Developer’s Diary: It’s about time!

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Delays

Timeouts
Basics

Different principles of waiting

1. busy waiting
2. blocking
Real life problem

Customer system used $\approx 25\%$ CPU when pressing touch and otherwise idle.
from drivers/input/touchscreen/wm9712.c\textsuperscript{1}:

\[
\begin{verbatim}
/*
 * Delay after issuing a POLL command.
 * The delay is 3 AC97 link frames + the touchpanel settling delay
 */
static inline void poll_delay(int d)
{
    udelay(3 * AC97_LINK_FRAME + delay_table[d]);
}
\end{verbatim}
\]
The setup

/*
 * Set adc sample delay.
 *
 * For accurate touchpanel measurements, some settling time may be
 * required between the switch matrix applying a voltage across the
 * touchpanel plate and the ADC sampling the signal.
 *
 * This delay can be set by setting delay = n, where n is the array
 * position of the delay in the array delay_table below.
 * Long delays > 1ms are supported for completeness, but are not
 * recommended.
 */

static int delay = 3;
module_param(delay, int, 0);
MODULE_PARM_DESC(delay, "Set adc sample delay.");
Delays

The table!

/*
 * ADC sample delay times in uS
 */

static const int delay_table[] = {
  21,    /* 1 AC97 Link frames */
  42,    /* 2 */
  84,    /* 4 */
  167,   /* 8 */
  333,   /* 16 */
  667,   /* 32 */
  1000,  /* 48 */
  1333,  /* 64 */
  2000,  /* 96 */
  2667,  /* 128 */
  3333,  /* 160 */
  4000,  /* 192 */
  4667,  /* 224 */
  5333,  /* 256 */
  6000,  /* 288 */
  0      /* No delay, switch matrix always on */
};
Any other delays like this?

Idea:

use ftrace to report delays
A few challenges using ftrace directly

- trace udelay directly
  On ARM: a define calling into an assembly function using two entry points

- function argument is convenient
  not supported

- combine with function_graph
  function_graph doesn’t have parent_ip which was needed

^2 sorry, forgot why, doh
Delays

Keep it simple!

--- a/arch/arm/include/asm/delay.h
+++ b/arch/arm/include/asm/delay.h
@@ -34,11 +34,12 @@ extern void __const_udelay(unsigned long);

#define MAX_UDELAY_MS 2

-#define udelay(n) \
- ((__builtin_constant_p(n) ? \
- ((n) > (MAX_UDELAY_MS * 1000) ? __bad_udelay() : \
- __const_udelay((n) * ((2199023U*HZ)>>11)))) : \
- __udelay(n))
+static inline void udelay(unsigned long n)
+{
+   trace_printk("delays %lu\n", n);
+   ((__builtin_constant_p(n) ? ((n) > (MAX_UDELAY_MS * 1000) ? __bad_udelay() : 
+   __const_udelay((n) * ((2199023U*HZ)>>11))) : __udelay(n));
+}

#ifndef /* defined(_ARM_DELAY_H) */
Delays

Typical output from a target

I’m brave: Demo time!
Delays when waiting for power-up

from arch/arm/mach-mxs/module-tx28.c:

/* Power up fec phy */
pr_debug("%s: Switching FEC PHY power on\n", __func__);
ret = gpio_direction_output(TX28_FEC_PHY_POWER, 1);
if (ret) {
    pr_err("Failed to power on PHY: %d\n", ret);
    goto free_gpios;
}
mdelay(26); /* 25ms according to data sheet */
Output from a target (with MMC)

Demo time again
Finding mmc_delay()

from drivers/mmc/core/core.h:

```c
static inline void mmc_delay(unsigned int ms) {
    if (ms < 1000 / HZ) {
        cond_resched();
        mdelay(ms);
    } else {
        msleep(ms);
    }
}
```
Overview

1. Delays

2. Timeouts
from drivers/net/netx-eth.c:

```c
static void
netx_eth_phy_write(struct net_device *ndev, int phy_id, int reg, int value) {
  unsigned int val;

  val = MIIMU_SNRDY | MIIMU_PREAMBLE | MIIMU_PHYADDR(phy_id) |
       MIIMU_REGADDR(reg) | MIIMU_PHY_NRES | MIIMU_OPMODE_WRITE |
       MIIMU_DATA(value);

  writel(val, NETX_MIIMU);
  while (readl(NETX_MIIMU) & MIIMU_SNRDY);
}
```
from arch/arm/mach-mxs/clock-mx28.c:

```c
for (i = 10000; i; i--)
    if (!(__raw_readl(CLKCTRL_BASE_ADDR + HW_CLKCTRL_HBUS) & BM_CLKCTRL_HBUS_ASM_BUSY))
        break;
if (!i) {
    pr_err("%s: divider writing timeout\n", __func__);
    return -ETIMEDOUT;
}
```
timeout = jiffies + msecs_to_jiffies(20);
while (time_before(jiffies, timeout)) {
    interrupt = this->read_word(this->base + ONENAND_REG_INTERRUPT);
    if (interrupt & flags)
        break;
    if (state != FL_READING && state != FL_PREPARING_ERASE)
        cond_resched();
}
Timeout #3

from drivers/media/dvb/dvb-core/dvb_ca_en50221.c:

```c
timeout = jiffies + timeout_hz;
while (1) {
    /* read the status and check for error */
    int res = ca->pub->read_cam_control(ca->pub, slot, CTRLIF_STATUS);
    if (res < 0)
        return -EIO;
    /* if we got the flags, it was successful! */
    if (res & waitFor) {
        return 0;
    }
    /* check for timeout */
    if (time_after(jiffies, timeout)) {
        break;
    }
    /* wait for a bit */
    msleep(1);
}
/* if we get here, we've timed out */
return -ETIMEDOUT;
```
from drivers/misc/eeprom/at24.c:

timeout = jiffies + msecs_to_jiffies(write_timeout);
do {
    read_time = jiffies;

    switch (at24->use_smbus) {
        status = ...  
    }

    if (status == count)
        return count;

    /* REVISIT: at HZ=100, this is sloooow */
    msleep(1);
} while (time_before(read_time, timeout));

return -ETIMEDOUT;
Timeouts

It's about time!

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The End

Thank you for your attention!

Questions? Comments?

- right now
- anytime at this conference
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