

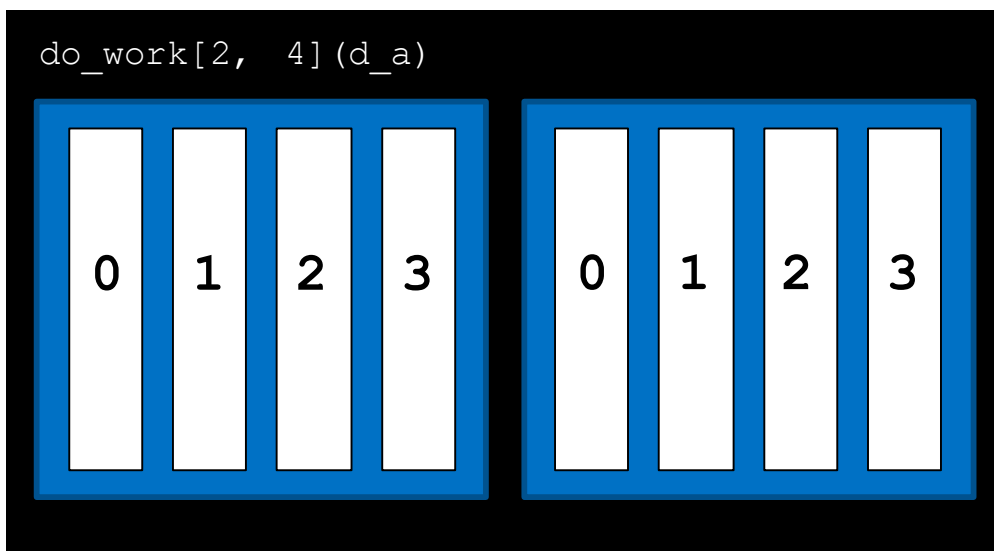
Grid-Stride Loops

GPU DATA

0	4	8	12	16	20	24	28
1	5	9	13	17	21	25	29
2	6	10	14	18	22	26	30
3	7	11	15	19	23	27	31

Often there are more data elements than there are threads in the grid

GPU

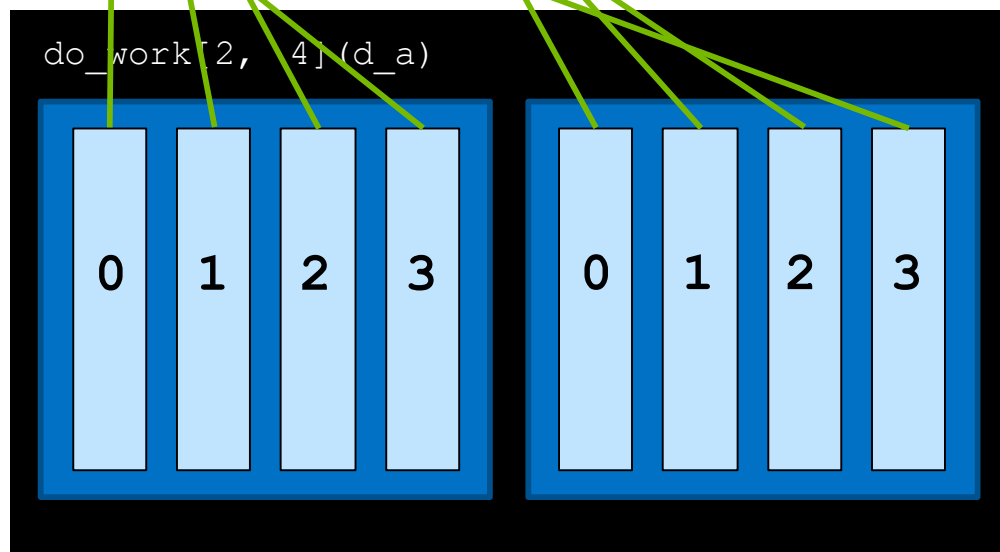


GPU
DATA

0	4	8	12	16	20	24	28
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In such scenarios threads
cannot work on only one
element

