```
/*
 * main.cpp
 *
 *  Created on: Jan 26, 2017
 *      Authors:      Andrew Jordan
 *                    Lucas Pruitt
 *                    Adam Moses
 *
 * Purpose: Simulate bash shell
 * Design:
 * If input from shell calling program
 * - copy arguments,fork,execute commands
 * If no input from shell calling program:
 * - Grab line of input
 * - Store in cstring
 * - Parse cstring
 *             - convert each individual command to string
 *             - use length of string to allocate new memory for char[]
 *             - put in Q of commands converted
 *             - use size of Q to allocate new memory for struct char[]
 *             - transfer all commands to the struct char[] from Q
 *             - add any > || >> || < || <<
 *      - Check if directory change command
 *      - If not changing directories
 *             - fork
 *             - have child check out I/O redirect and do so
 *             - have child process execute command
 *             - kill child process off
 *             - return to parent process
 *      - If exit or ctrl-C pressed, exit process
 *      - Repeat all steps above in infinite while in main.
 */

#include <iostream>
#include <unistd.h>
// used with chdir() -> changes working directory
#include <sys/wait.h>
#include <sys/types.h>
#include <stdlib.h>
#include <dirent.h>
#include <string>
#include <ctype.h>
#include <algorithm>
#include <string.h>
#include <stdio.h>
#include <signal.h>
#include <fcntl.h>
#include <sys/stat.h>
#include <queue>
#include <signal.h>
using namespace std;


struct args
{
       int argc;
       char **argv;
};

args* parser(char*);  // Parses arguments and stores them inside an args struct
void order(char*);      // Sets up order of functions called for reuse if needed
```

```
char* S2C(string,int);// Converts a string to a cstring, returns a char* to be stored in args
bool dir(args*);        // Changes and displays directories
void USER_PWD();        // Displays current working directory
void fork_off(args *);// Creates child process to do work and child is terminated with
kill(pid,SIGTERM);
void sig_handler (int);// Catches ctrl-C and calls quit_process()
void quit_process();  // Terminates current process with kill(pid,SIGTERM)


int main(int argc,char *argv[])
