

-ls 在根目錄底下的 bin 資料夾中。

1. 統計 ls 究竟呼叫了哪些 system call ?

acetox@acetox-VirtualBox:/bin\$ strace -c ls

% time	seconds	usecs/call	calls	errors	syscall

49.94	0.000450	23	20		write
14.65	0.000132	66	2		getdents
12.43	0.000112	9	12		mprotect
3.66	0.000033	3	11		close
3.33	0.000030	3	9		open
3.33	0.000030	2	19		mmap
3.00	0.000027	4	7		read
3.00	0.000027	27	1		munmap
2.22	0.000020	10	2	2	statfs
1.11	0.000010	1	10		fstat
0.78	0.000007	4	2		ioctl
0.67	0.000006	2	3		brk
0.55	0.000005	3	2		rt_sigaction
0.33	0.000003	3	1		getrlimit
0.33	0.000003	3	1		arch_prctl
0.22	0.000002	2	1		rt_sigprocmask
0.22	0.000002	2	1		set_tid_address
0.22	0.000002	2	1		set_robust_list
0.00	0.000000	0	7	7	access
0.00	0.000000	0	1		execve

100.00	0.000901		113	9	total

-可得知叫了 20 種 system call，其中以 getdents 呼叫最多次。

2. 拿掉 ch03 上課時範例 table 的 symbol table，觀察檔案大小的變化。

-拿掉 symbol table 前大小為 11k。

```
acetox@acetox-VirtualBox:~/Desktop/2018/ch03$ ls -alh table
-rwxrwxr-x 1 acetox acetox 11K  四  11 00:45 table
```

-拿掉 symbol table 後大小為 6.2k。

```
acetox@acetox-VirtualBox:~/Desktop/2018/ch03$ strip table
acetox@acetox-VirtualBox:~/Desktop/2018/ch03$ ls -alh table
-rwxrwxr-x 1 acetox acetox 6.2K  四  11 00:47 table
```

3. 試試看 table 是否還可以用。

```
acetox@acetox-VirtualBox:~/Desktop/2018/ch03$ gcc -g table.c -o table
acetox@acetox-VirtualBox:~/Desktop/2018/ch03$ strip table
acetox@acetox-VirtualBox:~/Desktop/2018/ch03$ ./table
hello
```