GPU



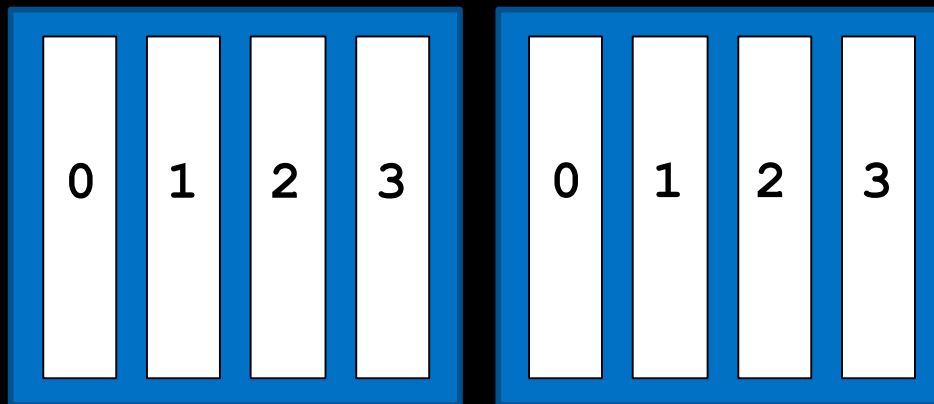
GPU DATA

0	4	8	12	16	20	24	28
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... or else work is left
undone

GPU

```
do_work[2, 4] (d_a)
```

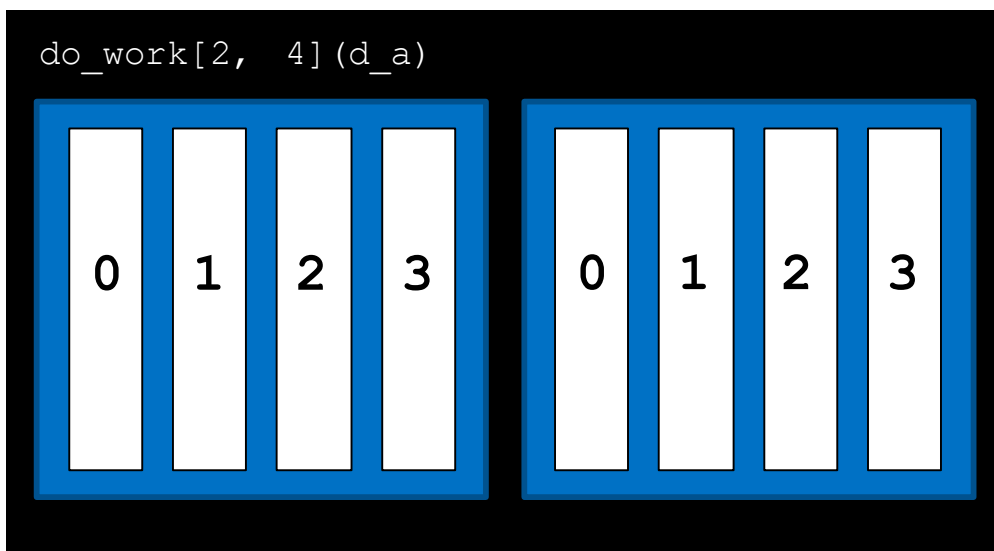


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One way to address this
programmatically is with a
grid-stride loop

GPU

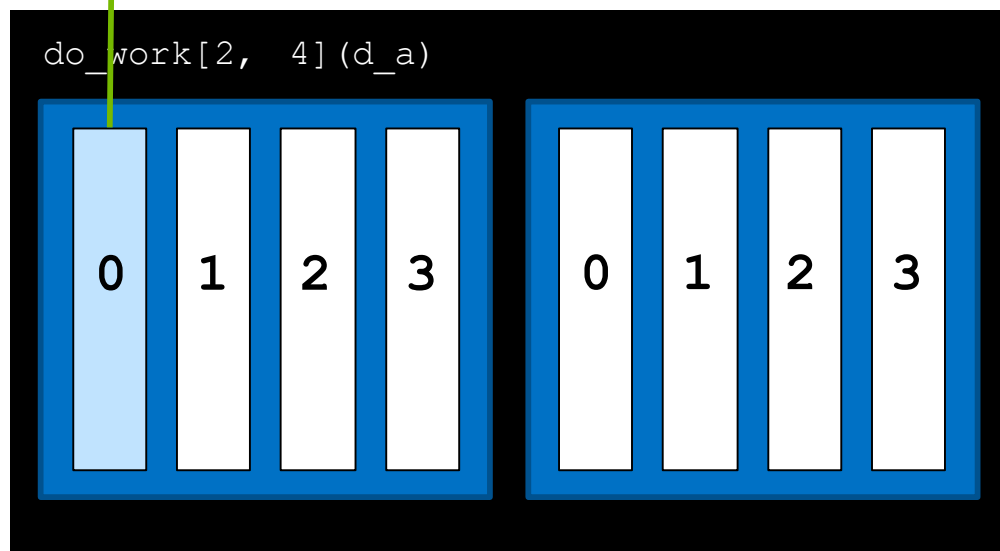


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In a grid-stride loop, the thread's first element is calculated as usual, with `cuda.grid()`

