

Concurrent CUDA Streams

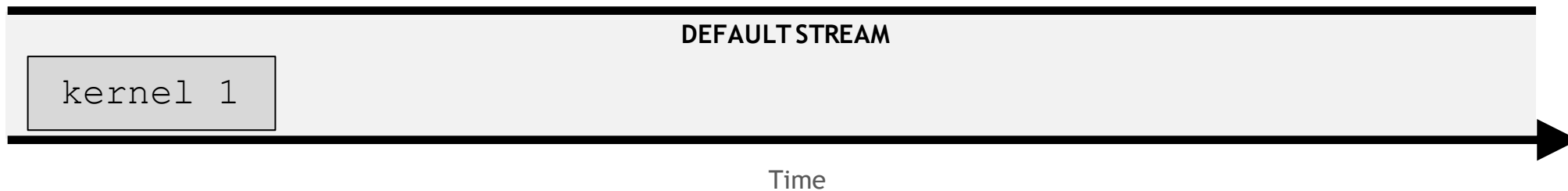
A **stream** is a series of instructions,
and CUDA has a **default stream**



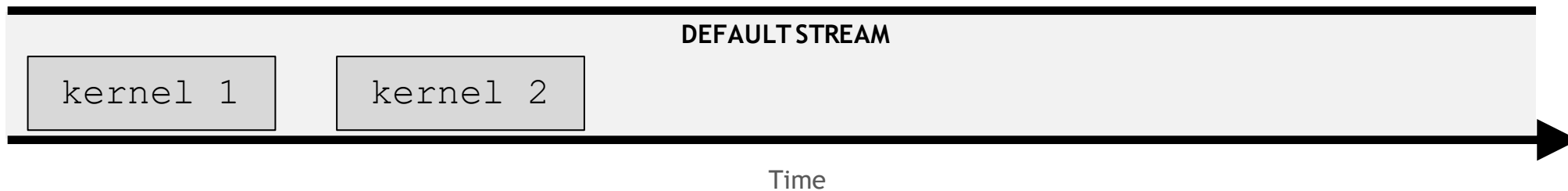
DEFAULT STREAM

Time

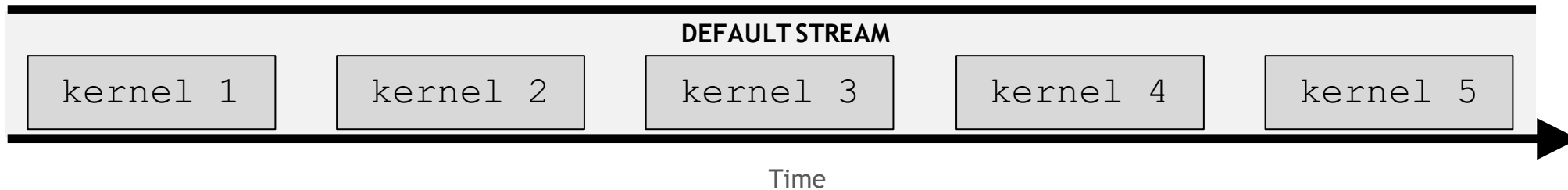
By default, CUDA kernels run in the
default stream



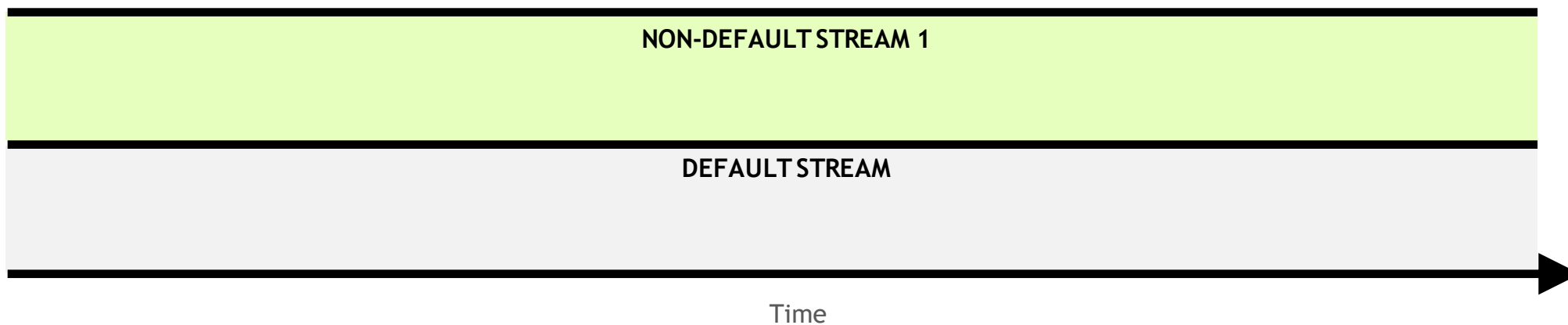
In any stream, including the default, an instruction in it (here a kernel launch) must complete before the next can begin



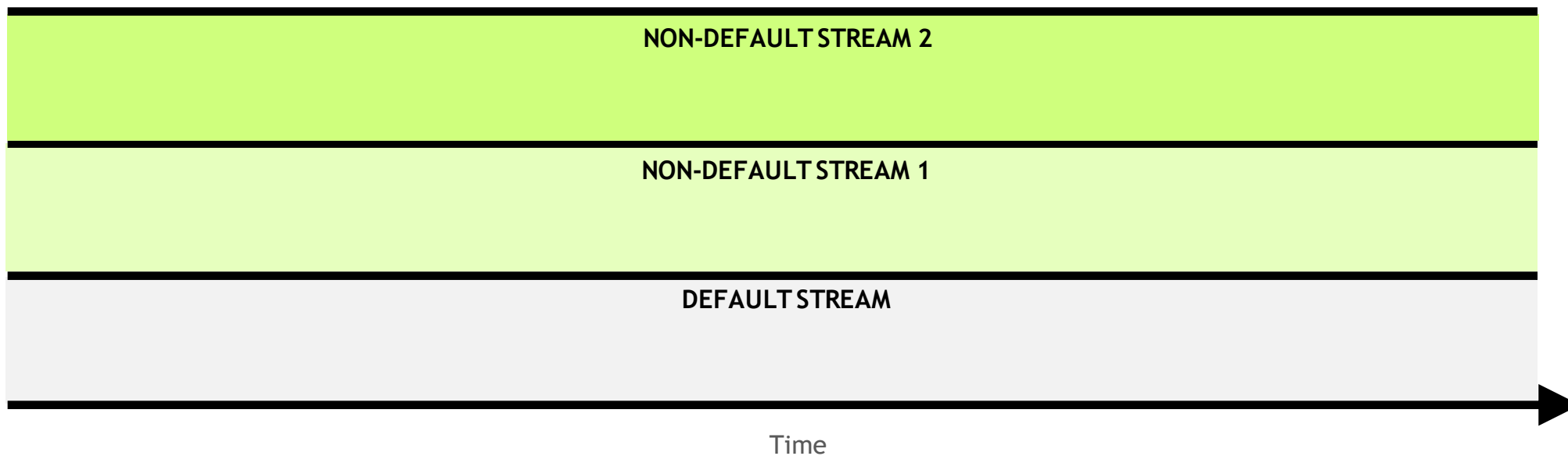
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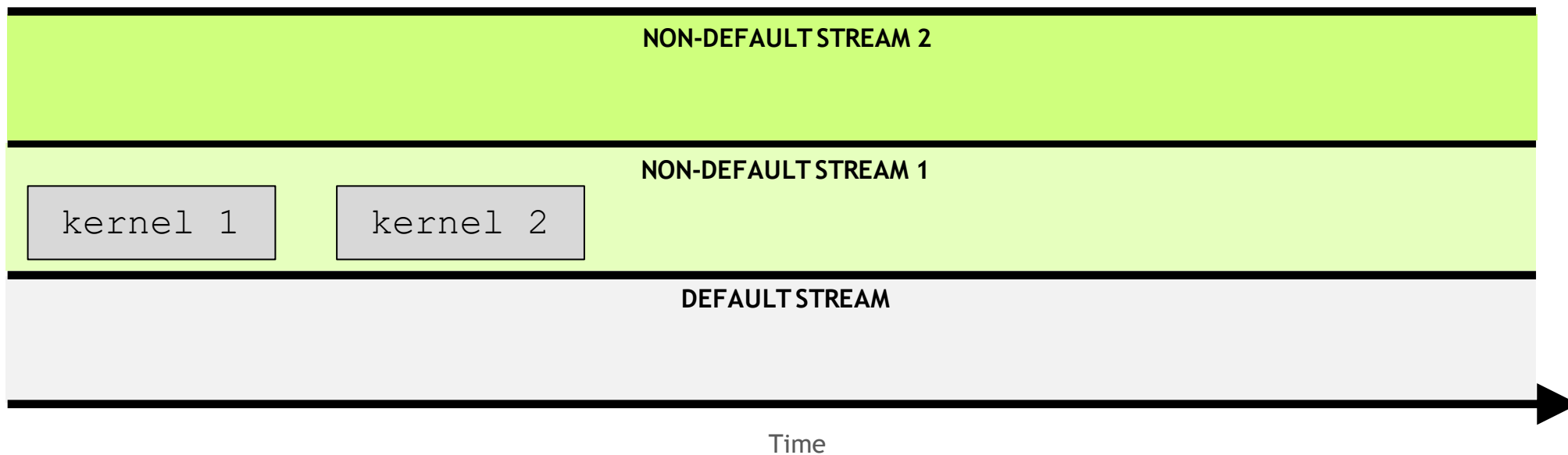
Non-default streams can also be created for kernel execution



