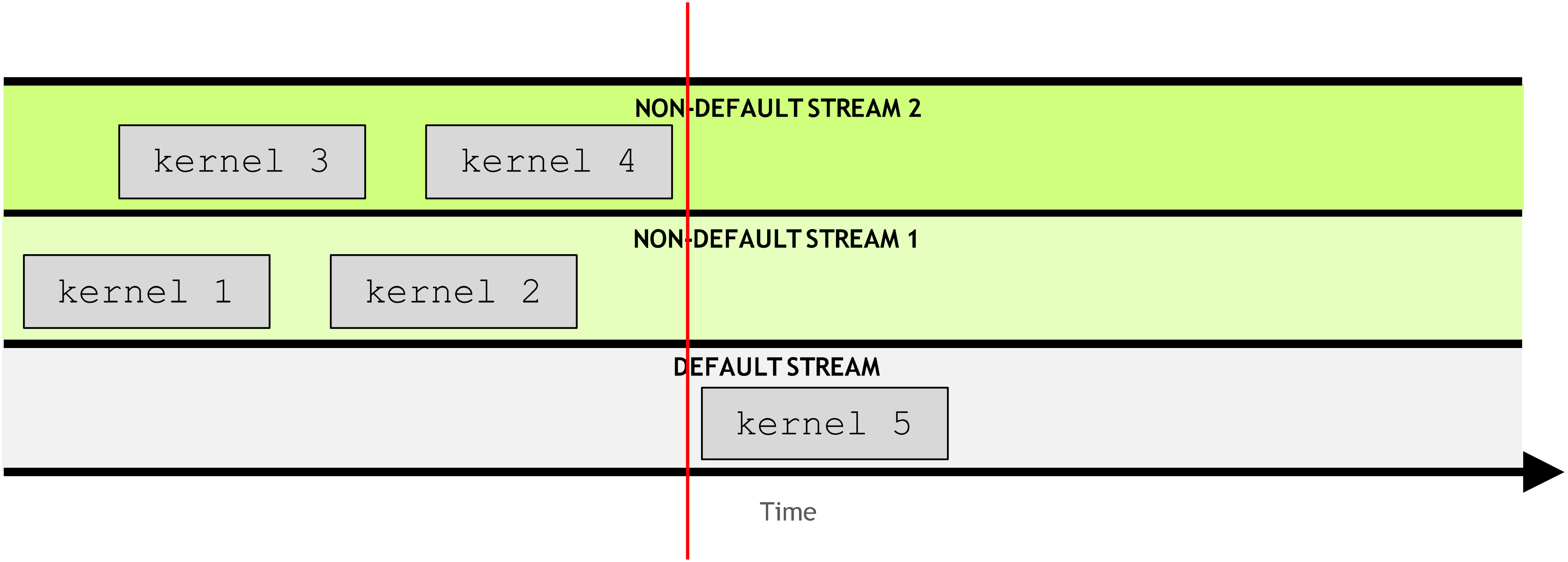

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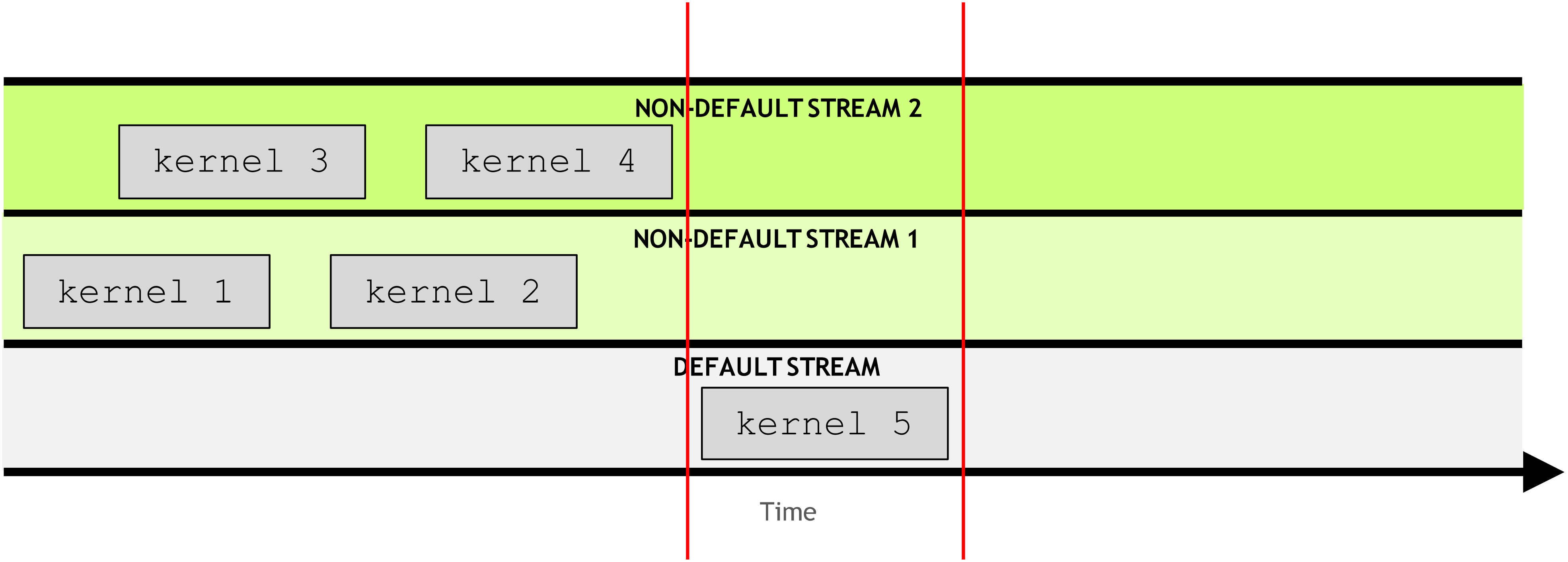

