

RapidIO Subsystem Guide

Matt Porter

mporter@kernel.crashing.org
mporter@mvista.com

RapidIO Subsystem Guide

by Matt Porter

Copyright © 2005 MontaVista Software, Inc.

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

1. Introduction.....	1
2. Known Bugs and Limitations	3
2.1. Bugs	3
2.2. Limitations	3
3. RapidIO driver interface.....	5
3.1. Functions.....	5
rio_local_read_config_32	5
rio_local_write_config_32	6
rio_local_read_config_16	7
rio_local_write_config_16	8
rio_local_read_config_8	9
rio_local_write_config_8	10
rio_read_config_32	11
rio_write_config_32	12
rio_read_config_16	13
rio_write_config_16	14
rio_read_config_8	15
rio_write_config_8	16
rio_send_doorbell	17
rio_init_mbox_res	18
rio_init_dbell_res	18
RIO_DEVICE	19
rio_add_outb_message	20
rio_add_inb_buffer	21
rio_get_inb_message	22
rio_name	23
rio_get_drvdata	24
rio_set_drvdata	25
rio_dev_get	26
rio_dev_put	27
rio_register_driver	27
rio_unregister_driver	28
rio_local_get_device_id	29
rio_request_inb_mbox	30
rio_release_inb_mbox	31
rio_request_outb_mbox	32
rio_release_outb_mbox	33
rio_request_inb_dbell	34
rio_release_inb_dbell	35
rio_request_outb_dbell	36

rio_release_outb_dbell.....	37
rio_get_asm.....	38
rio_get_device.....	39
4. Internals	41
4.1. Structures	41
struct rio_dev	41
struct rio_msg.....	43
struct rio_dbell	44
struct rio_mport.....	45
struct rio_net	47
struct rio_switch.....	48
struct rio_ops.....	49
struct rio_driver.....	50
struct rio_device_id.....	51
struct rio_route_ops	53
4.2. Enumeration and Discovery.....	54
rio_get_device_id.....	54
rio_set_device_id	55
rio_local_set_device_id	56
rio_clear_locks	57
rio_enum_host.....	57
rio_device_has_destid.....	58
rio_release_dev	59
rio_is_switch.....	60
rio_route_set_ops.....	61
rio_add_device	62
rio_setup_device	63
rio_sport_is_active	64
rio_route_add_entry	65
rio_route_get_entry.....	66
rio_get_host_deviceid_lock	67
rio_get_swpinfo_inport.....	68
rio_get_swpinfo_tports	69
rio_net_add_mport.....	70
rio_enum_peer	71
rio_enum_complete.....	72
rio_disc_peer.....	73
rio_mport_is_active	74
rio_alloc_net	75
rio_update_route_tables	76
rio_enum_mport.....	76
rio_build_route_tables	77
rio_enum_timeout.....	78

rio_disc_mport	79
4.3. Driver functionality	80
rio_setup_inb_dbell.....	80
rio_mport_get_feature.....	81
RIO_LOP_READ	82
RIO_LOP_WRITE	83
RIO_OP_READ.....	84
RIO_OP_WRITE.....	85
4.4. Device model support	86
rio_match_device	87
rio_device_probe.....	87
rio_device_remove.....	88
rio_match_bus.....	89
rio_bus_init	90
4.5. Sysfs support.....	91
rio_create_sysfs_dev_files	91
rio_remove_sysfs_dev_files	92
4.6. PPC32 support	93
rio_hw_add_outb_message.....	93
rio_hw_add_inb_buffer.....	94
rio_hw_get_inb_message.....	95
fsl_rio_doorbell_send	96
fsl_local_config_read.....	97
fsl_local_config_write.....	98
fsl_rio_config_read	99
fsl_rio_config_write.....	100
fsl_rio_tx_handler.....	102
rio_open_outb_mbox	103
rio_close_outb_mbox.....	103
fsl_rio_rx_handler.....	104
rio_open_inb_mbox	105
rio_close_inb_mbox.....	106
fsl_rio_dbell_handler	107
fsl_rio_doorbell_init	108
fsl_rio_setup.....	109
5. Credits.....	111

Chapter 1. Introduction

RapidIO is a high speed switched fabric interconnect with features aimed at the embedded market. RapidIO provides support for memory-mapped I/O as well as message-based transactions over the switched fabric network. RapidIO has a standardized discovery mechanism not unlike the PCI bus standard that allows simple detection of devices in a network.

This documentation is provided for developers intending to support RapidIO on new architectures, write new drivers, or to understand the subsystem internals.

Chapter 2. Known Bugs and Limitations

2.1. Bugs

None. ;)

2.2. Limitations

1. Access/management of RapidIO memory regions is not supported
2. Multiple host enumeration is not supported

Chapter 3. RapidIO driver interface

Drivers are provided a set of calls in order to interface with the subsystem to gather info on devices, request/map memory region resources, and manage mailboxes/doorbells.

3.1. Functions

rio_local_read_config_32

LINUX

Kernel Hackers Manual March 2019

Name

`rio_local_read_config_32` — Read 32 bits from local configuration space

Synopsis

```
int rio_local_read_config_32 (struct rio_mport * port, u32
    offset, u32 * data);
```

Arguments

port

Master port

offset

Offset into local configuration space

data

Pointer to read data into

Description

Reads 32 bits of data from the specified offset within the local device's configuration space.

rio_local_write_config_32

LINUX

Kernel Hackers Manual March 2019

Name

`rio_local_write_config_32` — Write 32 bits to local configuration space

Synopsis

```
int rio_local_write_config_32 (struct rio_mport * port, u32
offset, u32 data);
```

Arguments

port

Master port

offset

Offset into local configuration space

data

Data to be written

Description

Writes 32 bits of data to the specified offset within the local device's configuration space.

rio_local_read_config_16

LINUX

Kernel Hackers Manual March 2019

Name

`rio_local_read_config_16` — Read 16 bits from local configuration space

Synopsis

```
int rio_local_read_config_16 (struct rio_mport * port, u32
offset, u16 * data);
```

Arguments

port

Master port

offset

Offset into local configuration space

data

Pointer to read data into

Description

Reads 16 bits of data from the specified offset within the local device's configuration space.

rio_local_write_config_16

LINUX

Kernel Hackers Manual March 2019

Name

`rio_local_write_config_16` — Write 16 bits to local configuration space

Synopsis

```
int rio_local_write_config_16 (struct rio_mport * port, u32
offset, u16 data);
```

Arguments

port

Master port

offset

Offset into local configuration space

data

Data to be written

Description

Writes 16 bits of data to the specified offset within the local device's configuration space.

rio_local_read_config_8

LINUX

Kernel Hackers Manual March 2019

Name

`rio_local_read_config_8` — Read 8 bits from local configuration space

Synopsis

```
int rio_local_read_config_8 (struct rio_mport * port, u32
offset, u8 * data);
```

Arguments

port

Master port

offset

Offset into local configuration space

data

Pointer to read data into

Description

Reads 8 bits of data from the specified offset within the local device's configuration space.

rio_local_write_config_8

LINUX

Kernel Hackers Manual March 2019

Name

`rio_local_write_config_8` — Write 8 bits to local configuration space

Synopsis

```
int rio_local_write_config_8 (struct rio_mport * port, u32
offset, u8 data);
```

Arguments

port

Master port

offset

Offset into local configuration space

data

Data to be written

Description

Writes 8 bits of data to the specified offset within the local device's configuration space.

