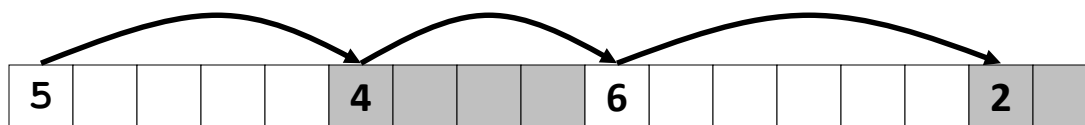


# Keeping Track of Free Blocks

- Method 1: *Implicit free list* using length—links all blocks



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- Method 2: *Explicit free list* using pointers



- Method 3: *Segregated free list*

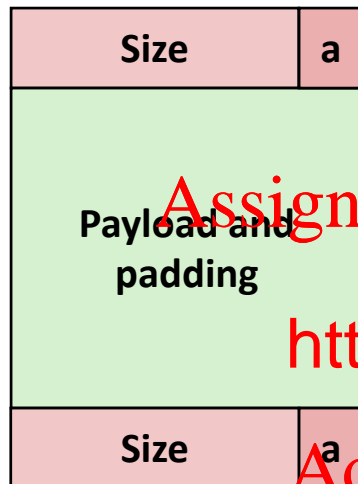
- Different free lists for different size classes

- Method 4: *Blocks sorted by size*

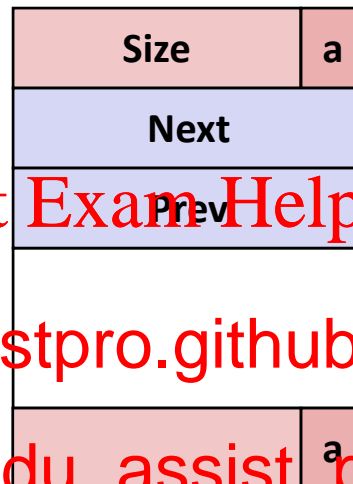
- Can use a balanced tree (e.g. Red-Black tree) with pointers within each free block, and the length used as a key

# Explicit Free Lists

Allocated (as before)



Free



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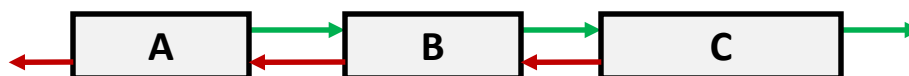
<https://eduassistpro.github.io/>

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- Maintain list(s) of *free* blocks, not *all* blocks
  - The “next” free block could be anywhere
    - So we need to store forward/back pointers, not just sizes
  - Still need boundary tags for coalescing
  - Luckily we track only free blocks, so we can use payload area

# Explicit Free Lists

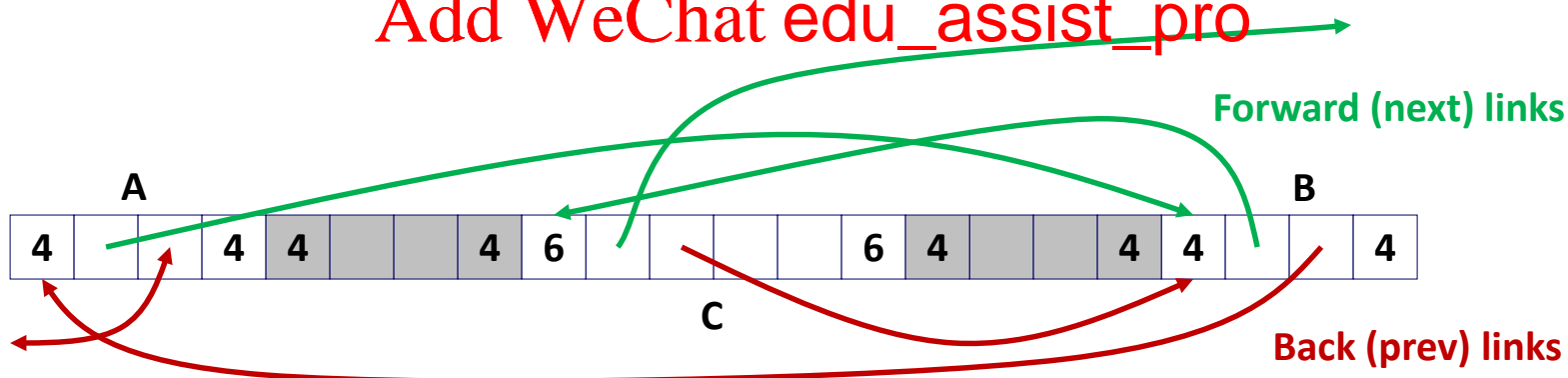
## ■ Logically:



