

SWE3004 Operating Systems, Fall 2024

# **Project 0. Introduction of xv6**

TA)

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# Project plan

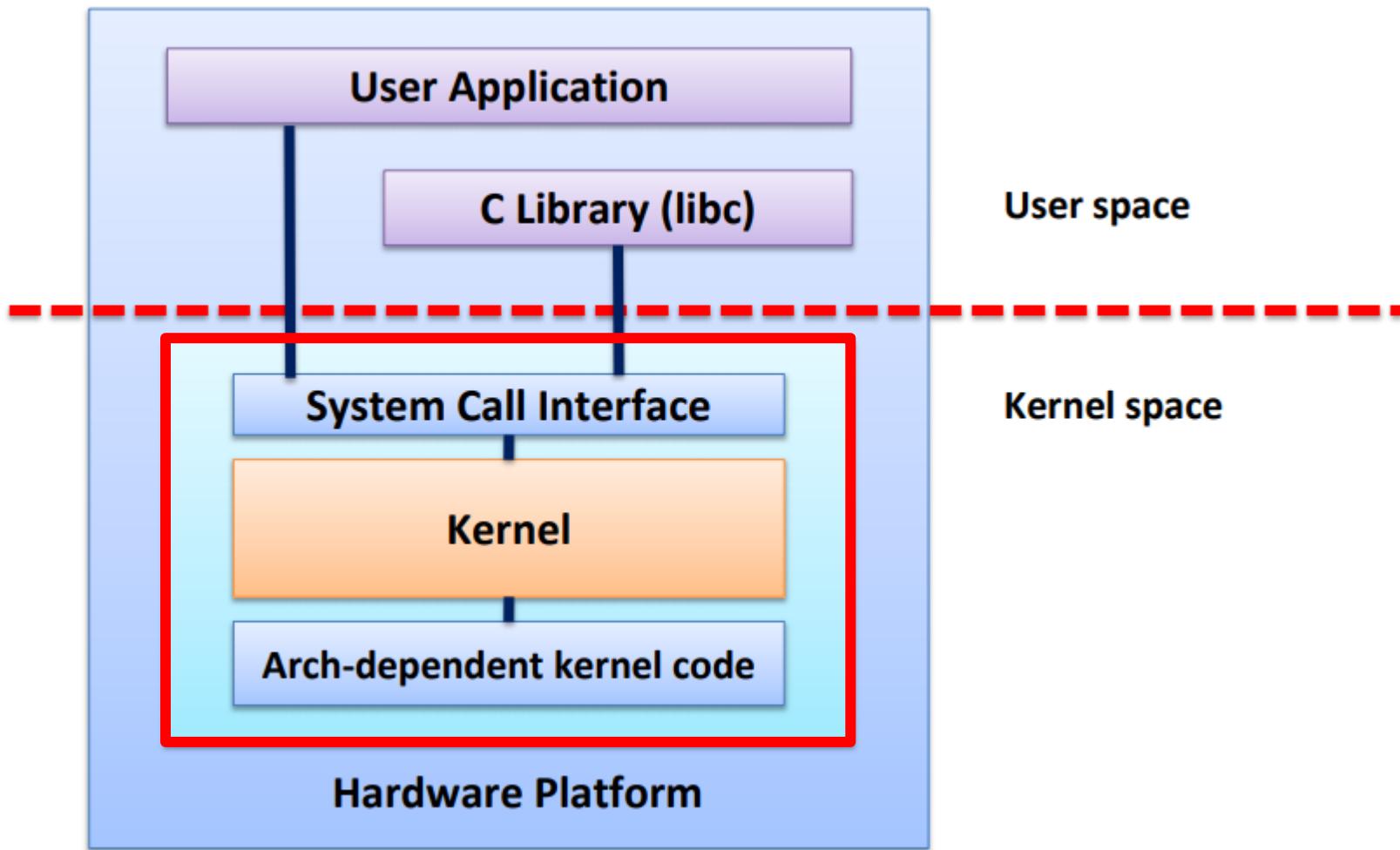
## ▪ Schedule and points

	Assignment	Schedule	Point
0	Booting xv6 operating system	9/9 ~ 9/18	10
1	System call	9/19 ~ 10/2	15
2	CPU scheduling	10/3 ~ 10/16	25
3	Virtual memory	10/31 ~ 11/13	25
4	Page replacement	11/14 ~ 11/27	25
5	File systems	11/28 ~ 12/11	0 (optional)

