



exFAT for Linux FUSE User Guide

Version 1.00

For use with exFAT for Linux FUSE versions 1.01 and above

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Table of Contents

1	System Overview.....	3
1.1	Introduction	4
1.2	Feature Check	6
1.3	Packages and Documents	7
	Packages.....	7
	Documents	7
1.4	Change History	8
2	Source File List	9
2.1	FUSE Source Code.....	9
2.2	Version File	9
3	About FUSE.....	10
4	Using and Testing exFAT.....	11
4.1	Compiling exFAT	11
4.2	Running exFAT	11
4.3	Testing exFAT	12
4.4	Using Standard Commands	12
	Formatting a drive	12
	Mounting a drive	12
	Listing mounted drives	12
	Creating a file	13
	Listing files.....	13
	Displaying a new file	13

1 System Overview

This chapter contains the fundamental information for this module.

The component sections are as follows:

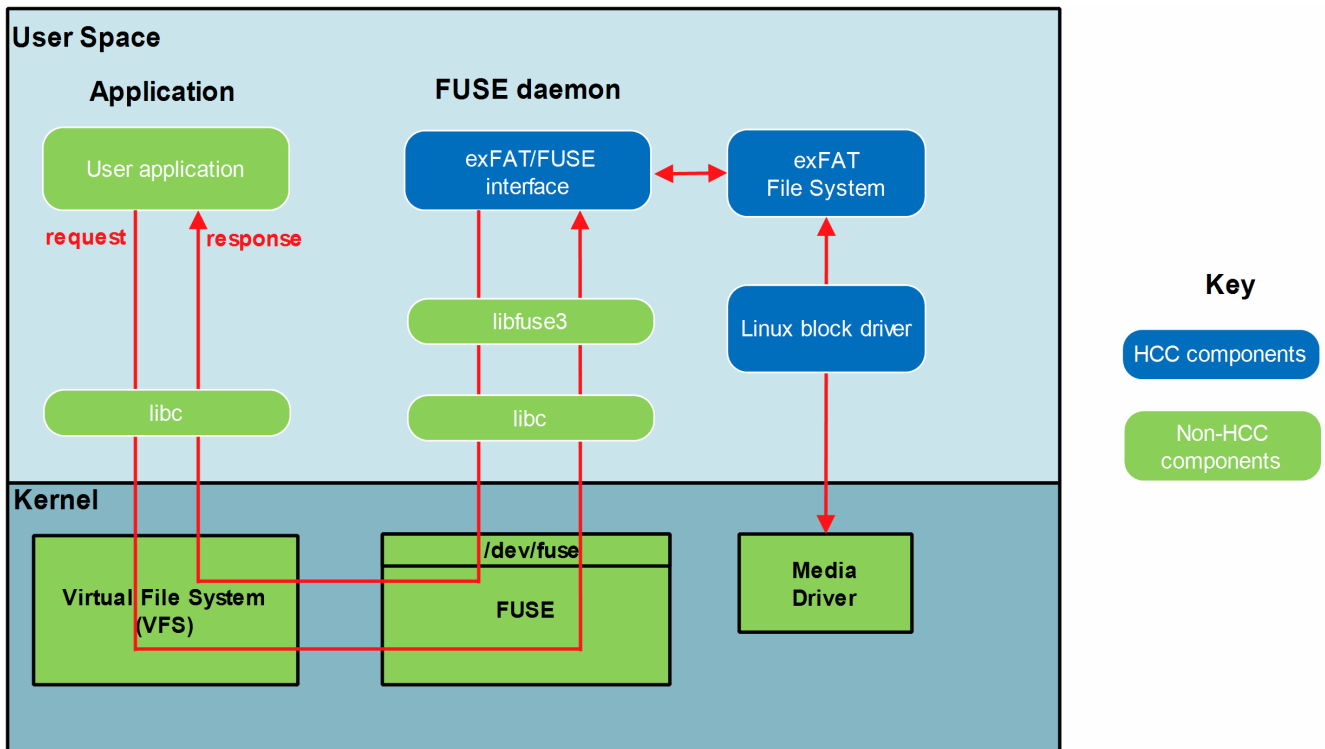
- [Introduction](#) – describes the main elements of the module.
- [Feature Check](#) – summarizes the main features of the module as bullet points.
- [Packages and Documents](#) – the *Packages* section lists the packages that you need in order to use this module. The *Documents* section lists the relevant user guides.
- [Change History](#) – lists the earlier versions of this manual, giving the software version that each manual describes.

1.1 Introduction

This guide is for those who wish to implement HCC's exFAT file system on a Linux system. HCC Embedded's exFAT for Linux uses the standard FUSE (Filesystem in User Space) library.