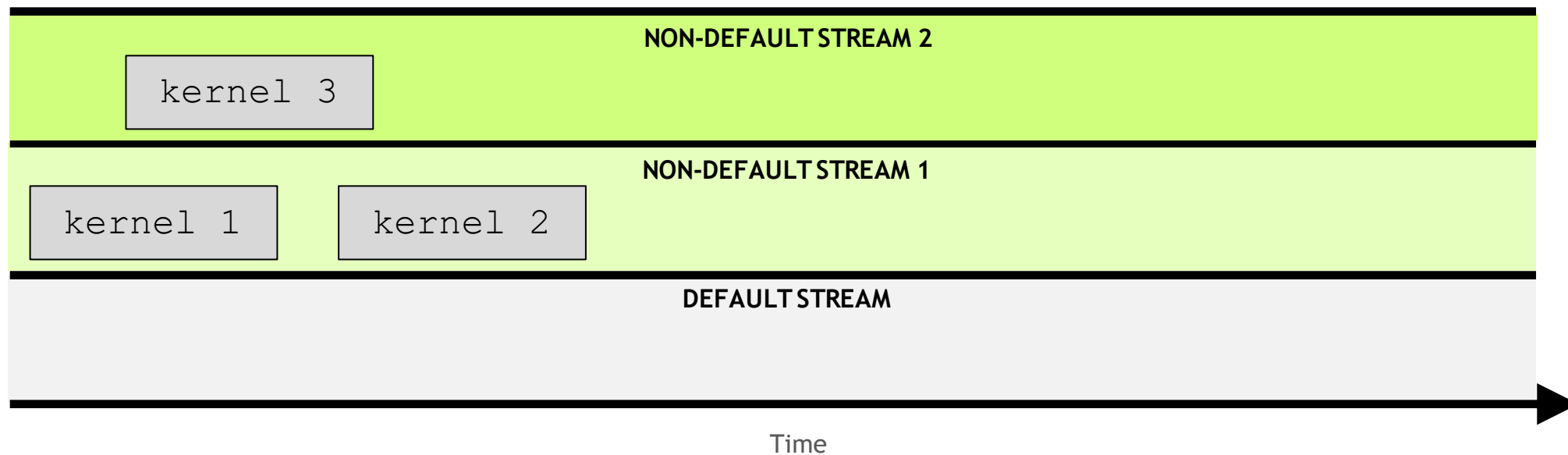
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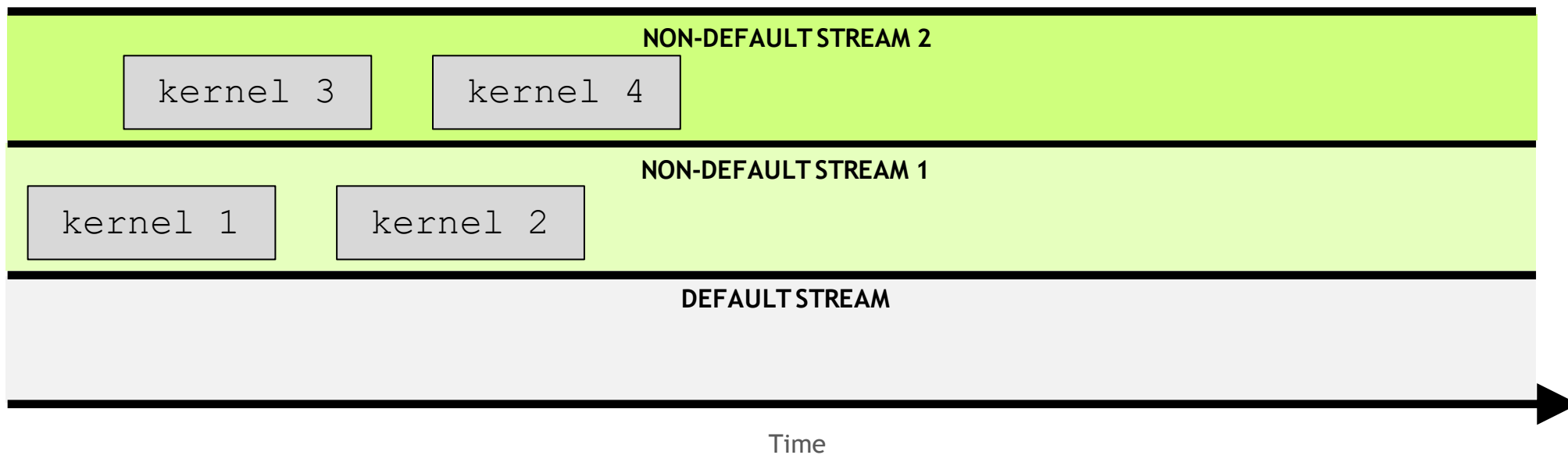
Kernels within any single stream must execute in order



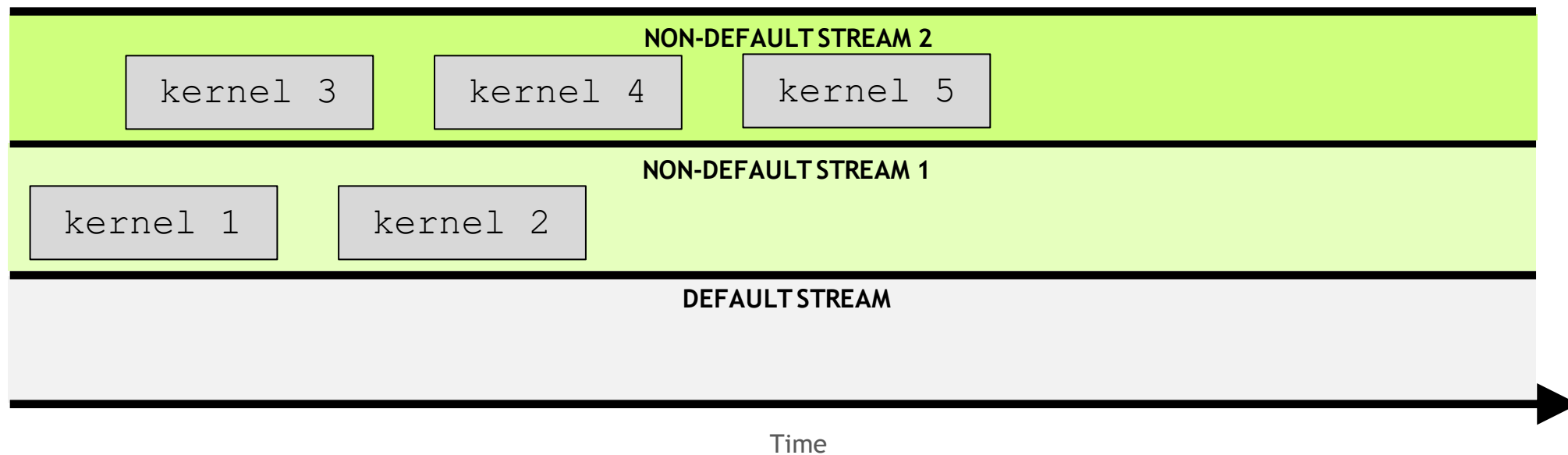
However, kernels in **different, non-default streams**, can interact concurrently



