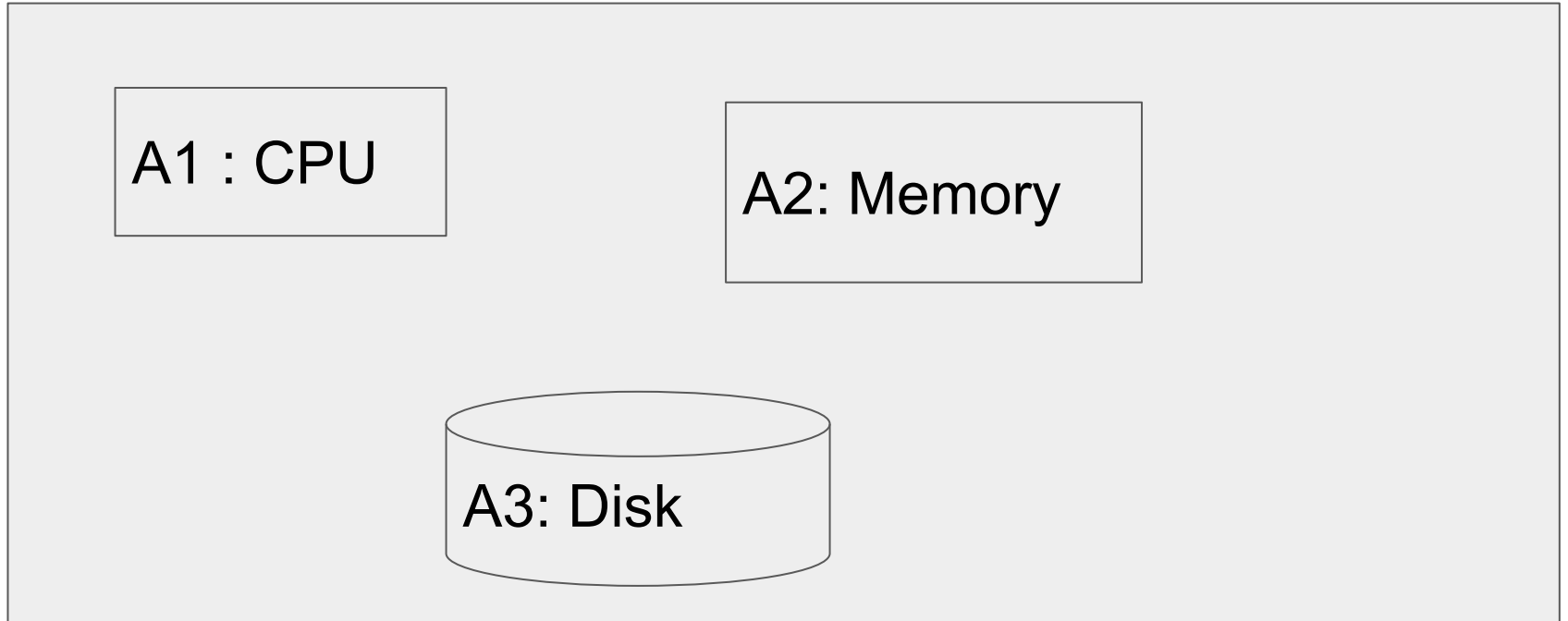


A3: File Systems Overview

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Operating System



What is a file system?

Layout of data on disk.

Many file systems available

cd to linux/fs. See list of file systems

50+ file systems!

We will look at ext2

ext2 file system

The second extended file system.

Contains files and directories.

Each file and directory has an inode (information node) data structure.

Each file and directory has a unique number - inode number

Directories are also stored as files, more below.

Important file system commands (Demo)

Create/Format a file system (fuseext2)

Mount a file system

Create a file

Create a directory

Remove a file

Unmount a file system (fusermount)

Directory

Special files that store file/directory names

Each directory structure stores

directory/file name

length of directory/file name.

inode number of the file/directory.

Inode

inode number - each file and directory has one.

inode - information node - stores information about the file or directory.

Stores

- location of data blocks on disk
- Size
- Permission
- link count
- creation times.

commands

ext2_ls <my_disk> <path_on_fs>

ext2_cp <my_disk> <path_on_my_computer> <path_on_fs>

ext2_mkdir <my_disk> <path_on_fs>

ext2_ln <my_disk> <path_on_fs> <link_path_on_fs> [**DEMO**]

ext2_rm <my_disk> <path_on_fs>

Disclaimer

Following slides DO NOT contain all information required for performing A3

Please refer Official A3 assignment handout and ext2 documentation for any irregularities.

These slides provide information to begin exploring ext2

useful command - dumpe2fs

```
$ sudo dumpe2fs DISKNAME.img
```

```
Inode count:      32
```

```
Block size:      1024
```

```
Block count:     128
```

```
Group 0: (Blocks 1-127)
```

```
Primary superblock at 1, Group descriptors at 2-2
```

```
Block bitmap at 3 (+2), Inode bitmap at 4 (+3)
```

```
Inode table at 5-8 (+4)
```

```
105 free blocks, 20 free inodes, 2 directories
```

```
Free blocks: 23-127
```

```
Free inodes: 13-32
```

Important Data Structures

Super Block (1)	Group Descriptor (2)	Block Bitmap (3)	Inode Bitmap (4)	Inode Table (5-8)	Reserved (9-22)	Data and Directory (23-127)
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ext2 superblock - important fields

`free_block_count`

`free_inode_count`

ls
cp
mkdir
ln
rm

ext2 group descriptor - important fields

Holds location of

Block bitmap

Inode bitmap

Inode table

Also holds

Free blocks count

Free directory count

Free inodes count

ls
cp
mkdir
ln
rm

Struct ext2 inode

Stored sequentially on inode map.

Important fields

i_mode (IS_FILE | IS_DIR)

i_size (File/Directory Size)

i_links_count (number of hard links)

i_blocks (number of blocks)

ls
cp
mkdir
ln
rm

Struct ext2 inode

`i_block_array[15]` (location of blocks)

0-11 - direct blocks

12 - single in-direct block. (12 -19)

13-14 not required for this assignment

While allocating/deallocating inode

- set **inode_bitmap** to 1/0

ls
cp
mkdir
ln
rm

ext2 directory - important fields

inode number

record length

name length

file type

ls
cp
mkdir
ln
rm

ext2 data blocks

Will contain raw data for files (**ext2_cp**)

Or a directory structure (**ext2_mkdir/ext2_in/ext2_cp/**)

Or a single indirect block (for files larger than ? bytes)

Hint: number of direct blocks * size of each block

Location of data block numbers - **ext2_inode.i_block[]** array.

While allocating/deleting a data block:

- set corresponding bit in **block bitmap** to 1/0.

ls
cp
mkdir
ln
rm