GPU

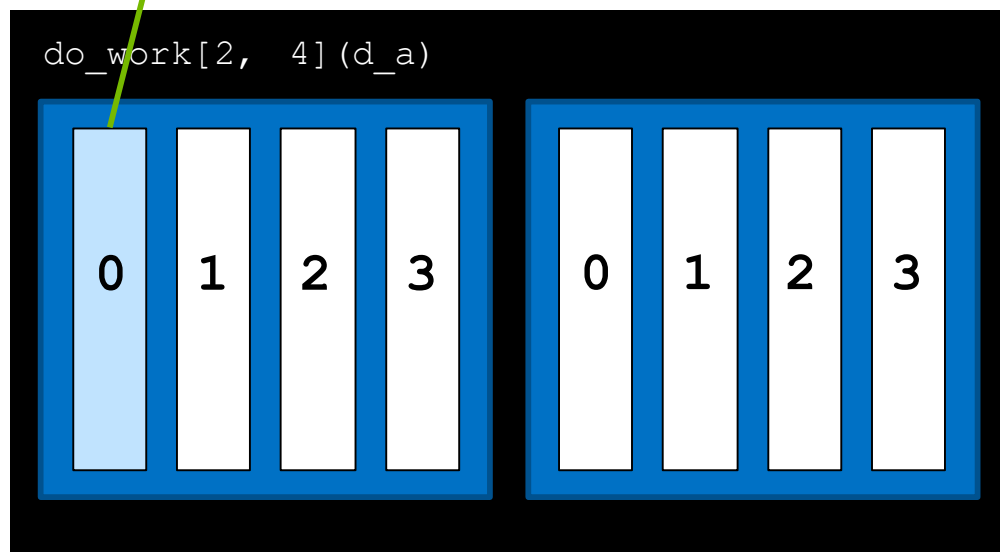


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The thread then strides forward by the total number of threads in the grid
 $(\text{blockDim.x} * \text{gridDim.x})$, in this case
8

GPU

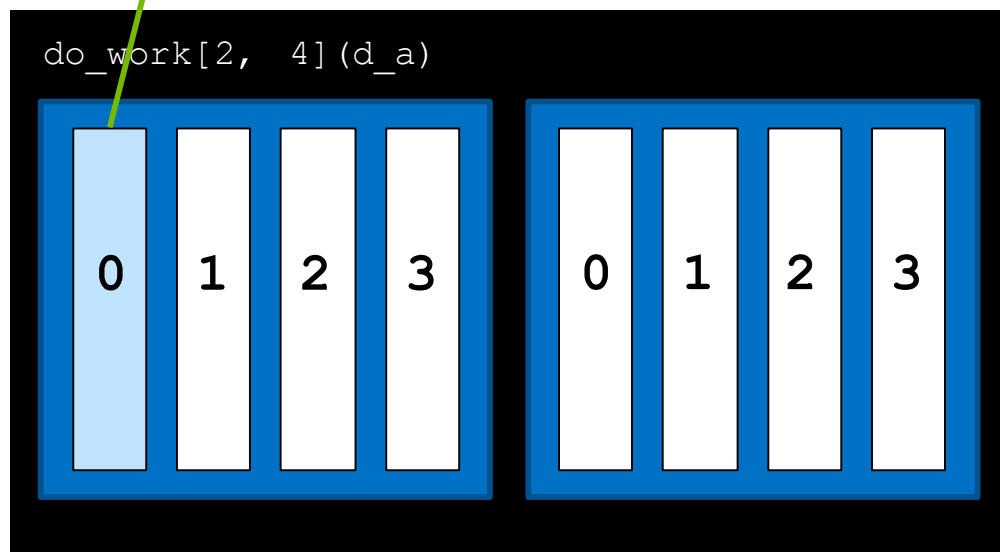


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Numba provides another convenience function for this common calculation: `cuda.gridsize()`, returning the number of threads in the grid

