

哈尔滨工业大学

实验报告

实验（七）

题 目 TinyShell

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第 1 章 实验基本信息

1.1 实验目的

理解现代计算机系统进程与并发的基本知识
掌握 linux 异常控制流和信号机制的基本原理和相关系统函数
掌握 shell 的基本原理和实现方法
深入理解 Linux 信号响应可能导致的并发冲突及解决方法
培养 Linux 下的软件系统开发与测试能力

1.2 实验环境与工具

1.2.1 硬件环境

X64 CPU; 2GHz; 2G RAM; 256GHD Disk 以上

1.2.2 软件环境

Windows7 64 位以上; VirtualBox/Vmware 11 以上; Ubuntu 16.04 LTS 64 位/
优麒麟 64 位

1.2.3 开发工具

Visual Studio 2010 64 位以上; GDB/OBJDUMP; DDD/EDB 等

1.3 实验预习

上实验课前, 必须认真预习实验指导书 (PPT 或 PDF)

了解实验的目的、实验环境与软硬件工具、实验操作步骤, 复习与实验有关的理论知识。

了解进程、作业、信号的基本概念和原理

了解 shell 的基本原理

熟知进程创建、回收的方法和相关系统函数

熟知信号机制和信号处理相关的系统函数

第 2 章 实验预习

总分 20 分

2.1 进程的概念、创建和回收方法（5 分）

进程的经典定义就是一个执行中程序的实例。

每次用户通过向 shell 输入一个可执行目标文件的名字，运行程序时，shell 就会创建一个进程，然后在这个新进程的上下文中运行这个可执行文件。

Exit 函数以 status 退出状态来终止进程（另一种设置退出状态的方法是从主程序中返回一个整数值）

父进程通过调用 fork 函数来创建一个新的运行的子进程。

当一个进程由于某种原因终止时，内核并不是立即把它从系统中清除。进程被保持在一种已终止的状态中，直到它们被父进程回收。当父进程回收已终止的子进程时，内核将子进程的退出状态传递给父进程，然后抛弃已终止的进程，从此时开始，该进程就不存在了。如果父进程已经终止，内核会安排 init 进程回收僵死进程。一个进程可以通过调用 waitpid 函数来等待它的子进程终止或停止。

2.2 信号的机制、种类（5 分）

一个信号就是一条小消息，它通知进程系统中发生了一个某种类型的事件。

软中断信号（signal，又简称为信号）用来通知进程发生了异步事件。在软件层次上是对中断机制的一种模拟，在原理上，一个进程收到一个信号与处理器收到一个中断请求可以说是一样的。信号是进程间通信机制中唯一的异步通信机制，一个进程不必通过任何操作来等待信号的到达，事实上，进程也不知道信号到底什么时候到达。进程之间可以互相通过系统调用 kill 发送软中断信号。内核也可以因为内部事件而给进程发送信号，通知进程发生了某个事件。信号机制除了基本通知功能外，还可以传递附加信息。

收到信号的进程对各种信号有不同的处理方法。处理方法可以分为三类：

第一种是类似中断的处理程序，对于需要处理的信号，进程可以指定处理函数，由该函数来处理。

第二种方法是，忽略某个信号，对该信号不做任何处理，就象未发生过一样。

第三种方法是，对该信号的处理保留系统的默认值，这种缺省操作，对大部

分的信号的缺省操作是使得进程终止。进程通过系统调用 `signal` 来指定进程对某个信号的处理行为。

信号的种类：可以从两个不同的分类角度对信号进行分类：

可靠性方面：可靠信号与不可靠信号；

与时间的关系上：实时信号与非实时信号

2.3 信号的发送方法、阻塞方法、处理程序的设置方法（5 分）

发送方法：1.用 `/bin/kill` 向程序发送信号

2.从键盘发送信号

3.用 `kill` 函数发送信号

4.用 `alarm` 函数发送信号

阻塞型号：1.隐式阻塞机制。内核默认阻塞任何当前程序正在处理信号类型的待处理的信号。内核默认阻塞与当前正在处理信号类型相同的待处理信号 如，一个 `SIGINT` 信号处理程序不能被另一个 `SIGINT` 信号中断（此时另一个 `SIGINT` 信号被阻塞）

2.显示阻塞机制。应用程序可以使用 `sigprocmask` 函数和它的辅助函数，明确的阻塞和解除阻塞选定的信号。`sigprocmask` 函数及其辅助函数可以明确地阻塞/解除阻塞 选定的信号 辅助函数 `sigemptyset` –初始化 `set` 为空集合 `sigfillset` –把每个信号都添加到 `set` 中 `sigaddset` –把指定的信号 `signum` 添加到 `set` `sigdelset` –从 `set` 中删除指定的信号 `signum`

处理程序的设置方法：

为了保证安全 1.处理程序要尽可能简单 2.在处理程序中只调用异步信号安全函数。3 保存和恢复 `errno` 4.阻塞所有的信号，保护对共享全局数据结构的访问。4.用 `volatile` 声明全局变量 5.用 `sig_atomic_t` 声明标志。

未处理的信号是不排队的，所以不可以用信号对其他进程中发生的事件计数。必须回收所有终止的子进程 将 `wait` 放入一个循环回收所有终止的子进程

2.4 什么是 shell，功能和处理流程（5 分）

Shell 是一个交互型应用级程序，代表用户运行其他程序。

shell 执行一系列的读 / 求值步骤。

读步骤读取用户的命令行，求值步骤解析命令，代表用户运行

第 3 章 TinyShell 的设计与实现

总分 45 分

3.1 设计

3.1.1 void eval(char *cmdline) 函数 (10 分)

函数功能：执行用户输入的命令

参 数：键盘读入

处理流程：如果用户请求了一个内置的命令 (quit, jobs, bg 或者 fg)：立即执行。否则，fork 一个子进程执行。如果是在前台执行的，要等待它终止然后返回。

要点分析：

1. 避免子进程在添加到列表之前被 reap 掉，在运行程序和添加任务的过程中务必要屏蔽 SIGCHLD。由于子进程会集成父进程的特性，所以记得要在子进程中调用 execve 前解除屏蔽；

2. 子进程和父进程在同一个进程组之中，为了避免 Signal 对子进程的运行产生干扰，应该把子进程放入一个新的进程组，所以要在调用 execve 前调用 setpgid(0, 0)；

3. 由于子进程的 reap 依赖于 SIGCHLD，所以 waitfg 的调用要放在解除屏蔽之后。

3.1.2 int builtin_cmd(char **argv) 函数 (5 分)

函数功能：执行内部命令

参 数：执行的键盘的命令名字和所有参数，argv[0]是可执行目标文件的名字

处理流程：条件判断是何种命令 (quit, jobs, bg, fg)，然后立即执行。

要点分析：当输入 quit 时，退出 tsh。输入 jobs 就列出存在的 job。输入 fg/bg 是前台后台执行命令。

3.1.3 void do_bgfg(char **argv) 函数 (5 分)

函数功能：执行 bg 和 fg 命令

参 数：执行的键盘的命令名字和所有参数，argv[0]是可执行目标文件的名字

处理流程：这个函数进行前后台切换，需要做的就是修改一下任务的状态，发送 SIGCONT 给进程。如果进程切换成后台运行，就输出进程对应的 jid、pid、cmdline。如果进程切换成前台运行，就调用 waitfg。