rio_read_config_32

LINUX

Kernel Hackers Manual March 2019

Name

`rio_read_config_32` — Read 32 bits from configuration space

Synopsis

```
int rio_read_config_32 (struct rio_dev * rdev, u32 offset, u32  
* data);
```

Arguments

rdev

RIO device

offset

Offset into device configuration space

data

Pointer to read data into

Description

Reads 32 bits of data from the specified offset within the RIO device's configuration space.

rio_write_config_32

LINUX

Kernel Hackers Manual March 2019

Name

`rio_write_config_32` — Write 32 bits to configuration space

Synopsis

```
int rio_write_config_32 (struct rio_dev * rdev, u32 offset,
u32 data);
```

Arguments

rdev

RIO device

offset

Offset into device configuration space

data

Data to be written

Description

Writes 32 bits of data to the specified offset within the RIO device's configuration space.

rio_read_config_16

LINUX

Kernel Hackers Manual March 2019

Name

`rio_read_config_16` — Read 16 bits from configuration space

Synopsis

```
int rio_read_config_16 (struct rio_dev * rdev, u32 offset, u16  
* data);
```

Arguments

rdev

RIO device

offset

Offset into device configuration space

data

Pointer to read data into

Description

Reads 16 bits of data from the specified offset within the RIO device's configuration space.

rio_write_config_16

LINUX

Kernel Hackers Manual March 2019

Name

`rio_write_config_16` — Write 16 bits to configuration space

Synopsis

```
int rio_write_config_16 (struct rio_dev * rdev, u32 offset,
u16 data);
```

Arguments

rdev

RIO device

offset

Offset into device configuration space

data

Data to be written

Description

Writes 16 bits of data to the specified offset within the RIO device's configuration space.

rio_read_config_8

LINUX

Kernel Hackers Manual March 2019

Name

`rio_read_config_8` — Read 8 bits from configuration space

Synopsis

```
int rio_read_config_8 (struct rio_dev * rdev, u32 offset, u8 * data);
```

Arguments

rdev

RIO device

offset

Offset into device configuration space

data

Pointer to read data into

Description

Reads 8 bits of data from the specified offset within the RIO device's configuration space.

rio_write_config_8

LINUX

Kernel Hackers Manual March 2019

Name

`rio_write_config_8` — Write 8 bits to configuration space

Synopsis

```
int rio_write_config_8 (struct rio_dev * rdev, u32 offset, u8 data);
```

Arguments

rdev

RIO device

offset

Offset into device configuration space

data

Data to be written

Description

Writes 8 bits of data to the specified offset within the RIO device's configuration space.

rio_send_doorbell

LINUX

Kernel Hackers Manual March 2019

Name

`rio_send_doorbell` — Send a doorbell message to a device

Synopsis

```
int rio_send_doorbell (struct rio_dev * rdev, u16 data);
```

Arguments

rdev

RIO device

data

Doorbell message data

Description

Send a doorbell message to a RIO device. The doorbell message has a 16-bit info field provided by the *data* argument.

rio_init_mbox_res

LINUX

Kernel Hackers Manual March 2019

Name

`rio_init_mbox_res` — Initialize a RIO mailbox resource

Synopsis

```
void rio_init_mbox_res (struct resource * res, int start, int  
end);
```

Arguments

res

resource struct

start

start of mailbox range

end

end of mailbox range

Description

This function is used to initialize the fields of a resource for use as a mailbox resource. It initializes a range of mailboxes using the start and end arguments.

rio_init_dbell_res

LINUX

Kernel Hackers Manual March 2019

Name

`rio_init_dbell_res` — Initialize a RIO doorbell resource

Synopsis

```
void rio_init_dbell_res (struct resource * res, u16 start, u16  
end);
```

Arguments

res

resource struct

start

start of doorbell range

end

end of doorbell range

Description

This function is used to initialize the fields of a resource for use as a doorbell resource. It initializes a range of doorbell messages using the start and end arguments.

RIO_DEVICE

LINUX

Kernel Hackers Manual March 2019

Name

`RIO_DEVICE` — macro used to describe a specific RIO device

Synopsis

```
RIO_DEVICE ( dev, ven );
```

Arguments

dev

the 16 bit RIO device ID

ven

the 16 bit RIO vendor ID

Description

This macro is used to create a struct `rio_device_id` that matches a specific device. The assembly vendor and assembly device fields will be set to `RIO_ANY_ID`.

rio_add_outb_message

LINUX

Name

`rio_add_outb_message` — Add RIO message to an outbound mailbox queue

Synopsis

```
int rio_add_outb_message (struct rio_mport * mport, struct  
rio_dev * rdev, int mbox, void * buffer, size_t len);
```

Arguments

mport

RIO master port containing the outbound queue

rdev

RIO device the message is be sent to

mbox

The outbound mailbox queue

buffer

Pointer to the message buffer

len

Length of the message buffer

Description

Adds a RIO message buffer to an outbound mailbox queue for transmission.
Returns 0 on success.

rio_add_inb_buffer

LINUX

Kernel Hackers Manual March 2019

Name

`rio_add_inb_buffer` — Add buffer to an inbound mailbox queue

Synopsis

```
int rio_add_inb_buffer (struct rio_mport * mport, int mbox,  
void * buffer);
```

Arguments

mport

Master port containing the inbound mailbox

mbox

The inbound mailbox number

buffer

Pointer to the message buffer

Description

Adds a buffer to an inbound mailbox queue for reception. Returns 0 on success.

rio_get_inb_message

LINUX

Kernel Hackers Manual March 2019

Name

`rio_get_inb_message` — Get A RIO message from an inbound mailbox queue

Synopsis

```
void * rio_get_inb_message (struct rio_mport * mport, int mbox);
```

Arguments

mport

Master port containing the inbound mailbox

mbox

The inbound mailbox number

Description

Get a RIO message from an inbound mailbox queue. Returns 0 on success.

rio_name

LINUX

Name

`rio_name` — Get the unique RIO device identifier

Synopsis

```
const char * rio_name (struct rio_dev * rdev);
```

Arguments

rdev

RIO device

Description

Get the unique RIO device identifier. Returns the device identifier string.

rio_get_drvdata

LINUX

Name

`rio_get_drvdata` — Get RIO driver specific data

Synopsis

```
void * rio_get_drvdata (struct rio_dev * rdev);
```

Arguments

rdev

RIO device

Description

Get RIO driver specific data. Returns a pointer to the driver specific data.

rio_set_drvdata

LINUX

Kernel Hackers Manual March 2019

Name

`rio_set_drvdata` — Set RIO driver specific data

Synopsis

```
void rio_set_drvdata (struct rio_dev * rdev, void * data);
```

Arguments

rdev

RIO device

data

Pointer to driver specific data

Description

Set RIO driver specific data. device struct driver data pointer is set to the *data* argument.

rio_dev_get

LINUX

Kernel Hackers Manual March 2019

Name

`rio_dev_get` — Increments the reference count of the RIO device structure

Synopsis

```
struct rio_dev * rio_dev_get (struct rio_dev * rdev);
```

Arguments

rdev

RIO device being referenced

Description

Each live reference to a device should be refcounted.