GPU

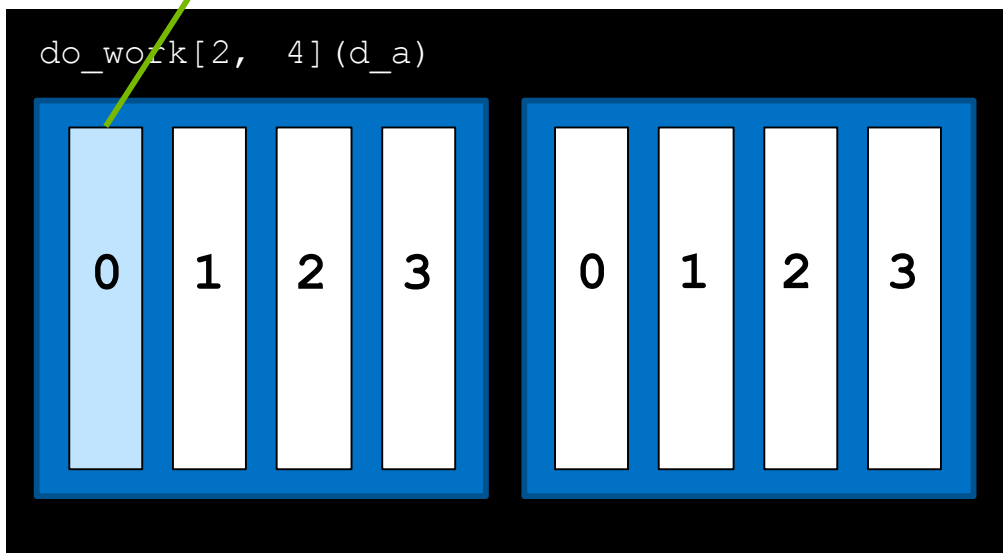


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The thread continues in this way until its data index is greater than the number of data elements

GPU

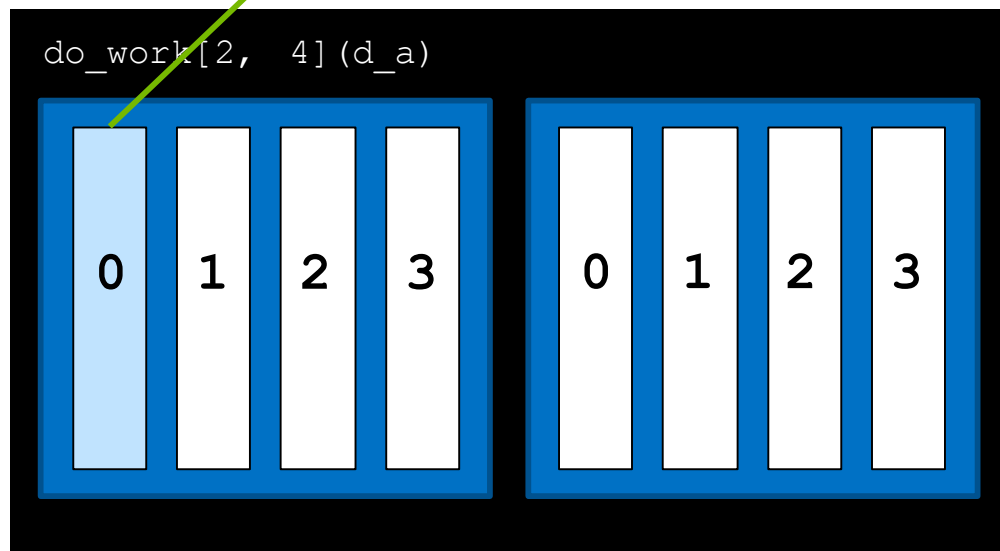


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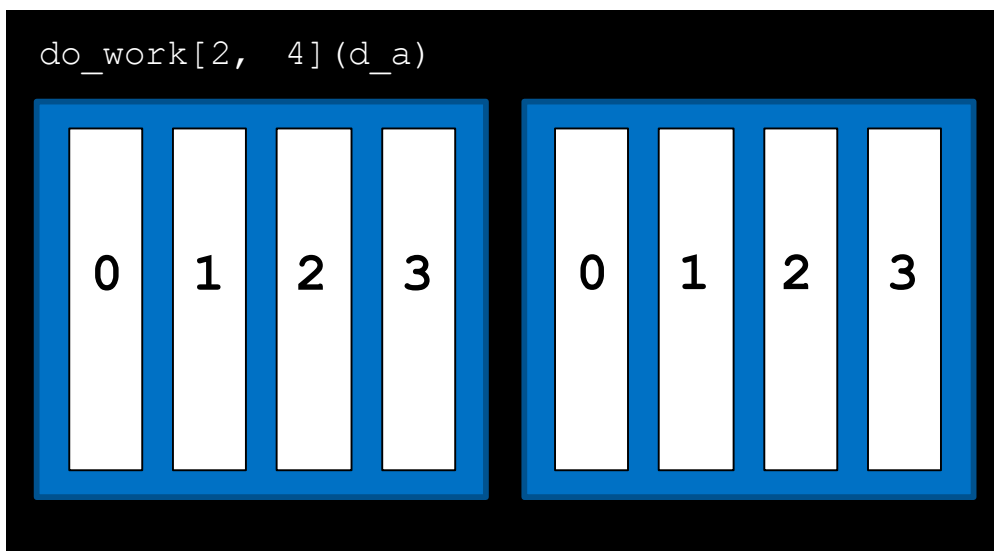


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With all threads working in parallel using a grid stride loop...

