

File System Design And Implementation For Virtual Operating Systems

Taurin Tan-atichat

Computer Science and Engineering
University of California, San Diego

Joe Pasquale

Computer Science and Engineering
University of California, San Diego

Motivation

- Virtual Operating Systems (VOSs) provide an environment for applications to run portably across all platforms
- VOSs allow non-super users to add, modify and remove kernel features easily
- VOSs typically do not contain file systems which are essential for permanent storage, virtual memory, and the hierarchical organization of files

Background

- Base file system considered as an array of fixed size blocks
- Base operation is read from/write to block N

0	1	2	3
4	5	6	7
8	9	10	11
12	13	14	15
16	17	18	19
20	21	22	23
24	25	26	27
28	29	30	31

Design

- Divide blocks into 3 sections
- File System Metadata contains information about the entire file system
- File Metadata contains information about a specific file
- Datablock contains actual data of files

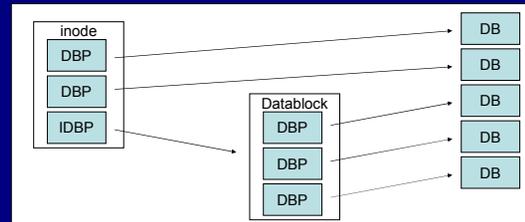
FSM	FSM	FSM	FSM
FM	FM	FM	FM
FM	FM	FM	FM
DB	DB	DB	DB
DB	DB	DB	DB
DB	DB	DB	DB
DB	DB	DB	DB
DB	DB	DB	DB
DB	DB	DB	DB

Implementation

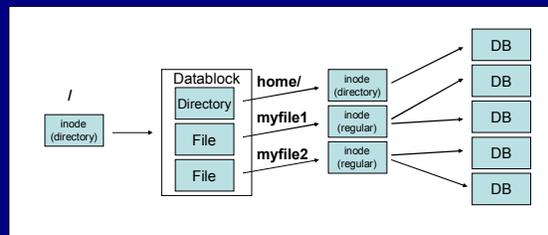
- File System Metadata (superblock) contains bit maps for free blocks of File Metadata and Datablocks, and locations of bit maps on file system



- File Metadata (inode) contains file type, size, direct datablock pointers, and indirect datablock pointers



- Directories are treated as regular files but their contents contain a list of directory entries that each contain the name of the file and a File Metadata (inode) Pointer



Optimization

- Disk access is very slow; disk is in milliseconds (10^{-3}) while memory is in nanoseconds (10^{-9})
- Cache most recently used metadata in memory
- Cache most recently used datablocks in memory
- Flush buffers when necessary



Future Work

- Implement various caching algorithms and compare hit/miss rates
- Model file system on a real disk and compare performance of different scheduling algorithms

