SNS COLLEGE OF TECHNOLOGY

An Autonomous Institution

Coimbatore-35

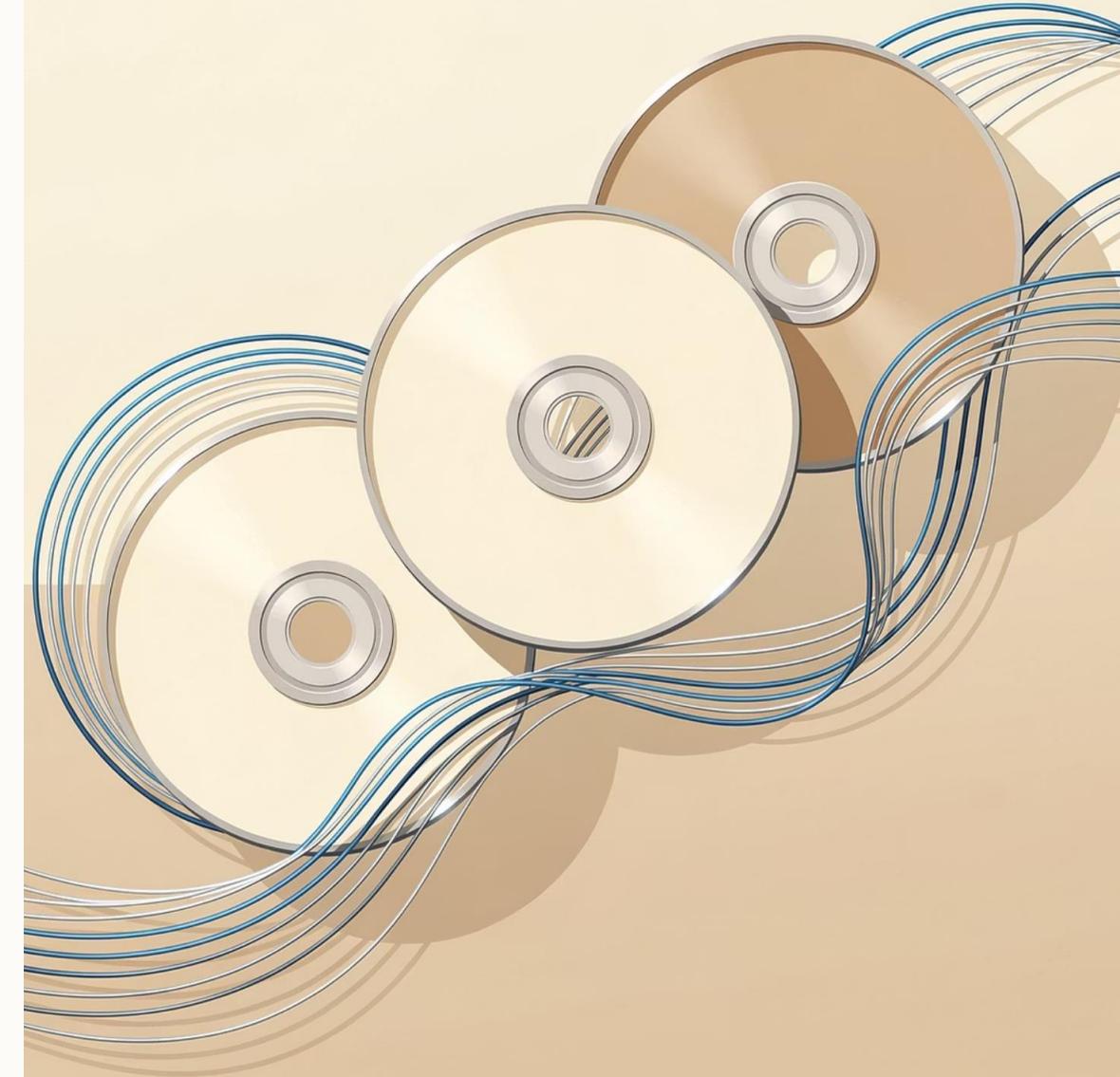## Department of Computer Science and Engineering