# Project plan

- Total 6 projects
  - 0) Booting xv6 operating system
  - 1) System call
  - 2) CPU scheduling
  - 3) Virtual memory
  - 4) Page replacement
  - 5) File systems

# Operating System



# xv6 Operating System

- Unix-like teaching operating system developed by MIT
- Based on multiprocessor x86 system

```
cpu1: starting 1
cpu0: starting 0
sb: size 1000 nblocks 941 ninodes 200 nlog 30 logstart 2 inodestart 32 bmap start 58
init: starting sh
$ ls
.
..
README      2 2 2290
cat         2 3 13332
echo        2 4 12404
forktest    2 5 8120
grep        2 6 15152
init        2 7 12992
kill         2 8 12452
ln          2 9 12352
ls          2 10 14576
mkdir       2 11 12476
rm          2 12 12452
sh          2 13 23092
stressfs   2 14 13132
usertests  2 15 56004
wc          2 16 13980
zombie     2 17 12184
console    3 18 0
$ █
```

xv6 shell status with ls command

# Development Environment

- **Ui Server**
  - Problems caused by development in other environments will be your own risk.
- **Connection method example**
  - If your student id is 2024123456,
  - \$ ssh s24123456@swui.skku.edu –p 1398
  - If you are new to ui server, your password is initially set to pw24123456

# Clone & booting xv6

- \$ git clone <https://github.com/mit-pdos/xv6-public.git>
- Run xv6
  - \$ cd xv6-public
  - \$ make qemu-nox
- Terminate xv6
  - ctrl + ‘a’ → ‘x’

# Project 0. Booting xv6

- Print your student id, name, and any message(optional) on boot message

```
cpu1: starting 1
cpu0: starting 0
sb: size 1000 nblocks 941 ninodes 200 nlog 30 logstart 2 inodestart 32 bmap start 58
init: starting sh
Student ID: 201xxxxxxxx
Name: Gildong Hong
=====Any Message=====
$
```

- Hint : Use grep or other analysis tool

# Submission

- Use the *submit* & *check-submission* file in Ui Server
  - \$ make clean
  - \$ ~swe3004/bin/submit pa0 xv6-public

```
2020712258@swji:/home/2020712258$ ~swe3004/bin/submit pa0 xv6-public
user name          :2020712258
Submitted Files for pa0:
File Name           File Size      Time
-----
pa0-2020712258-Mar.04.10.15.283459208    18214964      Thu Mar  4 10:15:44 2021
```

- you can submit several times, and the submission history can be checked through check-submission
  - Only the last submission will be graded

```
2020712258@swji:/home/2020712258$ ~swe3004/bin/check-submission pa0
Submitted Files for pa0:
File Name           File Size      Time
-----
pa0-2020712258-Mar.04.10.16.838017360    18214964      Thu Mar  4 10:16:08 2021
pa0-2020712258-Mar.04.10.15.283459208    18214964      Thu Mar  4 10:15:44 2021

Your last submission
[#]           File Name           File Size
```

# Submission

- Cautions
  - Please check that the submission was successful

Submitted Files for pa0:		File Size	Time
File Name			
pa0-swe3004-Sep.06.19.58.759206525	①	18341208	Tue Sep 6 19:58:14 2022
pa0-swe3004-Mar.07.21.14.438787364	②	126	Tue Mar 7 21:14:18 2023
pa0-swe3004-Mar.07.21.13.764123202	③	45	Tue Mar 7 21:13:10 2023

- ① Submitted successful xv6
- ② Submitted an empty file
- ③ Submit from the incorrect directory

# Submission

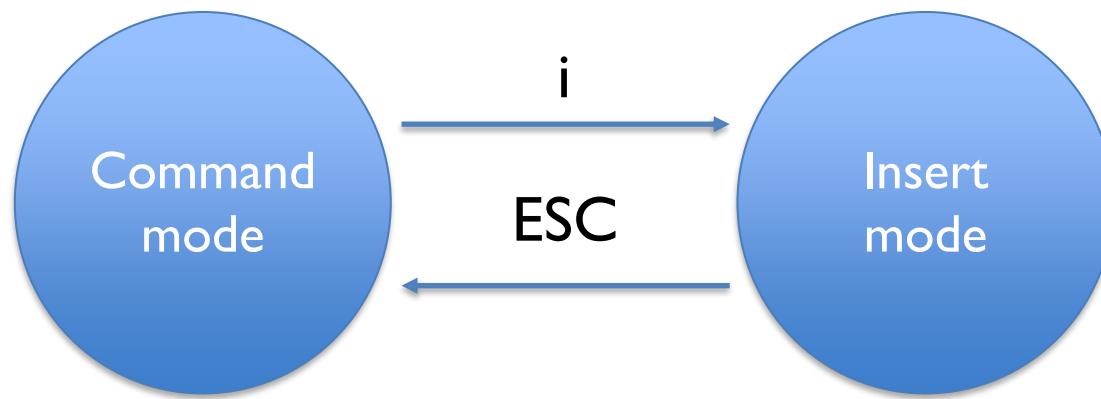
- PLEASE DO NOT COPY
  - We will run inspection program on all the submissions
  - Any unannounced penalty can be given to **both students**
    - 0 points / negative points / F grade ...
- Due date: 9/18(Wed.), 23:59:59 PM
  - -25% per day for delayed submission

