

TI81XX PSP PM Clock Framework User Guide



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Linux PSP

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IMPORTANT

TI81xx refers to DM816x, DM814x and DM813X.

About this manual

This document gives an overview as well as implementation details of Clock framework in linux psp on TI81XX devices.

Introduction

This document provides details about clock generation and distribution in hardware, Clock tree implementation in software, Enabling, disabling and changing rate of a clock.

Software Implementation

Hardware connections are *mimicked* in software to create complete network of clocks called the Clock Tree.

Parent clock: The clock which provides source

Child clock: A clock to which source is provided

Sibling clock: Clocks drawing source from same parent clock

- Clock data structure

```
struct clk {
    struct list_head    node;
    const struct clkops *ops;
    const char          *name;
    struct clk          *parent;
    struct list_head    children;
    struct list_head    sibling;          /* node for children */
    ..... Many fields are omitted here.....
    unsigned long       rate;
    unsigned long       (*recalc)(struct clk *);
    int                 (*set_rate)(struct clk *, unsigned long);
    long                (*round_rate)(struct clk *, unsigned long);
    .....
    s8                  usecount;
    .....
};
```

NOTE: Refer to `<linux_kernel>/arch/arm/plat-omap/include/plat/clock.h` for description of each field.

Usage

- For all of the following operations include `clk.h`,

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

Enabling And Disabling Clock

Acquire/Get clock Pointer

- To get a pointer the the clock structure

```
struct clk *clkp;  
clkp = clk_get(dev_id, clk_name);  
if(!clkp)  
    pr_err("clk_get failed\n");
```

- `dev_id` of some clocks may be NULL in that case pass NULL in place of `dev_id`

NOTE: Refer to `<kernel_installation>/arch/arm/mach-omap2/clock814x_data.c` or `<kernel_installation>/arch/arm/mach-omap2/clock816x_data.c` to find whether the device id of a clock is NULL or valid string. You can find this info in `ti814x_clks[]` array, where in the first field is `dev_id` and second field is clock name. `clkp = clk_get(NULL, clk_name);`

- Example

```
struct clk *clkp;  
  
clkp = clk_get(NULL, "gem_fck");  
if(!clkp)  
    pr_err("clk_get failed for gem_fck\n");
```

Release/Put clock Pointer

- To free the pointer to the clock structure, use the clock pointer(`clkp`) acquired through `clk_get()`,

```
clk_put(clkp);
```

Enable Clock

- A clock must be enabled before using it as a source of clock to any module, to enable the clock, use the clock pointer(`clkp`) acquired through `clk_get()`,

```
clk_enable(clkp);
```

Disable Clock

- A clock can be disabled when the clock is no longer required by any modules or its children clocks, to disable the clock, use the clock pointer(clkp) acquired through clk_get(),

```
clk_disable(clkp);
```

Change Clock Rate

Get clock current rate

- To get the current frequency/rate of the clock, use the clock pointer(clkp) acquired through clk_get(),

```
u32 clk_rate;
clk_rate = clk_get_rate(clkp);
```

Change clock rate

- To change the current frequency/rate of the clock and set a new rate, use the clock pointer(clkp) acquired through clk_get(),

```
clk_rate = clk_set_rate(clkp, new_rate);
```

- Changing clock rate may be un-successful in following cases:

```
- Clock is drawing source from a fixed rate clock source (e.g. OSC0, OSC1, XREF etc)
- Clock is in use by more than one modules/children, usecount > 1
- Clock source is in use by more than one children.
```

Change clock Parent

- Currently change parent is not supported through clock framework((at run time))

Alternatively, this can be done from uboot command prompt as below:

1. Load uboot, wait for 1st stage to complete
 2. Interrupt the autoboot of 2nd stage (countdown from 3-0)
 3. Find the clockselection register corresponding to the clk whose parent needs to be changed, refer to TRM/PRCM doc
 4. write the value corresponding to new parent to the register
- ex:

```
to write to a reg:# mw 0x481c50c4 0x3
to read from a reg:# md 0x481c50c4 1
for help:# help
```

Browsing DebugFs for Clock configuration

Clock tree from debugfs

Details of clocks such as rate, usecount and flags can be viewed through debugfs entries of the clocks. To access these details one has to mount the debugfs root directory first, follow the steps below to mount debugfs and view clock details:

1. Create a directory to mount the debugfs root or use /sys/kernel/debug

```
$ mount -t debugfs debugfs /sys/kernel/debug
```

2. Change to clock directory under debugfs, clock entries arranged exactly same as clock tree, ie. root clock -> child clock & sibling clocks, to see the details,

```
$ cd /sys/kernel/debug/clock
root@ti8168-evm:/sys/kernel/debug/clock# ls
```

ex:

```
root@ti8168-evm:~# cd /sys/kernel/debug/clock/
root@ti8168-evm:/sys/kernel/debug/clock# ls osc0_clkin_ck/dsp_dpll_ck/gem_fck/
flags  rate  usecount
root@ti8168-evm:/sys/kernel/debug/clock# cd osc0_clkin_ck/dsp_dpll_ck/gem_fck/
root@ti8168-evm:/sys/kernel/debug/clock/osc0_clkin_ck/dsp_dpll_ck/gem_fck# cat rate
500000000
```

Finding a clock

- To find a clock, ex: "gem_ick"

```
root@ti8168-evm:/sys/kernel/debug/clock# ls -lR | grep gem_ick
```

Using Script to dump details

The shell script given below can be used to browse the clock tree for debugging purposes.

```
#!/bin/sh
# Clock tree browser
# Version: 1.0
# Copyright (C) {2011} Texas Instruments Incorporated - http://www.ti.com/
#
# USAGE
# $ browser [attribute] [clock]
# attribute - can be either rate; flags or usecount
# clock - clock source to browse; optional parameter; if not specified
#         displays the specified attribute for all the clocks in system
#
# EXAMPLES
# $browser rate dpll1_fck # Display rate for dpll1_fck
# $browser rate dpll1 # Display rate for all clocks associated with dpll1
#
# ASSUMPTIONS
# Assumes debug filesystem is available and mounted at /sys/kernel/debug
cd /sys/kernel/debug/clock/
```

```
if [ "$2" != "" ]
then find ./ -type f -name $1 | grep $2 > /var/myfile;
else find ./ -type f -name $1 > /var/myfile;
fi
while read line
do
echo "$line ==> `cat $line`;
done < "/var/myfile"
```

Copy the above script to a file, say "browser", copy this file to your file system(nfs/ramdisk) and chmod to execution,

Mount the debugfs as explained above then execute: 1. To list current *rate* of all clocks

```
$/browser rate
```

2. To list rate of a particular clock

```
$/browser rate gem_ick
```

3. similarly you can list the usecount.

FAQ

Q: Why am i not able to change rate of a clock using `clk_set_rate()`?

A: Check if the clock is sourced from a PLL or a fixed clock. Only Clocks, whose root source is from a pll can be changed to run at different rates.

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