要点分析：其中主要是 JID 和 PID 的判断。bg job 给后台 job 发送 SIGCONT 信号来继续执行该任务，fg job 给前台 job 发送 SIGCONT 信号来继续执行该任务。首先要判断进程是否继续执行。关于前后台的执行，主要做的就是修改 job 的

state 状态。

3. 1.4 void waitfg(pid_t pid) 函数 (5 分)

函数功能: block 进程直到它不再是前台进程

参 数: 进程号

处理流程: 只要进程 pid 在前台运行, 就一直等待, 直到进程终止或者停止。

要点分析: 调用 while 循环即可

3. 1.5 void sigchld_handler(int sig) 函数 (10 分)

函数功能: SIGCHLD 信号处理

参 数: 信号

处理流程: 这是处理 SIGCHLD 的函数, 子进程一旦 terminated 或者 stopped 或者自然结束, 它就会被触发。用 waitpid 判断到底是哪个进程触发的, 然后再根据不同的情况采取不同的措施。如果进程是自然结束的, 那么直接把它从任务列表里删掉就好; 如果进程是被强制 terminated 的, 那么在把它从任务列表里删除的同时, 还要输出导致进程终止的 Signal 类型; 如果进程 stopped, 那么 把任务的状态设为 ST (stopped), 同时输出导致进程中止的 Signal 类型。

要点分析:

sigchld_handler 是用来捕获 SIGCHLD 信号的, 比起其他两个信号处理函数, 这个是用来回收进程的。用到了 WIFSTOPPED, WIFSIGNALED, WIFEXITED, 分别代表判断进程被停止, 被未捕获的信号停止, exit 的停止。其实就是回收过程中的僵尸进程的回收, Ctrl-Z、Ctrl-C 信号下进程的回收。

3.2 程序实现 (tsh.c 的全部内容) (10 分)

重点检查代码风格:

(1) 用较好的代码注释说明——5 分

(2) 检查每个系统调用的返回值——5 分

第 4 章 TinyShell 测试

总分 15 分

4.1 测试方法

针对 tsh 和参考 shell 程序 tshref, 完成测试项目 4.1-4.15 的对比测试, 并将测试结果截图或者通过重定向保存到文本文件(例如: ./sdriver.pl -t trace01.txt -s ./tsh -a "-p" > tshresult01.txt)。

4.2 测试结果评价

tsh 与 tshref 的输出在一下两个方面可以不同:

(1) PID

(2)测试文件 trace11.txt, trace12.txt 和 trace13.txt 中的/bin/ps 命令, 每次运行的输出都会不同, 但每个 mysplit 进程的运行状态应该相同。

除了上述两方面允许的差异, tsh 与 tshref 的输出相同则判为正确, 如不同则给出原因分析。

4.3 自测试结果

4.3.1 测试用例 trace01.txt 的输出截图 (1 分)

tsh 测试结果		tshref 测试结果	
			
测试结论	相同/不同, 原因分析如下: 相同		

4.3.2 测试用例 trace02.txt 的输出截图 (1 分)

tsh 测试结果	tshref 测试结果
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<pre>l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit\$ make test02 ./sdriver.pl -t trace02.txt -s ./tsh -a "-p" # # trace02.txt - Process builtin quit command. #</pre>	<pre>l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit\$ make rtest02 ./sdriver.pl -t trace02.txt -s ./tshref -a "-p" # # trace02.txt - Process builtin quit command. #</pre>
测试结论	相同/不同，原因分析如下： 相同

4.3.3 测试用例 trace03.txt 的输出截图（1 分）

tsh 测试结果	tshref 测试结果
<pre>l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit\$ make test03 ./sdriver.pl -t trace03.txt -s ./tsh -a "-p" # # trace03.txt - Run a foreground job. # tsh> quit</pre>	<pre>l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit\$ make rtest03 ./sdriver.pl -t trace03.txt -s ./tshref -a "-p" # # trace03.txt - Run a foreground job. # tsh> quit</pre>
测试结论	相同/不同，原因分析如下： 相同

4.3.4 测试用例 trace04.txt 的输出截图（1 分）

tsh 测试结果	tshref 测试结果
<pre>l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit\$ make test04 ./sdriver.pl -t trace04.txt -s ./tsh -a "-p" # # trace04.txt - Run a background job. # tsh> ./myspin 1 & [1] (2435) ./myspin 1 &</pre>	<pre>l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit\$ make rtest04 ./sdriver.pl -t trace04.txt -s ./tshref -a "-p" # # trace04.txt - Run a background job. # tsh> ./myspin 1 & [1] (2445) ./myspin 1 &</pre>
测试结论	相同/不同，原因分析如下： 相同

4.3.5 测试用例 trace05.txt 的输出截图（1 分）

tsh 测试结果	tshref 测试结果
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<pre> l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit\$ make test05 ./sdriver.pl -t trace05.txt -s ./tsh -a "-p" # # trace05.txt - Process jobs builtin command. # tsh> ./myspin 2 & [1] (2498) ./myspin 2 & tsh> ./myspin 3 & [2] (2500) ./myspin 3 & tsh> jobs [1] (2498) Running ./myspin 2 & [2] (2500) Running ./myspin 3 & </pre>	<pre> l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit\$ make rtest05 ./sdriver.pl -t trace05.txt -s ./tshref -a "-p" # # trace05.txt - Process jobs builtin command. # tsh> ./myspin 2 & [1] (2507) ./myspin 2 & tsh> ./myspin 3 & [2] (2509) ./myspin 3 & tsh> jobs [1] (2507) Running ./myspin 2 & [2] (2509) Running ./myspin 3 & </pre>
测试结论	相同/不同，原因分析如下： 相同

4.3.6 测试用例 trace06.txt 的输出截图（1 分）

tsh 测试结果	tshref 测试结果
<pre> l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit\$ make test06 ./sdriver.pl -t trace06.txt -s ./tsh -a "-p" # # trace06.txt - Forward SIGINT to foreground job. # tsh> ./myspin 4 Job [1] (2516) terminated by signal 2 </pre>	<pre> l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit\$ make rtest06 ./sdriver.pl -t trace06.txt -s ./tshref -a "-p" # # trace06.txt - Forward SIGINT to foreground job. # tsh> ./myspin 4 Job [1] (2522) terminated by signal 2 </pre>
测试结论	相同/不同，原因分析如下： 相同

4.3.7 测试用例 trace07.txt 的输出截图（1 分）

tsh 测试结果	tshref 测试结果
<pre> l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit\$ make test07 ./sdriver.pl -t trace07.txt -s ./tsh -a "-p" # # trace07.txt - Forward SIGINT only to foreground job. # tsh> ./myspin 4 & [1] (3450) ./myspin 4 & tsh> ./myspin 5 Job [2] (3452) terminated by signal 2 tsh> jobs [1] (3450) Running ./myspin 4 & </pre>	<pre> l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit\$ make rtest07 ./sdriver.pl -t trace07.txt -s ./tshref -a "-p" # # trace07.txt - Forward SIGINT only to foreground job. # tsh> ./myspin 4 & [1] (3459) ./myspin 4 & tsh> ./myspin 5 Job [2] (3461) terminated by signal 2 tsh> jobs [1] (3459) Running ./myspin 4 & </pre>
测试结论	相同/不同，原因分析如下： 相同