# Questions

- If you have questions, please ask on icampus
  - Please use the discussion board
  - Discussion board preferred over messages
- You can also visit Corporate Collaboration Center #85533
  - Please iCampus message TA before visiting
- Reading xv6 commentary will help you a lot
  - <http://csl.skku.edu/uploads/SSE3044S20/book-revI.pdf>

# Appendix. Vim

- Vi Improved
- Text Editor program for Unix
- `sudo apt-get install vim`



# Useful Vim command

- In command mode

Command	Operation
:w	save changes to a file
:q	quit Vim
:wq	save changes and quit Vim
/[string]	search the string from forward
?[string]	search the string from backward
:sp	Divide the window (horizontal)
:vs	Divide the window (vertical)
ctrl + w -> w	move window-to-window

Command	Operation
dd	delete the line
yy	copy the line
p	paste

# Vim Setting

- Vim Preference Setting
  - vimrc : settings file used by Vim

Command	Operation
set nu	display line number
set nonu	hide line number
set mouse=a	enable auto visual mode using mouse
set mouse-=a	disable auto visual mode using mouse
set autoindent	set automatic indentation
set ts=[#]	adjust tap size
set et	expand tap

~/.vimrc

```
set et ts=4  
set nu  
set mouse=a  
set autoindent
```

# Source code analysis tool

- Ctags, cscope are useful when analyzes source code
  - Also vim editor supports ctags and cscope
- Ctags
  - it recognizes symbols in source code and connects file to each other
  - Allow definitions to be quickly and easily located by a text editor
- Cscope
  - Search for a string or function that calls a function

# Ctags

- Vim setting for ctags
  - \$ sudo apt-get install ctags
  - \$ ctags -R (use in top-level kernel source directory)
  - \$ vi ~/.vimrc
  - Add “set tags=[Location of tag file]/tags”
    - Ex)

```
set tags=/home/seungwoo/xv6-sse-local/tags
```



check your  
path!

# Ctags

- Ctags usage (in Vim)

- Ctrl + ] : follow tag

```
for(i=1; i<argc; i++)  
    kill(atoi(argv[i]));  
exit();
```