Drivers for RIO devices should normally record such references in their `probe` methods, when they bind to a device, and release them by calling `rio_dev_put`, in their `disconnect` methods.

rio_dev_put

LINUX

Kernel Hackers Manual March 2019

Name

`rio_dev_put` — Release a use of the RIO device structure

Synopsis

```
void rio_dev_put (struct rio_dev * rdev);
```

Arguments

rdev

RIO device being disconnected

Description

Must be called when a user of a device is finished with it. When the last user of the device calls this function, the memory of the device is freed.

rio_register_driver

LINUX

Kernel Hackers Manual March 2019

Name

`rio_register_driver` — register a new RIO driver

Synopsis

```
int rio_register_driver (struct rio_driver * rdrv);
```

Arguments

rdrv

the RIO driver structure to register

Description

Adds a struct `rio_driver` to the list of registered drivers. Returns a negative value on error, otherwise 0. If no error occurred, the driver remains registered even if no device was claimed during registration.

rio_unregister_driver

LINUX

Name

`rio_unregister_driver` — unregister a RIO driver

Synopsis

```
void rio_unregister_driver (struct rio_driver * rdrv);
```

Arguments

rdrv

the RIO driver structure to unregister

Description

Deletes the struct `rio_driver` from the list of registered RIO drivers, gives it a chance to clean up by calling its `remove` function for each device it was responsible for, and marks those devices as driverless.

rio_local_get_device_id

LINUX

Name

`rio_local_get_device_id` — Get the base/extended device id for a port

Synopsis

```
ul6 rio_local_get_device_id (struct rio_mport * port);
```

Arguments

port

RIO master port from which to get the deviceid

Description

Reads the base/extended device id from the local device implementing the master port. Returns the 8/16-bit device id.

rio_request_inb_mbox

LINUX

Kernel Hackers Manual March 2019

Name

`rio_request_inb_mbox` — request inbound mailbox service

Synopsis

```
int rio_request_inb_mbox (struct rio_mport * mport, void *  
dev_id, int mbox, int entries, void (*minb) (struct rio_mport  
* mport, void *dev_id, int mbox, int slot));
```

Arguments

mport

RIO master port from which to allocate the mailbox resource

dev_id

Device specific pointer to pass on event

mbox

Mailbox number to claim

entries

Number of entries in inbound mailbox queue

minb

Callback to execute when inbound message is received

Description

Requests ownership of an inbound mailbox resource and binds a callback function to the resource. Returns 0 on success.

rio_release_inb_mbox

LINUX

Kernel Hackers Manual March 2019

Name

`rio_release_inb_mbox` — release inbound mailbox message service

Synopsis

```
int rio_release_inb_mbox (struct rio_mport * mport, int mbox);
```

Arguments

mport

RIO master port from which to release the mailbox resource

mbox

Mailbox number to release

Description

Releases ownership of an inbound mailbox resource. Returns 0 if the request has been satisfied.

rio_request_outb_mbox

LINUX

Kernel Hackers Manual March 2019

Name

`rio_request_outb_mbox` — request outbound mailbox service

Synopsis

```
int rio_request_outb_mbox (struct rio_mport * mport, void *  
dev_id, int mbox, int entries, void (*moutb) (struct rio_mport  
* mport, void *dev_id, int mbox, int slot));
```

Arguments

mport

RIO master port from which to allocate the mailbox resource

dev_id

Device specific pointer to pass on event

mbox

Mailbox number to claim

entries

Number of entries in outbound mailbox queue

moutb

Callback to execute when outbound message is sent

Description

Requests ownership of an outbound mailbox resource and binds a callback function to the resource. Returns 0 on success.

rio_release_outb_mbox

LINUX

Kernel Hackers Manual March 2019

Name

rio_release_outb_mbox — release outbound mailbox message service

Synopsis

```
int rio_release_outb_mbox (struct rio_mport * mport, int
mbox);
```

Arguments

mport

RIO master port from which to release the mailbox resource

mbox

Mailbox number to release

Description

Releases ownership of an inbound mailbox resource. Returns 0 if the request has been satisfied.

rio_request_inb_dbell

LINUX

Kernel Hackers Manual March 2019

Name

`rio_request_inb_dbell` — request inbound doorbell message service

Synopsis

```
int rio_request_inb_dbell (struct rio_mport * mport, void *
dev_id, ul6 start, ul6 end, void (*dinb) (struct rio_mport *
```



```
mport, void *dev_id, u16 src, u16 dst, u16 info));
```

Arguments

mport

RIO master port from which to allocate the doorbell resource

dev_id

Device specific pointer to pass on event

start

Doorbell info range start

end

Doorbell info range end

dinb

Callback to execute when doorbell is received

Description

Requests ownership of an inbound doorbell resource and binds a callback function to the resource. Returns 0 if the request has been satisfied.

rio_release_inb_dbell

LINUX

Kernel Hackers Manual March 2019

Name

rio_release_inb_dbell — release inbound doorbell message service

Synopsis

```
int rio_release_inb_dbell (struct rio_mport * mport, u16
start, u16 end);
```

Arguments

mport

RIO master port from which to release the doorbell resource

start

Doorbell info range start

end

Doorbell info range end

Description

Releases ownership of an inbound doorbell resource and removes callback from the doorbell event list. Returns 0 if the request has been satisfied.

rio_request_outb_dbell

LINUX

Kernel Hackers Manual March 2019

Name

`rio_request_outb_dbell` — request outbound doorbell message range

Synopsis

```
struct resource * rio_request_outb_dbell (struct rio_dev *  
rdev, u16 start, u16 end);
```

Arguments

rdev

RIO device from which to allocate the doorbell resource

start

Doorbell message range start

end

Doorbell message range end

Description

Requests ownership of a doorbell message range. Returns a resource if the request has been satisfied or `NULL` on failure.

rio_release_outb_dbell

LINUX

Kernel Hackers Manual March 2019

Name

`rio_release_outb_dbell` — release outbound doorbell message range

Synopsis

```
int rio_release_outb_dbell (struct rio_dev * rdev, struct
resource * res);
```

Arguments

rdev

RIO device from which to release the doorbell resource

res

Doorbell resource to be freed

Description

Releases ownership of a doorbell message range. Returns 0 if the request has been satisfied.

rio_get_asm

LINUX

Kernel Hackers Manual March 2019

Name

`rio_get_asm` — Begin or continue searching for a RIO device by
vid/did/asm_vid/asm_did

Synopsis

```
struct rio_dev * rio_get_asm (ul6 vid, ul6 did, ul6 asm_vid,
ul6 asm_did, struct rio_dev * from);
```

Arguments

vid

RIO vid to match or RIO_ANY_ID to match all vids

did

RIO did to match or RIO_ANY_ID to match all dids

asm_vid

RIO asm_vid to match or RIO_ANY_ID to match all asm_vids

asm_did

RIO asm_did to match or RIO_ANY_ID to match all asm_dids

from

Previous RIO device found in search, or NULL for new search

Description

Iterates through the list of known RIO devices. If a RIO device is found with a matching *vid*, *did*, *asm_vid*, *asm_did*, the reference count to the device is incremented and a pointer to its device structure is returned. Otherwise, NULL is returned. A new search is initiated by passing NULL to the *from* argument. Otherwise, if *from* is not NULL, searches continue from next device on the global list. The reference count for *from* is always decremented if it is not NULL.

rio_get_device

LINUX

Kernel Hackers Manual March 2019

Name

`rio_get_device` — Begin or continue searching for a RIO device by vid/did

Synopsis

```
struct rio_dev * rio_get_device (u16 vid, u16 did, struct  
rio_dev * from);
```

Arguments

vid

RIO vid to match or `RIO_ANY_ID` to match all vids

did

RIO did to match or `RIO_ANY_ID` to match all dids

from

Previous RIO device found in search, or `NULL` for new search

Description

Iterates through the list of known RIO devices. If a RIO device is found with a matching *vid* and *did*, the reference count to the device is incremented and a pointer to its device structure is returned. Otherwise, `NULL` is returned. A new search is initiated by passing `NULL` to the *from* argument. Otherwise, if *from* is not `NULL`, searches continue from next device on the global list. The reference count for *from* is always decremented if it is not `NULL`.

