操作系统 Operating Systems

L28 生磁盘的使用

Raw Disks

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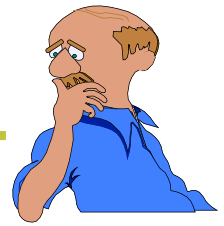
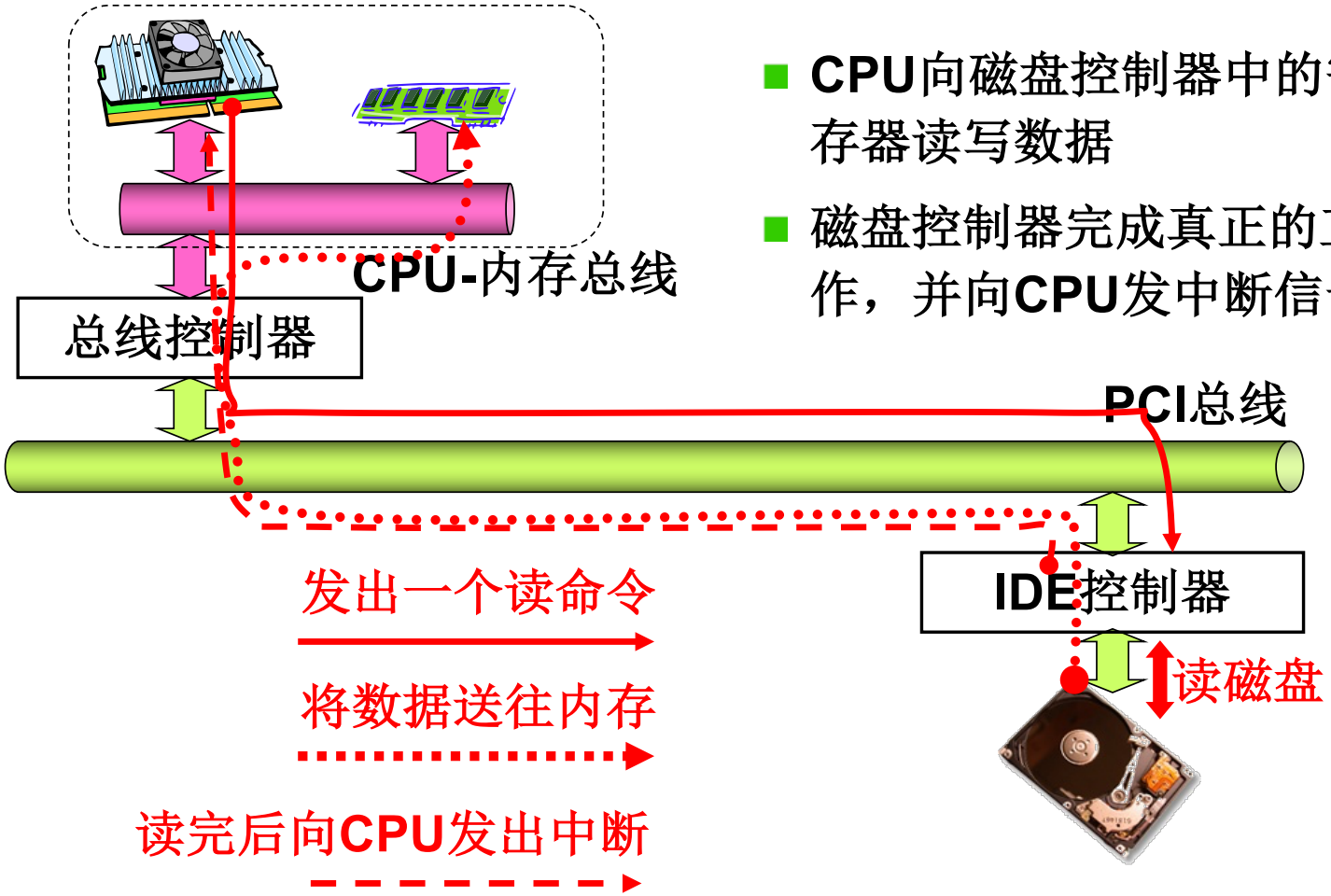
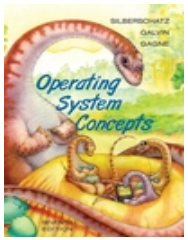
仍然从硬件开始...