{
        if (argc>1)
        {
                args *aptr = new args;
                aptr->argc = argc;
                aptr->argv = new char*[argc+1];
                for (int i=1;i<argc;i++)
                        aptr->argv[i-1]=argv[i];
                aptr->argv[aptr->argc] = '\0';
                fork_off(aptr);
        }

        char input[1500];
        while (true)
        {
                if (signal(SIGINT,sig_handler)== SIG_ERR)
                {
                        cout<<"Signal not caught"<<endl;
                }
                for (int i=0;i<1500;i++)
                                input[i]= '\0';


                fgets(input,1500,stdin);
                order(input);
        }// end infinite while
        return 0;
}
void order(char *input)
{
        args *aptr;
        aptr = parser(input);
        fork_off(aptr);
}
void fork_off(args *aptr)
{
        bool runexec;
        int checkEXEC;
        if (aptr->argv[0]== std::string("exit_"))
                quit_process();

                runexec = dir(aptr);
                        if (!runexec)
                        {
                                pid_t REpid = fork(); // returned pid
                                                switch (REpid)
                                                {
                                                        case -1:
                                                                perror ("fork");
                                                                exit(1);
                                                                break;
```

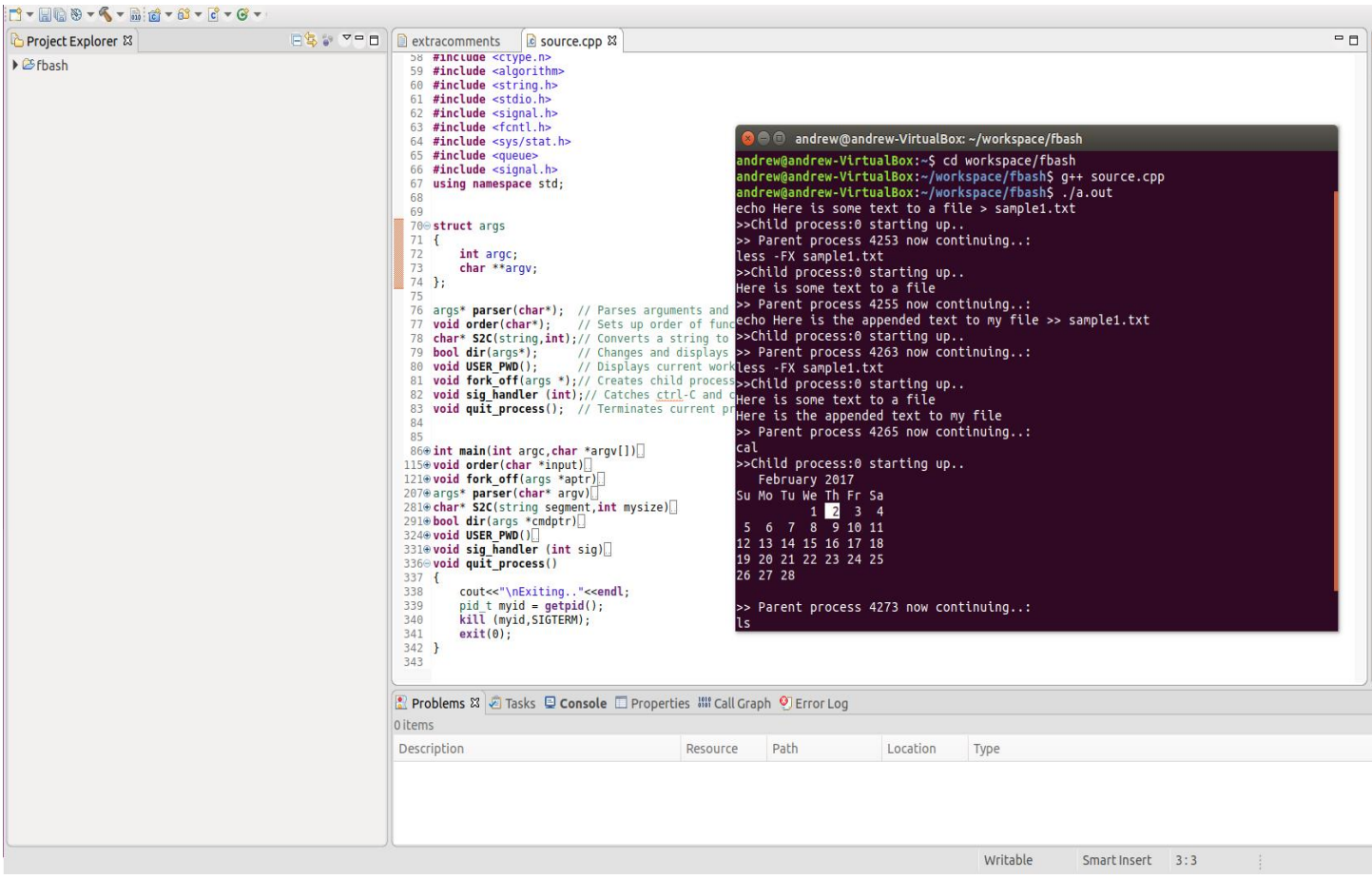
```
starting up.."<<endl;



std::string(">") ||

std::string("<") ||

std::string("<<") ||

std::string(">>"))



std::string(">"))


open(aptr->argv[m + 1],O_CREAT

        |O_WRONLY|O_TRUNC, 0644);



>argv[0], aptr->argv);

std::string(">>"))


+ 1],

        O_CREAT|O_WRONLY|O_APPEND, 0644);



>argv[0], aptr->argv);

std::string("<"))


>argv[m+1], O_CREAT


== -1)



||buffer[i] == '\t'||buffer[i] == '\r'|| buffer[i] == '\a')
```

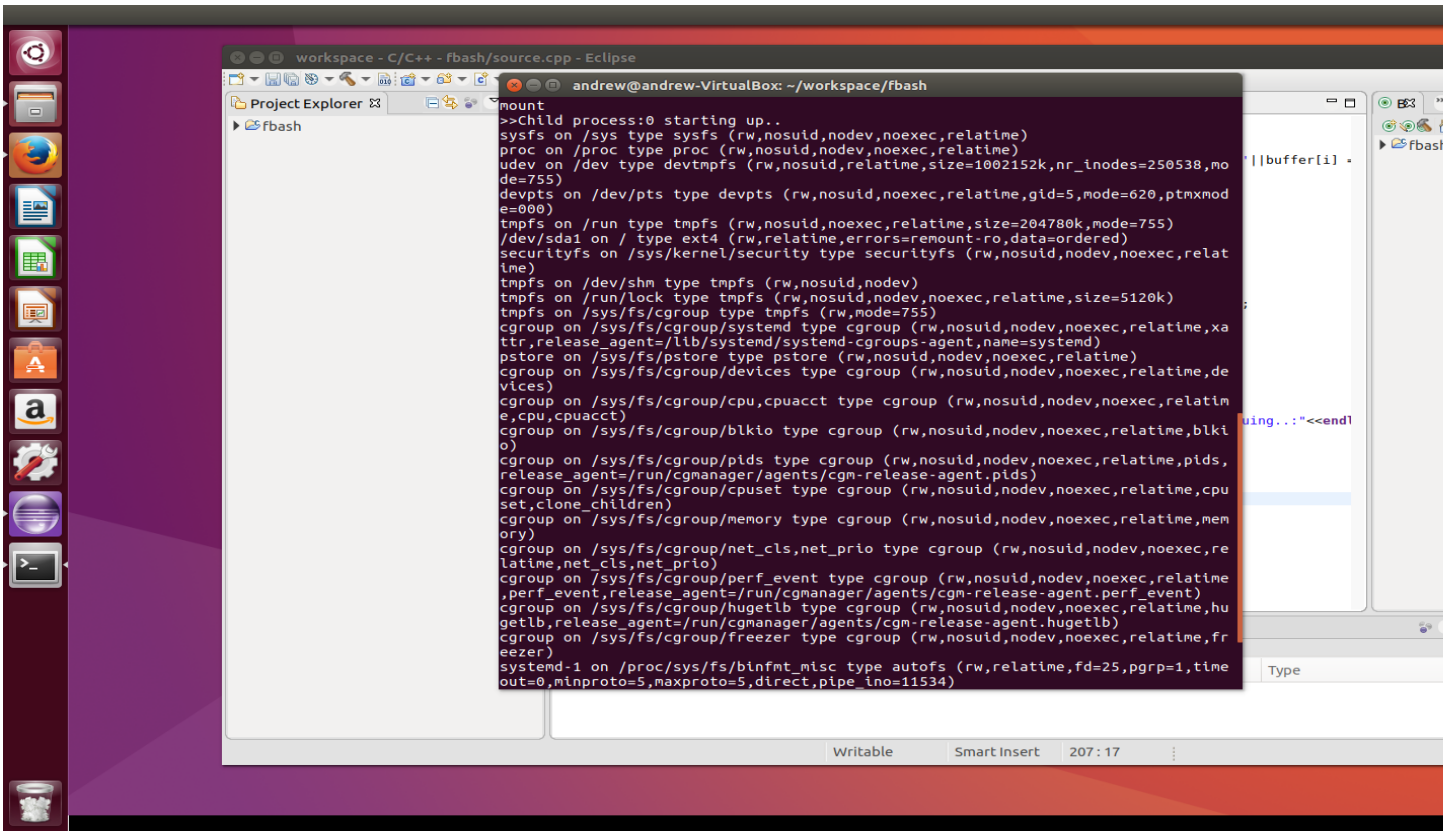
```
case 0:
{
        cout<<">>Child process:"<<REpid<<"


        int m = 0;
        for (int i = 0; i < aptr->argc; i++)
          {
            if (aptr->argv[i] ==