Chapter 4. Internals

This chapter contains the autogenerated documentation of the RapidIO subsystem.

4.1. Structures

struct rio_dev

LINUX

Kernel Hackers Manual March 2019

Name

struct rio_dev — RIO device info

Synopsis

```
struct rio_dev {
    struct list_head global_list;
    struct list_head net_list;
    struct rio_net * net;
    u16 did;
    u16 vid;
    u32 device_rev;
    u16 asm_did;
    u16 asm_vid;
    u16 asm_rev;
    u16 efptr;
    u32 pef;
    u32 swpinfo;
    u32 src_ops;
    u32 dst_ops;
    u64 dma_mask;
    struct rio_switch * rswitch;
    struct rio_driver * driver;
    struct device dev;
    struct resource riores[RIO_MAX_DEV_RESOURCES];
    u16 destid;
};
```

Members

global_list

Node in list of all RIO devices

net_list

Node in list of RIO devices in a network

net

Network this device is a part of

did

Device ID

vid

Vendor ID

device_rev

Device revision

asm_did

Assembly device ID

asm_vid

Assembly vendor ID

asm_rev

Assembly revision

efptr

Extended feature pointer

pef

Processing element features

swpinfo

Switch port info

src_ops

Source operation capabilities

`dst_ops`

Destination operation capabilities

`dma_mask`

Mask of bits of RIO address this device implements

`rswitch`

Pointer to struct `rio_switch` if valid for this device

`driver`

Driver claiming this device

`dev`

Device model device

`riores[RIO_MAX_DEV_RESOURCES]`

RIO resources this device owns

`destid`

Network destination ID

struct `rio_msg`

LINUX

Kernel Hackers Manual March 2019

Name

`struct rio_msg` — RIO message event

Synopsis

```
struct rio_msg {
    struct resource * res;
    void (* mcback) (struct rio_mport * mport, void *dev_id, int mbox, int s);
};
```

Members

res

Mailbox resource

mcback

Message event callback

struct rio_dbell

LINUX

Kernel Hackers Manual March 2019

Name

struct rio_dbell — RIO doorbell event

Synopsis

```
struct rio_dbell {
    struct list_head node;
    struct resource * res;
    void (* dinb) (struct rio_mport *mport, void *dev_id, u16 src, u16 dst,
        void * dev_id;
};
```

Members

node

Node in list of doorbell events

res

Doorbell resource

dinb

Doorbell event callback

dev_id

Device specific pointer to pass on event

struct rio_mport

LINUX

Kernel Hackers Manual March 2019

Name

struct rio_mport — RIO master port info

Synopsis

```
struct rio_mport {
    struct list_head dbells;
    struct list_head node;
    struct list_head nnode;
    struct resource iores;
    struct resource riores[RIO_MAX_MPORT_RESOURCES];
    struct rio_msg inb_msg[RIO_MAX_MBOX];
    struct rio_msg outb_msg[RIO_MAX_MBOX];
    int host_deviceid;
    struct rio_ops * ops;
    unsigned char id;
    unsigned char index;
    unsigned int sys_size;
    enum rio_phy_type phy_type;
    unsigned char name[40];
    void * priv;
};
```

Members

dbells

List of doorbell events

node

Node in global list of master ports

nnode

Node in network list of master ports

iores

I/O mem resource that this master port interface owns

riores[RIO_MAX_MPORT_RESOURCES]

RIO resources that this master port interfaces owns

inb_msg[RIO_MAX_MBOX]

RIO inbound message event descriptors

outb_msg[RIO_MAX_MBOX]

RIO outbound message event descriptors

host_deviceid

Host device ID associated with this master port

ops

configuration space functions

id

Port ID, unique among all ports

index

Port index, unique among all port interfaces of the same type

sys_size

RapidIO common transport system size

phy_type

RapidIO phy type

name[40]

Port name string

priv

Master port private data

struct rio_net

LINUX

Kernel Hackers Manual March 2019

Name

struct rio_net — RIO network info

Synopsis

```
struct rio_net {
    struct list_head node;
    struct list_head devices;
    struct list_head mports;
    struct rio_mport * hport;
    unsigned char id;
};
```

Members

node

Node in global list of RIO networks

devices

List of devices in this network

mports

List of master ports accessing this network

hport

Default port for accessing this network

id

RIO network ID

struct rio_switch

LINUX

Kernel Hackers Manual March 2019

Name

struct rio_switch — RIO switch info

Synopsis

```
struct rio_switch {
    struct list_head node;
    u16 switchid;
    u16 hopcount;
    u16 destid;
    u8 * route_table;
    int (* add_entry) (struct rio_mport * mport, u16 destid, u8 hopcount, u16 switchid);
    int (* get_entry) (struct rio_mport * mport, u16 destid, u8 hopcount, u16 switchid);
};
```

Members

node

Node in global list of switches

switchid

Switch ID that is unique across a network

hopcount

Hopcount to this switch

destid

Associated destid in the path

route_table

Copy of switch routing table

add_entry

Callback for switch-specific route add function

get_entry

Callback for switch-specific route get function

struct rio_ops

LINUX

Kernel Hackers Manual March 2019

Name

struct rio_ops — Low-level RIO configuration space operations

Synopsis

```
struct rio_ops {
    int (* lcread) (struct rio_mport *mport, int index, u32 offset, int len,
    int (* lcwrite) (struct rio_mport *mport, int index, u32 offset, int len,
    int (* cread) (struct rio_mport *mport, int index, u16 destid, u8 hopcount,
    int (* cwrite) (struct rio_mport *mport, int index, u16 destid, u8 hopcount,
    int (* dsend) (struct rio_mport *mport, int index, u16 destid, u16 data,
};
```

Members

`lcread`

Callback to perform local (master port) read of config space.

`lcwrite`

Callback to perform local (master port) write of config space.

`cread`

Callback to perform network read of config space.

`cwrite`

Callback to perform network write of config space.

`dsend`

Callback to send a doorbell message.

struct rio_driver

LINUX

Kernel Hackers Manual March 2019

Name

`struct rio_driver` — RIO driver info

Synopsis

```
struct rio_driver {
    struct list_head node;
    char * name;
    const struct rio_device_id * id_table;
    int (* probe) (struct rio_dev * dev, const struct rio_device_id * id);
    void (* remove) (struct rio_dev * dev);
    int (* suspend) (struct rio_dev * dev, u32 state);
    int (* resume) (struct rio_dev * dev);
    int (* enable_wake) (struct rio_dev * dev, u32 state, int enable);
}
```



```
struct device_driver driver;  
};
```

Members

node

Node in list of drivers

name

RIO driver name

id_table

RIO device ids to be associated with this driver

probe

RIO device inserted

remove

RIO device removed

suspend

RIO device suspended

resume

RIO device awakened

enable_wake

RIO device enable wake event

driver

LDM driver struct

Description

Provides info on a RIO device driver for insertion/removal and power management purposes.

struct rio_device_id

LINUX

Kernel Hackers Manual March 2019

Name

`struct rio_device_id` — RIO device identifier

Synopsis

```
struct rio_device_id {  
    u16 did;  
    u16 vid;  
    u16 asm_did;  
    u16 asm_vid;  
};
```

Members

`did`

RIO device ID

`vid`

RIO vendor ID

`asm_did`

RIO assembly device ID

`asm_vid`

RIO assembly vendor ID

Description

Identifies a RIO device based on both the device/vendor IDs and the assembly device/vendor IDs.

struct rio_route_ops

LINUX

Kernel Hackers Manual March 2019

Name

struct rio_route_ops — Per-switch route operations

Synopsis

```
struct rio_route_ops {
    u16 vid;
    u16 did;
    int (* add_hook) (struct rio_mport * mport, u16 destid, u8 hopcount, u16
    int (* get_hook) (struct rio_mport * mport, u16 destid, u8 hopcount, u16
};
```

Members

vid

RIO vendor ID

did

RIO device ID

add_hook

Callback that adds a route entry

get_hook

Callback that gets a route entry

Description

Defines the operations that are necessary to manipulate the route tables for a particular RIO switch device.

