

操作系统实验一报告

一、 Linux 的基本指令和 vi 基本编辑

Linux 基本指令有 pwd(查看当前路径)、ls(列举当前目录下的所有文件和目录)、cp(复制文件)、rm(删除文件)、grep(搜索文本等)

```
cjx@ubuntu: ~/Desktop/SysHw1
cjx@ubuntu:~/Desktop/SysHw1$ pwd
/home/cjx/Desktop/SysHw1
cjx@ubuntu:~/Desktop/SysHw1$ ls
Hello Hello.c
cjx@ubuntu:~/Desktop/SysHw1$ cp Hello.c Hello2.c
cjx@ubuntu:~/Desktop/SysHw1$ ls
Hello Hello2.c Hello.c
cjx@ubuntu:~/Desktop/SysHw1$
```

```
cjx@ubuntu: ~/Desktop/SysHw1
cjx@ubuntu:~/Desktop/SysHw1$ pwd
/home/cjx/Desktop/SysHw1
cjx@ubuntu:~/Desktop/SysHw1$ ls
Hello Hello.c
cjx@ubuntu:~/Desktop/SysHw1$ cp Hello.c Hello2.c
cjx@ubuntu:~/Desktop/SysHw1$ ls
Hello Hello2.c Hello.c
cjx@ubuntu:~/Desktop/SysHw1$ grep "include" *.c
Hello2.c:#include<stdio.h>
Hello.c:#include<stdio.h>
cjx@ubuntu:~/Desktop/SysHw1$ rm Hello2.c
cjx@ubuntu:~/Desktop/SysHw1$ ls
Hello Hello.c
cjx@ubuntu:~/Desktop/SysHw1$
```

二、 查看 Linux 进程

利用 who、w、ps 和 top 等指令查看 Linux 下的进程执行情况

```
cjx@ubuntu: ~
cjx@ubuntu:~$ who
cjx      pts/1        2016-09-25 00:47 (:0.0)
cjx@ubuntu:~$ w
 00:47:18 up  1:35,  1 user,  load average: 0.02, 0.11, 0.13
USER      TTY      FROM          LOGIN@      IDLE   JCPU   PCPU WHAT
cjx      pts/1        :0.0          00:47       3.00s  0.16s  0.00s w
cjx@ubuntu:~$ ps
  PID TTY          TIME CMD
 3947 pts/1        00:00:00 bash
 4004 pts/1        00:00:00 ps
cjx@ubuntu:~$ top
```

```
cjx@ubuntu: ~/Desktop/SysHw1
cjx@ubuntu:~/Desktop/SysHw1$ ps --help
***** simple selection *****
-A all processes
-N negate selection
-a all w/ tty except session leaders
-d all except session leaders
-e all processes
T all processes on this terminal
a all w/ tty, including other users
g OBSOLETE -- DO NOT USE
r only running processes
x processes w/o controlling ttys
***** output format *****
-o,o user-defined
-j,j job control
-O,O preloaded
-l,l long
-F extra full
***** misc options *****
-V,V show version
-m,m,-L,-T,H threads
-M,Z security data
-w,w wide output
***** selection by list *****
-C by command name
-G by real group ID (supports names)
-U by real user ID (supports names)
-g by session OR by effective group name
-p by process ID
-s processes in the sessions given
-t by tty
-u by effective user ID (supports names)
U processes for specified users
t by tty
***** long options *****
--Group --User --pid --cols --ppid
--group --user --sid --rows --info
--cumulative --format --deselect
--sort --tty --forest --version
--heading --no-heading --context
f ASCII art forest
-y change -l format
-c scheduling class
-H process hierarchy
```

```

cjsx@ubuntu: ~/Desktop/SysHw1
a all w/ tty, including other users -t by tty
g OBSOLETE -- DO NOT USE -u by effective user ID (supports names)
r only running processes U processes for specified users
x processes w/o controlling ttys t by tty
***** output format ***** ***** long options *****
-o,o user-defined -f full --Group --User --pid --cols --ppid
-j,j job control s signal --group --user --sid --rows --info
-O,O preloaded -o v virtual memory --cumulative --format --deselect
-l,l long u user-oriented --sort --tty --forest --version
-F extra full X registers --heading --no-heading --context
***** misc options *****
-V,V show version L list format codes f ASCII art forest
-m,m,-L,-T,H threads S children in sum -y change -l format
-M,Z security data c true command name -c scheduling class
-w,w wide output n numeric WCHAN,UID -H process hierarchy
cjsx@ubuntu:~/Desktop/SysHw1$ ps
  PID TTY          TIME CMD
  3747 pts/1    00:00:00 bash
  3838 pts/1    00:00:00 ps
cjsx@ubuntu:~/Desktop/SysHw1$ ps -l
 F S  UID      PID   PPID  C PRI  NI ADDR SZ WCHAN  TTY          TIME CMD
 0 S   1000    3747    3736  0  80   0 -  6800 wait  pts/1    00:00:00 bash
 0 R   1000    3839    3747  0  80   0 -  3480 -      pts/1    00:00:00 ps
cjsx@ubuntu:~/Desktop/SysHw1$

