极客大学算法训练营
第三课
数组、链表、跳表

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目录

第一节

数组、链表、跳表的基本实现和特性

Array

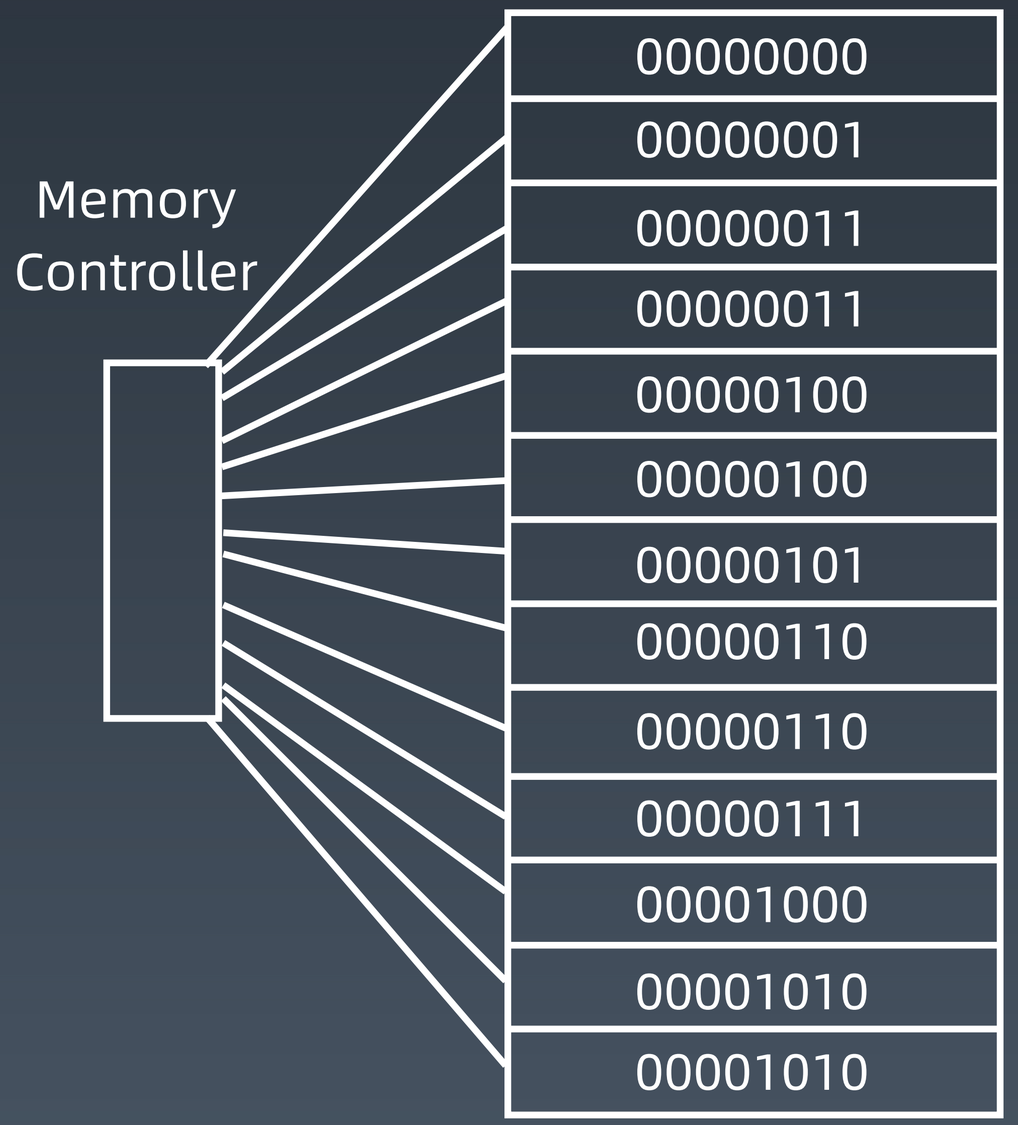
Java, C++: `int a[100];`

Python: `list = []`

JavaScript: `let x = [1, 2, 3]`

Array

0	00000011
1	00000001
2	00000101
3	00000100
4	00000011
5	00000000
6	00000000
7	00000000
8	00000000



