

Homework 2 (100 Pts) - Due Sunday February 10th (before midnight)
Revision 2019.01.25

Name: Monish H Nene

[Problem 1] Record your Repository

Provide us a Github link to your repositories. Include a link to the repository on the top of your assignment to turn in. 2

Answer: <https://github.com/monishnene>

[Problem 2 - 20 Pts] Track system calls and library calls with File IO

Show all 3 outputs (ltrace, strace, perf) in your report.

Answer:

ltrace host

```
Activities Terminal Fri 20:13 monish: HW2
File Edit View Search Terminal Help
0.000000 SYS_brk(0) = 0x561d87291000 <0.000048>
0.000751 SYS_access("/etc/ld.so.nohwcap", 00) = -2 <0.000100>
0.000221 SYS_access("/etc/ld.so.preload", 04) = -2 <0.000089>
0.000485 SYS_openat(0xffffffff9c, 0x7f3b08470428, 0x80000, 0) = 3 <0.000084>
0.000124 SYS_fstat(3, 0x7ffedac665a0) = 0 <0.000014>
0.000029 SYS_mmap(0, 0x157db, 1, 2) = 0x7f3b08660000 <0.000037>
0.000061 SYS_close(3) = 0 <0.000012>
0.000044 SYS_access("/etc/ld.so.nohwcap", 00) = -2 <0.000076>
0.000204 SYS_openat(0xffffffff9c, 0x7f3b08678dd0, 0x80000, 0) = 3 <0.000107>
0.001100 SYS_read(3, "\177ELF\002\001\001\003", 832) = 832 <0.000577>
0.000659 SYS_fstat(3, 0x7ffedac66600) = 0 <0.000029>
0.000051 SYS_mmap(0, 8192, 3, 34) = 0x7f3b0865e000 <0.000051>
0.000091 SYS_mmap(0, 0x3f0ae0, 5, 2050) = 0x7f3b0805e000 <0.000037>
0.000066 SYS_mprotect(0x7f3b08245000, 2097152, 0) = 0 <0.000027>
0.000044 SYS_mmap(0x7f3b08445000, 0x6000, 3, 2066) = 0x7f3b08445000 <0.000039>
0.000074 SYS_mmap(0x7f3b0844b000, 0x3ae0, 3, 50) = 0x7f3b0844b000 <0.000183>
0.000229 SYS_close(3) = 0 <0.000016>
0.000061 SYS_arch_prctl(4098, 0x7f3b0865f4c0, 0x7f3b0865fe10, 0x7f3b0865e998) = 0 <0.000030>
0.000137 SYS_mprotect(0x7f3b08445000, 16384, 1) = 0 <0.000027>
0.000052 SYS_mprotect(0x561d85ddd000, 4096, 1) = 0 <0.000026>
0.000191 SYS_mprotect(0x7f3b08676000, 4096, 1) = 0 <0.000029>
0.000052 SYS_munmap(0x7f3b08660000, 88027) = 0 <0.000043>
0.004569 malloc(100 <unfinished ...>
0.000557 SYS_brk(0) = 0x561d87291000 <0.000046>
0.000046 SYS_brk(0x561d872b2000) = 0x561d872b2000 <0.000018>
0.000054 <... malloc resumed> ) = 0x561d87291260 <0.000646>
0.000030 malloc(100) = 0x561d872912d0 <0.000118>
0.000172 strlen("commandline_test_string ") = 24 <0.000185>
0.000222 fopen("test.txt", "w" <unfinished ...>
0.000556 SYS_openat(0xffffffff9c, 0x561d85bdce63, 577, 438) = 3 <0.000164>
0.000202 <... fopen resumed> ) = 0x561d87291340 <0.000750>
0.000031 fwrite("commandline_test_string ", 1, 24, 0x561d87291340 <unfinished ...>
0.000344 SYS_fstat(3, 0x7ffedac66d70) = 0 <0.000030>
0.000056 <... fwrite resumed> ) = 24 <0.000392>
0.000029 fclose(0x561d87291340 <unfinished ...>
0.000298 SYS_write(3, "commandline_test_string ", 24) = 24 <0.000138>
0.000165 SYS_close(3) = 0 <0.000078>
0.000128 <... fclose resumed> ) = 0 <0.000582>
0.000031 malloc(100) = 0x561d87291570 <0.000281>
0.000324 sprintf("chmod 222 test.txt", "chmod %d %s", 222, "test.txt") = 18 <0.000153>
0.000308 system("chmod 222 test.txt" <unfinished ...>
0.000176 SYS_rt_sigaction(2, 0x7ffedac66c20, 0x7ffedac66cc0, 8) = 0 <0.000050>
0.000070 SYS_rt_sigaction(3, 0x7ffedac66c20, 0x7ffedac66cc0, 8) = 0 <0.000028>
0.000054 SYS_rt_sigprocmask(0, 0x7ffedac66e58, 0x7ffedac66dd0, 8) = 0 <0.000028>
0.000053 SYS_clone(0x100011, 0, 0x7ffedac66d8c, 8) = 0x3449 <0.000332>
0.000377 SYS_wait4(0x3449, 0x7ffedac66d88, 0, 0) = 0x3449 <0.005361>
0.005482 SYS_rt_sigaction(2, 0x7ffedac66c20, 0, 8) = 0 <0.000044>
0.000073 SYS_rt_sigaction(3, 0x7ffedac66c20, 0, 8) = 0 <0.000028>
```

File Edit View Search Terminal Help

```

0.000377 SYS_wait4(0x3449, 0x7ffedac66d88, 0, 0) = 0x3449 <0.005361>
0.005482 SYS_rt_sigaction(2, 0x7ffedac66c20, 0, 8) = 0 <0.000044>
0.000073 SYS_rt_sigaction(3, 0x7ffedac66c20, 0, 8) = 0 <0.000028>
0.000054 SYS_rt_sigprocmask(2, 0x7ffedac66dd0, 0, 8) = 0 <0.000027>
0.000062 --- SIGCHLD (Child exited) ---
0.000022 <... system resumed> ) = 0 <0.006418>
0.000036 free(0x561d87291570) = <void> <0.000414>
0.000460 strlen("This string is appended\n") = 24 <0.000187>
0.000225 fopen("test.txt", "a" <unfinished ...>
0.000178 SYS_openat(0xffffffff9c, 0x561d85bdce63, 1089, 438) = 3 <0.000067>
0.000077 SYS_lseek(3, 0, 2) = 24 <0.000017>
0.000040 <... fopen resumed> ) = 0x561d87291340 <0.000288>
0.000029 fwrite("This string is appended\n", 1, 24, 0x561d87291340 <unfinished ...>
0.000515 SYS_fstat(3, 0x7ffedac66d70) = 0 <0.000041>
0.000067 <... fwrite resumed> ) = 24 <0.000570>
0.000031 fclose(0x561d87291340 <unfinished ...>
0.000153 SYS_write(3, "This string is appended\n", 24) = 24 <0.000154>
0.000181 SYS_close(3) = 0 <0.000032>
0.000078 <... fclose resumed> ) = 0 <0.000403>
0.000031 fopen("test.txt", "r" <unfinished ...>
0.000166 SYS_openat(0xffffffff9c, 0x561d85bdce63, 0, 0) = 3 <0.000058>
0.000085 <... fopen resumed> ) = 0x561d87291340 <0.000245>
0.000028 malloc(100) = 0x561d87291570 <0.006972>
0.008144 sprintf("chmod 444 test.txt", "chmod %d %s", 444, "test.txt") = 18 <0.000503>
0.001525 system("chmod 444 test.txt" <unfinished ...>
0.005065 SYS_rt_sigaction(2, 0x7ffedac66c20, 0x7ffedac66cc0, 8) = 0 <0.000087>
0.000101 SYS_rt_sigaction(3, 0x7ffedac66c20, 0x7ffedac66cc0, 8) = 0 <0.000031>
0.000060 SYS_rt_sigprocmask(0, 0x7ffedac66e58, 0x7ffedac66dd0, 8) = 0 <0.000030>
0.000057 SYS_clone(0x100011, 0, 0x7ffedac66d8c, 8) = 0x344b <0.000186>
0.000227 SYS_wait4(0x344b, 0x7ffedac66d88, 0, 0) = 0x344b <0.005665>
0.005796 SYS_rt_sigaction(2, 0x7ffedac66c20, 0, 8) = 0 <0.000092>
0.000125 SYS_rt_sigaction(3, 0x7ffedac66c20, 0, 8) = 0 <0.000028>
0.000055 SYS_rt_sigprocmask(2, 0x7ffedac66dd0, 0, 8) = 0 <0.000028>
0.000057 --- SIGCHLD (Child exited) ---
0.000207 <... system resumed> ) = 0 <0.011560>
0.000203 free(0x561d87291570) = <void> <0.000166>
0.000214 fgetc(0x561d87291340 <unfinished ...>
0.000115 SYS_fstat(3, 0x7ffedac66e10) = 0 <0.000027>
0.000039 SYS_read(3, "commandline_test_string This str"..., 4096) = 48 <0.000020>
0.000117 <... fgetc resumed> ) = 'c' <0.000265>
0.000024 printf("read char output = %c\n", 'c' <unfinished ...>
0.000181 SYS_fstat(1, 0x7ffedac66790) = 0 <0.000025>
0.000033 SYS_write(1, "read char output = c\n", 21) = 21 <0.001022>
0.001769 <... printf resumed> ) = 21 <0.001961>
0.000050 fgets("ommandline_test_string This stri"..., 100, 0x561d87291340) = 0x561d87291260 <0.000338>
0.000909 printf("read string output = %s\n", "ommandline_test_string This stri"... <unfinished ...>