```

```

cjsx@ubuntu: ~/Desktop/SysHw1
cjsx@ubuntu:~/Desktop/SysHw1$ ps aux
USER      PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
root         1  0.0  0.2 24420  2128 ?        Ss   Sep24    0:01 /sbin/init
root         2  0.0  0.0      0      0 ?        S    Sep24    0:00 [kthreadd]
root         3  0.0  0.0      0      0 ?        S    Sep24    0:00 [ksoftirqd/0]
root         4  0.0  0.0      0      0 ?        S    Sep24    0:02 [kworker/0:0]
root         5  0.0  0.0      0      0 ?        S    Sep24    0:01 [kworker/u:0]
root         6  0.0  0.0      0      0 ?        S    Sep24    0:00 [migration/0]
root         7  0.0  0.0      0      0 ?        S    Sep24    0:00 [watchdog/0]
root         8  0.0  0.0      0      0 ?        S<   Sep24    0:00 [cpuset]
root         9  0.0  0.0      0      0 ?        S<   Sep24    0:00 [khelper]
root        10  0.0  0.0      0      0 ?        S    Sep24    0:00 [kdevtmpfs]
root        11  0.0  0.0      0      0 ?        S<   Sep24    0:00 [netns]
root        12  0.0  0.0      0      0 ?        S    Sep24    0:00 [sync_supers]
root        13  0.0  0.0      0      0 ?        S    Sep24    0:00 [bdi-default]
root        14  0.0  0.0      0      0 ?        S<   Sep24    0:00 [kintegrityd]
root        15  0.0  0.0      0      0 ?        S<   Sep24    0:00 [kblockd]
root        16  0.0  0.0      0      0 ?        S<   Sep24    0:00 [ata_sff]
root        17  0.0  0.0      0      0 ?        S    Sep24    0:00 [khubd]
root        18  0.0  0.0      0      0 ?        S<   Sep24    0:00 [md]
root        21  0.0  0.0      0      0 ?        S    Sep24    0:00 [khungtaskd]
root        22  0.0  0.0      0      0 ?        S    Sep24    0:00 [kswapd0]
root        23  0.0  0.0      0      0 ?        S<   Sep24    0:00 [vmstat]
root        24  0.0  0.0      0      0 ?        SN   Sep24    0:00 [ksmd]