                aptr->argv[i] ==

                aptr->argv[i] ==

                aptr->argv[i] ==

               {m = i; }

          }
        if (aptr->argv[m] ==

          {

                        int newfd =



                close(STDOUT_FILENO);
                dup2(newfd, 1);
                aptr->argv[m] = NULL;
                checkEXEC = execvp(aptr-

          }
        if (aptr->argv[m] ==

          {
                int newfd = open(aptr->argv[m



                close(STDOUT_FILENO);
                dup2(newfd, 1);
                aptr->argv[m] = NULL;
                checkEXEC = execvp(aptr-

          }
        if (aptr->argv[m] ==

          {
                        char buffer[1000];
                auto newID = open(aptr-

                        |O_RDONLY, 0644);

                if(read(newID, buffer, 1000)

                        exit(-1);

            for(int i = 0; i < 1000; i++)
                if(buffer[i] == '\n'
```

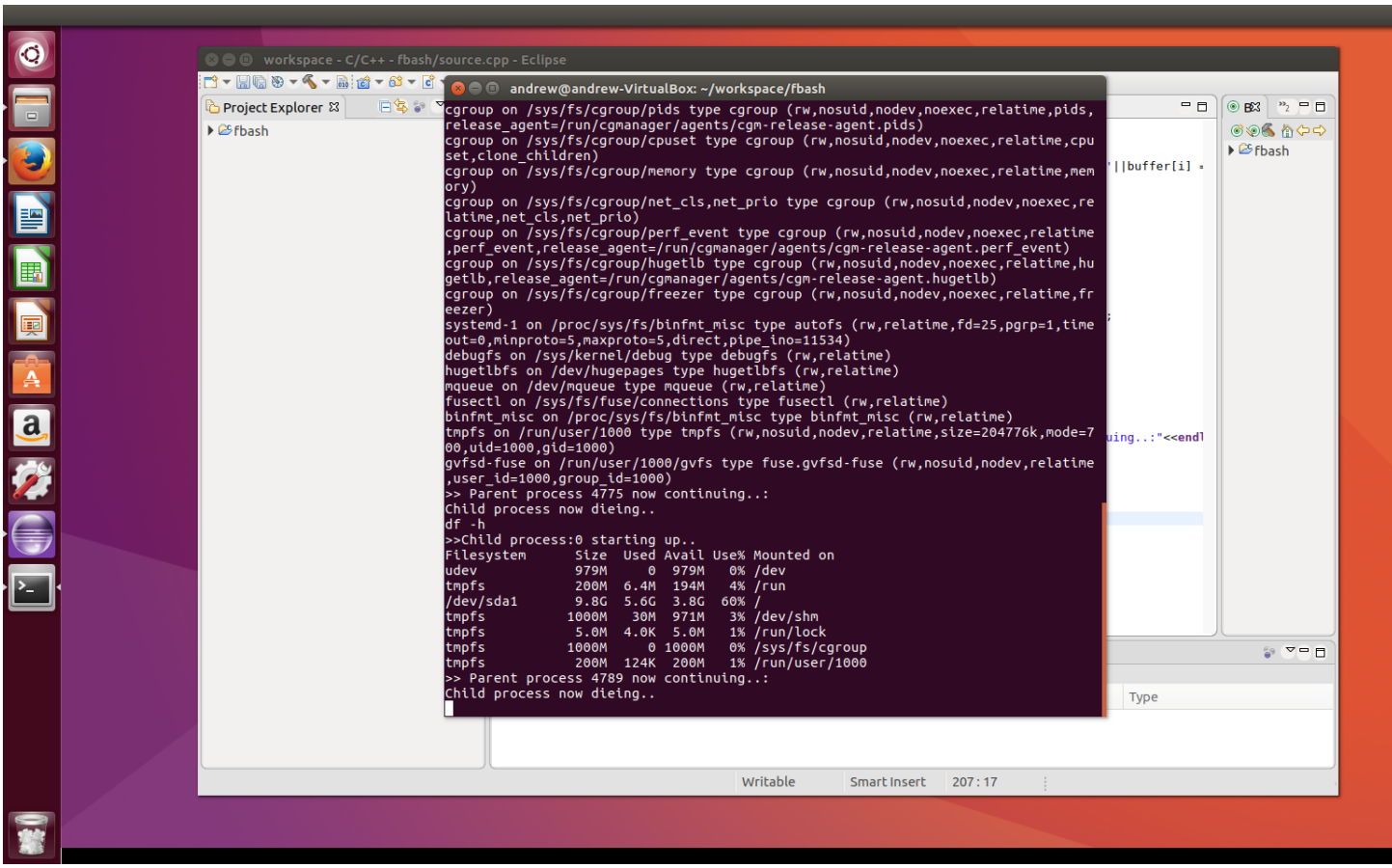
```
                                                                        buffer[i] = ' ';

                                                                    // Set last place to NULL
                                                                    buffer[999] = '\0';
                                                                    aptr->argv[m] = buffer;
                                                                    aptr->argv[m + 1] = NULL;
                                                                    execvp(aptr->argv[0], aptr-
>argv);
                                                                  }

                                                                else
                                                                 checkEXEC = execvp (aptr->argv[0],
aptr->argv);

                                                                if (checkEXEC == -1)
                                                                       perror("exec");
                                                                break;
                                                        }
                                                        default:
                                                                if (wait(0)==-1)
