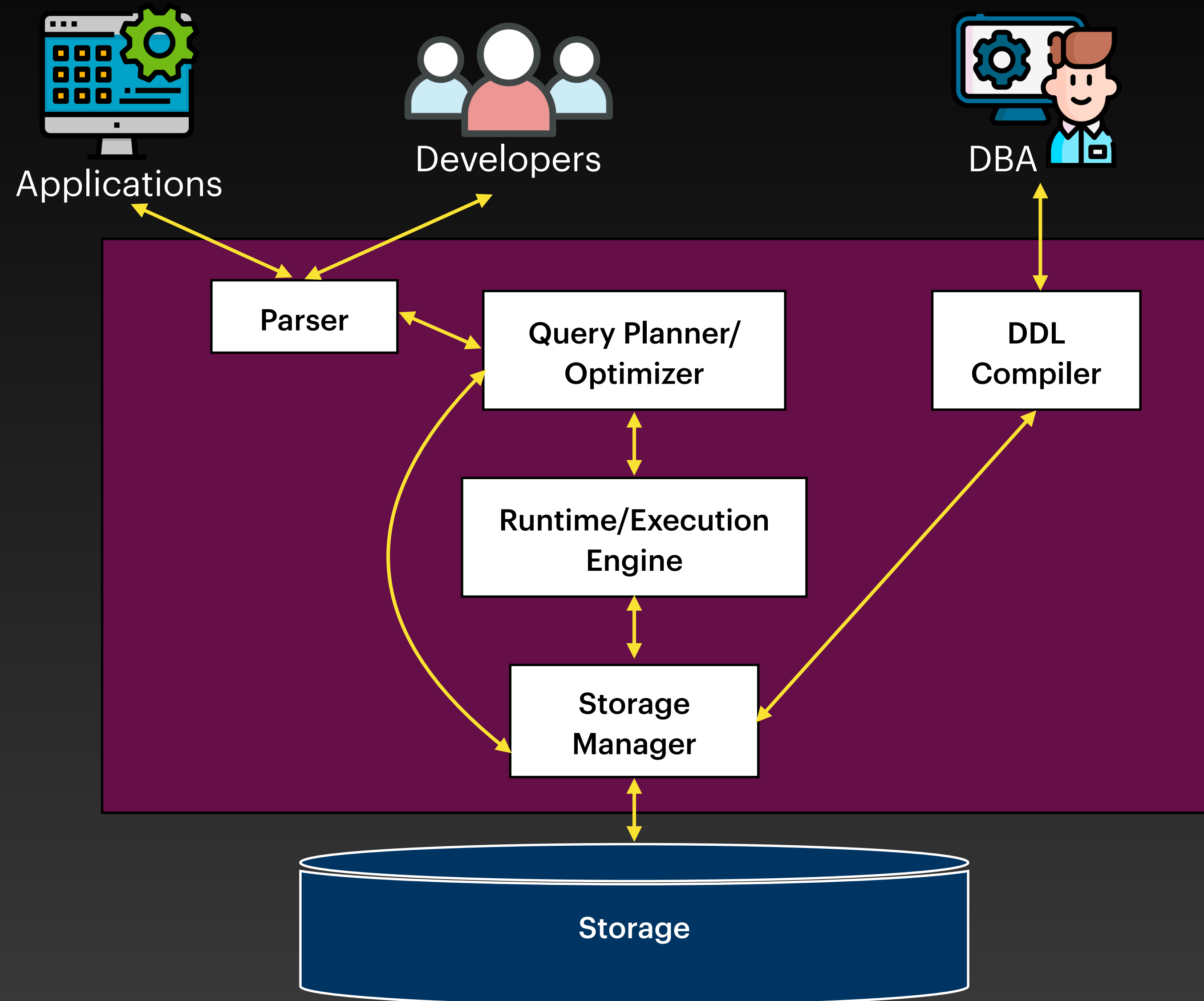


DATABASE STORAGE PART 1



DBMS Structure



Storage Types

Volatile

Random access

Bytes

CPU Registers

CPU Cache

DRAM

Non-volatile

Sequential access

Blocks/Pages

SSD

HDD

Network Storage

Smaller
Faster
More Expensive



Larger
Slower
Cheaper

Access Times

L1 Cache	1 ns
L2 Cache	4 ns
DRAM	100 ns
SSD	16,000 ns
HDD	2,000,000 ns
Network Storage	~50,000,000 ns

