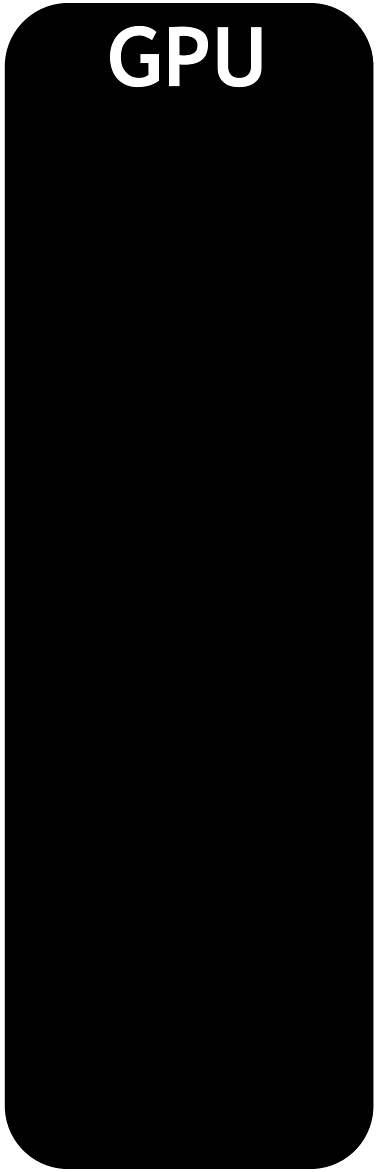
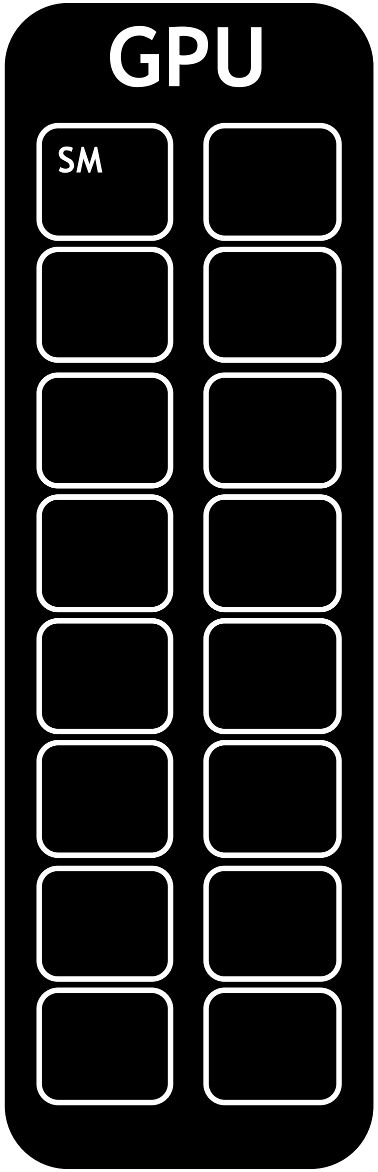
# Streaming Multiprocessors



NVIDIA GPUs contain functional units called **Streaming Multiprocessors**, or **SMs**