23CST206–OPERATING SYSTEMS AND VIRTUALIZATION

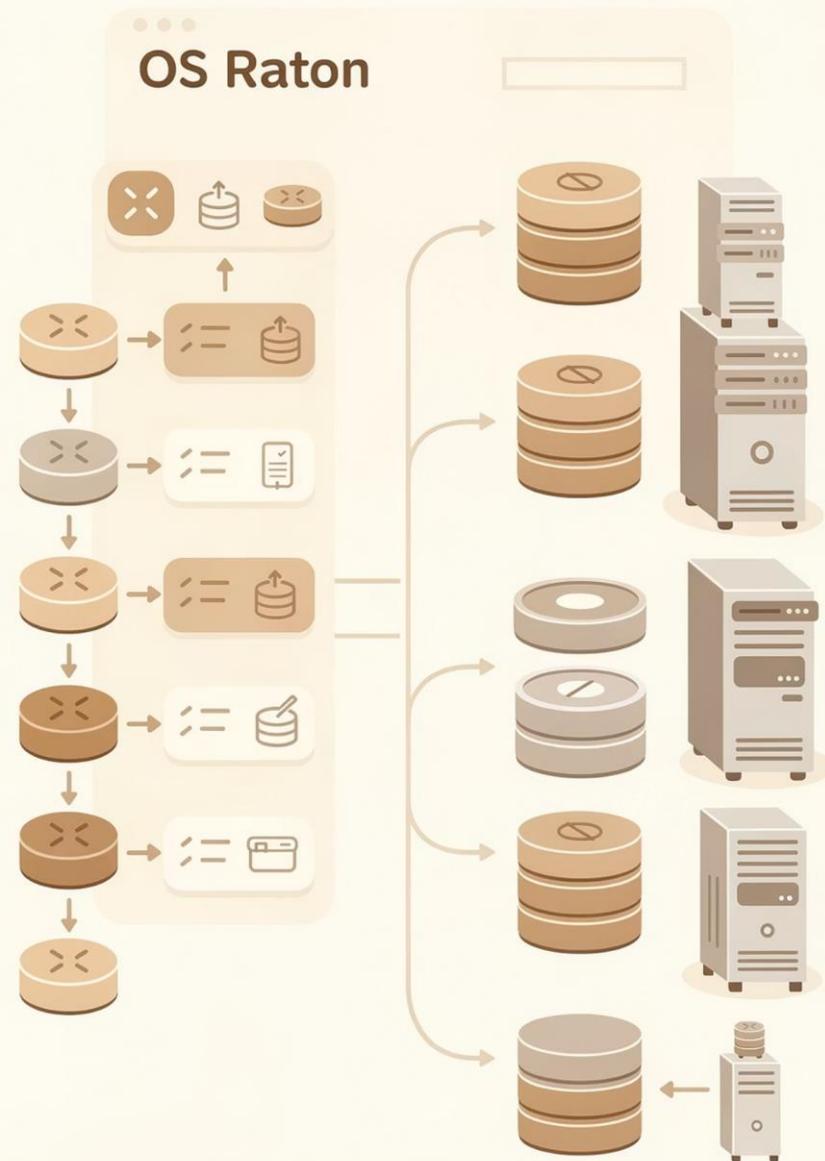## B.E- CSE /IV SEMESTER

UNIT – III MEMORY MANAGEMENT

Topic 6:Disk Scheduling in OS

Disk Scheduling in Operating Systems

What is Disk Scheduling?

