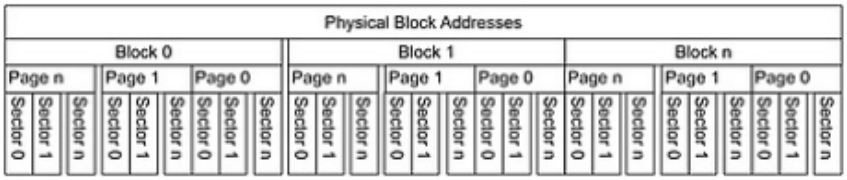
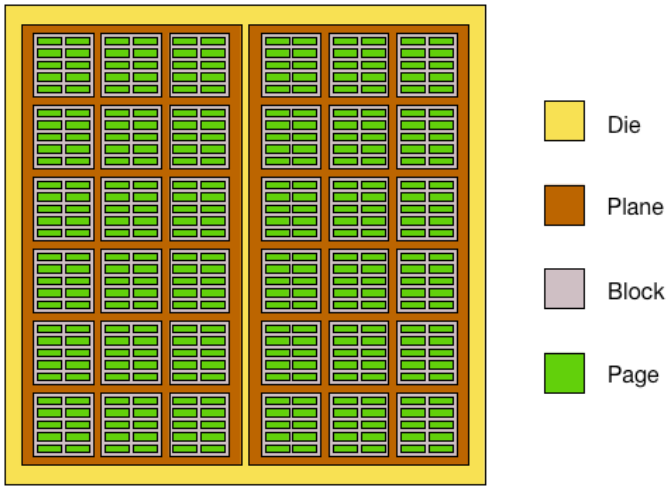
1 Flash-Based SSDs

Vocabularies

1. **Flash Solid-State Storage**
   - Is a type of non-volatile computer storage that stores and retrieves digital information using only electronic circuits, without any involvement of moving mechanical parts
2. **NAND-Based Flash**
   - Is an electronic non-volatile computer memory storage medium using NAND-gate that can be electrically erased and reprogrammed.
3. **Flash Page**
   - Is the smallest unit that can be programmed into flash
4. **Flash Block**
   - Is a group of pages and the smallest unit that can be erased.

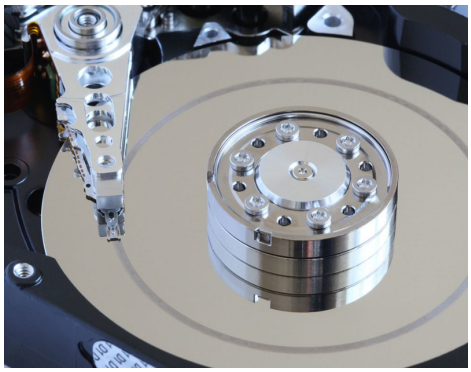




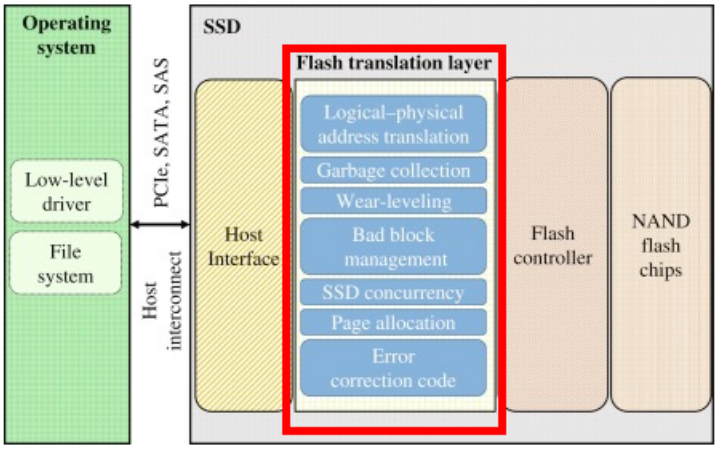
5. **Wear Out**

- Is similar to going past **expiration date**
- Means it has exceeded their endurance rating

6. **Single-Level Cell**
   - Is a type of cell in solid-state storage that stores one bit of data per transister (0 or 1)
7. **Multi-Level Cell**
   - Is a type of cell in solid-state storage that stores two bits of data (i.e 00, 01, 10, 11) per cell using two different levels of charge
8. **Triple-Level Cell**
   - Is a type of cell in solid-state storage that stores three bits of data per cell (i.e 000, 001, 010, 011, 100, 101, 110, 111)
9. **Head Crash**
   - Is a condition where the drive head makes contact with the recording surface



10. **Disturbance**
    - Is also known as **read disturbance** or **program disturbance**
    - Is a condition where accesing a bit in a page causes some bits to get flipped in neighboring pages
11. **Flash Transition Layer**
    - Is an intermediate system made up software and hardware that manages SSD operations



12. **Wear Leveling**

    - Is a technique for prolonging the service life of some kinds of erasable computer storage media, such as flash memory, which is used in solid-state drives (SSDs)

13. **Direct Mapped**

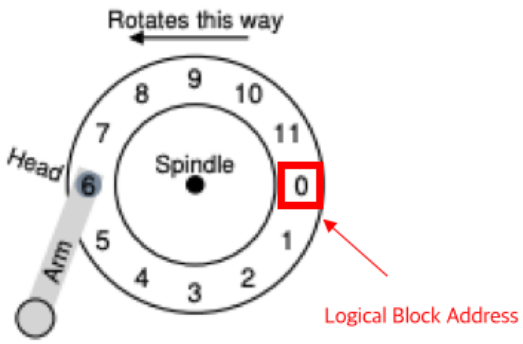
    - Is a simplest organization of an **Flash Transition Layer** that maps read of logical page N directly to read of playsical page N.

14. **Logging**

    - Is a concept in **log-structured file system** that buffer all writes (data + metadata) using an in-memory segment; once the segment is full, write the segment to a log

15. **Logical Block Address**

    - Is a common scheme used for specifying the location of blocks of data stored on computer storage devices, generally in secondary storage system



16. **In-Memory Mapping Table**

    - Is a table inside the memory of the secondary storage device (is persistent in some form) that stores the physical address of each logical block in the system

17. **Garbage Block**

    - Is also called **Dead Block**
    - Is old version of block in secondary storage, such as solid state drive

18. **Garbage Collection**

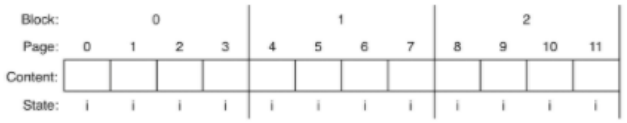
    - Is the process of finding garbage blocks and reclaiming them for future use

19. **Cache Flush**

    - Is the process of clearing out sections of memory to ensure writes have actually been persisted in solid state drive

20. **Trim**

    - Is an operation that takes an address (and possibly a length) and informs the device that the block(s) specified by the address (and length) have been deleted



A page can be in one of 4 states:

- i - initial state
- E - erased (an erased page can be written to)
- V - valid (a valid page has a mapping from logical block to page number)
- + - trim (the page no longer has a mapping from logical block to page number)

21. **Overprovision**
22. **Background**
23. **Page-Level FTL**
24. **Hybrid Mapping**
25. **Log Blocks**
26. **Switch Merge**
27. **Partial Merge**
28. **Full Merge**

1.1 Storing a Single Bit

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