Array 增加元素

Inserting

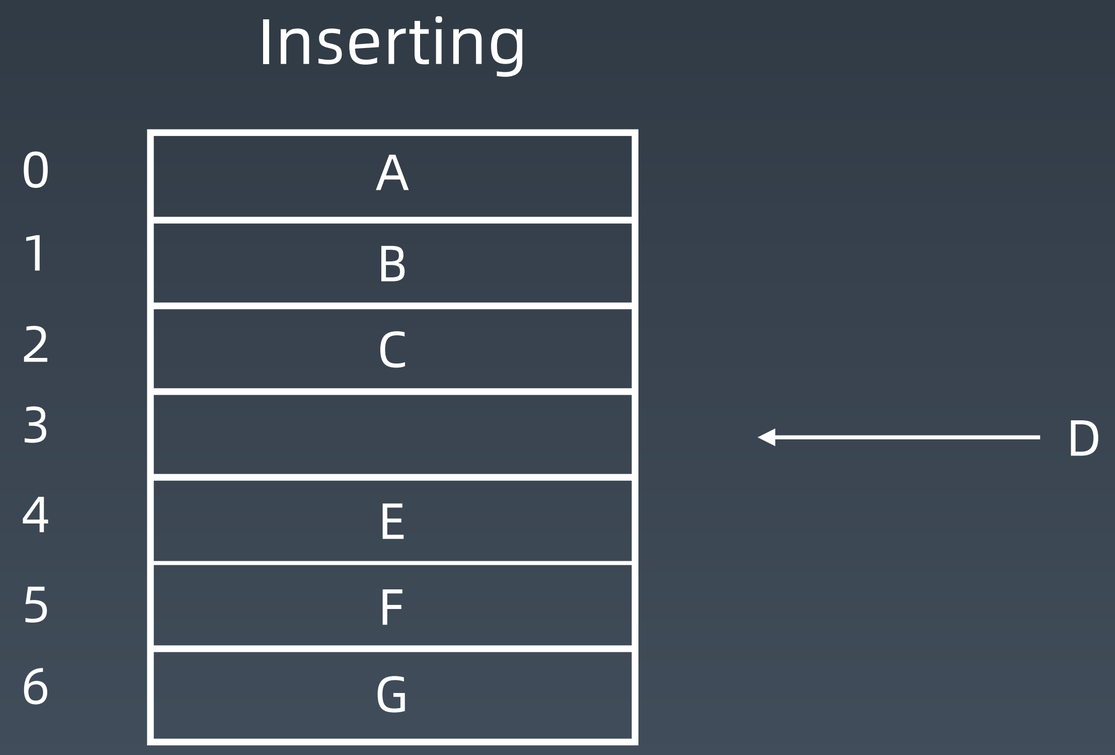
0	A
1	B
2	C
3	E
4	F
5	G
6	

Array 增加元素

Inserting

0	A	
1	B	
2	C	
3	E	D
4	F	
5	G	
6		

Array 增加元素



Array 增加元素

Inserting

0	A
1	B
2	C
3	D
4	E
5	F
6	G

Array 删除元素

Deleting

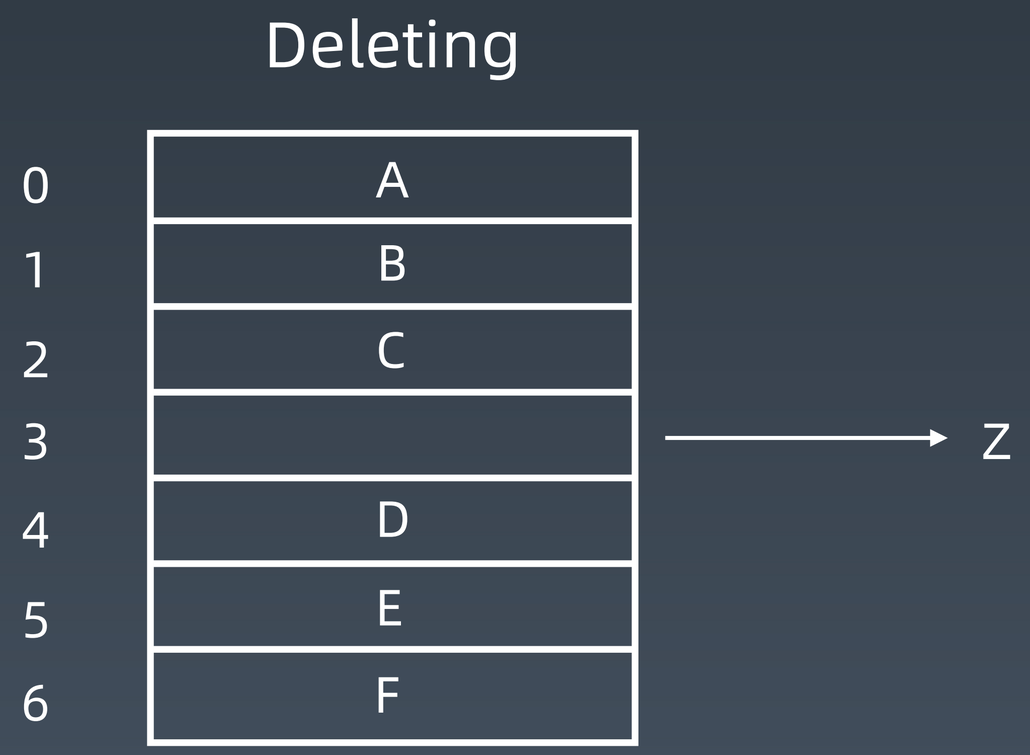