```



```
cjx@ubuntu: ~/Desktop/SysHw1
cjx      3746  0.0  0.0  14780   828 ?        S    00:08   0:00  gnome-pty-help
cjx      3747  0.0  0.4  27200  4312 pts/1    Ss   00:08   0:00  bash
cjx      3840  0.0  0.1  22352  1276 pts/1    R+   00:26   0:00  ps aux
cjx@ubuntu:~/Desktop/SysHw1$ ps -la
F S      UID      PID      PPID      C  PRI  NI ADDR SZ WCHAN  TTY          TIME CMD
4 S      0         1         0  0  80   0  -   6105 poll_s ?          00:00:01 init
1 S      0         2         0  0  80   0  -         0 kthrea ?          00:00:00 kthreadd
1 S      0         3         2  0  80   0  -         0 run_ks ?          00:00:00 ksoftirqd/0
1 S      0         4         2  0  80   0  -         0 worker ?          00:00:02 kworker/0:0
5 S      0         5         2  0  80   0  -         0 worker ?          00:00:01 kworker/u:0
1 S      0         6         2  0 -40   -  -         0 cpu_st ?          00:00:00 migration/0
5 S      0         7         2  0 -40   -  -         0 watchdog ?        00:00:00 watchdog/0
1 S      0         8         2  0  60 -20   -  -         0 rescue ?          00:00:00 cpuset
1 S      0         9         2  0  60 -20   -  -         0 rescue ?          00:00:00 khelper
5 S      0        10         2  0  80   0  -         0 devtmp ?          00:00:00 kdevtmpfs
1 S      0        11         2  0  60 -20   -  -         0 rescue ?          00:00:00 netns
1 S      0        12         2  0  80   0  -         0 bdi_sy ?          00:00:00 sync_supers
1 S      0        13         2  0  80   0  -         0 bdi_fo ?          00:00:00 bdi-default
1 S      0        14         2  0  60 -20   -  -         0 rescue ?          00:00:00 kintegrityd
1 S      0        15         2  0  60 -20   -  -         0 rescue ?          00:00:00 kblockd
1 S      0        16         2  0  60 -20   -  -         0 rescue ?          00:00:00 ata_sff
1 S      0        17         2  0  80   0  -         0 hub_th ?          00:00:00 khubd
1 S      0        18         2  0  60 -20   -  -         0 rescue ?          00:00:00 md
1 S      0        21         2  0  80   0  -         0 watchdog ?        00:00:00 khungtaskd
```

```
cjx@ubuntu: ~/Desktop/SysHw1
cjx@ubuntu:~/Desktop/SysHw1$ ps ajxf
PPID      PID      PGID      SID  TTY          TPGID  STAT      UID    TIME COMMAND
0         2         0         0 ?          -1 S      0      0:00 [kthreadd]
2         3         0         0 ?          -1 S      0      0:00 \_ [ksoftirqd/0]
2         4         0         0 ?          -1 S      0      0:02 \_ [kworker/0:0]
2         5         0         0 ?          -1 S      0      0:01 \_ [kworker/u:0]
2         6         0         0 ?          -1 S      0      0:00 \_ [migration/0]
2         7         0         0 ?          -1 S      0      0:00 \_ [watchdog/0]
2         8         0         0 ?          -1 S<      0      0:00 \_ [cpuset]
2         9         0         0 ?          -1 S<      0      0:00 \_ [khelper]
2        10         0         0 ?          -1 S      0      0:00 \_ [kdevtmpfs]
2        11         0         0 ?          -1 S<      0      0:00 \_ [netns]
2        12         0         0 ?          -1 S      0      0:00 \_ [sync_supers]
2        13         0         0 ?          -1 S      0      0:00 \_ [bdi-default]
2        14         0         0 ?          -1 S<      0      0:00 \_ [kintegrityd]
2        15         0         0 ?          -1 S<      0      0:00 \_ [kblockd]
2        16         0         0 ?          -1 S<      0      0:00 \_ [ata_sff]
2        17         0         0 ?          -1 S      0      0:00 \_ [khubd]
2        18         0         0 ?          -1 S<      0      0:00 \_ [md]
2        21         0         0 ?          -1 S      0      0:00 \_ [khungtaskd]
2        22         0         0 ?          -1 S      0      0:00 \_ [kswapd0]
2        23         0         0 ?          -1 S<      0      0:00 \_ [vmstat]
2        24         0         0 ?          -1 SN      0      0:00 \_ [ksmd]
2        25         0         0 ?          -1 SN      0      0:00 \_ [khugepaged]
```

```

cjsx@ubuntu: ~/Desktop/SysHw1
1 2670 2455 2455 ? -1 SL 1000 0:00 /usr/lib/unity-len
1 2671 2455 2455 ? -1 SL 1000 0:00 /usr/lib/unity-len
1 2673 2455 2455 ? -1 SL 1000 0:00 /usr/lib/unity-len
1 2674 2455 2455 ? -1 SL 1000 0:00 /usr/bin/python /u
1 2703 2455 2455 ? -1 SL 1000 0:00 /usr/bin/zeitgeist
1 2710 2455 2455 ? -1 SL 1000 0:00 /usr/lib/zeitgeist
2710 2717 2455 2455 ? -1 S 1000 0:00 \_ /bin/cat
1 2711 2455 2455 ? -1 SL 1000 0:00 zeitgeist-datahub
1 2739 2455 2455 ? -1 SL 1000 0:00 /usr/lib/unity-len
1 2741 2455 2455 ? -1 SL 1000 0:00 /usr/bin/python /u
1 2798 2455 2455 ? -1 SL 1000 0:00 /usr/lib/telepathy
1 2803 2455 2455 ? -1 SL 1000 0:00 /usr/lib/gnome-onl
1 2865 2455 2455 ? -1 SL 1000 0:00 /usr/bin/python /u
1 2917 910 910 ? -1 S 0 0:00 /usr/bin/python /u
1 3067 2455 2455 ? -1 S 1000 0:01 /usr/lib/gvfs/gvfs
1 3202 2416 2416 ? -1 SL 1000 0:00 /usr/lib/libreoffi
3202 3224 2416 2416 ? -1 SL 1000 0:19 \_ /usr/lib/libre
1 3314 2455 2455 ? -1 SL 1000 0:00 /usr/lib/x86_64-li
1 3324 2416 2416 ? -1 SL 1000 0:02 /usr/bin/python /u
1 3736 2416 2416 ? -1 SL 1000 0:04 gnome-terminal
3736 3746 2416 2416 ? -1 S 1000 0:00 \_ gnome-pty-help
3736 3747 3747 3747 pts/1 3842 Ss 1000 0:00 \_ bash
3747 3842 3842 3747 pts/1 3842 R+ 1000 0:00 \_ ps ajxf
cjsx@ubuntu:~/Desktop/SysHw1$ clear