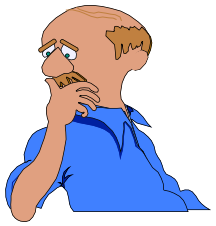




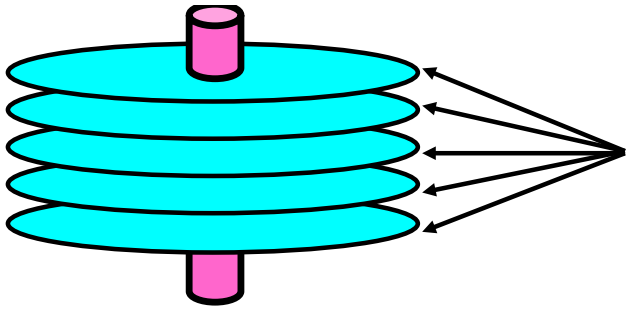
- CPU向磁盘控制器中的寄存器读写数据
- 磁盘控制器完成真正的工作，并向CPU发中断信号



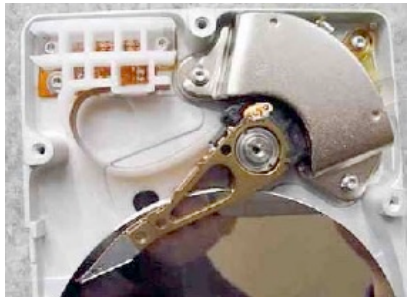
使用磁盘从认识磁盘开始



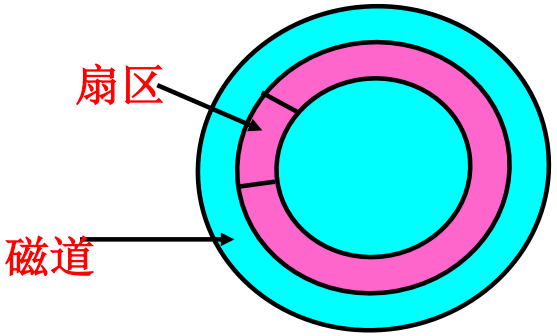
- 画一个示意图:



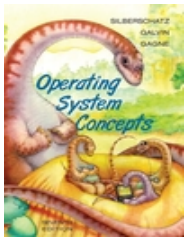
盘面



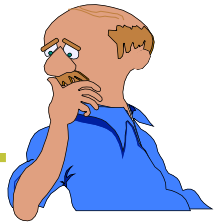
- 看看俯视图:



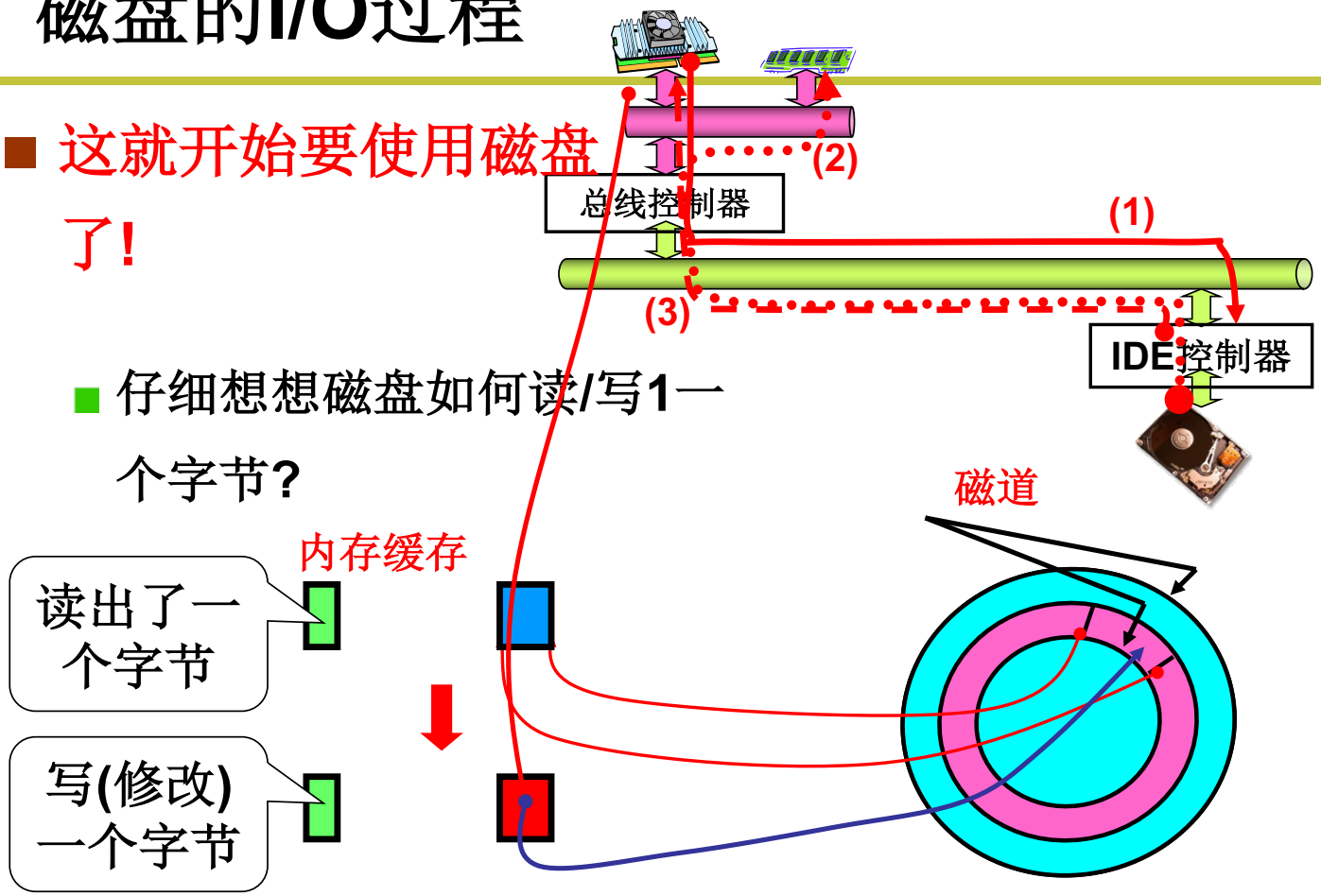
- 磁盘的访问单位是扇区
- 扇区大小：512字节
- 扇区的大小是传输时间和碎片浪费的折衷



