

Arboreal User Guide

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Installing Arboreal

Arboreal is currently not integrated with the kernel and as such runs similarly to a virtual file system albeit with a more experimental structure. Future work will be focused on direct integration with the kernel in order to provide more traditional usability. In the meantime playing around with and testing the file system can be achieved through a few easy steps:

1. **Download the project**
2. **Change the directory (within the shell) to the folder within the project hierarchy named** `Source`
3. **Type** `make` **into your shell**
4. **You will now need to first run the daemon process. This process intercepts all communication attempts with the File System and will execute functions accordingly. There are a number of command line arguments that can be passed to the daemon:**
 - `-d` **This flag is used to tell the daemon to enable debugging**
 - `-v` **This flag is used to tell the daemon to return file information (such as that returned by a call to find) with as much information as possible. Omitting this flag will cause the daemon to return a reduced version of the file information**
 - **You may enable either of these options or both (input order does not matter, that is** `-d -v` **will work the same as** `-v -d` **)**
5. **Finally, Simply Type** `./daemon` **followed by your chosen flag or flags (be sure to include a space in between). For example, if I wanted to run the daemon with verbose file information and debugging enabled the command would look like:** `./daemon -v -d`

At this point you'll be ready to move on to the next step, starting the command line or GUI interface. Notice that the daemon does not output anything to the screen as it is running. **This is OK!** Its whole purpose is to be a background process that aids communication with the file system. **If you decided to enable debugging, the output will be located in a file called** `Arboreal.log` .

A final note:

By typing make, the "disk" will be formatted for you with the default values and partition names and counts. It is possible to change these to better suit your needs however it is a little bit more involved.

1. **Open and edit a file called** `diskInfo.d` **(It is located in the** `Source` **folder)**
2. **Using the following syntax, edit the file as you see fit:**
 - **Line 1 needs to always be:**
`Diskfile name, number of blocks on disk, size of each block in bytes, number of partitions` (Omit the commas in favor of spaces)
 - **Lines 2 to X need to always be:** `Partition name, number of blocks in the partition, maximum filename size` (Again omit commas in favor of spaces)
 - **There are restrictions on values for** `diskInfo` :
 - **Filename sizes** are restricted to **no more than** `block size / 2`
 - **Block size must be a power of 2**
 - Bear in mind that there exists a **hardcap on the number of tags that can be associated with a file** and it is equal to:
$$(((\text{block size} - \text{filename size} - 136) / \text{sizeof}(\text{BlkNumType})) + (\text{block size} / \text{sizeof}(\text{BlkNumType})))$$
 - The **maximum possible blocksize** is `16 Kb`
3. **Next you will have to open** `daemon.cpp` **(it is located under** `Source/FileSystem/` **) and edit this line of code:**
 - `d = new Disk(#1, #,2 const_cast<char *>("diskfile_name"));`

- **Change #1 to whatever value you picked for** `number of blocks` **in** `diskInfo.d` .
 - So if I decided that I wanted 4000 blocks I would type `4000` in for `#1` (**The number here and in `diskInfo.d` MUST MATCH**).
- **Change #2 to whatever value you picked for** `block size in bytes` **in** `diskInfo.d`
 - So if I decided that I wanted blocks to be 4096 bytes large I would type `4096` in for `#2` (**Once again I stress that the number here and in `diskInfo.d` MUST MATCH**)
- **Finally, change** `diskfile_name` **to the name of the disk file you chose in** `diskInfo.d` (make sure they match!!)

4. You are now almost ready, the final step is to type `make clean` followed by `make` in the shell and run the through the same steps as above for starting the daemon

5. You are now good to go!

Starting The Command Line

Before beginning anything below, make sure that a daemon process (and ONLY ONE daemon process) is running, if the command line cannot connect to the daemon process it will quit on startup with an appropriate error message

The command line utility has multiple optional arguments but it does contain a single mandatory argument. This is the **Partition Name** that the command line will be working on. If no partition name is given the command line will fail on startup with an appropriate error message. Additionally it is important to note that **the partition that is given to the command line must already exist**. If it does not, an appropriate error will be thrown. Finally, **it does not matter if the partition is already in use by another command line and it does not matter how many command lines are currently active**, in both cases you will still be able to work with the file system (provided that the partition you gave exists). After providing the partition name you are free to run the command line. However, should you wish to, there are some optional command line arguments:

- `-d` **This argument will enable debugging for both the command line and the liaison process**
- `-s` **This argument will alert the command line that input will be coming from a file rather than a user**
- `-s -d` **This will enable debugging for the command line AND alert it to the fact that input will be coming from a file rather than a user**

For example, if i wished to pipe input from a file to the command line and enable debugging, I would run the command line process like so:

```
./commandline PartitionName -s -d < some_random_file.ext
```

(Note that `./commandline -d -s < some_random_file.ext` will not work, that is, make sure the debug flag comes last!)