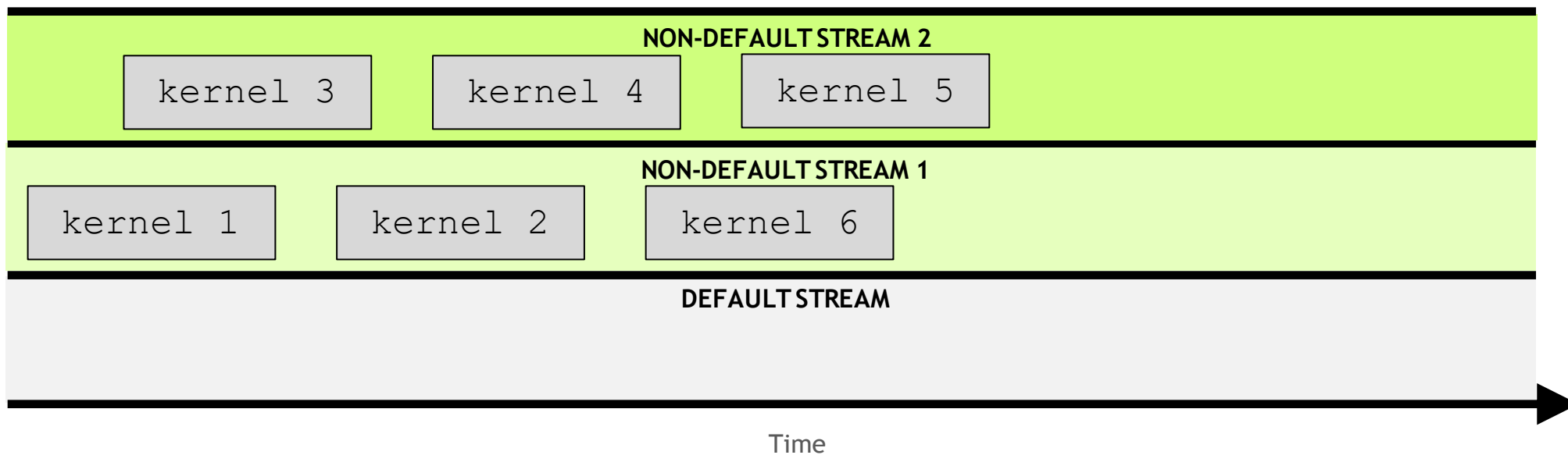
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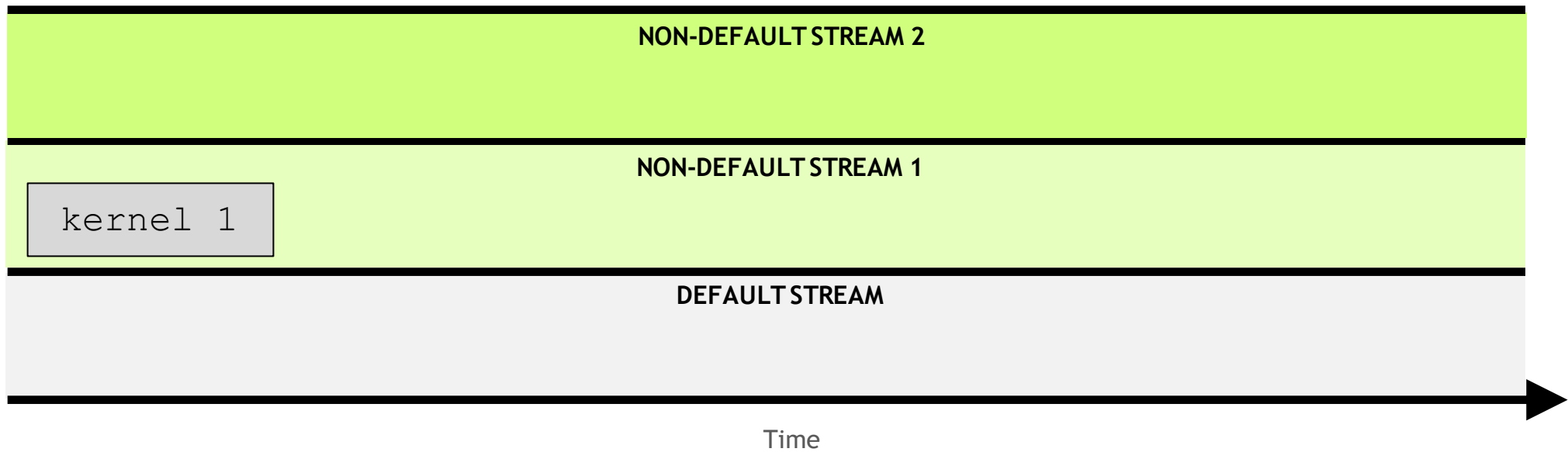
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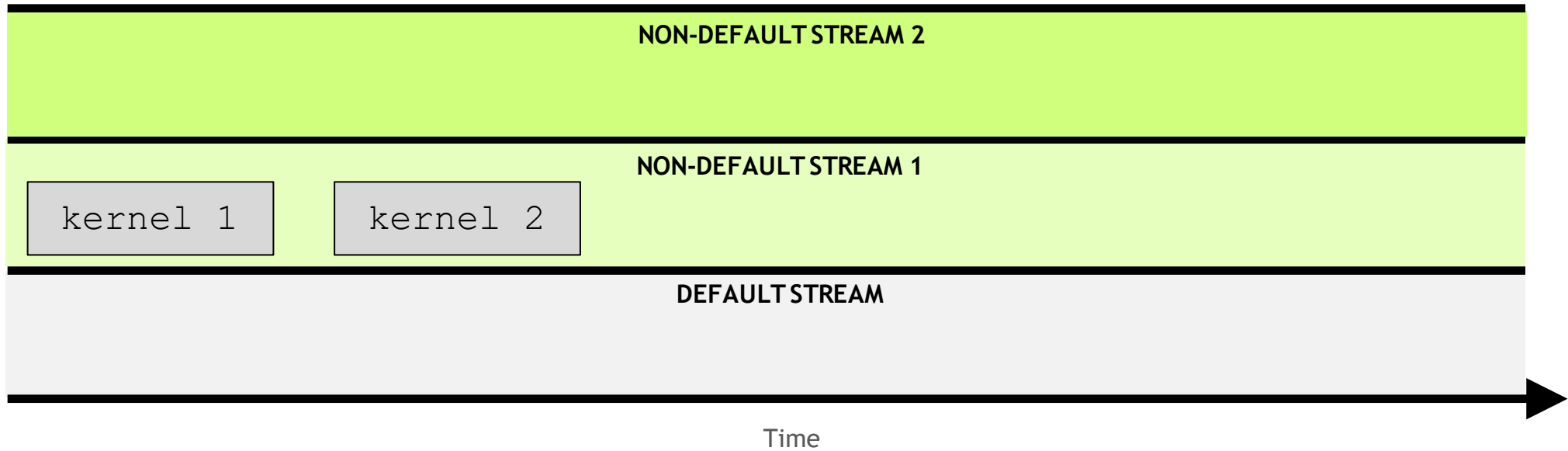
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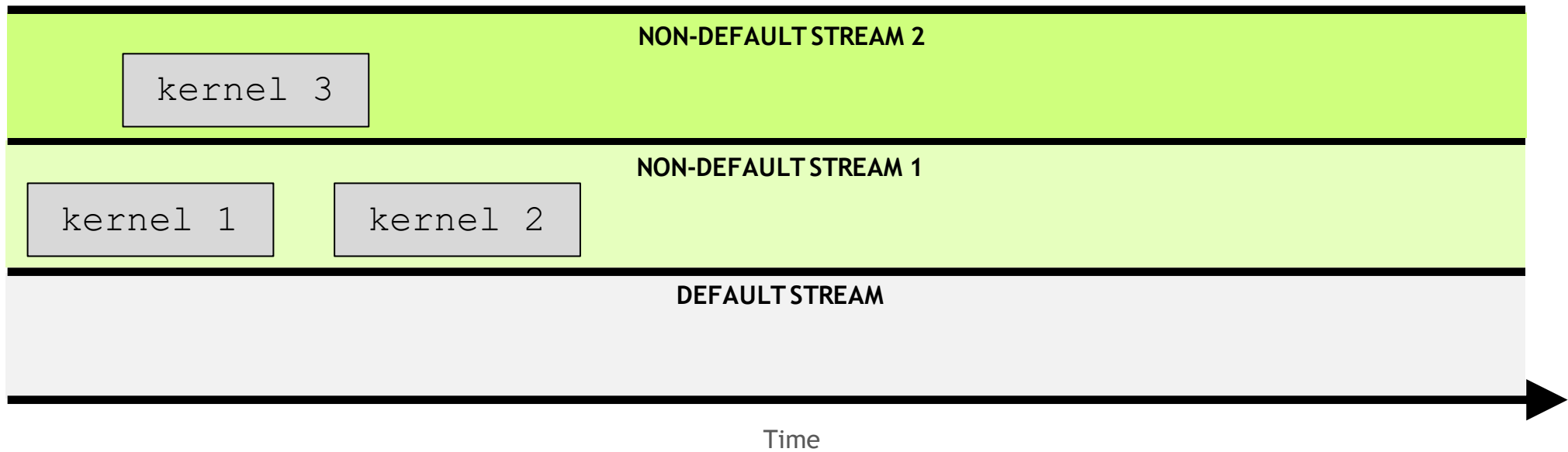
The default stream is special: **it blocks all kernels in all other streams**



