

DBMS

- Reading 64 bit in RAM require 100 ns but in SSD require 150,000 ns but in HDD require 10,000,000 ns
- **Storage manager**
 - Responsible for maintaining database files
 - organize the files as collections of pages
 - track read and write to these pages and available storage space.
- **Page**
 - Fixed size block of data
 - 512B - 16KB
 - SQL Server, Postgres => 8KB, MySQL => 16KB
 - It contains tuples, meta-data, indexes, log records and more.
 - Some systems require the page to be self-contained (all information about the page is inside the page.)
 - Each page is given a unique identifier, the storage manager use this ID to find the page.
 - Different databases manage pages in files on disks in different ways (Heap file, tree file, hashing file)
 - **Heap File**
 - Unordered collection of pages where tuples stored in random pages
 - Need meta-data to know which page have free space and more.
 - Two ways to implement => page directory. linked list
 - Page directory (good one)
 - The DBMS maintains special pages that track the location of each page and a meta-data about each one (ex. number of free slots in each one)
 - The DBMS make sure that the directory pages are in sync with data pages.
 - Linked list

- At the beginning of the file stores two things:
 - Head of the page list
 - Head of the data page list
 - each page keep track the number of free slots in itself
- Page Header
 - Every page contains a header of meta-data about the page's contents:
 - Page size, checksum, DBMS version and compression information.
 - Some systems require pages to be self-contained (ex. Oracle)
- Page Layout
 - We need to decide how to organise the data inside of the page. Two approaches :
 - Tuple
 - Log structured
 - Tuple
 - Strawman Idea
 - Keep track of the number of tuples in a page and then just append a new tuple to the end, it depends on that attributes or elements have a fixed size.
 - But what happen if we delete a tuple from the middle for example ?!
 - what happen if we have a variable length attributes ?
 - Slotted pages
 - The most common layout scheme
 - Header or slot array
 - each element in the array points to the start position of each tuple.
 - keeps track the number of used slots.
 - What happen if we delete a tuple from the middle for example ?

- it depends on the implementation
you may continue as you are and let the gap or shift the elements to remove the gap.
- Each tuple have a unique ID, most common (page_id, slot_number)
but we cannot depends on the ID because if we delete a slot before the ID will not change.
- ID have different size in different DBMS
 - PostgreSQL ==> CTID(6-Bytes)
 - SQLite ==> ROWID (8-Bytes)
- Log Structured
 - SOON
- Tuple Layout
 - A sequence of bytes, DBMS interpret those bytes into value.
 - Each tuple is prefixed with a header contains the tuple meta-date