4.3.8 测试用例 trace08.txt 的输出截图（1 分）

tsh 测试结果	tshref 测试结果
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<pre> l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit\$ make test08 ./sdriver.pl -t trace08.txt -s ./tsh -a "-p" # # trace08.txt - Forward SIGTSTP only to foreground job. # tsh> ./myspin 4 & [1] (3468) ./myspin 4 & tsh> ./myspin 5 Job [2] (3470) stopped by signal 20 tsh> jobs [1] (3468) Running ./myspin 4 & [2] (3470) Stopped ./myspin 5 </pre>	<pre> l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit\$ make rtest08 ./sdriver.pl -t trace08.txt -s ./tshref -a "-p" # # trace08.txt - Forward SIGTSTP only to foreground job. # tsh> ./myspin 4 & [1] (3480) ./myspin 4 & tsh> ./myspin 5 Job [2] (3482) stopped by signal 20 tsh> jobs [1] (3480) Running ./myspin 4 & [2] (3482) Stopped ./myspin 5 </pre>
测试结论	相同/不同，原因分析如下： 相同

4.3.9 测试用例 trace09.txt 的输出截图（1 分）

tsh 测试结果	tshref 测试结果
<pre> l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit\$ make test09 ./sdriver.pl -t trace09.txt -s ./tsh -a "-p" # # trace09.txt - Process bg builtin command # tsh> ./myspin 4 & [1] (3518) ./myspin 4 & tsh> ./myspin 5 Job [2] (3520) stopped by signal 20 tsh> jobs [1] (3518) Running ./myspin 4 & [2] (3520) Stopped ./myspin 5 tsh> bg %2 [2] (3520) ./myspin 5 tsh> jobs [1] (3518) Running ./myspin 4 & [2] (3520) Running ./myspin 5 </pre>	<pre> l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit\$ make rtest09 ./sdriver.pl -t trace09.txt -s ./tshref -a "-p" # # trace09.txt - Process bg builtin command # tsh> ./myspin 4 & [1] (3531) ./myspin 4 & tsh> ./myspin 5 Job [2] (3533) stopped by signal 20 tsh> jobs [1] (3531) Running ./myspin 4 & [2] (3533) Stopped ./myspin 5 tsh> bg %2 [2] (3533) ./myspin 5 tsh> jobs [1] (3531) Running ./myspin 4 & [2] (3533) Running ./myspin 5 </pre>
测试结论	相同/不同，原因分析如下： 相同

4.3.10 测试用例 trace10.txt 的输出截图（1 分）

tsh 测试结果	tshref 测试结果
<pre> l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit\$ make test10 ./sdriver.pl -t trace10.txt -s ./tsh -a "-p" # # trace10.txt - Process fg builtin command. # tsh> ./myspin 4 & [1] (3542) ./myspin 4 & tsh> fg %1 Job [1] (3542) stopped by signal 20 tsh> jobs [1] (3542) Stopped ./myspin 4 & tsh> fg %1 tsh> jobs </pre>	<pre> l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit\$ make rtest10 ./sdriver.pl -t trace10.txt -s ./tshref -a "-p" # # trace10.txt - Process fg builtin command. # tsh> ./myspin 4 & [1] (3552) ./myspin 4 & tsh> fg %1 Job [1] (3552) stopped by signal 20 tsh> jobs [1] (3552) Stopped ./myspin 4 & tsh> fg %1 tsh> jobs </pre>
测试结论	相同/不同，原因分析如下： 相同