4.2. Enumeration and Discovery

rio_get_device_id

LINUX

Kernel Hackers Manual March 2019

Name

`rio_get_device_id` — Get the base/extended device id for a device

Synopsis

```
u16 rio_get_device_id (struct rio_mport * port, u16 destid, u8  
hopcount);
```

Arguments

port

RIO master port

destid

Destination ID of device

hopcount

Hopcount to device

Description

Reads the base/extended device id from a device. Returns the 8/16-bit device ID.

rio_set_device_id

LINUX

Kernel Hackers Manual March 2019

Name

rio_set_device_id — Set the base/extended device id for a device

Synopsis

```
void rio_set_device_id (struct rio_mport * port, u16 destid,  
u8 hopcount, u16 did);
```

Arguments

port

RIO master port

destid

Destination ID of device

hopcount

Hopcount to device

did

Device ID value to be written

Description

Writes the base/extended device id from a device.

rio_local_set_device_id

LINUX

Kernel Hackers Manual March 2019

Name

`rio_local_set_device_id` — Set the base/extended device id for a port

Synopsis

```
void rio_local_set_device_id (struct rio_mport * port, u16  
did);
```

Arguments

port

RIO master port

did

Device ID value to be written

Description

Writes the base/extended device id from a device.

rio_clear_locks

LINUX

Kernel Hackers Manual March 2019

Name

`rio_clear_locks` — Release all host locks and signal enumeration complete

Synopsis

```
int rio_clear_locks (struct rio_mport * port);
```

Arguments

port

Master port to issue transaction

Description

Marks the component tag CSR on each device with the enumeration complete flag. When complete, it then release the host locks on each device. Returns 0 on success or `-EINVAL` on failure.

rio_enum_host

LINUX

Kernel Hackers Manual March 2019

Name

`rio_enum_host` — Set host lock and initialize host destination ID

Synopsis

```
int rio_enum_host (struct rio_mport * port);
```

Arguments

port

Master port to issue transaction

Description

Sets the local host master port lock and destination ID register with the host device ID value. The host device ID value is provided by the platform. Returns 0 on success or -1 on failure.

rio_device_has_destid

LINUX

Name

`rio_device_has_destid` — Test if a device contains a destination ID register

Synopsis

```
int rio_device_has_destid (struct rio_mport * port, int  
src_ops, int dst_ops);
```

Arguments

port

Master port to issue transaction

src_ops

RIO device source operations

dst_ops

RIO device destination operations

Description

Checks the provided *src_ops* and *dst_ops* for the necessary transaction capabilities that indicate whether or not a device will implement a destination ID register. Returns 1 if true or 0 if false.

rio_release_dev

LINUX

Name

`rio_release_dev` — Frees a RIO device struct

Synopsis

```
void rio_release_dev (struct device * dev);
```

Arguments

dev

LDM device associated with a RIO device struct

Description

Gets the RIO device struct associated a RIO device struct. The RIO device struct is freed.

rio_is_switch

LINUX

Name

`rio_is_switch` — Tests if a RIO device has switch capabilities

Synopsis

```
int rio_is_switch (struct rio_dev * rdev);
```

Arguments

rdev

RIO device

Description

Gets the RIO device Processing Element Features register contents and tests for switch capabilities. Returns 1 if the device is a switch or 0 if it is not a switch. The RIO device struct is freed.

rio_route_set_ops

LINUX

Kernel Hackers Manual March 2019

Name

`rio_route_set_ops` — Sets routing operations for a particular vendor switch

Synopsis

```
void rio_route_set_ops (struct rio_dev * rdev);
```

Arguments

rdev

RIO device

Description

Searches the RIO route ops table for known switch types. If the vid and did match a switch table entry, then set the `add_entry` and `get_entry` ops to the table entry values.

rio_add_device

LINUX

Kernel Hackers Manual March 2019

Name

`rio_add_device` — Adds a RIO device to the device model

Synopsis

```
int rio_add_device (struct rio_dev * rdev);
```

Arguments

rdev

RIO device

Description

Adds the RIO device to the global device list and adds the RIO device to the RIO device list. Creates the generic sysfs nodes for an RIO device.

rio_setup_device

LINUX

Kernel Hackers Manual March 2019

Name

`rio_setup_device` — Allocates and sets up a RIO device

Synopsis

```
struct rio_dev * rio_setup_device (struct rio_net * net,
struct rio_mport * port, u16 destid, u8 hopcount, int
do_enum);
```

Arguments

net

RIO network

port

Master port to send transactions

destid

Current destination ID

hopcount

Current hopcount

do_enum

Enumeration/Discovery mode flag

Description

Allocates a RIO device and configures fields based on configuration space contents. If device has a destination ID register, a destination ID is either assigned in enumeration mode or read from configuration space in discovery mode. If the device has switch capabilities, then a switch is allocated and configured appropriately. Returns a pointer to a RIO device on success or NULL on failure.

rio_sport_is_active

LINUX

Kernel Hackers Manual March 2019

Name

`rio_sport_is_active` — Tests if a switch port has an active connection.

Synopsis

```
int rio_sport_is_active (struct rio_mport * port, u16 destid,  
u8 hopcount, int sport);
```

Arguments

port

Master port to send transaction

destid

Associated destination ID for switch

hopcount

Hopcount to reach switch

sport

Switch port number

Description

Reads the port error status CSR for a particular switch port to determine if the port has an active link. Returns `PORT_N_ERR_STS_PORT_OK` if the port is active or 0 if it is inactive.

rio_route_add_entry

LINUX

Kernel Hackers Manual March 2019

Name

`rio_route_add_entry` — Add a route entry to a switch routing table

Synopsis

```
int rio_route_add_entry (struct rio_mport * mport, struct
rio_switch * rswitch, u16 table, u16 route_destid, u8
route_port);
```

Arguments

mport

Master port to send transaction

rswitch

Switch device

table

Routing table ID

route_destid

Destination ID to be routed

route_port

Port number to be routed

Description

Calls the switch specific `add_entry` method to add a route entry on a switch. The route table can be specified using the *table* argument if a switch has per port routing tables or the normal use is to specify all tables (or the global table) by passing `RIO_GLOBAL_TABLE` in *table*. Returns 0 on success or `-EINVAL` on failure.

