Московский Авиационный Институт

(Национальный Исследовательский Университет)

Факультет информационных технологий и прикладной математики

Кафедра вычислительной математики и программирования

Лабораторная работа №1 по курсу

«Операционные системы»

Тема работы

Приобретение практических навыков диагностики работы программного обеспечения.

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Оценка: _____
Дата: _____
Подпись: _____

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Содержание

Репозиторий

Постановка задачи

При выполнении лабораторной работы необходимо продемонстрировать ключевые системные вызовы, которые в ней используются и то, что их использование соответствует варианту ЛР.

Общие сведения о программе

Лабораторная работа №4 на работу с memory-mapped files.

Демонстрация работы dtruss:

parent.cpp:

```
9793/0xfd95b: thread_selfid(0x0, 0x0, 0x0)                = 1038683 0
9793/0xfd95b: open(".\0", 0x0, 0x1)              = 3 0
9793/0xfd95b: fstat64(0x3, 0x7FFF5DF05700, 0x1)                = 0 0
9793/0xfd95b: fcntl(0x3, 0x32, 0x7FFF5DF059C0)                = 0 0
9793/0xfd95b: close(0x3)              = 0 0
9793/0xfd95b: stat64("/Users/igor/Desktop/NOW/OS/lab3/os_lab4/src\0", 0x7FFF5DF05670, 0x7FFF5DF059C0)              = 0 0
9793/0xfd95b: issetugid(0x7FFF5DF059C0, 0x7FFF5DF05670, 0x7FFF5DF059C0)              = 0 0
9793/0xfd95b: csrctl(0x0, 0x7FFF5DF058EC, 0x4)                = -1 Err#1
9793/0xfd95b: csops(0x0, 0x0, 0x7FFF5DF059C0)              = 0 0
9793/0xfd95b: shared_region_check_np(0x7FFF5DF02FD8, 0x0, 0x7FFF5DF059C0)              = 0 0
9793/0xfd95b: getpid(0x7FFF5DF02FD8, 0x0, 0x7FFF5DF059C0)                = 9793 0
9793/0xfd95b: proc_info(0x2, 0x2641, 0x8)                = 1272 0
9793/0xfd95b: stat64("/usr/lib/libc++.1.dylib\0", 0x7FFF5DF04C88, 0x8)              = 0 0
9793/0xfd95b: stat64("/usr/lib/libSystem.B.dylib\0", 0x7FFF5DF04C88, 0x8)              = 0 0
9793/0xfd95b: stat64("/usr/lib/libc++abi.dylib\0", 0x7FFF5DF04B98, 0x8)              = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libcache.dylib\0", 0x7FFF5DF046C8, 0x8) = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libcommonCrypto.dylib\0", 0x7FFF5DF046C8, 0x8)                = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libcompiler_rt.dylib\0", 0x7FFF5DF046C8, 0x8)                = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libcopyfile.dylib\0", 0x7FFF5DF046C8, 0x8)                = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libcorecrypto.dylib\0", 0x7FFF5DF046C8, 0x8)                = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libdispatch.dylib\0", 0x7FFF5DF046C8, 0x8)                = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libdyld.dylib\0", 0x7FFF5DF046C8, 0x8)      = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libkeymgr.dylib\0", 0x7FFF5DF046C8, 0x8 = 0 0
9793/0xfd95b: stat64("/usr/lib/system/liblaunch.dylib\0", 0x7FFF5DF046C8, 0x8 = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libmacho.dylib\0", 0x7FFF5DF046C8, 0x8) = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libquarantine.dylib\0", 0x7FFF5DF046C8, 0x8)                = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libremovefile.dylib\0", 0x7FFF5DF046C8, 0x8)                = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libsystem_asl.dylib\0", 0x7FFF5DF046C8, 0x8)                = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libsystem_blocks.dylib\0", 0x7FFF5DF046C8, 0x8)                = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libsystem_c.dylib\0", 0x7FFF5DF046C8, 0x8)                = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libsystem_configuration.dylib\0", 0x7FFF5DF046C8, 0x8)                = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libsystem_coreservices.dylib\0", 0x7FFF5DF046C8, 0x8)                = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libsystem_coretls.dylib\0", 0x7FFF5DF046C8, 0x8)                = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libsystem_dnssd.dylib\0", 0x7FFF5DF046C8, 0x8)                = 0 0
```

```