```



```
monish: HW2
File Edit View Search Terminal Help
0.005065 SYS_rt_sigaction(2, 0x7ffedac66c20, 0x7ffedac66cc0, 8) = 0 <0.000087>
0.000101 SYS_rt_sigaction(3, 0x7ffedac66c20, 0x7ffedac66cc0, 8) = 0 <0.000031>
0.000060 SYS_rt_sigprocmask(0, 0x7ffedac66e58, 0x7ffedac66dd0, 8) = 0 <0.000030>
0.000057 SYS_clone(0x100011, 0, 0x7ffedac66d8c, 8) = 0x344b <0.000186>
0.000227 SYS_wait4(0x344b, 0x7ffedac66d88, 0, 0) = 0x344b <0.005665>
0.005796 SYS_rt_sigaction(2, 0x7ffedac66c20, 0, 8) = 0 <0.000092>
0.000125 SYS_rt_sigaction(3, 0x7ffedac66c20, 0, 8) = 0 <0.000028>
0.000055 SYS_rt_sigprocmask(2, 0x7ffedac66dd0, 0, 8) = 0 <0.000028>
0.000057 --- SIGCHLD (Child exited) ---
0.000207 <... system resumed> ) = 0 <0.011560>
0.000203 free(0x561d87291570) = <void> <0.000166>
0.000214 fgetc(0x561d87291340 <unfinished ...>
0.000115 SYS_fstat(3, 0x7ffedac66e10) = 0 <0.000027>
0.000039 SYS_read(3, "commandline_test_string This str"... , 4096) = 48 <0.000020>
0.000117 <... fgetc resumed> ) = 'c' <0.000265>
0.000024 printf("read char output = %c\n", 'c' <unfinished ...>
0.000181 SYS_fstat(1, 0x7ffedac66790) = 0 <0.000025>
0.000033 SYS_write(1, "read char output = c\n", 21) = 21 <0.001022>
0.001769 <... printf resumed> ) = 21 <0.001961>
0.000050 fgets("ommandline_test_string This stri"... , 100, 0x561d87291340) = 0x561d87291260 <0.000338>
0.000909 printf("read string output = %s\n", "ommandline_test_string This stri"... <unfinished ...>
0.000385 SYS_write(1, "read string output = ommandline_"... , 68) = 68 <0.000558>
0.000585 SYS_write(1, "\n", 1) = 1 <0.000070>
0.000112 <... printf resumed> ) = 69 <0.001069>
0.000035 malloc(100) = 0x561d87291570 <0.000149>
0.000187 sprintf("chmod 666 test.txt", "chmod %d %s", 666, "test.txt") = 18 <0.000279>
0.000434 system("chmod 666 test.txt" <unfinished ...>
0.000512 SYS_rt_sigaction(2, 0x7ffedac66c20, 0x7ffedac66cc0, 8) = 0 <0.000072>
0.000090 SYS_rt_sigaction(3, 0x7ffedac66c20, 0x7ffedac66cc0, 8) = 0 <0.000028>
0.000337 SYS_rt_sigprocmask(0, 0x7ffedac66e58, 0x7ffedac66dd0, 8) = 0 <0.000049>
0.000092 SYS_clone(0x100011, 0, 0x7ffedac66d8c, 8) = 0x344d <0.000282>
0.000409 SYS_wait4(0x344d, 0x7ffedac66d88, 0, 0) = 0x344d <0.014822>
0.015066 SYS_rt_sigaction(2, 0x7ffedac66c20, 0, 8) = 0 <0.000042>
0.000069 SYS_rt_sigaction(3, 0x7ffedac66c20, 0, 8) = 0 <0.000026>
0.000051 SYS_rt_sigprocmask(2, 0x7ffedac66dd0, 0, 8) = 0 <0.000026>
0.000052 --- SIGCHLD (Child exited) ---
0.000021 <... system resumed> ) = 0 <0.016693>
0.000040 free(0x561d87291570) = <void> <0.000164>
0.000215 fflush(0x7f3b08449a00) = 0 <0.017351>
0.017501 fclose(0x561d87291340 <unfinished ...>
0.001961 SYS_close(3) = 0 <0.000829>
0.000776 <... fclose resumed> ) = 0 <0.002257>
0.001358 free(0x561d87291260) = <void> <0.001474>
0.001542 free(0x561d872912d0) = <void> <0.000151>
0.000211 SYS_exit_group(0 <no return ...>
0.000169 +++ exited (status 0) +++

116,3 Bot
```

Strace host

```
monish: HW2
File Edit View Search Terminal Help
0.000000 execve("./fileio.elf", ["/fileio.elf", "commandline_test_string"], 0x7fffc5f085d8
/* 17 vars */) = 0 <0.000203>
0.000614 brk(NULL) = 0x55d435691000 <0.000007>
0.000206 access("/etc/ld.so.nohwcap", F_OK) = -1 ENOENT (No such file or directory) <0.00001
3>
0.000069 access("/etc/ld.so.preload", R_OK) = -1 ENOENT (No such file or directory) <0.00000
8>
0.000035 openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3 <0.000015>
0.000038 fstat(3, {st_mode=S_IFREG|0644, st_size=88027, ...}) = 0 <0.000007>
0.000033 mmap(NULL, 88027, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7f4a858ea000 <0.000008>
0.000028 close(3) = 0 <0.000006>
0.000031 access("/etc/ld.so.nohwcap", F_OK) = -1 ENOENT (No such file or directory) <0.00000
8>
0.000035 openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libc.so.6", O_RDONLY|O_CLOEXEC) = 3 <0.0000
11>
0.000030 read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\3\0\0\0\1\0\0\0\260\34\2\0\0\0\0\0"...
) = 832 <0.000008>
0.000029 fstat(3, {st_mode=S_IFREG|0755, st_size=2030544, ...}) = 0 <0.000006>
0.000027 mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f4a85
8e8000 <0.000007>
0.000167 mmap(NULL, 4131552, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f4a8
52e8000 <0.000019>
0.000049 mprotect(0x7f4a854cf000, 2097152, PROT_NONE) = 0 <0.000019>
0.000037 mmap(0x7f4a856cf000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRI
TE, 3, 0x1e7000) = 0x7f4a856cf000 <0.000015>
0.000042 mmap(0x7f4a856d5000, 15072, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMO
US, -1, 0) = 0x7f4a856d5000 <0.000009>
0.000039 close(3) = 0 <0.000006>
0.000044 arch_prctl(ARCH_SET_FS, 0x7f4a858e94c0) = 0 <0.000006>
0.000111 mprotect(0x7f4a856cf000, 16384, PROT_READ) = 0 <0.000015>
0.000043 mprotect(0x55d435261000, 4096, PROT_READ) = 0 <0.000011>
0.000038 mprotect(0x7f4a85900000, 4096, PROT_READ) = 0 <0.000033>
0.000053 munmap(0x7f4a858ea000, 88027) = 0 <0.001337>
0.002249 brk(NULL) = 0x55d435691000 <0.000011>
0.000049 brk(0x55d4356b2000) = 0x55d4356b2000 <0.000013>
0.000195 openat(AT_FDCWD, "test.txt", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 3 <0.000095>
0.000149 fstat(3, {st_mode=S_IFREG|0666, st_size=0, ...}) = 0 <0.000008>
0.000470 write(3, "commandline_test_string ", 24) = 24 <0.000482>
0.000527 close(3) = 0 <0.000387>
0.000497 rt_sigaction(SIGINT, {sa_handler=SIG_IGN, sa_mask=[], sa_flags=SA_RESTORER, sa_rest
orer=0x7f4a85326f20}, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=0}, 8) = 0 <0.000008>
0.000049 rt_sigaction(SIGQUIT, {sa_handler=SIG_IGN, sa_mask=[], sa_flags=SA_RESTORER, sa_res
torer=0x7f4a85326f20}, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=0}, 8) = 0 <0.000006>
0.000028 rt_sigprocmask(SIG_BLOCK, [CHLD], [], 8) = 0 <0.000007>
0.000030 clone(child_stack=NULL, flags=CLONE_PARENT_SETTID|SIGCHLD, parent_tidptr=0x7ffeb783
76ec) = 13395 <0.000704>
0.000801 wait4(13395, [{WIFEXITED(s) && WEXITSTATUS(s) == 0}], 0, NULL) = 13395 <0.015086>
@@@
1,1 Top
```


