

## Concepts

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## File System Design & Implementation

### Course Objective

This course focuses on issues in designing File Systems for Linux and presents algorithms and designs used in a variety of file systems. Particular emphasis is given to the way file systems are designed, with broader discussion of operating system issues. At the end of course participants will have basic information and understanding of how file systems are built on Linux. The course also provides exposure to advance cluster file systems.

### Course Contents

#### File System Basics

User's View of the File System  
"Everything is a file", Types of files  
Process visa-vis files  
File Descriptors, fd\_sets

#### Introduction to advanced FS features

Byte Range Locking  
Advisory Vs Mandatory  
Fcntl based notifications and operations  
Mount command

#### File System framework

Common File Object Model  
Object Oriented Design  
Objects and functions

#### The Four Objects

Superblock  
Inode  
Dentry,  
File  
Directory Name Lookup Cache  
Address Space Operations  
Disk Quota Operations

#### Implementation Overview

Mapping File system objects to VFS objects.  
Inside VFS objects  
Attaching Root dentry Object.  
Readsuper()  
Address space operating  
Super block operation  
Ancillary Kernel Support Routines.  
Namei.bmap, generic\_xxx()

#### Meta data operation

Implementation overview  
Lookup  
Readdir  
Truncate  
Mkdir/ rmdir  
open / create / close semantics  
Pathname traversal  
Understanding inode->isem.

#### Data operation Implementation overview

The 3 data flow paths.  
Implementation of memory mapped files  
Read / Write  
Implementing Vectored I/O  
Direct I/O

#### Ext2 implementation overview

Ext2 Metadata Structures  
Mechanism of solving the metadata update problem  
Journaling in Block Device Drivers,  
Soft Updates.

#### Introduction to Virtual Memory

#### Kernel Memory Management & Allocation

#### Implementation of dummy file system

#### Overview of advance cluster file system

High Availability  
Load Balancing  
RPC Mechanism

**Reference:**

Linux File Systems  
Moshe Bar

In Search of Clusters  
Gregory Pfister

**Prerequisite:**

Fluent C Programming skills  
Sound Linux Kernel Fundamentals