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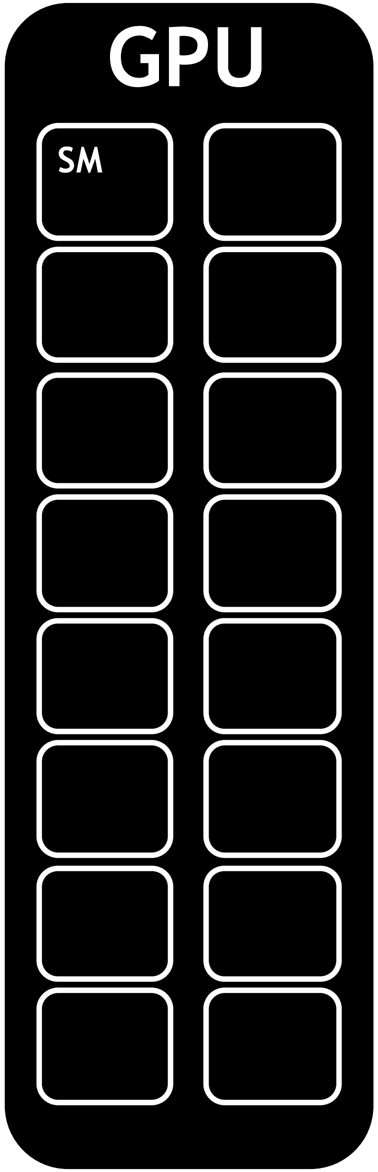
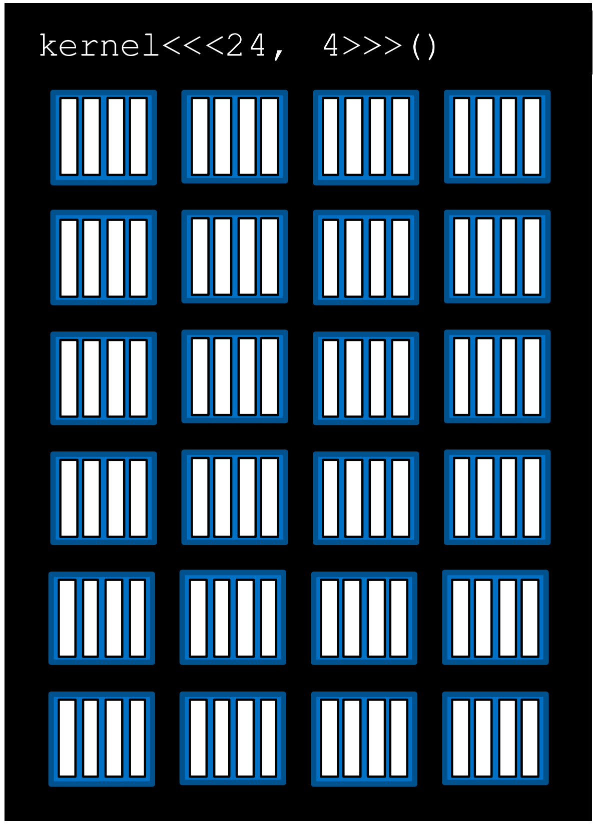
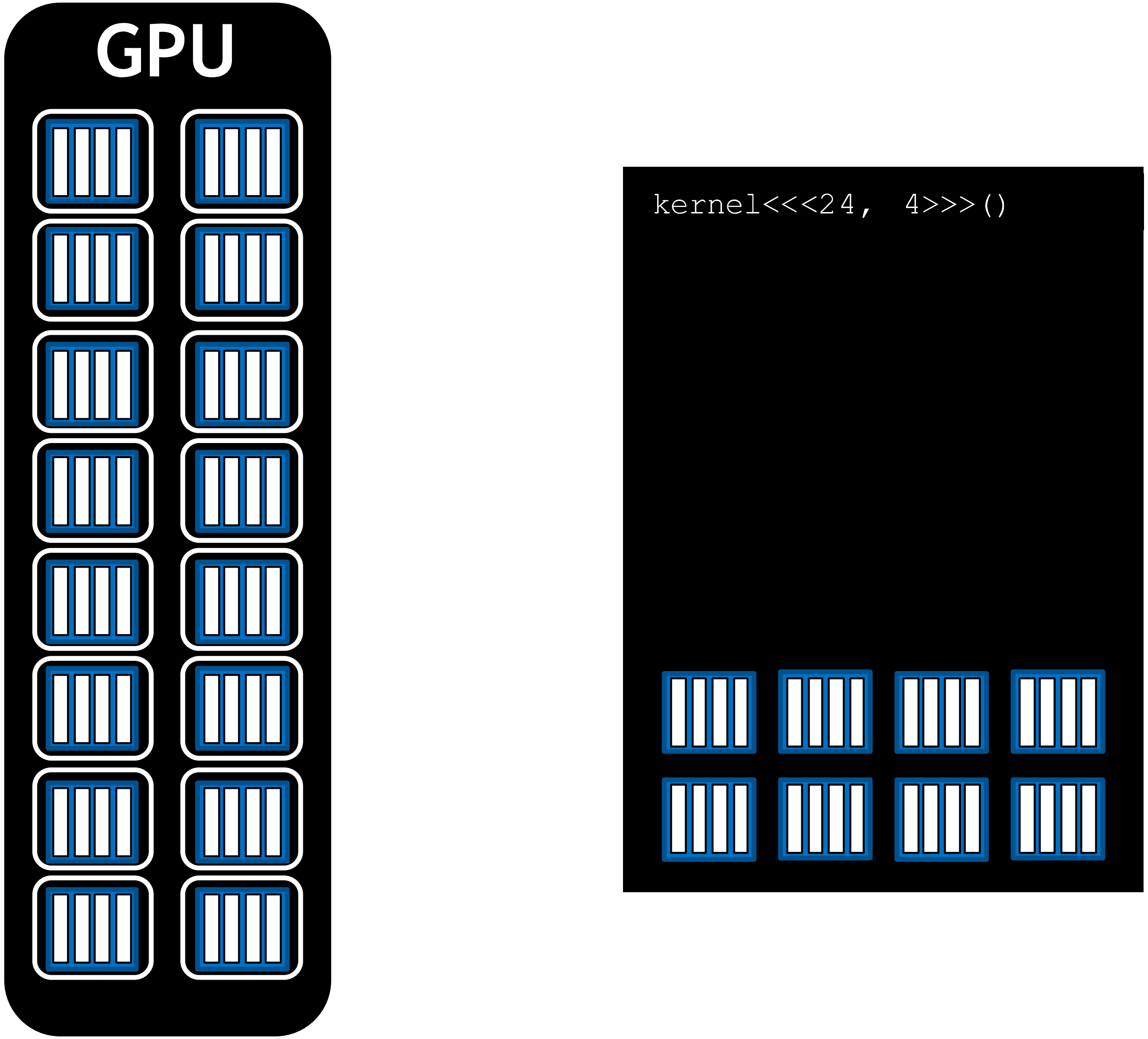
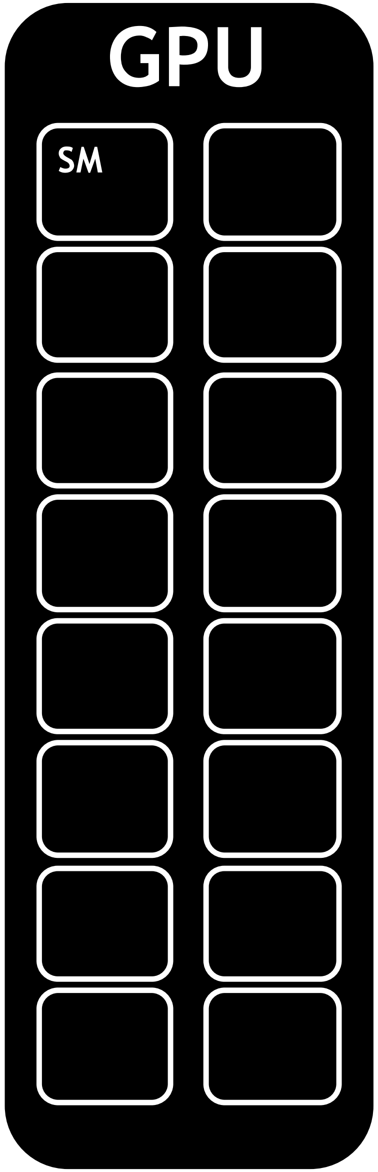