0	A
1	B
2	C
3	Z
4	D
5	E
6	F

Array 删除元素

Deleting

0	A
1	B
2	C
3	Z
4	D
5	E
6	F

Array 删除元素



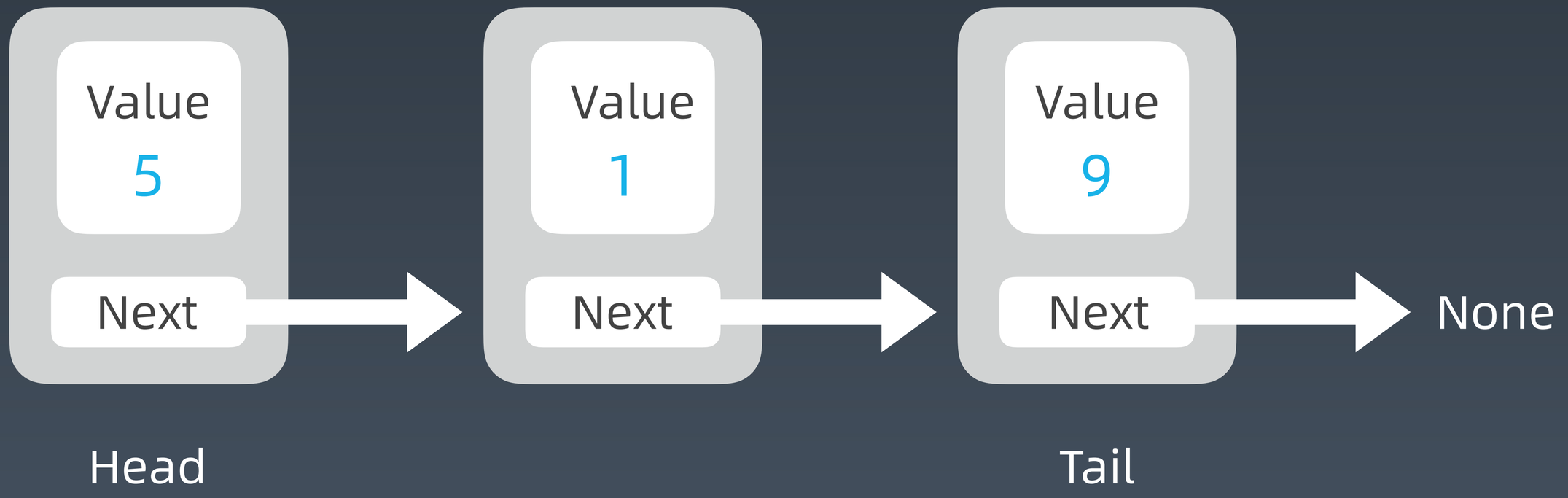
Array 删除元素

Deleting

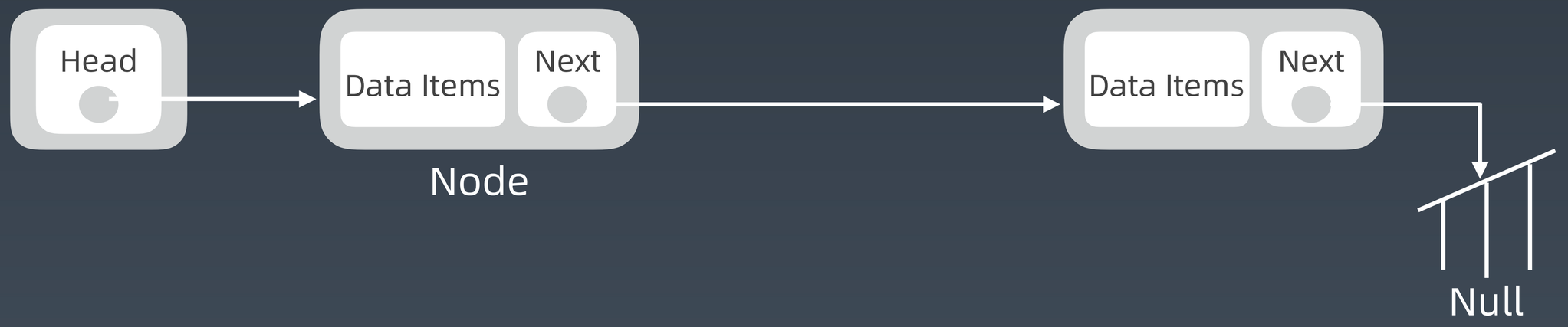
0	A
1	B
2	C
3	D
4	E
5	F
6	

Z

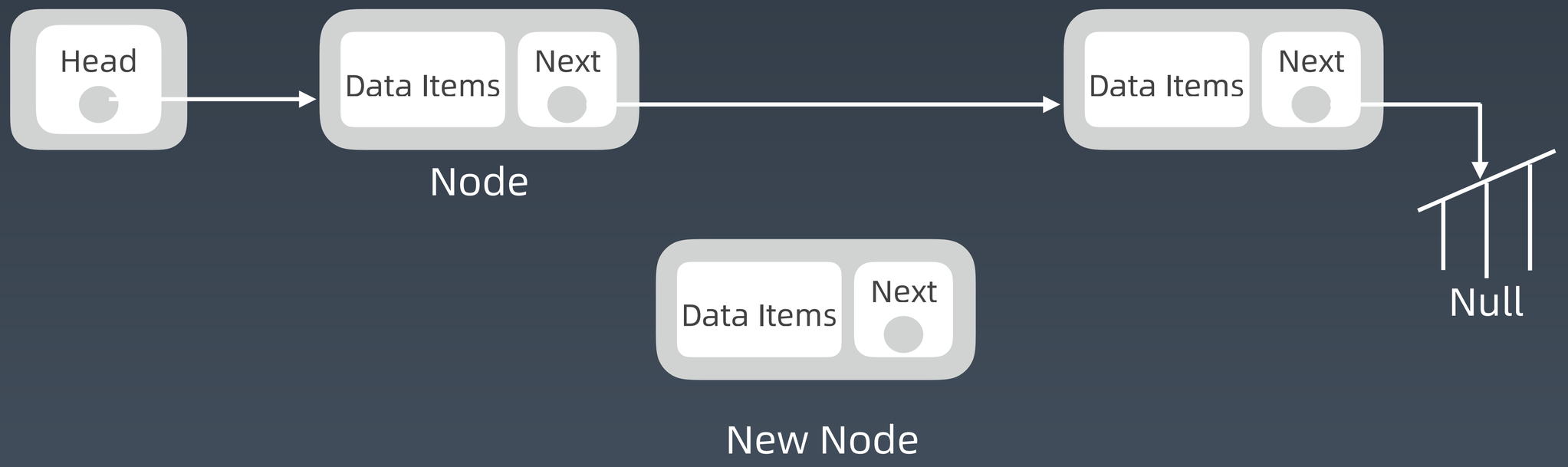