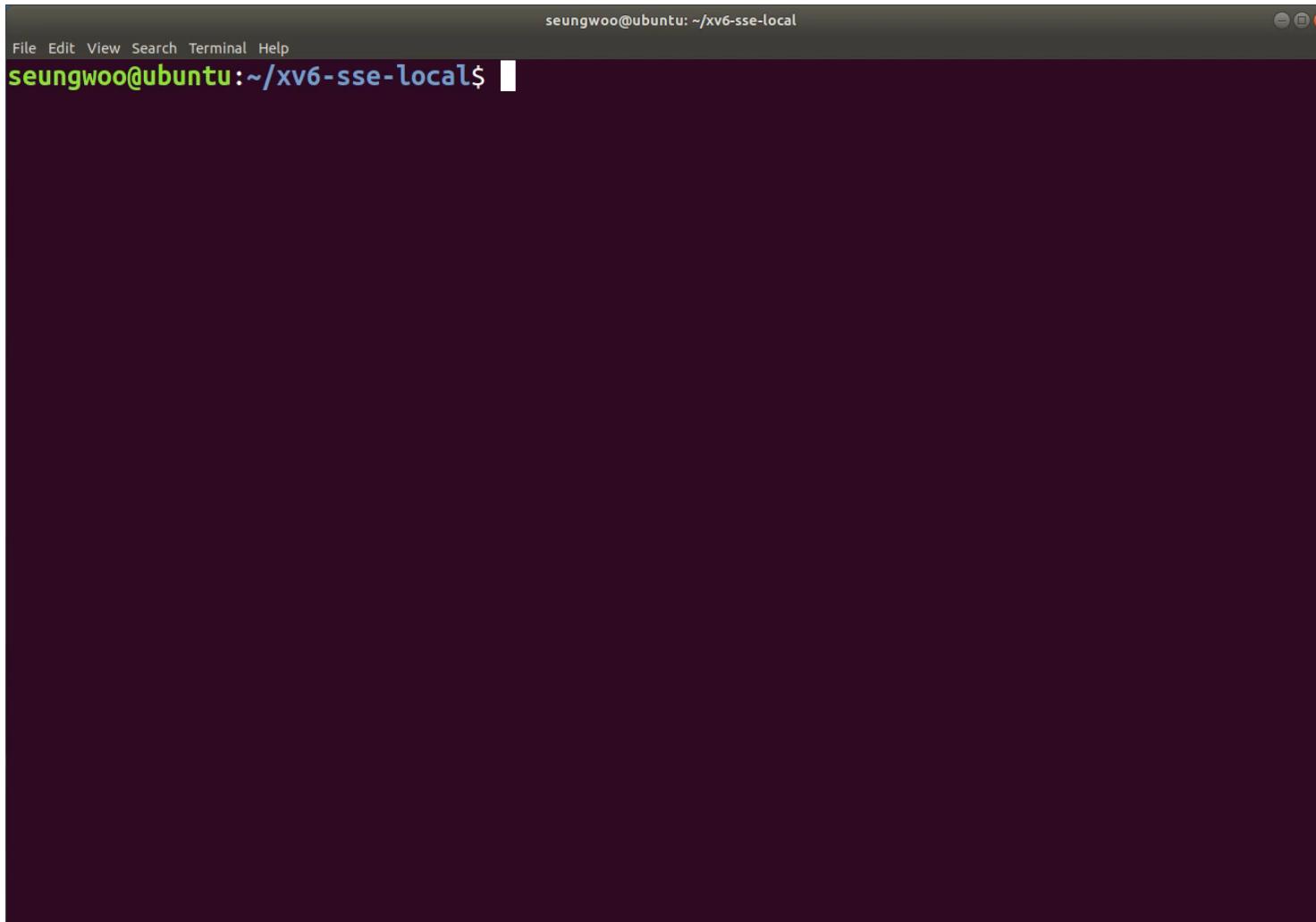
```
int  
kill(int pid)  
{  
    struct proc *p;  
  
    acquire(&ptable.lock);
```

- Ctrl + T : back to last tag

```
int  
kill(int pid)  
{  
    struct proc *p;  
  
    acquire(&ptable.lock);
```

```
for(i=1; i<argc; i++)  
    kill(atoi(argv[i]));  
exit();
```

# Ctags

A screenshot of a terminal window titled "seungwoo@ubuntu: ~/xv6-sse-local". The window has a dark background and a light gray header bar. The title bar shows the user name "seungwoo", the host name "ubuntu", and the current directory "~/xv6-sse-local". Below the title bar is a menu bar with options: File, Edit, View, Search, Terminal, and Help. The main area of the terminal is a dark gray color, and it contains a single line of text: "seungwoo@ubuntu:~/xv6-sse-local\$". A small white square cursor is located at the end of the command line.

# Cscope

- Vim setting for cscope
  - \$ sudo apt-get install cscope
  - \$ cscope -R (use in top-level kernel source directory)
  - Ctrl + D
  - vi ~/.vimrc
  - Add

```
set cst
cs add /home/seungwoo/xv6-sse-local/cscope.out /home/seungwoo/xv6-sse-local/
```



Check your path!

# Cscope

- Cscope usage (in Vim)

- :cs find [type] [search]

type	Operation
0 or s	Find this C symbol
1 or g	Find this definition
2 or d	Find functions called by this function
3 or c	Find functions calling this function
4 or t	Find assignments to