4.3.11 测试用例 trace11.txt 的输出截图（1 分）

tsh 测试结果	tshref 测试结果
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l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit$ make test11
./sdriver.pl -t trace11.txt -s ./tsh -a "-p"
#
# trace11.txt - Forward SIGINT to every process in foreground process group
#
tsh> ./mysplit 4
Job [1] (3562) terminated by signal 2
tsh> /bin/ps a
PID TTY STAT TIME COMMAND
863 tty1 Ssl+ 0:00 /usr/lib/gdm3/gdm-wayland-session gnome-session --aut
LibreOffice Writer /gdm/greeter/autostart
867 tty1 Ssl+ 0:00 /usr/lib/gnome-session/gnome-session-binary --autosta
rt /usr/share/gdm/greeter/autostart
873 tty1 Sl+ 0:08 /usr/bin/gnome-shell
889 tty1 S+ 0:00 /usr/bin/Xwayland :1024 -rootless -terminate -accessx
-core -listen 4 -listen 5 -displayfd 6
915 tty1 Sl 0:00 ibus-daemon --xim --panel disable
918 tty1 Sl 0:00 /usr/lib/ibus/ibus-dconf
921 tty1 Sl 0:00 /usr/lib/ibus/ibus-x11 --kill-daemon
943 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-xsettings
949 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-a11y-settings
954 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-clipboard
956 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-color
957 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-datetime
958 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-housekeeping
959 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-keyboard
960 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-media-keys
964 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-mouse
965 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-power
967 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-print-notification
970 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-rfkill
972 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-screensaver-proxy
973 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sharing
975 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-smartcard
979 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sound
986 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-wacom
1033 tty1 Sl 0:00 /usr/lib/ibus/ibus-engine-simple
1068 tty2 Ssl+ 0:00 /usr/lib/gdm3/gdm-x-session --run-script env GNOME_SH
ELL_SESSION_MODE=ubuntu gnome-session --session=ubuntu
1070 tty2 Sl+ 0:19 /usr/lib/Xorg/Xorg vt2 -displayfd 3 -auth /run/user/1
000/gdm/Xauthority -background none -noreset -keeptty -verbose 3
1080 tty2 Sl+ 0:00 /usr/lib/gnome-session/gnome-session-binary --session
=ubuntu
1080 tty2 Sl+ 0:00 /usr/lib/gnome-session/gnome-session-binary --session
=ubuntu
1276 tty2 RL+ 2:13 /usr/bin/gnome-shell
1576 tty2 Sl 0:00 ibus-daemon --xim --panel disable
1580 tty2 Sl 0:00 /usr/lib/ibus/ibus-dconf
1582 tty2 Sl 0:00 /usr/lib/ibus/ibus-x11 --kill-daemon
1656 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-power
1658 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-print-notification
1659 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-rfkill
1660 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-screensaver-proxy
1661 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sharing
1662 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-smartcard
1668 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-xsettings
1670 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sound
1673 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-wacom
1683 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-a11y-settings
1688 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-color
1690 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-clipboard
1691 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-housekeeping
1694 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-datetime
1695 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-media-keys
1698 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-keyboard
1703 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-mouse
1713 tty2 Sl+ 0:00 /usr/lib/gnome-disk-utility/gsd-disk-utility-notifier
1755 tty2 Sl+ 0:03 nautilus-desktop
1758 tty2 Sl+ 0:07 /usr/bin/gnome-software --gapplication-service
1764 tty2 Sl+ 0:00 /usr/lib/ibus/ibus-engine-simple
1930 tty2 Sl 0:00 /usr/lib/ibus/ibus-engine-libpinyin --ibus
2008 tty2 Sl 0:00 /usr/lib/ibus/ibus-engine-hangul --ibus
2009 tty2 Sl 0:00 update-notifier
2041 tty2 Sl+ 0:00 /usr/lib/deja-dup/deja-dup-monitor
2208 tty2 Sl+ 0:00 bash
2392 pts/0 Ss 0:00 make test11
3557 pts/0 S+ 0:00 /bin/sh -c ./sdriver.pl -t trace11.txt -s ./tsh -a "-
p"
3559 pts/0 S+ 0:00 /usr/bin/perl ./sdriver.pl -t trace11.txt -s ./tsh -a
-p
3560 pts/0 S+ 0:00 ./tsh -p
3565 pts/0 R 0:00 /bin/ps a

```

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l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit$ make rtest11
./sdriver.pl -t trace11.txt -s ./tshref -a "-p"
#
# trace11.txt - Forward SIGINT to every process in foreground process group
#
tsh> ./mysplit 4
Job [1] (3571) terminated by signal 2
tsh> /bin/ps a
PID TTY STAT TIME COMMAND
863 tty1 Ssl+ 0:00 /usr/lib/gdm3/gdm-wayland-session gnome-session --aut
ostart /usr/share/gdm/greeter/autostart
867 tty1 Sl+ 0:00 /usr/lib/gnome-session/gnome-session-binary --autosta
rt /usr/share/gdm/greeter/autostart
873 tty1 Sl+ 0:08 /usr/bin/gnome-shell
889 tty1 S+ 0:00 /usr/bin/Xwayland :1024 -rootless -terminate -accessx
-core -listen 4 -listen 5 -displayfd 6
915 tty1 Sl 0:00 ibus-daemon --xim --panel disable
918 tty1 Sl 0:00 /usr/lib/ibus/ibus-dconf
921 tty1 Sl 0:00 /usr/lib/ibus/ibus-x11 --kill-daemon
943 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-xsettings
949 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-a11y-settings
954 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-clipboard
956 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-color
957 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-datetime
958 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-housekeeping
959 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-keyboard
960 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-media-keys
964 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-mouse
965 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-power
967 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-print-notification
970 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-rfkill
972 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-screensaver-proxy
973 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sharing
975 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-smartcard
979 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sound
986 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-wacom
1033 tty1 Sl 0:00 /usr/lib/ibus/ibus-engine-simple
1068 tty2 Ssl+ 0:00 /usr/lib/gdm3/gdm-x-session --run-script env GNOME_SH
ELL_SESSION_MODE=ubuntu gnome-session --session=ubuntu
1070 tty2 RL+ 0:19 /usr/lib/Xorg/Xorg vt2 -displayfd 3 -auth /run/user/1
000/gdm/Xauthority -background none -noreset -keeptty -verbose 3
1080 tty2 Sl+ 0:00 /usr/lib/gnome-session/gnome-session-binary --session
=ubuntu
1080 tty2 Sl+ 0:00 /usr/lib/gnome-session/gnome-session-binary --session
=ubuntu
1276 tty2 RL+ 2:14 /usr/bin/gnome-shell
1576 tty2 Sl 0:00 ibus-daemon --xim --panel disable
1580 tty2 Sl 0:00 /usr/lib/ibus/ibus-dconf
1582 tty2 Sl 0:00 /usr/lib/ibus/ibus-x11 --kill-daemon
1656 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-power
1658 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-print-notification
1659 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-rfkill
1660 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-screensaver-proxy
1661 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sharing
1662 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-smartcard
1668 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-xsettings
1670 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sound
1673 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-wacom
1683 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-a11y-settings
1688 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-color
1690 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-clipboard
1691 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-housekeeping
1694 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-datetime
1695 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-media-keys
1698 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-keyboard
1703 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-mouse
1713 tty2 Sl+ 0:00 /usr/lib/gnome-disk-utility/gsd-disk-utility-notifier
1755 tty2 Sl+ 0:03 nautilus-desktop
1758 tty2 Sl+ 0:07 /usr/bin/gnome-software --gapplication-service
1764 tty2 Sl+ 0:00 /usr/lib/ibus/ibus-engine-simple
1930 tty2 Sl 0:00 /usr/lib/ibus/ibus-engine-libpinyin --ibus
2008 tty2 Sl 0:00 /usr/lib/ibus/ibus-engine-hangul --ibus
2009 tty2 Sl 0:00 update-notifier
2041 tty2 Sl+ 0:00 /usr/lib/deja-dup/deja-dup-monitor
2208 tty2 Sl+ 0:00 bash
2392 pts/0 Ss 0:00 make rtest11
3557 pts/0 S+ 0:00 /bin/sh -c ./sdriver.pl -t trace11.txt -s ./tshref -a
-p
3559 pts/0 S+ 0:00 /usr/bin/perl ./sdriver.pl -t trace11.txt -s ./tshref
-a -p
3569 pts/0 S+ 0:00 ./tshref -p
3574 pts/0 R 0:00 /bin/ps a

```

测试结论	相同/不同，原因分析如下： 相同
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4.3.12 测试用例 trace12.txt 的输出截图（1 分）

tsh 测试结果	tshref 测试结果
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计算机系统实验报告