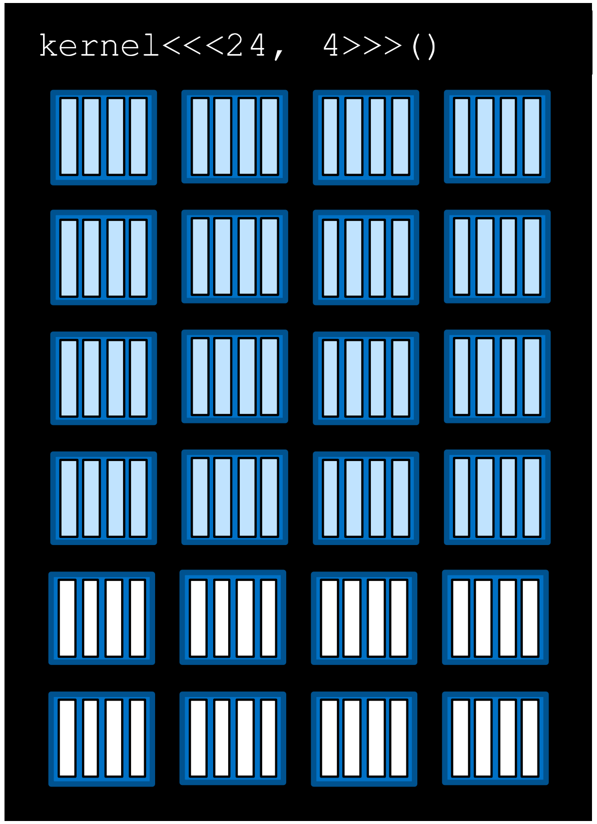

```
kernel<<<24, 4>>>()
```

Blocks of threads are scheduled to run on SMs



Depending on the number of SMs on a GPU, and the requirements of a block, more than one block can be scheduled on an SM





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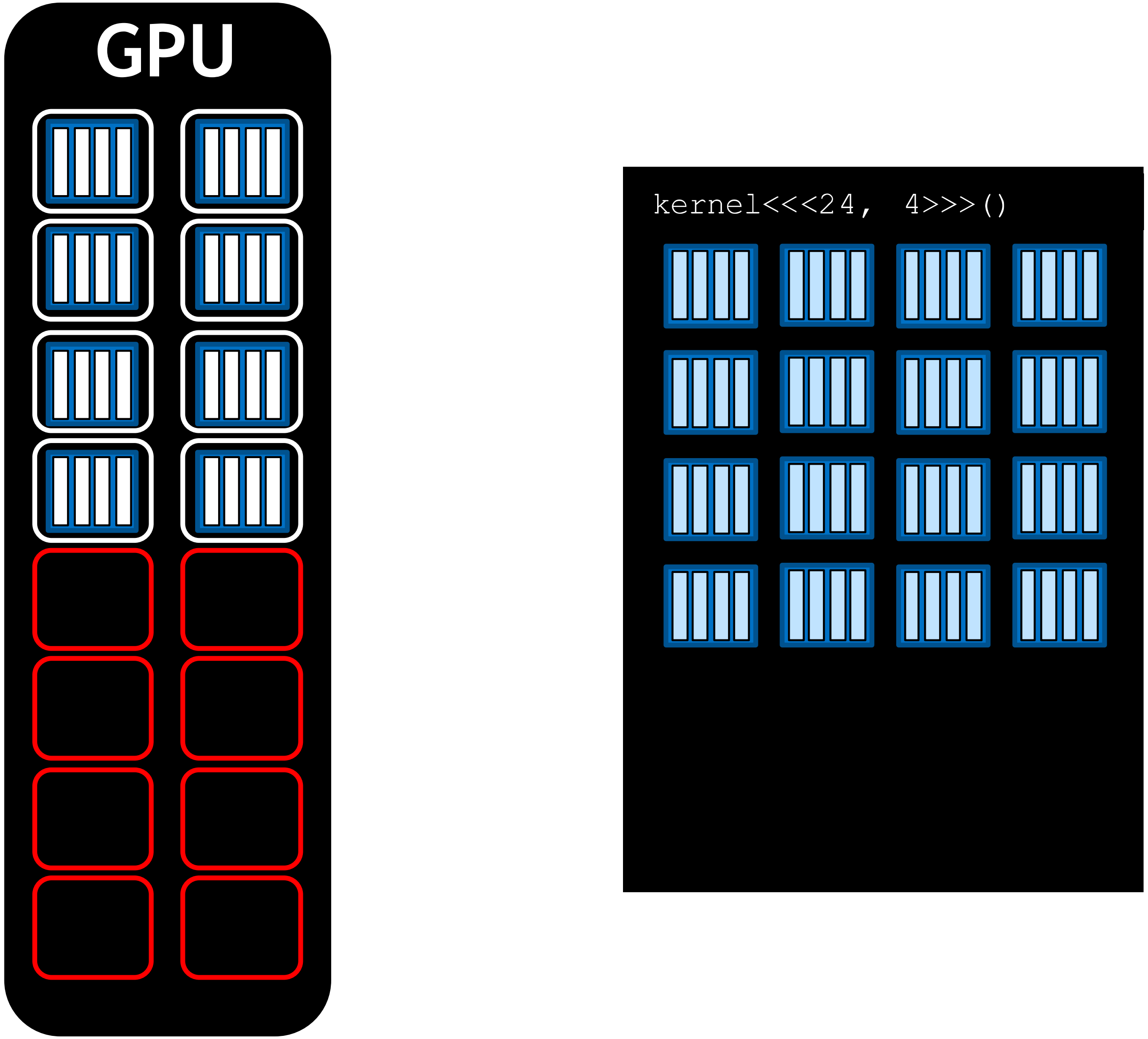
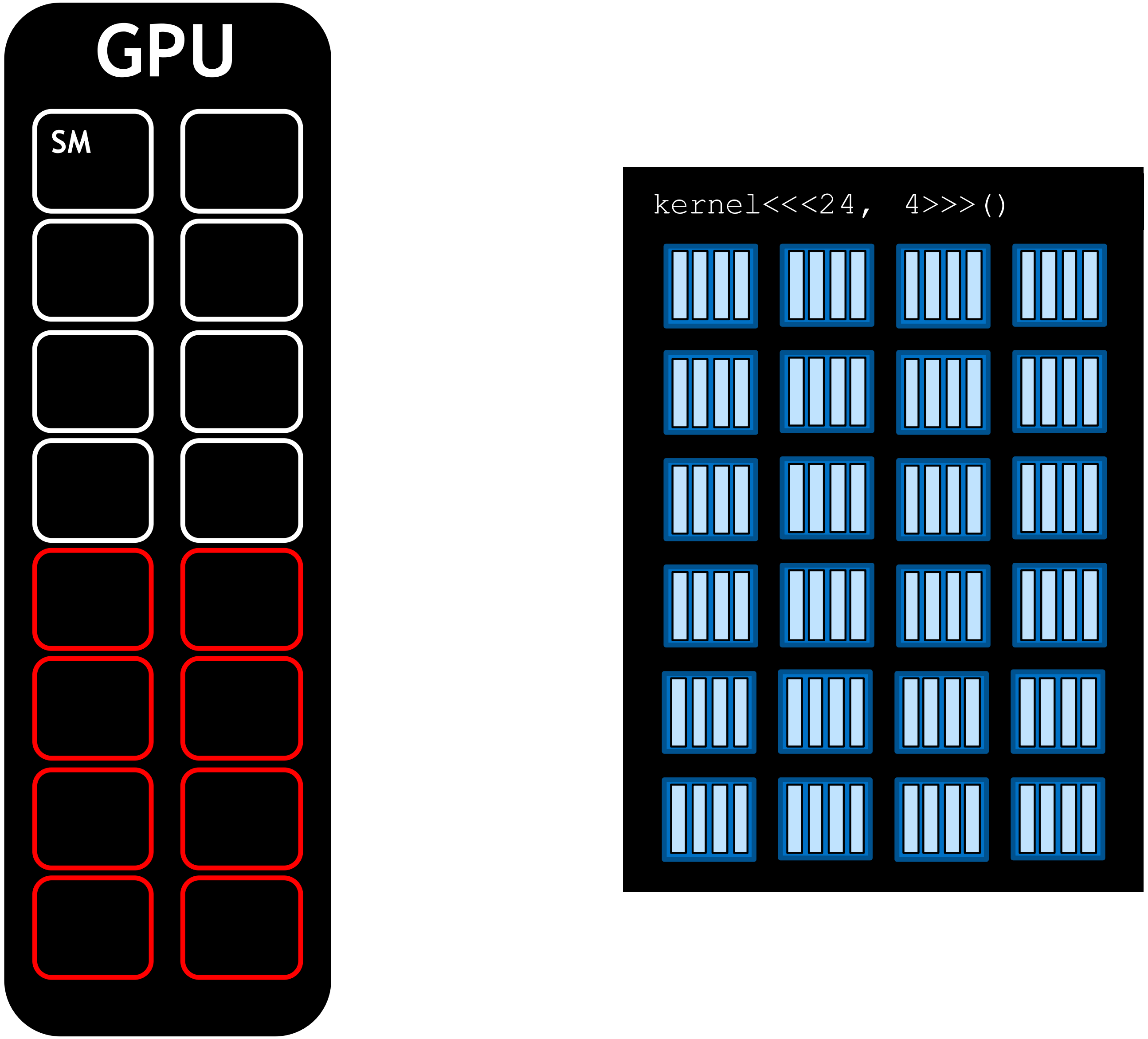


```
kernel<<<24, 4>>>()
```