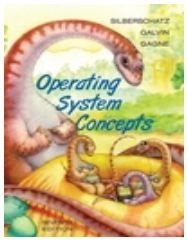
磁盘的I/O过程



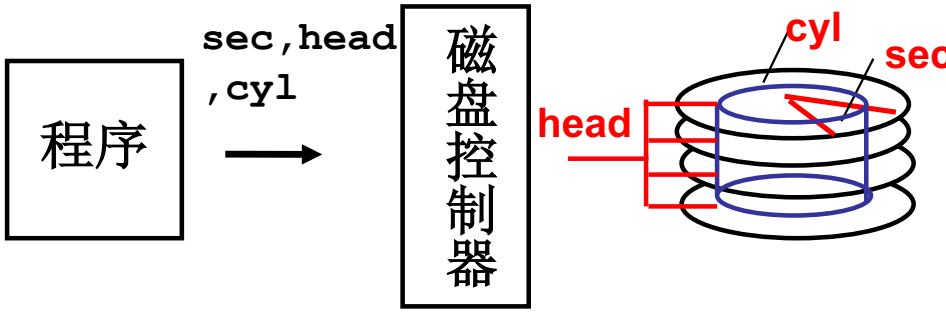
- 这就开始要使用磁盘了!
  - 仔细想想磁盘如何读/写1一个字节?



  - 磁盘I/O过程: 控制器→寻道→旋转→传输!



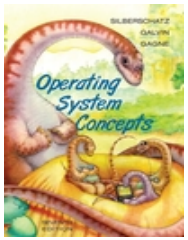
最直接的使用磁盘



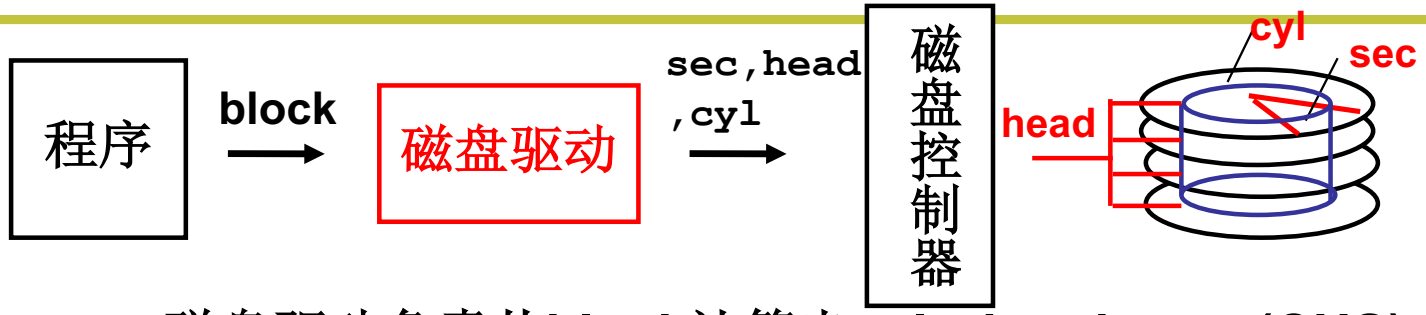
- 只要往控制器中写柱面、磁头、扇区、缓存位置

```
void do_hd_request(void)
{   ...hd_out(dev,nsect,sec,head,cyl,WIN_WRITE,...);
    port_write(HD_DATA,CURRENT->buffer,256);}
```

```
void hd_out(drive, nsect, sec, head, cyl, cmd...)
{   port = HD_DATA; //数据寄存器端口(0x1f0)
    outb_p(nsect,++port); outb_p(sect,++port);
    outb_p(cyl,++port); outb_port(cyl>>8,++port);
    outb_p(0xA0|(drive<<4)|head, ++port);
    outb_p(cmd, ++port); }
```