<pre> l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit\$ make test12 ./sdriver.pl -t trace12.txt -s ./tsh -a "-p" # # trace12.txt - Forward SIGTSTP to every process in foreground process group # tsh> ./mysplit 4 Job [1] (3580) stopped by signal 20 tsh> jobs [1] (3580) Stopped ./mysplit 4 tsh> /bin/ps a PID TTY STAT TIME COMMAND 863 tty1 Ssl+ 0:00 /usr/lib/gdm3/gdm-wayland-session gnome-session --aut ostart /usr/share/gdm/greeter/autostart 867 tty1 Sl+ 0:00 /usr/lib/gnome-session/gnome-session-binary --autosta rt /usr/share/gdm/greeter/autostart 873 tty1 Sl+ 0:08 /usr/bin/gnome-shell 889 tty1 S+ 0:00 /usr/bin/Xwayland :1024 -rootless -terminate -accessx -core -listen 4 -listen 5 -displayfd 6 915 tty1 Sl 0:00ibus-daemon --x11 --panel disable 918 tty1 Sl 0:00 /usr/lib/ibus/ibus-dconf 921 tty1 Sl 0:00 /usr/lib/ibus/ibus-x11 --kill-daemon 943 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-xsettings 949 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-a11y-settings 954 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-clipboard 956 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-color 957 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-datetime 958 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-housekeeping 959 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-keyboard 960 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-media-keys 964 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-mouse 965 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-power 967 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-print-notification s 970 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-rfkill 972 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-screensaver-proxy 973 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sharing 975 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-smartcard 979 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sound 986 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-wacom 1033 tty1 Sl 0:00 /usr/lib/ibus/ibus-engine-simple 1068 tty2 Ssl+ 0:00 /usr/lib/gdm3/gdm-x-session --run-script env GNOME_SH ELL_SESSION_MODE=ubuntu gnome-session --session=ubuntu 1070 tty2 Sl+ 0:19 /usr/lib/xorg/Xorg vt2 -displayfd 3 -auth /run/user/1 000/gdm/Xauthority -background none -noreset -keeptty -verbose 3 1080 tty2 Sl+ 0:00 /usr/lib/gnome-session/gnome-session-binary --session =ubuntu 1276 tty2 Rl+ 2:15 /usr/bin/gnome-shell 1576 tty2 Sl 0:00ibus-daemon --x11 --panel disable 1580 tty2 Sl 0:00 /usr/lib/ibus/ibus-dconf 1582 tty2 Sl 0:00 /usr/lib/ibus/ibus-x11 --kill-daemon 1656 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-power 1658 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-print-notification s 1659 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-rfkill 1660 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-screensaver-proxy 1661 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sharing 1662 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-smartcard 1668 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-xsettings 1670 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sound 1673 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-wacom 1683 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-a11y-settings 1688 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-color 1690 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-clipboard 1691 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-housekeeping 1694 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-datetime 1695 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-media-keys 1698 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-keyboard 1703 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-mouse 1713 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-printer 1755 tty2 Sl+ 0:00 /usr/lib/gnome-disk-utility/gsd-disk-utility-notif 1758 tty2 Sl+ 0:03 nautilus-desktop 1764 tty2 Sll+ 0:07 /usr/bin/gnome-software --gapplication-service 1930 tty2 Sl 0:00 /usr/lib/ibus/ibus-engine-simple 2008 tty2 Sl 0:00 /usr/lib/ibus/ibus-engine-libpinyin --ibus 2009 tty2 Sl 0:00 /usr/lib/ibus/ibus-engine-hangul --ibus 2041 tty2 Sl+ 0:00 update-notifier 2208 tty2 Sl+ 0:00 /usr/lib/deja-dup/deja-dup-monitor 2392 pts/0 Ss 0:00 bash 3575 pts/0 S+ 0:00 make test12 3576 pts/0 S+ 0:00 /bin/sh -c ./sdriver.pl -t trace12.txt -s ./tsh -a "- p" 3577 pts/0 S+ 0:00 /usr/bin/perl ./sdriver.pl -t trace12.txt -s ./tsh -a -p 3577 pts/0 S+ 0:00 /usr/bin/perl ./sdriver.pl -t trace12.txt -s ./tsh -a -p 3578 pts/0 T 0:00 ./mysplit 4 3581 pts/0 T 0:00 ./mysplit 4 3584 pts/0 R 0:00 /bin/ps a </pre>	<pre> l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit\$ make rtest12 ./sdriver.pl -t trace12.txt -s ./tshref -a "-p" # # trace12.txt - Forward SIGTSTP to every process in foreground process group # tsh> ./mysplit 4 Job [1] (3590) stopped by signal 20 tsh> jobs [1] (3590) Stopped ./mysplit 4 tsh> /bin/ps a PID TTY STAT TIME COMMAND 863 tty1 Ssl+ 0:00 /usr/lib/gdm3/gdm-wayland-session gnome-session --aut ostart /usr/share/gdm/greeter/autostart 867 tty1 Sl+ 0:00 /usr/lib/gnome-session/gnome-session-binary --autosta rt /usr/share/gdm/greeter/autostart 873 tty1 Sl+ 0:08 /usr/bin/gnome-shell 889 tty1 S+ 0:00 /usr/bin/Xwayland :1024 -rootless -terminate -accessx -core -listen 4 -listen 5 -displayfd 6 915 tty1 Sl 0:00ibus-daemon --x11 --panel disable 918 tty1 Sl 0:00 /usr/lib/ibus/ibus-dconf 921 tty1 Sl 0:00 /usr/lib/ibus/ibus-x11 --kill-daemon 943 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-xsettings 949 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-a11y-settings 954 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-clipboard 956 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-color 957 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-datetime 958 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-housekeeping 959 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-keyboard 960 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-media-keys 964 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-mouse 965 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-power 967 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-print-notification s 970 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-rfkill 972 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-screensaver-proxy 973 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sharing 975 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-smartcard 979 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sound 986 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-wacom 1033 tty1 Sl 0:00 /usr/lib/ibus/ibus-engine-simple 1068 tty2 Ssl+ 0:00 /usr/lib/gdm3/gdm-x-session --run-script env GNOME_SH ELL_SESSION_MODE=ubuntu gnome-session --session=ubuntu 1070 tty2 Sl+ 0:19 /usr/lib/xorg/Xorg vt2 -displayfd 3 -auth /run/user/1 000/gdm/Xauthority -background none -noreset -keeptty -verbose 3 1080 tty2 Sl+ 0:00 /usr/lib/gnome-session/gnome-session-binary --session =ubuntu 1276 tty2 Rl+ 2:16 /usr/bin/gnome-shell 1576 tty2 Sl 0:00ibus-daemon --x11 --panel disable 1580 tty2 Sl 0:00 /usr/lib/ibus/ibus-dconf 1582 tty2 Sl 0:00 /usr/lib/ibus/ibus-x11 --kill-daemon 1656 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-power 1658 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-print-notification s 1659 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-rfkill 1660 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-screensaver-proxy 1661 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sharing 1662 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-smartcard 1668 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-xsettings 1670 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sound 1673 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-wacom 1683 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-a11y-settings 1688 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-color 1690 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-clipboard 1691 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-housekeeping 1694 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-datetime 1695 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-media-keys 1698 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-keyboard 1703 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-mouse 1713 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-printer 1755 tty2 Sl+ 0:00 /usr/lib/gnome-disk-utility/gsd-disk-utility-notif 1758 tty2 Sl+ 0:03 nautilus-desktop 1764 tty2 Sll+ 0:07 /usr/bin/gnome-software --gapplication-service 1930 tty2 Sl 0:00 /usr/lib/ibus/ibus-engine-simple 2008 tty2 Sl 0:00 /usr/lib/ibus/ibus-engine-libpinyin --ibus 2009 tty2 Sl 0:00 /usr/lib/ibus/ibus-engine-hangul --ibus 2041 tty2 Sl+ 0:00 update-notifier 2208 tty2 Sl+ 0:00 /usr/lib/deja-dup/deja-dup-monitor 2392 pts/0 Ss 0:00 bash 3585 pts/0 S+ 0:00 make rtest12 3586 pts/0 S+ 0:00 /bin/sh -c ./sdriver.pl -t trace12.txt -s ./tshref -a -p" 3587 pts/0 S+ 0:00 /usr/bin/perl ./sdriver.pl -t trace12.txt -s ./tshref -a -p 3588 pts/0 S+ 0:00 ./tshref -p 3590 pts/0 T 0:00 ./mysplit 4 3590 pts/0 T 0:00 ./mysplit 4 3591 pts/0 T 0:00 ./mysplit 4 3594 pts/0 R 0:00 /bin/ps a </pre>
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测试结论