rio_route_get_entry

LINUX

Kernel Hackers Manual March 2019

Name

`rio_route_get_entry` — Read a route entry in a switch routing table

Synopsis

```
int rio_route_get_entry (struct rio_mport * mport, struct  
rio_switch * rswitch, u16 table, u16 route_destid, u8 *  
route_port);
```

Arguments

mport

Master port to send transaction

rswitch

Switch device

table

Routing table ID

route_destid

Destination ID to be routed

route_port

Pointer to read port number into

Description

Calls the switch specific `get_entry` method to read a route entry in a switch. The route table can be specified using the *table* argument if a switch has per port routing tables or the normal use is to specify all tables (or the global table) by passing `RIO_GLOBAL_TABLE` in *table*. Returns 0 on success or `-EINVAL` on failure.

rio_get_host_deviceid_lock

LINUX

Kernel Hackers Manual March 2019

Name

`rio_get_host_deviceid_lock` — Reads the Host Device ID Lock CSR on a device

Synopsis

```
u16 rio_get_host_deviceid_lock (struct rio_mport * port, u8  
hopcount);
```

Arguments

port

Master port to send transaction

hopcount

Number of hops to the device

Description

Used during enumeration to read the Host Device ID Lock CSR on a RIO device. Returns the value of the lock register.

rio_get_swpinfo_inport

LINUX

Name

`rio_get_swpinfo_inport` — Gets the ingress port number

Synopsis

```
u8 rio_get_swpinfo_inport (struct rio_mport * mport, u16  
destid, u8 hopcount);
```

Arguments

mport

Master port to send transaction

destid

Destination ID associated with the switch

hopcount

Number of hops to the device

Description

Returns port number being used to access the switch device.

`rio_get_swpinfo_tports`

LINUX

Name

`rio_get_swpinfo_tports` — Gets total number of ports on the switch

Synopsis

```
u8 rio_get_swpinfo_tports (struct rio_mport * mport, u16  
destid, u8 hopcount);
```

Arguments

mport

Master port to send transaction

destid

Destination ID associated with the switch

hopcount

Number of hops to the device

Description

Returns total numbers of ports implemented by the switch device.

`rio_net_add_mport`

LINUX

Name

`rio_net_add_mport` — Add a master port to a RIO network

Synopsis

```
void rio_net_add_mport (struct rio_net * net, struct rio_mport
* port);
```

Arguments

net

RIO network

port

Master port to add

Description

Adds a master port to the network list of associated master ports..

rio_enum_peer

LINUX

Name

`rio_enum_peer` — Recursively enumerate a RIO network through a master port

Synopsis

```
int rio_enum_peer (struct rio_net * net, struct rio_mport *  
port, u8 hopcount);
```

Arguments

net

RIO network being enumerated

port

Master port to send transactions

hopcount

Number of hops into the network

Description

Recursively enumerates a RIO network. Transactions are sent via the master port passed in *port*.

rio_enum_complete

LINUX

Kernel Hackers Manual March 2019

Name

`rio_enum_complete` — Tests if enumeration of a network is complete

Synopsis

```
int rio_enum_complete (struct rio_mport * port);
```

Arguments

port

Master port to send transaction

Description

Tests the Component Tag CSR for presence of the magic enumeration complete flag. Return 1 if enumeration is complete or 0 if enumeration is incomplete.

rio_disc_peer

LINUX

Kernel Hackers Manual March 2019

Name

`rio_disc_peer` — Recursively discovers a RIO network through a master port

Synopsis

```
int rio_disc_peer (struct rio_net * net, struct rio_mport *  
port, u16 destid, u8 hopcount);
```

Arguments

net

RIO network being discovered

port

Master port to send transactions

destid

Current destination ID in network

hopcount

Number of hops into the network

Description

Recursively discovers a RIO network. Transactions are sent via the master port passed in *port*.

rio_mport_is_active

LINUX

Kernel Hackers Manual March 2019

Name

`rio_mport_is_active` — Tests if master port link is active

Synopsis

```
int rio_mport_is_active (struct rio_mport * port);
```


Arguments

port

Master port to test

Description

Reads the port error status CSR for the master port to determine if the port has an active link. Returns `PORT_N_ERR_STS_PORT_OK` if the master port is active or 0 if it is inactive.

rio_alloc_net

LINUX

Kernel Hackers Manual March 2019

Name

`rio_alloc_net` — Allocate and configure a new RIO network

Synopsis

```
struct rio_net * rio_alloc_net (struct rio_mport * port);
```

Arguments

port

Master port associated with the RIO network

Description

Allocates a RIO network structure, initializes per-network list heads, and adds the associated master port to the network list of associated master ports. Returns a RIO network pointer on success or `NULL` on failure.

rio_update_route_tables

LINUX

Kernel Hackers Manual March 2019

Name

`rio_update_route_tables` — Updates route tables in switches

Synopsis

```
void rio_update_route_tables (struct rio_mport * port);
```

Arguments

port

Master port associated with the RIO network

Description

For each enumerated device, ensure that each switch in a system has correct routing entries. Add routes for devices that were unknown during the first enumeration pass through the switch.

rio_enum_mport

LINUX

Kernel Hackers Manual March 2019

Name

`rio_enum_mport` — Start enumeration through a master port

Synopsis

```
int rio_enum_mport (struct rio_mport * mport);
```

Arguments

mport

Master port to send transactions

Description

Starts the enumeration process. If somebody has enumerated our master port device, then give up. If not and we have an active link, then start recursive peer enumeration. Returns 0 if enumeration succeeds or `-EBUSY` if enumeration fails.

rio_build_route_tables

LINUX

Name

`rio_build_route_tables` — Generate route tables from switch route entries

Synopsis

```
void rio_build_route_tables ( void );
```

Arguments

void

no arguments

Description

For each switch device, generate a route table by copying existing route entries from the switch.

rio_enum_timeout

LINUX

Name

`rio_enum_timeout` — Signal that enumeration timed out

Synopsis

```
void rio_enum_timeout (unsigned long data);
```

Arguments

data

Address of timeout flag.

Description

When the enumeration complete timer expires, set a flag that signals to the discovery process that enumeration did not complete in a sane amount of time.

rio_disc_mport

LINUX

Kernel Hackers Manual March 2019

Name

`rio_disc_mport` — Start discovery through a master port

Synopsis

```
int rio_disc_mport (struct rio_mport * mport);
```

Arguments

mport

Master port to send transactions

Description

Starts the discovery process. If we have an active link, then wait for the signal that enumeration is complete. When enumeration completion is signaled, start recursive peer discovery. Returns 0 if discovery succeeds or `-EBUSY` on failure.