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## ■ Physically: blocks <https://eduassistpro.github.io/>

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# Allocating From Explicit Free Lists

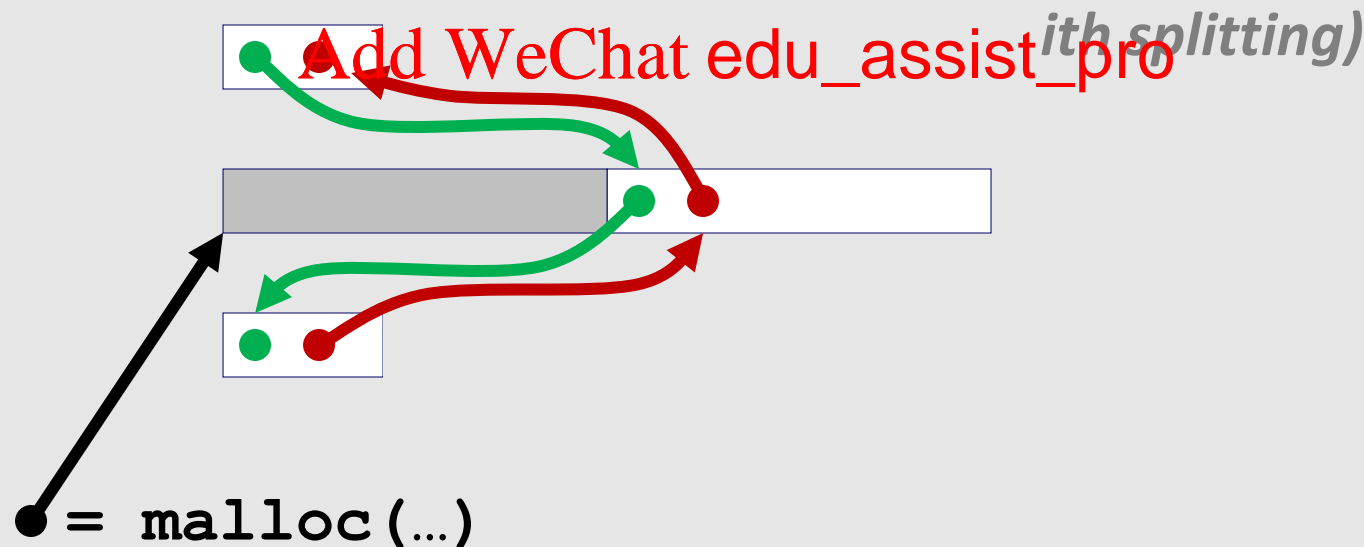
conceptual graphic

*Before*



<https://eduassistpro.github.io/>

*After*



# Freeing With Explicit Free Lists

- **Insertion policy:** Where in the free list do you put a newly freed block?
  - LIFO (last-in-first-out) policy
    - Insert freed block at the beginning of the free list
    - **Pro:** simple a
    - **Con:** studies <https://eduassistpro.github.io/> than address ordered
  - Address-ordered policy
    - Insert freed blocks so that free list blocks are always in address order:
 
$$addr(prev) < addr(curr) < addr(next)$$
    - **Con:** requires search
    - **Pro:** studies suggest fragmentation is lower than LIFO

# Explicit List Summary

## ■ Comparison to implicit list:

- Allocate is linear time in number of *free* blocks instead of *all* blocks
  - *Much faster* when most of the memory is full
- Slightly more complicated allocate and free since needs to splice blocks in and out of the list
- Some extra space needed for each block)
  - Does this increase internal frag

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## ■ Most common use of linked lists is in conjunction with segregated free lists

- Keep multiple linked lists of different size classes, or possibly for different types of objects