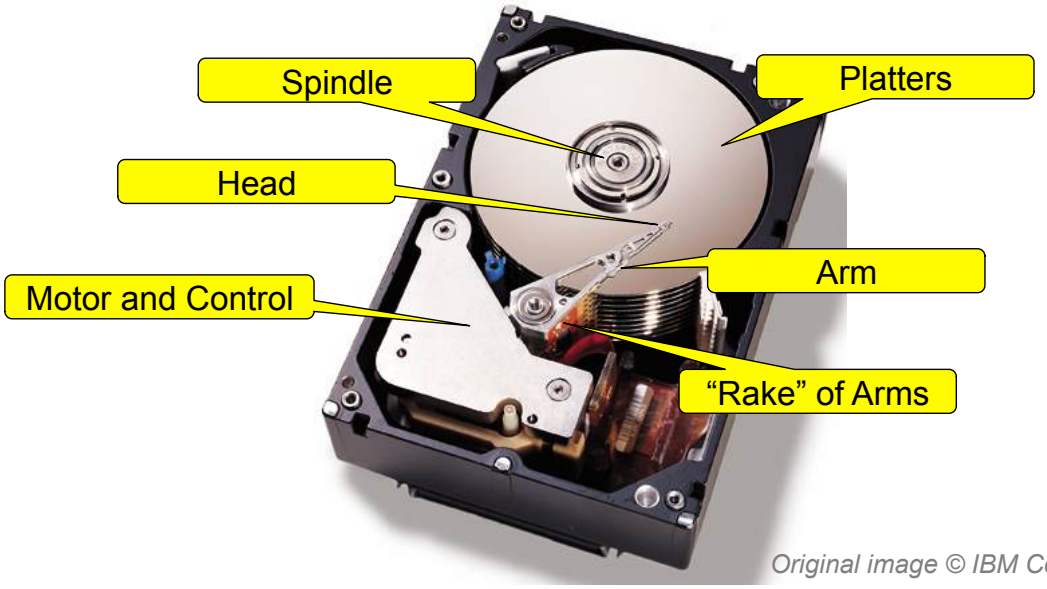
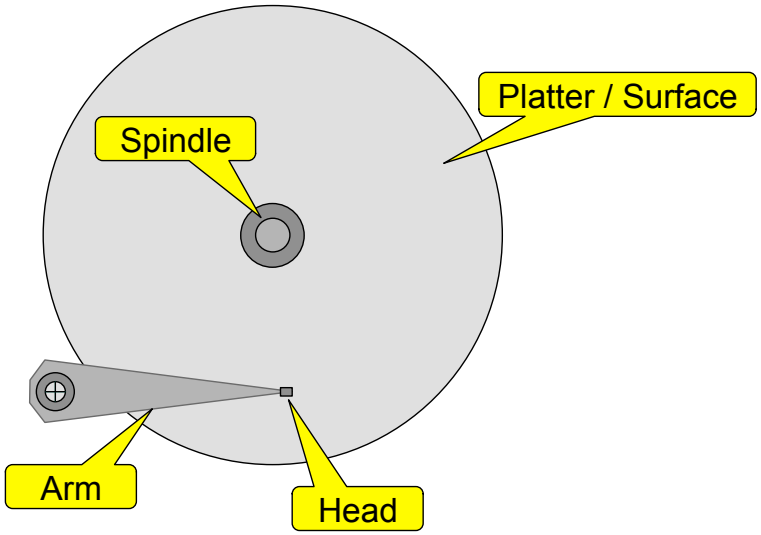
Hard Disk Drives

- Structure of a Hard Disk Drive
- Performance Modeling of Hard Disk Drives
- Disk Scheduling

