

# **SuperH Interfaces Guide**

**Paul Mundt**

**`lethal@linux-sh.org`**

# **SuperH Interfaces Guide**

by Paul Mundt

Copyright © 2008-2010 Paul Mundt

Copyright © 2008-2010 Renesas Technology Corp.

Copyright © 2010 Renesas Electronics Corp.

This documentation is free software; you can redistribute it and/or modify it under the terms of the GNU General Public License version 2 as published by the Free Software Foundation.

This program is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU General Public License for more details.

You should have received a copy of the GNU General Public License along with this program; if not, write to the Free Software Foundation, Inc., 59 Temple Place, Suite 330, Boston, MA 02111-1307 USA

For more details see the file COPYING in the source distribution of Linux.

# Table of Contents

<b>1. Memory Management .....</b>	<b>1</b>
1.1. SH-4 .....	1
1.1.1. Store Queue API .....	1
sq_flush_range .....	1
sq_remap .....	2
sq_unmap .....	3
1.2. SH-5 .....	3
1.2.1. TLB Interfaces .....	4
sh64_tlb_init .....	4
sh64_next_free_dtlb_entry .....	4
sh64_get_wired_dtlb_entry .....	5
sh64_put_wired_dtlb_entry .....	6
sh64_setup_tlb_slot .....	6
sh64_tearardown_tlb_slot .....	7
for_each_dtlb_entry .....	8
for_each_itlb_entry .....	9
__flush_tlb_slot .....	10
<b>2. Machine Specific Interfaces .....</b>	<b>11</b>
2.1. mach-dreamcast .....	11
aica_rtc_gettimeofday .....	11
aica_rtc_settimeofday .....	11
2.2. mach-x3proto .....	12
ilsel_enable .....	12
ilsel_enable_fixed .....	13
ilsel_disable .....	14
<b>3. Busses .....</b>	<b>17</b>
3.1. SuperHyway .....	17
superhyway_add_device .....	17
superhyway_register_driver .....	18
superhyway_unregister_driver .....	19
3.2. Maple .....	19
maple_driver_register .....	20
maple_driver_unregister .....	20
maple_getcond_callback .....	21
maple_add_packet .....	22



# Chapter 1. Memory Management

## 1.1. SH-4

### 1.1.1. Store Queue API

## sq\_flush\_range

**LINUX**

Kernel Hackers Manual July 2015

### Name

`sq_flush_range` — Flush (prefetch) a specific SQ range

### Synopsis

```
void sq_flush_range (unsigned long start, unsigned int len);
```

### Arguments

*start*

the store queue address to start flushing from

*len*

the length to flush

### Description

Flushes the store queue cache from *start* to *start + len* in a linear fashion.

# sq\_remap

## LINUX

Kernel Hackers Manual July 2015

### Name

`sq_remap` — Map a physical address through the Store Queues

### Synopsis

```
unsigned long sq_remap (unsigned long phys, unsigned int size,  
const char * name, pgprot_t prot);
```

### Arguments

*phys*

Physical address of mapping.

*size*

Length of mapping.

*name*

User invoking mapping.

*prot*

Protection bits.

## Description

Remaps the physical address *phys* through the next available store queue address of *size* length. *name* is logged at boot time as well as through the sysfs interface.

# sq\_unmap

## LINUX

Kernel Hackers Manual July 2015

## Name

sq\_unmap — Unmap a Store Queue allocation

## Synopsis

```
void sq_unmap (unsigned long vaddr);
```

## Arguments

*vaddr*

Pre-allocated Store Queue mapping.

## Description

Unmaps the store queue allocation *map* that was previously created by `sq_remap`. Also frees up the pte that was previously inserted into the kernel page table and discards the UTLB translation.

## 1.2. SH-5

### 1.2.1. TLB Interfaces

## sh64\_tlb\_init

**LINUX**

Kernel Hackers Manual July 2015

### Name

`sh64_tlb_init` — Perform initial setup for the DTLB and ITLB.

