

ltrace: It is used to debug and understand what a program does, by analysing the library calls that the program makes and displays the shared libraries that the program calls upon to function. It does this by executing the program and intercepting all the calls made to external libraries in the program, thus receiving the list of the program's dependencies. It can also intercept and list all the system calls and the signals.

strace: It is used to monitor and modify system calls, signals and the interactions between the specified program/process and the kernel. Similar to ltrace, the strace utility does this by executing the program to list the system calls and the signals that it generates.

ldd: It is a tool which is similar to the ones above, it lists the shared objects/libraries (.so files) that are required by any executable. It does this by invoking the standard dynamic linker with necessary flags required to trace the loaded objects set to true (LD_TRACE_LOADED_OBJECTS=1). This will make the dynamic linker inspect the executable's dependencies and then load the shared objects that do so.

nm: It is used to list the symbols that exist in an object file. It will list the symbol type, the symbol value and the symbol name. It comes with a variety of options which can be used to format the output to required preferences.

Script started on 2020-10-03 10:51:25-04:00 [TERM="xterm-256color" TTY="/dev/pts/1" COLUMNS="95" LINES="31"]

```
\033[0m;gurusaran@guru: ~/Desktop/Assignment-2\007\033[1;34mgurusaran@guru\033[00m:\033[1;32m~/Desktop/Assignment-2\033[00m$ ls
\033[0m\033[01;34mP0\033[0m \033[01;32mP0.tbz\033[0m tools
\033[0m;gurusaran@guru: ~/Desktop/Assignment-2\007\033[1;34mgurusaran@guru\033[00m:\033[1;32m~/Desktop/Assignment-2\033[00m$ cd P\033[K0/
\033[0m;gurusaran@guru: ~/Desktop/Assignment-2/P0\007\033[1;34mgurusaran@guru\033[00m:\033[1;32m~/Desktop/Assignment-2/P0\033[00m$ make
g++ -g -Wall -ansi -pedantic -c simDisk.C
g++ -g -Wall -ansi -pedantic -c bitVector.C
g++ -g -Wall -ansi -pedantic -c directory.C
g++ -g -Wall -ansi -pedantic -c file.C
g++ -g -Wall -ansi -pedantic -c iNodes.C
g++ -g -Wall -ansi -pedantic -c volume.C
g++ -g -Wall -ansi -pedantic -c shell.C
g++ -o P0 -g -Wall -ansi -pedantic simDisk.o bitVector.o directory.o file.o iNodes.o volume.o shell.o
\033[0m;gurusaran@guru: ~/Desktop/Assignment-2/P0\007\033[1;34mgurusaran@guru\033[00m:\033[1;32m~/Desktop/Assignment-2/P0\033[00m$ ltrace POST\033[K033[K033[K033[K.C.P0
Can't execute './P0': No such file or directory
failed to initialize process 2968: No such file or directory
couldn't open program './P0': No such file or directory
\033[0m;gurusaran@guru: ~/Desktop/Assignment-2/P0\007\033[1;34mgurusaran@guru\033[00m:\033[1;32m~/Desktop/Assignment-2/P0\033[00m$ ltrace ./P0\033[K0
puts("The shell has only the following"...The shell has only the following cmds:
)
= 39
printf("\t%s\t%s\n", "quit", "" quit
)
= 7
printf("\t%s\t%s\n", "mkdisk", "" mkdisk
)
= 9
printf("\t%s\t%s\n", "fddisk", "" fddisk
)
= 9
printf("\t%s\t%s\n", "rddisk", "u" rddisk u
)
= 10
printf("\t%s\t%s\n", "wrdisk", "us" wrdisk us
)
= 11
printf("\t%s\t%s\n", "echo", "ssss" echo ssss
)
= 11
printf("\t%s\t%s\n", "mkfs", "uu" mkfs uu
```