But if I wanted to just enable debugging and read from user input, I would run the command line process like so:

```
./commandline PartitionName -d
```

At this point you should see the arboreal header and `Arboreal >>` indicating that the command line is ready to accept input. **To send input to the command line simply type the command you wish to execute** (see *Valid Commands And Their Syntax* section for commands or type `help` or `h`) and press enter.

Note

If you chose to enable debugging for the command line, all debug output will be written to a file named `Arboreal.log`. Do not worry if this file does not yet exist, it will be created for you on startup.

////////////////////////////////////

Valid Commands And Their Syntax

Before we begin please make note of a few things:

1. **There is a maximum command size of 4096 bytes** Although a lot of these commands have support for defining multiple operations within a single command (such as search for multiple files by name without having to enter a separate `find -f` command for each file), if the total size of the command exceeds the current default of `4096 bytes`, the command will fail to send and be ignored.
2. **DO NOT include spaces between `list` and/or `set` items or between items and `{}` or `[]` or `/`.**
3. Commands of the form `../tag/tag/file` or `../tag/tag` only **emulate** directory structures. In fact, **Arboreal does not have the concept of a directory**. However, this style of syntax is universally understood and easy to type and so was maintained.

"Help" Commands

```
1 | Arboreal >> help
2 | Arboreal >> h
```

These two commands will bring up a helper subprocess which will display a list of the command archetypes and show the user the specific commands (and their syntax) that are housed under each archetype. The helper subprocess continues running until the user decides to quit it.

```
1 | Arboreal >> -h --command_archetype
2 |
3 | e.g.
4 | Arboreal >> -h --find
```

This version of the help command will show the usage for a single command archetype. (Unlike the `help` or `h` commands it will not start a "helper" subprocess but will simply display the usage for the particular archetype and await the next file system command)

"Quit" Commands

```
1 | Arboreal >> quit
2 | Arboreal >> q
3 | Arboreal >> Q
```

All of these will attempt to terminate the current command line process. This command does not affect other concurrently running command lines it will only quit the currently active command line process. The user must confirm the quit before the command will actually be executed. this is to prevent accidental quits. The quit commands are built with proper cleanup in mind and should not leave any junk behind.

Changing The Current Working Directory

```
1 | Arboreal >> cd tagnameX/../../tagnameXn
2 | Arboreal >> cd ../tagname1/tagname2
```

Changing "directories" is quite easy and supports relative paths and absolute paths.

- Version 1 will change to the "directory" which includes files tagged with all of the tags included in the command. That is, if you were to `cd Documents/December/Papers` all files "within" the "directory" would be tagged with `Documents, December, Papers`.
- Version 2 will append whatever you typed to the current working directory. **You MUST include the period.** For example if I'm currently in the "directory" `Documents/December/Papers` and I `cd ../CreativeWriting/BeerBrawls`, my resultant "directory" will be `Documents/December/Papers/CreativeWriting/BeerBrawls`.

"Find" Commands

Find Files By Tag

```
1 | Arboreal >> find -t [tagnameX,...,tagnameXn]
2 | Arboreal >> find -t {tagnameX,...,tagnameXn}
3 | Arboreal >> find -t [tagnameZ,{tagnameX,...,tagnameXn},...,tagnameZn]
4 | Arboreal >> find -t {tagnameZ,tagnameZ1,[tagnameX,...,tagnameXn],...,tagnameZn}
```

This command searches for files by tag. It is quite powerful and allows you to search for any combination of tags. Commands that use `{ }` are called `sets` and will tell the file system to **search for ALL files which are tagged with ALL of the specified tags**. You can think of this as a bunch of `&&` operations, that is, you want a file tagged with :

```
{ this tag, and this tag, and this tag, ... etc }
```

Commands that use `[]` are called `lists` and will tell the system to **search for ANY file which is tagged with ANY of the tags specified**. You can think of this as a bunch of `||` operations, that is, you want a file tagged with:

```
[this tag, or this tag, or this tag, ... etc]
```