Grid dimensions divisible by the number of SMs on a GPU can promote full SM utilization

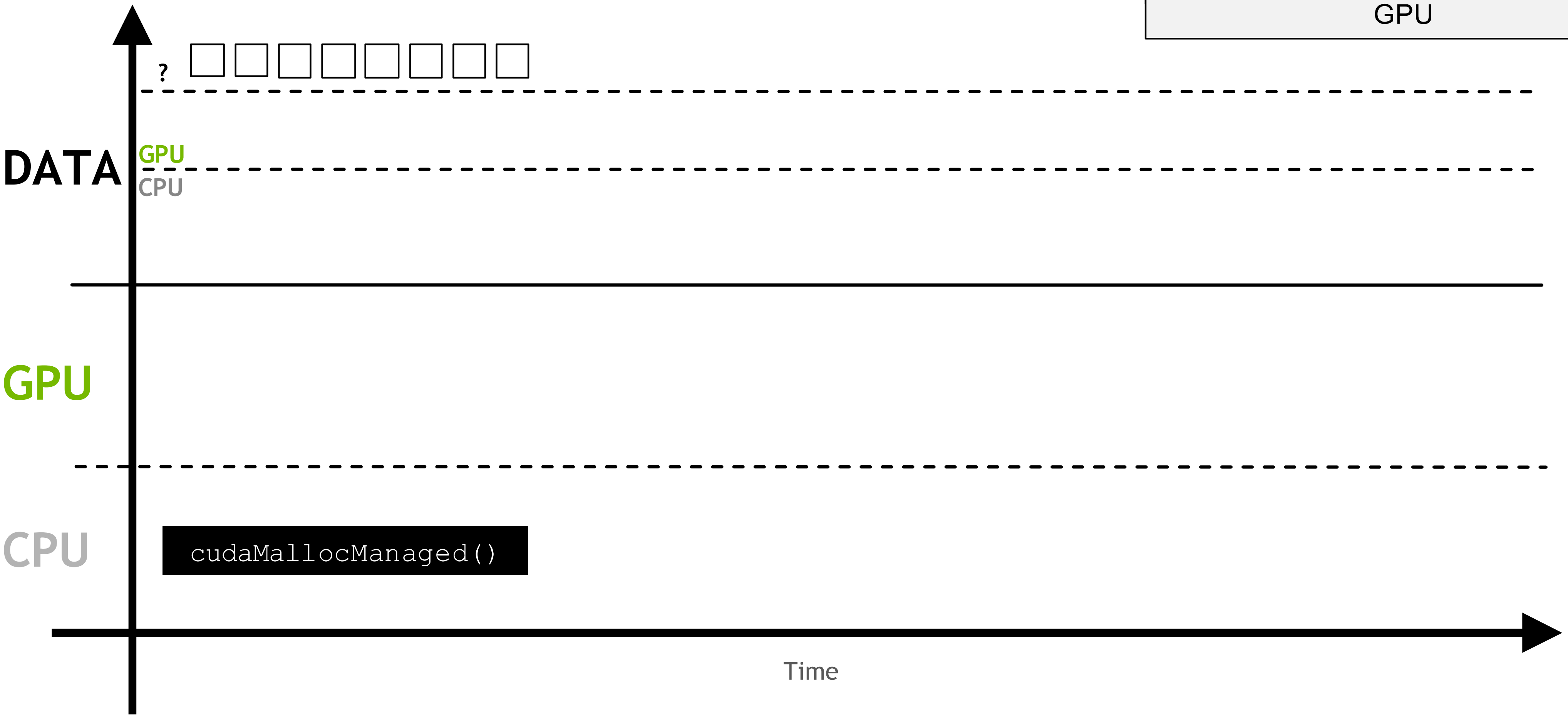


```
kernel<<<24, 4>>>()
```

Here there are fallow SMs

# Unified Memory Behavior

When **UM** is allocated, it may not be resident initially on the CPU or the GPU



?