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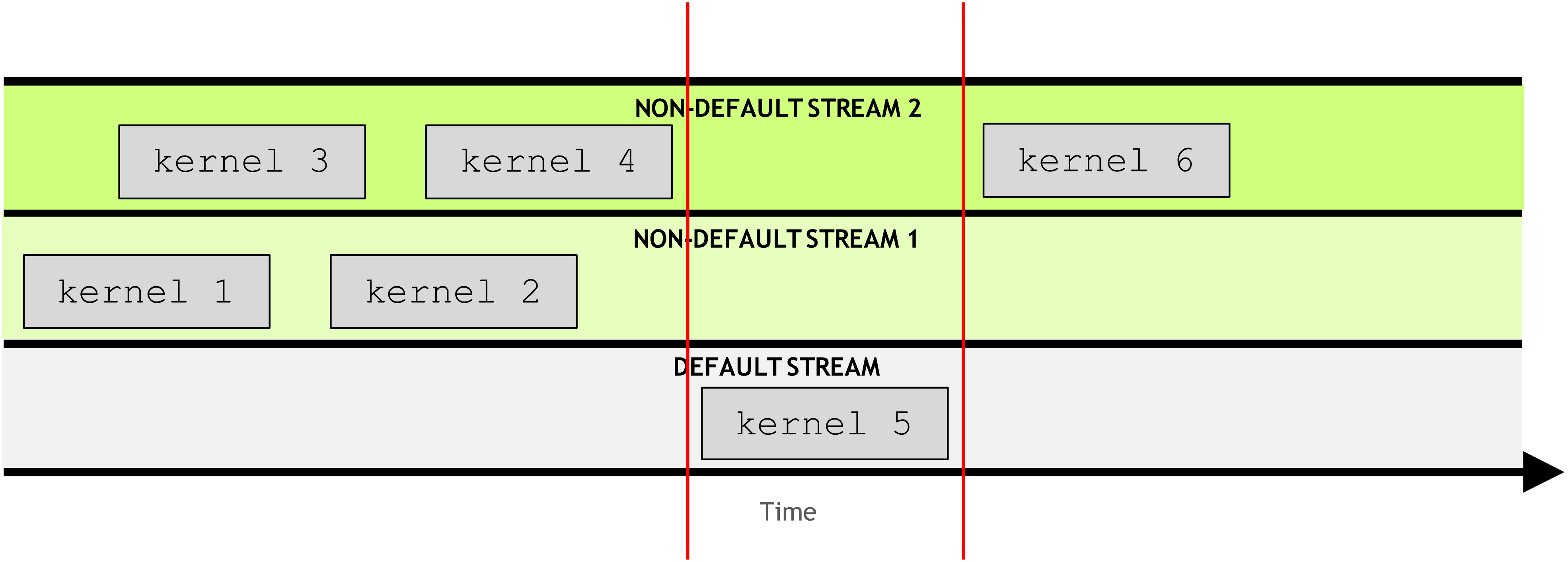

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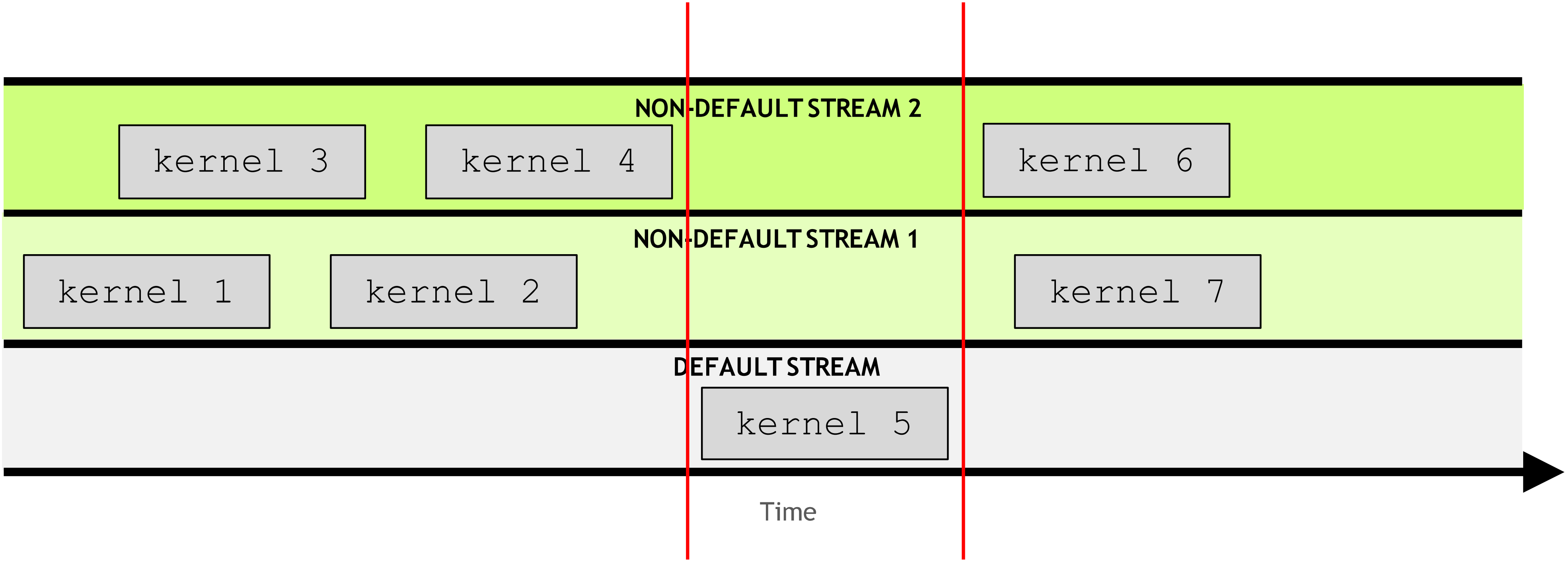