通过盘块号读写磁盘(一层抽象)



- 磁盘驱动负责从block计算出cyl，head，sec(CHS)

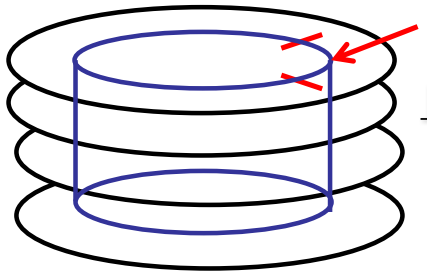
问题：如何编址?为什么这样编址？ block相邻的盘块可以快速读出

磁盘访问时间 = 写入控制器时间 + 寻道时间 + 旋转时间 + 传输时间

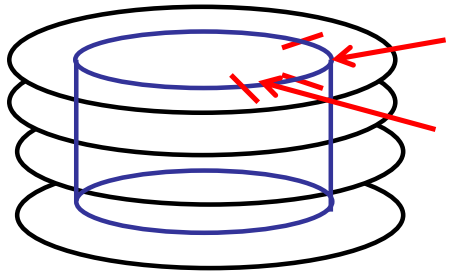
50M/秒,约0.3ms

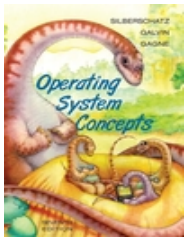
12 ms to 8 ms

7200转/分钟:半周 4 ms

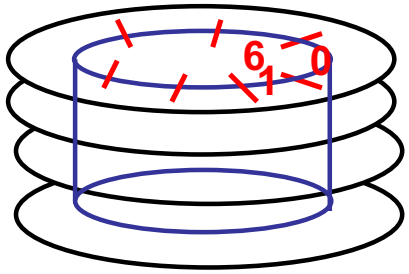


问题：1号扇区在哪里?

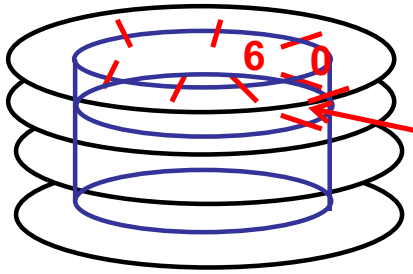




从CHS到扇区号，从扇区到盘块



问题：接下来呢？



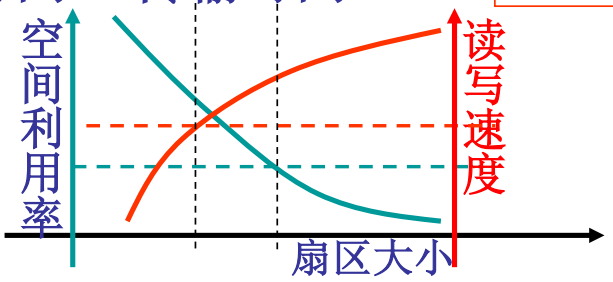
问题：C、H、S得到的扇区号是？ C×(Heads×Sectors) + H×Sectors + S

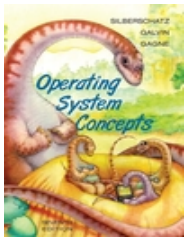
磁盘访问时间 = 写入控制器时间 + 寻道时间 + 旋转时间 + 传输时间

共计约10ms

扇区大小固定，但操作系统可以每次读/写连续的几个扇区(盘块)

- 从扇区到盘块: 每次读写1 K：碎片0.5K；读写速度100K/秒；每次读写1 M：碎片0.5M；读写速度约40M/秒





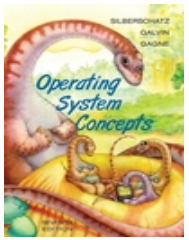
再接着使用磁盘：程序输出block

```
static void make_request()
{   struct requset *req;
    req=request+NR_REQUEST;
    req->sector=bh->b_blocknr<<1;
    add_request(major+blk_dev,req); }
```