Disk scheduling is a method used by the operating system to decide the order in which pending disk I/O requests will be serviced.
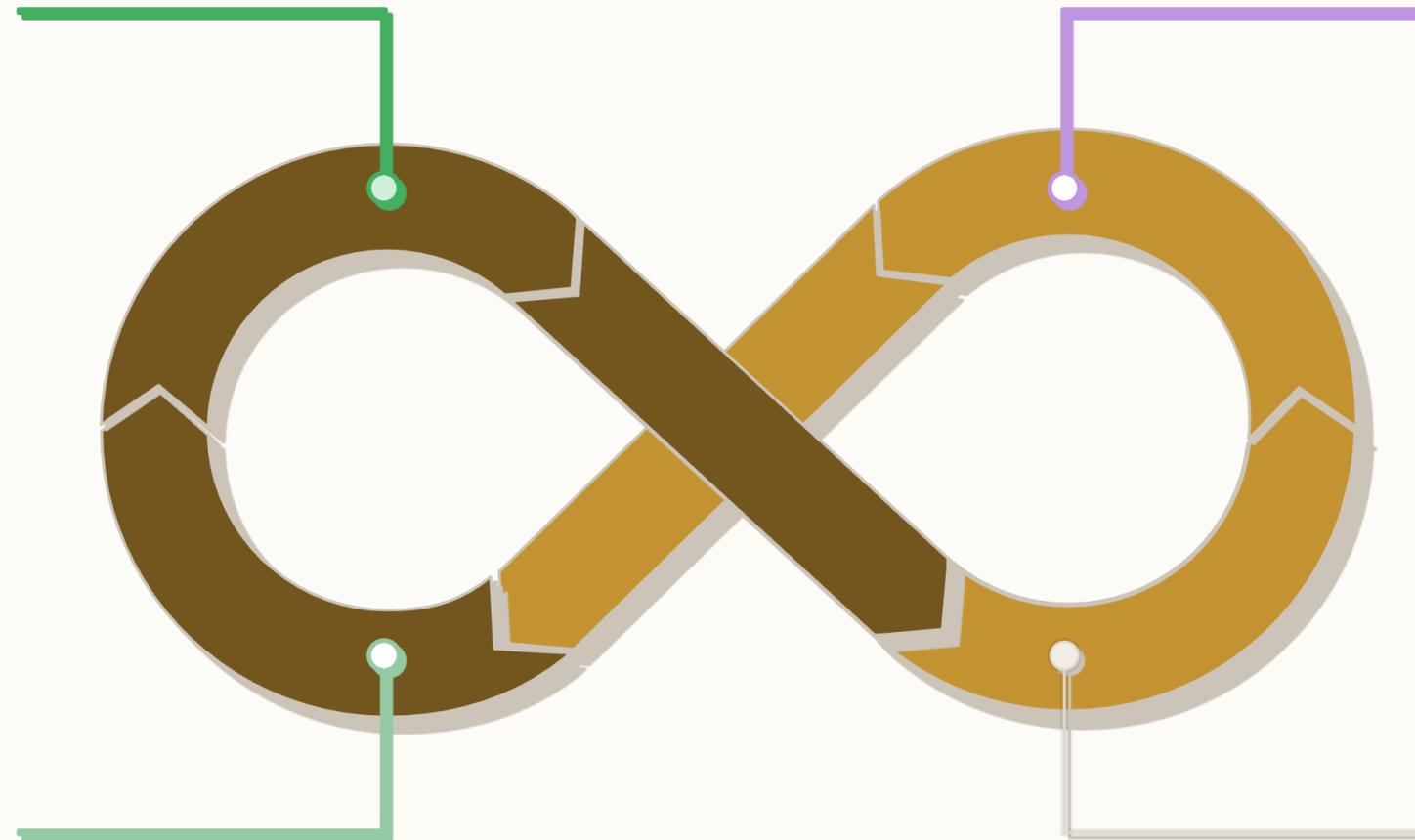
Why Disk Scheduling is Needed

Mechanical Limits

Speed Disparity

Minimize Head Movement

Concurrent Requests

Key Terms

01

Seek Time

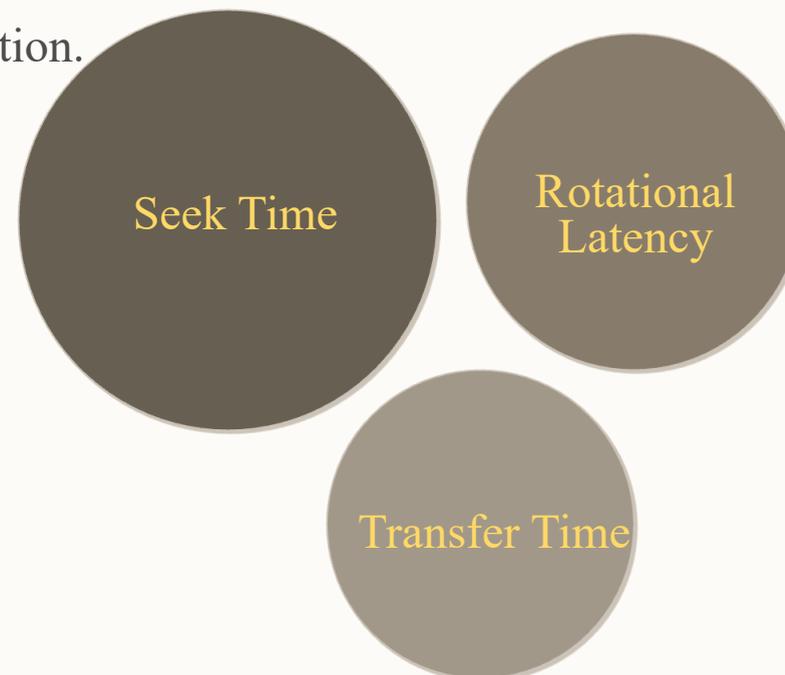Time to move the disk arm to the track containing the desired sector.

