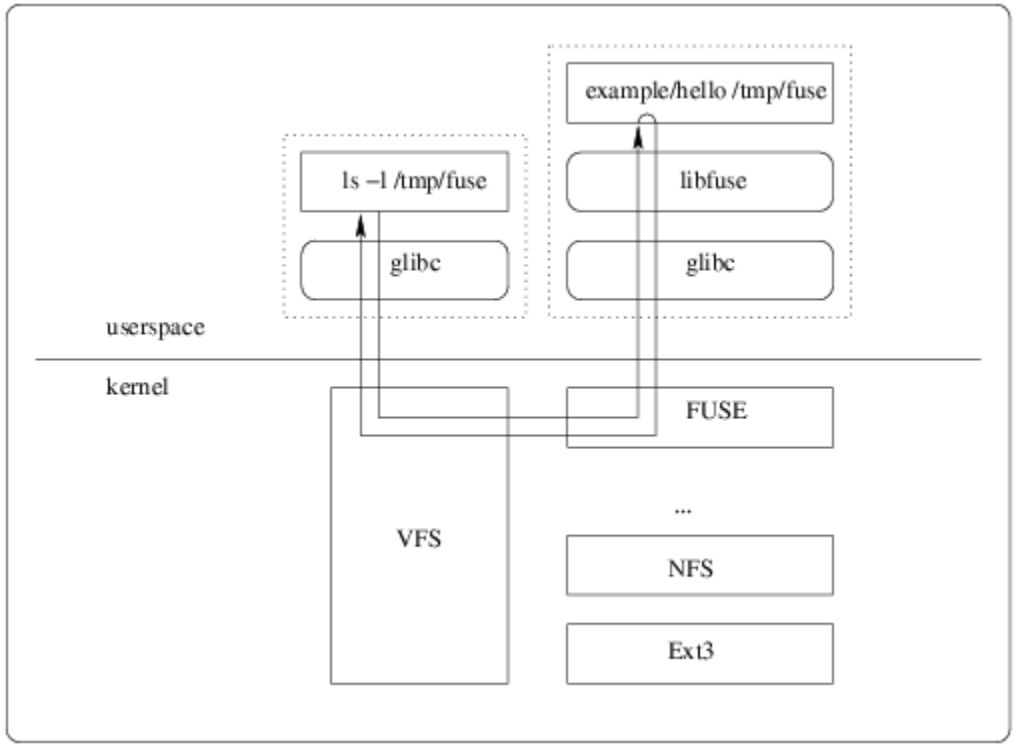
FILESYSTEM IN USERSPACE (FUSE)

BLG413E – System Programming, Practice Session 4

Filesystem in userspace (FUSE)

- Simple installation (no need to patch or recompile the kernel)
- Secure implementation
- Usable by non privileged users (via userspace-kernel interface)



FUSE Development

- **Install:** libfuse-dev
- **To use FUSE library functions:** #include <fuse.h>
- **Main function of FUSE:** fuse_main(argc, argv, op, user_data)

#define fuse_main (argc, argv, op, user_data)

Main function of FUSE.

This is for the lazy. This is all that has to be called from the main() function.

This function does the following:

- parses command line options (-d -s and -h)
- passes relevant mount options to the **fuse_mount()**
- installs signal handlers for INT, HUP, TERM and PIPE
- registers an exit handler to unmount the filesystem on program exit
- creates a fuse handle
- registers the operations
- calls either the single-threaded or the multi-threaded event loop

Note: this is currently implemented as a macro.

Parameters:

argc	the argument counter passed to the main() function
argv	the argument vector passed to the main() function
op	the file system operation
user_data	user data supplied in the context during the init() method

Returns:

0 on success, nonzero on failure

Hello world in FUSE

- See hello.c
- **Compiling:** gcc hello.c -o hello -D_FILE_OFFSET_BITS=64 -lfuse
  - -lfuse: link FUSE
  - -D_FILE_OFFSET_BITS=64: force all file access calls to use the 64 bit variants. Not setting -D_FILE_OFFSET_BITS=64 would result in different sized types in several structures and function calls. Moreover, FUSE requires to set -D_FILE_OFFSET_BITS=64.

Hello world in FUSE

- **Mounting:** ./hello <mount_dir>
  - grep hello /etc/mtab
  - cat <mount_dir>/hello
- **Unmounting:** fusermount –u <mount_dir>
  - grep hello /etc/mtab
- **Running in debug mode:** ./hello -d <mount_dir>

lists all currently mounted file systems along with their initialization options

Read Only File System (ROFS)

- See rofs.c
- **Compiling:** gcc rofs.c -o rofs -Wall -ansi -W -std=c99 -g -ggdb -D_GNU_SOURCE -D_FILE_OFFSET_BITS=64 -lfuse
  - -Wall: enable all basic compiler's warning messages
  - -ansi: enforce ANSI C standards
  - -W: enable some extra warning flags that are not enabled by –Wall
  - -std=c99: use c99 standards
  - -g: produce debugging information in the operating system's native format
  - -ggdb: produce debugging information for use by GDB
  - -D_GNU_SOURCE: use GNU standards

Read Only File System (ROFS)

- **Mounting:** ./rofs test1 test2

  (It is better to use ROFS in debug mode as it gives problems when it is mounted normally)

  → **Mounting in debug mode:** ./rofs –d test1 test2

  - ls -l
  - grep rofs /etc/mtab
- **Unmounting:** fusermount –u test2
  - ls -l
  - grep rofs /etc/mtab

Read Only File System (ROFS)

- Try to create a file/directory under test1 and see what happens under test2
- Try to create a file/directory under test2
- Try to modify a file under test2