This product is supplied as source code from which a Linux executable can be built. This executable can then be used to mount an exFAT drive whose files can be accessed like any other files in the system.

The diagram below summarizes the FUSE architecture.



This shows the three HCC components in blue:

- The exFAT file system.
- The exFAT/FUSE interface - this wrapper that provides the interface from FUSE to HCC exFAT.
- The Linux block driver - converts the HCC media driver interface to a Linux block media driver.

HCC Embedded is a licensed supplier of exFAT implementations and can provide a full technology and patent license solution for incorporation into customers' devices. This means:

- For those who already have a Microsoft license for exFAT, HCC can supply its exFAT software implementation.
- For those who do not have a Microsoft license for exFAT, HCC can provide a Microsoft-approved license for exFAT and supply its exFAT software implementation.

Note: To use this product, the following extra packages are required:

- **fs_exfat** - the HCC exFAT File System. For full details of HCC's exFAT (Extended File Allocation Table) file system, refer to the *HCC exFAT File System User Guide*.
- **mdriver_blk_linux** - interfaces HCC media driver specification to Linux block media driver.

Note:

- HCC offers hardware and firmware development consultancy to assist developers with the implementation of various types of file system.
- Although every attempt has been made to simplify the system's use, developers must have a good understanding of the requirements of the systems they are designing in order to obtain the maximum practical benefits.

1.2 Feature Check

The main features of Microsoft's exFAT are the following:

- Almost unlimited card storage – exFAT means devices can handle growing requirements for media file storage, raising capacity from 32 GB to 256 TB.
- Handles vast amounts of media in one directory – exFAT can handle more than 100 HD movies, 4000 RAW images, or 60 hours of HD recording in a single directory.
- Interoperability between systems and devices – exFAT supports interoperability between many operating systems, so there's no need to keep reformatting files and media.
- Fast transfer speeds – file saves on SDXC cards can achieve their full speed of 300 MBps.
- Provides an extensible format – this includes parameters that OEMs can define to customize exFAT for specific devices.

The main features of the HCC system are the following:

- Conforms to the HCC Advanced Embedded Framework.
- Designed for integration with both RTOS and non-RTOS based systems.
- Linux FUSE integration available.
- Supports FUSE library version 2.x and FUSE 3.x.
- Multiple instances can be run with multiple volumes, one for each volume used.
- Cache options for optimal performance.
- Code size 32 KB.
- RAM usage >6 KB.
- ANSI 'C'.
- Unicode 16.
- Multiple open files.
- Multiple users of open files.
- Multiple volumes.
- Multi-sector read/write.
- Variable sector sizes.
- Partition handling.
- Handles media errors.
- Test suite.
- Zero copy.
- Re-entrant.
- Boundary alignment offset for the FAT table.
- Boundary alignment offset for the data region.

1.3 Packages and Documents

Packages

This table lists the packages that need to be used with this module, and also optional modules that may interact with this module, depending on your system's design:

Package	Description
hcc_base_doc	This contains the two guides that will help you get started.
fs_fuse_hcc_exfat	The exFAT for Linux FUSE package described in this document.
fs_exfat	The exFAT File System package that this package interfaces to.
mdriver_blk_linux	This interfaces HCC standard media driver interface to a standard Linux media block driver

Documents

For an overview of HCC file systems and guidance on choosing a file system, see [Product Information](#) on the main HCC website.

Readers should note the points in the [HCC Documentation Guidelines](#) on the HCC documentation website.

HCC Firmware Quick Start Guide

This document describes how to install packages provided by HCC in the target development environment. Also follow the *Quick Start Guide* when HCC provides package updates.

HCC Source Tree Guide

This document describes the HCC source tree. It gives an overview of the system to make clear the logic behind its organization.

HCC exFAT File System User Guide

This document describes the main HCC exFAT file system package.

HCC exFAT for Linux FUSE User Guide

This is this document.

1.4 Change History

This section describes past changes to this manual.

- To download this manual, [see File System PDFs](#).
- For the history of changes made to the package code itself, see [History: fs_fuse_hcc_exfat](#).

The current version of this manual is 1.00. The full list of versions is as follows:

Manual version	Date	Software version	Reason for change
1.00	2019-02-13	1.01	First version.

2 Source File List

This section lists and describes all the source code files included in the system. These files follow HCC Embedded's standard source tree system, described in the [HCC Source Tree Guide](#). All references to file pathnames refer to locations within this standard source tree, not within the package you initially receive.

Note: Do not modify any files.