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)
printf("\t%s\t%s\n", "findfs", "findfs")
)
printf("\t%s\t%s\n", "inode", "inode u")
)
printf("\t%s\t%s\n", "q", "q")
)
puts("Start with ! to invoke a Unix sh"...Start with ! to invoke a Unix shell cmd)
)
printf("%s", "sh350% ")
fgets(sh350% q
"q\n", 1023, 0x7fc3b7207980)
strlen("q\n")
printf("cmd [%s]\n", "q"cmd [q]
)
strtok("q", " \t")
strcmp("q", "quit")
strcmp("q", "mkdisk")
strcmp("q", "fddisk")
strcmp("q", "rddisk")
strcmp("q", "wrddisk")
strcmp("q", "echo")
strcmp("q", "mkfs")
strcmp("q", "findfs")
strcmp("q", "inode")
strcmp("q", "q")
strlen("")
_znam(0, 0x55777392e205, 0x7fffffff, 0)
exit(0 <no return ...>
+++ exited (status 0) +++
\033]0;gurusaran@guru: ~/Desktop/Assignment-2/P0\007\033[1;34mgurusaran@guru\033[00m:\033[1;32
m~/Desktop/Assignment-2/P0\033[00m$ strace ./P0
execve("./P0", ["/P0"], 0x7fff111f9340 /* 48 vars */) = 0
brk(NULL)
access("/etc/ld.so.preload", R_OK)
openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3
fstat(3, {st_mode=S_IFREG|0644, st_size=85378, ...}) = 0
mmap(NULL, 85378, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7f938aaea000
close(3)
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libstdc++.so.6", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\300\240\t\0\0\0\0"..., 832) = 832
fstat(3, {st_mode=S_IFREG|0644, st_size=1870824, ...}) = 0
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f938aae8000
mmap(NULL, 1886208, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f938a91b000
mprotect(0x7f938a9b1000, 1204224, PROT_NONE) = 0
mmap(0x7f938a9b1000, 901120, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x96
000) = 0x7f938a9b1000
mmap(0x7f938aa8d000, 299008, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x172000) = 0x
7f938aa8d000
mmap(0x7f938aad7000, 57344, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1b
b000) = 0x7f938aad7000
mmap(0x7f938aae5000, 10240, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0)
= 0x7f938aae5000
close(3)
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libgcc_s.so.1", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0203\0\0\0\0\0"..., 832) = 832
fstat(3, {st_mode=S_IFREG|0644, st_size=100736, ...}) = 0
mmap(NULL, 103496, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f938a901000
mmap(0x7f938a904000, 69632, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x300
0) = 0x7f938a904000
mmap(0x7f938a915000, 16384, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x14000) = 0x7f
938a915000
mmap(0x7f938a919000, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x170