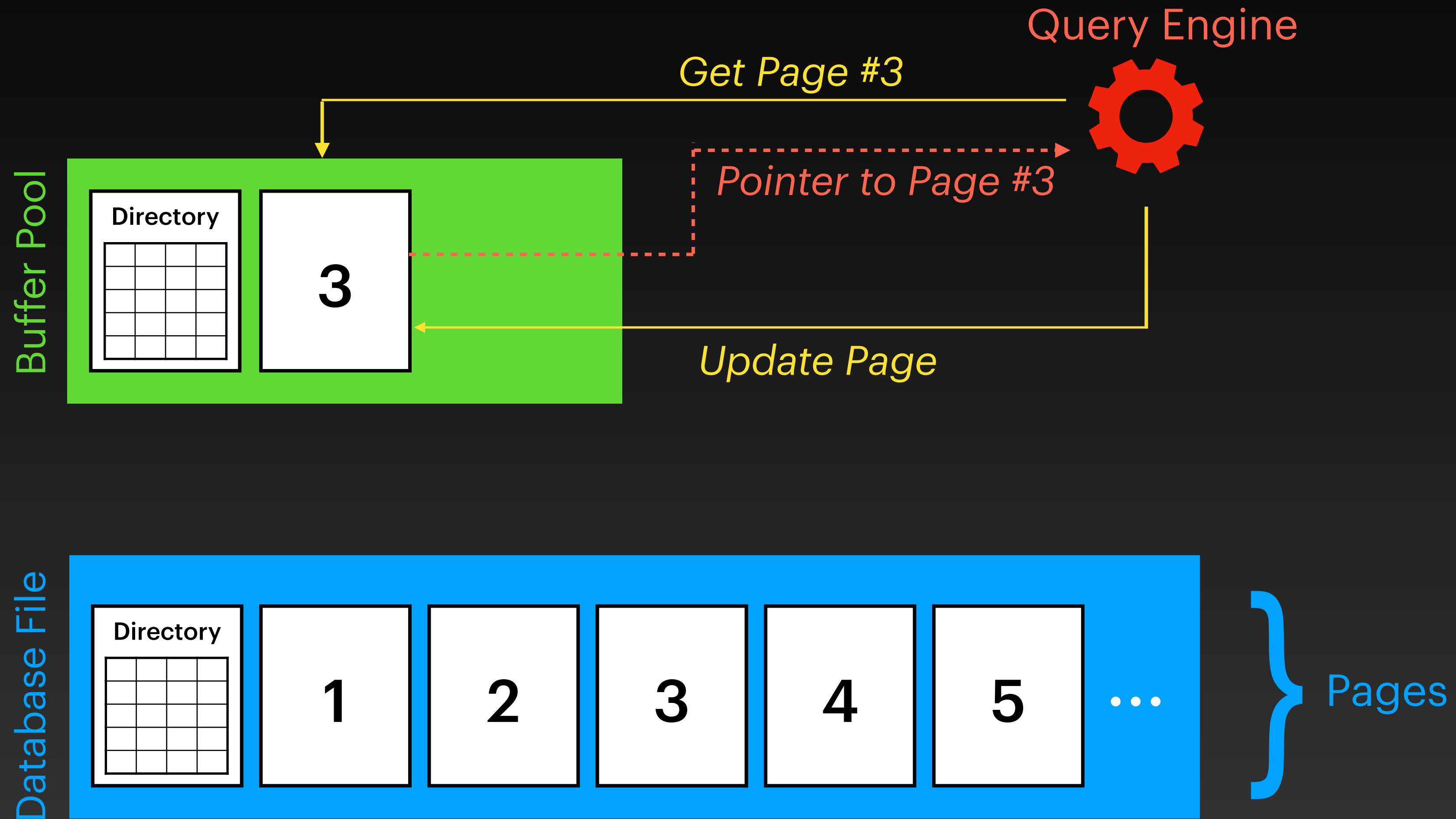
Design Goals

- Manage data that exceed the available memory
- Minimize reading/writing to disk (expensive)
- When accessing data on disk, maximize sequential access

