Data Storage Organization

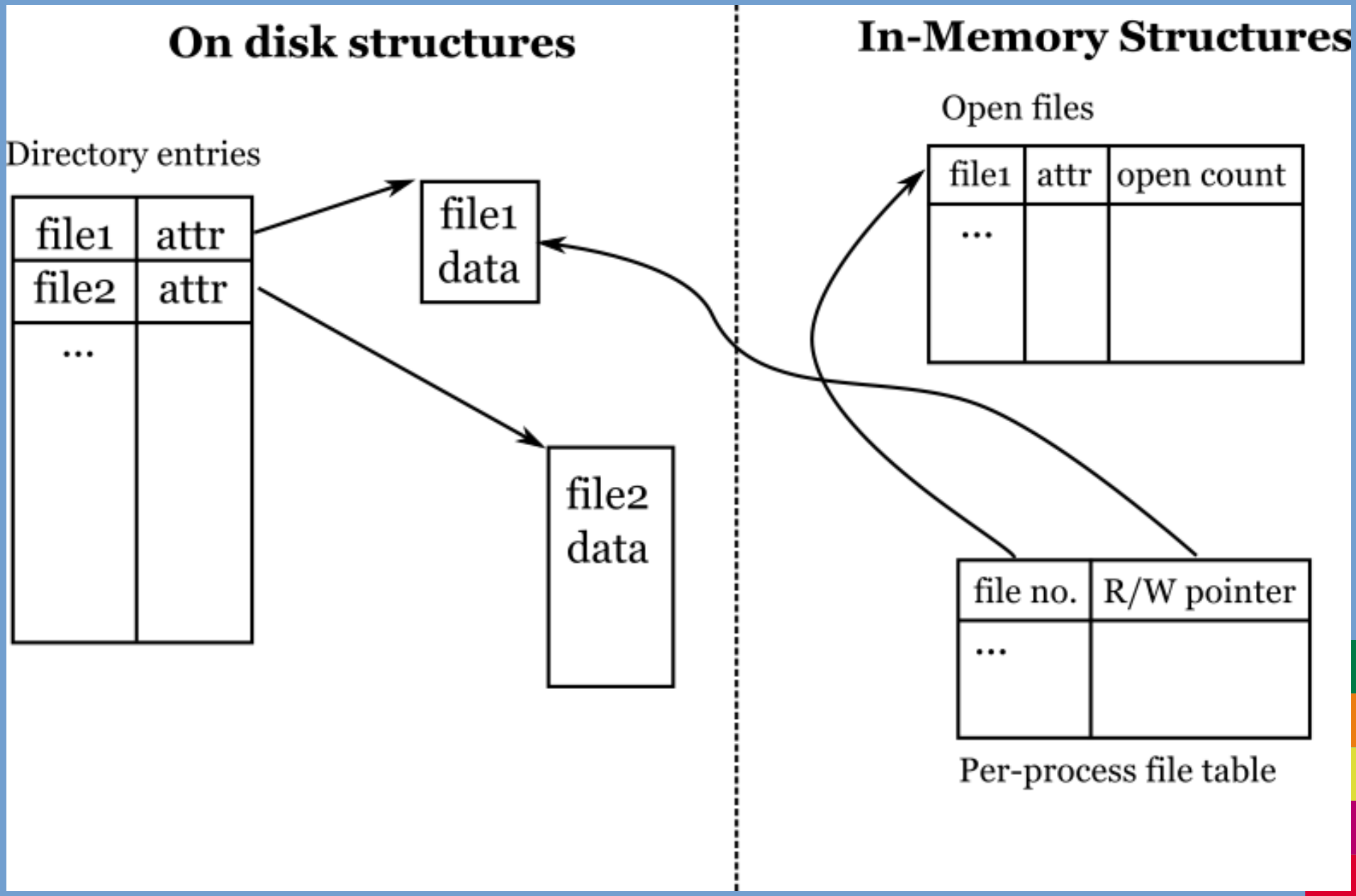
- It is clear we want to store data, in fact *lots* of it.
- We are given a disk which can hold several terabytes of data.
- How do we organize/structure this storage?