-table 執行檔仍然可使用，因為只有 symbol table 被拿掉而已。

4. 試試看使用 objdump -R 觀察 ls 有連結哪些函式庫。

```
acetox@acetox-VirtualBox:/bin$ objdump -R ls

ls:          file format elf64-x86-64

DYNAMIC RELOCATION RECORDS
OFFSET          TYPE              VALUE
000000000061dff8 R_X86_64_GLOB_DAT  __gmon_start__
000000000061e600 R_X86_64_COPY      __progname@@GLIBC_2.2.5
000000000061e608 R_X86_64_COPY      stdout@@GLIBC_2.2.5
000000000061e610 R_X86_64_COPY      optind@@GLIBC_2.2.5
000000000061e618 R_X86_64_COPY      optarg@@GLIBC_2.2.5
000000000061e620 R_X86_64_COPY      __progname_full@@GLIBC_2.2.5
000000000061e640 R_X86_64_COPY      stderr@@GLIBC_2.2.5
000000000061e018 R_X86_64_JUMP_SLOT __ctype_toupper_loc@GLIBC_2.3
000000000061e020 R_X86_64_JUMP_SLOT __uflow@GLIBC_2.2.5
000000000061e028 R_X86_64_JUMP_SLOT getenv@GLIBC_2.2.5
000000000061e030 R_X86_64_JUMP_SLOT sigprocmask@GLIBC_2.2.5
000000000061e038 R_X86_64_JUMP_SLOT raise@GLIBC_2.2.5
000000000061e040 R_X86_64_JUMP_SLOT free@GLIBC_2.2.5
000000000061e048 R_X86_64_JUMP_SLOT localtime@GLIBC_2.2.5
000000000061e050 R_X86_64_JUMP_SLOT __mempcpy_chk@GLIBC_2.3.4
000000000061e058 R_X86_64_JUMP_SLOT abort@GLIBC_2.2.5
000000000061e060 R_X86_64_JUMP_SLOT __errno_location@GLIBC_2.2.5
000000000061e068 R_X86_64_JUMP_SLOT strncmp@GLIBC_2.2.5
000000000061e070 R_X86_64_JUMP_SLOT localtime_r@GLIBC_2.2.5
000000000061e078 R_X86_64_JUMP_SLOT _exit@GLIBC_2.2.5
000000000061e080 R_X86_64_JUMP_SLOT strcpy@GLIBC_2.2.5
000000000061e088 R_X86_64_JUMP_SLOT __fpending@GLIBC_2.2.5
000000000061e090 R_X86_64_JUMP_SLOT isatty@GLIBC_2.2.5
000000000061e098 R_X86_64_JUMP_SLOT sigaction@GLIBC_2.2.5
000000000061e0a0 R_X86_64_JUMP_SLOT iswcntrl@GLIBC_2.2.5
000000000061e0a8 R_X86_64_JUMP_SLOT wcswidth@GLIBC_2.2.5
000000000061e0b0 R_X86_64_JUMP_SLOT localeconv@GLIBC_2.2.5
000000000061e0b8 R_X86_64_JUMP_SLOT mbstowcs@GLIBC_2.2.5
```

```
0000000000061e0b8 R_X86_64_JUMP_SLOT mbstowcs@GLIBC_2.2.5
0000000000061e0c0 R_X86_64_JUMP_SLOT readlink@GLIBC_2.2.5
0000000000061e0c8 R_X86_64_JUMP_SLOT clock_gettime@GLIBC_2.17
0000000000061e0d0 R_X86_64_JUMP_SLOT setenv@GLIBC_2.2.5
0000000000061e0d8 R_X86_64_JUMP_SLOT textdomain@GLIBC_2.2.5
0000000000061e0e0 R_X86_64_JUMP_SLOT fclose@GLIBC_2.2.5
0000000000061e0e8 R_X86_64_JUMP_SLOT opendir@GLIBC_2.2.5
0000000000061e0f0 R_X86_64_JUMP_SLOT getpwuid@GLIBC_2.2.5
0000000000061e0f8 R_X86_64_JUMP_SLOT bindtextdomain@GLIBC_2.2.5
0000000000061e100 R_X86_64_JUMP_SLOT stpcpy@GLIBC_2.2.5
0000000000061e108 R_X86_64_JUMP_SLOT dcgettext@GLIBC_2.2.5
0000000000061e110 R_X86_64_JUMP_SLOT __ctype_get_mb_cur_max@GLIBC_2.2.5
0000000000061e118 R_X86_64_JUMP_SLOT strlen@GLIBC_2.2.5
0000000000061e120 R_X86_64_JUMP_SLOT __lxstat@GLIBC_2.2.5
0000000000061e128 R_X86_64_JUMP_SLOT __stack_chk_fail@GLIBC_2.4
0000000000061e130 R_X86_64_JUMP_SLOT getopt_long@GLIBC_2.2.5
0000000000061e138 R_X86_64_JUMP_SLOT mbrtowc@GLIBC_2.2.5
0000000000061e140 R_X86_64_JUMP_SLOT strchr@GLIBC_2.2.5
0000000000061e148 R_X86_64_JUMP_SLOT getgrgid@GLIBC_2.2.5
0000000000061e150 R_X86_64_JUMP_SLOT __overflow@GLIBC_2.2.5
0000000000061e158 R_X86_64_JUMP_SLOT strrchr@GLIBC_2.2.5
0000000000061e160 R_X86_64_JUMP_SLOT fgetfilecon
0000000000061e168 R_X86_64_JUMP_SLOT gmtime_r@GLIBC_2.2.5
0000000000061e170 R_X86_64_JUMP_SLOT lseek@GLIBC_2.2.5
0000000000061e178 R_X86_64_JUMP_SLOT gettimeofday@GLIBC_2.2.5
0000000000061e180 R_X86_64_JUMP_SLOT __assert_fail@GLIBC_2.2.5
0000000000061e188 R_X86_64_JUMP_SLOT __strtoul_internal@GLIBC_2.2.5
0000000000061e190 R_X86_64_JUMP_SLOT fnmatch@GLIBC_2.2.5
0000000000061e198 R_X86_64_JUMP_SLOT memset@GLIBC_2.2.5
0000000000061e1a0 R_X86_64_JUMP_SLOT fscanf@GLIBC_2.2.5
0000000000061e1a8 R_X86_64_JUMP_SLOT ioctl@GLIBC_2.2.5
0000000000061e1b0 R_X86_64_JUMP_SLOT close@GLIBC_2.2.5