What's great is that you can actually nest any of these within one another! Although nesting a bunch of `sets` or `lists` won't be any different from simply using one big list or set (i.e. `[t1,t2,t3,t4]` is the exact same as `[t1,t2,t3,t4]` this goes for `sets` as well). However, things get interesting when you pass a command such as:

```
find -t [tag1,tag2,{tag45,tag78,[tag9,tag10],tag5},tag100]
```

This particular command will search for any file with:

```
1 | ( tag1 )
2 | -or- ( tag2 )
3 | -or- ( tag100 )
4 | -or- ( tag45 & tag78 & tag9 & tag5 )
5 | -or- ( tag45 & tag78 & tag10 & tag5 )
```

(Of course you can accomplish similar things with a command that is a `list` nested within a `set` rather than this example which is a `set` nested within a `list`)

As you can see, nesting these operations creates some really powerful search options!

Find Files By Name

```
1 | Arboreal >> find -f [filenameX(.ext),...,filenameXn(.ext)]
```

This command will (as the title suggests) find a file based on its name. In order to make searching for multiple files easier, you have the option of defining several filenames to search for. For example:

```
1 | Arboreal >> find -f [BookReport.pdf,ExperimentData.numbers,Makefile]
```

Will search for a file named `BookReport.pdf` , a file named `ExperimentData.numbers` , and a file named `Makefile` . **This command does not support nested `[]` or `{}` as these have no meaning when searching for files by name.**

It is also important to note that, while file extensions are optional for this command, a search for `BookReport` will NOT return `BookReport.pdf` and a search for `BookReport.pdf` will NOT return `BookReport` .

Both finding files by tag and by name will return file information and the total number of files found. If the file could not be found or the tag exists but is completely empty, a message stating so will be returned instead. If the results are a mixture of non-existent and existent files, the appropriate message will be printed for each file (either the file information or "not found" message) and a count of the total number of files found will still be displayed.

"New" Commands

Creating New Tags

```
1 | Arboreal >> new -t [tagnameX,...,tagnameXn]
```

You may specify any number of new tags to be created provided that the resultant command length does not exceed the maximum of `4096 bytes` . You also need not worry if a tag already exists but you did not know it at the time. **The file system will skip the creation of tags that already exist and tell you if that happens.** You can call this command from anywhere, that is, it does not care about the current working directory.

Creating New Files

```
1 | Arboreal >> new -f [filenameX(.ext),...,filenameX2(.ext)]
2
3 | Arboreal >> new -f tagnameX/.../tagnameXn/filename(.ext)
```

There are two ways of creating a new file and they have a very important distinction between them:

- **#1:** allows you to create any number of files **within the current working directory ONLY**
- **#3:** allows you to create a **SINGLE file regardless of the current working directory however, you MUST specify the absolute "path" of the file.** (*In a future update we may implement relative paths for this as well*)

If a file could not be created (possibly because it already exists), an appropriate message will be returned instead of the newly created file's information.

"Delete" Commands

Deleting Tags

```
1 | Arboreal >> delete -t [tagnameX,...,tagnameXn]
```

Delete any number of tags. **Tags will be deleted ONLY if they are empty.**

Deleting Files

```
1 | Arboreal >> delete -f [filenameX(.ext),...,filenameXn(.ext)]
2 |
3 | Arboreal >> delete -f tagnameX/.../tagnameXn/filename(.ext)
```

As with the `new` commands, there are two ways to delete a file:

- **#1:** will delete any number of files **provided that they exist within the current working directory.**
- **#3:** will delete a **single file regardless of current working directory, however, the file's absolute "path" MUST be provided.** *(In a future update we may implement relative paths for this as well)*

Although extensions on files are optional for these commands, you should be aware that:

```
delete -f [BookReport.pdf] will NOT delete [BookReport] delete -f [BookReport] will NOT delete [BookReport.pdf]
```

"Tag" Commands

```
1 | Arboreal >> tag [filenameX(.ext),...,filenameXn(.ext)] +> [tagnameX,...,tagnameXn]
2 |
3 | Arboreal >> tag tagnameX/.../tagnameXn/filename(.ext) +> [tagnameX,...,tagnameXn]
```

You may start noticing a pattern here of commands coming in pairs. This is completely natural and you are not going crazy. As with previous commands there are two ways to tag a file:

- **#1:** will **tag any number of files within the current working directory with any number of tags.** If the file or files have already been associated with a given tag then that tag is skipped.
- **#3:** will **tag a file regardless of the current working directory but the file's absolute path MUST be provided.**