Filing Cabinet

Ikea ERIK

Directory Organization

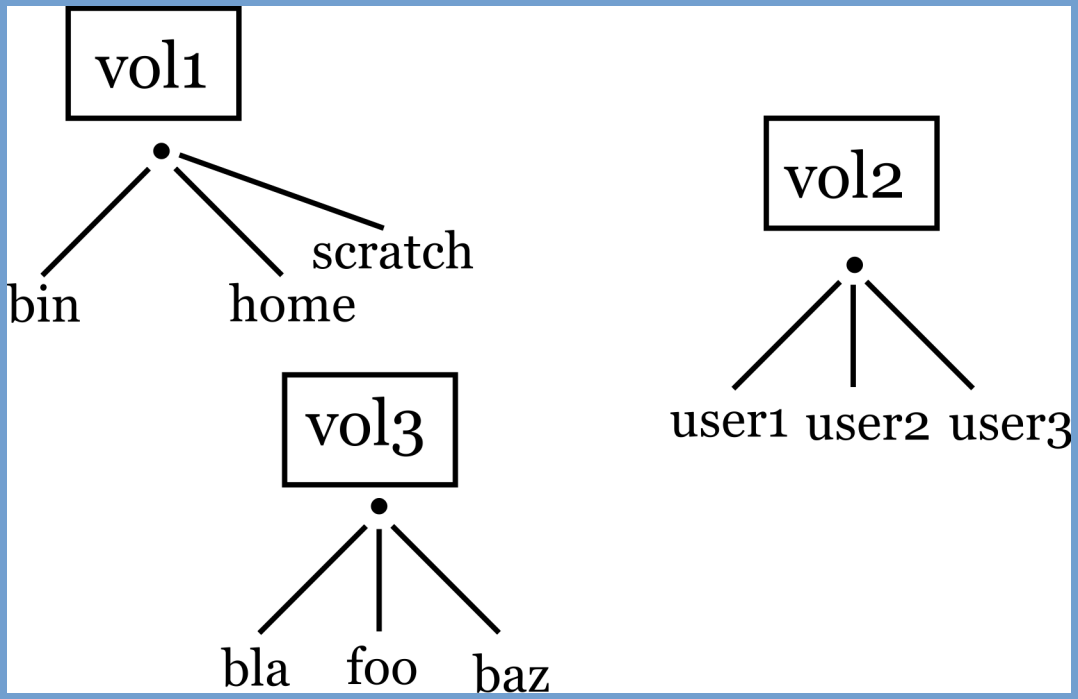
- Filing cabinet.
- Drawers ↔ Disks / volumes.
  - Folders ↔ Directories.
    - Sheets of paper ↔ Files


On disk structures
In-Memory Structures
Directory entries
file1
attr
file2
attr
...
file1
data
file2
data
Open files
file1
attr
open count
...
file no.
R/W pointer
...
Per-process file table