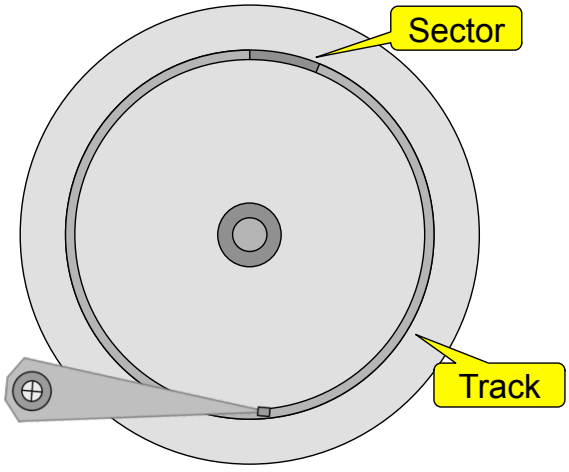
Disk Structure



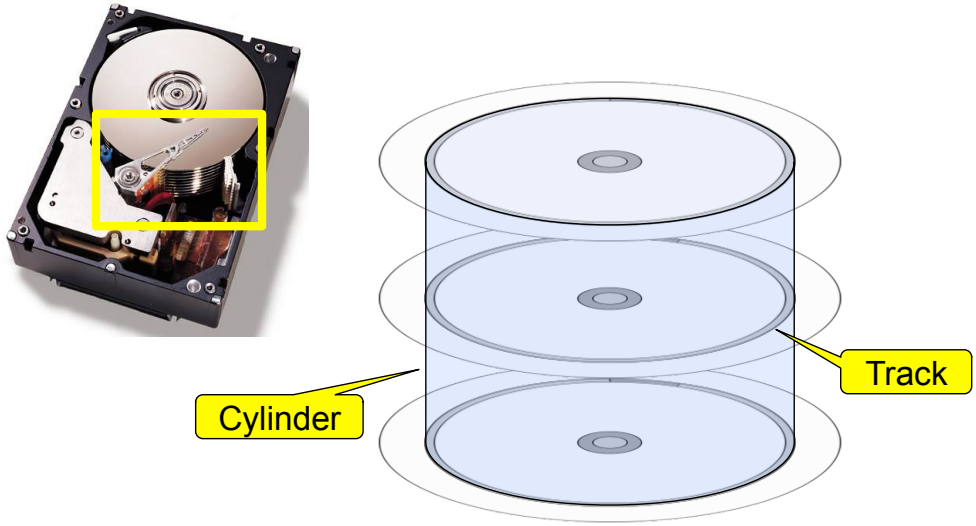
Disk Structure



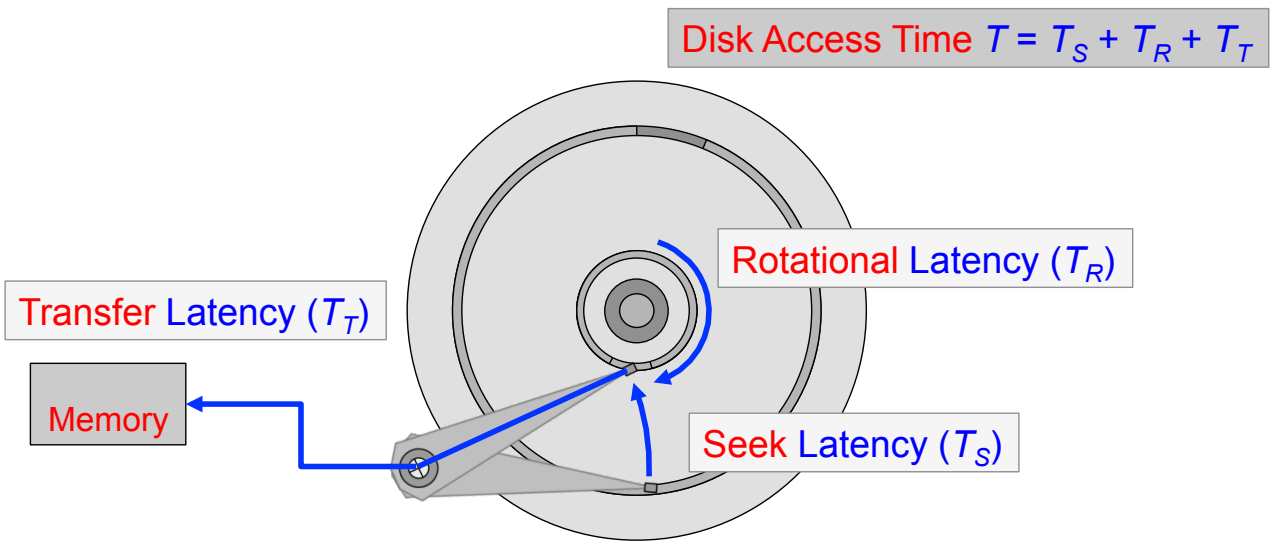
Disk Structure



Disk Structure



Disk Performance Model



Disk Performance Model

Seek Latency: T_s
- n = number of tracks traversed
- m = "track traversal time"
- s = startup time