GPU

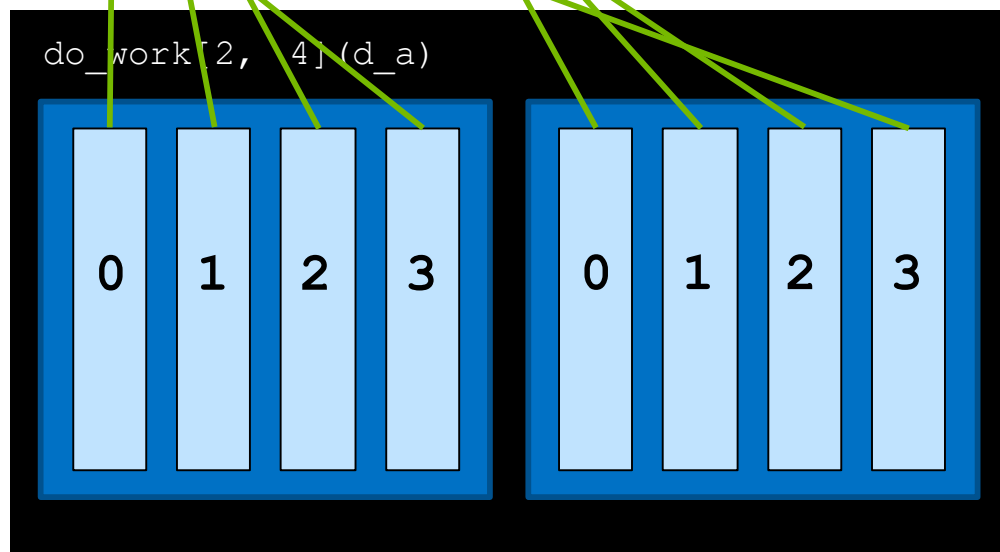


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... all elements are covered

GPU

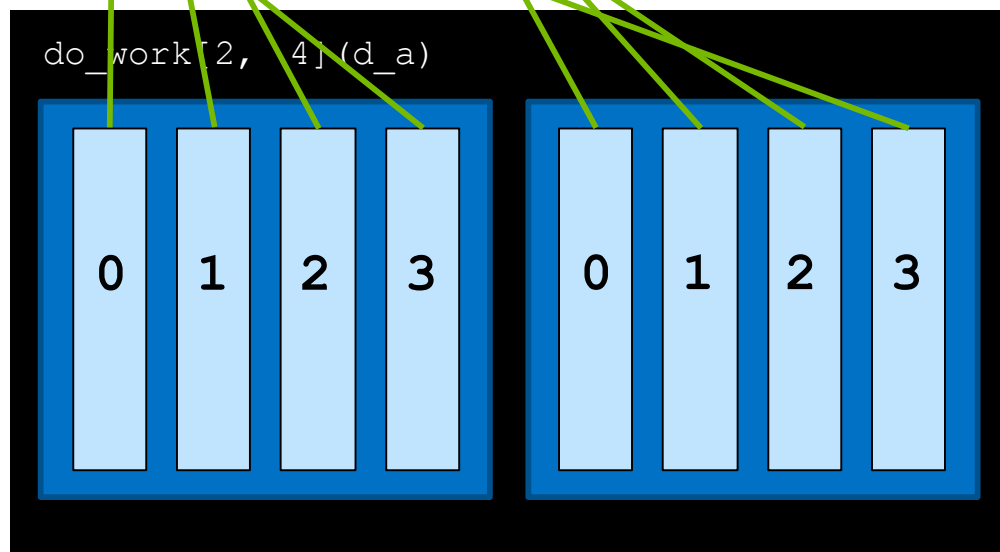


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Additionally the device
coalesces memory
reads/writes into as few
transactions as possible for
performance...