```

三、

四、 Linux 进程信息（写出具体含义）

```

cjsx@ubuntu: ~
top - 00:48:06 up 1:35, 1 user, load average: 0.12, 0.13, 0.14
Tasks: 177 total, 1 running, 175 sleeping, 0 stopped, 1 zombie
Cpu(s): 1.3%us, 0.7%sy, 0.0%ni, 98.0%id, 0.0%wa, 0.0%hi, 0.0%si, 0.0%st
Mem: 1005576k total, 880276k used, 125300k free, 20756k buffers
Swap: 1046524k total, 65348k used, 981176k free, 256700k cached

  PID USER      PR  NI  VIRT  RES  SHR  S  %CPU  %MEM    TIME+  COMMAND
 1316 root        20   0   254m 114m 11m   S   0.7  11.6   0:53.21 Xorg
 3224 cjsx        20   0  1188m  98m  34m   S   0.3  10.1   0:25.10 soffice.bin
 3438 root        20   0     0     0     0   S   0.3   0.0   0:03.76 kworker/0:2
 4005 cjsx        20   0  17332 1352  964   R   0.3   0.1   0:00.04 top
    1 root        20   0  24420 2128 1256   S   0.0   0.2   0:01.85 init
    2 root        20   0     0     0     0   S   0.0   0.0   0:00.00 kthreadd
    3 root        20   0     0     0     0   S   0.0   0.0   0:00.46 ksoftirqd/0
    4 root        20   0     0     0     0   S   0.0   0.0   0:02.34 kworker/0:0
    5 root        20   0     0     0     0   S   0.0   0.0   0:01.24 kworker/u:0
    6 root        RT   0     0     0     0   S   0.0   0.0   0:00.00 migration/0
    7 root        RT   0     0     0     0   S   0.0   0.0   0:00.06 watchdog/0
    8 root         0 -20     0     0     0   S   0.0   0.0   0:00.00 cpuset
    9 root         0 -20     0     0     0   S   0.0   0.0   0:00.00 khelper
   10 root        20   0     0     0     0   S   0.0   0.0   0:00.00 kdevtmpfs
   11 root         0 -20     0     0     0   S   0.0   0.0   0:00.00 netns
   12 root        20   0     0     0     0   S   0.0   0.0   0:00.02 sync_supers
   13 root        20   0     0     0     0   S   0.0   0.0   0:00.00 bdi-default