Disk-based DBMS

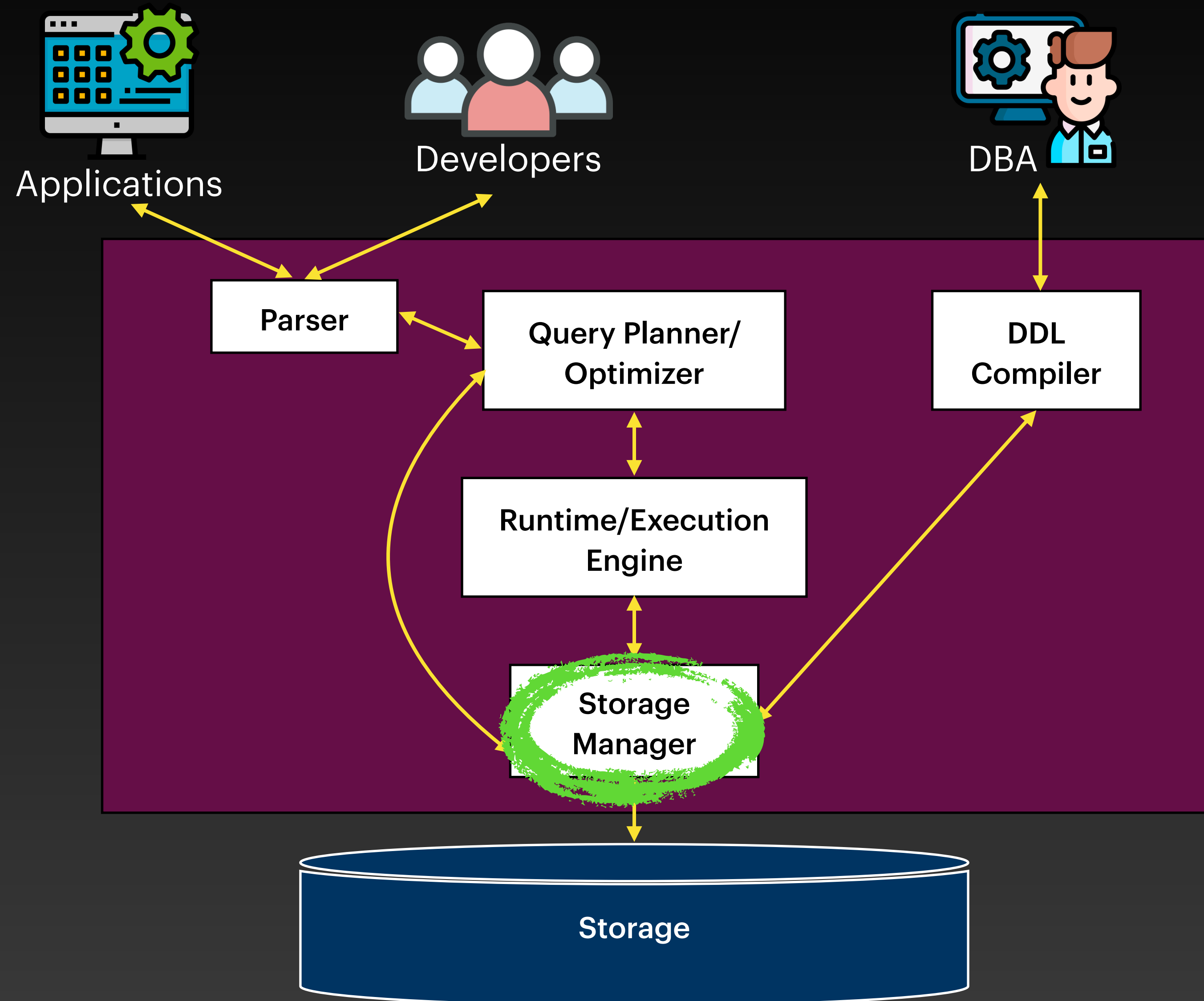


Memory



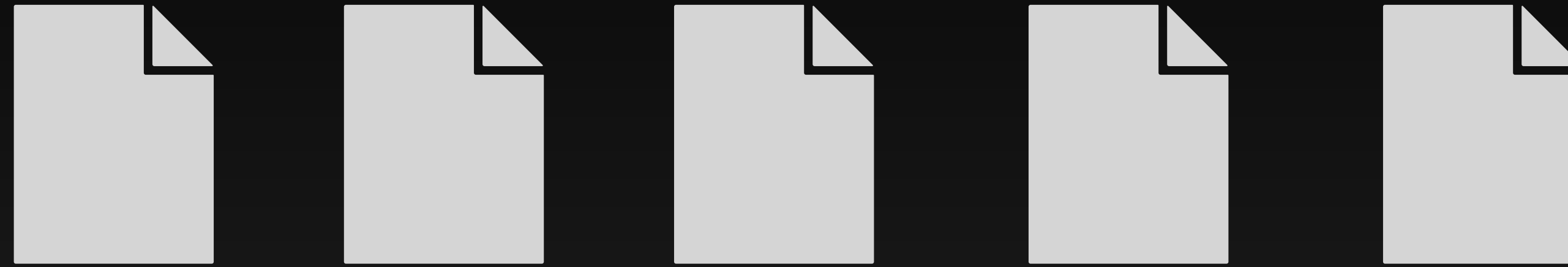
Disk

DBMS Structure



Database Storage

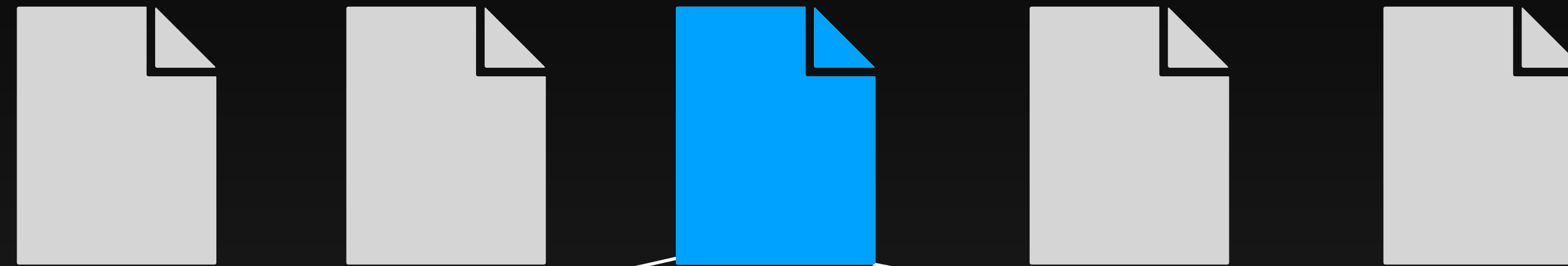