File Edit View Search Terminal Help

```

0.000527 close(3) = 0 <0.000387>
0.000497 rt_sigaction(SIGINT, {sa_handler=SIG_IGN, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0x7f4a85326f20}, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=0}, 8) = 0 <0.000008>
0.000049 rt_sigaction(SIGQUIT, {sa_handler=SIG_IGN, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0x7f4a85326f20}, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=0}, 8) = 0 <0.000006>
0.000028 rt_sigprocmask(SIG_BLOCK, [CHLD], [], 8) = 0 <0.000007>
0.000030 clone(child_stack=NULL, flags=CLONE_PARENT_SETTID|SIGCHLD, parent_tidptr=0x7ffeb78376ec) = 13395 <0.000704>
0.000801 wait4(13395, [{WIFEXITED(s) && WEXITSTATUS(s) == 0}], 0, NULL) = 13395 <0.015086>
0.015176 rt_sigaction(SIGINT, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0x7f4a85326f20}, NULL, 8) = 0 <0.000008>
0.000036 rt_sigaction(SIGQUIT, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0x7f4a85326f20}, NULL, 8) = 0 <0.000006>
0.000027 rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0 <0.000007>
0.000026 --- SIGCHLD {si_signo=SIGCHLD, si_code=CLD_EXITED, si_pid=13395, si_uid=0, si_status=0, si_utime=0, si_stime=0} ---
0.000024 openat(AT_FDCWD, "test.txt", O_WRONLY|O_CREAT|O_APPEND, 0666) = 3 <0.000022>
0.000051 lseek(3, 0, SEEK_END) = 24 <0.000006>
0.000026 fstat(3, {st_mode=S_IFREG|0222, st_size=24, ...}) = 0 <0.000007>
0.000034 write(3, "This string is appended\n", 24) = 24 <0.000024>
0.000054 close(3) = 0 <0.000014>
0.000040 openat(AT_FDCWD, "test.txt", O_RDONLY) = 3 <0.000011>
0.000037 rt_sigaction(SIGINT, {sa_handler=SIG_IGN, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0x7f4a85326f20}, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0x7f4a85326f20}, 8) = 0 <0.000007>
0.000042 rt_sigaction(SIGQUIT, {sa_handler=SIG_IGN, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0x7f4a85326f20}, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0x7f4a85326f20}, 8) = 0 <0.000006>
0.000030 rt_sigprocmask(SIG_BLOCK, [CHLD], [], 8) = 0 <0.000007>
0.000028 clone(child_stack=NULL, flags=CLONE_PARENT_SETTID|SIGCHLD, parent_tidptr=0x7ffeb78376ec) = 13397 <0.000059>
0.000084 wait4(13397, [{WIFEXITED(s) && WEXITSTATUS(s) == 0}], 0, NULL) = 13397 <0.011376>
0.011438 rt_sigaction(SIGINT, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0x7f4a85326f20}, NULL, 8) = 0 <0.000007>
0.000033 rt_sigaction(SIGQUIT, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0x7f4a85326f20}, NULL, 8) = 0 <0.000006>
0.000027 rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0 <0.000006>
0.000025 --- SIGCHLD {si_signo=SIGCHLD, si_code=CLD_EXITED, si_pid=13397, si_uid=0, si_status=0, si_utime=0, si_stime=0} ---
0.000020 fstat(3, {st_mode=S_IFREG|0444, st_size=48, ...}) = 0 <0.000008>
0.000034 read(3, "commandline_test_string This str...", 4096) = 48 <0.000011>
0.000035 fstat(1, {st_mode=S_IFCHR|0620, st_rdev=makedev(136, 1), ...}) = 0 <0.000007>
0.000030 write(1, "read char output = c\n", 21) = 21 <0.000138>
0.000171 write(1, "read string output = ommandline_", 68) = 68 <0.000206>
0.000239 write(1, "\n", 1) = 1 <0.000038>
0.000071 rt_sigaction(SIGINT, {sa_handler=SIG_IGN, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0x7f4a85326f20}, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0x7f4a85326f20}, 8) = 0 <0.000007>

```

32,1

46%

```

monish: HW2
File Edit View Search Terminal Help
0.000020 fstat(3, {st_mode=S_IFREG|0444, st_size=48, ...}) = 0 <0.000008>
0.000034 read(3, "commandline_test_string This str"... , 4096) = 48 <0.000011>
0.000035 fstat(1, {st_mode=S_IFCHR|0620, st_rdev=makedev(136, 1), ...}) = 0 <0.000007>
0.000030 write(1, "read char output = c\n", 21) = 21 <0.000138>
0.000171 write(1, "read string output = ommandline_"..., 68) = 68 <0.000206>
0.000239 write(1, "\n", 1) = 1 <0.000038>
0.000071 rt_sigaction(SIGINT, {sa_handler=SIG_IGN, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0x7f4a85326f20}, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0x7f4a85326f20}, 8) = 0 <0.000007>
0.000034 rt_sigaction(SIGQUIT, {sa_handler=SIG_IGN, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0x7f4a85326f20}, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0x7f4a85326f20}, 8) = 0 <0.000006>
0.000029 rt_sigprocmask(SIG_BLOCK, [CHLD], [], 8) = 0 <0.000006>
0.000028 clone(child_stack=NULL, flags=CLONE_PARENT_SETTID|SIGCHLD, parent_tidptr=0x7ffeb78376ec) = 13399 <0.000063>
0.000086 wait4(13399, [{WIFEXITED(s) && WEXITSTATUS(s) == 0}], 0, NULL) = 13399 <0.009735>
0.009808 rt_sigaction(SIGINT, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0x7f4a85326f20}, NULL, 8) = 0 <0.000008>
0.000035 rt_sigaction(SIGQUIT, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0x7f4a85326f20}, NULL, 8) = 0 <0.000008>
0.000028 rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0 <0.000006>
0.000026 --- SIGCHLD {si_signo=SIGCHLD, si_code=CLD_EXITED, si_pid=13399, si_uid=0, si_status=0, si_utime=0, si_stime=0} ---
0.000025 close(3) = 0 <0.000009>
0.000048 exit_group(0) = ?
0.000127 +++ exited with 0 +++
% time      seconds  usecs/call     calls    errors syscall
-----
85.59      0.011118      3706         3          wait4
 6.05      0.000786       262         3          clone
 2.60      0.000338       338         1          munmap
 2.17      0.000282        56         5          close
 2.13      0.000277        55         5          write
 0.78      0.000101        20         5          openat
 0.26      0.000034         3        12          rt_sigaction
 0.12      0.000016         3         6          rt_sigprocmask
 0.12      0.000015         5         3          brk
 0.11      0.000014         2         6          fstat
 0.05      0.000007         4         2          read
 0.02      0.000002         2         1          lseek
 0.00      0.000000         0         5          mmap
 0.00      0.000000         0         4          mprotect
 0.00      0.000000         0         3          access
 0.00      0.000000         0         1          execve
 0.00      0.000000         0         1          arch_prctl
-----
100.00      0.012990          66         3 total