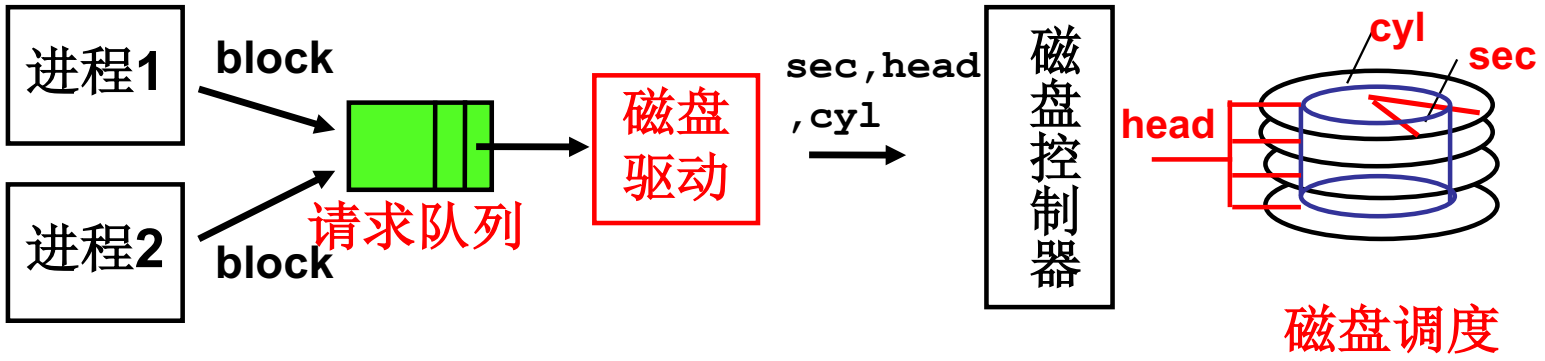
问题：Linux 0.11盘块多大?

block = C×(Heads×Sectors) + H×Sectors + S ➔ S = block%Sectors

```
void do_hd_request(void)
{ unsigned int block=CURRENT->sector;
  __asm__("divl %4":"=a"(block),"=d"(sec):"0"(block),
        "1"(0),"r"(hd_info[dev].sect));
  __asm__("divl %4":"=a"(cyl),"=d"(head):"0"(block),
          "1"(0),"r"(hd_info[dev].head));
  hd_out(dev,nsect,sec,head,cyl,WIN_WRITE,...);
   ... }
```



多个进程通过队列使用磁盘(第二层抽象)

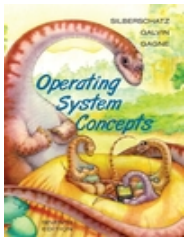


- 多个磁盘访问请求出现在请求队列怎么办?
- 调度的目标是什么? 调度时主要考察什么?

目标当然是平均访问延迟小!

寻道时间是主要矛盾!

- 给调度算法，仍然从FCFS开始...