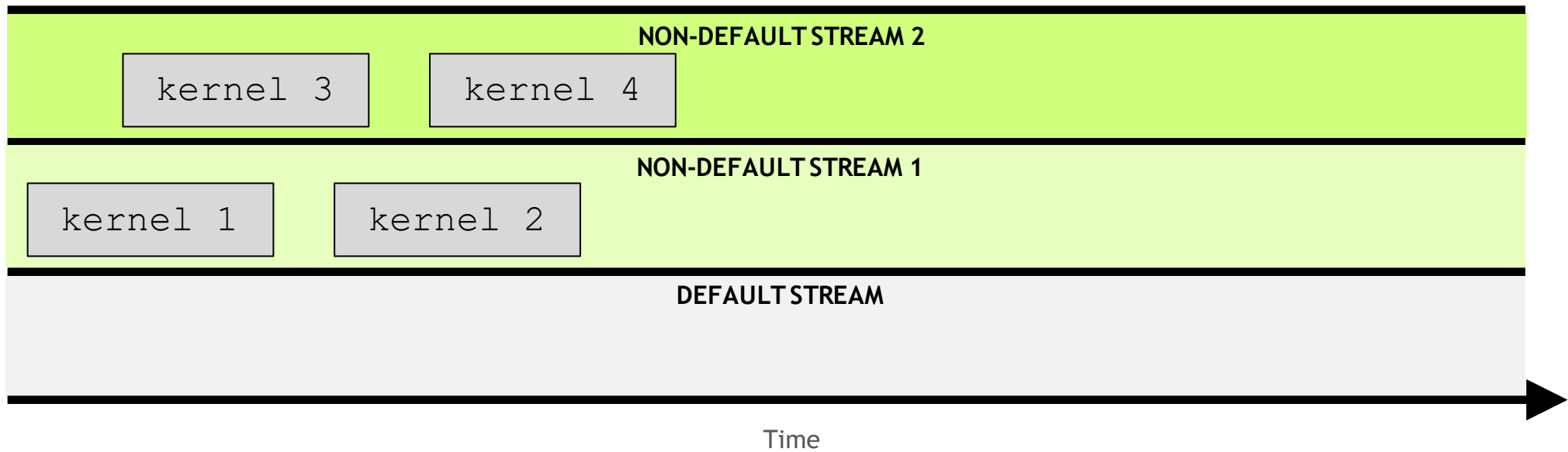
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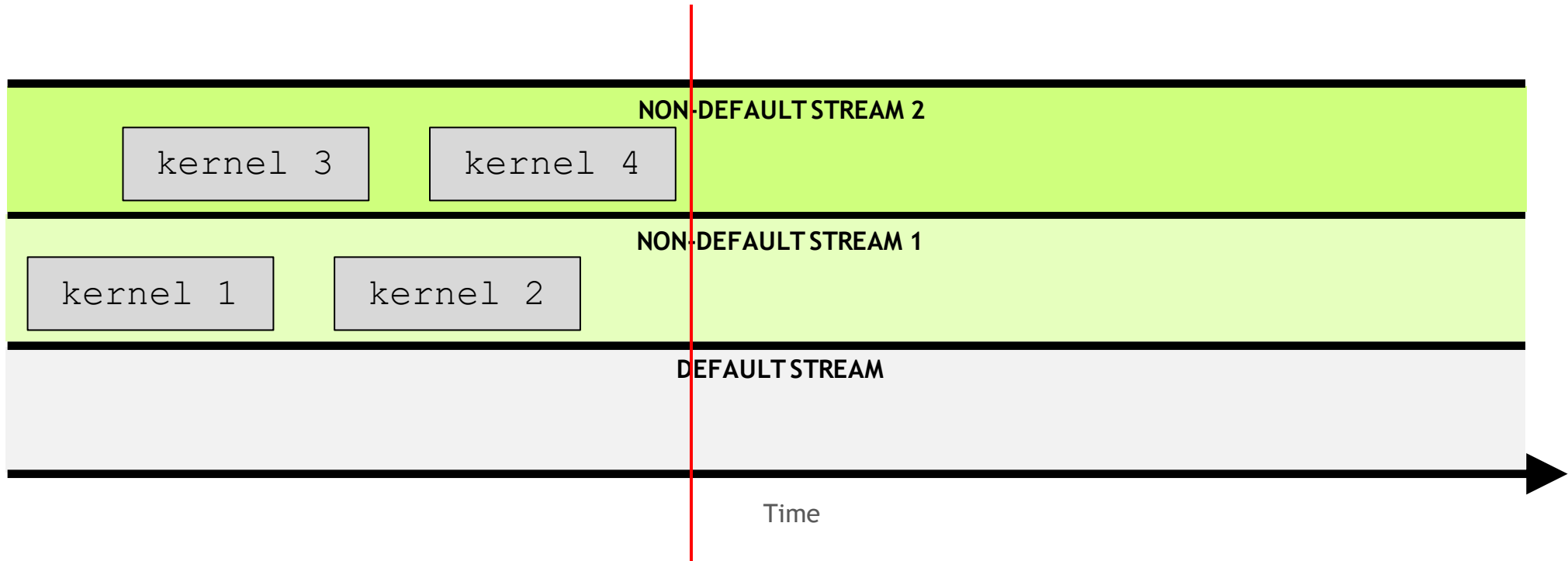
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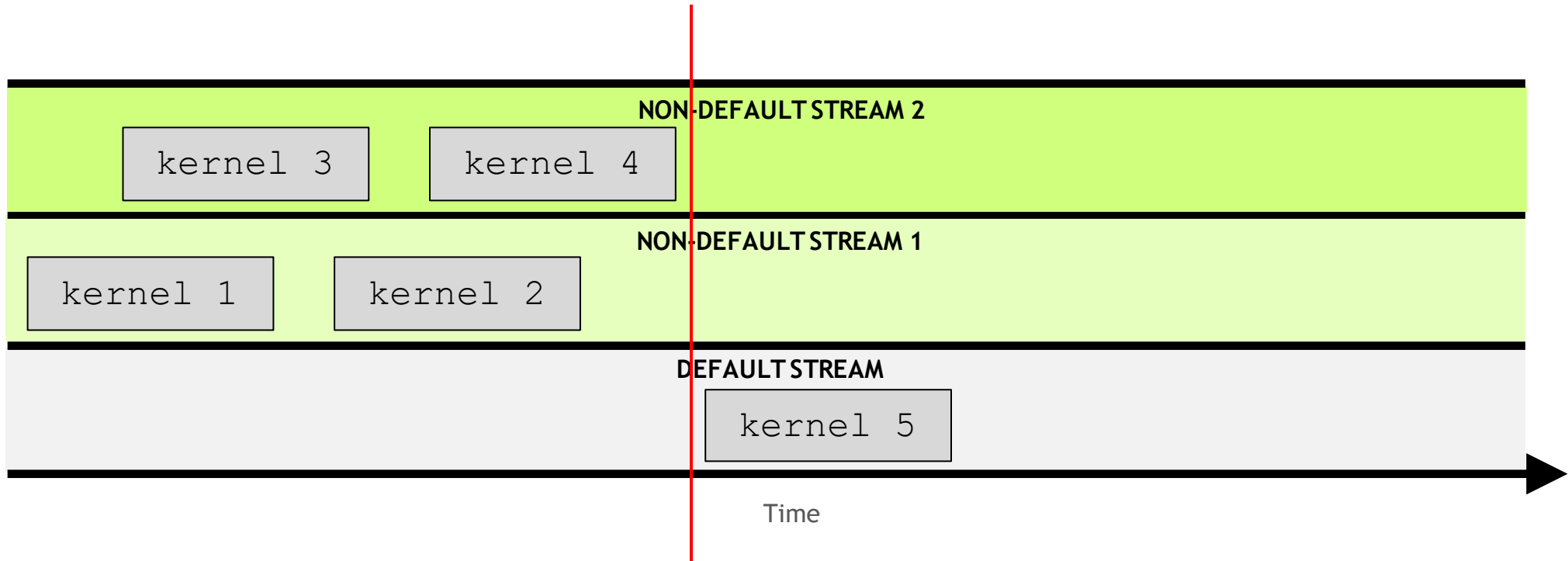
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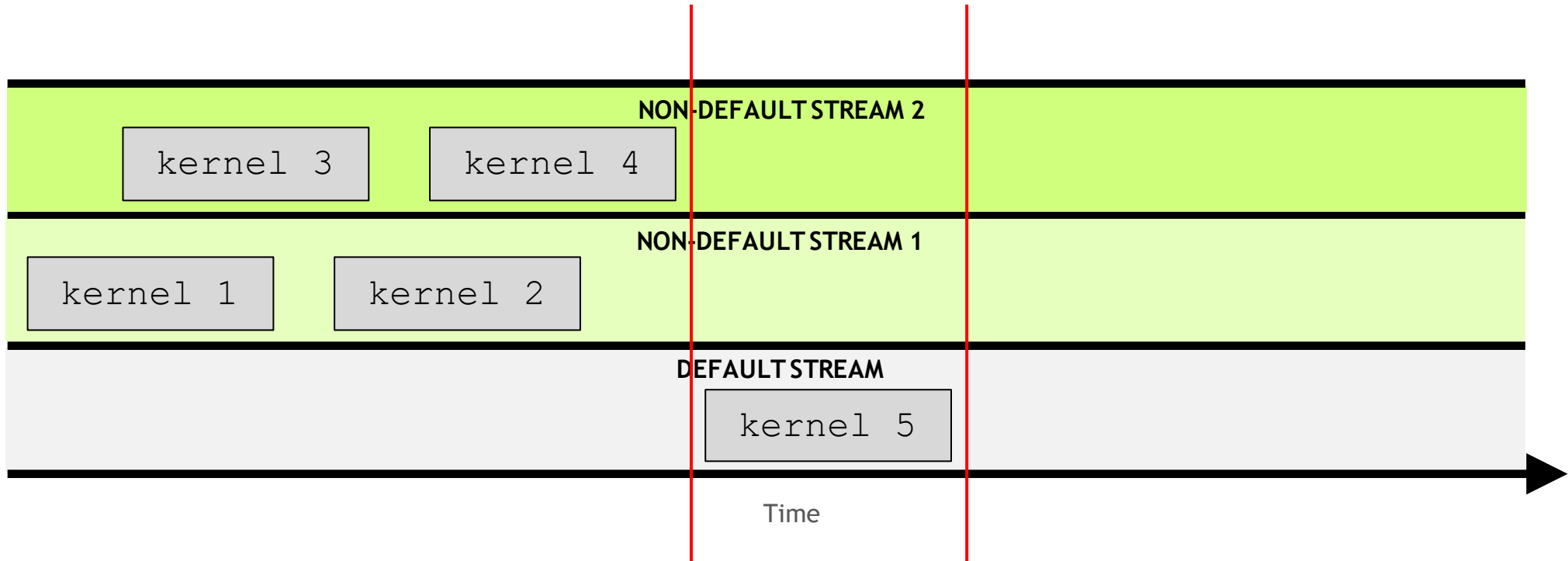