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00) = 0x7f938a919000
close(3) = 0
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libc.so.6", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0n\2\0\0\0\0"..., 832) = 832
fstat(3, {st_mode=S_IFREG|0755, st_size=1839792, ...}) = 0
mmap(NULL, 1852680, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f938a73c000
mprotect(0x7f938a761000, 1662976, PROT_NONE) = 0
mmap(0x7f938a761000, 1355776, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x25000) = 0x7f938a761000
mmap(0x7f938a8ac000, 303104, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x170000) = 0x7f938a8ac000
mmap(0x7f938a8f7000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1ba000) = 0x7f938a8f7000
mmap(0x7f938a8fd000, 13576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7f938a8fd000
close(3) = 0
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libm.so.6", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0\362\0\0\0\0\0"..., 832) = 832
fstat(3, {st_mode=S_IFREG|0644, st_size=1321344, ...}) = 0
mmap(NULL, 1323280, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f938a5f8000
mmap(0x7f938a607000, 630784, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0xf000) = 0x7f938a607000
mmap(0x7f938a6a1000, 626688, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0xa9000) = 0x7f938a6a1000
mmap(0x7f938a73a000, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x141000) = 0x7f938a73a000
close(3) = 0
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f938a5f6000
arch_prctl(ARCH_SET_FS, 0x7f938a5f7100) = 0
mprotect(0x7f938a8f7000, 12288, PROT_READ) = 0
mprotect(0x7f938a73a000, 4096, PROT_READ) = 0
mprotect(0x7f938a919000, 4096, PROT_READ) = 0
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f938a5f4000
mprotect(0x7f938aad7000, 45056, PROT_READ) = 0
mprotect(0x562805c19000, 4096, PROT_READ) = 0
mprotect(0x7f938ab29000, 4096, PROT_READ) = 0
munmap(0x7f938aaea000, 85378) = 0
brk(NULL) = 0x562806790000
brk(0x5628067b1000) = 0x5628067b1000
fstat(1, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0x2), ...}) = 0
write(1, "The shell has only the following"..., 39The shell has only the following cmds:
) = 39
write(1, "\tquit\t\t\n", 7 quit
) = 7
write(1, "\tmkdisk\t\t\n", 9 mkdisk
) = 9
write(1, "\tfddisk\t\t\n", 9 fddisk
) = 9
write(1, "\trddisk\tu\n", 10 rddisk u
) = 10
write(1, "\twrdisk\tus\n", 11 wrdisk us
) = 11
write(1, "\techo\tssss\n", 11 echo ssss
) = 11
write(1, "\tmkfs\tuu\n", 9 mkfs uu
) = 9
write(1, "\tfindfs\t\n", 9 findfs
) = 9
write(1, "\tinode\tu\n", 9 inode u
) = 9
write(1, "\tq\t\n", 4 q
) = 4
write(1, "Start with ! to invoke a Unix sh"..., 40Start with ! to invoke a Unix shell cmd

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) = 40
fstat(0, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0x2), ...}) = 0
write(1, "sh350% ", 7sh350% ) = 7
read(0, ^C0x5628067a22c0, 1024) = ? ERESTARTSYS (To be restarted if SA_RESTART is set)
strace: Process 2975 detached