```

92,1

Bot

Perf host


```

File Edit Log Configuration Controlsignals View Help
[ 1.590559] ledtrig-cpu: registered to indicate activity on CPUs
[ 1.599785] oprofile: using arm/armv7
[ 1.604342] Initializing XFRM netlink socket
[ 1.609226] NET: Registered protocol family 10
[ 1.621510] Segment Routing with IPv6
[ 1.625474] sit: IPv6, IPv4 and MPLS over IPv4 tunneling driver
[ 1.633628] NET: Registered protocol family 17
[ 1.638347] NET: Registered protocol family 15
[ 1.643534] Key type dns_resolver registered
[ 1.648156] omap_voltage_late_init: Voltage driver support not added
[ 1.654920] sr_dev_init: No voltage domain specified for smartreflex0. Cannot initialize
[ 1.663438] sr_dev_init: No voltage domain specified for smartreflex1. Cannot initialize
[ 1.672353] ThumbEE CPU extension supported.
[ 1.676846] Registering SWP/SWPB emulation handler
[ 1.681948] SmartReflex Class3 initialized
[ 1.720415] mmc0: host does not support reading read-only switch, assuming write-enable
[ 1.733981] mmc0: new high speed SDHC card at address aaaa
[ 1.742266] mmcblk0: mmc0:aaaa SC32G 29.7 GiB
[ 1.754320] mmcblk0: p1 p2
[ 1.764041] random: fast init done
[ 1.775883] mmc1: new high speed MMC card at address 0001
[ 1.783690] mmcblk1: mmc1:0001 Q2J54A 3.64 GiB
[ 1.789485] mmcblk1boot0: mmc1:0001 Q2J54A partition 1 2.00 MiB
[ 1.797409] mmcblk1boot1: mmc1:0001 Q2J54A partition 2 2.00 MiB
[ 1.805076] mmcblk1rpmb: mmc1:0001 Q2J54A partition 3 512 KiB
[ 1.815363] mmcblk1: p1
[ 1.831310] tps65217 0-0024: TPS65217 ID 0xe version 1.2
[ 1.837556] omap_i2c 44e0b000.i2c: bus 0 rev0.11 at 400 kHz
[ 1.847337] omap_i2c 4819c000.i2c: bus 2 rev0.11 at 100 kHz
[ 1.854832] hctosys: unable to open rtc device (rtc0)
[ 1.860254] sr_init: No PMIC hook to init smartreflex
[ 1.865760] sr_init: platform driver register failed for SR
[ 1.908592] EXT4-fs (mmcblk0p2): mounted filesystem with ordered data mode. Opts: (null)
[ 1.917596] VFS: Mounted root (ext4 filesystem) on device 179:2.
[ 1.928660] devtmpfs: mounted
[ 1.934172] Freeing unused kernel memory: 1024K
[ 2.053011] EXT4-fs (mmcblk0p2): re-mounted. Opts: data=ordered
Starting syslogd: OK
Starting klogd: OK
Initializing random number generator... [ 2.307348] random: dd: uninitialized urandom read (512 bytes read)
done.
Starting network: OK

Welcome to Buildroot
buildroot login: █

```

```

Welcome to Buildroot
buildroot login: root
# ls
# cd /
# ls
bin      lib      lost+found  opt      run      tmp
dev      lib32    media       proc     sbin     usr
etc      linuxrc  mnt         root     sys      var
# cd usr
# ls
# cd bin
# ls
[
[|
ar      eject      last       nslookup   shred      unlzop
awk     env        ldd        od          sort       unxz
base64  expr      less       openvt     strings    unzip
basename factor    logger     passwd     svc        uptime
bunzip2 find      lsof       patch      tail       uuencode
bzip2   flock     lspci      printf     tee        vlock
chrt    fold     lscpi      readlink   telnet     w
chvt    free     lsusb     realpath   test       wc
cksum   fuser    lzcat     renice     tftp       wget
clear   getconf  lzma      reset      time       which
cmp     head     lzopcat   resize     top        who
crontab hexdump  md5sum    seq        tr          whoami
cut     hexedit  msg       setfatatr  traceroute  xargs
dc      hostid   microcom  setkeycodes truncate    xxd
deallocvt id        mkfifo    setuid     tty        xz
diff    install  mkpasswd  shalsum    uniq       xzcat
dirname ipcrm    nt        sha256sum  unix2dos   yes
dos2unix iocs     nohup     sha3sum    unlink
du      killall  nproc     sha512sum  unlzma
# ls -la
total 29
drwxr-xr-x 2 root root 2048 Feb 3 2019 .
drwxr-xr-x 6 root root 1024 Feb 3 2019 ..
lrwxrwxrwx 1 root root 17 Feb 3 2019 [ -> ../../bin/busybox
lrwxrwxrwx 1 root root 17 Feb 3 2019 [! -> ../../bin/busybox
lrwxrwxrwx 1 root root 17 Feb 3 2019 ar -> ../../bin/busybox
lrwxrwxrwx 1 root root 17 Feb 3 2019 awk -> ../../bin/busybox
lrwxrwxrwx 1 root root 17 Feb 3 2019 basename -> ../../bin/busybox
lrwxrwxrwx 1 root root 17 Feb 3 2019 bunzip2 -> ../../bin/busybox
lrwxrwxrwx 1 root root 17 Feb 3 2019 bzip2 -> ../../bin/busybox
lrwxrwxrwx 1 root root 17 Feb 3 2019 chrt -> ../../bin/busybox

```

My Buildroot image login:

```

[ 1.663269] sr_dev_init: No voltage domain specified for smartreflex1. Cannot initialize
[ 1.672202] ThumbEE CPU extension supported.
[ 1.676696] Registering SWP/SWPB emulation handler
[ 1.681704] SmartReflex: Class3 initialized
[ 1.720225] mmc0: host does not support reading read-only switch, assuming write-enable
[ 1.731742] mmc0: new high speed SDHC card at address aaaa
[ 1.740888] mmcblk0: mmc0:aaaa SC32G 29.7 GiB
[ 1.753193] mmcblk0: p1 p2
[ 1.763567] random: fast init done
[ 1.775187] mmc1: new high speed MMC card at address 0001
[ 1.782651] mmcblk1: mmc1:0001 Q2J54A 3.64 GiB
[ 1.788780] mmcblk1boot0: mmc1:0001 Q2J54A partition 1 2.00 MiB
[ 1.796680] mmcblk1boot1: mmc1:0001 Q2J54A partition 2 2.00 MiB
[ 1.804298] mmcblk1rmb: mmc1:0001 Q2J54A partition 3 512 KiB
[ 1.814515] mmcblk1: p1
[ 1.830596] tps65217 0-0024: TPS65217 ID 0xe version 1.2
[ 1.836855] omap_i2c 44e0b000.i2c: bus 0 rev0.11 at 400 kHz
[ 1.846590] omap_i2c 4819c000.i2c: bus 2 rev0.11 at 100 kHz
[ 1.853977] hctosys: unable to open rtc device (rtc0)
[ 1.859270] sr_init: No PMIC hook to init smartreflex
[ 1.864895] sr_init: platform driver register failed for SR
[ 1.918866] EXT4-fs (mmcblk0p2): recovery complete
[ 1.926979] EXT4-fs (mmcblk0p2): mounted filesystem with ordered data mode. Opts: (null)
[ 1.935820] VFS: Mounted root (ext4 filesystem) on device 179:2.
[ 1.946774] devtmpfs: mounted
[ 1.952061] Freeing unused kernel memory: 1024K
[ 2.064580] EXT4-fs (mmcblk0p2): re-mounted. Opts: data=ordered
Starting syslogd: OK
Starting klogd: OK
Initializing random number generator... [ 2.336918] random: dd: uninitialized urandom read (512 bytes read)
done.
Starting network: OK
Starting cron ... done.
[ 2.512747] random: crond: uninitialized urandom read (6 bytes read)

Is it really working v1.0
monishnene login: root
# cd ..
# ls
Makefile      fileio.elf    media         run           usr
bin           lib           mnt           sbin         var
cron_sort.elf lib32         opt           sortfunc.elf
dev           linuxrc      proc          sys
etc           lost+found   root          tmp
#

Is it really working v1.0
monishnene login: root
# ls
# cd ..
# ls
Makefile      fileio.elf    lost+found    proc          sys
bin           lib           media         root          tmp
dev           lib32        mnt           run           usr
etc           linuxrc      opt           sbin         var
# ls-la
-sh: ls-la: not found
# ls -la
total 38
drwxr-xr-x 18 root root      1024 Feb  9 2019 .
drwxr-xr-x 18 root root      1024 Feb  9 2019 ..
-rw-r--r--  1 root root      1324 Feb  9 2019 Makefile
drwxr-xr-x  2 root root      2048 Feb  9 2019 bin
drwxr-xr-x  4 root root      2780 Jan  1 00:00 dev
drwxr-xr-x  6 root root      1024 Jan  1 00:00 etc
-rwxr-xr-x  1 root root     11212 Feb  9 2019 fileio.elf
drwxr-xr-x  3 root root      1024 Feb  9 2019 lib
lrwxrwxrwx  1 root root         3 Feb  9 2019 lib32 -> lib
lrwxrwxrwx  1 root root        11 Feb  9 2019 linuxrc -> bin/busybox
drwx----- 2 root root     12288 Feb  9 2019 lost+found
drwxr-xr-x  2 root root      1024 Feb  3 2019 media
drwxr-xr-x  2 root root      1024 Feb  3 2019 mnt
drwxr-xr-x  2 root root      1024 Feb  3 2019 opt
dr-xr-xr-x 50 root root         0 Jan  1 00:00 proc
drwx----- 2 root root      1024 Jan  1 00:00 root
drwxr-xr-x  3 root root      140 Jan  1 00:00 run
drwxr-xr-x  2 root root      1024 Feb  9 2019 sbin
dr-xr-xr-x 12 root root         0 Jan  1 00:00 sys
drwxrwxrwt  2 root root         0 Jan  1 00:00 tmp
drwxr-xr-x  7 root root      1024 Feb  9 2019 usr
drwxr-xr-x  4 root root      1024 Feb  9 2019 var
# cd sys
# ls
block      class    devices  fs        module
bus        dev      firmware kernel    power
# cd kernel/
# ls
config      kexec_crash_size  rcu normal
debug       kexec_loaded     tracing
fscaps      mm               uevent_helper
iommu_groups  notes            uevent_seqnum
tmp         noefliten