```

F: 标志位 (flags), 具体有哪些值及其含义可以参考 man ps 里面关于 flags 的相关内容

S: 状态, 下面那几个进程的状态为 S 表示是在 sleeping 状态 (即等待状态)

PID: 当前进程号
PPID: 当前进程的父进程号
C: CPU 占用百分率
PRI: 优先级
NI: Nice 值
ADDR: 交换地址

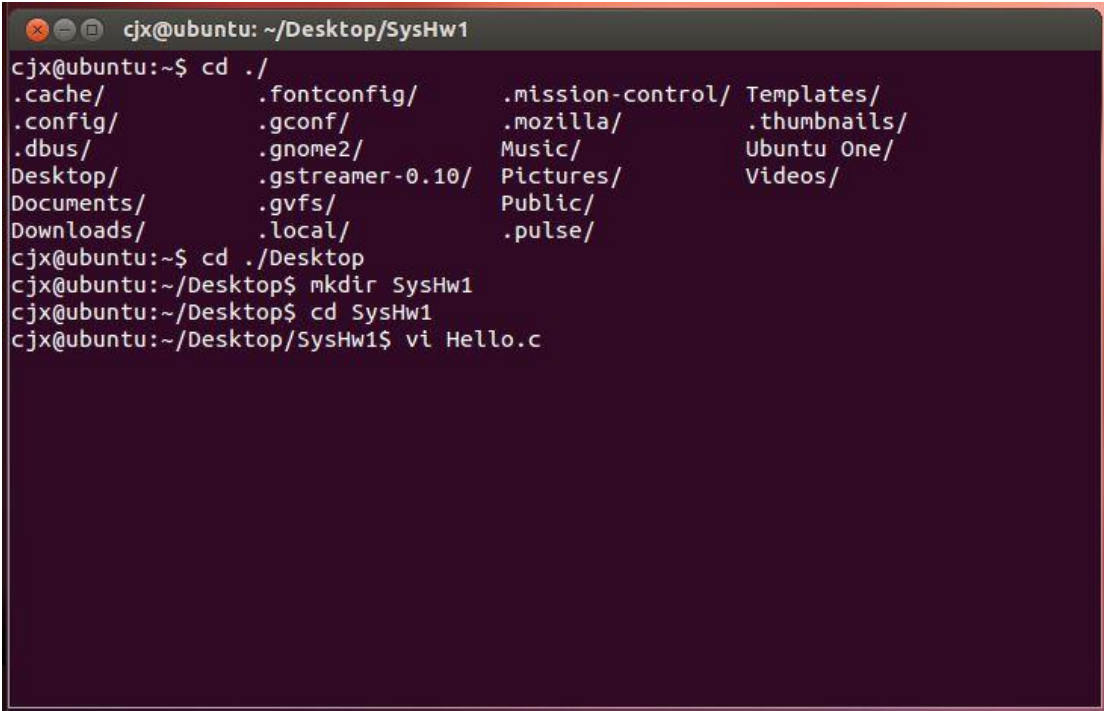
SZ: 虚拟内存大小
WCHAN: 当前进程正在等待的事件（比如等待 semaphore, 等待 IO 等）
STIME: 进程启动时间（什么时候开始运行的）
TIME: 进程占用 cpu 时间
TTY: 进程对应控制终端（可以没有）
CMD: 进程对应的命令行参数