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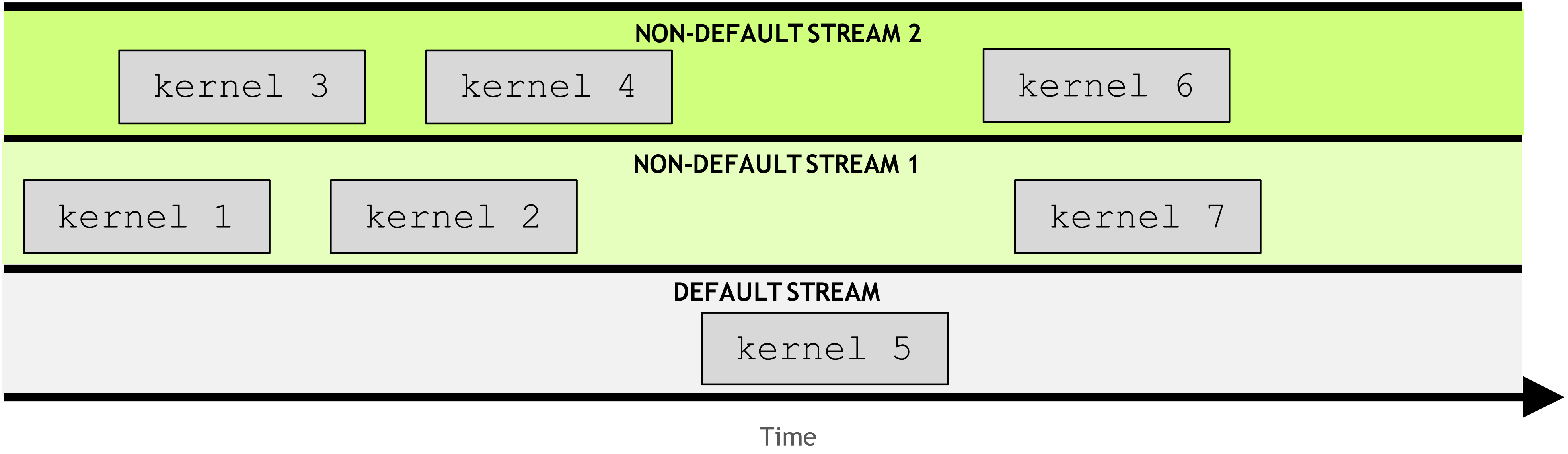
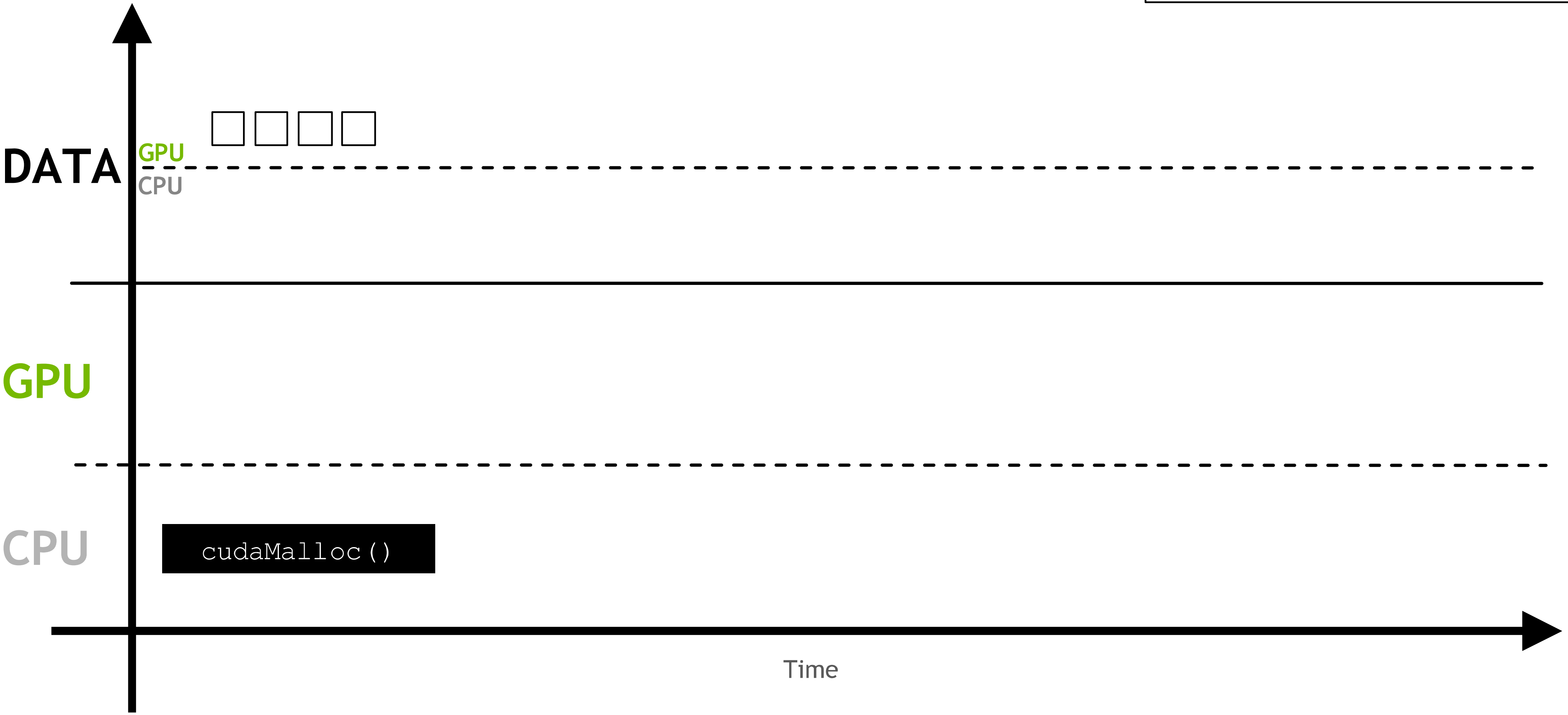
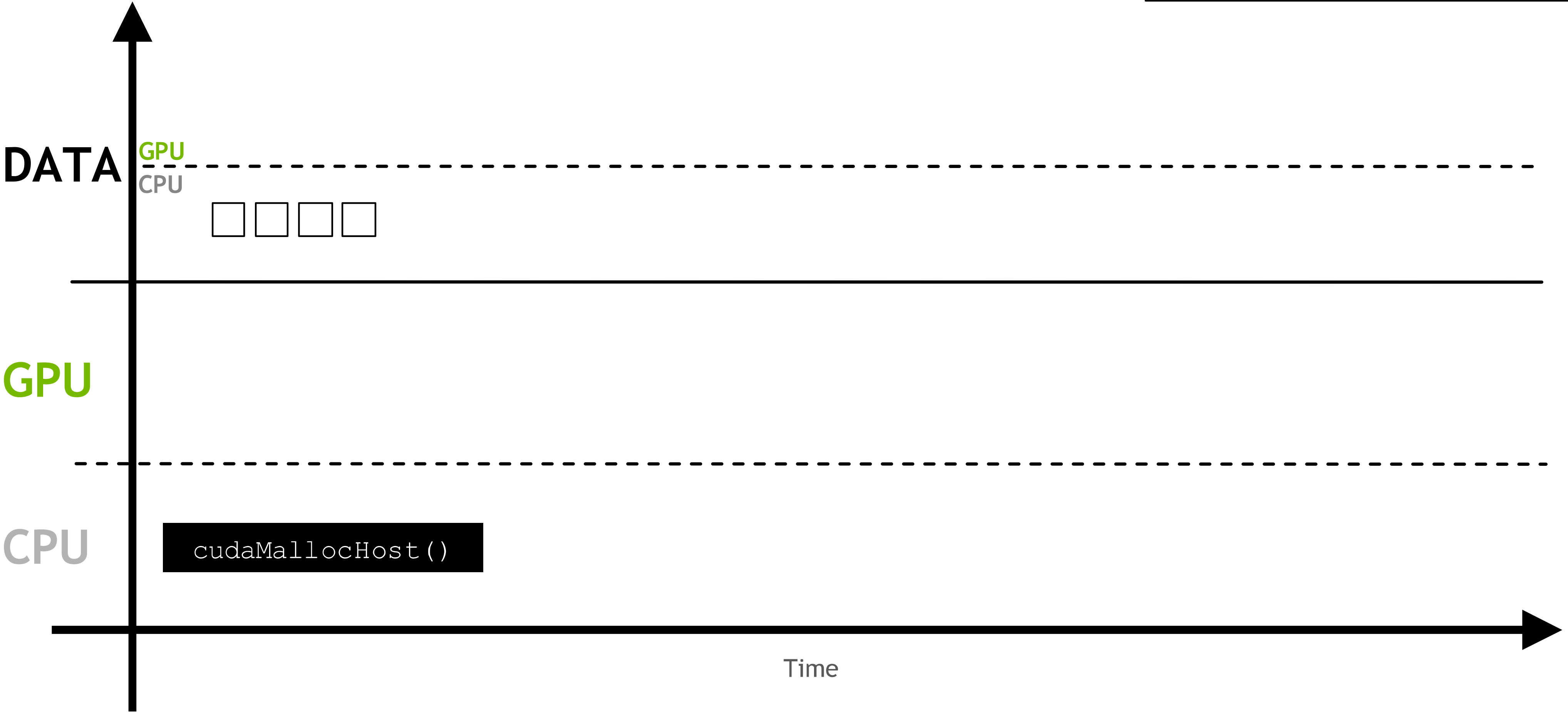