```

[Problem 4 - 10 Pts] Port Your File IO program to BBG

From a BBG console command line, run your program and collect the BBG version of ltrace, strace and perf stat of the interesting stats that you collected from Problem 1.

Answer:

Ltrace bbg


```
# ltrace ./fileio.elf monish nene Q4ltrace
dwfl report elf fileio.elf@0x10000 (/fileio.elf) 109: address range overlaps an existing module
Backend initialization failed.
Couldn't load ELF object /lib/ld-uClibc.so.0: Success
_uClibc_main(0x1085c, 4, 0xbe8a0e24, 0x10538 <unfinished ...>
malloc(100) = 0x22008
malloc(100) = 0x22070
strlen("monish nene Q4ltrace ") = 21
fopen("test.txt", "w") = 0x220d8
fwrite("monish nene Q4ltrace ", 1, 21, 0x220d8) = 21
fclose(0x220d8) = 0
malloc(100) = 0x22120
sprintf("chmod 222 test.txt", "chmod %d %s", 222, "test.txt") = 18
system("chmod 222 test.txt" <no return ...>
--- SIGCHLD (Child exited) ---
<... system resumed> ) = 0
free(0x22120) = <void>
strlen("This string is appended\n") = 24
fopen("test.txt", "a") = 0x220d8
fwrite("This string is appended\n", 1, 24, 0x220d8) = 24
fclose(0x220d8) = 0
fopen("test.txt", "r") = 0x220d8
malloc(100) = 0x23128
sprintf("chmod 444 test.txt", "chmod %d %s", 444, "test.txt") = 18
system("chmod 444 test.txt" <no return ...>
--- SIGCHLD (Child exited) ---
<... system resumed> ) = 0
free(0x23128) = <void>
fgetc(0x220d8) = 'm'
printf("read char output = %c\n", 'm' read char output = m
) = 21
fgets("onish nene Q4ltrace This string "..., 100, 0x220d8) = 0x22008
printf("read string output = %s\n", "onish nene Q4ltrace This string "...read string output = onish nene Q4ltrace This string is appended
) = 66
malloc(100) = 0x23128
sprintf("chmod 666 test.txt", "chmod %d %s", 666, "test.txt") = 18
system("chmod 666 test.txt" <no return ...>
--- SIGCHLD (Child exited) ---
<... system resumed> ) = 0
free(0x23128) = <void>
fflush(0xb6f2a078) = 0
fclose(0x220d8) = 0
free(0x22008) = <void>
free(0x22070) = <void>
+++ exited (status 0) +++
```

Strace bbg

[illegible]

```

clone(child_stack=NULL, flags=CLONE_PARENT_SETTID|SIGCHLD, parent_tidptr=0xbebb2c38) = 117
wait4(117, [{WIFEXITED(s) && WEXITSTATUS(s) == 0}], 0, NULL) = 117
rt_sigaction(SIGINT, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0xb6ef4914}, NULL, 8) = 0
rt_sigaction(SIGQUIT, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0xb6ef4914}, NULL, 8) = 0
rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0
--- SIGCHLD {si_signo=SIGCHLD, si_code=CLD_EXITED, si_pid=117, si_uid=0, si_status=0, si_utime=0, si_stime=1} ---
open("test.txt", O_WRONLY|O_CREAT|O_APPEND, 0666) = 3
ioctl(3, TCGETS, 0xbebb2bf4) = -1 ENOTTY (Inappropriate ioctl for device)
write(3, "This string is appended\n", 24) = 24
close(3) = 0
open("test.txt", O_RDONLY) = 3
ioctl(3, TCGETS, 0xbebb2c14) = -1 ENOTTY (Inappropriate ioctl for device)
rt_sigaction(SIGINT, {sa_handler=SIG_IGN, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0xb6ef4914}, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0xb6ef4914}, 8) = 0
rt_sigaction(SIGQUIT, {sa_handler=SIG_IGN, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0xb6ef4914}, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0xb6ef4914}, 8) = 0
rt_sigprocmask(SIG_BLOCK, [CHLD], [], 8) = 0
clone(child_stack=NULL, flags=CLONE_PARENT_SETTID|SIGCHLD, parent_tidptr=0xbebb2c38) = 118
wait4(118, [{WIFEXITED(s) && WEXITSTATUS(s) == 0}], 0, NULL) = 118
rt_sigaction(SIGINT, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0xb6ef4914}, NULL, 8) = 0
rt_sigaction(SIGQUIT, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0xb6ef4914}, NULL, 8) = 0
rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0
--- SIGCHLD {si_signo=SIGCHLD, si_code=CLD_EXITED, si_pid=118, si_uid=0, si_status=0, si_utime=0, si_stime=1} ---
read(3, "monish nene Q4strace This string"...., 4096) = 45
write(1, "read char output = m\n", 21read char output = m
) = 21
write(1, "read string output = onish nene "...., 65read string output = onish nene Q4strace This string is appended
) = 65
write(1, "\n", 1
) = 1
rt_sigaction(SIGINT, {sa_handler=SIG_IGN, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0xb6ef4914}, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0xb6ef4914}, 8) = 0
rt_sigaction(SIGQUIT, {sa_handler=SIG_IGN, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0xb6ef4914}, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0xb6ef4914}, 8) = 0
rt_sigprocmask(SIG_BLOCK, [CHLD], [], 8) = 0
clone(child_stack=NULL, flags=CLONE_PARENT_SETTID|SIGCHLD, parent_tidptr=0xbebb2c38) = 119
wait4(119, [{WIFEXITED(s) && WEXITSTATUS(s) == 0}], 0, NULL) = 119
rt_sigaction(SIGINT, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0xb6ef4914}, NULL, 8) = 0
rt_sigaction(SIGQUIT, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=SA_RESTORER, sa_restorer=0xb6ef4914}, NULL, 8) = 0
rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0
--- SIGCHLD {si_signo=SIGCHLD, si_code=CLD_EXITED, si_pid=119, si_uid=0, si_status=0, si_utime=0, si_stime=1} ---
close(3) = 0
exit_group(0) = ?
+++ exited with 0 +++
#

