

## 임베디드 시스템 실습

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우선 syscall함수를 만들고, makefile과 table을 수정하는 과정입니다. Syscall table 322번에 min\_world를 추가해주었습니다.

```
seungmin@seungmin-W65-W67RC: ~/goldfish/arch/x86/sysc...
308 common setns sys_setns
309 common getcpu sys_getcpu
310 64 process_vm_readv sys_process_vm_readv
311 64 process_vm_writev sys_process_vm_writev
312 common kcmp sys_kcmp
313 common finit_module sys_finit_module
# 314 common sched_setattr sys_sched_setattr
# 315 common sched_getattr sys_sched_getattr
# 316 common renameat2 sys_renameat2
317 common seccomp sys_seccomp

322 common min_world sys_min_world
#
# x32-specific system call numbers start at 512 to avoid cache impact
# for native 64-bit operation.
#
512 x32 rt_sigaction compat_sys_rt_sigaction
513 x32 rt_sigreturn stub_x32_rt_sigreturn
514 x32 ioctl compat_sys_ioctl
515 x32 readv compat_sys_readv
516 x32 writev compat_sys_writev
517 x32 recvfrom compat_sys_recvfrom
518 x32 sendmsg compat_sys_sendmsg
"syscall_64.tbl" 363L, 12508C 328,11-16 92%
```

그 후 syscall함수를 만들어 주었습니다.

```
#include <linux/kernel.h>

asmmlinkage long sys_min_world(void)
{
    printk("Hello, My name is Seungmin~~~\n");
    return 0;
}
```

Makefile에 syscall\_test의 object파일을 추가한 이후 compile까지 해주었습니다.

```
seungmin@seungmin-W65-W67RC: ~/goldfish/arch/x86/mm
obj-y := init.o init_${BITS}.o fault.o ioremap.o extable.o pageattr.o mmap.o
\
pat.o pgtable.o physaddr.o gup.o setup_nx.o syscall_test.o

# Make sure __phys_addr has no stackprotector
nostackp := $(call cc-option, -fno-stack-protector)
CFLAGS_physaddr.o := $(nostackp)
CFLAGS_setup_nx.o := $(nostackp)

obj-$(CONFIG_X86_PAT) += pat_rbtrees.o
obj-$(CONFIG_SMP) += tlb.o

obj-$(CONFIG_X86_32) += pgtable_32.o iomap_32.o

obj-$(CONFIG_HUGETLB_PAGE) += hugetlbpage.o
obj-$(CONFIG_X86_PT_DUMP) += dump_pagetables.o

obj-$(CONFIG_HIGHMEM) += highmem_32.o

obj-$(CONFIG_KMEMCHECK) += kmemcheck/

obj-$(CONFIG_MMIOTRACE) += mmiotrace.o
mmiotrace-y := kmio.o pf_in.o mmio-mod.o
"Makefile" 30L, 936C 1,67-69 꼭대기

seungmin@seungmin-W65-W67RC: ~
highmem_32.c mm_internal.h pat.o srat.c
hugetlbpage.c mmap.c pat_internal.h testmmiotrace.c
hugetlbpage.o mmap.o pat_rbtrees.c tlb.c
init.c mmio-mod.c pat_rbtrees.o tlb.o
seungmin@seungmin-W65-W67RC:~/goldfish/arch/x86/mm$ vi syscall_test.c
seungmin@seungmin-W65-W67RC:~/goldfish/arch/x86/mm$ vi syscall_test.c
seungmin@seungmin-W65-W67RC:~/goldfish/arch/x86/mm$ ci Makefile

명령어 'ci' 을(를) 찾을 수 없습니다. 그러나 다음을 통해 설치할 수 있습니다:
sudo apt install rcs

seungmin@seungmin-W65-W67RC:~/goldfish/arch/x86/mm$ vi Makefile
seungmin@seungmin-W65-W67RC:~/goldfish/arch/x86/mm$ cd ..
seungmin@seungmin-W65-W67RC:~/goldfish/arch/x86$ cd syscalls/
seungmin@seungmin-W65-W67RC:~/goldfish/arch/x86/syscalls$ vi syscall_64.tbl
seungmin@seungmin-W65-W67RC:~/goldfish/arch/x86/syscalls$ cd ..
seungmin@seungmin-W65-W67RC:~/goldfish/arch/x86$ cd ..
seungmin@seungmin-W65-W67RC:~/goldfish/arch$ cd ..
seungmin@seungmin-W65-W67RC:~/goldfish$ export ARCH=x86_64
seungmin@seungmin-W65-W67RC:~/goldfish$ export CROSS_COMPILE=~/x86_64-linux-android-4.9/bin/x86_64-linux-android-
seungmin@seungmin-W65-W67RC:~/goldfish$ make x86_64_ranchu_defconfig
arch/x86/configs/x86_64_ranchu_defconfig:128:warning: override: reassigning to symbol NETFILTER_TPROXY
#
# configuration written to .config
#
seungmin@seungmin-W65-W67RC:~/goldfish$ make -j4
scripts/kconfig/conf --silentoldconfig Kconfig
make[1]: 'all'을(를) 위해 할 일이 없습니다.
CHK include/generated/uapi/linux/version.h
CC scripts/mod/devicetable-offsets.s
GEN scripts/mod/devicetable-offsets.h
HOSTCC scripts/mod/file2alias.o
```