\033]0;gurusaran@guru: ~/Desktop/Assignment-2/P0\007\033[1;34mgurusaran@guru\033[00m:\033[1;32m~/Desktop/Assignment-2/P0\033[00m$ ldd P0
        linux-vdso.so.1 (0x00007ffde67d7000)
        libstdc++.so.6 => /lib/x86_64-linux-gnu/libstdc++.so.6 (0x00007effee612000)
        libgcc_s.so.1 => /lib/x86_64-linux-gnu/libgcc_s.so.1 (0x00007effee5f8000)
        libc.so.6 => /lib/x86_64-linux-gnu/libc.so.6 (0x00007effee433000)
        libm.so.6 => /lib/x86_64-linux-gnu/libm.so.6 (0x00007effee2ef000)
        /lib64/ld-linux-x86-64.so.2 (0x00007effee7fe000)
\033]0;gurusaran@guru: ~/Desktop/Assignment-2/P0\007\033[1;34mgurusaran@guru\033[00m:\033[1;32m~/Desktop/Assignment-2/P0\033[00m$ nm P0
          U atoi@@GLIBC_2.2.5
00000000000007260 B __bss_start
00000000000007278 B cfv
          U close@@GLIBC_2.2.5
00000000000007120 D cmdTable
00000000000007268 b completed.7452
          w __cxa_finalize@@GLIBC_2.2.5
00000000000007100 D __data_start
00000000000007100 W data_start
00000000000001210 t deregister_tm_clones
00000000000001280 t __do_global_dtors_aux
00000000000006dd0 d __do_global_dtors_aux_fini_array_entry
00000000000007108 D __dso_handle
00000000000007110 V DW.ref.__gxx_personality_v0
00000000000006dd8 d _DYNAMIC
00000000000007260 D _edata
00000000000007280 B _end
          U exit@@GLIBC_2.2.5
          U fclose@@GLIBC_2.2.5
          U fgets@@GLIBC_2.2.5
00000000000003a30 T _fini
          U fopen@@GLIBC_2.2.5
000000000000012c0 t frame_dummy
00000000000006dc8 d __frame_dummy_init_array_entry
00000000000004ef4 r __FRAME_END__
          U fscanf@@GLIBC_2.2.5
00000000000003a20 T __fstat
00000000000003a20 t fstat
          U __fxstat@@GLIBC_2.2.5
00000000000007000 d _GLOBAL_OFFSET_TABLE_
          w __gmon_start__
00000000000004320 r __GNU_EH_FRAME_HDR
          U __gxx_personality_v0@@CXXABI_1.3
00000000000001000 t _init
00000000000006dd0 d __init_array_end
00000000000006dc8 d __init_array_start
00000000000004000 R _IO_stdin_used
          w _ITM_deregisterTMCloneTable
          w _ITM_registerTMCloneTable
00000000000003a10 T __libc_csu_fini
000000000000039b0 T __libc_csu_init
          U __libc_start_main@@GLIBC_2.2.5
          U lseek@@GLIBC_2.2.5
000000000000038df T main
          U memcpy@@GLIBC_2.14
          U memset@@GLIBC_2.2.5
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00000000000007118 D ncmsgs
                      U open@@GLIBC_2.2.5
                      U printf@@GLIBC_2.2.5
                      U puts@@GLIBC_2.2.5
                      U read@@GLIBC_2.2.5
00000000000001240 t register_tm_clones
00000000000007270 B simDisk
                      U sprintf@@GLIBC_2.2.5
000000000000011e0 T _start
00000000000007260 B stdin@@GLIBC_2.2.5
                      U strcmp@@GLIBC_2.2.5
                      U strlen@@GLIBC_2.2.5
                      U strncpy@@GLIBC_2.2.5
                      U strtok@@GLIBC_2.2.5
                      U system@@GLIBC_2.2.5
00000000000007260 D __TMC_END__
                      U _Unwind_Resume@@GCC_3.0
                      U write@@GLIBC_2.2.5
0000000000000317a T _Z10doMakeDiskP3Arg
0000000000000327e T _Z10doReadDiskP3Arg
00000000000002ef7 T _Z10releaseCfzv
000000000000031b2 T _Z11doWriteDiskP3Arg
00000000000002f91 T _Z13isAlphaNumDotc
00000000000002ec5 T _Z14releaseSimDiskv
00000000000002f40 T _Z4TODOPKc
00000000000002f29 T _Z4TODov
00000000000002fd5 T _Z5toNumPKc
0000000000000346d T _Z5usagev
00000000000003306 T _Z6doEchoP3Arg
000000000000032e6 T _Z6doQuitP3Arg
00000000000003439 T _Z7doInodeP3Arg
00000000000003824 T _Z7findCmdPc
00000000000002f6b T _Z7isDigitc
00000000000003883 T _Z7ourgetsPcj
000000000000033f4 T _Z8doFindFSP3Arg
0000000000000338a T _Z8doMakeFSP3Arg
000000000000034e6 T _Z9invokeCmdv
0000000000000302f T _Z9mkSimDiskv
                      U _ZdlPv@@GLIBCXX_3.4
00000000000002e6a T _ZN10FileVolume10writeBlockEjPv
00000000000002e98 T _ZN10FileVolume9readBlockEjPv
00000000000002d78 T _ZN10FileVolumeC1EP7SimDisk
00000000000002bfc T _ZN10FileVolumeC1EP7SimDiskjj
00000000000002d78 T _ZN10FileVolumeC2EP7SimDisk
00000000000002bfc T _ZN10FileVolumeC2EP7SimDiskjj
00000000000001eee T _ZN4File10writeBlockEjPv
00000000000001f50 T _ZN4File11appendBytesEPvj
00000000000001e44 T _ZN4File14appendOneBlockEPvj
000000000000020c2 T _ZN4File20deletePrecedingBytesEj
00000000000001d74 T _ZN4File23prepareToReadByteByByteEv
00000000000001db2 T _ZN4File8nextByteEPv
00000000000001c9c T _ZN4File9readBlockEjPv
00000000000001c0e T _ZN4FileC1EP10FileVolumej
00000000000001c0e T _ZN4FileC2EP10FileVolumej
00000000000001c78 T _ZN4FileD1Ev
00000000000001c78 T _ZN4FileD2Ev
00000000000002616 T _ZN6Inodes11getFileSizeEj
000000000000026ce T _ZN6Inodes11incFileSizeEji
00000000000002662 T _ZN6Inodes11setFileSizeEjj
000000000000025a6 T _ZN6Inodes12getFreeInodeEv
00000000000002a20 T _ZN6Inodes13releaseBlocksEj
000000000000027e2 T _ZN6Inodes14addBlockNumberEjj
000000000000029c0 T _ZN6Inodes14getBlockNumberEjj
```