9793/0xfd95b: stat64("/usr/lib/system/libsystem_info.dylib\0", 0x7FFF5DF046C8, 0x8)                    = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libsystem_kernel.dylib\0", 0x7FFF5DF046C8, 0x8)                  = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libsystem_m.dylib\0", 0x7FFF5DF046C8, 0x8)                       = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libsystem_malloc.dylib\0", 0x7FFF5DF046C8, 0x8)                  = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libsystem_network.dylib\0", 0x7FFF5DF046C8, 0x8)                 = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libsystem_networkextension.dylib\0", 0x7FFF5DF046C8, 0x8)              = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libsystem_notify.dylib\0", 0x7FFF5DF046C8, 0x8)                  = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libsystem_platform.dylib\0", 0x7FFF5DF046C8, 0x8)                = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libsystem_pthread.dylib\0", 0x7FFF5DF046C8, 0x8)                 = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libsystem_sandbox.dylib\0", 0x7FFF5DF046C8, 0x8)                 = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libsystem_secinit.dylib\0", 0x7FFF5DF046C8, 0x8)                 = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libsystem_symptoms.dylib\0", 0x7FFF5DF046C8, 0x8)                      = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libsystem_trace.dylib\0", 0x7FFF5DF046C8, 0x8)                   = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libunwind.dylib\0", 0x7FFF5DF046C8, 0x8 = 0 0
9793/0xfd95b: stat64("/usr/lib/system/libxpc.dylib\0", 0x7FFF5DF046C8, 0x8)        = 0 0
9793/0xfd95b: stat64("/usr/lib/libobjc.A.dylib\0", 0x7FFF5DF03988, 0x8)            = 0 0
9793/0xfd95b: open("/dev/dtracehelper\0", 0x2, 0x7FFF5DF05870)                     = 3 0
9793/0xfd95b: ioctl(0x3, 0x80086804, 0x7FFF5DF057F8)                = 0 0
9793/0xfd95b: close(0x3)                = 0 0
9793/0xfd95b: thread_selfid(0x3, 0x80086804, 0x7FFF5DF057F8)                       = 1038683 0
9793/0xfd95b: bsdthread_register(0x7FFFC2770080, 0x7FFFC2770070, 0x2000)   = 1073741919 0
9793/0xfd95b: ulock_wake(0x1, 0x7FFF5DF04F6C, 0x0)                  = -1 Err#2
9793/0xfd95b: issetugid(0x1, 0x7FFF5DF04F6C, 0x0)                   = 0 0
9793/0xfd95b: mprotect(0x101CFF000, 0x88, 0x1)                = 0 0
9793/0xfd95b: mprotect(0x101D01000, 0x1000, 0x0)                   = 0 0
9793/0xfd95b: mprotect(0x101D17000, 0x1000, 0x0)                   = 0 0
9793/0xfd95b: mprotect(0x101D18000, 0x1000, 0x0)                   = 0 0
9793/0xfd95b: mprotect(0x101D2E000, 0x1000, 0x0)                   = 0 0
9793/0xfd95b: mprotect(0x101D2F000, 0x1000, 0x1)                   = 0 0
9793/0xfd95b: mprotect(0x101CFF000, 0x88, 0x3)                = 0 0
9793/0xfd95b: mprotect(0x101CFF000, 0x88, 0x1)                = 0 0
9793/0xfd95b: getpid(0x101CFF000, 0x88, 0x1)                 = 9793 0
9793/0xfd95b: stat64("/AppleInternal/XBS/.isChrooted\0", 0x7FFF5DF04E28, 0x1) = -1 Err#2
9793/0xfd95b: stat64("/AppleInternal\0", 0x7FFF5DF04EC0, 0x1)                      = -1 Err#2
9793/0xfd95b: csops(0x2641, 0x7, 0x7FFF5DF04950)                    = -1 Err#22
dtrace: error on enabled probe ID 2158 (ID 561: syscall::sysctl:return): invalid kernel access in action #11 at DIF offset 40
9793/0xfd95b: ulock_wake(0x1, 0x7FFF5DF04ED0, 0x0)                  = -1 Err#2
9793/0xfd95b: csops(0x2641, 0x7, 0x7FFF5DF04230)                    = -1 Err#22
9793/0xfd95b: getrlimit(0x1008, 0x7FFF5DF06438, 0x7FFF5DF04230)                = 0 0
9793/0xfd95b: fstat64(0x0, 0x7FFF5DF06458, 0x7FFF5DF04230)                     = 0 0
9793/0xfd95b: ioctl(0x0, 0x4004667A, 0x7FFF5DF0649C)                = 0 0
dtrace: error on enabled probe ID 2135 (ID 949: syscall::read_nocancel:return): invalid kernel access in action #13 at DIF offset 92
dtrace: error on enabled probe ID 2135 (ID 949: syscall::read_nocancel:return): invalid kernel access in action #13 at DIF offset 92
9793/0xfd95b: shm_open(0x101CFAF2C, 0x202, 0x180)                   = 3 0
9793/0xfd95b: ftruncate(0x3, 0x8, 0x180)                = 0 0
9793/0xfd95b: mmap(0x0, 0x8, 0x3, 0x1, 0x3, 0x0)                    = 0x101D30000 0
9793/0xfd95b: fork()                = 9794 0
9794/0xfd960: thread_selfid(0x0, 0x0, 0x0)                 = 1038688 0
9793/0xfd95b: munmap(0x101D30000, 0x8)                = 0 0
9794/0xfd960: bsdthread_register(0x7FFFC2770080, 0x7FFFC2770070, 0x2000)   = -1 Err#22
9794/0xfd960: getpid(0x7FFFC2770080, 0x7FFFC2770070, 0x2000)                   = 9794 0
9794/0xfd960: __mac_syscall(0x7FFFC277BC46, 0x4, 0x7FFF5DF06408)                     = -1 Err#45
9794/0xfd960: csops(0x2642, 0xB, 0x7FFF5DF06448)                    = -1 Err#22
dtrace: error on enabled probe ID 2109 (ID 275: syscall::execve:return): invalid address (0x101cfaf67) in action #12 at DIF offset 24
```