Database Files



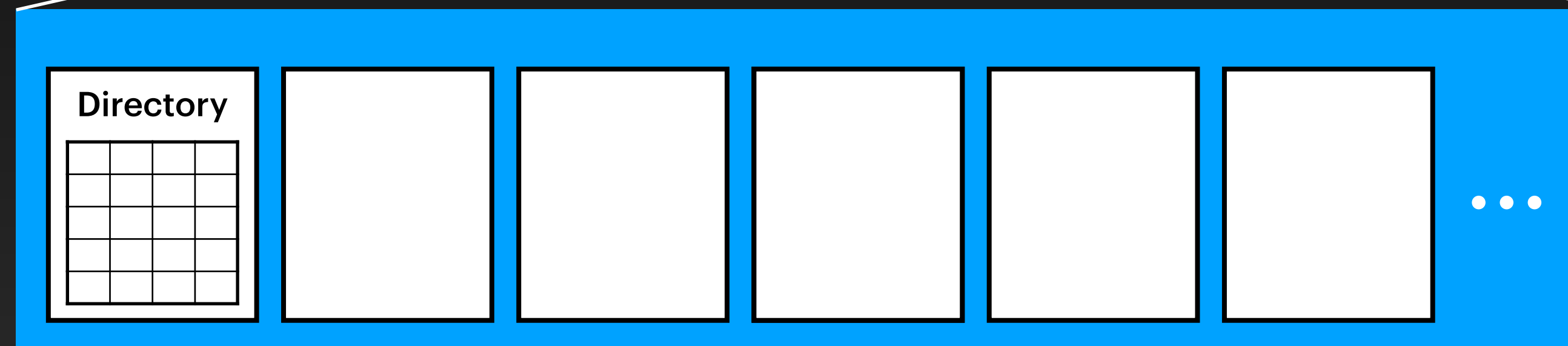
- System-specific file format
- OS does not understand the contents
- Single file/multiple files

