VE482 Lab Report

Lab 6 - Fall 2020

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Zathura Plugin

Steps to build Zathura

```bash
#!/bin/bash
# Environment: Focal
# install essential tools
sudo apt install libglib2.0-dev libgtk-3-dev libgirara-dev doxygen check libjson-c-dev gettext clang
# clone the library of zathura locally
# Note: currently, the develop branch cannot be compiled correctly (2020-11-6)
git clone ssh://git@git.pwmt.org:10022/pwmt/zathura.git
cd zathura
git checkout master
# build
# Note: if girara not found, compile and install it by yourself from https://pwmt.org/projects/girara/installation/
cd zathura
mkdir build
meson build
cd build
ninja
ninja install # install Zathura onto the machine
```

Zathura plugin implementation[1] [2] [3]

The mechanism of plugin management of Zathura is a combination of **Discovering** and **Registering**. Zathura plugin-related files will be moved to a path specified by the variable `plugin_path` during the installation. After that, Zathura searches for and loads them when running. During Registering, the following information will be registered:

- name
- version information (major, minor, revision)
- a list of supported content types
- document functions

Zathura core defines a set of functionality that the plugin mush implement in order for the main program to run correctly:

- open
- free
- page init/clear
- page rendering

The skeleton of a simple Zathura plugin is provided as follow:

```
#include <zathura/plugin-api.h>

ZATHURA_PLUGIN_REGISTER_WITH_FUNCTIONS(
  "txt",
  VERSION_MAJOR, VERSION_MINOR, VERSION_REV,
  ZATHURA_PLUGIN_FUNCTIONS({
    .document_open            = txt_document_open,
    .document_free            = txt_document_free,
    .page_init                = txt_page_init,
    .page_clear               = txt_page_clear,
    .page_render_cairo        = txt_page_render_cairo,
  }),
  ZATHURA_PLUGIN_MIMETYPES({
    "text/plain"
  })
)

/**
 * Open a txt document
 *
 * @param document Zathura document
 * @return ZATHURA_ERROR_OK if no error occurred otherwise see
 *   zathura_error_t
 */
GIRARA_HIDDEN zathura_error_t txt_document_open(zathura_document_t* document);

/**
 * Closes and frees the internal document structure
 *
 * @param document Zathura document
 * @return ZATHURA_ERROR_OK if no error occurred otherwise see
 *   zathura_error_t
 */
GIRARA_HIDDEN zathura_error_t txt_document_free(zathura_document_t* document, void* txt_document);

/**
 * Initializes the page with the needed values
 *
 * @param page The page object
 * @return ZATHURA_ERROR_OK when no error occurred, otherwise see
 *    zathura_error_t
 */
GIRARA_HIDDEN zathura_error_t txt_page_init(zathura_page_t* page);

/**
 * Frees a PostScript page
 *
 * @param page Page
 * @return ZATHURA_ERROR_OK if no error occurred otherwise see
 *   zathura_error_t
 */
GIRARA_HIDDEN zathura_error_t txt_page_clear(zathura_page_t* page, void* txt_page);

/**
 * Renders a page onto a cairo object
 *
 * @param page Page
 * @param cairo Cairo object
 * @param printing Set to true if page should be rendered for printing
 * @return ZATHURA_ERROR_OK if no error occurred otherwise see
 *   zathura_error_t
 */
GIRARA_HIDDEN zathura_error_t txt_page_render_cairo(zathura_page_t* page, void* txt_page, cairo_t* cairo, bool printing);

```

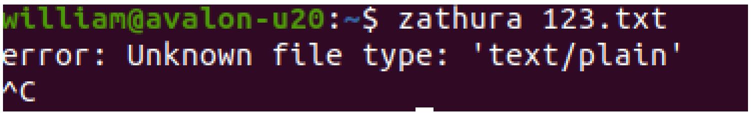
zathura-txt implementation[4] [5] [6]

See `./zathura-txt/*` for details.

step to rebuild Zathura (additional plugin added)