GPU

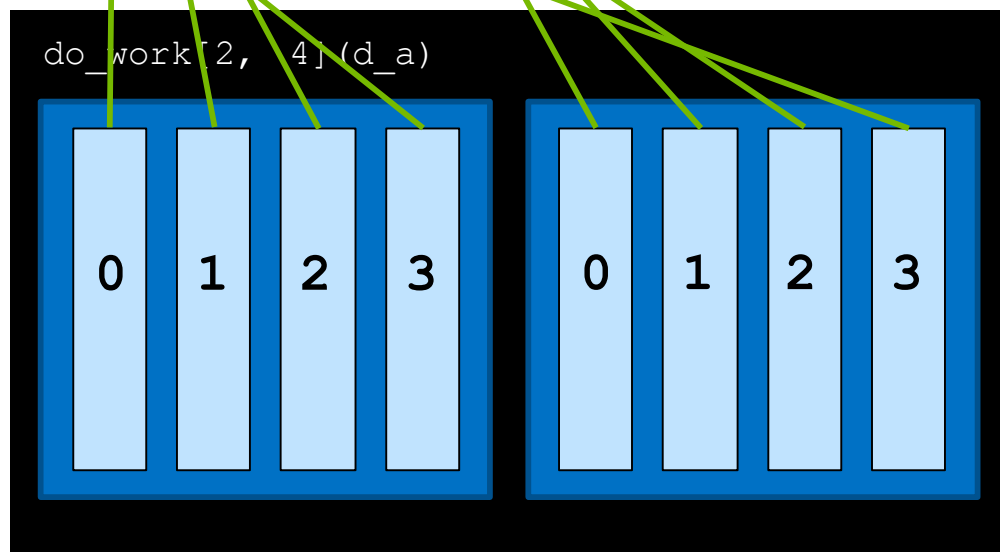


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And grid stride loops support this **memory coalescing** because threads executing in parallel will access adjacent data elements

GPU

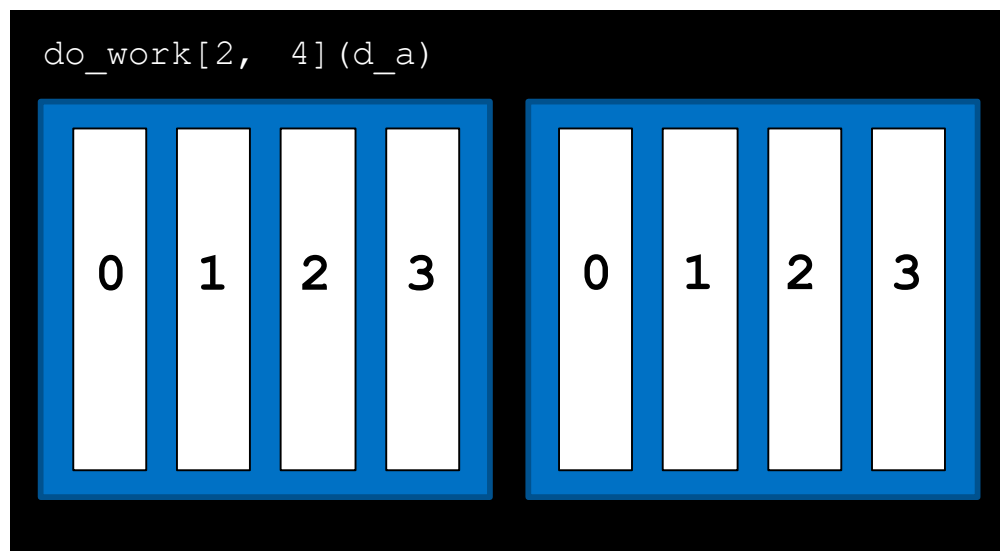


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With all threads working in this way, all elements are covered with the performance advantage of memory coalescing