五、Linux 使用体会（与 Window 相比）

初次使用 linux 系统，通过终端敲击一条条指令进行系统操作，相比于 window 的图形界面，确实有些不习惯，用得不是太方便。但是通过一条条指令的操作，我更加清楚地了解到了计算机运行的原理。比如 C 语言程序的编辑和运行，先是 vi 编辑，再 gcc，最后 gdb，程序运行背后的原理就显得具体形象，而不像 window 那样抽象成几个图形按键。通过网上查找资料得知 linux 是编程的最后系统，我似乎有那么一点点理解，记下来我需要继续使用 linux 系统，才能发现更多和应用 linux 系统的“过机之处”。

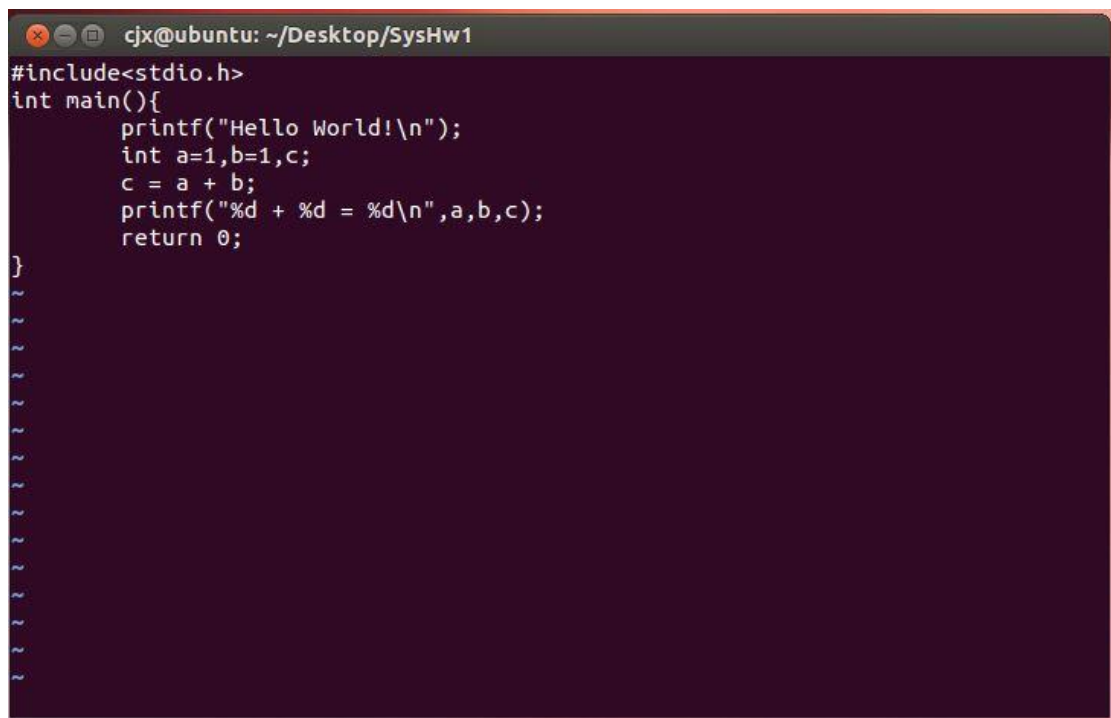
六、vi、gcc 和 gdc 的使用

1. 创建文件



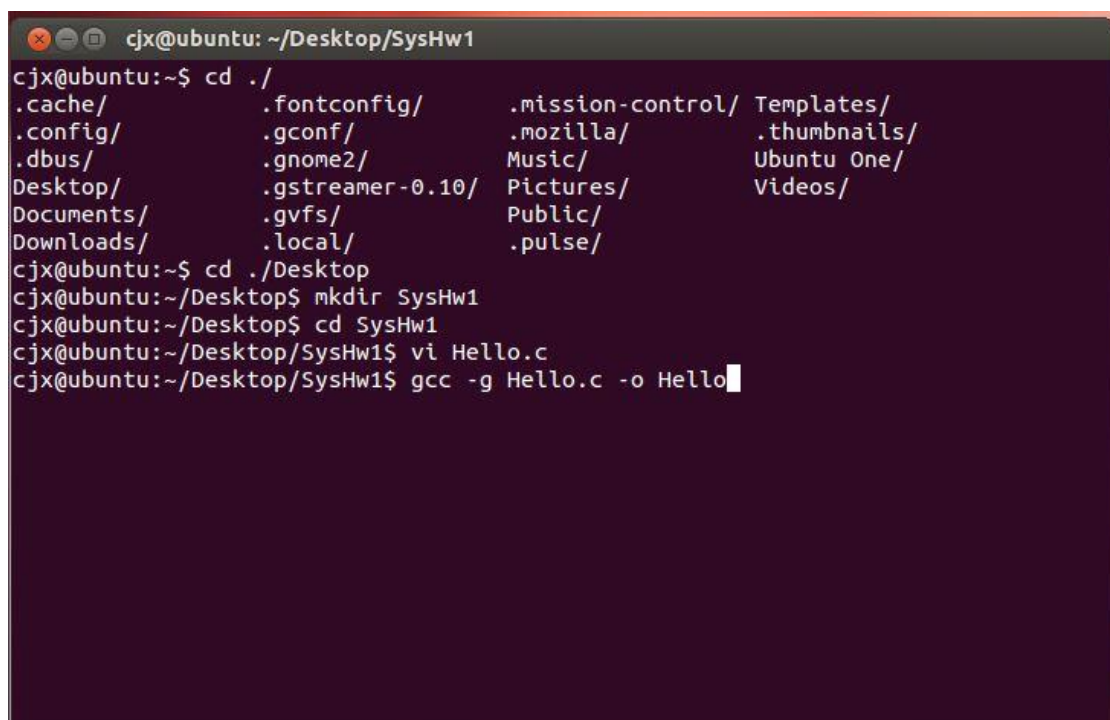
```
cjx@ubuntu: ~/Desktop/SysHw1
cjx@ubuntu:~$ cd ./
.cache/          .fontconfig/    .mission-control/ Templates/
.config/         .gconf/         .mozilla/       .thumbnails/
.dbus/          .gnome2/        Music/          Ubuntu One/
Desktop/        .gstreamer-0.10/ Pictures/        Videos/
Documents/      .gvfs/          Public/
Downloads/     .local/         .pulse/
cjx@ubuntu:~$ cd ./Desktop
cjx@ubuntu:~/Desktop$ mkdir SysHw1
cjx@ubuntu:~/Desktop$ cd SysHw1
cjx@ubuntu:~/Desktop/SysHw1$ vi Hello.c
```

2. Vi 编辑文件



```
cjx@ubuntu: ~/Desktop/SysHw1
#include<stdio.h>
int main(){
    printf("Hello World!\n");
    int a=1,b=1,c;
    c = a + b;
    printf("%d + %d = %d\n",a,b,c);
    return 0;
}
~
~
~
~
~
~
~
~
~
~
```

