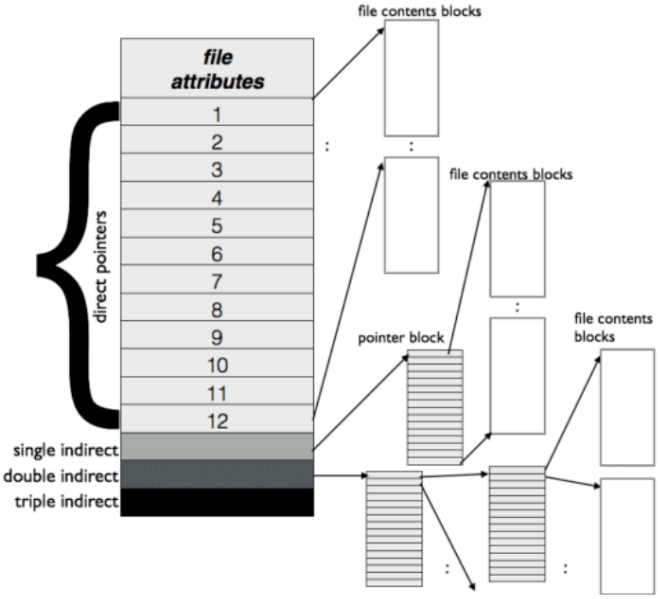
1. a) 1) 4 - inode blocks. 1 for the file `c`, and 3 for the directdories `/`, `a`, `b`
   2) 3 - directory blocks - one for root `/`, one for `a`, the other for `b`
   3) 1 - single indirect block as far as we know. The file definitely has more than 12 blocks (# of data blocks pointed by direct pounters), but less than 1036 (# of data blocks pointed by direct pointers and single indirect pointers). We are reading block 1034.
   4) 1 - data block for file `c`

   b) All of the above

Notes

- **Inode**



  - Is short form of **index node**
  - Describes a file system object such as file or data
  - Contains all information about a file/directory, including
    - File Type,
    - Size
    - Number of blocks allocated to it
    - Protection information
    - Time information (e.g time created, time modified)
    - Location of data blocks residing on disk

References

1) Wikipedia, Inode, link
2) Machanick, Philip. (2016). Teaching Operating Systems: Just Enough Abstraction. 642. 10.1007/978-3-319-47680-3_10., link

c) Size, the location of data blocks that reside on disk

Notes

- I wonder what information about blocks inode has. Is it total number of blocks both inode and data, or just data?
- I struggled a bit on this one. I should find an easier way to remember which information inode has

d) **Rough Work**

- **Creash Scenarios**
  - When only new data block is written to disk
    - This is fine in system's point of view
    - No inode points to it (it doesn't contain any information about file)
    - No bitmap points to it
    - Is as if write never occured
  - When only the updated inode is written to disk
    - There is no bitmap that's pointing to it
    - There is new inode where existing inode is
    - The data block `Db` hasn't been created
    - Reading data where `Db` is will return garbage data
    - there is a term for this. Is called **File-System inconsistency**
  - When only inode bitmap is written to disk
    - inode block pointed by bitmap is assumed to be allocated
    - But there is no desired inode where it's pointing
    - This is another example of **File-System-Inconsistency**
    - If left as is, then space cannot be used for future use (**inode leak**)
  - When only data bitmap is written to disk
    - data block pointed by bitmap is assumed to be allocated
    - But there is no desired inode where it's pointing
    - This is another example of **File-System-Inconsistency**
    - If left as is, then space cannot be used for future use (**data leak**)

Notes

- I wonder how system call for reading file/directory works in UNIX. Does it check for bitmap?
- I wonder how system call for deleting file/directory works in UNIX
- I wonder how system call for creatubg file/directory works in UNIX
- **Creating Files**

  - **Syntax:**

    ```
    int fd = open("foo". O_CREAT|O_WRONLY|O_TRUNC, S_IRUSR|S_IWUSR)
    ```

    * Is a system call
    * `O_CREAT` - Creates file "foo" if does not exist
    * `O_WRONLY` - Open file for writing only (default)
    * `O_TRUNC` - Overwrites existing file Need example/Clarification
    * Can have multiple flags
  -

- **Reading and Writing Files**
- **Reading and Writing Files**
- **Renaming Files**
- **Removing Files**
- **Making Directories**
- **Reading Directories**
- **Removing Directories**
- **Hard Links**
- **Symbolic Links**