Linked List



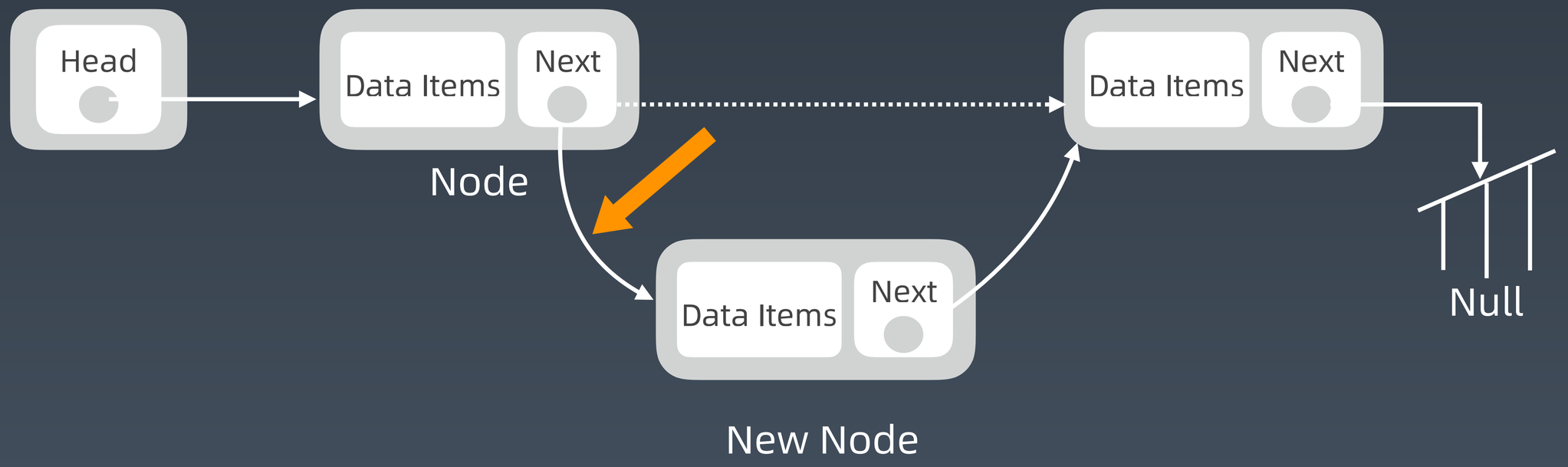
Linked List 增加结点



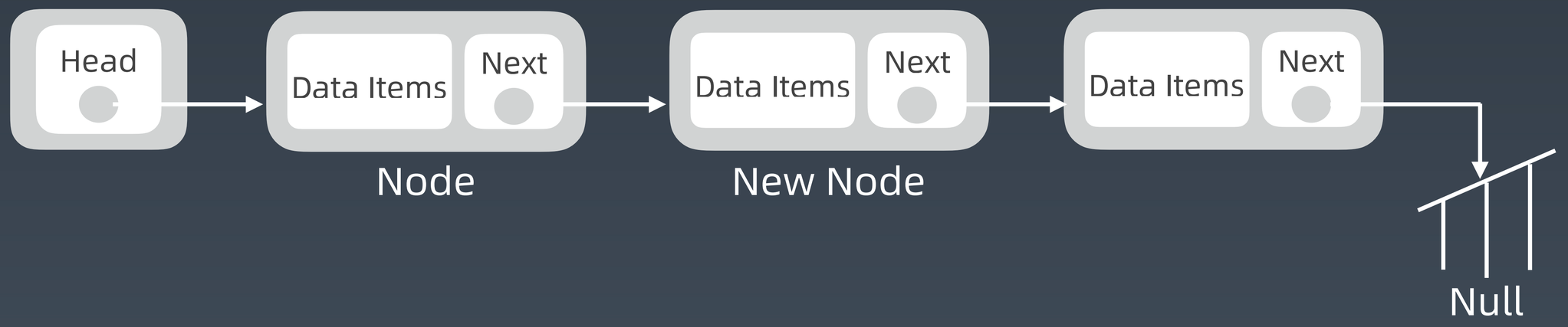
Linked List 增加结点



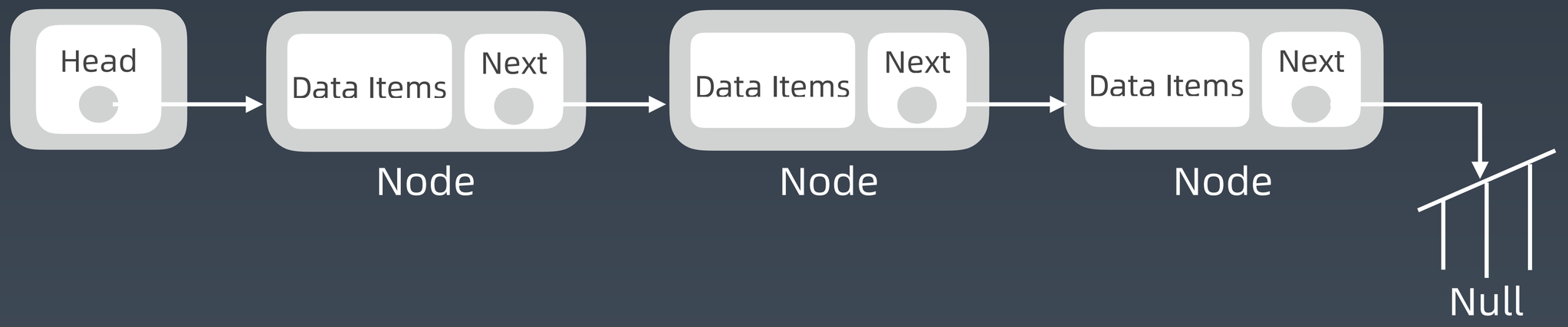
Linked List 增加结点



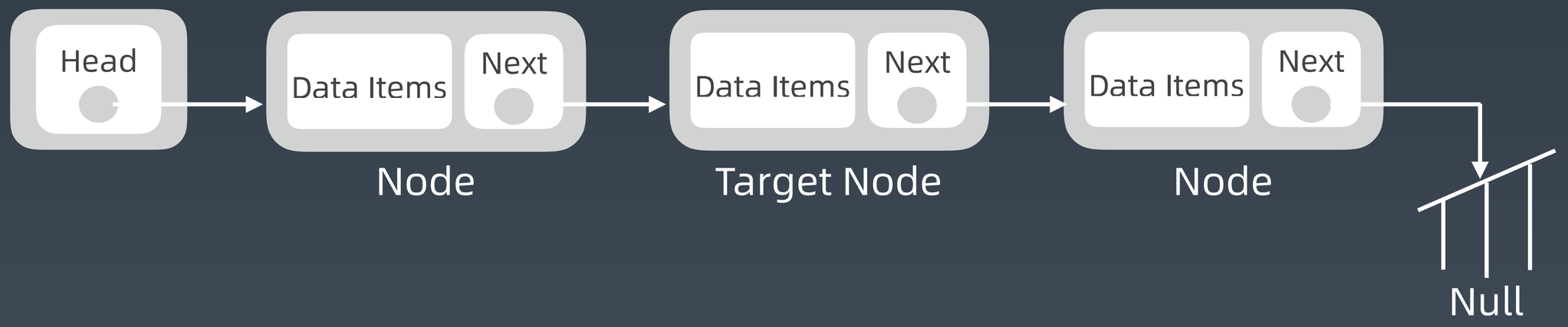
Linked List 增加结点