child.cpp:

```
9794/0xfd961: thread_selfid(0x0, 0x0, 0x0)                          = 1038689 0
9794/0xfd961: open(".\0", 0x0, 0x1)                    = 3 0
9794/0xfd961: fstat64(0x3, 0x7FFF504A1700, 0x1)                     = 0 0
9794/0xfd961: fcntl(0x3, 0x32, 0x7FFF504A19C0)                      = 0 0
9794/0xfd961: close(0x3)                = 0 0
9794/0xfd961: stat64("/Users/igor/Desktop/NOW/OS/lab3/os_lab4/src\0", 0x7FFF504A1670, 0x7FFF504A19C0)              = 0 0
9794/0xfd961: issetugid(0x7FFF504A19C0, 0x7FFF504A1670, 0x7FFF504A19C0)           = 0 0
9794/0xfd961: csrctl(0x0, 0x7FFF504A18EC, 0x4)           = -1 Err#1
9794/0xfd961: csops(0x0, 0x0, 0x7FFF504A19C0)           = 0 0
9794/0xfd961: shared_region_check_np(0x7FFF5049EFD8, 0x0, 0x7FFF504A19C0)           = 0 0
9794/0xfd961: getpid(0x7FFF5049EFD8, 0x0, 0x7FFF504A19C0)           = 9794 0
9794/0xfd961: proc_info(0x2, 0x2642, 0x8)              = 1272 0
9794/0xfd961: stat64("/usr/lib/libc++.1.dylib\0", 0x7FFF504A0C88, 0x8)          = 0 0
9794/0xfd961: stat64("/usr/lib/libSystem.B.dylib\0", 0x7FFF504A0C88, 0x8)          = 0 0
9794/0xfd961: stat64("/usr/lib/libc++abi.dylib\0", 0x7FFF504A0B98, 0x8)          = 0 0
9794/0xfd961: stat64("/usr/lib/system/libcache.dylib\0", 0x7FFF504A06C8, 0x8) = 0 0
9794/0xfd961: stat64("/usr/lib/system/libcommonCrypto.dylib\0", 0x7FFF504A06C8, 0x8)             = 0 0
9794/0xfd961: stat64("/usr/lib/system/libcompiler_rt.dylib\0", 0x7FFF504A06C8, 0x8)             = 0 0
9794/0xfd961: stat64("/usr/lib/system/libcopyfile.dylib\0", 0x7FFF504A06C8, 0x8)             = 0 0
9794/0xfd961: stat64("/usr/lib/system/libcorecrypto.dylib\0", 0x7FFF504A06C8, 0x8)             = 0 0
9794/0xfd961: stat64("/usr/lib/system/libdispatch.dylib\0", 0x7FFF504A06C8, 0x8)             = 0 0
9794/0xfd961: stat64("/usr/lib/system/libdyld.dylib\0", 0x7FFF504A06C8, 0x8)     = 0 0
9794/0xfd961: stat64("/usr/lib/system/libkeymgr.dylib\0", 0x7FFF504A06C8, 0x8 = 0 0
9794/0xfd961: stat64("/usr/lib/system/liblaunch.dylib\0", 0x7FFF504A06C8, 0x8 = 0 0
9794/0xfd961: stat64("/usr/lib/system/libmacho.dylib\0", 0x7FFF504A06C8, 0x8) = 0 0
9794/0xfd961: stat64("/usr/lib/system/libquarantine.dylib\0", 0x7FFF504A06C8, 0x8)             = 0 0
9794/0xfd961: stat64("/usr/lib/system/libremovefile.dylib\0", 0x7FFF504A06C8, 0x8)             = 0 0
9794/0xfd961: stat64("/usr/lib/system/libsystem_asl.dylib\0", 0x7FFF504A06C8, 0x8)             = 0 0
9794/0xfd961: stat64("/usr/lib/system/libsystem_blocks.dylib\0", 0x7FFF504A06C8, 0x8)             = 0 0
9794/0xfd961: stat64("/usr/lib/system/libsystem_c.dylib\0", 0x7FFF504A06C8, 0x8)             = 0 0