$T_S = m \times n + s$

Rotational Latency: T_R
- r = # revolutions per time unit

$T_R = 1 / 2r$

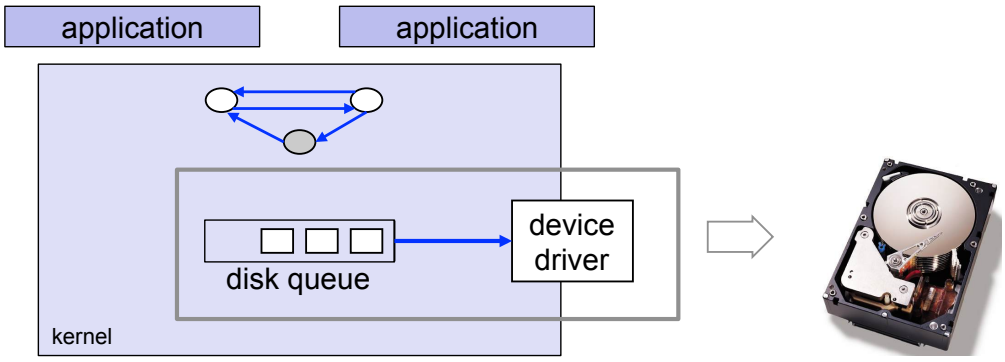
Transfer Latency: T_T
- b = # bytes to be transferred
- N = number of bytes on track

$T_T = b / rN$

Disk Access Time:

$T = T_S + T_R + T_T$

Disk Scheduling



Q: Does it pay off to think about scheduling policy in disk queue?

Evaluation: Compare time for service for given request sequence.
Distinguish only by cylinder.

Evaluation of Disk Scheduling

Seek Latency: T_s

n = number of tracks traversed
m = "track traversal time"
s = startup time

$$T_S = m \times n + s$$

Rotational Latency: T_R

r = # revolutions per time unit

$$T_R = 1 / 2r$$

Transfer Latency: T_T

b = # bytes to be transferred
N = number of bytes on track

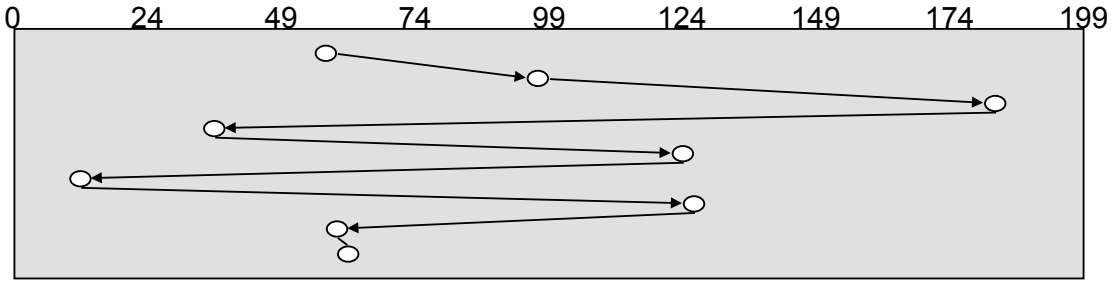
$$T_T = b / rN$$

Disk Access Time:

$$T = T_S + T_R + T_T$$

FCFS Scheduling

Request Sequence: 98, 183, 37, 122, 14, 124, 65, 67



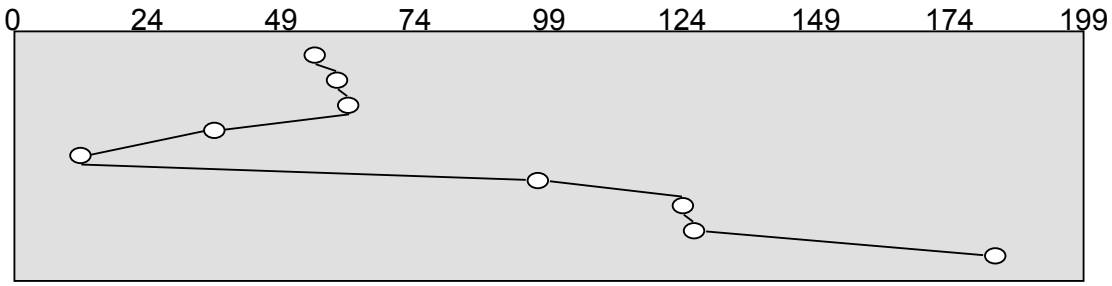
total head movement: **640 tracks**

FCFS Pros:
- simple
- fair

FCFS Cons:
- poor average service time

Shortest-Seek-Time-First (SSTF)

Request Sequence: 98, 183, 37, 122, 14, 124, 65, 67



total head movement: **236 tracks**

Always serve "closest" request.