```

Perf bbg


```

# perf stat -o perf_test.txt ./fileio.elf monish nene Q4perf
read char output = m
read string output = onish nene Q4perf This string is appended

# cat perf_test.txt
# started on Thu Jan  1 00:00:46 1970

Performance counter stats for './fileio.elf monish nene Q4perf':

    56.284212      task-clock (msec)      #    0.783 CPUs utilized
         16      context-switches      #    0.284 K/sec
          0      cpu-migrations      #    0.000 K/sec
        288      page-faults      #    0.005 M/sec
    52758918      cycles      #    0.937 GHz
    15471247      instructions      #    0.29  insn per cycle
    1881650      branches      #   33.431 M/sec
    479405      branch-misses      #   25.48% of all branches

    0.071907542 seconds time elapsed

# perf stat ./fileio.elf monish nene Q4perf
read char output = m
read string output = onish nene Q4perf This string is appended

Performance counter stats for './fileio.elf monish nene Q4perf':

    49.266626      task-clock (msec)      #    0.893 CPUs utilized
         13      context-switches      #    0.264 K/sec
          0      cpu-migrations      #    0.000 K/sec
        297      page-faults      #    0.006 M/sec
    47924763      cycles      #    0.973 GHz
    14289833      instructions      #    0.30  insn per cycle
    1763970      branches      #   35.805 M/sec
    459400      branch-misses      #   26.04% of all branches

    0.055170583 seconds time elapsed

# █

```

[Problem 5 - 30 Pts] Implement Your Own System Call on BBG

Your report should include screenshots of example output of your multiple program runs, including both successful and failure cases (annotated with the “use-case” comments), appropriate BBG kernel logs with printk comments noting the use-cases. Report the time it takes to perform your syscall using timestamps from the log f

Merge sort used for sorting

```
Case 1: [ 27.130926] Data size is less than 256
[ 170.608376] Entering sys_merge_sort
[ 170.616854] The input buffer is as follows
[ 170.621647] Exiting sys_merge_sort
```

```
Case 2:
Error: Unknown error 1002
```

```
Case 3: [ 170.628730] NULL pointer buffers passed
Error: Unknown error 1002
```

```
Case 4: [ 170.629434] NULL pointer buffers passed
Error: Unknown error 1001
```

```
Case 5: [ 170.637847] Negative size allocated
Error: Unknown error 1000
# █
```

UMMARY) © 2001-2006 Red Hat, Inc.

```
[ 0.493333] io scheduler noop registered
[ 0.493366] io scheduler deadline registered
[ 0.493492] io scheduler cfq registered (default)
[ 0.493511] io scheduler mq-deadline registered
[ 0.493526] io scheduler kyber registered
[ 0.495496] pinctrl-single 44e10800.pinmux: 142 pins at pa f9e10800 size 568
[ 0.499794] Serial: 8250/16550 driver, 6 ports, IRQ sharing enabled
[ 0.505414] omap_uart 44e09000.serial: no wakeirq for uart0
[ 0.505459] of_get_named_gpiod_flags: can't parse 'rts-gpio' property of node '/ocp/ser
[ 0.505862] 44e09000.serial: tty00 at MMIO 0x44e09000 (irq = 30, base_baud = 3000000) is
[ 1.231347] console [tty00] enabled
[ 1.236552] omap_uart 48024000.serial: no wakeirq for uart2
[ 1.242547] of_get_named_gpiod_flags: can't parse 'rts-gpio' property of node '/ocp/ser
[ 1.242907] 48024000.serial: tty02 at MMIO 0x48024000 (irq = 31, base_baud = 3000000) is
[ 1.280797] brd: module loaded
[ 1.309241] loop: module loaded
[ 1.315032] mtdoops: mtd device (mtddev=name/number) must be supplied
[ 1.324342] mdio_bus fixed-0: GPIO lookup for consumer reset
[ 1.324360] mdio_bus fixed-0: using lookup tables for GPIO lookup
[ 1.324450] mdio_bus fixed-0: lookup for GPIO reset failed
[ 1.324653] libphy: Fixed MDIO Bus: probed
[ 1.346506] mdio_bus 4a101000.mdio: GPIO lookup for consumer reset
[ 1.346529] mdio_bus 4a101000.mdio: using lookup tables for GPIO lookup
[ 1.346545] mdio_bus 4a101000.mdio: lookup for GPIO reset failed
[ 1.399681] davinci_mdio 4a101000.mdio: davinci mdio revision 1.6, bus freq 1000000
[ 1.407711] davinci_mdio 4a101000.mdio: detected phy mask ffffffff
[ 1.418381] libphy: 4a101000.mdio: probed
[ 1.422825] davinci_mdio 4a101000.mdio: phy[0]: device 4a101000.mdio:00, driver SMSC LAN
[ 1.433816] cpsw 4a100000.ethernet: Detected MACID = f0:45:da:74:32:4e
[ 1.441232] cpsw 4a100000.ethernet: initialized cpsw ale version 1.4
[ 1.447877] cpsw 4a100000.ethernet: ALE Table size 1024
[ 1.453536] cpsw 4a100000.ethernet: cpts: overflow check period 500 (jiffies)
[ 1.464110] i2c /dev entries driver
[ 1.471366] omap_hsmmc 48060000.mmc: GPIO lookup for consumer cd
[ 1.471386] omap_hsmmc 48060000.mmc: using device tree for GPIO lookup
[ 1.471435] of_get_named_gpiod_flags: parsed 'cd-gpios' property of node '/ocp/mmc@4806
[ 1.471555] omap_hsmmc 48060000.mmc: Got CD GPIO
[ 1.476421] omap_hsmmc 48060000.mmc: GPIO lookup for consumer wp
[ 1.476433] omap_hsmmc 48060000.mmc: using device tree for GPIO lookup
[ 1.476449] of_get_named_gpiod_flags: can't parse 'wp-gpios' property of node '/ocp/mmc@
[ 1.476464] of_get_named_gpiod_flags: can't parse 'wp-gpio' property of node '/ocp/mmc@
[ 1.476476] omap_hsmmc 48060000.mmc: using lookup tables for GPIO lookup
[ 1.476492] omap_hsmmc 48060000.mmc: lookup for GPIO wp failed
[ 1.531692] omap_hsmmc 481d8000.mmc: GPIO lookup for consumer cd
[ 1.531714] omap_hsmmc 481d8000.mmc: using device tree for GPIO lookup
```



```
( 1.599727) oprofile: using arm/armv7
( 1.604263) Initializing XFRM netlink socket
( 1.609151) NET: Registered protocol family 10
( 1.621395) Segment Routing with IPv6
( 1.625358) sit: IPv6, IPv4 and MPLS over IPv4 tunneling driver
( 1.633522) NET: Registered protocol family 17
( 1.638235) NET: Registered protocol family 15
( 1.643401) Key type dns_resolver registered
( 1.648032) omap_voltage_late_init: Voltage driver support not added
( 1.654787) sr_dev_init: No voltage domain specified for smartreflex0. Cannot initialize
( 1.663294) sr_dev_init: No voltage domain specified for smartreflex1. Cannot initialize
( 1.672229) ThumbEE CPU extension supported.
( 1.676722) Registering SWP/SWPB emulation handler
( 1.681818) SmartReflex Class3 initialized
( 1.720277) mmc0: host does not support reading read-only switch, assuming write-enable
( 1.733866) mmc0: new high speed SDHC card at address aaaa
( 1.742151) mmcblk0: mmc0:aaaa SC32G 29.7 GiB
( 1.754105) mmcblk0: p1 p2
( 1.764115) random: fast init done
( 1.775417) mmc1: new high speed MMC card at address 0001
( 1.783118) mmcblk1: mmc1:0001 Q2J54A 3.64 GiB
( 1.789258) mmcblk1boot0: mmc1:0001 Q2J54A partition 1 2.00 MiB
( 1.796916) mmcblk1boot1: mmc1:0001 Q2J54A partition 2 2.00 MiB
( 1.804313) mmcblk1rmb: mmc1:0001 Q2J54A partition 3 512 KiB
( 1.814552) mmcblk1: p1
( 1.831359) tps65217 0-0024: TPS65217 ID 0xe version 1.2
( 1.837628) omap_i2c 44e0b000.i2c: bus 0 rev0.11 at 400 kHz
( 1.847961) omap_i2c 4819c000.i2c: bus 2 rev0.11 at 100 kHz
( 1.854788) hctosys: unable to open rtc device (rtc0)
( 1.860186) sr_init: No PMIC hook to init smartreflex
( 1.865693) sr_init: platform driver register failed for SR
( 1.913525) EXT4-fs (mmcblk0p2): mounted filesystem with ordered data mode. Opts: (null)
( 1.922468) VFS: Mounted root (ext4 filesystem) on device 179:2.
( 1.933988) devtmpfs: mounted
( 1.939105) Freeing unused kernel memory: 1024K
( 2.056937) EXT4-fs (mmcblk0p2): re-mounted. Opts: data=ordered
( 2.328161) random: dd: uninitialized urandom read (512 bytes read)
( 2.502623) random: crond: uninitialized urandom read (6 bytes read)
( 27.096677) Enter init sys merge sort
( 27.101198) The input buffer is as follows
( 27.105902) Exiting sys merge sort
( 27.113176) NULL pointer buffers passed
( 27.113893) NULL pointer buffers passed
( 27.122580) Negative size allocated
#
```