02

Rotational Latency

Time waiting for the sector to rotate under the head.

03

Transfer Time

Time to read/write data once head is in position.

Seek Time

Rotational Latency

Transfer Time
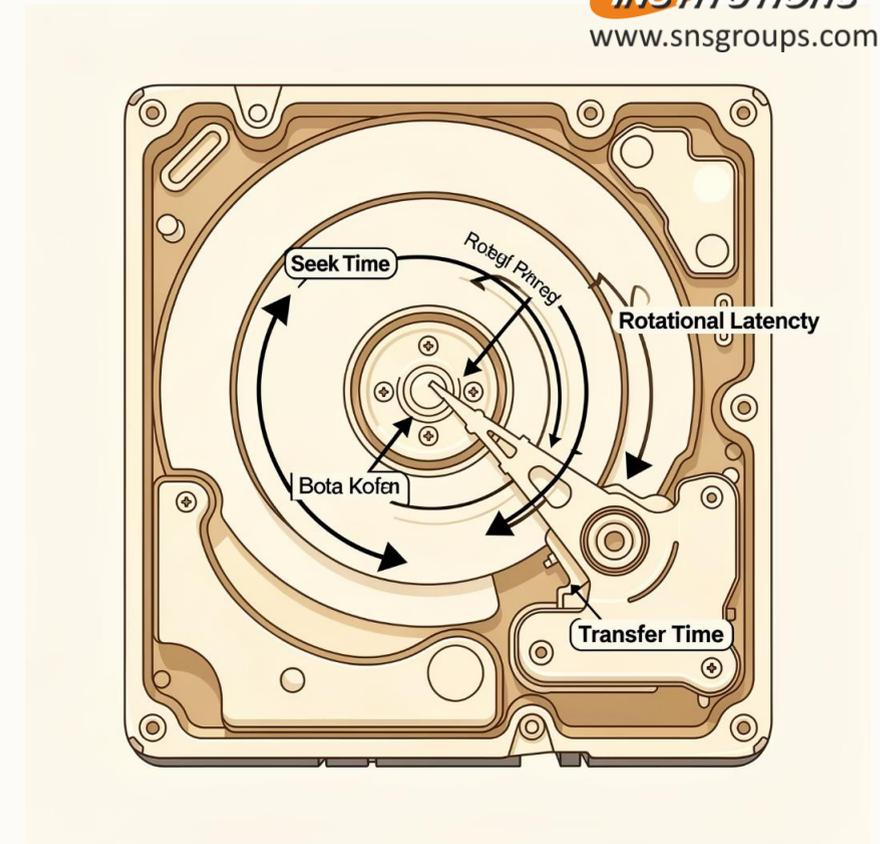
ALGORITHM 1

FCFS (First-Come, First-Serve)

Movement

50→95→180→34

How It Works

Requests served in arrival order

FCFS Disk Scheduling

Example

Head=50, requests:95,180,34

Disadvantage

May cause long average seek times

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FCFS Disk Scheduling in OS

Request Queue
Sequence of disk I/O requests as they arrive

Head Movement
Disk head moves in exact order of request arrival

No Starvation
Every request is eventually serviced without skipping

Simple Implementation
Easy to implement with minimal overhead

High Average Seek Time
Can cause longer delays due to no optimization

Suitability
Best for systems with low request traffic

Example
Requests: 55, 58, 39, 18, 90, 160, 150, 38, 184, serviced in arrival order

ALGORITHM 2

SSTF (Shortest Seek Time First)

Strategy

Chooses the request closest to the current head position.
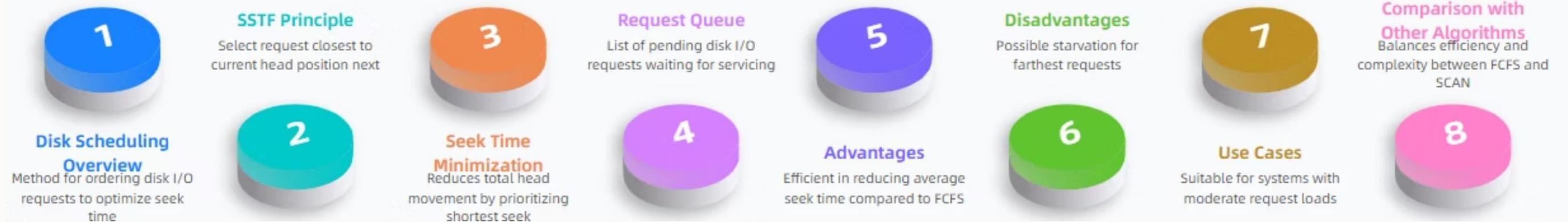
Advantage