### Synopsis

```
int sh64_tlb_init ( void );
```

### Arguments

*void*

no arguments

## sh64\_next\_free\_dtlb\_entry

**LINUX**



## Name

`sh64_next_free_dtlb_entry` — Find the next available DTLB entry

## Synopsis

```
unsigned long long sh64_next_free_dtlb_entry ( void );
```

## Arguments

*void*

no arguments

# sh64\_get\_wired\_dtlb\_entry

## LINUX

## Name

`sh64_get_wired_dtlb_entry` — Allocate a wired (locked-in) entry in the DTLB

## Synopsis

```
unsigned long long sh64_get_wired_dtlb_entry ( void );
```

## Arguments

*void*

no arguments

# sh64\_put\_wired\_dtlb\_entry

## LINUX

Kernel Hackers Manual July 2015

## Name

`sh64_put_wired_dtlb_entry` — Free a wired (locked-in) entry in the DTLB.

## Synopsis

```
int sh64_put_wired_dtlb_entry (unsigned long long entry);
```

## Arguments

*entry*

Address of TLB slot.

## Description

Works like a stack, last one to allocate must be first one to free.

# sh64\_setup\_tlb\_slot

## LINUX

Kernel Hackers Manual July 2015

### Name

`sh64_setup_tlb_slot` — Load up a translation in a wired slot.

### Synopsis

```
void sh64_setup_tlb_slot (unsigned long long config_addr,  
unsigned long eaddr, unsigned long asid, unsigned long paddr);
```

### Arguments

*config\_addr*

Address of TLB slot.

*eaddr*

Virtual address.

*asid*

Address Space Identifier.

*paddr*

Physical address.

### Description

Load up a virtual<->physical translation for *eaddr*<->*paddr* in the pre-allocated TLB slot *config\_addr* (see `sh64_get_wired_dtlb_entry`).

# sh64\_teardown\_tlb\_slot

## LINUX

Kernel Hackers Manual July 2015

### Name

`sh64_teardown_tlb_slot` — Teardown a translation.

### Synopsis

```
void sh64_teardown_tlb_slot (unsigned long long config_addr);
```

### Arguments

*config\_addr*

Address of TLB slot.

### Description

Teardown any existing mapping in the TLB slot *config\_addr*.

# for\_each\_dtlb\_entry

## LINUX

Kernel Hackers Manual July 2015

### Name

`for_each_dtlb_entry` — Iterate over free (non-wired) DTLB entries

## Synopsis

```
for_each_dtlb_entry ( tlb );
```

## Arguments

*tlb*

TLB entry

## for\_each\_itlb\_entry

### LINUX

Kernel Hackers Manual July 2015

## Name

`for_each_itlb_entry` — Iterate over free (non-wired) ITLB entries

## Synopsis

```
for_each_itlb_entry ( tlb );
```

## Arguments

*tlb*

TLB entry

# \_\_flush\_tlb\_slot

## LINUX

Kernel Hackers Manual July 2015

### Name

`__flush_tlb_slot` — Flushes TLB slot *slot*.

### Synopsis

```
void __flush_tlb_slot (unsigned long long slot);
```

### Arguments

*slot*

Address of TLB slot.

# Chapter 2. Machine Specific Interfaces

## 2.1. mach-dreamcast

### aica\_rtc\_gettimeofday

#### LINUX

Kernel Hackers Manual July 2015

#### Name

`aica_rtc_gettimeofday` — Get the time from the AICA RTC

#### Synopsis

```
void aica_rtc_gettimeofday (struct timespec * ts);
```

#### Arguments

*ts*

pointer to resulting timespec

#### Description

Grabs the current RTC seconds counter and adjusts it to the Unix Epoch.

# aica\_rtc\_settimeofday

## LINUX

Kernel Hackers Manual July 2015

### Name

`aica_rtc_settimeofday` — Set the AICA RTC to the current time

### Synopsis

```
int aica_rtc_settimeofday (const time_t secs);
```

### Arguments

*secs*

contains the `time_t` to set

### Description

Adjusts the given *tv* to the AICA Epoch and sets the RTC seconds counter.

## 2.2. mach-x3proto

### ilsele\_enable

## LINUX



## Name

`ilssel_enable` — Enable an ILSEL set.

## Synopsis

```
int ilssel_enable (ilssel_source_t set);
```

## Arguments

*set*

ILSEL source (see `ilssel_source_t` enum in `include/asm-sh/ilssel.h`).

## Description

Enables a given non-aliased ILSEL source ( $\leq$  ILSEL\_KEY) at the highest available interrupt level. Callers should take care to order callsites noting descending interrupt levels. Aliasing FPGA and external board IRQs need to use `ilssel_enable_fixed`.

The return value is an IRQ number that can later be taken down with `ilssel_disable`.