(As always extensions on file names are optional but not providing them (if the file has one) will result in the expected file not being tagged or else an error stating that the file does not exist)

"Untag" Commands

```
1 | Arboreal >> untag [filenameX(.ext),...,filenameXn(.ext)] -> [tagname1,...,tagnameXn]
2 |
3 | Arboreal >> untag tagnameX/.../tagnameXn/filename(.ext) -> [tagnameX,...,tagnameXn]
```

- **#1:** will untag any number of files **provided that they are within the current working directory** and that they **are in fact tagged with the tags that you wish to be removed**.
- **#3:** will untag a **single file regardless of the current working directory**, provided that the file's **absolute path** is given and that the file is tagged with the tags you want to remove

(As always extensions on file names are optional but not providing them (if the file has one) will result in the expected file not being untagged or else an error stating that the file does not exist)

"Merge" Commands

Please note that these are still in production and not currently available

```
1 | Arboreal >> merge tagnameX => tagnameY
2 |
3 | Arboreal >> merge [tagnameX1,...,tagnameXn] => tagnameY
```

- **#1:** will merge `tagnameX` into `tagnameY`
- **#3:** will merge `tagnameX - tagnameXn` into `tagnameY`

"Open" Commands

```
1 | Arboreal >> open filename(.ext)
2 | Arboreal >> open tagnameX/.../tagnameXn/filename(.ext)
```

- **#1:** will open a file **provided that it exists within the current directory**
- **Version 2** will open a file regardless of the current working directory **provided that the file exists and the file's absolute path is provided**

"Close" Commands

```
1 | Arboreal >> close filename(.ext)
2 |
3 | Arboreal >> close tagnameX/.../tagnameXn/filename(.ext)
```

- **#1:** will close a file **provided that it is currently open**
- **#3:** will close a file regardless of the current working directory **provided that the file is open and the file's absolute path is provided**

"Read" Commands

Please note that these are still in production and not currently available

```
1 | Arboreal >> read filename(.ext)
2 |
3 | Arboreal >> read filename(.ext) -b #-of-bytes-to-read
4 |
5 | Arboreal >> read tagnameX/.../tagnameXn/filename(.ext)
6 |
7 | Arboreal >> read tagnameX/.../tagnameXn/filename(.ext) -b #-of-bytes-to-read
```

- **#1:** reads the entire contents of a file and outputs them to the screen. Will automatically open the file named (assuming it exists) **provided that the file is within the current working directory.**
- **#3:** reads **X bytes** of a file and outputs them to the screen. Will automatically open the file named, (assuming it exists) **provided that the file is within the current working directory.**
- **#5:** reads the entire contents of a file and outputs them to the screen. Will automatically open the file named (assuming it exists) **regardless of the current directory.**
- **#7:** reads **X bytes** of a file and outputs them to the screen. Will automatically open the file named (assuming it exists) **regardless of the current directory.**

"Write" Commands

Please note that these are still in production and not currently available

```
1 | Arboreal >> write tagnameX/.../tagnameXn/filename(.ext)
2 |
3 | Arboreal >> write -a tagnameX/.../tagnameXn/filename(.ext)
4 |
5 | Arboreal >> write filename(.ext)
6 |
7 | Arboreal >> write -a filename(.ext)
```

- **#1:** Writes whatever comes after the command is executed to the specified file. **Full path to file MUST be provided. Previous file contents WILL be OVERWRITTEN**
- **#3:** Appends whatever comes after the command is executed to the specified file. **Full path to file MUST be provided**
- **#5:** Writes whatever comes after the command is executed to the specified file. **File MUST be within the current directory. Previous file contents WILL be OVERWRITTEN**
- **#7:** Appends whatever comes after the command is executed to the specified file. **File MUST be within the current directory.**

"Copy" Commands

Please note that these are still in production and not currently available

```
1 Arboreal >> copy tagnameX/.../tagnameXn/filename(.ext) -> tagnameX/.../tagnameXn/filename2(.ext)
2
3 Arboreal >> copy filename1(.ext) -> filename2(.ext)
4
5 Arboreal >> copy -b Z tagnameX/.../tagnameXn/filename(.ext) -> tagnameX/.../tagnameXn/filename2(.ext)
6
7 Arboreal >> copy -b Z filename(.ext) -> filename2(.ext)
8
9 Arboreal >> copy -a -b Z tagnameX/.../tagnameXn/filename(.ext) -> tagnameX/.../tagnameXn/filename2(.ext)
10
11 Arboreal >> copy -a -b Z filename(.ext) -> filename2(.ext)
```