Non-Unified Memory

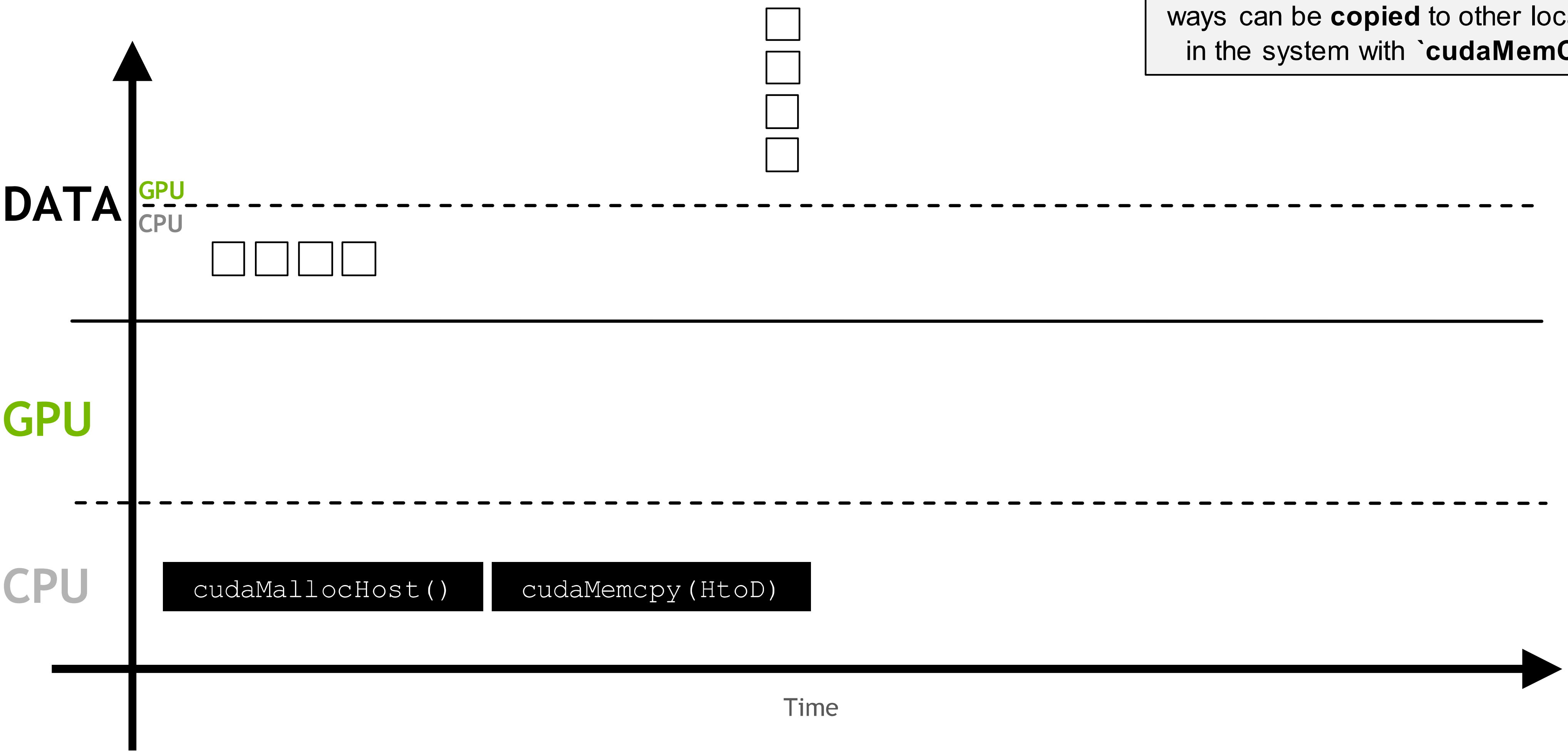
Memory can be allocated directly to the GPU with `**cudaMalloc**`