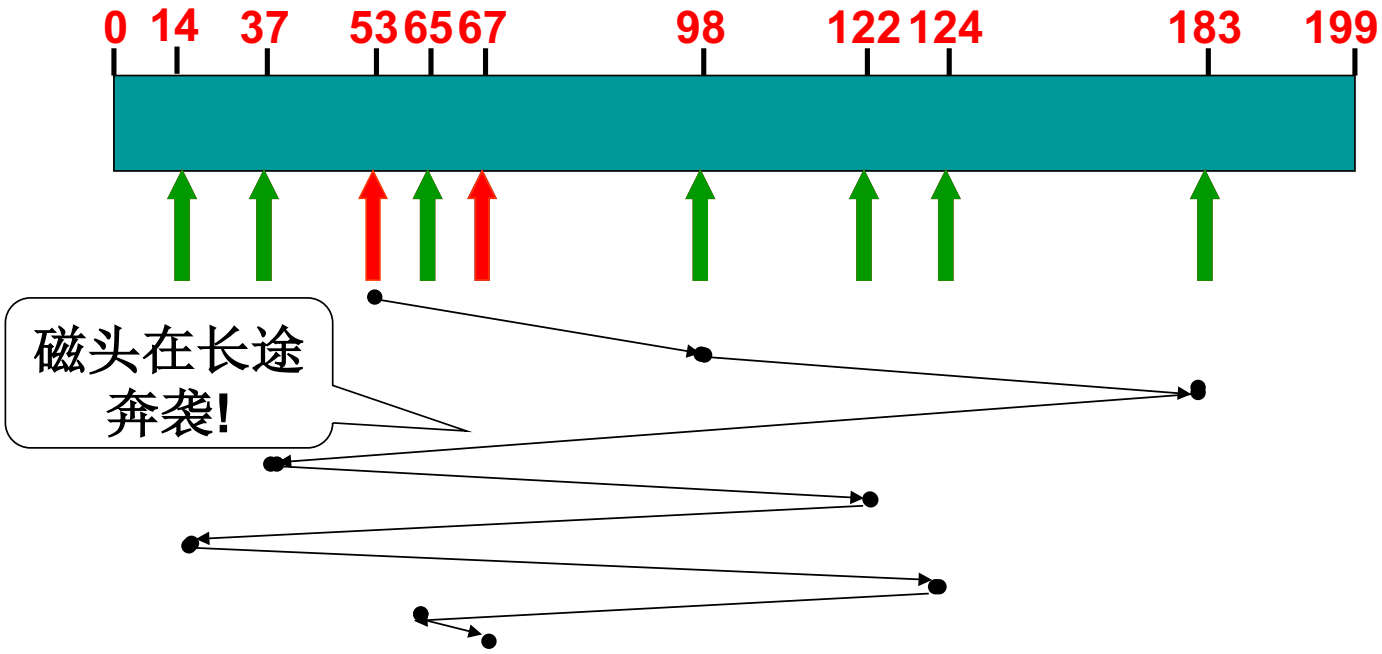
FCFS磁盘调度算法

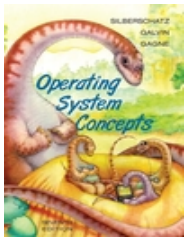
- 最直观、最公平的调度：
  - 一个实例: 磁头开始位置=53；

    请求队列=98, 183, 37, 122, 14, 124, 65, 67

FCFS: 磁头共移动640磁道!

在移动过程中把经过的请求处理了!