## `ilssel_enable_fixed`

**LINUX**

## Name

`ilssel_enable_fixed` — Enable an ILSEL set at a fixed interrupt level

## Synopsis

```
int ilssel_enable_fixed (ilssel_source_t set, unsigned int
level);
```

## Arguments

*set*

ILSEL source (see `ilssel_source_t` enum in `include/asm-sh/ilssel.h`).

*level*

Interrupt level (1 - 15)

## Description

Enables a given ILSEL source at a fixed interrupt level. Necessary both for level reservation as well as for aliased sources that only exist on special ILSEL#s.

Returns an IRQ number (as `ilssel_enable`).

## `ilssel_disable`

**LINUX**

## Name

`ilssel_disable` — Disable an ILSEL set

## Synopsis

```
void ilssel_disable (unsigned int irq);
```

## Arguments

*irq*

Bit position for ILSEL set value (retval from enable routines)

## Description

Disable a previously enabled ILSEL set.



# Chapter 3. Busses

## 3.1. SuperHyway

### superhyway\_add\_device

**LINUX**

Kernel Hackers Manual July 2015

#### Name

superhyway\_add\_device — Add a SuperHyway module

#### Synopsis

```
int superhyway_add_device (unsigned long base, struct  
superhyway_device * sdev, struct superhyway_bus * bus);
```

#### Arguments

*base*

Physical address where module is mapped.

*sdev*

SuperHyway device to add, or NULL to allocate a new one.

*bus*

Bus where SuperHyway module resides.

## Description

This is responsible for adding a new SuperHyway module. This sets up a new struct `superhyway_device` for the module being added if `sdev == NULL`.

Devices are initially added in the order that they are scanned (from the top-down of the memory map), and are assigned an ID based on the order that they are added. Any manual addition of a module will thus get the ID after the devices already discovered regardless of where it resides in memory.

Further work can and should be done in `superhyway_scan_bus`, to be sure that any new modules are properly discovered and subsequently registered.

## superhyway\_register\_driver

### LINUX

Kernel Hackers Manual July 2015

### Name

`superhyway_register_driver` — Register a new SuperHyway driver

### Synopsis

```
int superhyway_register_driver (struct superhyway_driver *  
drv);
```

### Arguments

*drv*

SuperHyway driver to register.

## Description

This registers the passed in *drv*. Any devices matching the id table will automatically be populated and handed off to the driver's specified probe routine.

# superhyway\_unregister\_driver

## LINUX

Kernel Hackers Manual July 2015

## Name

`superhyway_unregister_driver` — Unregister a SuperHyway driver

## Synopsis

```
void superhyway_unregister_driver (struct superhyway_driver *  
drv);
```

## Arguments

*drv*

SuperHyway driver to unregister.

## Description

This cleans up after `superhyway_register_driver`, and should be invoked in the exit path of any module drivers.

## 3.2. Maple

### maple\_driver\_register

**LINUX**

Kernel Hackers Manual July 2015

#### Name

`maple_driver_register` — register a maple driver

#### Synopsis

```
int maple_driver_register (struct maple_driver * drv);
```

#### Arguments

*drv*

maple driver to be registered.

#### Description

Registers the passed in *drv*, while updating the bus type. Devices with matching function IDs will be automatically probed.

### maple\_driver\_unregister

**LINUX**



## Name

`maple_driver_unregister` — unregister a maple driver.

## Synopsis

```
void maple_driver_unregister (struct maple_driver * drv);
```

## Arguments

*drv*

maple driver to unregister.

## Description

Cleans up after `maple_driver_register`. To be invoked in the exit path of any module drivers.

# maple\_getcond\_callback

## LINUX

## Name

`maple_getcond_callback` — setup handling  
`MAPLE_COMMAND_GETCOND`

## Synopsis

```
void maple_getcond_callback (struct maple_device * dev, void  
(*callback) (struct mapleq *mq), unsigned long interval,  
unsigned long function);
```

## Arguments

*dev*

device responding

*callback*

handler callback

*interval*

interval in jiffies between callbacks

*function*

the function code for the device

## maple\_add\_packet

### LINUX

Kernel Hackers Manual July 2015

## Name

`maple_add_packet` — add a single instruction to the maple bus queue

## Synopsis

```
int maple_add_packet (struct maple_device * mdev, u32  
function, u32 command, size_t length, void * data);
```

## Arguments

*mdev*

maple device

*function*

function on device being queried

*command*

maple command to add

*length*

length of command string (in 32 bit words)

*data*

remainder of command string