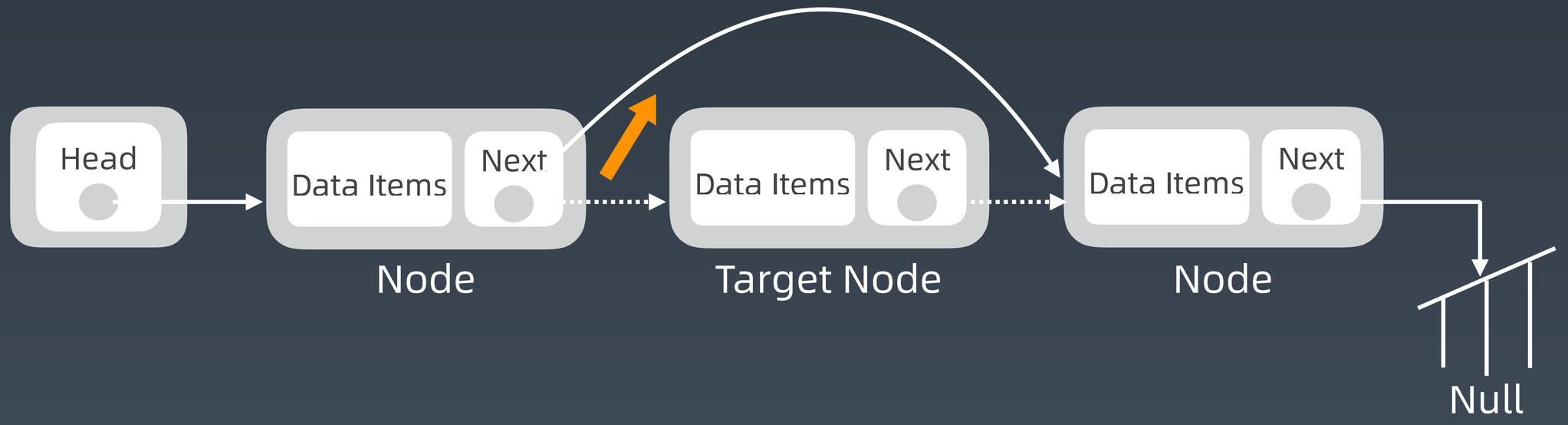
Linked List 删除结点



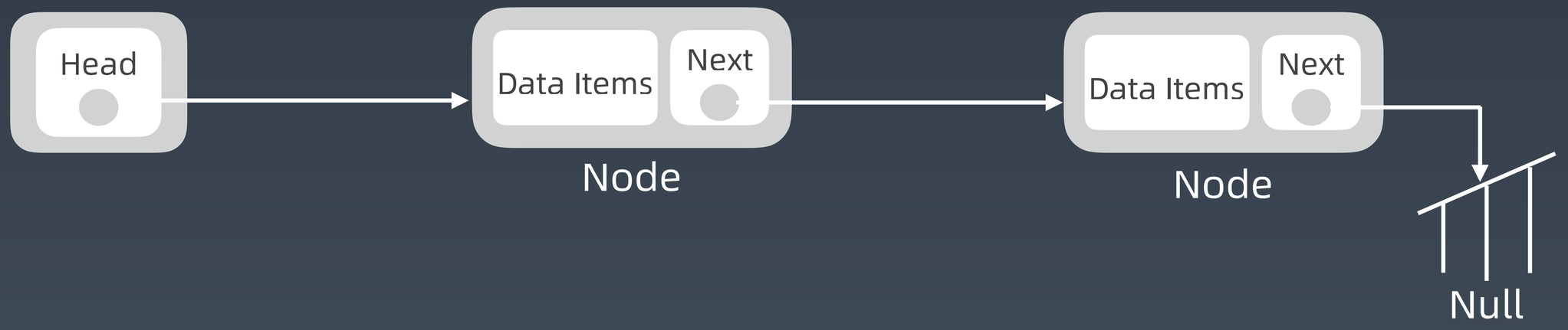
Linked List 删除结点



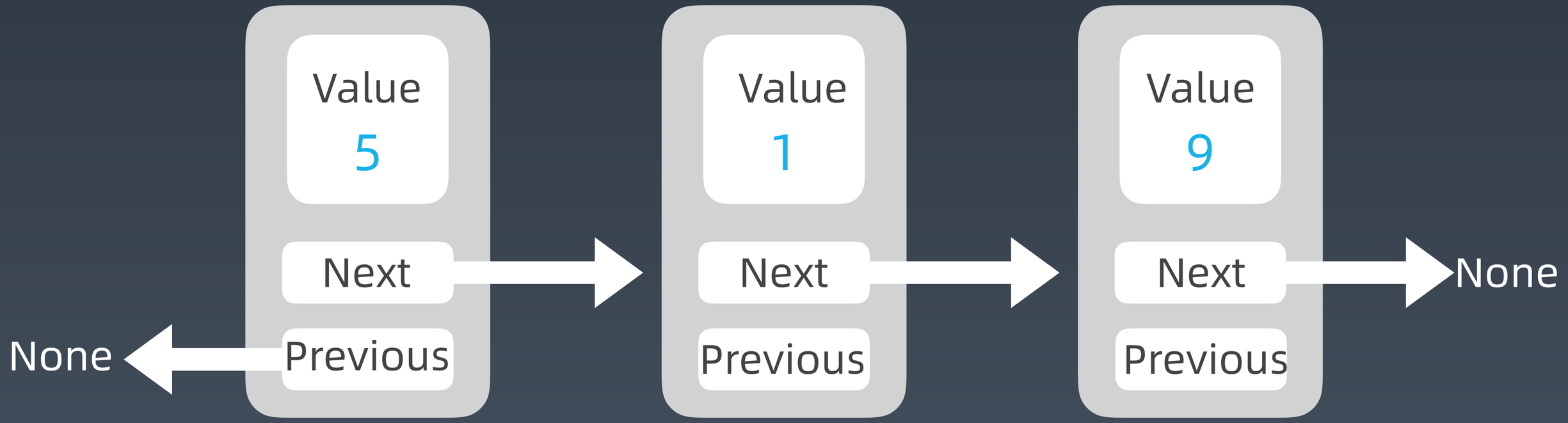
Linked List 删除结点



Linked List 删除结点



Double Linked List



时间复杂度

prepend	O(1)
append	O(1)
lookup	O(n)
insert	O(1)
delete	O(1)