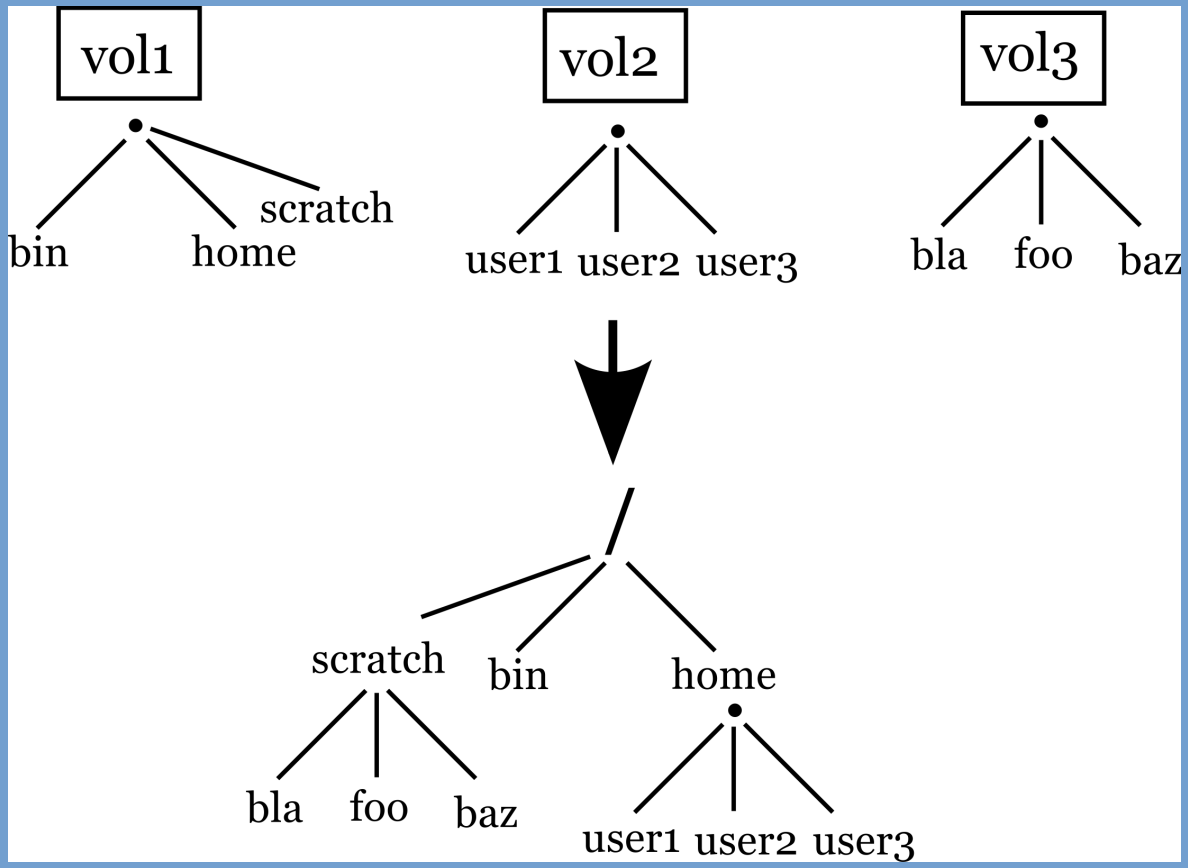
Link types

- Symbolic link
  - New directory entry type.
  - Contains file name (symbolic) of link target.
  - Following this pointer: “resolving the link”.
- Hard link
  - Duplicated directory entry.
  - Directory entries point at “inodes”.
  - In the “inode” a reference count is kept.