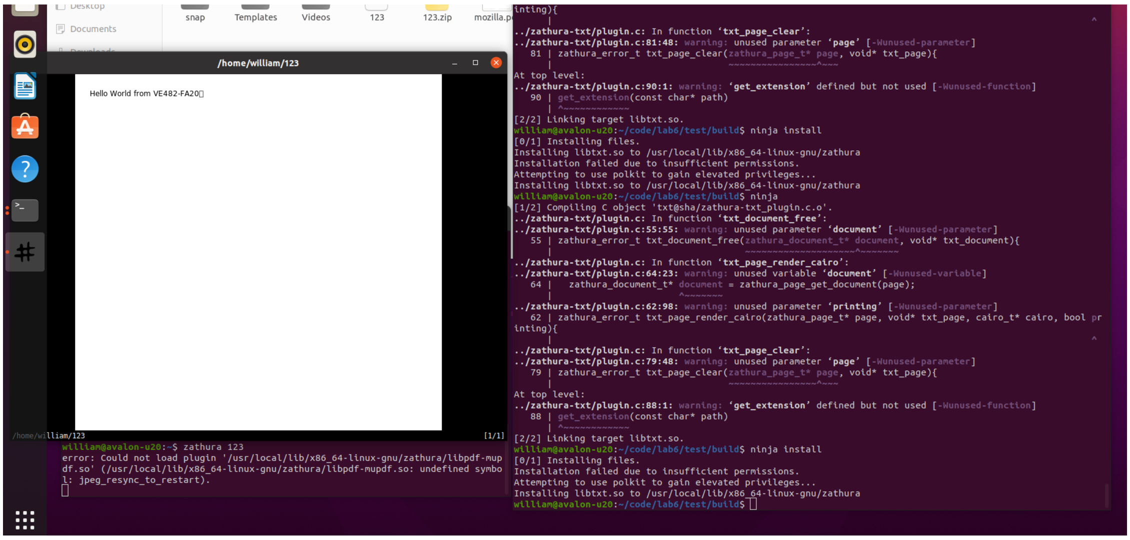
```bash
#!/bin/bash
# make sure the subdirectory build/ exists
meson build
cd build
ninja
ninja install
```

Before the rebuild:



```
william@avalon-u20:~$ zathura 123.txt
error: Unknown file type: 'text/plain'
^C
```

After the rebuild:



/home/william/123

Hello World from VE482-FA20

```
/home/william/123                                                    [1/1]
william@avalon-u20:~$ zathura 123
error: Could not load plugin '/usr/local/lib/x86_64-linux-gnu/zathura/libpdf-mup
df.so' (/usr/local/lib/x86_64-linux-gnu/zathura/libpdf-mupdf.so: undefined symbo
l: jpeg_resync_to_restart).
```

```
inting){
      |                                                                    ^
../zathura-txt/plugin.c: In function 'txt_page_clear':
../zathura-txt/plugin.c:81:48: warning: unused parameter 'page' [-Wunused-parameter]
   81 | zathura_error_t txt_page_clear(zathura_page_t* page, void* txt_page){
      |                                ~~~~~~~~~~~~~~~~^~~~
At top level:
../zathura-txt/plugin.c:90:1: warning: 'get_extension' defined but not used [-Wunused-function]
   90 | get_extension(const char* path)
      | ^~~~~~~~~~~~~
[2/2] Linking target libtxt.so.
william@avalon-u20:~/code/lab6/test/build$ ninja install
[0/1] Installing files.
Installing libtxt.so to /usr/local/lib/x86_64-linux-gnu/zathura
Installation failed due to insufficient permissions.
Attempting to use polkit to gain elevated privileges...
Installing libtxt.so to /usr/local/lib/x86_64-linux-gnu/zathura
william@avalon-u20:~/code/lab6/test/build$ ninja
[1/2] Compiling C object 'txt@sha/zathura-txt_plugin.c.o'.
../zathura-txt/plugin.c: In function 'txt_document_free':
../zathura-txt/plugin.c:55:55: warning: unused parameter 'document' [-Wunused-parameter]
   55 | zathura_error_t txt_document_free(zathura_document_t* document, void* txt_document){
      |                                   ~~~~~~~~~~~~~~~~~~~~^~~~~~~~
../zathura-txt/plugin.c: In function 'txt_page_render_cairo':
../zathura-txt/plugin.c:64:23: warning: unused variable 'document' [-Wunused-variable]
   64 |   zathura_document_t* document = zathura_page_get_document(page);
      |                       ^~~~~~~~
../zathura-txt/plugin.c:62:98: warning: unused parameter 'printing' [-Wunused-parameter]
   62 | zathura_error_t txt_page_render_cairo(zathura_page_t* page, void* txt_page, cairo_t* cairo, bool pr
inting){
      |                                                                    ^
../zathura-txt/plugin.c: In function 'txt_page_clear':
../zathura-txt/plugin.c:79:48: warning: unused parameter 'page' [-Wunused-parameter]
   79 | zathura_error_t txt_page_clear(zathura_page_t* page, void* txt_page){
      |                                ~~~~~~~~~~~~~~~~^~~~
At top level:
../zathura-txt/plugin.c:88:1: warning: 'get_extension' defined but not used [-Wunused-function]
   88 | get_extension(const char* path)
      | ^~~~~~~~~~~~~
[2/2] Linking target libtxt.so.
william@avalon-u20:~/code/lab6/test/build$ ninja install
[0/1] Installing files.
Installation failed due to insufficient permissions.
Attempting to use polkit to gain elevated privileges...
Installing libtxt.so to /usr/local/lib/x86_64-linux-gnu/zathura
william@avalon-u20:~/code/lab6/test/build$ 
```