DATA

GPU

CPU

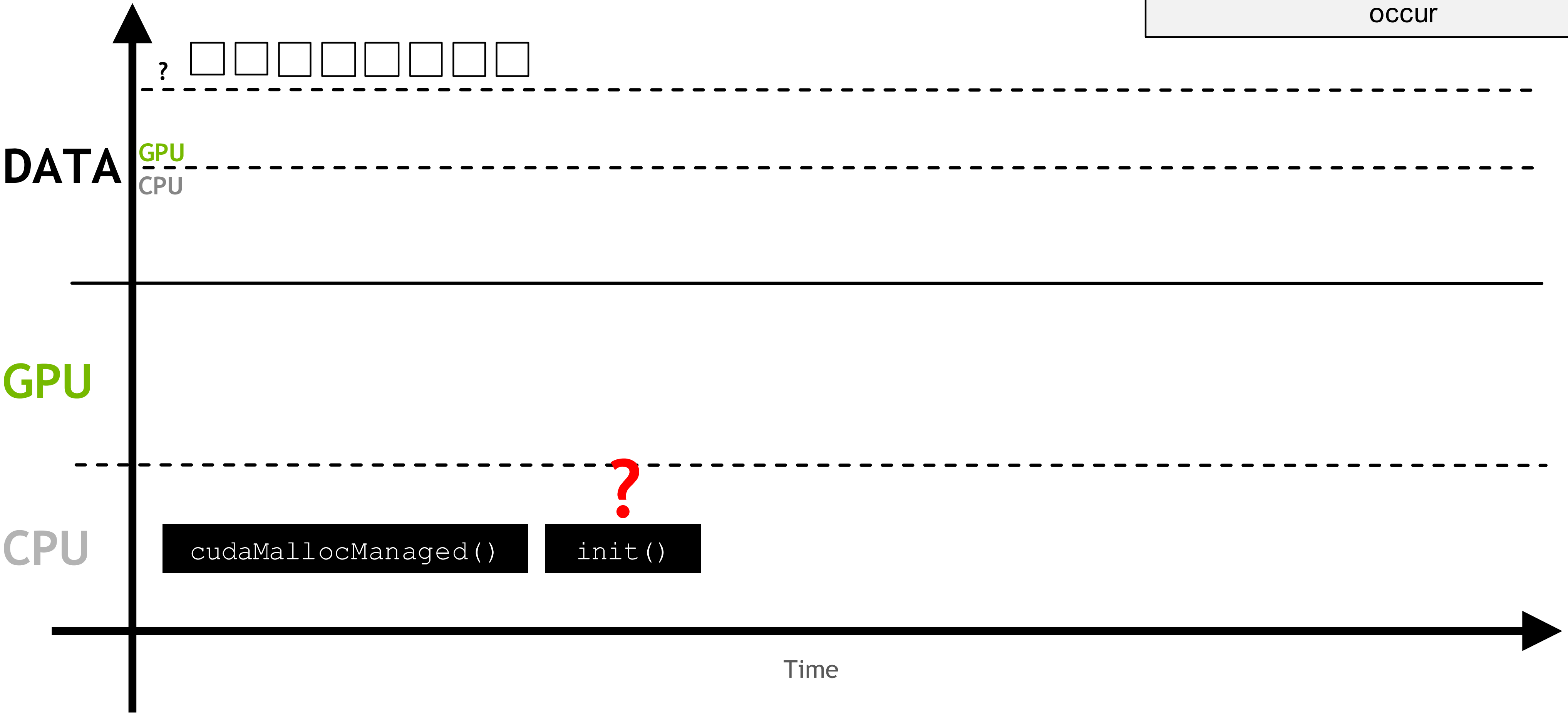
GPU

CPU

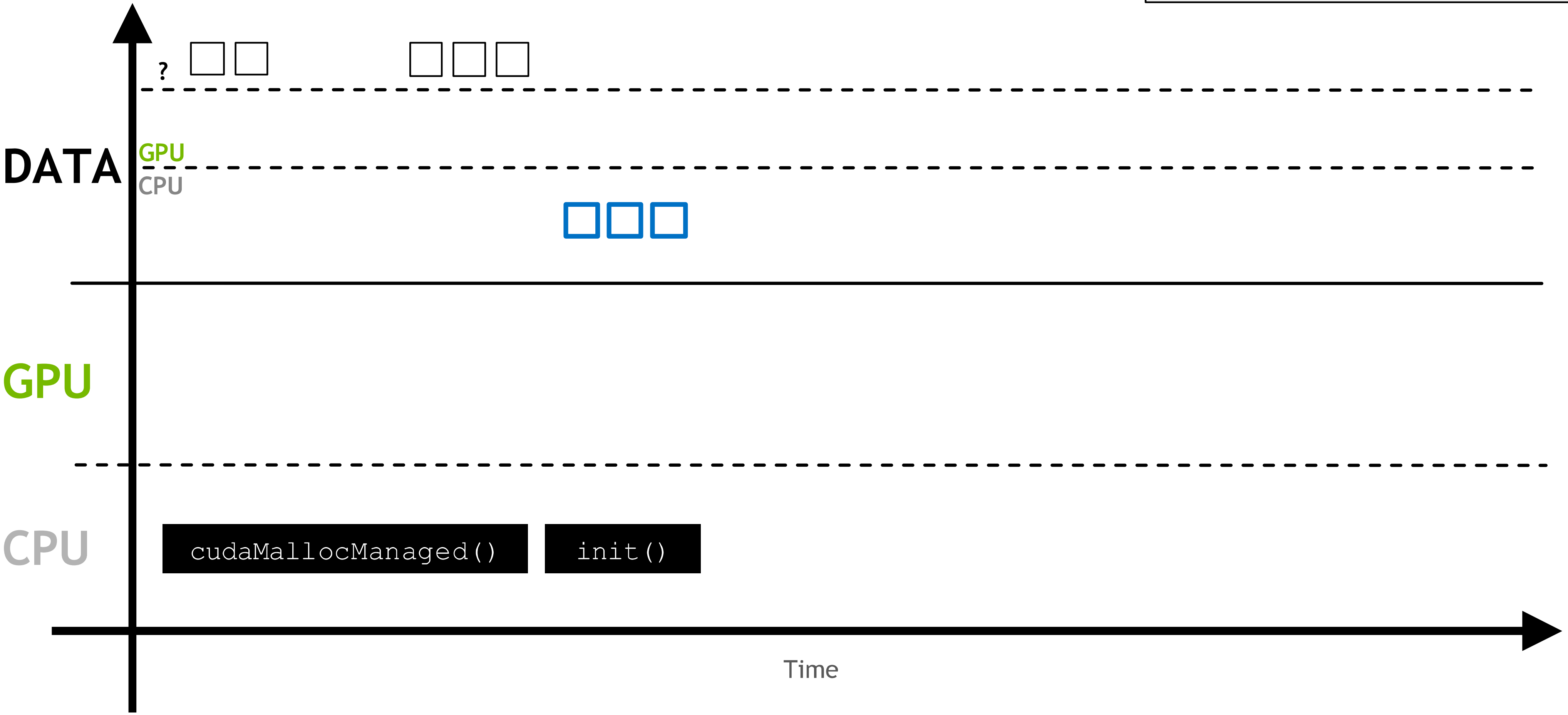
`cudaMallocManaged()`