Reduces total head movement significantly.
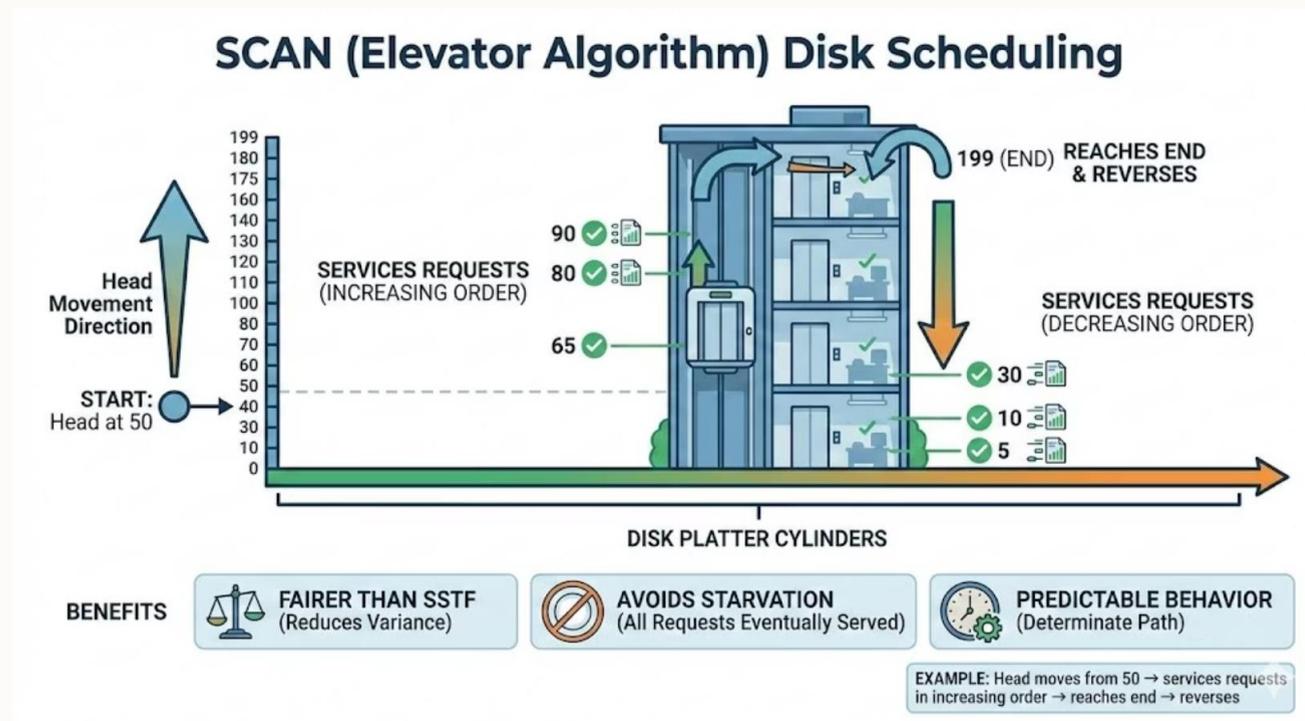
Disadvantage

May cause starvation for far-away requests.

📋 **Example:** Head at 50, requests: 95, 180, 34 → Closest is 34 → then 95 → 180

SSTF (Shortest Seek Time First) Disk Scheduling in OS

1

SSTF Principle
Select request closest to current head position next

3

Request Queue
List of pending disk I/O requests waiting for servicing

5

Disadvantages
Possible starvation for farthest requests

7

Comparison with Other Algorithms
Balances efficiency and complexity between FCFS and SCAN

Disk Scheduling Overview
Method for ordering disk I/O requests to optimize seek time

2

Seek Time Minimization
Reduces total head movement by prioritizing shortest seek

4

Advantages
Efficient in reducing average seek time compared to FCFS

6

Use Cases
Suitable for systems with moderate request loads

8

ALGORITHM 3

SCAN (Elevator Algorithm)