[Problem 6 - 10 Pts] Create a CRON/Systemd task on BBG

Report the collected information and the outputs from your system call for a period greater than 30 minutes.

```
Time & Date : Thu Jan 1 00:30:01 1970
Process ID = 160
User ID = 0
Sorted Data = [ 2144477510, 2136713659, 2134372205, 2130753515, 2120867951, 2103048578, 2087302716, 2073563725, 2044580029, 2039506936, 2039341633, 2013382793, 2010462308, 2005164024, 1
987284248, 1984027345, 1968947724, 1964467011, 1939445379, 1933298977, 1924382692, 1914971396, 1881214602, 1873328026, 1867271804, 1867177248, 1865800233, 1850474052, 1831459945, 182977
1952, 1815714083, 1811688253, 1805359971, 1802519492, 1802169077, 1787024876, 1775110132, 1771094662, 1769842674, 1763536925, 1756759046, 1750190852, 1744489894, 1735833692, 1735545834, 1
725485617, 1724760666, 1716075898, 1710225901, 1702343930, 1694571692, 1693529327, 1690355648, 1683787454, 1665308862, 1658113646, 1649634427, 1647735773, 1646752485, 1643013280, 1634
759552, 1632588357, 1612528734, 1608480952, 1602055884, 1599768769, 1598524494, 1582644185, 1569576644, 1561233505, 1553116730, 1550028769, 1541669408, 1525326591, 1504505952, 1498069392
1, 149693190, 1491164926, 1488023314, 1486533474, 1485306710, 1484184380, 1472599961, 1446443255, 1436533443, 1431600270, 1420863936, 1414570240, 1411755682, 1393448239, 1390869536, 13
71111742, 1369505025, 1348642734, 1343992678, 1341728862, 1324702957, 1324368873, 1323984980, 1323830657, 1299631046, 1281404996, 1277752761, 1272767376, 1269816925, 1248673633, 1246762
419, 1245503727, 1242365922, 1208498886, 1204773517, 1195998647, 1190566935, 1185896804, 1169346080, 1160346778, 1159602700, 1157254376, 1150959079, 1143616645, 1141859459, 1125148546, 1
120559229, 1113975744, 1104427951, 1104249487, 1099545795, 1096691868, 1089289028, 1073704501, 1065337899, 1063686278, 1046515573, 1045856654, 1042147566, 1035245145, 10339
50850, 1022169809, 908172706, 907080273, 977227208, 969835882, 968146554, 947506904, 944631382, 941879779, 941025244, 931540164, 928260692, 923020454, 923183831, 921173279, 900187177, 8
93333654, 891151410, 880381421, 878284474, 859844793, 856700221, 843342985, 840614469, 829844480, 824620908, 815008453, 809776580, 796665138, 796544888, 702034995, 790592590, 781834099,
778585637, 773365768, 773121111, 768568094, 760805674, 760603602, 757092830, 754568191, 754260622, 747361952, 746031257, 714746008, 704145869, 699853007, 669467668, 666196750, 655008096
7, 644548732, 623977649, 621768077, 614497631, 611491493, 601996005, 591604360, 590917249, 589787477, 589424487, 588257015, 563014620, 558248968, 558047405, 533926627, 519876759, 517494
781, 506139688, 499396554, 403917024, 440674275, 439379333, 439168052, 422121003, 403963652, 400103618, 398722305, 396608456, 396493736, 387598837, 379817501, 369868735, 368350474, 3567
42612, 346204597, 319643356, 317714425, 316185917, 298494701, 208555777, 266005024, 259243600, 257266523, 254480578, 245602678, 240335709, 228039004, 206159025, 199647073, 190662875, 17
8431467, 172771414, 171265614, 161321730, 145334890, 137432891, 95030572, 90919058, 79181032, 77210693, 60399747, 54631483, 49011688, 46652031, 38263533, 35859517, 15745862, 6568194,]

Time & Date : Thu Jan 1 00:40:01 1970
Process ID = 165
User ID = 0
Sorted Data = [ 2145173776, 2144924683, 2141777459, 2115097631, 2109313562, 2097745340, 2074887721, 2070251967, 2055933152, 2054529444, 2041802493, 2040254823, 2039243528, 2033959634, 2
026589093, 2024279132, 2023547136, 2013747813, 1996443487, 1990872172, 1988411690, 1978249025, 1967887528, 1963521667, 1958415040, 1950080801, 1948877474, 1944020977, 1924170175, 191916
0601, 1895163040, 1873644053, 1872710099, 1829846720, 1824140531, 1819615948, 1817288888, 1806138332, 1794308793, 1793093626, 1788397702, 1786040943, 1785733477, 1779364919, 1775664710, 1
770070094, 1756010492, 1755627149, 1754287125, 1742113641, 1739562702, 1713184128, 1701734978, 1695810836, 1695260692, 1694182982, 1687283683, 1681556222, 1663424820, 1652520433, 1637
35741, 1625532173, 1624019835, 1610029012, 1610684344, 1611462494, 1610325228, 1601611609, 1592837239, 1579865596, 1571936822, 1570246470, 1567428050, 1555004082, 1550216492, 154333371
7, 1541066240, 1539488308, 1532500355, 1516804960, 1506422607, 1467340002, 1455789063, 1449947989, 1444625877, 1444315172, 1410725116, 1391345461, 1381973234, 1378162123, 1364174678, 13
54658371, 1339824407, 1334118219, 1331664011, 1318997644, 1318556737, 1314955871, 1280655404, 1270004481, 1268875548, 1258314217, 1248360134, 1246107890, 1242436494, 1241173877, 1236195
755, 1234157676, 1231632665, 1229098561, 1217637324, 1216302830, 1212322779, 1206971856, 1198800441, 1180752450, 1180026321, 1177729695, 1176193267, 1166655449, 1165721610, 1161164979,
1149593084, 1146704821, 1142885701, 1127572364, 1112808031, 1108000386, 1092674230, 1088197818, 108047966, 1080530356, 1079361750, 1078019579, 1076064847, 1075021189, 1065927531, 10425
67703, 1037009050, 1029133099, 1021382242, 1019911104, 1016554940, 1010757102, 1008003130, 1004482683, 996055049, 99235741, 988208813, 983212156, 980948752, 970160895, 962251130, 95902
3720, 956537972, 955754748, 930997517, 916992890, 915913130, 913354165, 908126265, 903065768, 902985560, 899765630, 898816702, 895660295, 875899088, 854187141, 853342566, 849239971, 835
414397, 812386943, 805114046, 796986771, 795892925, 787861206, 787712495, 785791972, 781934720, 775645417, 773865112, 773182522, 772455779, 762314004, 757427969, 745102446, 744079469, 7
36935508, 719287604, 713037352, 707867345, 704484827, 699289257, 670950703, 644005168, 643716989, 642293139, 636850644, 634897152, 625158558, 609704701, 588565515, 548355333, 541623063,
536622017, 471826417, 466735833, 464409048, 462330643, 461869410, 448127627, 436500432, 418926732, 389668589, 367387021, 367140450, 364281688, 357193729, 347686866, 331602523, 331648871
3, 207921055, 201500544, 209115606, 253540860, 252480804, 252187097, 251044526, 250945520, 238487008, 210446099, 178448646, 109093114, 169755076, 159525880, 142905326, 131425903, 124063
084, 120577325, 120340350, 113097686, 112233340, 83562548, 80008098, 74675143, 58108295, 57659974, 52367157, 49503522, 48304710, 46876529, 46851194, 40928086, 35537927, 30433237, 289295
12,]
```

084, 120577325, 120340350, 113097686, 112233340, 83562548, 80008898, 74675143, 58108295, 57659974, 52367157, 49503522, 48304710, 46876529, 46851194, 40928086, 35537927, 30433237, 28929512,.]

