

CSc 360

Operating Systems

File Systems

Jianping Pan
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Review

- Operating systems
 - process management
 - how to share CPU: jobs, processes, threads
 - scheduling, communication, synchronization
 - memory management
 - how to share memory: physical, logical, virtual
 - paging, allocation, replacement
- What's next?
 - I/O management, particularly file systems

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File concepts

- File: logical storage unit for information
 - normally on disk and tape: nonvolatile
- File type: data (text, binary, ...), program
- File attributes: meta information
 - name, size, time, owner, protection, location, ...
 - kept in directory (a special file)
- File operations
 - create, write, read, seek, append, truncate, etc

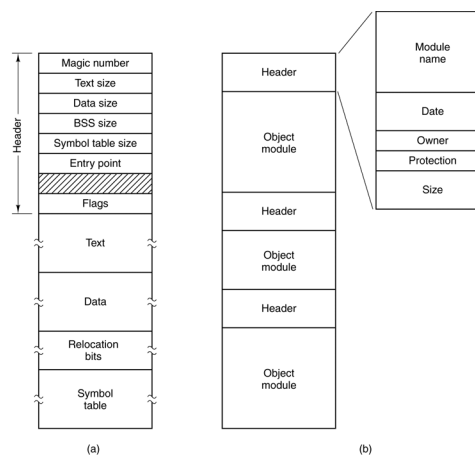
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File structures

- How information organized within a file
 - unstructured, or
 - structured w/ records
- Example
 - binary executable
 - binary archive
 - modules



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File access

- Sequential access
 - variable length records, i.e., r_1, r_2, \dots, r_n
 - to access record r_i , go through r_1 to r_{i-1} first
- Direct access
 - fixed length records of size s
 - i -th record: offset $(i-1)*s$
- Indexed access
 - access index first

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Directory concepts

- A special file
 - a collection of meta information of files
 - normally structured
 - and allow direct access
- Directory operations
 - “file” operations on directory records
- File systems on disk
 - partitions, file systems (FDT/FAT), files

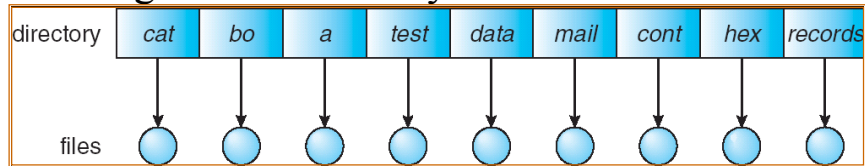
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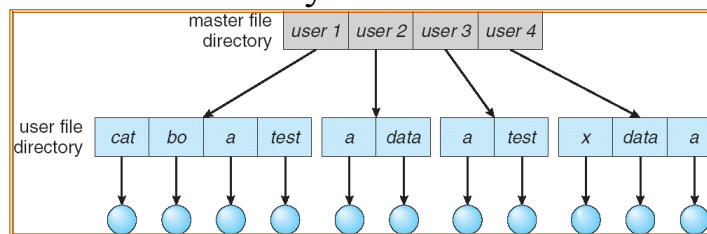
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Directory structures

- Single-level directory



- Two-level directory



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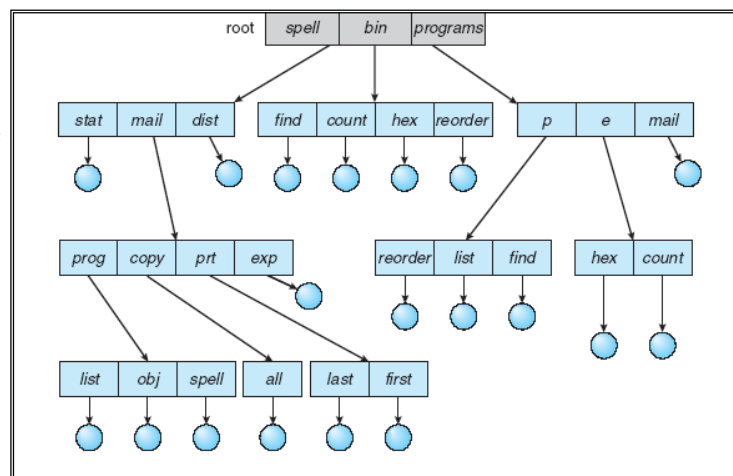
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Directory structures: tree

- Path

- absolute
- relative



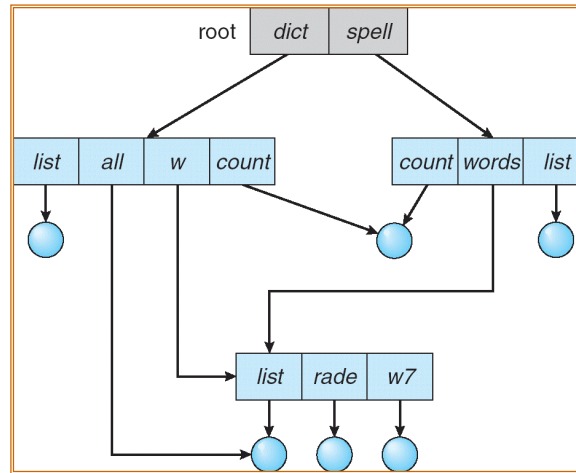
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Directory structures: graph

- Links
 - hard links
 - symbolic links
- Link operations
 - resolve links
 - delete links/files
- Acyclic-graph
 - loop-free



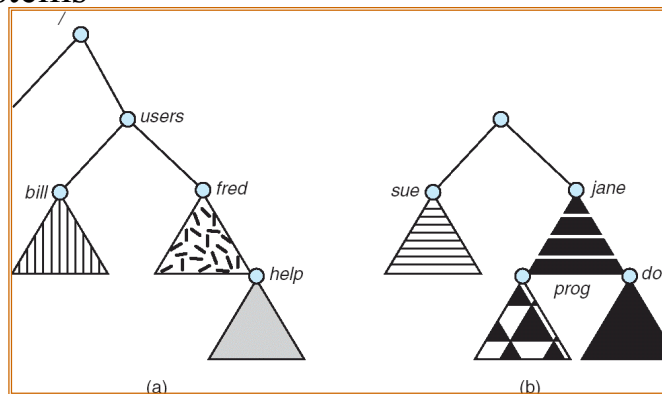
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File system operations

- Mount file systems
 - mount point
 - directory
 - directory with files?
 - multi-mount



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Share and protection

- File attributes
 - owner: user ID, group ID
- Type of access
 - read, write, execute, etc
- Share over the network
 - host ID
 - NFS: network file systems
 - remote procedure calls

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Failure mode

- Local file systems
 - hardware failure
 - corrupted information
- remote file systems
 - network failure
- Fault-tolerant systems
 - keep state at both sides, or
 - stateless but less secure

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Consistency control

- Multiple users access a file simultaneously
 - lock!
 - entire file, or
 - certain records
 - complexity and (network) overhead
- Consistency semantics
 - Unix semantics: write immediately visible
 - session (open()-close()) semantics: e.g., AFS

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This lecture

- File systems
 - file
 - directory
 - file system
- Explore further
 - Linux file/directory commands
 - /bin/mount

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Next lecture

- File system implementation
 - read OSC7Ch11