Database Storage

Database Files



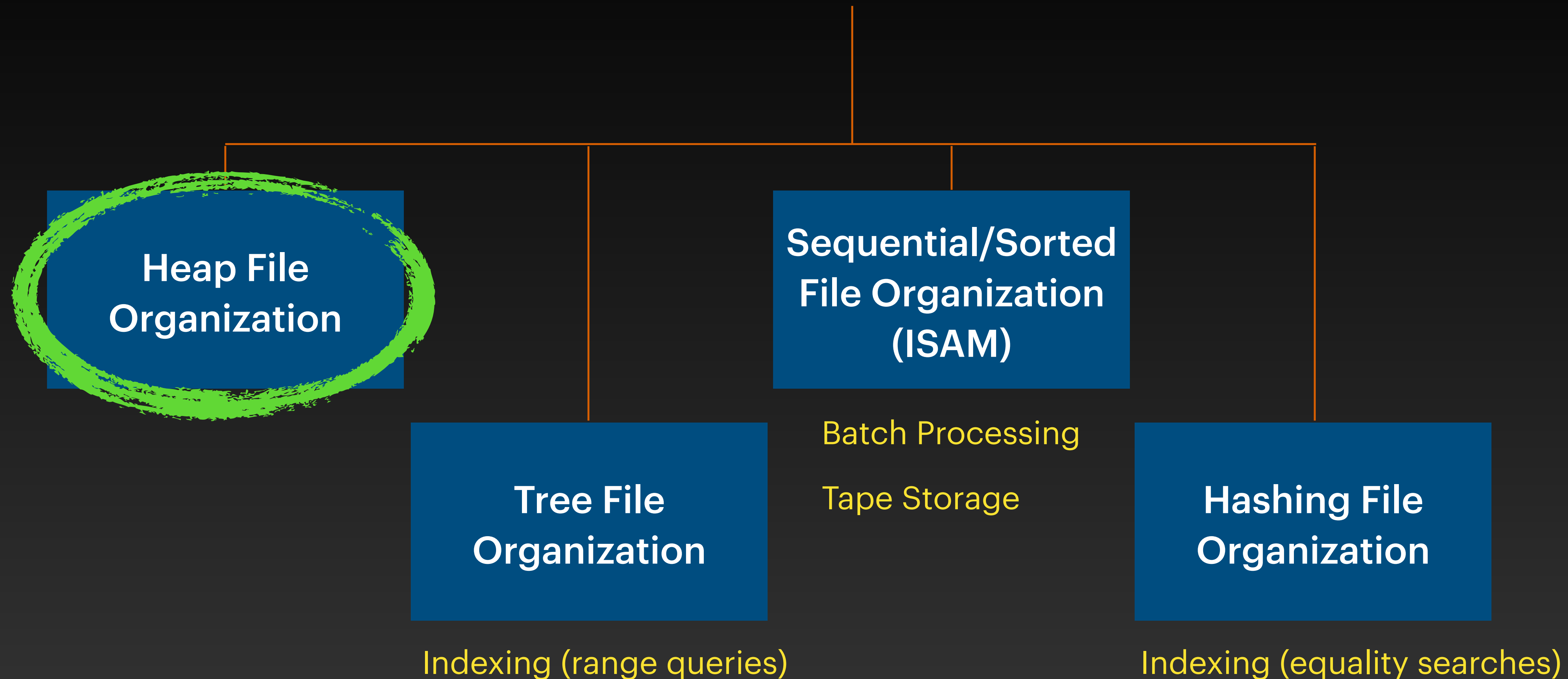
Pages



What is a Page?

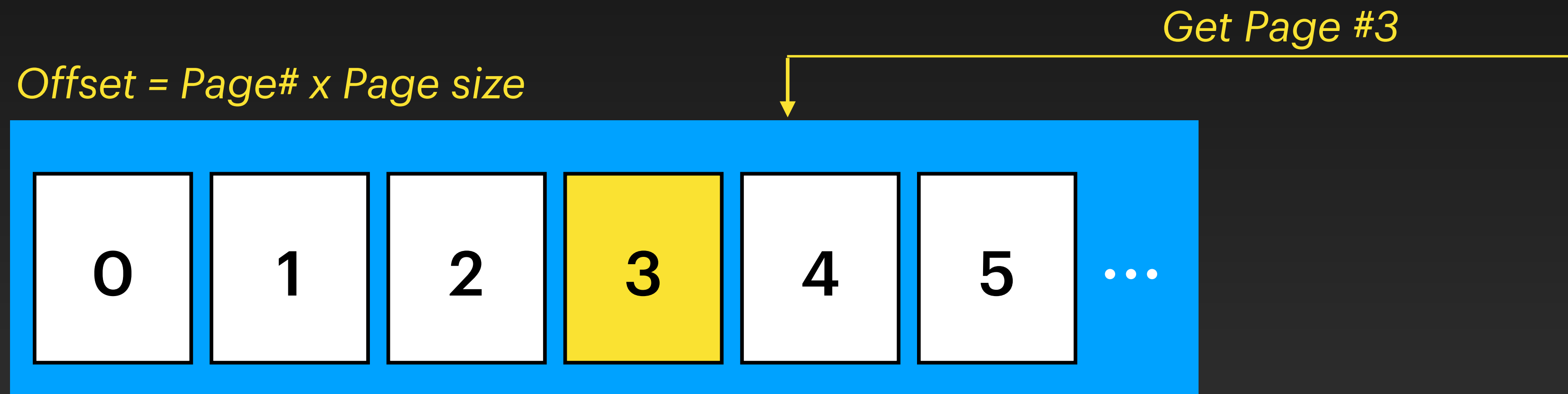
- Fixed-size block of data
- Can contain anything
 - Tuples, meta-data, indexes, log records, ...
- Unique ID for each page
 - DBMS can map a page id to a physical location