                                                                       perror("wait");
                                                                cout<<">> Parent process "<<REpid<<"
now continuing..:"<<endl;
                                                                break;
                                                }//end switch
                        cout<<"Child process now dieing.."<<endl;
                        kill (REpid,SIGTERM);
                        }// if runexec
}// end fork off
args* parser(char* argv)
{
        args *arguments = new args;
        string segment = "";
        int segment_size = 0;
        int i = 0;
        char *GGRTR = new char[3]{'>', '>', '\0'};
        char *LLESS = new char[3]{'<', '<', '\0'};
        char *GRTR = new char[2]{'>', '\0'};
        char *LESS = new char[2]{'<', '\0'};
        bool store_command = false;
        queue<char*> Qcommands;

        while (argv[i] != '\0')
        {
                while ((argv[i] != ' ')
                        && (argv[i] != '\n')
                        && (argv[i] != '\r')
                        && (argv[i] != '\t')
                        && (argv[i] != '>')
                        && (argv[i] != '<'))
                {
                        segment += argv[i];
                        segment_size++;
                        i++;
                        store_command = true;
                }
                if (store_command)
                {
                        Qcommands.push(S2C(segment, segment_size));
                        segment = "";
                        segment_size = 0;
```

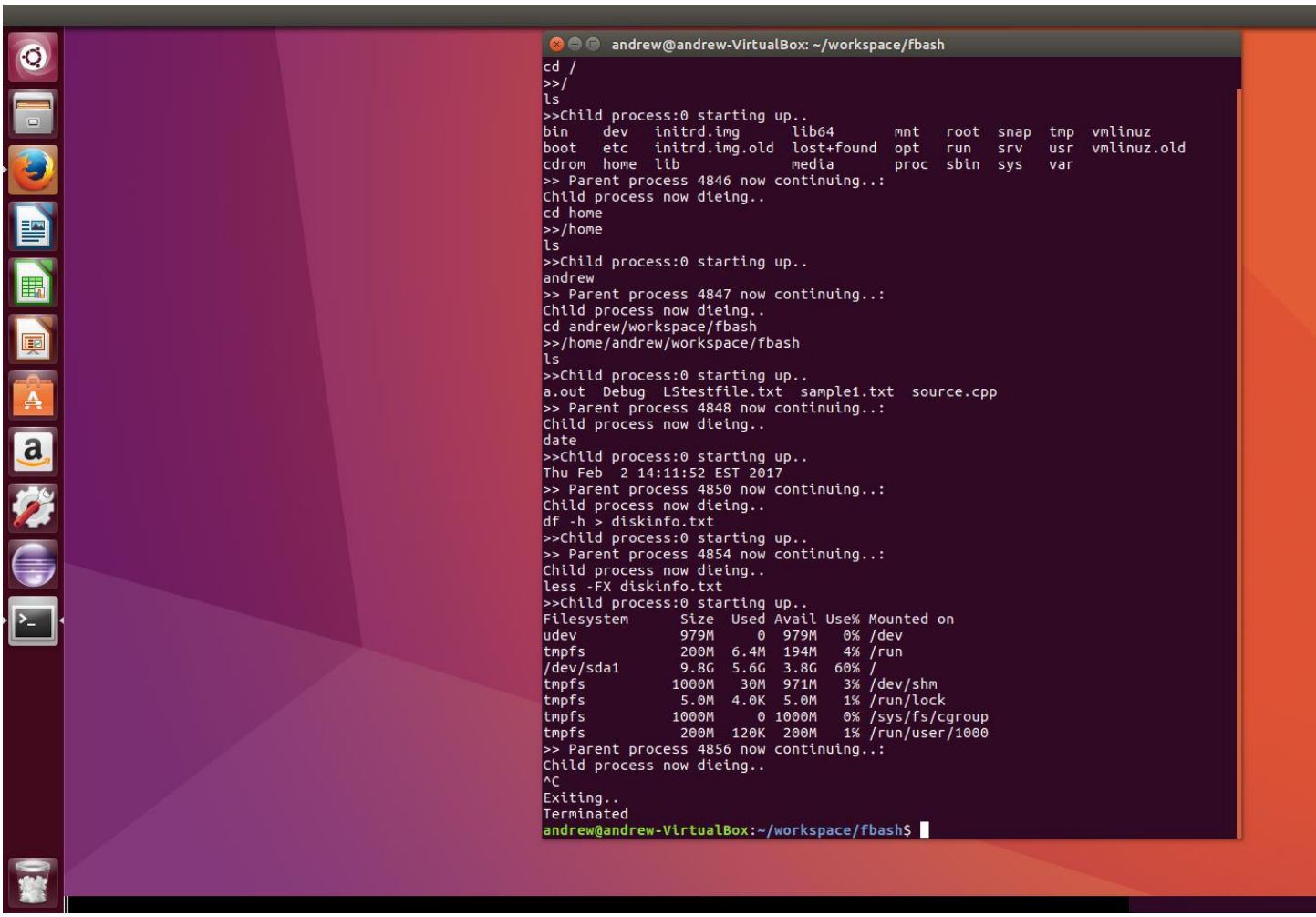
```
                        store_command = false;
                }

                if (argv[i] == '>')
                {
                        int double_check = i;
                        if (argv[double_check + 1] == '>')
                        {
                                Qcommands.push(GGRTR);
                                i++;
                        }
                        if (argv[double_check + 1] != '>')
                                Qcommands.push(GRTR);
                }//end if >

                if (argv[i] == '<')
                {
                        int double_check = i;