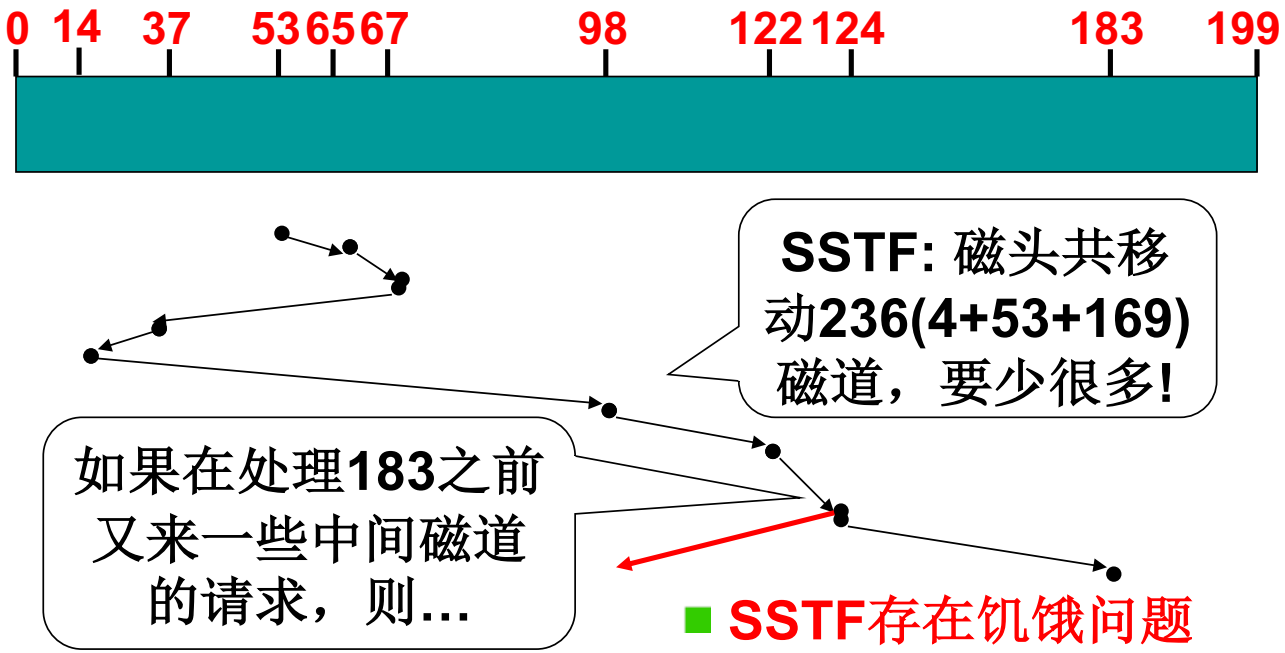




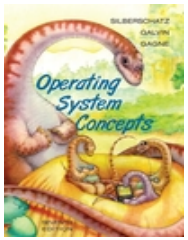
SSTF磁盘调度

- **Shortest-seek-time First：**
  - 继续该实例: 磁头开始位置=53；

    请求队列=98, 183, 37, 122, 14, 124, 65, 67



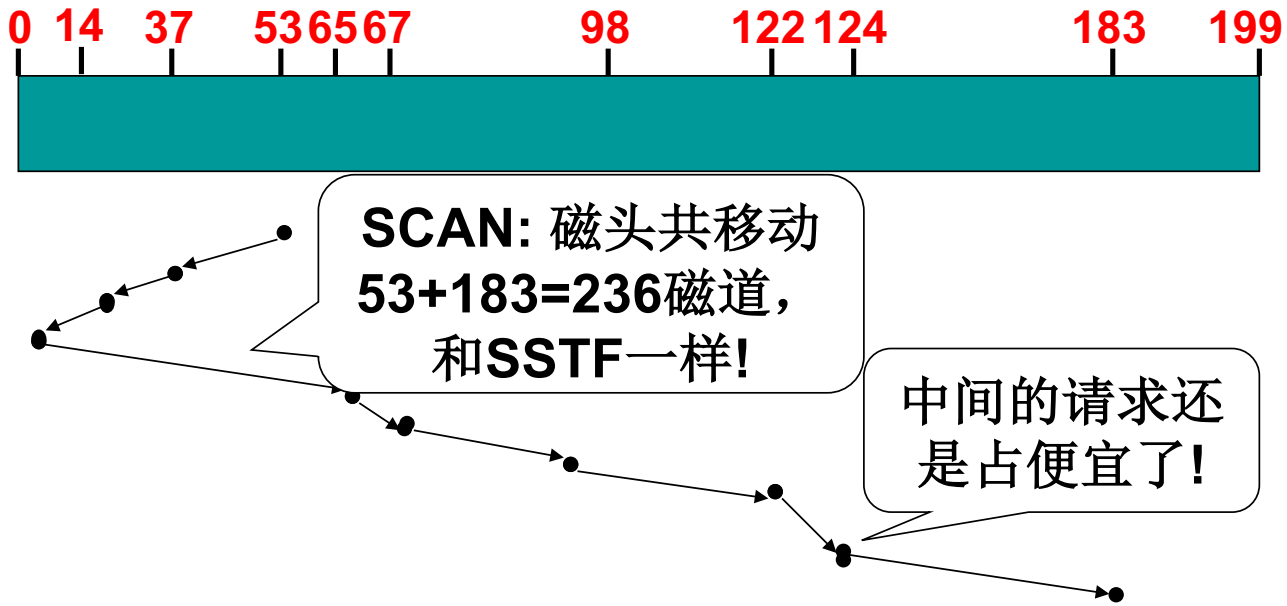
  - SSTF存在饥饿问题

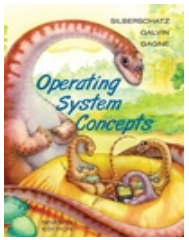


SCAN磁盘调度

- **SSTF+中途不回折：每个请求都有处理机会**
  - 继续该实例: 磁头开始位置=53；

    请求队列=98, 183, 37, 122, 14, 124, 65, 67

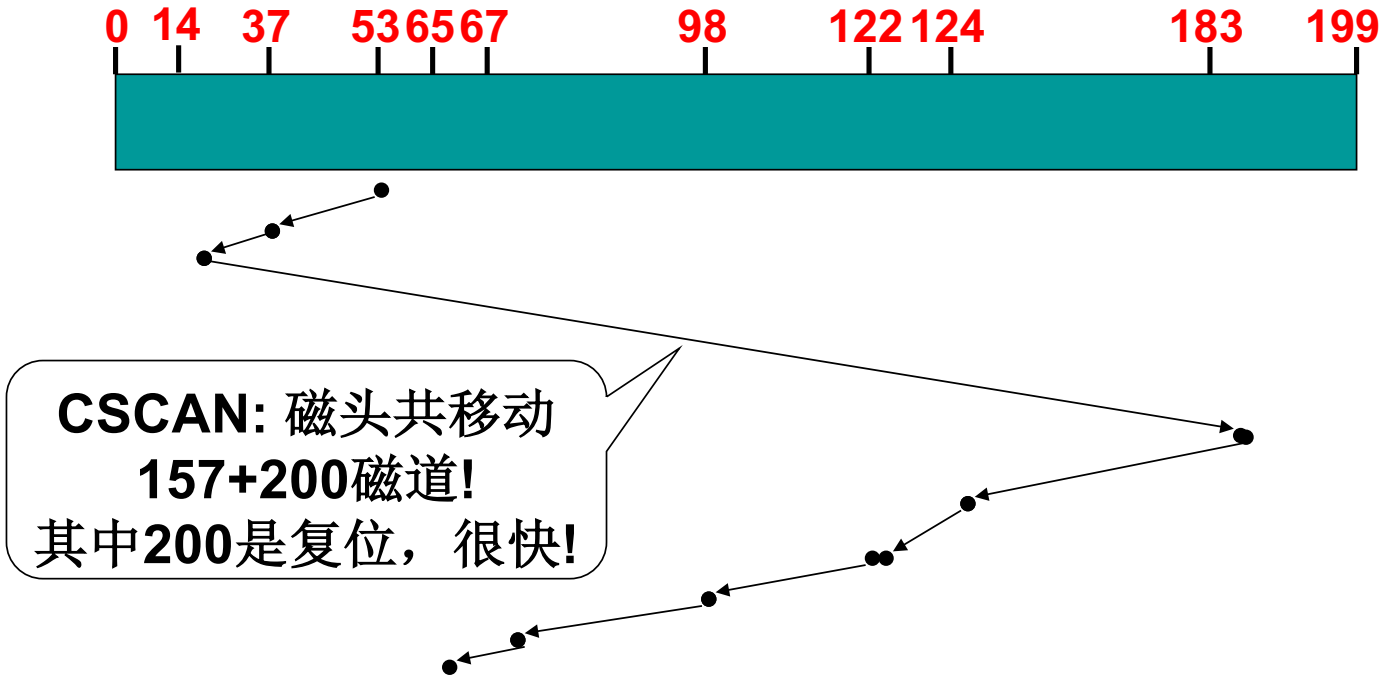


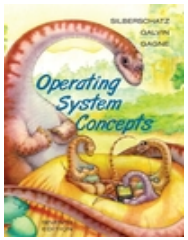


C-SCAN磁盘调度(电梯算法)

- SCAN+直接移到另一端：两端请求都能很快处理
  - 继续该实例: 磁头开始位置=53；

    请求队列=98, 183, 37, 122, 14, 124, 65, 67





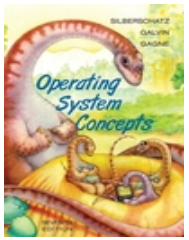
多个进程共同使用磁盘

```
static void make_request()
{   ...req->sector=bh->b_blocknr<<1;
    add_request(major+blk_dev,req); }
```

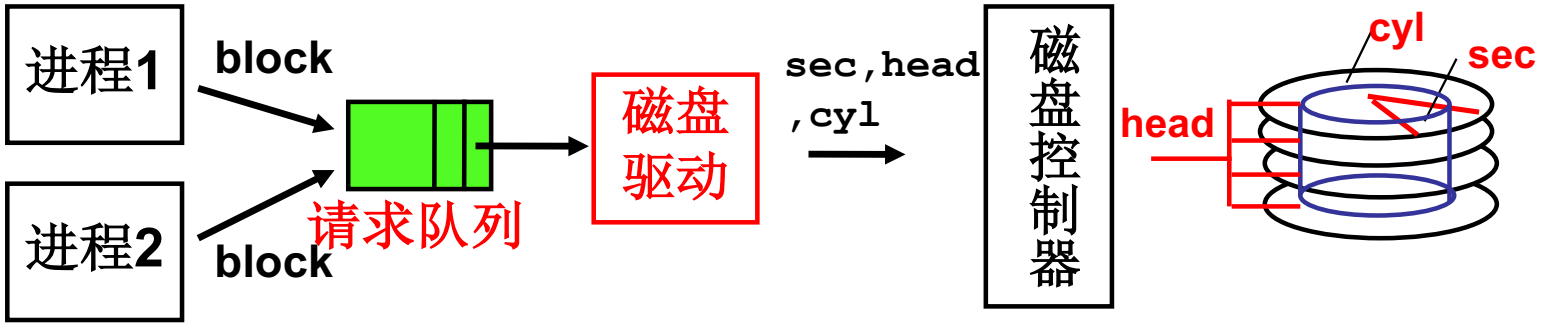
```
static void add_request(struct blk_dev_struct *dev,
struct request *req)
{ struct requset *tmp=dev->current_request;
  req->next=NULL; cli();   //关中断(互斥)
  for(;tmp->next;tmp=tmp->next)
   if((IN_ORDER(tmp,req)||!IN_ORDER(tmp,tmp->next))
       &&IN_ORDER(req,tmp->next)) break;
  req->next=tmp->next; tmp->next=req; sti();}
```

sector = C×(Heads×Sectors) + H×Sectors + S

```
#define IN_ORDER(s1, s2) \
  ((s1)->dev<(s2)->dev)||((s1)->dev == (s2)->dev\
     && (s1)->sector<(s2)->sector))
```



生磁盘(raw disk)的使用整理



- (1) 进程“得到盘块号”，算出扇区号(sector)
- (2) 用扇区号make req，用电梯算法add_request
- (3) 进程sleep_on
- (4) 磁盘中断处理

```
static void read_intr(void)
{   end_request(1);
    do_hd_request();
```

唤醒进程!

- (5) do_hd_request算出cyl,head,sector
- (6) hd_out调用outp(…)完成端口写