Plugin Architecture Design

architecture design [7]

See `./cmplx-sort/*` for details.

Skeleton of the plugin:

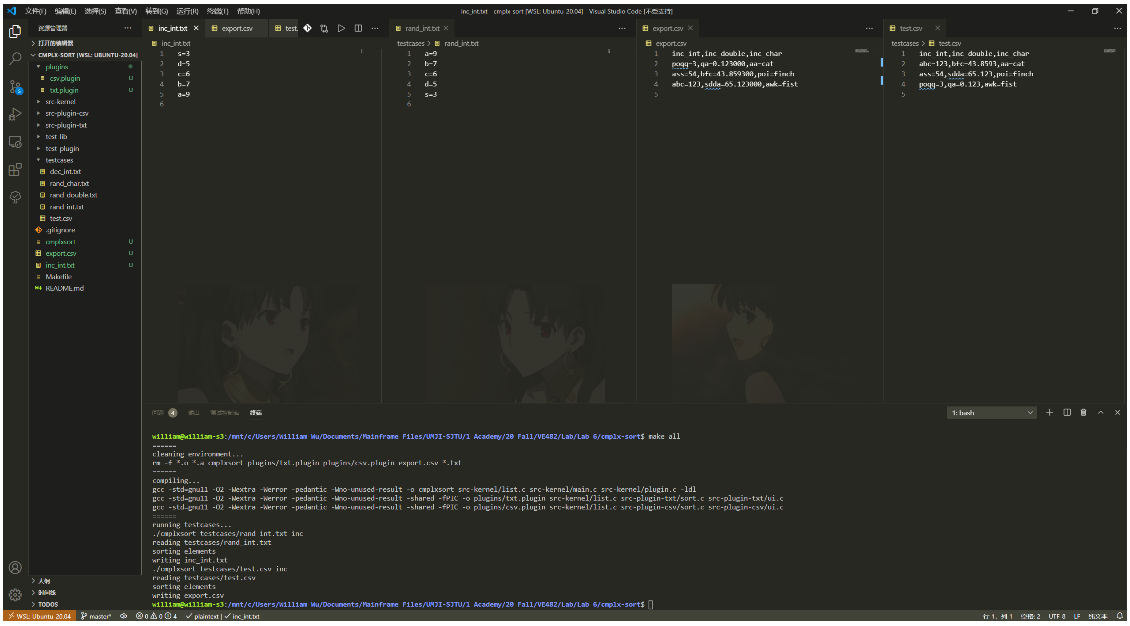
```c
// plugin.h (kernel)
typedef struct _Handle{
  void *handle; // handle for dynamic loading functions
  char type[36]; // name of the file type
  // void (*sort)(Type*, List*); // function pointer for sort
  void (*ui_cmd)(char**); // function pointer for ui_cmd
  // ...
} Handle;

int pluginInit(Handle **handle);
```

```c
// ui.h/c (csv-plugin)
#include "../src-kernel/plugin-api.h"
void ui_cmd(char *argv[]){
  // ...
}
```

plugin-csv implementation [8] [9] [10]

The implementation of the csv file plugin is completed. See `./cmplx-sort/*` for details. A makefile and simple testcases are included.