                        if (argv[double_check + 1] == '<')
                        {
                                Qcommands.push(LLESS);
                                i++;
                        }
                        if (argv[double_check + 1] != '<')
                                Qcommands.push(LESS);
                }//end if <
                i++;
        }//end while

        //Allocate memory for arguments inside of struct
        int counter = Qcommands.size();
        arguments->argc = counter;
        arguments->argv = new char*[counter+1];

        // Transfer commands into struct
        for (int i = 0; i < counter; i++,Qcommands.pop())
                arguments->argv[i] = Qcommands.front();

        arguments->argv[counter] = '\0';
        //return pointer containing arguments
        return arguments;
}
char* S2C(string segment,int mysize)
{
        //grab new memory for cstring
        char *temp = new char[mysize+1];
        // transfer characters from string to new char array
        for (int i = 0; i < mysize; i++)
                temp[i] = segment[i];
        temp[mysize] = '\0';
        return temp;
}
bool dir(args *cmdptr)
{
        int changedir_test;
        bool temp = false;
        // cycle through commands
        for (int i =0;i<cmdptr->argc;i++)
        {
                if (cmdptr->argv[i]==std::string("cd"))
                {
```

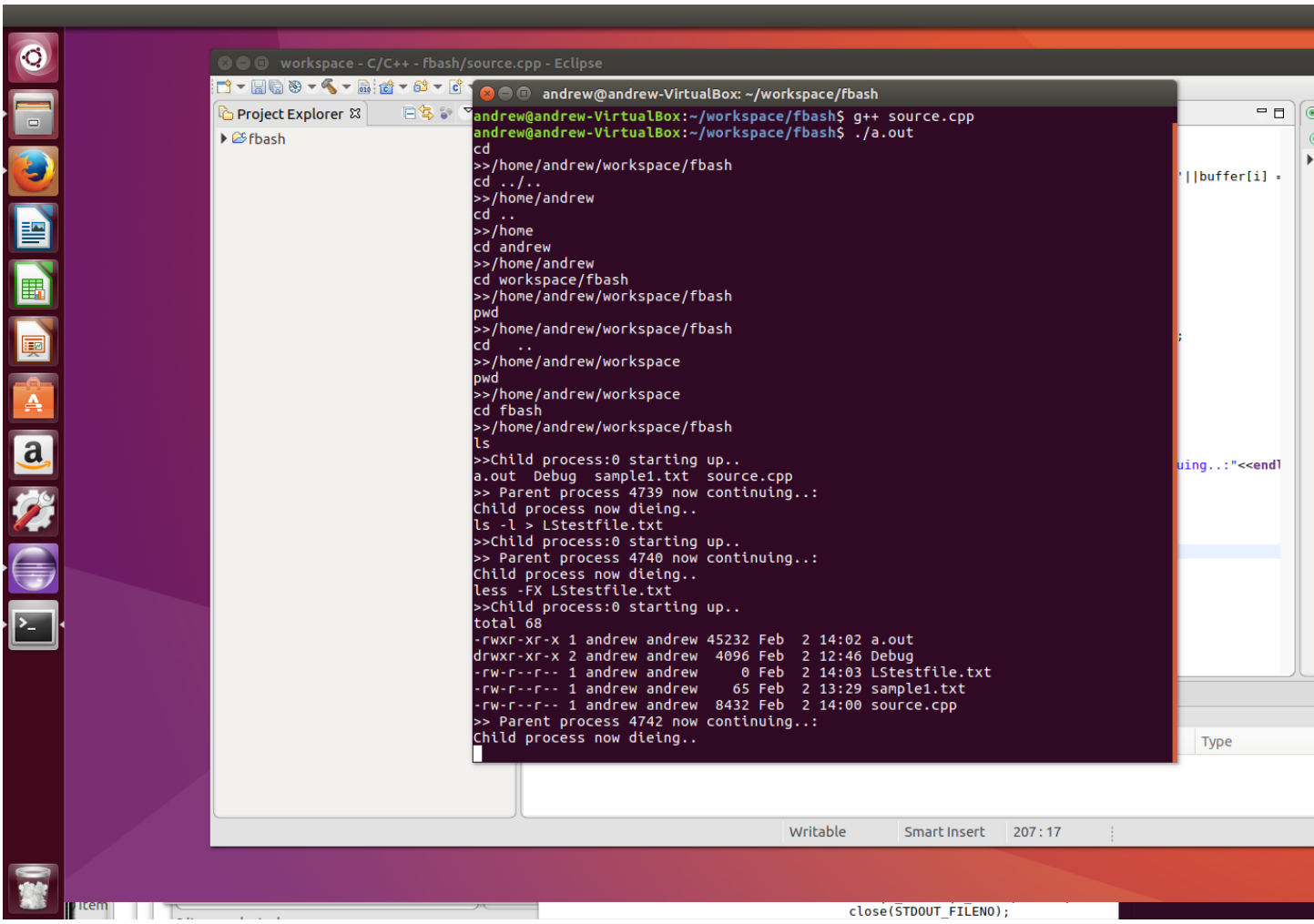
```
                        if (cmdptr->argv[i+1]=='\0')
                                changedir_test = 1;
                        else if (cmdptr->argv[i+1]==std::string(".."))
                                changedir_test = chdir("..");
                        else if (cmdptr->argv[i+1]==std::string("../.."))
                                changedir_test = chdir("../..");
                        else if (cmdptr->argv[i+1]!='\0')
                                changedir_test = chdir(cmdptr->argv[i+1]);

                        if (changedir_test == -1)
                                cout<<">>Error:Did not change directories."<<endl;
                        if (changedir_test != -1)
                                {
                                        USER_PWD();
                                        return true;