Array 时间复杂度

prepend	O(1)
append	O(1)
lookup	O(1)
insert	O(n)
delete	O(n)

跳表

Skip List

链表的缺陷

prepend	O(1)
append	O(1)
lookup	O(n)
insert	O(1)
delete	O(1)

如何给链表加速

原始
链表

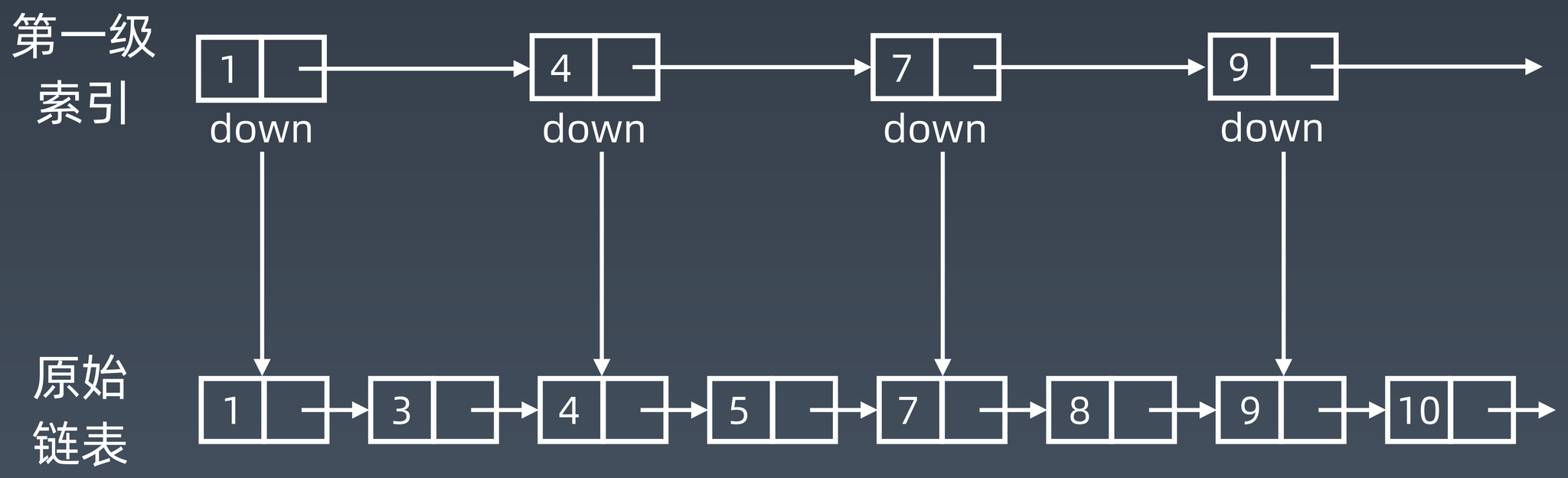
时间复杂度：查询 O(n)