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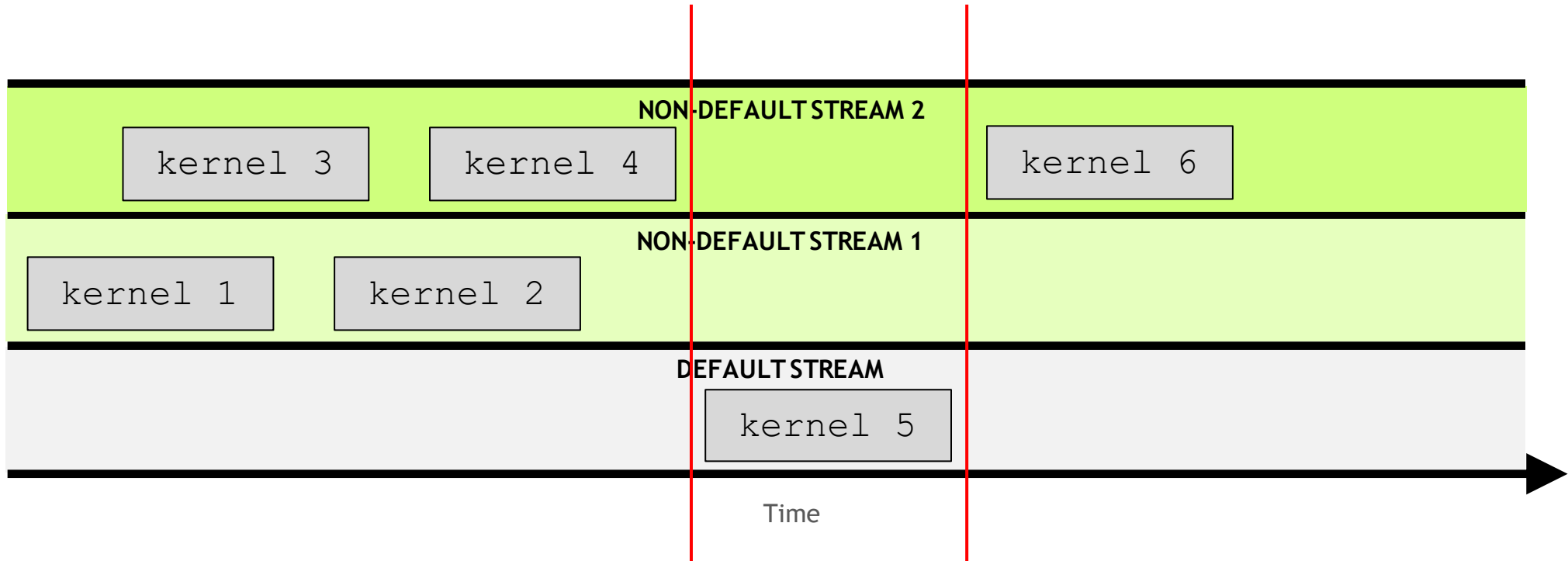
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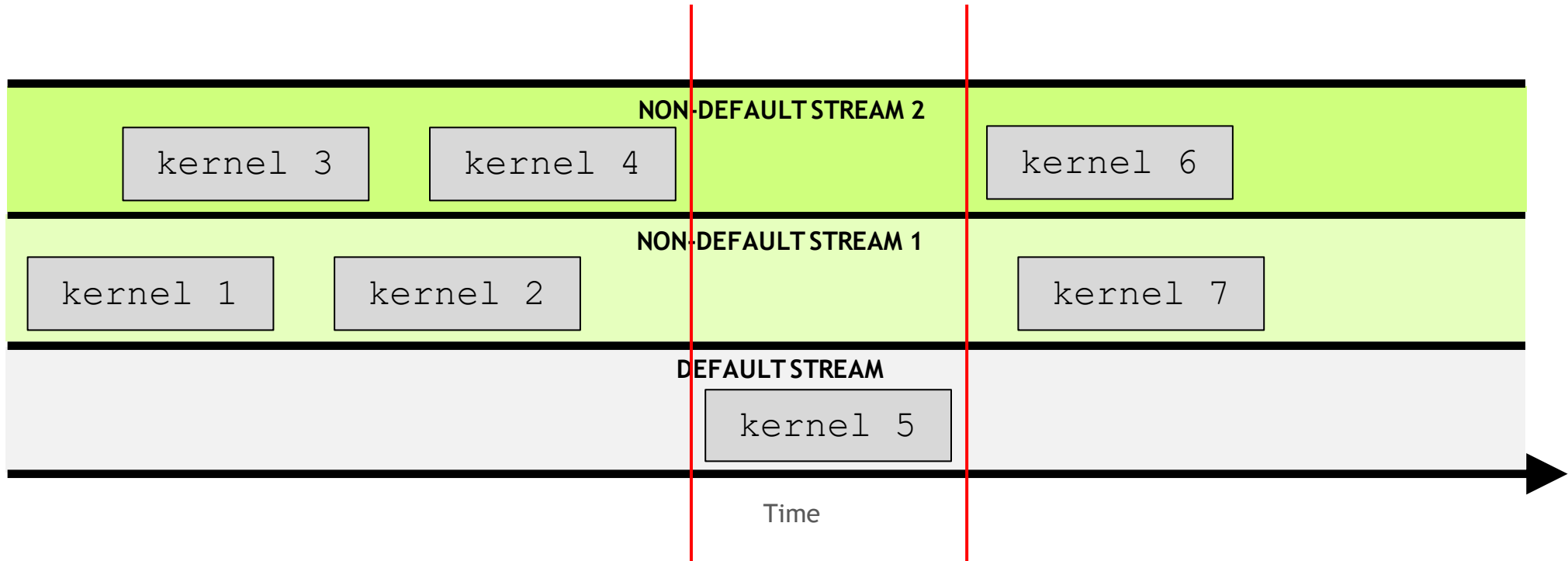
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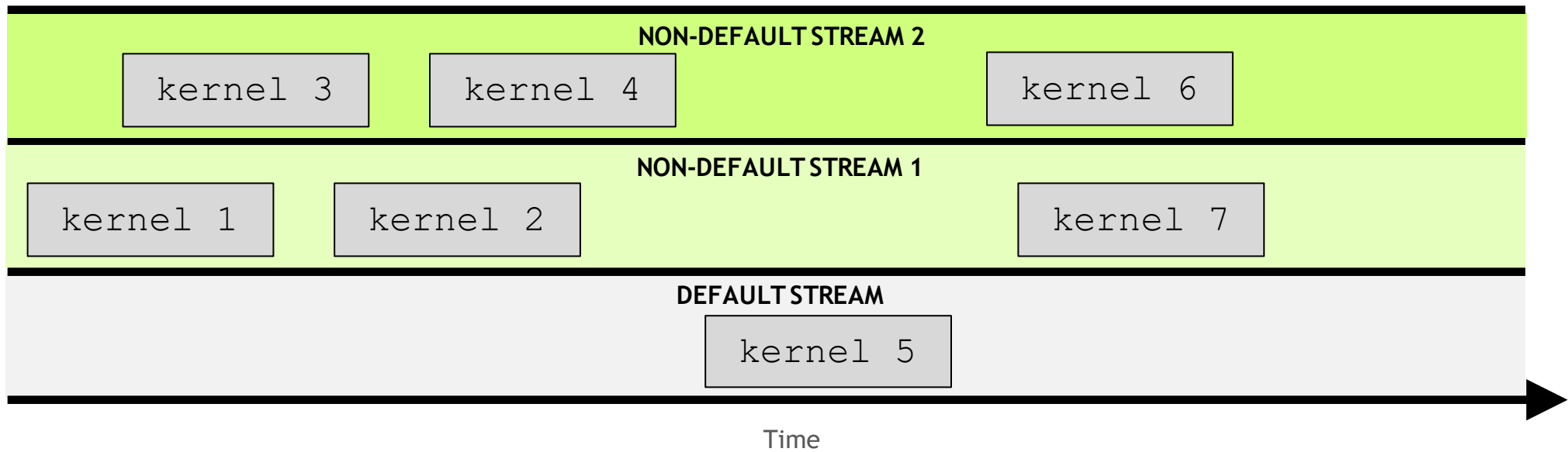
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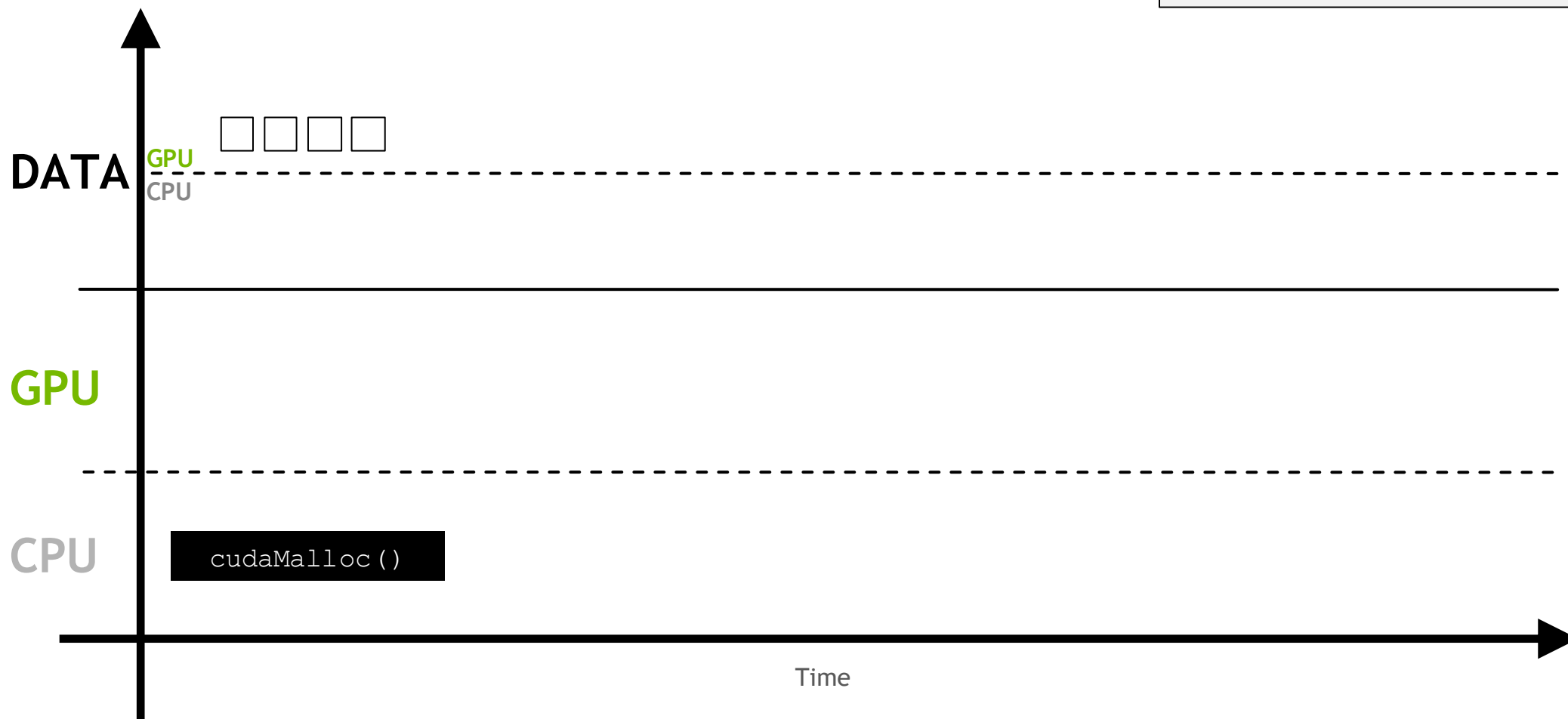