9794/0xfd961: stat64("/usr/lib/system/libsystem_configuration.dylib\0", 0x7FFF504A06C8, 0x8)               = 0 0
9794/0xfd961: stat64("/usr/lib/system/libsystem_coreservices.dylib\0", 0x7FFF504A06C8, 0x8)               = 0 0
9794/0xfd961: stat64("/usr/lib/system/libsystem_coretls.dylib\0", 0x7FFF504A06C8, 0x8)             = 0 0
9794/0xfd961: stat64("/usr/lib/system/libsystem_dnssd.dylib\0", 0x7FFF504A06C8, 0x8)             = 0 0
9794/0xfd961: stat64("/usr/lib/system/libsystem_info.dylib\0", 0x7FFF504A06C8, 0x8)             = 0 0
9794/0xfd961: stat64("/usr/lib/system/libsystem_kernel.dylib\0", 0x7FFF504A06C8, 0x8)             = 0 0
9794/0xfd961: stat64("/usr/lib/system/libsystem_m.dylib\0", 0x7FFF504A06C8, 0x8)             = 0 0
9794/0xfd961: stat64("/usr/lib/system/libsystem_malloc.dylib\0", 0x7FFF504A06C8, 0x8)             = 0 0
9794/0xfd961: stat64("/usr/lib/system/libsystem_network.dylib\0", 0x7FFF504A06C8, 0x8)             = 0 0
9794/0xfd961: stat64("/usr/lib/system/libsystem_networkextension.dylib\0", 0x7FFF504A06C8, 0x8)               = 0 0
9794/0xfd961: stat64("/usr/lib/system/libsystem_notify.dylib\0", 0x7FFF504A06C8, 0x8)             = 0 0
9794/0xfd961: stat64("/usr/lib/system/libsystem_platform.dylib\0", 0x7FFF504A06C8, 0x8)             = 0 0
9794/0xfd961: stat64("/usr/lib/system/libsystem_pthread.dylib\0", 0x7FFF504A06C8, 0x8)             = 0 0
9794/0xfd961: stat64("/usr/lib/system/libsystem_sandbox.dylib\0", 0x7FFF504A06C8, 0x8)             = 0 0
9794/0xfd961: stat64("/usr/lib/system/libsystem_secinit.dylib\0", 0x7FFF504A06C8, 0x8)             = 0 0
9794/0xfd961: stat64("/usr/lib/system/libsystem_symptoms.dylib\0", 0x7FFF504A06C8, 0x8)               = 0 0
9794/0xfd961: stat64("/usr/lib/system/libsystem_trace.dylib\0", 0x7FFF504A06C8, 0x8)             = 0 0
9794/0xfd961: stat64("/usr/lib/system/libunwind.dylib\0", 0x7FFF504A06C8, 0x8 = 0 0
9794/0xfd961: stat64("/usr/lib/system/libxpc.dylib\0", 0x7FFF504A06C8, 0x8)       = 0 0
9794/0xfd961: stat64("/usr/lib/libobjc.A.dylib\0", 0x7FFF5049F988, 0x8)          = 0 0
9794/0xfd961: open("/dev/dtracehelper\0", 0x2, 0x7FFF504A1870)                 = 3 0
9794/0xfd961: ioctl(0x3, 0x80086804, 0x7FFF504A17F8)              = 0 0
9794/0xfd961: close(0x3)                = 0 0
9794/0xfd961: thread_selfid(0x3, 0x80086804, 0x7FFF504A17F8)              = 1038689 0
9794/0xfd961: bsdthread_register(0x7FFFC2770080, 0x7FFFC2770070, 0x2000) = 1073741919 0
9794/0xfd961: ulock_wake(0x1, 0x7FFF504A0F6C, 0x0)              = -1 Err#2
9794/0xfd961: issetugid(0x1, 0x7FFF504A0F6C, 0x0)              = 0 0
9794/0xfd961: mprotect(0x10F768000, 0x88, 0x1)              = 0 0
```