Test result:



inc_int.txt

```
s=3
d=5
c=6
b=7
a=9
```

testcases > rand_int.txt

```
a=9
b=7
c=6
d=5
s=3
```

export.csv

```
inc_int,inc_double,inc_char
poqq=3,qa=0.123000,aa=cat
ass=54,bfc=43.859300,poi=finch
abc=123,sdda=65.123000,awk=fist
```

testcases > test.csv

```
inc_int,inc_double,inc_char
abc=123,bfc=43.8593,aa=cat
ass=54,sdda=65.123,poi=finch
poqq=3,qa=0.123,awk=fist
```

```
william@william-s3:/mnt/c/Users/William Wu/Documents/Mainframe Files/UMJI-SJTU/1 Academy/20 Fall/VE482/Lab/Lab 6/cmplx-sort$ make all
======
cleaning environment...
rm -f *.o *.a cmplxsort plugins/txt.plugin plugins/csv.plugin export.csv *.txt
======
compiling...
gcc -std=gnu11 -O2 -Wextra -Werror -pedantic -Wno-unused-result -o cmplxsort src-kernel/list.c src-kernel/main.c src-kernel/plugin.c -ldl
gcc -std=gnu11 -O2 -Wextra -Werror -pedantic -Wno-unused-result -shared -fPIC -o plugins/txt.plugin src-kernel/list.c src-plugin-txt/sort.c src-plugin-txt/ui.c
gcc -std=gnu11 -O2 -Wextra -Werror -pedantic -Wno-unused-result -shared -fPIC -o plugins/csv.plugin src-kernel/list.c src-plugin-csv/sort.c src-plugin-csv/ui.c
======
running testcases...
./cmplxsort testcases/rand_int.txt inc
reading testcases/rand_int.txt
sorting elements
writing inc_int.txt
./cmplxsort testcases/test.csv inc
reading testcases/test.csv
sorting elements
writing export.csv
william@william-s3:/mnt/c/Users/William Wu/Documents/Mainframe Files/UMJI-SJTU/1 Academy/20 Fall/VE482/Lab/Lab 6/cmplx-sort$
```

1. Zathura Source Code, *GitLab* , 2020. https://git.pwmt.org/pwmt/zathura (accessed Nov. 06, 2020). ↩

2. Zathura Overview, *Pwmt.org* , 2020. https://pwmt.org/projects/zathura/ (accessed Nov. 06, 2020). ↩

3. Zathura Plugin Documentation, *Pwmt.org* , 2020. https://pwmt.org/projects/zathura/plugins/development/ (accessed Nov. 06, 2020). ↩

4. Zathura-cb Source Code, *GitLab* , 2020. https://git.pwmt.org/pwmt/zathura-cb (accessed Nov. 06, 2020). ↩

5. Zathura-cb Documentation, *Pwmt.org* , 2020. https://pwmt.org/projects/zathura-cb/ (accessed Nov. 06, 2020). ↩

6. J. Bodnar, "Text in Cairo," *Zetcode.com* , 2020. http://zetcode.com/gfx/cairo/cairotext/ (accessed Nov. 08, 2020). ↩

7. Sven Gregori, "It' s All In The Libs – Building A Plugin System Using Dynamic Loading," *Hackaday* , Jul. 12, 2018. https://hackaday.com/2018/07/12/its-all-in-the-libs-building-a-plugin-system-using-dynamic-loading/ (accessed Nov. 07, 2020). ↩

8. samoz, "How can I get the list of files in a directory using C or C++?," *Stack Overflow* , Mar. 04, 2009. https://stackoverflow.com/questions/612097/how-can-i-get-the-list-of-files-in-a-directory-using-c-or-c (accessed Nov. 07, 2020). ↩

9. T. ivory, "ISO C Void * and Function Pointers," *Stack Overflow* , Jan. 03, 2013. https://stackoverflow.com/questions/14134245/iso-c-void-and-function-pointers (accessed Nov. 07, 2020). ↩

10. "strsep(3) - Linux manual page," *Man7.org* , 2019. https://man7.org/linux/man-pages/man3/strsep.3.html (accessed Nov. 07, 2020). ↩