```
0000000000000279a T _ZN6Inodes17addDoubleIndirectEPjjj
000000000000027be T _ZN6Inodes17addSingleIndirectEPjjj
00000000000002776 T _ZN6Inodes17addTripleIndirectEPjjj
00000000000002b44 T _ZN6Inodes4showEj
00000000000002284 T _ZN6Inodes6createEP10FileVolumejjj
00000000000002afe T _ZN6Inodes7releaseEj
0000000000000246e T _ZN6Inodes8getInodeEjPj
00000000000002554 T _ZN6Inodes8putInodeEj
00000000000002422 T _ZN6Inodes8reCreateEP10FileVolume
0000000000000294e T _ZN6Inodes9lastBlockEj
00000000000001552 T _ZN7SimDisk10readSectorEjPv
000000000000015e0 T _ZN7SimDisk11writeSectorEjPv
0000000000000149a T _ZN7SimDisk13makeDiskImageEv
0000000000000143c T _ZN7SimDisk13openDiskImageEj
0000000000000166e T _ZN7SimDisk6findfsEv
000000000000016be T _ZN7SimDisk6makefsEjj
000000000000013f0 T _ZN7SimDisk8paramsOKEv
000000000000012c6 T _ZN7SimDiskC1EPKcjj
000000000000012c6 T _ZN7SimDiskC2EPKcjj
00000000000001a84 T _ZN9BitVector10getFreeBitEv
0000000000000171a T _ZN9BitVector6createEP10FileVolumejj
000000000000018be T _ZN9BitVector6getBitEj
0000000000000196e T _ZN9BitVector6setBitEjj
00000000000001830 T _ZN9BitVector8reCreateEP10FileVolumejj
00000000000001ae6 T _ZN9Directory6createEP10FileVolume
00000000000001be4 T _ZN9Directory8reCreateEP10FileVolume
U _Znam@@GLIBCXX_3.4
U _Znwm@@GLIBCXX_3.4
\033]0;gurusaran@guru: ~/Desktop/Assignment-2/P0\007\033[1;34mgurusaran@guru\033[00m:\033[1;32
m~/Desktop/Assignment-2/P0\033[00m$ nm bi\007tVector.o
U _GLOBAL_OFFSET_TABLE_
U memset
U _ZN10FileVolume10writeBlockEjPv
U _ZN10FileVolume9readBlockEjPv
0000000000000036a T _ZN9BitVector10getFreeBitEv
00000000000000000 T _ZN9BitVector6createEP10FileVolumejj
000000000000001a4 T _ZN9BitVector6getBitEj
00000000000000254 T _ZN9BitVector6setBitEjj
00000000000000116 T _ZN9BitVector8reCreateEP10FileVolumejj
U _Znam
\033]0;gurusaran@guru: ~/Desktop/Assignment-2/P0\007\033[1;34mgurusaran@guru\033[00m:\033[1;32
m~/Desktop/Assignment-2/P0\033[00m$ exit
exit
```

Script done on 2020-10-03 10:54:50-04:00 [COMMAND_EXIT_CODE="0"]