SCAN (Elevator Algorithm) Disk Scheduling
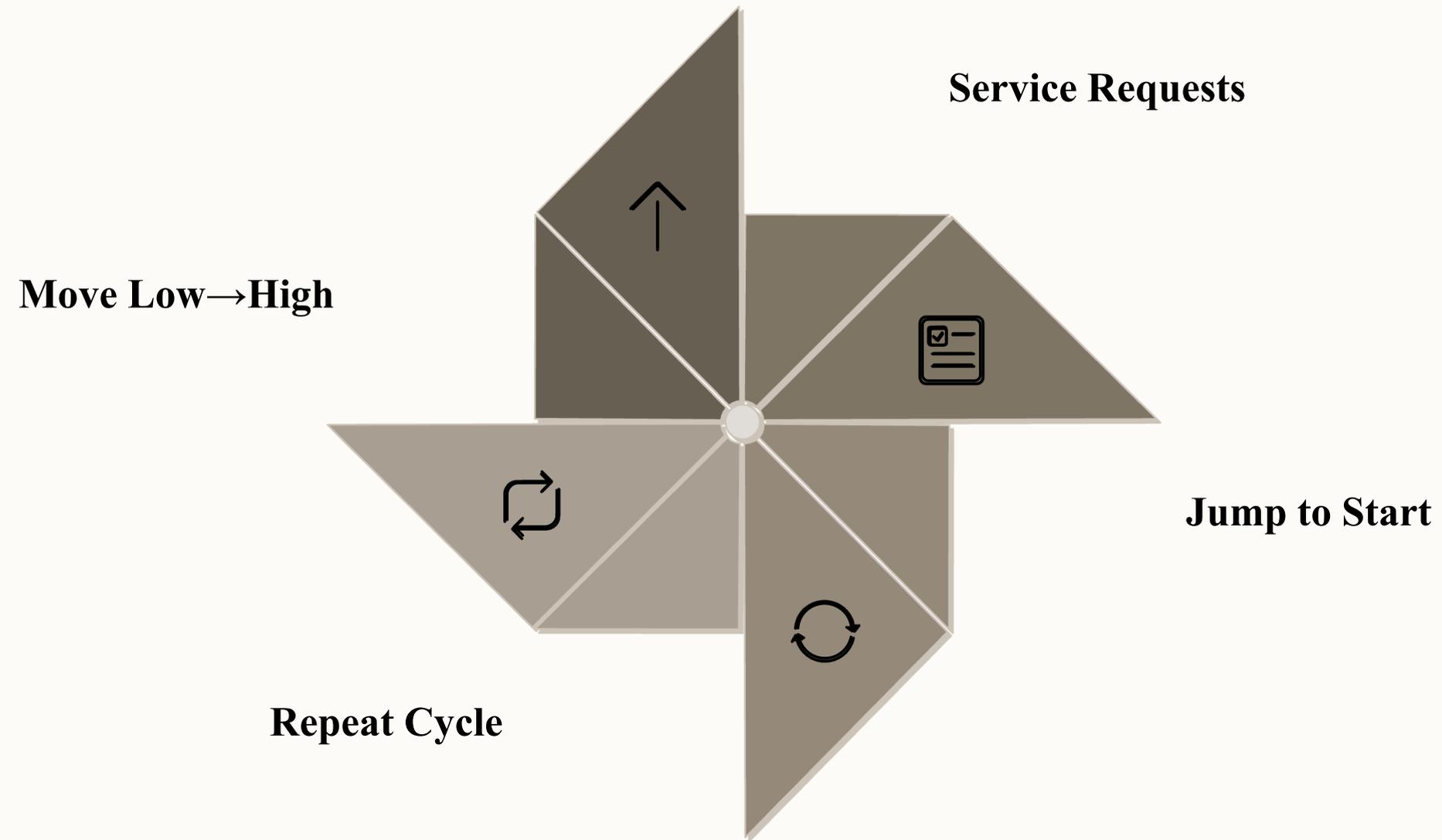
Mechanism

Head moves in one direction, servicing all requests until the end, then reverses direction.

Benefits

- Fairer than SSTF
- Avoids starvation
- Predictable behavior

Example: Head moves from 50 → services requests in increasing order → reaches end → reverses.

ALGORITHM 4

C-SCAN (Circular SCAN)

Service Requests

Move Low→High

Jump to Start

Repeat Cycle

Head moves in one direction only, then jumps to the start without servicing requests on the return journey. This ensures more uniform wait times across all requests.