                                }
                }// if cd

                if (cmdptr->argv[i]==std::string("pwd"))
                        {
                                USER_PWD();
                                return true;
                        }
        }// end for
return temp;
}// end non_exe
void USER_PWD()
{
        char buffer[200];
        char *newpath = getcwd(buffer,200);
        string currpath = newpath;
        cout<<">>"<<currpath<<endl;
}
void sig_handler (int sig)
{
        if (sig == SIGINT)
                quit_process();
}
void quit_process()
{
        cout<<"\nExiting.."<<endl;
        pid_t myid = getpid();
        kill (myid,SIGTERM);
        exit(0);
}
```


Project Explorer
fbash
extracomments
source.cpp
#include <ctype.h>
#include <algorithm>
#include <string.h>
#include <stdio.h>
#include <signal.h>
#include <fcntl.h>
#include <sys/stat.h>
#include <queue>
#include <signal.h>
using namespace std;
struct args
{
int argc;
char **argv;
};
args* parser(char*); // Parses arguments and
void order(char*); // Sets up order of func
char* S2C(string,int);// Converts a string to
bool dir(args*); // Changes and displays
void USER_PWD(); // Displays current work
void fork_off(args *);// Creates child process
void sig_handler (int);// Catches ctrl-C and c
void quit_process(); // Terminates current pr
int main(int argc,char *argv[])
void order(char *input)
void fork_off(args *aptr)
args* parser(char* argv)
char* S2C(string segment,int mysize)
bool dir(args *cmdptr)
void USER_PWD()
void sig_handler (int sig)
void quit_process()
{
cout<<"\nExiting.."<<endl;
pid_t myid = getpid();
kill (myid,SIGTERM);
exit(0);
}
andrew@andrew-VirtualBox: ~/workspace/fbash
andrew@andrew-VirtualBox:~$ cd workspace/fbash
andrew@andrew-VirtualBox:~/workspace/fbash$ g++ source.cpp
andrew@andrew-VirtualBox:~/workspace/fbash$ ./a.out
echo Here is some text to a file > sample1.txt
>>Child process:0 starting up..
>> Parent process 4253 now continuing..:
less -FX sample1.txt
>>Child process:0 starting up..
Here is some text to a file
>> Parent process 4255 now continuing..:
echo Here is the appended text to my file >> sample1.txt
>>Child process:0 starting up..
>> Parent process 4263 now continuing..:
less -FX sample1.txt
>>Child process:0 starting up..