相同/不同，原因分析如下： 相同

4.3.13 测试用例 trace13.txt 的输出截图（1 分）

tsh 测试结果

tshref 测试结果

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<pre> l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit\$ make test13 ./sdriver.pl -t trace13.txt -s ./tsh -a "-p" # # trace13.txt - Restart every stopped process in process group # tsh> ./mysplit 4 Job [1] (3600) stopped by signal 20 tsh> jobs [1] (3600) Stopped ./mysplit 4 tsh> bin/ps a PID TTY STAT TIME COMMAND 863 tty1 Ssl+ 0:00 /usr/lib/gdm3/gdm-wayland-session gnome-session --autostart /usr/share/gdm/greeter/autostart 867 tty1 Sl+ 0:00 /usr/lib/gnome-session/gnome-session-binary --autostart /usr/share/gdm/greeter/autostart 873 tty1 Sl+ 0:00 /usr/bin/gnome-shell 889 tty1 S+ 0:00 /usr/bin/Xwayland :1024 -rootless -terminate -accessx -core -listen 4 -listen 5 -displayfd 6 915 tty1 Sl 0:00 ibus-daemon --xim --panel disable 918 tty1 Sl 0:00 /usr/lib/ibus/ibus-dconf 921 tty1 Sl 0:00 /usr/lib/ibus/ibus-x11 --kill-daemon 943 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-xsettings 949 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-a11y-settings 954 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-clipboard 956 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-color 957 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-datetime 958 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-housekeeping 959 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-keyboard 960 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-media-keys 964 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-mouse 965 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-power 967 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-print-notification s 970 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-rfkill 972 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-screensaver-proxy 973 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sharing 975 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-smartcard 979 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sound 986 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-wacom 1033 tty1 Sl 0:00 /usr/lib/ibus/ibus-engine-simple 1068 tty2 Ssl+ 0:00 /usr/lib/gdm3/gdm-x-session --run-script env GNOME_SH ELL_SESSION_MODE=ubuntu gnome-session --session=ubuntu 1070 tty2 Rl+ 0:19 /usr/lib/Xorg/Xorg vt2 -displayfd 3 -auth /run/user/1000/gdm/Xauthority -background none -nolisten -keeptty -verbose 3 1080 tty2 Sl+ 0:00 /usr/lib/gnome-session/gnome-session-binary --session=ubuntu 1276 tty2 Rl+ 2:17 /usr/bin/gnome-shell 1576 tty2 Sl 0:00 ibus-daemon --xim --panel disable 1580 tty2 Sl 0:00 /usr/lib/ibus/ibus-dconf 1582 tty2 Sl 0:00 /usr/lib/ibus/ibus-x11 --kill-daemon 1656 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-power 1658 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-print-notification s 1659 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-rfkill 1660 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-screensaver-proxy 1661 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sharing 1662 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-smartcard 1668 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-xsettings 1670 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sound 1673 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-wacom 1683 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-a11y-settings 1688 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-color 1690 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-clipboard 1691 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-housekeeping 1694 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-datetime 1695 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-keyboard 1698 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-media-keys 1703 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-mouse 1713 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-printer 1755 tty2 Sl+ 0:00 /usr/lib/gnome-disk-utility/gsd-disk-utility-notify 1758 tty2 Sl+ 0:03 nautilus-desktop 1764 tty2 Sll+ 0:07 /usr/bin/gnome-software --gapplication-service 1930 tty2 Sl 0:00 /usr/lib/ibus/ibus-engine-simple 2088 tty2 Sl 0:00 /usr/lib/ibus/ibus-engine-libpinyin --ibus 2089 tty2 Sl 0:00 /usr/lib/ibus/ibus-engine-hangul --ibus 2041 tty2 Sl+ 0:00 update-notifier 2208 tty2 Sl+ 0:00 /usr/lib/deja-dup/deja-dup-monitor 2392 pts/0 Ss 0:00 bash 3595 pts/0 S+ 0:00 make test13 3596 pts/0 S+ 0:00 /bin/sh -c ./sdriver.pl -t trace13.txt -s ./tsh -a "-p" 3597 pts/0 S+ 0:00 /usr/bin/perl ./sdriver.pl -t trace13.txt -s ./tsh -a "-p" 3598 pts/0 S+ 0:00 ./tsh -p 3600 pts/0 T 0:00 ./mysplit 4 </pre>	<pre> l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit\$ make rtest13 ./sdriver.pl -t trace13.txt -s ./tshref -a "-p" # # trace13.txt - Restart every stopped process in process group # tsh> ./mysplit 4 Job [1] (3614) stopped by signal 20 tsh> jobs [1] (3614) Stopped ./mysplit 4 tsh> bin/ps a PID TTY STAT TIME COMMAND 863 tty1 Ssl+ 0:00 /usr/lib/gdm3/gdm-wayland-session gnome-session --autostart /usr/share/gdm/greeter/autostart 867 tty1 Sl+ 0:00 /usr/lib/gnome-session/gnome-session-binary --autostart /usr/share/gdm/greeter/autostart 873 tty1 Sl+ 0:00 /usr/bin/gnome-shell 889 tty1 S+ 0:00 /usr/bin/Xwayland :1024 -rootless -terminate -accessx -core -listen 4 -listen 5 -displayfd 6 915 tty1 Sl 0:00 ibus-daemon --xim --panel disable 918 tty1 Sl 0:00 /usr/lib/ibus/ibus-dconf 921 tty1 Sl 0:00 /usr/lib/ibus/ibus-x11 --kill-daemon 943 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-xsettings 949 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-a11y-settings 954 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-clipboard 956 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-color 957 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-datetime 958 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-housekeeping 959 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-keyboard 960 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-media-keys 964 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-mouse 965 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-power 967 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-print-notification s 970 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-rfkill 972 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-screensaver-proxy 973 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sharing 975 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-smartcard 979 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sound 986 tty1 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-wacom 1033 tty1 Sl 0:00 /usr/lib/ibus/ibus-engine-simple 1068 tty2 Ssl+ 0:00 /usr/lib/gdm3/gdm-x-session --run-script env GNOME_SH ELL_SESSION_MODE=ubuntu gnome-session --session=ubuntu 1070 tty2 Sl+ 0:20 /usr/lib/Xorg/Xorg vt2 -displayfd 3 -auth /run/user/1000/gdm/Xauthority -background none -nolisten -keeptty -verbose 3 1080 tty2 Sl+ 0:00 /usr/lib/gnome-session/gnome-session-binary --session=ubuntu 1276 tty2 Rl+ 2:18 /usr/bin/gnome-shell 1576 tty2 Sl 0:00 ibus-daemon --xim --panel disable 1580 tty2 Sl 0:00 /usr/lib/ibus/ibus-dconf 1582 tty2 Sl 0:00 /usr/lib/ibus/ibus-x11 --kill-daemon 1656 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-power 1658 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-print-notification s 1659 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-rfkill 1660 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-screensaver-proxy 1661 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sharing 1662 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-smartcard 1668 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-xsettings 1670 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sound 1673 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-wacom 1683 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-a11y-settings 1688 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-color 1690 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-clipboard 1691 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-housekeeping 1694 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-datetime 1695 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-keyboard 1698 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-media-keys 1703 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-mouse 1713 tty2 Sl+ 0:00 /usr/lib/gnome-settings-daemon/gsd-printer 1755 tty2 Sl+ 0:00 /usr/lib/gnome-disk-utility/gsd-disk-utility-notify 1758 tty2 Sl+ 0:03 nautilus-desktop 1764 tty2 Sll+ 0:07 /usr/bin/gnome-software --gapplication-service 1930 tty2 Sl 0:00 /usr/lib/ibus/ibus-engine-simple 2088 tty2 Sl 0:00 /usr/lib/ibus/ibus-engine-libpinyin --ibus 2089 tty2 Sl 0:00 /usr/lib/ibus/ibus-engine-hangul --ibus 2041 tty2 Sl+ 0:00 update-notifier 2208 tty2 Sl+ 0:00 /usr/lib/deja-dup/deja-dup-monitor 2392 pts/0 Ss 0:00 bash 3609 pts/0 S+ 0:00 make rtest13 3610 pts/0 S+ 0:00 /bin/sh -c ./sdriver.pl -t trace13.txt -s ./tshref -a "-p" 3611 pts/0 S+ 0:00 /usr/bin/perl ./sdriver.pl -t trace13.txt -s ./tshref -a "-p" 3612 pts/0 S+ 0:00 ./tshref -p 3614 pts/0 T 0:00 ./mysplit 4 3615 pts/0 T 0:00 ./mysplit 4 3618 pts/0 R 0:00 /bin/ps a </pre>