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◎◎ ALGORITHM 5

LOOK / C-LOOK

1	2	3

Variation

Modified version of SCAN / C-SCAN algorithms.

Optimization

Head only goes as far as the last request in that direction.

Benefit

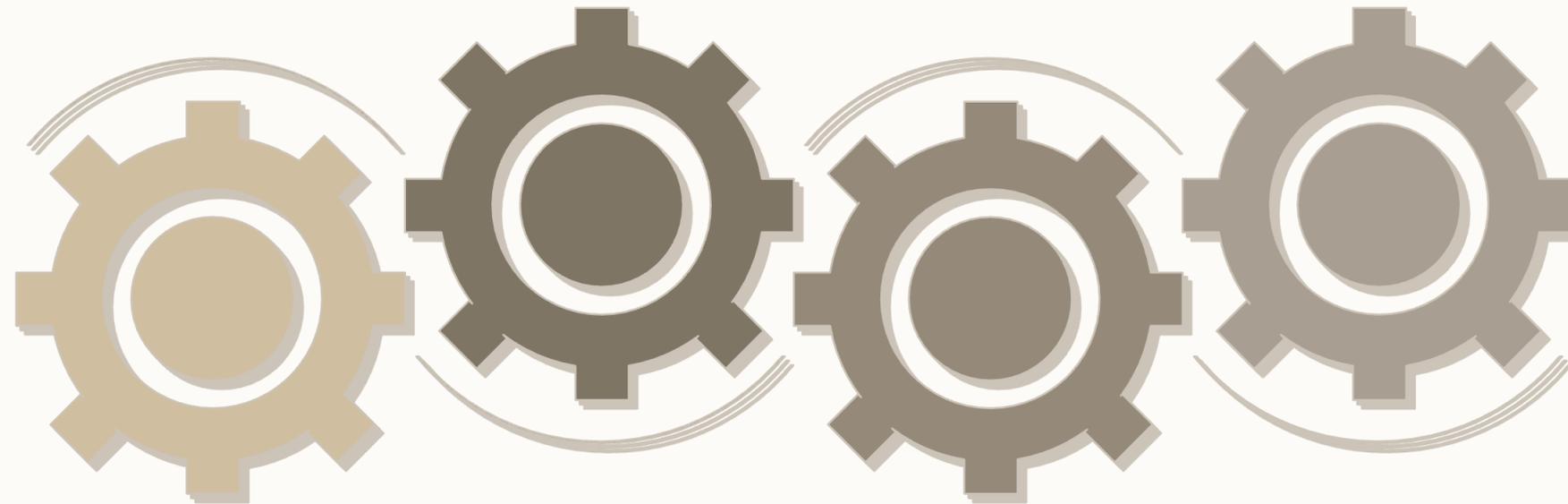Reduces unnecessary travel to disk edges.

Factors Affecting Disk Scheduling

Head Position

Determine the physical location
of the disk read/write heads.

Performance Goal

Define the target metrics for
system throughput and latency.

Request Pattern

Analyze the sequence and
frequency of data requests.

Disk Size

Consider the total storage
capacity and available space.

Problem Statement

Problem Statement: Efficient Disk Management

Allocate Space Efficiently
Optimize disk usage to prevent fragmentation and wasted space

1

3

2

Minimize Seek Time and Latency
Reduce mechanical delays and improve data retrieval speed

Handle Multiple Requests Fairly
Ensure equitable scheduling among competing I/O operations

Define
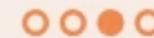
Ideate (Possible Solutions)

Disk Scheduling & Allocation Overview

Disk Scheduling Algorithms
Various algorithms for scheduling disk access requests