File System Mounting



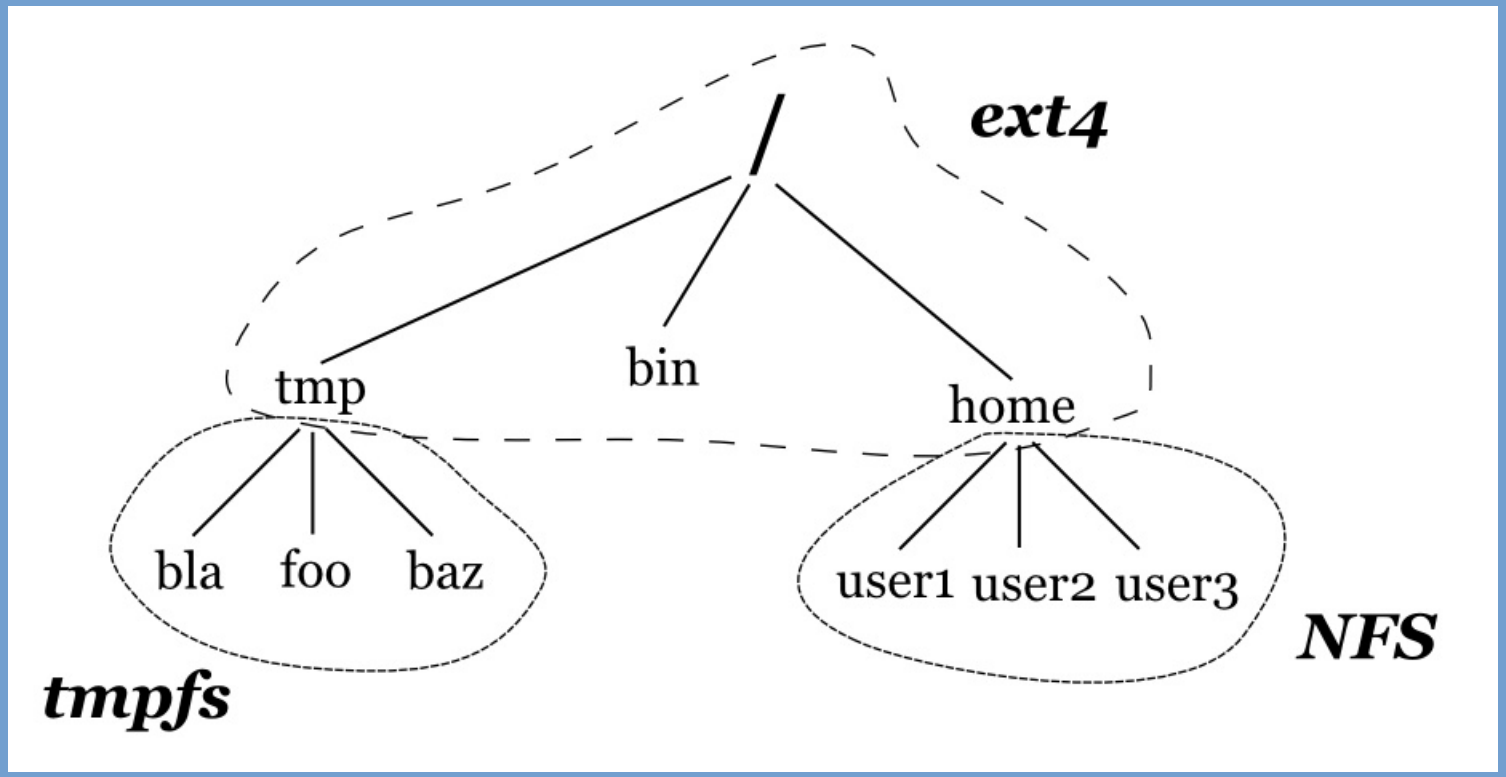
File System Mounting



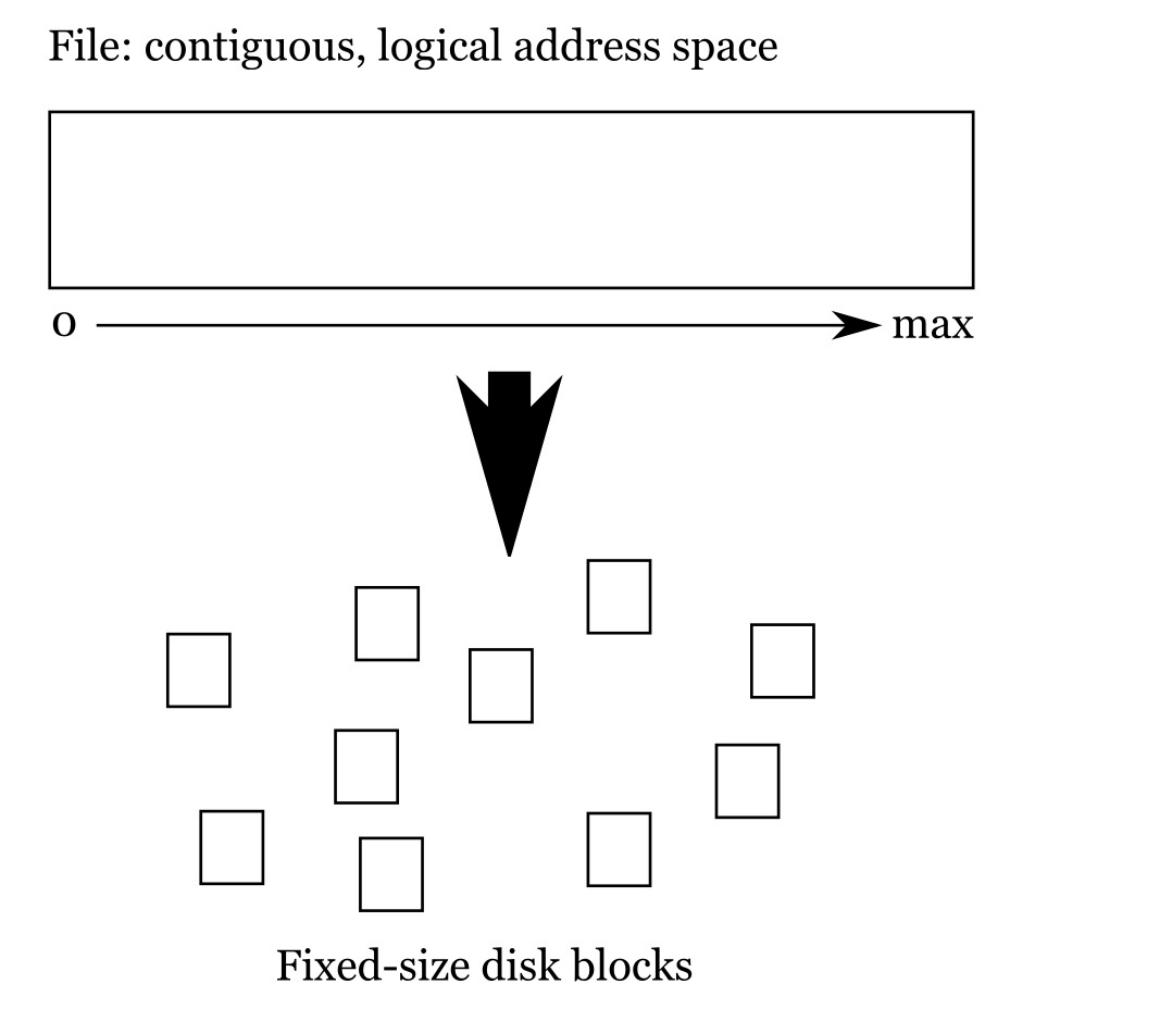
Chapter 11: File system implementation

Why Virtual File Systems?

- At different mount points, different **types** of file systems may be mounted:



Disk Block Allocation



Chapter 12: Mass storage systems

NFS vs. iSCSI

- NFS, CIFS, AFP

  → File-based systems. Remote host is accessed using requests for particular files. No knowledge about underlying file system.

- iSCSI

  → Block-based systems. Remote host is accessed using requests for particular disk blocks. Client determines file system.

Parity

- **Odd parity**
  - 0 1 1 0 → 0 1 1 0 1
  - Added parity bit causes number to the odd.
  - We can close any bit and still recover, why?
- **Even parity**
  - 0 1 1 0 → 0 1 1 0 0