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3601 pts/0 T 0:00 ./mysplit 4	3604 pts/0 R 0:00 /bin/ps a	tsht> fg %1	tsht> /bin/ps a
PID TTY STAT TIME COMMAND			
863 tty1 Ssl+ 0:00 /usr/lib/gdm3/gdm-wayland-session gnome-session --aut			
ostart /usr/share/gdm/greeter/autostart			
867 tty1 SL+ 0:00 /usr/lib/gnome-session/gnome-session-binary --autosta			
rt /usr/share/gdm/greeter/autostart			
873 tty1 SL+ 0:00 /usr/bin/gnome-shell			
889 tty1 S+ 0:00 /usr/bin/Xwayland :1024 -rootless -terminate -accessx			
-core -listen 4 -listen 5 -displayfd 6			
915 tty1 SL 0:00 ibus-daemon --xim --panel disable			
918 tty1 SL 0:00 /usr/lib/ibus/ibus-dconf			
921 tty1 SL 0:00 /usr/lib/ibus/ibus-x11 --kill-daemon			
943 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-xsettings			
949 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-a11y-settings			
954 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-clipboard			
956 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-color			
957 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-datetime			
958 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-housekeeping			
959 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-keyboard			
960 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-media-keys			
964 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-mouse			
965 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-power			
967 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-print-notification			
970 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-rfkill			
972 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-screensaver-proxy			
973 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sharing			
975 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-smartcard			
979 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sound			
986 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-wacom			
1033 tty1 SL 0:00 /usr/lib/ibus/ibus-engine-simple			
1068 tty2 Ssl+ 0:00 /usr/lib/gdm3/gdm-x-session --run-script env GNOME_SH			
ELL_SESSION_MODE=ubuntu gnome-session --session=ubuntu			
1070 tty2 SL+ 0:20 /usr/lib/Xorg/Xorg vt2 -displayfd 3 -auth /run/user/1			
000/gdm/Xauthority -background none -noreset -keeptty -verbose 3			
1080 tty2 SL+ 0:00 /usr/lib/gnome-session/gnome-session-binary --session			
=ubuntu			
1276 tty2 RL+ 2:17 /usr/bin/gnome-shell			
1576 tty2 SL 0:00 ibus-daemon --xim --panel disable			
1580 tty2 SL 0:00 /usr/lib/ibus/ibus-dconf			
1582 tty2 SL 0:00 /usr/lib/ibus/ibus-x11 --kill-daemon			
1656 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-power			
1658 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-print-notification			
1659 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-rfkill			
1660 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-screensaver-proxy			
1661 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sharing			
1662 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-smartcard			
1668 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-xsettings			
1670 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sound			
1673 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-wacom			
1683 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-a11y-settings			
1688 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-color			
1690 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-clipboard			
1691 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-housekeeping			
1694 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-datetime			
1695 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-media-keys			
1698 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-keyboard			
1703 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-mouse			
1713 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-printer			
1755 tty2 SL+ 0:00 /usr/lib/gnome-disk-utility/gsd-disk-utility-notify			
1758 tty2 SL+ 0:03 nautilus-desktop			
1764 tty2 SLL+ 0:07 /usr/bin/gnome-software --gapplication-service			
1930 tty2 SL 0:00 /usr/lib/ibus/ibus-engine-simple			
2008 tty2 SL 0:00 /usr/lib/ibus/ibus-engine-libpinyin --ibus			
2009 tty2 SL 0:00 /usr/lib/ibus/ibus-engine-hangul --ibus			
2041 tty2 SL+ 0:00 update-notifier			
2208 tty2 SL+ 0:00 /usr/lib/deja-dup/deja-dup-monitor			
2392 pts/0 Ss 0:00 bash			
3595 pts/0 S+ 0:00 make test13			
3596 pts/0 S+ 0:00 /bin/sh -c ./sdriver.pl -t trace13.txt -s ./tshref -a			
-p			
3597 pts/0 S+ 0:00 /usr/bin/perl ./sdriver.pl -t trace13.txt -s ./tshref -a			
-p			
3598 pts/0 S+ 0:00 ./tshref -p			
3607 pts/0 R 0:00 /bin/ps a			
tsht> fg %1			
tsht> /bin/ps a			
PID TTY STAT TIME COMMAND			
863 tty1 Ssl+ 0:00 /usr/lib/gdm3/gdm-wayland-session gnome-session --aut			
ostart /usr/share/gdm/greeter/autostart			
867 tty1 SL+ 0:00 /usr/lib/gnome-session/gnome-session-binary --autosta			
rt /usr/share/gdm/greeter/autostart			
873 tty1 SL+ 0:00 /usr/bin/gnome-shell			
889 tty1 S+ 0:00 /usr/bin/Xwayland :1024 -rootless -terminate -accessx			
-core -listen 4 -listen 5 -displayfd 6			
915 tty1 SL 0:00 ibus-daemon --xim --panel disable			
918 tty1 SL 0:00 /usr/lib/ibus/ibus-dconf			
921 tty1 SL 0:00 /usr/lib/ibus/ibus-x11 --kill-daemon			
943 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-xsettings			
949 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-a11y-settings			
954 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-clipboard			
956 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-color			
957 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-datetime			
958 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-housekeeping			
959 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-keyboard			
960 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-media-keys			
964 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-mouse			
965 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-power			
967 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-print-notification			
970 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-rfkill			
972 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-screensaver-proxy			
973 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sharing			
975 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-smartcard			
979 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sound			
986 tty1 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-wacom			
1033 tty1 SL 0:00 /usr/lib/ibus/ibus-engine-simple			
1068 tty2 Ssl+ 0:00 /usr/lib/gdm3/gdm-x-session --run-script env GNOME_SH			
ELL_SESSION_MODE=ubuntu gnome-session --session=ubuntu			
1070 tty2 SL+ 0:20 /usr/lib/Xorg/Xorg vt2 -displayfd 3 -auth /run/user/1			
000/gdm/Xauthority -background none -noreset -keeptty -verbose 3			
1080 tty2 SL+ 0:00 /usr/lib/gnome-session/gnome-session-binary --session			
=ubuntu			
1276 tty2 RL+ 2:19 /usr/bin/gnome-shell			
1576 tty2 SL 0:00 ibus-daemon --xim --panel disable			
1580 tty2 SL 0:00 /usr/lib/ibus/ibus-dconf			
1582 tty2 SL 0:00 /usr/lib/ibus/ibus-x11 --kill-daemon			
1656 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-power			
1658 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-print-notification			
1659 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-rfkill			
1660 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-screensaver-proxy			
1661 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sharing			
1662 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-smartcard			
1668 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-xsettings			
1670 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-sound			
1673 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-wacom			
1683 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-a11y-settings			
1688 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-color			
1690 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-clipboard			
1691 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-housekeeping			
1694 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-datetime			
1695 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-media-keys			
1698 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-keyboard			
1703 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-mouse			
1713 tty2 SL+ 0:00 /usr/lib/gnome-settings-daemon/gsd-printer			
1755 tty2 SL+ 0:00 /usr/lib/gnome-disk-utility/gsd-disk-utility-notify			
1758 tty2 SL+ 0:03 nautilus-desktop			
1764 tty2 SLL+ 0:07 /usr/bin/gnome-software --gapplication-service			
1930 tty2 SL 0:00 /usr/lib/ibus/ibus-engine-simple			
2008 tty2 SL 0:00 /usr/lib/ibus/ibus-engine-libpinyin --ibus			
2009 tty2 SL 0:00 /usr/lib/ibus/ibus-engine-hangul --ibus			
2041 tty2 SL+ 0:00 update-notifier			
2208 tty2 SL+ 0:00 /usr/lib/deja-dup/deja-dup-monitor			
2392 pts/0 Ss 0:00 bash			
3609 pts/0 S+ 0:00 make rtest13			
3610 pts/0 S+ 0:00 /bin/sh -c ./sdriver.pl -t trace13.txt -s ./tshref -a			
-p			
3611 pts/0 S+ 0:00 /usr/bin/perl ./sdriver.pl -t trace13.txt -s ./tshref			
-a -p			
3612 pts/0 S+ 0:00 ./tshref -p			
3621 pts/0 R 0:00 /bin/ps a			