2.1 FUSE Source Code

These files are in the directory `src/exfat/fuse`. **These files should only be modified by HCC.**

File	Description
<code>fuse_hcc_exfat.c</code>	Implements FUSE library version 2.x.
<code>fuse3_hcc_exfat.c</code>	Implements FUSE library version 3.x.

2.2 Version File

The file `src/version/ver_fuse_hcc_exfat.h` contains the version number of this module. This version number is checked by all modules that use this module to ensure system consistency over upgrades.

3 About FUSE

FUSE is the standard FUSE (Filesystem in User Space) library. This HCC package has been tested with two versions of FUSE.

Different versions of FUSE have different installation procedures. This example shows how to install FUSE version 3.4.1.

Note: HCC uses the FUSE library to interface to exFAT but this is not HCC software so follow your FUSE instructions.

To compile the FUSE 3.4.1 binary, run the commands shown below:

```
# apt-get update
# apt-get install make gcc binutils meson libfuse-dev pkg-config python3-pip
# pip3 install -U pytest
# wget https://github.com/libfuse/libfuse/releases/download/fuse-3.4.1/fuse-3.4.1.tar.xz
# tar xf fuse-3.4.1.tar.xz
# cd fuse-3.4.1
# # The following directions are documented here: https://github.com/libfuse/libfuse
# mkdir build
# cd build
# meson ..
# ninja
# python3 -m pytest test/
# ninja install
```

4 Using and Testing exFAT

This section describes how to:

1. Compile exFAT.
2. Run exFAT.
3. Test exFAT.
4. Use standard Linux commands to access the exFAT files.

4.1 Compiling exFAT

To build exFAT:

1. Take all the source code from the exFAT package.
2. From the FUSE package take either the FUSE2 or FUSE3 source code.
3. Take the block media driver source code.
4. Compile the source code.

The output is a Linux executable named, for example, **myhcc_exfat**.

4.2 Running exFAT

As in a standard Linux system you must create a mount point for each exFAT volume. For example, you might call these **myvolume1**, **myvolume2**, and **myvolume3**.

Some sample commands are shown below. Here **my_hcc_exfat** is the name of the executable.

To format an SD card with exFAT, use this command:

```
# ./my_hcc_exfat -o allow_other -s --format -i /dev/mmcblk1 /myvolume1
```

To mount an SD card with exFAT, use this command:

```
# ./my_hcc_exfat -o allow_other -s -i /dev/mmcblk1 /myvolume1
```

To mount an SD card with exFAT with debug prints, use this command:

```
# ./my_hcc_exfat -o allow_other -s -d -i /dev/mmcblk1 /myvolume2
```

To run the test suite without mounting the card, use this command:

```
# ./my_hcc_exfat -o allow_other -s --test -i /dev/mmcblk1 /myvolume3
```

After mounting exFAT, you can access files on the volume, for example using **/myvolume1**. Access the exFAT files in exactly the same way as the files on any other Linux volume.

The commands detailed in [Using Standard Commands](#) are examples of command usage.

4.3 Testing exFAT

A test suite is provided to test exFAT.

To run HCC's test suite for exFAT, do the following:

1. Run the command **make** in the directory **hcc/util/tests** to compile the test suite.
2. Mount the exFAT media in the **/myvolume** directory.
3. Start the test by using the following command:

```
~/hcc/util/tests# ./test_hcc_exfat -dir /myvolume
```

4.4 Using Standard Commands

This section gives examples using standard Linux commands with exFAT files.

Formatting a drive

Note that all data on the **/dev/mmcblk1** will be lost. The drive will not be mounted to **/myvolume1**. To format a drive, use this command:

```
root@linux:~# ./my_hcc_exfat
-o allow_other -s --format -i /dev/mmcblk1 /myvolume1
Formatting drive...
Drive formatted
```

Mounting a drive

To mount a drive, use this command:

```
root@linux:~# ./my_hcc_exfat -o allow_other -s -i /dev/mmcblk1 /myvolume1
```

Listing mounted drives

To list mounted drives, where the exFAT volume is mounted to **/myvolume1**:

```
root@linux:~# mount
...
my_hcc_exfat on /myvolume1 type fuse.my_hcc_exfat
(rw,nosuid,nodev,relatime,user_id=0,group_id=0,allow_other)
```

Creating a file

To create a file on the media, use this command:

```
root@linux:~# echo Hello world >/myvolume1/hello.txt
```

Listing files

To list files, use this command:

```
root@linux:~# ls -l /myvolume1

total 1

-rw-rw-rw- 1 root root 12 Feb 12 13:14 hello.txt
```

Displaying a new file

To display the newly created file, use this command:

```
root@linux:~# cat /myvolume1/hello.txt
```

```
Hello world
```

```
## Unmount drive
```

```
root@linux:~# umount /myvolume1
```