GPU

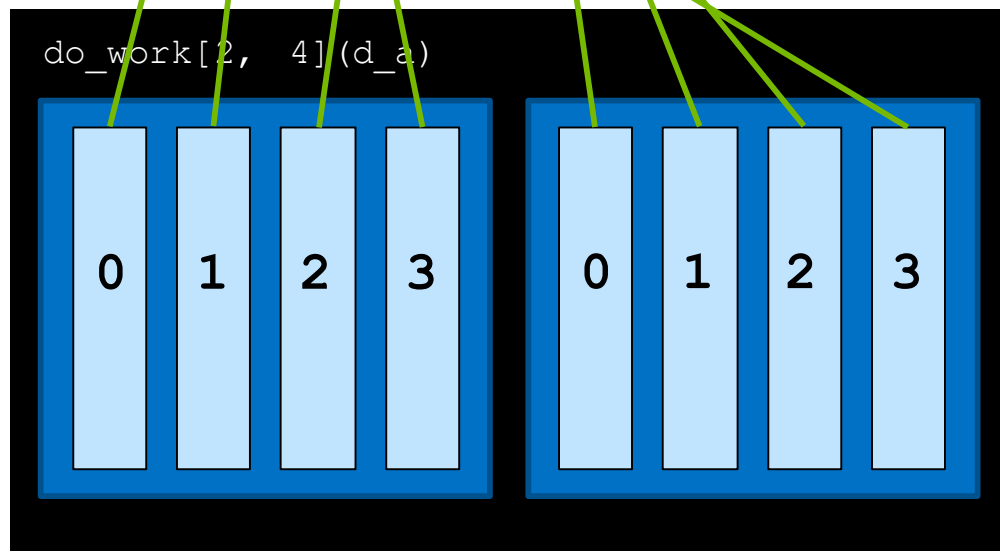


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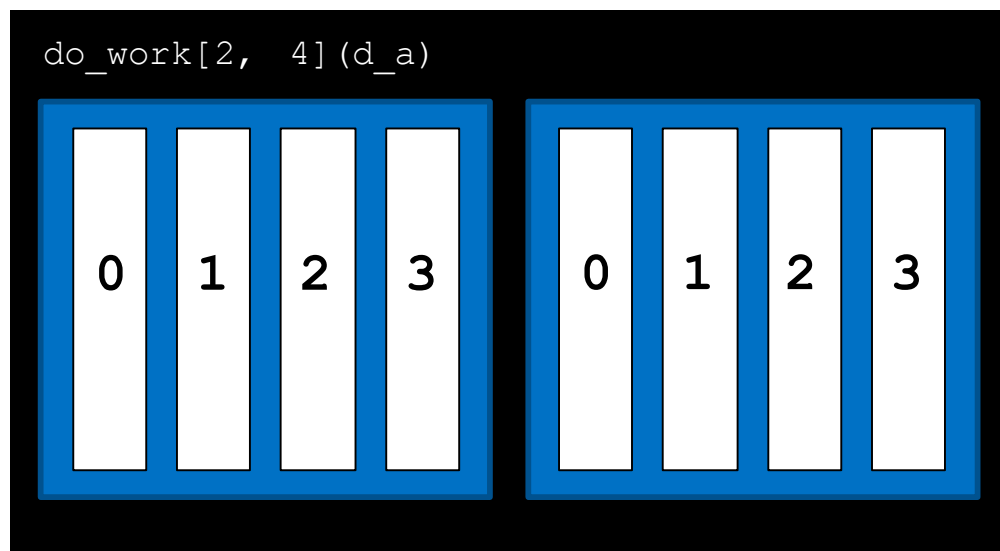


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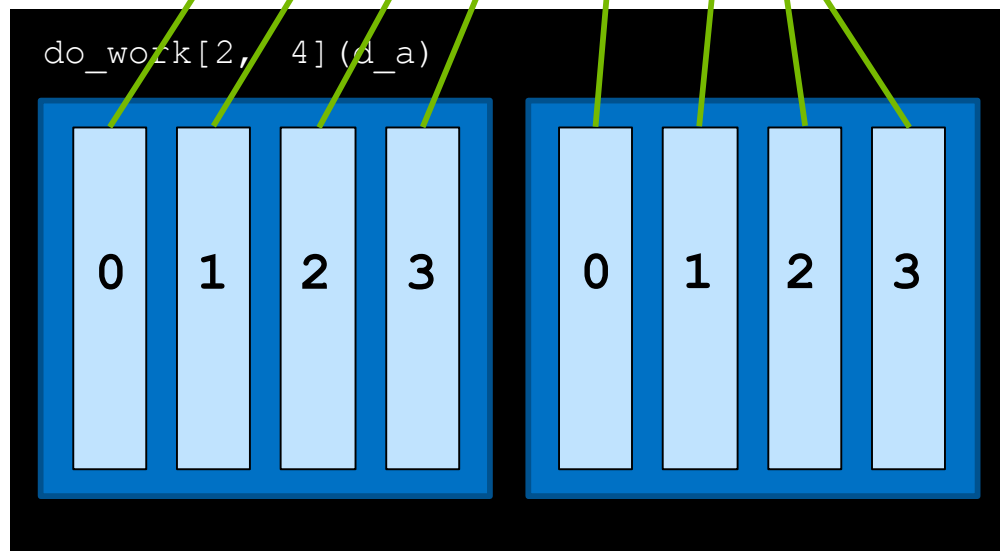