SSTF Pros:

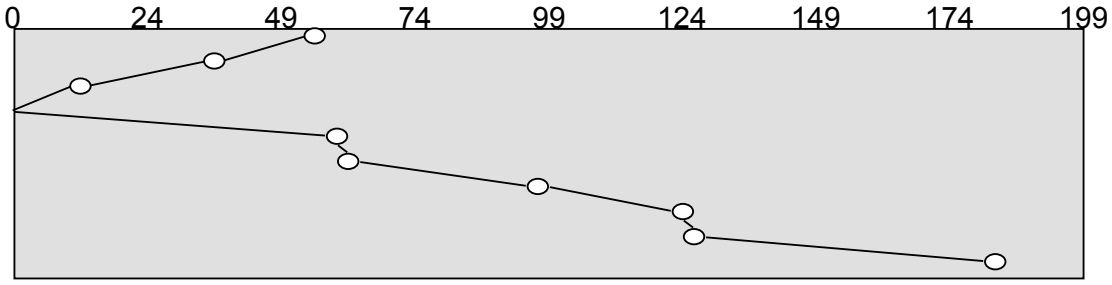
– short service times

SSTF Cons:

– Starvation!

Elevator Algorithm (SCAN)

Request Sequence: 98, 183, 37, 122, 14, 124, 65, 67



total head movement: **236 tracks**

Continuously scan disk from one end to the other.

SCAN Pros:

– short service times

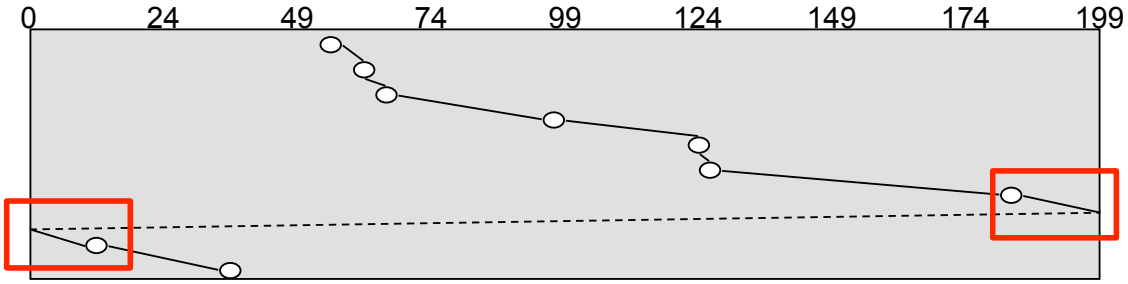
SCAN Cons:

–When scanning, few requests after us, since just passed through.

–Problem: When we change direction at end, requests there are very new.

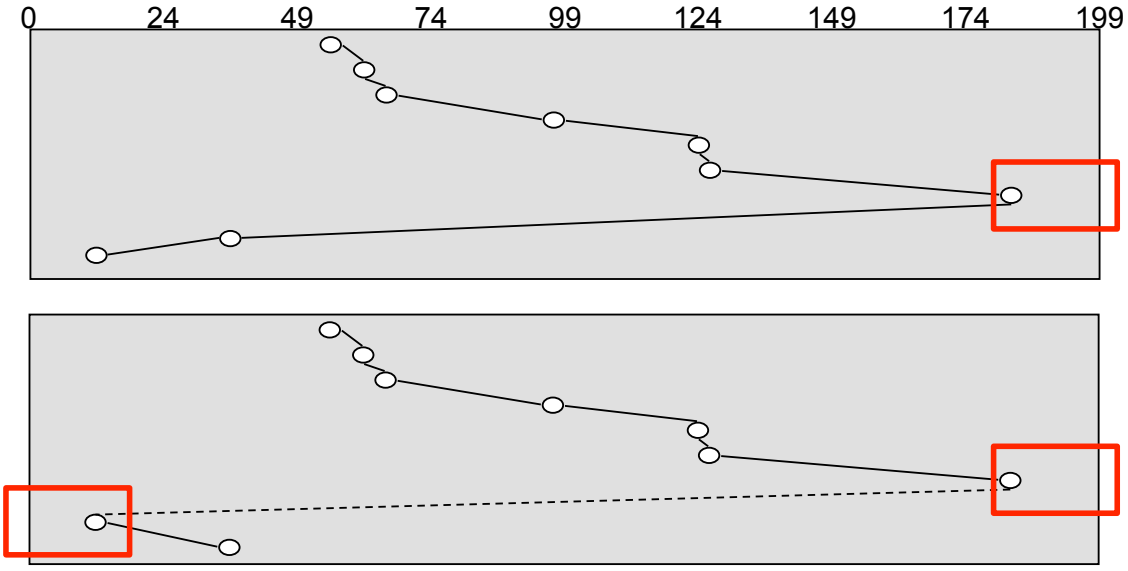
Circular SCAN (C-SCAN)

Request Sequence: 98, 183, 37, 122, 14, 124, 65, 67



Reduce variance in service time by always starting at the beginning of the disk.

LOOK, C-LOOK



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