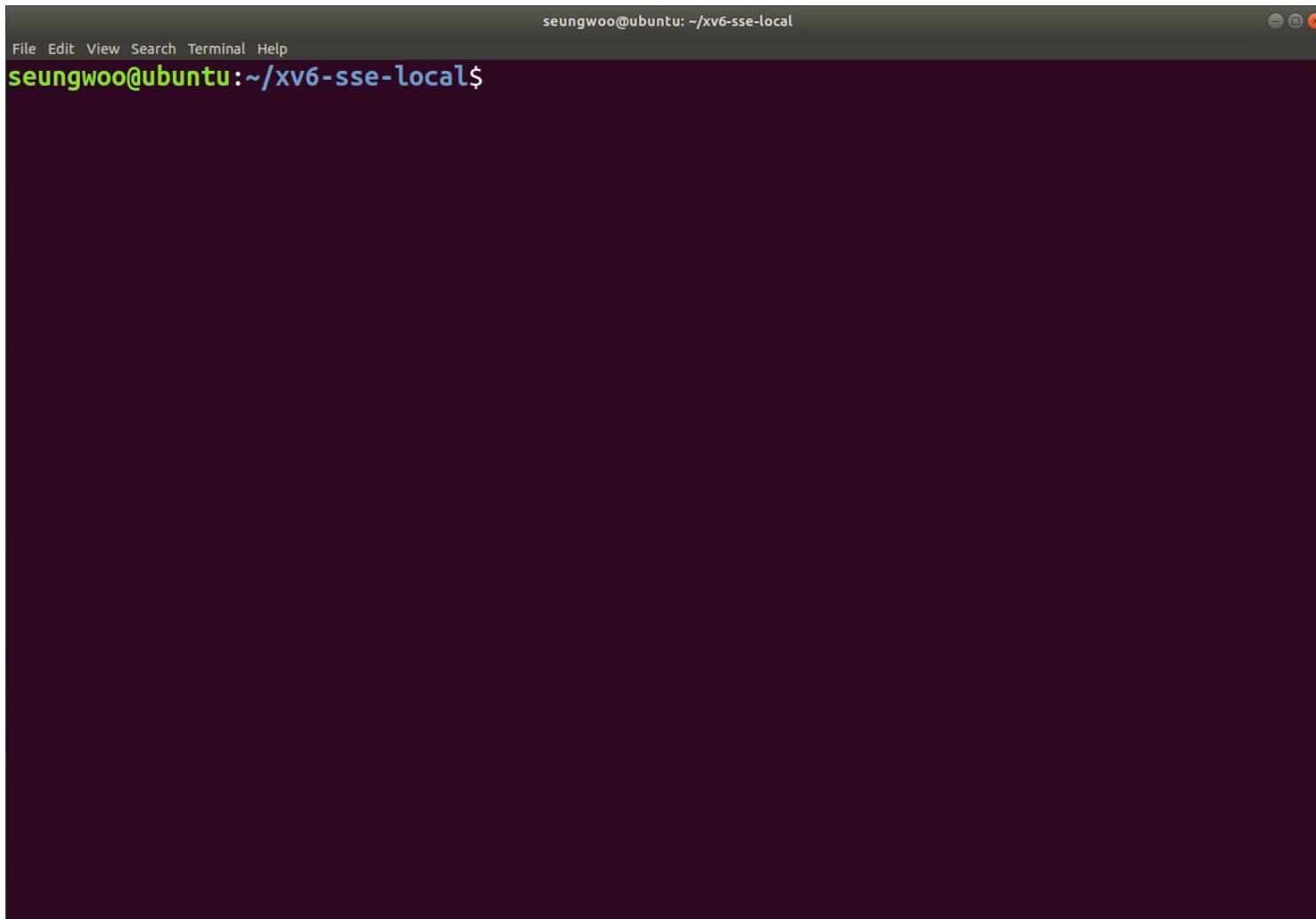
- ex) :cs find c [search function]

```
:cs find c fetchint
```



```
Cscope tag: fetchint
#  line  filename / context / line
1  155  defs.h <>panic>>
      int fetchint(uint, int *);
2  155  defs.h <>scheduler>>
      int fetchint(uint, int *);
```

# Cscope



A screenshot of a terminal window titled "seungwoo@ubuntu: ~/xv6-sse-local". The window has a dark background and a light-colored title bar. The title bar also shows the command "seungwoo@ubuntu:~/xv6-sse-local\$". Below the title bar is a menu bar with options: File, Edit, View, Search, Terminal, Help. The main area of the terminal is completely black, indicating that no output or input has been displayed.

# Any other useful shell command

- Grep usage
  - grep -nR “[string to search]”
    - Find the file where the string exists and also show line number
    - Easier to use than cscope

- Ex)

```
grep -nR fetchint
```



```
syscall.c:18:fetchint(uint addr, int *ip)
syscall.c:52:    return fetchint((myproc()->tf->
kernel.sym:161:801047e0 fetchint
dist/defs.h:154:int          fetchint(uint,
dist/syscall.c:18:fetchint(uint addr, int *ip)
```

- Silversearcher-ag usage

- \$ ag [string to search]