이후 마지막으로 userspace에서 syscall을 호출하는 함수를 만든 후 android-toolchain으로 compile한 이후 adb를 통해 연결해주어 전송하였습니다.

[illegible]

최종적으로 adb를 사용하여 파일을 실행한 화면입니다.

```
seungmin@seungmin-W65-W67RC:~$ ls
Android          my-android-toolchain      다운로드 사진
AndroidStudioProjects userspace.c                문서 음악
a.out            x86_64-linux-android-4.9  바탕화면 램플릿
goldfish         공개                       비디오

seungmin@seungmin-W65-W67RC:~$ vi userspace.c
seungmin@seungmin-W65-W67RC:~$ ~/my-android-toolchain/bin/x86_64-linux-android-gcc -pie userspace.c
seungmin@seungmin-W65-W67RC:~$ adb devices
List of devices attached
adb server version (41) doesn't match this client (39); killing...
* daemon started successfully
emulator-5554    device

seungmin@seungmin-W65-W67RC:~$ adb push a.out /data/local/tmp
a.out: 1 file pushed. 0.6 MB/s (7352 bytes in 0.011s)
seungmin@seungmin-W65-W67RC:~$ adb shell
generic_x86_64:/ $ su
generic_x86_64:/ # ./data/local/tmp/a.out
generic_x86_64:/ # dmesg | grep "min"
[ 0.000000] Linux version 3.10.0+ (seungmin@seungmin-W65-W67RC) (gcc version 4.9.x 20150123 (prerelease) (GCC) )
#4 SMP PREEMPT Tue Mar 2 18:29:10 KST 2021
[ 0.021385] pid_max: default: 32768 minimum: 301
[ 0.818718] ieee80211 phy0: Selected rate control algorithm 'minstrel_ht'
[ 0.819930] ieee80211 phy1: Selected rate control algorithm 'minstrel_ht'
[ 1.508240] e2fsck: e2fsck terminated by exit(8)
[ 9.321710] ieee80211 phy0: mac80211_hwsim_conf_tx (queue=0 txop=0 cw_min=15 cw_max=1023 aifs=2)
[ 9.321713] ieee80211 phy0: mac80211_hwsim_conf_tx (queue=1 txop=0 cw_min=15 cw_max=1023 aifs=2)
[ 9.321715] ieee80211 phy0: mac80211_hwsim_conf_tx (queue=2 txop=0 cw_min=15 cw_max=1023 aifs=2)
[ 9.321717] ieee80211 phy0: mac80211_hwsim_conf_tx (queue=3 txop=0 cw_min=15 cw_max=1023 aifs=2)
[ 81.844764] Hello, My name is Seungmin~~~
generic_x86_64:/ # dmesg | grep "Seungmin"
[ 81.844764] Hello, My name is Seungmin~~~
generic_x86_64:/ #
```