Time

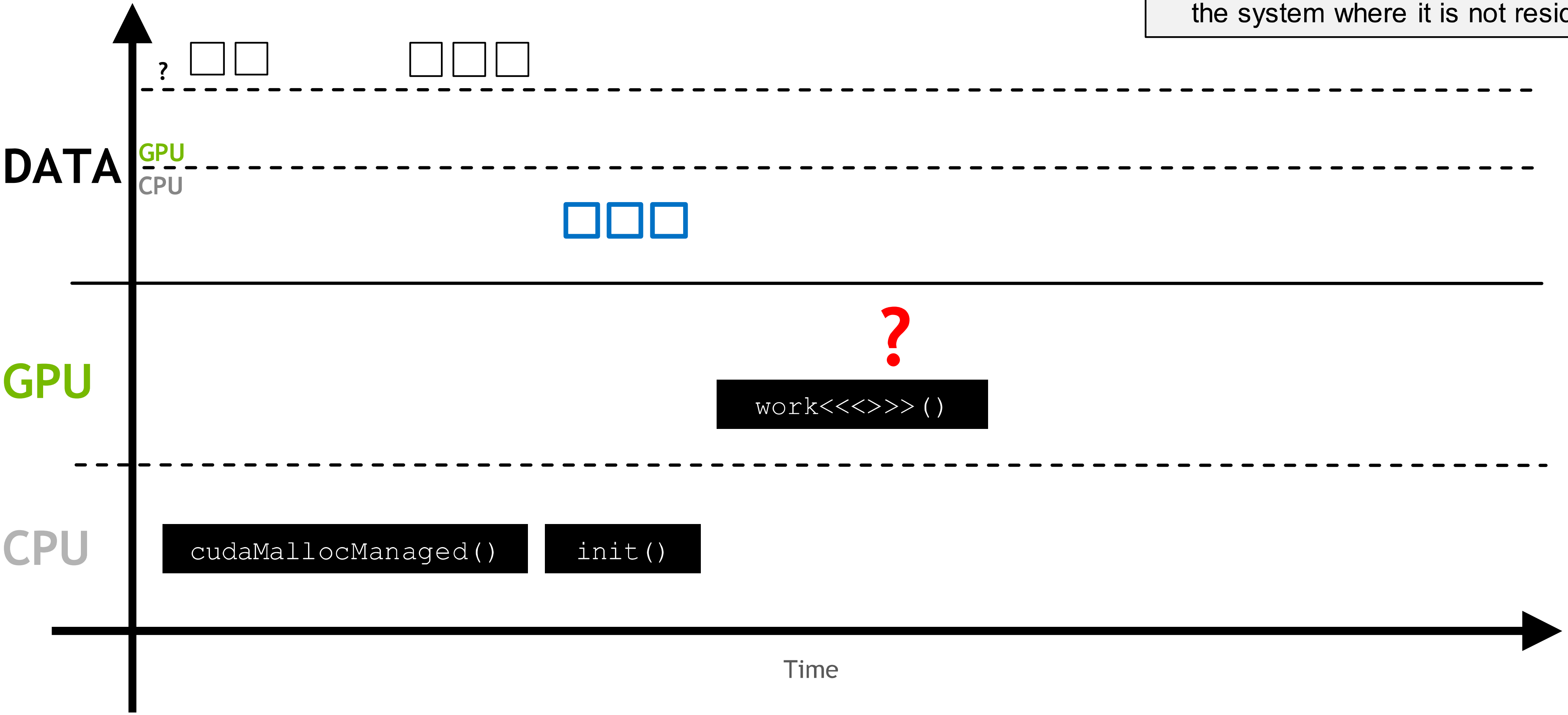
When some work asks for the memory for the first time, a **page fault** will occur