Here is some text to a file
Here is the appended text to my file
>> Parent process 4265 now continuing..:
cal
>>Child process:0 starting up..
February 2017
Su Mo Tu We Th Fr Sa
1 2 3 4
5 6 7 8 9 10 11
12 13 14 15 16 17 18
19 20 21 22 23 24 25
26 27 28
>> Parent process 4273 now continuing..:
ls
Problems
Tasks
Console
Properties
Call Graph
Error Log
0 items
Description
Resource
Path
Location
Type
Writable
Smart Insert
3 : 3


workspace - C/C++ - fbash/source.cpp - Eclipse
Project Explorer
fbash
andrew@andrew-VirtualBox: ~/workspace/fbash
mount
>>Child process:0 starting up..
sysfs on /sys type sysfs (rw,nosuid,nodev,noexec,relatime)
proc on /proc type proc (rw,nosuid,nodev,noexec,relatime)
udev on /dev type devtmpfs (rw,nosuid,relatime,size=1002152k,nr_inodes=250538,mode=755)
devpts on /dev/pts type devpts (rw,nosuid,noexec,relatime,gid=5,mode=620,ptmxmode=000)
tmpfs on /run type tmpfs (rw,nosuid,noexec,relatime,size=204780k,mode=755)
/dev/sda1 on / type ext4 (rw,relatime,errors=remount-ro,data=ordered)
securityfs on /sys/kernel/security type securityfs (rw,nosuid,nodev,noexec,relatime)
tmpfs on /dev/shm type tmpfs (rw,nosuid,nodev)
tmpfs on /run/lock type tmpfs (rw,nosuid,nodev,noexec,relatime,size=5120k)
tmpfs on /sys/fs/cgroup type tmpfs (rw,mode=755)
cgroup on /sys/fs/cgroup/systemd type cgroup (rw,nosuid,nodev,noexec,relatime,xattr,release_agent=/lib/systemd/systemd-cgroups-agent,name=systemd)
pstore on /sys/fs/pstore type pstore (rw,nosuid,nodev,noexec,relatime)
cgroup on /sys/fs/cgroup/devices type cgroup (rw,nosuid,nodev,noexec,relatime,devices)
cgroup on /sys/fs/cgroup/cpu,cpuacct type cgroup (rw,nosuid,nodev,noexec,relatime,cpu,cpuacct)
cgroup on /sys/fs/cgroup/blkio type cgroup (rw,nosuid,nodev,noexec,relatime,blkio)
cgroup on /sys/fs/cgroup/pids type cgroup (rw,nosuid,nodev,noexec,relatime,pids,release_agent=/run/cgmanager/agents/cgm-release-agent.pids)
cgroup on /sys/fs/cgroup/cpuset type cgroup (rw,nosuid,nodev,noexec,relatime,cpuset,clone_children)
cgroup on /sys/fs/cgroup/memory type cgroup (rw,nosuid,nodev,noexec,relatime,memory)
cgroup on /sys/fs/cgroup/net_cls,net_prio type cgroup (rw,nosuid,nodev,noexec,relatime,net_cls,net_prio)
cgroup on /sys/fs/cgroup/perf_event type cgroup (rw,nosuid,nodev,noexec,relatime,perf_event,release_agent=/run/cgmanager/agents/cgm-release-agent.perf_event)
cgroup on /sys/fs/cgroup/hugetlb type cgroup (rw,nosuid,nodev,noexec,relatime,hugetlb,release_agent=/run/cgmanager/agents/cgm-release-agent.hugetlb)
cgroup on /sys/fs/cgroup/freezer type cgroup (rw,nosuid,nodev,noexec,relatime,freezer)
systemd-1 on /proc/sys/fs/binfmt_misc type autofs (rw,relatime,fd=25,pgrp=1,timeout=0,minproto=5,maxproto=5,direct,pipe_ino=11534)
Type
Writable
Smart Insert
207 : 17


workspace - C/C++ - fbash/source.cpp - Eclipse
Project Explorer
fbash
andrew@andrew-VirtualBox: ~/workspace/fbash
cgroup on /sys/fs/cgroup/pids type cgroup (rw,nosuid,nodev,noexec,relatime,pids,release_agent=/run/cgmanager/agents/cgm-release-agent.pids)
cgroup on /sys/fs/cgroup/cpuset type cgroup (rw,nosuid,nodev,noexec,relatime,cpuset,clone_children)
cgroup on /sys/fs/cgroup/memory type cgroup (rw,nosuid,nodev,noexec,relatime,memory)
cgroup on /sys/fs/cgroup/net_cls,net_prio type cgroup (rw,nosuid,nodev,noexec,relatime,net_cls,net_prio)
cgroup on /sys/fs/cgroup/perf_event type cgroup (rw,nosuid,nodev,noexec,relatime,perf_event,release_agent=/run/cgmanager/agents/cgm-release-agent.perf_event)
cgroup on /sys/fs/cgroup/hugetlb type cgroup (rw,nosuid,nodev,noexec,relatime,hugetlb,release_agent=/run/cgmanager/agents/cgm-release-agent.hugetlb)
cgroup on /sys/fs/cgroup/freezer type cgroup (rw,nosuid,nodev,noexec,relatime,freezer)
systemd-1 on /proc/sys/fs/binfmt_misc type autofs (rw,relatime,fd=25,pgrp=1,timeout=0,minproto=5,maxproto=5,direct,pipe_ino=11534)
debugfs on /sys/kernel/debug type debugfs (rw,relatime)
hugetlbfs on /dev/hugepages type hugetlbfs (rw,relatime)
mqueue on /dev/mqueue type mqueue (rw,relatime)
fusectl on /sys/fs/fuse/connections type fusectl (rw,relatime)
binfmt_misc on /proc/sys/fs/binfmt_misc type binfmt_misc (rw,relatime)
tmpfs on /run/user/1000 type tmpfs (rw,nosuid,nodev,relatime,size=204776k,mode=700,uid=1000,gid=1000)
gvfsd-fuse on /run/user/1000/gvfs type fuse.gvfsd-fuse (rw,nosuid,nodev,relatime,user_id=1000,group_id=1000)
>> Parent process 4775 now continuing..:
Child process now dieing..