Memory can be allocated directly to the host with **`cudaMallocHost`**



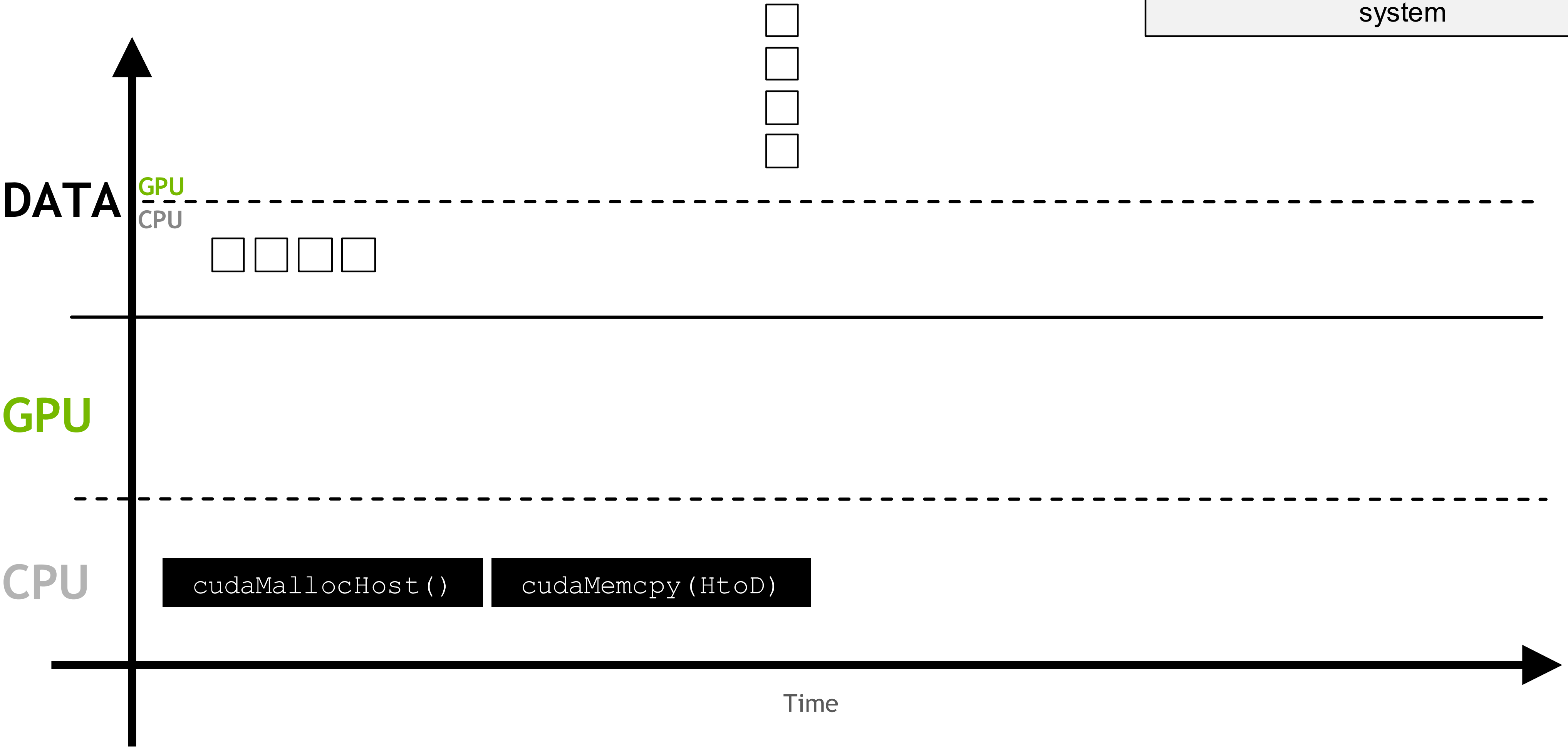
Memory allocated in either of these ways can be **copied** to other locations in the system with **`cudaMemCpy`**



cudaMallocHost()

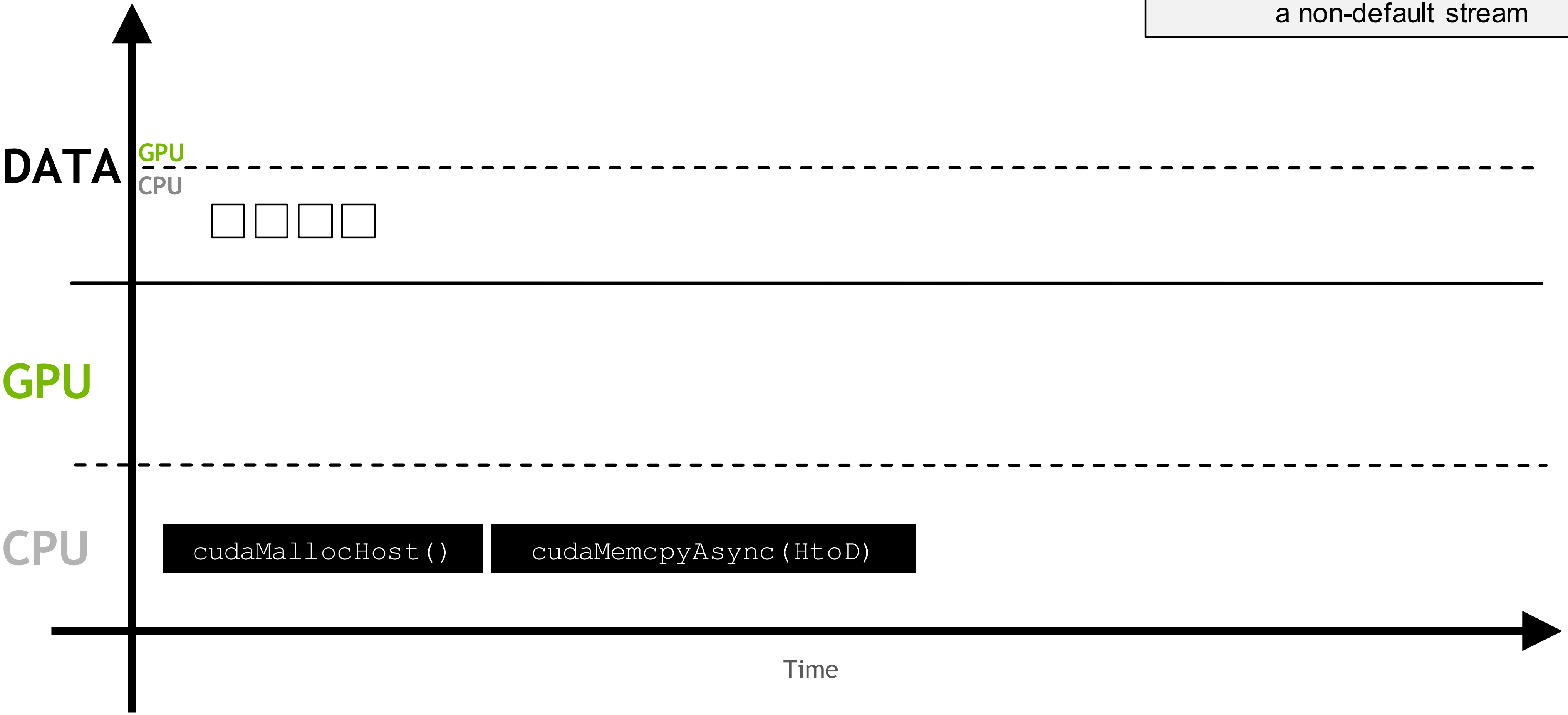
cudaMemcpy(HtoD)