The page fault will trigger the migration of the demanded memory



This process repeats anytime the memory is requested somewhere in the system where it is not resident



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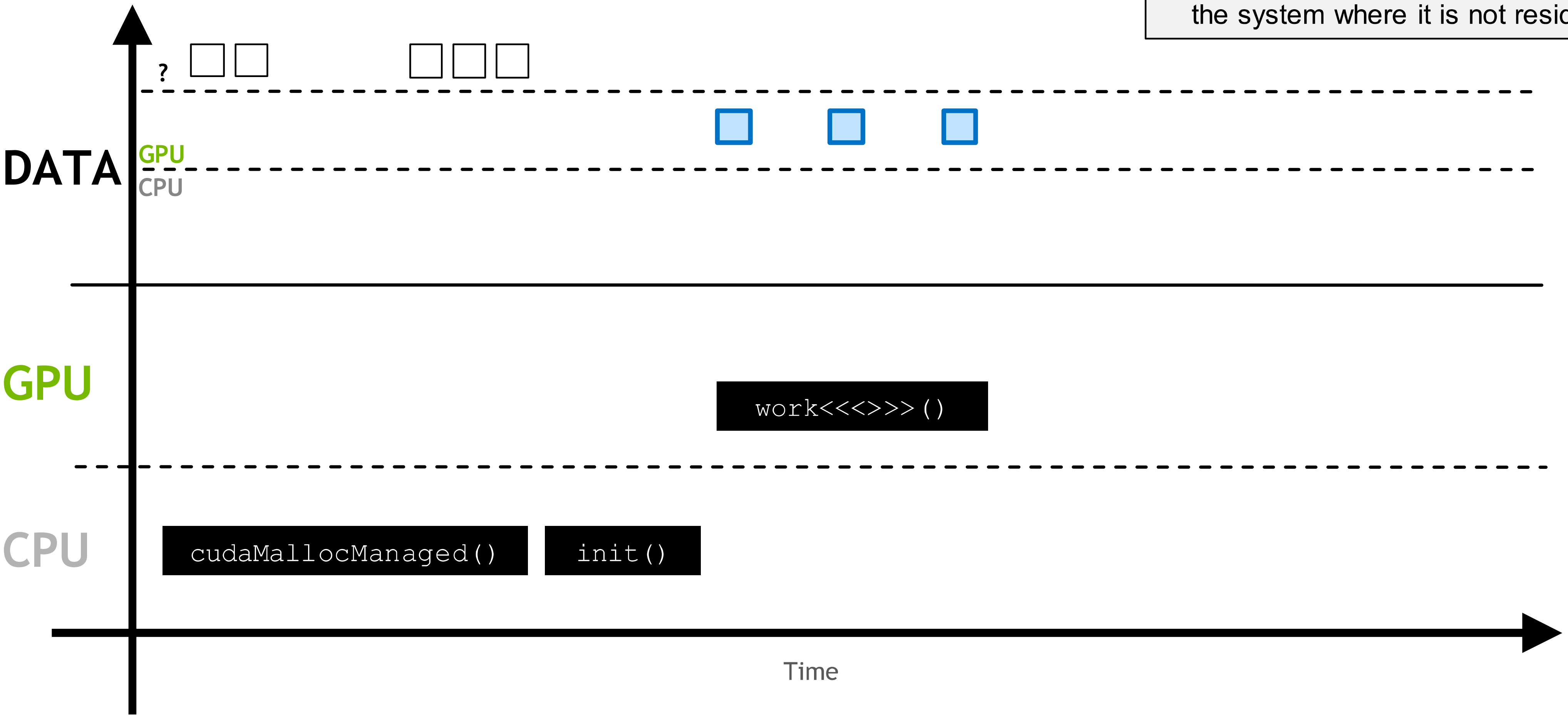
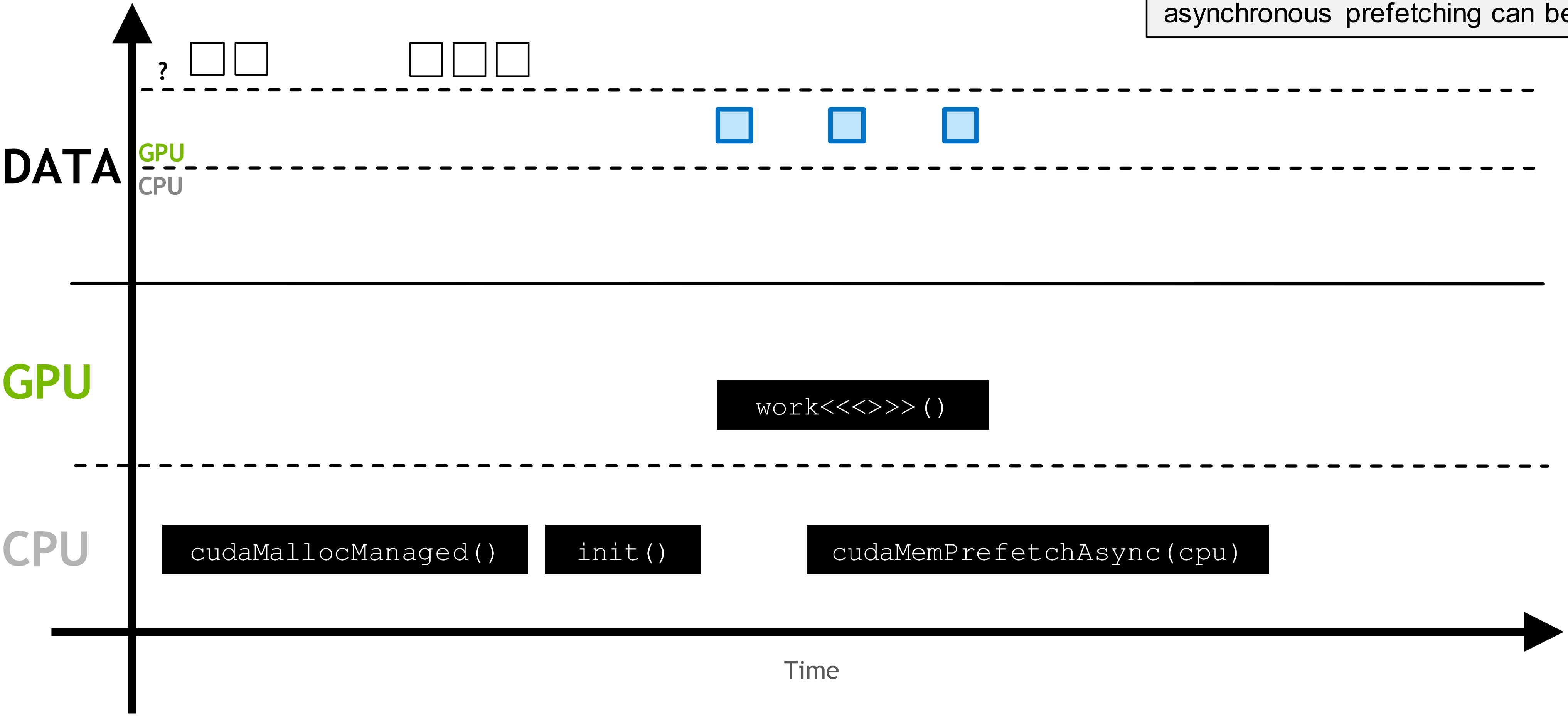
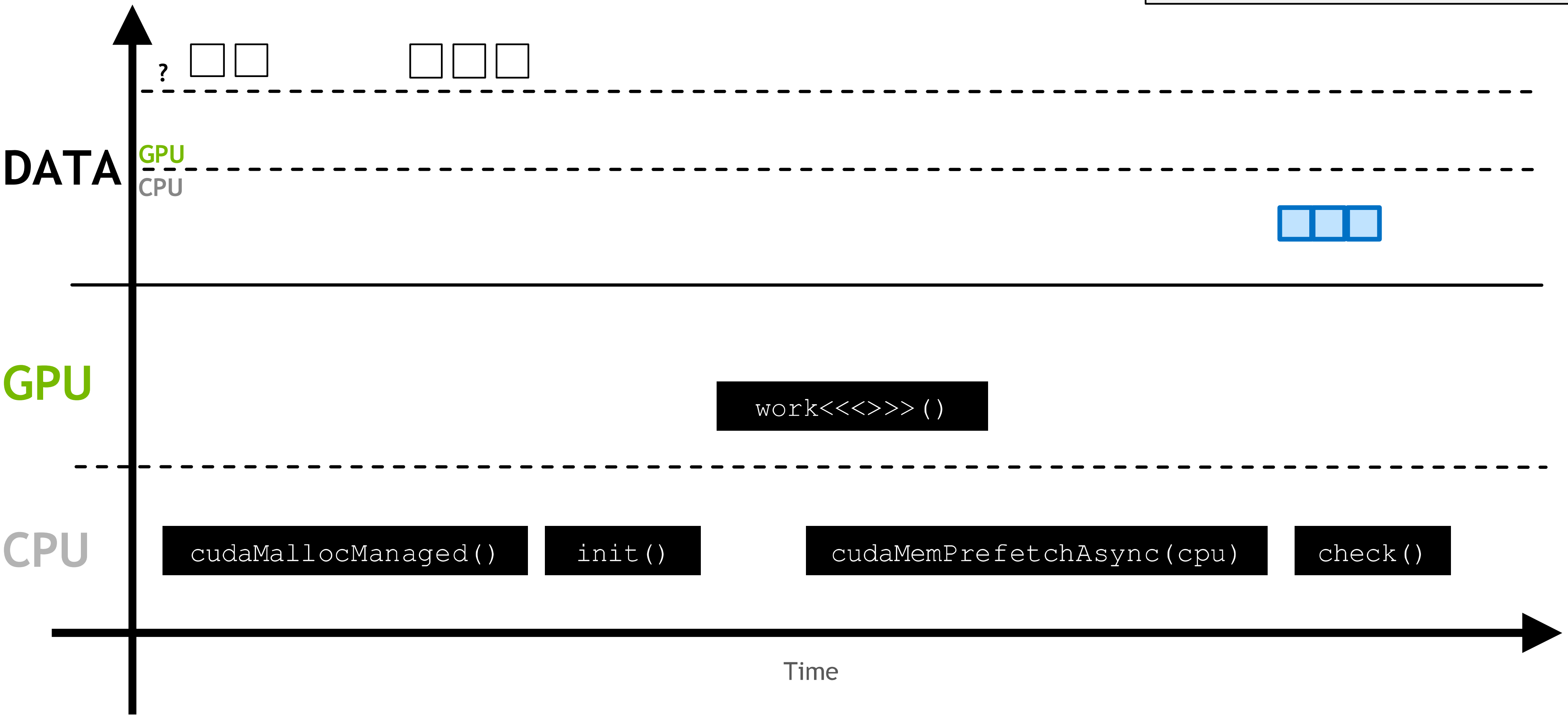


If it is known that the memory **will be** accessed somewhere it is not resident, asynchronous prefetching can be used



This moves the memory in larger batches, and prevents page faulting



?

DATA

GPU

CPU

GPU

work<<<>>>()

CPU

cudaMallocManaged()

init()

cudaMemPrefetchAsync(cpu)

check()

Time

DEEP
LEARNING
INSTITUTE

www.nvidia.com/dli