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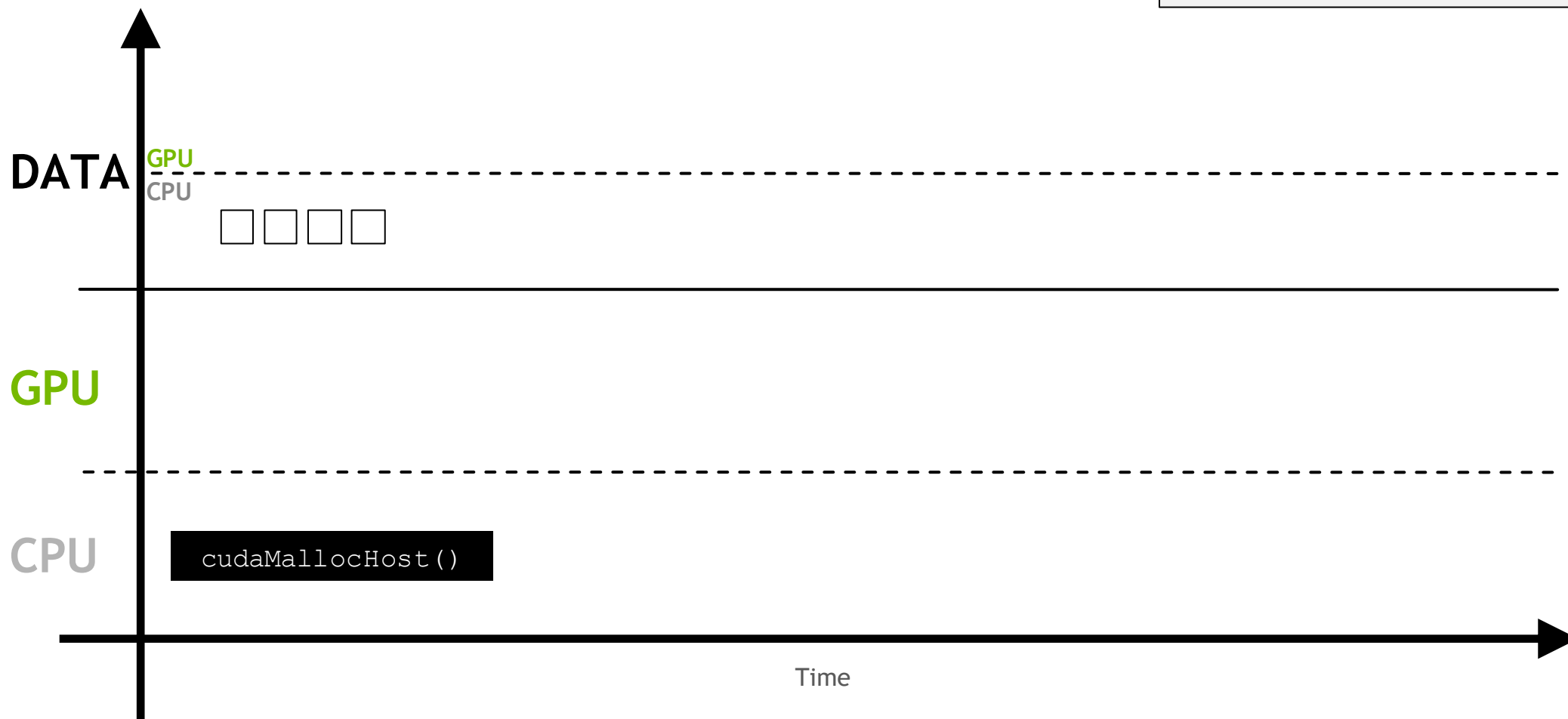