4.3. Driver functionality

rio_setup_inb_dbell

LINUX

Kernel Hackers Manual March 2019

Name

`rio_setup_inb_dbell` — bind inbound doorbell callback

Synopsis

```
int rio_setup_inb_dbell (struct rio_mport * mport, void *  
dev_id, struct resource * res, void (*dinb) (struct rio_mport  
* mport, void *dev_id, u16 src, u16 dst, u16 info));
```

Arguments

mport

RIO master port to bind the doorbell callback

dev_id

Device specific pointer to pass on event

res

Doorbell message resource

dinb

Callback to execute when doorbell is received

Description

Adds a doorbell resource/callback pair into a port's doorbell event list. Returns 0 if the request has been satisfied.

rio_mport_get_feature

LINUX

Kernel Hackers Manual March 2019

Name

`rio_mport_get_feature` — query for devices' extended features

Synopsis

```
u32 rio_mport_get_feature (struct rio_mport * port, int local,
u16 destid, u8 hopcount, int ftr);
```

Arguments

port

Master port to issue transaction

local

Indicate a local master port or remote device access

destid

Destination ID of the device

hopcount

Number of switch hops to the device

fttr

Extended feature code

Description

Tell if a device supports a given RapidIO capability. Returns the offset of the requested extended feature block within the device's RIO configuration space or 0 in case the device does not support it. Possible values for *fttr*:

RIO_EFB_PAR_EP_ID LP/LVDS EP Devices

RIO_EFB_PAR_EP_REC_ID LP/LVDS EP Recovery Devices

RIO_EFB_PAR_EP_FREE_ID LP/LVDS EP Free Devices

RIO_EFB_SER_EP_ID LP/Serial EP Devices

RIO_EFB_SER_EP_REC_ID LP/Serial EP Recovery Devices

RIO_EFB_SER_EP_FREE_ID LP/Serial EP Free Devices

RIO_LOP_READ

LINUX

Name

RIO_LOP_READ — Generate rio_local_read_config_* functions

Synopsis

```
RIO_LOP_READ ( size, type, len );
```

Arguments

size

Size of configuration space read (8, 16, 32 bits)

type

C type of value argument

len

Length of configuration space read (1, 2, 4 bytes)

Description

Generates rio_local_read_config_* functions used to access configuration space registers on the local device.

RIO_LOP_WRITE

LINUX

Name

RIO_LOP_WRITE — Generate rio_local_write_config_* functions

Synopsis

```
RIO_LOP_WRITE ( size, type, len );
```

Arguments

size

Size of configuration space write (8, 16, 32 bits)

type

C type of value argument

len

Length of configuration space write (1, 2, 4 bytes)

Description

Generates rio_local_write_config_* functions used to access configuration space registers on the local device.

RIO_OP_READ

LINUX

Name

RIO_OP_READ — Generate rio_mport_read_config_* functions

Synopsis

```
RIO_OP_READ ( size, type, len);
```

Arguments

size

Size of configuration space read (8, 16, 32 bits)

type

C type of value argument

len

Length of configuration space read (1, 2, 4 bytes)

Description

Generates rio_mport_read_config_* functions used to access configuration space registers on the local device.

RIO_OP_WRITE

LINUX

Name

RIO_OP_WRITE — Generate rio_mport_write_config_* functions

Synopsis

```
RIO_OP_WRITE ( size, type, len );
```

Arguments

size

Size of configuration space write (8, 16, 32 bits)

type

C type of value argument

len

Length of configuration space write (1, 2, 4 bytes)

Description

Generates rio_mport_write_config_* functions used to access configuration space registers on the local device.

4.4. Device model support

rio_match_device

LINUX

Kernel Hackers Manual March 2019

Name

`rio_match_device` — Tell if a RIO device has a matching RIO device id structure

Synopsis

```
const struct rio_device_id * rio_match_device (const struct
rio_device_id * id, const struct rio_dev * rdev);
```

Arguments

id

the RIO device id structure to match against

rdev

the RIO device structure to match against

Description

Used from driver probe and bus matching to check whether a RIO device matches a device id structure provided by a RIO driver. Returns the matching struct `rio_device_id` or `NULL` if there is no match.

rio_device_probe

LINUX

Kernel Hackers Manual March 2019

Name

`rio_device_probe` — Tell if a RIO device structure has a matching RIO device id structure

Synopsis

```
int rio_device_probe (struct device * dev);
```

Arguments

dev

the RIO device structure to match against

Description

return 0 and set `rio_dev->driver` when `drv` claims `rio_dev`, else error

rio_device_remove

LINUX

Name

`rio_device_remove` — Remove a RIO device from the system

Synopsis

```
int rio_device_remove (struct device * dev);
```

Arguments

dev

the RIO device structure to match against

Description

Remove a RIO device from the system. If it has an associated driver, then run the driver `remove` method. Then update the reference count.

rio_match_bus

LINUX

Name

`rio_match_bus` — Tell if a RIO device structure has a matching RIO driver device id structure

Synopsis

```
int rio_match_bus (struct device * dev, struct device_driver *  
drv);
```

Arguments

dev

the standard device structure to match against

drv

the standard driver structure containing the ids to match against

Description

Used by a driver to check whether a RIO device present in the system is in its list of supported devices. Returns 1 if there is a matching struct `rio_device_id` or 0 if there is no match.

rio_bus_init

LINUX

Kernel Hackers Manual March 2019

Name

`rio_bus_init` — Register the RapidIO bus with the device model

Synopsis

```
int rio_bus_init ( void );
```


Arguments

void

no arguments

Description

Registers the RIO bus device and RIO bus type with the Linux device model.

4.5. Sysfs support

rio_create_sysfs_dev_files

LINUX

Kernel Hackers Manual March 2019

Name

`rio_create_sysfs_dev_files` — create RIO specific sysfs files

Synopsis

```
int rio_create_sysfs_dev_files (struct rio_dev * rdev);
```

Arguments

rdev

device whose entries should be created

Description

Create files when *rdev* is added to sysfs.

rio_remove_sysfs_dev_files

LINUX

Kernel Hackers Manual March 2019

Name

`rio_remove_sysfs_dev_files` — cleanup RIO specific sysfs files

Synopsis

```
void rio_remove_sysfs_dev_files (struct rio_dev * rdev);
```

Arguments

rdev

device whose entries we should free

Description

Cleanup when *rdev* is removed from sysfs.

4.6. PPC32 support

rio_hw_add_outb_message

LINUX

Kernel Hackers Manual March 2019

Name

`rio_hw_add_outb_message` — Add message to the MPC85xx outbound message queue

Synopsis

```
int rio_hw_add_outb_message (struct rio_mport * mport, struct
rio_dev * rdev, int mbox, void * buffer, size_t len);
```

Arguments

mport

Master port with outbound message queue

rdev

Target of outbound message

mbox

Outbound mailbox

buffer

Message to add to outbound queue

len

Length of message

Description

Adds the *buffer* message to the MPC85xx outbound message queue. Returns 0 on success or `-EINVAL` on failure.

rio_hw_add_inb_buffer

LINUX

Kernel Hackers Manual March 2019

Name

`rio_hw_add_inb_buffer` — Add buffer to the MPC85xx inbound message queue

Synopsis

```
int rio_hw_add_inb_buffer (struct rio_mport * mport, int mbox,
void * buf);
```

Arguments

mport

Master port implementing the inbound message unit

mbox

Inbound mailbox number

buf

Buffer to add to inbound queue

Description

Adds the *buf* buffer to the MPC85xx inbound message queue. Returns 0 on success or `-EINVAL` on failure.

rio_hw_get_inb_message

LINUX

Kernel Hackers Manual March 2019

Name

`rio_hw_get_inb_message` — Fetch inbound message from the MPC85xx message unit

Synopsis

```
void * rio_hw_get_inb_message (struct rio_mport * mport, int
mbox);
```

Arguments

mport

Master port implementing the inbound message unit

mbox

Inbound mailbox number

Description

Gets the next available inbound message from the inbound message queue. A pointer to the message is returned on success or NULL on failure.

fsl_rio_doorbell_send

LINUX

Kernel Hackers Manual March 2019

Name

`fsl_rio_doorbell_send` — Send a MPC85xx doorbell message

Synopsis

```
int fsl_rio_doorbell_send (struct rio_mport * mport, int
index, u16 destid, u16 data);
```

