《操作系统》课下作业 (OS-HW8)

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P548, 11.1　Consider a program that accesses a single I/O device and compare unbuffered I/O to the use of a buffer. Show that the use of the buffer can reduce the running time by at most a factor of two.

解. 假设总 I/O 时间为 T, 用户进程消耗数据的时间为 C. 无缓冲区的情况下, 一次完整 I/O 加上消耗数据的时间为 $T_{\text{nobuffer}} = T + C$, 如下图所示:

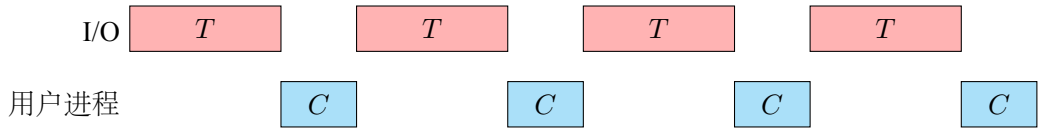

图 1: 无缓冲区示意图

有单缓冲区的情况下, 一次完整 I/O 加上消耗数据的时间为 $T_{\text{buffer}} = \max(T, C)$, 如下图所示: (假设整个过程很长, 平均时间, 不考虑第一次和最后一次 I/O)

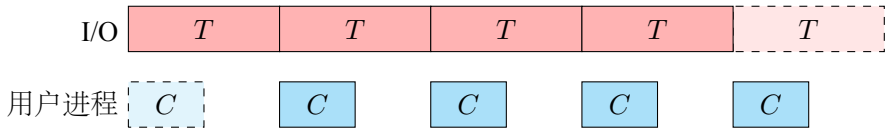

图 2: 有单缓冲区示意图

容易看出, 当 $T = C$ 时, $(T_{\text{nobuffer}}/T_{\text{buffer}})_{\max} = 2$, 即最多提速两倍.

P548, 11.3　Consider a disk drive with 4,000 cylinders, numbered from 0 to 3,999. The request queue has the following composition:

$$1045 \quad 750 \quad 932 \quad 878 \quad 1365 \quad 1787 \quad 1245 \quad 664 \quad 1678 \quad 1897$$

If the current position is 1167 and the previous request was served at 1250, compute the total distance (in cylinders) that the disk arm would move for each of the following algorithms: FIFO, SSTF, SCAN, and C-SCAN scheduling.

解.

FIFO. 即先到的请求先满足.

访问顺序	横跨磁道数目
1045	|1045-1167|=122
750	|750-1045|=295
932	|932-750|=182
878	|878-932|=54
1365	|1365-878|=487
1787	|1787-1365|=422
1245	|1245-1787|=542
664	|664-1245|=581
1678	|1678-664|=1014
1897	|1897-1678|=219

总跨磁道数: 122+295+182+54+487+422+542+581+1014+219=3918.

SSTF. 即每次选择离当前位置最近的.

访问顺序	横跨磁道数目
1245	|1245-1167|=78
1365	|1365-1245|=120
1678	|1678-1365|=313
1787	|1787-1678|=109
1897	|1897-1787|=110
1045	|1045-1897|=852
932	|932-1045|=113
878	|878-932|=54
750	|750-878|=128
664	|664-750|=86

总跨磁道数: 78+120+313+109+110+852+113+54+128+86=1963.

SCAN. 即“来回扫描”(注意一开始磁头是向编号变小的方向移动的).

访问顺序	横跨磁道数目
1045	|1045-1167|=122
932	|932-1045|=113
878	|878-932|=54
750	|750-878|=128
664	|664-750|=86
1245	|1245-664|=581
1365	|1365-1245|=120
1678	|1678-1365|=313
1787	|1787-1678|=109
1897	|1897-1787|=110

总跨磁道数: 122+113+54+128+86+581+120+313+109+110=1736.

C-SCAN. 即“单向扫描”.

访问顺序	横跨磁道数目
1045	|1045-1167|=122
932	|932-1045|=113
878	|878-932|=54
750	|750-878|=128
664	|664-750|=86
1897	|1897-664|=1233
1787	|1787-1897|=110
1678	|1678-1787|=109
1365	|1365-1678|=313
1245	|1245-1365|=120

总跨磁道数: 122+113+54+128+86+1233+110+109+313+120=2388.