3. Gcc -g Hello.c -o Hello



```
cjx@ubuntu: ~/Desktop/SysHw1
cjx@ubuntu:~$ cd ./
.cache/          .fontconfig/     .mission-control/ Templates/
.config/          .gconf/          .mozilla/        .thumbnails/
.dbus/           .gnome2/         Music/           Ubuntu One/
Desktop/         .gstreamer-0.10/ Pictures/         Videos/
Documents/       .gvfs/           Public/
Downloads/       .local/          .pulse/
cjx@ubuntu:~$ cd ./Desktop
cjx@ubuntu:~/Desktop$ mkdir SysHw1
cjx@ubuntu:~/Desktop$ cd SysHw1
cjx@ubuntu:~/Desktop/SysHw1$ vi Hello.c
cjx@ubuntu:~/Desktop/SysHw1$ gcc -g Hello.c -o Hello
```

4. Gdb Hello

```
cjx@ubuntu: ~/Desktop/SysHw1
cjx@ubuntu:~$ cd ./
.cache/          .fontconfig/     .mission-control/ Templates/
.config/         .gconf/          .mozilla/        .thumbnails/
.dbus/          .gnome2/         Music/           Ubuntu One/
Desktop/        .gvfs/           Pictures/         Videos/
Documents/      .local/          .pulse/
Downloads/
cjx@ubuntu:~$ cd ./Desktop
cjx@ubuntu:~/Desktop$ mkdir SysHw1
cjx@ubuntu:~/Desktop$ cd SysHw1
cjx@ubuntu:~/Desktop/SysHw1$ vi Hello.c
cjx@ubuntu:~/Desktop/SysHw1$ gcc -g Hello.c -o Hello
cjx@ubuntu:~/Desktop/SysHw1$ gdb Hello
GNU gdb (Ubuntu/Linaro 7.4-2012.02-0ubuntu2) 7.4-2012.02
Copyright (C) 2012 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law. Type "show copying"
and "show warranty" for details.
This GDB was configured as "x86_64-linux-gnu".
For bug reporting instructions, please see:
<http://bugs.launchpad.net/gdb-linaro/>...
Reading symbols from /home/cjx/Desktop/SysHw1/Hello...done.
(gdb) █
```

5. 1 查看载入文件

```
cjx@ubuntu: ~/Desktop/SysHw1
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law. Type "show copying"
and "show warranty" for details.
This GDB was configured as "x86_64-linux-gnu".
For bug reporting instructions, please see:
<http://bugs.launchpad.net/gdb-linaro/>...
Reading symbols from /home/cjx/Desktop/SysHw1/Hello...done.
(gdb) l
1      #include<stdio.h>
2      int main(){
3          printf("Hello World!\n");
4          int a=1,b=1,c;
5          c = a + b;
6          printf("%d + %d = %d\n",a,b,c);
7          return 0;
8      }
9
(gdb) b 3
Breakpoint 1 at 0x40054c: file Hello.c, line 3.
(gdb) info b
Num      Type      Disp Enb Address      What
1        breakpoint keep y   0x000000000040054c in main at Hello.c:3
(gdb) █
```

6. b 3 设置断点


```
cjx@ubuntu: ~/Desktop/SysHw1
(gdb) b 3
Breakpoint 1 at 0x40054c: file Hello.c, line 3.
(gdb) info b
Num      Type           Disp Enb Address            What
1        breakpoint     keep y   0x0000000000040054c in main at Hello.c:3
(gdb) r
Starting program: /home/cjx/Desktop/SysHw1/Hello

Breakpoint 1, main () at Hello.c:3
3          printf("Hello World!\n");
(gdb) n
Hello World!
4          int a=1,b=1,c;
(gdb) p a
$1 = 32767
(gdb) n
5          c = a + b;
(gdb) p a
$2 = 1
(gdb) c
Continuing.
1 + 1 = 2
[Inferior 1 (process 3828) exited normally]
(gdb)
```

7. info b 查看断点信息
8. r 运行至断点
9. p a 查看变量 a 的值
10. n 下一步
11. c 继续运行