- **#1:** Copies the contents of "filename" to "filename2", **Overwrites "filename2" in the process; Absolute paths for both files MUST be provided.**
- **#3:** Copies the contents of "filename" to "filename2", **Overwrites "filename2" in the process; BOTH files MUST be within the current directory.**
- **#5:** Copies the first "Z" bytes from "filename" to "filename2", **Will overwrite the first "Z" bytes of "filename2" with the first "Z" bytes of "filename"; Absolute paths for both files MUST be provided.**
- **#7:** Copies the first "Z" bytes from "filename" to "filename2", **Will overwrite the first "Z" bytes of "filename2" with the first "Z" bytes of "filename"; BOTH files MUST be within the current directory.**
- **#9:** Appends the first "Z" bytes of "filename" to "filename2", **Does NOT overwrite the contents of "filename2"; Absolute paths for both files MUST be provided.**
- **#11:** Appends the first "Z" bytes of "filename" to "filename2", **Does NOT overwrite the contents of "filename2"; BOTH files MUST be within the current directory.**

"Rename" Commands

Version #3 Not Yet Available

```
1 Arboreal >> rename -t [tagname1old,...,tagnameXold] => [tagname1new,...,tagnameXnew]
2
3 Arboreal >> rename -f [filename1old(.ext),...,filenameXold(.ext)] => [filename1new(.ext),...,filenameXnew(.ext)]
4
5 Arboreal >> rename tagname1/.../tagnameX/filenameOld(.ext) => filenameNew(.ext)
```

- **#1:** Renames any number of tags. **Tags are renamed in order, that is, the tag at index == 1 in the first list will be renamed to the name at index == 1 in the second list.** If a tag will be renamed to another tag which already exist, or the tag to be renamed does not exist, the operation will fail.
- **#3:** (Not yet available) Renames any number of files. **All files to be renamed MUST exist within the current working directory; Files are renamed in order, that is, the file at index == 1 in the first list will be renamed to the name at index == 1 in the second list.** If a file will be renamed to another file which already exists, or the file to be renamed does not exist, the operation will fail.
- **#5:** Rename a single file from anywhere. **Absolute path to file MUST be provided** If a file will be renamed to another file which already exists, or the file to be renamed does not exist, the operation will fail.

"File Attributes" Commands

Version #3 Not Yet Available

```
1 | Arboreal >> attr tagname1/.../tagnameX/filename(.ext)
2 |
3 | Arboreal >> attr [filename1(.ext),...,filenameX(.ext)]
```

- **#1:** Gets the file attributes for a single file. **Absolute path to file MUST be provided.** If the file does not exist, the operation will fail.
- **#3:** (Not yet available) Get the attributes of any number of files provided that **those files exist AND are within the current directory.**

The Graphical User Interface

Troubleshooting

Help My List Command Keeps Coming Up As Invalid: Please remeber that there should be no spaces inbetween list elements.

Help My Open Command Keeps Coming Up As Invalid: Please remember that open comands require a flag such as -r or -w or -x infront of the file to be opened.

Help The Help Process Is Not Recognizing My Commands: Please remember that the help process syntax is `--command-from-table` no spaces.

Help I Can't Tag My File: Make sure that the tag you are trying to use actually exists / the file you want to tag exists

Help My List Commands Won't Work: In general any list command that is not a creation command requires that you be in the right tag space in order to work. Thus if you are trying to say tag files tagged with for example `tag1` from the root directory the command will fail unless you use the "complete path version". Simply `cd /tag1` in order to be able to use the list command again.

Help `lt` command shows only some of the tags: This is a known bug and has not yet been fixed. Just keep typing `lt` eventually all the tags will show up.

Help My File Extensions Aren't Working: File extensions can be only alphabetic charcters, no numbers please. If this is entered: `new -f [file.1]` the commandline will treat `1` as a file name and the `.` as an improper comma and the command will fail.

Help My Absolute Path Commands Aren't Working: Make sure all tags and files exist and make sure the path starts with `/`.

Help How Do I Display All Files: `find -t [default]`

Help I'm Sure I'm Correct But the Command Still Won't Work: Please open a github issue with the command you are trying to execute, what you typed in, and the Arboreal.log file generated (this will give us information as too what else was done previous to the bad command) we will get too it as soon as we can!