Non-Unified Memory

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



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



DATA

GPU
CPU



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

GPU

CPU

`cudaMallocHost()`

`cudaMemcpy(HtoD)`

Time

DATA

GPU
CPU



Copying leaves 2 copies in of in the system

GPU

CPU

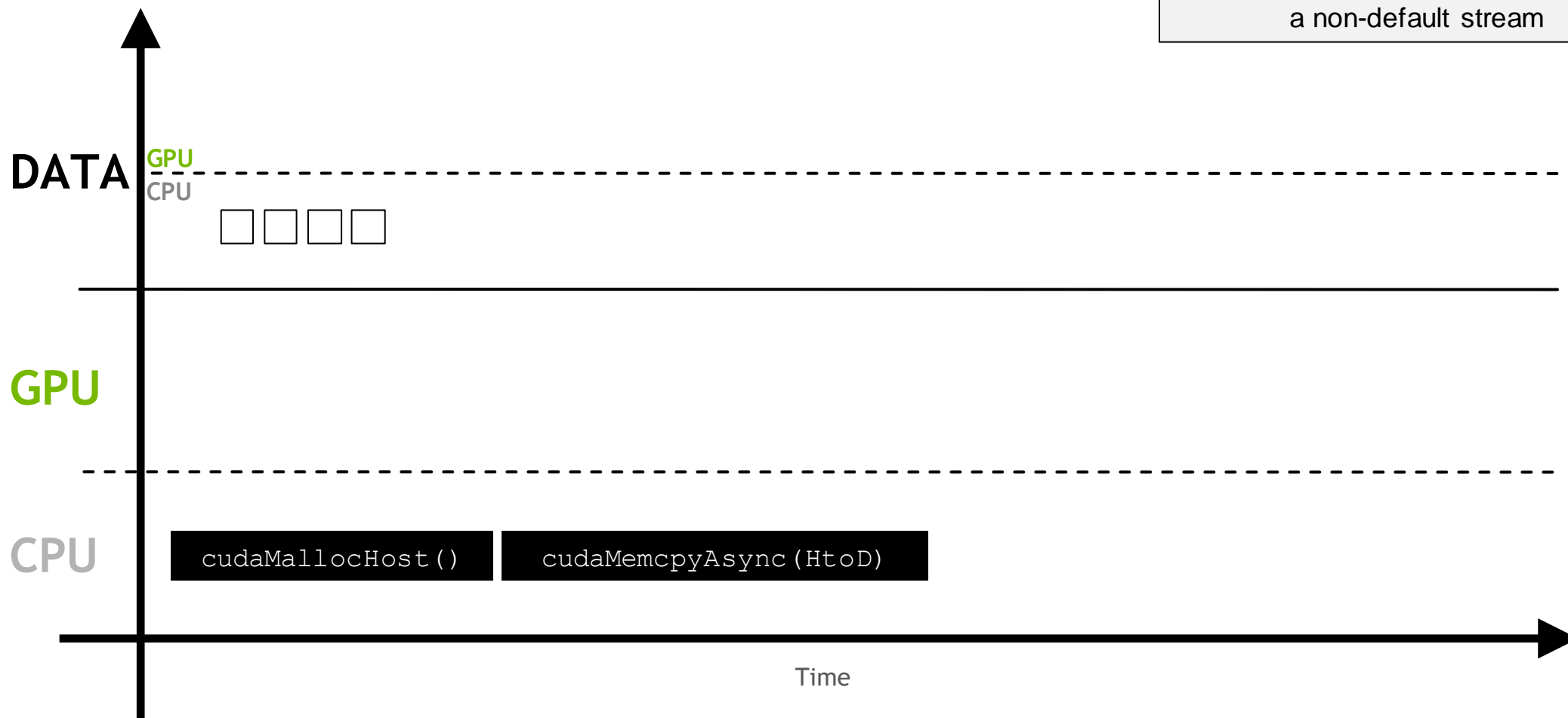
`cudaMallocHost()`

`cudaMemcpy(HtoD)`

Time

cudaMemcpyAsync

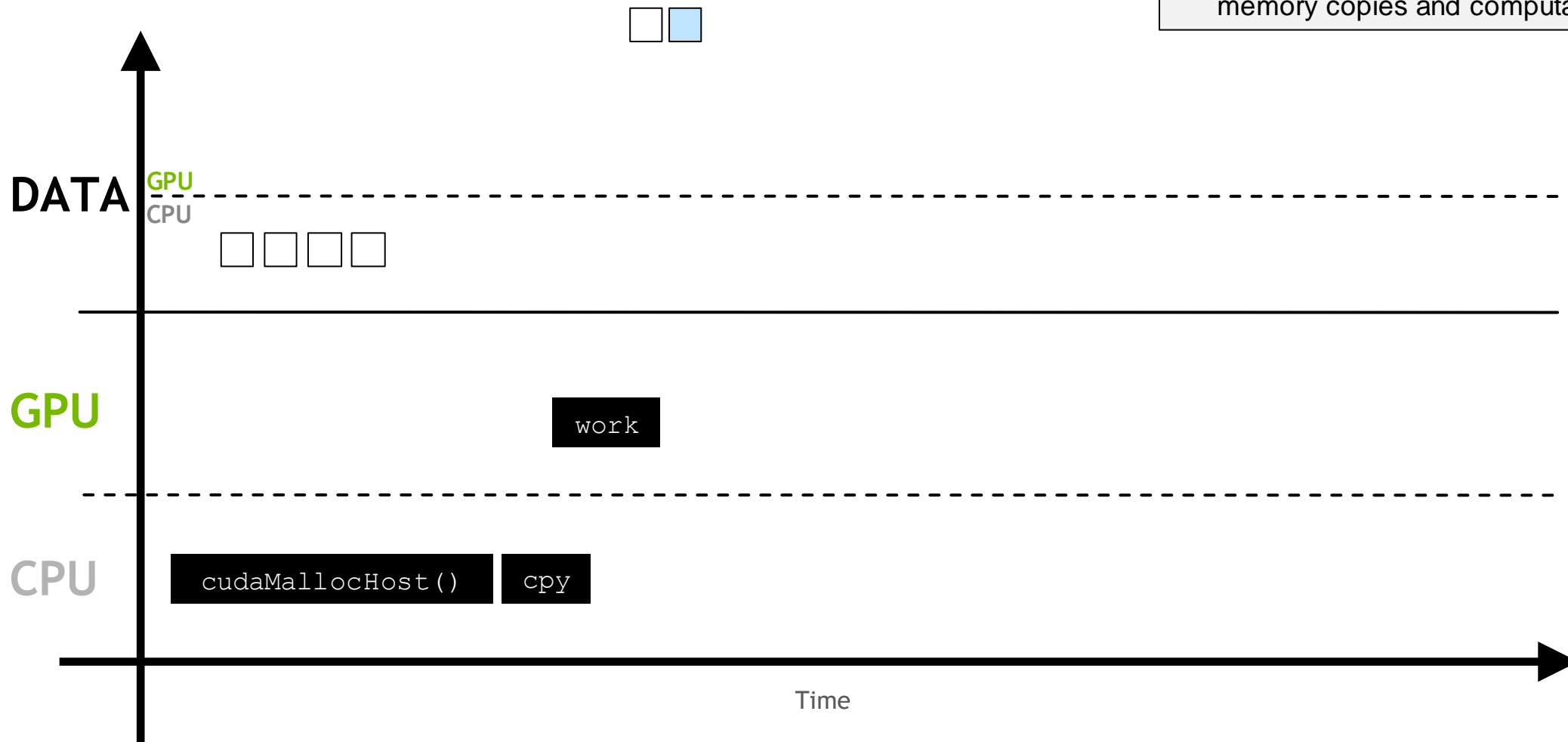
`cudaMemcpyAsync` can asynchronously transfer memory over a non-default stream



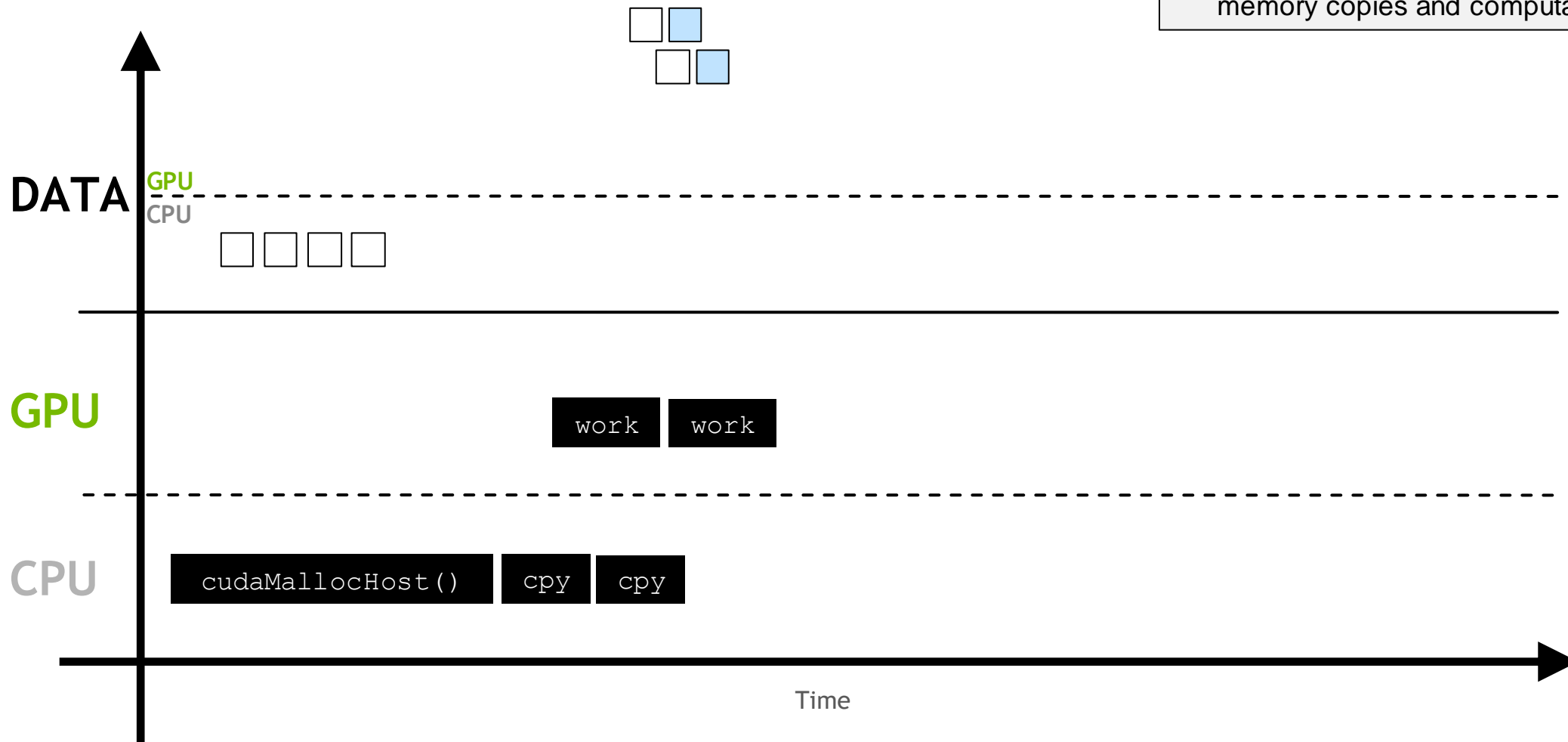
This can allow the **overlapping** memory copies and computation



