File System Efficiency

CS439: Principles of Computer Systems

Bringing It Together

- Virtual address spaces are mapped onto physical address spaces in physical memory
  - Pages are mapped to frames!
  - Lots of policies to consider: demand paging, page replacement, working set, …
- The heap is part of a process's virtual address space (and is thus paged!)
  - Can be explicitly or automatically managed
- I/O devices are important for system usability.
  - Each one consists of the device, the controller, a bus, and a port
  - One of the most important I/O devices is the disk, which provides stable storage.
- File systems make the disk usable
  - Goals include: efficiency, usability, reliability
  - File system metadata is in a superblock
  - File metadata is in a file header (inode in Linux/Unix)
  - File data is on disk in some format (contiguous, …)
  - File systems demonstrate mechanical sympathy, including through reserved space, block groups, first-free allocation…)

Vocabulary

contiguous allocation
fixed asymmetric tree
first-free placement
linked index blocks
copy-on-write filesystems
mechanical sympathy
1st-level indirect pointer
access control list
multilevel index blocks
multilevel indexed files
2nd-level indirect pointer
3rd-level indirect pointer
indexed allocation
fragmentation
locality heuristics
file metadata
reserved space
direct pointers
FAT file system
random access
indirect pointer
sequential access
solid state drive
direct allocation
linked allocation
wear leveling
file growth
efficiency
durability
inode array
buffer cache
data block
file record
remapping
file header
file layout
flexible tree
block groups
page
plane
bitmap
extents
free list
FFS
MFT
inode
NTFS
block
best fit
file data