Copying leaves 2 copies in of in the system

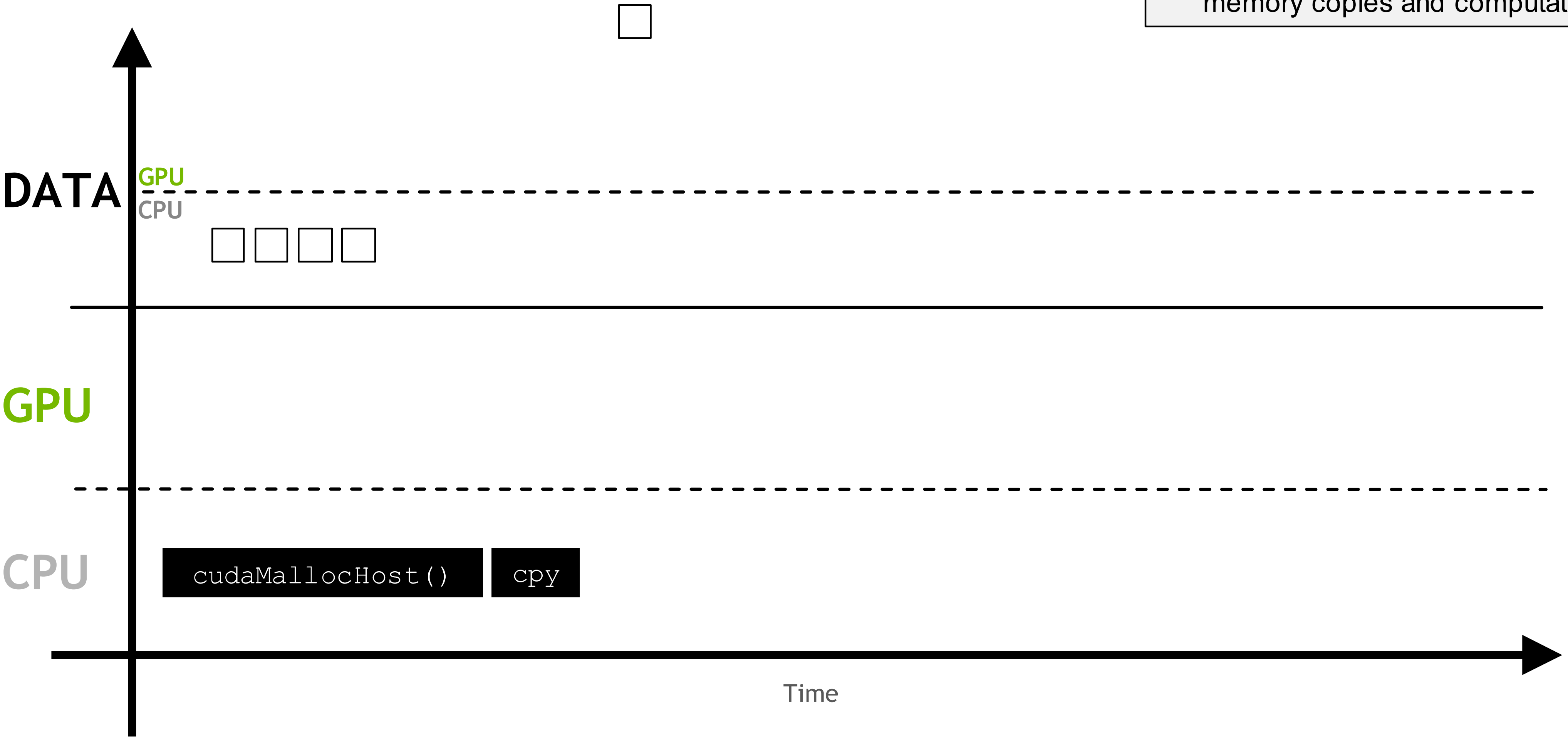


cudaMemcpyAsync

`cudaMemcpyAsync` can asynchronously transfer memory over a non-default stream



This can allow the **overlapping** memory copies and computation



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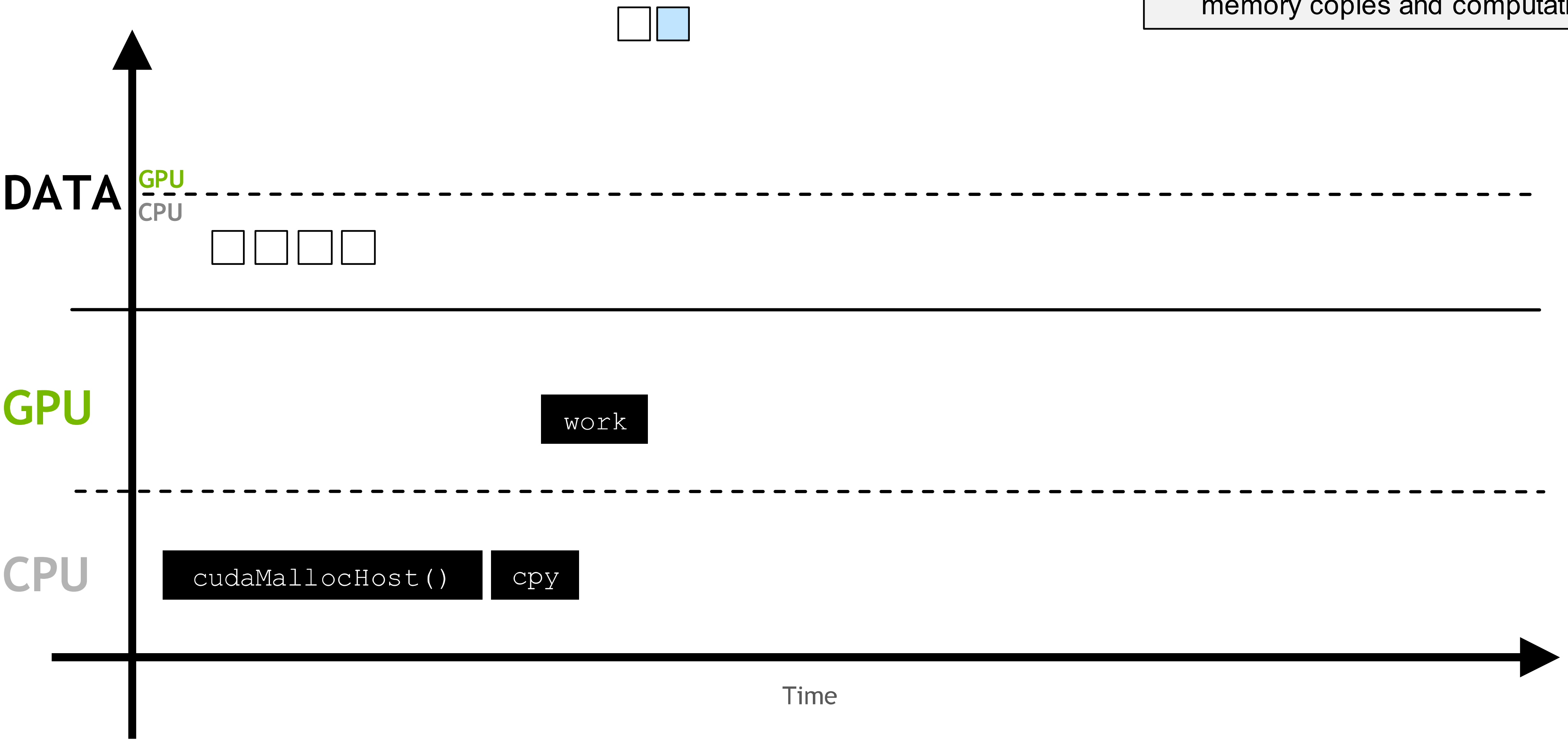