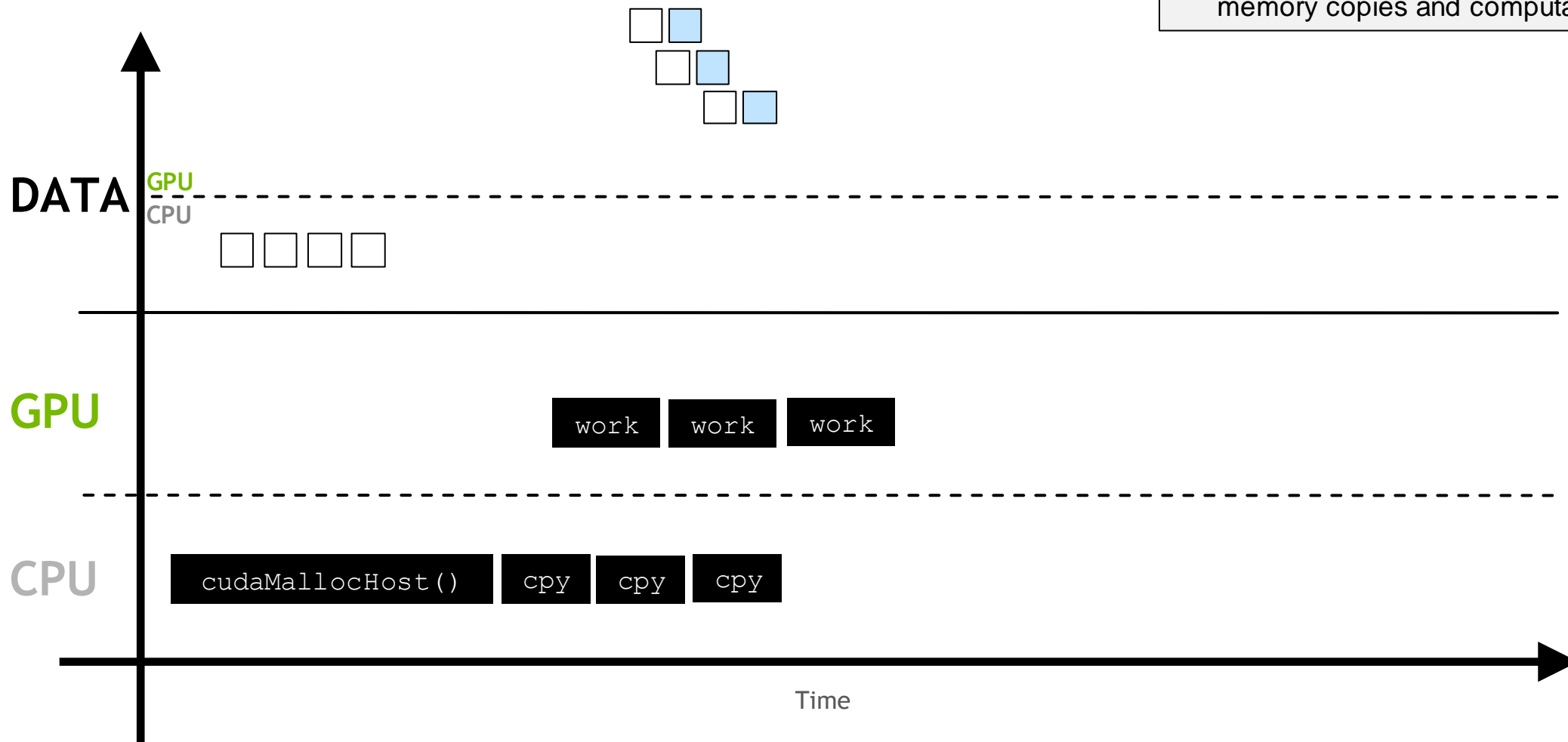
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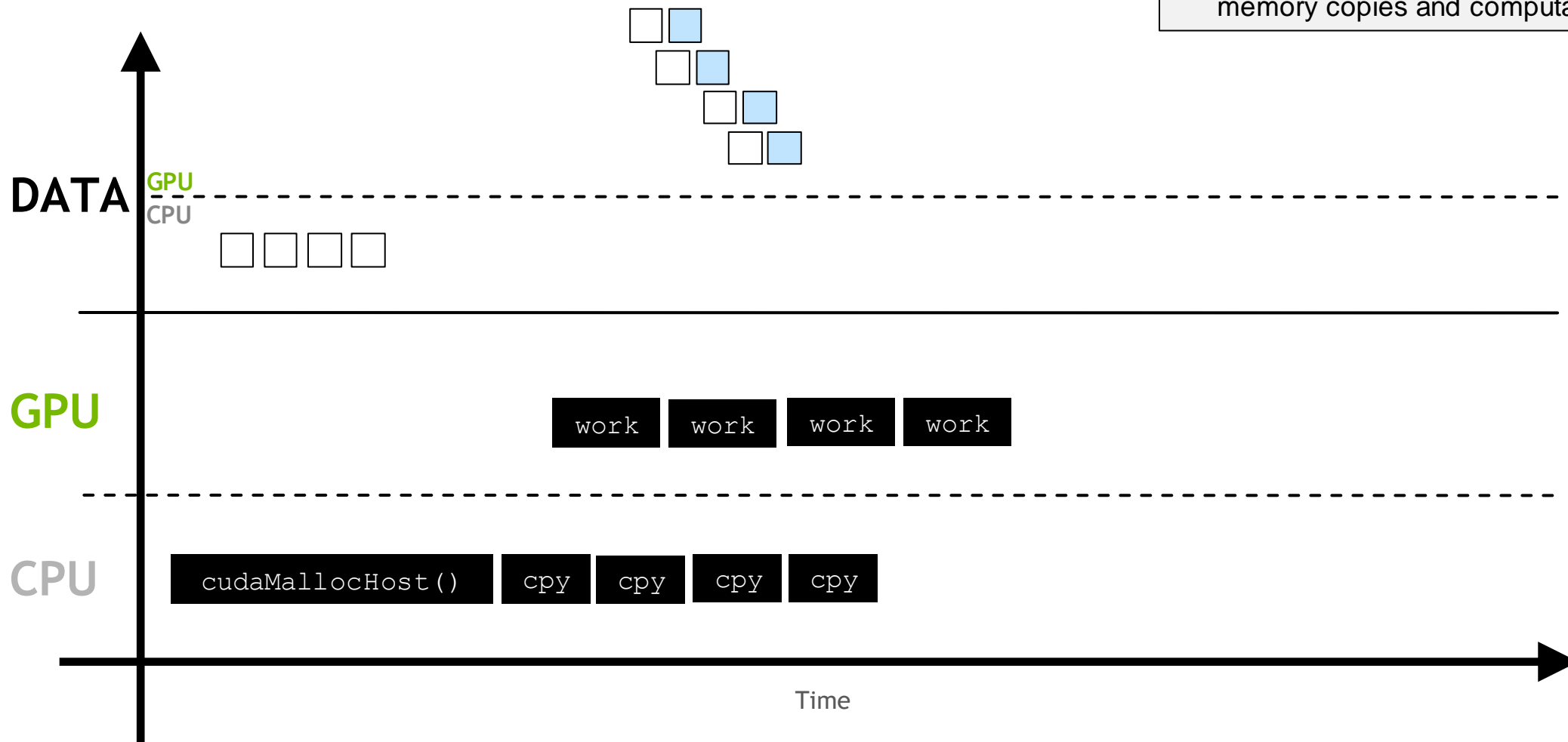
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