Time & Date : Thu Jan 1 00:50:01 1970

Process Id = 167

User ID = 0

Sorted Data = [2144534291, 2141378185, 2134554849, 2113371419, 2103609287, 2091364622, 2070414436, 2069797703, 2058395327, 2032336757, 2026523837, 1997113042, 1996793353, 1973561768, 1938795262, 1908832972, 1908697068, 1908422639, 1886831198, 1844269207, 1836548353, 1835002982, 1834085733, 1823793247, 1822056934, 1821821134, 1805378892, 1805139559, 1802884903, 1802150202, 1789936482, 1770669358, 1755605784, 1752537698, 1751000079, 1750375499, 1747752070, 1737494469, 1735708520, 173027963, 1722210453, 1718869318, 1714194473, 1699084822, 1697233099, 1696151475, 1681058066, 1675866441, 1656723877, 1650355224, 1650187524, 1637933862, 1630421392, 1622422772, 1618736644, 1618690735, 1601266681, 1598655277, 1577108185, 1561168684, 155624098, 1554878414, 1530756767, 1509924157, 1505246429, 1486839443, 1484099472, 1473170851, 1469994717, 1469942940, 1469090884, 1465449997, 1461558003, 1460188544, 1454918761, 1446715525, 1434709220, 1428741866, 1402740941, 1402371876, 1386044324, 1384004513, 1369170200, 1357994167, 1342485661, 1334577156, 1332526715, 1331267696, 1330553573, 1296608935, 1295828306, 1291241589, 1284813578, 1281412065, 1268885535, 1259284963, 1249665524, 1238706187, 1208423366, 1205474010, 1205267260, 1203370173, 1203095617, 1198855351, 1191823595, 1189133597, 1187961564, 1181057648, 1172059492, 1169956411, 1166403777, 1155679932, 1151912357, 1138333743, 1132302429, 1124492139, 1121440920, 1117746377, 1114730371, 1102142437, 1094030684, 1093404023, 1085168494, 1052264881, 1049864988, 1044824710, 1007474549, 1005309326, 984502871, 980869044, 972313019, 971588013, 967343965, 961637386, 961510599, 960776667, 951647452, 912727101, 907853092, 894510802, 879080313, 879531084, 875243039, 860180564, 855468482, 854464345, 835795138, 833481405, 827598542, 818113039, 808110363, 805975444, 789285933, 780040467, 774179334, 772180658, 767360427, 765471543, 749458919, 745690753, 742614459, 738883048, 722986711, 720638224, 711979774, 705812982, 695430408, 692348253, 688676925, 682791110, 661579784, 657226045, 656878651, 655860749, 645645483, 639133194, 633558082, 625309552, 622766422, 603964045, 599075236, 567644219, 566163653, 564066695, 552424481, 552254042, 544469761, 519477864, 518295487, 512104738, 505170454, 503055447, 493743108, 487243978, 486656046, 482305097, 480687018, 479108673, 461221627, 444667537, 442985408, 437624074, 436974455, 434640745, 430427922, 416846579, 414705390, 408365044, 406243866, 403176515, 387154221, 395024979, 392684841, 349699118, 339469740, 334753528, 333147568, 308276187, 300132463, 288555847, 277339029, 271720443, 264206400, 251674794, 248593302, 247255338, 246416879, 241754625, 239401616, 233431688, 231126626, 230312384, 216912247, 211858863, 195219830, 184610192, 178753127, 172812224, 149247966, 149096793, 132686633, 117158788, 103945655, 96690403, 89681158, 83046560, 79615772, 74810326, 69227315, 57665333, 27420218, 19627748, 14491419, 8135304, 7720854, 3156106,]

Time & Date : Thu Jan 1 01:00:01 1970

Process Id = 170

User ID = 0

Sorted Data = [2130263361, 2123405375, 2113482215, 2108129049, 2096836354, 2085366190, 2083477722, 2083211291, 2076062862, 2074022021, 2072058963, 2057853129, 2048124652, 2045370570, 2044660348, 2040322964, 2034334565, 2027372186, 2009050275, 2008942617, 1992890767, 1987861322, 1987265072, 1985930103, 1982159663, 1981746171, 1980187991, 1973684800, 1963754184, 1961851831, 1958099060, 1954916800, 1952867211, 1945317879, 1945141980, 1939683368, 1915659728, 1913718380, 1907884895, 1881869803, 1874712239, 1871511642, 1866412644, 1851453833, 1849642643, 1845697104, 1836592615, 1801840446, 1789214230, 1780240540, 1774709119, 1773323129, 1764159248, 1755107621, 1750701442, 1749633796, 1747666310, 1744677167, 1739654315, 1732708037, 1725605728, 1728489767, 1712167371, 1705651886, 1695940477, 1694020894, 1683925974, 1666192689, 1665868340, 1663426775, 1645319163, 1639485860, 1616674248, 1596581481, 1594399718, 1589669025, 1582956394, 1569116157, 1549878065, 1531538956, 1527581832, 1524409088, 1512931859, 1508143226, 1476483752, 1463337942, 1443316588, 1429498777, 1422549952, 1416842027, 1409679072, 140866241, 1403138848, 1396924140, 1374218123, 1373377914, 1340934087, 1337461849, 1336772534, 1331703090, 1317927789, 1315867015, 1306275139, 1300263621, 1297600465, 1295110694, 1258666796, 1245818954, 1235521422, 1229983104, 1218554007, 1207872098, 1195751698, 1194654870, 1185895755, 1176553958, 1171876455, 1131951343, 1131770055, 1113701247, 1109703912, 1105133173, 1090604948, 1087984823, 1087245074, 1075640236, 1073201794, 1058849473, 1053521501, 1051246995, 1051201006, 1046410130, 1039466121, 1035575549, 1033980710, 1031684925, 1018706087, 1018560187, 1013905034, 1012560130, 1004419310, 993262032, 968146430, 946042397, 945702599, 940533407, 935189791, 932410039, 926435893, 916109913, 914012172, 912507189, 902145573, 878515911, 864922264, 862228807, 847852457, 842626031, 838609850, 837082504, 833711580, 827176644, 822218266, 821607581, 813773713, 808801417, 803851107, 800876010, 776736630, 773852276, 770654042, 758212340, 756487587, 752176558, 750663009, 740592028, 739578840, 732261492, 730844693, 725159630, 716919041, 700762158, 675687117, 670070391, 662546820, 661852659, 653353840, 648009594, 644849531, 628742375, 627851226, 623046553, 616117915, 584822030, 572283184, 570423045, 565204006, 561082846, 557850813, 554960211, 549082510, 537801707, 514164820, 511378228, 511377570, 493645466, 490256650, 483716178, 459242448, 450902051, 437164814, 429287919, 421747709, 420050946, 404732343, 401077747, 399768901, 396389286, 395908419, 388381395, 373722890, 36533046, 355512036, 350430454, 342749920, 341728988, 331433763, 325390729, 322127235, 321260009, 320761417, 303481130, 302395484, 273762732, 270699590, 267316681, 262729491, 251227389, 227232840, 214841244, 105727657, 145801946, 139906436, 131322552, 121520744, 115238282, 109214939, 103483933, 84413691, 63262769, 41256395, 31845475, 22296233, 14140877, 12600536, 9410519,.]

█