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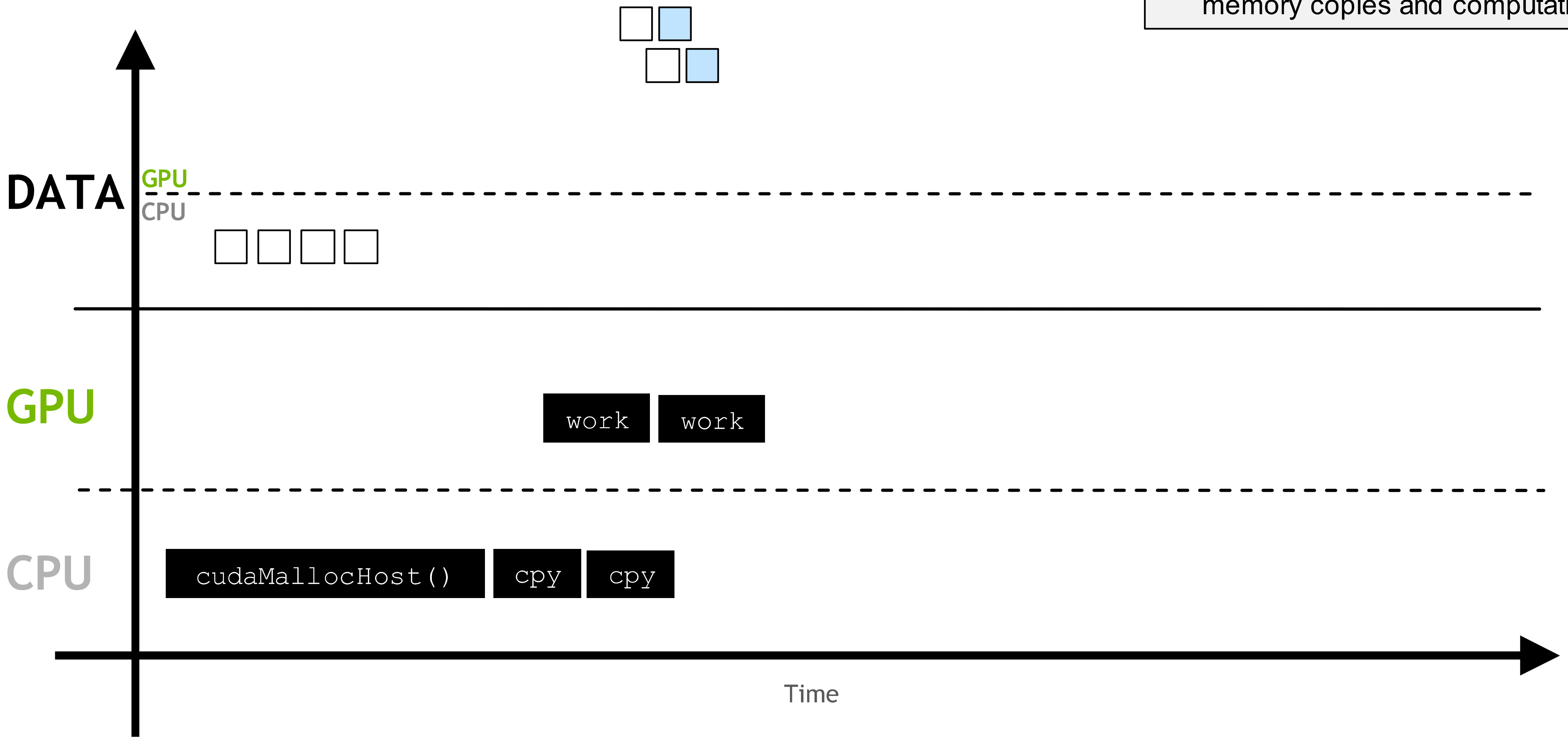