File Organization



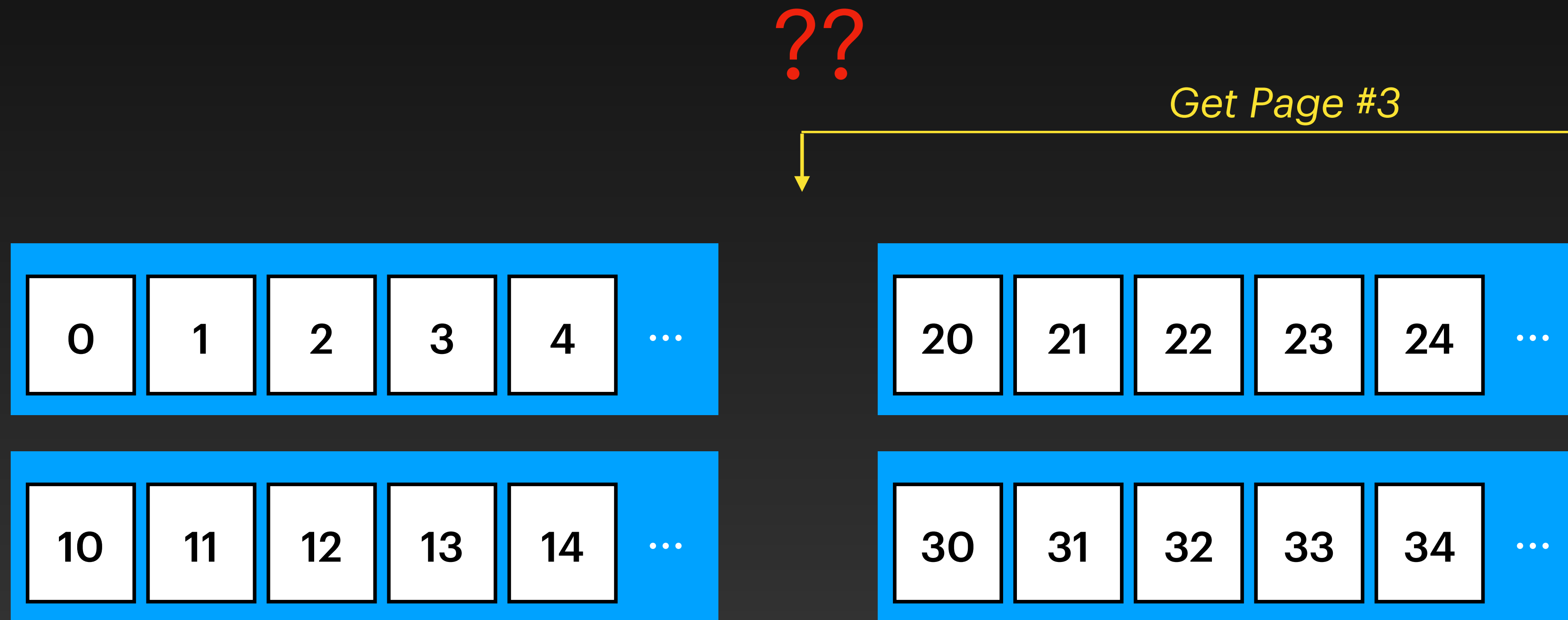
Heap File

- Single ordered file



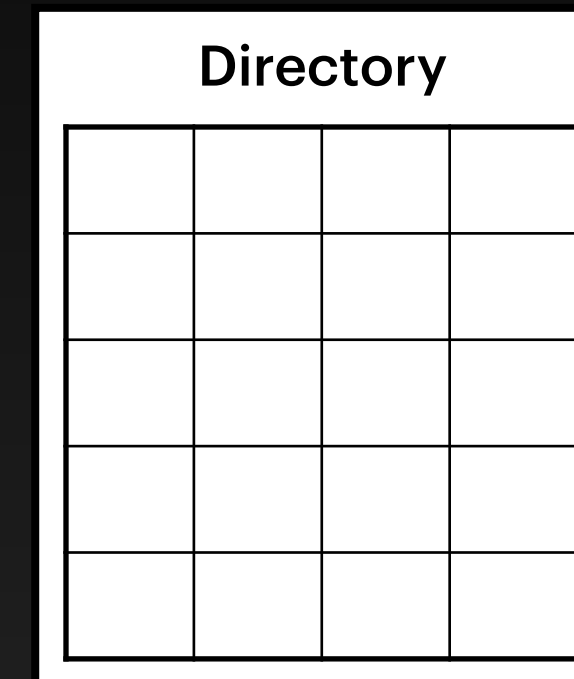
Heap File

- Multiple files



Heap File - Page Directory

- Special page(s) within each file
 - Location of each data page in the file
 - Number of free “slots” per page
 - List of free/empty pages
- Must be kept in sync with data pages



Heap File

- Multiple files