简单优化：添加头尾指针

然后呢？ — 思考

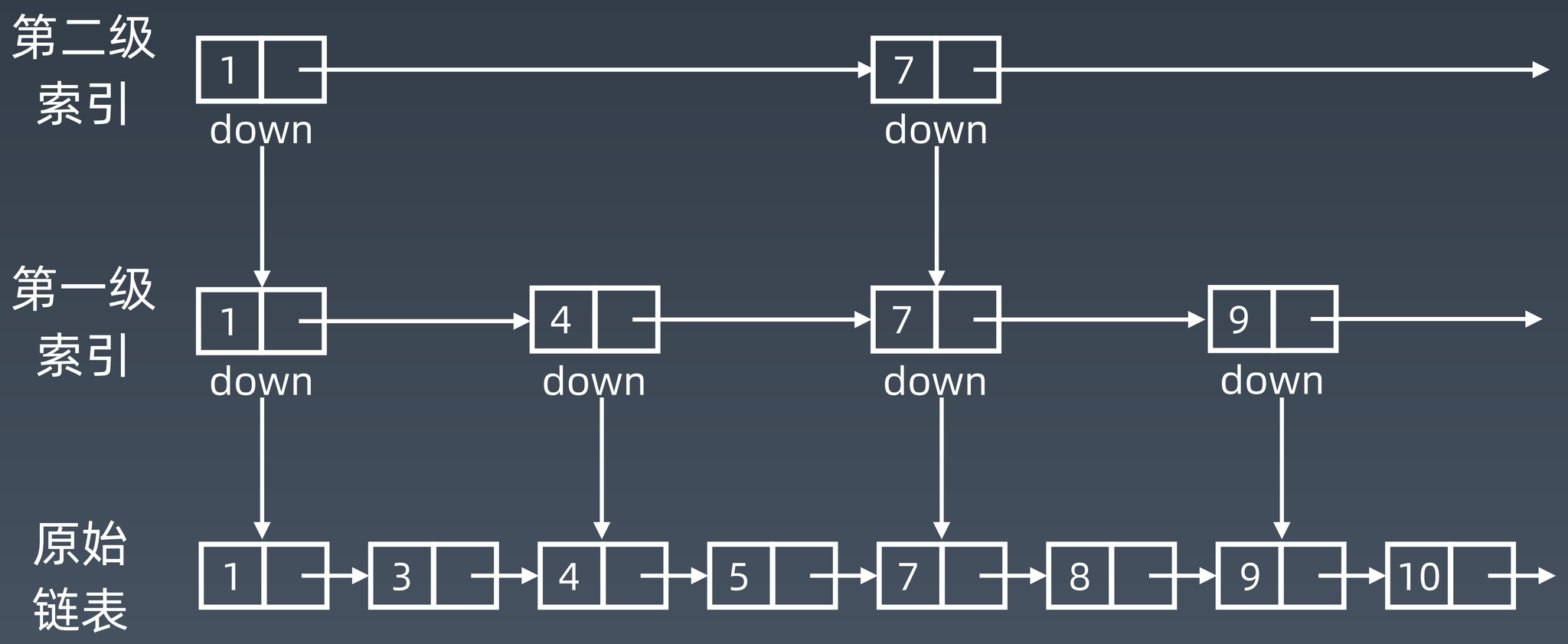
添加第一级索引

如何提高链表线性查找的效率？



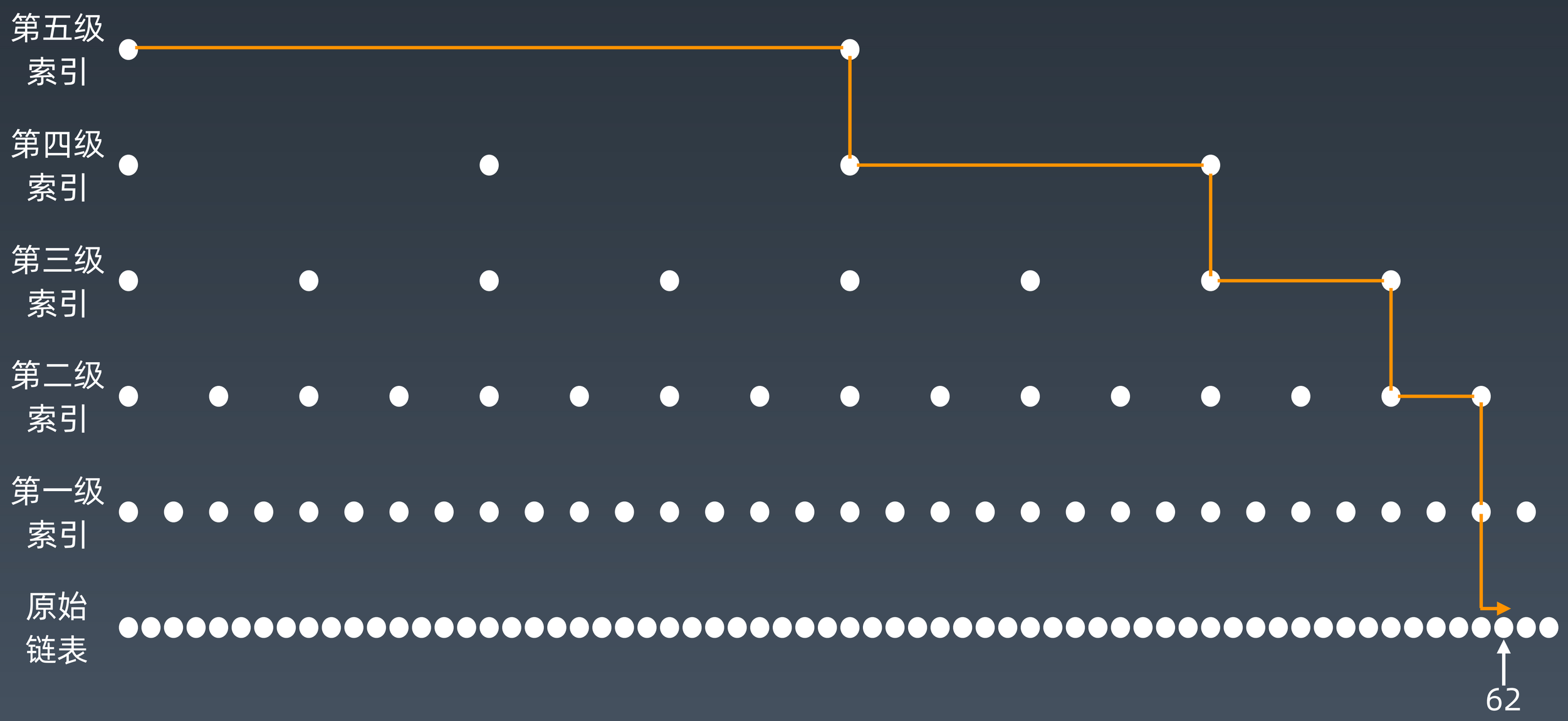
添加第二级索引

如何进一步提高链表查找的效率?