测试结论

相同/不同，原因分析如下： 相同

4.3.14 测试用例 trace14.txt 的输出截图（1 分）

tsh 测试结果	tshref 测试结果
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<pre>l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit\$ make test14 ./sdriver.pl -t trace14.txt -s ./tsh -a "-p" # # trace14.txt - Simple error handling # tsh> ./bogus ./bogus: Command not found tsh> ./myspin 4 & [1] (3629) ./myspin 4 & tsh> fg fg command requires PID or %jobid argument tsh> bg bg command requires PID or %jobid argument tsh> fg a fg: argument must be a PID or %jobid tsh> bg a bg: argument must be a PID or %jobid tsh> fg 9999999 (9999999): No such process tsh> bg 9999999 (9999999): No such process tsh> fg %2 %2: No such job tsh> fg %1 Job [1] (3629) stopped by signal 20 tsh> bg %2 %2: No such job tsh> bg %1 [1] (3629) ./myspin 4 & tsh> jobs [1] (3629) Running ./myspin 4 &</pre>	<pre>l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit\$ make rtest14 ./sdriver.pl -t trace14.txt -s ./tshref -a "-p" # # trace14.txt - Simple error handling # tsh> ./bogus ./bogus: Command not found tsh> ./myspin 4 & [1] (3648) ./myspin 4 & tsh> fg fg command requires PID or %jobid argument tsh> bg bg command requires PID or %jobid argument tsh> fg a fg: argument must be a PID or %jobid tsh> bg a bg: argument must be a PID or %jobid tsh> fg 9999999 (9999999): No such process tsh> bg 9999999 (9999999): No such process tsh> fg %2 %2: No such job tsh> fg %1 Job [1] (3648) stopped by signal 20 tsh> bg %2 %2: No such job tsh> bg %1 [1] (3648) ./myspin 4 & tsh> jobs [1] (3648) Running ./myspin 4 &</pre>
测试结论	相同/不同，原因分析如下： 相同

4.3.15 测试用例 trace15.txt 的输出截图（1 分）

tsh 测试结果	tshref 测试结果
<pre>l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit\$ make test15 ./파밀 ver.pl -t trace15.txt -s ./tsh -a "-p" # # trace15.txt - Putting it all together # tsh> ./bogus ./bogus: Command not found tsh> ./myspin 10 Job [1] (3667) terminated by signal 2 tsh> ./myspin 3 & [1] (3669) ./myspin 3 & tsh> ./myspin 4 & [2] (3671) ./myspin 4 & tsh> jobs [1] (3669) Running ./myspin 3 & [2] (3671) Running ./myspin 4 & tsh> fg %1 Job [1] (3669) stopped by signal 20 tsh> jobs [1] (3669) Stopped ./myspin 3 & [2] (3671) Running ./myspin 4 & tsh> bg %3 %3: No such job tsh> bg %1 [1] (3669) ./myspin 3 & tsh> jobs [1] (3669) Running ./myspin 3 & [2] (3671) Running ./myspin 4 & tsh> fg %1 tsh> quit</pre>	<pre>l170300901@l170300901-VirtualBox:~/share/shlab-handout-hit\$ make rtest15 ./sdriver.pl -t trace15.txt -s ./tshref -a "-p" # # trace15.txt - Putting it all together # tsh> ./bogus ./bogus: Command not found tsh> ./myspin 10 Job [1] (3687) terminated by signal 2 tsh> ./myspin 3 & [1] (3689) ./myspin 3 & tsh> ./myspin 4 & [2] (3691) ./myspin 4 & tsh> jobs [1] (3689) Running ./myspin 3 & [2] (3691) Running ./myspin 4 & tsh> fg %1 Job [1] (3689) stopped by signal 20 tsh> jobs [1] (3689) Stopped ./myspin 3 & [2] (3691) Running ./myspin 4 & tsh> bg %3 %3: No such job tsh> bg %1 [1] (3689) ./myspin 3 & tsh> jobs [1] (3689) Running ./myspin 3 & [2] (3691) Running ./myspin 4 & tsh> fg %1 tsh> quit</pre>
测试结论	相同/不同，原因分析如下： 相同

4. 4 自测试评分

根据节 4.3 的自测试结果，程序的测试评分为：_____。

第 4 章 总结

4.1 请总结本次实验的收获

我是韩国留学生. 因此用中文学习这个课程是非常困难的. 但是很多中国朋友告诉我和帮助我了解了课堂内容 所以我提高了很多汉语水平,也了解了很多 linux. 对我来说,这似乎是一次很好的经验,真的很幸福

4.2 请给出对本次实验内容的建议

我是留学生 。请多多关照。 谢谢老师 注：本章为酌情加分项。
注：本章为酌情加分项。

参考文献

为完成本次实验你翻阅的书籍与网站等

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