df -h
>>Child process:0 starting up..
Filesystem Size Used Avail Use% Mounted on
udev 979M 0 979M 0% /dev
tmpfs 200M 6.4M 194M 4% /run
/dev/sda1 9.8G 5.6G 3.8G 60% /
tmpfs 1000M 30M 971M 3% /dev/shm
tmpfs 5.0M 4.0K 5.0M 1% /run/lock
tmpfs 1000M 0 1000M 0% /sys/fs/cgroup
tmpfs 200M 124K 200M 1% /run/user/1000
>> Parent process 4789 now continuing..:
Child process now dieing..
Type
Writable
Smart Insert
207 : 17


andrew@andrew-VirtualBox: ~/workspace/fbash
cd /
>>/
ls
>>Child process:0 starting up..
bin dev initrd.img lib64 mnt root snap tmp vmlinuz
boot etc initrd.img.old lost+found opt run srv usr vmlinuz.old
cdrom home lib media proc sbin sys var
>> Parent process 4846 now continuing..:
Child process now dieing..
cd home
>>/home
ls
>>Child process:0 starting up..
andrew
>> Parent process 4847 now continuing..:
Child process now dieing..
cd andrew/workspace/fbash
>>/home/andrew/workspace/fbash
ls
>>Child process:0 starting up..
a.out Debug LStestfile.txt sample1.txt source.cpp
>> Parent process 4848 now continuing..:
Child process now dieing..
date
>>Child process:0 starting up..
Thu Feb 2 14:11:52 EST 2017
>> Parent process 4850 now continuing..:
Child process now dieing..
df -h > diskinfo.txt
>>Child process:0 starting up..
>> Parent process 4854 now continuing..:
Child process now dieing..
less -FX diskinfo.txt
>>Child process:0 starting up..
Filesystem Size Used Avail Use% Mounted on
udev 979M 0 979M 0% /dev
tmpfs 200M 6.4M 194M 4% /run
/dev/sda1 9.8G 5.6G 3.8G 60% /
tmpfs 1000M 30M 971M 3% /dev/shm
tmpfs 5.0M 4.0K 5.0M 1% /run/lock
tmpfs 1000M 0 1000M 0% /sys/fs/cgroup
tmpfs 200M 120K 200M 1% /run/user/1000
>> Parent process 4856 now continuing..:
Child process now dieing..
^C
Exiting..
Terminated
andrew@andrew-VirtualBox:~/workspace/fbash$


workspace - C/C++ - fbash/source.cpp - Eclipse
Project Explorer
fbash
andrew@andrew-VirtualBox: ~/workspace/fbash
andrew@andrew-VirtualBox:~/workspace/fbash$ g++ source.cpp
andrew@andrew-VirtualBox:~/workspace/fbash$ ./a.out
cd
>>/home/andrew/workspace/fbash
cd ../..
>>/home/andrew
cd ..
>>/home
cd andrew
>>/home/andrew
cd workspace/fbash
>>/home/andrew/workspace/fbash
pwd
>>/home/andrew/workspace/fbash
cd ..
>>/home/andrew/workspace
pwd
>>/home/andrew/workspace
cd fbash
>>/home/andrew/workspace/fbash
ls
>>Child process:0 starting up..
a.out Debug sample1.txt source.cpp
>> Parent process 4739 now continuing..:
Child process now dieing..
ls -l > LStestfile.txt
>>Child process:0 starting up..
>> Parent process 4740 now continuing..:
Child process now dieing..
less -FX LStestfile.txt
>>Child process:0 starting up..
total 68
-rwxr-xr-x 1 andrew andrew 45232 Feb 2 14:02 a.out
drwxr-xr-x 2 andrew andrew 4096 Feb 2 12:46 Debug
-rw-r--r-- 1 andrew andrew 0 Feb 2 14:03 LStestfile.txt
-rw-r--r-- 1 andrew andrew 65 Feb 2 13:29 sample1.txt
-rw-r--r-- 1 andrew andrew 8432 Feb 2 14:00 source.cpp
>> Parent process 4742 now continuing..:
Child process now dieing..
Type
Writable
Smart Insert
207 : 17
close(STDOUT_FILENO);