0000000000061e1b8 R_X86_64_JUMP_SLOT closedir@GLIBC_2.2.5
0000000000061e1c0 R_X86_64_JUMP_SLOT __libc_start_main@GLIBC_2.2.5
0000000000061e1c8 R_X86_64_JUMP_SLOT memcmp@GLIBC_2.2.5
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0000000000061e1c8 R_X86_64_JUMP_SLOT memcmp@GLIBC_2.2.5
0000000000061e1d0 R_X86_64_JUMP_SLOT _setjmp@GLIBC_2.2.5
0000000000061e1d8 R_X86_64_JUMP_SLOT fputs_unlocked@GLIBC_2.2.5
0000000000061e1e0 R_X86_64_JUMP_SLOT calloc@GLIBC_2.2.5
0000000000061e1e8 R_X86_64_JUMP_SLOT lgetfilecon
0000000000061e1f0 R_X86_64_JUMP_SLOT strcmp@GLIBC_2.2.5
0000000000061e1f8 R_X86_64_JUMP_SLOT signal@GLIBC_2.2.5
0000000000061e200 R_X86_64_JUMP_SLOT dirfd@GLIBC_2.2.5
0000000000061e208 R_X86_64_JUMP_SLOT getpwnam@GLIBC_2.2.5
0000000000061e210 R_X86_64_JUMP_SLOT __memcpy_chk@GLIBC_2.3.4
0000000000061e218 R_X86_64_JUMP_SLOT sigemptyset@GLIBC_2.2.5
0000000000061e220 R_X86_64_JUMP_SLOT memcpy@GLIBC_2.14
0000000000061e228 R_X86_64_JUMP_SLOT getgrnam@GLIBC_2.2.5
0000000000061e230 R_X86_64_JUMP_SLOT getfilecon
0000000000061e238 R_X86_64_JUMP_SLOT tzset@GLIBC_2.2.5
0000000000061e240 R_X86_64_JUMP_SLOT fileno@GLIBC_2.2.5
0000000000061e248 R_X86_64_JUMP_SLOT tcgetpgrp@GLIBC_2.2.5
0000000000061e250 R_X86_64_JUMP_SLOT __xstat@GLIBC_2.2.5
0000000000061e258 R_X86_64_JUMP_SLOT readdir@GLIBC_2.2.5
0000000000061e260 R_X86_64_JUMP_SLOT wcurwidth@GLIBC_2.2.5
0000000000061e268 R_X86_64_JUMP_SLOT malloc@GLIBC_2.2.5
0000000000061e270 R_X86_64_JUMP_SLOT fflush@GLIBC_2.2.5
0000000000061e278 R_X86_64_JUMP_SLOT nl_langinfo@GLIBC_2.2.5
0000000000061e280 R_X86_64_JUMP_SLOT ungetc@GLIBC_2.2.5
0000000000061e288 R_X86_64_JUMP_SLOT __fxstat@GLIBC_2.2.5
0000000000061e290 R_X86_64_JUMP_SLOT strcoll@GLIBC_2.2.5
0000000000061e298 R_X86_64_JUMP_SLOT __freading@GLIBC_2.2.5
0000000000061e2a0 R_X86_64_JUMP_SLOT fwrite_unlocked@GLIBC_2.2.5
0000000000061e2a8 R_X86_64_JUMP_SLOT realloc@GLIBC_2.2.5
0000000000061e2b0 R_X86_64_JUMP_SLOT stpncpy@GLIBC_2.2.5
0000000000061e2b8 R_X86_64_JUMP_SLOT fdopen@GLIBC_2.2.5
0000000000061e2c0 R_X86_64_JUMP_SLOT setlocale@GLIBC_2.2.5
0000000000061e2c8 R_X86_64_JUMP_SLOT __printf_chk@GLIBC_2.3.4
0000000000061e2d0 R_X86_64_JUMP_SLOT timegm@GLIBC_2.2.5
0000000000061e2d8 R_X86_64_JUMP_SLOT strftime@GLIBC_2.2.5
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0000000000061e2d8 R_X86_64_JUMP_SLOT strftime@GLIBC_2.2.5
0000000000061e2e0 R_X86_64_JUMP_SLOT memcpy@GLIBC_2.2.5
0000000000061e2e8 R_X86_64_JUMP_SLOT memmove@GLIBC_2.2.5
0000000000061e2f0 R_X86_64_JUMP_SLOT error@GLIBC_2.2.5
0000000000061e2f8 R_X86_64_JUMP_SLOT open@GLIBC_2.2.5
0000000000061e300 R_X86_64_JUMP_SLOT fseeko@GLIBC_2.2.5
0000000000061e308 R_X86_64_JUMP_SLOT unsetenv@GLIBC_2.2.5
0000000000061e310 R_X86_64_JUMP_SLOT strtoul@GLIBC_2.2.5
0000000000061e318 R_X86_64_JUMP_SLOT __cxa_atexit@GLIBC_2.2.5
0000000000061e320 R_X86_64_JUMP_SLOT wcstombs@GLIBC_2.2.5
0000000000061e328 R_X86_64_JUMP_SLOT getxattr@GLIBC_2.3
0000000000061e330 R_X86_64_JUMP_SLOT freecon
0000000000061e338 R_X86_64_JUMP_SLOT sigismember@GLIBC_2.2.5
0000000000061e340 R_X86_64_JUMP_SLOT exit@GLIBC_2.2.5
0000000000061e348 R_X86_64_JUMP_SLOT fwrite@GLIBC_2.2.5
0000000000061e350 R_X86_64_JUMP_SLOT __fprintf_chk@GLIBC_2.3.4
0000000000061e358 R_X86_64_JUMP_SLOT fflush_unlocked@GLIBC_2.2.5
0000000000061e360 R_X86_64_JUMP_SLOT mbsinit@GLIBC_2.2.5
0000000000061e368 R_X86_64_JUMP_SLOT iswprint@GLIBC_2.2.5
0000000000061e370 R_X86_64_JUMP_SLOT sigaddset@GLIBC_2.2.5
0000000000061e378 R_X86_64_JUMP_SLOT strstr@GLIBC_2.2.5
0000000000061e380 R_X86_64_JUMP_SLOT __ctype_tolower_loc@GLIBC_2.3
0000000000061e388 R_X86_64_JUMP_SLOT __ctype_b_loc@GLIBC_2.3
0000000000061e390 R_X86_64_JUMP_SLOT __sprintf_chk@GLIBC_2.3.4

```

-可看到ls 連結到了相當多的函式庫。