Arguments

mport

RapidIO master port info

index

ID of RapidIO interface

destid

Destination ID of target device

data

16-bit info field of RapidIO doorbell message

Description

Sends a MPC85xx doorbell message. Returns 0 on success or `-EINVAL` on failure.

fsl_local_config_read

LINUX

Kernel Hackers Manual March 2019

Name

`fsl_local_config_read` — Generate a MPC85xx local config space read

Synopsis

```
int fsl_local_config_read (struct rio_mport * mport, int
index, u32 offset, int len, u32 * data);
```

Arguments

mport

RapidIO master port info

index

ID of RapdiIO interface

offset

Offset into configuration space

len

Length (in bytes) of the maintenance transaction

data

Value to be read into

Description

Generates a MPC85xx local configuration space read. Returns 0 on success or `-EINVAL` on failure.

fsl_local_config_write

LINUX

Kernel Hackers Manual March 2019

Name

`fsl_local_config_write` — Generate a MPC85xx local config space write

Synopsis

```
int fsl_local_config_write (struct rio_mport * mport, int
index, u32 offset, int len, u32 data);
```

Arguments

mport

RapidIO master port info

index

ID of RapdiIO interface

offset

Offset into configuration space

len

Length (in bytes) of the maintenance transaction

data

Value to be written

Description

Generates a MPC85xx local configuration space write. Returns 0 on success or `-EINVAL` on failure.

fsl_rio_config_read

LINUX

Kernel Hackers Manual March 2019

Name

`fsl_rio_config_read` — Generate a MPC85xx read maintenance transaction

Synopsis

```
int fsl_rio_config_read (struct rio_mport * mport, int index,
u16 destid, u8 hopcount, u32 offset, int len, u32 * val);
```

Arguments

mport

RapidIO master port info

index

ID of RapidIO interface

destid

Destination ID of transaction

hopcount

Number of hops to target device

offset

Offset into configuration space

len

Length (in bytes) of the maintenance transaction

val

Location to be read into

Description

Generates a MPC85xx read maintenance transaction. Returns 0 on success or `-EINVAL` on failure.

fsl_rio_config_write

LINUX

Name

`fsl_rio_config_write` — Generate a MPC85xx write maintenance transaction

Synopsis

```
int fsl_rio_config_write (struct rio_mport * mport, int index,  
u16 destid, u8 hopcount, u32 offset, int len, u32 val);
```

Arguments

mport

RapidIO master port info

index

ID of RapidIO interface

destid

Destination ID of transaction

hopcount

Number of hops to target device

offset

Offset into configuration space

len

Length (in bytes) of the maintenance transaction

val

Value to be written

Description

Generates an MPC85xx write maintenance transaction. Returns 0 on success or `-EINVAL` on failure.

fsl_rio_tx_handler

LINUX

Kernel Hackers Manual March 2019

Name

`fsl_rio_tx_handler` — MPC85xx outbound message interrupt handler

Synopsis

```
irqreturn_t fsl_rio_tx_handler (int irq, void * dev_instance);
```

Arguments

irq

Linux interrupt number

dev_instance

Pointer to interrupt-specific data

Description

Handles outbound message interrupts. Executes a register outbound mailbox event handler and acks the interrupt occurrence.

rio_open_outb_mbox

LINUX

Kernel Hackers Manual March 2019

Name

`rio_open_outb_mbox` — Initialize MPC85xx outbound mailbox

Synopsis

```
int rio_open_outb_mbox (struct rio_mport * mport, void *
dev_id, int mbox, int entries);
```

Arguments

mport

Master port implementing the outbound message unit

dev_id

Device specific pointer to pass on event

mbox

Mailbox to open

entries

Number of entries in the outbound mailbox ring

Description

Initializes buffer ring, request the outbound message interrupt, and enables the outbound message unit. Returns 0 on success and `-EINVAL` or `-ENOMEM` on failure.

rio_close_outb_mbox

LINUX

Kernel Hackers Manual March 2019

Name

`rio_close_outb_mbox` — Shut down MPC85xx outbound mailbox

Synopsis

```
void rio_close_outb_mbox (struct rio_mport * mport, int mbox);
```

Arguments

mport

Master port implementing the outbound message unit

mbox

Mailbox to close

Description

Disables the outbound message unit, free all buffers, and frees the outbound message interrupt.

fsl_rio_rx_handler

LINUX

Name

`fsl_rio_rx_handler` — MPC85xx inbound message interrupt handler

Synopsis

```
irqreturn_t fsl_rio_rx_handler (int irq, void * dev_instance);
```

Arguments

irq

Linux interrupt number

dev_instance

Pointer to interrupt-specific data

Description

Handles inbound message interrupts. Executes a registered inbound mailbox event handler and acks the interrupt occurrence.

rio_open_inb_mbox

LINUX

Name

`rio_open_inb_mbox` — Initialize MPC85xx inbound mailbox

Synopsis

```
int rio_open_inb_mbox (struct rio_mport * mport, void *  
dev_id, int mbox, int entries);
```

Arguments

mport

Master port implementing the inbound message unit

dev_id

Device specific pointer to pass on event

mbox

Mailbox to open

entries

Number of entries in the inbound mailbox ring

Description

Initializes buffer ring, request the inbound message interrupt, and enables the inbound message unit. Returns 0 on success and `-EINVAL` or `-ENOMEM` on failure.

rio_close_inb_mbox

LINUX

Kernel Hackers Manual March 2019

Name

`rio_close_inb_mbox` — Shut down MPC85xx inbound mailbox

Synopsis

```
void rio_close_inb_mbox (struct rio_mport * mport, int mbox);
```

Arguments

mport

Master port implementing the inbound message unit

mbox

Mailbox to close

Description

Disables the inbound message unit, free all buffers, and frees the inbound message interrupt.

fsl_rio_dbell_handler

LINUX

Kernel Hackers Manual March 2019

Name

`fsl_rio_dbell_handler` — MPC85xx doorbell interrupt handler

Synopsis

```
irqreturn_t fsl_rio_dbell_handler (int irq, void *  
dev_instance);
```

Arguments

irq

Linux interrupt number

dev_instance

Pointer to interrupt-specific data

Description

Handles doorbell interrupts. Parses a list of registered doorbell event handlers and executes a matching event handler.

fsl_rio_doorbell_init

LINUX

Kernel Hackers Manual March 2019

Name

`fsl_rio_doorbell_init` — MPC85xx doorbell interface init

Synopsis

```
int fsl_rio_doorbell_init (struct rio_mport * mport);
```

Arguments

mport

Master port implementing the inbound doorbell unit

Description

Initializes doorbell unit hardware and inbound DMA buffer ring. Called from `fsl_rio_setup`. Returns 0 on success or `-ENOMEM` on failure.

fsl_rio_setup

LINUX

Kernel Hackers Manual March 2019

Name

`fsl_rio_setup` — Setup Freescale PowerPC RapidIO interface

Synopsis

```
int fsl_rio_setup (struct of_device * dev);
```

Arguments

dev

of_device pointer

Description

Initializes MPC85xx RapidIO hardware interface, configures master port with system-specific info, and registers the master port with the RapidIO subsystem.

Chapter 5. Credits

The following people have contributed to the RapidIO subsystem directly or indirectly:

1. Matt Porter<mporter@kernel.crashing.org>
2. Randy Vinson<rvinson@mvista.com>
3. Dan Malek<dan@embeddedalley.com>

The following people have contributed to this document:

1. Matt Porter<mporter@kernel.crashing.org>