添加多级索引

以此类推，增加多级索引


第五级
索引
第四级
索引
第三级
索引
第二级
索引
第一级
索引
原始
链表
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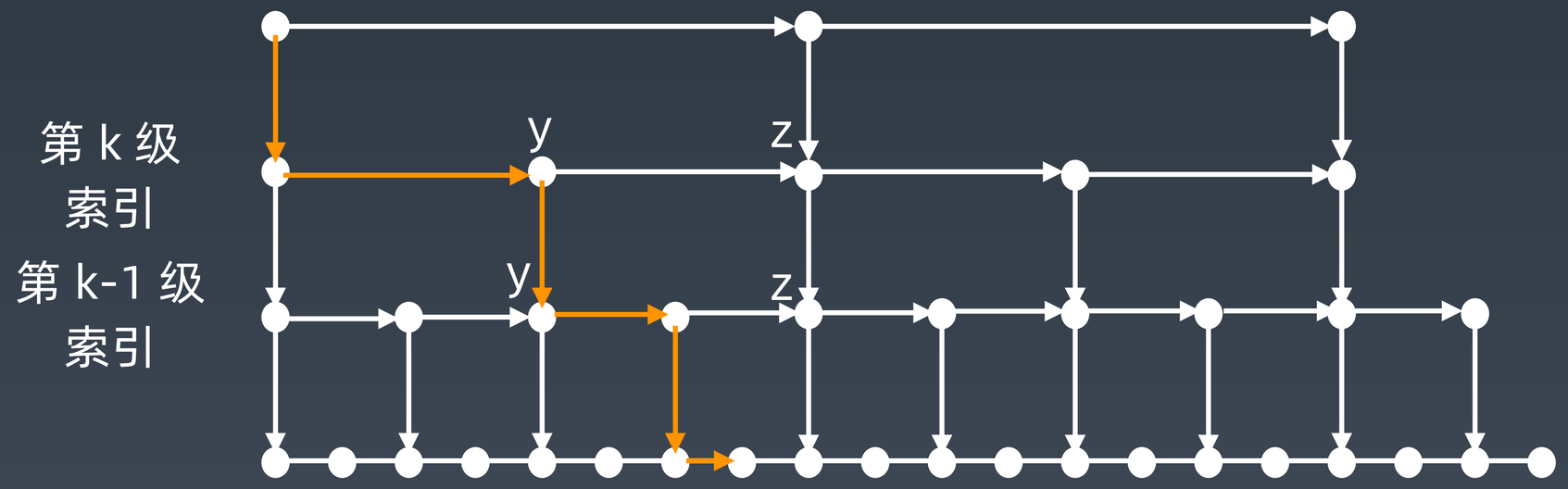
跳表查询的时间复杂度分析

n/2、n/4、n/8、第 k 级索引结点的个数就是 n/(2^k)

假设索引有 h 级，最高级的索引有 2 个结点。n/(2^h) = 2，从而求得 h = log2(n)-1

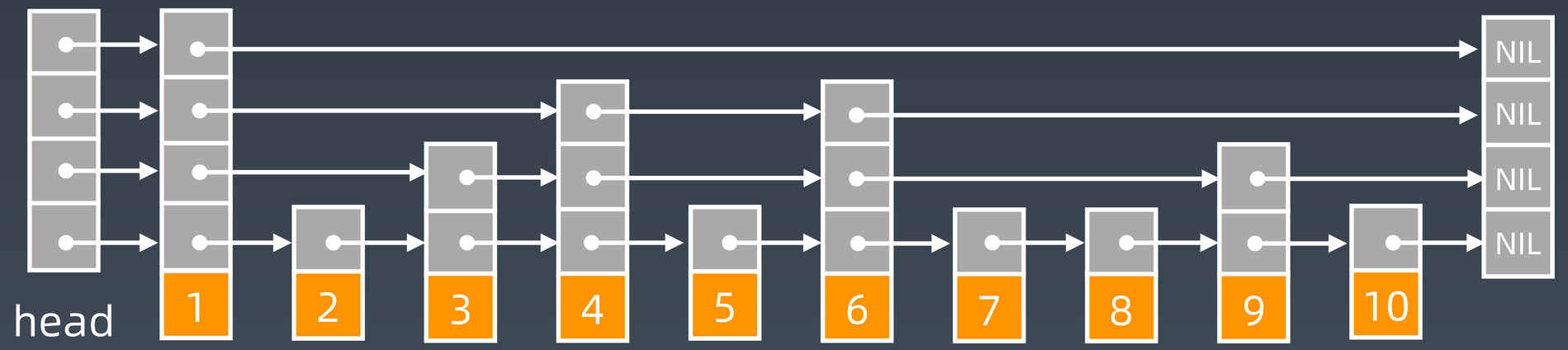
跳表查询的时间复杂度分析



索引的高度：logn，每层索引遍历的结点个数：3

在跳表中查询任意数据的时间复杂度就是 O(logn)

现实中跳表的形态



跳表的空间复杂度分析

原始链表大小为 n，每 2 个结点抽 1 个，每层索引的结点数：

$$\frac{n}{2}, \frac{n}{4}, \frac{n}{8}, \cdots, 8, 4, 2$$

原始链表大小为 n，每 3 个结点抽 1 个，每层索引的结点数：

$$\frac{n}{3}, \frac{n}{9}, \frac{n}{27}, \cdots, 9, 3, 1$$

空间复杂度是 O(n)

工程中的应用

LRU Cache - Linked list

https://www.jianshu.com/p/b1ab4a170c3c
https://leetcode-cn.com/problems/lru-cache

Redis - Skip List

https://redisbook.readthedocs.io/en/latest/internal-datastruct/skiplist.html
https://www.zhihu.com/question/20202931

小结

- 数组、链表、跳表的原理和实现
- 三者的时间复杂度、空间复杂度
- 工程运用
- 跳表：升维思想 + 空间换时间

第二节

实战题目解析

练习步骤

1. 5-10分钟：读题和思考

2. 有思路：自己开始做和写代码；不然，马上看题解！

3. 默写背诵、熟练

4. 然后开始自己写（闭卷）

实战练习题目 - Array

1. https://leetcode-cn.com/problems/container-with-most-water/
2. https://leetcode-cn.com/problems/move-zeroes/
3. https://leetcode-cn.com/problems/climbing-stairs/
4. https://leetcode-cn.com/problems/3sum/（高频老题）

实战练习题目 - Linked List

1. https://leetcode-cn.com/problems/reverse-linked-list/
2. https://leetcode-cn.com/problems/swap-nodes-in-pairs
3. **https://leetcode-cn.com/problems/linked-list-cycle**
4. https://leetcode-cn.com/problems/linked-list-cycle-ii
5. https://leetcode-cn.com/problems/reverse-nodes-in-k-group/

解法固定，熟能生巧

Homework

1. https://leetcode-cn.com/problems/remove-duplicates-from-sorted-array/
2. https://leetcode-cn.com/problems/rotate-array/
3. https://leetcode-cn.com/problems/merge-two-sorted-lists/
4. https://leetcode-cn.com/problems/merge-sorted-array/
5. https://leetcode-cn.com/problems/two-sum/
6. https://leetcode-cn.com/problems/move-zeroes/
7. https://leetcode-cn.com/problems/plus-one/

THANKS!

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