Disk Allocation Methods
Techniques to allocate disk space to files

Free Space Management
Methods to track free disk space

Buffering & Caching
Techniques to reduce disk head movement and latency
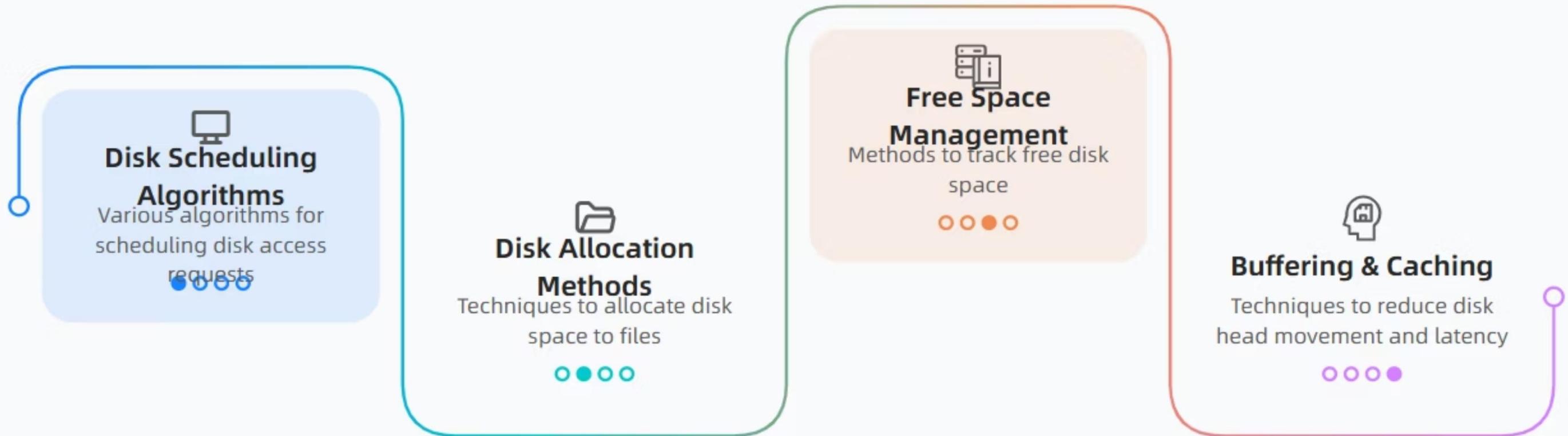
Prototype
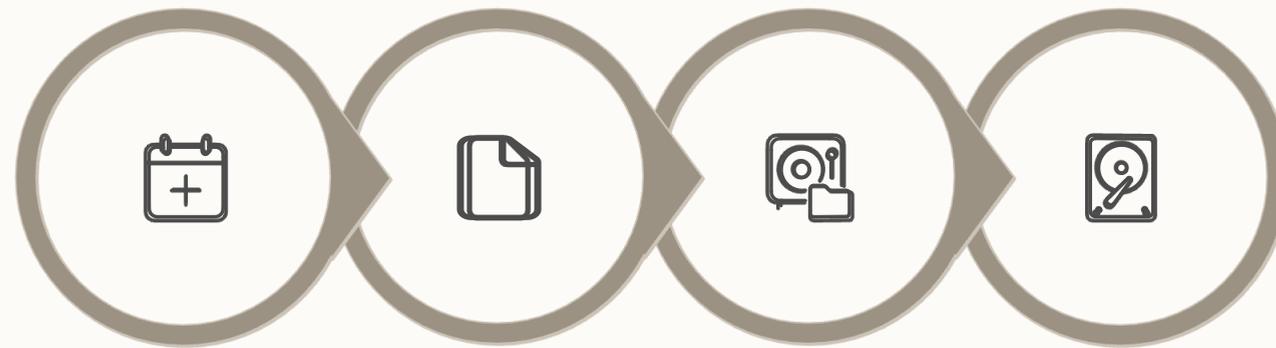
Scheduling Bitmap FS Buffer Cache Disk Driver

Scheduling

Implement OS scheduling algorithms

Free Space Map

Track free space using bitmaps

Buffer Cache

Reduce repeated I/O with caching

Disk Driver

Handle requests via controller

Test

Test

1 **Compare Average Seek Time**
Test different algorithms to find optimal performance.

Check CPU Idle Time
Measure efficiency when using DMA vs polling.
2

3 **Ensure Fair Servicing**
Verify all requests are handled without starvation.

Measure Performance
Test with small vs large number of requests.
4

Puzzle (Non-MCQ)

Puzzle (Non-MCQ)

Scenario: Disk has tracks 0 to 199. Current head position is **50**.
Requests are: **95, 180, 34, 119, 11, 123**

Questions:

1. Using FCFS, in what order are requests serviced?
2. Which request causes the largest head **movement**?

Using SSTF, which request is serviced first?

Puzzle Answer

FCFS order: **95 → 180 → 34 → 119 → 11 → 123**

Puzzle Answer

FCFS order: **95 → 180 → 34 → 119 → 11 → 123**

Largest head movement: **180 → 34** (distance = 146 tracks)

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