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```
9794/0xfd961:  mprotect(0x10F76A000, 0x1000, 0x0)                    = 0 0
9794/0xfd961:  mprotect(0x10F780000, 0x1000, 0x0)                    = 0 0
9794/0xfd961:  mprotect(0x10F781000, 0x1000, 0x0)                    = 0 0
9794/0xfd961:  mprotect(0x10F797000, 0x1000, 0x0)                    = 0 0
9794/0xfd961:  mprotect(0x10F798000, 0x1000, 0x1)                    = 0 0
9794/0xfd961:  mprotect(0x10F768000, 0x88, 0x3)            = 0 0
9794/0xfd961:  mprotect(0x10F768000, 0x88, 0x1)            = 0 0
9794/0xfd961:  getpid(0x10F768000, 0x88, 0x1)             = 9794 0
9794/0xfd961:  stat64("/AppleInternal/XBS/.isChrooted\0", 0x7FFF504A0E28, 0x1) = -1 Err#2
9794/0xfd961:  stat64("/AppleInternal\0", 0x7FFF504A0EC0, 0x1)            = -1 Err#2
9794/0xfd961:  csops(0x2642, 0x7, 0x7FFF504A0950)           = -1 Err#22
dtrace: error on enabled probe ID 2158 (ID 561: syscall::sysctl:return): invalid kernel access in action #11 at DIF offset 40
9794/0xfd961:  ulock_wake(0x1, 0x7FFF504A0ED0, 0x0)            = -1 Err#2
9794/0xfd961:  csops(0x2642, 0x7, 0x7FFF504A0230)            = -1 Err#22
9794/0xfd961:  shm_open(0x10F761E84, 0x0, 0x100)            = 3 0
9794/0xfd961:  mmap(0x0, 0x8, 0x1, 0x1, 0x3, 0x0)            = 0x10F799000 0
9794/0xfd961:  getrlimit(0x1008, 0x7FFF504A2548, 0x1)            = 0 0
9794/0xfd961:  open_nocancel("qwerty\0", 0x601, 0x1B6)            = 4 0
9794/0xfd961:  fstat64(0x4, 0x7FFF504A21D8, 0x1B6)            = 0 0
dtrace: error on enabled probe ID 2133 (ID 951: syscall::write_nocancel:return): invalid kernel access in action #13 at DIF offset 92
9794/0xfd961:  close_nocancel(0x4)            = 0 0
9794/0xfd961:  munmap(0x10F799000, 0x8)            = 0 0
9794/0xfd961:  shm_unlink(0x10F761E84, 0x8, 0x2)            = 0 0
dtrace: error on enabled probe ID 2315 (ID 901: syscall::thread_selfid:return): invalid user access in action #5 at DIF offset 0
```

Вывод: с помощью dtruss можно проследить за системными вызовами.