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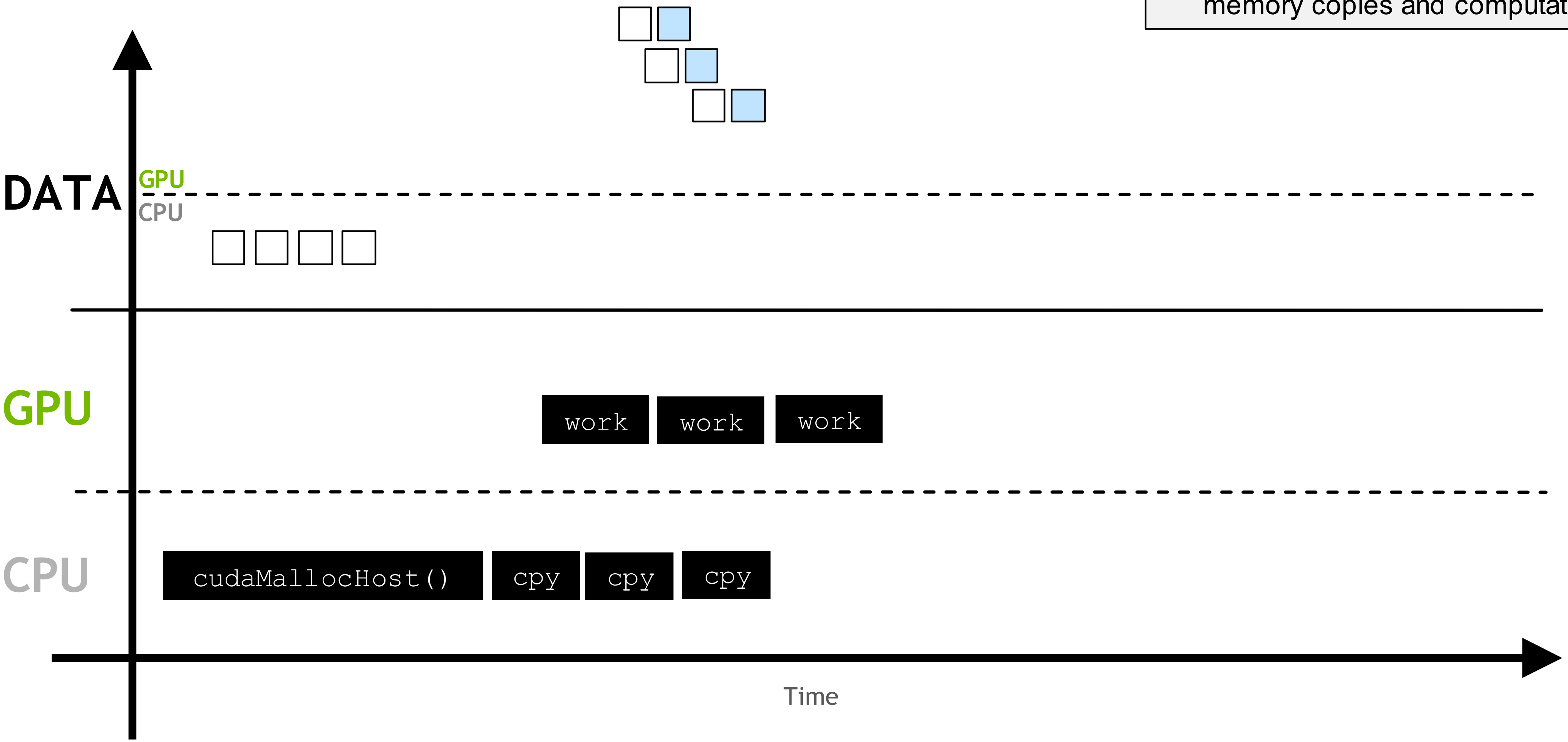

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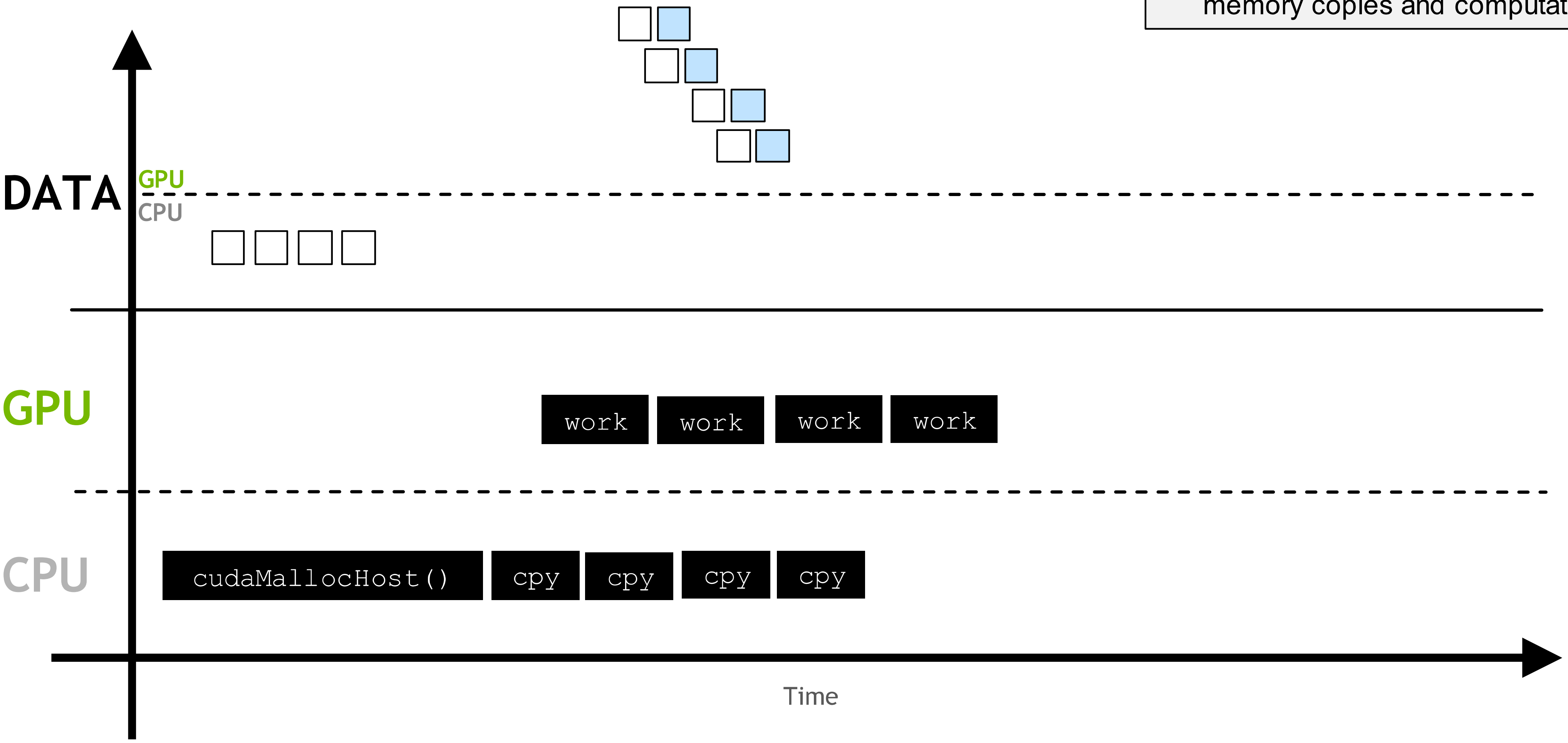

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