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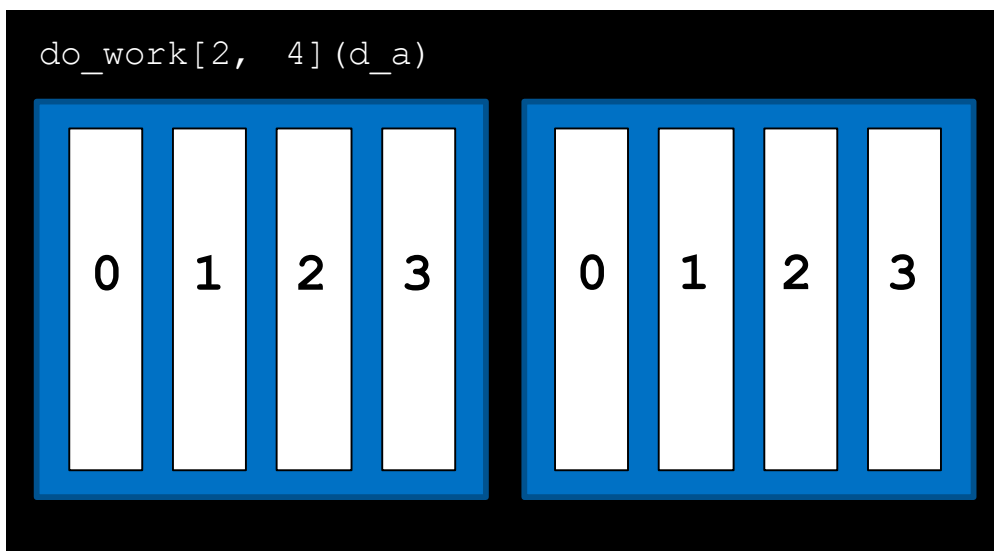


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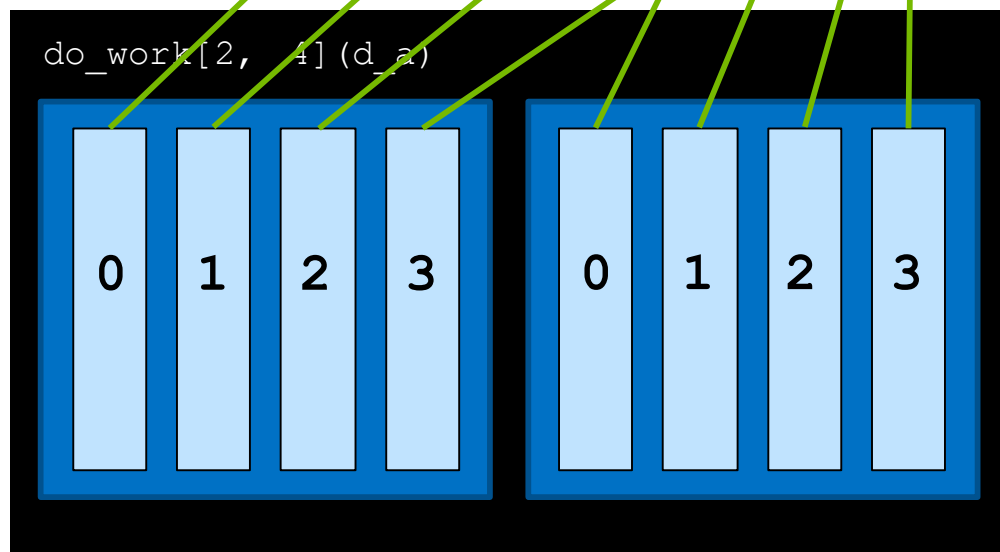


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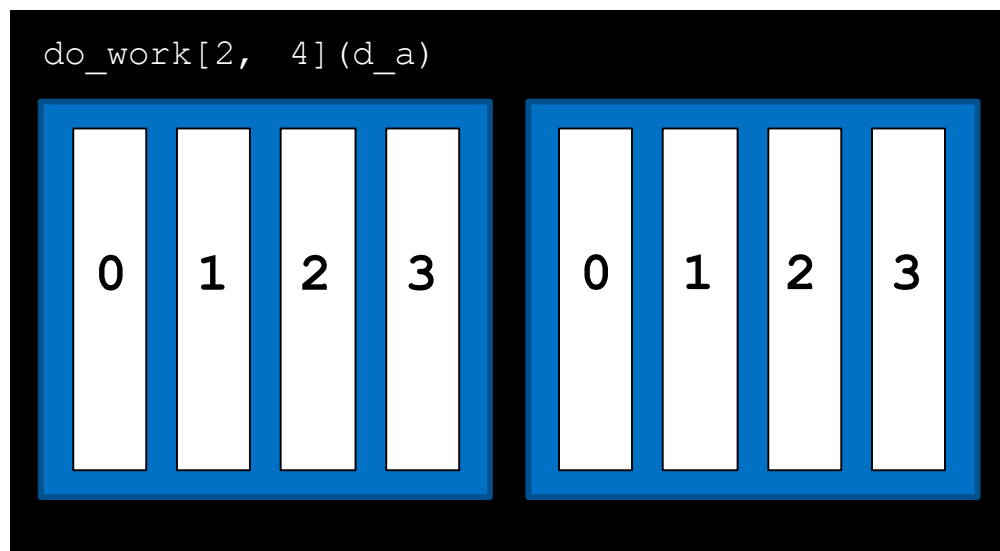


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GPU





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